

## Technical Memorandum No. 1

June 17, 2015

**TO:** Steve Ayers, Economic Development Director

**FROM:** Rick McLaughlin – MWDG

**RE:** **Development of Base Data for Verde River Recreation Management Plan**

---

The Town of Camp Verde and various stakeholders are planning to enhance access to the Verde River, Beaver Creek, and Clear Creek within corporate limits of the Town of Camp Verde. In addition, recreational improvements within the Verde River are proposed to increase river recreation use by boaters. These improvements would create a paddle trail through all or a portion of the 17 mile reach of the Verde River running through the Town. They could also create localized recreational attractions for paddlers and other in-river recreationalists.

This memorandum outlines efforts taken to develop the base information needed to support this planning activity. The various efforts are summarized below.

### Base Mapping

Base mapping is needed to develop and illustrate the various proposed improvements. The location of existing parks and Recreational Access Points (RAPs) relevant to the proposed improvements are also needed in the development of the recreational improvements. Base mapping along the Verde River was obtained from through a non-commercial data request from Yavapai County. This information was obtained in a GIS format and converted to AutoCAD to create the mapping attached to this memorandum. The mapping or GIS layers that were obtained include:

- Contours
- Aerial Photography
- Irrigation Ditches
- Town Boundary
- Property/Parcels
- Major and Minor Roads
- Hydrology

The Town provided a list of public parcels that are particularly relevant to this planning effort. These included proposed and existing parks, recreational access points, bridges and other

---

public lands along the Verde River. These properties, access points, and bridges are identified on the attached mapping. A listing of the public properties is included in Figure 1.

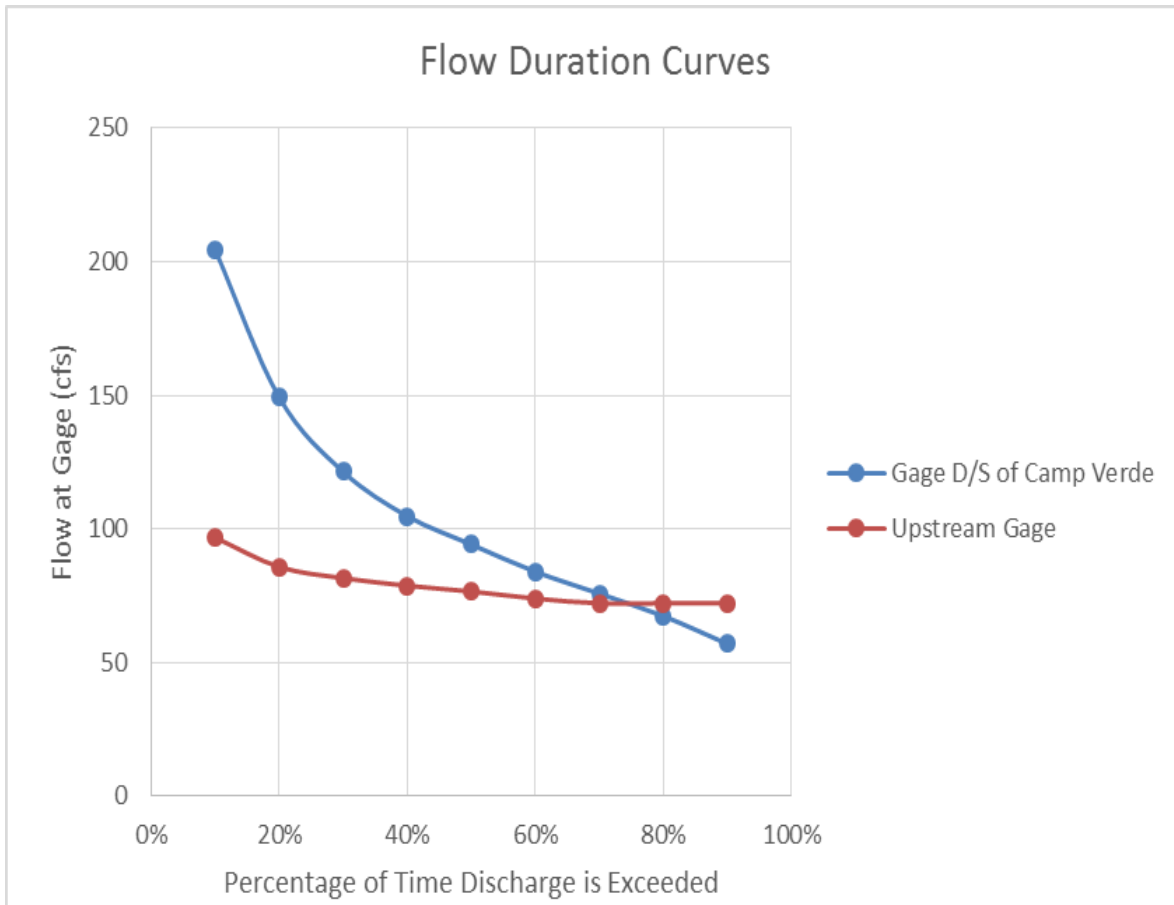
<b>Name(s)</b>	<b>Potential Uses or Purposes</b>	<b>Parcels(s)</b>	<b>Ownership</b>
Rezzonico Family Park	Trailhead, River Access Point	404-19-018A, 018D, 166 & 800-15-003T	Town
Rocking River Ranch	Multi-use River Front Park	404-14-005C,E,F,P,L & 404-14-006, A	Arizona State Parks
White Bridge	River Access	800-02-010C	Forest Service
Black Bridge	Pedestrian Bridge for River Trail	800-15-003T	Town
Simonton/Homestead River Park and Trail	River Trail/Natural Area/Park	800-25-001C, 800-25-001D	Arizona State Parks
Simonton/Homestead River Park and Trail	River Trail/Natural Area/Park	800-01-030N	Forest Service
Shield Ranch	Natural Area	404-14-004	The Nature Conservancy
Clear Creek River Access Point	River Access Point Day Use Area	800-01-016G	Forest Service
I-17 Properties	River Access Point/Day Use Area	403-021-021C, 243, 244, 250B, 251B, 252C, 253B, 254B & 403-11-094, 095	Town
Trusswell Property	River Access	404-09-099C, E & 404-14-001A, C	Forest Service

Note: These properties along with additional river access points and are shown on the attached mapping.

**Figure 1**  
**Parcels of Interest in Development of the Verde River**  
**Recreation Management Plan**

## Hydrology

There are existing USGS stream flow gages upstream and downstream of this reach of the Verde River through the Town of Camp Verde. The upstream gage is approximately 15 miles upstream of the Town and the downstream gage is approximately 3.5 miles downstream of the Town. Additionally there are gages upstream of the Verde River on Beaver Creek and on West Clear Creek. Figure 2 shows the percentage of time that flow is equaled or exceeded for the upstream and downstream gages for the average daily flow from May through September. Due to the intermediate diversions and tributaries (as outlined below), and the distant location of the gages, these gages and this exceedance analysis are of limited value in accessing recreational flow rates through the Town.

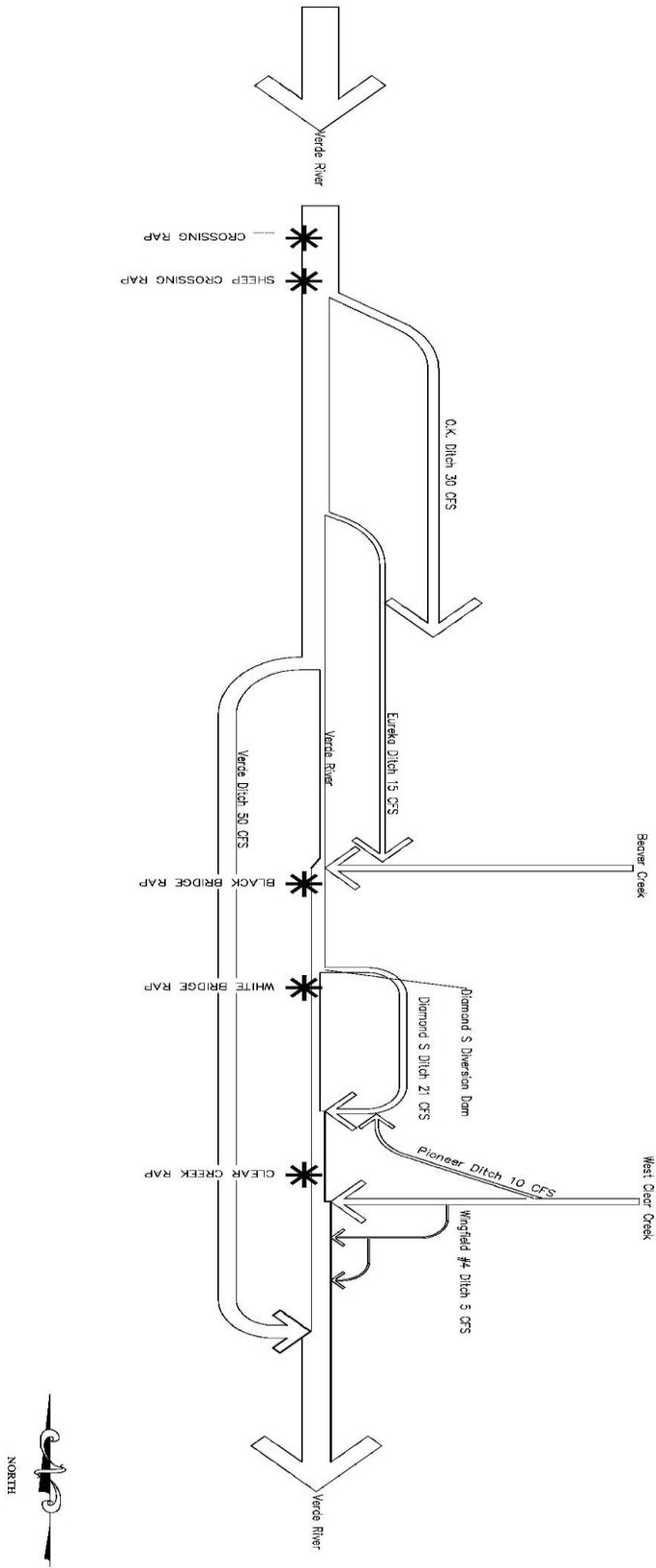


**Figure 2**  
**Flow Duration Curves for the USGS Flow Gages**  
**Upstream and Downstream of Camp Verde**

During an initial site visit, it became evident that the lack of flow in the Verde River through the Town is of paramount importance to its ecological functioning and in-river recreation. Flow within the reach of river through the Town of Camp Verde can be less than 1 cfs for significant reaches<sup>1</sup>. This is primarily due to the following ditches/diversions:

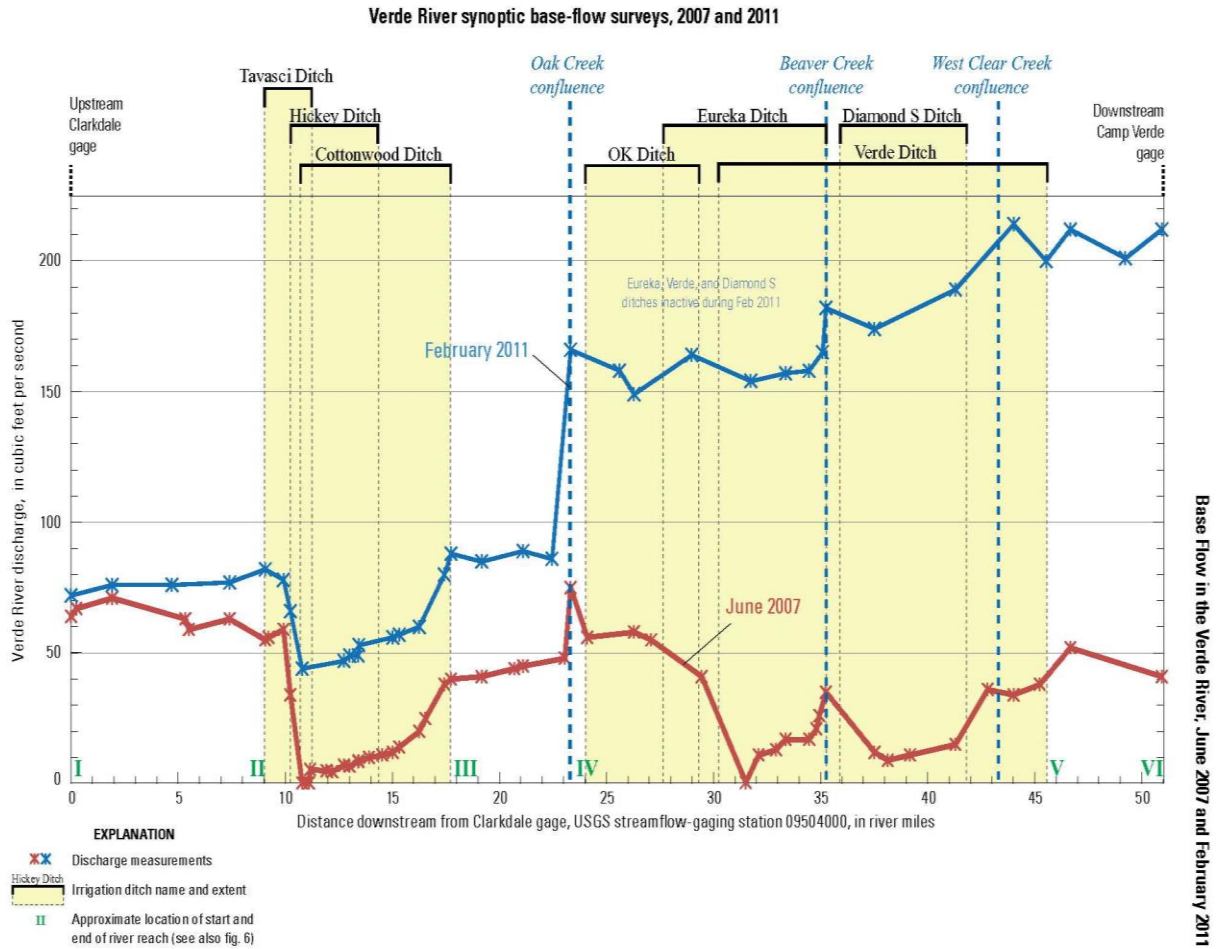
- O.K Ditch
- Eureka Ditch
- Verde Ditch
- Diamond S Ditch
- Jordon Meadow (pumped)

Figure 3 illustrates the relative location and conductivity of these diversions. Diversion flows shown in the figure are from the County GIS data base. The figure does not represent all intermediate return flows from the ditches or recharge from ground water and subsurface return flows from the ditches. Evaluation of these factors was conducted by the USGS and some of the results are shown in Figure 4.



**Figure 3**  
**Diversion Ditch Schematic**

By review of Figure 4, it can be observed that during the irrigation season the flow in the river is very low downstream of the Verde Ditch (about river mile 31.5) and downstream of the Diamond S Ditch diversion (downstream of river mile 35). Furthermore, a small pumped diversion for Jordon Meadows (located downstream of the Diamond S Diversion) takes additional water out of this reach of the river.



**Figure 4**  
**Synoptic base-flow measurements on the Verde River<sup>ii</sup>**

It is clear that for in-river recreation through the Town of Camp Verde to be realistic, the river needs to convey significantly more flow than has occurred in recent history. The Nature Conservancy<sup>i</sup> has partnered with Friends of Verde River Greenway, Verde Natural Resource Conservation District, Tamarisk Coalition and Arizona Game and Fish Department with common goals to:

1. Restore and protect flows in the Verde River with an emphasis on the Verde Valley.
2. Improve riparian habitat primarily through the removal of invasive plants, erosion control and native plant re-vegetation.
3. Equip farmers and ranchers with the tools and resources needed to be sustainable into the future.
4. Enable long-term farming operations in the Verde Valley to preserve the rural landscape, open space and protect investment in conservation projects.

Working collaboratively with agriculture through the Natural Resource Conservation Service (NRCS) Regional Conservation Partnership Program (RCPP), this partnership has already had a number of successes including funding for landowners to improve their irrigation system by converting from flood irrigation to drip, sprinkler, or other forms of more efficient irrigation. Additionally, the partnership is working with diverters to improve diversions and conveyance systems to reduce the amount of diverted flow by reducing the amount of return flow.

While flows through the Town have been insufficient to allow water-based recreation for most of the irrigation season, efforts are underway to increase low flows within this reach. These efforts are critical to allow for creating a paddle trail through the Town of Camp Verde.

Flood flows through the Town have been evaluated by the County and are provided in a comprehensive report.<sup>iii</sup> The 100-year and 500-year event flows are presented in the report. For planning and design, an estimate of the average annual flow is useful. We estimated this flow based upon the same rational used in the report. Using the USGS gage data, the increase in flows at the various intermediate tributaries was approximated using a ratio of tributary area. The following table (Figure 5) provides a cursory estimate of the average annual event flows. It should be noted that diversion flows were not taken into account in this approximation.

<b>Location</b>	<b>Tributary Area sq. miles</b>	<b>Average Annual Event (Approximated by MWDG) cfs</b>	<b>100-Year Event cfs</b>	<b>500 –Year Event cfs</b>
Oak Creek (Inflow into the Town)	3,776	400	100,000	193,000
Beaver Creek	4,287	480	121,200	241,000
West Clear Creek	4,619	530	135,600	273,900

**Figure 5  
Flood Flows through the Town of Camp Verde<sup>iii</sup>**

As can be observed in the table, flood flows are significant – particularly compared to the average annual event. These high flood flows will have an impact on planning and in the future design of recreational and other improvements within or near the Verde River throughout the Town.

## River Hydraulics

The HEC-RAS hydraulic model obtained from the County was utilized to estimate basic hydraulic parameters within this reach. The resulting profiles of the Verde River through the Town are shown on the attached Drawing Number 5. The average slope of the Verde River through the Town is about 0.18%. Typical flow depths during the average annual event are around 2 to 5 feet and 20 to 30 feet during the 100-year event.

A localized gradient much higher than 0.18% is needed for in-river recreational whitewater features. Given the extent of flooding that occurs within the reach, the ability to create “new” drops without exacerbating flooding is unlikely. Therefore, potential locations of in-river recreational whitewater features to create or enhance a paddle trail will most likely occur at where there is a localized higher gradient or drop. Additionally, the ability to create a paddle trail between the upstream properties, such as Rezzonico Park, with the downstream properties such as the Shield Ranch and Rocking River Ranch, make sites between these locations much more attractive. The locations listed in Figure 6 were identified based upon initial inspection of the profile and a site visit.

Location	Notes
Confluence of the Verde River with West Clear Creek	This drop is not “shown” on the gradient but can be observed in the field.
Verde Ditch Pump Station	This is at an intermediate intake for the Verde Ditch. It currently incorporates a man-made drop structure within the river bed.
The Diamond S Diversion	This drop is shown at about 9 feet on the profile. Given the amount of drop, its impediment to passage of river craft, and the central location, focus on this drop in the later phases of this study is likely.
Rezzonico Park	A small drop can be observed in the profile and influences of the Black Bridge may lend the site to recreational whitewater. Additionally, the site is ideally located next to this park.

**Figure 6**  
**Potential Locations for In-River**  
**Recreational Whitewater Improvements**

## Conclusions

The Verde River through the Town of Camp Verde is a low-gradient alluvial river with fine substrate materials. Diversions and other man-made features have greatly impacted the river by significantly lowering base flows and by creating steep drops to support irrigation diversions. These drops are relatively unstable features and at least one (the Diamond S Diversion) would need to be modified to create an active paddle trail. The focus of the future phase of this work will be in planning the physical features needed to create an effective paddle trail. Efforts to increase base flows within the river are paramount to creating a paddle trail. These efforts are currently being undertaken in other on-going efforts and will not be directly addressed as a part of this study.

-----End Memorandum-----

---

<sup>i</sup> From conversations and informal correspondence from Kim Schonek of the Nature Conservancy.

<sup>ii</sup> USGS, Spatial and Seasonal Variability of Base Flow in the Verde Valley, Central Arizona, 2007 and 2011, Scientific Investigations Report 2012-5192

<sup>iii</sup> Yavapai County Development Services, Prepared by HDR, Hydrologic Analysis, April 2010.