

**Appendix I**  
**List of USDWs on the Navajo Nation**

Background

An underground source of drinking water ("USDW"), as defined in §101.5 of the Navajo Nation UIC Regulations, is:

an aquifer or portion of an aquifer:

1. which supplies any public water system; or
2. which contains a sufficient quantity of groundwater to supply a public water system; and
  - i. currently supplies drinking water for human consumption; or
  - ii. contains fewer than 10,000 mg/l total dissolved solids; and
3. which is not an exempted aquifer.

The Navajo Nation has a surface area of about 25,000 square miles or 16,000,000 acres. The entire Navajo Nation falls within the south-central portion of the Colorado Plateau physiographic province. Within this Colorado Plateau area, three distinct structural basins developed: 1) San Juan Basin, New Mexico; 2) Paradox Basin, Southeastern Utah; and 3) Black Mesa Basin, Northeastern Arizona. Igneous and metamorphic basement rocks of Precambrian age underlie the sedimentary rocks at depths ranging from 1,000 to 15,000 feet below the surface. Sedimentary rocks range in age from Cambrian to Tertiary, but Permian and younger rocks are exposed in 96% of the area. USDWs can be encountered at the surface outcrop but also occur below the surface, as long as the total dissolved solids of the aquifer are less than 10,000 mg/l and the aquifer otherwise conforms to the definition of a USDW at §101.5 of the NNUIC Regulations. The Director has identified the following USDWs within the Navajo Nation:

A. USDWs in the San Juan Basin, N.W. New Mexico

The San Juan Basin is the structural depression covering approximately 30,000 square miles of Northwest New Mexico and a small portion of Southwestern Colorado. Maximum structural relief was reported by Kelley (1950) as 10,000 feet in San Juan Basin. The maximum stratigraphic thickness encountered to date is 14,423 feet in a drill hole near the structural center of the basin. It is estimated that two million acre-feet of fresh (less than 1,000 mg/l total dissolved solids) to slightly saline (1,000 mg/l to 3,000 mg/l of total dissolved solids) water could be recovered from the confined aquifers of the San Juan Basin.

Below is a list of aquifers, the geologic age of the aquifers, and the depth to the aquifer.

**Underground Sources of Drinking Water in the San Juan Basin, NW New Mexico**

<b>AQUIFER (USDWs)</b>	<b>GEOLOGIC AGE</b>	<b>DEPTH TO AQUIFER</b>
Valley Fill	Quaternary Age	Surface to 100 Feet
Chuska Sandstone	Eocene/Oligocene Age	Surface to 1,800 Feet
San Jose Formation	Eocene Age	Surface to 2,700 Feet
Nacimiento/Animas Fms.	Paleocene Age	Surface to 2,660 Feet

Ojo Alamo Sandstone	Paleocene Age	Surface to 3,645 Feet
Kirtland Shale/Fruitland Fm. Feet	Cretaceous Age	Surface to 3,000
Pictured Cliffs Sandstone	Cretaceous Age	Surface to 4,130 Feet
Cliff House Sandstone	Cretaceous Age	Surface to 6,150 Feet
Menefee Formation	Cretaceous Age	Surface to 6,262 Feet
Point Lookout Sandstone	Cretaceous Age	Surface to 6,400 Feet
Crevasse Canyon Formation	Cretaceous Age	Surface to 3,200 Feet
Gallup Sandstone	Cretaceous Age	Surface to 4300 Feet
Dakota Sandstone	Cretaceous Age	Surface to 8500 Feet
Morrison Formation	Jurassic Age	Surface to 8900 Feet
Bluff-Cow Springs Sandstone	Jurassic Age	Surface to 9000 Feet
Entrada Sandstone	Jurassic Age	Surface to 9300 Feet

References:

W.J. Stone, et al., 1983, Hydrogeologic and Water Resources of San Juan Basin, New Mexico, New Mexico Bureau of Mines and Mineral Resources Hydrologic Report 6

M.E. Cooley, et al., 1969, Regional Hydrogeology of the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, USGS Professional Paper 521-A

B. USDWs in the Paradox Basin, San Juan County, Utah

The Paradox Basin is located in Southeastern Utah in an area covering approximately 15,000 square miles. Maximum known thickness of the sedimentary section is about 10,000 feet. The Paradox Basin is an elongate, asymmetric, northwest-trending depositional trough, filled with Late Paleozoic and Early Mesozoic sedimentary rocks.

**Underground Sources of Drinking Water in the Paradox Basin, San Juan County, Utah**

AQUIFER (USDWs)	GEOLOGIC AGE	DEPTH TO AQUIFER
D Aquifer Burro Canyon Fm., Dakota Sandstone	Cretaceous Age	Surface to 500 Feet
M Aquifer (Bluff Ss., Salt Wash, Recapture, and Westwater Canyon Members of the Morrison Fm.)	Jurassic Age	Surface to 1,000 Feet
N Aquifer (Wingate Ss., Kayenta Fm., Navajo Ss., Carmel Fm., and Entrada Ss.)	Jurassic Age	Surface to 2,500 Feet
C Aquifer (De Chelley Sandstone)	Permian Age	Surface to 3,000 Feet
P Aquifer (Cutler Formation)	Permian Age	Surface to 3,500 Feet

Redwall Aquifer (Leadville Molas Pinkerton Trail, and Honaker Trail Fms.)	Mississippian and Pennsylvanian Ages	Surface to 4,000 Feet
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References:

Mike Lowe, 1996, Ground-Water Resources of the San Juan Basin in Utah Geological Association Guidebook Geology and Resources of the Paradox Basin

R.W. Gloyn, et al, 1995, Mineral, Energy, and Ground-Water Resources of San Juan County, Utah, Utah Geological Survey Special Study 86

M.E. Cooley, et al, 1969, Regional Hydrogeology of the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, USGS Professional Paper 521-A

C. USDWs in the Black Mesa Basin and Colorado Plateau area, Northeastern Arizona

Below is a list of aquifers in the Black Mesa Basin and Colorado Plateau area of Northeastern Arizona.

AQUIFER	GEOLOGIC AGE	DEPTH TO AQUIFER
Mesaverde Aquifer	Upper Cretaceous	Surface to 800 Feet
Dakota-Glen Canyon Aquifer (Dakota Fm, Morrison Fm, Entrada Fm.)	Lower Cretaceous/ Upper Jurassic	Surface to 2,000 Feet
Coconino - De Chelly Aquifer	Early Permian	Surface to 5,000 Feet

References:

Akers, J.P., and Harshbarger, J.W., 1958, Ground Water in Black Mesa Basin and Adjacent Areas in New Mexico Geological Society Guidebook Black Mesa Basin - Northeastern Arizona

M.E. Cooley, et al, 1969, Regional Hydrogeology of the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, USGS Professional Paper 521-A