WESTERN RESOURCE ADVOCATES

PROTECTING THE WEST'S LAND, AIR, AND WATER

Water Demand and Conservation Potential of Verde Valley Wells

EXECUTIVE SUMMARY

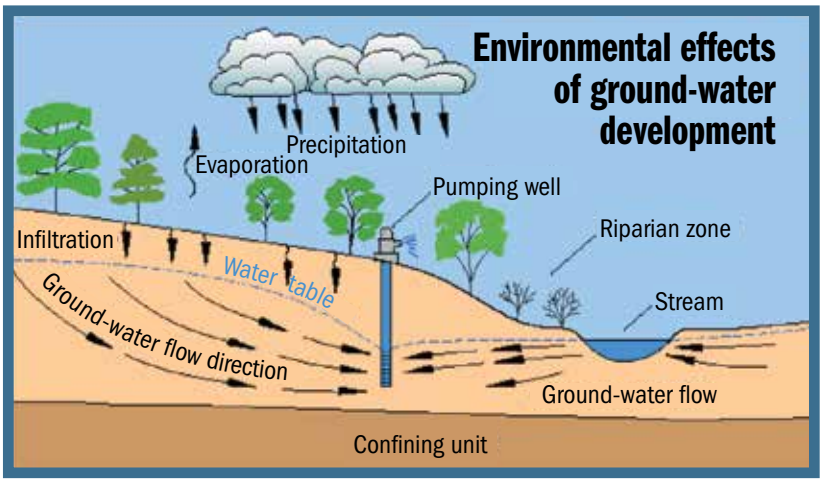
Groundwater pumping can have a significant impact on rivers and streams. The Verde River and its perennial tributaries are valuable resources to the Verde Valley and Arizona communities, providing water for irrigation, recreational opportunities such as fishing, and important habitat for wildlife. Rivers and streams also support economic opportunities, such as attracting visitors who watch birds and kayak. Protecting streams in the Verde Valley and throughout Arizona is in the interest of communities now and for future generations.

Western Resource Advocates (WRA) undertook this study to provide important information to the Verde Valley community on how wells in the area impact river and stream flow and on opportunities for well users to manage their water use to help keep rivers and streams healthy. A better understanding of well pumping impacts is critical to making water management decisions to protect the Verde River and its perennial tributaries.

Groundwater Pumping Reduces Flow in the Verde River and its Tributaries

In the Verde Valley, groundwater pumping from wells impacts stream flow and riparian vegetation. The degree of impact on rivers from groundwater pumping depends on many variables, including geologic features, well depth, pumping rate, and well location. A significant portion of stream flow in the Verde watershed is from groundwater that flows into the stream. When a well first begins pumping, the well withdraws water that is stored in the groundwater aquifer; however, over time, well pumping can change the direction of groundwater flow. As the well is pumped, stored groundwater is depleted, the water table falls, and the direction of groundwater flow can reverse, such that groundwater flows from the stream toward the well (Figure 1). In the extreme, this can result in the stream losing all its water to the aquifer, causing it to no longer flow.

Figure 1 **Effect of Well Pumping on Groundwater Flow**



Source: (U.S. Geological Survey 2015)

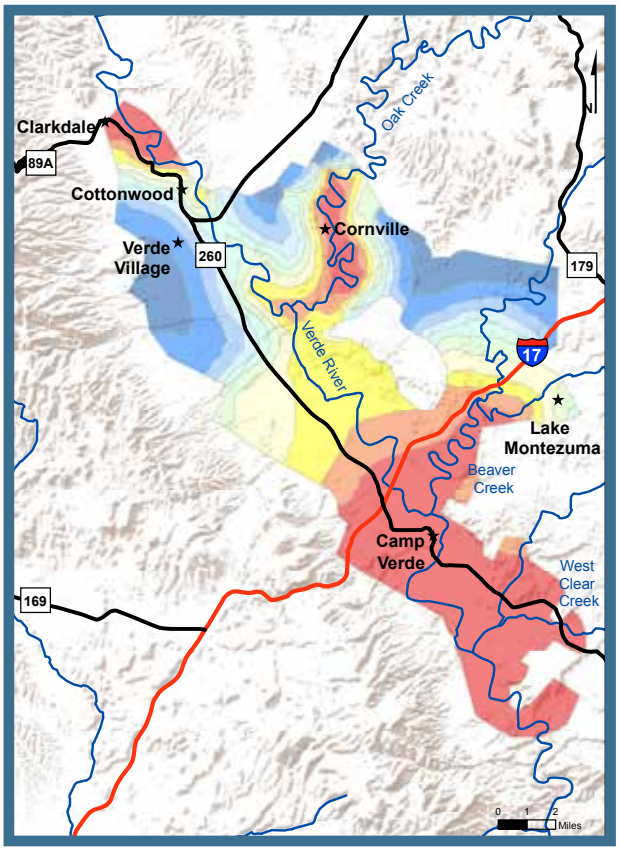
Little is known about the total water demand of wells in the Verde Valley with the exception of pumping from water provider wells, which is required to be reported annually to the Arizona Department of Water Resources. Depending on the location of wells, research shows that groundwater pumping can have a significant impact on stream flow. For example, groundwater pumping impacts were reported in a U.S. Geological Survey (USGS) study and described in depletion maps in two USGS reports conducted in cooperation with The Nature Conservancy. In addition, research showed that by 2005, base flow at Camp Verde had decreased by about 10,000 acre-feet a year because of pumping between 1910 and 2005 and that it would continue to decrease in the future, depending on the amount of groundwater pumped.[1]

WRA Developed a Methodology to Estimate Well Demand

WRA developed a methodology to estimate the demand and conservation potential of unmetered wells in two previous studies. For this current study, WRA applied the same methodology to wells pumping in the USGS 70% to 100% depletion zones of model layer 1 (shallow wells) of the Northern Arizona Regional Groundwater Flow Model. These zones are referred to as "stream impact areas" (SIAs) in this study. (Figure 2)

[1] An acre-foot is 325,851 gallons – enough water to fill an acre of land to a depth of one foot. In the Verde Valley, this amount of water can serve about 4 households or 10 people for 1 year.

Figure 2 Depletion After 50 Years of Well Pumping in Layer 1



Legend

- Interstate Highway
- Major Road
- Major Streams

Simulated capture of stream and spring flows and riparian evapotranspiration along the Verde River and its major tributaries as a percentage of pumping after 50 years of constant rate withdrawals from shallow wells.

- 0 - 10%
- 10 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- 50 - 60%
- 60 - 70%
- 70 - 80%
- 80 - 90%
- 90 - 100%

Sources: See Figure 1; (Leake and Pool 2010)

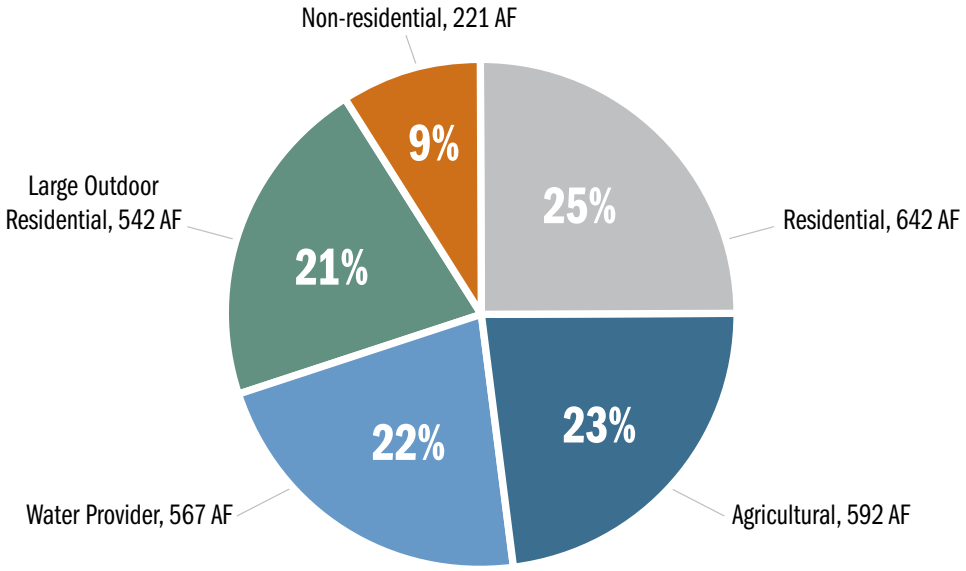
Groundwater pumping reduction strategies include replacing inefficient plumbing fixtures, irrigating efficiently, using rainwater for outdoor uses, and repairing water leaks.

The majority of wells in stream impact areas are domestic, with total water demand comparable to that of other water using sectors. There are multiple opportunities to reduce water use.

This investigation identified almost 3,000 wells in the stream impact areas, 88% of which are used for domestic purposes. Sixty-five percent of these domestic wells serve older homes that likely have inefficient pre-1994 federal plumbing code fixtures. These older homes could affordably and easily use less water, representing a significant water conservation opportunity that would reduce groundwater pumping.

While most of the wells in the stream impact areas are domestic, their water demand is estimated to be just 25% of the total volume of well withdrawals, followed by agriculture (23%), water provider (22%), large outdoor residential (21%), and commercial/non-residential (9%). (Figure 3). This suggests that **many sectors could explore groundwater pumping reduction strategies to help reduce the use of water connected to rivers and streams in the Verde Valley.**

Figure 3 Total Well Use in Verde Valley Stream Impact Areas, circa 2014



Total SIA Demand = 2,430 acre-feet/year

Note: AF = acre-feet

This study identifies groundwater demand-reduction strategies that could be implemented by well owners in stream impact areas (SIA) and provides estimates of savings, costs, potential funding sources, and examples of successful programs. A first-tier approach to reduce groundwater demand should strive to target wells that supply a variety of users, including residences, businesses, and agriculture. These target wells serve:

1. older homes, particularly in the Cornville/Oak Creek and Camp Verde 90% to 100% SIA
2. large residential outdoor irrigation in Camp Verde
3. flood-irrigated agriculture
4. water provider service areas
5. large non-residential users, such as schools

In addition to demand-reduction efforts, capturing and using rainwater and stormwater could augment water supplies and help replace well water. Rainwater and stormwater are renewable and free water sources.

Groundwater pumping and its impact on stream flow is significant and increasing. **All water users in the Verde Valley have a stake in using water in a sustainable manner in order to protect local water supplies, maintain river flow, and support the local economy.** Providing the tools to promote more sustainable groundwater use is critical to the health of the Verde River, its tributaries, and communities.

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Linda Stitzer
Arizona Senior Water Policy Advisor
linda.stitzer@westernresources.org
520.488.2436
westernresourceadvocates.org