

Central Plateau Planning Area

Background

The Central Plateau Planning Area is located in the north-central portion of the State. The Planning Area lies entirely within Coconino County. The largest community in the Planning Area is the City of Flagstaff. Other communities include Williams, Valle, Tusayan, and Grand Canyon Village. Much of the remainder of the Planning Area is sparsely populated. There are portions of two groundwater basins within the Planning Area, the Little Colorado River Plateau in the east and the Coconino Plateau in the west.



Important geologic features in the Planning Area include: the Mogollon Rim, which defines the southern border of the Planning Area; the San Francisco Peaks volcanic zone (including Humphreys Peak, the highest point in Arizona at 12,633 feet in elevation), with a number of volcanic cinder cones and the associated caldera considered to be potentially active; and the South Rim of the Grand Canyon National Park.

The Grand Canyon is of great geologic significance, with a record of three of the four eras of geological time, averaging 4,000 feet deep for its entire 277 miles. The Grand Canyon was given federal protection in 1893 and became a National Park in 1919. Receiving almost five million visitors each year, the Park serves not only as one of Arizona's most important economic sites, but is an ecological refuge, with relatively undisturbed remnants of rare ecosystems, including desert riparian communities, and is home to numerous rare, endemic, and federally protected plant and animal species.

The majority of the land in the Planning Area (60 percent) is owned and managed by the USDA Forest Service (Forest Service) including portions of the Kaibab and Coconino National Forests (*see Figure P.A. 5-1*). The National Park Service manages five percent of the land in the Planning Area, including a portion of the Grand Canyon National Park. Seven percent of the lands are State Trust Lands and 17 percent is privately held.

Water Supply Conditions

Groundwater

The Central Plateau Planning Area is located in the Colorado Plateau Physiographic Province. The main productive aquifers in this province are large regional aquifers consisting of sandstone and limestone. Some formations produce relatively little water, while some fracture zones within these sedimentary rocks may be highly productive locally. Such highly productive areas may provide opportunities for limited artificial recharge and recovery.

Groundwater conditions are highly variable across the Planning Area and include portions of the Coconino Plateau and Little Colorado River Plateau groundwater basins (*see Figure P.A. 5-2*). While some shallow perched aquifers exist in the Planning Area, regional aquifers can be deep and production can be highly variable, depending upon location. The City of Flagstaff produces groundwater from several distinct aquifers. The aquifer system in the vicinity of Flagstaff is complex and groundwater flow is poorly understood because of its depth and complex geologic structure. The City of Flagstaff's Woody

Mountain and Lake Mary well fields produce from this aquifer. Water levels in these well fields exhibit seasonal fluctuations and long-term declines due to pumping. Shallower volcanic aquifers, such as the caldera of the San Francisco Peaks, that have historically supplied much of the municipal water for the City of Flagstaff, can be productive.

Water levels in the Planning Area are typically quite deep. Tusayan's water supply plan reports water level depths of 2,347 and 2,425 feet below land surface in two system wells with well yields of 65 to 80 gallons per minute. While water has been found in perched aquifers near Williams at depths less than 950 feet below land surface, yields from these more shallow wells are generally less than five gallons per minute. At Williams, water level depths in three of the four water system wells are between 2,740 and 2,875 feet below land surface. Groundwater levels in the Planning Area are generally declining between 0.5 feet in the Williams area to 1.4 feet per year near Flagstaff.

Surface Water

The Central Plateau Planning area includes important sources of surface water drainage to the Little Colorado, Colorado and Verde River systems (see *Figure P.A. 5-3*). Several perennial streams also occur at the higher elevations in the Planning Area, and are adjacent and tributary to the Little Colorado River in the northeast and the Colorado River at the Grand Canyon in the north. Several regionally important reservoirs are within the Planning Area including the 1,390-acre Dogtown Reservoir operated by the City of Williams and the Lake Mary reservoir system, an important municipal supply for the City of Flagstaff with average yields of approximately 2,250 acre-feet.

Reclaimed Water

Several communities within the Planning Area operate central wastewater collection and treatment facilities. Reclaimed water generated from these facilities is extensively used directly for turf irrigation and at recreational facilities within the Planning Area. For example, the City of Flagstaff uses reclaimed water for landscape watering at schools, parks, cemeteries, golf courses and an athletic field at Northern Arizona University. In addition, a large industrial user, SCA Tissues, which had been Flagstaff's second largest potable water user, converted to 100 percent reclaimed water use in 2005, resulting in a potable water savings of more than 300 acre-feet per year. Flagstaff also has a reclaimed water hauling program that makes Class A+ and Class B reclaimed water available for non-potable uses from four locations throughout the city. The City also uses reclaimed water for recreational facilities, such as the Arizona Snow Bowl ski area for snow making in the winter months. Excess reclaimed water is discharged to Rio de Flag, which eventually percolates into the local aquifer.

Reclaimed water is also used at the Elephant Rock Golf Course in Williams. Reclaimed water generated at the South Grand Canyon Treatment Plant (SGCTP) is used at Tusayan for toilet flushing in hotels and businesses and for landscape irrigation. At Grand Canyon Village, reclaimed water from the SGCTP is reused for toilet flushing, landscape irrigation and other uses, including fire protection. Reclaimed water generated and treated at Valle is used for landscape irrigation and fire protection.

Ecological Resources

A number of listed threatened and endangered species are found in the Central Plateau Planning Area. In addition, several ecologically and economically important protected areas are present or partially located in the Planning Area (see *Figure P.A. 5-3*). The presence of a listed species or protected areas may be a critical consideration in water resource management and supply development. Protected

areas include the Sunset Crater Volcano (northwest of Flagstaff which erupted as recently as 1065 AD) and Wupatki and Walnut Canyon National Monuments near Flagstaff. Wilderness Areas, designated under the 1964 Wilderness Act to preserve and protect the designated area in its natural condition, include the Kachina Peak Wilderness Area located on Mt. Humphrey's (contains the only arctic-alpine vegetation in the state), and the Strawberry Crater and Kendrick Mountain Wilderness Areas. Finally, a portion of the South Rim of the Grand Canyon National Park defines the Central Plateau Planning Area on the north.

Water Demands

Table P.A. 5-1, below, presents the baseline and projected water demands for the Central Plateau Planning Area. The majority of the increased demands projected in this Planning Area reflect the potential municipal growth in this region. However, the projections may not adequately reflect the seasonal demands associated with the tourism that is the backbone of this region's economy.

Table P.A. 5-1. Projected Demands (in acre feet) – Central Plateau Planning Area

Sector	2010	2035	2060
Agriculture	1,962	1,962	1,962
Dairy	0	0	0
Feedlot	539	539	539
Municipal	12,248	15,734	18,522
Other Industrial	3,076	2,960	2,939
Mining	360		
High		450	450
Low		450	450
Power Plants	0		
High		0	0
Low		0	0
Rock Production	67		
High		1,059	1,259
Low		442	524
Turf	449		
High		454	466
Low		432	467
Total (High)	18,702	23,159	26,137
Total (Low)	18,702	22,519	25,404

Characteristics Affecting Future Demands and Water Supply Availability

Conservation, Reuse and Water Supply Development

Because of relatively scarce water supplies in the Central Plateau Planning Area, communities have made extraordinary efforts to conserve existing water supplies, develop new water supplies and reuse existing resources such as reclaimed water and gray water. As mentioned previously, communities in this Planning Area such as the City of Flagstaff, Williams, Grand Canyon Village and Tusayan have implemented measures to conserve existing resources and reuse reclaimed water for multiple purposes. Additionally, a rainwater harvesting system at the Tusayan airport is unprecedented in Arizona. The City

of Williams and Tusayan's well drilling programs are excellent examples of local efforts to improve supply reliability and better utilize available resources. The City of Flagstaff purchased Red Gap Ranch, located approximately 40 miles east of the City, to develop a well field to augment its available supplies and improve its water supply reliability.

Ecological Resources

This Planning Area contains some very significant areas that are not only important ecological resources for Arizona, but also important economic engines for tourism for this region and the State. While there is a need for communities in this Planning Area to develop supplies to meet growing needs and reduce their vulnerability to drought, the impacts to these ecological areas have to be managed such that both the intent for which these areas were established and water supply resiliency and economies of the communities reliant on the tourism are protected.

Strategies for Meeting Future Water Demands

Red Gap Ranch

The City of Flagstaff recently purchased Red Gap Ranch located along the Interstate-40 corridor 40 miles east of the City. The Ranch consists of 8,500 acres of City-owned land checker boarded with 7,500 acres of State Trust Land. Recent investigations have revealed groundwater at the Ranch at depths ranging from 235 to 550 feet below land surface. The Red Gap Ranch project is an example of groundwater development projects that may be explored to reduce vulnerability to drought and augment supplies in the Planning Area. The existence of large tracts of federal lands may limit the ability to construct the facilities necessary to transport water from the areas of water supply development and requires careful planning to reduce impacts to surrounding water uses and water dependent resources. Existing transportation corridors (such as Interstate 40 located parallel to the proposed transmission for the Red Gap Ranch pipeline – owned by the Arizona Department of Transportation) potentially offer the least ecological disturbance to important resources and native American cultural sites and ultimately lower costs to rate payers.

Reclaimed Water Reuse

Many municipalities in the Planning Area currently directly use reclaimed water for irrigation in parks, landscaping and other recreational facilities. Additional uses may be applied to industrial facilities as well as recharge and recovery. Currently, about 20 percent of all water deliveries in Flagstaff are derived from reclaimed water. The City also discharges unused reclaimed water from its two wastewater treatment plants into the Rio de Flag, which has become a reclaimed water dominated stream for approximately one mile from the point of discharge until it infiltrates underground. Groundwater mounding has been observed in this area. Delivering a portion of this reclaimed water to other areas for artificial recharge and recovery may provide opportunities to store this water to supplement summertime needs and reduce the mounding associated with this project.

Weather Modification

In conjunction with groundwater development, weather modification, or cloud seeding, is a potential strategy to either augment local water supplies or mitigate the impacts of groundwater management projects. For example, the mountainous topography within portions of the Planning Area situated along the southern edge of the Colorado Plateau expressing as the Mogollon Rim provides favorable

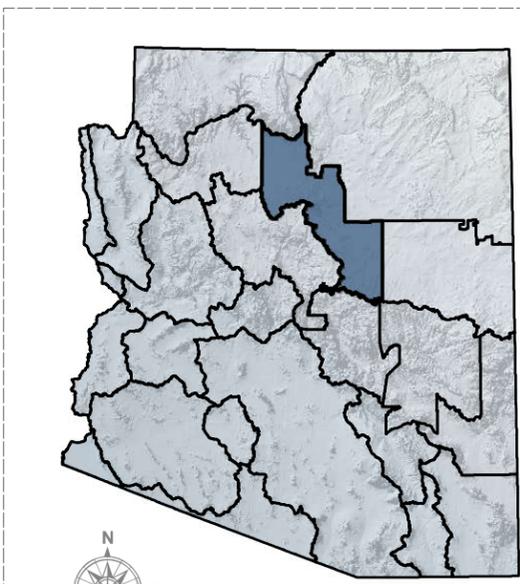
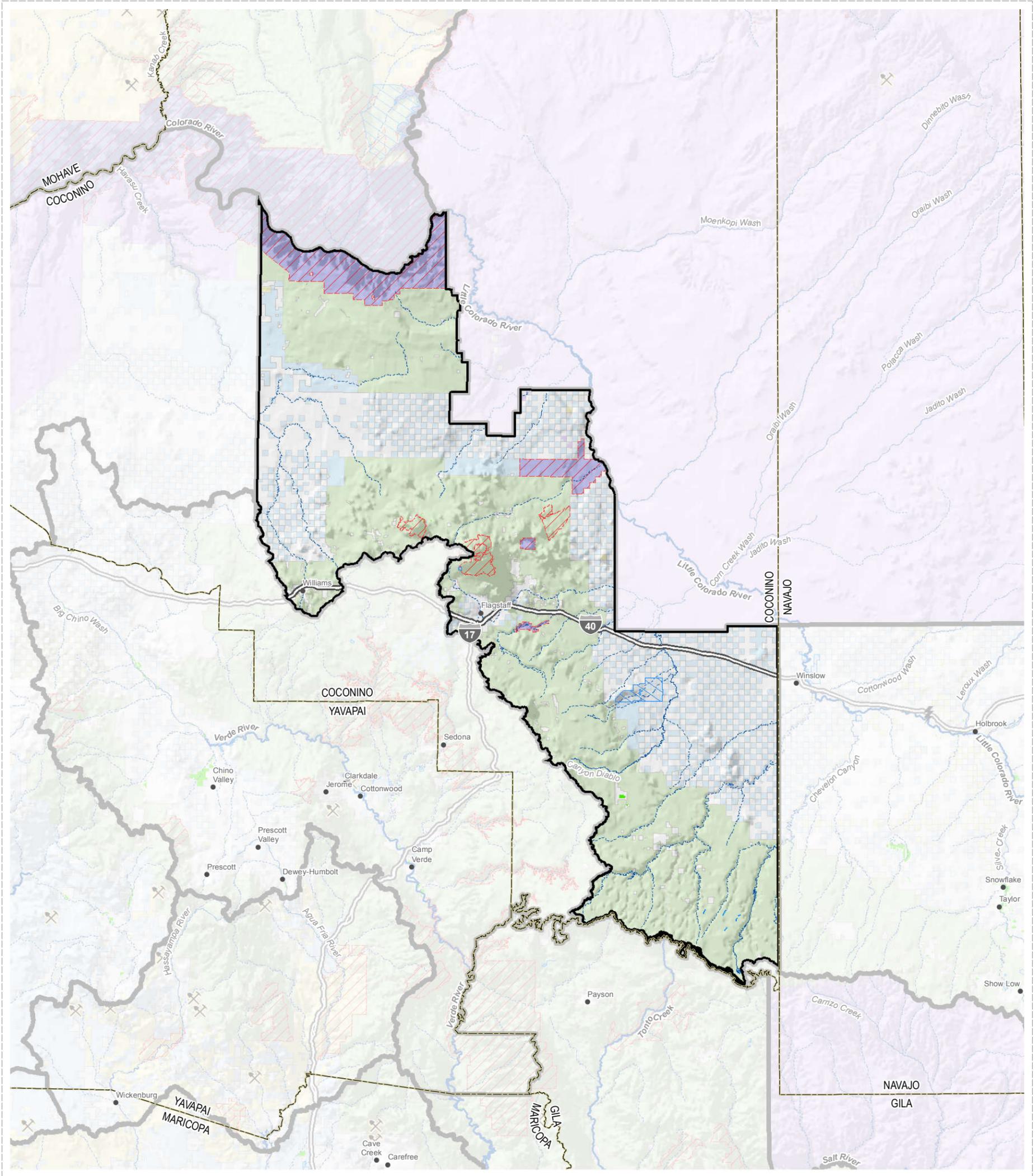
conditions for cloud seeding to increase precipitation and runoff and potentially mitigate impacts from use of supplies that are hydrologically connected to the Verde River.

Watershed/Forest Management

Watershed management practices aimed at increasing watershed yield have been evaluated in Arizona and exhibit promise for success. Due to the significant acreage of forested land in the Central Plateau Planning Area, continuation of this process and implementation of safe and effective strategies are important to water users within and outside of this Planning Area. Combining efforts with other management initiatives (such as the Four Forest Restoration Initiative) may be a cost-effective way to develop this option and provide multiple benefits to this Planning Area and those dependent on its resources. The Four Forest Restoration Initiative (4FRI) is a collaborative effort to restore forest ecosystems on portions of four National Forests - Coconino, Kaibab, Apache-Sitgreaves, and Tonto - along the Mogollon Rim in northern Arizona. The vision of 4FRI is restored forest ecosystems that support natural fire regimes, functioning populations of native plants and animals, and forests that pose little threat of destructive wildfire to thriving forest communities, as well as support sustainable forest industries that strengthen local economies while conserving natural resources and aesthetic values¹.

¹ <http://www.4fri.org/>

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)

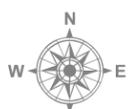
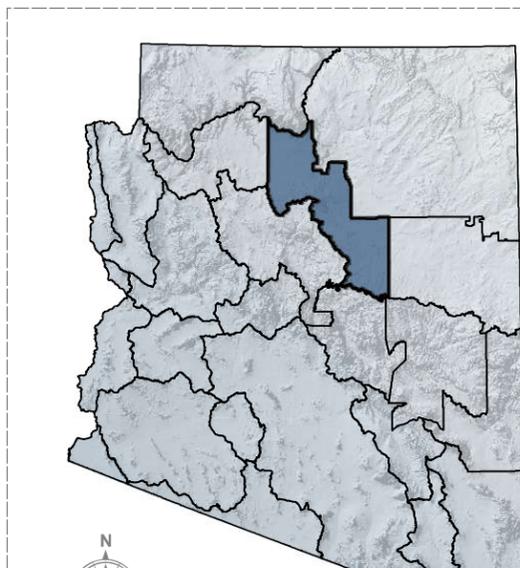
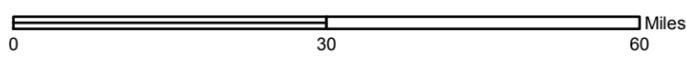
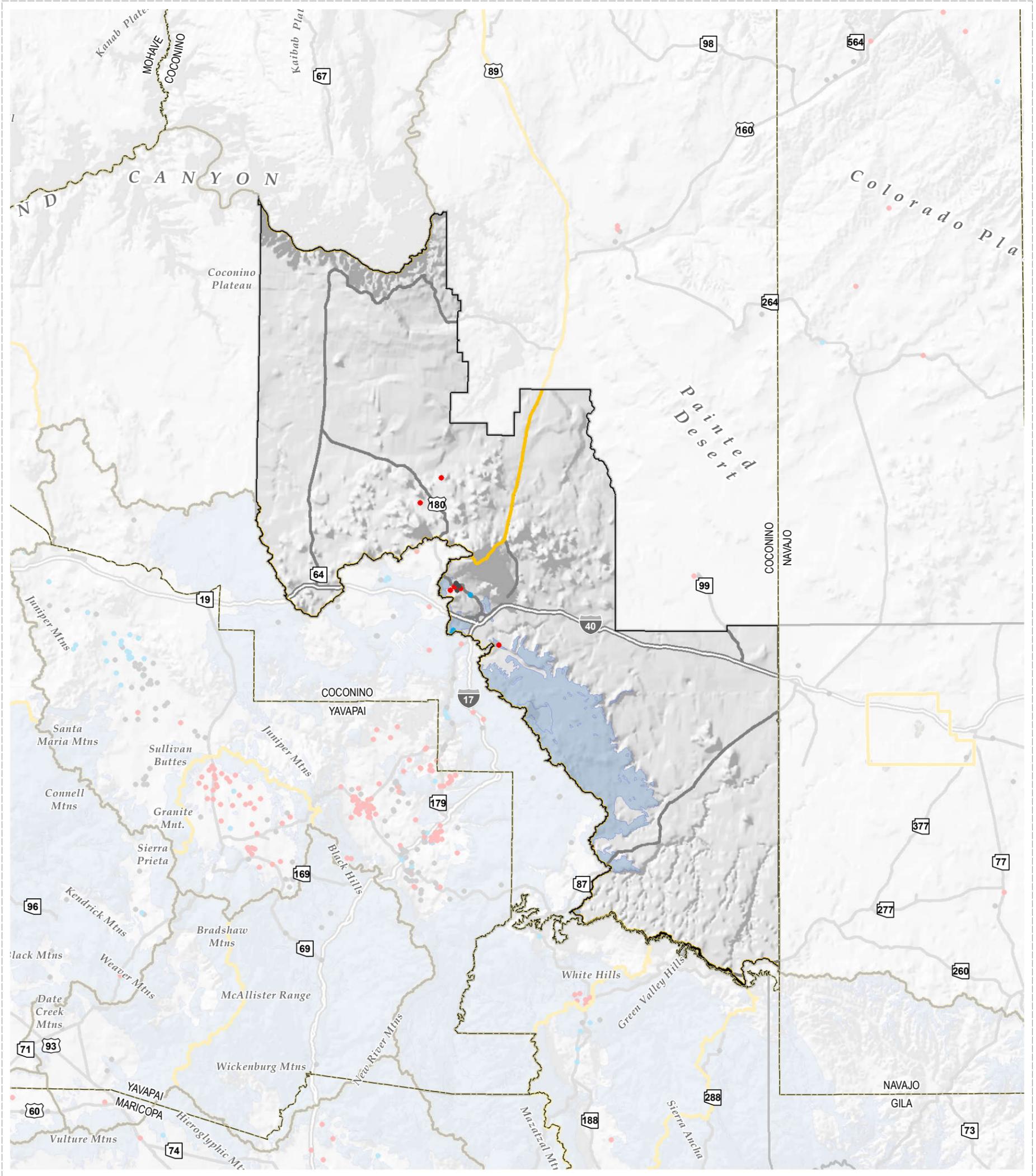
- Planning Area (ADWR)
- State (ALRIS)
- County (ALRIS)
- River or Stream (ASLD)
- Interstate (ADOT)
- Population Center (GNIS)
- Mine (ADMMR, ADWR)
- Hydroelectric Power Plant (ADEQ, ADWR)
- Thermoelectric Power Plant (ADEQ, ADWR)
- Agriculture (SWReGAP, 2004)
- Federal Conservation Land (USFS, BLM,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



Central Plateau Land Ownership

Figure P.A.5-1

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MAP LOCATION
(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

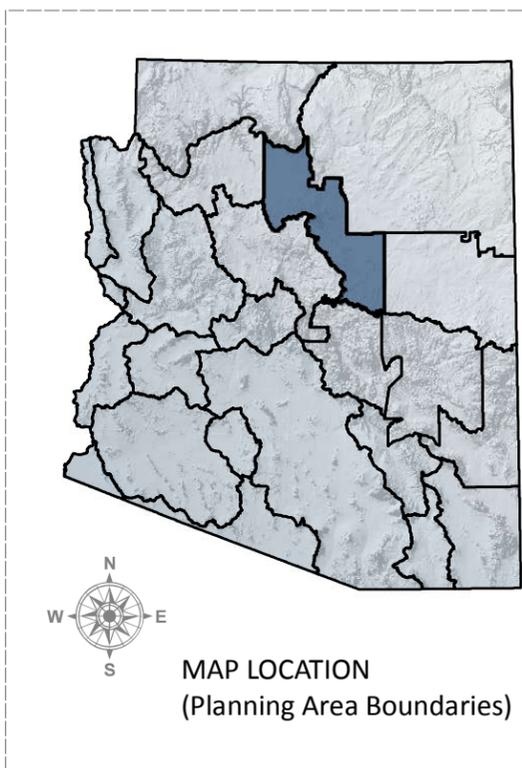
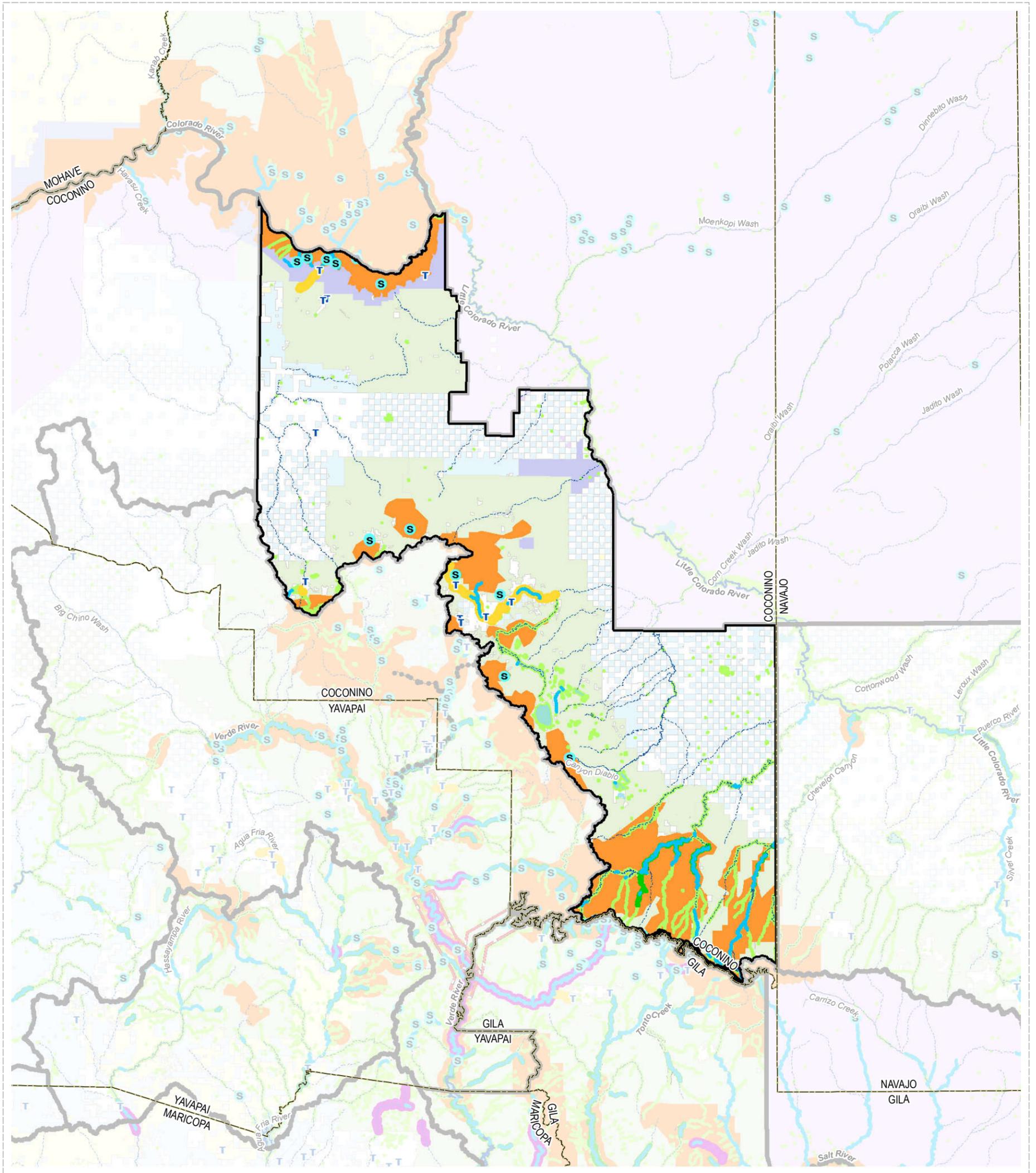
* Data provided by ADWR



Figure P.A.5-2

Central Plateau Groundwater Hydrology

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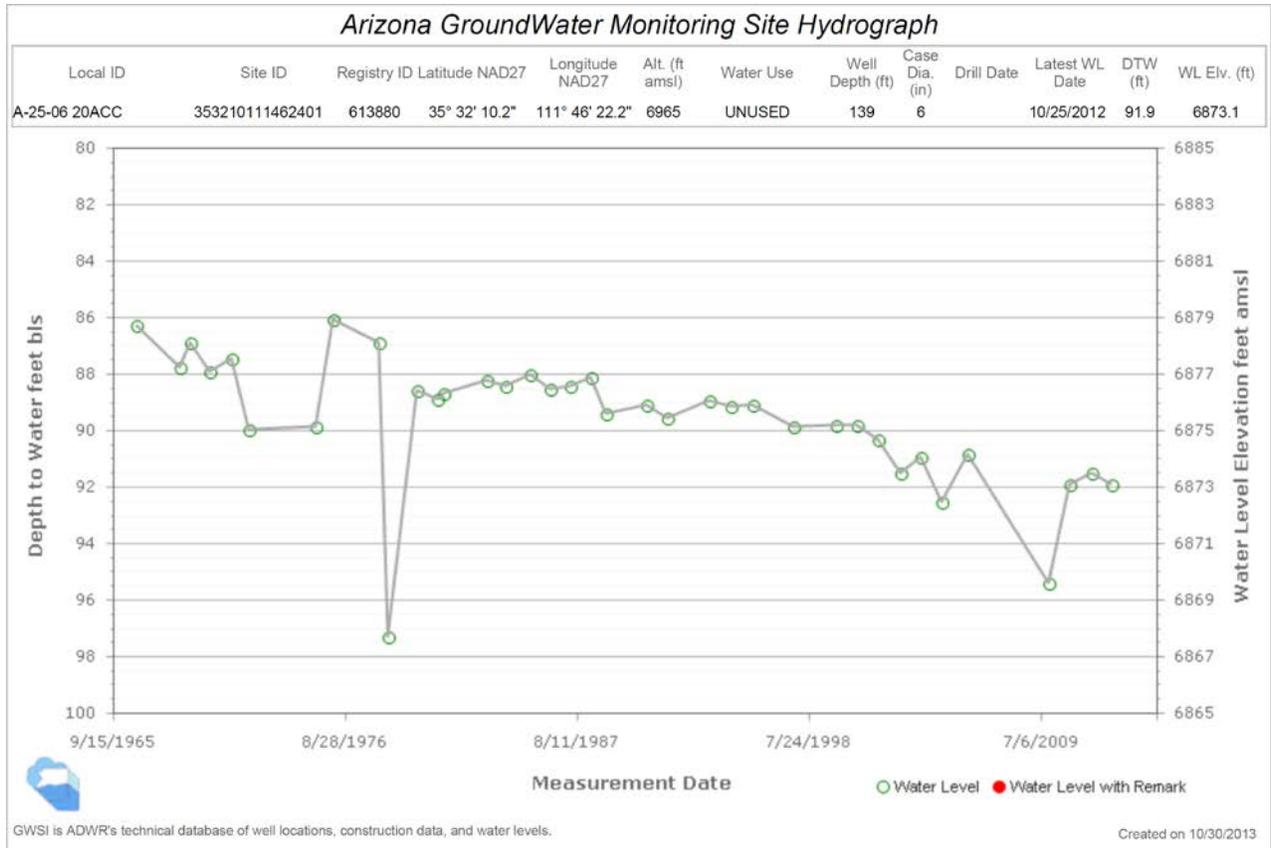


- Planning Area (ADWR)
- State (ALRIS)
- County (ALRIS)
- Reservoir or Lake (NHD)
- Waste Water Treatment Plant (ADEQ)
- Major Spring (ADWR, Pima County)
- Perennial Flow (ADEQ, USGS)
- River or Stream (ASLD)
- Outstanding Arizona Water (ADEQ)
- Effluent Dependent Stream (ADWR, NEMO)
- Instream Flow Certificate (ADWR)
- 1993 Riparian Inventory (AZGFD)
- Modeled Riparian Habitat (AZGFD)
- Designated ESA Critical Habitat (USFWS)
- Proposed ESA Critical Habitat (USFWS)
- Federally Designated Wild and Scenic River (USFS)
- BLM Land
- National Forest
- National Park
- Military Reserve
- Private and Other Land
- State Trust Land
- Tribal Land



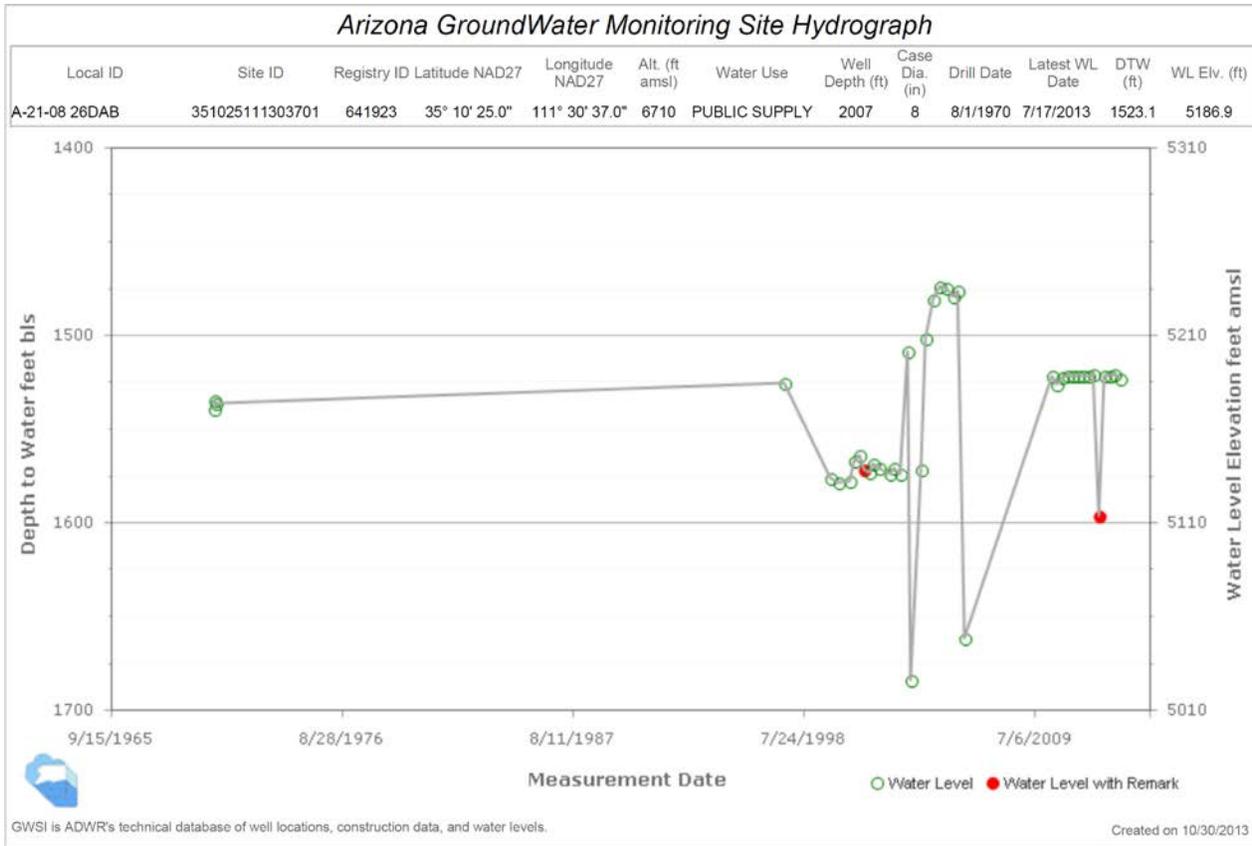
Figure P.A.5-3
Central Plateau
Surface Water and Natural Features

Coconino Plateau Basin – Central Plateau Planning Area

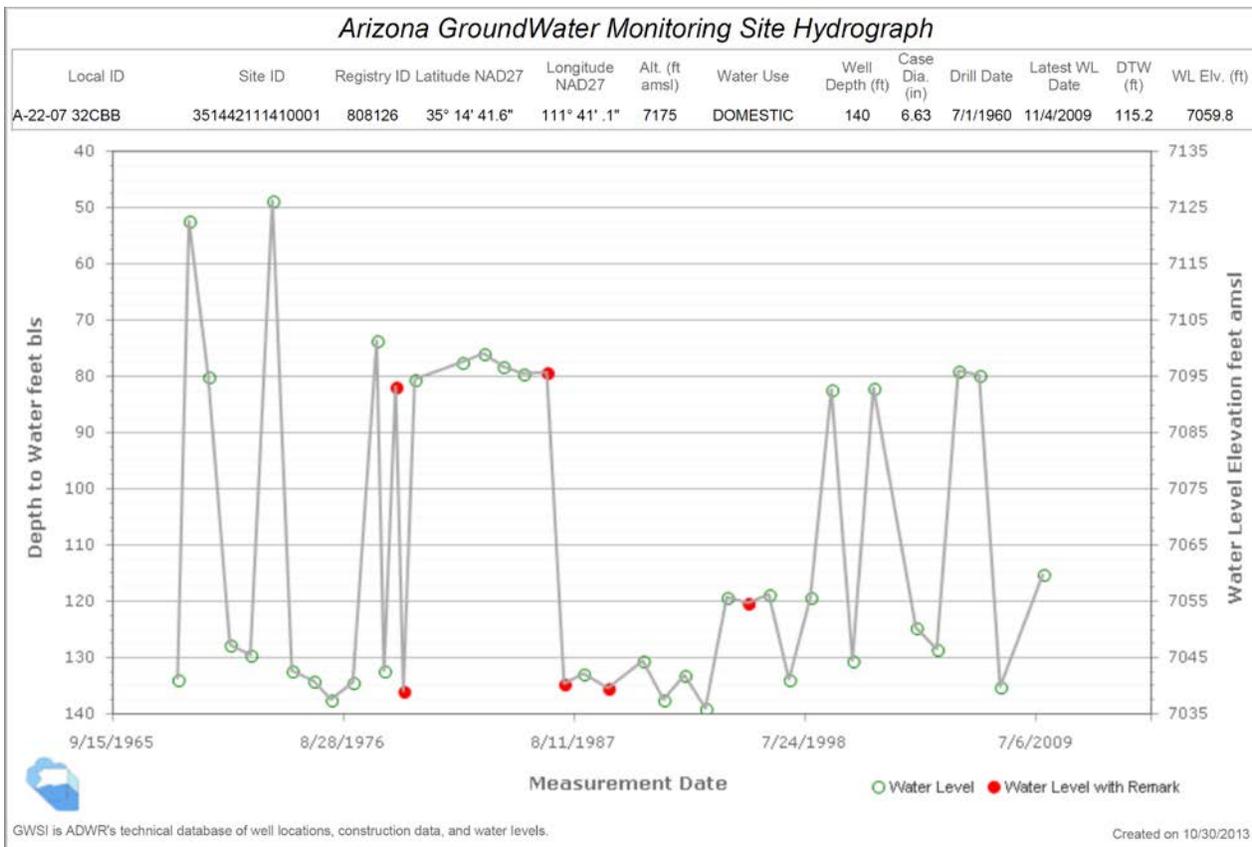


A-25-06 20ACC Coconino Plateau basin about 22 miles SE of Valle.

Little Colorado River Plateau Basin – Central Plateau Planning Area



A-21-08 26DAB Little Colorado River Plateau basin at Walnut Canyon National Monument.



A-22-07 32CBB Little Colorado River Plateau basin along Rio de Flag about 3.7 miles NW of Flagstaff.