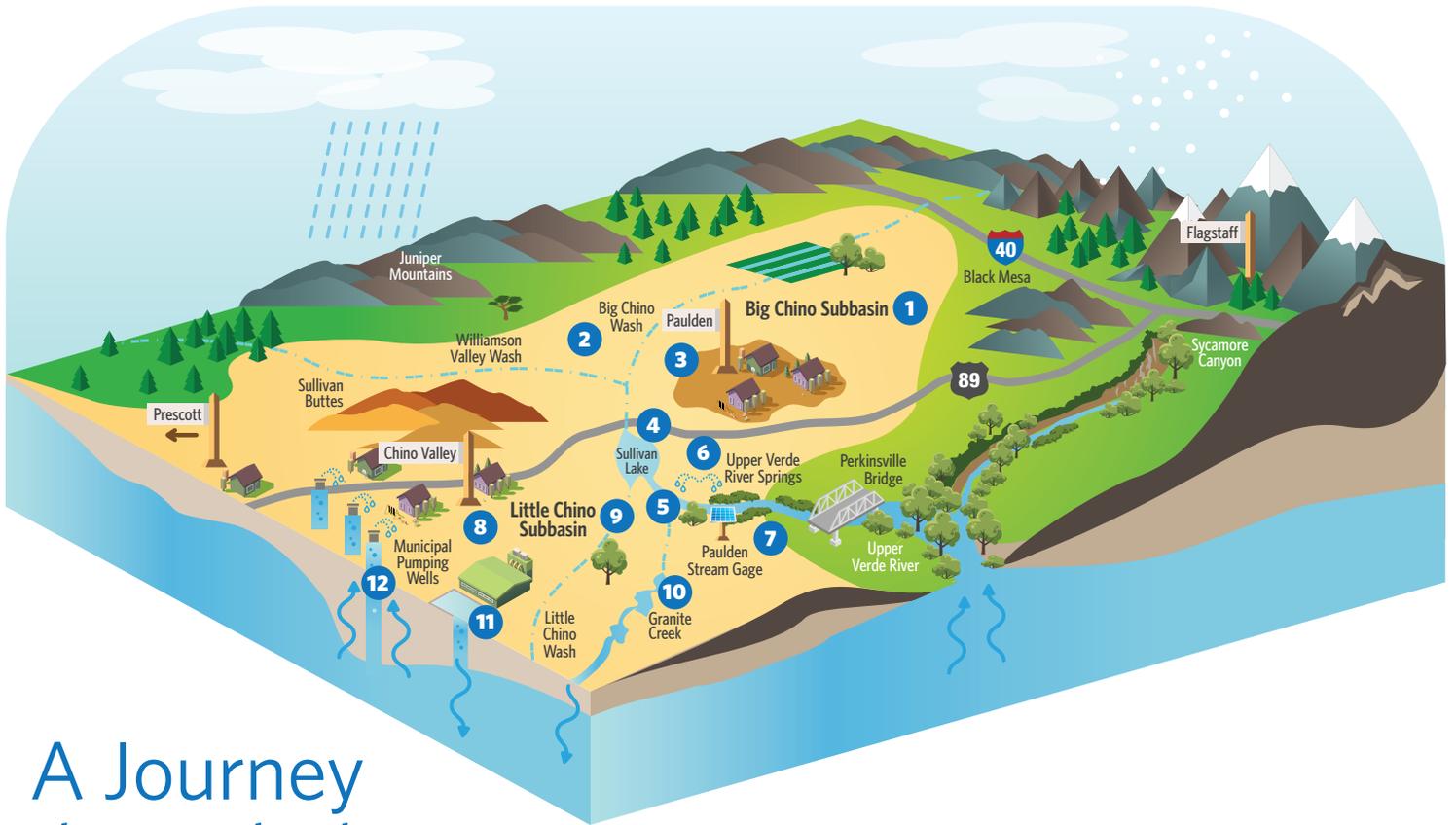


The Upper Verde River. What will it look like in 30 years?

The Verde River is unique: a rare perennial stream in the arid southwestern US that supports rich diversity of habitat and wildlife, people, and agriculture. The Verde River is located in the ancestral lands of the Yavapai-Apache Nation and the Fort McDowell Yavapai Nation whose reservations are located along the river downstream near Camp Verde and near its confluence with the Salt River near Phoenix. The Verde River supports the religious, cultural, and traditional practices of these Tribes. The Verde watershed is home to many species listed under the Endangered Species Act including native birds, fish, and snakes. The Upper Verde is a relatively remote stretch of the river offering a refuge for people to hike and camp, hunt and fish, kayak and swim, view and photograph wildlife, ride horses, and rock climb.

The Upper Verde River is sustained by groundwater discharges (baseflow) and intermittent stormwater runoff from precipitation. Baseflow levels have declined over the last few decades, driven by declining groundwater levels from groundwater pumping and extended drought. The primary concern for the next 30 years river is the potential for baseflows to drop further and no longer support year-round flow in this stretch of the river.

In this arid environment, a large watershed contributes to the small but critical amount of water that flows in the river. We must focus on this watershed for solutions to ensure that the river flows in the future.



A Journey through the Upper Verde Watershed

1 Big Chino Subbasin

Extending from Paulden to north of I-40, the Big Chino Subbasin is an 1,850 square mile valley with grasslands and pinyon-juniper forest surrounded by small mountain ranges. The land is a mix of private, state trust, and national forest. It is primarily rangeland with some irrigated agriculture, and the growing community of Paulden. Groundwater discharging from the Big Chino is estimated to be the source of approximately 80% of baseflow in the Upper Verde River.

2 Big Chino Wash

Big Chino Wash is an ephemeral stream that is the primary drainage for the Big Chino Subbasin. Williamson

Valley Wash, Partridge Creek, Pine Creek, and Walnut Creek are ephemeral tributaries to Big Chino Wash. During large precipitation events, Big Chino Wash channels runoff into Sullivan Lake and the Upper Verde River. Flood flows shape the channel, benefit native fish and disperse native vegetation.

3 Paulden

An unincorporated community near the headwaters of the Verde River, an estimated 10,000 people live in Paulden and it is growing. Residents rely on wells and private water companies for their drinking water and use septic tanks for sewer treatment since there is no centralized sewer treatment in the area.

4 Sullivan Lake

Sullivan Lake was created by the construction of Sullivan Dam in 1935 as a Works Progress Administration

project to create a public recreational facility. The lake filled with sediment by the mid-1940's. It is considered "mile zero" of the Verde River. Big Chino and Little Chino Washes are tributary to the lake, which fills during large storm events.

5 Upper Verde Wildlife

The Arizona Game and Fish Department Upper Verde River State Wildlife Area is managed for riparian habitat, threatened and endangered wildlife, and the area's notable native fish diversity and abundance. Designated by Audubon as an Important Bird Area, environmental education and compatible wildlife oriented recreation are important activities.

6 Upper Verde River Springs

Present-day perennial flow in the Upper Verde River is due primarily to discharge from the Upper Verde River Springs. The springs are a diffuse network that extends from the Granite

Creek confluence to the USGS Paulden stream gage at river mile 10. Both the Little Chino and Big Chino aquifers contribute to the springs.

7 Paulden Stream Gage

The USGS Paulden streamflow-gaging station, located at river mile 10, marks the downstream end of the Upper Verde Watershed. The mean annual baseflow - the amount of flow maintained by groundwater discharge - over the historical period of record (1963-present) is 24 cfs. Since 1996, baseflow has diminished due to groundwater pumping and drought. The largest observed flood flow is 23,200 cfs in 1993 - equivalent to several Colorado Rivers!

8 Little Chino Subbasin

The Little Chino Subbasin is a 310 square mile area entirely within the Prescott Active Management Area that includes Prescott, Chino Valley, and parts of Prescott Valley. Groundwater discharge from the Little Chino constitutes about 14% of the baseflow in the Upper Verde River.

9 Del Rio Springs

Del Rio Springs originally surfaced as hundreds of seeps in a grassland, gradually accumulating flow to become the historical headwaters of the Verde River. The first Territorial Capitol of Arizona was located here. Now, groundwater pumping in the Little Chino subbasin for agriculture and municipal use has reduced the discharge from the springs. The springs have not flowed into the Verde River for decades.

10 Granite Creek

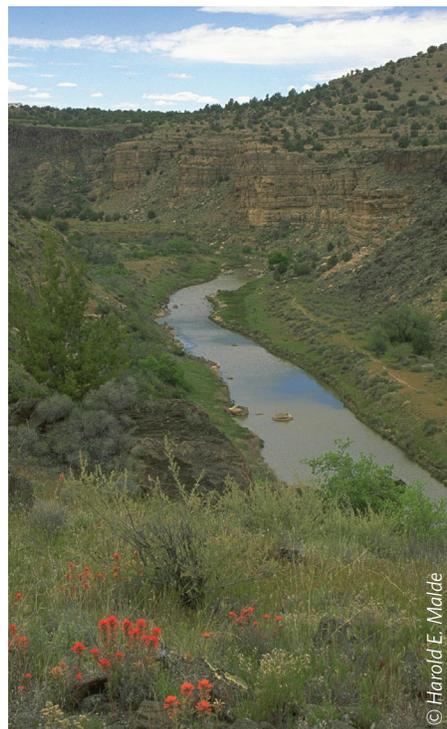
Granite Creek, an ephemeral wash draining the Prescott area, provides recharge to Little Chino aquifer. Watson and Willow Lakes near Prescott are connected to Granite Creek.

11 Reclaimed Water Recharge

The Town of Chino Valley operates a wastewater treatment plant and recharges treated effluent using basins to infiltrate the water underground. Recharge is an important water management tool - the location of recharge and volume determine how it will benefit the aquifer and the river.

12 Municipal Pumping Wells

The region depends entirely on groundwater from wells for its water supply. The rapidly growing communities of Prescott and Prescott Valley have large municipal wells in the Little and Big Chino Subbasins near the headwaters of the Verde River.



DEFINITIONS

Aquifer - an underground layer of permeable rock or sediment such as sand and gravel that contains groundwater. The aquifer is the saturated zone between the water table and an impermeable basement rock unit, such as clay or bedrock.

Baseflow - flow in the river when not influenced by precipitation events and is a result of groundwater discharge. Baseflow can change over time and is influenced by recharge, evapotranspiration, and groundwater pumping.

Reclaimed water - treated wastewater, or effluent. Reclaimed water is a source for recharge and reuse and is a critical component for long term water sustainability

Ephemeral - Ephemeral streams and washes only flow in direct response to precipitation and stormwater runoff in the drainage basin.

Evapotranspiration (ET) - water on the ground surface and in shallow soils that is lost to atmosphere and does not infiltrate to the aquifer. ET includes evaporation and transpiration by plants. In arid regions, such as the Upper Verde watershed, ET is greater than precipitation.

Intermittent - Intermittent streams or portions of streams are seasonal, flowing only certain times of the year in response to runoff or a fluctuating water table.

Perennial - Perennial streamflow is year-round. It consists of, surface runoff from precipitation and groundwater discharge.

Active Management Area - A land area defined by Arizona statute where groundwater use is regulated, with the goal of a long-term balance between groundwater withdrawals and recharge.

Recharge - the process where water on the surface infiltrates underground and reaches the water table to become groundwater. In the Big Chino, due to high rates of evapotranspiration by vegetation, only about 2 percent of precipitation infiltrates deep enough to recharge the groundwater

Enhanced Runoff - the volume of runoff that exceeds natural, predevelopment flood flows due to human development in the watershed, such as rooftops, streets, parking lots and alteration of natural vegetation.

Watershed - the area of land that drains to a low elevation discharge point, such as a stream. Activities, both natural and human, in a watershed directly impact the streamflow and water quality downstream.

How can we protect the Upper Verde River?

1. Education and Access

- Learn about the Upper Verde area and educate elected officials about the value of a flowing Verde River, and how to protect it.
- Respect the natural environment at current access points along the river that provide recreation opportunities, and take action whenever possible to protect the fragile riparian areas from overuse and abuse.

2. Augmented Recharge

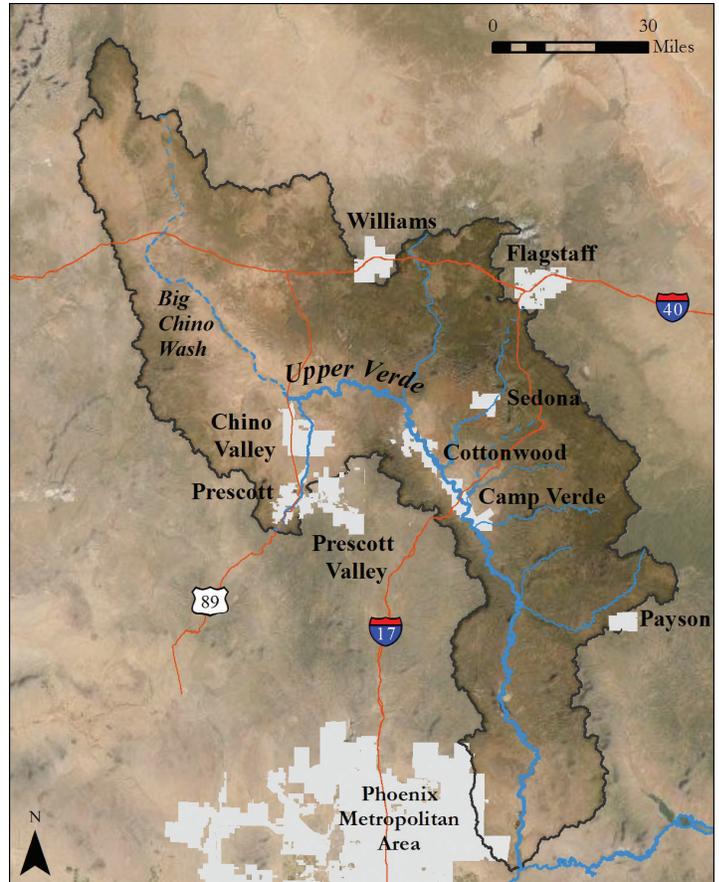
- Optimize the use of locally available water supply resources such as enhanced runoff and reclaimed water.
- Develop projects to recharge the aquifer in locations that support baseflow in the river while maintaining a natural flood flow regime.

3. Minimize Pumping Impacts

- Reduce net groundwater pumping in areas that have the greatest impact on baseflow.
- Plan for growth, and the water supply to support future growth, in locations and in a manner that minimizes potential impacts to the river.
- Develop water conservation programs to incentivize water savings.
- Explore the potential for voluntary land agreements that protect ranching and open space while limiting future groundwater pumping, such as through conservation easements.

4. Measure and Monitor

- Support continued monitoring of streamflow in perennial stretches of the Verde River and ephemeral tributaries, discharge from springs, groundwater levels, and pumping in the Big and Little Chino Subbasins.
- Use current groundwater modeling tools to evaluate pumping and recharge strategies.



The Verde River is a lush, green ribbon of life in the heart of Arizona, continuously flowing 190 miles from Paulden to the Salt River near Scottsdale.

More information is available from the project partners listed below, and from the USGS (search "Verde River " at <https://pubs.er.usgs.gov/>).

