

Water Blueprint

for the San Joaquin Valley

Blueprint Paper¹ #1

ENVIRONMENTALLY FRIENDLY WATER DIVERSIONS IN THE SACRAMENTO-SAN JOAQUIN DELTA

When water is diverted at the State Water Project (SWP) and Central Valley Project (CVP) pumping plants in the South Delta, millions of fish are salvaged annually upstream of the pumps and returned to the Delta. But some of the smaller and more sensitive species are entrained in the process; they are preyed upon by larger fish before they reach the salvage facilities, they are not diverted by the louvers intended to direct them to the salvage facilities and are killed at the pumps, or they are salvaged but die during the capture, handling, and release process. SWP's Skinner fish facilities, constructed from 1966 to 1970, are now 50 years old. While state-of-the-art at the time, conditions and species of concern have changed. With increasing need to protect the environment, the Blueprint is advocating for a new method for diverting water from sensitive ecosystems without harming fish: "Environmentally Friendly Diversions" (EFD).

The concept of diverting water from the bottom of the water body, in sensitive ecosystems, rather than the side, is not new. Fish, even newly hatched larval fish, have a natural buoyancy that keeps them suspended in the water. So long as downward water velocities are sufficiently slow, the fish will stay suspended in the water. For larval delta smelt, diversion rates of one inch per minute did not adversely affect survival. (The concept is currently in use in at least four rivers in California, and in the United States has been used to supply some communities with water for more than eight decades.) But these facilities are typically very expensive to build, requiring horizontal boring underneath the body of water. In the Delta, the availability of large, subsided islands provides the opportunity for constructing diversion facilities before being covered with water, resulting in far less expense. When completed, Environmentally Friendly Diversions remove water from the bottom of the water body rather than the side (Figure 1) over expansive areas, so that changes in vertical velocities are imperceptible to fish (Figure 2).

¹Blueprint Papers summarize topic-specific information – typically a potential component of a water solution for California. It is hoped that these papers stimulate discussion and lead to new ideas and better solutions. Correspondence and questions concerning this paper may be directed to Scott Hamilton, Scott@ResourceEconomics.net (661) 303 1540.

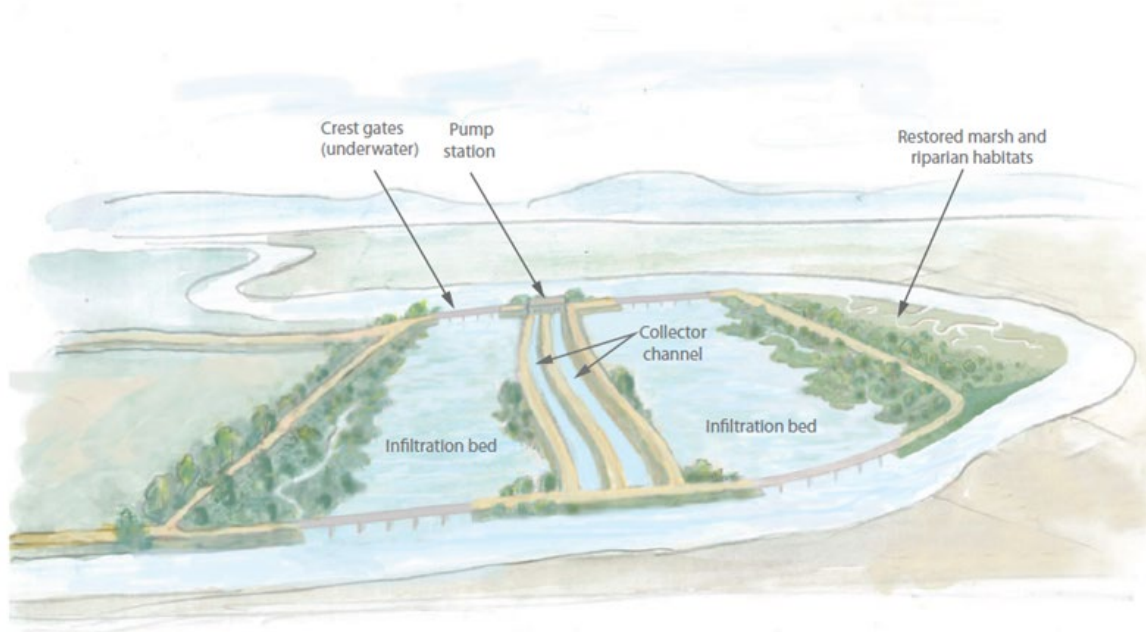
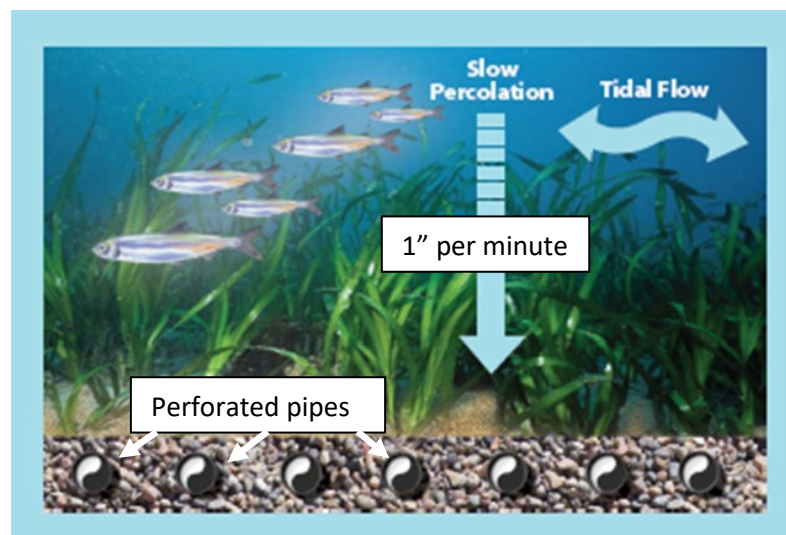


Figure 1. Project concept. Infiltration beds, large areas with buried perforated pipe, would be constructed on subsided Delta islands. Tidal and river flows would pass over the infiltration galleries so there is no “dead-end” that could harbor predators. The facility would appear like any other Delta channel. As pumps operate, water flows from the infiltration beds into collector channels, through a main pump station and into conveyance facilities for delivery. The infiltration galleries could be constructed in pairs to allow one gallery to be closed for maintenance while the other one continues to operate.

Figure 2. Biological mechanism. Fish, even at the youngest life stages, have a natural buoyancy that keeps them suspended in the water column. As long as the downward velocities are sufficiently slow, the fish will maintain their position in the water column, and water can be removed from the water body with no impact to the fish. Experiments with larval delta smelt have determined one inch per minute to be a safe operating velocity. Large quantities of water can be diverted with Environmentally Friendly Diversions because the infiltration area is hundreds of times greater than that of conventional vertical screens, allowing for much lower water velocities.



Several sites in the Delta may be worth considering (Figure 3):

- in the south Delta to eliminate entrainment at CVP and SWP facilities,
- in the central delta to reduce reverse flows in Old and Middle Rivers,
- at the head of Old River, to protect out-migrating salmon, and
- north of Walnut Grove to provide fresher water to the Central Delta.

The investigation to date of the implementation of Environmentally Friendly Diversions has been funded by the South Valley Water Resources Authority. More than \$1 million and seven year's work have been invested in the project so far, engaging teams of biologists, engineers, and water modelers. The Water Blueprint for the San Joaquin Valley sees the project as the key element in solving the water crisis in California.

Environmentally Friendly Diversions are intended to complement, not replace, other Delta Conveyance Facilities currently under consideration. A delta tunnel offers water quality and security that Environmentally Friendly Diversions cannot provide.

South Delta

Located close to Clifton Court Forebay, an EFD would divert water from Old River into Clifton Court Forebay. The gates to Clifton Court Forebay would remain closed, eliminating pre-screen losses in Clifton Court Forebay. Gates would be located in the channel leading to the CVP pumps, and the CVP could instead be fed by a new channel from Clifton Court Forebay. The capacity of a facility in the south Delta could be 6,000 cfs or more.

Central Delta

An EFD facility located in the central Delta would collect water from the larger channels in that area and would feed to Clifton Court Forebay via a new tunnel or channel. The facility might have a capacity up to 9,000 cfs and is intended to provide water project operators with increased flexibility.

North of Walnut Grove

Intended to supplement Cross Channel Gate Operations, this facility could prevent Sacramento River salmon from entering the interior Delta but allow fresh water to be diverted to meet water quality objectives. The Cross Channel gates would be operated when there are no salmon in the Sacramento River. EFD facilities would be operated when salmon are present. The capacity of this facility should be set with water quality objectives in mind. A facility with a capacity of 6,000 cfs might be considered. This site also offers the potential for the creation of salmon rearing habitat. A new water way with features reminiscent of the historic Delta could connect the Sacramento River from south of Hood to north of Walnut Grove, and in one portion, would flow over infiltration galleries of the

Environmentally Friendly Diversions. New levees would be constructed as necessary to protect farms and homes.

Head of Old River

To prevent San Joaquin salmonids from entering the south Delta, an Environmentally Friendly Diversion could be constructed at the head of Old River, keeping salmonids in the river but providing fresh water to the south Delta. An operable barrier at the Head of Old River is likely needed to facilitate boating.

The Essential Element in Solving the California Water Crisis

With increased concerns regarding water supplies from the Colorado River and the need for more water to preserve agriculture and the availability of fresh and affordable food as groundwater sustainability becomes reality, it is clear that local projects, as promising as they are, will not solve the water crisis in California. There is no amount of conservation, recycling, and desalination that can feasibly solve the problem. California must use its surplus water more wisely, capturing surplus high flow water but without harming fish. With Environmentally Friendly Diversions in the Delta, extensive groundwater storage becomes possible, providing resiliency for southern California and preserving agriculture.

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Revised December 17, 2022.

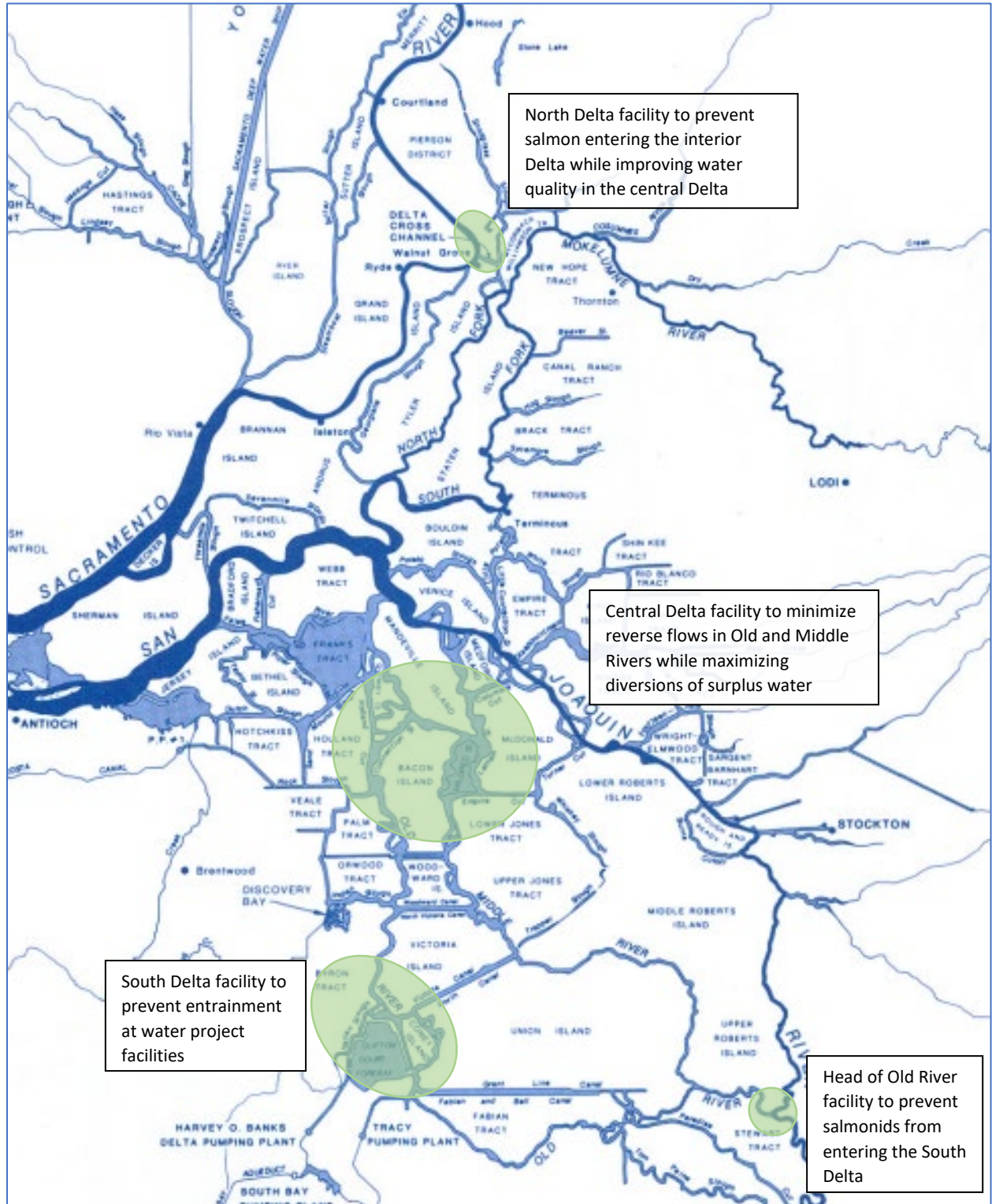


Figure 3. Possible sites for Environmentally Friendly Water Diversion projects.