

Winters Putah Creek Park - Part 1 - Case Study of a Failed Project

Description of the Project

The Winters Putah Creek Park project is a perfect example of good restoration intentions going awry and resulting in serious degradation of creek habitat by massive alteration of the natural form of the stream bed. This is being called “geomorphological engineering”.

The project was designed by the Solano County Water Agency (SCWA) to alter the streambed and riparian floodplain in three phases along the entire 1.2 miles of Putah Creek flowing through the City of Winters. The first phase was begun on the upper 1/3 end of the creek in 2011 by nearly clearcutting a mature riparian forest of native and non-native trees alike, from stream bank to stream bank, and importing over 70,000 cubic yards of alien, clayey fill. The soil was graded flat and smooth with a slight 2 percent slope toward stream. The floodplain and channel were heavily compacted and stream was left with only a narrow channel through the center of the former streambed. The final depth of the compacted fill varied from about 2 to over 12 ft.

Stream and floodplain features such as wetlands, ponds, swales, back-channels, undercut banks, and deep pools that create ecological diversity and complexity were completely eliminated in this process. The newly-formed barren floodplain was soon replanted with thousands of native plants. The intention was to quickly provide a fully functional riparian habitat complete with undercut banks and creek-side shading suitable for the entire food chain to thrive.

Phase 2 of the project on the lower 1/3 end of the creek was constructed using functionally the same process with grading also completed in 2011. Replanting also commenced almost immediately.

Phase 3 (the middle 1/3) of the project was prematurely started in 2014 but was stopped when it was discovered that SCWA had not applied for the appropriate permits from the Army Corp of Engineers and Central Valley

Flood Control Board for any of the phases of the project.

The stated objectives of the project were to enhance the overall habitat of the section of Putah Creek running through Winters by:

- 1) Removing invasive species (such as Arundo, Himalayan blackberry, and Eucalyptus) and replace with native species to provide a natural riparian forest and shading alongside Putah Creek. This would benefit all creek-dependent animal life forms including insects, birds, fish and mammals.
- 2) Lowering water temperatures in Winters and downstream to entice more trout migration into these lower sections of the creek.
- 3) Improving overall fish habitat to increase fish populations.

It was also proposed that stream temperatures would be lowered by simply increasing stream velocity through the newly narrowed Creek channel along with more shading provided by the anticipated replanted native riparian forest.

Proven Objective Project Failures

Unfortunately, the Winters Putah Creek project has failed to deliver on any of these main objectives. It has also produced some serious unintended adverse side effects.

1. Failure to Reestablish a Riparian Floodplain Habitat

Literally thousands of seedlings and saplings have been replanted in Phases 1 and 2 of the project in the years following completion of these phases. Almost all the replants have since died for lack of water because water cannot move from the stream to the trees through the dense compacted fill. In some parts of the project, dense compact impermeable fill extends more than 12 ft deep and blocks water from reaching the trees. The impermeable fill has completely disconnected the new creek channel from the original porous, gravelly, permeable floodplain .

This has also caused serious stress and even death of the few remaining trees on the periphery of the bulldozed floodplain. You see this in most every cottonwood on the south bank below the railroad bridge. New plant growth is now dominated by a patchwork of invasive grasses and herbaceous plants including, bermuda grass, Italian rye-grass, Johnson grass, cockle-bur, and star thistle.

Although requested, a precise analysis of the number of removed, replanted, and current status of native species on the floodplain has either not been provided by SCWA.

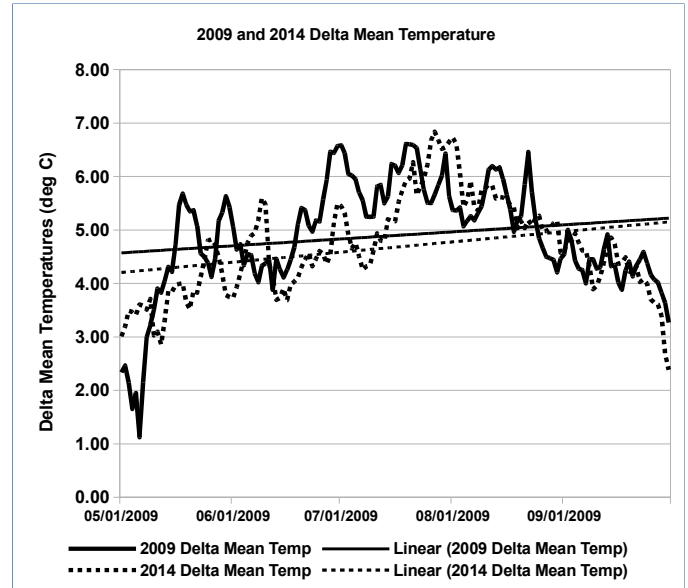
2. Failure to Reduce Creek Temperatures

Reducing creek temperatures to improve trout habitat was to be a major benefit of rechannelization based on geomorphological engineering principles. Unfortunately, the Solano County Water Agency has failed to provide any evidence that such a beneficial effect has occurred as a result of the Winters Putah Creek Parkway project

One problem in determining the success or failure in meeting this objective is that there were few temperature sensors maintained by the SCWA in locations in the Creek before the project. This limited “before and after” comparisons. According to SCWA, only one pair of sensor sites located at Winters Bridge (directly upstream of the project) and downstream the Stevenson Bridge provided sufficiently reliable temperature measurement data from May 1 through September 30 in both 2009 and 2014. This represents data from both a year before and a year after completion of Phases 1 and 2 of the project. The following graph shows the daily mean temperature differentials between these two sites for both 2009 and 2014.

As shown, the mean daily temperature differential between Winters Bridge and Stevenson Bridge site was approximately 0.25 – 0.5 deg C lower from April 1 to July 15 in 2014 (post-project) compared to 2009 (pre-project); albeit with large daily fluctuations. Beginning in August the mean temperature

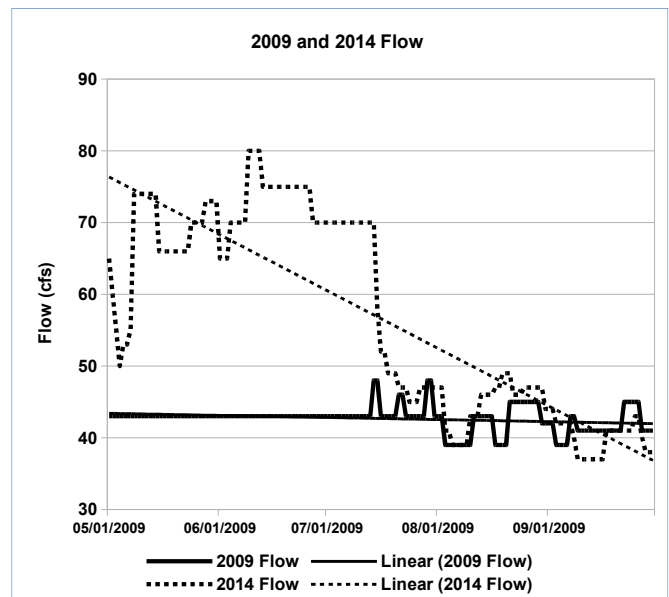
differential was not statistically different between 2009 and 2014.



SCWA engineers have stated that these decreased temperature differential spreads between these two sites, at least in May - early July of 2014 compared to 2009, is “compelling” evidence supporting their thesis that the Winters Putah Creek Park rechannelization project is producing cooler downstream temperatures.

We strongly disagree with their conclusions.

We subsequently obtained and also graphed the daily stream flow data over the exact same 2009 and 2014 time periods as the temperature data (shown in the following graph).



As is apparent in this 2nd graph, the modest difference in temperature differentials between 2009 and 2014 for the May to July period (in the first graph) are directly correlated to and likely entirely attributable to the average 75% greater instream flow released from the diversion dam in 2014 compared to 2009. By comparison, in August of both years when instream flows were near equal, there was virtually no difference in mean temperature differentials between the pre- and post-project years.

The SCWA's claim that this data indicates that the rechannelization project does, in fact, reduce downstream temperatures is without merit and simply failed to account for the dramatically increased instream flow in 2014. There is no other data suggesting that rechannelization has resulted in cooler downstream Creek temperatures. Proponents of the rechannelization project simply claim that just moving the water downstream faster will result in cooler water temperatures and this can be accomplished by channelizing the stream and removing large deep preexisting ponds. However, additional factors affecting Creek temperature have not been quantitatively considered by the SCWA.

The temperature regime of a stream like Putah Creek is the product of a complex set of variables including not just the linear velocity or speed at which water is moving downstream relative to the amount of solar radiation striking the creek.

One factor is evaporative cooling from the water surface during the day. Larger surface area of pools provide greater evaporative cooling than narrow channels. This would be even more likely if those cooling pools in question were heavily shaded to protect the water surface from solar radiation heat gain as existed pre-project.

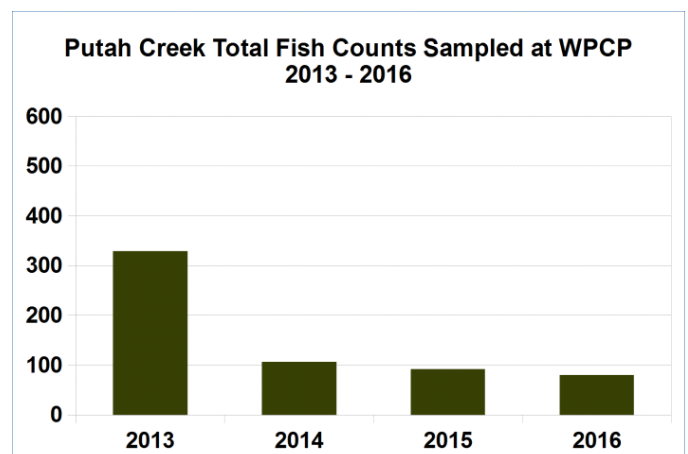
Pools with large surface area would also provide more convective cooling and black body radiation cooling at night. Additionally, deeper pools will provide substantial buffering capabilities due to the reservoir of cooler water

deeper in the pools where heat gain is minimized because the Creek water contacts with cooler groundwater sources and earth.

3. Failure to Increase Fish Populations

One of the cornerstone objectives of the Winters Putah Creek Park project has been to improve the Creek as fish habitat. However, this hypothesis has never been quantitatively tested with the results publicly disclosed even though the data has been available to the SCWA to do so for many years.

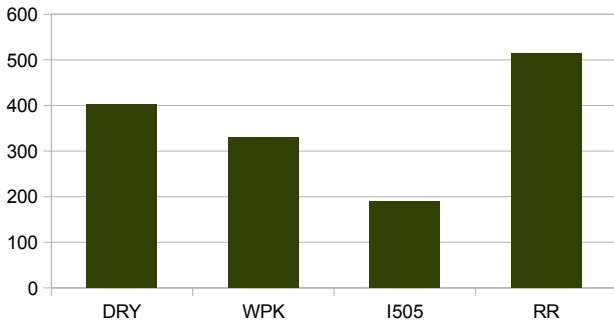
Although the SCWA has been collecting annual fish counts for the past several decades, they only recently publicly released fish count data for the years 2013 through 2016. Excerpts of this data are partially presented in the following graph.



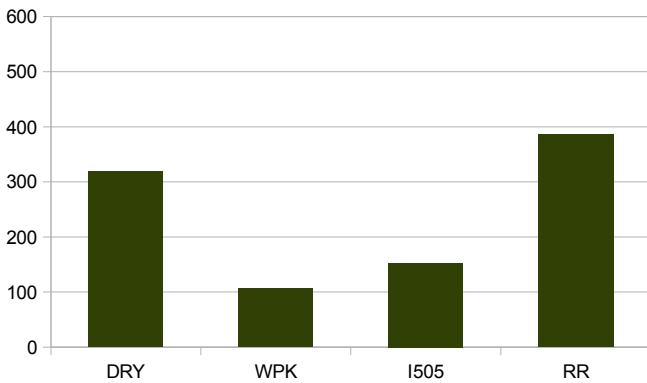
This shows an unmistakable 67% decrease in total fish populations in the Winters Putah Creek Park project area over time since the project was completed.

Additionally, the fish populations at the Winters Putah Creek Park (WPK) were compared to those at sites immediately upstream (Dry Creek - DRY) and downstream (I505 & RR- Russel Ranch) for the post project years of 2013 – 2016 as shown in the following series of graphs.

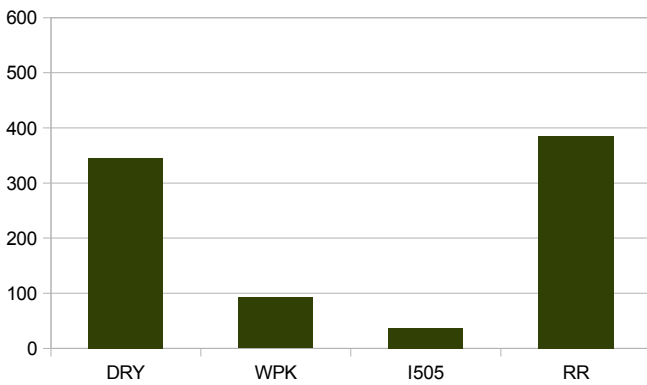
Putah Creek Total Fish Counts Sampled in 2013



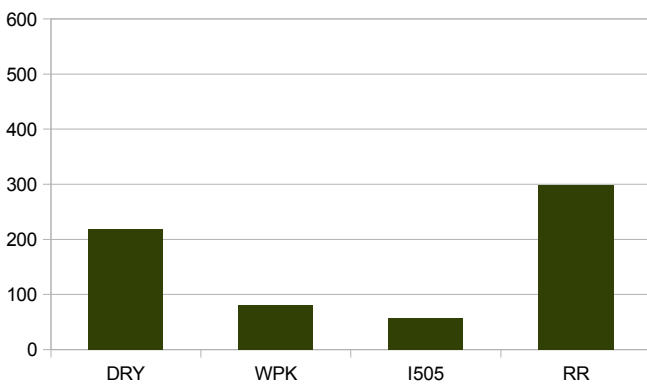
Putah Creek Total Fish Counts Sampled in 2014



Putah Creek Total Fish Counts Sampled in 2015



Putah Creek Total Fish Counts Sampled in 2016



These graphs conclusively shows that the total fish populations in the Winters Putah Creek Park project and immediately downstream at I505 are severally depressed compared to fish counts made immediately upstream and further downstream. It further casts doubt on the entire premise that drastic geomorphological engineering can beneficially impacts fish populations by narrowing the channel as claimed by project proponents.

Project proponents otherwise claim this decrease in fish populations was due to unusual drought conditions that existed for a number of years following the completion of the project. . However, because the stream is protected by regulated flows as a result of the Accord and these flows have been minimally maintained throughout the drought years, this statement is factually incorrect.

Further, trout populations were specifically projected to rise as a result of the geomorphological engineering work done in the Winters Putah Creek Park. Instead, that section of the Creek has not seen increasing trout populations over the recent years which have remained uniformly low and decreasing on average.

In summary, the claim that the geomorphological engineering used in this project beneficially improved fish habitat in the Winters Putah Creek Park project area is not substantiated by the available evidence which is the actual fish counts themselves

4. Significant Reduction in Annual Groundwater Recharge due to the Impermeable Compacted Soils

This project also has an unseen but very serious side-effect which has not been recognized nor evaluated by the SCWA. It is decreasing groundwater recharge.

In historical times (i.e. before Monticello Dam was constructed and water flow was only regulated by rainfall), Putah Creek would frequently run dry in the hottest summer months as the low flow of water sank into the porous streambed as it passed through

Winters. The Creek reemerged miles downstream when impermeable layers of soil forced the Creek back up to the surface.

Thus, due to the high porosity of the sandy, gravelly original bed of Putah Creek through Winters. Putah Creek water was a very significant source of groundwater recharge. This is the groundwater relied upon by the City of Winters for municipal needs and by surrounding farmers for irrigation needs.

As a result of the importation of unsuitable fill and compaction by heavy equipment, the stream bed and banks are now sufficiently nearly impermeable to the extent that it probably meets specifications for a landfill lining or a canal lining.

The potential maximum reduction in groundwater recharge water is easily calculated based on Solano County Water Agency's own data. SCWA has continuous data on flows upstream at the diversion dam and downstream at I-505. The lower flow at I-505 represents the water loss to groundwater and evapotranspiration.

According to SCWA data and as shown in Appendix A, there was an average loss of 15.5 cubic feet per second (cfs) of flow in the 4.2 mile reach from the Diversion Dam to I-505 during the months of August and September in the pre-project years of 2008 – 2010.

The months of August and September were chosen for investigation because they would presumably be unaffected by irrigation diversions from the Creek (which are not allowed after July 15) nor influenced by rain and/or surface runoff. During the post project years of 2013 – 2017, the average difference in flow during August and September decreased to 9.8 cfs. This represents a reduction in the difference of average flows from the pre-project period to the post-projects period of 5.6 cfs.

The volume of water potentially lost for aquifer recharge on an annual basis can thus be calculated in different units as follows:

$5.6 \text{ cfs} \times 86,400 \text{ sec/day} \times 365 \text{ days} = 176,600,000 \text{ cf/yr.}$

$176,600,000 \text{ cf/yr} \times 7.48 \text{ gal/cf} = 1.32 \text{ billion gallons/yr.}$

$176,000,000 \text{ cf} / 43,560 \text{ cf/ac-ft} = 4,054 \text{ ac-ft/yr.}$

These lower differences in flow between the pre-project and post-project years represents water that is not percolating into the ground as a result of the impermeable floodplain laid down by the project.

1.32 billion gallons of water not recharging the local aquifer is equal to about 2.7 times the annual water usage of Winters (497 million gallons/year). In other units of volume, 4,054 acre-ft of water is enough to irrigate about 1,350 acres at 3 ac-ft per year.

Winters municipal water supply is entirely groundwater sourced as is irrigation water for many nearby ranches. This loss of groundwater will have a severe affect on the municipal water supply of the City of Winters and the availability of groundwater to local farmers that will only become more evident over time

In Conclusion

Geomorphological engineering is not the solution it was claimed to be when used for restoration on creeks similar to Putah Creek. The Winters Putah Creek Park project has resulted in a almost complete failure to establish the riparian forest cut down to allow for creek channel alteration. Fish populations have plummeted in the Creek as it passes through the restored portion of the Park due to loss of favorable habitat. And the project has resulted in severe loss of groundwater recharge.

Heavy, massive earth-movers, bulldozers, and dump trucks are crude instruments to use to restore or create a complex, fine-grained, diverse stream or floodplain environment. What is needed is a lighter touch, more appreciation of the creek's complex floodplain, its wildlife, and the natural processes at work.

*Written by Friends of Putah Creek for public distribution.
June, 2018.*

Appendix A

Flow Loss Between Diversion Dam and I505

