Channel and floodplain restoration

Location: Merced County, CA
Client: California Bay-Delta Authority Ecosystem Restoration Program

In rivers regulated by large dams, changes to the river's morphology, hydrology, and sediment regimes can be so profound, and longitudinal and lateral disconnection so complete, that channel reconstruction using a 'naturalization' design approach is the only credible basis for restoration. The Dredger Tailings Reach (DTR) in the lower Merced River in California's Central Valley is longitudinally disconnected by flow regulation from four upstream dams and laterally disconnected as a result of historic gold mining which has overturned and elevated the floodplain. However, it is a primary spawning area, especially for anadromous fall-run Chinook salmon (*Oncorhynchus tshawytscha)*.

Stillwater Sciences, working with the California Department of Fish and Game (CDFG) and various subcontractors, evaluated strategies for channel and floodplain restoration in the seven-mile DTR, and developed detailed restoration plans for the 318-acre Merced River Ranch (MRR), purchased by CDFG to provide coarse sediment for river restoration projects.

The design goal was to improve ecological integrity in the reach and at the MRR specifically, by restoring fundamental fluvial channel and floodplain processes within the contemporary flow and sediment regimes. The design included re-scaling the channel and floodplain to function under the regulated flow conditions, augmenting coarse sediment in the reach to offset the lack of supply, re-sculpting the channel to provide habitat for valued native aquatic species (and to discourage non-natives), actively re-vegetating the restored floodplain with native species, and preserving existing stands of native vegetation.

We conducted several studies to support restoration planning, with a view towards providing transferable scientific information that reduces uncertainty in future restoration projects in the Central Valley. Studies included analysis of the volume and texture of the dredger tailings, an evaluation of potential methylmercury release from the re-use of tailings, and a native revegetation survival experiment. Two years of baseline surveys were conducted for fish, birds, invertebrates, channel form, and sediment transport dynamics. Detailed topographic surveys were used to construct reach-scale hydraulic and sediment transport models to interpret the prevailing flow regime under pre- and post-restored conditions.

A suite of testable goals and objectives were derived to guide restoration plans. Detailed channel and floodplain designs were developed centered on using a novel sediment transport model to optimize the balance of flow and sediment transport processes with a range of ecological criteria that provide maximum benefit to native fish and floodplain vegetation. Comprehensive plans were produced to revegetate and irrigate the regraded floodplain with native vegetation assemblages tailored to predicted periods of inundation, and a programmatic schedule of gravel processing and augmentation was developed to benefit native fish. The detailed post-project adaptive monitoring and evaluation plan uses weight-of-evidence associations between measured parameters to prove individual restoration benefits. Draft permit applications and cost estimates were prepared as a pre-cursor towards implementation funding.

Ultimately, the project will provide opportunities to test whether morphological channel reconstruction without additional river flow is a viable approach to achieving broader water resource management goals in the California Central Valley or other fragmented river systems.