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Subgroup: Improve Operational Efficiency and Transfers

Chapter 4 Conveyance—Delta

Conveyance through the Delta, located at the confluence of the Sacramento and San Joaquin rivers, naturally carries water westward from the upstream water drainage basins to the bays connected to the Pacific Ocean. The Delta, however, is also a highly manipulated network of natural streams and sloughs as well as artificial channels bordered by levees constructed to prevent flooding of adjacent islands (see Figure 4-1, Sacramento-San Joaquin River Delta). It is a critical element of both regional (e.g., Folsom South Canal) and interregional (Central Valley Project) water conveyance systems.

The demands upon the Delta conveyance system are many. They include provision of beneficial uses such as agricultural supply, industrial service supply, industrial process supply, navigation, recreation, sport fishing, habitat, migration of aquatic species, estuarine habitat, flood water conveyance, wetland habitat, and municipal and domestic water supply. Major demands on the through-Delta water are the State Water Project (SWP) and Central Valley Project (CVP) exporters in the south Delta, diverting for similar beneficial uses to the San Francisco Bay Area and Southern California. Special attention must also be given to supply adequate water for protection of State and federally listed species of concern within the Delta. Other in-Delta diverters include Contra Costa Water District, City of Stockton, and local farmers. The water flowing through the Delta to meet these users' needs must also be carefully managed to meet water quality standards set by the California State Water Resources Control Board. Some of the major constituents of concern are salinity, organic carbon, nutrients, dissolved oxygen, temperature, and turbidity. Water project operators manage inflows, exports, and in-Delta structures to control water as it moves into and through the Delta to meet the varying and growing demands.

All activities affecting or related to meeting the many demands on the Delta conveyance system will require thoughtful consideration of the Delta ecosystem health and how these actions will impact species of concern. Continuing declines in some native species populations, migrating through or living in the Delta, will increase the influence of the Delta ecosystem on exported water supply reliability, especially to the CVP and SWP. This influence has been highlighted with the ongoing investigations concerning the recent rapid decline of pelagic Delta fish populations and the federal court rulings. The recommendations of the pelagic organism investigations to reverse the population trend and the federal court decisions to protect salmon runs and dwindling populations of Delta smelt negatively impact major export water supplies. Any future activity proposed for Delta conveyance will need to consider the restoration and preservation of native habitat to benefit pelagic organisms and other native species.

Development of Delta conveyance activities, to optimally plan, operate, and maintain natural and constructed conveyance infrastructure, will require water managers, planners, engineers, and biologists to continue efforts to increase identification and understanding of the relationships between hydrodynamics, flow timing, fish timing and movement, water temperature, geomorphology, water quality, environmental responses, global climate change, and other conveyance-related considerations. They must also operate the conveyance facilities while complying with various laws, regulatory processes, and statutes such as the Public Trust Doctrine, the Water Code's Area of Origin statutes, riparian water rights, the California Environmental Quality Act, the National Environmental Protection Act, the Clean Water Act, and the State and

Federal Endangered Species Acts. Any proposed construction or operation of new facilities will be constrained by the same legal and regulatory framework.

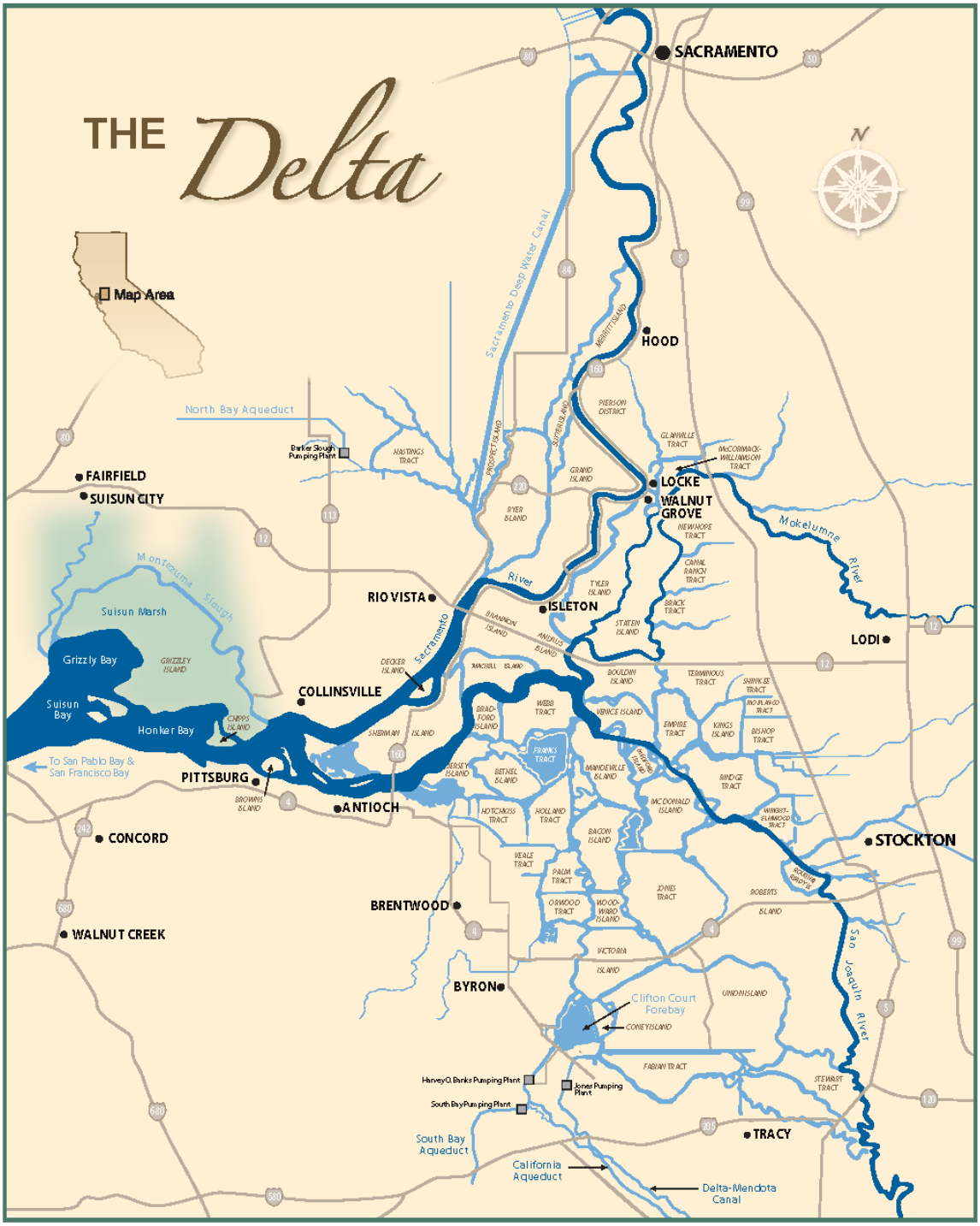

Figure 4-1 Sacramento-San Joaquin River Delta

Potential Benefits of Delta Conveyance

Generally, regional and interregional conveyance facilities provide a variety of benefits, including flood management, consumptive and non-consumptive environmental uses, water quality improvement, recreation, operational flexibility, and urban and agricultural water management.

The main benefits of Delta conveyance are in maintaining or increasing water supply reliability, protecting water quality, and providing water system operational flexibility. For the environmental sector, benefits include in-stream flows, appropriate water temperatures, and water quality for aquatic and riparian habitat. It is important to recognize that, in some cases, improving water supply reliability through operational flexibility is just as valuable as increasing overall supply.

Other specific benefits are:

- Conveyance is necessary for many of the other resource management strategies.
- Conveyance is needed to enable water transfers between sellers and buyers. In order for water to be developed by new groundwater or offstream surface storage, diversion facilities must be capable of filling available storage. Also, facilities must then be in place to convey the storage releases to the users at the right times and flow rates.
- Conveyance can improve water quality by moving more water when water quality conditions are better or less impacted by the movement of water, or by supplementing natural river flows and preventing excessive saltwater intrusion that can impair established beneficial uses and harm legal users of water in the Delta.
- Given the high-intensity, short duration characteristics of California's hydrology, improved conveyance capacities combined with adequate surface water or groundwater storage can enable diversions of more water during high flow, less competitive periods, and consequently reduce the pressure to divert water during low flow, highly competitive periods. This strategy could have additional benefits as an adaptation to future climate change.
- Conveyance improvements can provide the operational flexibility to divert and move water at times that are less harmful to fisheries or to reliably transport environmental water supplies to locations where or at times it can benefit fish and water quality.
- Delta water may be enhanced through sophisticated management projects controlling source water mixing and reducing salinity intrusion from seawater, for example with the Franks Tract Project.

Other benefits of conveyance improvements, which can vary by specific location and hydrology, generally include:

- Enlarged and enhanced conveyance systems may increase flood control capability with higher and more controlled flow through the Delta.
- Enhanced monitoring and assimilation of brackish effluent water, such as agricultural returns, storm water runoff and wastewater outfall, and conveyance through natural systems will increase water quality reliability for beneficial uses such as agricultural withdrawals, municipal water supply, aquatic habitat, and recreational activities.
- Increases in water use efficiency decreases regional water demand as well as return flows. This reduces the interregional conveyance demand through the Delta thus adding to the reliability of the state's water supply system.

- Redundancy in the Delta conveyance system will provide increases in resiliency and may, therefore, ensure some continuation of services during extreme events such as a long-term drought or following a catastrophic seismic event in the Delta.
- A larger conveyance will allow more pumping of water at optimal times, when energy costs are lower, and decrease pumping at peak energy demand periods, when energy costs are higher. Energy costs for pumping at night, for example, are less than costs during daytime when California's energy requirements peak for industrial and air conditioning uses. Project analyses will need to consider that some benefits may be offset by costs to enhance or increase conveyance capacity.
- Streams and channels enlarged for conveyance and flood passage may incorporate riparian habitat improvements that are designed for varying hydrology (including climate change) and operations.

Potential Financial Costs of Conveyance

Potential costs for conveyance can include both facility construction and operating maintenance costs that can be a significant portion of the costs in a water management system. These costs depend on the local circumstances, how far and when the water needs to be conveyed, and topography (for example, pumping vs. gravity flow). For example, the project costs are less to convey water through the Delta as opposed to construction of facilities to pump and convey water through isolated canals from the north Delta to the south Delta. Direct project costs also may include financing the capital investment. Other costs incurred by a project may include external costs, such as environmental stresses caused by construction and increased operation and maintenance costs of the project. However, the benefits of Delta conveyance improvements to increase environmental management response capabilities, water supply reliability, and operational flexibility may outweigh project costs.

DWR prepared "An Initial Assessment of Dual Delta Water Conveyance" for the Delta Vision Blue Ribbon Task Force. This report identified a range of costs for through-Delta improvements from $1.2 billion to $8.6 billion. The estimated costs for an isolated facility with a capacity up to 15,000 cfs ranged from $4.2 billion to $7.4 billion for an eastern or western alignment, respectively. The eastern alignment cost includes a canal, intake, fish screen, pumping plant, control structure, siphons, bridges, culverts, utility relocation, railway impacts, forebay, land, some mitigation, no operation and maintenance, and no planning. The western alignment cost includes a canal, pipeline, pumping plant, pipeline, tunnel, forebay, no mitigation, no operation and maintenance, and no planning. A combination of an isolated facility with through-Delta improvements ranged from $5.4 billion to $17.2 billion depending on alignment and degree of levee improvements selected for the through-Delta. The more expensive through-Delta improvement alternative would include levee earthwork, setback levees, channel dredging as well as intake, siphon, and operable gate components.

The Contra Costa Water District (CCWD) is constructing a screened 250 cfs intake on Victoria Canal that would relocate some of CCWD's diversions to obtain better source water quality and shift diversion from an unscreened intake on Rock Slough. The total project cost, including planning, design and construction, is estimated at $100 million.

Major Issues and Considerations Facing Conveyance

Managing California's water conveyance necessitates persistent efforts to address chronic issues, such as maintenance of an aging infrastructure, while simultaneously addressing new issues, such as decreased Delta smelt population. Current Bay-Delta planning efforts to address Delta Conveyance issues such as Delta Vision, the CALFED Science Program, and the Bay-Delta Conservation Plan include plans to meet the needs of water supply for consumptive use as well as the needs of the Delta ecosystems. Additional efforts to protect the Delta conveyance system also involve emergency planning for flood events, levee maintenance to increase levee integrity, and climate change impact assessment to better predict future conveyance infrastructure needs.

Maintaining optimal water quality within the Delta for both drinking water and for native species habitat will be a challenge. Control of water quality in a tidal estuary with fluctuating hydrology from season to season and year to year will require well understood and fully inclusive strategies.

Maintenance

It is essential, at a minimum, to maintain the current level of conveyance capacity for both natural and constructed facilities. Substantial reinvestment will be required just to maintain the current level of benefits due to aging infrastructure as well as diminishing conveyance capacity in natural watercourses. This is most critical from both a water supply and flood passage standpoint for channels in the Delta. Diminishing conveyance capacity is also a problem for flood management facilities such as bypasses that over time fill with silt, debris and plant growth that reduce the effectiveness for passing flood waters. In addition, rivers and streams depend upon a watershed that is in good condition. This is likely to take on very significant importance over time due to the increasingly higher costs of maintenance and the increasing demands of a growing population.

Science and Planning

Various programs have been studying Delta issues and expect to develop plans to improve the operation of the state's conveyance systems with a balanced approach to meeting the needs of its people and the environment. These studies in the Delta are particularly challenging because of potentially competitive demands on conveyance, such as needs for flood control improvements, for water quality improvements, for adequate water supply, and for Delta fisheries and habitat provisions.

The purpose of the Bay-Delta Conservation Plan (BDCP) is to create a stable regulatory framework to conserve and recover at-risk native species and natural communities in the Delta and provide water supply reliability. A joint Habitat Conservation Plan/Natural Community Conservation Plan is being developed through a collaborative process with water users, State and federal agencies, and non-governmental organizations. The BDCP will examine how to improve the design and operation of the State and federal water projects over both the short term and the long term and implement a major program for restoring and managing habitats within the Delta. The BDCP is being closely coordinated with the Governor's Delta Vision Task Force and receives technical support from the CALFED Ecosystem Restoration Program (ERP) to ensure consistency between BDCP and ERP planning activities.

The CALFED Storage Program is studying increases in upstream-of-Delta reservoir storage to increase management and statewide system flexibility. This system flexibility is expected to contribute to increase survival of anadromous fish and improve Delta water quality, ecosystem

restoration, and water supply reliability. To ensure the increased water storage is delivered to meet these needs, a reliable conveyance system will be needed. The projects within the CALFED Conveyance Program are based upon a through-Delta-only conveyance approach and include the evaluation of a through-Delta facility, Delta Cross Channel Reoperation, Franks Tract Project, permanent operable gates in the South Delta, south of Delta SWP/CVP aqueduct intertie, and CCWD Alternative Intake Project. These projects will also be evaluated assuming the possibility of a dual-conveyance system (through and around the Delta) for the Delta.

Contamination characterization of dredged sediments are being evaluated through the US Army Corps of Engineer's Long-term Management Strategy as part of ongoing channel and levee maintenance work needed for Delta conveyance. DWR's Delta Risk Management Strategy will evaluate and recommend levee standards for the Delta to increase through-Delta water supply reliability.

Area of Origin Interest

Interregional movement of water is sometimes opposed by the source-water counties. In addition to struggling to augment local water supplies to meet growing demands, area of origin interests often feel that downstream water users could or should be more committed to assisting in managing the natural infrastructure, such as the watersheds from which their imported water supply originates. Delta conveyance planning considerations will need to ensure water supplies to the areas of origin.

Climate Change

The potential for climate change will be a challenge as precipitation patterns may change as well as future water needs. Predicted effects of future climate change include warmer air temperatures, diminishing snowpacks, increased evaporation, and seasonal changes in water availability. Warmer temperatures will reduce dissolved oxygen levels, hindering the health of sensitive species such as salmon. This will also adversely promote algal blooms and microbial growth negatively affecting drinking water quality. Less precipitation is estimated to fall in the colder winter season reducing contributions to the snowpack, and more precipitation is estimated to fall later into a warmer spring season resulting in increased frequency and intensity of rainfall. This climate change scenario may require larger conveyance capacity and reservoir storage to successfully manage water for flood prevention and long-term water use. Further demands upon conveyance operations would arise from a prediction of a wider range of extremes of water year types.

Studies indicate wetter years will be wetter and drier years will be drier than those in recent record. In the Delta, a combination of higher outflow in wet years with projected sea level rise would increase the burden on levees. In drier years a sea level rise would increase salinity intrusion into the Delta and thus impact in-Delta water quality and water supply reliability.

Water Supply Reliability

Over the past several decades, increasing demand for the Delta's water resources have led to periodic shortages of sufficient water to protect Delta fisheries, maintain water quality, and meet the needs of both in-Delta and export area agricultural and municipal water users. The increasing occurrence of unmet demands continues to highlight the conflict among the needs of water users,

efforts to sustain the estuary's aquatic ecosystem, and support recovery of State and federally listed fish species.

Delta export reliability hinges on first satisfying water quality requirements for native Delta fish and the criteria for in-Delta water quality standards for consumptive use as well as in-Delta flow. The in-Delta water quality conditions will fluctuate with seawater intrusion, the quality and quantity of river and small stream inflows, in-Delta water management operations, and export pumping operations. Required inflows to the in-Delta ecosystem will also depend on the health of indigenous species and invasive species management actions.

Existing Delta conveyance does not provide long-term reliability to meet current and projected needs. Conveyance through the Delta in times of drought is especially challenging considering the various demands from agriculture, municipalities, and environmental needs. To improve through-Delta conveyance water supply reliability and provide greater operational flexibility, improvements to existing facilities in the form of updating aging infrastructure, upgrading existing capacities, adding redundancy to the system and constructing additional facilities may be needed.

The major issues pertaining to reliability of water supply transferred through the Delta include the following items.

- The integrity of more than 385 miles of Project levees and over 730 miles of non-Project levees throughout the Delta is continually undermined by such elements as storm events creating floods and seawater surges, island subsidence, natural levee erosion, poor quality peat soils used to build the original levees, seismic activity, burrowing animals, and sea level rise. These vulnerabilities call into question the long-term sustainability of using the Delta as a conveyance corridor. DWR's Delta Risk Management Strategy Phase II report will recommend levee standards for the Delta to increase through-Delta water supply reliability and reduce risks to water conveyance and other values in the Delta overall. In addition, DWR has developed an emergency response plan that has put in place tools to protect the Delta.
- Maintenance of in-Delta projects for beneficial uses such as recreational boating and swimming, sport fishing, shipping, agriculture, industrial, and drinking water supply will be an ongoing management challenge as political and fiscal climates evolve and resources for competing priorities become scarcer.
- Implementation of major conveyance facilities and improvements within the Delta will be financially costly. The federal, State, and local water agencies will need to combine their efforts to agree on project goals, plans, benefit/cost analysis, as well as financing mechanisms such as bonds, appropriations, and appropriate user fees.

Box 4-1 Flexible Operations Does Not Equal Increased Water Supply

Conveyance improvements can enhance water supply reliability by increasing operational flexibility without augmenting supplies. As more constraints have been put upon conveyance system operators, opportunities for moving water across the Delta and the reliability of those supplies is reduced. Increasing conveyance capacity would allow for greater exports when water is available to compensate for larger reductions in exports during fish-sensitive periods, thus maintaining overall exported water supply. Adding a pumping facility at a location that could be used when existing facilities have an unacceptable effect on Delta fish can be used to maintain overall water supply while simultaneously providing protection during fish sensitive periods.

Recommendations to Promote Conveyance

The following recommendations apply to federal, State, and local water agencies:

1) DWR should take the lead to improve the aging Delta infrastructure through actions such as increasing levee maintenance or replacing in-operable barriers with more efficient operable barriers.
2) DWR should take the lead to increase operational flexibility and conveyance reliability through the Delta to benefit water supply as well as aquatic ecosystems with Delta actions such as adding operational barrier structures, increasing channel conveyance capacities through dredging, or adding redundancy with an isolated conveyance facility.
3) DWR should take the lead to reduce energy needs through improved operational efficiency. Power consumption can be reduced through facilities maintenance and upgrades such as upgrades to export pumps. Water treatment plant power consumption and chemical usage could also be reduced by improving Delta water quality with structures such as operational barriers reducing seawater intrusion.
4) Establish performance metrics relating quantitative measurements (such as the quantity of deliveries for agricultural and urban users or miles of rehabilitated conveyance facilities) to qualitative indicators (, such as resiliency of conveyance to earthquakes or fewer regulatory conflicts). TMDL agreements should be balanced with conveyance improvements.
5) Ensure adequate resources to maintain the existing capacity and condition of artificial and natural conveyance facilities. This may include development of a strategy to maintain channel capacity in the Delta and existing floodways as well as financial support for regional, interregional, and Delta conveyance improvements.
6) Provide requested resources to support Delta Vision Blue Ribbon Tasks Force recommendations and address flagged issues.

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