ADEQ
Arizona Department of Environmental Quality
Janice K. Brewer, Governor
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FACT SHEET

Ambient Groundwater Quality of the Dripping Springs Wash Basin: A 2004-2005 Baseline Study – June 2011

INTRODUCTION

A baseline groundwater quality study of the Dripping Springs Wash basin was conducted in 2004-2005 by the Arizona Department of Environmental Quality (ADEQ) Ambient Groundwater Monitoring Program. ADEQ conducted this monitoring pursuant to Arizona Revised Statutes §49-225 that calls for ongoing monitoring of waters of the state including its aquifers. The fact sheet is a synopsis of the ADEQ Open File Report OFR 10-02.[1]

The Dripping Springs Wash groundwater basin encompasses approximately 445 square miles in a remote area of central Arizona (Figure 1) south of the town of Globe.[2] The sparsely populated basin, which has no communities located within it, is traversed by Arizona Highway 77. The western and southern portions of the basin are located in Pinal County, the northern portion is in Gila County, and the eastern portion is in Graham County (Map 1).

Roughly the eastern half of the Dripping Springs Wash basin is located within lands of the San Carlos Apache tribe and was not sampled as part of this study. The western half of the basin consists of a combination of Bureau of Land Management, State Trust, Forest Service and private lands. Only scattered domestic residences are found on private parcels mainly located along the Dripping Springs Wash. Groundwater is the primary source for domestic and stock water supply within the basin.[2]

GROUNDWATER CHARACTERISTICS

The basin is located in a mountainous area that contains small, sediment-filled valleys which store only minor amounts of groundwater.[2] The largest of the valleys is drained by the Dripping Springs Wash (Figure 2) which is a tributary to the Gila River. The Gila River enters the basin from the east just down gradient of Coolidge Dam and splits the basin roughly in half, flowing from the northeast to southwest. This perennial stream is controlled by releases from Coolidge Dam to meet downstream legal obligations.

The main source of groundwater, and where most well drilling has occurred in the basin, is the alluvium of the Dripping Springs Wash. Three hydrologic units are found in the drainage: younger alluvium, the Gila Conglomerate (or older alluvium) and consolidated rocks.[2] The major water producing unit is the younger alluvium that consists of mostly sand, silt and a small amount of gravel to a depth of around 150 feet below land surface. The younger alluvium has been tapped by wells that are used mainly for domestic and stock purposes (Figure 3). The older alluvium consists of stream deposits containing gravel and sand as well as lake deposits consisting of clay, silt, tuff and gypsum. The consolidated rocks, which make up the surrounding mountains, contain only minor amounts of groundwater and issue less than two gallons per minute to springs in the basin (Figure 4).[2]

Figure 1. The basin looking down-gradient toward the alluvium of Dripping Springs Wash. The image illustrates the remoteness and pristine nature of the region.

Groundwater movement, in both the northern half and southern half of the basin, is towards the center where outflow occurs along the Gila River. Groundwater storage in the basin, to a depth of 1,200 feet below land surface, is estimated at 0.15 million acre feet.[2]

METHODS OF INVESTIGATION

This ADEQ study is the first comprehensive examination of the groundwater quality of the Dripping Springs Wash basin. Since the eastern half of the basin is located within lands of the San Carlos Apache tribe, the study was designed to characterize the groundwater quality of the western portion of the Dripping Springs Wash basin.

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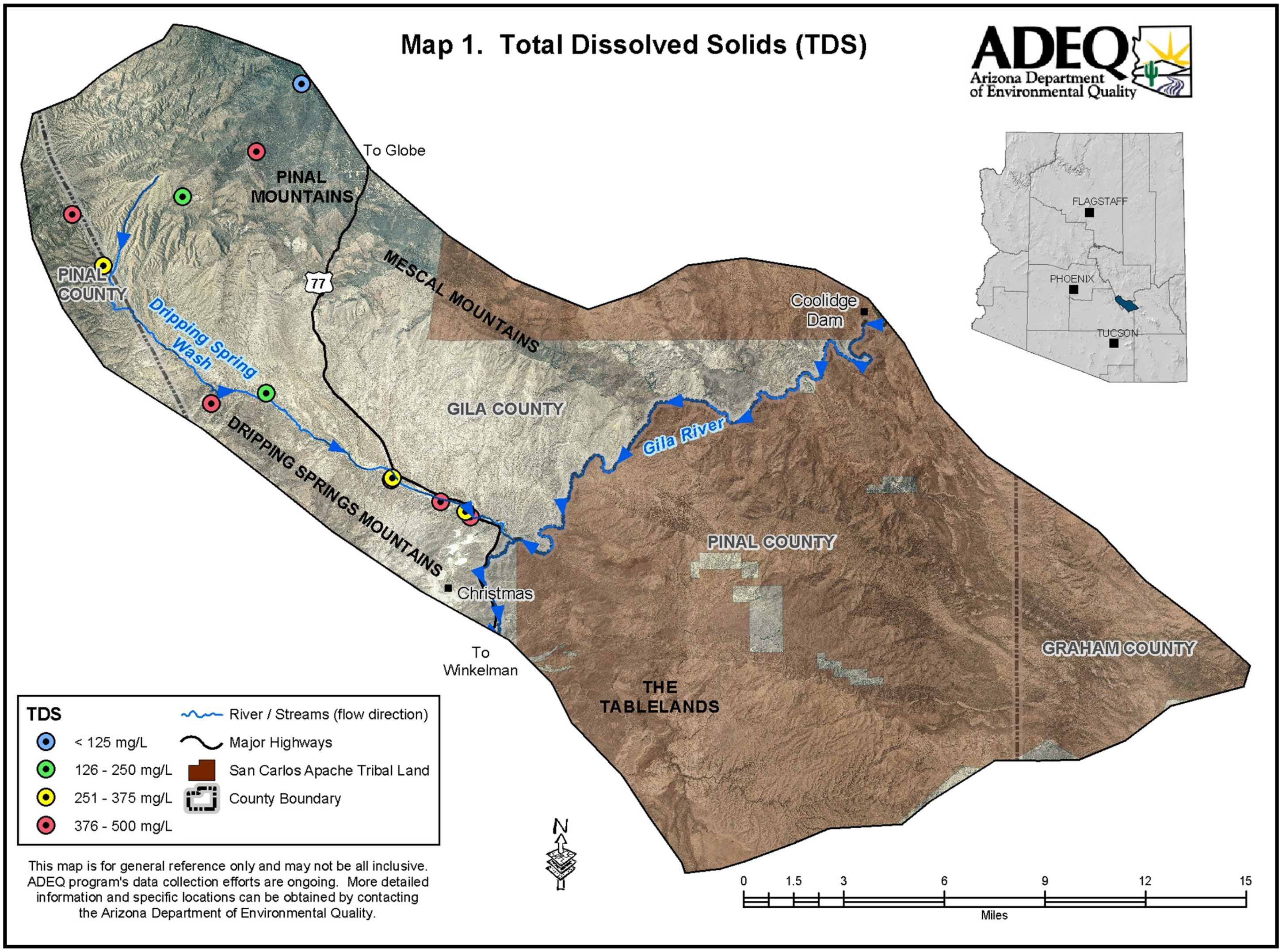

Map 1 – Sample sites in the Dripping Springs Wash basin are color-coded according to their Total Dissolved Solids (TDS) concentrations.

Samples were collected from 12 sites consisting of 7 domestic and or stock wells and 5 springs. Inorganic constituents and oxygen and deuterium isotopes were collected at all sites. At selected sites, radon (7 sites) and radiochemistry (7 sites) samples were also collected. Two (2) additional surface water sites were sampled for isotopes.

Sampling protocol followed the *ADEQ Quality Assurance Project Plan*. The effects of sampling equipment and procedures were not found to be significant based on seven quality assurance/quality control tests.[3]

WATER QUALITY SAMPLING RESULTS

Groundwater sample results were compared with the Safe Drinking Water Act (SDWA) water quality standards. Public water systems must meet these enforceable, health-based, water quality standards, called Primary Maximum Contaminant Levels (MCLs), when supplying water to their customers. Primary MCLs are based on a daily lifetime (70 years) consumption of two liters of water.[4] Of the 12 sites sampled, all had constituent concentrations that met Primary MCLs.

Groundwater sample results were also compared with SDWA water quality guidelines. Public water systems are encouraged to meet these unenforceable, aesthetics-based water quality guidelines, called Secondary MCLs, when supplying water to their customers. Water exceeding Secondary MCLs may be unpleasant to drink and/or create unwanted cosmetic or laundry effects but is not considered a health concern.[4] Of the 12 sites samples, all had constituent concentrations that met Secondary MCLs.

Radon is a naturally occurring, intermediate breakdown product from the radioactive decay of uranium-238 to lead-206. Of the 7 sites sampled for radon, none exceeded the proposed 4,000 picocuries per liter (pCi/L) standard that would apply if Arizona establishes an enhanced multimedia program to address the health risks from radon in indoor air. Six (6) sites exceeded the proposed 300 pCi/L standard that would apply if Arizona doesn't develop a multimedia program.[4]

Figure 2. The Dripping Springs Wash, shown at the Dripping Springs Road crossing, is an ephemeral waterway. Most wells in the basin draw water from the alluvium associated with the wash..

GROUNDWATER CHEMICAL COMPOSITION

Groundwater in the Dripping Springs Wash basin was predominantly of calcium-bicarbonate or mixed-bicarbonate chemistry (Figure 5). Levels of pH-field were *slightly alkaline* (above 7 su) at 9 sites, *slightly acidic* (below 7 su) at 3 sites. TDS concentrations were considered *fresh* (below 1,000 mg/L) at 12 sites (Map 1). Hardness concentrations were *soft* (below 75 mg/L) at 1 site, *moderately hard* (75 – 150 mg/L) at 1 site, *hard* (150 – 300 mg/L) at 6 sites, and *very hard* (above 300 mg/L) at 4 sites.

Nitrate concentrations were divided into natural background (0 sites at <0.2 mg/L), may or may not indicate human influence (11 sites at 0.2 – 3.0 mg/L), may result from human activities (1 site at 3.0 – 10 mg/L), and probably result from human activities (0 sites >10mg/L).[5]

Figure 3 – Most wells sampled for the study are shallow wells tapping the younger alluvium of the Dripping Springs Wash.

Most trace elements such as antimony, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and thallium were rarely–if ever—detected. Only fluoride and zinc were detected at more than 20 percent of the sites.

GROUNDWATER PATTERNS

Statistically significant groundwater quality patterns were found between sample sites consisting of wells located in the alluvium of Dripping Springs Wash and the six sites located up-gradient in consolidated rock that predominantly consisted of springs. Comparing these two groups, the sample sites in the alluvium exhibited significantly higher concentrations of temperature, sodium, and nitrate (Figure 6) than sample sites in the up-gradient, hard rock areas; the opposite pattern occurred with potassium (Kruskal-Wallis test, $p \leq 0.05$).

CONCLUSIONS

Interpretation of the analytical results of the 12 samples indicates that groundwater in the Dripping Springs Wash basin meets drinking water standards and is suitable for domestic, stock, municipal and irrigation purposes. [4]

The few groundwater quality patterns that were found in the basin appear to be of minor importance and probably result from both natural and anthropogenic causes. In down-gradient areas of alluvial basins, the dominant cation often evolves from calcium to sodium. This would explain the significantly higher sodium concentrations found along Dripping Springs Wash compared to sampled springs located up-gradient in consolidated rock.[6] There is more residential and ranch development in down-gradient alluvial areas along Dripping Springs Wash; impacts from domestic septic systems and livestock likely affect the significantly higher nitrate concentrations found in this area.

Figure 4 – Walnut Spring, located in the Dripping Springs Mountains, supplies water for livestock use.

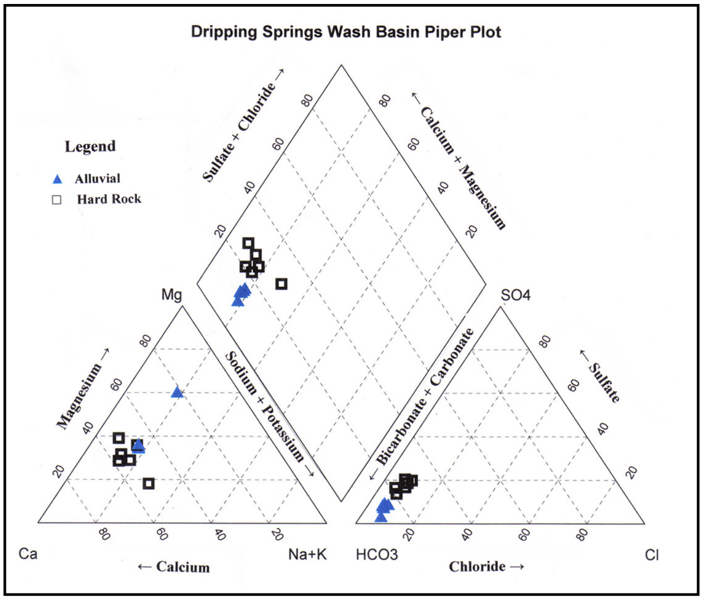

Figure 5 – Sample sites in the Dripping Springs Wash basin had a fairly uniform chemical composition consisting predominantly of calcium-bicarbonate or mixed-bicarbonate water chemistry.

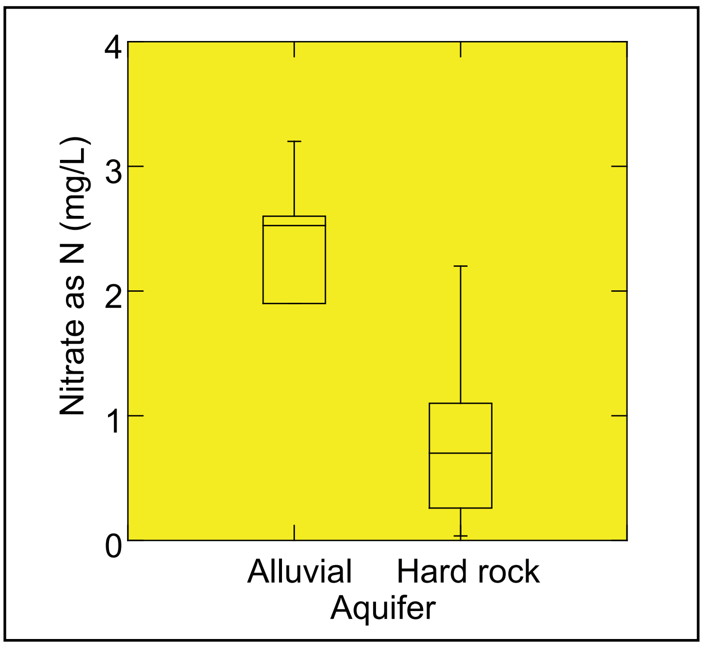

Figure 6 - Samples collected from wells in the alluvium along the Dripping Springs Wash, where most development has occurred, had significantly higher nitrate concentrations than samples collected predominantly from springs issuing from consolidated rock in remote, up-gradient locations (Kruskal-Wallis test, $p \leq 0.05$).

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Web site:
azdeq.gov/environ/water/assessment/ambient.html#studies

Maps by Jean Ann Rodine

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1 Towne, D.C., 2010, Ambient groundwater quality of the Dripping Springs Wash basin: A 2008-2009 baseline study: Arizona Department of Environmental Quality Open File Report OFR 10-02 p.

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