Conveyance – Regional/Local

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Chapter 5. Conveyance—Regional/Local

Conveyance provides for the movement of water. Conveyance infrastructure includes natural watercourses as well as constructed facilities like canals and pipelines, including control structures such as weirs. Examples of natural watercourses include streams, rivers, and groundwater aquifers. Conveyance facilities range in size from small local end-user distribution systems to the large systems that deliver water to or drain areas as large as multiple hydrologic regions. Conveyance facilities also require associated infrastructure such as pumping plants and power supply, diversion structures, fish ladders, and fish screens.

Conveyance in California

An extensive system of regional and interregional conveyance facilities in the state moves water from a source location to an area where it is needed and/or conveys excess water safely to protect existing resources. Broad water management objectives and evaluations usually do not include specific regional or interregional conveyance options. Analyses must be made at project-specific levels to determine if improvements to conveyance facilities can provide system benefits or the ability to increase water supply and deliveries.

Sacramento-San Joaquin Delta Conveyance

The Delta, located at the confluence of the Sacramento and San Joaquin rivers, is a critical element of both regional and interregional conveyance systems. It is composed of natural streams and sloughs as well as artificial channels. The Delta is a network of constructed islands protected by levees and interconnected waterways that move water through the Delta from the Sacramento and San Joaquin rivers and their upstream water drainage basins to the bays connected to the Pacific Ocean. Also relying on the Delta's waterways are in-Delta diversions for agriculture and municipal use and the south-of-Delta export facilities which export large quantities of water from the southern Delta for similar beneficial uses in the San Francisco Bay Area, the San Joaquin Valley and Southern California. A more thorough discussion of Delta conveyance issues is discussed in Chapter 4 of this volume.

Interregional Conveyance

California has an extensive system of conveyance facilities that move water with the use of natural waterways and constructed facilities throughout the state. The two longest (by distance) interregional conveyance projects in California are the State Water Project (SWP) and the federal Central Valley Project (CVP). Both the SWP and the CVP use

Figure 5-1 Conveyance facilities throughout the state

natural rivers, such as the Sacramento and Feather Rivers, and constructed conveyances, such as the California Aqueduct, the Delta-Mendota Canal and the Friant-Kern Canal to deliver water from storage reservoirs in Northern California to a broad array of agricultural water agencies in Northern California and the San Joaquin Valley, as well as urban water agencies in the Sacramento Valley, San Francisco Bay Area, Central Coast, and urban Southern California. Figure 5-1 presents a map showing the extensive amount of conveyance facilities throughout the state.

Local agencies have also developed a number of interregional conveyance systems. For example, East Bay Municipal Utility District and the San Francisco Public Utilities Commission have developed major conveyance systems that transport water from Sierra Nevada rivers directly to their service areas. The Los Angeles Department of Water and Power developed and operates the Los Angeles Aqueduct to convey water from the Owens Valley to Los Angeles. A major source of water in Southern California continues to be Colorado River water diverted and distributed via the All American Canal serving the Imperial Irrigation District, the Coachella Canal serving the Coachella Valley, and the Colorado River Aqueduct delivering water to urban Southern California. Each of these conveyance systems is a major contributor to each region's water supplies and overall water supply reliability.

The existing network of interregional conveyance systems would not be capable of producing benefits if not for the ability of local water agencies to use conveyance to distribute imported, or locally produced, water to the end users, such as treated drinking water to residential or industrial users or irrigation water to agricultural users. In fact, conveyance systems are necessary in order for benefits to accrue from virtually every other facet of local and regional water management, such as desalination, recycling, efficient use, and storage projects.

Regional Conveyance

At the local level, water is distributed from locally developed sources to the end users located within the same watershed or river system. Existing regional, multi-agency conveyance projects exist in all urban regions of California, particularly the San Francisco Bay Area and the Southern California regions surrounding the Los Angeles and San Diego areas. These systems often include emergency interconnects between various agencies, which can be used in events such as earthquakes and fires to transport water when the normal pipelines are inadequate to meet emergency needs.

Potential Benefits of Conveyance

Regional and interregional conveyance facilities can provide benefits to flood management, consumptive and non-consumptive environmental uses, water quality improvement, recreation, operational flexibility, groundwater basin conjunctive uses, and urban and agricultural water management.

The main benefits of conveyance to the urban, agricultural, and environmental water-use sectors are in maintaining or increasing water supply reliability, protecting water quality, augmenting current water supplies, and providing water system operational flexibility. Improvements in conveyance capacity can be achieved by locating and widening narrow points that constrict the movement of water to increase the water transmission capacity of the entire system. For example, an improvement in conveyance capacity can increase the amount of available surplus water or exchange water that can be transported to a conjunctive use project, which will enhance the capabilities of groundwater recharge. For the environmental sector, benefits from improved conveyance capacity can support improved in-stream flows, appropriate water temperatures for fish, and water quality for aquatic and riparian habitat.

In some cases, improving the reliability of existing water supplies can be just as valuable as increasing overall supply. Conveyance capacity improvements can enhance reliability without augmenting supplies by increasing operational flexibility to move water between storage locations and points of use. For example, water agencies in the Los Angeles, San Diego and the San Francisco Bay regions have been constructing alternative pipeline transmission facilities between reservoirs in different locations to provide system flexibility in an earthquake emergency.

Other types of benefits from improved conveyance include:

- Facilitates the movement of water for storage and use between water agencies and end users. In order for water to be developed from new groundwater conjunctive use or off-stream surface storage, diversion facilities must have adequate conveyance capacity to fill the storage. Also, facilities must then be in place to convey the water releases from storage to the users at the right times and flow rates.
- Improves water quality by transporting more river water when water quality conditions are high (minimal turbidity and contaminants) and reducing water diversions when water quality is poor.
- Enables diversions of more water during high river flows with less competitive use periods, and consequently reduce the pressure to divert water during low flow, highly competitive use periods. Given the high-intensity, short duration characteristics of California's hydrology, improved conveyance capacities combined with adequate surface water or groundwater storage make beneficial diversions possible.
- Provides the operational flexibility to divert and move water at times that are less harmful to fisheries.

Other specific benefits of conveyance improvements include:

- Enlarged and enhanced conveyance systems will increase flood control capability with higher and more controlled flow through the river basins, while increased surface storage retention ponds will decrease the magnitude of peak storm event outflows.
- Conveyance management practices such as spreading basins that slow overland storm event outflows will increase retention and thereby enhance groundwater

recharge processes that have been hindered by sprawling impervious surfaces characteristic of urbanization.

- Effective incorporation of Best Management Practices for storm water runoff, storm water retention basins, and grassy swales, for example, can reduce peak flows, contribute to groundwater recharge, and filter out nonpoint source (NPS) pollutants such as sediments and heavy metals. This, in turn, decreases the burdens on management for system conveyance, flood control, and water quality. Reducing peak discharge from heavy precipitation events in particular will decrease the demand on the conveyance system.
- Increases in water use efficiency decrease the water demand for a given region and also decrease the return flow from the region. As a result, the demand for interregional conveyance decreases and therefore reduces the burden on statewide water conveyance systems, thus adding to system-wide reliability.
- Increases in resiliency to extreme events by employing interconnected conveyance systems can provide some redundancy to ensure continuation of services during a long-term drought or following a catastrophic event such as an earthquake.
- Reductions in operating costs results from enlarged conveyance capacity that allows pumping of water at optimal times to decrease the energy requirements at peak California energy demand periods.
- Improvements to instream and riparian habitat. Enlarged streams and channels for flood passage can incorporate habitat improvements that are designed with varying hydrology (including climate change) and operations.

Potential Costs of Conveyance

Potential costs for conveyance vary significantly and can include both facility and operating 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, it costs less to convey water from Oroville Dam to the Delta via gravity flow through largely natural systems than to convey water from the Delta to the South Coast Hydrologic Region through a constructed conveyance system with canals and pumps. Conveying water through the Delta and over the Tehachapi Mountains increases water costs due to construction, operation, and maintenance costs for canals, pipelines, and pumping plant facilities. With additional conveyance capacity, flexible management strategies control cost, such as moving water during off-peak energy demand periods when power costs are lower.

The Contra Costa Water District (CCWD) is constructing a screened 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.

The Freeport Regional Water Project (FRWP) is a cooperative effort of Sacramento County Water Authority (SCWA) and East Bay Municipal Utility District (EBMUD) of Oakland to supply surface water from the Sacramento River to customers in central Sacramento County and the East Bay of California. When completed, the construction of this project is estimated at a total cost of $903 million.

Major Issues Facing Conveyance

Managing California's water conveyance systems requires persistent efforts to address chronic issues, such as maintenance of an aging infrastructure, while simultaneously addressing new issues, such as impacts to fish and environmental habitat. Along natural waterways and rivers, significant issues involve flooding impacts to adjacent lands and levee maintenance.

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 and diminishing conveyance capacity in natural watercourses. 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 floodwaters. 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.

Watersheds provide the critical functions of snow pack storage, runoff, and water filtration in groundwater. Therefore, watershed management activities will also require investment in maintenance as part of the natural infrastructure of the state's water system. As California's population increases and precipitation patterns fluctuate, a higher demand will be placed upon conveyance systems to move water to meet the need for protected source water as well as dispersed water use due to urban sprawl.

Science and Planning

Water managers, planners, and biologists continue to work to identify and understand the relationships among hydrodynamics, flow timing, fish timing and movement, water temperature, geomorphology, water quality, environmental responses, global climate change, and other conveyance-related considerations so that they can optimally plan, develop, operate, and maintain natural and constructed conveyance infrastructure. Various CALFED programs have been studying these factors to develop plans to improve the operation of the state's conveyance systems with a balanced approach to meet the needs of its people and the environment. These studies are conducted in regions where export demands must be met, flood control improvements are needed, water

quality improvements are being sought, and in-stream fisheries and their habitat must be protected.

The CALFED Surface Storage Program is studying increases in upstream-of-Delta reservoir storage to increase management and statewide system flexibility. This flexibility will contribute to increased survival of anadromous fish and improved Delta water quality, ecosystem restoration, and water supply reliability. To ensure that increased water storage is delivered to meet these needs, a reliable conveyance system will be needed. The projects of the CALFED Conveyance Program are based on a through-Delta-only conveyance approach and include the evaluation of a through-Delta facility, Delta Cross Channel Re-operation, 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.

The beneficial uses of dredged materials along with the characterization of contaminated sediments is being evaluated through the US Army Corps of Engineer's Long-term Management Strategy for dredging and levee maintenance work needed for conveyance in the Delta. DWR's Delta Risk Management Strategy will establish levee standards for the Delta to increase through-Delta water supply reliability.

Regulatory Compliance

Operation of conveyance facilities must comply with various laws, regulatory processes, and statutes such as the Public Trust Doctrine, Area of Origin statutes, California Environmental Quality Act, National Environmental Policy Act, the Clean Water Act, and the Endangered Species Act. When planning new projects to increase conveyance capacity, these proposals must also comply with the above regulations, especially the evaluation of CEQA and NEPA-required environmental impacts and alternatives.

Water Supply Reliability for Emergencies

Existing conveyance facilities do not provide long-term reliability to meet current and projected needs. Improvements to facilities in the form of updating aging infrastructure, upgrading existing capacities, and constructing additional facilities are needed to meet needs under changing conditions.

Greater interconnections are needed to help improve water supply reliability. Each water system has its own level of water supply reliability, based largely on storage and conveyance systems, hydrology, and level of demand. Operational flexibility, particularly during emergency conditions, is a primary benefit of greater interconnection of independent water systems, as demonstrated during previous droughts. Conveying water through the Delta in times of drought is especially challenging considering the various demand from agriculture, municipalities, and environmental needs.

Area of Origin Interests

Interregional movement of water is sometimes opposed by the water users or agencies located in the watershed where the water supply originates. In addition to struggling to augment local water supplies to meet growing demands, area of origin interests often feel that the downstream water users could or should be more committed to assisting in managing the natural infrastructure, such as watersheds, from which the imported water originates.

Climate Change

Climate change will be a challenge as precipitation patterns may change as well as future water needs. Climate change predictions include warmer air temperatures, diminishing snowpack, 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 promote algal blooms and microbial growth 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 scenario would 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. 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. A sea level rise in a drier year would increase salinity intrusion into the Delta and thus impact in-Delta water quality and water supply reliability.

Recommendations to Promote Conveyance

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

1. Improve conveyance systems. This could take the form of improving the aging infrastructure, increasing existing capacities, or adding new conveyance facilities.

2. Upgrade aging distribution systems that could provide reduced energy needs through improved efficiency and also provide improved water quality by eliminating sources of pollution from degraded pipelines.

3. Promote development of more extensive interconnections among water resources systems such as, and in addition to, the SWP/CVP aqueduct intertie or improved connectivity within the Bay Area and Southern California. It is likely that leadership and funding on this will be at the local level. Agreements should be solidified in advance to avoid reaching critical impasses during extreme droughts or catastrophes.

4. Establish performance metrics for quantitative indicators such as quantity of deliveries for agricultural and urban users and miles of rehabilitated conveyance facilities and qualitative indicators such as resiliency of conveyance to earthquakes and fewer regulatory conflicts.

5. Assure adequate resources to maintain the condition and capacity of existing constructed and natural conveyance facilities. This may include development of a strategy to maintain channel capacity in areas of the Delta and in flood management facilities. Financially support regional, interregional, and Delta conveyance improvements.

Selected References

Bay-Delta Conservation Plan, Conveyance Working Group, Proposed Actions and Criteria http://www.resources.ca.gov/bdcp/

Contra Costa Water District. Alternative Intake Project. http://www.ccwater-alternativeintake.com/

The Freeport Regional Water Project (FRWP) http://www.freeportproject.org/index.php

US Army Corps of Engineers. Long-term Management Strategy http://www.spn.usace.army.mil/ltms/