Middle Verde River Synoptic Streamflow Survey

Problem statement.—Information about streamflow conditions for the Middle Verde River and the downstream parts of its tributaries between the USGS gage near Clarkdale and the USGS gage below Camp Verde is needed in support of numerical ground-water and surface-water modeling efforts. More specifically, discharge information for streamflow, stream diversions, return flows, streambed infiltration, and ground-water discharge that occur in the Verde River and its tributaries are needed. An estimated 35,000 acre-ft of water is diverted for agricultural use each year; however, the uncertainty of this number is considered large. We propose a synoptic streamflow survey to collect discharge and other parameters that can be used to identify and quantify these flows in a more accurate and descriptive manner. The dataset is a necessity for construction of hydraulic or hydrologic models.

Objective.—The objective of this study is to collect stream discharge, specific conductance, temperature, pH, and dissolved oxygen data along:

- Verde River between the gages near Clarkdale (09504000) and below Camp Verde (09506000)
- Oak Creek from the USGS gage near Sedona (09504420) to its mouth
- Wet Beaver Creek from the USGS gage near Rimrock (09505200) and Dry Beaver Creek from the USGS gage near Rimrock (09505350) to their confluence and down to the mouth, and
- West Clear Creek from the USGS gage near Camp Verde (09505800) to its mouth.

Approach.—

A reconnaissance survey will be conducted to locate and estimate discharge associated with diversions and to record water quality parameters (temperature and specific conductivity) along the study reach. The specific discharge survey sites will be selected based on this preliminary analysis as well as historic data detailing the location of diversions.

The survey will be conducted over a two-day period during low-flow conditions (May-June, or Oct-Nov.) so that conditions are not affected by storm runoff. On the first day, discharge and physical parameter measurements will be collected on the Verde River and major diversions between the USGS gage near Clarkdale and the mouth of Oak Creek (about 24 miles). Four to 6 teams of 1-2 people traveling by boat or by vehicle will collect data in this reach, and an additional team traveling in a field truck will collect data on Oak Creek. Measurement sites will

be selected on the basis of changes in field parameters and observed diversions and return flows. Each team will collect discharge and physical parameter data, and will also take photographs, GPS locations, and ancillary notes at about 5 sites. At each site, two discharge measurements will be made so that the uncertainty with the discharge data can be assessed. This will be needed to assess whether changes in discharge in a reach are due to inflows/outflows or due to measurement error.

On the following day, data will be collected in a similar manner for the reach between the mouth of Oak Creek to Beasley Flats (about 24 river miles). The team in the field truck will make measurements on Wet Beaver Creek, Dry Beaver Creek, and West Clear Creek, and at the gage on the Verde below Camp Verde. It is anticipated that data will be collected at about 60 sites as part of this synoptic survey.

Products.— An oral presentation will be given showing results from this study and tabular summaries of the data will be made available to cooperating agencies and colleagues involved with the surface-water and ground-water modeling efforts. In addition, the stream-discharge and physical parameter data will be entered into the USGS National Water Information System database. It is anticipated that collecting data seasonally at a subset of sites from this survey will also be beneficial to the modeling efforts. Therefore, a proposal for subsequent data collection will be developed on the basis of this survey's results.

Personnel, workplan, and budget.— Execution of the stream survey will require one project chief for 300 hours of planning, data compilation, quality assurance, and archiving, and preparing the presentation and subsequent proposal. Ten hydrologic technicians will be needed for the data collection, for a total of 300 hours (30 hours each). Travel expenses, vehicle costs, and boat rentals will also be incurred. Total cost for the work described is $57,000. The USGS will contribute cooperative matching funds of $15,000.

Table 1. Projected Budget

Personnel	$47,500
Travel expenses	7,000
Vehicle and boats	2,500
Total	$57,000