Attachment 2

Mokelumne Fisheries

Attachment 2
Mokelumne Fisheries

Background

The lower Mokelumne River flows nearly 30 miles from the base of EBMUD's Camanche Dam to the tidal influence of the Sacramento-San Joaquin River Delta (Delta). The river is inhabited by a number of resident fish species and three anadromous species, including Pacific lamprey, fall-run Chinook salmon and steelhead. EBMUD's Lower Mokelumne River Management Plan was implemented in 1993 to provide a reliable water supply and to sustain and enhance the lower Mokelumne River fisheries, especially fall-run Chinook salmon and steelhead, and other aquatic and riparian resources. The 1998 Joint Settlement Agreement (JSA) between EBMUD, the California Department of Fish and Game, and the US Fish and Wildlife Service built upon the Lower Mokelumne River Management Plan. The JSA provides even more protection for lower Mokelumne River resources in addition to those undertaken by EBMUD under the 1993 plan. JSA improvements include a 10-fold or greater increase in water available for downstream release in dry and above-normal years along with substantial improvement to release (ramping rates) and coldwater pool management. The JSA also called for both in-river and riparian enhancement work that EBMUD has completed and is continuing to expand upon. EBMUD is committed to protecting the Mokelumne fisheries resource.

The Mokelumne is uniquely situated and classified. The 2009 "Central Valley Salmon and Steelhead Recovery Plan" developed by NOAA provides a thorough background of the various "diversity group" classifications within the Central Valley. It is important to understand that while the Mokelumne River is technically a tributary to the San Joaquin River, it is actually classified within the "northern Sierra Nevada diversity group," which is composed of streams tributary to the Sacramento River from the east as opposed to San Joaquin tributaries. The north and south forks that feed into the San Joaquin River are entirely within the Delta and serve as the primary conveyance channels for Sacramento River water destined for the State and Federal projects. In addition to the Mokelumne's unique classification, the outmigrating Mokelumne juvenile fish face unique challenges as the result of being a "between" system. The Mokelumne migration pathways are complex and very different than the migration pathways of other Delta tributaries.

Although the Mokelumne River provides a relatively small volumetric inflow to the Delta, it supports a disproportionately large fish population. EBMUD has invested heavily in ecosystem restoration projects and fish studies to ensure a healthy Mokelumne fish population. A key reason for the success is the Lower Mokelumne River Partnership (Partnership), comprised of representatives from EBMUD, CDFW, and USFWS. Working cooperatively with the many stakeholders involved within the Mokelumne watershed, the Partnership has implemented many projects related to habitat improvement, research, and monitoring. One of the most successful projects has been the ongoing spawning habitat improvement project, which has resulted in over 55,000 cubic yards of gravel being placed within the river. In 2013, more than 1,000, or about 2/3 of all the redds (spawning nests) built in the Mokelumne River, were built within the project area. Additionally, since 2000 the Mokelumne River Fish Hatchery has transitioned from a

facility dependent on egg imports to meet its production goals to one that can meet its goals using only Mokelumne origin broodstock.

Despite the ecological importance of the river and comments provided in June 2013, the draft BDCP inadequately assesses its impacts on the Mokelumne fishery. Although the Effects Analysis presented in Chapter 5 of the draft BDCP recognizes the Mokelumne as a tributary (central Delta versus San Joaquin) the analyses primarily lump it as "part of" either the San Joaquin or Sacramento Rivers. It inappropriately either extrapolates results from studies conducted on those river systems to the Mokelumne River, or it combines data from different systems to determine "overall" impacts on a species but fails to identify specific impacts on Mokelumne populations. The Mokelumne is a distinct river system and the Mokelumne fish face conditions that are significantly different from those in the San Joaquin and Sacramento Rivers. It is essential that the BDCP assess impacts specifically on the Mokelumne fishery.

DCC Operations

Within Chapter 3 there is still a lack of clarity regarding operations of the DCC. In 3.4.1.3.3 it states that there will be less than a 10% change in volume and frequency of flow diverted through the DCC. Yet, on 3.4-38 it states that reduced reliance on through-Delta conveyance via DCC will substantially reduce effects of existing flow anomalies such as weak and reduced flows. With an estimated volumetric change of less than 10% it does not appear there will be significant changes to the anomalies within the central Delta. Moreover, any substantial changes in operations are geared towards wetter years. In dry years there will be no changes to DCC operations.

Without specific DCC operating criteria and associated impact analysis, the conclusions regarding fisheries impacts are less than certain. As in our June 6, 2013 letter, we recommend adding the following:

- Improve description of DCC operations under the project scenarios. Specifically, focusing on modeling the movement of water from the DCC through the Mokelumne forks and to its ultimate destination (pumps or Delta outflow). What portion of the water conveyed through DCC will be exported? How will the percentage of water exported via the Mokelumne forks change seasonally or based on water year-type?
- Conduct studies focusing on survival and migratory pathways of young-of-year (YOY) Chinook salmon entering interior Delta via the Mokelumne and Cosumnes rivers under differing DCC operations.

Effects Analysis (Chapter 5)

While the plan now recognizes that the description of Mokelumne River in regards to its status (central delta tributary versus San Joaquin tributary) differs amongst various existing State and Federal documents, there is limited or no analysis focusing on Mokelumne origin salmonids. As an example, on page 5.5.5-40 it states that operations under the BDCP have considerable potential to reduce straying into the Sacramento River region. This conclusion is based, in part, on studies involving Merced River hatchery fish and reduced south Delta exports. The only data related to the Mokelumne River involves minor to no increases of Mokelumne water reaching Collinsville based on DSM2 fingerprinting.

However, the document fails to identify that one of the leading factors driving straying of Mokelumne origin Chinook salmon is the operation of the DCC. Both USFWS and CDFW recognize that DCC operations have the potential to affect pathway selection and ultimately straying rates of Mokelumne salmon to the Sacramento River basin, primarily the American River. The bulk of the existing straying data for the San Joaquin system is in fact made up of Mokelumne origin fish straying to the Sacramento River system. Since uncertain limited changes are proposed for DCC operations, it is very unlikely that significant reductions in stray rates of Mokelumne origin salmonids (included as San Joaquin origin salmon) would be achieved.

To a large degree the BDCP effects analysis fails to properly assess the potential impacts to salmonids originating from Central Delta tributaries, including the Mokelumne River. The reliance on study results from other systems to reach conclusions regarding Mokelumne issues results in inaccurate assumptions and conclusions. Conversely, the effects analysis identifies the need for specific studies focusing on interior Delta passage issues, but no timelines are presented. We recommend working with the Lower Mokelumne River Partnership to develop and execute studies focusing on Mokelumne origin juvenile and adult salmonids passage and survival through the interior Delta. The results of site specific research studies will allow for more rigorous analysis of effects of any proposed BDCP alternative.

Conservation Measure (CM) 15 (Localized Reduction of Predatory Fishes)
Aside from the 1,500 acres of potential habitat under the Cosumnes – Mokelumne Restoration Opportunity Area, CM-15 is one of the few other actions in the BDCP that could directly improve survival of juvenile salmonids within the central Delta. Predation, along with entrainment, has been identified as one of the key factors leading to reduced survival of salmonids using the migratory pathway. Currently the measure is being implemented as a pilot project and the funding provided may not be sufficient to keep the program going. Moreover, the sampling locations do not directly identify any locations within the central Delta. With limited options to improve conditions within the central Delta the control of predator populations, particularly hotspots, needs to be elevated to an ongoing effort with the appropriate funding allocated. Limiting study locations to those listed will not help improve conditions for covered and non-covered species in the central Delta.

Conservation Measures and Monitoring Action Costs
A key component of adaptive management is having well thought out monitoring programs in place in order to provide the feedback data required to make the appropriate management changes. Equally important to a successful project is adequate funding to complete the required monitoring. Larger projects involving greater levels of uncertainty need to insure that the known components are addressed appropriately, and that contingency planning (operational and financial) is incorporated into the monitoring feedback loop. Within the BDCP documentation there are numerous examples where the uncertainties involved have led to inadequate proposed monitoring and funding.

Overall, the budget estimates for the Monitoring Actions (MA) under the Conservation Measures (CM) appear to be significantly lower than the likely actual costs. Two examples are the estimated costs for CM 15 (Localized Reduction of Predatory Fish) and CM 16 (Nonphysical

Barriers). Under CM 15 and MA15-2 there appear to be two different estimates for annual monitoring costs. In 8.2.3.15 of Chapter 8 it has an approximate cost for reducing predators of approximately $1.84 million a year (excluding abandoned vessel and structure removal) (approximately $460,000 per crew). However, the plan calls for no more than a pilot program that could be used to develop a larger program. Under the required MA15-2 (Appendix 8A-121) it states an annual monitoring cost of $300,000. No cost breakdowns are given for MA15-2 and it is unclear where the equipment will come from or what the sampling frequency will be. Considering the level of effort required to monitor distribution of predators throughout the Delta and at hotspots, the estimated budget for MA15-2 is significantly below actual costs.

CM 16 calls for the installation of up to 7 nonphysical barriers within the Delta. Under MA16-2 (Appendix 8A-122) it states that the annual monitoring cost for one nonphysical barrier will be $250,000. The monitoring program will be similar to a previous study and involve the release of 1,000 acoustically tagged juvenile salmon. The cost per tag is approximately $350 and the total cost for tags for 1,000 salmon would be $350,000. Using the criteria laid out in the assumptions the cost in tags alone (no cameras, staff, analysis, etc.) in years 1-5 would be about $4.9 million. Table 8.A-47 states monitoring cost for CM16 in years 1-5 will be $3.5 million. Either the monitoring program assumptions are not accurate or the costs are significantly underestimated by at least $1.5 million, or 40%.

The cost differences above are significant and made more so by the fact that some contingency percentage has been added to each component. Carrying these inconsistencies through the other BDCP monitoring programs could result in a significant funding gap for the monitoring portion of the BDCP, with potentially serious ramifications for the adaptive management program as a whole.

Technical and Brief Comments

Effectiveness monitoring for restored habitats under CM4 – CM6 should include a measure of non-native predatory fish populations/densities. One success criterion is presence of covered fish species in the area, but other criteria should include survival rates and impacts from predators. One of the primary uncertainties regarding the creation of seasonal floodplain habitats is how they may be used by non-native fish, particularly in years when they may not drain due to high flow events.

5.5.6.1 states that out of basin steelhead stock are used as broodstock for the Mokelumne Hatchery. This practice was discontinued in 2008.

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ATTACHMENT 3

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Explanation of Abbreviations

BDCP	Bay Delta Conservation Plan
CEQA	California Environmental Quality Act
CER	Conceptual Engineering Report
CVP	Central Valley Project
DEIR/EIS	Draft Environmental Impact Report/Environmental Impact Statement
Delta	Sacramento-San Joaquin River Delta
DWR	California Department of Water Resources
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
FESA	Federal Endangered Species Act
HCP	Habitat Conservation Plan
msl	Mean Sea Level
NCCP	Natural Communities Conservation Plan
NCCPA	California Natural Community Conservation Planning Act
NEPA	National Environmental Policy Act
NMFS	U.S. Department of Commerce, National Marine Fisheries Service
psi	Pounds per square inch
Reclamation	U.S. Department of Interior, Bureau of Reclamation
ROW	Right-of-way
SWP	State Water Project
TBM	Tunnel Boring Machine
USFWS	U.S. Department of Interior, Fish and Wildlife Service

EXECUTIVE SUMMARY

The proposed Bay-Delta Conservation Plan Delta conveyance tunnel implementation could have significant and adverse impacts on the integrity and operation of the EBMUD Mokelumne Aqueducts. The new BDCP Delta conveyance could also have significant and adverse impacts on any future facilities of EBMUD that traverse the Delta, including a Mokelumne Delta tunnel project that would cross the proposed BDCP Delta conveyance route on Woodward Island. Before the new BDCP Delta Conveyance can be implemented, the public is being offered, consistent with the California Environmental Quality Act and the National Environmental Policy Act, the opportunity to comment on the effects of the BDCP on the human environment, including the opportunity to propose potential measures to mitigate for significant environmental effects. The construction and operation of the BDCP Delta conveyance tunnels could affect the existing Mokelumne Aqueducts and the proposed EBMUD Delta tunnel through the following mechanisms:

- Disrupt EBMUD water service operations
- Direct interference with the Aqueducts deep foundations
- Undermining and adversely impacting deep foundations
- Settlement due to lost ground associated with normal tunnel activities
- Settlement due to lowered groundwater level
- Seepage and associated piping into BDCP Conveyance Tunnels during the Tunnels' lifespan resulting in lost ground and settlement
- Tunnel lining failure of BDCP Conveyance Tunnels resulting in settlement or sinkholes
- BDCP Conveyance Tunnel construction shafts cause lateral earth movement and stress on Existing Mokelumne Aqueducts
- Settlement due to lowered groundwater level
- Damage to existing Mokelumne Aqueducts due to roads constructed for the BDCP Conveyance Tunnel Project crossing or parallel to the Mokelumne Aqueducts
- Damage to existing Mokelumne Aqueduct due to BDCP related utilities crossing or parallel to the Aqueducts
- New BDCP related electrical transmission line tower foundations affect existing Mokelumne Aqueducts
- Stray Electrical Currents Effecting Mokelumne Aqueducts or EBMUD Delta Tunnel

- Vertical Position (Elevation) of BDCP Conveyance Tunnels interferes with the Delta Tunnel
- Additional costs for Delta Tunnel construction and operation due to BDCP Conveyance Tunnels

Mitigation measures have been proposed to avoid, reduce, and compensate for these potentially significant effects on EBMUD facilities, operations and future plans.

1.0 INTRODUCTION

East Bay Municipal Utility District ("EBMUD") has prepared these comments on the Bay Delta Conservation Plan ("BDCP") Draft Environmental Impact Report / Environmental Impact Statement ("DEIR/EIS"), specifically related to how the California Environmental Quality Act ("CEQA") Preferred Alternative conveyance features would impact the facilities and operations of the existing 82-mile long Mokelumne Aqueduct System comprised of three large diameter steel pipelines that are above ground in the Delta region. Additionally, these comments also address how the CEQA Preferred Alternative conveyance features would impact EBMUD future plans to replace the existing Mokelumne Aqueducts through the Delta with a large diameter deep tunnel, the Mokelumne Aqueducts Delta Tunnel ("Delta Tunnel"). As part of the comments, EBMUD has proposed required mitigation measures to avoid or lessen potential impacts on EBMUD's existing facilities and recommended mitigation measures to avoid conflicts with the proposed future Delta Tunnel Project.

1.1 Purpose of BDCP Conveyance Tunnels

The BDCP CEQA preferred plan is to tunnel north/south through the Delta with two large diameter water conveyance tunnels that cross the existing Mokelumne Aqueducts alignment. EBMUD comments relate to the CEQA preferred plan. Other Delta conveyance options discussed in the DEIR/EIS would present a different set of concerns for EBMUD and are not addressed at this time. EBMUD is concerned that the construction and operation of the future BDCP water conveyance tunnels would adversely affect the existing Mokelumne Aqueducts and would interfere with the plan to replace the pipelines with a Mokelumne Aqueducts Delta Tunnel in the future. Specific comments are required on any conflicts that may arise between the proposed BDCP conveyance water tunnels and the Mokelumne Aqueducts existing and future facilities. These comments will address but are not limited to design and engineering, direct interferences, direct and secondary effects, geology and soils, construction impacts, and operational impacts.

1.2 Project Description

The "project", for the purposes of this technical memorandum, is composed of three discrete sets of physical facilities, two related to EBMUD operations, one existing and one proposed, and one related to the BDCP CEQA preferred project. The layout of these facilities is illustrated in **Figure 1 - Mokelumne Aqueducts and Proposed Delta Tunnel Plan**. The existing Mokelumne Aqueduct pipelines through the Delta are herein described as the Existing

Mokelumne Aqueducts, and the proposed EBMUD tunnel is herein described as the proposed Delta Tunnel. The BDCP CEQA preferred project is herein described as the BDCP Conveyance Tunnels, and is referenced in the BDCP DEIR/EIS as "Alternative 4 – Dual Conveyance with Modified Pipeline/Tunnel and Intakes 2, 3, and 5".

1.3 Limitations of Study

This review is only to evaluate and provide engineering and geologic related comments on how the tunnel conveyance portion of the BDCP Dual Conveyance affects the Existing Mokelumne Aqueducts and proposed Delta Tunnel, and does not include an evaluation of any other conveyance alternatives or conservation measures included in the BDCP DEIR/EIS. Only the BDCP DEIR/EIS and the Conceptual Engineering Report ("CER") have been used in this evaluation to describe the proposed BDCP Conveyance Tunnels features and the associated potential impacts and mitigation measures. Furthermore, this review only evaluates the potential effects of the BDCP Conveyance Tunnels, which has been developed to the conceptual design level, on the existing Mokelumne Aqueducts and the future Delta Tunnel as currently proposed by EBMUD. Future design development during the preliminary design phase of the BDCP Dual Conveyance may result in modifications to the horizontal alignment and vertical profile, tunnel diameter, and overall tunnel design and alter the potential impacts on the proposed Delta Tunnel.

2.0 EBMUD FACILITIES DESCRIPTIONS

2.1 Existing Mokelumne Aqueducts

The existing Mokelumne Aqueduct system consists of three large diameter pipelines as follows:

- Aqueduct No. 1: 65-inch diameter
- Aqueduct No. 2: 67-inch diameter
- Aqueduct No. 3: 87-inch diameter

These steel pipelines have a combination of riveted and welded joints, and operate at internal pressures of several hundred psi that vary with location and operational condition. The aqueducts have several burial and support configurations depending on the aqueduct and the location including: 1) buried, 2) buried on piles, 3) elevated on piles, and 4) dredged river crossings including simple burial, on piles, and with armoring mats.

The western reach of the aqueducts cross the Delta from approximately Holt to Bixler (approximately 10.5 miles) and are primarily elevated on pile supported bents at intervals of 20 to 42 feet. The piles are a combination of timber and precast concrete with depths typically ranging from 30 to 50 feet and as deep as 60 feet, with a minimum elevation of -65 feet msl. Within this reach at river and slough crossings, the aqueducts are buried in dredged trenches with a variety of foundation systems as detailed above.

The BDCP Conveyance Tunnels are shown in the DEIR/EIS to cross the EBMUD Aqueducts in the middle of Woodward Island, which is within the Delta area, and is shown on **Figure 1 - Mokelumne Aqueducts and Proposed Delta Tunnel Plan.** Within the crossing location, all three Aqueducts are elevated and on piles, with pile tips ranging from approximately 30 to 50 feet deep, corresponding to elevations of -40 to -60 feet msl.

2.2 Proposed Delta Tunnel

EBMUD has been evaluating risks to the Existing Mokelumne Aqueducts and potential structural alternatives through both short-term and long-term measures since at least 2007 when the EBMUD Board of Directors approved Motion Number 185-07 to accept the staff report "Strategy for Protecting the Mokelumne Aqueducts in the Delta" (EBMUD, 2007). The Board directed staff to use the report's findings and recommendations in planning future water conveyance capital improvement programs and in participating in state-wide Delta initiatives. The staff report evaluated various long-term measures and concluded that a deep tunnel across

the Delta would be the most cost-effective solution to mitigate the hazards and risks associated with seismic, scour, flooding, liquefaction and lateral spreading.

The proposed Delta Tunnel has been developed to the conceptual design level. The conceptual design identifies the proposed horizontal alignment and vertical profile for the proposed Delta Tunnel. However, refinements to the Delta Tunnel alignment and profile may occur in the future and would be fixed at the completion of the preliminary design phase. Based on work to date, the tunnel is envisioned to follow the existing EBMUD Aqueducts beginning near Interstate 5 in Stockton at the east, to Bixler at the west, a distance of 16.6 miles. Seven shafts, at approximate three mile intervals, are planned for the Delta Tunnel Project for construction and future access to the carrier pipes.

Based on the conceptual design, the proposed Delta Tunnel is expected to have an excavated diameter of approximately 21 feet and will be constructed using pressurized face tunnel boring machines (TBMs) and supported with precast concrete segments. The tunnel would house twin 87 inch (inside diameter) pressurized steel carrier pipes secured with cellular concrete backfill.

The proposed Delta Tunnel profile has been selected to be within vertical envelope or band typically 42 to 52 feet high. This band represents the tunnel diameter plus allowances for a range of likely profiles to be determined during the preliminary design phase. The band is a profile that varies in vertical position (elevation) and thickness (height) along the proposed tunnel alignment. At the highest point the crown is at an elevation of -48 feet, and at the lowest point the invert is at an elevation of -141 feet msl. At the location of the proposed BDCP Conveyance Tunnels, the proposed Delta Tunnel would be constructed within an elevation band between elevation -89 feet msl at the tunnel crown to -141 feet msl at the tunnel invert as shown in **Figure 2 — Proposed Tunnel Profile**.

3.0 BDCP DUAL CONVEYANCE – ALTERNATIVE 4

3.1 Tunnels and Shafts

As stated in Chapter 3 "Description of Alternatives" of the BDCP DEIR/EIS, Alternative 4 – Dual Conveyance Tunnels would consist of twin 40-foot-inside-diameter tunnels to convey water 30.2 miles from a new intermediate forebay on Glanville Tract to an expanded Clifton Court Forebay. The tunnel would be designed as a gravity-fed system, and would not, therefore, be pressurized. The tunnel would cross the Existing Mokelumne Aqueducts right-of-way on Woodward Island.

The proposed tunnels would be constructed with large-diameter TBMs through launch/retrieval shafts at approximately 3-mile intervals. Figure 3-21 of the EIR/EIS shows the tunnels with a "Typical depth of 100 ft. msl".

The DWR's Conceptual Engineering Report (2010), referenced within the DEIR/EIS, states: "the tunnel invert is assumed to be at 100 feet below mean sea level (msl) primarily to avoid peat deposits" and goes on to state that it would be lowered down to 160 feet below msl at the San Joaquin River and the Stockton Deep Water Ship Channel. Figure 11-6 of this report shows the tunnels with an invert depth of approximately 150 feet below msl. Moreover, in a recent update to the CER dated October 2013, for the Modified Pipeline Tunnel Option, the preliminary tunnel inverts range from 122 feet below msl at the north end of the North Tunnel at Intake No. 2 to 163 feet below msl at the North Clifton Court Forebay.

Based on a review of the DEIR/EIS and the CER (2010, 2013), the inverts of the 40-foot-diameter BDCP conveyance tunnels could range between elevations -100 to -163.

Figure 3-9 of the DEIR/EIS (alignment of alternative 4 tunnels) shows shafts approximately 1.5 miles to the north and to the south of the EBMUD Mokelumne Aqueduct. However, we note that the shaft locations could change in subsequent design phases, and include shafts near the EBMUD Mokelumne Aqueducts and proposed Delta Tunnel. If shafts are located near EBMUD facilities there would be substantial impacts from construction and operation that are not included in these review comments.

As noted in the CER and in conjunction with experience on other projects, the horizontal alignment and vertical profile for tunnels are typically fixed at the end of preliminary design. Therefore, changes in the final depth and profile of the BDCP conveyance tunnels could occur during the preliminary design phase.

3.2 Transmission Facilities and Other Requirements

Chapter 3 "Description of Alternatives" of the BDCP DEIR/EIS states that Alternative 4 – Dual Conveyance would require new transmission lines running from the existing electrical power grid to project substations. To deliver power to construct and operate the water conveyance facilities, it is assumed that the system would be split to connect to the existing grid in two different locations, one in the northern section of the alignment and one in the southern section.

In the latest available version of the CER, multiple transmission line routes are shown. The two new primary transmission line corridors are routed in a north-south direction. A number of the alternatives follow the general north-south alignment of the BDCP conveyance tunnels, crossing the Existing Mokelumne Aqueducts as well as the proposed Delta Tunnel alignment at Woodward Island (CER, 2013; Figure 3-25). ,

Chapter 3 of the DEIR/EIS "Description of Alternatives" also states that there would be borrow areas and areas identified for the storage and/or disposal of spoil, reusable tunnel material (RTM), and dredged material.

3.3 Operations

The DEIR/EIS (Pg. 3-27, line 27 and 28), states: "… to facilitate the gravity-fed system proposed under Alternative 4 (instead of being pressurized and pumped through an intermediate pumping plant)". Based on this statement, it is not known if the tunnels would be operated in an *open channel* condition, as a *full pipe* condition, or a combination depending on the operational requirements.

4.0 BDCP DRAFT EIR/EIS REVIEW PROCESS

The BDCP DEIR/EIS provides information relevant to the requirements of CEQA and NEPA to inform the public and decision-makers of the impacts on the human environmental of implementing actions undertaken or authorized by state and federal agencies, respectively. Both CEQA and NEPA require that agencies allow the public an opportunity to comment on draft CEQA and NEPA documents on substantive issues relative to the undertaking and its effects on the human environment. This document is in support of EBMUD asserting its rights under CEQA and NEPA to provide formal comments on the BDCP DEIR/EIS on substantive issues of concern to the continued reliable delivery of water to EBMUD customers at a reasonable cost.

As stated in the BDCP DEIR/EIS Chapter 1 "Introduction", the BDCP is a long-term multiple purpose plan that consists of a Habitat Conservation Plan ("HCP") and a Natural Community Conservation Plan ("NCCP") for the Delta. It is being developed pursuant to the Federal Endangered Species Act ("FESA"), the California Natural Community Conservation Planning Act ("NCCPA"), and other pertinent environmental laws and policies. The BDCP sets out a comprehensive conservation strategy for the Delta designed to restore and protect ecosystem health, water supply, and water quality within a stable regulatory framework through the following.

- New and/or modified State water conveyance facilities and operations of the State Water Project ("SWP") and Central Valley Project ("CVP"),
- Conservation, protection, restoration, and enhancement of habitats for native fish, wildlife, and plants within the Delta,
- Actions to address other ecological stressors to covered aquatic species in the Delta,
- Adaptive management of water conveyance facilities operations; the protection, restoration and enhancement of habitats; and measures to reduce other ecological stressors.

The BDCP, EIR/EIS, and supporting documentation will provide the basis for decisions concerning the applications for issuance of endangered species take permits for restoration activities and facility and operational changes in the SWP and authorizations related to operational changes in the CVP. The BDCP EIR/EIS will also be used to support the decisions of DWR and the participating water contractors to implement the actions of the BDCP, including the ultimate selected water conveyance option.

4.1 DEIR/EIS Public Review Process

As required by the CEQA and NEPA and their implementing regulations, the DEIR/EIS is circulated for public review and comment prior to a decision to implement the project. Comments are due on July 29, 2014. Responses to substantive comments will be included in the FEIR/EIS.

This document provides pertinent information to support EBMUD's comments on the DEIR/EIS relating specifically to engineering and geological issues of concern to EBMUD's Existing Mokelumne Aqueducts as well as the proposed Delta Tunnel from the construction and operations of the BDCP Conveyance Tunnels alternative, including appurtenance features such as shafts and transmission lines.

4.2 Lead Agencies Preferred Project

The CEQA/NEPA Lead Agencies are DWR for CEQA and Reclamation, the USFWS, and the NMFS, acting as lead agencies for compliance with NEPA. DWR has selected Alternative 4 – Dual Conveyance Tunnels with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 as the CEQA Preferred Alternative. This alternative is also the subject of a separate document, the "Bay Delta Conservation Plan" which is intended as the draft HCP and NCCP, consistent with the FESA and NCCPA.

The Federal Lead Agencies have not selected a preferred NEPA alternative, leaving some doubt as to the actual project that will be jointly selected for implementation and approved as the HCP/NCCP.

4.3 Level of Detail

The BDCP DEIR/EIS contains conceptual level engineering detail, which is a work in progress which concepts will undoubtedly change during future design development. This level of detail does not allow preliminary or final design level comments to be made as part of this review, and also makes it difficult to provide adequate comments on the sufficiency of DEIR/EIS to identify impacts and appropriate mitigation measures. Therefore, it is necessary as part of this review, to provide comments to the Lead Agencies on the recommendation for further detailed discussions EBMUD will expect to occur prior to final design decisions being made on the location and depths of the BDCP Conveyance Tunnels including appurtenances. See comments below in Section 5.0 regarding the consequences of the low level of detail.

5.0 BDCP DEIR/EIS Review Comments and Proposed Mitigation Measures

Sections of the BDCP DEIR/EIS has been reviewed and several issues of concern have been identified that may potentially impact EBMUD's existing Mokelumne Aqueducts and its future plans for replacing the Aqueducts with a single deep tunnel, the Delta Tunnel. All Chapters were scanned for references to EBMUD and the Mokelumne Aqueduct. Chapter 20 "Public Services and Utilities" addresses potential impacts and proposed mitigation measures concerning effects to water service providers. In Section 20.3.1 "Methods for Analysis", the DEIR states that construction activities were reviewed to assess the potential for effects on water service providers and infrastructure. As stated in Section 20.3.2 "Determination of Effects" alternatives were also considered to have an effect on public services and utilities if construction would result in disruption substantial enough to require temporary or permanent relocation of existing utility systems. In these sections of the DEIR/EIS, the potential impacts are discussed in a general nature with few specifics. Because the EIR/EIS will be used to support the implementation of the major conveyance facilities, and is intended to be at a project specific level, considerably more detail concerning specific impacts on individual utilities and development of specific mitigation measures is appropriate for the FEIR/EIS. This document provides the specific information on substantive issues related to EBMUD facilities that would be expected to be included in the FEIR/EIS.

Section 20.3.3.9 "Alternative 4 – Dual Conveyance Tunnels with Modified Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H)" Impact UT-6: "Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities" states that the water conveyance alignment and associated physical structures could interfere with the Mokelumne Aqueduct. This is the first reference to EBMUD's Mokelumne Aqueduct System. No further specific information on how the Mokelumne Aqueduct would be affected is given in this Chapter. A commitment is made to coordinate with utilities on relocations and modifications so that utility providers and local agencies can integrate potential other construction projects with the construction of the Conveyance Tunnels. The DEIR/EIS states that "Because relocation and disruption of existing utility infrastructure would be required under this alternative and would have the potential to create effects through the relocation of facilities, this would be an adverse effect."

Mitigation Measures UT-6a, UT-6b, and UT-6c are stated to be available to reduce the severity of this effect, but the conclusion is that with coordination with all utility providers and local agencies to integrate with other construction projects, the impact would not be adverse. Mitigation Measure UT-6a "Verify Locations of Utility Infrastructure", Mitigation Measures

UT-6b "Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability" and Mitigation Measure UT-6c "Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety" do not contain adequate information or detail for EBMUD to determine what all the impacts may be and whether there will be substantial unmitigated effects to the existing Mokelumne Aqueducts and its future plan to construct the Delta Tunnel.

During the preparation of the DEIR/EIS, DWR representatives Mr. Gordon Enas and Mr. Alan Davis corresponded with Garth Hall from EBMUD concerning Right of Way (ROW) issues at the Mokelumne Aqueducts crossing. These email conversations occurred during April and May of 2012. During those email exchanges, the BDCP representatives were made aware of the need for a tunnel easement to be negotiated for construction of the Dual Tunnel below the Mokelumne Aqueducts and furthermore, that EBMUD was in the process of initial project planning for a cross-Delta Tunnel beneath the existing Mokelumne Aqueduct. Mr. Hall suggested that engineering staff meet soon after the CEQA documentation is published so that design implications could be considered.

Design of the BDCP tunnels presented in the DEIR/EIS is at a very conceptual level and does not contain sufficient detail to perform a thorough review. There are many aspects of the design which are either undetermined or could change with subsequent engineering development which could impact the existing Mokelumne Aqueducts and the proposed Delta Tunnel. These items include but are not limited to tunnel profile and depth, shaft locations, tunnelling method(s), tunnel operation as open channel or pressurized, the use of a secondary lining, and the location of construction support facilities. Due to these uncertainties, the present review of potential impacts and appropriate mitigation measures is incomplete and will need to be revisited in the future upon further design refinement of the BDCP tunnels. The following comments and proposed mitigation measures presented below provide the analysis on potential adverse effects to EBMUD facilities, operations and Capital Improvement Plans, and potential mitigation measures that will need to be considered, negotiated, and included as part of any ROW agreement with BDCP implementing agencies based upon the information currently available. These comments also provide details on conflicts and potential resolutions for conflicts between the two tunnelling projects.

5.1 Effects on Existing Mokelumne Aqueducts and Proposed Mitigation Measures

Construction of the Dual Tunnel could adversely impact the existing EBMUD aqueducts in several ways including:

1) Direct interference,

2) Common or routine ground movement and settlement,

3) Sinkholes caused by major ground loss,

4) Long-term ground loss or movement, and

5) The need to sink a recovery or maintenance shaft.

5.1.1. BDCP Tunnels Cross EBMUD ROW

At the location where the proposed BDCP Conveyance tunnels cross the Mokelumne Aqueducts, EBMUD owns the ROW within which the Aqueducts are situated.

Impact: Disruption of EBMUD water service operations

The concerns of EBMUD are to:

1) Protect EBMUD water service customers from outages due to damage to the Mokelumne Aqueducts from construction and/or operation of the BDCP Conveyance Tunnels,

2) Avoid costly repairs to EBMUD facilities, and

3) Avoid potential consequential third party damages from aqueduct failure such as from flooding and scour.

Proposed Mitigation Measures: Fully comply with a ROW agreement addressing all potential impacts on EBMUD facilities

The BDCP implementing agencies will need to secure a tunnel ROW agreement with EBMUD in order to construct the BDCP Conveyance Tunnel in the ROW beneath the existing Mokelumne Aqueduct. EBMUD suggests that this process begin immediately in order for the BDCP Conveyance Tunnels design work to include appropriate safeguards as outlined in the impacts and mitigation measures below. EBMUD's ROW procedures are appended to this attachment (Appendix A).

5.1.2. Effects on Existing Mokelumne Aqueducts Due to BDCP Conveyance Tunnels Construction

Construction of the BDCP Conveyance Tunnels could result in adverse impacts such as settlement and sinkholes on the existing Mokelumne Aqueducts alignment. The potential impacts could occur in several ways as detailed below with associated suggested mitigation measures.

Impact: Direct interference with the Aqueducts' deep foundations

Piles supporting the aqueducts extend to a depth of approximately 60 feet and an elevation of -65 feet msl in some areas. If the two BDCP Conveyance Tunnels are relatively shallow, the tunnels would intersect the piles. Encountering the piles during tunnel construction would result in major complications and would cause settlement of the Mokelumne Aqueduct piles and pipeline with associated risk for damage and failure.

Proposed Mitigation Measures for direct interference

Locate the BDCP Conveyance Tunnels at a depth, or low enough elevation, to avoid direct interference.

Impact: Undermining and adversely impacting deep foundations

The BDCP Conveyance Tunnels would likely be constructed within the zone of influence for the Mokelumne Aqueduct piles and could reduce the ground support for the piles and/or cause settlement of the piles. This could occur even if the tunnels do not directly encounter the piles. The effects due to the occurrence of the impacts described below would be settlement and differential settlement of the aqueducts. Depending on the magnitude of the settlement the aqueducts would be damaged or there could be failure of the aqueducts.

Impact: Settlement due to lost ground or vibrations associated with normal tunnel activities

Common tunnelling methods result in lost ground especially from stress redistribution in the ground, face losses, overcut of the shield, and uncompensated losses around the segmental lining. Additionally, tunnelling and other construction activities can cause vibrations resulting in pile support system settlement and potential rupture of the existing Mokelumne Aqueducts. The effects of the lost ground migrates upward resulting in loose soils and causing settlement within a zone of influence. Although tunnelling equipment and methods may be employed to control the ground (e.g., utilization of a pressurized face TBM), unexpected situations may arise resulting in a major ground loss (ground run or inflow). Such a ground loss could result in major settlements extending above the tunnels possibly to the ground surface. Even if loosened ground associated with tunnel construction did not directly cause settlement of the aqueducts, the loosened ground would be more susceptible to liquefaction with associated ground movements

during seismic events. Any settlement or vibration can cause a rupture in the existing Mokelumne Aqueducts causing loss of water supply to EBMUD customers, flooding and scour of the area surrounding the rupture site causing further structural damage, and damage to adjacent landowners and levees.

Proposed Mitigation Measures for Undermining and Settlement:

To mitigate adverse undermining and settlement impacts during construction of the dual underground openings, the ground must be controlled while tunnelling in order to avoid ground loss at the face. The primary means for achieving this are:

1) Completion of a thorough exploration program of subsurface conditions in the vicinity of the intersection alignments, and zone of influence,
2) Obtain construction records of piles supporting the Mokelumne Aqueducts and position the tunnel at suitable depth to avoid adverse impacts,
3) Placement of the tunnel in soils that reduce construction impacts,
4) Placement of the tunnel with suitable cover to attenuate settlement,
5) Selection of appropriate tunnelling equipment and methods for the ground conditions,
6) Engaging qualified and experienced contractors,
7) Implement construction controls to reduce, detect, and address complications. Monitor muck volumes relative to the theoretical volume of the ground being excavated. To determine the magnitude of settlement there should be a ground monitoring program during construction such as with surface points, extensometers, and inclinometers. If potential damaging ground movements are detected compensation grouting can sometimes be used to reduce settlements,
8) Ground treatment with a zone of influence at and/or above the tunnels prior to tunnelling to form a more stable ground mass. Ground treatment can include jet grouting, permeation grouting, ground freezing, and potentially other methods prior to tunnelling through this area,
9) In the event that voids occur due to ground loss from tunnelling, compensation grouting can be used to fill voids and/or densify the ground to mitigate potential ground settlement to the existing Mokelumne Aqueducts and/or impacts to the integrity of the deep tunnels.

5.1.3. Effects on Existing Mokelumne Aqueducts due to Groundwater Issues

Although the current approach to tunnelling and shaft construction does not involve dewatering, complications during construction could result in lowering of the groundwater table, or the groundwater table may be lowered to address a construction complication.

Impact: Settlement due to lowered groundwater level

If the groundwater table is lowered for any reason, such as tunnelling, it would likely result in consolidation from an increase in effective stress on soft soils. This settlement would impart an increase risk on the existing Mokelumne Aqueducts.

Proposed Mitigation Measures:

Use project construction methods that avoid dewatering near the existing Mokelumne Aqueducts.

Earth pressure balance tunnel machines, if not operated correctly, can create significant ground disturbance including potential "frac-out" disturbing soils to the ground surface.

5.1.4. Effects on Existing Mokelumne Aqueducts due to Ground Loss Caused by BDCP Tunnels

The lining for the Dual Conveyance Tunnels is currently designed to be precast concrete segments. Unlike many water conveyance tunnels, there is no interior or secondary lining inside the concrete segments.

The presence of the BDCP Conveyance Tunnels could result in adverse impacts such as settlements and sinkholes on the existing Mokelumne Aqueducts throughout the lifetime of the BDCP Conveyance Tunnels. The potential impacts could occur in several ways as detailed below with associated suggested mitigation measures.

Impact: Seepage and associated piping into BDCP Conveyance Tunnels during the Tunnels' lifespan

Although the segmental lining would be bolted and gasketed, long-term degradation of the joints or lining may result in water seeping into the tunnels. This water inflow could carry soil particles resulting in piping, ground loss, settlement, and, potentially, sinkholes. Depending on the magnitude of the ground loss, the existing Mokelumne Aqueducts could be damaged or there could be failure of the aqueducts due to settlement.

Proposed Mitigation Measures:

Mitigation measures to address the potential for infiltration are based on avoidance, detection, and remediation including: design of the segmental lining for long term performance, tight quality controls during construction, inspection during and upon completion of construction, and routine inspections during the tunnel operational life. Another mitigation strategy is the use of a higher level of design and longer design life for the segments which may include additional reinforcement, stronger or more durable concrete, a more robust gasket system, and stronger

joints. The likelihood of this event can be reduced with the use of a secondary lining or carrier pipe surrounded with backfill grout inside the segmental concrete lining.

In the event that seepage or water inflow is detected during construction or during the operational life of the tunnels, the situation can be addressed with permeation (cement or chemical) grouting immediately outside the lining to cut off groundwater flow. Additionally, compensation grouting can be used to restore lost ground and/or to densify the ground to prevent the upward migration of settlement.

Impact: Tunnel lining failure of BDCP Conveyance Tunnels

Long-term degradation of the segmental concrete lining may result in failure of the lining. In the event that the tunnel lining fails or there is a collapse of the tunnel, it would result in major ground movement extending to the ground surface and potentially a sinkhole. With such an event, the resulting settlement would likely result in failure of the existing Mokelumne Aqueducts.

Proposed Mitigation Measures:

Mitigation measures to address the collapse or failure of a BDCP Conveyance Tunnel are based on avoidance, detection, and remediation including:

1) Design of the segmental lining for long term performance,
2) Inspection during and upon completion of construction, and routine inspections during the operational life of the tunnels,
3) Geotechnical instrumentation monitoring program around the tunnels beneath the aqueducts,
4) Use of a higher level of design and longer design life for the segments which may include the need for a more robust lining system,
5) Additional reinforcement, stronger or more durable concrete, multiple gaskets, and stronger joints,
6) Use of a carrier pipe surrounded with backfill grout inside the segmental concrete lining.

Settlement within the crossing zone should be measured for the long-term life of the tunnel. In the event that structural deficiencies of the segmental concrete lining are detected, the situation can be addressed with one or more of the following actions:

1) The lining can be improved with localized structural patches,
2) Permeation (cement or chemical) grouting can be used immediately outside the lining,
3) New secondary lining can be placed for full 360 degrees inside the segmental concrete lining,

4) Additionally, compensation grouting can be used to restore lost ground and/or densify the ground to prevent the upward migration of settlement.

5.1.5. BDCP Project Shaft Location Conflicts

Shafts for the Dual Conveyance Tunnels are shown in the DEIR/EIS to be located over a mile to the north and to the south of the existing Mokelumne Aqueducts. At these locations and distances, the shafts would not be expected to have direct impacts on the existing Mokelumne Aqueducts. However, shaft locations near the existing Mokelumne Aqueducts are possible during future design development, if a different tunnel alternative is implemented such as shown on Figure 3-2 of the DEIR/EIS, or if a rescue or maintenance shaft were deemed necessary during construction due to problems with the TBM.

Impact: BDCP Conveyance Tunnel construction shafts cause lateral earth movement and additional loads on Existing Mokelumne Aqueduct

Construction of the Dual Conveyance Tunnels Shafts could result in ground movements, especially lateral displacements, in the vicinity of the shafts. These ground movements could result in detrimental impacts on the existing Mokelumne Aqueducts and its pile foundations.

Proposed Mitigation Measures:

To mitigate adverse ground movement impacts, construction must control lost ground during shaft construction. The impacts resulting from ground movements can be reduced, although not eliminated, by controlling ground loss and providing ground support during shaft construction. The primary means for achieving this are:

1) Thorough exploration of subsurface conditions, including obtaining construction records of piles supporting the Mokelumne Aqueducts and positioning the tunnels at suitable depth,
2) Careful selection of shaft construction methods to provide stable lateral support for excavations,
3) Engaging qualified and experienced contractors,
4) Construction controls to reduce, detect, and address complications. To determine the magnitude of ground movement there should be a ground monitoring program during construction such as with surface points, extensometers, and inclinometers,
5) Treat the ground (ground treatment) in the vicinity of the shafts, Aqueducts, and Aqueduct foundations prior to construction to form a more stable ground mass, such as with jet grouting.

Impact: Settlement due to lowered groundwater level

If the groundwater table is lowered for any reason, it would likely result in consolidation from an increase in effective stress on soft soils, especially the peat. This settlement would impart an increase risk on the existing Mokelumne Aqueducts.

Proposed Mitigation Measures:

Use project construction methods that avoid dewatering near the existing Mokelumne Aqueducts.

5.1.6. Access Roads and Utilities

The DEIR/EIS does not provide details of likely haul routes and utilities necessary for construction of the BDCP Conveyance Tunnels. However, these support facilities will be necessary, and they may have adverse impacts on the existing Mokelumne Aqueducts.

Impact: Damage to existing Mokelumne Aqueducts due to roads crossing or parallel to Mokelumne Aqueducts

Access roads to support construction activities may cross over (or under) the existing Mokelumne Aqueducts. These roads may result in adverse loadings, ground settlement, vibrations, direct impacts, and other unforeseen damages to the Mokelumne Aqueducts.

Proposed Mitigation Measures:

To reduce the potential for damage, layout and design of BDCP Conveyance Tunnels support or access roads need to include consideration of the existing Mokelumne Aqueducts. These evaluations need to include review of the Mokelumne Aqueduct design and conditions at the proposed interface locations.

Impact: Damage to existing Mokelumne Aqueducts due to utilities crossing or parallel to Mokelumne Aqueducts

Utilities such as water and gas lines to support construction activities may cross over (or under) the existing Mokelumne Aqueducts. Construction of these utilities may result in ground settlement, direct impacts, and other unforeseen damages to the Mokelumne Aqueducts.

Proposed Mitigation Measures:

To reduce the potential for damage to the existing Mokelumne Aqueducts, layout and design of BDCP Conveyance Tunnels and support utilities need to include consideration of the location of the existing Mokelumne Aqueducts. These evaluations need to include review of the Mokelumne Aqueduct design and ground conditions at the proposed interface locations and development of appropriate protection methods.

5.1.7. New Transmission Lines

The DEIR/EIS provides limited details of likely electrical transmission line corridors being considered for supplying construction power for the BDCP Conveyance Tunnels (BDCP, 2013; Figure 3-25). The current proposed transmission corridor has a north-south alignment which parallels the BDCP Conveyance Tunnel on Woodward Island. The new transmission lines may have adverse impacts on the existing Mokelumne Aqueducts.

Impact: Tower foundations affect existing Mokelumne Aqueducts

Transmission line foundations located near the existing Mokelumne Aqueducts may adversely impact the Aqueducts from lateral ground movements and settlements.

Proposed Mitigation Measures:

Locate transmission towers far enough from the existing Mokelumne Aqueducts to influence the pile foundations and thus avoid adverse impacts. Design and construct the tower foundations using methods to avoid adverse impacts. During construction use a monitoring program to detect and address ground movement before damages occur.

Impact: Stray electrical currents effecting Mokelumne Aqueducts

Overhead electrical power transmission lines can induce voltages on pipelines that may cause AC induced corrosion (for buried pipeline sections) and create an electrical shock hazard for people, depending on the location of the transmission lines. AC induced corrosion is a significant issue resulting in metal loss on existing buried pipelines. Voltages can also be induced onto both buried pipelines and elevated pipelines similar to existing Mokelumne Aqueducts (containing a grounding system) located in close proximity to electrical power transmission grounding systems. Loss of structural integrity of the overhead transmission line could result in transmission line falling and coming into direct contact with the existing Mokelumne Aqueducts.

Proposed Mitigation Measures:

Mitigation measures can include modelling the steady state induced voltages caused by the electrical power transmission lines to determine the extent of any interference and installation of appropriate protection or correction action if the induced voltages are determined to be above applicable industry standards. Placement of a guard structure, directly located over the existing Mokelumne Aqueducts would prevent falling wires from direct contact with existing aqueducts.

5.2 Effects on Proposed Delta Tunnel and Proposed Mitigation Measures

The impacts of construction of the BDCP Conveyance Tunnels on the proposed EBMUD Delta Tunnel are similar to the impacts identified for the existing Mokelumne Aqueducts. However, in most instances the impacts are more severe do to the closer proximity of the proposed BDCP Conveyance Tunnels to the proposed Delta Tunnel. These impacts result from ground loss, settlement, vibrations, direct interference, and settlement from a lowered groundwater table. The results of these impacts are damage and potentially failure of the pipelines (e.g., carrier pipes) within the proposed EBMUD Delta Tunnel. However, it is likely that these impacts will be more acute due to a close proximity of the tunnels (small vertical separation), sensitivity of the pipelines within the tunnel, and the difficult access to repair damages to the integrity of the pipelines.

In addition, the following impacts and proposed mitigation measures are unique to the conflicts between the BDCP Conveyance Tunnels and EBMUD's Delta Tunnel.

5.2.1. BDCP Tunnels Cross EBMUD ROW

At the location where the proposed BDCP Dual Conveyance Tunnels cross the existing Mokelumne Aqueducts, EBMUD owns the ROW, surface and subsurface rights.

Impact: Disruption of EBMUD water service operations

The primary concern of EBMUD is to avoid damage and service disruption to the EBMUD Delta Tunnel after it is constructed, which would endanger water service to its customers and result in costly repairs. The second concern of EBMUD is to avoid costly measures by EBMUD to prevent direct interference or construction impacts in the event that the BDCP Conveyance Tunnels are constructed first.

Proposed Mitigation Measures: Negotiate ROW agreement

The BDCP Conveyance Tunnels implementing agencies will need to obtain a tunnel ROW agreement with EBMUD in order to gain access to excavate tunnels through the ROW that is proposed to contain the EBMUD Delta Tunnel. EBMUD suggests that this process begin immediately in order for the BDCP Conveyance Tunnels design to include appropriate safeguards as outlined in the impacts and mitigation measures in the sections above and below.

5.2.2. BDCP Conveyance Tunnels and Delta Tunnel Vertical Alignment Interference

The alignments of the BDCP Conveyance Tunnels and the EBMUD Delta Tunnel cross on Woodward Island. Due to each projects design requirements, the vertical depths or alignments of each may impact whether a gravity or pressurized flow operating system is required, the need for a more robust lining system and/or requirements for ground improvement, higher construction cost of a deeper vertical alignment, and/or higher operating costs over the project life cycle. Overall, there are potential impacts to operation and operational costs for each project. Regardless of which tunnel project is constructed first, the BDCP Conveyance Tunnels will need to avoid impacting the design and construction of the EBMUD Delta Tunnel as well as potential long term operational impacts.

Impact: Vertical Position (Elevation) of BDCP Conveyance Tunnels interferes with the Delta Tunnel

The two tunnel systems cannot be located at the same elevation. Additionally, vertical separation and buffer zones will be necessary between the tunnels to avoid adverse impacts on both tunnel systems. A summary of the main concerns follows:

1) The first tunnel project constructed will result in a zone of loosened soil above the tunnel and likely extending to the ground surface. With the second tunnel positioned above the first, this zone of loosened soil will likely make construction of the second tunnel more difficult due to necessary ground control and mitigation of lost ground.
2) With the second tunnel positioned below the first, ground loss and settlement from construction of the second tunnel would adversely impact and endanger the first tunnel from settlement and potential construction irregularities.

Proposed Mitigation Measures:

Require tunnel sequencing, vertical placement, and construction methods to eliminate direct conflict and reduce adverse impacts:

1) The vertical alignment of the BDCP Conveyance Tunnels will need to avoid interference with the vertical alignment of the Delta Tunnel.
2) Coordinate design of both projects such that the deeper tunnel is constructed first. This approach would greatly reduce construction impacts for the second tunnel(s) on the first tunnel(s). Depending on schedules for both projects, it may be beneficial to accelerate construction of the deeper tunnel prior to construction of the shallower tunnel(s) to avoid the most serious adverse impacts.
3) Provide appropriate separation between the two tunnel projects to reduce adverse impacts. The separation distance needs to be addressed during design development of

each project with consideration of ground conditions, construction methods, ground improvement, lining types and designs, and other factors.

4) Use ground improvement such as jet grouting, ground freezing, or alternative methods to stabilize the ground, reducing interference or impacts during construction, and facilitating construction.
5) Use very strict construction controls to reduce ground movements during tunnelling. Measures may include pressurized face tunnelling methods (EPB or slurry), monitoring the rate and volume of ground/muck removal during tunnelling, use of thick pressurized slurry in the TBM annulus/overcut, rapid grouting outside the lining segments after placement, and compensation grouting.
6) Implement ground surface monitoring during construction.
7) Have in place contingency plans in place to address irregularities that may arise during tunnel construction.

Impact: Additional costs for Delta Tunnel construction and operation due to BDCP Conveyance Tunnels

The presence, or future presence, of the BDCP Conveyance Tunnels may result in higher construction costs to EBMUD to avoid interference and/or to use construction methods to avoid adverse impacts and higher operation costs. The measures which may be necessary for EBMUD to implement include but are not limited to the following:

1) Deeper profile position for the Delta Tunnel: This would increase the costs of the shafts, and would make tunneling less efficient due to higher tunneling pressures, and transporting muck and supplies through the deeper shafts.
2) Higher profile position for the Delta Tunnel: This would result in higher risk of damage to the tunnel and pipelines from seismic liquefaction and long term settlements.
3) Ground improvement: It may be necessary to use ground improvement such as grouting or ground freezing to avoid detrimental impacts to the BDCP Conveyance Tunnels.
4) Special tunneling methods: To tunnel below or in the vicinity of the BDCP Conveyance Tunnels it may be necessary to use higher face pressure when tunneling, advance more slowly, controls contact grouting behind the segments, use a more robust segmental lining system, and use additional instrumentation and ground monitoring.
5) Pipeline operations: A deeper tunnel or different tunnel configuration may result in additional operational costs such as higher friction losses, higher pumping costs, and sediment accumulation in the pipelines.

Proposed Mitigation Measures:

Measures to mitigate these costs include the mitigation measures presented above for interference. Mitigation would likely be more efficient if some of the measures were

implemented prior to or during construction of the BDCP Conveyance Tunnels, rather than later with construction of the Delta Tunnel. Mitigation also would include compensation to EBMUD for the extra costs incurred to accommodate the Conveyance Tunnels through the EBMUD ROW.

Impact: Stray electrical currents effecting Delta Tunnel

If the BDCP Conveyance Tunnels pipelines have an impressed current cathodic protection system on the steel pipe, the EBMUD Delta Tunnel may be impacted by stray currents flowing onto the pipeline and becoming part of the return path to the source instead of just the surrounding soil. This phenomenon could create anodic metal dissolution (electrolysis) where the stray current leaves the pipeline. The localized corrosion rate can be a significant issue resulting in pipeline failure.

Proposed Mitigation Measures:

Mitigation measures will include determining the potential for electrical current based on the existing soil conditions, utility separation, and tunnel construction materials. Mitigation may consist of electrical isolation between tunnel systems and draining of the collected current by installing appropriate electrical grounding of the EBMUD Delta Tunnel, or addition of active cathodic protection systems on the EBMUD Delta Tunnel.

6.0 REFERENCES

California Department of Water Resources, 2013. Bay Delta Conservation Plan, Draft EIR/EIS, November.

California Department of Water Resources, 2010. Delta Habitat Conservation and Conveyance Program (DHCCP). Conceptual Engineering Report, All Tunnel Option, March 10.

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EBMUD, 2007. Strategy for Protecting the Aqueducts in the Delta, Technical Memorandum No.1 – Alternative Identification (Draft), July 3.

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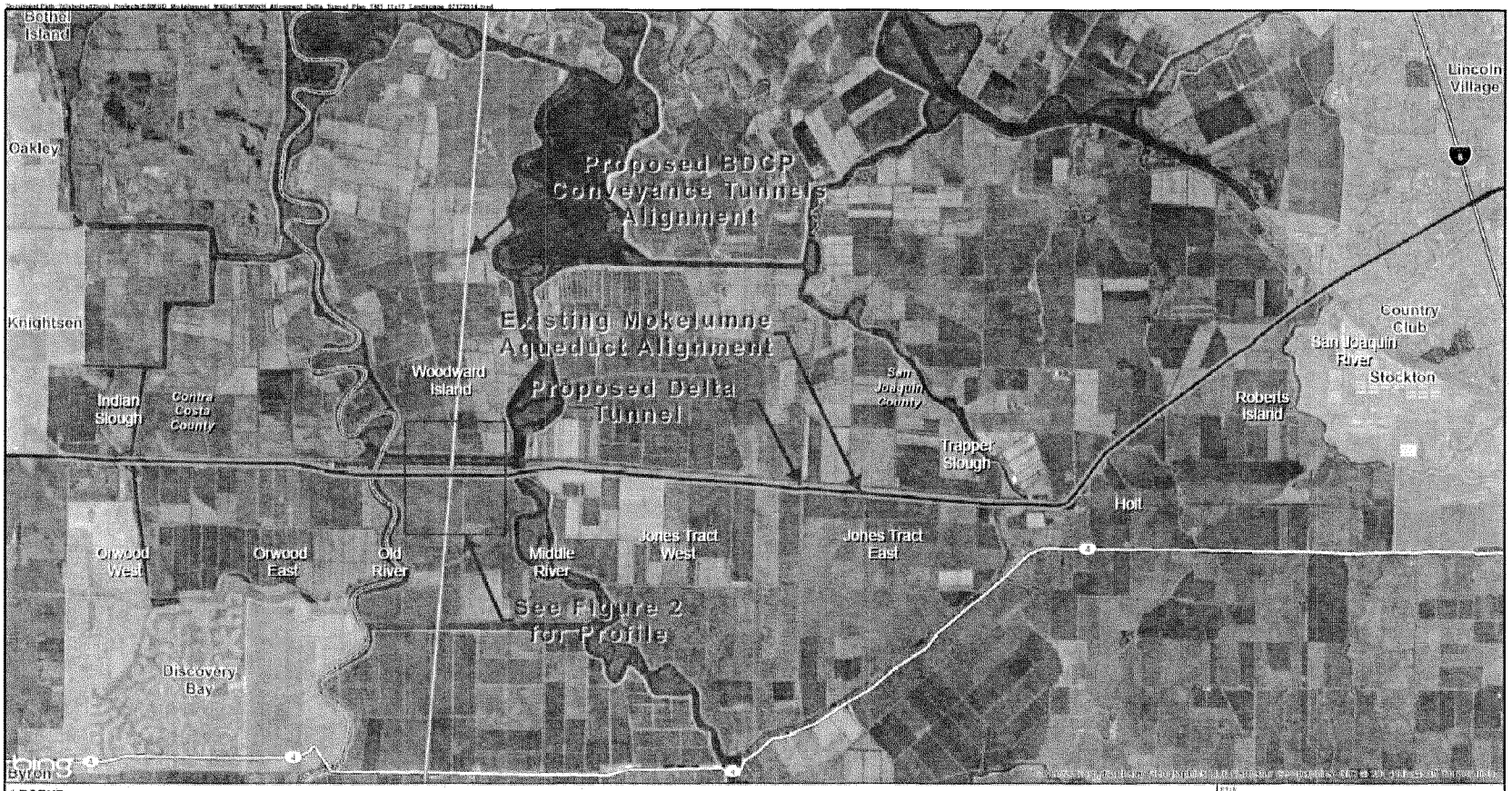
EBMUD, 2007. Strategy for Protecting the Aqueducts in the Delta, Technical Memorandum No.3 – Risk Evaluation (Draft), August 31.

FIGURES



LEGEND

- Proposed Delta Tunnel Alignment
- Existing Mokelumne Aqueduct Alignment
- Approximate Proposed BDCP Alignment
- Interstate
- Highway
- County

Date Saved: 7/16/2014

0 1 2 Miles

Mokelumne Aqueducts and Delta Tunnel Plan

Mokelumne Aqueducts Delta Tunnel Study

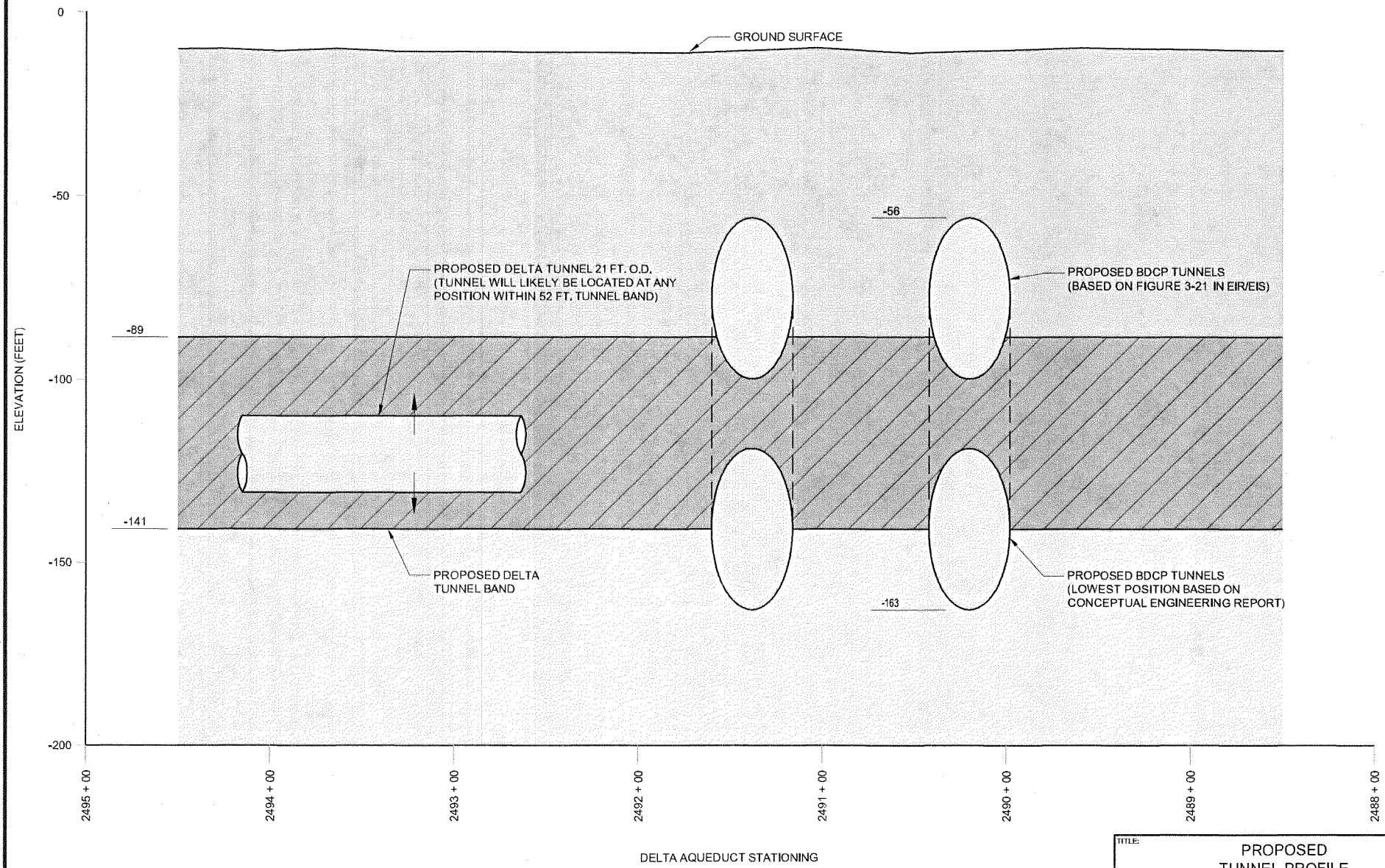
EBMUD

MWH

FIGURE 1

RECIRC2482

D:\pwdirectory jen\dms13808\10504305 Detail Sheet



TITLE: PROPOSED TUNNEL PROFILE	
PROJECT: Mokelumne Aqueducts Delta Tunnel Study - TM3	
DATA REFERENCES:	
EBMUD	MWH
	FIGURE: 2

RECIRC2482

Appendix A

EBMUD

Procedure 718

EFFECTIVE	26 JUL 13
SUPERSEDES	06 FEB 12
LEAD DEPARTMENT	O&M

RAW WATER AQUEDUCT RIGHT-OF-WAY NON-AQUEDUCT USES

PURPOSE - To establish procedures and criteria for review and authorization of surface and sub-surface use of District-owned property containing raw water aqueducts and raw water pipelines for purposes other than installation, maintenance, and operation of District raw water aqueducts.

Forms Used

L-14	Limited Land Use Permit
K-47	Work Request Agreement
N-15	Certificate of Public Liability Insurance
N-17	Certificate of Workers' Compensation Insurance
	Application for Use of EBMUD Property or Request for Information
	General Fund Receipts for Miscellaneous Payments

Authority and Responsibility

Use, development, and control of fee-owned rights-of-way for District and non-District uses must be consistent with water supply operation and security and the rights and obligations of the District. District and non-District uses of District-owned aqueduct rights-of-way may be permitted when they conform to Policy 7.01, Aqueduct Rights-of-Way Maintenance.

- No use of District aqueduct properties by others will be permitted as a condition to meet city/county zoning requirements or to obtain any land use permit, approval, or entitlement affecting properties not owned by the District.
- No use of District properties by others will be permitted except under terms of a written agreement.
- Use of raw water aqueduct rights-of-way for District purposes shall have the concurrence of the Aqueduct Section Superintendent.
- Use of aqueduct rights-of-way for District treated water lines shall include all applicable aqueduct protections required for similar third-party utility water line crossings.

For all raw water aqueducts and pipelines, acceptable long-term uses of the rights-of-way include but are not limited to: utility crossings, road crossings, limited agriculture, equestrian and pedestrian trails, parks, oil and gas leases, and District-owned ground water wells. Acceptable, long-term uses of rights-of-way and easements for future raw water aqueducts will be evaluated upon facility completion. Such uses will be authorized by letter, limited land use permits, revocable licenses, leases or easements, as appropriate. All approved uses will conform to the requirements and limitations described in Requirements for Entry or Use of Mokelumne, Lafayette, and Moraga Aqueducts and Raw Water Pipeline Rights-of-Way (Requirements for Entry or Use) (Supplement No.1 to Procedure 718) and all other conditions as specified in the written approval, permit or easement for each individual use.

The Water Supply Division is responsible for monitoring permitted uses and detecting and preventing unauthorized uses of raw water aqueduct rights-of- way. The Office of General Counsel and the Manager of Real Estate Services will be consulted when an unauthorized user will not voluntarily desist.

The Water Supply Division is responsible for coordinating the development of recommendations with respect to the terms and conditions to be stipulated when a District or non-District use of a raw water aqueduct right-of-way is to be permitted.

The Director of Engineering and Construction shall be consulted when needed to supply location analysis or to determine what structural, grading, drainage, corrosion protection or other engineering measures are required and to obtain estimates of engineering, design and inspection costs.

Inquiries and Applications for Use

For all raw water aqueducts and pipelines, applications and inquiries for use of raw water aqueduct rights-of-way shall be processed by the Water Supply Division. Applications for non-District uses will not be processed unless accompanied by the appropriate application fees outlined in Supplement No. 2 to Procedure 718, Fees and Documentation Charges, Use of Aqueduct Rights-of-Way by Others.

The Water Supply Division is responsible for:

- Providing requirements for use of the District's raw water aqueduct rights-of-way to applicants and to other District departments requesting use of the right-of-way. See Supplement No. 1, Requirements for Entry or Use.
- Checking for completeness to ensure compliance with the requirements for entry or use of raw water aqueduct rights-of-way contained in Requirements for Entry or Use plus any other conditions applicable to the proposed use.
- Collecting engineering, plan review and construction inspection costs and documentation of insurance coverage, if necessary.
- Monitoring existing encroachments and inspection of the construction of new approved encroachments.
- Providing information to the Engineering and Construction Department for technical input regarding additional permit requirements or special restrictions that may be applicable (in addition to those outlined in Supplement No. 1, attached) and for update of District raw water aqueduct right-of-way drawings.
- Collecting application fees and charges associated with the preparation and execution of revocable licenses.
- Assuring proper environmental documentation.

Real Estate Services is responsible for:

- Advising the Manager of Water Supply Division of any real estate matters which relate to a specific proposed use.
- Collecting application fees and charges, preparing and executing limited land use permits, leases, easements, and all other property-related agreements (except for revocable licenses and temporary entry permits) and recommending fees and charges appropriate to the property use allowed, and for securing payment. See Supplement No. 2, Fees and Documentation Charges, Use of Aqueduct Rights-of-Way by Others.
- Maintaining records relating to rights-of-way crossings and use, and providing information to the Survey Section and Engineering Services Division for the update of District raw water aqueduct right-of-way drawings.

Types of Permit License or Easement

The Manager of Water Supply Division shall keep available the forms listing the general requirements set forth in Requirements for Entry or Use for each of the following:

<u>Temporary Entry/Temporary Construction Permit</u>

For temporary access to raw water aqueduct right-of-way such as for surveying, potholing, construction, for temporary access via the District's right-of-way to property adjacent to the right-of-way, and other similar short-term situations.

Revocable License and Revocable Landscape License

For pipelines, sewers, storm drains, overhead and underground cables, public trails, landscaping and other crossings or lateral encroachments.

Limited Land Use Permit

Provides for agricultural or other surface use of the right-of-way for a period not to exceed one year (vehicular parking is prohibited). These permits are renewable annually if inspection reveals satisfactory conformance to conditions of permit.

Easement

For streets, highways, large pipelines, canals and railroads, and other permanent publicly owned encroachments. Easements are officially recorded with the county having jurisdiction. The fee or consideration will be significant and based on the value of the property being encumbered.

The Manager of Water Supply Division shall request review of any proposed revisions to application forms and lists of requirements from the Engineering and Construction Department, Real Estate Services Division, Office of General Counsel, and the District's Pipe Committee.

Processing Applications

Temporary Entry Permits

The Manager of Water Supply Division may issue temporary entry permits including standard and temporary conditions relating to the use. The Manager of Real Estate Services and the Office of General Counsel will be consulted regarding unusual circumstances.

Revocable Licenses

The Water Supply Division, if warranted, shall conduct a field investigation to determine requirements for aqueduct protection and, in consultation with the Design Division or the Pipeline Infrastructure Division, will set forth the engineering and operating requirements.

The Manager of Water Supply Division shall then specify any and all requirements, including special conditions to the applicant, discuss the terms and conditions of the license agreement as well as any processing, design and inspection costs and license fee. The Manager of Water Supply Division may then enter into a standard license agreement with relevant special conditions on behalf of the District. The Manager of Real Estate Services and the Office of General Counsel shall be consulted regarding any unusual circumstances.

Copies of all revocable licenses issued by the Water Supply Division shall be provided to the Manager of Real Estate Services.

Limited Land Use Permits

The Manager of Water Supply Division shall convey the District's requirements to the applicant and investigate to determine any special conditions.

Real Estate Services shall prepare the Limited Land Use Permit (Form L-14) in duplicate, including special conditions or stipulations, accompanied by a District-prepared location sketch that will refer to aqueduct stationing and other appropriate location identifiers, including adjacent aqueduct structures.

Engineering and Construction shall prepare the District-prepared location sketch.

After payment of the stipulated consideration determined by Real Estate Services, the Manager of Water Supply Division shall review and execute the permit. These copies are then returned to the Manager of Real Estate Services, together with any stipulated consideration.

Forty-five days before expiration of a Limited Land Use Permit, the Manager of Real Estate Services shall notify the Manager of Water Supply Division, who shall investigate the permittee's operations. If renewal of the permit is recommended, the permit will be renewed by letter from the Manager of Real Estate Services.

Leases and Easements

The Manager of Water Supply Division shall conduct a field investigation to determine requirements for aqueduct protection and, in consultation with the Design Division or Pipeline Infrastructure Division, if necessary, will set forth the engineering and operating requirements.

If structural or corrosion protective facilities are required, the Manager of Water Supply Division shall request the Manager of Design Division or Pipeline Infrastructure Division to proceed with the required design or plan reviews. (During design, the designer will communicate with the applicant's engineer.) Upon completion of design, the plans will be delivered to the applicant via the Manager of Water Supply Division, who will arrange for inspection as required.

The Manager of Real Estate Services shall discuss with the applicant the terms of the agreement and the amount of the consideration, including any processing, design, and inspection costs. Real Estate Services shall obtain an appraisal and engineering estimates, if necessary.

Upon agreement with the applicant, the Manager of Real Estate Services, shall draft, for review and approval by the Water Supply Division and Office of General Counsel, an agreement granting the applicant the property interest under the terms and for the consideration as approved. Real Estate Services shall assure that evidence of insurance is provided, if required. The lease or easement shall be submitted to the District's Board of Directors for approval, if required by Procedure 108. Two copies of the lease or easement shall be sent to the applicant with instructions to sign and return the copies, together with the consideration, to the Manager of Real Estate Services. Easements shall be recorded and the applicant shall provide the Manager of Real Estate Services with the recording data.

Approvals

District uses of the raw water aqueduct right-of-way shall be confirmed in writing listing any special conditions which may apply to the proposed use to the requesting District departments by the Manager of Water Supply Division.

Terminations

If the Water Supply Division terminates any permit or license, the Manager of Real Estate Services and the Design Division shall be so notified by memo.

Appeals

The final determination of the terms and conditions appropriate for District uses of aqueduct properties rests with the Director of Operations and Maintenance.

The final determination of the terms and conditions appropriate for a specific third party applicant rests with the General Manager and the Board of Directors. Appeals by third parties directed to the Board of Directors shall be forwarded to the General Manager for resolution.

Records

The Manager of Real Estate Services shall maintain a file containing copies of all documents relating to right-of-way crossings or uses and is responsible for the assignment of right-of-way crossing numbers to approved documents.

The Engineering Services Division of the Engineering and Construction Department shall maintain working sets of right-of-way prints for each District raw water aqueduct right-of-way. These prints shall be updated following:

1. Grant of Revocable License or Easement. Notice to be supplied by the Manager of Real Estate Services.

2. Completion of crossing construction covered by license or easement. Notice, including "as built" location data, to be supplied by the applicant to the Water Supply Division for transmittal to the Engineering and Construction Department. This notice will be routed through the Engineering and Construction Department., as necessary, then to the Manager of Real Estate Services. After right-of-way tracings are revised, new prints will be released to those having sets.

3. Termination of any raw water aqueduct right-of-way use. Notice to be supplied by the Manager of Real Estate Services.

Revised prints shall be released following all right-of-way drawing revisions.

Requirements and Fees

Requirements for use of raw water aqueduct right-of-way and fees for the processing of applications and documents related to such uses are included in the documents Requirements for Entry or Use and Fees and Documentation Charges, Use of Aqueduct Rights-of-Way by Others, respectively (see Supplement No. 2, attached). The Manager of Water Supply Division is responsible for periodic review and updating of Requirements for Entry or Use. The Manager of Real Estate Services is responsible for review and updating of Fees and Documentation Charges, Use of Aqueduct Rights-of-Way by Others.

References

Policy 7.01 – Aqueduct Rights-of-Way Maintenance
Procedure 108 – Real Estate Transactions
Procedure 436 – Miscellaneous Accounts Receivable and Cash Receipts

Requirements for Entry or Use of Mokelumne, Lafayette, and Moraga Aqueduct and Raw Water Pipeline Rights-of-Way (attached)
Fees and Documentation Charges Use of Aqueduct Rights-Of- Way by Others (attached)
Schedule of Rates and Charges to Customers of the East Bay Municipal Utility District – Real Property Use Application Fees – Resolution 33046-97

EBMUD

REQUIREMENTS FOR ENTRY OR USE OF MOKELUMNE, LAFAYETTE, AND MORAGA AQUEDUCTS and RAW WATER PIPELINE RIGHTS-OF-WAY

SUPPLEMENT NO. 1 TO PROCEDURE 718

East Bay Municipal Utility District
1804 West Main Street, **Stockton, CA 95203**
(209) 946-8000

1. Requests for encroachment rights or for other uses of the District's raw water aqueduct and pipeline properties shall be directed to the Manager of Water Supply Division, 1804 West Main Street, , Stockton, California 95203. Property uses shall only be permitted subject to appropriate written permit, license, easement, or lease agreement.

2. Requests for property uses shall be in writing and accompanied by a completed application, plan and profile drawings of the area and work involved. District aqueduct stationing and adjacent above-ground structures must be shown. Applicant's horizontal and vertical control must be correlated to the District's. Drawings and maps shall be full size (11x17inch) or half-size (8½ x 11 inch). Application must include complete insurance documentation.

3. The applicant must agree to indemnify and hold harmless the District from any loss, claim, or liability which may arise by reason of applicant's use of District property and may be required to provide insurance coverage.

4. All requests for uses of District property must be consistent with requirements and limitations set forth by Procedure 718 and will be reviewed and approved on a case-by-case basis.

5. District land and facilities shall be restored to a condition as good as that which existed before applicant's entry on the right-of-way.

6. Applicant's use of property shall not increase District costs or interfere with District access, operations, maintenance, or repair of its facilities.

7. The applicant must pay the District the appraised value of the easement or lease, if appropriate, for the rights granted to the applicant. Appropriate environmental documentation must be completed in accordance with the California Environmental Quality Act before the rights can be granted.

8. For any District-approved encroachment, the applicant must pay the District for any of the following measures, as needed:

    a. Design of structural protective measures
    b. Design of fences or other structures
    c. Corrosion control protective measures
    d. District engineering, plan review, and inspection of activities
    e. Environmental documentation
    f. Application, permit or license fees.

9. The plan for the execution of the work must be approved by the District.

10. The type and weight of equipment working over the aqueduct must be approved by the District.

11. The use of vibratory compaction equipment is prohibited on the aqueduct right-of-way unless otherwise approved by EBMUD. Allowable compaction effort, allowable equipment, and maximum depth of each lift of fill shall be subject to District review and approval before start of construction.

12. A minimum of 48 hours notice must be given to the District before work commences. To contact the District by telephone, call: the Aqueduct Section's Stockton Office at (209) 946-8000.

13. A preconstruction meeting is required prior to start of work.

14. No building or portions of buildings shall be constructed on the property. No other types of structures shall be constructed unless specific approval is given by the District.

15. No longitudinal encroachments such as drainage ditches; gas, phone, or electrical lines; pipelines, or roads will be permitted. All property line fences (including footings) must be located completely outside the aqueduct property lines.

16. No pile driving will be allowed within 100 feet of the aqueducts.

17. Railroad, freeway and highway crossings of the aqueduct right-of-way shall be on permanent bridges with a minimum vertical clearance of 14 feet 6 inches between the finished ground surface and the underside of the bridge. Crossings on grade will be over structurally-encased aqueducts with a sleeve for a fourth aqueduct.

18. Street and road crossings constructed on grade shall incorporate protection of the aqueducts. Protective measures will be designed by the District or by applicant's licensed engineer to District standards with specific District approval of each design.

19. Existing aqueduct protective measures such as concrete slabs shall not be cut, penetrated, or otherwise disturbed. If a protective measure is cut, penetrated, or disturbed, it shall be replaced with a new protective measure, designed by a District engineer or applicant's licensed engineer to District standards with specific District approval of design.

20. Traffic control fences or approved barriers shall be installed along each side of the street, road or trail before opening to the public.

21. Temporary construction fences and barricades shall be installed by contractor as directed by the District.

22. No geotechnical exploration such as drilling or boring shall be allowed on an Aqueduct right-of-way.

23. Any changes in finished grade must be approved by the Aqueduct Section. Earthfills or cuts on adjacent property shall not encroach onto District property except where authorized for vehicular crossings on grade and where the District determines that there will be no detrimental effect on the aqueducts or their maintenance.

24. Crossings shall be at an angle not less than 45 degrees to the aqueducts and on a constant grade across District property.

25. Sanitary sewers, water lines or petroleum product lines crossing above the aqueducts must be encased in a steel or polyvinyl chloride (PVC), or reinforced concrete pipe conduit or be imbedded in reinforced concrete with a minimum vertical clearance of two (2) feet between the casing/embedment and the top of District aqueducts unless other protective measures are provided.

26. All pipelines crossing below the aqueducts must be encased in a steel or reinforced concrete conduit and provide a minimum of three (3) feet of clearance between the casing and the bottom of the District aqueducts.

27. Trenchless construction methods such as horizontal directional drilling or jack-and-bore between the top of the aqueducts and the bottom of the protective structure (slab) are prohibited.

28. On pressurized pipe crossings, shutoff valves shall be provided outside and adjacent to both sides of District property.

29. At the point of crossing, steel pipeline crossings and steel casings shall incorporate electrolysis test leads, bond leads, and leads necessary for interference testing. Corrosion control devices, when required, must be approved by the District.

30. Cathodic protection for steel encasements must be installed as follows:

- Provide a dielectric coating to the exterior surface of the steel casing within the District's right-of-way, 16 mil epoxy or equivalent.
- Provide galvanic protection to the portion of the steel casing within the District's right-of-way in accordance with the National Association of Corrosion Engineers RP-01-69.
- If the carrier pipe is constructed of ductile iron or steel, provide electrical isolation between the carrier and casing using casing insulators; redwood skids are not permitted.
- Provide test results to the District demonstrating the adequacy of the cathodic protection system, and the adequacy of the electrical isolation of the carrier (if metallic) from the casing. The District reserves the right to witness any such tests.

31. Gravity drainage of District property shall be maintained. Open channels constructed across the right-of-way shall be paved with reinforced concrete. Headwalls, inlets, and other appurtenances shall be located outside District property. Drainage facilities shall be provided outside the District's property at the top and/or toe of fill slopes or cuts constructed adjacent to District property to assure adequate drainage.

32. Overhead electrical power conductors across the property shall be a minimum of 30 feet above ground. Communication and cable TV crossings shall be a minimum of 20 feet above the ground. Supporting poles or towers shall be located outside the aqueduct right-of-way.

33. Buried electrical cables passing over the aqueducts shall be installed in PVC conduit and encased in red concrete across the entire width of the right-of-way. In some cases, PVC-coated steel conduit with a red concrete cap may be substituted. All other buried cables shall be installed in conduits and marked in the appropriate Underground Service Alert (USA) colored marking materials and with surface signs installed at 4-foot intervals that include the utility name, type, and emergency contact information across the entire width of the aqueduct right-of-way. The minimum vertical clearance between the conduit and the top of the District's aqueducts is two (2) feet unless other protective measures are provided.

34. Electrical or telecommunications cables passing under the aqueducts shall be encased in conduit and marked at both edges of the aqueduct right-of-way with the appropriate USA color coded markers. The minimum vertical clearance between the conduit and the bottom of the District's aqueducts is two feet. For directional bored conduits the minimum vertical clearance is five feet.

35. Vehicular parking and storage of equipment or material on aqueduct property are specifically prohibited.

36. Extraction of oil and gas from aqueduct properties may be permitted under appropriate lease agreements.

37. All District survey monuments and markers shall be undisturbed. If any District survey markers or monuments must be disturbed, they will be replaced or relocated by the District at applicant's expense prior to the start of any ground disturbing work.

38. All aqueduct crossings involving mechanical excavation on the right-of-way require potholing of all three aqueducts at the site of the proposed crossing. Visible reference markings showing the aqueduct alignments and depths to top of pipe shall be maintained for the duration of any mechanical excavation on District property. Excavations within two (2) feet of aqueducts shall be made by hand. Entry permits are required for pothole work.

39. All grading or excavating of the right-of-way requires USA notification and the maintenance of a current inquiry identification number.

40. Certified six-sack mix is the minimum acceptable concrete batch to be used on the aqueduct right-of-way. Concrete compression strength shall be 3,000 per square inch (PSI) or better at 28 days. If samples do not reach 3,000 PSI at 28 days, the entire section of slab or encasement related to that sample must be removed and replaced at applicant's expense.

41. Each truckload of concrete to be placed on the aqueduct right-of-way may be sampled by the District. No water may be added to the mix after sampling.

42. Maximum allowable slump is three inches. All concrete exceeding three inches will be rejected and cannot be used on the aqueduct right-of-way.

43. No traffic will be allowed over protective slabs until 3,000 PSI is reached.

44. All work areas shall be inspected by the District for final approval. As-built drawing submittals are required for District approval.

EBMUD

FEES AND DOCUMENTATION CHARGES
USE OF AQUEDUCT RIGHTS-OF-WAY BY OTHERS

SUPPLEMENT NO. 2 TO PROCEDURE 718

TYPE OF DOCUMENT	APPLICATION FEE
Fee Title (Outright purchase of District property)	$2,000
Easement (Rights for permanent use of District property such as access, utilities, etc.)	$1,000
Quitclaim (Removal of District's right, title, and interest to property)	$1,000
Revocable License (Permission to use District property for periods exceeding one year. Subject to revocation)	$500

Revocable License and Application Fees:

Applicant	Application	Property Rights	Total
Government Agencies	May be Waived	$1,000	$1,000
Public Utilities	May be Waived	$1,000	$1,000
Privately Owned Public Utilities (AT&T, PG&E, etc.)	$500	$1,000	$1,500
Developers & other profit-seeking activities	$500	$1,000	$1,500
Private, nonprofit organizations	$500	$1,000	$1,500

Lease (The right to occupy and use District land for a specified time period)	$600
Telecommunication Lease (The right to occupy and use District land for a specified time period)	$2,000
Information Only (Request for information requiring research of District records)	$60/hr
Processing and Review of Watershed Land Use Proposals (Request for District to perform a formal evaluation of watershed land use proposal)	$60/hr ***(Plus all other District costs)***
Property Entry Permits, Rights of Entry, Temporary Construction Permits (Permission for temporary access onto District property)	$100
Limited Land Use Permit (Allows landscaping, gardening, or other minor surface use of District property; subject to annual renewal)	$25

1. In addition to the above charges, applicants will be required to reimburse the District for its costs of engineering, surveying, and inspection of the proposed use of encroachment.

2. Fair market value for property rights conveyed shall also be paid by the applicant, where appropriate including all costs (appraisal, recordation, title report, etc.).

Attachment 4

BDCP Impacts on Freeport Regional Water Project

Attachment 4
BDCP Impacts on Freeport Regional Water Project

This document focusses on three technical areas:

(1) assumed EBMUD diversions via Freeport Regional Water Project (FRWP) as a Central Valley Project North of Delta Municipal and Industrial (CVPNoDM&I) contractor[1];
(2) potential impacts to the ability to operate the FRWP due to reverse flow events[2] on the Sacramento River; and
(3) bypass flow requirements on the Sacramento River that relate to the reverse flow issue.

Summary

- While the assigned EBMUD diversion schedules at Freeport are consistent with the Freeport Project EIR/EIS, the assumed EBMUD diversions that serve as boundary conditions for the Calsim2 model and included in the project alternative and no action scenarios appear to be inconsistent with recent Calsim2 model updates or improvements incorporated into the BDCP modeling. In some cases contract year diversions exceed CVPNoDM&I allocations, some contract year diversions are reduced under *Late Long Term* (LLT) scenarios relative to *Early Long Term* (ELT) scenarios without explanation, and future level-of-development scenarios[3] do not account for the increased frequency of diversions planned for by EBMUD that are consistent with the terms of the District's LTRC with the Central Valley Project.
- Modeling simulations performed with DSM2 by DWR, which have been confirmed by independent DSM2 modeling, show a significant impact to the potential operation of the FRWP due to operation of the BDCP intakes. While ecosystem restoration actions included as part of the project description are shown to mitigate the potential increase in reverse flow events that would adversely impact FRWP, until the restoration component of the project is successfully implemented mitigation is required to reduce the potential impacts to less than significant.
- The proposed bypass flow rules are expected to limit the frequency of reverse flow events on the Sacramento River and, therefore, serve to limit the extent of reverse flow events on the Sacramento River that would impact FRWP operation. Therefore, the proposed bypass flow rules are a key component of the operating rules proposed as part of the project. The extent that the bypass flow rules are expected to constrain actual project operations, the implementation of the bypass rules, and the degree of regulatory oversight with respect to the bypass flow rules, however, is not clear from the project documentation. Clarification and potential assurances related to the proposed bypass flow rules is an important aspect of understanding and limiting potential project impacts to FRWP operation.

[1] As specified by Longterm Renewal Contract Between the United States and East Bay Municipal Utility District Providing for Project Water Service from the American River Division Contract No. 14-06-200-5183A-LTR1.
[2] Reverse flow events considered impactful meet certain reverse flow criterion defined later in this report.
[3] *I.e.* ELT and LLT cases.

Background

This analysis is based upon technical modeling results provided by the California Department of Water Resources (DWR) and used to support BDCP project documentation. The data reviewed include Calsim2 and DSM2 model output in seven modeling scenarios described below. MBK Engineers performed updated Calsim2 modeling that provided the District additional technical information necessary to analyze the BDCP project effects[4]. The MBK analysis is used as supplemental, supporting information in related technical areas.

The focus of this analysis is threefold (1) analyze assumptions related to EBMUD diversions via the FRWP facilities in terms of accuracy and consistency with both the Longterm Renewal Contract (LTRC) and recent planning studies undertaken by EBMUD, (2) to discern the frequency of reverse flow events in each of the model scenarios available, and (3) comment on the proposed bypass flow rules in terms of limiting the likelihood of reverse flow events under project operations.

With respect to the issue of analyzing the accuracy of assumptions concerning the quantity and timing of diversions at the FRWP intake, areas of concern relate to consistency in the annual (contract) year allocation and the overall CVPNoDM&I allocations. Furthermore, the diversion patterns need to be consistent with relevant anticipated diversions as triggered by the LTRC and including the increased frequency of active years of diversion with increasing level-of-development.

A reverse flow event is any event in which water flows up the mainstem of the Sacramento River north towards the City of Sacramento. However, discerning whether a given reverse flow is a potential impact to the operation of the FRWP the following criteria are applied. A reverse flow event is considered to have an impact on operation of FRWP intake if the upstream advective transport during the reverse flow event exceeds a threshold of 0.9 miles, the trigger for an automatic shutdown of the intake. A filter process was run on each model simulation output timeseries of velocity [ft/sec] at the FRWP intake to identify when the upstream advective transport at Freeport during the reverse flow events[5] exceeds 0.9 miles.

Modeling study names and descriptions analyzed are summarized in Table 1, which includes seven scenarios provided by DWR and four scenarios generated from the MBK analysis.

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[4] Consultant team with MBK Engineers has been hired by a multi-agency group that includes EBMUD to (1) update the Calsim2 model assumptions based on the best available information, and (2) to simulate *existing* and *BDCP Alt 4* cases with updated assumptions and without climate change effects included to better elucidate potential project benefits and impacts. CCWD staff utilized the Calsim2 results and California Department of Water Resources DSM2 model and set-up for the BDCP to perform refined long-term simulations of hydrodynamics and water quality effects under the various scenarios. Specifically, CCWD performed DSM2 studies for the four model scenarios described briefly in Table 1 (attached). DSM2 model output for each scenario is 15-minute time steps covering January 31, 1921 through September 30, 2003. This output period represents 2,898,433 data points per time series.

[5] *I.e.* when velocity is less than or equal to zero.

Technical Findings and Comments

Freeport Diversions
This section presents the technical findings related to the frequency and magnitude of the EBMUD diversions via the FRWP that serves as a boundary condition for the Calsim2 model. The following analysis is focused on a review of the seven model simulations provided by DWR used to support the project documentation (see Table 1).

- Existing condition scenarios[6] are assumed to be 2005 level-of-development and do not include Freeport diversions. This is a documented assumption in file *Public Draft BDCP EIR-EIS Chapter 5 Appendix 5A - BDCP EIR-EIS Modeling Technical Appendix - Parts A & B.pdf* page 5A-B134[7].

- In all No Action and Project simulations[8], the Freeport diversion schedule is generally consistent (in magnitude and frequency) with the 2020 Freeport diversion schedule[9] from the Freeport EIR/EIS[10]. This is also a documented assumption in *Public Draft BDCP EIR-EIS Chapter 5 Appendix 5A - BDCP EIR-EIS Modeling Technical Appendix - Parts A & B.pdf* page 5A-B134[11].

- For a given scenario *i.e.* No Action *or* Alternative 4 Project cases, Freeport diversions are reduced in the LLT scenario relative to the ELT scenario in a subset of the years that show a diversion (5 years[12] out of 23 active years or 22% in the No Action scenarios, and 4 years[13] out of 23 active years or 17% in the Alternative 4 scenarios). An examination of the CVPNoDM&I percent allocations does not explain the reductions in the diversions[14].

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[6] Simulation EX_ROA0_SPR0_CC0 and EX_No_FallX2_ROA0_SPR0_CC0.

[7] Excerpt, line 18 of the page cited:
Freeport Regional Water Project (FRWP) is not included

[8] Simulations NAA_ELT_ROA0_SLR15_CC5, NAA_LLT_ROA0_SLR45_CC5, NAA_ROA0_SLR0_CC0, ALT4_ELT_ROA25_SLR15_CC5, and ALT4_LLT_ROA65_SLR45_CC5.

[9] EBMUDSIM model archive reference study ID #6336.

[10] Results are generally within round-off tolerance +0.2% accounted for by conversion of 100MGD to 154.7cfs that is rounded to 155cfs in the Calsim2 work.

[11] Excerpt of lines 28-30 of the page cited:
Freeport Regional Water Project (FRWP) is included at full demand (EBMUD CVP contracts and SCWA CVP contract and new appropriative water rights and water acquisitions as modeled in the FRWP EIS/R)

[12] Contract years that are reduced in *LLT* relative to *ELT* under the *No Action* scenarios are 1933, 1934, 1977, 1990, and 1991.

[13] Contract years that are reduced in LLT relative to ELT under the *Alt 4 Project* scenarios are 1933, 1934, 1977, and 1991.

[14] For example, consider the ELT and LLT diversions for contract year 1933 under the *No Action* scenario, the EBMUD diversion at Freeport is 71,958AF in the ELT case and 65,664AF in the LLT case with CVPNoDM&I percent allocations equal to 53% in <u>both</u> the ELT and LLT studies which would allow for an allocation of 133,000AF*0.53=70,490AF. Note that the ELT diversion is approximately 0.2% higher than that computed from the percentage allocation which is explained by the round-off error in the conversion of 100MGD diversion in a month to the cfs equivalent of 154.7cfs rounded to 155cfs. What is unclear, however, is why the diversion is reduced

Furthermore, in one of the cases identified, the reductions that occur in selected contract years under the LLT condition relative to the ELT are not accounted for over the multi-year diversion sequence when the contract limitation constraining the consecutive three-year diversion sum to 165 TAF is in effect[15]. Note in the case of the 1990-1992 sequence, the 165 TAF 3-year contractual constraint is controlling in the ELT allocations leading to a relatively low diversion in year 3[16], but the LLT case reduces the diversion in the second year (1991)[17] and diversions in the third year (1992) are not increased by the amount the second year is reduced[18] such that this contract limitation is still controlling as it should be consistent with the contract provisions as documented[19].

- While the Freeport diversions schedule is consistent with the Freeport EIR/EIS, the diversion assignments in many years are incompatible with the CVPNoDM&I output from Calsim2. This indicates updates or changes to the Calsim2 operating rules from the time of the completion of the Freeport EIR/EIS to the BDCP project. Table 2 shows the breakdown for each simulation. Recall that there are no diversion assignments in the existing conditions. Under the *No Action* scenario roughly 43% of the diversions exceed the CVPNoDM&I percentage allocation. Similarly, in the *Alt4 Project* scenarios 43% and 39% of the diversions exceed the CVPNoDM&I percentage allocations for the ELT and LLT model studies, respectively.

- EBMUD's CVP contract conditions are summarized as footnote 5 in **Table B-19: American River Diversions Assumed in the Existing Conditions and No Action Alternative[20].** The third item listed, "(3) Diversions allowed only when EBMUD total storage drops below 500 TAF" is not fully accurate as stated and needs to be revised as follows, "(3) Diversions allowed only when projected October 1 EBMUD total storage drops below 500 TAF". The key revision to the listed item is the word "projected" to indicate that this is a projected or simulated storage *without* supplemental supplies that is used to trigger both supplemental supplies as well as the District's drought management program[21]. Also, the storage threshold applies to a specific date of the year, October 1[22]. As written, the criteria could be

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to *less than* that of the calculated value based on the 53% allocation under the LLT condition *i.e.* why is the diversion reduced to a 49% allocation for the LLT simulation when the CVPNoDM&I allocation is 53%?

[15] Where BDCP documentation clearly lists this contract provision as a modeled constraint of the Calsim2 study, see file *Public Draft BDCP EIR-EIS Chapter 5 Appendix 5A - BDCP EIR-EIS Modeling Technical Appendix - Parts A & B.pdf* page 5A-B137, where the last five lines of the table are referencing footnote "\5" of the table that presents the contractual limitations governing this specific CVP contractor where listed item (2) is excerpted as:

(2) 165 TAF maximum diversion amount over any 3 year period

[16] *I.e.* roughly 20TAF in 1992.

[17] *I.e.* from 78,192AF to 75,177AF for the respective ELT and LLT simulations under the *No Action* scenario and from 78,192AF to 68,679AF for the respective ELT and LLT simulations under the *ALT4 Project* scenario.

[18] *I.e.* roughly 4TAF in the no action case and about 10TAF in the action case

[19] See footnote 15.

[20] *Ibid.*

[21] For more information on the District's drought management program, the reader is referred to Chapter 3 of the UWMP 2010 available online at: http://www.ebmud.com/water-and-wastewater/water-supply/urban-water-management-plan, last accessed April 24th 2014.

[22] In practice where a monthly model is utilized, the end-of-September storage is used to represent the October 1 storage criteria.

misinterpreted to apply in any month of the year in which total storage drops below the 500 TAF threshold, and that is clearly inconsistent with the contract[23].

- As EBMUD demand increases at future levels-of-development, more years become eligible under the criteria defined by the District's LTRC as more years have projected end-of-September total system storage projected to be less than 500 TAF. The frequency of contract years with active diversions increases from roughly 22% to 34% from 2005 to 2040 level-of-development. Approximately 10 additional years show active diversions in 2040 compared to 2005 for the 1921 through 2003 hydrology[24]. Furthermore, the frequency is expected to increase beyond 2040 with growing customer demand. The Freeport diversion schedule utilized in both No Action and Alternative 4 Project scenarios is consistent with the 2020 Freeport diversion schedule and is, therefore, appropriate for use in the ELT studies; however, this diversion schedule is not accurate in terms of frequency and magnitude of diversions in the LLT studies. The increased frequency of diversions and the magnitude of the contract year diversions is non-negligible and could have a significant effect on Calsim2 results that is cascading to the other model studies that tier off of the Calsim2 results which could potentially affect the impacts assessment.

Reverse Flows

This section presents the technical analysis findings with respect to the reverse flows impacting FRWP operations. The analysis is based upon the DSM2 modeling output provided by DWR to EBMUD. Additional analysis using modeling performed by MBK Engineers and CCWD is also utilized to further clarify the potential effects of the proposed project.

- DWR DSM2 model output was provided for each of the seven simulations listed in Table 1. Model results provided spanned October 1, 1974 through September 20 1991 on 15-minute intervals. Table 3 presents the number of reverse flow events with advective transport exceeding 0.9 miles that would cause a shutdown of FRWP for each of the seven DWR model simulations. Figure 1 shows the number of reverse flow events per year over the hydrologic period simulated.

  Based on the results, reverse flow events generally increased over the planning horizon from the existing case without restoration (30) to the no action ELT case (70) increasing further still for the no action LLT (178). Among these three runs, the main factor changing is the anticipated effects of climate change represented by changes to the hydrology and sea level

[23] For precise language of the contract, see §3(a)(1) page 12, lines 253-254 of Longterm Renewal Contract Between the United States and East Bay Municipal Utility District Providing for Project Water Service from the American River Division Contract No. 14-06-200-5183A-LTR1 abbreviated throughout this report as the Longterm Renewal Contract or LTRC.

[24] For example, under 2005LOD with customer demand set to 214MGD, projected end-of-September total system storage (EOSTSS) is >500TAF in 1947. However, under 2040LOD with customer demand set to 230MGD, the projected EOSTSS drops below the 500TAF threshold and, therefore, becomes an eligible year for supplemental supplies under the CVP contract via the FRWP facilities. Note also that 1947 is generally a high allocation year where the CVPNoDM&I allocation is on the order of 70% (varying from 66% to 75% depending on the model study). A 70% allocation of 133TAF would result in a potential diversion of 93TAF which is clearly a non-negligible diversion that could potentially affect the modeling results and, therefore, the impacts assessment.

rise that clearly increases the frequency of impactful reverse flow events.

The Alternative 4 Project scenario, which includes the new facilities and the restoration action, significantly reduces the instances of the reverse flow events. For example, comparing the No Action ELT and Alternative 4 ELT simulations, the number of reverse flow instances impacting the Freeport operation are reduced from 70 instances to 14 instances and for the LLT scenarios the No Action cases shows 178 instances which are reduced to 21 instances under the Alternative 4 Project simulation. However, for the simulations provided by DWR, the project runs include both the new infrastructure and the restoration and, therefore, these two components of the project cannot be analyzed in isolation to determine their relative effect of either component on the reverse flow metric.

- Additional modeling performed by CCWD simulated the full hydrologic period that was simulated with Calsim2[25]. This modeling provided additional clarifying information regarding the effect of the two components of the project isolating the effect of restoration. Four DSM2 model simulations were analyzed as described in Table 1. The number of reverse flow events for the full 83-year period of record and shorter 19-year period that would result in a shutdown of FRWA are presented in Table 4. The distribution of the number of reverse flow events per year is plotted in Figure 2.

  When comparing the Base Case without restoration, essentially representing a No Action Scenario without climate change, to the Action Case, which includes the new facilities and the restoration, a significant reduction from 203 to 55 reverse flows instances is obtained for the hydrologic period of 1921 through 2003 and 55 to 12 instances when limited to the 19 years of hydrology[26] (see Table 4). Note however that the effect of the 25,000-acre restoration—consistent with the ELT scenario from the DWR modeling—is isolated by performing a Base Case and Action Case simulation with and without the restoration. With respect to the Base Case, the restoration reduces the number of reverse flow instances that would shut down the FRWP intake from 203 to 49 for 1921 through 2003 hydrology and from 55 to 11 cases for the shorter period spanning 1972 through 1991. With respect to the Action Case, 237 reverse flow instances that would shut down the FRWP intake are identified for the 1921 through 2003 hydrology which drops to 55 instances when the 25,000-acres of restoration are included. For the shorter period of hydrology from 1972 through 1991, the number of reverse flow instances that would shut down the FRWP intake drops from 64 without restoration included to 12 instances when the restoration is included. Thus, if restoration is not included in the Base Case, there are 203 reverse flow instances that would shut down the FRWP intake, increasing to 237 instances under the Action Case without restoration for 1921 through 2003 hydrology. For the shorter 19-year period of hydrology from 1972 through 1991, the Base Case shows 55 instances of reverse flows that would shut down the FRWP intake, increasing to 64 instances under the Action Case when the restoration is not included. **In conclusion, the results show a potential impact of the BDCP intakes on the FRWP, and the impact is mitigated by the proposed restoration.**

[25] *I.e.* January 31, 1921 2400hrs to September 30, 2003 2400hrs.
[26] *I.e.* 1972 through 1991.

However, until the restoration projects are effectively implemented, the BDCP intakes would have an adverse impact on the FRWP.

- Table B-9 DSM2 Inputs page 5A-B73 reports that the period simulated is a 16-year period 1976 through 1991. This represents a shortened hydrologic period simulated relative to the Calsim2 model that simulates an 83-year period from 1921 through 2003. The shortened 16-year period covers the two main drought periods[27]; however, this shorter 16-year period is skewed towards drier year types (see Figure 3). On the basis of the Sacramento Valley Water Year Hydrologic Classification, the Dry and Critical year types are the most frequent (at 56%) relative to Wet, Above Normal, and Below Normal year types (44%) in the 1976 through 1992 period. For the longer period of hydrology simulated with Calsim2, the wetter year types (*i.e.* Wet, Above Normal, and Below Normal) account for 66% of the 83-year period whereas the Dry and Critical year types account for 37%. While reverse flow events are expected to occur in the drier year types which are over-represented in the shorter 16-year period, the purpose of the impacts analysis is to discern the impact of the proposed project as compared to the no project or no action. Considering that the project effects are greatest in the wetter year types when regulatory constraints on the system are less restrictive to project operations, the approach of simulating a shorter period that is relatively dry means that the impacts analysis is based on a period in which the project operation is more constrained. Furthermore, since DSM2 boundary conditions are available for the full 83-year period of record, the reason to limit the DSM2 model to a shorter and drier hydrologic period seems arbitrary. Simulating a longer hydrologic period with more variation in hydrologic conditions seems more appropriate to base the analysis of potential impacts of the proposed project.

Bypass Flow Criteria

Bypass rules are presented and described in Appendix 5A[28]. The bypass rules are described as proposed rules, "which govern the amount of water required to remain in the river before any diversion can occur. Bypass rules are designed with the intent to avoid increased upstream tidal transport from downstream channels, …". These bypass rules are a key basis of the operating rules governing the project operations particularly in the context of the reverse flow issue on the Sacramento River. It is unclear whether these operating rules are intended to govern the actual operation of the proposed project once constructed. Are the proposed rules considered guidelines for the operation of the project or are they considered strict operating constraints that will be implemented as part of the project? Will the proposed bypass rules be incorporated into the operating permit(s) for the project? What is the process or procedure for changes to the proposed rules and what regulatory agencies if any are involved with monitoring and enforcement of the bypass rules? In order to have confidence that the project will not have additional impacts on FRWP, the bypass flow criteria need to be adopted as strict operating rules.

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[27] The 1976-1977 drought and five years of the six-year 1987-1992 drought

[28] See file *Public Draft BDCP EIR-EIS Chapter 5 Appendix 5A - BDCP EIR-EIS Modeling Technical Appendix - Parts A & B.pdf* pages 5A-A21 and 5A-A22; also 5A-B26 and 5A-B27.

Table 1: BDCP DSMII Model Scenarios with Description†.

Study Name	Description
Modeling Studies Generated by DWR Supporting the Public Project Documentation	
EX_ROA0_SLR0_CC0	Existing conditions with Fall X2 requirement; no sea level rise, no climate change, and no restoration
EX_No_FallX2_ROA0_SLR0_CC0	Existing conditions without Fall X2 requirement; no sea level rise, no climate change, and no restoration
NAA_ELT_ROA0_SLR15_CC5	No action/no project alternative representing ~2025 case no restoration sea level rise of 15cm and corresponding climate change
NAA_LLT_ROA0_SLR45_CC5	No action/no project alternative representing ~2060 case no restoration sea level rise of 45cm and corresponding climate change
NAA_ROA0_SLR0_CC0	General no action alternative: no restoration, no sea level rise, no climate change
ALT4_ELT_ROA25_SLR15_CC5	Action case representing ~2025 case with project completed: 25,000 acres of tidal marsh restoration completed, sea level rise of 15cm and corresponding climate change
ALT4_LLT_ROA65_SLR45_CC5	Action case representing ~2060 case with project completed: 65,000 acres of tidal marsh restoration completed, sea level rise of 45cm and corresponding climate change
Modeling Studies Generated by the MBK Analysis	
MBK_FutBase_CC0_SLR0	Updated baseline using existing SWP/CVP conveyance; no climate change; no sea level rise; no tidal marsh
MBK_FutBase_CC0_SLR0_ROA25	Same as MBK_FutBase_CC0_SLR0 with the additional 25,000 acres of tidal marsh as defined in the BDCP models for the Early Long Term (ELT). • To isolate the effect of tidal marsh restoration in the current system of SWP/CVP conveyance, compare this run to MBK_FutBase_CC0_SLR0.
MBK_BDCP_ALT4_CC0_SLR0_ROA0	BDCP Alt 4, operational scenario H3 (aka the Evaluated Starting Operations, or ESO); no climate change; no sea level rise; no tidal marsh. • To isolate the effect of the new conveyance system/operations if no tidal marsh is constructed, compare this run to MBK_FutBase_CC0_SLR0.
MBK_BDCP_ALT4_CC0_SLR0_ROA25	BDCP Alt 4, operational scenario H3 (aka the Evaluated Starting Operations, or ESO); no climate change; no sea level rise; with the 25,000 acres of tidal marsh as defined in the BDCP models for the Early Long Term (ELT) • To isolate the effect of the new conveyance system/operations assuming the full 25,000 acres of tidal marsh is constructed as assumed in the modeling, compare this run to MBK_FutBase_CC0_SLR0_ROA25. • To isolate the effect of tidal marsh restoration under the new conveyance system/operations, compare this run to MBK_BDCP_ALT4_CC0_SLR0_ROA0. • To see the combined effect of the new conveyance system/operations and the 25,000 acres of tidal marsh, compare this run to MBK_FutBase_CC0_SLR0. Note: this is the type of comparison that is done in the BDCP EIR/S (*i.e.* total effect of new conveyance plus assumed tidal marsh).

† Developed by D. Sereno (CCWD) where output folders provided include DSM2 output from Hydro and Qual where the latter output contains electrical conductivity (EC), a surrogate for salinity as well as fingerprinting results. Input time series for all scenarios were developed by MBK Engineers using Calsim2.

Table 2: **Cross Comparison of Central Valley Project North of Delta Municipal & Industrial (CVPNoDM&I) Percentage Allocations with Assigned EBMUD Contract Year Diversion.**

	Model Simulation ID						
	EX_ROA0_SLR0_CC0	EX_No_FallX2_ROA0_SLR0_CC0	NAA_ELT_ROA0_SLR15_CC5	NAA_LLT_ROA0_SLR45_CC5	NAA_ROA0_SLR0_CC0	ALT4_ELT_ROA25_SLR15_CC5	ALT4_LLT_ROA65_SLR45_CC5
Number of Years Contract Allocation is ≤ CVPNoDM&I percent Allocation	0	0	13	13	16	13	14
Number of Years Contract Allocation is > CVPNoDM&I percent Allocation	0	0	10	10	7	10	9
Total Number of Contract Years with Non-Zero Diversion Allocation	0	0	23	23	23	23	23

Table 3: **Reverse Flow Events with Advective Transport Exceeding 0.9 Miles for DWR Modeling Studies, 1974-1991 Hydrology.**

Model Study	Brief Description	Number of Events
EX_ROA0_SLR0_CC0	Existing Case, Includes Fall X2	25
EX_No_FallX2_ROA0_SLR0_CC0	Existing Case, No Fall X2	30
NAA_ELT_ROA0_SLR15_CC5	No Action Case, Early	70
NAA_LLT_ROA0_SLR45_CC5	No Action Case, Late	178
NAA_ROA0_SLR0_CC0	No Action Case, General	22
ALT4_ELT_ROA25_SLR15_CC5	Action Case, Early	14
ALT4_LLT_ROA65_SLR45_CC5	Action Case, Late	21

Table 4: **Reverse Flow Events with Advective Transport Exceeding 0.9 Miles for MBK Modeling Studies, 1921-2003 Hydrology and 1974-1991 Hydrology.**

Model Study	Brief Description	Number of Events 1921-2003 Hydrology	Number of Events 1974-1991 Hydrology
MBK_FutBase_CC0_SLR0	Base Case	203	55
MBK_BDCP_ALT4_CC0_SLR0_ROA0	Action Case	237	64
MBK_FutBase_CC0_SLR0_ROA25	Base Case with Restoration	49	11
MBK_BDCP_ALT4_CC0_SLR0_ROA25	Action Case with Restoration	55	12

Figure 1: **Reverse Flow Events per Year with Advective Transport Exceeding 0.9 Miles for DWR Modeling Studies, 1974-1991 Hydrology.**

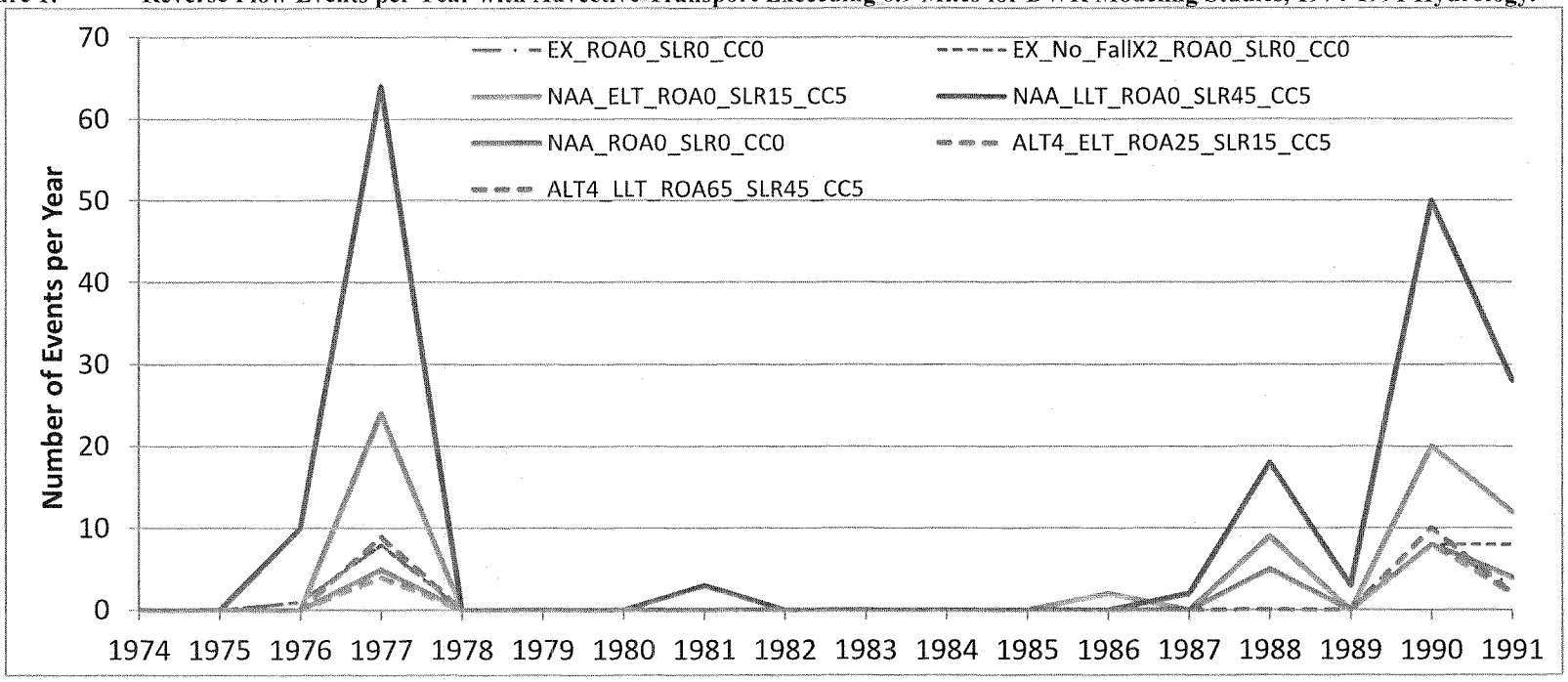


Figure 2: **Reverse Flow Incidents per Year with Advective Transport Exceeding 0.9 Miles for MBK Modeling Studies, 1921-2003 Hydrology.**

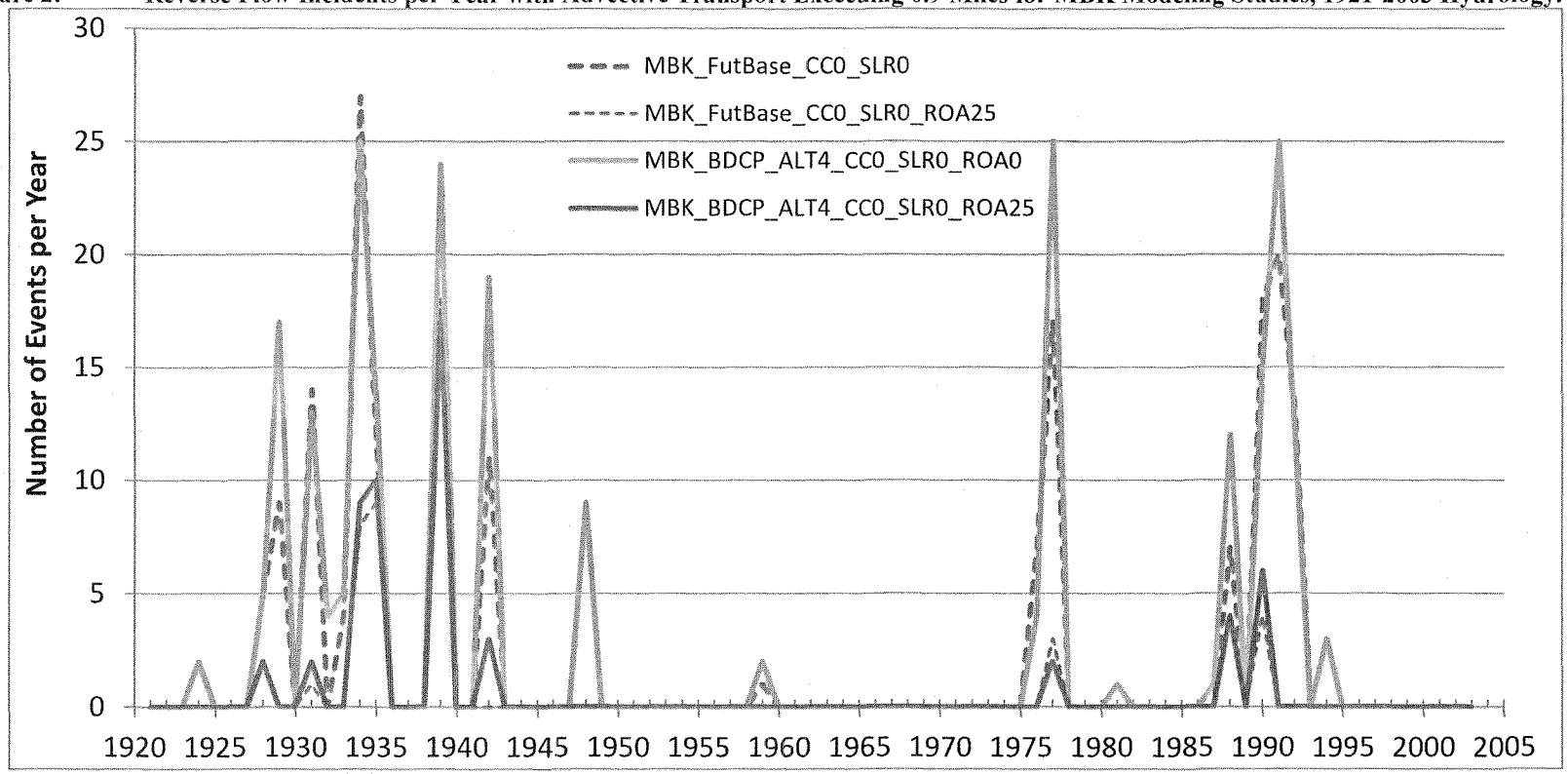
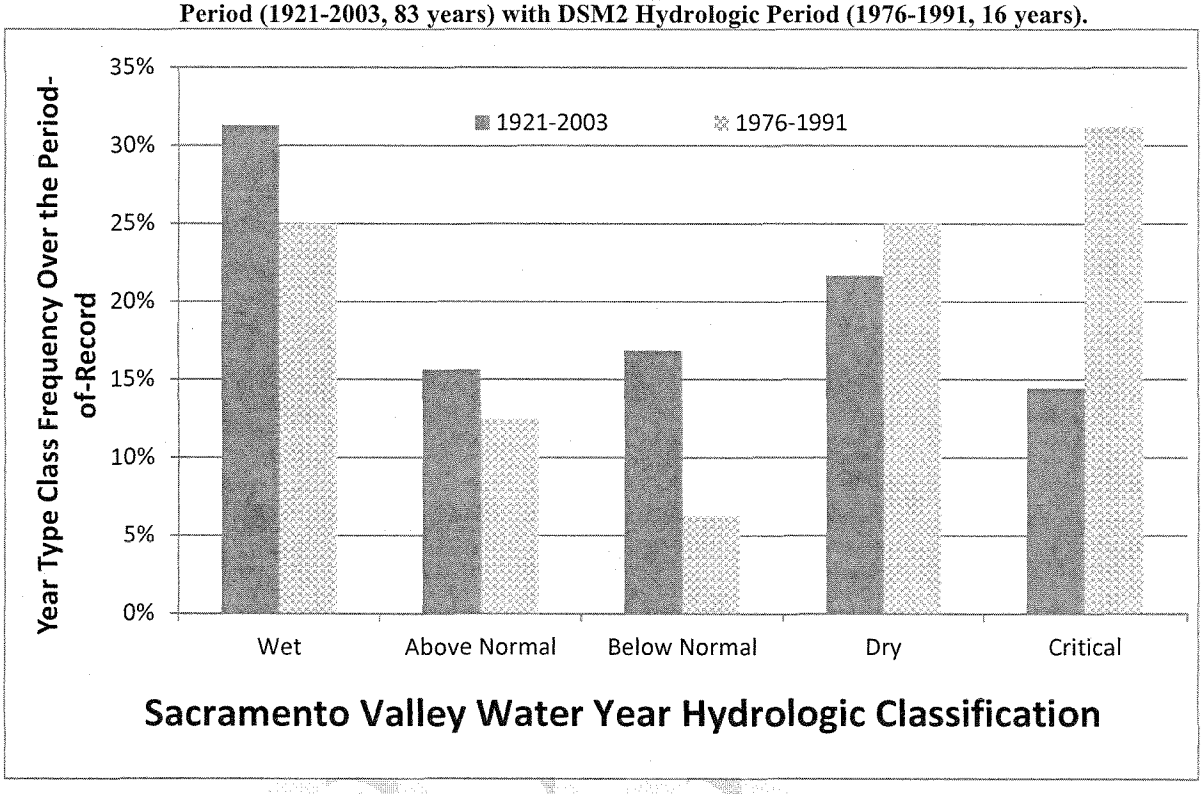


Figure 3: **Sacramento Valley Water Year Hydrologic Classification Frequency for Calsim2 Hydrologic Period (1921-2003, 83 years) with DSM2 Hydrologic Period (1976-1991, 16 years).**



From: Collier, Dorothy <dcollier@ebmud.com>
Sent: Wednesday, October 28, 2015 5:22 PM
To: BDCPcomments
Cc: Sykes, Richard
Subject: EBMUD's Comments on the Bay Delta Conservation Plan
Attachments: EBMUD WaterFix Comments 10-28-15.pdf

Attached are EBMUD's comments on the Bay Delta Conservation Plan and the Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement for your review.

If you have any questions about these comments, please contact Doug Wallace at (510) 287-1370.

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