

Chapter 3

Plan Formulation

This chapter briefly describes resource management measure to meet the planning objectives, constraints, conditions, and criteria developed in Chapter 2. A resources management measure is any structural or nonstructural action that could address one or more of the planning objectives. This chapter also describes the formulation of concept plans developed from identified resources management measures.

Plan Formulation Approach

Resources management measures are typically developed to address a specific planning objective. By combining measures, alternative concept plans are constructed that address all of the identified planning objectives. Because measures are not complete plans, the screening process for measures differs from that for alternative plans. Alternative plans are evaluated according to the four standard P&G criteria for water resources (completeness, effectiveness, efficiency, and acceptability), while measures are primarily screened based on their relative ability to contribute to study goals and planning objectives and their consistency with study planning criteria, constraints, and principles. This includes the potential for a measure to contribute to other study objectives when part of a complete alternative plan. For example, if a measure to address a single objective could be implemented independently, and no benefit would occur in combining it with measures to address other study objectives, it would likely be dropped from further study.

Screening of Resources Management Measures

Seven criteria were developed to establish the basis for screening resources management measures: (1) water quality criterion, (2) fisheries criterion, (3) reliability criterion, (4) regulatory criterion, (5) institutional criterion, (6) technical and operational criterion, and (7) cost criterion. The first three criteria are the purpose and needs criteria, while the other four are the practicability criteria. These seven criteria assess whether a measure could satisfy the project purpose and need, and provide a method to determine whether measures are available and practicable on the basis of logistics, existing technology, and cost. The water quality, fisheries, and reliability criteria are specific to this project, whereas the other criteria are consistent with similar criteria commonly used as part of measures evaluations, including several previous and successful Reclamation and/or CCWD projects (CCWD 1992; Reclamation 1997; and EBMUD et al., 2003). These criteria are further described below:

- **Water Quality Criterion** – A measure, either individually or in combination with other possible plans, must be capable of improving delivered water quality to treated-water and untreated-water customers, especially during drought periods; protecting and improving health and/or aesthetic benefits to customers; improving operational flexibility; and protecting delivered water quality during emergencies.
- **Fisheries Criterion** – A measure, either individually or in combination with other possible measures, must be capable of improving fisheries conditions around CCWD’s Delta intakes, especially around the Pumping Plant No. 1 and Rock Slough intake facilities.
- **Reliability Criterion** – A measure, either individually or in combination with other possible measures, must be capable of improving the reliability of CCWD’s delivered water quality to treated-water and untreated-water customers, especially during emergencies.
- **Regulatory Criterion** – A measure, either individually or in combination with other possible measures, must not have any permits or agency approvals that cannot be reasonably obtained given considerations of logistics or existing technology.
- **Institutional Criterion** – A measure, either individually or in combination with other possible measures, must not have any legal, ownership, public policy, or social constraints that cannot be reasonably solved given considerations of logistics or existing technology.
- **Technical and Operational Criterion** – A measure, either individually or in combination with other possible measure, must not have any unreasonable engineering or operational problems, involve questionable or untested technologies, or depend on a site or resource that is unreliable.
- **Cost Criterion** – A measure, either individually or in combination with other possible measures, must be developed, constructed, and operated in a financially responsible and cost-effective manner with a commensurate improvement in delivered water quality to CCWD customers.

Resources Management Measures

A comprehensive list is included in this section of possible types of measures that, either individually or in reasonable combinations, could meet the Project need and objectives or substantially contribute to the Project need and objectives. Both structural and nonstructural plans are included. Potential

measures to be considered were determined based on consideration of previous studies and reports (CALFED, 2000, 2004; CCWD, 1992, 1998, 2000, 2003 2005; DWR, 2005; and EBMUD et al., 2003); input from CCWD engineers, planners, and consultants; and results of NEPA/CEQA scoping activities. Alternative intake sites and other options for improving delivered water quality were originally investigated as part of studies conducted for the original Los Vaqueros Reservoir Project in the early 1990s (CCWD, 1992). Identified resources management measures are grouped into four categories. Three of these groups follow the grouping used in the EIR/EIS for the Project, and the fourth group is added to reflect fisheries protection objective.

Measures to Address Water Quality and Reliability

Measures for meeting the Project objectives of maintaining reliability and improving water quality of CCWD's delivered water supplies fall into four general groups: measures that improve source water at the existing Delta intakes; measures that develop new source water other than the Delta; measures that enhance water treatment capabilities of CCWD to address salinity; and measures to reduce fisheries impact at CCWD intakes

Group A. Protect/Improve Source Water at Existing Intakes

A1. Point-Source and Nonpoint-Source Discharge Reduction

CCWD relies exclusively on source water obtained from the Delta at its three existing intakes. With this measure, discharges (including agricultural, municipal, and stormwater drainage) in the Delta or near CCWD's intakes would be (1) collected and rerouted to alternate discharge locations farther from the CCWD intakes, (2) reduced, or (3) treated prior to discharge to the Delta. This measure has the potential to improve localized Delta water quality by reducing the concentration of organic carbon, pesticides, salts (e.g., chloride, bromide), and other constituents that impact source water quality for drinking water. Performance of measure A1 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could partially meet the need and objective of protecting and improving delivered water quality during dry periods, but would not improve reliability through operational flexibility or protect water quality during emergencies. It also would not contribute to fisheries protection around CCWD's Rock Slough intake.
- **Practicability Criteria** – Institutional constraints associated with this measure include an absence of laws or pending legislation to mandate improvements in, or the quality of drainage water to, the Delta, and substantial cost (and time) would be needed to achieve extensive and meaningful landowner and agency consensus and cooperation. Achieving agency and landowner cooperation for such alternatives

would require additional studies, substantial outreach efforts, and substantial funding mechanisms.

A2. Increased Water Quality/Regulatory Standards in Delta

This measure entails promulgating new water quality standards and/or regulatory requirements that would target specific constituents of concern with regard to drinking water, which could include salinity, TOC, and other organic and inorganic constituents. These new standards and/or requirements could target specific activities such as agricultural or municipal discharges to improve overall untreated-water quality at CCWD's intakes. This measure would require actions by Reclamation, as well as DWR, SWRCB, CVRWQCB, and EPA, and would be implemented through Basin Plan amendments, the SWRCB WQCP for the Bay Delta Estuary, or other water quality standard modifications. Performance of measure A2 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could partially meet the need and objective of protecting water quality, but would not improve reliability through operational flexibility or protect water quality during emergencies. It also would not contribute to fisheries protection around CCWD's Rock Slough intake.
- **Practicability Criteria** – This measure would also not meet the regulatory criterion because of (1) significant indirect environmental impacts to aquatic habitats and fish in upstream reservoirs and rivers from substantially modified flows to reduce seawater intrusion, and (2) substantial CVP and SWP water supply impacts resulting from substantially increased flows necessary to significantly reduce salinity at CCWD's intakes, especially during drought periods. This measure would require significant actions by CVRWQCB, SWRCB, EPA, and others. It is not reasonable at this time to conclude that this plan would be implemented in the foreseeable future or improve CCWD's source water quality sufficiently.

A3. Modifications to Delta Water Supply Management and Operations

This measure would involve modifying the manner in which water supply to and through the Delta is managed and operated by the CVP and SWP to meet water supply and other responsibilities, focusing more on increasing upstream releases when Delta concentrations of constituents of concern to drinking water are highest and when Delta water quality does not meet CALFED drinking water quality goals or CCWD source water quality goals. Upstream releases are currently made as part of complex regulatory requirements to maintain specific salinity levels at specific Delta locations. Modifications would increase CVP and/or SWP responsibilities beyond those required by existing water right decisions. However, modified operations could focus on meeting CCWD or CALFED goals for Delta drinking water quality at CCWD's intakes by targeting specific constituents of concern such as salinity and TOC. Modified

operations are especially important during drought years and late summer and fall conditions when Delta concentrations of salinity, organic carbon, and other constituents of concern for drinking water are highest. Typical water supply management and operation modifications to accomplish these goals would include the following:

- Increase controlled water releases from upstream storage reservoirs of the CVP and SWP to increase Delta inflows and improve water quality at CCWD's intakes at appropriate times
- Reduce Delta exports to limit saltwater intrusion near CCWD intakes at appropriate times

Performance of measure A3 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could potentially meet the needs and objectives of protecting water quality, and would improve reliability through operational flexibility to protect water quality during emergencies. However, it would not contribute to fisheries protection around CCWD's Rock Slough intake.
- **Practicability Criteria** – This measure faces substantial regulatory and institutional constraints that render it impractical. Reoperation of Reclamation and DWR facilities to improve water quality at CCWD's intakes is difficult and to a large extent unattainable. Both Reclamation and DWR must meet numerous complex legal requirements, in addition to meeting water quality goals, including fisheries requirements for instream flows, temperature, and water quality. This measure would have substantial redirected impacts, especially to CVP and SWP water supplies that serve a majority of California's urban and agricultural water users.

A4. Delta Levee Improvements

The Delta consists of a series of waterways and islands. These islands are substantially below sea level and must be protected by levees. About 1,100 miles of levees are needed to protect Delta land uses and water quality for Delta and export users. When a Delta levee fails, large volumes of water can flood an island, thereby modifying Delta hydrodynamics and impacting seawater intrusion into the Delta. This measure would consist of structural improvements to Delta levees to reduce the risk of levee failure and the corresponding high salinity caused by saltwater intrusion.

CALFED has initiated the Levee System Integrity Program to provide base-level protection, special levee improvement projects, a levee subsidence control plan, and a levee emergency response plan for Delta levees. Severe funding limitations have precluded the Levee System Integrity Program from making

the substantial levee improvements proposed in the Delta. The United States Army Corps of Engineers (USACE) has completed the Sacramento and San Joaquin River Basins Comprehensive Study to evaluate and recommend solutions to flooding problems in the Central Valley, including the Delta. However, only a few projects were identified for near-term funding, and these projects would not affect or protect Delta water quality. CALFED, USACE, DWR, The Reclamation Board of the State of California (The Reclamation Board), and local Reclamation Districts (RD) are currently involved in Delta levee improvement efforts. However, for a variety of reasons, including funding issues, substantial risk of Delta levee failures still exists, as evidenced by the flooding of Jones Tract in 2004.

Under this measure, no additional CCWD facilities would be required because the focus would be on structural improvements of existing levees throughout the Delta, but particularly for those levees close to CCWD's existing intakes. Performance of measure A4 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could partially meet the need and objectives of improving reliability through reducing the likelihood of levee failure and seawater intrusion. However, it would not contribute to improving water quality, nor would it contribute to fisheries protection around CCWD's Rock Slough intake.
- **Practicability Criteria** – Planning and implementing a large-scale Delta levee improvements project would require substantial coordination between agencies, and may not be feasible for institutional reasons. Further, USACE and DWR estimate costs to improve Delta levees at several billion dollars, and funding mechanisms to make the necessary structural improvements throughout the Delta are not in place.

A5. Delta Hydraulic Improvements

The Delta is a highly managed system, and numerous hydraulic improvements have been made to the system to convey water of adequate quality to CVP and SWP exporters. Delta hydraulic improvements include tidal control gates, barriers, and channel modifications. All of these types of improvements have been made in the Delta by DWR to convey water to its customers. This measure includes additional and modified facilities to inhibit salt trapping and mixing, and thus improve Delta water quality at CCWD's existing intakes by reducing seawater intrusion in the region.

DWR recently completed studies of three flooded Delta islands (Franks Tract, Big Break, and Lower Sherman Lake) to evaluate whether hydraulic modifications at these sites could improve Delta water quality, the ecosystem, and recreation. The prefeasibility study report showed that modifications at Franks Tract had the most promise for improving Delta water quality;

modifications to the other two flooded islands provided minimal water quality benefits (DWR 2005). Performance of measure A5 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could potentially meet the need and objectives of improving and protecting delivered water quality during dry periods. However, it would not improve reliability of adequate water quality during emergencies, nor would it contribute to fisheries protection around CCWD’s Rock Slough intake.
- **Practicability Criteria** – The DWR prefeasibility study on Delta flooded islands concluded that only Franks Tract modifications are worth further investigation, which would involve constructing tidal gates and/or improving the existing levees surrounding Franks Tract to reduce tidal flows and salinity mixing. There is uncertainty about cost associated with various project alternatives, as well as about meeting the numerous regulatory (including environmental) and institutional constraints this measure would involve.

Group B. Obtain New/Alternative Source Water

B1. Regional Water Management/Intertie with Treated-Water, Untreated-Water or Sources

The concept of regional water management consists of pooling and joint management of water resources in the study area, which is limited to Bay Area water purveyors that are directly adjacent to CCWD’s service area, or that operate conveyance facilities that cross through or near CCWD’s service area. In this context, “regional” refers generally to the Bay and East Bay areas; any plans outside these areas would result in substantial conveyance costs and environmental impacts and are not considered further. Regional water management plans include untreated-water interties/exchanges with other water agencies, such as EBMUD, the City of San Francisco, Santa Clara Valley Water District, Zone 7, and Alameda County Water District. These untreated-water interties/exchanges could be used with CCWD’s existing water rights at a changed point of diversion, or could represent a new water supply source for CCWD.

Performance of measure B1 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could conceptually meet the need and objective of improving and protecting delivered water quality during dry periods. It would also provide additional reliability during emergencies, and contributes to fisheries protection around CCWD’s Rock Slough intake by reducing diversions from the unscreened intake.

- **Practicability Criteria** – The potential for a regional management agreement or intertie varies by agency and water source. However, in general, these agencies either lack supplies or delivery capacities during drought and late summer and fall periods, when CCWD needs these supplies. In addition, with some of these agencies, significant institutional barriers exist. Below is a brief summary of key issues with major regional water purveyors:
 - Expanding interties with EBMUD is constrained by the limited capacity of the Mokelumne Aqueduct during key periods of the year. In addition, EBMUD’s Mokelumne River and American River sources have no available surplus water during droughts and late summer and fall. There are also institutional barriers to developing an agreement with EBMUD.
 - An intertie with the South Bay Aqueduct is constrained by the limited capacity in the aqueduct, preventing the SWP from meeting all its contract deliveries in some years. Therefore, it is highly unlikely that any extra capacity would exist for CCWD to obtain additional supplies. This option would also require significant infrastructure costs and institutional issues related to sharing capacity, supply, and costs.
 - The City of San Francisco and other Bay Area water utilities have limited water supplies and conveyance capacities, which could not be used on any regular basis to meet CCWD’s needs, especially during droughts and late summer and fall.

B2. Relocation of Some CCWD Diversions at Old River to New Intake

This measure entails constructing an alternative intake and relocating pumping from CCWD’s existing intake at Old River to another location within the Delta to access available source water having higher water quality. Past and ongoing CCWD modeling studies and water quality sampling results have consistently shown that Delta locations relatively close to existing CCWD Old River facilities (primarily Middle River and Victoria Canal) have water quality at certain critical times that is better than water quality conditions at the Old River intake. For example, studies during the original Los Vaqueros Project alternatives evaluation showed that a Middle River intake, both with and without a reservoir, would provide substantial water quality benefits, and such an intake was proposed as a project alternative. However, because of a number of factors, including cost and reduced water supply reliability, the Middle River intake alternative was rejected as the preferred alternative (Contra Costa Water District, 1992).

This measure includes construction of a new intake, and alternative pipeline alignments, and instituting alternative operational scenarios to relocate Old River pumping to the new intake location. The existing Old River intake could

be taken out of service, maintained only for emergency purposes, or used in concert with the new intake for operational flexibility. Reclamation and CCWD would need to modify certain water rights for a new point of diversion.

Performance of the measure B2 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria.** Water quality varies geographically and seasonally in the Delta, and certain locations in the south and central Delta have water quality that is better than what is available at CCWD's Old River intake. Therefore, this measure could potentially meet the need and objectives of improving and protecting delivered water quality during dry periods. It would also provide additional reliability during emergencies by providing an additional intake on the Delta. However, because this measure would primarily modify diversions from Old River, it would only contribute incidentally to fisheries protection around CCWD's Rock Slough intake.
- **Practicability Criteria.** This measure could be reasonably implemented and would not face major regulatory, institutional, technical and operational, or cost constraints. However, there is significant opposition from Central and South Delta water users to building an intake on Middle River. To implement this measure, Reclamation would need to petition the State Water Resources Control Board for a new point of diversion/rediversion on certain water rights and modify CCWD's CVP contract to relocate some CCWD contract water from the Old River intake.

B3. Supplemental Water Conservation and Reclamation

Supplemental water conservation and reclamation could potentially improve water quality indirectly by reducing water demands and thereby allowing CCWD to minimize its need to divert Delta water and/or use less water from Los Vaqueros Reservoir during dry months or droughts. A water conservation plan would have to achieve savings significantly greater than the savings already attained and projected to be attained through CCWD's existing conservation program. CCWD's Future Water Supply Study evaluated significantly increasing conservation as a means of meeting future water supply needs (CCWD, 1998). It was determined that conservation could not reliably provide significant water savings above the level already implemented in CCWD's conservation programs (CCWD, 1998; 2002). Note that about one-third of CCWD's water demand is for industrial use, which has limited potential for conservation. CCWD is currently a signatory to the Memorandum of Understanding Regarding Urban Water Conservation in California developed by the California Urban Water Conservation Council. As part of this agreement, CCWD continually evaluates its conservation program to maximize water savings. "Reclaimed water" is defined as effluent that has been treated adequately and reliably to a high quality to be suitable for beneficial uses.

Reclaimed water, which is not intended for drinking, could be used for landscape and crop irrigation, industrial processing, heating and cooling, dust suppression and soil compaction, flushing toilets in commercial buildings, wetland enhancement, stream flow augmentation, and groundwater recharge.

Performance of measure B3 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – Implementing additional conservation and reclamation measures above the current level would only result in minor water quality benefits, and the results of such a program would not be reliable. In addition, conservation and recycled water would not focus on the fall period when water quality improvement is most needed, and would not improve CCWD's water quality during extended dry periods when Los Vaqueros Reservoir may not have sufficient supplies for blending. Consequently, this measure would not provide adequate demand reduction to meet or even approach meeting the Project needs and objectives. Operational flexibility and water quality protection during emergencies also would not be improved. This measure also would not address fisheries protection.
- **Practicability Criteria** – This measure could be reasonably implemented and would not face regulatory, institutional, technical and operational, or major cost constraints.

B4. Bottled Water

Under this measure, CCWD would supply bottled water for individual customers, either when CCWD's delivered water quality objectives were not attained or during an emergency that would exceed the demand of Los Vaqueros Reservoir. This measure would involve purchasing, storing, monitoring, and delivering bottled water to individual residences, workplaces, commercial establishments, and other public facilities, or contracting with an existing company to perform these services. It is expected that an extremely large warehouse and testing facility, as well as parking and maintenance space sufficient for a fleet of delivery trucks, would be needed.

A volume of at least 2 liters per person per day would be required to meet basic ingestion needs, and more would be required to meet cooking requirements. If bottled water were supplied only when CCWD's water quality objectives were not met, monitoring and communication systems or notices would be needed to notify customers when to switch to bottled water. Bottled water would need to be provided to approximately 500,000 people who live in CCWD's service area. Performance of measure B4 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could potentially meet the need and objective of improving and protecting delivered water quality during dry periods. However, it would provide only partial reliability benefits during emergencies, and would not contribute to fisheries protection around CCWD’s Rock Slough intake.
- **Practicability Criteria** – The widespread and continued mass distribution of bottled water would be a large and expensive undertaking that would be substantially higher in cost than other potential alternatives. In addition, CCWD’s industrial and irrigation customers would not benefit from this measure.

B5. Sierra Source Supply

Sierra source supply measures would involve constructing a new intake at a point upstream from the Delta where better water quality could be obtained. The goal would be to access this water directly without any regional partners. One alternative would involve moving the diversion point for CCWD’s entire diversion to a Sierra source point, similar to supplies used by EBMUD or the City of San Francisco. Conceptually, this could be accomplished by obtaining new CCWD water rights or changing the point of diversion of CCWD’s existing CVP water rights to a new Sierra location. Another measure would be to maintain the existing intakes and develop a new Sierra diversion (with the same capacity as the Old River intake) for use during times of high salinity, whereby the water would be transferred from the Sierra through the Delta via a pipeline.

Sierra supply source measures would require construction of diversion facilities and a new conveyance system to bring water from the Sierra source point to the CCWD service area. New water rights also would be needed. A Sierra supply source could theoretically be developed within the following river basins where water quality is generally better than Delta water quality: American, Feather, Sacramento, Stanislaus, Cosumnes, Mokelumne, Calaveras, Tuolumne, and San Joaquin. Performance of measure B5 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could potentially meet the need and objective of improving and protecting delivered water quality during dry periods. It also would provide additional reliability during emergencies, and contribute to fisheries protection around CCWD’s Rock Slough intake by reducing diversions from the unscreened intake.
- **Practicability Criteria** – This measure would likely face severe regulatory (including environmental), institutional, technical and operational, and cost constraints. Obtaining new water rights or changing the point of diversion of existing CVP water rights for a new Sierra supply (such as the Cosumnes, Stanislaus, Mokelumne, American, or Tuolumne rivers) would be extremely difficult, if not

impossible. Moreover, the cost to construct a pipeline to access a Sierra supply would be extremely high. Regulatory constraints would be massive because numerous agencies (USFWS, NMFS, CDFG, and SWRCB), water districts, and both water and environmental stakeholders would be opposed to such a project. This measure could also increase the potential for fisheries impacts on the source river by diverting water during drought and low-flow late summer and fall periods.

B6. Groundwater Management/Conjunctive Use

Groundwater management measures could include groundwater production/recharge facilities or individual property-specific wells. If needed, desalination and conveyance facilities could also be constructed to obtain, treat, and distribute groundwater to CCWD customers. This plan would require the availability of willing sellers from whom CCWD would exchange/transfer CCWD's CVP surface water rights for groundwater rights, or would require CCWD to acquire additional groundwater rights.

Major facilities for this measure would include groundwater production and recharge facilities. Production facilities would include groundwater production wells, a well field collection system, and conveyance facilities (e.g., pipelines, pumping facilities) to deliver groundwater to the Contra Costa Canal. The recharge facilities would include a recharge basin and conveyance facilities from the Contra Costa Canal to the groundwater basin to deliver recharge water from the Delta during those times when Delta water quality is good. A desalination plant could be constructed in association with the groundwater facilities to provide improved water quality for groundwater sources with high chloride concentrations.

Potential groundwater sources include the east Contra Costa County basin, Livermore Valley basin, Delta basin, and San Joaquin County basin. Preliminary studies of the east Contra Costa County basin estimate the yield at 3,000 to 6,000 acre-feet per year with chloride concentrations ranging from 64 to 295 mg/L, and average chloride at about 210 mg/L. Groundwater quality in the Livermore Valley basin is only fair, with chloride concentrations averaging 130 mg/L. The Delta basin has average chloride concentrations of over 1,000 mg/L throughout the San Joaquin County portion of the basin. Water quality in the San Joaquin County basin is much better, with chloride concentrations averaging about 75 mg/L, but there are serious overdraft conditions in this basin (CCWD, 1992).

Performance of measure B6 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – The groundwater basins in and near CCWD's service area would not provide the quality of water necessary to improve water quality for CCWD delivered supplies. However, this

- **Practicability Criteria** – This measure would face numerous and complex institutional and regulatory constraints, including strong public opposition from a variety of local and regional stakeholders in San Joaquin County, which holds the only practical groundwater resource in the area. San Joaquin County has management controls over groundwater extraction and is actively seeking additional water supplies. It is highly unlikely that San Joaquin County officials would approve groundwater export given the present groundwater overdraft problems and water supply needs in San Joaquin County. Moreover, the capital costs for accessing groundwater in San Joaquin County would likely be over \$500 million (CCWD, 1992).

B7. Water Transfers/Exchanges

This measure would entail the transfer of water to CCWD from water supply sources not under the control or ownership of CCWD. Transfers would be negotiated with one or more entities holding water rights, such as other CVP contractors, SWP contractors, or individual contractors such as Yuba County Water Agency. Water transfers to CCWD would need to be conveyed through the Delta, and CCWD has participated in several temporary water transfers with Yuba County Water Agency. This measure would only improve delivered water quality if CCWD could access better quality water than is currently available at CCWD's Delta intakes and have that water conveyed to its system. Performance of measure B7 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure would not improve water quality at existing CCWD intakes because transfer water would still be conveyed through the Delta to reach CCWD's intakes. It also would not provide operational flexibility and water quality protection during emergencies, nor would it address fisheries protection.
- **Practicability Criteria** – This measure would face severe regulatory and institutional constraints. Water transfers large enough to improve salinity at CCWD's intakes would need to be very large, and the necessary institutional mechanisms are not in place to ensure that the transfers would result in increased outflow to improve water quality rather than increased export pumping. The availability of willing sellers to transfer water under stringent CVP and SWP requirements may also be difficult.

Group C. Enhance Existing Water Treatment

C1. Supplemental Treatment at CCWD Water Treatment Plants

This measure entails incorporating advanced treatment technologies at the Bollman WTP and/or the Randall-Bold WTP to further reduce the targeted constituents of concern and to better meet CCWD's goals. This measure could also include treatment facilities used by CCWD's untreated-water customers or new CCWD treatment facilities. CCWD currently uses both GAC and advanced oxidation treatment processes. However, several technologies exist that may further improve overall delivered water quality. Potential methods for providing supplemental water treatment at CCWD's WTPs include the following:

- Constructing additional GAC treatment processes at the existing WTPs to further enhance taste and odor control.
- Constructing UV treatment technology as an alternate form of disinfection to improve delivered water quality by preventing the formation of disinfection byproducts and enhancing health, taste, and odor benefits.

This measure would only benefit CCWD's treated water customers if it included upgrades to treatment facilities used by CCWD untreated-water customers and/or new facilities for untreated-water customers. Performance of measure C1 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure would only partially meet the objective of improving delivered water quality through improving taste and odor of delivered treated water. However, it would not address water quality concerns regarding chlorides or bromides. It also would not provide operational flexibility and water quality protection during emergencies, nor does it address fisheries protection.
- **Practicability Criteria** – This measure would only minimally address the Project needs and objectives and would not provide benefits to untreated-water customers without upgraded/new facilities and substantial increased costs and institutional arrangements.

C2. Desalination Plant.

CCWD could construct a desalination plant and treat either Bay or Delta water. Desalination is a water treatment process used to remove salt and other dissolved minerals from water. Some processes may also remove other contaminants of concern, such as dissolved metals, microorganisms, and organics. Desalination processes can be used for either brackish water (total dissolved solids (TDS) of 500 to 10,000 mg/L) or seawater (TDS of 10,000 to 50,000 mg/L). Performance of measure C2 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure generally would meet the Project needs and objectives through improving delivered water quality, especially during drought, and would improve operational flexibility by providing the flexibility to divert Delta water of a wider range of quality and still meet delivery goals. Depending on how the plan is developed, it could provide some protection during emergencies by enabling CCWD to treat lower quality water. However, it would not address fisheries protection.
- **Practicability Criteria** – This measure would reasonably meet the regulatory (including environmental) and institutional criteria, although typical environmental issues associated with desalination plants (brine disposal, facility siting, and increased energy use) would need to be resolved.

C3. Home Water Treatment Devices

This measure would involve providing CCWD's customers with point-of-use (i.e., home water treatment) devices to reduce salinity in their drinking water. Point-of-use devices typically treat water in batches and deliver water to a single tap. Types of point-of-use systems include pour-through, faucet-mount, counter-top-manual-fill, and plumbed-in. The extent of water quality improvement varies with the sophistication of the devices. Home water treatment devices include the following:

- GAC treatment devices (taste and odor control only)
- Ion-exchange water softeners to reduce hardness (e.g., calcium, magnesium) (taste and odor control only)
- Simple home filtration devices (taste and odor control only)
- Distillation units (this is the only unit that also removes most dissolved solids such as salts, minerals, particles, and some organic chemicals)

Performance of measure C3 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could only partially meet the Project needs and objectives to improve delivered water quality and protect and improve the health and/or aesthetic benefits to customers. Home water treatment devices, with the exception of distillation units, would not improve water quality with respect to salinity; consequently, distillation units would be required to meet the water quality criterion. Operational flexibility would not be improved, but some aspects of protecting water quality during an emergency would be met. No fisheries improvement is expected, because no reduction in Rock Slough diversions would occur under this measure.

- **Practicability Criteria** – This measure faces substantial technical and operational constraints, including installing, monitoring, maintaining, and replacing distillation units continuously on a widespread basis. Implementation of this measure at such a large scale on an annual basis would be unprecedented in the United States and could involve questionable or untested technologies relative to the institutional constraints presented above. The need to install devices at the point-of-use, such as a private residence, would likely be unacceptable to some customers and would pose a major institutional constraint. Costs to implement this measure would also be substantial and continuous.

Measures to Address Fisheries

Measures for meeting the plan objectives of reducing fisheries impact at CCWD's Rock Slough intake are described below

Group D. Protect Fisheries Around CCWD Intakes

D1. Installation of Fish Screens at Rock Slough Intake

Currently, CCWD diverts most of its water supplies from two sources, the Old River intake, which is equipped with a state-of-the-art positive barrier fish screen, and the Rock Slough intake, which is unscreened. The unscreened Rock Slough intake is also located in a dead-end slough in an area with greater fish densities, increasing the likelihood of fish entrainment losses. This measure would involve retrofitting the Rock Slough intake with a fish screen to mitigate fishery impacts in the proximity of CCWD's Rock Slough intake. Performance of measure D1 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure would contribute to fisheries protection around CCWD's Rock Slough intake. However, it would not provide any water quality or reliability improvement benefits.
- **Practicability Criteria** – This measure could be reasonably implemented and would not face major regulatory, institutional, technical and operational, or cost constraints.

D2. Relocation of All or Some CCWD Diversions at Rock Slough to New Intake

This measure is similar to measure B2, which involves constructing an alternative intake and relocating pumping from CCWD's existing intakes (including Rock Slough) to another location within the Delta to access available source water having higher water quality than is found at the current intake locations. However, the main difference between the two measures is that measure D2 focuses on relocating the Rock Slough intake, while measure B2 focuses only on relocating the Old River intake and not relocating pumping from Rock Slough. The new intake, equipped with state-of-the-art fish screens, would result in a net reduction in fisheries impacts because diversions would be

reduced from the unscreened Rock Slough intake. Performance of measure D2 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – Similar to measure B2, this measure could potentially meet the need and objectives of improving and protecting delivered water quality during dry periods. It would also furnish additional reliability during emergencies by providing an additional intake in the Delta. In addition, because this measure would modify diversions from the Rock Slough intake, it would contribute to fisheries protection around the intake.
- **Practicability Criteria** – This measure could be reasonably implemented and does not face major regulatory, institutional, technical and operational, or cost constraints. Reclamation would need to modify CCWD's CVP contract to relocate some CCWD contract water from the Rock Slough intake.

D3. Replacement of All or Some of CCWD Diversions at Rock Slough with a New Water Source

This measure would replace all of CCWD current diversions at Rock Slough intake with a new water source(s) by relocating the intake point from Rock Slough to Middle River. The new intake would be a screened intake to provide fisheries benefits, while diverting higher water quality from Middle River compared to current water quality at Rock Slough. Performance of measure D3 against the screening criteria is summarized as follows:

- **Needs and Objectives Criteria** – This measure could potentially meet the needs and objectives of improving and protecting delivered water quality during dry periods. It would contribute to fisheries protection around CCWD's Rock Slough intake by relocating diversions to a screened intake. However, since it does not add an additional diversion point, it would not contribute to operational flexibility or reliability during emergencies.
- **Practicability Criteria** – This measure could potentially face institutional, regulatory and environmental constraints. Obtaining new water rights for a new supply would be difficult. However, changing the point of diversion of existing CVP water rights would be reasonably achievable. This measure would likely affect the Delta water quality compliance station at Contra Costa Canal Pumping Plant No. 1. This measure could also increase the potential for fisheries impacts on the source river(s) by diverting water during drought and low-flow late summer and early fall periods.

Measures Retained for Further Development

Based on the preceding discussion and evaluation of resources management measures, a formal screening process was constructed to provide a consistent

basis for elimination/retention of resources measurement measures. The process of screening measures is summarized in Table 3-1. The first step in the screening process was to score each measure against each of the three criteria for purpose and need and the five practicability criteria. Based on these scores, measures were either retained or eliminated from further consideration. For a measure to be retained, it had to meet the following two conditions:

1. Measure must achieve, address, or contribute to, at least one of the planning objectives.
2. Measure should not violate any of the practicability criteria (i.e., should be reasonably implementable).

Based on the screening process shown in Table 3-1, six resources management measures were retained, which are developed into alternative concept plans in the following section. The six retained measures include the following:

- A5 – Delta hydraulic improvements
- B2 – relocation of some Old River diversions to new intake with higher water quality
- C2 – desalination plant
- D1 – Installation of fish screens at Rock Slough intake
- D2 – relocation of all or some CCWD diversions at Rock Slough to a screened intake
- D3 – replacement of all or some CCWD diversions at Rock Slough by a new water source with screened intake

Table 3-1. Summary of Resources Management Measures Screening for the Alternative Intake Project

	Resources Management Measures	Screening Criteria							Assessment	Measure Retained
		Purpose and Need Criteria			Practicability Criteria					
		Improves CCWD Delivered Water Quality During Dry Periods	Reduces Fisheries Impact Around CCWD Intakes	Improves Supply Reliability During Emergencies	Regulatory: Approvals Can Be Reasonably Obtained	Institutional: No Legal, Ownership, Public Policy, or Social Constraints	Technical & Operational Feasibility	Cost Effective		
Group A Measures. Protect/Improve Source Water at Existing Intakes										
A1	Point-Source and Nonpoint-Source Discharge Reduction	Partial	No	No	Yes	No	Yes	Yes	Could partially improve water quality, especially during drought periods. Not practical due to lack of laws mandating drainage improvement, and substantial cost and time to achieve cooperation of involved parties.	No
A2	Increased Water Quality/ Regulatory Standards in Delta	Partial	No	No	No	No	Maybe	No	Significant environmental, CVP, and SWP impacts. Complex and speculative nature of institutional agreements would make it impractical.	No
A3	Modifications to Delta Water Supply Management and Operations	Yes	Yes	No	No	No	No	No	Substantial modifications of CVP and SWP operations would be required, which would make it impractical.	No
A4	Delta Levee Improvements	No	No	Partial	No	No	Yes	No	Would partially improve reliability of CCWD's supplies. High costs (billions) with no funding mechanisms in place, and required complex institutional arrangements would make it impractical.	No
A5	Delta Hydraulic Improvements	Yes	No	No	Maybe	Maybe	Yes	Maybe	Could improve water quality during drought periods. Would require numerous regulatory agreements and may have significant effects on the Delta ecosystem.	Yes
Group B Measures. Obtain New/Alternative Source Water										
B1	Regional Water Management/Intertie with Untreated-Water or Treated-Water Sources	Yes	Yes	Yes	Yes	No	Maybe	Yes	Significant institutional barriers and complex technical and operational issues would make it impractical within reasonable time frames.	No
B2	Relocation of Some CCWD Old River Diversions to New Intake with Higher Water Quality	Yes	No	Yes	Yes	Yes	Yes	Yes	Would improve delivered water supply, increase reliability during emergencies, and reduce fisheries impacts through fish screens.	Yes
B3	Supplemental CCWD Water Conservation and Reclamation	No	No	No	Yes	Yes	Yes	Yes	Would not improve water quality during extended dry periods, or operational flexibility and water quality protection during emergencies, nor improve fisheries in the vicinity of CCWD intakes.	No
B4	Bottled Water	Yes	No	Partial	Yes	No	No	No	Widespread and continued mass distribution of bottled water to large portion of CCWD's customers would not be practical.	No
B5	Sierra Source Supply	Yes	Yes	Yes	No	No	No	No	Measure would be faced with severe regulatory (including environmental), institutional, technical and operational, and cost constraints.	No
B6	Groundwater Management/Conjunctive Use	No	Yes	Yes	Yes	No	No	No	Groundwater quality in basins in and near CCWD's service area would not be adequate. Accessing groundwater in San Joaquin County would be expensive and strongly opposed.	No
B7	Water Transfers/Exchanges	No	No	No	No	No	Yes	Yes	Very large water transfers would be required to improve salinity at CCWD intakes. Does not improve reliability of CCWD's supplies during emergencies. Significant institutional barriers exist.	No
Group C Measures. Enhance Existing Water Treatment										
C1	Supplemental Treatment at CCWD Water Treatment Plants	Partial	No	No	Yes	No	Yes	No	Would partially improve taste and odor of delivered supply, but not chlorides or bromides. Would provide only minor protection of water quality during emergencies. Would minimally address Project objectives.	No
C2	Desalination Plant	Yes	Partial	Yes	Yes	Yes	Yes	Maybe	Would provide flexibility to divert wide range of water quality from the Delta during droughts and emergencies. Regulatory and institutional criteria could potentially be met.	Yes
C3	Home Water Treatment Devices	Partial	No	Partial	Yes	Maybe	No	No	Would partially improve water quality of delivered supply, and increase reliability during emergencies. Large scale implementation and maintenance would be economically and technically impractical.	No
Group D Measures. Protect Fisheries Around CCWD Intakes										
D1	Installation of Fish Screens at Rock Slough Intake	No	Yes	No	Yes	Yes	Yes	Yes	Retrofitting Pumping Plant No. 1 with fish screens would provide adequate fisheries protection. However, this measure would have no water quality or reliability benefits.	Yes
D2	Relocation of All or Some CCWD Diversions at Rock Slough to a Screened Intake	Maybe	Yes	Yes	Yes	Yes	Yes	Yes	May improve delivered water supply, could increase reliability during emergencies, and would reduce fisheries impacts through fish screens.	Yes
D3	Replacement of All or Some CCWD Diversions at Rock Slough with a New Water Source	Yes	Yes	Yes	Yes	Maybe	Yes	Maybe	Regulatory (including environmental), institutional, technical and operational, and cost constraints.	Yes
Key:	Yes: Meets the criterion Partial: Meets some but not all of the criterion Maybe: May or may not meet the criterion depending on how the Project is implemented, and/or further analysis is necessary to determine whether criterion is met No: Does not meet the criterion							CCWD = Contra Costa Water District CVP = Central Valley Project Delta = Sacramento-San Joaquin Delta SWP = State Water Project		

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Concept Plans Considered

This section describes concept plans that were formulated from the retained resource management measures. Based on the six retained resources management measures, four alternative concept plans have been formulated to address planning objectives of the Project. Table 3-2 summarizes the development of each concept plan through combining different resource management measures. Description of the concept plans starts with the No-Action Plan, followed by a brief description of each of the four concept plans. The No-Action Plan represents a baseline to evaluate the performance of the concept plans. The alternative concept plans are further developed and evaluated in the following chapters.

No-Action Plan

The No-Action Plan represents a projection of current conditions to reasonably foreseeable future conditions that could occur if no action plans are implemented. Under this plan, CCWD would continue to operate and maintain its existing facilities to maximize delivered water quality given physical limitations of the existing infrastructure, and consistent with environmental regulations and permit conditions. In the near term, no substantive or predictable operational changes would be implemented under the No-Action Plan. Under future levels of demand (Table 2-1), the No-Action Plan includes the expansion of the Old River pump station to a capacity of 320 cfs consistent with the CCWD Future Water Supply Implementation (CCWD, 1998).

The No-Action Plan (i.e., future without-project) would include CCWD's Old River Water Quality Improvement Project and the Rock Slough Water Quality Improvement Project, both of which have recently been completed; and the EBMUD Intertie with the FRWP, which is currently under construction and anticipated to be completed in mid-2007. It would also include the Contra Costa Canal Encasement Project, for which the EIR/EIS was recently approved; Phase 1 of the project has been funded.

Plan 1 – Victoria Canal Intake 1

Plan 1 is based on resources management measures B2 and D2 (see Table 3-2). Measure B2 would seasonally relocate Old River intake diversions to Victoria Canal. Measure D2 would relocate some Rock Slough diversions to a screened intake. Hence, Plan 1 would involve a new intake on Victoria Canal that would replace some of CCWD's existing diversions at Old River and Rock Slough. Victoria Canal is a Delta location with better source water quality that receives its water flows from the Middle River. This plan could provide fisheries benefits to threatened and endangered species because fish mortality would be reduced with the new screened diversion compared to the unscreened diversion on Rock Slough. However, Rock Slough would continue to provide a portion

of CCWD supply, but would be used less frequently. Therefore, this plan could provide water quality, supply reliability, and fisheries protection benefits.

Table 3-2. Development of Concept Plans for the Alternative Intake Project

	Retained Resources Management Measures	Alternative Concept Plans				
		No-Action Plan	Plan 1	Plan 2	Plan 3	Plan 4
A5	Delta Hydraulic Improvements					✓
B2	Relocation of Some CCWD Old River Diversions to New Intake with Higher Water Quality		✓			
C2	Desalination Plant			✓		
D1	Installation of Fish Screens at Rock Slough Intake					✓
D2	Relocation of All or Some CCWD Diversions at Rock Slough to a New Screened Intake		✓	✓		
D3	Replacement of All or Some CCWD Diversions at Rock Slough by a New Water Source				✓	

Key: ✓ = Measure included in concept plan.

Plan 2 – Desalination Treatment Plant

Plan 2 is based on resources management measures C2 and D2 (see Table 3-2). Measure C2 would install desalination treatment processes at the existing Bollman WTP to reduce salinity and improve quality of delivered supplies. Measure D2 would relocate some Rock Slough diversions to a screened intake. Plan 2 would provide high-quality desalinated water to customers served by the Bollman WTP and reduce overall demands on the Rock Slough unscreened intake by increasing diversions through the Mallard Slough screened intake. The reduced demands from the Rock Slough intake would also reduce the quantity of blending water required from the Los Vaqueros Reservoir to meet delivered water quality goals. This would allow the Los Vaqueros Project to be used more effectively to provide high-quality water to the remaining untreated- and treated-water customers. Therefore, this plan could provide water quality, supply reliability, and fisheries protection benefits.

Plan 3 – Victoria Canal Intake

Plan 3 is based on resources management measure D3, which relocates the Rock Slough intake to a new location on the Middle River that provides better water quality. The plan would involve building a new screened intake on the Middle River that would feed Pumping Plant No. 1 through a pipeline to the Contra Costa Canal entrance. To eliminate potential water quality deterioration

in the Contra Costa Canal sections between Pumping Plant No. 1 and the entrance point to the Contra Costa Canal, this plan assumes that the Canal Encasement Project would be implemented and is part of the future without-project conditions. The new screened intake would contribute to an overall reduction in fisheries mortality rates compared to the current unscreened intake on Rock Slough. Plan 3 would also contribute to supply reliability during emergencies because, operationally, CCWD would be able to switch back from the Middle River to Rock Slough for water diversions. Hence, CCWD would have access to not only alternative, but also additional diversion locations. In addition, moving the current diversion point from Rock Slough to the Middle River would improve reliability because CCWD would have access to a new water source (i.e., Middle River) compared to only Old River, from which both the Rock Slough and Old River intakes are fed. Therefore, this plan would provide water quality improvement benefits, supply reliability, and net fisheries benefits.

Plan 4 – Delta Hydraulics Modifications

Plan 4 is based on resources management measures A5 and D1 (see Table 3-2). Measure A5 would implement Delta hydraulic improvements (e.g., Franks Tract project) that could contribute to water quality improvements at CCWD intakes. Measure D1 would involve retrofitting the Rock Slough intake at the entrance to the Contra Costa Canal with fish screens to reduce impact to fisheries. Therefore, this plan could provide water quality and fisheries protection benefits. However, because Plan 4 does not add an additional diversion point in the Delta, it would not provide supply reliability improvements during emergencies.

Concept Plans Retained for Further Development

Table 3-3 briefly assesses how each of the four formulated concept plans may contribute to the planning objectives of the study. The assessment shows that all four plans have the potential to contribute to both water quality improvements and fisheries protection goals. However, only Plans 1, 2, and 3 have the potential to improve reliability of adequate quality supplies during emergencies. Plan 4 does not provide for additional operational flexibility (e.g., through a new intake location), or the ability to address rapid deterioration of water quality at CCWD intakes (e.g., through additional desalination treatment).

Following their complete development, alternative concept plans are evaluated according to the four standard P&G criteria for water resources, which include completeness, effectiveness, efficiency, and acceptability. Although the formulated concept plans have not been fully developed, the preceding assessment of their contribution to the planning objectives suggests that Plan 4 would not meet the P&G criterion of completeness. Therefore, based on this preliminary evaluation for completeness, only Plans 1, 2, and 3 will be further

considered and developed in the following chapters. This will help focus the evaluation on complete alternative plans.

Table 3-3. Contribution of Formulated Concept Plans to the Planning Objectives

Contribution to Planning Objectives	Alternative Concept Plans			
	Plan 1	Plan 2	Plan 3	Plan 4
Could contribute to improving CCWD's delivered water quality during dry periods?	Yes	Yes	Yes	Yes
Could reduce fisheries impact around CCWD's intakes?	Yes	Yes	Yes	Yes
Could improve supply reliability during emergencies?	Yes	Yes	Yes	No