

WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT

MEMORANDUM

TO: File 100.5.10.1

FROM: Thomas Suggs

DATE: October 15, 2018

SUBJECT: **Gaging Stations - Southern Stream Group – Project Update**

Background. For many years, the runoff from the southern stream group (including Grapevine and El Paso creeks) has been broadly estimated at about 10,000 acre-feet per year, although there is probably not a great deal of research to support this. Recently, with the passage of SGMA, there has been a great deal of local interest in estimating surface runoff to the Southern San Joaquin Valley. Beginning in about 2017, it was felt that it would serve the mutual interests of the District, the Wildlands Conservancy, and Maricopa Orchards to work together to attempt to document the amount of surface water that runs off each year from the San Emigdio Range¹.

Jon Reiter, as I recall, first proposed the idea of long term, low cost, low tech stream gaging in several San Emigdio Range watersheds. Based on that idea, I wrote and circulated a brief project description in December 2017. In that memorandum there was some early consideration of permanent concrete weirs, infrared monitoring of water levels in culverts, and even one tree-mounted data logger, but in the end, it seemed most practical to use steel staff gages at all sites. Heavy steel pipe and concrete footings would be used to help resist cow rubbing and damage by floating debris. Staff gages would have painted steel scales attached for easy visual observation of stream stage (depth) and would have a short piece of iron pipe that would serve as a stilling well and holder for a small data logger.

Recent Progress. For the last year or so, work has focused on selecting permanent gage sites, building and installing the staff gages, and surveying the stream cross sections. A table of gage locations (Table 1) and a location map follow.

An estimate of equipment costs to date is shown in Table 2. Table 2 does not include labor and in-kind contributions by WRM and Wind Wolves Preserve (WWP). The District is serving as the financial agent for the project, and in a few weeks, when the final bill is received from John R. Wilson, Inc., the District will generate an invoice to Maricopa Orchards seeking reimbursement for project equipment costs.

In January 2018, the District purchased five (HOBO U20L) water level data loggers plus a data reader (HOBO U-DTW-1 shuttle) and six sets of graduated staff markers (painted steel scales). These data loggers are completely self-contained and are capable of recording and storing depth

¹ Tejon Ranch operates infrared stream stage recorders on Grapevine and El Paso creeks, although I don't have access to their historical data at this time and I don't know what they do in terms of estimating flow rates.

of submergence (up to 13 feet of depth) once per minute for 5 years. After about 5 years, the batteries tend to run out. If the water depth is greater than 13 feet, the logger will max out and just show a flat spot in the record.

WWP personnel fabricated 5-foot tall staff gages in February and March 2018 per my design. Eric, Neil and I made a couple of field trips to the Preserve in 2017 and 2018 guided by Dan York and the WWP rangers, and together we selected appropriate gage sites. WWP rangers then installed staff gages in the five preselected creek locations (one each in the San Emigdio, Pleitito, Pleito, Salt, and Tecuya Creek watersheds) during April 2018. In May, District staff and WWP personnel inspected the staff gages, affixed the rulers, and downloaded the first run of data from the loggers to assure that they were functioning. All of the streams except San Emigdio Creek were dry of course, but we were able to see that the loggers were recording.



Figure 1. Typical HOBOT U20L data logger



Figure 2. Typical staff gage. This one is located in Tecuya Creek

In August 2018, the District received competing quotes for surveying services and then retained John R. Wilson, Inc, (the low bid) to conduct a LIDAR survey of the stream channels and to draft detailed topographic maps and sections of the stream gages sites. Wilson was my preferred firm anyway, as we have worked with them in the past on small projects. The Wilson crew, guided by Eric and the WWP rangers, surveyed all sites on September 18th and 19th, 2018. Wilson is currently preparing detailed topographic maps of the stream channel sections of interest. I requested that the survey extend at least 75 feet upstream and 75 feet downstream the staff gages

so that we can be sure we are looking at a nice, straight reach of stream. The topo maps will be used to develop a table of water depth, or stage, vs. cross section of flow.

At any time, the flow rate, or discharge, is a function of the cross section and the velocity of flow. And the cross section of flow in the stream is a function of the stream stage. Accordingly, the stage record can be transformed reliably into a discharge record through process of field observation and calibration. It is standard civil engineering practice to express that relationship through a stage-discharge curve. The next phase of work will focus on reading the data loggers and developing the stage-discharge curve for each stream gage site.

Next Phase of Work. Calibration can only occur during a few short lived, flashy runoff events. Accordingly, the calibration process will require trips to the gage sites during and immediately after storm events. It is likely that much of the basin runoff occurs during a few large events that may be spaced several years apart, so it will be very helpful to have those large events in the calibration record, even if the largest storms occur at night or on weekends. We should attempt to conduct calibration for at least 2 years and then assess where we are at. Teams, communications, access, and field procedures should be worked out by November 1, 2018 so that we can make the most of the 2018-2019 rainy season.

Calibration is a low tech undertaking. It will involve sending two persons to the site: one will throw oranges in the stream and the other will record the time to travel 100 feet or some other distance that is practical. Visual observations of depth and velocity of flow will be related (by time) to the record on the logger. Eventually, we will develop curves so that stage can be easily related to flow rate. Flow rate integrated over the entire rainy season will give us the annual runoff.²

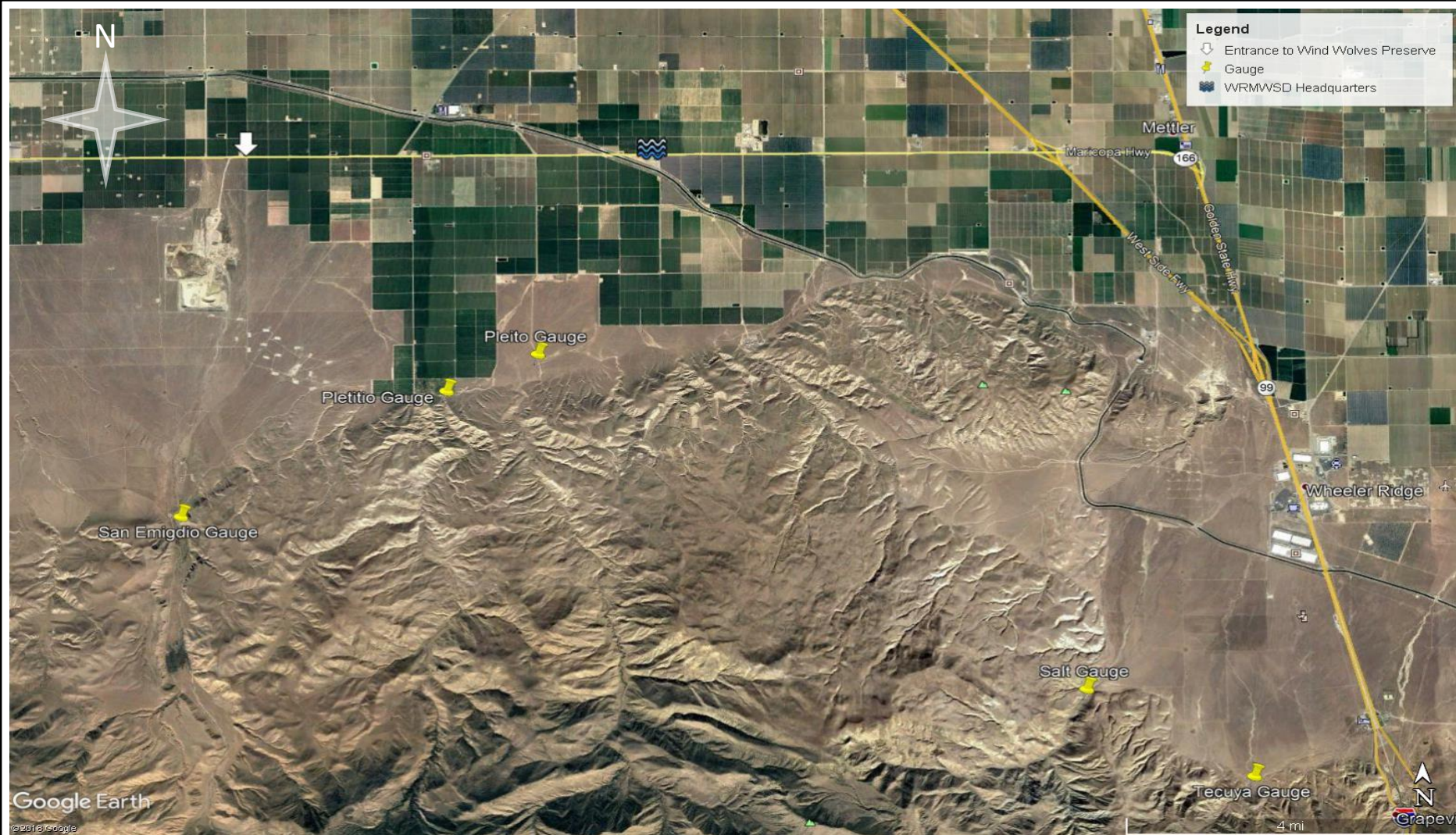
2. We can assume that a minimal amount of runoff infiltrates or evaporates above the gage site and that the runoff seen at the gage sites represents the true runoff to the greater valley floor. From casual observation, it can also be assumed that much of the runoff flowing past the gage sites soaks into the alluvial sediments a short distance downstream, but some fraction flows out to the middle of the basin. Santiago Creek and San Emigdio Creek seem to pond at the California Aqueduct or the Rim Ditch, whereas Pleito, Pleitito, and Tecuya creeks have good overshoots and don't seem to be impeded by the Aqueduct. Grapevine and El Paso creeks have been known to drain as far as Weedpatch and Lamont before spreading out.

TABLE 1.
GAGE LOCATIONS

Station ID	Creek	Lat/Long
SECNY	San Emigdio	34.981530° -119.185086°
PTCNY	Pletito	35.007323° -119.128774°
PLCNY	Pleito	35.014947° -119.109393°
SLCNY	Salt	34.945718° -118.993371°
TYCNY	Tecuya	34.927983° -118.958500°

TABLE 2.
ESTIMATED EQUIPMENT COSTS TO DATE

Equipment	
Onset Computers: HOB0 water level data loggers, 4 ea., HOB0 shuttle (data reader), 1 ea.	1,468.00
Onset Computers: HOB0 water level data logger1, 1 ea.	208.34
Forrestry Suppliers, Inc.: Steel staff gage scales, 6 ea.	299.00
Surveying	
John R. Wilson, Inc.: Labor to establish cross sections of flow at five stream gage sites; assume 3 days site work plus 5 days post processing; deliverables will include an AutoCAD .dwg file showing topographic contours for each site	4,212.00
Estimated Total – Not Final - W/O 18-01-02	\$6,187.34



Wheeler Ridge Water Storage District



Staff Gauge Overview Map

11 July, 2018

