

Estimated Water Demand and Conservation Potential of Domestic Wells in the Sierra Vista Subwatershed, Arizona



**WESTERN RESOURCE
ADVOCATES**

FACT SHEET

A study to promote conservation programs and water planning for domestic wells through development of demand estimates

Prepared for Western Resource Advocates
by Plateau Resources, LLC



Xeriscape landscaping. Photo: Cado Daily, University of Arizona, Cochise County Cooperative Extension

Successful water resource planning and management, including development of effective water conservation programs, requires accurate water supply and demand information. In Arizona, agricultural, industrial, and commercial water demand that is served by water systems is either reported annually to the Arizona Department of Water Resources or estimated using relatively well-understood metrics. However, residential demand served by domestic wells outside of water service areas is not well known because these wells are not typically metered and reporting is not required. This demand can be large in some areas and may be located where groundwater pumping intercepts water that would otherwise support streamflow and maintain riparian ecosystems.

All water users, including domestic well users, have a stake in using their water resources in a sustainable manner.

To better understand residential domestic well use for planning purposes and to identify appropriate conservation approaches, Western Resource Advocates funded a study that developed a method to estimate demand and the water conservation potential of domestic wells in the Sierra Vista Subwatershed (SVS) in southeastern Arizona. This area contains the San

Domestic wells in unincorporated areas of the Sierra Vista Subwatershed in southeastern Arizona serve about 16% of the area's population—approximately 5,000 households.



Rainwater harvesting tank. Photo: Christina Bickelmann



Outdoor irrigation in the SVS.
Photo: Plateau Resources, LLC

Pedro River and the San Pedro Riparian National Conservation Area, an area of rich biodiversity, as well as the communities of Sierra Vista, Tombstone, much of Bisbee, and Fort Huachuca (Figure 1).

The study uses proxies for metered water use, such as housing age and landscaped area size, to estimate indoor and outdoor water demand. It also discusses conservation strategies and shows domestic well use estimates from studies in other areas for comparison. In addition, because sustaining healthy river flows in the San Pedro River is critical, the study identifies the location of domestic well use that most impacts the river.

Domestic wells in unincorporated areas of the SVS serve about 16% of the area's population, approximately 5,000 households on parcels generally one acre in size or larger. Houses vary in age and type, and outdoor water uses range from pasture, orchards, and stock watering to parcels with native vegetation.

Effective and targeted water conservation programs require separate analysis of indoor and outdoor use. As a proxy for indoor water use, the study assumes that the older the house, the less efficient the indoor plumbing fixtures and the greater the demand. This assumption is supported by several national "end-use" studies that metered individual household water uses. Other factors, like housing size or residents' income, were not considered. County



FIGURE Nº 1 THE SIERRA VISTA SUBWATERSHED, ARIZONA

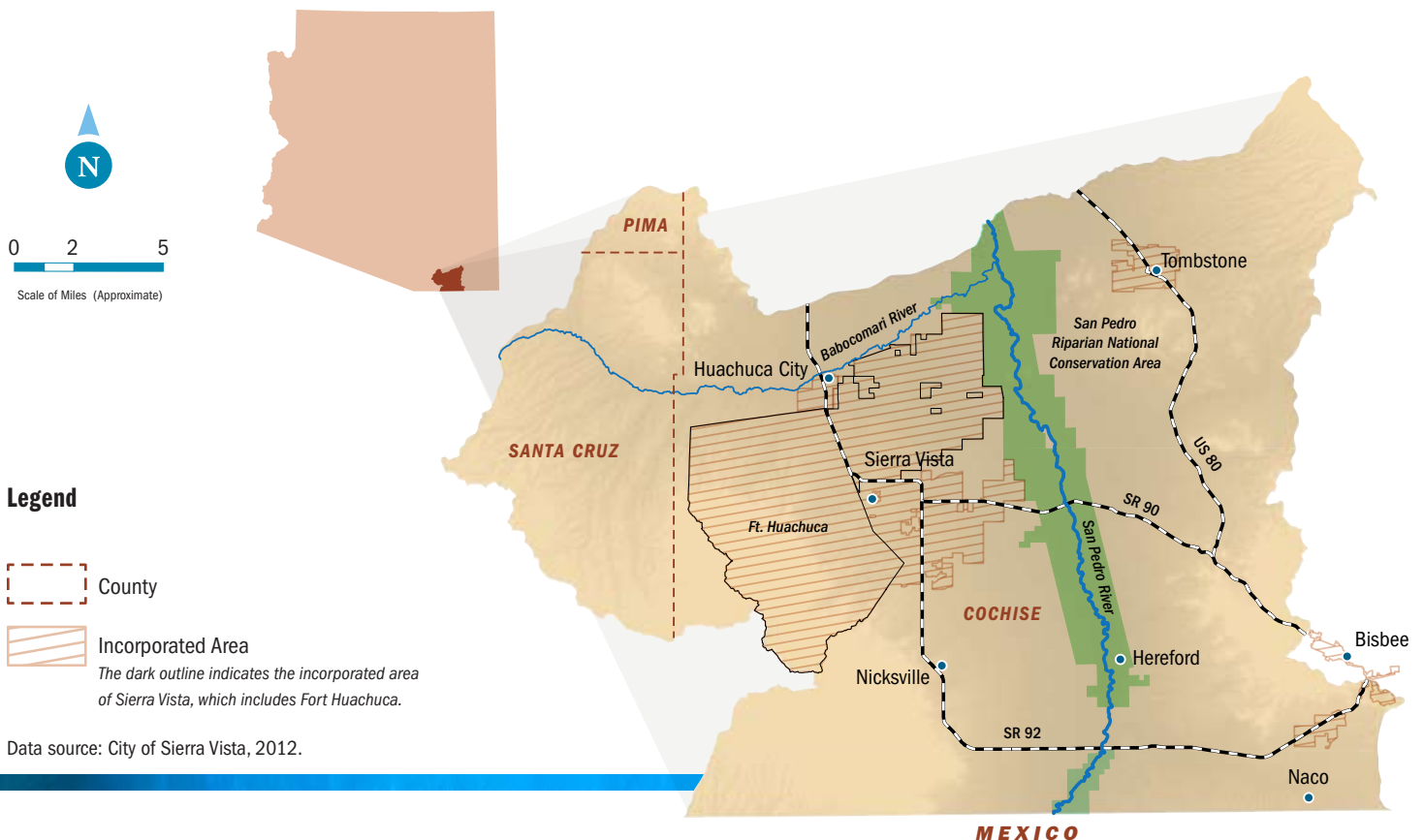


TABLE N° 1 ESTIMATED INDOOR WATER USE BASED ON HOME AGES IN THE STUDY AREA

Home Age	Number (Percentage) of Households Not Served by a Water Provider	Estimated Average Daily Indoor Water Use Per Household (gallons)						
		Toilets	Clothes Washer	Showers	Faucets	Leaks	Other	Total
Before 1997	2,190 (51%)	44.4	36.0	27.8	26.2	22.8	9.1	166.3
1997 to Present	2,140 (49%)	22.6	23.8	24.6	20.7	16.2	7.0	114.9
Homes retrofitted with High-Efficiency Fixtures	–	18.4	21.1	21.6	18.2	10.1	9.5	98.9

assessor data were used to separate 4,330 houses into age categories, and the potential water savings for pre-1997 houses and post-1997 houses was calculated based on end-use study information. **By replacing old fixtures with high-efficiency ones, pre-1997 houses could save 67 gallons of water each day and newer houses 16 gallons daily (Table 1).**

Outdoor demand was estimated using aerial imagery and field investigation to identify the location, size and type of outdoor water use. Demand was calculated using the watering requirement for each type of use, accounting for losses due to different irrigation methods. A relatively modest amount of irrigated area (about 75 acres) was found, but most of the demand identified was for pasture and orchard irrigation, where groundwater pumping could be reduced by improving irrigation efficiency. In addition, rainwater harvesting from roofs, patios, and driveways can meet outdoor water needs using simple methods that direct rainwater to planted areas or storage tanks that collect and distribute rainwater for later use.

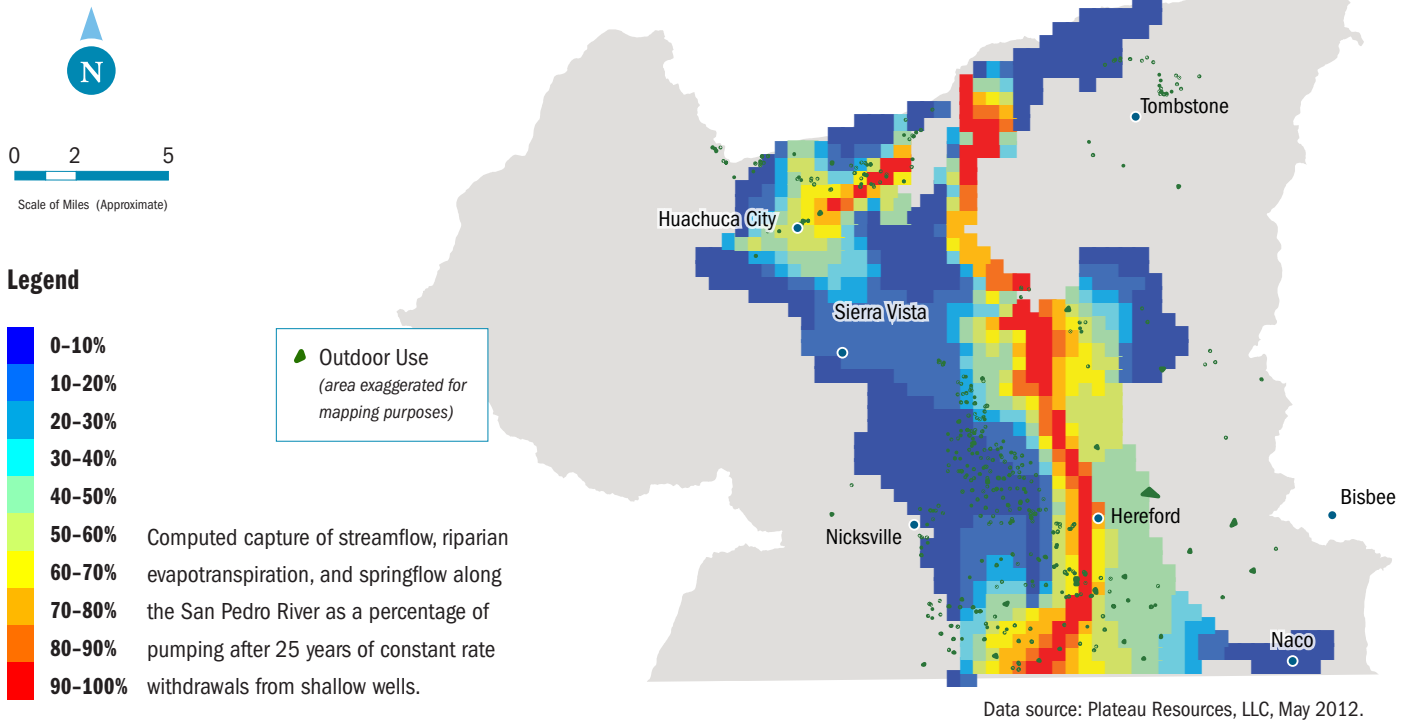
Reusing residential wastewater can also reduce demand and groundwater pumping. The study identified where it could be cost-effective to extend existing sewer lines to nearby parcels served by domestic wells and septic systems. The wastewater currently discharged to septic systems could be collected and delivered for irrigation or recharged to replenish the aquifer. Alternatively, homeowners could be encouraged to use their gray water (water collected from sinks, showers, bathtubs, and clothes washers) to replace groundwater for certain outdoor and even indoor uses, like toilet flushing.

The percentage of groundwater flow captured by domestic wells that would otherwise flow to the San Pedro River and eventually impact the ecosystem was also evaluated. Wells located closer to the river typically capture a greater fraction of flow than wells further away. **For this reason, conservation efforts that focus on older homes with substantial outdoor water use in the areas of highest groundwater capture will provide the most immediate benefit to the river (Figure 2). Large-scale indoor fixture and appliance replacement, leak reduction, irrigation scheduling, improvements to irrigation systems, and rainwater harvesting can effectively reduce domestic well use.**



San Pedro River, Arizona. Photo courtesy of Tana Kappel/ The Nature Conservancy

FIGURE Nº 2 COMPARISON OF GROUNDWATER CAPTURE ZONES TO MAPPED OUTDOOR WATER USES IN THE STUDY AREA



While the study did not specifically estimate how much water is used daily by each person, the indoor and outdoor demand analysis compares favorably to estimates and metered well data from other studies that show an average use of about 112 gallons per person daily.

An important objective of the study was to develop an estimation method that could be easily used in other parts of the state utilizing a modest amount of information, as domestic well use is prevalent across Arizona. The most critical information needed includes water provider maps, population data, parcel maps and files that contain construction dates, aerial imagery, and climate records. While having metered water-use data is always preferred, the study provides a first approximation of the relative demand and conservation potential of domestic wells. All water users, including domestic well users, have a stake in using their water resources in a sustainable manner.



WESTERN RESOURCE ADVOCATES

Western Resource Advocates is a nonprofit conservation organization dedicated to protecting the West's land, air, and water.

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