Action Categories for Bay-Delta Solutions

Introduction

Action categories are groupings of similar actions that could be taken to solve or contribute to solutions of problems in the Bay-Delta system. Preliminary descriptions of 11 action categories are presented here to indicate the level of detail that could be useful for discussing types of actions to be considered for attaining the CALFED program objectives. Each of the descriptions identifies types of actions encompassed by the category, the purposes of those types of actions, constraints in implementing those types of actions, and linkages of each category to other categories that could produce greater overall benefits (i.e. synergisms).

The workshop discussion will focus on whether the level of detail in these category descriptions will be useful in developing alternative sets of solutions to Bay-Delta problems. At the workshop, a more comprehensive list of potential action categories will be presented as a basis for discussing which categories provide greater overall benefits in finding Bay-Delta solutions and what additional action categories need to be described.

List of Example Categories Included

Restoration of Delta Riverine Habitat

Restoration of Upstream Anadromous Fish Habitat

Installation of Barriers to Fish Movement

Changes in Locations of Diversions

Water Conservation

Water Reclamation

Water Transfers

New or Expanded Off-Stream Storage

Construction and Improvement of Conveyance Facilities

Delta Channel Modifications

Levee Maintenance and Stabilization

Restoration of Delta Riverine Habitat

Description

The amount of high quality Delta riverine habitat remaining has decreased over time as a result of levee maintenance, channel dredging, erosion from boat wakes, and other Delta land use activities. Restoration of Delta riverine habitat may include physical reconstruction of the river bank and shallow areas, revegetation, and placement of physical objects such as woody materials to enhance aquatic habitat value. Restoration may be combined with channel modifications and construction of levees, actions to prevent future degradation of existing and restored riverine areas, and protection and restoration of remaining channel islands.

Purpose

Restoration of riverine habitat is intended to improve degraded riverine areas by increasing the quantity and enhancing the quality of habitat for resident fishes, other organisms, and wildlife through physical enhancements of river banks and shallow areas, and through revegetation.

Constraints

Restoration of riverine habitat may cause environmental impacts on water quality and terrestrial habitat. Protection of restored riverine areas requires addressing erosion caused by channel flows, waves due to wind and/or boat wakes, and trespassing. Constraints to restoration may include the need to continue channel dredging and levee maintenance, which often requires the removal of vegetation and disposal of new dredged materials.

Linkage to Other CALFED Action Categories

Restoration of Delta riverine habitat can be combined with increased flood protection, and levee maintenance and stabilization provide multiple beneficial uses. To maximize connectivity with supporting habitats, riverine restoration can be linked to restoration of wetlands and riparian habitats, and shallow-water habitat in the Delta. Increases in fish populations resulting from habitat improvements can reduce conflicts between water exports and Endangered Species Act requirements.

Restoration of Upstream Anadromous Fish Habitat

Description

Anadromous fish habitat has declined drastically over time in the Central Valley rivers because of human activities in the watershed. Restoration of anadromous fish habitat upstream of the Delta in the rivers and tributary streams may include restoring flows to rivers and tributaries; protecting, enhancing, and restoring migrating, spawning, rearing, and holding habitat; developing management plans; modifying hatchery practices; improving law enforcement; and conducting monitoring programs.

Purpose

Restoration of anadromous fish habitat upstream of the Delta in the rivers and tributary streams will improve anadromous fish production in the Central Valley. Restoration would increase the amount of spawning, rearing, and migration habitat in rivers and tributaries.

Constraints

Restoring instream flows to rivers and tributaries will reduce water available locally for out-of-stream uses. Increasing instream flows in tributaries may increase the flood risk in rivers and tributaries, as well as downstream. Restoring habitats may constrain some uses of stream side habitats (such as grazing) to protect water quality and spawning bed conditions. Focusing planning efforts on anadromous fish restoration in some watersheds may restrict other activities and uses.

Linkage to Other CALFED Action Categories

Restoration of upstream anadromous fish habitat can be linked to restoration of upstream riparian habitat and upstream wetland habitat. Such restoration also can be linked to improvements in fish passage and migration, fish screens, fish behavioral barriers, diversion reductions, changes in location and flow conditions of diversions, threatened and endangered species protection, and adaptive management strategies. Restoration of upstream anadromous fish habitat can be combined with fish passage and migration improvements, modification of diversion patterns and locations, and Delta inflow/outflow/export management to increase populations of anadromous fish species.

Installation of Barriers to Fish Movement

Description

Fish barriers can consist of either physical barriers such as gates and screens or behavioral barriers such as acoustic devices that alter fish swimming behavior to direct them away from predominant flow patterns. Behavioral barriers do not block water movement and navigation as physical barriers do. Fish barriers are being considered for the upper and lower ends of Old River and at other Delta locations where substantial flows are directed away from historical migratory pathways by export pumping. For example, behavioral barriers are being considered to prevent fish from moving toward the central Delta with flows from the Sacramento River through the Delta Cross Channel, Georgiana Slough, and Three-Mile Slough. Additionally, the Delta Cross Channel gates can be operated to form a physical barrier to fish transport toward the central Delta when critical life-stages of fish are moving down the Sacramento River near the cross channel.

Purpose

Installation of fish barriers in the Delta could reduce the movement of fish toward the south Delta pumping plants and help direct the fish downstream to the Bay, thus reducing losses of anadromous fish to Delta diversions. By directing outmigrating fish through the Delta, fish barriers would increase the flexibility of export pumping while reducing losses of anadromous fish populations. Physical barriers, but not behavioral barriers, may also improve water circulation and quality. Physical barriers can also be installed at upstream locations to prevent anadromous fish from straying into uninhabitable watercourses (e.g. the San Joaquin River above the Merced River).

Constraints

Installations of fish barriers in the Delta can have logistical and technical problems. A barrier in one location may create problems at other locations. For example, a physical barrier at the head of Old River to keep San Joaquin River salmon from moving into Old River in the spring may block recreational navigation or transport of flows important for water quality. Also, construction and operation of physical barriers may be costly. Because of uncertainties in the performance of behavioral barriers, such barriers should be installed using adaptive management strategies in conjunction with real-time monitoring. Operation and maintenance of behavioral barriers would be labor intensive and costly.

Linkages to Other Action Categories

Installation of barriers to fish movement can be linked to other improvements for fish passage and migration, installation of fish screens, predator removal and control, changes to locations of diversions, and adaptive management strategies. Barriers to fish movement can also be linked to modifications of water project operations, channel modifications, improvements to conveyance facilities, Delta inflow/outflow/export management, and management of agricultural drainage in the south Delta to produce greater overall benefits for anadromous fish populations.

Changes in Locations of Diversions

Description

Anadromous and resident fish (juveniles, eggs and larvae) and other aquatic organisms are lost through entrainment at diversions in the Bay, Delta, rivers, and tributaries. The locations of diversions partially determine the extent of potential losses of fish at the diversions. Relocation of certain diversions to sites with different flow conditions could reduce the losses of fish at these diversions. For example, relocating the State Water Project (SWP) diversion at Clifton Court Forebay to Italian Slough, during specific periods of time when species of concern are found to be adjacent to the forebay intake gates could reduce losses of vulnerable fish to predators in Clifton Court Forebay. Moving agricultural diversions on Sacramento River tributaries (such as Big Chico Creek) to locations where diversions would comprise a much smaller proportion of total flow, could reduce the potentially high losses of young salmon. Also, relocating the Central Valley Project and SWP diversions to locations more favorable for screening could reduce losses of important fish species.

Purpose

Changing locations of specific diversions in the Bay, Delta, rivers, and tributaries to sites where flow conditions make fish less vulnerable to entrainment could reduce losses of critical life-stages of salmon, steelhead, striped bass, and other aquatic organisms.

Constraints

Changing locations of diversions and installation of new diversion facilities and equipment are costly. New diversion facilities, and conveyance facilities between the new diversions and existing distribution systems, will require environmental assessments for the impacts of those facilities.

Linkages to Other CALFED Action Categories

Changing locations of diversions can be linked to improvement and construction of conveyance facilities, modifications of water project operations (e.g. to reduce entrainment during particularly sensitive periods), development of offstream storage to reduce need for continuous diversions, Delta inflow/outflow/export management, improvements for fish passage and migration, fish screens, predator removal and control, and behavioral barriers to fish movement. Finally, an adaptive management strategy, using real-time monitoring for the presence or absence of critical fish life-stages, should be used to optimize the operational effectiveness of any relocated diversion facility.

Changing the locations of diversions can be combined with modification of water project operations and delta inflow, outflow and export management to enhance fish passage and migration improvements.

Water Conservation

Description

Water conservation focuses on reducing the demand for water by increasing the efficiency with which water is used in agricultural, industrial, and urban settings. Water conservation can include implementation of Urban Best Management Practices and Agricultural Efficient Water Management Practices such as increasing the efficiency of irrigation, reducing consumption of water in industrial processes, and installing low-flow plumbing devices in homes. Water conservation can also be encouraged institutionally, such as by restricting lawn watering to certain days and times and by implementing policies such as conservation pricing and financial incentives. Water conservation is actively implemented in many parts of the state.

Purpose

Implementing water conservation measures could substantially reduce water needs, thereby potentially reducing the need for water from the Delta and the necessity of developing new water facilities and sources. For example, the Metropolitan Water District of Southern California estimates that demand for water in Southern California could be reduced by 13% through water conservation.

Constraints

Implementing large-scale water conservation programs would be expensive to individuals, businesses, and public agencies and can dislocate existing business operations and arrangements. Strict water conservation also tends to reduce flexibility to reduce water consumption in years of extreme drought.

Linkage to Other CALFED Action Categories

Implementation of water conservation programs can be linked to water reclamation programs, long-term drought contingency planning, watershed management, improvements to conveyance facilities, groundwater banking and management, management of agricultural drainage, management of urban/industrial drainage, adjustments of water rates to reflect all of the costs of providing water, and establishment of institutional arrangements for long-term water management. For example, water conservation, in combination with water reclamation, groundwater banking and management, and adjustment of water rates to reflect all of the costs of providing water can reduce the need for water exports from the Delta. Reductions in the need for exports may result in reduced exports which, in turn, can lead to improvements in aquatic habitat conditions (for example, Delta outflow) and in water quality for in-Delta beneficial uses.

Water Reclamation

Description

Water reclamation is the process by which water that has been previously used for one purpose is treated to levels established by federal and state standards, depending on the subsequent use, and reused. For example, many agencies are reclaiming treated wastewater and using the reclaimed water to irrigate crops, urban landscapes, and median strips or for industrial applications such as power plant cooling and process water for paper mills. Most reclaimed wastewater is used to recharge ground water basins for later extraction and use or to repel saltwater intrusion into aquifers.

Purpose

Water reclamation and reuse is generally considered as a way to reduce water demands for water imports by reusing local supplies. Implementation of major water reclamation programs, such as those currently underway in Southern California, could reduce demands on the Delta by providing an alternative source to diversions through or around the Delta. This reduction of Delta export demand would benefit Delta water quality and ecosystem quality.

Constraints

Depending on the type of reuse scenario, reclamation can be moderately expensive and can require parallel transmission and distribution systems to ensure separation of potable and reclaimed water. Groundwater recharge, however, is generally cost-effective because large amounts of reclaimed water can be reused with relatively minimal capital costs. The use of reclaimed water often requires an extensive public education program to deal with public perceptions on health issues. Use of reclaimed water is highly regulated by California law and extensive studies of health effects in areas of high reuse have shown no measurable adverse effects.

Linkage to Other CALFED Action Categories

Reclaimed water could be used to enhance or create new habitat areas for fish and wildlife. For example, wastewater treatment plant effluent can be used as a water source for constructed wetlands. Reclaimed water could also be used as an alternate source for some activities that currently use fresh water, such as irrigation and groundwater recharge, thereby making more fresh water available for other uses. Water reclamation, in combination with water conservation, groundwater banking and management, and adjustment of water rates to reflect the appropriate cost of water, can reduce the demand for water exports from the Delta. Reductions in Delta exports can result, in turn, in improvements in aquatic habitat conditions (e.g. Delta outflow) and in water quality for in-Delta beneficial uses.

Water Transfers

Description

Water transfers consist of negotiated agreements between parties that allow water that is typically available or used in one area to be transferred for use in another area. Transfers can occur within a hydrologic basin or between basins, and they can involve the purchase or exchange of water. Three types of transfers are defined in the California Water Code: temporary urgency transfers (less than 1 year), temporary transfers (less than 1 year), and long-term transfers (more than 1 year). Proposals have been made to modify and clarify sections of the California Water Code to facilitate water transfers. Transfers from north-of-Delta to south-of-Delta may require use of available excess diversion and conveyance capacity for wheeling of transferred water.

Purpose

Water transfers are intended to increase the reliability of water supply by reallocating water from areas with excess or unneeded water to areas where demand exceeds supply, either in short-term drought situations or for long-term supplies. Transfers are considered an important tool for solving some of California's water supply and allocation problems, in part because they generally have fewer environmental impacts and costs than construction of new facilities. Water transfers can also directly serve environmental purposes if the water is transferred for use at wildlife reserves, for in-stream flows, or for Delta in-flow or outflow.

Constraints

Large-scale and long-term water transfers could have adverse economic consequences if water is made available for transfer by fallowing farmland. The fallowed land would not require labor and materials for farming, therefore causing secondary effects on "third-party" businesses and local agencies that depend on agriculture. In cases where the party providing the water replaces the transferred supply with groundwater, exacerbation of groundwater overdrafting may occur. Water available for transfer as a result of conservation actions or unneeded supplies in the source area would have fewer economic consequences. Water transfers also may be constrained by legal interpretations and applications of the water rights system and area-of-origin statutes. Transfers also may require transport of water through the Delta and increased diversions to deliver water to the end user. Such increases could require increased Delta export pumping which could affect fish and wildlife. Transfers can be specifically designed, however, to minimize fish and wildlife impacts and take advantage of windows of opportunity to enhance habitat conditions for important fisheries resources.

Linkage to Other CALFED Action Categories

Water transfers can be linked to land fallowing (in source areas), groundwater banking and management, long-term drought contingency planning, Delta inflow/outflow/export management, construction of off-stream storage (e.g., use of in-Delta reservoirs to increase flexibility of transfer timing), and establishment of institutional arrangements for long-term water management. Increases in diversion and conveyance capacity and more efficient processing of water transfer agreements are needed to maximize the efficiency of water transfers.

New or Expanded Off-Stream Storage

Description

New or expanded off-stream storage, the creation of water storage capacity in locations away from the sources of water, may include constructing new reservoirs or increasing the capacity of existing reservoirs. Several off-stream storage reservoirs are presently in the planning or construction phase, including the Los Vaqueros Reservoir, a project of the Contra Costa Water District; the Domenigoni Valley Reservoir, a project of the Metropolitan Water District of Southern California; Los Banos Grande, a project of the California Department of Water Resources; and the proposed Delta Wetlands project within the Delta.

Purpose

New or expanded off-stream storage is intended to increase the reliability and supply of water. The additional storage capacity can also improve the reliability of water supplies by providing flexibility in the timing of diversions. These diversions can be stored when flood water is available and used in times of low water availability. The additional storage may also have water quality benefits, if the extra capacity allows water to be diverted from the source supply when quality is good (generally, during heavier flows).

Constraints

The cost of constructing additional off-stream storage can be very high. Also, if the storage site is distant from the water source or the destination, pumping costs can be very high. Two other major constraints are the limited number of appropriate sites for constructing reservoirs and the environmental impacts associated with the construction and operation of reservoirs, conveyance facilities, and pumping stations.

Linkage to Other CALFED Action Categories

The provision of additional off-stream storage can be linked to watershed management, increase in diversion capacity, water transfers (that can be managed using off-stream storage), groundwater banking and management, construction and improvement of conveyance facilities, Delta inflow/outflow/export management, and changes in locations of diversions. New or expanded off-stream storage requires an increase in diversion and conveyance capacity to effectively use the available supply and developed storage capacity. Increases in diversion and conveyance capacities may be required to allow off-stream storage to facilitate water transfers.

Construction and Improvement of Conveyance Facilities

Description

Conveyance facilities include canals, pipelines, siphon-reservoir complexes, and channels, and their intakes and outfalls. The key routes for water conveyance through the Bay-Delta system is from Delta inflow locations to Delta outlflow and export locations. Facilities to more efficiently transport water between these endpoints could be located within or around the edges of the Delta. Existing channels such as the Delta Cross Channel could be improved (by being widened, for example). Existing intakes at the Delta export facilities (such as Clifton Court Forebay) could be expanded or otherwise improved. Conveyance facilities are important in south-of-Delta export areas to more efficiently use and conserve water that flows into the Delta.

Purpose

Conveyance facilities can be improved or constructed to more efficiently move water through the Bay-Delta system to better serve water quality and habitat objectives in the Delta. Improvements to existing conveyance facilities and construction of new conveyance facilities contribute to better and more efficient management of water supplies. More direct and/or enclosed conveyance facilities conserve water otherwise lost to seepage, leakage, contamination by salinity intrusion, or evaporation.

Constraints

As with all facilities, cost is a serious constraint for conveyance improvements and construction. Such facilities in the Delta also face serious constraints because of the important aquatic and wetland habitats where they would be sited. Other types of environmental constraints for Delta facility construction are losses of existing land uses, impacts to economic and cultural resources, and impacts to terrestrial habitats. Depending on the size, location (e.g., intakes), and operation of the conveyance facilities, ecosystem health can be adversely affected.

Linkage to Other CALFED Action Categories

Improvements and construction of conveyance facilities can be linked to most other types of actions that might be implemented in the Bay-Delta system and in south-of-Delta use areas. For example, modifications of state and federal water project operations, water conservation, construction of in-stream and off-stream storage facilities, facilitation of water transfers, groundwater conjunctive use programs, and Delta inflow/outflow/export management can be combined to more efficiently manage water supplies to benefit all beneficial uses in the Bay-Delta system. Also, construction and improvements of conveyance facilities can be combined with Delta inflow/outflow/export management to improve habitat conditions for fish passage and migration.

Delta Channel Modifications

Description

Channel modifications can consist of deepening, widening and straightening channels, and modifying levees to increase the conveyance of water supply or floodwaters within the Delta, address water quality concerns, and reestablish a net down-estuary flow. Activities can include dredging, creating levee setbacks, and constructing physical barriers and weirs.

Purpose

Channel modifications can contribute to improvements in Delta water supply and water quality conditions by facilitating transfers of Delta inflow to locations for Delta export. Installation of barriers and weirs can be used to modify channel conveyance patterns, for example, to increase transport of high-quality water to areas where it is needed. Alternatively, barriers or weirs can be used to reduce transport of poor-quality water (for example, waters subject to salinity intrusion or contaminated with agricultural drainage) to sensitive locations. Channel modifications can also improve flood control by increasing the capacity to convey flood waters through the Delta.

Constraints

Constraints on channel modifications include land acquisition costs, losses of productive land uses, dredged-material disposal costs and impacts, increases in seepage, blockage or disruption of fish migration patterns, losses and disturbance of important aquatic and wetland habitats (such as shallow riverine habitat and channel tule islands), and mobilization of toxic constituents in dredged materials.

Linkage to Other CALFED Action Categories

Channel modifications can be linked to levee maintenance and stabilization, construction of new flood control protection, construction of conveyance facilities, dredged-material management, and restoration of aquatic and wetland habitats.

Delta channel modifications to increase channel capacity can provide opportunities for the restoration of riparian and shallow water habitats as well as facilitate Delta inflow/ouflow/export management.

Levee Maintenance and Stabilization

Description

Levee maintenance and stabilization increases the reliability and stability of existing levees that provide flood protection for Delta islands. Levee maintenance and stabilization actions therefore consist of actions such as adding berms, widening levees, placing stone protection, or keeping the levee clear of vegetation. Also, institutional arrangements could be established to ensure funding so that levees are rehabilitated and maintained to uniform standards.

Purpose

Levee maintenance and stabilization contribute to maintaining the reliability of the Bay-Delta system and protecting its beneficial uses. Reliability of existing flood control facilities around Delta islands protects existing land uses for agriculture, wildlife habitat, and infrastructure such as transportation facilities, gas transmission lines, and water conveyance systems. Levee reliability in the western Delta is also crucial to protecting Delta water quality from salinity intrusion that can result from island inundation.

Constraints

Lack of funding and habitat impacts are major constraints to levee maintenance and stabilization actions. Aquatic habitats provide important habitat features for both aquatic and wetland ecosystems. Both direct maintenance and rehabilitation of levees and establishment of comprehensive institutional arrangements to ensure these actions are implemented would be costly. Thus, levee maintenance and rehabilitation projects need to be designed to address potential impacts to habitats.

Linkage to Other CALFED Action Categories

Levee maintenance and stabilization actions can be linked for combined positive benefits to actions in categories such as reduction of land subsidence (to reduce depths of island interiors under protection), construction of conveyance facilities and channel modifications in the Delta to achieve water supply or water quality purposes, management of dredged materials (for example, as a source of levee construction material), restoration of riparian and wetland habitats, establishment of long-term funding mechanisms for levee maintenance, and regional land use planning.

For example, levee maintenance and stabilization could be combined with establishment of floodways and habitat restoration to create corridors for wildlife movement between Delta habitats.