

# SOLANO COUNTY WATER AGENCY



## MEMORANDUM

**TO:** Rich Marovich  
**FROM:** Gavin Poore  
**DATE:** August 21, 2024  
**SUBJECT:** Pleasant's Creek Rock Vane Project Summary

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### **Intro:**

For the purpose of securing grant funding intended for the construction and monitoring of restoration projects in Solano County, this memo analyzes the effectiveness of the Pleasant's Creek Rock Vanes. This multi-benefit project was performed as an emergency response to the 2020 LNU Lightning Complex Fire which burned the entire watershed of the creek. The loss of vegetation and hardened ground increased the risk of a massive surface runoff event which would have greatly accelerated erosion in Pleasant's Creek which feeds into Lake Solano, a diversion reservoir that provides irrigation and municipal water for the entire Solano County. These rock structures are designed to slow the rate of vertical and horizontal erosion while trapping sediment and forming inset floodplains improving both water quality and habitat metrics.

### **Background:**

Pleasant's Creek is undergoing geomorphic degradation due to hydrologic changes brought about by the installation of Monticello Dam. The frequent large-scale floods that once filled Putah Creek's valley are now captured in Lake Berryessa, causing all tributaries to dramatically steepen their hydrologic slope during runoff events. Pleasant's Creek has responded to this shift in slope by downcutting into a gully, and then widening this gully to accommodate for increased flood water energy in the absence of a functional floodplain. The purpose of the rock vanes are to create steps in the over-steeped hydrologic slope which lets high energy flood water expend its kinetic force on scour holes below the structure in a controlled manner. Depending on the shape of the vane they either deflect flow away from an outside bank in a bend or center flow in the middle of the channel away from both banks.



*Figure 1: Historic Photo showing massive lateral erosion and new inset floodplain developing at creek's newly shifted elevation*

## Project Results:

The rock vanes have overall remained in operable condition and have functioned as designed with a few exceptions where strong flood-water current eroded behind the rocks embedded into the bank. An as-built longitudinal survey of the thalweg and vane inverts was taken immediately after construction, providing a baseline that future surveys can compare to and quantify how much sediment is being captured by the structures. While no official second survey has taken place yet, a cursory observation of the easily accessible vanes show that they all have trapped significant amounts of sediment and developed inset floodplains while centering downstream scouring away from the toe of the bank.



Figure 2: Same location as Figure 1. Photo taken one year after project completion and implementation of rock vanes, installation of a bench at floodplain elevation which reduced the slope of the bank facilitating the growth of vegetation and minimizing erosion.

Beyond the erosion prevention function of the vanes, the habitat improvements since construction are unprecedented. Pleasant's Creek is historically an ephemeral or a very limited intermittent stream type meaning it typically dries up shortly after the rain season ends which results in a very short amount of time for wetland plant growth. What we are seeing now after the installation of the rock vanes is a transition to a dependable intermittent stream bordering on perennial with longer periods of flow into the dry season and year-round water retention in pools. This is likely due to the increased groundwater recharge that occurs as a byproduct of the structures retaining water upstream and forming deep scour pools below. After surface flows stop in the spring there is large groundwater bank that feeds back into the creek over the entire summer. Many reaches that were previously dry washes have transitioned into thriving wetlands.



Figure 3: Comparison photos of the same location showing before and after transition from ephemeral wash with limited seasonal vegetation into wetland with year-round riparian vegetation. (Photos taken 4 years apart)

## Next Steps for Pleasant's Creek

A cursory observation of the rock vanes after four years of implementation shows tremendous success in erosion prevention, sediment capture, floodplain development, and groundwater recharge. A longitudinal profile survey paired with an environmental evaluation would quantify these observed improvements and determine if the structures need additional enhancement to continue trapping sediment. If the current set of vanes have reached their sediment holding capacity, then another layer of rock can be set above them using the existing structures as footings. It is expected that quasi-equilibrium can be achieved far in advance of any channel capacity concerns, as the creek has incised 15 to 25 feet below historic floodplain elevation. Additionally, the raised and widened floodplain will help reduce erosion potential, so theoretically the amount of sediment entrapment needed will be reduced over time as well. Ideally the structures would be evaluated every 5 to 10 years, depending on severity of rain events, and rebuilt whenever their sediment capacity is reached. It's important to rebuild all the rock-vanes at once instead of in phases as maintaining the overall hydraulic slope prevents unwanted concentration of energy dissipation.

While a baseline longitudinal survey of the thalweg and vane inverts was completed at the time of construction, cross sections of the channel above rock vanes were never measured. This limits the accuracy of volume estimations for trapped sediment behind the vanes, an important metric of success for this project. It is recommended to perform a LIDAR topographic/bathymetric survey, this would provide a continuous map of ground elevations for the entire channel, an excellent reference point to track the effectiveness of future vane implementations and an update to the existing longitudinal profile displaying the progress already made.

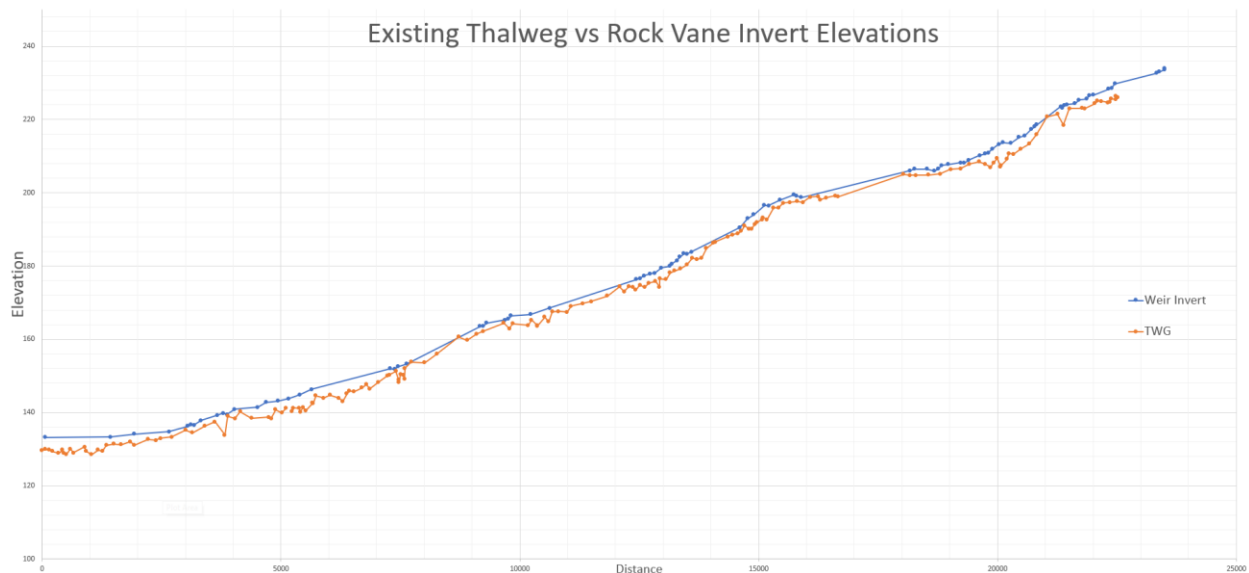


Figure 4: Baseline longitudinal profile showing the top of each rock vane's lowest elevation rock and the channel thalweg. This shows a limited view of the channel's morphology, as opposed to a 3D continuous elevation map.

## PROJECT OBJECTIVES

- Reduce accelerated rate of lateral bank erosion.
- Reduce elevated sediment volume delivered to Lake Solano and the downstream diversion.
- Trap sediment behind rock structures by raising grade elevation of the streambed.
- Dissipate the energy of flood flows within the channel by creation of a step-pool morphology.
- Enhance summer flows within Pleasants Creek by enhanced groundwater storage.
- Enhance the riparian corridor ecosystem diversity and vigor.

## OUTLINE OF PROPOSED FUTURE ACTIONS

- Complete new surveys to bolster existing baseline data.
- Stage rock materials required to raise 6.5 miles of channel bed elevation at existing vane locations.
- Enhance existing access ramps and bench features for native revegetation efforts and weed control.
- Layback vertical bank segments where feasible utilizing landowner cooperative agreements.
- Develop a comprehensive native revegetation strategy including an invasive species control program.
- Develop a thorough monitoring plan focused on project evaluation of objectives.

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