

## Navajo/Hopi Planning Area

### Background

The Navajo/Hopi Planning Area is located in the far northeast corner of the State. The Planning Area includes both the Hopi Reservation and the Navajo Nation, and the City of Page. San Juan Southern Paiute tribal members also occupy lands located within the Navajo Nation. The Planning Area is comprised of portions of Coconino, Navajo, and Apache counties. There are portions of five watersheds within the Navajo/Hopi Planning Area: Little Colorado, Lower San Juan, Upper Colorado-Dirty Devil, Upper San Juan, and Lower Colorado. The Planning Area encompasses a large portion of the Little Colorado River Plateau Groundwater Basin and a small portion of the Coconino Plateau Groundwater Basin. Population centers include the City of Page, the Navajo communities of Tuba City, Window Rock, Chinle, and Kayenta, and Hopi communities Moenkopi, Shongopovi, Kykotsmovi, and Second Mesa.



Nearly all of the land within this Planning Area is under tribal ownership (see *Figure P.A. 14-1*). Navajo Nation lands within the Planning Area total approximately 14,600 square miles while the Hopi Reservation encompasses about 2,500 square miles. The primary land uses are livestock grazing, farming, and mining. The City of Page immediately south of the Arizona-Utah border in the northwestern part of the Planning Area encompasses approximately 24 square miles of land.

### Water Supply Conditions

#### Groundwater

The Navajo/Hopi Planning Area is located within the Colorado Plateau Physiographic Province, characterized by mostly level, horizontally stratified sedimentary rocks that have been eroded into canyons and plateaus, and some high mountains. This province contains regional aquifers within sandstone and limestone layers and relatively thin deposits of alluvium that support unconfined aquifers along streams.

Water levels in the Planning Area have generally declined due to groundwater pumping (see *Figure P.A. 14-2*). Groundwater level declines of 1.7 feet per year were observed for the period from 1984 to 2004 near Kayenta (Black Mesa area) as a result of groundwater pumping for a coal slurry pipeline and other coal mining operations, and for municipal purposes. However, since the closure of the Mohave Generating Station in Laughlin, Nevada, the coal slurry pipeline is no longer operating and groundwater withdrawals have decreased significantly. Water level declines have also been observed near Tuba City and in some areas of the Hopi Reservation and the western Black Mesa drainage area. Near Page, water levels declined significantly in some wells that are hydraulically connected to the surface water level of Lake Powell which, in recent years, has dropped to historic low levels since its complete filling and high-water mark in 1980. In December, 2013, the reservoir was at 43 percent of full capacity.

Groundwater in much of the Planning Area is highly mineralized and the quality is marginal to unsuitable for domestic use due to high concentrations of dissolved solids and other parameters

that exceed drinking water standards. Nevertheless, it is utilized in the north-central parts of the Planning Area for domestic use.

### Surface Water

The Little Colorado River Watershed covers most of the Planning Area and extends west into the Coconino Plateau Basin where it drains to the Colorado River. The Little Colorado River is the major surface drainage in the Watershed, originating in the White Mountains and flowing northwest to its confluence with the Colorado River in the Grand Canyon National Park (see *Figure P.A. 14-3*). The maximum recorded annual flow in the watershed was 816,449 acre-feet at the active gage on the Little Colorado River near Cameron. The median annual flow at this station is 138,315 acre-feet.

Within the watershed, reaches of the Little Colorado River have impaired water quality due to levels of turbidity, lead, copper and silver in excess of use standards. In addition, eight lakes are impaired due primarily to concentrations of mercury exceeding use standards.

The Lower San Juan River Watershed drains most of the northeastern portion of the Planning Area (see *Figure P.A. 14-3*). Chinle Creek is the major drainage, collecting most of the surface water runoff in the area that originates primarily in the Chuska Mountains and the Defiance Plateau. The Watershed drains northward toward Utah and the San Juan River, which in turn is tributary to the Colorado River. Currently, only one of the four stream gages is active; a real-time gage at Chinle Creek near Mexican Water south of the Utah border. The maximum recorded flow in the watershed was measured at this remaining active gage with a flow of almost 67,700 acre-feet in 1982. Median flow at this gage is about 15,500 acre-feet per year.

Arizona has a 50,000 acre-foot entitlement to the Upper Basin of the Colorado River<sup>1</sup>. At the present time, this water supply is utilized by: (1) the Navajo Nation for irrigated agriculture, reservoirs, domestic use and livestock related uses; (2) the City of Page for domestic uses; (3) the Glen Canyon National Recreation Area; and (4) Salt River Project for the Navajo Generating Station (NGS). Table P.A. 14-1 shows Arizona's total consumptive use of Colorado River water in the Upper Basin from 1996 through 2010<sup>2</sup>. At this time, the US Environmental Protection Agency (EPA) and the owners of the NGS are negotiating alternatives to meet compliance with EPA Clean Air standards. If the currently proposed alternative - to shut down one of the units at NGS - is adopted, the use of Colorado River water at NGS is expected to decrease, possibly making some of this Upper Colorado River Basin entitlement available to meet other demands in the Planning Area.

### Reclaimed Water

Many of the communities on the Navajo Nation and the Hopi Reservation are served by wastewater treatment plants. Based on aerial image review, it appears that the majority of this potential reclaimed water supply is disposed of through evaporation ponds. Most of the City of Page is served by a centralized wastewater treatment system. Reclaimed water from this facility is delivered for reuse on the Lake Powell National Golf Course.

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<sup>1</sup> This is in addition to the 2.8 MAF Lower Basin entitlement which is diverted below Hoover Dam.

<sup>2</sup> US Bureau of Reclamation

**Table P.A. 14-1. Provisional Arizona Upper Colorado River Utilization, 1996-2010**

Colorado River Water Supplied											
Year	Navajo Generating Station	City of Page - Diversion	City of Page - Depletion	Diversion to Depletion Ratio	Le Chee	Navajo Irrigation	Reservoir Evaporation	Stockpond Evaporation	Reservoir and Stockpond Evaporation	Glen Canyon Recreation Area	Subtotal
1996	21,427	3,060	2,152	1.422	100	426	5,806	682	6,488	348	30,941
1997	22,364	2,613	1,723	1.517	95	399	5,687	686	6,373	378	31,332
1998	25,017	2,589	1,779	1.455	95	463	5,234	897	6,131	336	33,821
1999	26,697	2,567	1,800	1.426	89	486	4,927	866	5,793	445	35,310
2000	28,709	2,768	1,903	1.455	99	649	4,470	920	5,390	265	37,015
2001	27,620	3,837	1,833	2.093	90	515	4,359	900	5,259	387	35,704
2002	28,415	2,641	1,848	1.429	86	436	3,606	693	4,299	369	35,453
2003	26,284	2,550	1,770	1.441	101	488	3,784	734	4,518	318	33,479
2004	27,375	2,283	1,588	1.438	103	580	3,620	918	4,538	198	34,382
2005	26,200	2,028	1,376	1.474	98	609	3,523	873	4,396	280	32,959
2006	26,660	2,262	1,638	1.381	97	572	3,655	780	4,435	338	33,740
2007	27,604	2,321	402	5.774	95	835	3,523	867	4,390	338	33,664
2008	26,334	2,321	402	5.774	95	1,047	3,467	897	4,364	338	32,580
2009	26,073	2,240	318	7.044	95	916	3,751	735	4,486	334	32,222
2010	23,948	2,096	1,459	1.437	91	1,640	3,303	920	4,223	256	31,619
<b>2000-2010 Average</b>	<b>26,838</b>	<b>2,486</b>	<b>1,322</b>	<b>2.794</b>	<b>95</b>	<b>753</b>	<b>3,733</b>	<b>840</b>	<b>4,573</b>	<b>311</b>	<b>33,892</b>
<b>1996-2010 Average</b>	<b>26,048</b>	<b>2,545</b>	<b>1,466</b>	<b>2.437</b>	<b>95</b>	<b>671</b>	<b>4,181</b>	<b>825</b>	<b>5,006</b>	<b>329</b>	<b>33,615</b>

Ecological Resources

There are many environmental resources located within the Planning Area (see Figure P.A. 14-3). Critical habitat has been designated for federally listed threatened or endangered species including the Apache Trout, Mexican Spotted Owl, Little Colorado Spinedace, Navajo Sedge, and the Southwestern Willow Flycatcher. Native fish reintroductions have occurred in several streams. Several riparian areas have been mapped in the northeastern portion of the Planning Area. In addition, Canyon de Chelly and Navajo National Monument are located within the Planning Area on the Navajo Nation.

**Water Demands**

Table P.A. 14-2 below presents the baseline and projected water demands for the Navajo/Hopi Planning Area. The Navajo Generating Station (NGS) is currently the largest single water user in the Planning Area. NGS is cooled by a portion of Arizona's 50,000 acre-foot entitlement of Upper Basin Colorado River water diverted from Lake Powell. NGS was estimated to consume nearly 24,000 acre-feet of Colorado River water in 2010. Projections WRDC included in Table P.A. 14-2 project power plant use to increase to the full volume of Arizona's Upper Basin entitlement. Given the potential reduction to only two of the three units at NGS, pursuant to the proposed alternative being discussed with EPA (August 2013), these projections may be higher than what is now being anticipated.

Municipal use represents the second highest water use in the Navajo/Hopi Planning Area and is projected to increase by 2060. The City of Page relies on a portion of Arizona's of Upper Basin allocation through on diversions from Lake Powell, reporting diversions of 2,096 acre-feet in 2010. The balance of municipal demand in the Planning Area is groundwater served and distributed among the communities of the Navajo Nation and Hopi Tribe.

**Table P.A. 14-2. Projected Water Demands (in acre feet) - Navajo/Hopi Planning Area**

Sector	2010	2035	2060
Agriculture	1,963	1,963	1,963
Dairy	0	0	0
Feedlot	0	0	0
Municipal	19,022	23,093	26,402
Other Industrial	0	0	0
Mining	601		
High		750	750
Low		750	750
Power Plants	23,948		
High		50,000	50,000
Low		40,205	46,425
Rock Production	132		
High		1,818	2,149
Low		756	895
Turf	738		
High		705	703
Low		670	704
<b>Total (High)</b>	<b>46,404</b>	<b>78,328</b>	<b>81,966</b>
<b>Total (Low)</b>	<b>46,404</b>	<b>67,436</b>	<b>77,140</b>

### Characteristics Affecting Future Demands and Water Supply Availability

#### Unresolved Indian Water Rights Claims

Conflicts between the Hopi and Navajo and between the tribes and non-Indian water users, including water supply issues, have proven difficult to resolve. Water rights settlement discussions with the tribes, the federal government and State parties had been the primary focus through 2012 in resolving these issues. Legislation was introduced in the fall of 2012 by Arizona Senators Jon Kyl and John McCain that would have provided groundwater projects for the Navajo and Hopi Tribes in exchange for dismissal of the tribes' claims to water from the Little Colorado River and provided a framework for future settlement to the tribes' claims to the Lower Colorado River. The legislation was removed at the request of the Navajo Nation and the Hopi Tribe as a result of further discussions with their respective tribal councils.

In June of 2013, the Navajo Nation re-initiated litigation originally filed on March 14, 2003. In this action, the Navajo Nation alleges that various federal agencies and entities have failed to consider the water rights of the Navajo Nation, or protect their interests in the Lower Colorado River when operational decisions were made, resulting in detriment to the Navajo Nation's water rights. The State of Arizona is an intervener in this action. This re-initiation of litigation followed the failure to reach a settlement, as described above. As is typical in litigation, uncertainty regarding the outcome of this case creates significant uncertainty for both tribes and the State parties with respect to development of water supplies to meet both current and projected demands.

### General Stream Adjudication

The general stream adjudications are judicial proceedings to determine or establish the extent and priority of water rights in the Gila and Little Colorado River systems. Over 14,000 claimants and water users are joined in the Little Colorado River Adjudication that will result in the Superior Court issuing a comprehensive final decree of water rights. Until that process is complete, uncertainty regarding the extent and priority of water rights in this Planning Area will make it difficult to identify strategies for meeting the projected water demands.

### Infrastructure and Dispersed Population Centers

The residents of the Navajo/Hopi Planning Area are largely traditional peoples. It is an arid land with limited vegetative cover and limited available water supplies. Many of the settlements date to a time prior to the advent of centralized water distribution systems and rely on local springs or intermittent and ephemeral surface water flows to sustain the traditional lifestyles of their residents. Aside from the major population centers and smaller communities located in this Planning Area, population is widely dispersed across approximately 17,100 square miles in Arizona. The relatively sparse population distribution across both the Navajo Nation and Hopi lands increases the technical and financial challenges of meeting the needs of an underserved population, due to the distances that water may need to be transported and the limited demands to be served. The Navajo Department of Water Resources estimated that approximately 30 percent of the households on the Navajo Reservation are without direct access to public water systems and haul water long distances to provide water for their families<sup>3</sup>. It is assumed that the same holds true for the Hopi lands, but the extent of water hauling is at this time unknown.

Groundwater is believed to be available in quantities that are likely to be sustainable at current and projected municipal and domestic demands within the Navajo/Hopi Planning Area. Unfortunately, it is not commonly found in locations that are convenient to the current points of demand, nor available from depths that are economically feasible for the current population. Additionally, concentration of groundwater pumping at the larger demand centers has resulted in declines in local water levels. As discussed above, portions of the Navajo/Hopi Planning Area exhibit water quality challenges for potable use, including TDS and uranium.

## **Strategies for Meeting Future Water Demands**

### Resolution of Indian and Non-Indian Water Rights Claims

Reaching resolution of water rights claims of the Navajo Nation, the Hopi Tribe and the Southern Paiute is the single most important step in ensuring long-term water supply sustainability for this region, as well as providing water supply certainty for other planning areas reliant on the Little Colorado and Colorado rivers. For example, mainstem Colorado River water and Colorado River water delivered through the CAP canal are important water sources for the Basin and Range AMAs, Colorado Mainstem – North and Colorado Mainstem – South Planning Areas. The outcome

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<sup>3</sup> The Navajo Nation's Department of Water Resources prepared a Draft Water Resource Development Strategy for the Navajo Nation (July, 1011) [http://www.tribesandclimatechange.org/docs/tribes\\_357.pdf](http://www.tribesandclimatechange.org/docs/tribes_357.pdf). The report addressed a large range of alternatives including: regional water supply projects; local-scale projects; and providing assistance to water haulers, who serve upwards of 30 percent of residents on the Reservation.

of any settlement or litigation of tribal water right claims has the potential to impact the supply availability to these areas. This is especially true of the CAP service area within the Basin and Range AMA Planning Area because CAP is a junior priority holder to Colorado River supplies.

Currently, water rights settlement negotiations have stalled and the Navajo Nation has decided to proceed with its litigation against the United States on issues related to operations in the Lower Colorado River Basin. Settlement negotiations are typically more productive than litigation and result in outcomes that can provide federally financed infrastructure to deliver water to Indian communities, or alternatives that guarantee water supplies are used within the State to benefit Arizona citizens. ADWR believes that efforts should be made to resume settlement discussions and resolve claims in a manner beneficial to tribal communities within Arizona. Correspondingly, resolution of the Little Colorado River Adjudication is essential to provide long-term certainty for water users in Arizona dependent on water supplies from the Little Colorado River. A comprehensive focus on what is needed to complete the Adjudication is essential and could help provide guidance to ADWR so adequate funding can be identified and obtained to complete the necessary technical work to support completion of this process.

The Omnibus Public Land Management Act of 2009 provided authorization to construct the Navajo-Gallup Water Supply Project. The San Juan Navajo Water Rights Settlement was signed by the Secretary of the Interior, the Navajo Nation President and the state of New Mexico in 2010. A major component of that settlement was the financing and construction of the Navajo-Gallup Pipeline Project. Once constructed, the project will convey a reliable municipal and industrial water supply from the San Juan River to the eastern section of the Navajo Nation in New Mexico. The project includes approximately 280 miles of pipeline, several pumping plants, and two water treatment plants and, in 2007, was estimated to cost \$865 million to construct.

The Arizona Water Settlements Act of 2004 requires the Secretary of Interior to reallocate 6,411 acre-feet per year of Non-Indian agricultural priority CAP water to the Navajo Nation for use in Arizona<sup>4</sup>. The most recent settlement proposal, rejected in December of 2012 by the Navajo and Hopi, would have facilitated the use of this water to serve communities within the Navajo Nation near the Arizona-New Mexico border (primarily Window Rock) by diverting water from the San Juan River in New Mexico, delivering the water through the Navajo-Gallup Water Supply Project. The project would have been financed by the US. Unfortunately, the settlement discussions were suspended in December of 2012, but this option is an example of what could be done under a successful settlement of the claims.

#### Increase Access to Locally Available Groundwater

ADWR believes that enhanced access to the groundwater resources within the Navajo/Hopi Planning Area can serve to meet current and projected water demands throughout much of the Planning Area. This strategy includes the development or rehabilitation of many small to moderate scale production, transmission, and distribution projects. For areas where expansive distribution systems are currently infeasible, community wells and watering points need to be constructed or upgraded to improve access for water haulers, perhaps utilizing commercial water

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<sup>4</sup> The United States and the State of Arizona are each required to firm 50 percent of the NIA priority CAP water to the equivalent of M&I priority CAP water until January 1, 2108.

hauling services. Additionally, measures such as wider distribution of groundwater pumping, increased local aquifer replenishment, or replacing pumping with renewable supplies, such as surface water or reclaimed water, would serve to lessen the rates of decline seen near the large demand centers. Meeting local demands in the Planning Area may also require either construction of wells in a manner that isolates poor quality supplies from higher quality local sources, or construction and operation of treatment works, likely either wellhead treatment or point of use systems.

Leveraging existing hydrogeologic information with additional studies, drilling and testing of wells, planning and development of water delivery and storage infrastructure, and monitoring and modeling will provide a basis for prudent use and ideal locations of potential groundwater supplies. Regional projects will maximize the number of water users that can have reasonable access to the mainline delivery systems; however, cooperation across political boundaries may be necessary to successfully implement some of these options.

#### Reclaimed Water Reuse

Diversions of Colorado River water by the City of Page are offset by reclaimed water discharges to the Colorado River. These discharges are monitored and used by Reclamation to determine the City's consumptive use of Colorado River each year. With the exception of turf irrigation at Lake Powell National Golf Course in Page, there is limited reuse of reclaimed water in the Navajo/Hopi Planning Area. The use of reclaimed water is limited due to low demand for on-site non-potable supplies and lack of centralized sewer systems. However, reclaimed water could be made available for restoration of environmental resources and industrial or appropriate agricultural water uses. Increasing the utility of this resource would likely require upgrading wastewater treatment works throughout the Planning Area to produce reclaimed water of a quality suitable for reuse or aquifer enhancement.

#### Expanded Monitoring & Data Collection

Monitoring of water use within the Navajo/Hopi Planning Area is conducted by tribal and federal authorities. The monitoring and reporting is not consolidated within Arizona's statewide programs, such as the Community Water System Reports (City of Page). Monitoring water conditions and metering and reporting water use across the Planning Area would serve to improve analysis of current hydrologic conditions. Data collection is a crucial element in the development of groundwater models, which have proven to be invaluable tools throughout the State in developing more thorough understanding of regional hydrologic systems and evaluating future conditions and projecting potential impacts of new uses and/or alternative water management strategies. In addition, exploration drilling and testing will increase understanding of the local groundwater systems, in addition to augmenting available supplies and mitigating local pumping impacts.

#### Watershed Management

According to the Navajo Department of Water Resources (NDWR), almost all of the watersheds on the Navajo Nation are degraded due to historic land use practices that have had a major impact on the watersheds. The result of this degradation is an increase in the intensity of runoff events, which produce additional sediment loads in local streams and reservoirs. These events incise

channels, which de-waters alluvial groundwater and, in turn, negatively impacts riparian areas and reduces the carrying capacity of the watershed.

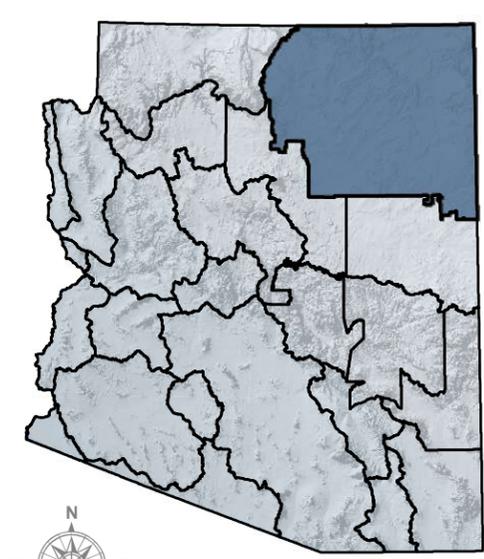
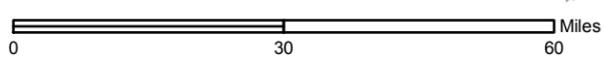
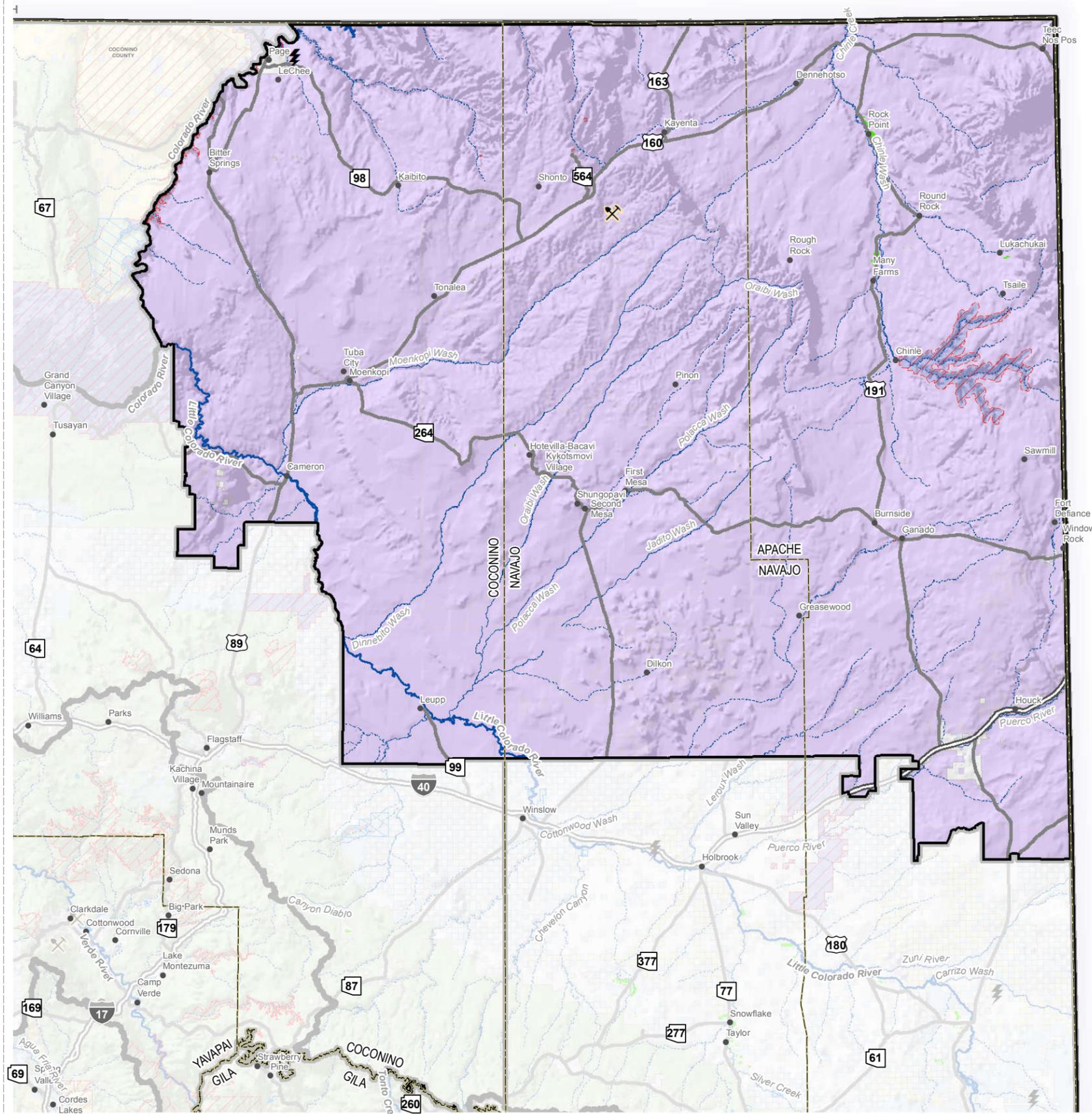
The NDWR has received Arizona Water Protection Fund grants for watershed restoration - the Tsai/Canyon del Muerto Watershed Restoration Demonstration Project and the Red Lake Wash Watershed Restoration/Demonstration Project. Additional projects that have been initiated include: 1) the National Fish and Wildlife Asaayi Habitat Restoration Project; 2) the Rio Puerco Watershed Bluewater Restoration Project; and 3) Restoration of the Pueblo Colorado upstream of Hubbell's Trading Post, which was funded by the US Bureau of Indian Affairs (BIA). The work in the Rio Puerco Watershed was conducted under the Bureau of Land Management's Rio Puerco Watershed Act. With watershed improvements, floods can be attenuated, natural recharge can be increased, and wetland values can also be enhanced and, with proper grazing management, forage production can be increased.

#### Summary

Development and delivery of renewable water supplies, such as proposed by the Navajo-Gallup Pipeline Project, is only practical for specific large population centers and has limited application across much of the Planning Area. A more cost-effective and long-term approach for this Planning Area, due to the dispersed location of water users, is strategically located groundwater projects. These projects can be located in or near population centers, or in areas that can serve remote populations, either directly or through commercial water hauling services. Long-term groundwater supplies may need to be developed in deep aquifer systems and may require additional water treatment to acceptably serve intended uses. However, it is also important to develop these projects in areas that do not imperil existing springs that serve as important local sources of water supplies for habitat and people.

Most importantly, to ensure long-term protection and to provide secure Federal financing for these projects, a comprehensive water rights settlement is imperative to develop the water supplies necessary to improve the quality of life within the Planning Area and support the long-term economic viability of this region.

NOTE: Because GIS data for this project were acquired from multiple sources employing different land base grids and varying accuracy standards, some inconsistencies were encountered. The user is responsible for understanding the accuracy limitations of GIS data layers and is responsible for the results of any application of the data for other than their intended purpose.



MAP LOCATION  
(Planning Area Boundaries)

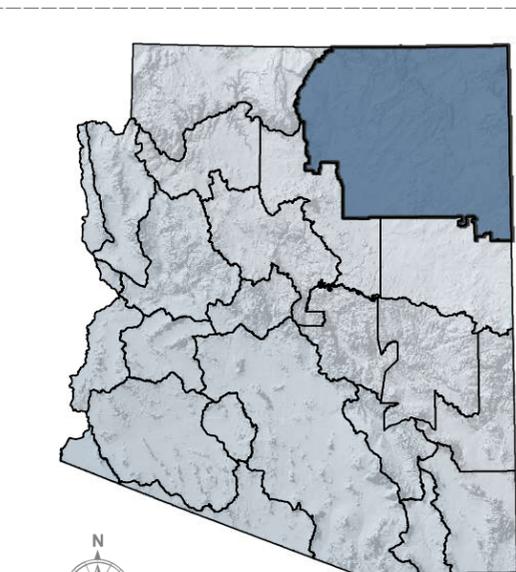
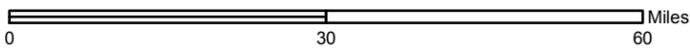
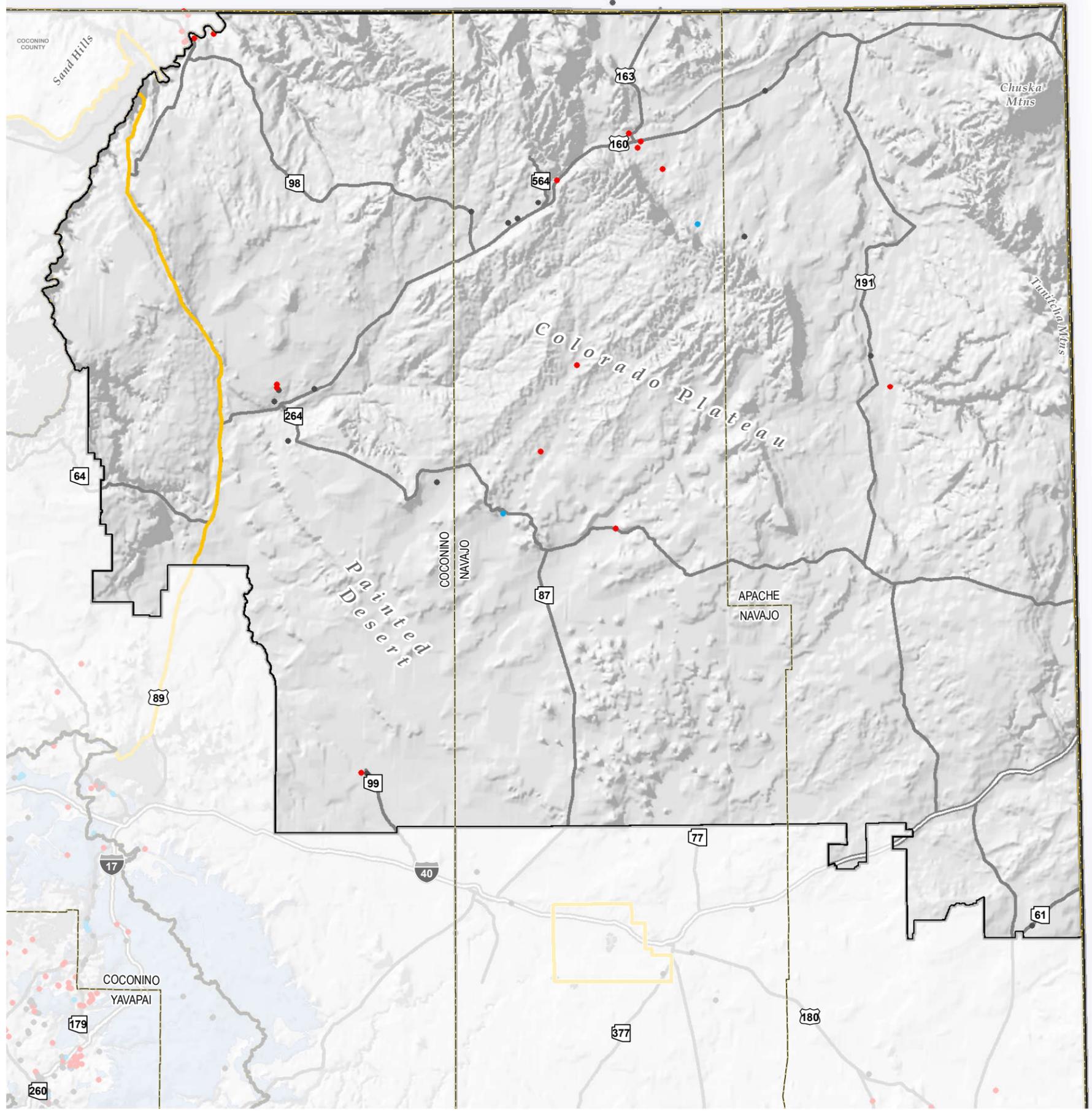
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- State (ALRIS)
- County (ALRIS)
- River or Stream (ASLD)
- Interstate (ADOT)
- Population Center (GNIS)
- Mine (ADMMR, ADWR)
- Hydroelectric Power Plant (ADEQ, ADWR)
- Thermoelectric Power Plant (ADEQ, ADWR)
- Agriculture (SWReGAP, 2004)
- Federal Conservation Land (USFS, BLM, NPS)
- State Managed Conservation Land (AZGFD, AZSP)
- BLM Land
- National Forest
- National Park
- Military Reserve
- Private and Other Land
- State Trust Land
- Tribal Land



# Navajo / Hopi Land Ownership

Figure P.A.14-1

NOTE: Because GIS data for this project were acquired from multiple sources employing different land base grids and varying accuracy standards, some inconsistencies were encountered. The user is responsible for understanding the accuracy limitations of GIS data layers and is responsible for the results of any application of the data for other than their intended purpose.



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(Planning Area Boundaries)

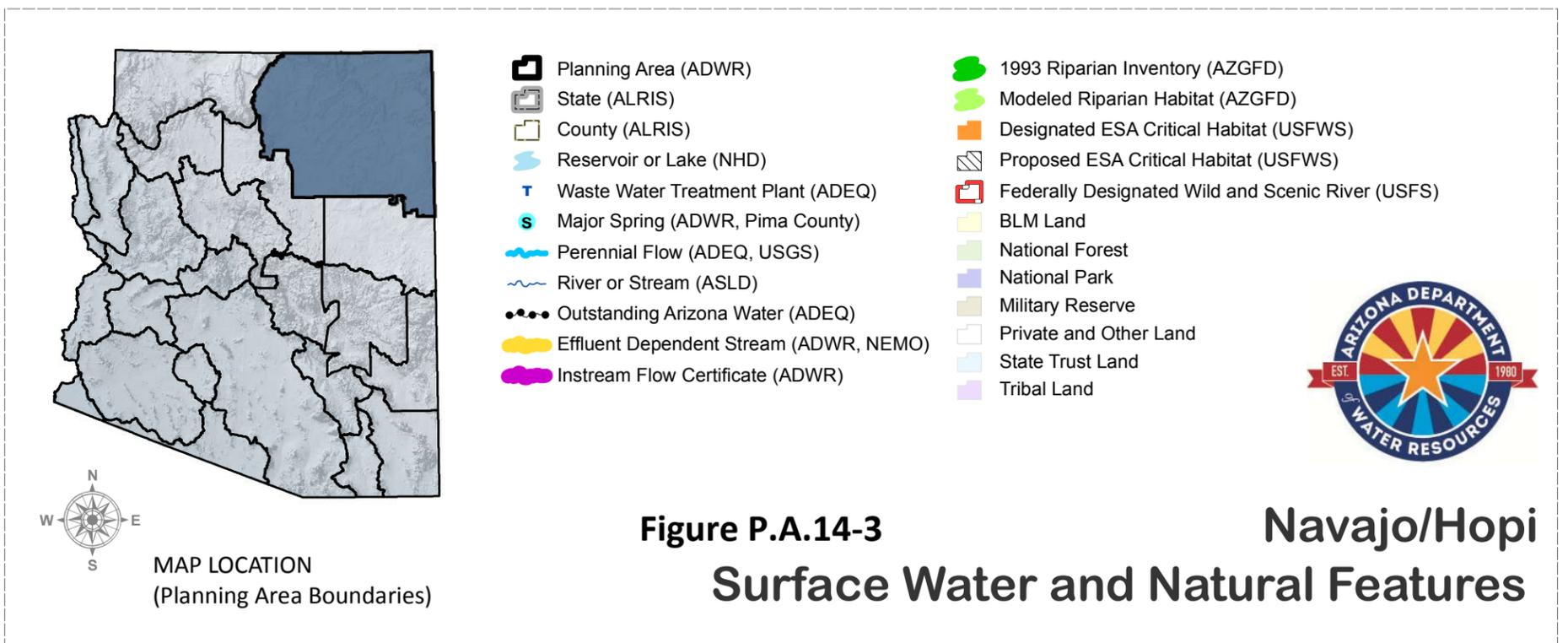
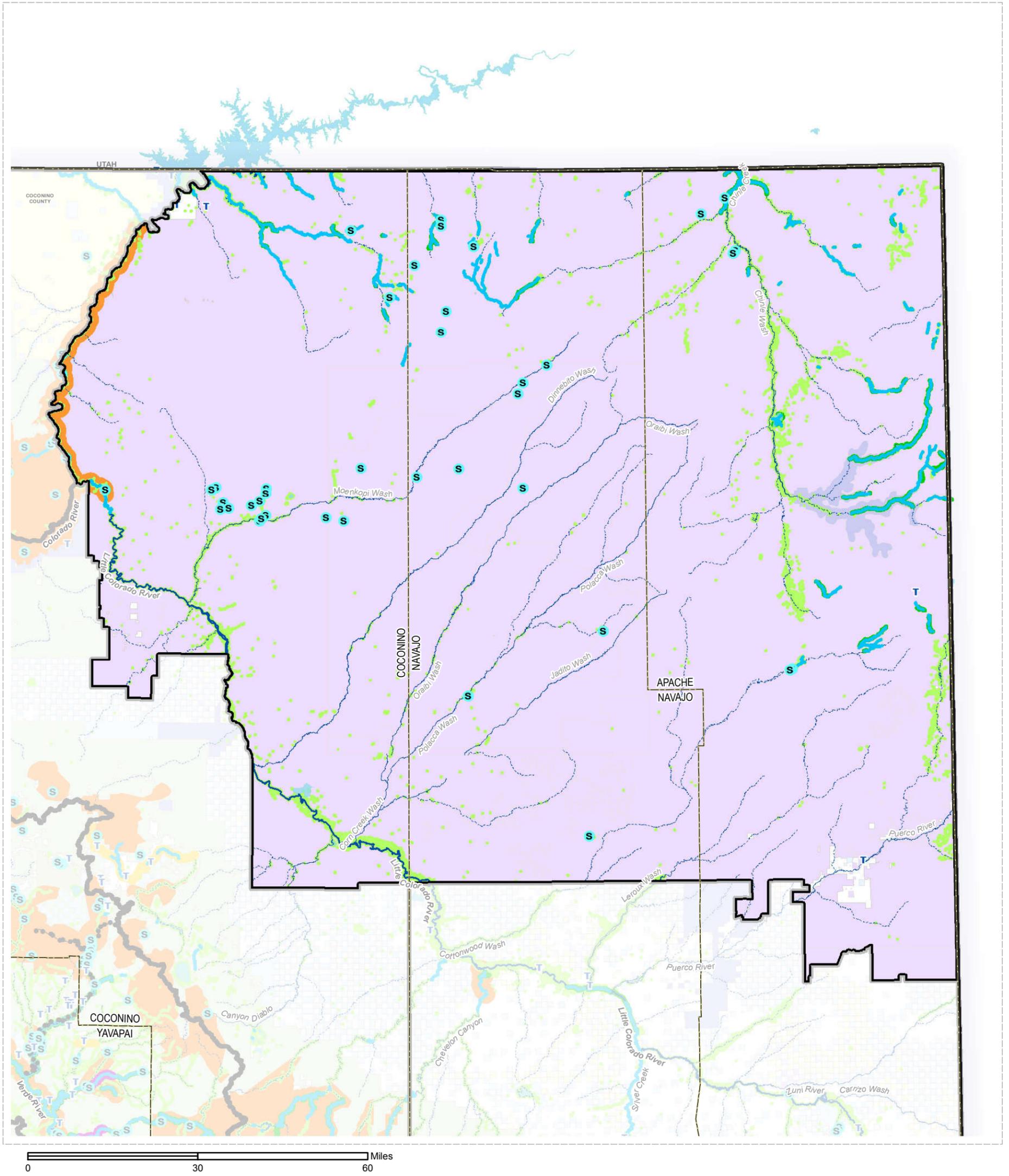
- Planning Area (ADWR)
  - State (ALRIS)
  - County (ALRIS)
  - Groundwater Basin (ADWR)
  - Area of Active Land Subsidence (ADWR)
  - Hard Rock Geology (AZ Bureau of Mines, UofA)
  - Interstate (ADOT)
- Recent Water Level Change \* (1990's through 2000's)
    - Minor WL Change +5' to -5'
    - Negative
    - Positive
- \* Data provided by ADWR



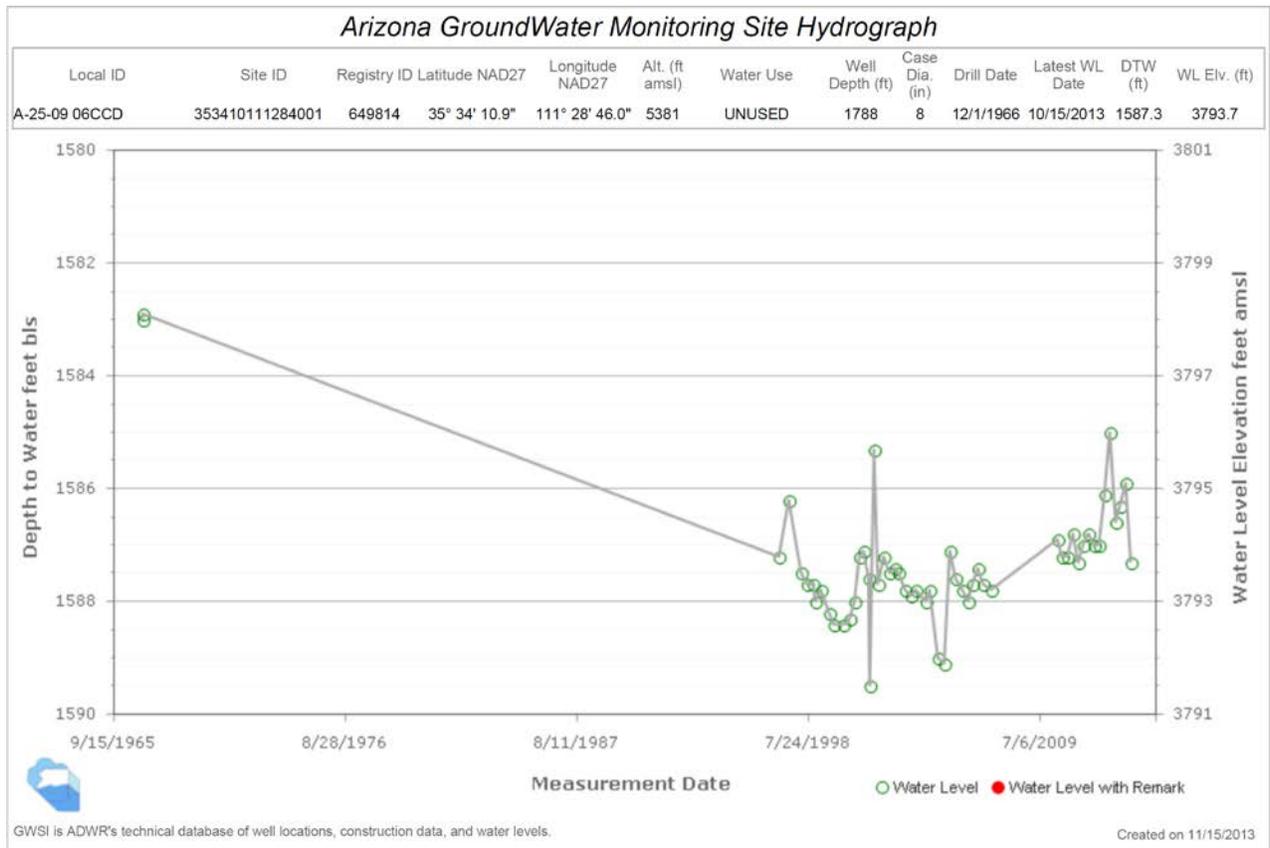
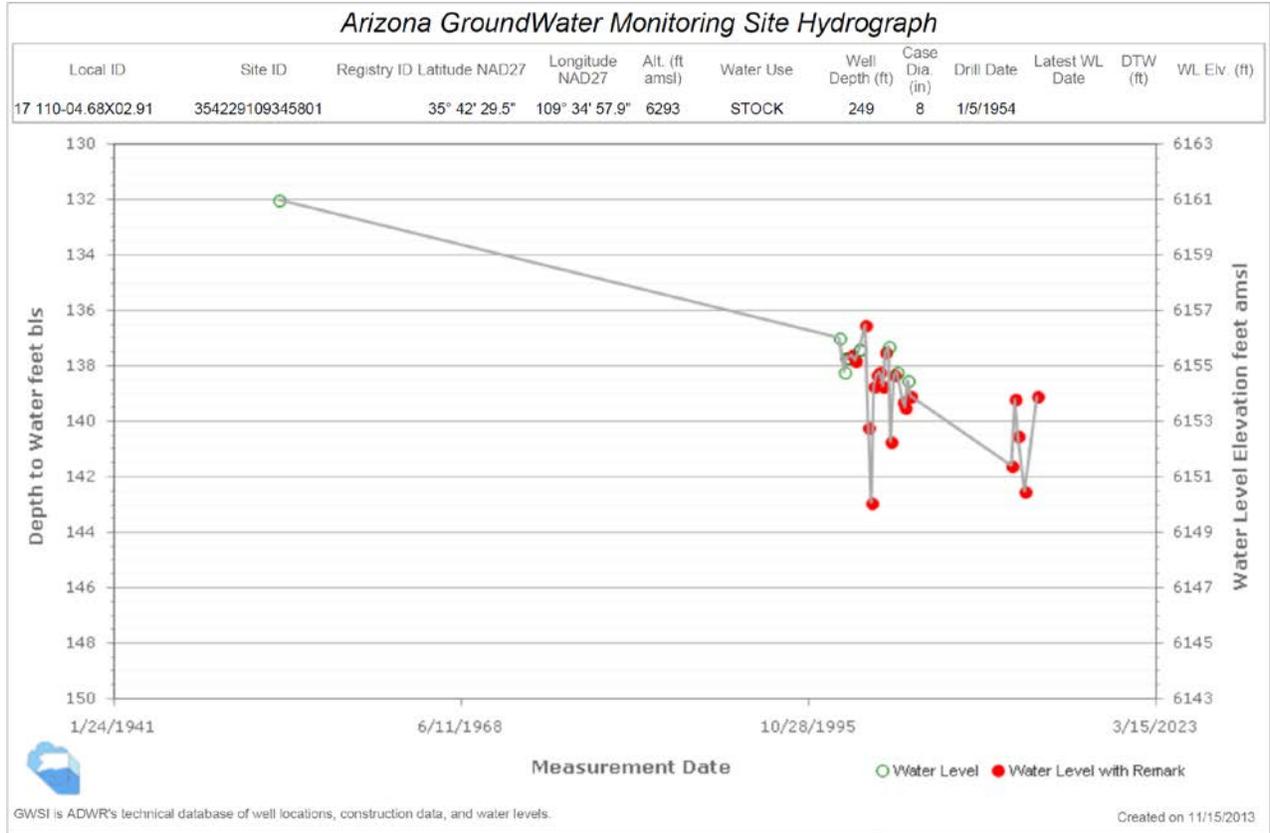
Figure P.A.14-2

# Navajo/Hopi Groundwater Hydrology

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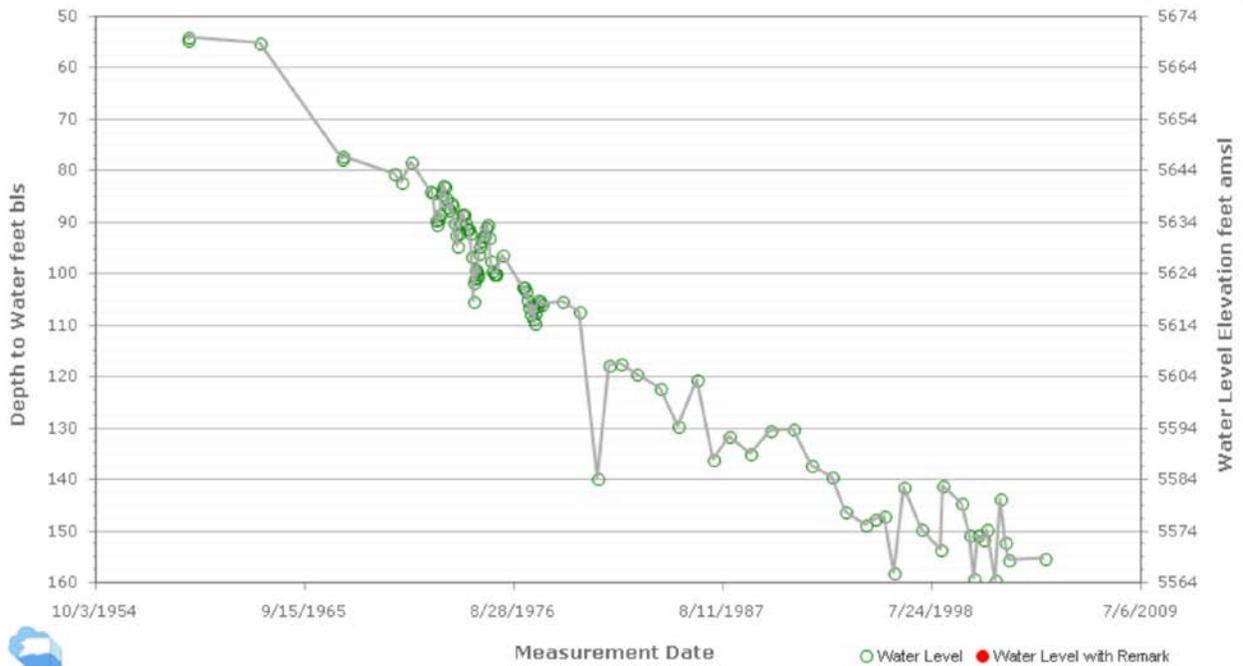


# Little Colorado River Plateau Basin – Navajo/Hopi Planning Area



### Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
08 039-00.70X01.57 B	364338110154601		36° 43' 38.0"	110° 15' 45.0"	5724	UNUSED	868		7/13/1959	6/16/2004	155.1	5568.9

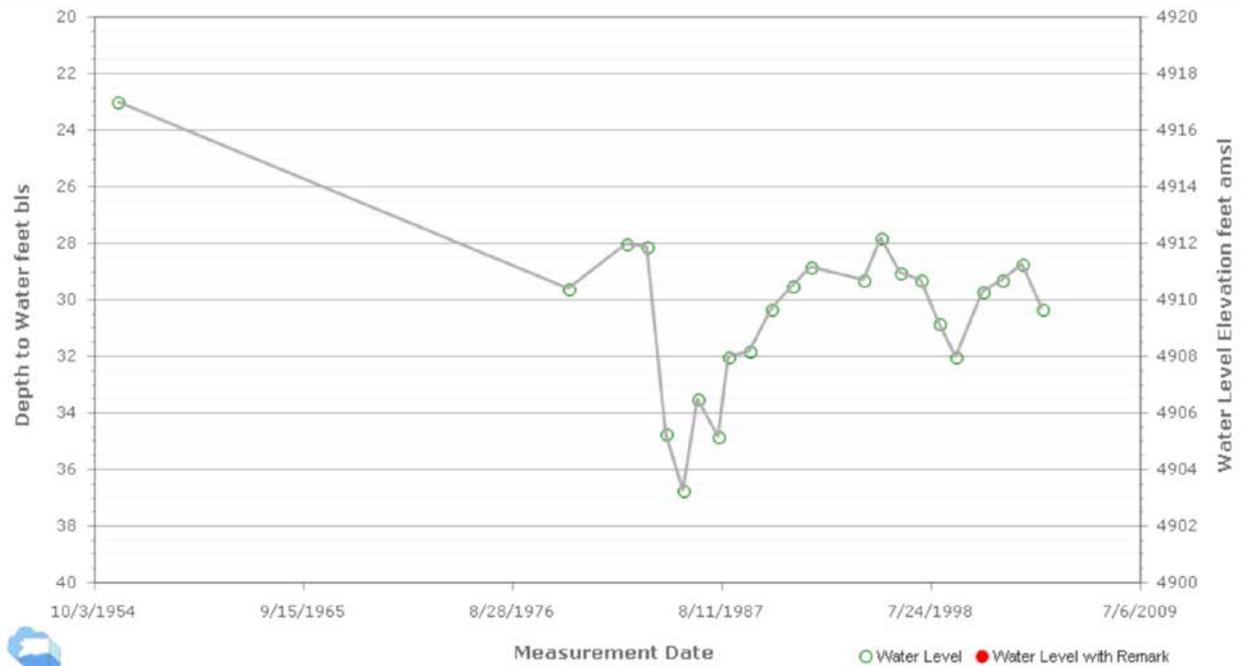


GWSI is ADWR's technical database of well locations, construction data, and water levels.

Created on 11/15/2013

### Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
03 077-13.77X08.52	360734111144801		36° 7' 34.0"	111° 14' 48.0"	4940	DOMESTIC	229	10	12/2/1955	5/10/2004	30.3	4909.7



GWSI is ADWR's technical database of well locations, construction data, and water levels.

Created on 11/15/2013