BRACKISH WATER DESALINATION FACILITY

Final Environmental Impact Report
State Clearinghouse No.: 2017082044

Prepared for
City of Antioch

October 2018

ESA

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Antioch Brackish Water Desalination Project Final EIR

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CHAPTER 1
Introduction and List of Commenters

1.1 Purpose of this Document

This Final Environmental Impact Report (Final EIR) document includes all agency and public comments received on the Draft Environmental Impact Report (Draft EIR, SCH #2017082044) for the Antioch Brackish Water Desalination Project (proposed project). Written comments were received by the City of Antioch during the public comment period from June 29, 2018 through August 13, 2018. Verbal comments were also received during a public comment session before the Antioch Planning Commission on August 1, 2018.

Section 15088(a) of the CEQA Guidelines states that:

> "The lead agency shall evaluate comments on environmental issues received from persons who reviewed the Draft EIR and shall prepare a written response. The lead agency shall respond to comments received during the noticed comment period and any extensions and may respond to late comments." Accordingly, the City of Antioch has evaluated the comments received on the Draft EIR for the proposed project and prepared written responses to those comments.

The Final EIR is comprised of the following elements:

- Draft EIR and Appendices.
- List of persons, organizations, and public agencies commenting on the Draft EIR.
- Copies of all comments received.
- Written responses to those comments.
- Revisions to the Draft EIR initiated by City staff or resulting from comments received.

This Final EIR document has been prepared in accordance with CEQA, and will be used by the decision-makers during project hearings.

1.2 Organization of the Final EIR

The Final EIR is organized as follows:

Chapter 1 – Introduction and List of Commenters: This chapter summarizes the project under consideration and describes the contents of the Final EIR. This chapter also contains a list of all of the agencies, organizations, and individuals that submitted comments on the Draft EIR during the public review period.

Chapter 2 – Comments and Responses: This chapter contains the comment letters received on the Draft EIR, followed by responses to individual comments. Letters are grouped by agencies, organizations, and individuals, but are otherwise presented in the order in which they were received. Each comment letter is presented with brackets indicating how the letter has been divided into individual comments. Each comment is given a binomial with the letter number appearing first, followed by the comment number. For example, comments in Letter 1 are numbered 1-1, 1-2, 1-3, and so on. Immediately following the letter are responses, each with binomials that correspond to the bracketed comments.

Some comments that were submitted to the City do not pertain to CEQA environmental issues or do not address the adequacy of the analysis contained in the Draft EIR. When a comment does not directly pertain to environmental issues analyzed in the Draft EIR, does not ask a question about the adequacy of the analysis contained in the Draft EIR, expresses an opinion related to the merits of the project, or does not question an element of or conclusion of the Draft EIR, the response notes the comment and may provide additional information where appropriate. The intent is to recognize the comment. Many comments express opinions about the merits or specific aspects of the proposed project and these are included in the Final EIR for consideration by the decision-makers.

Chapter 3 – Revisions to the Draft EIR: This chapter summarizes refinements and text changes made to the Draft EIR in response to comments made on the Draft EIR and/or staff-initiated text changes. Changes to the text of the Draft EIR are shown by either a line through the text that has been deleted, or is underlined where new text has been inserted. The revisions contain clarification, amplification, and corrections that have been identified since publication of the Draft EIR. The text revisions do not result in a change in the analysis and conclusions presented in the Draft EIR.

Chapter 4 – Mitigation Monitoring and Reporting Program: This chapter contains the Mitigation Monitoring and Reporting Program (MMRP) to aid the City in its implementation and monitoring of measures adopted in the EIR, and to comply with the requirements of Public Resources Code Section 21081.6(a).

1.3 Summary of Proposed Project

The City proposes to construct, operate, and maintain the Antioch Brackish Water Desalination Project (proposed project). The City proposes to replace the existing San Joaquin River intake pump station, construct a desalination facility with associated equipment and appurtenances; and

construction of pipelines for the conveyance of source water and brine concentrate. The desalination plant would have the capacity to produce up to 6 million gallons per day (mgd) of desalinated product water to offset use of purchased water.

The project facilities would be located in the cities of Antioch and Pittsburg, California. The project components include the following:

- **Desalination Facility** – The desalination facility would produce up to 6 mgd of finished water and would be constructed south and east of 'Plant A' within the fenceline of the existing Water Treatment Plant (WTP) at 401 Putnam Street. Salinity would be removed from water pumped from the River using a treatment system called reverse osmosis (RO). The RO treatment system would be housed in a new 10,700-square-foot building located at the site. In addition to the RO treatment system, the desalination facility includes storage tanks, pumps, an electrical substation, and associated piping, equipment and appurtenances to support the RO system. Locating the desalination facility at the WTP would allow use of existing infrastructure as part of the overall treatment process including use of Plant A's conventional treatment for removal of solids prior to RO treatment. A new pipeline would be constructed to allow filtered water from Plant A to flow to the new desalination facility. Permeate from the RO system would undergo post-treatment before entering Plant A's existing clearwell for distribution. The proposed desalination facility would only be operated during times of year when the salinity of River water is too high for public consumption. These poor water quality conditions have historically been limited to summer and fall months but may extend to longer periods in the future due to changes in Delta water management and frequency of droughts.

- **Intake Pump Station Replacement and Raw Water Pipeline Connection** – The proposed project would require a direct connection to the City's existing River water intake. The existing intake pump station would be demolished and a new pump station would be constructed. The intake capacity of the new intake pump station for river water would remain at a firm capacity of 16 mgd. Conceptual design of the new intake pipeline system would include three 36-inch diameter submerged pipelines extending approximately 150 feet into the river. Each of the pipelines would be equipped with a fish screen that meets the protective criteria of the California Department of Fish and Wildlife (CDFW) and National Marine Fisheries Service (NMFS). The new pump station would be located approximately 200 feet inland from shore within the existing parking lot with an approximate area of 2,400 square feet. A new pipeline branch (up to approximately 3,000 feet long) from the existing pipeline underneath Long Tree Way to the WTP would allow a direct connection to maximize use of existing infrastructure.

- **Brine Disposal Pipeline** – River intake pumping at 8 mgd would produce 6 mgd of finished water and approximately 2 mgd of brine flows from the RO system. An approximately 4.3-mile-long brine disposal pipeline from the desalination facility to the existing Delta Diablo Wastewater Treatment Plant (WWTP) outfall would be constructed within roadway rights-of-way in the cities of Antioch and Pittsburg. The brine would be mixed with treated wastewater from the WWTP prior to discharge through the existing WWTP outfall.

1.4 Required Jurisdictional Approvals

The anticipated permits and approvals required for the proposed project are described below:

1.4.1 Federal

- U.S. Army Corps of Engineers – Clean Water Act Section 404/Rivers and Harbor Act Section 10 Dredge and Fill Permit
- U.S. Fish and Wildlife Service – Endangered Species Act Section 7 Consultation
- National Marine Fisheries Service – Endangered Species Act Section 7 Consultation
- California Office of Historic Preservation – National Historic Preservation Act Section 106 Compliance
- U.S. Coast Guard – Private Aids to Navigation Permit for pump station intake

1.4.2 State

- State Water Resources Control Board (SWRCB) – Stormwater General Construction Permit and Stormwater Pollution Prevention Plan, if more than 1 acre of land is disturbed
- State Historic Preservation Officer – National Historic Preservation Act Section 106 compliance
- California Natural Resources Agency Central Valley Flood Protection Board – Section 6 Board Permit
- Regional Water Quality Control Board (RWQCB) – Section 401 Water Quality Certification
- California Department of Public Health – Domestic Water Supply Permit Amendment for change in the water system
- California Department of Fish and Wildlife –California Endangered Species Act compliance, Section 1602 Streambed Alteration Agreement
- California Department of Transportation – Encroachment Permit for constructing pipeline within any state rights-of-way
- Delta Stewardship Council – Certification of Consistency with the Delta Plan
- State Lands Commission – General Permit

1.4.3 Regional and Local

- City of Antioch – certification of the Final EIR, project approval, encroachment and excavation permit, tree removal
- City of Pittsburg – Encroachment Permit
- Bay Area Rapid Transit (BART) – Construction permit

- Delta Diablo Sanitation District – Brine disposal coverage in scheduled NPDES renewal, Encroachment Permit
- Union Pacific Railroad – Encroachment Agreement and Right of Entry for Survey

The project would require review and recommendation by the Planning Commission to the City Council, followed by consideration and action by the City Council. The EIR is intended to provide the CEQA-required environmental documentation for use in considering these and any other City approvals required to implement the project.

1.5 Public Participation and Review

The City of Antioch has complied with all noticing and public review requirements of CEQA. This compliance included notification of all responsible and trustee agencies and interested groups, organizations, and individuals that the Draft EIR was available for review. The following list of actions took place during the preparation, distribution, and review of the Draft EIR:

- On August 15, 2017, the City sent a Notice of Preparation (NOP) to the State Clearinghouse [SCH No. 2017082044], responsible and trustee government agencies, organizations, and individuals potentially interested in the project. The NOP requested that agencies with regulatory authority over any aspect of the project describe that authority and identify relevant environmental issues that should be addressed in the EIR. Interested members of the public were also invited to comment. A scoping meeting was held on September 5, 2017.
- On June 29, 2018, a Notice of Completion (NOC) was filed with the State Clearinghouse to announce the availability of the Draft EIR. Copies of the Draft EIR were distributed to the Clearinghouse and interested agencies following the requirements of CEQA Guidelines Sections 15085 and 15206. Notices of the Draft EIR's availability were also distributed to interested agencies, organizations, and individuals using the same distribution process as outlined above. An announcement was also posted in a newspaper of general circulation. The Draft EIR was also published on the City's website and filed at the County Clerk's office. The 45-day public comment period began on June 29, 2018, and ended on August 13, 2018.
- On August 1, 2018, a public meeting was held before the City of Antioch Planning Commission to solicit public comment.

1.6 List of Commenters

The City received 7 comment letters during the comment period on the Draft EIR for the proposed project, and also received verbal public comments from the public during a City Planning Commission hearing held on August 1, 2018. The table below indicates the numerical designation for each comment letter, the author of the comment letter, and the date of the comment letter. Letters are grouped by agencies, organizations, and individuals, but are otherwise presented in the order in which they were received.

COMMENT LETTERS CONCERNING THE ANTIOCH BRACKISH WATER DESALINATION PROJECT DRAFT EIR

Letter #	Entity	Author(s) of Comment Letter/e-mail	Date Received
Agencies			
1	State Clearinghouse	Scott Morgan, Director	July 23, 2018
2	California Department of Transportation	Patricia Maurice, District Branch Chief	July 30, 2018
3	Delta Stewardship Council	Jeff Henderson, Deputy Executive Officer	August 13, 2018
4	Contra Costa Water District	Leah Orloff, Water Resources Manager	August 13, 2018
5	Delta Diablo	Brian Thomas, Engineering Services Director	August 13, 2018
6	California Department of Fish and Wildlife	Gregg Erickson, Regional Manager Bay Delta Region	August 17, 2018
Organizations			
7	San Francisco Baykeeper	Erica A. Mahard, Managing Attorney	August 13, 2018
Planning Commission Hearing			
PC-1	Planning Commission Hearing	Denise Skaggs	August 1, 2018

CHAPTER 2
Comments and Responses

2.1 Introduction

This section contains the comment letters that were received on the Draft EIR. Following each comment letter is a response by the City intended to supplement, clarify, or amend information provided in the Draft EIR or refer the reader to the appropriate place in the document where the requested information can be found. Comments that are not directly related to environmental issues may be discussed or noted for the record. Where text changes in the Draft EIR are warranted based upon the comments, those changes are discussed in the response to comments and also included in Chapter 3, *Revisions to the Draft EIR*.

2.2 Individual Responses

This section contains the responses to comments submitted during the public review period. Commenters on the Draft EIR, their associated agencies, and assigned letter identifications are listed in the table below. This section presents the comment letters received on the Draft EIR and comments made during the public hearing on the proposed project held before the City's Planning Commission on August 1, 2018. Each comment letter received during the public comment period was bracketed to identify individual topics, and individual responses to those comments are provided. If a subject matter of one letter overlaps that of another letter, the reader may be referred to more than one group of comments and responses to review all information on a given subject. Where this occurs, cross-references are provided.

COMMENT LETTERS CONCERNING THE ANTIOCH BRACKISH WATER DESALINATION PROJECT DRAFT EIR

Letter #	Entity	Author(s) of Comment Letter/e-mail	Date Received
Agencies			
1	State Clearinghouse	Scott Morgan, Director	July 23, 2018
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5	Delta Diablo	Brian Thomas, Engineering Services Director	August 13, 2018
6	California Department of Fish and Wildlife	Gregg Erickson, Regional Manager Bay Delta Region	August 17, 2018
Organizations			
7	San Francisco Baykeeper	Erica A. Mahard, Managing Attorney	August 13, 2018
Planning Commission Hearing			
PC-1	Planning Commission Hearing	Denise Skaggs	August 1, 2018

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Memorandum

Date: July 12, 2018

To: All Reviewing Agencies

From: Scott Morgan, Director

Re: SCH # **2017082044**

City of Antioch Brackish Water Desalination Project

The Lead Agency has corrected some information regarding the above-mentioned project. Please see the attached materials for more specific information. All other project information remains the same. 1-1

cc: Scott Buenting
City of Antioch
200 H Street
Antioch, CA 94509

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
1-916-322-2318 FAX 1-916-558-3184 www.opr.ca.gov

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P. O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH # 2017082044

Project Title: City of Antioch Brackish Water Desalination Project

Lead Agency: City of Antioch — Contact Person: Scott Buenling
Mailing Address: 200 H Street — Phone: (925) 779-7050
City: Antioch — Zip: 94509 — County: Contra Costa

Project Location: County: Contra Costa — City/Nearest Community: Antioch, Pittsburg
Cross Streets: Putnam Street between D St. and G St.; McElheny Road and Fulton Shipyard Road, Pittsburg-Antioch Highway — Zip Code: 94509
Lat. / Long. (degrees, minutes, and seconds): Varies __ ° __ ' __ " N/ __ ° __ ' __ " W — Total Acres:
Assessor's Parcel No.: Varies (see attached) — Section: 25 — Twp.: 2N — Range: 1E — Base: Meridian-Mt. Diablo
Within 2 Miles: State Hwy #: 4 — Waterways: San Joaquin River
Airports: None — Railways: Amtrak — Schools: Multiple

Document Type:
CEQA: ☐ NOP ☐ Early Cons ☐ Neg Dec ☐ Mit Neg Dec ☒ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ☐ Other
NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI ☐ Other: ☐ Joint Document ☐ Final Document ☐ Other

Governor's Office of Planning & Research
JUN 29 2018
STATE CLEARINGHOUSE

Local Action Type:
☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other Water Supply

Development Type:
☐ Residential: Units ____ Acres ____
☐ Office: Sq.ft. ____ Acres ____ Employees ____
☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
☐ Educational
☐ Recreational
☐ Transportation: Type
☐ Mining: Mineral
☐ Power: Type ____ MW ____
☐ Waste Treatment: Type ____ MGD ____
☐ Hazardous Waste: Type
☒ Water Facilities: Type Desalination facility, appurtenances, pipelines, intake pump station replacement
☐ Other:

Project Issues Discussed in Document:
☒ Aesthetic/Visual ☒ Agricultural Land ☒ Air Quality ☒ Archeological/Historical ☒ Biological Resources ☐ Coastal Zone ☒ Drainage/Absorption ☐ Economic/Jobs
☐ Fiscal ☒ Flood Plain/Flooding ☒ Forest Land/Fire Hazard ☒ Geologic/Seismic ☒ Minerals ☒ Noise ☒ Population/Housing Balance ☒ Public Services/Facilities
☒ Recreation/Parks ☒ Schools/Universities ☐ Septic Systems ☐ Sewer Capacity ☒ Soil Erosion/Compaction/Grading ☒ Solid Waste ☒ Toxic/Hazardous ☒ Traffic/Circulation
☒ Vegetation ☒ Water Quality ☒ Water Supply/Groundwater ☐ Wetland/Riparian ☒ Growth Inducement ☒ Land Use ☒ Cumulative Effects ☐ Other:

Present Land Use/Zoning/General Plan Designation:
Open Space, Neighborhood Commercial, Medium Low Density Residential

Project Description: *(please use a separate page if necessary)*
The proposed project consists of the construction of a desalination facility at the City's water treatment plant (WTP) with the capacity to produce up to 6 million gallons per day (mgd) of finished water; demolition of the existing San Joaquin River intake pump station; construction of a new intake pump station; approximately 3,000 feet of pipeline from the existing raw water pipeline underneath Long Tree Way to the City's WTP to allow a direct connection to maximize use of existing infrastructure; and approximately 4 miles of pipeline from the desalination facility to the Delta Diablo wastewater treatment plant (WWTP) to discharge brine with the WWTP effluent through the existing Delta Diablo outfall to New York Slough. The main objectives of the proposed project are to improve water supply reliability and water quality for its customers; develop a reliable and drought-resistance water source to reduce dependency on purchased water supplies; maximize and preserve the use of the City's pre-1914 water rights; and provide cost effective operational flexibility for the City.

State Clearinghouse Contact: cy (916) 445-0613
State Review Began: 6 - 29 - 2018
SCH COMPLIANCE 8 - 13 - 2018

Please note State Clearinghouse Number (SCH#) on all Comments
SCH#: 2017082044
Please forward late comments directly to the Lead Agency

AQMD/APCD 2
(Resources: 6 / 30)

Project Sent to the following State Agencies

- X Resources
- ___ Boating & Waterways
- X Central Valley Flood Prot.
- ___ Coastal Comm
- ___ Colorado Rvr Bd
- ___ Conservation
- X CDFW # 3
- ___ Cal Fire
- ___ Historic Preservation
- X Parks & Rec
- ___ Bay Cons & Dev Comm.
- ___ DWR

CalSTA
- ___ Aeronautics
- ___ CHP
- X Caltrans# 4
- ___ Trans Planning

Other
- ___ Education
- X OES
- ___ Food & Agriculture
- ___ HCD

State/Consumer Svcs
- ___ General Services

Cal EPA
- ___ ARB: Airport & Freight
- ___ ARB: Transportation Projects
- ___ ARB: Major Industrial/Energy
- ___ Resources, Recycl.& Recovery
- R SWRCB: Div. of Drinking Wate
- ___ **SWRCB: Div. Drinking Wtr #** 1
- ___ SWRCB: Div. Financial Assist.
- X SWRCB: Wtr Quality
- X SWRCB: Wtr Rights
- X Reg. WQCB # 2
- ___ Toxic Sub Ctrl-CTC

Yth/Adlt Corrections
- ___ Corrections

Independent Comm
- ___ Delta Protection Comm
- X Delta Stewardship Council
- ___ Energy Commission
- X NAHC
- X Public Utilities Comm
- ___ Santa Monica Bay Restoration
- X State Lands Comm
- ___ Tahoe Rgl Plan Agency
- ___ ___ Conservancy

- ___ Other:

Letter 1 Response — **Scott Morgan, State of California Governor's Office of Planning and Research**, July 23, 2018

1-1 The comment is a memorandum notifying reviewing agencies that the State Clearinghouse corrected information regarding the proposed project. This was in response to an updated Notice of Availability informing the State Clearinghouse of the rescheduled Planning Commission hearing date. The project information remains the same and no further responses is required.

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY EDMUND G. BROWN Jr., Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
OFFICE OF TRANSIT AND COMMUNITY PLANNING
P.O. BOX 23660, MS-10D
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
www.dot.ca.gov

Making Conservation a California Way of Life.

July 25, 2018

Scott Buenting
Project Manager
City of Antioch
PO BOX 5007
Antioch, California 94531-5007

SCH #2017082044
GTS# 04-CC-2018-0238
GTS ID: 7476
PM: CC-04-27.291-28.233

Subject: Regarding Notice of availability (NOA) of Draft Environmental Impact Report for Antioch's Brackish Water Desalination Plant

Mr. Buenting:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above-referenced project. In tandem with the Metropolitan Transportation Commission's (MTC) Sustainable Communities Strategy (SCS), Caltrans mission signals a modernization of our approach to evaluate and mitigate impacts to the State Transportation Network (STN). Caltrans *Strategic Management Plan 2015-2020* aims to reduce Vehicle Miles Travelled (VMT) by tripling bicycle and doubling both pedestrian and transit travel by 2020. Our comments are based on the Draft Environmental Impact Report for Antioch's Brackish Water Desalination Plant that you submitted to this office for review.

Project Understanding

The City of Antioch proposes to construct a brackish water desalination plant with associated equipment and appurtenances to replace the existing San Joaquin River intake pump station and construct pipelines to convey source water and brine concentrate. These proposed facilities will be in the cities of Antioch and Pittsburg and the proposed pipelines would cross State Right of Way at State Route 4 at approximately Post Mile 27.291 and Post Mile 28.233.

Encroachment Permit

Please be advised that any sign or work within Caltrans ROW will require an encroachment permit prior to construction. To apply for an encroachment permit, please complete an encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State ROW, and submit to the following address: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660,

2-1

Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. 2-1 cont.

See the website link below for more information:

http://www.dot.ca.gov/hq/traffops/developserv/permits.

If you have any questions, please contact Michael Meloy, Associate Environmental Planner, at (510) 286-5433 or michael.meloy@dot.ca.gov.

Sincerely,

PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

"Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability"

Letter 2 Patricia Maurice, California Department of Transportation
Response July 30, 2018

2-1 The comment states that construction within State Right of Way will require an encroachment permit prior to construction and that traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. The comment provides a link to the encroachment permit application.

The comment is noted. The Draft EIR acknowledges on page 2-62 that the project would require an encroachment permit from Caltrans for any work within state rights-of-way. Mitigation Measure 3.17-1a also commits the City to obtaining the necessary road encroachment permits prior to construction.

DELTA STEWARDSHIP COUNCIL
A California State Agency

980 NINTH STREET, SUITE 1500
SACRAMENTO, CALIFORNIA 95814
HTTP://DELTACOUNCIL.CA.GOV
(916) 445-5511

August 13, 2018

Scott Buenting, Project Manager
City of Antioch
PO Box 5007
Antioch, CA 94531-5007

Via email: SBuenting@ci.antioch.ca.us

RE: Comments on the Public Draft Environmental Impact Report for the Proposed City of Antioch Brackish Water Desalination Project, SCH# 2017082044

Dear Mr. Scott Buenting:

Thank you for the opportunity to review and comment on the City of Antioch's (City) Proposed Brackish Water Desalination Project (Project) Public Draft Environmental Impact Report (DEIR) dated June 2018. The Delta Stewardship Council (Council) previously sent a letter with comments on the NOP for the Project on September 13, 2017.

The DEIR describes the proposed Project facilities as:

- a new intake pump station and fish screen to replace existing river intake facilities;
- a new raw water pipeline connection to the City's existing raw water pipeline to allow water to be conveyed directly from the San Joaquin River to the City's Water Treatment Plant,
- a desalination plant with a finished water capacity of 6 mgd and related facilities, and
- a brine disposal pipeline and connection to Delta Diablo's Wastewater Treatment Plant (WWTP) outfall back into the San Joaquin River.

The DEIR states that the Project objectives are to improve water supply reliability and water quality for customers; develop a reliable and drought-resistant water source to reduce dependency on purchased water supplies by maximizing the use of the City's pre-1914 water rights; maximize the use of existing infrastructure to maintain economic feasibility; provide cost effective operational flexibility to allow the City to respond to changes in source water quality, emergencies, changes in climate, and Delta conditions; and preserve the value of the City's pre-1914 water rights.

"Coequal goals" means the two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place."

– CA Water Code §85054

The Council is an independent State of California agency established by the Sacramento-San Joaquin Delta Reform Act of 2009 (SBX7 1; Delta Reform Act). The Council is charged with furthering California's coequal goals for the Delta through the adoption and implementation of the Delta Plan, regulatory portions of which became effective on September 1, 2013.

As stated in the Delta Reform Act, the State has "'coequal goals' (which) means two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place" (Water Code section 85054).

Through the Delta Reform Act, the Council was granted specific regulatory and appellate authority over certain actions of State or local public agencies that take place in whole or in part in the Delta. To do this, the Delta Plan contains a set of regulatory policies with which State and local agencies are required to comply. The Delta Reform Act specifically established a certification process for compliance with the Delta Plan. This means that State and local agencies that propose to carry out, approve, or fund a qualifying action in whole or in part in the Delta, called a "covered action," must certify that this covered action is consistent with the Delta Plan and must file a certificate of consistency with the Council that includes detailed findings.

Based on the Project description and objectives, Council staff believe the Project meets the definition of a covered action. The project would support one of the coequal goals to provide a more reliable water supply for California, particularly for the City of Antioch. By potentially developing a flexible local water supply, the City can improve its regional water self-reliance and reduce reliance on the Delta, especially when Delta water quality and flow requirements may restrict available Delta exports.

For the purposes of compliance with both the Delta Reform Act and CEQA, we offer the following comments below for your consideration in preparation of the Final Environmental Impact Report (FEIR).

Comments on the DEIR

The following comments address actions outlined in the DEIR relevant to the Delta Plan.

Regulatory Setting: The Council commends the City for acknowledging that the proposed Project requires a certification of consistency with the Delta Plan (DEIR, p. 2-62). In the next section of this letter, we identify Delta Plan policies applicable to the Project. These policies should be identified in the applicable regulatory setting discussion for each topic in the FEIR, as noted in the comments below.

Inconsistencies with the Delta Plan: The FEIR should discuss any inconsistencies between the proposed project and the Delta Plan, as required by 15125(d) of CEQA Guidelines. Please

3-1

note that the CEQA Guidelines' Appendix G states that a project that is inconsistent with any applicable land use plan, policy, or regulation may result in a finding of significant impact on biological resources. 3-1 cont.

Chapter 3.11 Delta Hydrology and Water Quality: The DEIR identifies two Delta Plan recommendations, Recommendation **WQ R1**, Protect Beneficial Uses, and Recommendation **WQ R2**, Identify Covered Action Impacts in Section 3.11.2 on page 3.11-16, and again in the analysis of Impact 3.11-1 on page 3.11-38 (Table 3.11-8). These are Delta Plan recommendations, not regulatory policies. They do not represent criteria that a covered action would need to meet to demonstrate consistency with the Delta Plan. The Project can demonstrate consistency with the Delta Plan by filing a certification of consistency, as described in detail on the Council's website: http://deltacouncil.ca.gov/how-certify. 3-2

Please correct references to **WQ R1** and **WQ R2** in Section 3.11 of the FEIR from Delta Plan "policies" to Delta Plan "recommendations".

Comments regarding Delta Plan Policies

The following section describes Delta Plan policies that may be applicable to the Project based on the available information. This information is offered to assist the City to describe the relationship between the Project and the Delta Plan in the FEIR as part of the record supporting the City's certification of consistency.

The Delta Plan includes regulatory policies that are applicable to all covered actions. Below, we have highlighted key regulatory policies that may be specifically relevant to the Project. To better assist in your certification of consistency, we encourage you to review the following Delta Plan policies before filing:

Detailed Findings to Establish Consistency with the Delta Plan: Delta Plan Policy **G P1** (23 Cal. Code Regs. section 5002) requires that ecosystem restoration and water management covered actions include adequate provisions for continued implementation of adaptive management, appropriate to the scope of the action. This requirement is satisfied through: A) the development of an adaptive management plan that is consistent with the framework described in Appendix 1B of the Delta Plan (http://deltacouncil.ca.gov/sites/default/files/2015/09/Appendix%201B.pdf); and B) documentation of adequate resources to implement the proposed adaptive management plan. Funding of any monitoring, on-going mitigation and the facilitation of the adaptive management plan needs to be identified and secure. 3-3

Mitigation Measures: Delta Plan Policy **G P1** requires that actions, not exempt from the California Environmental Quality Act and subject to Delta Plan regulations, must include applicable feasible mitigation measures consistent with those identified in the Delta Plan Program EIR or substitute mitigation measures that are equally or more effective. Mitigation Measures in the Delta Plan's Mitigation and Monitoring Report Program are available at: 3-4

(http://deltacouncil.ca.gov/sites/default/files/documents/files/Agenda%20Item%206a_attach%202.pdf) 3-4 cont.

Best Available Science and Adaptive Management: Delta Plan Policy **G P1** also states that actions subject to Delta Plan regulations must document use of best available science as relevant to the purpose and nature of the Project. The regulatory definition of "best available science" is provided in Appendix 1A of the Delta Plan (http://deltacouncil.ca.gov/sites/default/files/2015/09/Appendix%201A.pdf). We recommend that the project proponents prepare an adaptive management strategy and plan consistent with the framework described in Appendix 1B of the Delta Plan. 3-5

Reduce Reliance on the Delta through Improved Regional Water Self-Reliance: Delta Plan Policy **WR P1** (23 Cal. Code Regs. section 5003) requires proposed actions that export water from, transfer water through, or use water in the Delta shall contribute to reduced reliance on the Delta and improve regional self-reliance. The Project proposes to use Delta water as its source to store water for the various private and public uses. To be consistent with the Delta Plan, Project proponents should describe how operations and timing of their diversions of Delta water would provide improved regional water supply self-reliance particularly when the flow in the Delta is critically low and drought conditions exist. 3-6

Please identify Policy **WR P1** in Section 3.10.2, Local Hydrology and Water Quality - Regulatory Framework of the FEIR under a Delta Stewardship Council – Delta Plan heading.

Delta Flow Objectives: Delta Plan Policy **ER P1** (23 Cal. Code Regs. section 5005) requires that the State Water Resources Control Board's Bay-Delta Water Quality Control Plan (Water Board's Bay-Delta WQCP) flow objectives be used to determine consistency with the Delta Plan. Water Code sections 85057.5(a)(3) and 5001(j)(1)(E) cover a proposed action that could significantly affect flow in the Delta. The Draft EIR identifies Project objectives to improve water supply reliability and water quality for customers and to develop a reliable and drought-resistant water source to reduce dependency on purchased water supplies. The Project should support water deliveries that align with the Water Board's Bay-Delta WQCP flow objectives. 3-7

Please identify Policy **ER P1** in Section 3.11.2, Delta Hydrology and Water Quality - Regulatory Framework of the FEIR under a Delta Stewardship Council – Delta Plan heading.

Restore Habitat in a Manner Consistent with the Delta Plan: Delta Plan Policy **ER P2** (23 Cal. Code Regs. section 5006) states that habitat restoration must be consistent with Appendix 3 of the Delta Plan regulations and that restoration will occur at appropriate elevations. Appendix 3 of the Delta Plan (http://deltacouncil.ca.gov/sites/default/files/2015/09/Appendix%203.pdf), which is an excerpt from the 2011 Draft Ecosystem Restoration Program Conservation Strategy, provides a vision for a mosaic of different habitat types within the Delta including open water, subsided lands, floodplains, and upland areas. It also includes a vision for use of Delta agricultural lands to support special-status wildlife species. 3-8

Please identify Policy **ER P2** in Section 3.4.2, Terrestrial Biological Resources – Regulatory Framework in the FEIR under a Delta Stewardship Council – Delta Plan heading.

3-8 cont.

Restore Opportunities to Restore Habitat: Delta Plan Policy **ER P3** (23 Cal. Code Regs. section 5007) requires that, within the priority habitat restoration areas (PHRAs) depicted in Appendix 5 of the Delta Plan (http://deltacouncil.ca.gov/sites/default/files/2015/09/Appendix%205.pdf), significant adverse impacts to the opportunity to restore habitat must be avoided or mitigated. According to the DEIR section 3.4.3 on page 3.4-22 states, "Potential project impacts were identified to a select number of special-status birds, migratory bird species, and one bat species, each of which has the potential to occur within or in the general vicinity of the project footprint." These types of impacts in the PHRAs will need to be avoided or mitigated at equal or greater value to the mitigation measures outlined in the Delta Plan Mitigation and Monitoring Reporting Program (http://deltacouncil.ca.gov/sites/default/files/documents/files/Agenda%20Item%206a_attach%202.pdf).

3-9

Please identify Policy **ER P3** in Section 3.4.2, Terrestrial Biological Resources – Regulatory Framework in the FEIR under a Delta Stewardship Council – Delta Plan heading.

Avoid Introductions of and Habitat Improvements for Invasive Nonnative Species: Delta Plan Policy **ER P5** (23 Cal. Code Regs. section 5009) calls for avoiding introduction and habitat improvements for invasive, nonnative species or mitigating these potential impacts in a manner that appropriately protects the ecosystem. Analysis on this matter should address both nonnative wildlife species as well as terrestrial and aquatic weeds. To the maximum extent practicable, covered actions should avoid or mitigate for conditions that would lead to establishment of nonnative invasive species. In the event that mitigation is warranted, mitigation and minimization measures should be consistent with the Delta Plan Mitigation Monitoring and Reporting Program.

3-10

Please identify Policy **ER P5** in Section 3.3.2, Aquatic Biological Resources – Regulatory Framework in the FEIR under a Delta Stewardship Council – Delta Plan heading.

Locate New Urban Development Wisely: Delta Plan Policy **DP P1** (23 Cal. Code Regs. section 5010) calls for locating new residential, commercial, and industrial development within areas designated for development in the Delta Plan, based on city and county general plans approved before adoption of the Delta Plan on May 17, 2013. Development is also permitted outside areas designated for development if it is consistent with the land uses designated in county general plans approved before adoption of the Delta Plan. The Council notes that the DEIR analyzes consistency with Policy **DP P1** in Section 3.12, Land Use and Planning.

3-11

Respect Local Land Use When Siting Water or Flood Facilities or Restoring Habitats: Delta Plan Policy **DP P2** (23 Cal. Code Regs. section 5011) requires that water management facilities, ecosystem restoration, and flood management infrastructure must be sited to avoid or reduce conflicts with existing uses or those uses described or depicted in city and county general plans for their jurisdictions or spheres of influence when feasible, considering comments from local agencies and the Delta Protection Commission.

The DEIR identifies proposed water management facility improvements in the Delta, including replacing the existing San Joaquin River intake pump station, constructing a desalination facility with associated equipment and appurtenances; and constructing pipelines for the conveyance of source water and brine concentrate. The Council notes that the DEIR analyzes consistency with Policy **DP P2** in Section 3.12, Land Use and Planning.

3-12

Closing Comments

The Council would like to continue to work with the City to ensure the consistency of the Brackish Water Desalination Project with the Delta Plan, and we look forward to continued coordination to further our related efforts.

Council staff is available to continue discussions about how to ensure that your project is consistent with the Delta Plan as you proceed in the next stages of your project approval process. I encourage you to contact Anthony Navasero of my staff at (916) 445-5471 or Anthony.Navasero@deltacouncil.ca.gov with any questions, comments, or concerns.

Sincerely,

Jeff Henderson, AICP
Deputy Executive Officer
Delta Stewardship Council

Letter 3 Jeff Henderson, Delta Stewardship Council
Response August 13, 2018

3-1 The comment states that the FEIR should discuss any inconsistencies between the proposed project and the Delta Plan, as required by CEQA Guidelines Section 15125(d). Contrary to the comment, CEQA Guidelines Section 15125(d) does not require than an EIR conclude that an environmental impact would occur whenever there is an inconsistency with an applicable plan. Impacts associated with consistency of a project with an applicable land use plan, policy, or regulation is set forth under the second bullet point under "Significance Criterion" on page 3.12-5 of the Draft EIR (consistent with significance criterion 'b' of the Land Use and Planning Section of Appendix G to the State CEQA Guidelines). Table 3.12-2 on page 3.12-8 of the Draft EIR includes an analysis of the project's potential to conflict with applicable plans and policies related to land use. A conflict with existing regulations is not, in itself, deemed a significant impact unless that impact results in an adverse physical impact relative to baseline conditions. The physical environmental effects of the proposed project's construction and operation and potential to conflict with applicable plans are discussed in their respective sections in the EIR.

3-2 The comment requests that references to WQ R1 and WQ R2 from the Delta Plan be corrected and does not raise any issues regarding the environmental impact analysis. Please refer to response to comment 3-7 below which consolidates the Draft EIR text revisions on page 3.11-16.

3-3 The comment explains the requirements of Delta Plan Policy G P1 and does not raise any issues regarding the environmental impact analysis. The City will discuss the applicability of an adaptive management plan with the Delta Stewardship Council prior to filing a certificate of consistency.

3-4 The comment states that projects not exempt from CEQA and subject to Delta Plan regulations must include applicable feasible mitigation measures consistent with those identified in the Delta Plan Program EIR or substitute mitigation measures that are equally or more effective. The comment provides a link to the Delta Plan Program MMRP but does not elaborate or raise any issues regarding the proposed project's environmental analysis. The EIR identifies mitigation measures for potentially significant impacts in accordance with CEQA Guidelines Section 15126.4. These mitigation measures are consistent with applicable measures identified in the Delta Plan Program MMRP.

3-5 Please see response to comment 3-2 above.

3-6 The main objectives of the proposed project are to develop a flexible local water supply, maximize the use of and value of the City's pre-1914 water rights, and provide operational flexibility to respond to changes in Delta conditions. The comment does not raise any issues regarding the environmental impact analysis.

The comment requests that Section 3.10-2 of the EIR identify Delta Plan Policy WR P1. Because this policy is related to Delta flow, it is more appropriate to include it in Section 3.11, Delta Hydrology and Water Quality. Please see response to comment 3-7 below which includes revisions to the Draft EIR as it relates to the Delta Plan.

3-7 The comment does not raise any issues regarding the environmental impact analysis. The comment requests that Section 3.11-2 of the EIR identify Delta Plan Policy ER P1. The Draft EIR, page 3.11-16 is revised as follows:

> The following policies and recommendations from the Delta Plan are relevant to water quality:
>
> **WR P1** Reduce reliance on the Delta through improved regional water self reliance.
>
> ~~***Policy***~~ ***Recommendation WQ R1:*** Water quality in the Delta should be maintained at a level that supports, enhances, and protects beneficial uses identified in the applicable State Water Resources Control Board or regional water quality control board water quality control plans.
>
> ~~***Policy***~~ ***Recommendation WQ R2:*** Covered actions should identify any significant impacts to water quality.
>
> **ER P1** (a) The State Water Resources Control Board's Bay Delta Water Quality Control Plan flow objectives shall be used to determine consistency with the Delta Plan. If and when the flow objectives are revised by the State Water Resources Control Board, the revised flow objectives shall be used to determine consistency with the Delta Plan.
>
> (b) For purposes of Water Code section 85057.5(a)(3) and Section 50031(j)(1)(E) of this Chapter, the policy set forth in subsection (a) covers a proposed action that could significantly affect flow in the Delta.

3-8 The comment summarizes Delta Plan Policy ER P2 and that habitat restoration must be consistent with Appendix 3 of the Delta Plan regulations and restoration actions. Based on the Delta Plan's elevation map which is used as a guide to determine appropriate habitat restoration actions, the proposed project is within the area identified as "Urban" and therefore the restoration requirements do not apply. Nevertheless, the Draft EIR identifies Mitigation Measure 3.4-3 for the intake pump station site to recontour San Joaquin River bed to emulate existing aquatic conditions at the site, and Mitigation Measure 3.3-5 to purchase mitigation credits for shallow water habitat. Impacts to habitat would therefore be less than significant.

3-9 The comment requests that Section 3.4.2 of the EIR identify Delta Plan Policy ER P3. This specific policy was not included in the EIR or identified as applicable because the project

components are not located within priority habitat restoration areas as depicted in Appendix 5 of the Delta Plan.

3-10 The comment requests that Section 3.3.2 of the EIR identify Delta Plan Policy ER P5. The Draft EIR, page 3.3-19 is revised as follows:

> ***Delta Stewardship Council – Delta Plan***
>
> The Delta Stewardship Council is a State agency created through the Delta Reform Act of 2009 to develop and implement a legally enforceable long-term management plan for the Delta and Suisun Marsh. The Delta Plan, adopted by the Delta Stewardship Council in 2013, is a comprehensive, long-term management plan for the Delta. It creates new rules and recommendations to further the state's coequal goals for the Delta: Improve statewide water supply reliability, and protect and restore a vibrant and healthy Delta ecosystem, all in a manner that preserves, protects and enhances the unique agricultural, cultural, and recreational characteristics of the Delta.
>
> The following policy from the Delta Plan is relevant to aquatic biological resources:
>
> **ER P5** (a) The potential for new introductions of, or improved habitat conditions for, nonnative invasive species, striped bass, or bass must be fully considered and avoided or mitigated in a way that appropriately protects the ecosystem.
>
> (b) For purposes of Water Code Section 85057.5(a)(3) and Section 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that has the reasonable probability of introducing, or improving habitat conditions for, nonnative invasive species.

3-11 The comment notes that the Draft EIR analyzes consistency with Policy DP P1 in Section 3.12, *Land Use and Planning*. The comment does not raise any issues regarding the environmental impact analysis.

3-12 The comment notes that the Draft EIR analyzes consistency with Policy DP P2 in Section 3.12, *Land Use and Planning*. The comment does not raise any issues regarding the environmental impact analysis.

Comment Letter 4

CONTRA COSTA WATER DISTRICT

August 13, 2018

Scott Buenting
City of Antioch
PO Box 5007
Antioch, CA 94531-5007

Confirmation copy submitted electronically to: SBuenting@ci.antioch.ca.us

Subject: Comments on Draft Environmental Impact Report for City of Antioch Brackish Water Desalination Project

Dear Mr. Buenting:

Contra Costa Water District (CCWD) appreciates the opportunity to provide input on the Draft Environmental Impact Report (Draft EIR) for the City of Antioch (City) Brackish Water Desalination Project (Project). The proposed Project consists of construction of a 6 million gallon per day (MGD) desalination facility, replacement of the City's intake pump station, and pipelines to convey desalinated water and brine for disposal to the Delta. The Project would rely on the City's pre-1914 water right for service of desalinated water within the City boundaries.

CCWD depends on the Sacramento-San Joaquin Delta to supply water to over 500,000 people in eastern and northern Contra Costa County, including the City of Antioch. CCWD has a strong interest in protecting the quality of its Delta water supply and ensuring the costs and benefits of the service it provides are equitably shared by its customers. We appreciate that the Draft EIR included an analysis of the water quality impacts at CCWD's water intakes in the Delta. CCWD has the following comments on the Draft EIR.

Characterization of CCWD Supply to City. The Draft EIR indicates that the City's current agreement with CCWD is for a peak demand of 25,000 gallons per minute (Pages 2-7, 3.15-2). However, the City does not currently have an agreement that provides for a specified peak raw water demand. CCWD's municipal customers, such as the City, are provided raw water service under CCWD's Code of Regulations (https://www.ccwater.com/344/Code-of-Regulations). The City and CCWD have two supplemental agreements:

- Raw Water Service Agreement (July 2000) establishes a minimum take of raw water that must be taken and/or paid for by the City annually. The current minimum take amount is 6,961 acre-feet annually.
- Treated Water Service Agreement (December 2001) which provides the City with up to 10 MGD of capacity in the Randall-Bold Water Treatment Plant. The City's current capacity right in Randall-Bold is approximately 6 MGD.

We request that any descriptions of the contractual relationship and obligations between CCWD and the City in the Draft EIR be updated to reflect the existing agreements.

4-1

1331 Concord Avenue • Concord, CA 94520 • (925) 688-8000 • fax (925) 688-8122 • www.ccwater.com

Bay Area Regional Desalination Project. On pages 3.3-20 and 3.3-34 the Draft EIR references work performed for the Bay Area Regional Desalination Project, as follows:

> "*Bay Area Regional Desalination Project, Entrainment and Source Water Study (Tenera, 2010):*
>
> *Results: experimental entrainment surveys resulted in entrainment of relatively low amounts of special-status species (smelt); Antioch Intake would be smaller and, therefore, entrainment vulnerabilities would be commensurately less.*"

4-2

The 2010 report was used, in part, to determine that Impact 3.3-7, operation of the proposed intake facility could impinge and/or entrain fish, including fish eggs and larvae, would be less than significant. The 2010 report to which the Draft EIR refers did not contain a full impact analysis nor did it analyze the entrainment results of the pilot project in the context of an environmental impact report. The 2010 report concludes that operations of a regional desalination facility at the Mallard Slough Pump Station when larval delta and long smelt are present may require U.S. Fish and Wildlife Service and California Department of Fish and Wildlife review. We request that any results or reports from the Regional Desalination Project be properly characterized in the Draft EIR and that there is no implication that the environmental impacts of the Regional Desalination Project have been evaluated.

If you have any questions about this letter, please call me at 925-688-8083.

Sincerely,

Leah Orloff
Water Resources Manager

LO/MM:wec

Letter 4 Leah Orloff, Contra Costa Water District
Response August 13, 2018

4-1 The comment provides clarification regarding the characterization of the contractual relationship and obligations between CCWD and the City. The comment is noted and information has been updated or corrected as appropriate.

The first paragraph on page 2-7 of the Draft EIR is revised to read:

> As a municipal customer of CCWD, the City is provided raw water service under CCWD's Code of Regulations. In addition, the City and CCWD currently have two supplemental agreements. The July 2000 Raw Water Service Agreement governs the City of Antioch's purchase of raw water from CCWD diverted from the Contra Costa Canal. The 2000 agreement includes a provision for a minimum take of raw water that must be taken and/or paid for by the City annually. The December 2001 Treated Water Service Agreement provides the City with up to 10 mgd capacity in the Randall-Bold Water Treatment Plant. The City's current capacity right in Randall-Bold WTP is approximately 6 mgd. ~~The City's current agreement with CCWD is for a peak demand of 25,000 gallons per minute (gpm) (36.0 mgd).~~ Between 2005 and 2010, the City purchased an average of approximately 4,000 MG per year (12,325 AFY) from CCWD (City of Antioch, 2016).

4-2 The comment states that the Tenera 2010 report for the Bay Area Regional Desalination Project was used in part to determine that Impact 3.3-7 would have a less-than-significant impact related to fish entrainment, including fish eggs and larvae. The comment further states that the 2010 report did not contain a full impact analysis or analyze entrainment results of the pilot project in the context of the EIR, and requested that results or reports from the Regional Desalination Project be properly characterized in the EIR such that there is no implication that environmental impacts of the Regional Desalination Project have been evaluated.

The Tenera 2010 report was used in the impact analysis, along with other Delta diversions and fish entrainment and impingement risk studies and monitoring data, to provide context. Referencing the Tenera 2010 study was not intended to imply that that environmental impacts of the Regional Desalination Project have been evaluated. The Draft EIR, page 3.3-34 is revised as follows in order to appropriately caveat the use of results from Tenera (2010):

> It is important to note that Tenera (2010) was a pilot analysis examining potential entrainment and was not conducted as part of this, or any other, CEQA analysis EIR. Tenera (2010) concluded that operations of a regional desalination facility at the Mallard Slough Pump Station would require USFWS and CDFW review.

The results of the pilot analyses on entrainment for larval fish and fish eggs show the following (Tenera, 2010):

These revisions do not change the analysis or conclusions presented in the Draft EIR.

Delta Diablo
A CALIFORNIA SPECIAL DISTRICT

August 13, 2018

VIA E-MAIL (SBuenting@ci.antioch.ca.us)

Mr. Scott Buenting, Project Manager
City of Antioch
200 H Street
Antioch, CA 94509

SUBJECT: DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE ANTIOCH BRACKISH WATER DESALINATION PROJECT COMMENTS

Dear Mr. Buenting:

Delta Diablo (District) appreciates the opportunity to provide questions and comments related to the draft Environmental Impact Report (EIR) for the City of Antioch (City) Brackish Water Desalination Project as part of the California Environmental Quality Act (CEQA) process.

The project, as described in the draft EIR, proposes to discharge up to 2 million gallons per day (MGD) of brine at approximately 35,000 to 45,000 mg/L of total dissolved solids (TDS) through the District's existing outfall. As the preferred disposal option for the reverse osmosis (RO) concentrate waste stream (brine) generated by the project, the District is very interested in the characterization of the brine and potential impacts to receiving water quality, as well as wastewater treatment plant (WWTP) operations and regulatory compliance. It should be noted that the analysis of impacts to the District's discharge and ability to meet regulatory limits is complicated by the atypical nature of our existing effluent discharge which is made up of recycled water blowdown from two power plants, an industrial brine, and secondary treated effluent.

Brine Disposal Options Screening Results
Section 5.3.2 describes the screening results of different brine disposal options and indicates that the City evaluated brine disposal alternatives for their site-specific application using information from a previous study for a Pilot Plant. The section includes a discussion about why land-based disposal options were not considered or evaluated. However, it does not elaborate on why the other alternatives identified in the Pilot Plant study were not evaluated further. Was the analysis conducted in the Pilot Plant study? If so, please include a summary of the analysis or attach the Pilot Study report as an appendix.

5-1

Brine Characterization and Scenario Planning
The District will require further characterization of the brine to better assess the impacts to the District's discharge and our ability to comply with regulatory requirements. While desalination plant operations and chemical usage were briefly addressed in the draft EIR

5-2

on an annual basis, the District needs to know details about the variability of the brine discharge volume and composition, the specific make up of desalination plant chemicals that may be in the brine, and the associated maximum concentration, dosage, duration and frequency of use for each chemical. Our understanding is that other reverse osmosis plants have experienced greater cleaning requirements than originally anticipated.

The brine composition will be evaluated along with the variability and make-up of the existing waste streams that currently contribute to the District's discharge as noted above. Careful consideration is needed to understand and predict the different combination of flows that may occur in the District's discharge. These potential discharge scenarios may impact several components of the District's discharge permit as described below.

5-2 cont.

Discharge Permits

The District's discharge is permitted under a National Pollutant Discharge Elimination System (NPDES) permit (Order No. R2-2014-0030) issued by the San Francisco Bay Regional Water Quality Control Board (Regional Water Board). The District's ability to accept and discharge the brine is subject to Regional Water Board approval.

Additionally, discharge from the District's outfall is covered under two watershed permits: *Waste Discharge Requirements for Mercury and PCBs from Municipal and Industrial Wastewater Discharges to San Francisco Bay* (Order No. R2-2017-0041) and *Waste Discharge Requirements for Nutrients from Municipal Wastewater Discharges to San Francisco Bay* (Order No. R2-2014-0014). Further evaluation and possible negotiation with the Regional Water Board may be needed to accommodate additional mass loading from the acceptance of brine.

5-3

In general, the EIR analysis considers the impacts of the project on the Delta. The project removes up to 8 MGD of water and the associated mass of constituents and returns 2 MGD of brine with a large fraction of the constituents, so that on the large scale there is negligible impact to the flows and water quality in the Delta. However, the near-field impacts may have an impact on the District's ability to comply with our NPDES and watershed permit limits.

Dilution Credit

Several of the District's effluent limits are based in part on the available dilution from the District's outfall diffuser and dilution is listed in the prohibitions section of the District's NPDES permit. The District appreciates the number of scenarios and the level of effort that were conducted for the EIR dilution modeling. The modeling results indicate that the initial dilution may decrease from the current permitted level of 61:1 to minimum value of 23:1. While the draft EIR analysis does not foresee any compliance issues, the modeling scenarios and results must ultimately be approved by the Regional Water Board. Once the final approved dilution credit is known (for both acute and chronic

5-4

conditions), the Regional Water Board will adjust the District's effluent limits to reflect the new dilution credit. The District's current discharge, combined with the brine discharge, will then need to be checked against the recalculated effluent limits to verify the District's ability to meet the permit limits. If there are probable compliance issues, modifications to the District's outfall diffuser and/or the addition of desalination plant brine equalization facilities may need to be constructed.

5-4 cont.

Reasonable Potential Analysis
The discussion of near-field effects of the brine discharge in Section 3.11.4 focuses primarily on TDS. While the section addresses the ability of the brine addition to comply with the District's existing NPDES permit limits (except for cyanide), the new dilution credit was not taken into account for ammonia. Please note that a reasonable potential analysis (RPA) is needed to determine potential future limits. As this project progresses through the permitting process, an RPA will need to be performed for all water quality parameters regulated by the Regional Water Board under the different discharge scenarios, as the scenario with minimum dilution may not necessarily correspond to the condition with compliance jeopardy. The RPA results will need to be compared against the new effluent limits using the new dilution credit to assess the District's compliance ability.

5-5

Toxicity Testing
The District's discharge is currently subject to whole effluent toxicity testing, both acute and chronic. As part of the permitting process with the Regional Water Board, the testing species selection and the District's ability to comply with toxicity limits will need to be evaluated. Because toxicity testing is difficult to simulate, comprehensive toxicity testing may be necessary during the desalination plant start-up. This has presented a challenge to other desalination facilities and Toxicity Reduction Evaluations and/or Toxicity Identification Evaluations may be required.

5-6

Facilities Impact and Reliability Study
As the project progresses, a facilities and reliability study will need to be completed to better understand the potential impacts of the brine on the District's installed assets and maintenance program. Potential impacts include increased corrosivity of the brine and solids precipitation in pipelines due to the new blended water quality.

5-7

Plant Shutdowns
The District's WWTP periodically experiences shutdowns for routine maintenance and capital improvement projects. On average, shutdowns occur approximately 6 times per year for a period of 8-12 hours. Unless accommodations are included in the project, only brine will be discharged from the District's outfall during these events. Accommodations for these occurrences may include options such as discontinuation of brine generation, brine storage, or NPDES permitting to allow the disposal of brine only.

5-8

Your consideration of the District's comments as part of the CEQA process is greatly appreciated. As the project moves forward, we will continue to work with the City to resolve operational and permitting challenges.

Sincerely,

Brian Thomas
Engineering Services Director / District Engineer

AWR:drb

cc: Vince De Lange, General Manager
Dean Eckerson, Resource Recovery Services Director
Joaquin Gonzalez, Operations Manager
Amanda Roa, Environmental Programs Manager
District File CORP.03.05-CORRES
Chron File

Letter 5 **Brian Thomas, Delta Diablo**
Response August 13, 2018

5-1 The comment requests clarification regarding screening results of the brine disposal options in Section 5.3.2 of the Draft EIR. The EIR text warrants clarification in terms of the characterization of the pilot plant study and subsequent evaluations conducted by the City. As noted on page 5-8 of the Draft EIR, the previous study for the pilot plant concluded that several opportunities for managing desalination concentrate would be available in east Contra Costa Region. These opportunities included mixing the concentrate with wastewater effluent produced by Delta Diablo and/or the Central Contra Costa Sanitary District (CCCSD), comingling with spent cooling water from the Mirant power plant, or discharges into Mirant's power plant's intake itself. The previous pilot plant study did not include further specific information, recommendations, or analysis of these options.

To provide clarification, the previous pilot plant study was the source of measured water quality data used in developing the conceptual design of the proposed project. Project-specific brine management and disposal options were evaluated in a separate technical memorandum, as noted on page 5-5 of the Draft EIR (Carollo, 2016). With regard to other options of mixing the concentrate with CCCSD or Mirant power plant, a 2010 study by URS evaluated existing facilities and assets in the vicinity of eastern Contra Costa County for potential desalination plant site implementation, including conveyance and disposal of the brine. Conveyance of the brine to either CCCSD or Mirant would require a potential combination of slip-lining abandoned or non-critical pipelines and new brine pipeline construction to complete the connections to the facilities (URS, 2010).

Section 15126.6(a) of the State CEQA Guidelines requires analysis of a range of reasonable alternatives to the project, or to the project's location, that would feasibly attain most of the project's basic objectives, but would avoid or substantially lessen any of its significant effects. Furthermore, according to Section 15126.6(b) of the CEQA Guidelines also states that "the discussion of alternatives shall focus on alternatives to the project or its location which are capable of *avoiding or substantially lessening any significant effects of the project*". The Mirant and CCCSD facilities are located an additional 4 to 11-miles west of the proposed brine disposal pipeline and would require a greater amount of excavation and construction. Therefore, these options would result in greater construction impacts and would not reduce, avoid, or eliminate potential impacts of the proposed project.

Section 5.3.2, *Brine Disposal Options Screening Results* (pages 5-8 and 5-9 of the EIR), is revised as follows to provide clarification:

> This analysis considers an alternative disposal option for brine generated by the desalination plant and is summarized in **Table 5-2** below.

TABLE 5-2
BRINE DISPOSAL OPTIONS SCREENING RESULTS

Brine Disposal Option	Description	Screening Results
Surface water discharge	This option would discharge brine directly to a local or remote water body, and would require construction of an engineered solution (e.g., new outfall and diffuser).	*This option would discharge brine without dilution to local surface waters. Not carried forward because the California Ocean Plan Amendments[1] encourage co-location with a wastewater treatment plant outfall to dilute brine with wastewater effluent before it is discharged.*
Combine brine with CCCSD WWTP or Mirant power plant effluent	This option would discharge brine with effluent produced by CCCSD or Mirant power plant, and would require a combination of slip-lining abandoned or non-critical pipelines and new brine pipeline construction to complete the connections to these facilities.	*The Mirant and CCCSD facilities are located an additional 4 to 11-miles west of the proposed brine disposal pipeline and would require a greater amount of excavation and construction. This option is not carried forward because other discharge locations offer no advantages to the proposed project. It would not reduce, avoid, or eliminate potential impacts of the proposed project.*

NOTE:
1. The California Ocean Plan Amendments apply to coastal desalination plants using ocean water and are not directly applicable to the proposed desalination facility treating water from the San Joaquin River. However, these amendments are used as a guideline for this project.

The primary screening criteria for these options were:

- Technically feasible and capable of receiving the entire brine flow (2 mgd) from the brackish water desalination facility;
- Due to cost and viability for the City, the option should be a single, reliable brine management method;
- Must not require capital costs that would surpass additional revenue gained from implementation.

As described in Section 2.4, *Project Component Selection and Considerations,* a previous study for a Pilot Plant concluded that several opportunities for managing desalination concentrate would be available in the east Contra Costa region. Mixing the concentrate with wastewater effluent produced by Delta Diablo and/or the Central Contra Costa Sanitary District (CCCSD) were identified as opportunities for further consideration. Comingling with spent cooling water from the Mirant power plant, which is located east of the Mallard Slough Pump Station, or discharges into the power plant's intake itself, were also identified as potentially acceptable low cost options. The previous pilot plant study was the source of measured water quality data used in developing the conceptual design of the proposed project. Project-specific brine management and disposal options were also evaluated in a separate technical memorandum during the proposed project's development (Carollo, 2016). ~~The City~~

~~subsequently evaluated brine disposal alternatives for their site-specific application using information from the study.~~

Land-based brine discharge options were considered and eliminated from further analysis for several reasons, including: the impacts associated with the truck trips required to move 2 mgd of liquid brine to a processing facility or other disposal or treatment area; the infeasibility of developing a substantially large area that would be needed for the use of evaporation ponds; the lack of a market for the salt product in California (e.g. as a de-icing agent); the infeasibility of using the very saline brine as irrigation water or for dust control; and the infeasibility of deep well injection due to regulations requiring a 30 mile setback from known fault lines.

Based on this initial screening, no brine disposal alternative options were retained for evaluation in the second step of the process.

5-2 The comment states that Delta Diablo will require further characterization of the brine including volume, composition, desalination plant chemicals that may be in the brine, and the associated maximum concentration, dosage, duration, and frequency of use for each chemical. In addition, the comment states the brine composition will be evaluated with the existing waste streams that currently contribute to Delta Diablo's discharge.

The City recognizes Delta Diablo's need to complete a detailed, NPDES-level evaluation of potential changes to discharge water quality that could result from implementation of the desalination plant as part of its permit renewal, which would include completion of a Reasonable Potential (RP) analysis for individual constituents to demonstrate compliance with the California Toxics Rule (CTR) and State Implementation Plan (SIP). Data needed to support this process are not presently available to the extent needed to support a Reasonable Potential analysis. This information will, however, be available in advance of the permitting process. To this end, if the project is approved, the project team will work closely with Delta Diablo to provide all information and data needed to support an updated permit from the RWQCB. Consistent with other permitted RO membrane treatment processes in the Bay Area such as the ACWD Brackish Water Treatment Facility and the RARE Reverse Osmosis Treatment Facility implemented by EBMUD, the proposed project would be required to provide data to support characterization of brine composition, variability of brine discharge volumes, variability of brine composition with respect to key/permitted water quality constituents, and relevant maximum chemical dosing and concentrations contained in the brine discharge. The City recognizes that reverse osmosis membrane cleaning and other maintenance activities can require chemical usage. Chemical usage rates considered in the permit application and supporting documentation will be based on real-world chemical consumption data from other reverse osmosis facilities using the same technology and with similar input water composition, in order to best estimate chemical usage and, as relevant, the amount of any residual chemicals discharged to the brine system.

5-3 The comment states that further evaluation and negotiation with the Regional Water Board may be needed to accommodate additional mass loading from the acceptance of brine. The City concurs that Delta Diablo's ability to accept and discharge brine from the project would be subject to permit approval from the SFRWQCB. The City further recognizes that Delta Diablo, along with other relevant regional dischargers, is subject to Order No. R2-2017-0041 and Order No. R2-2014-0014. Any additional evaluation and / or possible negotiation with the SFRWQCB regarding water quality constituent loading from the project would be identified during the update and revision process for Delta Diablo's wastewater discharge NPDES permit (Order No. R2-2014-0030). If the project is approved, the City will work with Delta Diablo to provide data and other information needed to the SFRWQCB, as relevant.

With respect to near-field effects of the project on Delta Diablo's ability to comply with its existing NPDES permit, the results and analysis of the dilution study (included as Appendix D to the Draft EIR) will be used to support the NPDES permit application / development process. These data will be used to (1) delineate the dilutions received during the various discharge scenarios, (2) identify the corresponding effluent quality under each scenario, and (3) compare that resulting water quality to the corresponding effluent limits identified in the permit.

Regarding the project potentially impacting Delta Diablo's ability to comply with applicable permit limits, as discussed in the Draft EIR (page 3.11-18), the project would concentrate ambient concentrations of constituents in Delta waters in the resulting discharged brine. However, at the watershed level, the project would not increase the total mass loading of mercury, PCBs, or nutrients, because it would only return constituents originally sourced from the watershed back to the watershed, as discussed for copper and total ammonia on pages 3.11-40 and 3.11-41 of the Draft EIR. Therefore, the project is generally not expected to result in water quality degradation at the watershed level.

5-4 The comment acknowledges the number of scenarios and level of effort conducted for the EIR dilution modeling, and notes that while the EIR does not foresee any compliance issues, the scenarios and results must ultimately be approved by the Regional Water Board.

As discussed on page 3.11-29 of the Draft EIR and as noted by Delta Diablo, the modeled change in dilution from 61:1 to 23:1 (minimum) is not expected to result in an environmentally significant change to water quality in the Delta. Note also that as discussed on page 3.11-25 of the Draft EIR, the modeled brine concentration of 32,000 mg/L is a conservative high overestimate for the composition of the brine water discharge, based on a high estimate of peak potential brine concentration. Nonetheless, the City recognizes that a reduction in the dilution ratio could require approval of the SFRWQCB during the NPDES permit update process. Part of this process would likely require comparison of the anticipated discharge—including brine from the proposed project—to any updated effluent limitations promulgated by the SFRWQCB in the

revised permit. Please refer to response to comment 5-3 for additional information on the permitting process and key considerations therein.

5-5 The comment notes that a reasonable potential analysis (RPA) will be needed for all water quality parameters regulated by the Regional Water Board. The City acknowledges that completion of a RPA will be required during the NPDES permitting process with the SFRWQCB. To that end, the City will work with Delta Diablo during the NPDES permit update process to identify and prepare the range of RPAs needed to assess the most likely range of discharge scenarios, as warranted to meet SFRWQCB requirements.

5-6 The comment notes that comprehensive toxicity testing may be necessary during the desalination plant start-up as Delta Diablo is currently subject to both acute and chronic toxicity testing. The City will work with Delta Diablo to identify the most appropriate toxicity test species to use during toxicity testing and to assess an appropriate range of toxicity values to support the permitting and compliance process, including during startup if warranted.

5-7 The commenter suggests that a Facilities Impact and Reliability Study would be required in order to better understand how the proposed brine discharge could affect Delta Diablo's existing installed assets and/or ongoing operations, where Delta Diablo's key concerns include potential for brine corrosivity and solids precipitation. The City will collaborate with Delta Diablo to assess the need for, and complete a Facilities Impact and Reliability Study as part of the project development and permitting process.

5-8 The comment notes that unless accommodations are included in the project, brine would be discharged from the outfall during the WWTP's periodic shutdowns for maintenance and capital improvement projects. The City has met with Delta Diablo staff several times and a brine discharge agreement will be developed between the two agencies.

The brine during Delta Diablo WWTP maintenance shutdowns will be managed in accordance with the brine discharge agreement and within the limits of the revised NPDES permit. Actions to be taken in order to maintain compliance will be determined during the permitting process. The City will identify viable measures – including additional NPDES conditions, or other solutions as identified – in order to maintain permit compliance. Additionally, the City will work with Delta Diablo during the NPDES permit update process to identify any additional language to conditions regarding the timing of periodic brine-only discharges during Delta Diablo maintenance.

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
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Fairfield, CA 94534
(707) 428-2002
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***EDMUND G. BROWN JR.**, Governor*
***CHARLTON H. BONHAM,** Director*

August 17, 2018

Mr. Scott Buenting, Project Manager
City of Antioch
200 H Street
Antioch, CA 94509

Dear Mr. Buenting:

Subject: City of Antioch Brackish Water Desalination Project, Draft Environmental Impact Report, SCH #2017082044, Contra Costa County

The California Department of Fish and Wildlife (CDFW) has reviewed the draft Environmental Impact Report (EIR) for the proposed City of Antioch Brackish Water Desalination Project (Project) pursuant to the California Environmental Quality Act (CEQA) and CEQA Guidelines. In accordance with our mandates, CDFW is submitting comments on the draft EIR as a means to inform the City of Antioch (City), as the Lead Agency, of our concerns regarding potentially significant impacts to sensitive resources associated with the proposed Project.

CDFW ROLE

CDFW is a Trustee Agency with responsibility under CEQA (Pub. Resources Code, § 21000 et seq.) pursuant to CEQA Guidelines section 15386 for commenting on projects that could impact fish, plant, and wildlife resources. CDFW is also considered a Responsible Agency if a project would require discretionary approval, such as a California Endangered Species Act (CESA) Incidental Take Permit (ITP), a Lake and Streambed Alteration (LSA) Agreement, or other provisions of the Fish and Game Code that afford protection to the state's fish and wildlife trust resources.

REGULATORY REQUIREMENTS

California Endangered Species Act
Please be advised that a CESA ITP must be obtained if the Project has the potential to result in "take" of plants or animals listed under CESA, either during construction or over the life of the Project (Fish and Game Code, § 2080 et seq.). Issuance of a CESA ITP is subject to CEQA documentation; therefore, the CEQA document must specify impacts, mitigation measures, and a mitigation monitoring and reporting program. If the Project will impact CESA listed species, early consultation is encouraged, as potential significant modification to the Project and mitigation measures may be required in order to obtain a CESA ITP.

6-1

CEQA requires a Mandatory Finding of Significance if the Project is likely to substantially restrict the range or reduce the population of a threatened or endangered species. (Pub. Resources Code, §§ 21001, subd. (c), 21083; CEQA Guidelines, §§ 15380, 15064, and 15065). Impacts must be avoided or mitigated to less-than-significant levels unless the CEQA Lead Agency makes and supports Findings of Overriding Consideration (FOC). The CEQA Lead Agency's FOC does not eliminate the Project proponent's obligation to comply with Fish and Game Code section 2080.

Lake and Streambed Alteration
CDFW requires an LSA Notification (Notification), pursuant to Fish and Game Code section 1600 et. seq., for Project activities affecting lakes or streams and associated riparian habitat. Notification is required for any activity that may substantially divert or obstruct the natural flow; change or use material from the bed, channel, or bank including associated riparian or wetland resources; or deposit or dispose of material where it may pass into a river, lake or stream. Work within ephemeral streams, washes, watercourse with a subsurface flow, and floodplains are subject to notification requirements. CDFW will consider the CEQA document of the Project and may issue an LSA Agreement. CDFW may not execute the final LSA Agreement (or ITP) until it has complied with CEQA as a Responsible Agency.

6-1 cont.

PROJECT DESCRIPTION SUMMARY

Proponent: City of Antioch

Objective: Construct facilities for desalination and increase volume of diverted surface flows.

Location: The Cities of Antioch and Pittsburg, Contra Costa County, California.

Timeframe: Project construction would be over a 14-month period between February 2019 and March 2020.

The Project proposes to construct a desalination plant with the capacity to produce up to 6 million gallons per day (mgd) of desalinated product water to offset use of purchased water. The Project elements include: construction of a new 6 mgd capacity desalination facility at the City's water treatment plant; demolition of the existing 16 mgd capacity San Joaquin River intake pump station; construction of a new 16 mgd capacity intake pump station; installation of 3,000 feet of pipeline from the new intake pump station to the water treatment plant; installation of 4 miles of pipeline from the desalination facility to the Delta Diablo wastewater treatment plant; and discharge of brine into New York Slough.

COMMENTS AND RECOMMENDATIONS

CDFW offers the following comments and recommendations to assist the City in adequately identifying and/or mitigating the Project's significant, or potentially significant, direct and indirect impacts on fish and wildlife (biological) resources.

Chapter 2, Section 2.9, Section 3.3.2, and Section 3.4.2

Comment 1: Project requires Notification under Fish and Game Code Section 1600 et. seq.
Current and proposed activities described in the draft EIR are subject to Notification and CDFW may require an LSA Agreement, pursuant to Section 1600 et seq. of the Fish and Game Code. These activities include: ongoing water diversion operations; release of brine concentrate into the San Joaquin River; and construction of conveyance pipelines that intersect West Antioch Creek and Los Medanos Waterway.

6-2

Please submit Notification to CDFW at the Bay Delta Office listed above. To obtain information about the LSA notification process, please access our website at

https://www.wildlife.ca.gov/Conservation/LSA; or to request a notification package, contact the Bay Delta Regional Office at (707) 428-2002. 6-2 cont.

Chapter 3, Section 3.0.5 Cumulative Analysis

Comment 2: Legal basis to divert water is unclear
The draft EIR includes statements regarding the City's pre-1914 appropriative water rights; however, there is no description of the pre-1914 rate of diversion, annual volumes diverted or if the Project will result in an expansion of these metrics above pre-1914 levels. CDFW recommends that the City include a description of the above items and identify whether there will be an expansion of use above pre-1914 levels. If an expansion of use is identified, then CDFW recommends that the Project consult with the State Water Resources Control Board on what basis of right for diversion would be required. 6-3

Comment 3: The Project does not analyze impacts to ongoing large-scale fish habitat restoration efforts
The draft EIR does not address potential impacts of the Project to the Department of Water Resources' (DWR) Fish Restoration Program (FRP) Projects that are immediately adjacent to the proposed outfall and within the greater area of the Delta and Suisun Marsh. A fluctuation of salinity levels not previously contemplated in restoration plans can negatively impact the success of ongoing tidal marsh restoration efforts. CDFW recommends a revision of the draft EIR to include an analysis of the impacts to FRP Projects. CDFW also recommends that the draft EIR include a measure that requires coordination with DWR's FRP to ensure the Project's operation does not adversely impact ongoing restoration efforts. 6-4

Chapter 3.3 Aquatic Biological Resources

Comment 5: Impacts from increased volumes of diversion has been insufficiently described
Historically, the amount of water diverted for the City's municipal water needs has been dictated by the water quality supplemented with water of higher quality diverted from upstream sources and provided to the City through the Contra Costa Water District (CCWD). With the addition of desalination technology, the restrictive nature of past water diversion is eliminated. The stated purpose of the desalination plant is to divert water during dry years. Currently, the City diverts 3,569 million gallons (mg) in a wet year and 1,525 mg in a dry year. The proposed increase would allow diversion of up to 5,840 mg, or a 63% increase from current diversion amounts in wet years, and a 283% increase in dry years. This increase in diversion has Delta-wide impacts that have not been sufficiently addressed in the draft EIR. Due to the complexity of the Delta water system and to aid in evaluating the Project's potential impacts, CDFW recommends the Project's analyses be revised to include the maximum diversion scenario by month in all year types, and include a 2-D rendering of the areas where salinity would be impacted (i.e. increases) for each scenario. 6-5

Comment 6: Fish food web impacts have not been analyzed
The dilution modeling in Appendix D utilize data from the years 1978 - 1991, and only examines data from stations upstream and directly adjacent to the proposed Project outfall. Given that DWR has daily monitoring stations throughout the Delta, and Project impacts have the potential to adversely affect the estuaries of Suisun Bay and San Pablo Bay, CDFW cannot fully evaluate the impacts of the Project to the Delta's fish food web. CDFW requests justification for use of 6-6

data that is not the best available data, and exclusion of a wider set of data from stations to the West. CDFW recommends revising the draft EIR to include an analysis of the direct impacts to the Delta's suite of native fish, including recreational and commercial fisheries, and indirect impacts to benthic organisms, macroinvertebrates, zooplankton, and phytoplankton blooms that form the food web for the fisheries within the Delta, Suisun Bay, and San Pablo Bay. CDFW recommends the Project's impacts analyses be revised to include an analysis and discussion that includes the most recent drought data, the increased diversions and changes in water regimes since 1991, and with additional analyses that include the following: 6-6 cont.

1. An analysis of the Project's operational impacts to the Low Salinity Zone (LSZ)
2. An analysis of the chemical composition of the proposed brine releases and discharge impacts
3. An analysis of the Project's operational impacts to dissolved oxygen (DO) levels
4. An analysis of the Project's operational impacts to the temperature gradient within the Delta as result of increased effluence releases.

Comment 7: Impact analysis should include impacts to the Low Salinity Zone
X2 is a measure of the distance from the Golden Gate Bridge to the point where daily average salinity is 2 parts per thousand (ppt) at 1 meter off the bottom[1]. The LSZ is an area defined as having a range of salinities, usually 0.5 to 6 ppt[2]. The timing, size, and location of the LSZ is important to the rearing of many young fish, including Delta smelt and longfin smelt. Analysis of Project impacts to the LSZ allows for a more in-depth evaluation of the effects of salinity changes in the Delta. The Project's analysis of X2 has been considered in Chapter 3.11 and in the Dilution Modeling in Appendix D, but restricting the analysis to only this model does not utilize the best available data and understates the impacts from the proposed brine release. Quantifying the modeling of scenarios on a yearly basis instead of monthly does not represent acute impacts based on seasonal fluctuations. CDFW recommends the draft EIR be revised to incorporate an impacts analysis to the LSZ, in addition the X2 impacts, represented by month and year type accompanied by a two-dimensional representation of the change over time and area within the Delta, or a discussion that justifies exclusion of the LSZ from the analysis. 6-7

Comment 8: Baseline salinity prior to discharge is unclear
Brine composition can vary widely and the concentration of salts and/or chemicals resulting from desalination has the potential for negative impacts on incubation and direct toxicity to the suite of native fish present in the Delta. The locations of the Antioch intake and Pittsburg outflow have the potential to adversely impact the LSZ within the Delta and fish rearing habitat. CDFW recommends the draft EIR include an analysis of the proposed chemical composition of brine releases compared to baseline seasonal variances and identify impacts to the LSZ, if any are found. 6-8

Comment 9: Analysis lacks worst-case scenario analysis
It is unclear if the Dilution model was run utilizing the stated 6 mgd diversion, the 8 mgd diversion, or the instantaneous maximum of 16 mgd diversion amounts allowed by the proposed 6-9

[1] Jassby et al., The Abundance of several Common Species of Fish Varies Positively with Flow Entering the Estuary, as Indexed by X2, 1995
[2] MacWilliams et al., Three-Dimensional Modeling of Hydrodynamic and Salinity in the San Francisco Estuary: and Evaluation of Model Accuracy, X2, and the Low-Salinity Zone, San Francisco Estuary and Watershed Science, 2015

pumps. CDFW recommends providing clarification for simulations run, and inclusion of minimum, optimal, and maximum diversion amounts referencing changes over area and time for drought, surplus, and optimal year types in the impacts analysis throughout the draft EIR. 6-9 cont.

Comment 10a: Mitigation insufficient to mitigate to less-than-significant
The Project has the potential to impact special-status fish species that utilize the Delta through direct take, impingement and entrainment of eggs, larvae, and adult fish, barotrauma, and temporary and permanent losses of habitat. These special-status fish species include Central Valley spring-run and Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*) and green sturgeon (*Acipenser medirostris*). To reduce Project impacts on special-status fish species to a level of less-than significant CDFW makes the following recommendations:

Comment 10b: Impacts 3.3.1 and 3.3.2 - The draft EIR should be revised to include the following minimization measures: 6-10

> *"Water Pollution: Permittee and all contractors shall be subject to the water pollution regulations found in Fish and Game Code Sections 5650 and 12015.*
>
> *Spill Contingency Plan Required: Permittee shall submit for approval an oil/toxic materials spill contingency plan to CDFW prior to commencement of operations. The plan shall identify the location of containment and abatement materials on-site and the notification and cleanup procedures to be followed by Permittee in the event of a spill.*
>
> *Spill Cleanup: Permittee shall begin the cleanup of all spills immediately. CDFW shall be notified immediately by the Permittee of any spills and shall be consulted regarding cleanup procedures. The Permittee shall have all spill clean-up equipment on site during construction.*
>
> *Spill Containment: All activities performed in or near waters of the state shall have absorbent materials designated for spill containment and clean-up activities on-site for use in an accidental spill. The Permittee shall immediately notify the California Governor's Office of Emergency Services at 1-800-852-7550 and immediately initiate the clean-up activities. CDFW shall be notified by the Permittee and consulted regarding clean-up procedures.*
>
> *Erosion Control Measures: At no time shall silt-laden runoff be allowed to enter the river or streams, or directed to where it may enter the channel. Erosion control measures, such as, silt fences, settling tanks, straw hay bales, gravel or rock lined ditches, water check bars, and broadcasted straw shall be used where ever silt-laden water has the potential to leave the work site and enter the waterway."*

Comment 10c: Impacts 3.3-3, 3.3-4, 3.3-5, 3.3-6, 3.3-7, 3.3-8, and 3.3-C-1 through 3.3-C-8 are likely to result in take of special-status fish species within the Project areas and surrounding habitat. This includes incidental take from dewatering, entrainment, impingement, barotrauma and water quality degradation. To ensure impacts to special-status fish species are mitigated to a level of less-than-significant, CDFW recommends incorporation of specific and enforceable avoidance and minimization measures in a revised draft EIR, including a restricted work window 6-11

of August 1 to November 30, biological monitoring throughout the course of the Project, underwater acoustic monitoring while pile driving and removal occurs. CDFW also recommends the inclusion of a compensatory mitigation requirement to offset loss of rearing habitat for special-status fish at a minimum of a 3:1 mitigation ratio (conservation to loss) for permanent impacts, and a 1:1 ratio for temporary impacts. CDFW recommends the City obtain take coverage through an ITP issued by CDFW for the Project construction, and for ongoing and future diversion operations.

6-11 cont.

Comment 10d: Impacts 3.3.7 and 3.3-C-7 - To reduce impacts to a level of less-than significant, CDFW recommends the draft EIR be revised to include the following Mitigation Measure:

> *"The intake pipes shall be fitted with fish screens that meet CDFW screening criteria to prevent both entrainment and impingement of fish species. CDFW fish screen criteria can be found in the California Salmonid Stream Habitat Restoration Manual's Appendix S available online at https://www.wildlife.ca.gov/Grants/FRGP/Guidance"*

6-12

Chapter 3.4 Terrestrial Biological Resources

Comment 11a: Draft EIR lacks mitigation for special-status plant impacts
Table C-1 identifies several rare plant species that have the potential to be adversely impacted by Project activities. To ensure impacts to special-status plants are mitigated to less-than-significant, CDFW recommends incorporation of specific and enforceable avoidance and minimization measures in a revised draft EIR, including pre-construction surveys, a restoration/remediation plan, and inclusion of compensatory mitigation at a minimum of a 3:1 mitigation ratio (conservation to loss) for permanent impacts, and a 1:1 ratio for temporary impacts to special-status plants. If take of Mason's lilaeopsis (*Lilaeopsis masonii*) cannot be fully avoided, then CDFW recommends the City obtain incidental take coverage through an ITP.

CDFW recommends the addition of a mitigation measure in the revised draft EIR with the following language:

6-13

> *"Special-Status Plant Assessment and Avoidance: A Qualified Botanist shall conduct a minimum of two (2) surveys for each special-status plant species with potential to occur within the Project Site prior to initiation of Project Activities during the appropriate blooming period in accordance with CDFW's Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities (https://www.wildlife.ca.gov/conservation/survey-protocols)."*

CDFW also recommends the measure state the following:

> *"A qualified botanist shall develop and implement a restoration/remediation and mitigation plan according to CDFW guidelines and in coordination with. At a minimum, the plan shall include collection of reproductive structures from affected plants, a full description of microhabitat conditions necessary for each affected species, seed germination requirements, restoration techniques for temporarily disturbed occurrences, assessments of potential transplant and enhancement sites, success and performance criteria, and monitoring programs, as well as measures to ensure long-term sustainability."*

In addition, the measure should be revised to require conservation and management in perpetuity through recordation of conservation easements on lands where mitigation occurs to ensure impacts to special-status plant species are mitigated to a level of less-than-significant. Conservation lands should be placed under a conservation easement, an endowment should be funded for managing the lands for the benefit of the conserved species in perpetuity, and a long-term management plan should be prepared and implemented by a land manager. The Grantee of the conservation easement should be an entity that has gone through the due diligence process for approval by CDFW to hold or manage conservation lands.

6-13 cont.

Comment 11b: Mitigation Measure 3.4-1a - Nesting birds have the potential to occur within the vicinity of the proposed Project (Table C-1). The Project may adversely impact nesting birds by resulting in nest abandonment, loss of young and reduced health and vigor of chicks (resulting in reduced survival rates), temporary loss of nesting habitat, and breeding and foraging disturbance through Project activities. To ensure impacts to nesting birds are mitigated to a level of less-than-significant, CDFW recommends that the draft EIR be revised to include the addition of the following specific and enforceable mitigation measure in the event nesting birds are detected:

> *"Nesting Bird Assessment and Avoidance: Prior to the initiation of construction, including ground disturbing activities scheduled to occur between February 1 and September 1, a Qualified Biologist shall conduct a habitat assessment and nesting survey for nesting bird species no more than five (5) days prior to the initiation of work. Surveys shall encompass all potential habitats (e.g., grasslands and tree cavities) within 250 feet of the Project site. The Qualified Biologist conducting the surveys shall be familiar with the breeding behaviors and nest structures for birds known to nest in the Project site. Surveys shall be conducted during periods of peak activity (early morning, dusk) and shall be of sufficient duration to observe movement patterns. Survey results, including a description of timing, duration and methods used, shall be submitted to CDFW for review forty-eight hours prior to the initiation of the Project. If a lapse in Project activity of seven days (7) or more occurs, the survey shall be repeated and no work shall proceed until the results have been submitted to CDFW.*
>
> *If nesting birds are found then no work shall be initiated until species-specific buffers have been established in consultation with CDFW. The buffer area(s) shall be fenced off from work activities and avoided until the young have fledged, as determined by the Qualified Biologist. Active nests found inside the limits of species-specific buffer zones or nests within the vicinity of the Project site showing signs of distress from Project activity as determined by the Qualified Biologist shall be monitored daily during the duration of the Project for changes in bird behavior. Buffer areas of active nests within the vicinity of the Project site showing signs of distress or disruptions to nesting behaviors from Project activity, as determined by the Qualified Biologist, shall have their buffers immediately adjusted by the Qualified Biologist until no further interruptions to breeding behavior are detectable.*
>
> *The Permittee or representatives of the Permittee shall not disturb or destroy the nests or eggs of fully protected species or of other birds as per Fish and Game Code section 3503."*

6-14

Comment 11c: Mitigation Measure 3.4-1a - Burrowing owl (*Athene cunicularia*; BUOW) has moderate potential to occur within the vicinity of the proposed Project (Table C-1). The Project may adversely impact BUOW by resulting in nest abandonment, loss of young and reduced health and vigor of chicks (resulting in reduced survival rates), temporary loss of nesting habitat, and breeding and foraging disturbance through Project activities. To ensure impacts to BUOW are mitigated to less-than-significant, CDFW recommends incorporation of specific and enforceable avoidance and minimization measures in the draft EIR and inclusion of compensatory mitigation at a minimum of a 3:1 mitigation ratio (conservation to loss) for permanent impacts, and a 1:1 ratio for temporary impacts to BUOW habitats. Conservation lands should be placed under a conservation easement, an endowment should be funded for managing the lands for the benefit of the conserved species in perpetuity, and a long-term management plan should be prepared and implemented by a land manager. The Grantee of the conservation easement should be an entity that has gone through the due diligence process for approval by CDFW to hold or manage conservation lands. CDFW also recommends Measure 3.4-1a be updated to incorporate the breeding and non-breeding survey and reports methodologies of CDFW's 2012 *Staff Report on Burrowing Owl Mitigation* available at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83842&inline.

6-15

Comment 11d: Mitigation Measure 3.4-1a – The draft EIR recognizes that Swainson's hawk (*Buteo swainsoni;* SWHA) has a high potential to occur within the vicinity of the proposed Project. The Project may adversely impact SWHA by resulting in nest abandonment, loss of young and reduced health and vigor of chicks (resulting in reduced survival rates), temporary loss of nesting habitat, and breeding and foraging disturbance through Project activities. As such, a CESA ITP from CDFW may be warranted for SWHA. To ensure impacts to SWHA are mitigated to less-than-significant, CDFW recommends that the draft EIR be revised to include the addition of the following specific and enforceable mitigation measure in the event nesting birds are detected:

> *"If Project-related construction occurs during the breeding season for SWHA (March 15 to September 15) then a qualified biologist shall perform nesting surveys in accordance with the Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley (Swainson's Hawk Technical Advisory Committee 2000 available online at: https://www.wildlife.ca.gov/conservation/survey-protocols. If a Swainson's hawk nest is found then a ¼-mile no work buffer zone shall be established until chicks have fledged"*

If take to SWHA cannot be fully avoided, then CDFW recommends the Project obtain SWHA take coverage through an ITP issued by CDFW.

6-16

Comment 11e: Mitigation Measure 3.4-1a - Impacts to white-tailed kite (*Elanus leucurus;* WTKI) must be fully avoided. WTKI has a high potential to occur within the vicinity of the proposed Project (Table C-1). The Project may adversely impact WTKI by resulting in nest abandonment, loss of young and reduced health and vigor of chicks (resulting in reduced survival rates), temporary loss of nesting habitat, and breeding and foraging disturbance through Project activities. WTKI is classified as a Fully Protected species under State law, thus impacts to WTKI must be fully avoided. CDFW recommends revising Measure 3.4-1a to ensure that the Project will fully avoid ***all impacts*** to this species.

6-17

Comment 11f: Mitigation Measure 3.4-1b - Western red bat (*Lasiurus blossevillii*) has moderate potential to occur within the vicinity of the proposed Project (Table C-1). The Project may adversely impact the western red bat through disturbance from Project activities, resulting in roost abandonment, loss of young and reduced health and vigor of pups (resulting in reduced survival rates), temporary loss of roosting and nursery habitat, and breeding and foraging disturbance through Project activities. To ensure impacts to bat species are mitigated to a level of less-than-significant, CDFW recommends the draft EIR be revised to include additional specific and enforceable mitigation measure, as well as a restricted work window, and defined protection buffers in the event bats are detected:

> *"Bat Habitat Assessment and Avoidance: A Qualified Biologist shall conduct a habitat assessment for bat species within and adjacent to Project site where culverts, structures and/or trees would be removed or otherwise disturbed for a period of more than two (2) hours. The assessment shall occur no more than five (5) days prior to the initiation of construction and include a visual inspection of features within 50 feet of all Project sites for potential roosting features (bats need not be present). Habitat features found during the survey shall be flagged or marked. If bats (individuals or colonies, not just roosting habitat) are detected during the habitat assessment, no work shall proceed until CDFW has been consulted.*
>
> *If any habitat features identified in the habitat assessment will be altered or disturbed by Project activities, a Qualified Biologist shall conduct two visual surveys for bats (observation of presence of bats during foraging period) and use of ultrasonic detectors (Anabat, etc.) during all dusk emergence and pre-dawn re-entry. Each survey needs to be conducted within one 24-hour period. In addition, a phased disturbance strategy shall be employed. Non-habitat trees or structural features shall be removed one (1) day prior to removal of habitat features. Permittee shall not attempt to directly disturb (e.g. shake, prod etc.) roosting features. Phased disturbance strategies shall only be permitted to occur from March 1 to April 15 or September 1 to October 15. Alternative actions may be developed in consultation with CDFW."*

6-18

Additional Mitigation Measures

Comment 12: CDFW also recommends the following avoidance and minimization measures to be included in the draft EIR:

> *"Open Pipes Restriction: All pipes, culverts, or similar structures that are stored at the construction site (either vertically or horizontally) for one or more overnight periods will be securely capped on both ends prior to storage and thoroughly inspected for wildlife prior to implementation by a Qualified Biologist.*
>
> *Fence and Sign Post Restriction: Any fencing posts or signs installed, temporarily or permanently, throughout the course of the Project shall have the top three post holes covered or filled with screws or bolts to prevent the entrapment of wildlife, specifically birds of prey."*

6-19

ENVIRONMENTAL DATA

CEQA requires that information developed in environmental impact reports and negative declarations be incorporated into a database which may be used to make subsequent or supplemental environmental determinations [Pub. Resources Code, § 21003, subd. (e)]. Accordingly, please report any special-status species and natural communities detected during Project surveys to the California Natural Diversity Database (CNDDB). The CNNDB field survey form can be found at the following link: https://www.wildlife.ca.gov/Data/CNDDB/Submitting-Data#44524420-pdf-field-survey-form. The completed form can be mailed electronically to CNDDB at the following email address: cnddb@wildlife.ca.gov. The types of information reported to CNDDB can be found at the following link: https://www.wildlife.ca.gov/Data/CNDDB/Plants-and-Animals.

6-20

CONCLUSION

To ensure significant impacts are adequately mitigated to a level less-than-significant, CDFW recommends the revisions to mitigation measures, described above, be incorporated as enforceable conditions into the revised draft EIR. CDFW appreciates the opportunity to comment on the draft EIR to assist the City in identifying and mitigating Project impacts on biological resources.

6-21

Questions regarding this letter or further coordination should be directed to Ms. Jeanette Griffin, Environmental Scientist, at (209) 234-3447 or Jeanette.Griffin@wildlife.ca.gov; or Ms. Melissa Farinha, Senior Environmental Scientist (Supervisory), at (707) 944-5579.

Sincerely,

Gregg Erickson
Regional Manager
Bay Delta Region

cc:
Office of Planning and Research, State Clearinghouse, Sacramento
Richard Mills, Department of Water Resources – Richard.Mills@water.ca.gov
Brian Coats, State Water Resources Control Board – Brian.Coats@waterboards.ca.gov
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Letter 6 California Department of Fish and Wildlife Response

6-1 The comment describes the regulatory requirements and CDFW's role. The comment informs the reader that: (1) California Endangered Species Act (CESA) Permit must be obtained if the project has the potential to result in the take of plant or animal species listed under CESA; and (2) an LSA Notification is required for project activities affecting lakes or streams and associated riparian habitat. The comment also notes that if a Findings of Overriding Consideration is required, that it does not eliminate the project proponent's obligation to comply with section 2080 of the Fish and Game Code. This comment is noted. Consultation with CDFW, as well as other resource agencies, will be initiated during the permitting phase of the project and prior to construction as needed to ensure any impacts relating to resources under their jurisdiction remain less than significant.

6-2 The comment states that the project requires notification under Fish and Game Code Section 1600 et. seq. and CDFW may require an LSA Agreement. The comment is noted and the City will submit the Notification as part of the permitting process.

6-3 The comment requests clarification regarding the description of the City's pre-1914 water rights. The City of Antioch possesses adjudicated pre-1914 appropriative water rights in the Delta with a priority date of at least 1868, and therefore from a water rights perspective has no numerical limit on how much water it can use from the Delta. The City uses its river intake and its water rights as the primary source of water and has an intake capacity of 16 mgd. Under the proposed project, the intake pump station capacity would remain the same and therefore would not result in an expansion of capacity above current levels.

6-4 The comment recommends revision of the Draft EIR to include an analysis of the impacts to Fish Restoration Program (FRP) projects. Section 3.3, *Aquatic Biological Resources* of the Draft EIR does include spatial analysis and concludes that effects are localized in the immediate vicinity of the outfall diffuser. As stated on page 3.3-38 of the Draft EIR, modelled brine water discharge across different operational scenarios showed relatively minor increases in salinities in the effluent plume under the proposed project versus existing conditions (see also Draft EIR Appendix D, Table 8 of the Near-Field modeling results). Salinities at the zone of initial dilution (ZID) under the minimum dilution modeling alternative ranged from 0.3 to 1.1 practical salinity units (psu) across operation scenarios (see Appendix D, Table 8 of the Near-Field modeling results). The maximum difference in salinity at ZID between the proposed project and existing conditions was 0.7 psu. In addition to small differences in plume salinities between the proposed project and existing conditions, the maximum ZID along the channel over the tidal cycle for all operating scenarios under the proposed project ranged from 53 to 881 feet, resulting in an extremely small area of impact relative the expansive amount of fish habitat available in the Suisun Bay and San Pablo Bay Outside the area of the ZID, salinity conditions would

return to near-ambient levels. Because the modeling demonstrates that the area of potential impact is localized in the immediate vicinity of the outfall diffuser, it can be concluded that the project would not have an effect on FRP projects, which are well outside the area of effect.

6-5 The comment states that the impacts from increased volumes of diversion have not been sufficiently described. The comment recommends that the analyses be revised to include the maximum diversion scenario by month in all year types, and include a 2-D rendering of areas where salinity would be impacted. The impact analysis in the Draft EIR includes simulated project intake operations applied to 16-year DSM2 Model hydrologic conditions (net Delta outflow) to estimate the proportion of net Delta outflow diverted by the Antioch intake, with and without the project, across the 16-year period of record. By evaluating the proportion of water diverted on monthly time steps across a 16-year period of record, this analysis captures years and months with varying diversion amounts and background hydrology (critically dry, dry, normal, above normal, and wet conditions) and, therefore, simulates a wide range of possible impacts associated with different conditions (diversion and background hydrology). The results of this analysis, on page 3.3-35 of the Draft EIR, show that "monthly mean percentage of net Delta outflow water diverted under the with-project scenario varied between 0.03 and 0.21 percent across the 1976-1991 model period of record," indicating an extremely small proportion of the outflow withdrawn by the project. Comparing the project to existing conditions, the maximum difference was 0.15 percent point. Because the modeled impact to flows in the Delta is extremely small (i.e., less than two-tenths of a percentage point), any indirect impact to salinities (or other water quality variables) in the vicinity of the project would also be expected to be extremely small and indiscernible. Therefore, additional 2-D modeling of salinity impacts is not warranted.

6-6 The comment states that fish food web impacts have not been analyzed. The comment recommends that the Draft EIR be revised to include an analysis of indirect impacts to organisms that make up the Suisun Bay and San Pablo Bay estuaries food web and additional analyses to evaluate impacts to the Low Salinity Zone (LSZ), chemical constituents of the brine discharge, dissolved oxygen (DO), and temperatures. The comment also states that the Draft EIR did not use the best available data because it did not use data from stations to the west.

Draft EIR Impact 3.3-8 provides a full analysis of potential project impacts associated with the "discharge of brine waste, which could result in direct mortality of fish species or degradation and/or loss of aquatic habitat." As stated on page 3.3-38 of the Draft EIR, and described above in response to comment 6-4, modelled brine discharge across different operation scenarios showed relatively small increases in salinities in the effluent plume under the proposed project versus existing conditions (see also also Appendix D, Table 8 of the Near-Field modeling results). In addition to small differences in plume salinities between the proposed project and existing conditions, the maximum ZID along the channel over the tidal cycle for all operating scenarios under the proposed project ranged from 53 to 881 feet, resulting in an extremely small area of impact relative the

expansive amount of fish habitat adjacent to the project site. Outside the area of ZID, salinity conditions would return to near-ambient levels.

The modeling demonstrates that the magnitude of the effect of increased discharge is relatively small: salinities at ZID under the minimum dilution modeling alternative ranged from 0.3 to 1.1 psu across operation scenarios [see Appendix D, Table 8 of the Near-Field modeling results]; the maximum difference in salinity at ZID between the proposed project and existing conditions was 0.7 psu. Other chemical constituents that are naturally occurring in Delta waters may exhibit similar relative increases within the ZID because the brine discharge is composed of concentrates of constituents removed as part of the desalination process. Additionally, the area of potential impact is localized in the immediate vicinity of the outfall diffuser, which makes up an extremely small fraction of the expansive habitat volume in the Suisun Bay and San Pablo Bay. As a result, it can be concluded that the project would not result in a discernable change in the temperature gradient in the Delta, it would not affect the size or position of the Low Salinity Zone, and would not result in degradation or loss of aquatic habitat to an extent which would result in an effect on the regional fish food web. Further, because the effect is localized, there is no need to include data from additional stations to the west in the analysis, because the stations are located well outside the area of effect.

Additionally, because the impact to flows in the Delta was modeled to be minor and localized, any indirect impact to salinities, the food web, DO, or temperatures in the broader estuary, associated with flow-related effects, would also be expected to be relatively minor and localized. Therefore, additional analyses of indirect impacts would be warranted.

6-7 The comment states that analysis should include impacts to the Low Salinity Zone. See response to comment 6-5 regarding the effect of increased diversions on the salinities. While monthly impacts to the low salinity zone was not modeled, the monthly diversion of net Delta outflow was modeled over a 16-year period of record. As described above, because the modeled impact to flows in the Delta was extremely small (i.e., less than two-tenths of a percentage point), any indirect impact to the low salinity zone in the vicinity of the project would also be expected to be extremely small and indiscernible. Therefore, additional analysis is not warranted.

6-8 The comment suggests revising the EIR to include analysis of chemical composition of brine releases compared to baseline seasonal variances and identify impacts to the low salinity zone. As described on page 3.3-39 of the Draft EIR, modelled brine water discharge results indicate a relatively small difference in salinity between the proposed project and existing conditions (maximum difference of 0.7 psu), with that change only extended from 53 to 881 feet at a maximum, indicating a very small area of low magnitude impact. Other chemical constituents that are naturally occurring in Delta waters may exhibit similar relative increases within the ZID because the project brine discharge is composed of concentrates of constituents removed as part of the

desalinization process. Because the magnitude of the effect is small and extremely localized, additional analysis of impacts to the low salinity zone is not warranted.

6-9 The comment requests clarification for dilution model simulations run and inclusion of minimum, optimal, and maximum diversion amounts referencing changes over area and time for drought, surplus, and optimal year types.

The dilution analysis presented in the Draft EIR includes a range of conditions represented by different scenarios and combinations of discharge/brine production/receiving water hydrology. See discussion of model assumptions starting on page 3.3-38 and Appendix D of the Draft EIR. In addition, the modeling relied on conservative assumptions to examine the maximum potential impact. The modeling used a conservative assumption for the salinity of the brine water discharge, by using the peak brine concentration of 32,000 mg/L across the modeling run. In addition, salinities were compared between the proposed project and existing conditions at the minimum dilution. Likewise, the maximum difference in salinity across scenarios and maximum area of impact was used to evaluate the impact of the Project (page 3.3-39), in order to be conservative (avoid underestimating the impact).

6-10 The comment states that there is insufficient mitigation to reduce impacts to less-than-significant levels and suggests a number of additional measures to include. As described in Section 3.10, *Local Hydrology and Water Quality*, the Construction General Permit requires preparation and implementation of a Stormwater Pollution Prevention Pollution Program (SWPPP). Implementation of the SWPPP would require application of best management practices (BMPs) to reduce impacts to erosion, water pollution, spill prevention measures, equipment and fuel storage etc. (see Impact 3.10-1 on page 3.10-17 of the Draft EIR). The BMPs would include, but would not be limited to, physical barriers to prevent erosion and sedimentation, construction of sedimentation basins, limitations on work periods during storm events, use of infiltration swales, protection of stockpiled materials, and a variety of other measures that would substantially reduce or prevent erosion and the potential for impacts to surface water quality from occurring during construction. Compliance with and implementation of Construction General Permit requirements would reduce such impacts to less-than-significant levels and additional measures are not warranted.

6-11 The comment recommends a number of avoidance and minimization measures to ensure that impacts to special-status fish are mitigated to a less-than-significant level. These measures are already included in the Draft EIR as follows:

- **Work window of August 1 – Nov 30**. Mitigation Measure 3.3-3b on page 3.3-25 of the Draft EIR would require implementing a more conservative in-water work windows of August 1 - October 31.

- **Biological monitoring.** Mitigation Measure 3.3-3b on page 3.3-25 of the Draft EIR already requires “a qualified biologist or resource specialist shall be present during such work to monitor construction activities and ensure compliance with terms and conditions of permits issued by regulatory agencies.”

- **Underwater acoustic monitoring:** Mitigation Measure 3.3-4 on page 3.3-28 of the Draft EIR would require underwater sound level monitoring during pile-driving activities.

- **Compensatory mitigation requirements for special-status fish as minimum 3:1 ratio for permanent, and 1:1 ratio for temporary impacts.** Mitigation Measure 3.3-3d on page 3.3-26 of the Draft EIR would require implementing additional measures as part of obtaining permit approvals. In addition, Mitigation Measure 3.3-5 on page 3.3-29 of the Draft EIR would require the purchase of mitigation credits as determined in consultation with agencies.

6-12 The comment suggests inclusion of a mitigation measure to state intake pipes shall be fitted with fish screens that meet CDFW screening criteria to prevent both entrainment and impingement of fish species. The Project Description on page 2-16 already describes fish screens that pipelines will be equipped with: "Each of the pipelines would be equipped with a fish screen that meets the protective criteria of the California Department of Fish and Wildlife (CDFW) and National Marine Fisheries Service (NMFS)." In addition, as stated on page 3.3-31 of the EIR under Impact 3.3-7, "The proposed intake structure… would include a fish screen designed to meet or exceed applicable NMFS and CDFW criteria (and USFWS recommended guidelines for tidal waters), which would minimize the potential for fish entrainment and impingement for most species and life stages."

6-13 The comment states that the EIR lacks mitigation for special-status plant impacts and recommends the addition of a mitigation measure for special-status plant assessment and avoidance. As described on page 3.4-6 of the EIR, the initial list of plant and wildlife species considered for potential effects of the proposed project were identified using the U.S. Fish and Wildlife Service (USFWS) Species List (USFWS, 2017); CDFW California Natural Diversity Database (CNDDB) commercial version for 7.5-minute topographic quadrangles Diablo, Tassajara, Byron Hot Springs, Clayton, Antioch South, Brentwood, Honker Bay, Antioch North, and Jersey Island (CDFW, 2017); and California Native Plant Society, Inventory of Rare and Endangered Plants (online edition, v8-02) (CNPS, 2017). This preliminary list was further screened to assess habitat for rare plants in the project area on a field review on December 16, 2017. Refer to Draft EIR Appendix C, Special-Status Terrestrial and Wildlife Species Considered for a complete list of these species, and the likelihood of occurrence. Table C-1 does not identify impacts to special-status plants, as the comment states. While Table C-1 considered many rare plants that occur in the regional project vicinity, the table identified no rare plants with potential to occur in the project area.

Table C-1 in Appendix C notes that the potential for species occurrence within the project area for Mason's lilaeopsis (*Lilaeopsis masonii)* is unlikely. As stated on pages 3.4-6 and 3.4-7 of the Draft EIR, "none of the special-status plant species identified in Appendix C are expected to occur on the project footprint due to the absence of habitat on the site, or because the project is outside of the species' known range…Focused botanical surveys were not warranted for the project because the project component sites are entirely

developed or disturbed and habitat for rare plant species was not identified on the San Joaquin River waterfront. In addition, no sensitive natural communities are present within the project footprint." The proposed project would not result in a potentially significant impact to special-status plants. Therefore, there is no nexus to require the project to include the suggested mitigation measures suggested for special-status plant impacts.

6-14 The comment recommends the inclusion of specific measures for project impacts on nesting birds. Impact 3.4-1 on pages 3.4-22 to 3.4-24 of the Draft EIR analyzes the project impacts on nesting birds. This section also provides Mitigation Measure 3.4-1a, which would reduce impacts to nesting birds to a less-than-significant level by requiring pre-construction nesting bird surveys for species protected by the Migratory Bird Treaty Act and Fish and Game Code. The mitigation includes specific measures for the timeframe of construction activities, schedule for surveys, buffer distances, and protocol in the event active nests are found. CDFW does not have a standard protocol to survey for nesting birds. While the comment recommends an alternative protocol to survey for nesting birds, it does not cite any deficiencies with the proposed survey methodology or with the environmental impact analysis.

6-15 CDFW recommends the use of compensatory mitigation for burrowing owls at a 3:1 ratio for permanent impacts and 1:1 for temporary impacts to burrowing owl habitats, and recommends that Mitigation Measure 3.4-1a be updated to include the survey and reporting methodology in the CDFW 2012 *Staff Report on Burrowing Owl Mitigation*. As stated in the Draft EIR (page 3.4-22), burrowing owl could potentially nest in the annual grasslands to the north of Pittsburg-Antioch Highway in the vicinity of the project footprint. In this area, the pipeline would be within the paved highway and would not temporarily or permanently impact burrowing owl habitat. Hence, recommended compensatory mitigation would not apply to the project. It is possible that owls nesting near the Pittsburg-Antioch Highway, if present, could be subject to noise or construction-related disturbances. The comment requests updating Mitigation Measure 3.4-1a to reflect the recommendations of the CDFW 2012 *Staff Report on Burrowing Owl Mitigation*. The Draft EIR, pages ES-11 and 3.3-24 are revised as follows:

Mitigation Measure 3.4-1a: Pre-construction Nesting Bird Surveys

c) Burrowing owl Take Avoidance Surveys shall be conducted according to the methodologies prescribed in the CDFW *Staff Report on Burrowing Owl Mitigation* (CDFG, 2012) for annual grasslands located north of the Pittsburg-Antioch Highway. Take Avoidance Surveys shall be conducted 14 days prior or less to initiating ground disturbance. As burrowing owls may recolonize a site after only a few days, time lapses greater than 14 days between project activities require subsequent surveys, including but not limited to a final survey conducted within 24 hours prior to ground disturbance to ensure absence. Surveys are intended to identify burrows and burrowing owls outside of the study area, which may be impacted by factors such as noise and vibration (heavy equipment) during project construction. As no access is available to grasslands north of the highway, a pedestrian surveys transect shall be performed from the northern edge of the public right-of-way.

i. If burrowing owls are detected during surveys, the following restricted activity dates and setback distances derived from the 2012 Staff Report on Burrowing Owl Mitigation (CDFG 2012) shall apply, or as otherwise coordinated with the CDFW:

1. Occupied burrows shall not be disturbed during the nesting season, from February 1 through August 31;

2. No disturbance shall occur within 50 meters (approximately 160 feet) of occupied burrows during October 16 through March 31 or within 200 meters (approximately 660 feet) April 1 through October 15;

3. No earth-moving activities or other disturbance shall occur within the aforementioned buffer zones of occupied burrows. These buffer zones shall be well-marked. If burrowing owls were found in the study area, a qualified biologist shall also delineate the extent of burrowing owl habitat on the site; and

4. Buffers may be modified by a qualified burrowing owl biologist that is knowledgeable enough to establish buffer sizes that are commensurate with the acclimation of western burrowing owls to disturbance. These buffers if modified over that prescribed above, shall be coordinated with the CDFW.

5. Because no burrowing owl habitat occurs on-site, passive relocation of owls is not anticipated. Information regarding the occurrence of burrowing owls near the project site shall be reported to the CNDDB.

6-16 CDFW recommends that Mitigation Measure 3.4-1a be revised to reflect the Swainson's hawk survey methodology from the Swainson's Hawk Technical Advisory Committee's 2000 report, *Recommended Timing and Methodology for Swainson's Hawk Nesting Survey in California's Central Valley*. In response to the comment, Mitigation Measure 3.4-1a on Draft EIR, page 3.3-24 is revised as follows:

Mitigation Measure 3.4-1a: Pre-construction Nesting Bird Surveys

d) Preconstruction Surveys for Swainson's hawk and white-tailed kite. If construction activities occur between February 1 and August 31, the Project Applicant shall retain a qualified biologist to conduct surveys for Swainson's hawk and white-tailed kite in accordance with the Swainson's Hawk Technical Advisory Committee 2000 guidelines (SHTAC 2000), or current guidance. Surveys shall cover a minimum of a 0.5-mile radius around the construction area. If nesting Swainson's hawks or white-tailed kites are detected, the qualified biologist shall establish a 0.5-mile no-disturbance buffer. Buffers shall be maintained until the qualified biologist has determined that the young have fledged and are no longer reliant upon the nest or parental care for survival. No habitat loss would occur for either species; hence, compensatory mitigation is not necessary.

6-17 Please see the response to Comment 6-16.

6-18 The comment recommends the inclusion of specific measures for project impacts on western red bat. Impact 3.4-1 on pages 3.4-25 to 3.4-26 of the Draft EIR analyzes the project impacts on western red bat. This section also provides Mitigation Measure 3.4-1b, which would reduce impacts to roosting bats to a less-than-significant level by requiring pre-construction roost surveys within 200 feet of project activities. The mitigation includes specific measures for the timeframe of construction activities, schedule for surveys, buffer distances, and protocol in the event active bat roosts are found. CDFW does not have a standard protocol to survey for roosting bats. While the comment recommends an alternative protocol to survey for roosting bats, it does not cite any deficiencies with the proposed survey methodology or with the environmental impact analysis.

6-19 CDFW requests the inclusion of two avoidance and minimization measures for the EIR to avoid and minimize impacts to common wildlife: a requirement that pipes be securely capped and inspected by a qualified biologist prior to use, and a requirement that fence and sign posts be capped to prevent wildlife entrapment. While the project will require extensive use of pipes, construction would be mostly an urban build and no special-status species have been identified that would enter pipes. Hence, no significant impacts are identified that would necessitate the capping of pipes or inspection of pipes by a qualified biologist. In addition, no fence or sign posts would be erected by the project. Therefore, avian species would not be subject to entrapment in fence or sign posts. Hence, the recommendation to add additional avoidance and minimization measures is noted.

6-20 The comment requests that a completed CNDDB field survey form be submitted for any special-status species and natural communities detected during project surveys. As noted on pages 3.4-7 to 3.4-10 of the EIR, suitable habitat for burrowing owl, white-tailed kite, and loggerhead shrike were identified in the project area; however, they were not identified within the project footprint. It is standard for surveying biologists to report the occurrence of special-status species to the CNDDB. The comments do not reflect a deficiency in the Draft EIR analysis; therefore, these comments are noted, and no additional analysis is warranted.

6-21 Comment noted. Responses to each comment are provided above.

Comment Letter 7

SAN FRANCISCO BAYKEEPER®

Transmitted via email

August 13, 2018

Scott Buenting
Project Manager
City of Antioch
PO Box 5007
Antioch, California 94531-5007
Email: SBuenting@ci.antioch.ca.us

Re: City of Antioch Brackish Water Desalination Project SCH# 2017082044

Dear Mr. Buenting:

On behalf of San Francisco Baykeeper ("Baykeeper") and our over 5,000 members and supporters, I am writing to comment on the Draft Environmental Impact Report ("DEIR") for the Antioch Brackish Water Desalination Project ("Project").

1. **The DEIR Fails to Evaluate the Potential that the Project Will Cause or Contribute to Violations of Water Quality Standards for Selenium in North San Francisco Bay.**

Baykeeper is primarily concerned that the DEIR fails to fully evaluate the water quality impacts from the discharge of brine. As stated in the DEIR, the volume of brine discharge will range from 13% to 21% of the total discharges from the Delta Diablo Sanitary District Wastewater Treatment Plant ("DDSD")[1] While the DEIR evaluates the impact of Total Dissolved Solids, the DEIR wholly fails to evaluate the potential impact of other pollutants, in particular selenium, being discharged through the highly-concentrated brine.

North San Francisco Bay, including portions of the Delta, Suisun Bay, and portions of the Central Bay, is impaired for selenium due to bioaccumulation of selenium in fish tissue. "The observed bioaccumulation of selenium in fish is the basis of impairment of the estuarine habitat (EST) and could pose a threat to other estuarine organisms including waterfowl and shorebirds. Other designated uses of the Bay, such as preservation of rare and endangered species (RARE) as well as commercial and sport fishing (COMM) could also be affected by selenium."[2] 7-1

In 2015, the San Francisco Bay Regional Water Quality Control Board amended the Water Quality Control Plan for the San Francisco Bay Basin to establish a Total Maximum Daily Load ("TMDL") and Implementation Plan for Selenium in North San Francisco Bay. The U.S. Environmental Protection Agency ("EPA") is in the process of finalizing Revised Numeric Criteria for Selenium for the San Francisco Bay and Delta. Both the TMDL and revised numeric criteria for selenium in North

[1] DEIR, Table 2-8, p. 2-60.
[2] North San Francisco Bay Selenium TMDL Staff Report (November 2015) at p. 5, *available at* https://www.waterboards.ca.gov/sanfranciscobay/board_info/agendas/2015/November/6_appendix_c.pdf.

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San Francisco Bay contain concentration-based targets for selenium in fish tissue. Recent monitoring conducted by the U.S. Geological Survey ("USGS") and the San Francisco Bay Regional Monitoring Program shows that these standards are not being met.[3]

The discharge point for DDSD is just upstream of areas that are listed as impaired for selenium. However, the DEIR does not mention selenium and fails to analyze the consequences of discharging brine that will have concentrations of selenium that are four times that of the intake water. The DEIR must be revised to analyze the impact of the selenium in the brine discharge, as well as the impact of these discharges on the implementation of the TMDL.

The DEIR should also analyze the cumulative impacts of this project with respect to implementation of the California WaterFix project, which is anticipated to result in a significant increase in selenium concentrations in fish tissue concentrations for the federally-listed green sturgeon (find citation). Renowned USGS scientist Dr. Sam Luoma has warned of the risks associated with selenium resulting from proposed Delta water diversions such as the WaterFix, as well as this Project, stating that "It's clearly a serious problem and it could get worse", and "We're trading clean Sacramento River water and in return we're getting low-quality San Joaquin River water."[4] An EPA scientist was quoted in the same article saying "we shouldn't be adding any more selenium into the system."[5]

While neither the WaterFix nor this Project will likely increase selenium loads, increased concentrations pose serious risks to wildlife. Suisun Bay has demonstrated itself highly sensitive to slight modifications in selenium concentrations. The DEIR must analyze these effects to determine the potential for further exacerbating water quality impacts and exceedances of existing numeric selenium targets.

7-1 cont.

2. The NPDES Permit for DDSD Must Be Amended to Reflect the Brine Discharges and to Ensure the Discharges Will Not Result in a Violation of Water Quality Standards.

During the scoping process, the Delta Diablo Sanitary District raised several issues related to the impact of the brine discharges on its National Pollutant Discharge Elimination System ("NPDES") permit.[6] Specifically, DDSD noted that the NPDES permit must properly characterize DDSD's discharges.[7] DDSD also stated that "the brine would be expected to contain elevated levels of many additional chemicals of concern in addition to TDS."[8]

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[3] *See* Sun, Jennifer; Davis, Jay; Stewart, Robin. Draft RMP Technical Report, Selenium in Muscle Plugs of White Sturgeon from North San Francisco Bay, 2015-2017, attached hereto as **Exhibit A**.
[4] Taugher M., *Environmental poison in San Francisco Bay could increase with Delta Water Plan* (Contra Costa Times, September 15, 2011), available at https://www.mercurynews.com/2011/09/15/environmental-poison-in-san-francisco-bay-could-increase-with-delta-water-plan/ (accessed online on August 13, 2018).
[5] *Id.*
[6] Letter from Phil Govea, P.E. to Scott Buenting, re: Comments on the Notice of Preparation of an Environmental Impact Report and Scoping Meeting for the City of Antioch Brackish Water Desalination Project, September 14, 2017 ("DDSD Scoping Comments").
[7] *Id.* at 2.
[8] *Id.*

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The DEIR wholly fails to respond to these significant concerns raised by DDSD. Baykeeper raised the issue of increased concentrations of selenium in Comment 1 above, however, the DEIR also fails to assess elevated levels of other additional pollutants, as indicated by the DDSD Scoping Comments. The DEIR must be revised to fully consider the impacts of increased concentration of all pollutants that are discharged via the brine, in addition to TDS.

Moreover, the DDSD NPDES permit must be amended to account for the addition of the brine discharges. Since the current NPDES permit does not include the brine discharges that will result from the Project, the NPDES permit must be amended to characterize the pollutants that will be discharged as a result of adding the brine. Moreover, the NPDES permit must also be amended to include appropriate effluent limits and monitoring to account for the addition of different types of pollutants from the brine. Currently, DDSD's NPDES Permit includes effluent limits and requires monitoring for BOD, TSS, oil & grease, pH, Total residual chlorine, copper, cyanide, dioxin-TEQ, and Total Ammonia.[9] These parameters do not indicate the additional pollutants that will be discharged once the brine is added to the effluent stream. The Final EIR should be clear that the Project will require that DDSD's NPDES permit will be amended to characterize the brine discharges properly and to include effluent limits and monitoring for all pollutants that will discharged, including but not limited to those standard parameters listed above. 7-2

3. The DEIR Does Not Include Sufficient Evidence to Support its Conclusion that the Fish Screens Will Effectively Protect Fish from Impingement.

The DEIR determines that "the new diversion would include fish screen designed to meet or exceed applicable NMFS and CDFW criteria (and USFWS recommended guidelines for tidal waters), which would minimize the potential for fish entrainment and impingement for most species and life stages."[10] The DEIR also states that "entrainment or impingement of Chinook Salmon, Steelhead, and Green Sturgeon is unlikely because these species would only be present in the vicinity of the intake as juvenile or adult life stages, which are not vulnerable to entrainment or impingement because fish screen design and operating criteria would be protective."[11] The DEIR goes on to say that the fish screens for the Project are designed similarly to the fish screen for the WaterFix.[12] 7-3

The effectiveness of fish screens in protecting juvenile salmon from impingement depends greatly on their design, and the design of the intakes proposed by the WaterFix fail to protect fish species. For instance, fish screens are less effective when the intake structure is placed at a gentle curve or in relatively straight sections of a waterway.[13] The intake structure proposed for the Project is located in a slight curve of the San Joaquin River, but the DEIR fails to specifically analyze whether the location of the intake structure will undermine the effectiveness of the fish screen. The EIR must be revised to include this analysis.

[9] DEIR at 3.11-18.
[10] DEIR at 3.3.-37.
[11] DEIR at 3.3-31.
[12] DEIR at 3.3-41.
[13] Dave Vogel, *The Twin Tunnels Project: A Disaster for Salmon, Part 1 of a Series* (California Fisheries Blog, July 3, 2017), available at http://calsport.org/fisheriesblog/?p=1741.

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In addition, the velocity at which the intake structures pull in water can greatly affect whether fish, especially juvenile salmon, will be impinged on the screen. The DEIR states that, like the WaterFix, this Project "would be designed to avoid and/or minimize velocity gradients."[14] The DEIR does not state what specific design criteria will be implemented and therefore does not provide substantial evidence for the DEIR's conclusion regarding the effectiveness of the fish screens. Moreover, the WaterFix design will result in velocities that will not prevent impingement of juvenile salmon.[15] The National Marine Fisheries Services has established a criterion that young salmon should not be exposed to fish screens for more than 60 seconds, which the WaterFix design will not meet.[16] The DEIR has not evaluated whether this Project will meet this criterion. The EIR must be revised to include this evaluation.

7-3 cont.

4. The DEIR Fails to Analyze Reasonable Alternatives.

Chapter 5 of the DEIR purports to analyze alternatives to the Project; however, the DEIR fails to fully consider an alternative that could reduce the impacts of brine discharges, fails to consider alternatives to brine disposal, and does not consider the impact of water conservation and efficiency efforts.

First, the alternatives analysis purports to analyze the option of installing a short section of new pipe to connect the existing pipeline from the river to the existing pipes that supplies water from the Reservoir. The DEIR states that "[t]his option could lower the TDS concentration of the RO feed water, which could reduce the need for RO treatment (thereby using less energy) and would lower the TDS concentration of the brine."[17] The DEIR combined this with a proposal that would reduce the footprint of the intake facility. The DEIR then dismisses this alternative because the reduced footprint intake facility would not meet all the objectives of the Project, but this analysis does not indicate why the City could not (or should not) go forward with the raw water pipeline connection option. The Final EIR should fully analyze this option, as it appears that it would reduce construction impacts, as well as reduce energy use and the water quality and species impacts from brine discharges. Although the City has not determined that these impacts are significant, for the reasons stated in this letter, the DEIR has failed to evaluate potential significant impacts from the brine discharges. Moreover, further evaluation of this alternative may help the decisionmakers determine whether the raw water pipeline connection option should be implemented, even if it is not necessary to avoid significant impacts.

7-4

Second, the DEIR fails to analyze alternatives to brine discharge other than discharge via DDSD. Engineered wetlands have shown promise for reducing heavy metals and other contaminant and at least two (2) California-based projects could be relied upon for lessons learned, based in Oxnard and at the Santa Clara Valley Water District's ("SCVWD") Silicon Valley Advanced Water Purification

7-5

[14] DEIR at 3.3-41.
[15] *See* Dave Vogel, *The Twin Tunnels Project: A Disaster for Salmon, Part 2 of a Series* (California Fisheries Blog, August 2, 2017), available at http://calsport.org/fisheriesblog/?m=201708&paged=2.
[16] *See id.*; *see also* National Marine Fisheries Service Southwest Region, Fish Screen Criteria for Anadromous Salmonids (January 1997) at p. 7, *available at* http://www.westcoast.fisheries.noaa.gov/publications/hydropower/southwest_region_1997_fish_screen_design_criteria.pdf.
[17] DEIR at 5-10; *see also id.* at 5-13.

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Center. A three-year pilot project conducted by the City of Oxnard, California, studied the ability of engineered brackish wetlands of various types to remediate and thrive in RO concentrate (CH2M, 2007b). The wetlands chosen for study consisted of mesocosm "bins" with controlled flow conditions and plant communities chosen based on compatibility with an average RO concentrate TDS of approximately 5,000 mg/l.[18] The study concluded removal of "non-conservative" elements (nitrate, phosphorus, selenium, and copper among others) from water indeed occurred through natural chemical and biological processes, and the extent of removal depended on the wetland type used.[19] The removal was most pronounced for selenium, nitrate, and phosphorus. Following these promising results, Oxnard has constructed engineered wetlands at their purification facility for further testing. The Santa Clara Valley Water District is also currently evaluating the use of treating reverse osmosis concentrate with engineered wetlands. Early results should be reviewed to establish additional information regarding feasibility and effectiveness.

7-5 cont.

Finally, the only alternatives the DEIR analyzes are variations on building the desalination plant. The DEIR does not analyze conservation, stormwater capture, recycling, or any combination of these water supply options in its alternatives analysis. These options can significantly reduce demand for water supplies, while also being more cost-effective than large water infrastructure projects.[20] Even if these options may not be a viable alternative the Project, the City should invest in water conservation, stormwater capture, and recycling to eliminate the need to divert even more water from the San Joaquin River as population increases.

5. The City Should Fully Remove the Existing Pump Station as It Moves Forward with the Project.

The DEIR states that the existing pump station would be demolished and piles under the pump station would be removed, but the existing pier leading up to the pump station would remain in place.[21] It is unclear if there is any reason to leave the existing pier once the pump station has been removed. Remnants of old piers, which are treated with creosote or other chemicals, continue to leach toxins into the water, can cause other negative impacts to species, and are unsightly, causing negative aesthetic impacts.[22] Unless removing the pier would cause additional environmental impacts, Baykeeper urges the City to remove all of the old infrastructure that will no longer be used as a result of this Project.

7-6

[18] MNS Engineers. (2017). *Revised Final Advanced Water Purification System Feasibility Study*. Accessed on Aug 13, 2018, *available at* www.cityofpaloalto.org.
[19] CH2M HILL. (2005). *Additional Testing for the Membrane Concentrate Pilot Wetlands Project*. City of Oxnard.
[20] *See* Pacific Institute and NRDC, *The Untapped Potential of California's Water Supply: Efficiency, Reuse, and Stormwater* (June 2014), attached hereto as **Exhibit B**; *see also* NRDC, *Proceed with Caution II: California's Droughts and Desalination in Context* (March 2016), attached hereto as **Exhibit C**.
[21] DEIR at 2-17.
[22] *See* Werme, Christine *et a*l. *Removal of Creosote-Treated Pilings and Structures from San Francisco Bay* (San Francisco Estuary Institute, December 2010), at p. 1, 22-32, *available at* https://www.sfei.org/sites/default/files/ReportNo605_Creosote_Dec2010_finalJan13.pdf.

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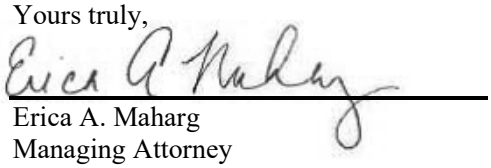
Conclusion

Baykeeper appreciates the opportunity to comment on this Project and the City's consideration of the issues raised in this letter. If you have any questions or concerns, please contact me at erica@baykeeper.org or 510-735-9700, x106.

Yours truly,



Erica A. Maharg
Managing Attorney

Draft RMP Technical Report

Selenium in Muscle Plugs of White Sturgeon from North San Francisco Bay, 2015-2017

Jennifer Sun and Jay Davis
San Francisco Estuary Institute

Robin Stewart
United States Geological Survey

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Executive Summary

This report presents the findings from a study evaluating selenium concentrations in white sturgeon (*Acipenser transmontanus*) muscle tissues collected from live sturgeon during the California Department of Fish and Wildlife's fall sturgeon tagging studies in North San Francisco Bay. The goal of this study was to non-lethally collect a large number of sturgeon muscle plugs and analyze them for selenium, in order to (1) establish an understanding of current status, trends, and drivers of variability in sturgeon muscle selenium concentrations and (2) establish an opportunity for long-term sturgeon selenium monitoring with muscle plugs, through development of field and laboratory methods and informing the monitoring design. Monitoring of selenium in white sturgeon is needed to evaluate the effectiveness of the TMDL for selenium in the North Bay. This technical report provides documentation of the study and presents its major findings in the context of all historically available data on sturgeon muscle selenium concentrations in San Francisco Bay.

Sample collection was conducted through a collaboration with the California Department of Fish and Wildlife (CDFW), which conducts an annual sturgeon tagging survey in August-October in Suisun and San Pablo Bays to track trends in the population. This effort presents a unique, long-term opportunity to non-lethally collect a large number of sturgeon muscle tissue samples for selenium analysis using muscle plugs. Through this collaboration, a large number of samples – 30 samples in 2015, 38 samples in 2016, and 58 samples in 2017 – were successfully collected and analyzed for selenium. This work established monitoring in collaboration with CDFW as the most feasible, cost-effective, and least-invasive method for collecting sturgeon muscle tissue samples for monitoring status and trends in sturgeon selenium concentrations.

The Muscle Plug study presented an opportunity not only to establish a 3-year baseline of current adult sturgeon selenium concentrations, but also to evaluate the effect of annual hydrology on sturgeon selenium concentrations. Selenium was elevated in sturgeon monitored in 2015 (mean=11.8 ug/g dw), a critically dry water year, and slightly lower but still elevated in 2016, a below normal water year (mean=10.6 ug/g dw). In contrast, concentrations in 2017, a wet water year, were significantly lower (mean=7.3 ug/g dw) than in 2015 and 2016. This suggests that the elevated sturgeon selenium concentrations observed between fall 2014 and spring 2017 in the present study and a companion study (the Sturgeon Derby Study - Sun et al. 2018 in prep.) were driven largely by hydrology rather than changes in selenium sources or loads.

Hydrology, fish length, and several additional potential drivers of sturgeon muscle selenium variability were further analyzed using all available historical data for San Francisco Bay. These included biological factors (fish length or age, sex, and reproductive stage) and environmental factors that affect dietary selenium, including annual and seasonal hydrology (freshwater inflow from the Delta, assessed using water year type and month of sampling) and foraging location. Analyses of these individual factors were then used to inform both statistical analyses of long-term trends and the long-term monitoring design for sturgeon muscle selenium.

The results of the larger analysis indicate that annual hydrology, fish length, and foraging location are significant drivers of variability in sturgeon muscle selenium concentrations. Water year type could only be evaluated using the current study – the only one with a consistent sampling design spanning multiple

water year types. Juveniles (< 105 cm total length) were shown to have significantly lower selenium concentrations than adults, but no significant relationship between length and selenium concentrations was observed among adults. Elevated selenium concentrations are observed in North Bay compared to the Delta or other regions of the Bay. In contrast, sex was not found to be a significant driver of selenium concentrations. Additionally, data were too limited and sparsely distributed to statistically evaluate the effect of reproductive stage or season, but available data do not suggest a strong effect from either factor.

The results of these analyses suggest that future monitoring should focus on adults only, target an equal distribution of lengths across the target size range, and does not need to account for sex or reproductive stage through blood plasma sex steroid analyses. Several factors cannot be controlled (annual hydrology) in the future monitoring design, or are fixed based on the CDFW monitoring design (season = fall monitoring; foraging location = primarily North Bay). However, the significant influence of annual hydrology on sturgeon muscle selenium concentrations indicates that water year type should be included as a covariate in future long-term trend analyses.

Mixed effects models were explored to control for individual or interacting effects of these drivers on sturgeon muscle selenium concentrations while analyzing for long-term selenium trends in sturgeon muscle selenium. The most parsimonious model evaluated indicated a significant declining trend between 1986 and 2017. However, the long-term trend identified by this model was weak, and did not persist if the anomalously high selenium concentration years of 1989 and 1990 were removed from the model. The robustness of this analysis is also limited by the sparse data available to run these models, and therefore the conclusions of this analysis should be considered preliminary.

Overall, this study successfully established an approach for long-term sturgeon muscle plug monitoring, as well as a current baseline of selenium concentrations against which long-term trends can be evaluated. Data show that selenium concentrations have occasionally been elevated in recent years, with annual mean concentrations above the TMDL numeric target; however, trend analyses do not suggest long-term increasing concentrations. Continued long-term monitoring of sturgeon muscle plugs, using a consistent monitoring design informed by the results of this pilot study (Grieb et al., in prep), will ultimately provide valuable information on long-term trends in selenium concentrations in white sturgeon in the North Bay, and the effectiveness of the North Bay Selenium TMDL.

Introduction

Selenium (Se) is an essential micronutrient that can bioaccumulate and become toxic at concentrations just an order of magnitude greater than those required for biological function (SFBRWQCB 2015). Since 1998, San Francisco Bay has been identified as impaired by Se under the Clean Water Act, with levels of potential concern in diving ducks and fish, including white sturgeon (*Acipenser transmontanus*), particularly in North San Francisco Bay. The primary source of Se loading into North Bay is runoff from Central Valley watersheds through the Delta, including agricultural return flows from regions in which selenium is naturally occurring in soils. Petroleum refineries and runoff from local tributaries contribute additional inputs of Se; minor sources include other industrial and municipal dischargers and atmospheric deposition (SFBRWQCB 2015). Despite significant selenium load reductions from both Central Valley runoff and petroleum refineries since the 1990s, selenium concentrations in wildlife have continued to occasionally exceed toxicity thresholds and regulatory guidelines (Presser and Luoma 2013, SFBRWQCB 2015).

To address Se impairment, the San Francisco Bay Regional Water Quality Control Board initiated development of a Se total maximum daily load (TMDL) for North San Francisco Bay in 2007. The TMDL that was formally approved in 2016 established numerical fish tissue targets for muscle and whole body samples (11.3 and 8.0 ug/g dw, respectively), which were subsequently adopted as numeric targets for the North Bay in the Basin Plan. The North Bay TMDL and the numeric targets established within it apply to the region extending from Suisun Bay to the Bay Bridge in Central Bay. In June 2016, the US Environmental Protection Agency (USEPA) also released draft revised Clean Water Act criteria for fish tissue in the entire San Francisco Bay-Delta. The criteria proposed for muscle and whole body fish tissue (11.3 and 8.5 ppm dw) for the protection of wildlife were similar to the targets in the North Bay TMDL. These criteria were proposed as instantaneous measurements not to be exceeded.

White sturgeon was identified in the North Bay TMDL as the key indicator species to be monitored to measure attainment of the TMDL muscle tissue target. White sturgeon is a bottom-feeding species that is considered particularly vulnerable to Se exposure in the Bay because its diet consists primarily of the Se-rich overbite clam (*Potamocorbula amurensis*) (Stewart et al. 2004; Beckon and Maurer 2008; Zeug et al. 2014). Studies suggest that this invasive clam species is up to 10 times slower at releasing accumulated selenium compared to other sturgeon prey species (Stewart et al. 2004). Although white sturgeon can be found from South San Francisco Bay to the upper reaches of the Sacramento and San Joaquin River systems, where they spawn, the San Francisco Bay white sturgeon population predominantly resides and feeds in the North Bay, which hosts a large population of overbite clam. Attainment of the TMDL target in white sturgeon is expected to be protective of other species in the Bay as well, include green sturgeon, which are currently listed as a threatened species.

In order to support implementation of the TMDL, the Selenium Workgroup of the Regional Monitoring Program for Water Quality in San Francisco Bay has been developing a monitoring method that will allow for the routine collection of large numbers of white sturgeon muscle tissue samples. During RMP Status and Trends sport fish sampling in 2009 and 2014, and the 2016 and 2017 RMP Sturgeon Derby special study, paired muscle plug and fillet samples were analyzed for selenium as part of an effort to establish a non-lethal and efficient method of collecting sturgeon muscle tissue using plugs. Results from these studies show that muscle plug and muscle fillet selenium are strongly correlated,

indicating that muscle plugs can be used as proxies for muscle fillets to monitor selenium in sturgeon muscle tissue (Sun et al. 2017; Sun et al. [in prep]).

The RMP piloted this muscle plug monitoring method on live white sturgeon in 2014, through a collaboration with the California Department of Fish and Wildlife (CDFW), which collected samples for the RMP *pro-bono* during its annual sturgeon population tagging survey in North Bay (Sun et al. 2016). This pilot study identified several challenges in field sample collection (i.e., staff capacity and sample storage) and laboratory analysis (i.e., sample storage). The purpose of the current study was to non-lethally collect and analyze a large number of sturgeon muscle plugs for selenium, address the logistical challenges, establish a baseline of current sturgeon muscle selenium concentrations, and further assess this opportunity to conduct long-term sturgeon selenium monitoring. To achieve these goals, this Study addressed several objectives:

1. evaluate the current status and long-term trends in sturgeon muscle selenium concentrations;
2. assess drivers of variability in sturgeon muscle selenium concentrations, in order to constrain variability in future monitoring designs and statistical analyses;
3. pilot the muscle plug monitoring and selenium analysis methods; and
4. inform the long term monitoring design.

This report presents results from the 2015-2017 Muscle Plug study and evaluates the current status and trends in sturgeon muscle selenium in the context of all available sturgeon muscle selenium data collected in San Francisco Bay. These analyses are then used as the basis for recommendations for the development of a long-term monitoring plan and statistical analyses for tracking long-term trends in sturgeon selenium.

Methods

Field Sample Collection

Sturgeon tissue samples were collected through a pro-bono collaboration with the California Department of Fish and Wildlife (CDFW), which conducts an annual sturgeon tagging survey in North Bay each August-October. While the CDFW survey includes both San Pablo and Suisun Bay, the majority of sampling in recent years has focused in Grizzly Bay (Figure 1). The survey does not include a spatially distributed screen of North Bay, but rather focuses on areas where catch is suspected to be the greatest, to allow the greatest number of fish to be tagged.

The RMP's target study design aimed to collect tissue samples from 60 adult sturgeon, equally distributed across each 10 cm increment between 100-160 cm, fork length. Sturgeon smaller than 100 cm in fork length were smaller than the sturgeon slot limit (40-60 in, or approximately 102-152 cm, fork length) and avoided when possible. In 2015 and 2016, US Fish and Wildlife Service staff collected muscle plug (selenium analyses) and blood plasma (sex steroid analyses) pro-bono for the RMP, alongside fin ray samples collected for the concurrent USFWS study, which were used for age estimation and microchemistry analyses. In order to collect the target 60 samples in 2015, tissues were disproportionately collected from smaller fish, as well as in several fish above the 160 cm limit; however, no samples were collected from sturgeon smaller than 100 cm fork length. In 2016, RMP funds were not allocated for sample collection coordination, though the CDFW and USFWS offered to still collect

samples later in the season. As a result, a smaller sample number and size range was sampled: 40% of the 38 sturgeon sampled were smaller than 100 cm fork length (Figure 2). In 2017, following the conclusion of the USFWS study, CDFW staff began collecting muscle plug samples for the RMP; due to staffing limitations, however, blood plasma and fin ray samples were no longer collected.

Two to three muscle plug samples were collected from each fish using a disposable 5 mm biopsy punch. Samples were collected through the skin from the epaxial muscle, just behind the dorsal fin and just offset from the midline, and stored chilled in a 2 mL cryovial with the skin on until the end of each sampling day. Samples were then frozen at the end of each sampling day until processing. Blood plasma samples were drawn using a syringe and sealed vacutainer from a blood vessel just behind the anal fin. Whole blood samples were stored on wet ice and centrifuged at the end of each sampling day, at which point the blood plasma was drawn off into microcentrifuge tubes and stored frozen until analyzed. Lastly, small fin ray clips were collected using hand shears.

The target study design and tissue collection methods are described further in the 2015 Sturgeon Muscle Plug Study Sampling & Analysis Plan (Appendix C). The full CDFW field sampling effort – including description of sampling methods, summary of concurrent non-RMP studies, summaries of the sturgeon surveyed, and maps of sampling locations – is further described in the CDFW 2015-2017 Field Season Summary reports for the Sturgeon Population Study (DuBois & Harris, 2015; DuBois & Harris, 2016; DuBois & Danos 2017).

Muscle Plug Sample Processing

Muscle plug samples were stored chilled in the field and frozen at the end of each sampling day in a commercial freezer with the skin on. In 2015, samples were stored frozen at a USFWS facility until the end of the field season, at which point they were transported to the analytical laboratory at USGS-Menlo Park and stored at -80 ^{0}C until sample processing and analysis. In 2016, samples were transported to a commercial freezer at SFEI at the end of the field season, where they were stored until the end of the 2017 field season, when they were transferred to USGS-Menlo Park. In both years, samples were processed by USGS prior to digestion for selenium analyses. Skin removal was conducted while the muscle plugs were still frozen using a sharp, clean scalpel, which was used to remove the black skin disc along with approximately 2 mm of additional tissue below the skin. The sample vial weight was measured; the remaining muscle tissue was then returned to empty sample vials and reweighed to obtain a wet tissue weight. Samples were subsequently freeze dried in preparation for analysis. This method was also used for the RMP 2014 Muscle Plug study samples.

In 2017, samples were stored in a commercial freezer at the end of each field sampling day. On the last sampling date each week, frozen samples were brought onto the sampling boat and transferred at the end of the day with newly collected samples to SFEI. Because all samples were thawed by the end of the day, thawed samples were then immediately processed at SFEI at the end of the day. The skin disc, and in some cases a lipid layer immediately underneath the skin, were removed with dissection scissors by visual inspection of the plugs. Muscle tissue, skin, and lipid were differentiated by color (skin is a black color) and texture (lipid is more opaque than muscle tissue) when possible. When no lipid layer was apparent, the skin and muscle tissue were separated approximately 1-2 mm below the skin tissue; when lipid appeared to be present not in a layer but mixed with muscle tissue, it was not removed to preserve muscle tissue for analysis. A wet tissue weight was recorded. The skin-off tissue samples were then

frozen in a commercial freezer until the end of the sampling season, when all samples were transported to USGS-Menlo Park and stored at -80 ^{0}C before the samples were re-weighed and freeze dried. Similar methods were used for the RMP 2015-2017 Sturgeon Derby study muscle plug samples, which were processed in the field by RMP staff prior to freeze-drying and further processing in the laboratory.

Laboratory Analysis and QA/QC

Selenium

After muscle plug samples (skin-off) were freeze-dried and subsampled, subsamples were digested and analyzed for total Se and moisture by USGS (HG-ID-ICP-MS) following methods described by Kleckner et al. (2017). Due to the small sample masses, samples are not homogenized before digestion; instead, whole freeze-dried plugs and directly subsampled with a clean scalpel blade for analysis.

The 2015 samples were run in a single lab batch, and the 2016-2017 samples were run together across three lab batches. At least three method blanks and three replicates each of two different certified reference materials (CRMs) were run with each lab batch. Laboratory replicates were run at a minimum frequency of 1 for every 10 field samples, with the exception of the first 2016-2017 sample lab batch, during which no replicates were run. Matrix spike and matrix spike duplicates of either a CRM or field sample were run with each 2016-2017 lab batch. Accuracy was evaluated using CRMs with certified values for Se, precision was analyzed using duplicate samples, and selenium recovery was evaluated using the matrix spike samples. Selenium results are reported blank corrected.

All samples analyzed in 2015 met RMP QA/QC standards (Yee et al. 2017). For duplicates and rerun samples, the first rerun sample result was reported.

The 2016 and 2017 samples were analyzed together in three lab batches. No laboratory replicates were run in the first batch, so the second lab batch included both between-batch replicates (run in both the first and second batch) and within-batch replicates (run twice within the second lab batch). For two samples, results across the first two lab batches failed QA/QC precision standards (although duplicates of these samples run within the second batch did meet QA/QC precision standards), prompting a third analytical run with further between- and within-batch replicates.

In the final dataset, after three sample runs, eight samples (one collected in 2016; seven collected in 2017) were flagged by the analytical laboratory for failing QA/QC precision standards. The laboratory hypothesized that the variability was due to higher lipid content and heterogeneous distribution of lipid and muscle tissue within in these plugs; sample processing notes also indicate that several of these samples appeared to include substantial lipid that could not be separated from the muscle tissue. However, because confirmation of the lipid content in the samples analyzed was not possible, none of the flagged results were rejected.

For three other samples collected in 2017, several results were rejected based on sample processing notes indicating that the tissue analyzed appeared to have high fat content and was not representative of muscle tissue. These rejects resulted in no report resulted for two samples and a single result reported from the first lab batch for the third sample (17MP-WST-ST-21). For all 2016-2017 samples, selenium concentrations presented in this report are averages of all results reported by the

laboratory, with the exception of rejected results. Results were first averaged between duplicates in the same lab batch, and subsequently among averages for all lab batches. Further discussion of the QA/QC results are presented in Appendix B.

Isotopes

Carbon (δ^{13}C), nitrogen (δ^{15}N), and sulfur (δ^{34}S) isotope ratios in muscle plugs were measured by UC Davis with an elemental analyzer interfaced to a continuous flow isotope ratio mass spectrometer (EA-IRMS). Detailed sample preparation and method descriptions are available on the UC Davis Stable Isotope Facility website (http://stableisotopefacility.ucdavis.edu/ 13cand15n.html; http://stableisotopefacility.ucdavis.edu/34s.html). δ^{13}C and δ^{15}N isotopes were run concurrently, while δ^{34}S isotopes were run separately. At least one lab replicate was run for each isotope in each lab batch, with the exception of δ^{34}S isotopes in 2015, when not enough sample mass was available for a δ^{34}S isotope duplicate. QA/QC analyses included CRMs, laboratory control materials (LCMs) for isotope percent masses, and additional LCMs for isotopes. No method blanks were analyzed. Detailed QA/QC results are presented in Appendix B.

Sex Steroids

Testosterone (T) and estradiol (E2) were measured in blood plasma by the USFWS Bozeman Fish Technology Center, following Fitzpatrick et al (1986) and Feist et al. (1990). All samples were run in duplicate and reported as an average of duplicate samples. Duplicate results with a greater than 10% difference were rejected and samples were rerun. For the 2015 samples, the intra-and inter-assay coefficients of variation for all assays were less than 5 and 10%, respectively. The lower limit of detection was 0.10 ng/mL for T and 0.16 ng/mL for E2. **[QA/QC results from 2016 samples forthcoming].**

The sex and reproductive stage of each fish was predicted based on T and E2 cutoff values established by the Webb Lab, summarized in the table below.

T	**E2**	**Predicted Sex / Reproductive Stage**	**Associated Developmental stage**
T<4	E2<1.5	Non-reproductive Female	Undergoing differentiation or pre-vitellogenic
T < 4	E2 ≥ 1.5	Female Undergoing Follicular Atresia (post-ovulatory or atretic)	Post-ovulatory or atretic
T ≥ 4	E2 ≥ 1.5	Reproductive Female	Early vitellogenic, vitellogenic, or undergoing oocyte maturation
40 > T ≥ 4	E2 < 1.0	Non-reproductive Male	Undergoing differentiation or pre-meiotic
T ≥ 40	E2 < 1.0	Reproductive Male	Undergoing onset of meiosis through spermiation
nd	nd	Non-reproductive; Unknown Sex	Post-spermiation

The majority of fish were categorized as non-reproductive females or non-reproductive males. However, the error rate for detecting the difference between non-reproductive males and females can be high, and the laboratory often does not differentiate between sexes for non-reproductive fish (Webb et al. 2002; Molly Webb, personal communication; USFWS, unpublished data from 2016 Sturgeon Derby). The error rate in assigning sex and reproductive stage to reproductively mature males and females is much lower, < 5% (Webb et al. 2002; Molly Webb, personal communication).

Method Development

The 2015-2017 monitoring and continued collaboration with CDFW further demonstrated the viability of the non-lethal muscle plug monitoring method piloted in 2014. In 2017, CDFW staff were able to collect samples directly for the RMP without USFWS staff assistance, further establishing the CDFW sturgeon surveys as a potential continuing opportunity for long-term monitoring of selenium in sturgeon tissue. Muscle plug samples were successfully collected from a large number of sturgeon with sufficient mass for selenium analyses. In 2015, all samples had sufficient mass for δ^{13}C and δ^{15}N analyses, and all but one had sufficient mass for δ^{34}S as well; in 2016-2017, 79 of 96 samples had sufficient mass for δ^{13}C and δ^{15}N analyses, and 78 had sufficient mass for δ^{34}S analyses. Additional work conducted as part of the 2015-2017 Sturgeon Derby study and prior RMP Status and Trends monitoring efforts have also established muscle plugs as good proxies for muscle fillet selenium concentrations (Sun et al. 2018).

However, substantial variability observed in the 2016-2017 selenium results indicated that further sample processing method development is needed. Notably, the same sample processing methods have been used for all muscle plugs analyzed by USGS-Menlo Park since 2014. In prior sample sets, duplicates subsampled from non-homogenized muscle plugs were consistent and met method quality objectives (RPD<<35%). Therefore, the variability observed in the 2016 and 2017 samples was unexpected, particularly given that the 2015 and 2016 samples were processed using identical methods at USGS-Menlo Park.

In particular, improved methods are needed to remove lipid from muscle plugs and/or homogenize plug tissue before analysis. Laboratory or method inter-comparisons conducted on true laboratory replicates will not be possible given the small sample masses of plug samples; however, comparisons could be conducted using field replicates sampled from sturgeon fillets collected during the 2019 RMP Status and Trends study.

Statistical Analyses

The combined dataset indicated that selenium concentrations in sturgeon muscle tissue are log-normally distributed. Statistics were conducted using parametric methods on data that was log-transformed to meet assumptions of normality and heterogeneity of variances. In some cases, unequal sample group sizes and unequal variances required the use of alternative statistical tests as described in the text.

Results and Discussion

Muscle selenium concentrations were measured in 30 sturgeon in 2015, 38 sturgeon in 2016, and 58 sturgeon in 2017. Selenium concentration ranges, means, medians, variances, and percents of samples exceeding the TMDL numeric target for each year are presented in Table 1. Samples from an additional 28 sturgeon collected in 2015 are archived at -80 ^{0}C at USGS-Menlo Park. Selenium concentrations and δ^{13}C, δ^{15}N, and δ^{34}S isotope ratios for individual samples are presented in Appendix A and are available through the Contaminant Data Display and Download tool (CD3, www.sfei.org/cd3) as well as the California Environmental Data Exchange Network (CEDEN, http://ceden.waterboards.ca.gov/AdvancedQueryTool).

Dataset Summary and Comparison to TMDL Target

Selenium concentrations were variable and log-normally distributed, with coefficients of variation ranging from 0.54 to 0.62 across years (Figure 3). Mean and median selenium concentrations in adult sturgeon decreased each year between 2015 and 2017 (Figure 3). Concentrations in fall 2015 were elevated: the mean concentration (11.8 ug/g dw) was above the TMDL numeric target (11.3 ug/g dw) while the median concentration was just below (10.9 ug/g dw), and 47% of individual samples exceeded the target. Concentrations in fall 2016 were slightly lower but still elevated (median=11.0 ug/g dw, mean=10.6 ug/g dw, 44% exceedances). In contrast, concentrations measured in 2017 were significantly lower (Welch's one-way ANOVA, $p=1.3x10^{-3}$; Games-Howell post-hoc test, 2015 vs 2017: p=0.04; 2016 vs 2017: $p=2.9x10^{-3}$).

Sturgeon sampled in 2016 were much smaller than those sampled in 2015-2017 (Table 1) – 40% of sturgeon sampled in 2016 were smaller than 105 cm total length, a value used to distinguish juvenile and adult sturgeon. When selenium results from sturgeon smaller than 105 cm are included, the mean and median concentrations for 2016 were substantially lower (median=7.6 ug/g dw; mean=8.8 ug/g dw; 29% above the target), and no longer significantly greater than those observed in 2017.

Sources of Variability

Several factors are contributing to inter- and intra-annual variability in observed selenium concentrations (Figures 4-5). In this section, six factors that have been measured in prior sturgeon selenium studies are evaluated, including biological factors (fish length or age, sex, and reproductive stage) and environmental factors that affect dietary selenium, including annual and seasonal hydrology (freshwater inflow from the Delta, assessed using water year type and month of sampling) and foraging location. Understanding these drivers of muscle tissue selenium will inform two objectives:

1. evaluating long-trends – determining what drivers of variability should be controlled for in regression analyses, or used to exclude data that are not comparable to the majority of the historical dataset; and
2. developing a long-term monitoring design – assessing how to constrain or eliminate sources of variability in the monitoring design that may confound the detection of long-term trends (i.e., focusing on a specific fish length or season).

These factors are analyzed in the context of the 2015-2017 Muscle Plug study data, as well as all historically available data on selenium in sturgeon in the Bay. A summary of the key findings and their implications for the two objectives is presented in Table 3. Linear regression analyses were also used to conduct a more robust analysis of the interactive effects of key drivers on sturgeon selenium concentrations (see "Long-Term Trend Analysis" section).

Fish Length or Age and Maturity

Selenium generally is not known to accumulate with time or age. However, higher muscle tissue Se concentrations in larger sturgeon size classes were reported by Linares-Casenave et al. (2015), who postulated that this could be due to differences in foraging behavior between juvenile and adult sturgeon. While age is relatively difficult to measure and frequently not reported with fish contaminant data, length data are easily collected and reported, and sturgeon age and length are correlated (Linares-Casenave et al. 2015; Brennan & Cailliet 1989). In this report, length is used as a proxy for fish age and maturity (i.e., juvenile or adult).

Estimates of the approximate age and length of maturation in white sturgeon are variable; for the Sacramento-San Joaquin population, females are estimated to mature around 12-16 years or 95-135 cm fork length (Moyle 2002), and males at around 10-12 years or 75-105 cm FL. The current study was designed to target sturgeon primarily within the sport fish regulation slot limit (40-60 inches fork length, or approximately 102-152 cm fork length). Linares-Casenave delineated three size classes in their 2015 study, with the 105 cm as the cutoff between the first and second size classes (roughly, juveniles and small adults). For the purposes of this report, 105 cm total length is used to roughly distinguish between juveniles and adults. When total length data were not available, the following regression was used to estimate total length, calculated from all available studies with both total and fork length data reported (RMP S&T 2014, 2015-2016 RMP Muscle Plug studies, Linares-Casenave et al. 2015):

$$\text{Total Length} = (1.10 \times \text{Fork Length}) + 4.50 \quad (R^2=0.99, p=2.2\times10^{-16})$$

In 2016, significantly lower selenium concentrations were observed in juveniles (<105 cm TL) compared to adults (Welch's t-test, $p=3.5 \times 10^{-4}$), consistent with the findings reported by Linares-Casenave et al. (2015). Although the present study targeted adult fish, 35% of samples (13 of 38 samples) collected in 2016 were from fish smaller than 105 cm TL, because sampling was not coordinated by the RMP that year. In 2015 and 2017, no fish smaller than the slot limit were sampled, and none of the fish sampled were considered juveniles.

Among adults, no consistent pattern was observed between fish length and selenium concentration. No significant relationship between fork length and selenium concentration was observed in adults in 2016 and 2017 (linear regression, 2016: p=0.93; 2017: p=0.87; fork length was used here because total length was not directly measured in 2017). These results are again consistent with data from Linares-Casenave et al. (2015), in which no significant relationship was observed among adults (p=0.50). In 2015, a negative relationship was observed, with the highest concentrations observed in the smaller adults (linear regression, $p=2.5 \times 10^{-3}$, $R^2 = 0.26$). Similar results were observed when analyzing the data in the same manner as Linares-Casenave et al. (2015), which compared two adult size classes (106-150 cm TL and >150 cm TL; Welch's t-test, 2015: $p=2.7 \times 10^{-3}$, 2016: 0.63, 2017: 0.87, Linares-Casenave et al. 2015: p=0.13). A similar negative relationship between fork length and muscle selenium

concentrations was observed in adults measured in the Selenium Verification Study (Figure 6). This study included some of the highest selenium concentrations in the entire Bay dataset, and was conducted during critically dry and dry water years, suggesting a potential interaction between water year type or flow and fork length (Figure 7). Notably, although no statistically significant relationship between fish length and muscle selenium was observed in 2016, a dry water year, the highest concentrations were observed in small adults (Figure 2).

These results indicate that fish length and sturgeon muscle tissue selenium are related. Lower concentrations were observed in juveniles compared to adults; among adults, no clear linear relationship was observed, although there may be an interaction between annual hydrology and fork length. This suggests that long-term selenium trend monitoring should focus on adults, and may not need to control for size among adults. Interactions between the effect of length and other environmental drivers on selenium concentrations in adults can be further explored using regression models (see "Long-Term Trend Analysis" section). Future long-term monitoring should continue to focus on adults only, distributed across the target size range (100-160 cm fork length, or approximately 115-181 cm total length; smaller fish are outside the slot limit and will not be sampled) when possible, to obtain further information and support efforts to control for any effects of sturgeon age or length on selenium concentrations.

Sex and Reproductive Stage

Differences in tissue selenium levels between sturgeon of different sexes and reproductive stages are important to consider given the primary mechanism of selenium impairment: maternal transfer to vitellogenin and egg yolk proteins. Vitellogenic, or pre-spawning, females (called "reproductive" in this report) are therefore a particularly sensitive population. White sturgeon are iteroparous, spawning every two to four years (Chapman et al. 1996), so only a subset of the mature females are reproductive in any one year. The spawning season predominantly occurs between March and April of each year, though spawning females are found between February and May (Doroshev et al. 1997, Kohlhorst et al. 1976. While selenium concentrations in ovary and liver tissues can be expected to be higher in vitellogenic females, given the incorporation of selenium into vitellogenin proteins, the linkage between vitellogenesis and selenium in muscle tissue is less clearly established. However, a prior study found significantly higher selenium concentrations in the muscle tissue as well as liver and ovaries in vitellogenic compared to pre-vitellogenic sturgeon (Linares-Casenave et al. 2015). No significant differences were observed by Linares-Casenave et al. between males and females overall. To further test these findings, sex and reproductive stage were assessed in the current study using testosterone and estradiol levels measured in blood plasma in 2015 and 2016 (see Methods section).

Sex

In this study, males and females were relatively evenly represented, including 15 females and 15 males in 2015, and 17 females and 21 males in 2016. However, the vast majority of sturgeon measured during this study were predicted to be non-reproductive (25 of 30 sampled in 2015 and all 38 sampled in 2016), and the prediction error rate between non-reproductive males and females is considered high (Webb et al. *personal communication*; see Methods section). Therefore, evaluating the effect of sex on sturgeon muscle selenium in this study may not be highly reliable. Lethal sampling and direct sex identification based on gonads can be used to more reliably evaluate this effect.

No statistically significant differences were observed between sexes in either the current study or previous studies conducted in the Bay (Welch's t-test, Table 2, Figure 8). The sample sizes in most prior studies involving lethal sample collection (i.e., more reliable sex identification) are small (Linares-Casenave et al. 2015: n=47; RMP Status and Trends 2003-2014, n=7 to n=12 per year), but thus far the data provide no evidence that muscle selenium differs between males and females. Therefore, any selenium trends observed in the population overall should reflect trends in female sturgeon specifically as well.

Reproductive stage

Limited data from reproductive sturgeon are available from either the current study or previous studies to further evaluate the relationship observed by Linares-Casenave et al. (2015). The error rate for correctly identifying reproductive sturgeon is considered low (Molly Webb *personal communication*; see Methods section); however, few reproductive sturgeon, and in particular reproductive females, were identified in this study. Only two of fifteen females (and three of fifteen males) sampled in 2015 and none of the 17 females (and three of 21 males) sampled in 2016 were predicted to be at a mature reproductive stage. Sex steroids were not analyzed and reproductive stage was not predicted in 2017.

The two female sturgeon predicted to be vitellogenic in 2015 had low selenium concentrations (2.3 and 5.9 ug/g dw), contrary to expectations following Linares-Casenave et al. (2015). However, the isotope results for these sturgeon suggest that prior to sampling, they may have been largely feeding outside of North Bay. Historically, sturgeon with the highest selenium concentrations have been collected within North Bay, suggesting higher dietary selenium levels in this region (see "Foraging area" subsection). Low δ^{13} C in the first sturgeon (-27.12) suggests that it was feeding in the Delta; a particularly low δ^{34} S in the second sturgeon (7.8) also suggests it had predominantly been feeding outside of Suisun Bay. Thus, lower dietary selenium levels due to different foraging locations could be masking the effect of increased muscle tissue selenium uptake in these sturgeon that were predicted to be vitellogenic.

Therefore, although results from RMP studies, including the current study, do not support the Linares-Casenave et al. (2015) finding of higher muscle selenium in vitellogenic females, they are based on too few samples to clearly contradict it. Our analysis does suggest, however, that dietary selenium levels has a greater impact on sturgeon muscle selenium concentrations than reproductive stage. Dietary selenium levels can be affected by a variety of factors, including feeding location or annual and seasonal hydrologic patterns affecting freshwater dilution of local selenium inputs or upstream selenium inputs (Stewart et al. 2013). It is possible that the effect observed by Linares-Casenave et al. (2015) would be more easily observable in the winter and early spring (November-March), when sturgeon tissues would be expected to have higher concentrations than in the fall based on seasonal patterns in clam selenium concentrations (Stewart et al. 2013). Assuming approximately a 2-3 month lag between clam and sturgeon tissue selenium (Sun et al. 2018 in prep, Beckon 2016, Stewart et al. *unpublished data*), early spring sturgeon tissues (January-February) would reflect clam selenium concentrations in the late fall and winter (September-December), when levels are elevated; fall sturgeon tissues during the period of the current study (September-October), in contrast, would reflect summer clam concentrations (June-August), which are generally lower (Stewart et al. 2013). Notably, all of the vitellogenic females sampled by Linares-Casenave et al. were sampled between March and May, when dietary selenium would be expected to be elevated, and could have influenced the concentrations observed in those sturgeon.

It is notable that even in the 2016 RMP Sturgeon Derby Study, which was conducted in late January – early February, few reproductive females were observed (2 of 9 females sampled), and they did not show elevated concentrations in muscle tissue (or ovary and liver tissue) compared the non-reproductive females (Figure 6). However, the sample size for this study was small, and reproductive stage was estimated using sex steroids rather than being confirmed with histology analyses.

From a toxicological perspective, it would be valuable to continue evaluating selenium concentrations in vitellogenic sturgeon specifically, to understand risks to this particularly sensitive population. Our current results are still inconclusive about the relative risks to the sensitive compared to the overall sturgeon population, particularly during different seasons or water years. Further measurement of vitellogenic sturgeon leading up to and during the spawning season would enable a better evaluation of this relationship. Additional monitoring of female sturgeon generally across seasons within similar water years – particularly wet years – would also be necessary to further deconvolute the impact of reproductive stage and seasonal hydrology on muscle selenium concentrations.

From a regulatory perspective, however, it is not essential to focus additional study or future monitoring specifically on the sensitive vitellogenic female population, according to recent EPA monitoring guidance for the implementation of the 2016 EPA ambient water quality criteria for selenium in freshwaters (USEPA 2017). The current study also showed that few vitellogenic females are likely to be sampled during the fall, when long-term monitoring is proposed to occur. This matches expectations, given that this sampling period is approximately half a year prior to the spawning season. Therefore, any effect of reproductive stage on muscle selenium in vitellogenic sturgeon, if present, is unlikely to substantially contribute to variability observed during fall sturgeon monitoring. Furthermore, if future muscle plug monitoring continues through the current collaboration with CDFW, collecting blood plasma samples may also be logistically challenging due to limited staff capacity.

Therefore, based on the current information available it does not seem necessary to continue monitoring sex steroids during long-term September-October muscle plug sampling. Additionally, given the limited data on reproductive stage available in previous studies, and the expectation that few vitellogenic females will be represented in future sampling, it appears acceptable to not account for reproductive stage in long-term trend analyses.

Hydrology – Annual (Water Year Type) and Seasonal (Month)

Annual and seasonal hydrologic patterns in freshwater inflow from the Delta have been shown to have a significant effect on selenium concentrations in *Potamocorbula* (Stewart et al. 2013), the dominant prey item of white sturgeon in North Bay. While selenium inputs from point-source dischargers in North Bay remain relatively constant year-round, freshwater inflows from the Delta vary significantly. High volumes of freshwater flow from the Delta during wet years and winter months can dilute other sources of selenium inputs to North Bay, reducing selenium concentrations in both the water column and prey such as *Potamocorbula.* Sturgeon muscle tissue will respond more slowly than clams to hydrology-driven changes in selenium concentrations, but will provide a more spatially and temporally integrated representation of clam selenium concentrations. The consistency of the response to hydrologic patterns in clams from the Delta confluence to San Pablo Bay suggest that a similar pattern could be observed in sturgeon.

Previously collected sturgeon muscle selenium data were unevenly distributed across water year types and seasons, and co-occurred with variation in other potential drivers of fish tissue selenium (i.e., fork length, foraging location, etc.); therefore a robust statistical analysis of the effect of both annual and seasonal hydrological patterns on sturgeon muscle selenium is not currently possible. However, qualitative data analysis and statistical evaluation of data from the current study are presented below.

Water Year Type

To evaluate the effect of interannual hydrologic patterns, sturgeon muscle selenium data were compared with estimates of freshwater inflow from the Delta to the North Bay. The California Department of Water Resources uses a classification index to categorize water year types for the two dominant tributaries to the Bay, the Sacramento and San Joaquin Rivers, based on unimpaired runoff measured at various locations along on each river in September and October each year. Water Years are classified as Wet, Above Normal, Below Normal, Dry, or Critical on each river based on total volume measured (http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST). Water year 2015 was considered critically dry on both rivers; flow in 2016 was considered below normal on the Sacramento River and dry on the San Joaquin River; and 2017 was considered a wet year on both rivers.

Correlating environmental selenium levels with sturgeon muscle selenium concentrations requires consideration of a lag time between ambient water selenium exposure at the bottom of the food web and uptake into sturgeon tissues. Stewart et al. (2013) estimated a 60 day lag time between selenium in the water column and selenium in clams based on a biodynamic bioaccumulation model following Lee et al. (2006). Through an empirical analysis of USGS clam data and RMP Sturgeon Derby data from spring 2015-2017, Stewart et al. also estimated a 3 month time lag between selenium in clams and selenium in sturgeon muscle tissue (*unpublished*). A separate statistical analysis estimates a 50-120 day lag time between selenium in water and clams, and an approximately a 6 month lag (178 days) between selenium in the water column and selenium in sturgeon muscle tissues, based on whole sturgeon tissue collected from the Grassland Bypass Project (Beckon et al. 2016). For the purposes of this report, a 6 month time lag is used when describing comparisons of sturgeon selenium to water year types.

The present study, which spanned critically dry, below normal, and wet years on the Sacramento River as well as critically dry, dry, and wet years on the San Joaquin River, and followed a largely consistent study design, presented an excellent opportunity to evaluate this effect during fall months. Samples were collected during the same months each year (September and October) and from the same locations (Suisun Bay, focused in Grizzly Bay) throughout the study, minimizing the potential impact of these drivers on differences in observed selenium concentrations across years. Adult sturgeon muscle tissue selenium was found to be significantly higher in 2015 and 2016 (critically dry and dry years) than in 2017 (wet year); no significant difference was observed between 2015 and 2016 (see “Dataset Summary”). These results support expectations based on observed patterns in clam selenium concentrations in response to Delta flow (Stewart et al. 2013).

A qualitative analysis of previous data indicates a similar pattern, with the highest selenium concentrations observed in sturgeon sampled in or immediately following critically dry or dry water years (Figures 9-10). Concentrations over 30 ug/g dw, for example, were observed only during critically dry, dry, or below normal water years, with the exception of a single sample collected in January of a wet water year (Stewart et al. 2004).

These data indicate that annual hydrology, as reflected in water year type designation, is a significant driver of sturgeon muscle tissue selenium concentration. This suggests that the elevated selenium concentrations observed during the 2015-2017 Sturgeon Derby studies, for example, may have been driven largely by low flow conditions during these critically dry and below normal water years, rather than actual increases in selenium sources or loads. To account for this effect, long-term trend analyses must consider the effect of water year type on selenium variation, either through including hydrology as a factor in regression analyses or limiting trend analyses to similar water year types.

Season

Limited data are available to assess the effect of seasonal hydrology on sturgeon muscle selenium. The current study was conducted during the fall season each year, and therefore cannot be directly used to assess seasonal drivers of sturgeon muscle selenium. Two previous studies were conducted across multiple seasons, but sampling month generally co-occurred with other drivers such as fish length, sampling location, or water year, making it difficult to isolate the seasonal effect. Furthermore, the effect of reproductive stage, which follows a seasonal pattern, on sturgeon muscle selenium is not entirely clear, further confounding the analysis of seasonal hydrologic patterns.

Assuming a two to three month lag between clam and sturgeon muscle selenium, and parallel seasonal patterns to those observed in clams, higher sturgeon muscle selenium concentrations would be expected during November-March (Stewart et al. 2013). Existing data are insufficient to assess this hypothesis. During the Selenium Verification Study, the highest concentrations were observed in February and March, when concentrations regularly exceeded 20 ug/g dw. However, sturgeon sampled during most other months with lower mean concentrations were either juveniles (October and December) or their size was not recorded (April and May). Linares-Casenave et al. (2015), on the other hand, found higher concentrations in April, May, and December than in March and June. However, only three fish were sampled in March and October; in July, the majority of fish were juveniles, which already are expected to show lower concentrations. Furthermore, the Linares-Casenave et al. study was conducted across wet and dry years.

Given that both annual and seasonal effects are driven largely by hydrology, an interaction between these two factors would be expected. Not enough data are available to deconvolute these factors here, but long-term trend analyses may need to include a season-water year interaction term.

It should be noted that data from the current study and future fall monitoring should not be considered representative of year-round tissue selenium concentrations and associated risks. Assuming a 2-3 month lag between clam and sturgeon tissue selenium concentrations, sturgeon sampled in September and October would reflect clams consumed in June-August. The highest clam concentrations are typically observed in September-December, suggesting that sturgeon tissue selenium would be higher in November-March. However, an advantage of monitoring consistently during the same time of year would be controlling for seasonal effects when evaluating long-term trends. Furthermore, consistent fall monitoring avoids the potential added seasonal variability observed in the spring due to possible reproductive stage effects.

Foraging area

Selenium sources and food web processes differ significantly between regions of the San Francisco Bay-Delta, making foraging location an important potential driver of selenium concentrations in sturgeon. North Bay receives nearly 90% of freshwater and sediment inflows to the Bay, including selenium loads from Central Valley agricultural runoff that move through the Delta, as well as oil refinery effluent, and to lesser degrees, wastewater effluent and other tributary inflows (SFBRWQCB 2015). Telemetry data indicate that white sturgeon are highly mobile, but can remain in North Bay for months at a time (Miller et al. [in prep]).

Previous studies suggest that selenium concentrations are higher in sturgeon caught in North Bay. In RMP Status and Trends sport fish monitoring between 1997 and 2014, significantly higher concentrations were observed in sturgeon collected in North Bay compared to other embayments. In 2014 in particular, significantly elevated concentrations were observed in two sturgeon collected in Suisun Bay compared to those collected in San Pablo Bay or other embayments (Sun et al. 2017a; Suisun and San Pablo Bays were not distinguished in prior RMP S&T studies). Other prior monitoring studies that included sturgeon sampled from both Suisun and San Pablo Bays (Selenium Verification Study, Stewart et al. 2004, 2017 Sturgeon Derby) similarly showed higher mean concentrations in fish collected from Suisun Bay compared to San Pablo Bay or the Delta.

In contrast, Linares-Casenave et al. (2015) found significantly higher concentrations in both male and female sturgeon caught in San Pablo Bay compared to Suisun Bay (males: San Pablo Bay n=15, Suisun Bay n=6; females: San Pablo Bay n=11, Suisun Bay N=15). Unlike the previously described studies, however, in this study different sampling locations also largely co-occurred with different sampling seasons (San Pablo Bay sturgeon were predominantly caught during the spawning season [March-May], including all vitellogenic females; Suisun Bay sturgeon were predominantly caught during the post-spawning season [July; one caught in March and one in October], and included no vitellogenic females), which may have confounded the observed pattern.

Anecdotally, almost no Sturgeon Derby anglers collected sturgeon in San Pablo Bay during the drought years of 2015-2016, while a larger number of fish were caught in San Pablo Bay in 2017. This suggests a potential interaction between water year type and foraging location (and related food abundance and quality), with higher sturgeon abundance in Suisun Bay during drier years. This would coincide with elevated clam selenium concentrations in Suisun Bay during dry years, likely resulting in particularly high sturgeon concentrations observed in this location during dry years as well. While previously collected data are insufficient to assess this hypothesis using robust statistical methods, they are consistent with this pattern, with the highest concentrations (i.e., above 20 ug/g dw) observed almost entirely in sturgeon collected in Suisun Bay during critically dry water years.

The North Bay Selenium TMDL applies to the region between Broad Slough (at the confluence of the San Joaquin and Sacramento Rivers) and the Bay Bridge in Central Bay. The majority of sturgeon sampled in previous studies has also been collected from the North Bay region (346 of 411 samples [84%]; in some cases sturgeon collection location was estimated or anecdotal). The current study focused almost entirely on North Bay, with a few samples occasionally collected further upstream in the rivers. Fishing for the CDFW survey generally takes places in both San Pablo and Suisun Bays, but the vast majority of sampling has occurred in Suisun Bay, and within Grizzly Bay in particular (Figure 1). The

relatively high concentrations in this region contribute to the observed frequency of occurrence of concentrations above the TMDL target. However, the North Bay is prime habitat for San Francisco Bay sturgeon, so the data from the Muscle Plug Study and other North Bay studies are appropriate indicators of sturgeon exposure.

Future sturgeon monitoring should continue to focus on North Bay, both to provide data for assessment of the North Bay TMDL and due to the logistical difficulty of regularly collecting large numbers of sturgeon tissue samples outside of North Bay. CDFW sampling may also largely continue to focus on Suisun Bay, and Grizzly Bay in particular, where sturgeon are abundant and by-catch is lower compared to San Pablo Bay. Monitoring this region to detect selenium trends in sturgeon is also of particular interest as Suisun Bay is the receiving water for Delta flows and related selenium loads.

Long-Term Trend Analysis

Muscle selenium concentrations measured in 2015-2017 fell within the range of previous observations. The mean and maximum selenium concentrations measured during the critically dry water year of 2015 fell within the upper range of historical concentrations (Figure 5). Aside from samples collected in the present study in 2015-2016, the only other studies that included measured selenium concentrations above 20 ug/g dw were the Selenium Verification Study and prior Sturgeon Derby studies (Stewart et al. 2004, Sun et al. in prep); aside from the current study in 2015, the only other studies with annual mean concentrations above the TMDL numeric target were also the Selenium Verification study and a Sturgeon Derby study (2017). Concentrations measured in the current study in 2017 were well within the range of historical averages.

As previously noted, significantly higher concentrations were observed in adults (total length > 105 cm) in the dry years of 2015 (critically dry on both the Sacramento and San Joaquin Rivers) and 2016 (below normal on the Sacramento River, critically dry on the San Joaquin River) compared to 2017 (wet years on both rivers) (Figure 2). The significantly lower concentrations observed in 2017 suggest that the relatively high concentrations observed across the three RMP studies between the summer of 2014 (2014 Status and Trends) and winter 2017 (2017 Sturgeon Derby) were driven by dry hydrologic conditions rather than actual increases in selenium loads from sources (Figure 3).

Considering the San Francisco Bay sturgeon muscle selenium dataset as a whole, there is no evidence of a long-term trend in selenium concentrations (Figure 4; linear regression on log-transformed data, 1987-2017: $p=0.054$, $R^2=5.9\times10^{-3}$; with the anomalously high years 1989-1990 removed, $p=0.24$, $R^2=9.6\times10^{-4}$). However, multiple interacting drivers of selenium variability are likely co-occurring within the sparsely distributed historical sturgeon muscle tissue selenium dataset, which was compiled from a variety of studies that were not strictly designed to evaluate these drivers.

Regression Analyses

Mixed effect model and linear regression analyses were used to control for individual or interacting effects of these drivers on sturgeon muscle selenium concentrations while analyzing for long-term selenium trends in sturgeon muscle selenium. Table 3 below summarizes the key biological and environmental drivers of selenium variability evaluated in the previous section, and describes the evaluation and use of these factors in an initial set of mixed effect models.

The full mixed effect model included water year (continuous), water year type (categorical), and total length (continuous) as fixed effects, and log-transformed sturgeon muscle selenium as the dependent variable. Season was included as a random effect to evaluate the variance associated with this factor. The model was run on a dataset limited to adults (estimated > 105 cm total length) collected within North Bay (n=270, samples from 66% of sturgeon). Sex, reproductive stage, and interaction effects were excluded from this initial model due to limited sex and reproductive stage information, as well as the sparse data available to assess these multiple factors.

An initial comparison between full models with and without the random effect structure indicated that including season as a random effect in the model did not improve model performance. Variance explained by the random effect, season, was shown to be negligible in the full model, indicating that available data does not suggest season is a driver of variability in sturgeon selenium concentrations. Further analyses of the fixed effects was conducted using standard multiple regression models.

A set of models with varying combinations of predictor variables was evaluated. Models including water year as a measure of time were also compared against a null model and a model without water year, to assess the relative significance of changes in selenium concentrations over time compared to other drivers of selenium variability (Table 4). The best model was identified using second-order Akaike Information Criterion coefficients (AIC_c, where the model with the smallest AIC_c is considered most parsimonious), and p-values were used to determine which predictors had a significant influence on sturgeon muscle selenium concentrations.

Table 4 summarizes the results of the model set with varying predictor variables. Among the models that did not include interacting variables, the best model included water year and water year type, but not sturgeon total length. The results of this model indicate a significant ($p=5.23 \times 10^{-3}$) but very weakly negative temporal trend ($R^2=0.04$). Significantly lower selenium concentrations were found during wet years compared to critically dry years (p=0.001) and dry years (p=0.03), but no other significant differences between water year types were found.

Several additional models were run with interaction effects; among all models, the most parsimonious model included a significant negative temporal trend ($p=2.9 \times 10^{-3}$), as well as significant interaction effects between water year type and both water year (4.8×10^{-2}) and total length ($p=1.2 \times 10^{-3}$). Significantly higher selenium concentrations were found during critically dry and dry years compared to below normal years (p=0.02 in both cases), but no other significant differences between water year types were found. Additionally, the relationship between total length and sturgeon muscle selenium was found to be significantly different during dry and critically dry years compared to wet years.

However, the adjusted R^2 for the overall model was low (0.15). Figures 9 and 10 demonstrate the paucity of data available to evaluate the effect of each factor included in this model, which limited the robustness of this analysis. The significant trends identified by this model were therefore weak and should be considered preliminary, pending further data collection.

Conclusions

This muscle plug selenium monitoring study has established fall muscle plug monitoring as a cost-effective and feasible means of non-invasively collecting sturgeon tissues for selenium analyses. Additional laboratory sample processing method development is needed, but analyses of selenium in the small muscle plug samples has also been shown to be feasible. Results from this study also successfully established an understanding of current baseline sturgeon muscle selenium concentrations and enabled an analysis of key drivers of selenium variability, which helped to inform the design of a long-term sturgeon selenium monitoring plan as well as long-term trend analyses.

Selenium concentrations were elevated in 2015 and 2016, during critically dry and below normal water years, but were significantly lower in 2017, a wet water year. The mean concentration measured in 2015 (11. 8 ug/g dw) was above the TMDL numeric target (11.3 ug/g dw), while 47% of individual samples exceeded the target. The mean concentration among adults in 2016 was slightly lower but still elevated (10.6 ug/g dw, 44% above the target). In contrast, the mean concentration measured in 2017 dropped to 7.3 ug/g dw, significantly lower than the 2015-2016 concentrations, with only 12% of individual samples above the TMDL target. These results suggest that hydrology is a significant driver of observed variability in sturgeon selenium concentrations, with higher concentrations observed under dry conditions. This in turn suggests the elevated sturgeon selenium concentrations observed in North Bay between fall 2014 and spring 2017 may have been driven by dry hydrologic conditions rather than actual increases in selenium sources.

Further analysis of fish length in the context of all available historical data on sturgeon muscle selenium supports the finding that significantly higher selenium concentrations are observed in adults compared to juveniles. Among adults, no significant relationship between fish length and muscle selenium was observed. However, a significant interaction between fish length and water year type was found during the mixed effects model analysis. This suggests that future monitoring should focus on adults only, and target an even size distribution of sturgeon across the target size range, in order to reduce variability and control for fish length in future statistical trend analyses.

Analysis of historical foraging location data indicated that elevated concentrations are observed in sturgeon collected in North Bay, where future monitoring is planned to occur. Monitoring should continue to focus on this sensitive region, which receives selenium loads from the Delta and supports a large population of sturgeon in the Bay.

Several other factors evaluated were not found to be significant drivers of sturgeon muscle selenium variability. Historical data provided no evidence that sex was a significant driver of selenium concentrations, with no significant differences observed between males and females in each historical study. Data were too limited and sparsely distributed to statistically evaluate the effect of reproductive stage or season. However, available data do not suggest a significant relationship between reproductive stage and sturgeon muscle selenium. Statistical analyses indicate that season explains almost no variability, when included as a random effect in mixed effects models.

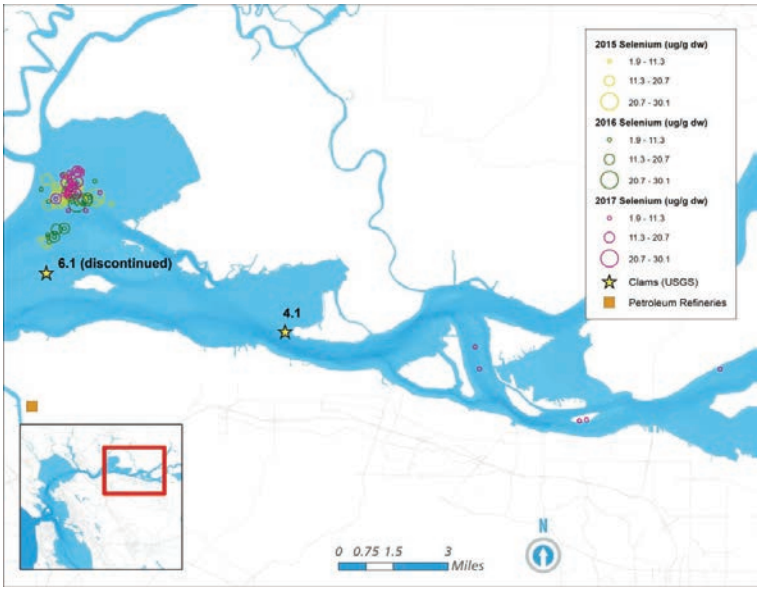
Limited data were available to conduct long-term trend analyses in the context of these drivers of variability. Between 1986 and 2017, a weak but significantly declining trend was observed in both ordinary and multiple linear regression analyses that account for variability due to fish length and water

year type. In both cases, when data from the anomalously high concentration years 1989-1990 are removed, this declining trend is no longer significant. The sparse data used to conduct this regression analysis and large proportion of remaining unexplained variability indicates that the results of this model should be considered preliminary. Long-term data collection through continued muscle plug monitoring, utilizing a consistent monitoring design, will enable more robust analyses of long-term trends in the future (Grieb et al. in prep).

Figures

Figure 1. White sturgeon sampling locations, 2015-2017.

(A) Full extent of the sampling map, including samples collected upstream of Honker Bay in 2017.



(B) Zoomed-in map of Grizzly Bay, where the majority of sampling occurred.

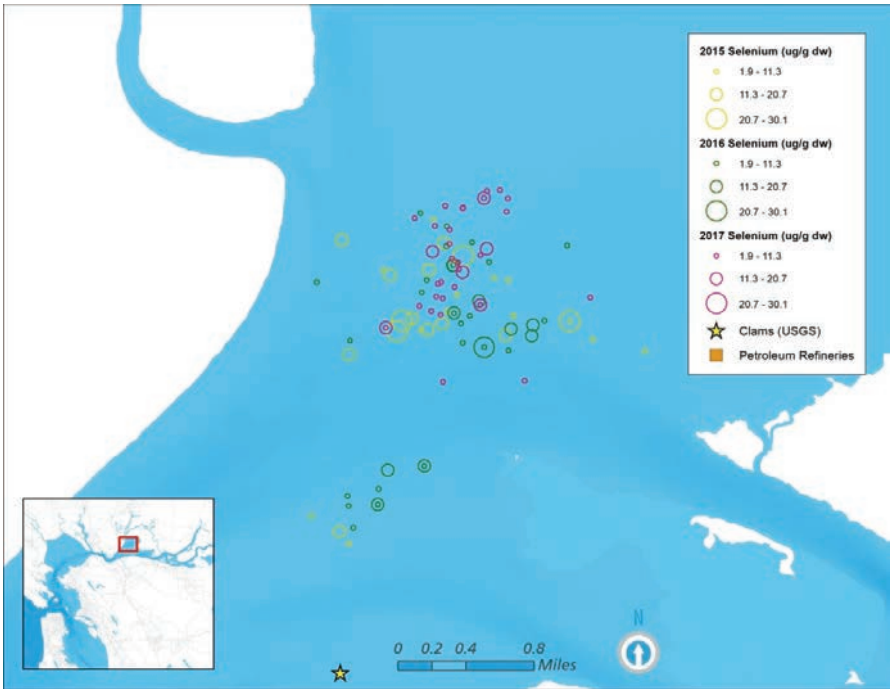


Figure 2. Total length versus selenium for all RMP Muscle Plug study samples (2014-2017). Each point represents an individual sturgeon. Points shown with a black outlines failed RMP QA/QC precision standards, but are shown as averages of all replicates measured for that sturgeon.

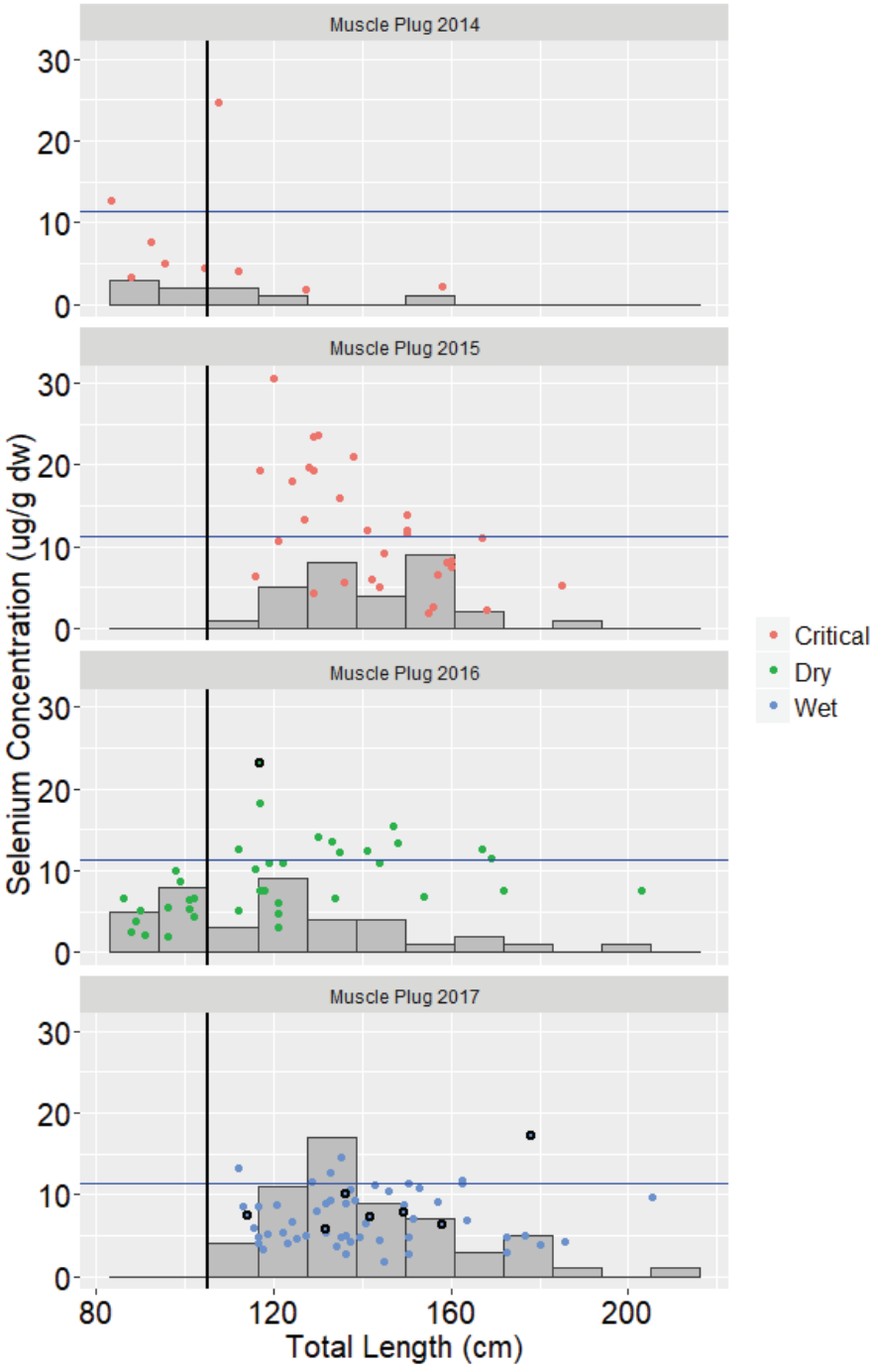


Figure 3. Selenium in white sturgeon muscle plugs, 2015-2017 Muscle Plug study, for all adults (total length > 105 cm) sampled in North Bay. Each point represents an individual sturgeon. Points shown with a black outlines failed RMP QA/QC precision standards, but are shown as averages of all replicates measured for that sturgeon.

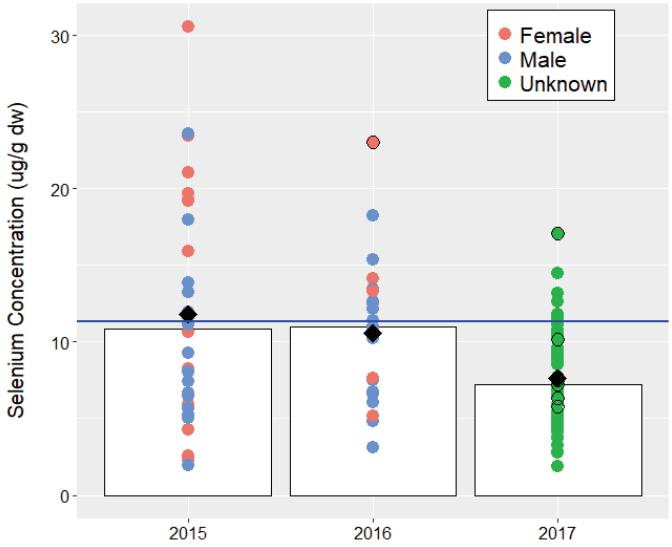


Figure 4. Selenium in white sturgeon muscle plugs, for all adults (total length > 105 cm) sampled in North Bay. Each point represents an individual sturgeon. Points shown with a black outlines failed RMP QA/QC precision standards, but are shown as averages of all replicates measured for that sturgeon.

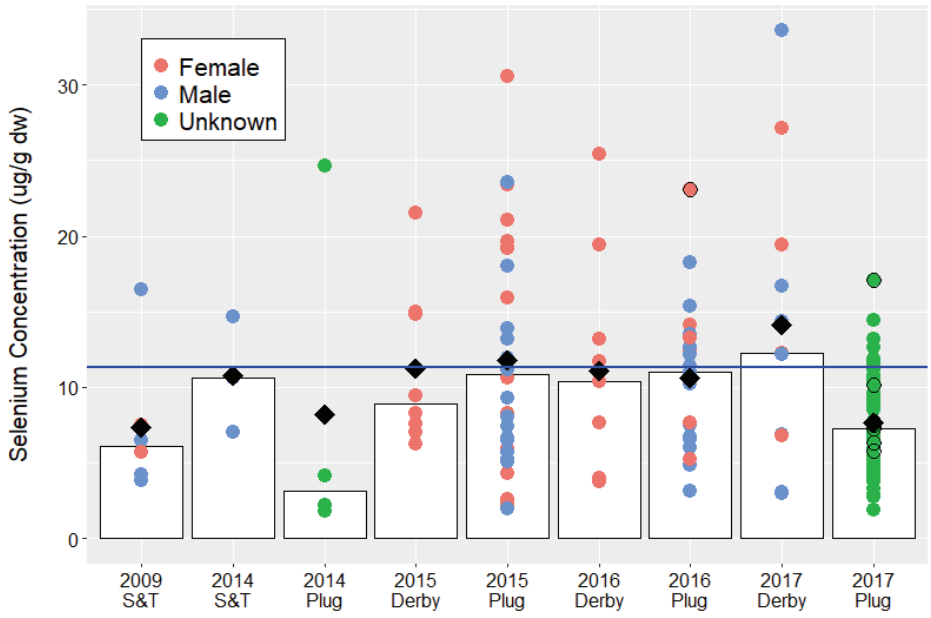


Figure 5. Selenium in white sturgeon muscle tissue (muscle plugs and muscle fillets), including all adults (total length > 105 cm) previously sampled in the Bay. For RMP studies in which both muscle plugs and fillets were collected, fillet results were used for the Status and Trends studies, and plug results were used for the Sturgeon Derby studies.

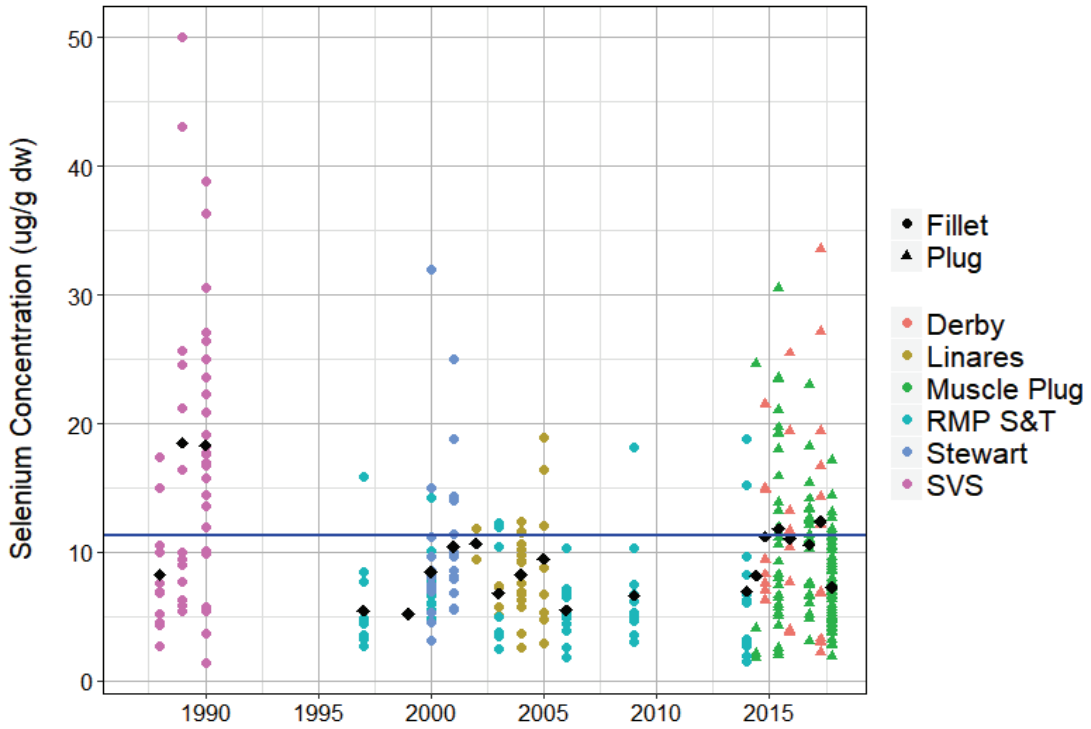


Figure 6. Total length versus selenium for all Bay studies.

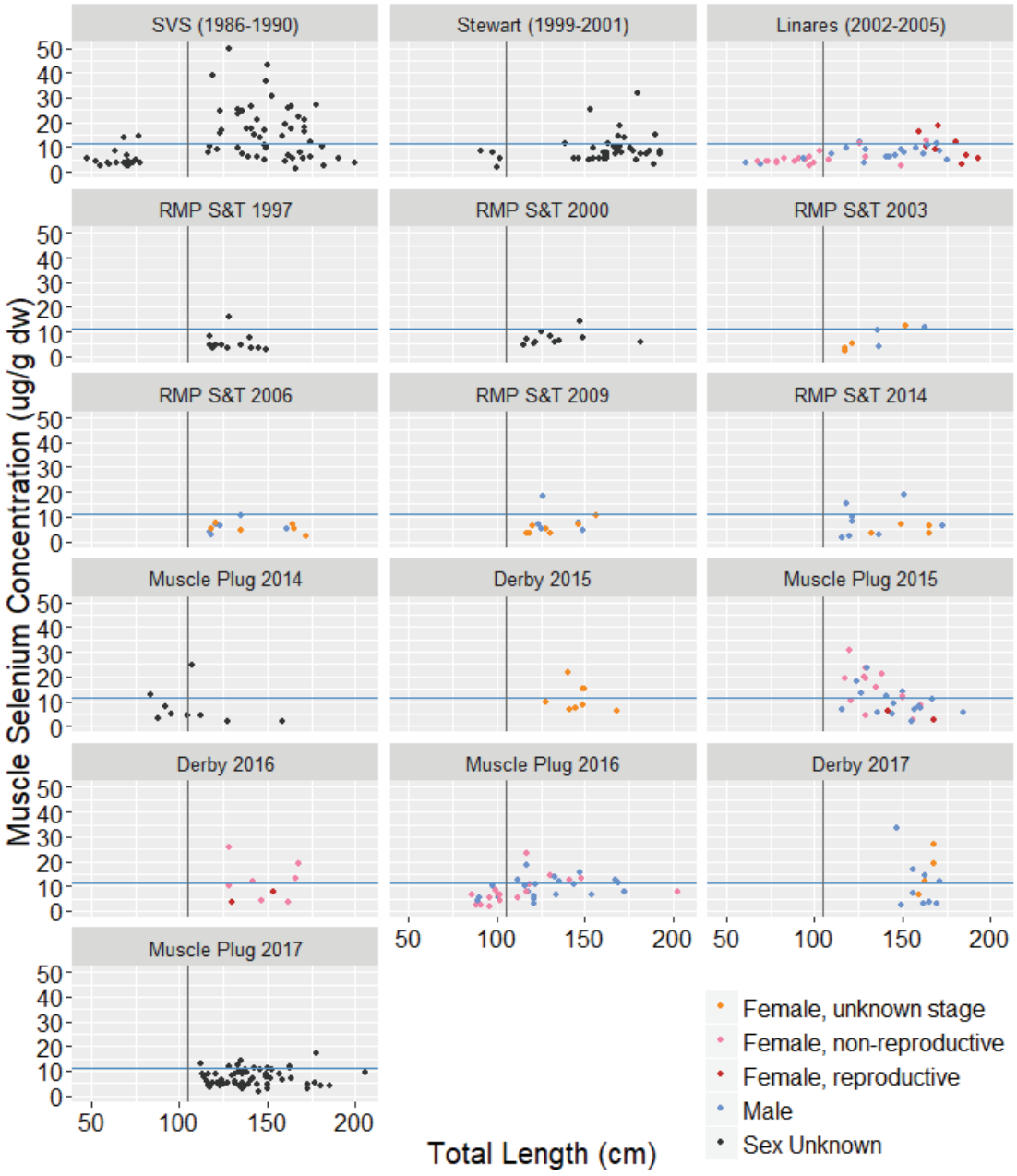


Figure 7. Total length versus water year type. Water year types are based on California Department of Water Resource's water year designations for the Sacramento River, assuming a 6 month lag between selenium in the water column and sturgeon muscle tissue. Data include all previous selenium results for white sturgeon sampled in North Bay.

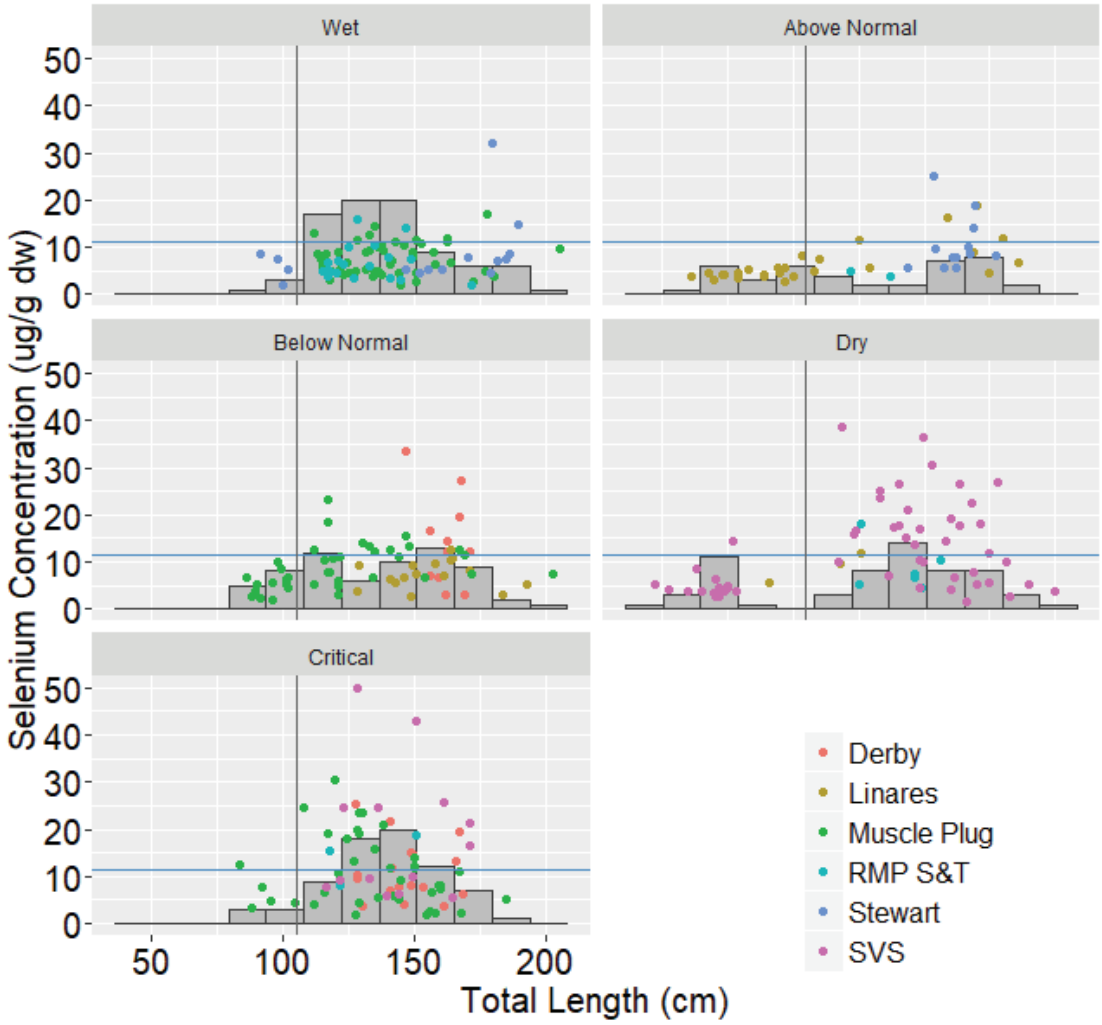


Figure 8. Selenium in female versus male white sturgeon, across all Bay studies. Data include all previous selenium results for white sturgeon sampled in the Bay.

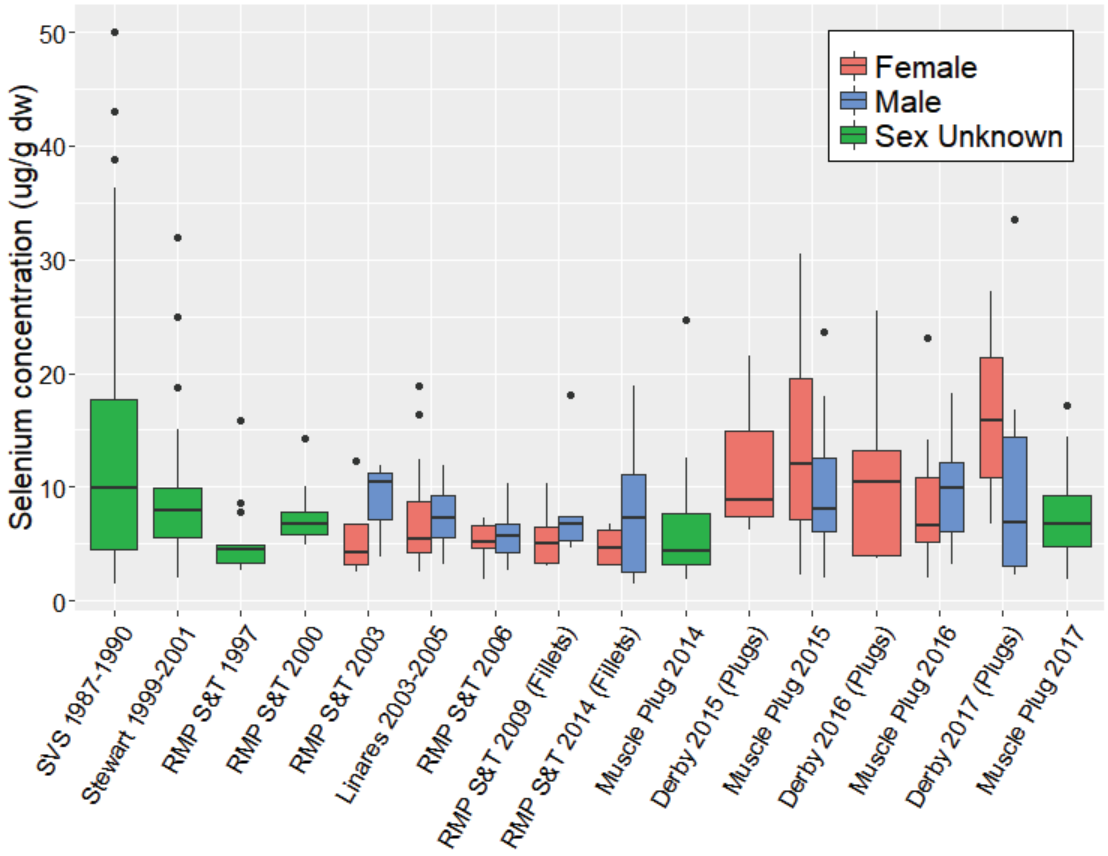


Figure 9. Selenium in white sturgeon muscle tissue, across water year types and months. Water year types are based on California Department of Water Resource's water year designations for the Sacramento River, assuming a 6 month lag between selenium in the water column and sturgeon muscle tissue. Data include all historical selenium results for white sturgeon sampled in North Bay.

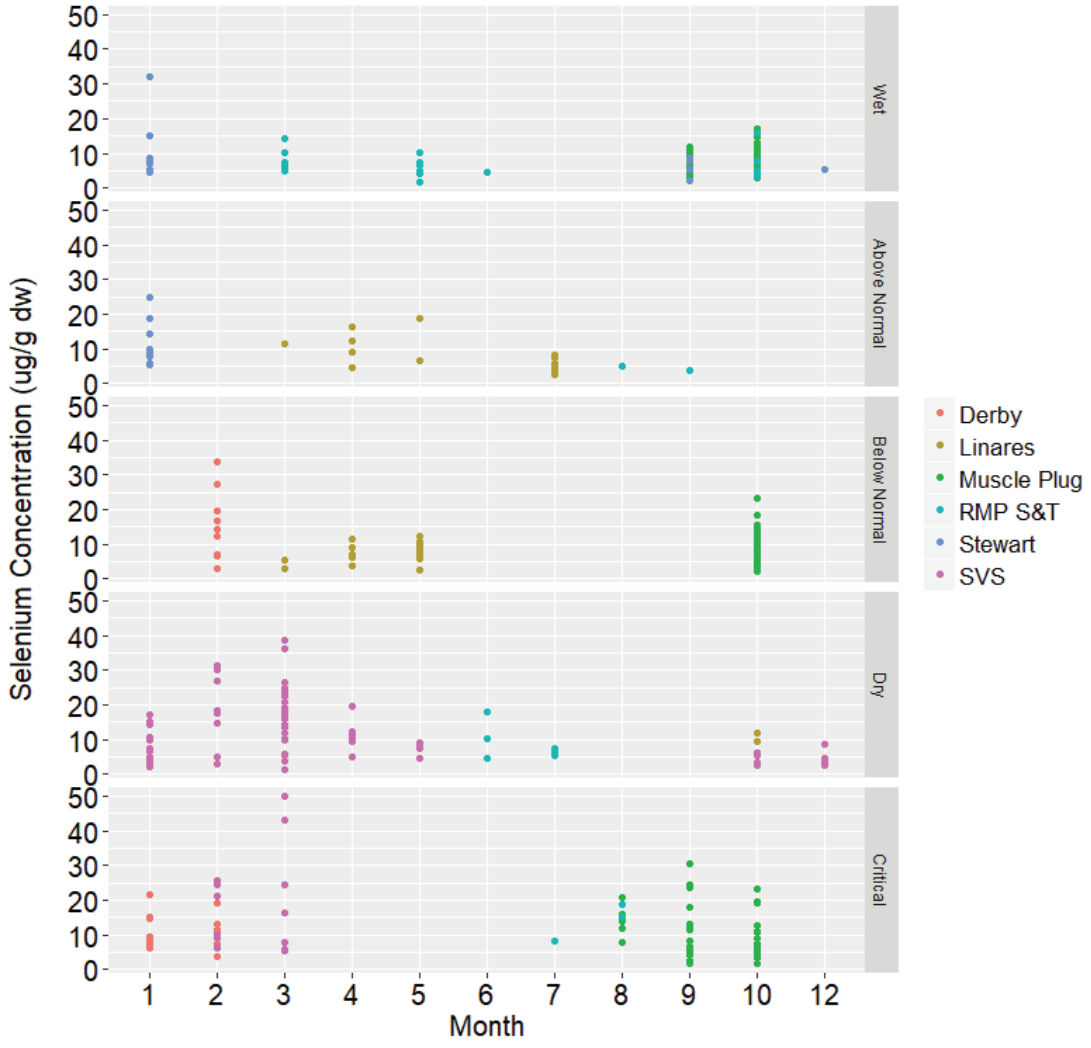
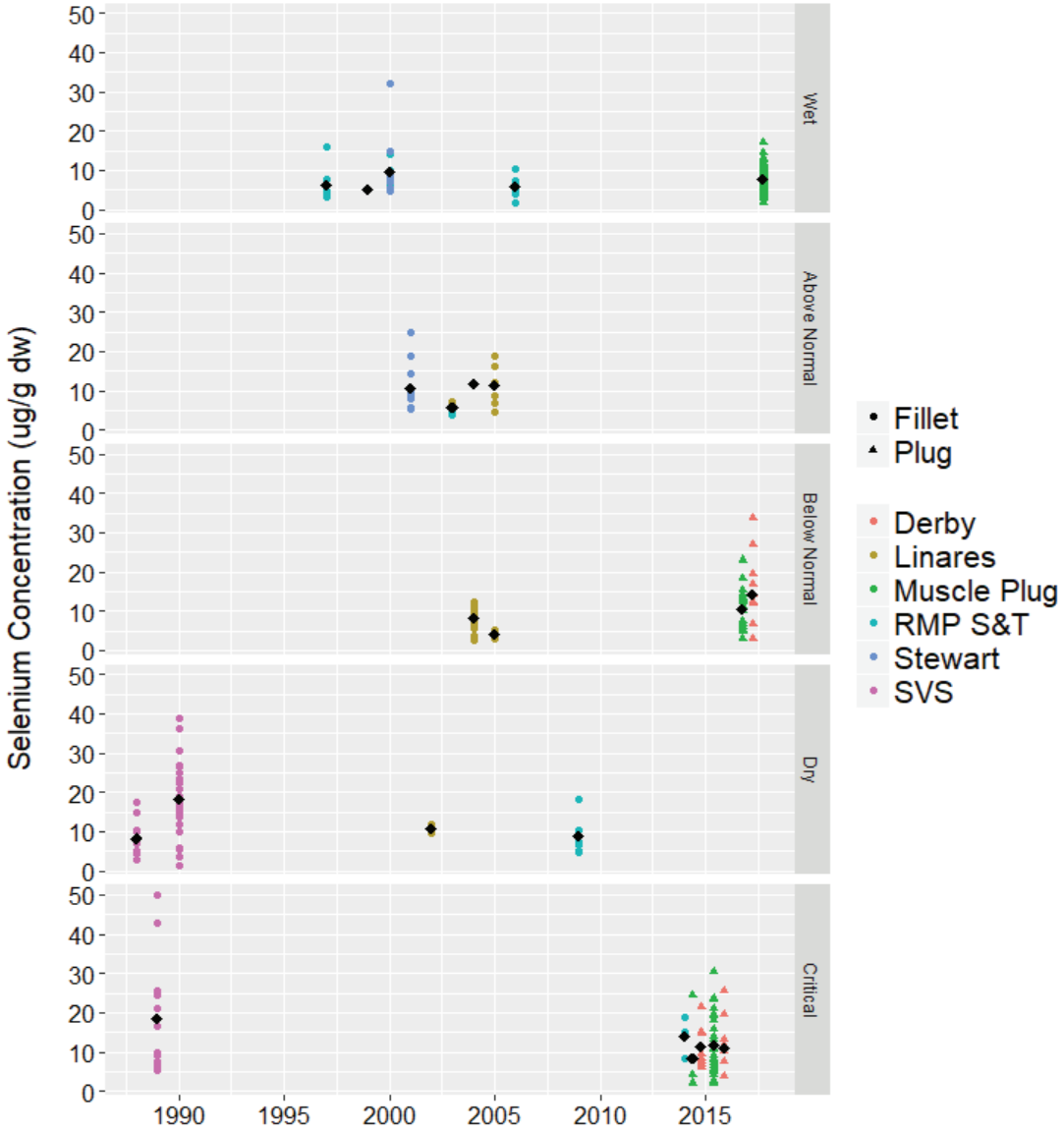


Figure 10. White sturgeon muscle tissue selenium trend across water year types. Water year types are based on California Department of Water Resource's water year designations for the Sacramento River, assuming a 6 month lag between selenium in the water column and sturgeon muscle tissue. Data include all historical selenium results for adult white sturgeon sampled in North Bay. Linear regression analyses were conducted on this dataset.



Tables

Table 1. Summary of selenium concentrations in adult white sturgeon muscle plugs, 2015-2017

Year	Sample Number	Fork Lengths, cm (min-max; median)	Min	Max	Median	Mean	Standard Error	Coefficient of Variation	% of samples above North Bay TMDL threshold (11.3 ug/g dw)
2014	4	94-140; 105	1.8	25	3.1	8.2	5.5	135%	25%
2015	30	101-162; 124	2.0	31	10.9	11.8	1.3	62%	47%
2016	25	99-178; 114	3.1	23	11.0	10.6	0.9	43%	44%
2017	58	98-183; 121	1.9	17	6.8	7.3	0.4	45%	12%

Table 2. Summary statistics and comparisons of muscle selenium concentrations in female versus male white sturgeon.

Study	Geometric mean +/- SD, ug/g dw (n)		Welch's t-test p-value
	Male	Female	
RMP Status & Trends 2003	7.8 +/- 1.9 (3)	4.8 +/- 2.0 (4)	0.38
Linares-Casenave et al. 2015 (2002-2005)	6.8 +/- 1.5 (21)	5.9 +/- 1.7 (26)	0.32
RMP Status & Trends 2006	5.3 +/- 1.6 (6)	4.7 +/- 1.7 (6)	0.67
RMP Status & Trends 2009 (fillets)	7.4 +/- 1.7 (5)	4.9 +/- 1.6 (7)	0.21
RMP Status & Trends 2014 (fillets)	5.7 +/- 2.6 (8)	4.5 +/- 1.5 (4)	0.55
RMP Muscle Plug 2015	8.4 +/- 1.8 (15)	10.8 +/- 2.2 (15)	0.34
RMP Muscle Plug 2016	8.4 +/- 1.6 (21)	6.7 +/- 2.0 (17)	0.26
RMP Sturgeon Derby 2017 (plugs)	7.1 +/- 2.6 (9)	14.5 +/- 1.8 (4)	0.14

Table 3. Summary of drivers of sturgeon muscle selenium variability

Factor	Model Use	Description
Water Year	Fixed effect (continuous)	Include as continuous variable for long-term trend analysis
Water Year Type	Fixed effect (categorical)	Data from the current study suggests that water year type has a significant effect on sturgeon selenium, matching expectations based on clam selenium patterns. Include as a categorical variable to evaluate effect. Use water year type designation for the Sacramento River, which is typically the dominant source of inflow to North Bay.
Season	Random effect (categorical)	Historical data are not exntensive enough to statistically evaluate this factor. Qualitative data analysis and understanding of environmental and physiological processes suggest that higher concentrations should be expected in spring than summer or fall. Long-term monitoring in collaboration with the CDFW sturgeon tagging survey will occur during only one season (fall). The effect of season on sturgeon selenium will not affect the detection of long-term trends based on fall sampling with the CDFW. Therefore, additional data to further assess this factor will not be collected in the future, and assessing the effect of season on sturgeon selenium is a lower priority. Include as a random effect to control for any effect that may be present.
Foraging location	Data constrained to include fish collected in North Bay only Not included in the model	Historical data suggests that higher concentrations are observed in North Bay, which is the area of regulatory interest. 85% of historical samples were collected in North Bay and 100% of future samples will be collected in North Bay. This constraint will reduce variability without substantially reducing the data evaluated by this analysis.
Age/Length	Data constrained to include adults only Fixed effect (continuous)	Historical data suggests that juveniles have lower muscle selenium concentrations than adults. Future monitoring will focus only on adults. Constraining the analysis to adults will reduce variability while focusing on the main population of interest for future monitoring. No clear trend in selenium concentrations among adults has been observed. Further evaluation of the significance of this factor and any potential interaction effects can be evaluated by including this factor in model comparisons.
Sex Reproductive Stage	Not assessed in the model Not assessed in the model	Historical data suggest that there is no significant effect of sex on selenium concentrations, and there is not enough historical data to include this factor the model. There is not enough historical data to evaluate this effect, or include this factor in the model. EPA monitoring guidance indicates that monitoring should not be designed to target a segment of the population based on reproductive stage.

Table 4. Linear regression model selection results. The most parsimonious model is highlighted in yellow.

Predictor Variables	AICc	Factor p-values				
		Water Year	Water Year Type	Total Length	Total Length x Water Year Type	Water Year x Water Year Type
NULL	534.90					
Water Year + Water Year Type + Total Length	518.60	4.18E-03	1.07E-03	0.18		
Water Year + Total Length	529.48	5.29E-03		0.21		
Water Year + Water Year Type	518.45	5.23E-03	1.09E-03			
Water Year	529.07	5.34E-03				
Water Year + Total Length * Water Year Type	512.94	3.68E-03	7.18E-04	0.19	9.84E-03	
Water Year * Water Year Type + Total Length	517.05	3.83E-03	9.13E-04	0.18		5.87E-02
Water Year * Water Year Type + Water Year Type * Total Length	506.05	2.97E-03	5.78E-04	0.16	1.18E-03	4.77E-02
Water Year Type*Total Length	512.19		2.60E-05	0.48	7.95E-03	

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ISSUE BRIEF

JUNE 2014
IB:14-05-C

The Untapped Potential of California's Water Supply: Efficiency, Reuse, and Stormwater

California is suffering from a third year of drought, with near-record-low reservoirs, mountain snowpack, soil moisture, and river runoff. As a direct result, far less water than usual is available for cities, farms, and natural ecosystems. There are far-reaching effects that will intensify if dry conditions persist. Several response strategies are available that will provide both near-term relief and long-term benefits. This report examines the significant potential contributions available from four priority opportunities: improved efficiency in urban and agricultural water use, reuse and recycling of water, and increased capture of local rain water.

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California is a land of hydrological extremes, from water-rich mountains and redwood forests in the north to some of the driest deserts in North America in the south. It suffers both epic floods and persistent droughts. The existing water infrastructure and management systems reflect these extremes, with massive dams, canals, and pumping stations to store and transfer water, and hundreds of intertwined laws, institutions, and organizations promoting overlapping and sometimes conflicting water interests. The drought could end next year or it could continue, with even greater consequences in the coming years. But even during good years, disputes over water are common and claims of water shortages rampant. Dry years magnify disagreements over allocation, management, and use of California's water resources.

For much of the 20th century, California's water supply strategy has meant building reservoirs and conveyance systems to store and divert surface waters, and drilling groundwater wells to tap our aquifers. Hundreds of billions of federal, state, and local dollars have been invested in these supply options, allowing the state to grow to nearly 40 million people with a $2 trillion economy (LAO, 2013; Hanak et al., 2012). But traditional supply options are tapped out. Rivers are over-allocated even in wet years. There is a dearth of new options for surface reservoirs, and those that exist are expensive, politically controversial, and offer only modest improvements in water supply for a relatively few users. Groundwater is so severely overdrafted that there are growing tensions among neighbors and damage to public roads, structures, and, ironically, water delivery canals from the land subsiding over depleted aquifers.

The good news is that solutions to our water problem exist. They are being implemented to varying degrees around the state with good results, but a lot more can be done. During a drought as severe as the current one, the incentives to work cooperatively and aggressively to implement solutions are even greater. In this report, we examine the opportunities for four cost-effective and technically feasible strategies—urban and agricultural water conservation and efficiency, water reuse, and stormwater capture—to improve the ability of cities, farmers, homeowners, and businesses to cope with drought and address longstanding water challenges in California. We conclude that these strategies can provide 10.8 million to 13.7 million acre-feet per year of water in new supplies and demand reductions, improving the reliability of our current system and reducing the risks of shortages and water conflicts.

NATURE OF THE CHALLENGE: THE "GAP"

California's water system is out of balance. The current water use pattern is unsustainable, and there is a large and growing gap between the water desired and the water made available by nature. Human demands for water in the form of water rights claims, agricultural irrigation, and growing cities and suburbs greatly exceed—even in wet years—volumes that can be sustainably extracted from natural river flows and groundwater aquifers. Major rivers, such as the San Joaquin, have been entirely de-watered. Declines in groundwater levels in some areas due to overpumping of groundwater are measured in hundreds of vertical feet and millions of acre-feet.

Estimates of the overall "gap" are difficult because large volumes of water use are not measured or reported, California's natural water supply varies greatly between wet and dry years, and because water "demand" can be artificially inflated by over-allocation of rivers, inefficient use, price subsidies, the failure to prevent groundwater overdraft, and other hard limits on supply. But there are a wide variety of signs of the gap:

Sacramento-San Joaquin River Delta

The Sacramento-San Joaquin River Delta illustrates the unsustainable gap between how much water we take from our rivers and how much those rivers can provide. The Delta is vitally important to California. It is the primary hub for moving water from north to south. It is home to hundreds of species of birds, fish, and wildlife (DSC, 2013), including two-thirds of the state's salmon and at least half of the Pacific Flyway migratory water birds (USFWS, 2001). It is also a vibrant farming community. But excessive water diversions have contributed to a crisis that threatens the Delta's ability to perform any of these functions. In response to this crisis, in 2009, the State Legislature directed the State Water Resources Control Board (State Board) to determine how much water the Delta would need to fully protect public trust resources in the Delta.[1] For an average weather year, the State Board found that substantially increased flows from the Sacramento and San Joaquin River basins through the Delta into San Francisco Bay are needed to restore and maintain viable populations of fish and wildlife under existing conditions.[2] The Board's findings indicate that we currently divert almost 5 million acre-feet more water in an average year from the Delta than is compatible with a healthy Delta.[3] While these findings were designed to inform future planning decisions without considering other changes to the system or balancing other beneficial uses, the State Board's determination illustrates the yawning gap between our water demands in California and how much our surface waters can supply.

Groundwater Overdraft

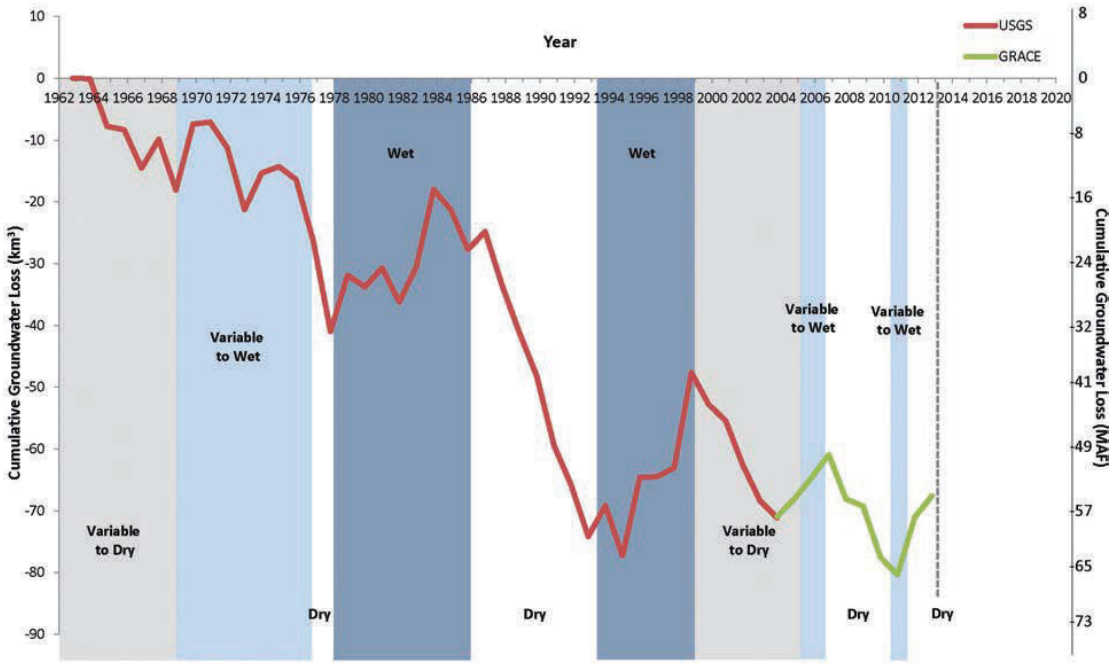
Groundwater is a vital resource for California. In average years, it provides nearly 40 percent of the state's water supply. That number goes up to 45 percent in dry years and close to 60 percent in a drought (DWR, 2014a). Moreover, many small- and medium-sized communities, such as Lodi, are completely dependent on groundwater. A clear indicator of the gap between water supply and water use in California is the extensive and unsustainable overdraft of groundwater, i.e., groundwater extracted beyond the natural recharge rate of the aquifer. Chronic overdraft has led to falling groundwater levels, dry wells, land subsidence, decreased groundwater storage capacity, decreased water quality, and stream depletion (Borchers et al., 2014).

As shown in Figure 1, groundwater levels are declining across major parts of the state. According to the Department of Water Resources (2014a), since spring 2008, groundwater levels have dropped to all-time lows in most areas of the state and especially in the northern portion of the San Francisco Bay hydrologic region, the southern San Joaquin Valley, and the South Lahontan and South Coast hydrologic regions. In many areas of the San Joaquin Valley, recent groundwater levels are more than 100 feet below previous historic lows. While some groundwater recharge occurs in wet years, that recharge is more than offset by pumping in dry and even average years, with over 50 million acre-feet of groundwater having been lost over the last half century (UCCHM, 2014). A comprehensive statewide assessment of groundwater overdraft has not been conducted since 1980, and there are major gaps in groundwater monitoring.[4] DWR has been estimating with considerable uncertainty that overdraft is between 1 million and 2 million acre-feet per year (DWR, 2003).

There are strong indications, however, that groundwater overdraft is worsening. Recent data indicates that the Sacramento and San Joaquin River Basins collectively lost over 16 million acre-feet of groundwater between October 2003 and March 2010, or about 2.5 million acre-feet per year (Famiglietti, 2014). This period captured a moderate drought, and thus we would expect overdraft to be higher than in non-drought periods. But while groundwater levels increased in 2011 and 2012, they did not fully recover to pre-drought levels, resulting in a net loss in groundwater storage at time when California enters a far more severe drought.

The gap between water supply and use from the state's groundwater basins and from the Sacramento-San Joaquin Delta alone exceeds 6 million acre-feet of water per year. We know that this underestimates the gap, as numerous studies have identified considerable unmet environmental flow objectives in other parts of the state (Hayden and Rosekrans, 2004). Moreover, we know that these "gaps" are expected to grow with the increasing challenges posed by population growth and climate change (DWR, 2013a).

Figure 1. Cumulative groundwater loss (in km³ and million acre-feet) for California's Central Valley since 1962



Note: Cumulative groundwater losses (cubic km and million acre-ft) in California's Central Valley since 1962 from USGS and NASA GRACE data. Figure from UCCHM (2014) and extends figure B9 from *Faunt* [2009]. The red line shows data from USGS calibrated groundwater model simulations [Faunt, 2009] from 1962-2003. The green line shows GRACE-based estimates of groundwater storage losses from *Famiglietti* et al. [2011] and updated for UCCHM(2014). Background colors represent periods of drought (white), of variable to dry conditions (grey), of variable to wet conditions (light blue) and wet conditions (blue). Groundwater depletion mostly occurs during drought; and progressive droughts are lowering groundwater storage to unsustainable levels.

Source: UC Center for Hydrologic Modeling (UCCHM), 2014. Water Storage Changes in California's Sacramento and San Joaquin River Basins From GRACE: Preliminary Updated Results for 2003-2013. University of California, Irvine UCCHM Water Advisory #1, February 3, 2014. Available at https://webfiles.uci.edu/jfamigli/Advisory/UCCHM_Water_Advisory_1.pdf.

Figure courtesy of Jay Famiglietti, UCCHM, UC Irvine

OPPORTUNITIES

The good news is that California can fill the gaps between water supply and use with a wide range of strategies that are cost-effective, technically feasible, more resistant to drought than the current system, and compatible with healthy river and groundwater basins. New supply options include greatly expanded water reuse and stormwater capture. Demand-management options include the adoption of more comprehensive efficiency improvements for cities and farms that allow us to continue to provide the goods and services we want, with less water. Efforts in these areas have been underway in California for decades, and laudable progress has been made, but much more can be done.

Efficiency, water reuse, and stormwater capture can provide effective drought responses in the near-term and permanent water-supply reliability benefits for the state. Moreover, by reducing reliance on imported water supplies and groundwater pumping, they can cut energy use and greenhouse emissions, reduce the need to develop costly new water and wastewater infrastructure, and eliminate pollution from stormwater and wastewater discharges. Finally, these strategies can also generate new jobs and provide new business opportunities.

To better understand the extent to which these alternatives could reduce pressure on the state's rivers and groundwater basins, the Pacific Institute, Natural Resources Defense Council, and Professor Robert Wilkinson from the University of California, Santa Barbara undertook a series of assessments of the potential for urban and agricultural water conservation and efficiency, water reuse, and stormwater capture. In particular, we evaluated the technical potential, i.e., the total water supplies and demand reductions that are feasible given current technologies and practices.[5] These measures are already being adopted in California and have been shown to be cost-effective compared to other water supply alternatives (Cooley et al. 2010; DWR, 2013b). The next section provides a short summary of the additional technical potential for each of these strategies.

Improving Agricultural Water-Use Efficiency

Agriculture uses approximately 80 percent of California's developed water supply (DWR, 2014b). As such a large user, it is heavily impacted by the availability and reliability of California's water resources. Moreover, agriculture can play an important role in helping the state achieve a more sustainable water future. California irrigators have already made progress in modernizing irrigation practices, but more can be done to promote long-term sustainable water use and ensure that agricultural communities remain healthy and competitive. Since 2000, several research studies—including two sponsored by the CALFED Bay-Delta Program and a third by the nonprofit Pacific Institute—have shown that there is significant untapped agricultural water-use efficiency potential in California (CALFED, 2000 and 2006; Cooley et al., 2009). Although the studies varied in their geographic scope and in their approach, the researchers came up with remarkably similar numbers, finding that agricultural water use could be reduced by 5.6 million to 6.6 million acre-feet per year, or by about 17 to 22 percent, while maintaining current irrigated acreage and mix of crops. As much as 0.6 million to 2.0 million acre-feet per year represent savings in consumptive use, which can then be allocated to other uses. The rest of the savings reflect reductions in the amount of water taken from rivers, streams, and groundwater, leading to improvements in water quality, instream flow, and energy savings, among other benefits. Additional water savings could be achieved by temporarily or permanently fallowing land or switching crop types, but these options were not evaluated here.

Improving Urban Water-Use Efficiency

Greater urban water conservation and efficiency can reduce unnecessary and excessive demands for water, save energy, reduce water and wastewater treatment costs, and eliminate the need for costly new infrastructure. Between 2001 and 2010, California's urban water use averaged 9.1 million acre-feet per year, accounting for about one-fifth of the state's developed water use (DWR, 2014b). By adopting proven technologies and practices, businesses can improve water-use efficiency by 30 to 60 percent. Residential users can improve home water-use efficiency by 40 to 60 percent by repairing leaks, installing the most efficient appliances and fixtures, and adopting landscape designs with less turf grass and more native and drought tolerant plants. In addition, water utilities can expand their efforts to identify and cut leaks and losses in underground pipes and other components of their distribution systems. Together, these savings could reduce urban water use by 2.9 million to 5.2 million acre-feet per year.

Greater Water Reuse

Water reuse is a reliable, local water supply that reduces vulnerability to droughts and other water-supply constraints. It can also provide economic and environmental benefits by reducing energy use, diversions from rivers and streams, and pollution from wastewater discharges. There is significant opportunity to expand water reuse in California. An estimated 670,000 acre-feet of municipal wastewater is already beneficially reused in the state each year (SWRCB and DWR, 2012). Onsite reuse—including the use of graywater—is also practiced across California, although data are not available to estimate the extent of reuse. We estimate that the water reuse potential in California, beyond current levels, ranges from 1.2 million to 1.8 million acre-feet per year, after taking into account efficiency opportunities. Approximately two-thirds of the reuse potential is in coastal areas where wastewater is discharged into the ocean or into streams that drain into the ocean. In these areas, expanding water reuse can provide both water-supply and water-quality benefits.

Expanding Stormwater Capture and Use

Municipalities used to manage stormwater by channeling it away from developed land and urban centers as quickly as possible. This approach reduces the amount of freshwater available for groundwater recharge and use, and it creates tremendous pollution problems with stormwater discharges to rivers, lakes, and ocean waters. As water resources have become increasingly constrained, there is new interest in capturing stormwater runoff as a sustainable source of supply (CNRA, 2014). In California, there are substantial opportunities to use stormwater beneficially to recharge groundwater supplies or for direct use for non-potable applications. Our assessment indicates that capturing stormwater from paved surfaces and rooftops in urbanized Southern California and the San Francisco Bay Area can increase average annual water supplies by 420,000 to 630,000 acre-feet or more each year, while also reducing both flooding and a leading cause of surface water pollution in the state.

Combined Water Supply and Demand Reductions

Together, these improvements in water conservation and efficiency, water reuse, and stormwater capture can provide 10.8 – 13.7 million acre-feet in new supplies and demand reductions. As shown in Figure 2, these savings can be realized throughout the state. There are, however, important regional differences. In the Central Valley and the Colorado River hydrologic region, for example, the majority of savings are from agriculture, although savings from other strategies are also available. In coastal areas, the majority of savings are in urban areas. Statewide, urban conservation and efficiency combined with water reuse and stormwater capture provide the equivalent in new supplies and demand reductions as agricultural efficiency (Table 1).

Along the coast and in areas that drain into a salt sink, these measures provide water supply and water quality benefits. In inland areas, some portion of the yield of these measures may already be used by a downstream user and thus do not constitute "new" supply. However, even in such locations, the measures described here can improve the reliability of water supplies, leave water instream for use by ecosystems, replace the need for potable water, and reduce pressure on the state's overtaxed rivers and groundwater basins.

Figure 2. Total water supply and demand changes with four drought response strategies, in thousand acre-feet per year, by hydrologic region

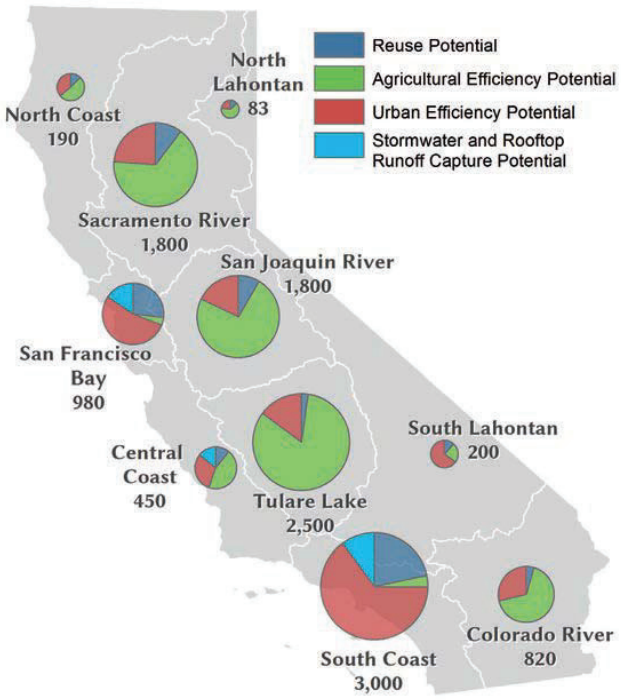


Table 1. Statewide water supply and demand changes with four drought response strategies

Strategy	Water Savings (million acre-feet per year)
Agricultural water conservation and efficiency	5.6 – 6.6
Urban water conservation and efficiency	2.9 – 5.2
Water reuse	1.2 – 1.8
Stormwater capture	0.4 – 0.6

Note: Stormwater capture was only examined in the San Francisco Bay Area and the South Coast. There is additional potential to capture stormwater in other regions of the state, although we did not evaluate that here. The values shown in this figure represent the midpoint of the ranges for each strategy.

CONCLUSIONS

We conclude that there is tremendous untapped potential to improve efficiency and augment supplies in California. Water efficiency, water reuse, and stormwater capture can provide 10.8 million – 13.7 million acre-feet of water in new supplies and demand reductions. These alternatives can provide both effective drought responses in the near-term and permanent water-supply reliability benefits for the state. Additionally, they can reduce energy use and greenhouse emissions, lower environmental impacts, and create new business and employment opportunities. Given the large potential and broad agreement about these strategies, state, federal, and local water agencies should move much more rapidly to implement policies to capture this potential.

California is reaching, and in many cases has exceeded, the physical, economic, ecological, and social limits of traditional supply options. We must expand the way we think about both "supply" and "demand"—away from costly old approaches and toward more sustainable options for expanding supply, including water reuse and stormwater capture, and improving water use efficiency. There is no "silver bullet" solution to our water problems, as all rational observers acknowledge. Instead, we need a diverse portfolio of sustainable solutions. But the need to do many things does not mean we must, or can afford, to do everything. We must do the most effective things first.

Identifying the technical potential to expand non-traditional supply options and increase water-use efficiency savings is just the first step in tackling California's water problems. Equally, if not more, important is adopting policies and developing programs to achieve those savings. A substantial body of law and policy already points the way to a more sustainable future for our state. For example, the California Constitution prohibits the waste of water. Likewise, the Brown Administration's California Water Action Plan supports local water projects that increase regional self-reliance and result in integrated, multi-benefit solutions. Many of these themes are also expressed in policy documents and recommendations from the California Urban Water Conservation Council, the Pacific Institute, the Association of California Water Agencies, the Delta Stewardship Council, the California Council on Science and Technology, the California Water Foundation, and others.

There is broad agreement on the value of improved efficiency, water reuse, and stormwater capture. The challenge is not a lack of knowledge or vision about what to do, but rather the urgent need for more effective implementation of strategies already known to work. Many innovative policymakers around the state have proposed new approaches to promote more widespread implementation of these strategies. We look forward to working with the Governor, agency heads, legislative leaders, water suppliers, and civic and business leaders to follow up with more specific actions for bringing the supply and demand for water in California into a sustainable balance.

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Footnotes

1 Water Code section 85086(c)(1): "For the purpose of informing planning decisions for the Delta Plan and the Bay Delta Conservation Plan, the board shall, pursuant to its public trust obligations, develop new flow criteria for the Delta ecosystem necessary to protect public trust resources."

2 See, e.g., page 5 of SWRCB and California EPA (2010a), recommending the general magnitude and timing of 75 percent of unimpaired Delta outflow from January through June, from approximately 30 percent in drier years to almost 100 percent in wetter years; 75 percent of unimpaired Sacramento River inflow from November through June, from an average of about 50 percent from April through June; and 60 percent of unimpaired San Joaquin River inflow from February through June, from approximately 20 percent in drier years to almost 50 percent in wetter years.

3 SWRCB and California EPA (2010b) at 180, Scenario B (2,258 thousand acre-feet (TAF) north-of-Delta delivery difference + 1,031 TAF south-of-Delta delivery difference = 1,609 TAF Vernalis flow difference = 4,898 TAF).

4 Of California's 515 alluvial groundwater basins, 169 are fully or partially monitored under the CASGEM Program and 40 of the 126 High and Medium priority basins are not monitored under CASGEM. The greatest groundwater monitoring data gaps are in the Sacramento, San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions (DWR 2014a).

5 The technical potential estimated in these analyses is based on current use patterns and does not include population and economic growth, or changes in the total acreage or types of crops grown in the state. Increased population can result in increased demand, and these tools can help offset that growth. We do not examine the economic or market potential of these alternatives.

Authors and Acknowledgements

The lead author of this report is Peter Gleick, with additional contributions by Heather Cooley, Kate Poole and Ed Osann. Support for this work was provided by the Pisces Foundation. Numerous individuals provided comments on this report; we thank them for their input.

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ISSUE BRIEF

MARCH 2016
IB: 16-03-B

PROCEED WITH CAUTION II:
California's Droughts and Desalination in Context

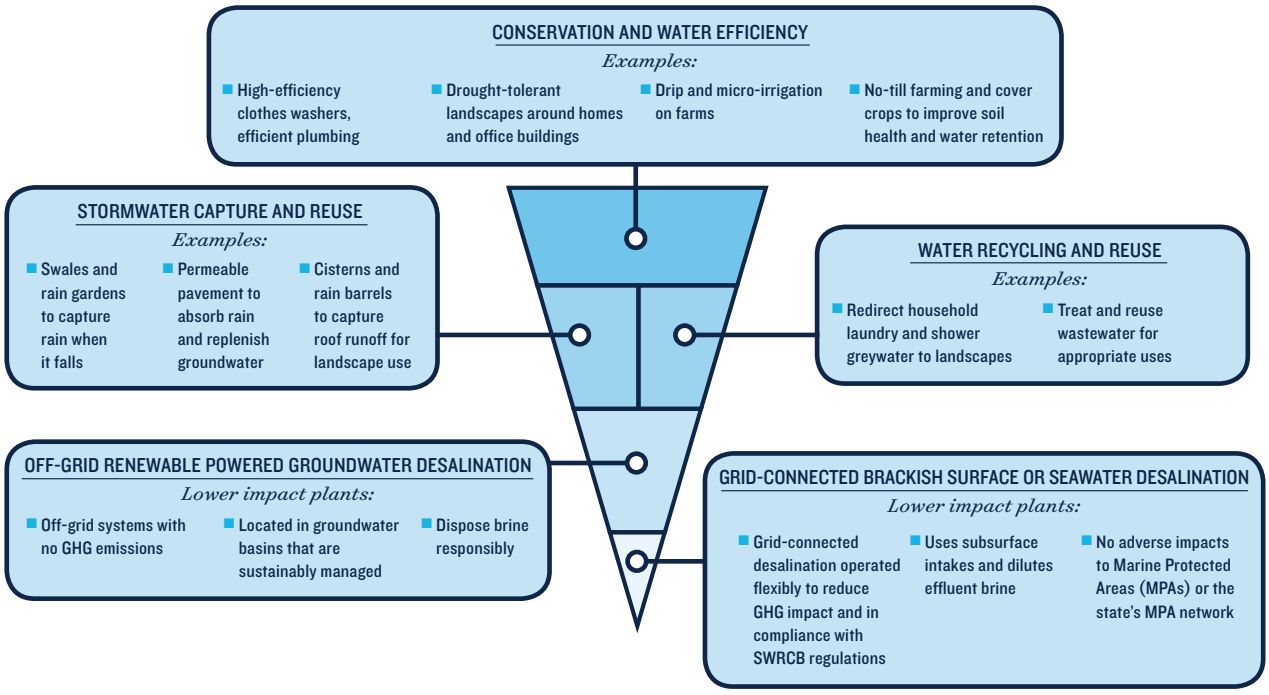
I. INTRODUCTION

Over the last four years, California has experienced some of the driest and hottest periods on record,[1] resulting in extreme drought conditions across virtually the entire state.[2] As scientists predict a hotter and drier future for California, some observers question whether California's water shortage can be solved through seawater desalination. The question has become even more pertinent after California passed the Proposition 1 relief package (Water Bond, Assembly Bill 1471), which provides $7.545 billion for new water projects and allocates $100 million for desalination. The funds have not been distributed yet but could finance brackish groundwater, brackish surface water, and/or seawater desalination plants as pilot or full-scale projects.[3] As California considers desalination plants, we recommend the state proceed with caution.

NRDC, California Coastkeeper Alliance, California Coast Protection Network, Orange County Coastkeeper, Heal the Bay, the Nature Conservancy, and Surfrider co-authored this paper as an overview of the science related to desalination, and as a policy guidance tool. Here, we demonstrate why conventional seawater desalination should be reserved as the last option to address long-term droughts, while offering more sustainable alternatives. With careful application of our information and recommendations, California can meet the state's water needs without compromising valuable natural resources or slowing the state's leadership on climate policy.

CHART I: PREFERRED PRIORITIZATION OF CALIFORNIA WATER RESOURCES

(Based on application of cost, energy, efficiency, and environmental considerations. Note this prioritization can change based on local resource needs and conditions.)



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In general, seawater desalination is far more expensive and energy-intensive than alternative water supply and demand reduction options and poses serious threats to marine and coastal resources.[4] Desalination of brackish[5] surface water,[6] likewise, presents many of the same cost, energy, and environmental disadvantages. Desalination facilities often take many years to build and operationalize. Furthermore, they may not be cost-effective to operate once built, resulting in stranded assets that increase ratepayer costs for little or no return. Thus, both seawater and brackish surface water desalination should only be pursued after we have exhausted other alternatives, including water conservation, water-use efficiency, stormwater capture, water recycling, onsite reuse and brackish groundwater desalination. We recommend that water utilities adopt or update water management plans that prioritize these preferred water resources first. Should desalination be deemed appropriate, projects should be scaled to meet demonstrated water supply needs, utilizing best management practices (BMPs) and best available technology (BAT), as described in the Evaluative Matrix in the Recommendations section.

II. WHAT IS DESALINATION?

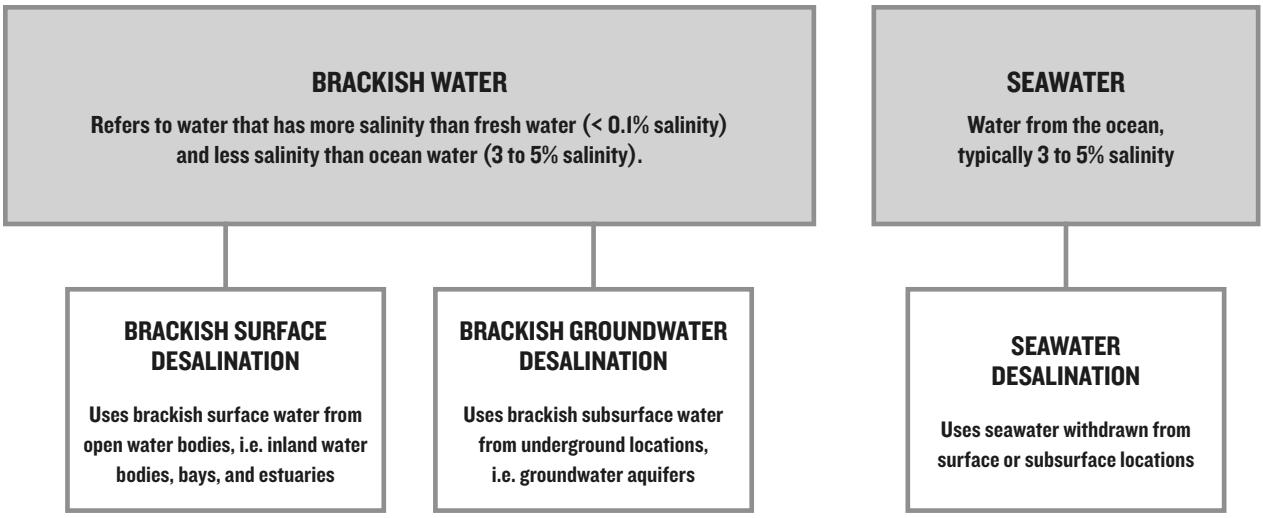
Desalination is the process of removing salt and other minerals from seawater, brackish water, wastewater, or contaminated groundwater to create pure water for drinking and other purposes.[7] While desalination technologies vary, most modern plants use reverse osmosis, in which high volumes of saline water pass through membranes under high pressure to remove salts.[8]

Much of the recent discussion of desalination as a water supply alternative focuses on seawater desalination. Desalination can, however, be applied to brackish surface water, found in the tidal mixing zone of California's estuaries and bays, as well as brackish groundwater or contaminated water from underground aquifers. These other types of desalination—particularly brackish groundwater desalination can play a role in meeting California's water demand.

California's 2013 Water Plan Update indicated that brackish groundwater desalination plants significantly outnumber seawater desalination plants, both in number of facilities and in water produced. The Plan identified 23 brackish groundwater desalination plants in operation—with a combined annual capacity of 139,627 acre-feet per year.[10] Of those, 22 are located in Southern California, and one is in the San Francisco Bay Area.[11] The majority are located in adjudicated groundwater basins. The update also noted three such plants in the design and construction phase, along with 17 more proposed plants.[12]

By comparison, as of 2016, there are 12 existing seawater desalination plants with a combined annual capacity of 62,840 acre-feet per year for all active facilities, which is—less than half the capacity of all groundwater desalination plants.[13] One brackish surface water plant in the San Francisco Bay Area has completed pilot testing and is currently under study for full-scale design.[14] There are currently no such plants in operation.

CHART 2: TYPES OF DESALINATION[9]



III. DESALINATION IS EXPENSIVE

The average price per acre-foot of water produced by seawater desalination is four to eight times higher than alternative sources. Estimates for proposed seawater desalination plants in California range from $1,900 to more than $3,000 per acre-foot.[15] A plant that produces 50 million gallons per day (MGD[16]), such as the one recently constructed in Carlsbad, is projected to cost between $2,042 to $2,290 per acre foot.[17] The estimated cost of water from brackish desalination plants ranges from $600 to $3,000 per acre-foot.[18] Alternative water resources, including imported water, efficiency and recycled water, are all generally significantly cheaper.

While the cost of seawater desalination has declined over the past 20 years, it remains very expensive and is generally not competitive with the lower-impact water resources described in our Recommendations.[20] Additionally, alternatives such as water conservation, water efficiency, stormwater capture, and water recycling often provide multiple benefits, including lower energy costs, pollution abatement, reduced demand on sensitive aquatic ecosystems, and flood control. While economic value of these benefits is often not included in per-acre-foot cost estimates, they should be included in project cost-benefit analyses.

IV. DESALINATION IS ENERGY INTENSIVE

Desalinating water uses more energy, per unit of water, than any other source. In fact, energy accounts for 37 percent of the operating cost to run a reverse osmosis seawater desalination plant.[21] For example, the Carlsbad seawater desalination plant is currently the most energy-intensive water source in the region's water supply portfolio and requires 52 percent more energy per acre-foot than water delivered to San Diego from the State Water Project.[22] The energy intensity of various water supply options can differ based on technology, size, and location. For example, seawater desalination energy intensity can range from 3,300 kilowatt hour per acre-foot (kWh/af) to 5,900 kWh/af.[23] In Figure 2, we focus on the relative energy intensities of average water supply options in Southern California.[24]

California's current water management system is already extremely energy-intensive. According to Navigant Consulting, "water-related energy use consumes 19 percent of the state's electricity, 30 percent of its natural gas, and 88 billion gallons of diesel fuel every year."[26] This system level total includes energy used to heat water for various end uses as well as downstream energy used to treat wastewater. "Embedded energy" refers to the total energy used to move a unit of water from its source, to its end user, and finally to disposal. Not all water contains the same

FIGURE 1: COST OF CALIFORNIA'S WATER RESOURCES[19]

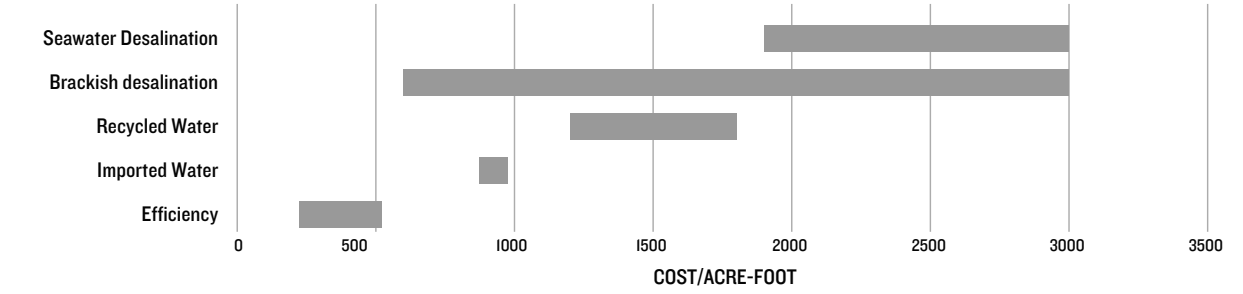
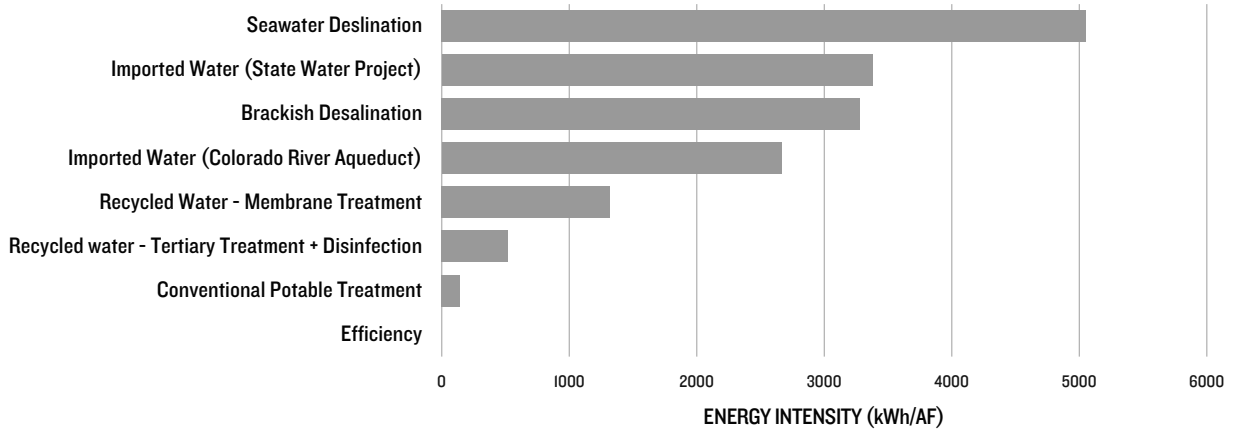


FIGURE 2: AVERAGE ENERGY INTENSITY OF CALIFORNIA'S WATER RESOURCES[25]



amount of embedded energy: embedded energy in water depends on the various energy intensities at each stage of the process. As noted in Figure 2, different water sources have different energy intensities, greatly impacting the amount of energy embedded in our total water system.

California is a global leader in expanding energy efficiency and reducing greenhouse gas (GHG) emissions. In fact, the state plans to reduce GHG emissions by 40 percent below 1990 levels by 2030.[27] Expanding energy-intensive water treatment technology will make it more challenging and expensive to achieve the state's climate goals. Conventional desalination plants connected to the electric grid increase electricity consumption from fossil fuel plants, which increase GHG emissions in the power sector. California should, instead, prioritize water supply and treatment options that are more energy efficient, such as water efficiency, stormwater capture and recycled water. If desalination is pursued, we recommend reducing the energy consumed at the plant, the corresponding GHG emissions, and grid reliability impacts.

RELATED CONCEPTS

Energy intensity = how much energy it takes to bring each gallon of water to your house

GHG intensity = how much carbon dioxide is emitted to make the energy to bring each gallon of water to your house

Example: a renewably-powered brackish desal plant has a relatively high energy intensity, but because the GHG intensity of making the energy is zero, its water production results in no carbon emissions

V. STRATEGIES FOR REDUCING DESALINATION PLANTS' GHG EMISSIONS AND GRID RELIABILITY IMPACTS

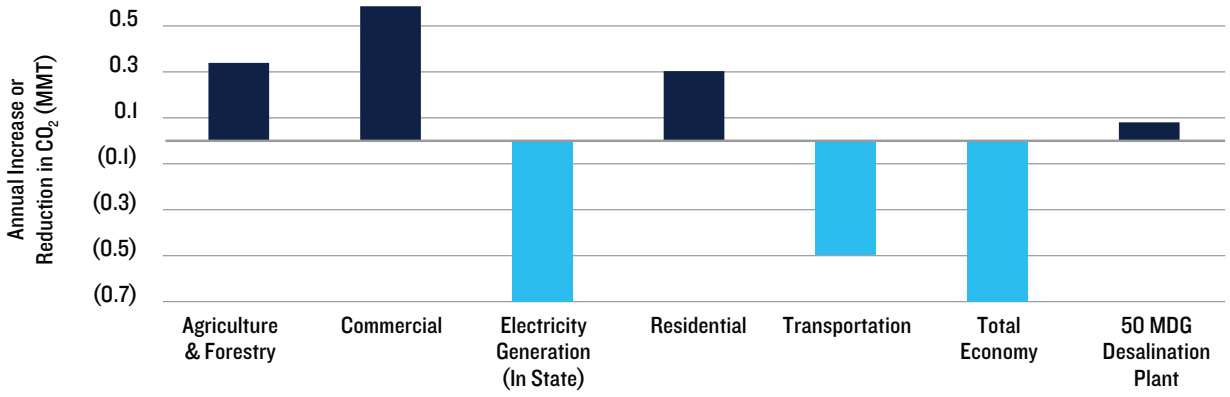
In its 2013 Climate Change Scoping Plan, the California Air Resources Board (CARB) stated that one way for the state to achieve GHG emissions reductions is to replace existing water supply and treatment processes with more energy efficient options.[28] Most desalination plants would take the state in the opposite direction, as conventionally desalinated water is more GHG-intensive than preferred water resources.

Desalination plants produce most of their GHG emissions indirectly, through electricity consumption during facility operations (though a small fraction are emitted during plant construction). The emissions levels vary depending on the GHG intensity of the electricity source (for example, solar energy versus fossil fuels) and how the plant is operated. The bulk of California's desalination fleet simply draws electricity from the grid when needed and increases GHG emissions. To avoid these impacts, and only after preferred water supply options have been implemented, we need strategies to reduce the emissions from desalination plants.

Conventional Desalination Plants Should Be Deprioritized And Should Mitigate Their Indirect GHG Emissions With Compliance-Grade Instruments

Conventional desalination plants are connected to the electric grid, operate continuously and create new GHG emissions from the electricity they use. While California has a relatively clean electric grid, the bulk of the electricity used to power conventional desalination plants still comes from fossil fuel power plants. For example, one seawater desalination plant the size of the Poseidon Resources facility in Carlsbad, if unmitigated, would create GHG emissions that register on a statewide level. That's equivalent to approximately one-tenth of the statewide average annual reductions in carbon emissions over the last five years.

FIGURE 3: INCREASES AND REDUCTIONS IN GHGS FOR SELECT SECTORS OF CALIFORNIA ECONOMY, ON AVERAGE ANNUAL BASIS SINCE 2009,[29] AND ANNUAL INCREASE FROM A 50 MGD DESALINATION PLANT.[30]



Considering California's ambitious GHG emissions reduction goal, conventional desalination plants should use credible, compliance-grade, GHG-reduction instruments to mitigate their sizeable impacts. While numerous instruments are available to reduce GHG impacts, it is critical that they meet the state's standards under Assembly Bill 32, the California Global Warming Solutions Act of 2006. Simply put, they must be real, permanent, quantifiable, verifiable, enforceable and additional.[31]

Conventional Desalination Plants Impact Local Electric Grids and Should Reduce Their Energy Consumption Through Energy Efficiency Improvements

Connecting desalination plants to the electric grid places an additional and unplanned load on the electric system. Several of the proposed locations for new desalination plants, including virtually all coastal locations in southern California, are in electrically constrained local areas—locations where new resources are being built just to meet the existing and future electricity demand. For example, after accounting for significant retirements of old power plants, the California Public Utilities Commission (CPUC) authorized Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E) to add more than 5,000 MW of new generation resources in coastal areas of southern California to meet projected energy needs. But the CPUC made these decisions based on status quo levels of growth in Southern California, not accounting for new desalination plants.[32] The increase of large seawater desalination plants—like the Carlsbad plant that draws 38 MW of electricity from SDG&E's fossil-fuel dominated grid—creates an additional and unaccounted for load on the electric system that, all else being equal, will require new resources. The annual energy consumption of a desalination plant like Carlsbad, of 274 GWh, would surpass the amount saved by a year's worth of SDG&E's energy efficiency programs,[33] and place a peak capacity demand on the system greater than all the reductions from all of SDG&E's residential demand response programs at peak need.[34]

To reduce their burden on the grid, we recommend that conventional desalination plants reduce their energy consumption through energy efficiency improvements to plant equipment and processes.

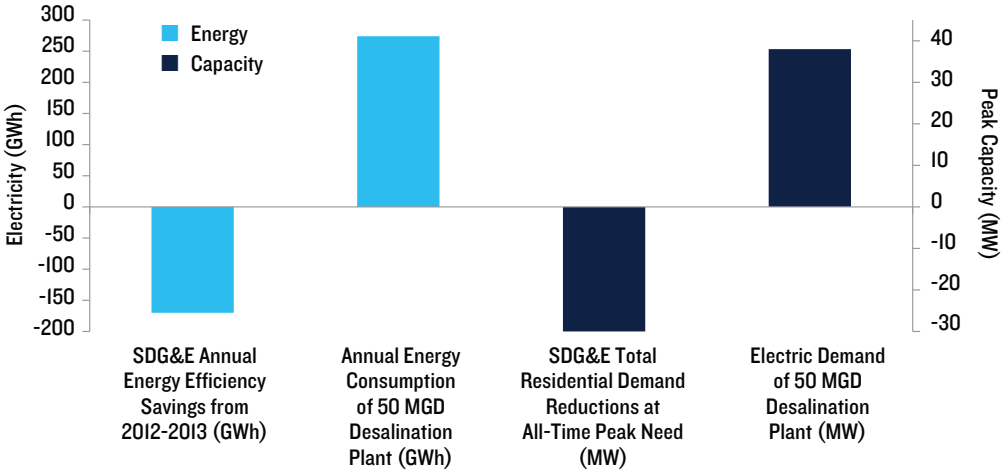
Conventional Desalination Plants Have Not Yet—But Should—Reduce Their GHG Emissions by Operating Flexibly

Desalination plants that primarily operate when there is excess generation on the grid has emerged as a theoretical option to meet both electric grid and water needs. However, such a desalination plant has not yet been deployed commercially or operated in the United States.

Flexible operating hours at commercial scale have not been demonstrated—only small desalination plants in research and development stages, not large-scale commercial plants,[36] have been able to ramp up and down. This is mostly because of the inevitable wear and tear on filters, pumps, and parts and because financial incentives encourage continuous operation. Operating a desalination plant for only those hours of the day when needed generates less revenue and amortizes total costs over fewer units produced. Some seawater desalination plants have take-or-pay contracts, including the Poseidon plant in Carlsbad, California,[37] which means that the utility and its billpayers pay for water whether or not it is produced. This provides a strong incentive to operate the plant around the clock, as the Carlsbad plant does, and as Huntington Beach plant is proposed to do. All in all, large-scale desalination plants should change their designs to operate flexibly to integrate more renewable energy and contracting parties should not structure payments that create additional economic barriers to flexible operations.

Additionally, energy-storage can enable grid-connected flexible operations. For example, on November 9, 2015, Inland Empire Utility Agency (IEUA) announced its intention to install 3.5 MW of energy storage systems for

FIGURE 4: ENERGY AND CAPACITY EQUIVALENTS FOR SAN DIEGO'S DEMAND SIDE RESOURCES AND DESALINATION PLANT [35]



six of its water recycling and desalination plants.[38] Energy storage allows desalination plants to wean itself off the electric grid when fossil fuels are producing the plant's electricity, and to draw from the grid when renewable sources are producing the plant's electricity. However, because the exact times of renewable electricity generation vary, monitoring the daily and seasonal energy consumption patterns of these desalination projects will be critical to verify whether energy storage reduces their carbon emissions.

Powering desalination plants on stand-alone renewable resources is a more costly option, but guarantees no additional GHG emissions, no adverse grid impacts and should be prioritized before conventional plants

Desalination plants that are powered entirely by stand-alone renewable energy guarantee that a desalination plant will result in no additional GHG emissions. These facilities do not connect to the electric grid; rather they are solely powered by renewable energy, like solar, wind, or potentially geothermal resources. Such plants reduce GHG emissions for the water sector. California's scale of off-grid, renewable-powered desalination plants, however, is presently insignificant.

Cost and reliability are two main barriers to stand-alone renewable energy. On-site renewable energy costs are generally higher, compared to the grid (given that on-site systems do not receive any benefits of the larger network). Renewable energy varies by day and season, so in order to operate a plant in the absence of renewable energy; a plant needs to be able to draw energy from storage[39] or ramp down its production—and account for these flexible operations in financial and engineering plans.[40] Both of these options increase costs, but the environmental benefits should be prioritized.

For example, the Panoche Water District operates a pilot stand-alone solar-powered brackish water desalination plant in Fresno, California. The District is planning a commercial version in 2016, [41] where it will use stand-alone thermal solar energy, and use thermal energy storage to increase reliability. There are also several small international plants (and one field test in Nevada) powered by stand-alone solar energy.[42]

VI. SEAWATER DESALINATION CAN CAUSE SIGNIFICANT HARM TO THE ENVIRONMENT

Seawater desalination takes in large volumes of seawater that contain aquatic life and discharges highly concentrated saline water, or "brine," posing significant threats to the marine environment. These impacts may be particularly severe on the network of marine protected areas (MPAs) recently established in 16 percent of the state's coastal waters.[43] California must ensure seawater desalination does not undermine its investment in maintaining vibrant, economically valuable marine ecosystems.

Outdated open ocean intake technology can kill billions of fish and other marine life each year

Of the seawater extracted for desalination, typically 45 to 55 percent is converted to freshwater, which means these plants must take in twice as much seawater to produce an equal amount of freshwater. [44] A number of large-scale desalination projects in California have proposed to use open ocean intakes or large outdated pipes above the seafloor that kill marine life in the process of taking in source water. Marine animals are frequently injured or killed when they become trapped or "impinged" on the screens that are put across the front of these intake pipes. Smaller organisms, such as fish eggs and larvae, can pass through the screens but suffer a nearly 100 percent fatality rate as they become "entrained" in the plant's interior workings.[45]

Discharge of concentrated brine can be toxic to marine organisms

The brine produced by desalination can have serious impacts, including acute and chronic salinity toxicity, when discharged into the marine environment.[46] Brine is composed of highly concentrated constituents normally found in seawater (e.g. magnesium, boron, and sulfate). It is often combined with a suite of chemicals, used throughout the desalination process, including aluminum chloride, polyphosphates and biocides. These chemicals can be toxic to marine organisms, even at low concentrations.[47] Brine may also contain heavy metals from corroding equipment, and it may cause thermal pollution, because it is warmer than receiving waters.[48]

Since most seawater desalination plants discharge their brine into estuaries or the ocean, the use of brine diffusers—discharging the brine into sub-tidal offshore areas with persistent turbulent flows—can help minimize negative impacts.[49] Another brine discharge mitigation strategy is flow-augmentation, which involves in-plant dilution by mixing brine with additional seawater prior to discharge. However, this method requires additional seawater intake, and can significantly increase impingement and entrainment, threatening marine life.[50]

Desalination may threaten California's newly created Marine Protected Area (MPA) network

In 2012, California finalized the nation's first science-based network of MPAs, under its landmark Marine Life Protection Act.[51] Along the entire state's coastline, this network of 124 protected areas was created to safeguard marine life and habitats for future generations. Although no desalination surface intakes or discharge structures will be permitted in these areas, plants with infrastructure sited near MPAs could cause significant impacts from intakes and brine discharge. They may also reduce connectivity between MPAs through entrainment and impingement, thereby compromising the network's effectiveness.

CAUTIONARY TALES OF DEMAND RISK

When evaluating expensive desalination projects in response to the pressing drought, California should learn from past mistakes. These examples illustrate the danger of demand risk—"the risk that water demand will be insufficient to justify continued operation of the desalination plant due to the availability of less expensive water supply and demand management resources." [52]

In response to the 1987 to 1992 drought, the city of Santa Barbara spent $34 million to build a desalination plant that was promptly placed on long-term shutdown because of the plant's very high operational costs.[53] Now, the city is considering a two-year process to reactivate the plant, at an additional cost of $55 million.[54]

Similarly, in Australia, severe drought from the mid-1990s until 2012 prompted the construction of six large-scale seawater desalination plants at a cost of $10 billion Australian Dollars (AUD).[55] The plants took years to build. Meanwhile, the National Water Initiative implemented water policy reforms and improved efficiency measures that led to cheaper water supply alternatives.[56] By the time the plants were operational, the abatement of the drought and proliferation of cost-effective alternatives made desalinated water prohibitively expensive.[57] As of 2015, most of these facilities stood idle, or operated at a significantly reduced capacity:

NAME	LOCATION	CAPACITY (MILLION GALLONS PER DAY)	COST (AUD)	STATUS
Gold Coast Desalination Plant	Queensland	33	$1.2 billion	Suspended to reduce residential water bills. [58]
Victorian Desalination Plant	Wonthaggi	108	$3.6 billion	No production since December 2012, and the government has placed a zero-water order for the supply period ending June 2016. [59] Meanwhile, water consumers continue to pay $670 million AUD annually for the plant's construction through water bill surcharges during this time. [60]
Sydney Desalination Plant	Kurnell	66	$2 billion	No water produced since 2012. In 2015, it was reported that water consumers have paid around $534.7 million AUD for the facility due to a 50-year guaranteed water contract. [61]
Adelaide Desalination plant	Lonsdale	71	$2.2 billion	When the drought ended, the plant was scheduled to be shut down.[62] As of December 2014, however, it has been operating at minimum capacity, producing freshwater at only 10 percent of its potential.[63]
Southern Seawater Desal Plant	Binningup	71	$955 million	Active[64]
Perth Seawater Desal Plant	Kwinana	34	$387 million	Active[65]

In response to the current drought, California should carefully evaluate these past, expensive experiences with seawater desalination and instead prioritize water resources that are less expensive, less risky and have fewer environmental impacts.

VII. BRACKISH WATER DESALINATION CAN CAUSE SIGNIFICANT HARM TO THE ENVIRONMENT

Brackish surface water desalination and brackish groundwater desalination can also harm the environment, if facilities are not sited, constructed, and operated responsibly. Brackish surface water facilities can damage freshwater ecosystems, while brackish groundwater facilities can cause subsidence issues for California's natural aquifers.

Surface brackish water desalination plants raise environmental risks for California's estuaries and deltas

Brackish surface water desalination raises environmental concerns for California's estuaries in the same way that seawater desalination threatens marine environments. These desalination plants can kill aquatic life through open intake structures and brine disposal. They also threaten habitats and protected areas and impair ecosystem productivity. California's estuaries contain many imperiled aquatic species that are critical for a functioning ecosystem and ecological balance and diversity, including commercially valuable species such as chinook salmon.[66] Thus, brackish surface water desalination plants should include subsurface intake structures, responsibly dispose of brine, and avoid building facilities near sensitive habitats.

Groundwater desalination plants have fewer environmental risks than brackish surface water and seawater desalination plants

Brackish groundwater does not pose the same threats to marine or estuarine environments as seawater and brackish surface water desalination. This is particularly true if it includes environmentally safe brine disposal strategies. Brackish groundwater desalination can also improve the availability of local water supplies by making poor quality water sources available for use.

Still, there is the risk of groundwater overdraft, which is associated with land subsidence, increased energy use to pump water at lower depths, and water quality problems. It may also impact neighboring wells.[67] Thus, it is important to site these plants in sustainably managed groundwater basins. For example, Orange County actively recharges its aquifer with recycled water.[68] Desalination is not the only—nor the predominant—cause of these problems, but each of these impacts damage aquifers' potential as a reliable source of water.

IX. HOW DOES CALIFORNIA REGULATE DESALINATION?

Multiple state agencies have authority to create policy or administer regulations regarding seawater desalination, including the State Water Resources Control Board (SWRCB), California State Lands Commission, and California Coastal Commission. The SWRCB is California's designated water pollution control agency under the Federal Water Pollution Control Act. In conjunction with the Regional Water Boards, it is authorized to issue Waste Discharge Requirements and National Pollutant Discharge Elimination System permits.[69]

State Water Resources Control Board

On January 28, 2016, the SWRCB approved an amendment to the state's Water Quality Control Plan for the Ocean Waters of California (Ocean Plan Amendment or OPA) to address impacts associated with the construction and operation of new or expanded seawater desalination plants.[70] The OPA requires such facilities to use BAT and BMPs to minimize intake and mortality of marine life, as described below:

- **Intake technology:**
  The OPA establishes several requirements for seawater intakes at all new or expanded seawater desalination plants. First, plants must have subsurface intakes (which draw water from the undersea substrate, such as sand sediment, rather than above the seafloor), unless the Regional Water Board responsible for permitting a plant determines that subsurface intakes are not feasible. This determination must be based on an analysis of geotechnical data, oceanographic conditions, design constraints, energy use, and project life cycle costs. It must also account for the presence of sensitive habitats or species. The Board may not determine that subsurface intakes are infeasible merely because they are more costly than open-ocean intakes.[71] When subsurface intakes are deemed infeasible, facilities must install 1mm slot screens on open ocean intakes (or an alternative method that provides equivalent protection), and ensure that water velocity through the screen does not exceed 0.15 meters per second to protect marine life. Second, the owner or operator must evaluate a reasonable range of project sites, including those that would support the use of subsurface intakes, before choosing a location. Lastly, if subsurface intakes are not feasible, the owner or operator must evaluate alternative design capacities.[72]
- **Brine Disposal Methods:**
  The OPA establishes preferences and standards for brine disposal, prioritizing disposal by comingling brine with treated wastewater to dilute harmful pollutants. When treated wastewater is not an option, pressurized, spray brine diffusers are recommended. Moreover, the OPA prohibits flow augmentation[73] (in-plant dilution of brine with additional seawater prior to discharge) for any plants with open ocean intakes, with an exemption for the recently constructed Carlsbad desalination plant. Regardless of the technology used to discharge brine, the OPA regulates receiving water salinity to a maximum of 2.0 parts per thousand above background salinity no further than 100 meters horizontally from each discharge point.[74]
- **Siting:**
  The OPA requires desalination plants avoid impacts to sensitive habitats and MPAs. It also prohibits intake and discharge structures within MPAs—except subsurface intakes that cause no sea life mortality.

Regulation of Intakes from Once-Through Cooling Technology

The authoring organizations have spent decades working with state and federal agencies to develop regulations to minimize the intake and mortality of marine life from open ocean intakes and antiquated once-through cooling technology for coastal power plants.[75] The SWRCB's 2010 regulations required power plants on the coast and estuaries to employ "best technology available" to reduce the entrainment and impingement of marine life.[76]

California State Lands Commission

The California State Lands Commission (SLC) has regulatory authority over public trust lands, including tidal lands and those under navigable waters. It also has authority to "exclusively administer and control all [public trust lands]" to "lease or otherwise dispose of such lands, as provided by law."[77] The SLC must grant permission for any private company or public entity must to use sovereign lands for any public trust use. Applications "must include an outline of the proposed project, supporting environmental data, and payment of appropriate fees."[78]

The California Coastal Commission

The California Coastal Commission (CCC) regulates use of the shoreline and coastal waters, in partnership with coastal cities and counties. The CCC issues coastal development permits (CDP), certifies local governments' Local Coastal Programs, reviews appeals of locally issued CDPs, and conducts federal consistency review pursuant to the Coastal Zone Management Act (CZMA). When considering desalination projects, the CCC must evaluate whether plant design and siting is consistent with the California Coastal Act, which protects environmentally sensitive habitats, marine resources, biological productivity of coastal waters, and public access.[79] The CCC must also determine whether seawater desalination facilities qualify as coastal-dependent

developments, as the California Coastal Act prioritizes such uses over other development on or near the shoreline.[80]

Ocean Protection Council

The Ocean Protection Council (OPC) is responsible for improving the effectiveness of ocean management in California by coordinating state agencies and enhancing scientific understanding through data collection and sharing. OPC's 2012–2017 Strategic Plan identifies desalination as a priority issue and acknowledges its own key role in promoting interagency collaboration for siting, design, mitigating, and permitting desalination facilities.[81] Given this strategic priority, OPC is well positioned to support the SWRCB's coordination of agency evaluation of desalination projects through the development of Memorandum of Agreement between the CCC, SLC, and California Department of Fish and Wildlife. [82]

Other Agencies and Local Governments

The Department of Water Resources does not have a regulatory role regarding desalination, but it does prepare the California Water Plan with stakeholder input. This plan is updated every five years to assess trends, challenges, and opportunities in water management.[83] The 2013 Water Plan Update contains a Desalination Resource Management Strategy that surveys issues to consider when developing a desalination project. The Strategy, however, is non-binding.[84]

Local governments, local water districts, the California State Parks Department, and the Department of Public Health, may also participate in siting and overseeing seawater desalination projects. These entities are tasked with certifying environmental impact documents, negotiating water purchase agreements, granting easements for proposed pipelines that would carry desalinated water or for other infrastructure, and issuing Wholesale Drinking Water permits.[85]

X. RECOMMENDATIONS

Given the significant energy, climate, and financial costs of desalination, California should prioritize water conservation, water use efficiency, stormwater capture, wastewater recycling, and renewably-powered groundwater desalination . Brackish surface and seawater desalination should only be pursued once these cheaper, safer alternatives have been implemented. If and when it is considered, decision makers should be careful to minimize adverse effects on sensitive marine and estuarine environments and minimize GHG emissions.

Our recommendations outline policies and planning processes that should inform any decisions related to desalination plants. These recommendations can help decision makers achieve water supply goals while minimizing costs and environmental impacts associated with desalination.

I. Less costly and lower impact water supply options should be prioritized over grid-connected seawater and surface water desalination.

Water conservation, water use efficiency, stormwater capture, rainwater harvesting, wastewater recycling, and brackish groundwater desalination are generally less expensive and have fewer environmental impacts than grid-connected seawater or brackish surface water desalination. They should be pursued before seawater or brackish surface water desalination is considered.

A. Conservation and water efficiency

Conservation and water efficiency should be California's top priority. In response to an emergency directive from Governor Brown, the state's urban residents used water conservation and efficiency measures to save more than 1.087 million acre-feet of water between June and December 2015, compared to the same months in 2013.[86] That's more water than would be generated annually by 19 new seawater desalination plants the size of the Poseidon plant in Carlsbad.[87] Throughout the drought, California has taken many steps to promote urban water conservation and efficiency, many of which will have lasting impacts on reducing water demand. For example, in 2015, the California Energy Commission adopted the nation's strongest water efficiency standards for faucets, toilets, urinals, and showerheads.[88] But significant water efficiency savings potential remains in California: California's urban water consumption ranks higher than other countries that use desalination at 201 gallons per capita per day (GPCD). That is in comparison to Australia's urban water use of 80 to 130 GPCD in the early 2000's, Israel's 84 GPCD, and Spain's 76 GPCD.[89] NRDC and Pacific Institute's 2014 report, "The Untapped Potential of California's Water Supply: Efficiency, Reuse, and Stormwater," found that agricultural water conservation and efficiency could reduce demand by 5.6 to 6.6 million acre-feet per year, while urban water conservation and efficiency has the potential to yield an additional savings of 2.9 to 5.2 million acre-feet per year.[90]

B. Water recycling and reuse

Increased wastewater recycling, especially the vast quantities of treated wastewater California currently dumps into the ocean, is another important drought-proof alternative that has far fewer adverse environmental impacts than desalination. "The Untapped Potential of California's Water Supply" estimated that California's water reuse potential at 1.2 to 1.8 million acre-feet per year, even after significant improvements to urban water use efficiency.[91] Orange County's Sanitation District built a world-renowned water reuse facility that produces enough purified water to serve 500,000 people.[92] According to the Report Card for America's Infrastructure, this facility is 35 to 75 percent cheaper than saltwater desalination and will consume half the energy.[93]

By prohibiting ocean discharges from wastewater treatment plants by a date certain, where feasible and cost-effective, the state could dramatically accelerate the adoption of water recycling and improve the drought resistance of urban communities. This shift could significantly expand the state's water supply for all water users. It would have at least two additional benefits. First, it would improve coastal water quality by reducing ocean discharges, particularly of treated wastewater. Second, it could potentially reduce GHG emissions, since recycled water consumes less electricity than many alternative water supply sources, including water imported from the Bay-Delta to Southern California and ocean or brackish water desalination.

C. Low-impact development techniques, including green infrastructure and stormwater capture

By treating stormwater as a waste product that needs to be disposed, California's cities and urban areas turn a valuable water supply resource into a water quality problem. For example, a one-inch storm in Los Angeles County generates up to 10 billion gallons of runoff that flows through storm drains and is discharged into the ocean.[94] Stormwater runoff is also California's leading source of surface water pollution. Left untreated, it carries bacteria, metals, and other pollutants to our waterways, harming the environment and causing hundreds of millions of dollars in public health costs per year.[95] "The Untapped Potential of California's Water Supply" estimated that capturing stormwater in urban southern California and the San Francisco Bay could increase average water supplied by 420,000 to 630,000 acre-feet each year, while reducing flooding and surface water pollution.[96]

Low impact development (LID) is a land-use planning and engineering approach that emphasizes rainwater harvesting. This method uses water infiltration into the ground through parks, open spaces, and swales, as well as rainwater capture in rain barrels or cisterns for later use onsite in urban areas.[97] Expanding LID could allow California to increase its water supply, improve water quality, and expand green space in urban environments. Improved stormwater management increases safe and reliable water sources while consuming less energy and generating fewer GHGs.[98]

D. Brackish groundwater desalination plants

Small-scale, brackish groundwater desalination plants that rely on stand-alone renewable energy pose fewer environmental risks than large-scale, grid-connected seawater desalination plants that harm California's marine ecosystem. There are currently 23 groundwater desalination plants in California. There is significant potential to support brackish groundwater plants in the agricultural Central Valley, where irrigation drainage tainted by minerals, including salt and selenium, can be treated for agricultural use or potentially potable water. To minimize impacts, these plants should sustainably manage their effluent brine and use zero-discharge processes, which reclaim salts and other byproducts. Moreover, the least impactful plants would be powered by stand-alone renewable energy that result in no additional GHG emissions and supporting groundwater management through pumped basins.

2. If California determines that all other water supply strategies have been implemented and seawater desalination and brackish surface water desalination are necessary, desalination plants should be guided by comprehensive statewide policy that utilizes BMPs and BAT and be situated to minimize environmental impacts.

The following matrix summarizes the impacts of various methods and technologies, identifying the least impactful options.

CHART 3: EVALUATIVE FRAMEWORK

CRITERIA	LOWEST IMPACT (BEST)	MODERATE IMPACT	HIGH IMPACT (WORST)
Intake technology	Subsurface Intakes		Open ocean intakes
Brine disposal methods	Commingling brine with wastewater*	Multiport diffusers	Flow augmentation from surface intakes
Siting intake and discharge structures (alternative sites must be considered per SWRCB desalination policy)	Outside MPA boundaries; sited to avoid impacts to sensitive ecological areas, marine wildlife and organisms and MPAs.		Adverse impacts to MPAs, interferes with connectivity of MPAs, and/or affects areas with sensitive marine, habitats, wildlife and organisms.
Design Capacity	Capacity designed to accommodate subsurface intakes and meet demonstrated community water needs.		Capacity designed to maximize water production, regardless of need.
Energy and GHG Emissions	Standalone plant powered by renewables with no GHG emissions	Grid connected plant operating primarily during times of excess renewable generation	Grid connected plant operating continuously with high GHG emissions

* Note: SWRCB's requirement per the OPA. This does not preclude any future wastewater recycling.

- **Intake Structures**
  We strongly agree with the SWRCB's analysis, which identifies sub-seafloor intake systems as the preferred technology to minimize environmental impacts. This technology significantly improves raw water quality, while reducing financial and environmental impacts, decreasing the carbon footprint, and reducing the cost of treated water to consumers. Subsurface intakes also provide filtration and active biological treatment of raw seawater. Contaminants like algae and bacteria are removed by natural filtration through layers of rock or sand, reducing the need for treatment in the desalination process.[99] We recommend conducting lifecycle cost analyses that include all environmental, energy, and siting impacts over the entire operating period , rather than only considering initial capital costs, to determine whether subsurface intakes are feasible.
- **Discharges**
  Following SWRCB policy, we recommend commingling brine with wastewater before discharge to reduce harmful effluent pollutants and minimize marine impacts. However, we strongly argue that water recycling options should be maximized before desalination options are pursued, and if diluting brine waste from desalination using wastewater impedes water recycling options, it should not be used. In that case, brine dilution through multiport diffusers will be the preferred BMP.
- **Siting Intake and Discharges Structures**
  We recommend siting new brackish surface water and seawater desalination plants based on the application of the best geospatial data to choose a site that will minimize impacts to marine and estuarine life. As detailed in the OPA, the best locations pose no adverse impacts to MPAs or other sensitive ecological areas. We recommend a thorough alternative site analysis to evaluate a range of project sites where subsurface intakes can be utilized.
- **Design Capacity**
  We recommend that desalination plants be designed to meet demonstrated community water needs, accounting for county general plans and urban water management plans, rather than design capacity to maximize water production and sales. Moreover, Regional Water Boards must follow SWRCB policy and cannot deem subsurface intakes infeasible if the design capacity is in excess of local water needs.
- **Energy and Carbon**
  We recommend prioritizing plant designs that avoid or reduce GHG emissions. To achieve the highest degree of certainty, desalination plants should rely on stand-alone renewable energy to reduce GHG emissions. Stand-alone renewable energy (and likely storage), instead of connecting to the electricity grid, can increase operating costs. However, it eliminates the plant's GHG emissions as well as adverse impacts on the electricity grid. We recommend that grid-connected plants primarily draw electricity from the grid at times when facilitates integrate more renewable energy onto the electric grid, which requires overcoming financial and engineering barriers to flexible operation. For both flexibly operated desalination plants and conventional plants connected to the grid with continuous operations, we recommend making the plant's processes more energy efficient and mitigating GHG impacts through CARB compliance-grade offsets or allowances and monitoring consumption patterns on a daily and seasonal basis in order to verify GHG impacts.

ENDNOTES

1 United States Geological Survery, "California Drought Information," ca.water.usgs.gov/data/drought.

2 Kyle Kim and Thomas Suh Lauder, "215 Drought Maps Show Just How Thirsty California has Become," Los Angeles Times, www.latimes.com/science/la-me-g-california-drought-map-htmlstory.html.

3 Office of Governor Edmund G. Brown Jr., "Governor Brown, Legislative Leaders Announce $1 Billion Emergency Drought Package," State of California, https://www.gov.ca.gov/news.php?id=18893.

4 California Dep't of Fish and Wildlife, "California Marine Protected Areas (MPAs)", California Department of Fish and Wildlife, www.dfg.ca.gov/marine/mpa.

5 There are no fixed delineations between "fresh" and "brackish", but generally "brackish" water refers to water that has more salinity than fresh water (< 0.1% salinity) and less salinity than ocean water (>3.0% salinity). Brackish water refers to a degree of salinity, not a location, and can be withdrawn from subsurface as well as surface waters. California Department of Water Resources, "California Water Plan: Updated 2013, Volume 3, Chapter 10, www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol3_Ch10_Desalination.pdf.

6 Surface water refers to the location of the water source and includes open water bodies like oceans, inland water bodies, bays, and estuaries; whereas subsurface water refers to underground locations, like aquifers. California Department of Water Resources, "California Water Plan: Updated 2013, Volume 3, Chapter 10, www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol3_Ch10_Desalination.pdf.

7 United States Geological Survey, "Saline Water: Desalination", http://water.usgs.gov/edu/drinkseawater.html.

8 Heather Cooley, Peter Gleick, Gary Wolff, "Desalination, With a Grain of Salt: A California Perspective, *Pacific Institute* (June, 2016), pacinst.org/wp-content/uploads/sites/21/2015/01/desalination-grain-of-salt.pdf.

9 California Department of Water Resources, "California Water Plan: Updated 2013, Volume 3, Chapter 10, www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol3_Ch10_Desalination.pdf.

10 An acre-foot is the amount of water needed to cover an acre of space with one foot of water. It is the equivalent of 325,851 gallons of water.

11 California Department of Water Resources, "California Water Plan: Updated 2013, Volume 3, Chapter 10, www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol3_Ch10_Desalination.pdf.

12 *Id.*

13 California State Water Resources Control Board, "Final Staff Report Including the Final Substitute Environmental Documentation Amendment to the Water Quality Control Plan for Ocean Waters of California Addressing Desalination Facilities Intakes, Brine Discharges, and the Incorporation of Other Non-Substantive Changes" (May 2015), 18 and 21.

14 Bay Area Regional Desalination Project, "Anticipated Project Milestones," www.regionaldesal.com/schedule.html.

15 *Id.* at 11.

16 MGD refers to "million gallons per day" and is a measurement of volume of water produced over time. Acre-feet/year is another measurement of volume of water produced over time. 1 MGD is equivalent to around 1,120 acre-feet per year.

17 Local Costal Program Planning Grants Application Form, "City of Carlsbad LCP Planning and Sea Level Rise Update", www.coastal.ca.gov/lcp/grant-apps-14-15/sandiego/Carlsbad_2014_LCP_Application.pdf.

18 *Id.* at 11.

19 *Id.* and Heather Cooley, Newsha Ajami, Key Issues in Seawater Desalination in California: Costs and Financing, Pacific Institute (November 27, 2012), pacinst.org/publication/costs-and-financing-of-seawater-desalination-in-california/.

20 Heather Cooley, Newsha Ajami, Key Issues in Seawater Desalination in California: Costs and Financing, Pacific Institute (November 27, 2012), pacinst.org/publication/costs-and-financing-of-seawater-desalination-in-california/.

21 *Id.* at 11.

22 To highlight the differences in water supply options, we focus only on extraction, production, and conveyance to the distribution system. Carlsbad uses roughly 4,900 kWh/acre-foot whereas imported water from the state water project to Southern California uses 3,214 kWh/acre foot. Carlsbad Seawater Desalination Project, "Energy Minimization and Greenhouse Gas Reduction Plan", (December 10, 2008), carlsbaddesal.com/Websites/carlsbaddesal/images/Project_Documents/Final_GHG_Plan_121008.pdf.

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Letter 7 Erica Mahard, San Francisco Baykeeper
Response August 13, 2018

7-1 The comment states that the Draft EIR evaluates the impact of Total Dissolved Solids (TDS) but fails to fully evaluate the water quality impacts from the discharge of brine as it relates to other pollutants, in particular selenium. The City recognizes that selenium is a water quality constituent of concern in the Delta. Selenium is bioaccumulative and concentrates up the food web, causing teratogenesis and other deleterious conditions to affected wildlife, particularly among higher trophic levels. Under existing conditions, selenium concentrations in the Delta vary spatially. Selenium concentrations along the Sacramento River are typically low, ranging from 0.005 to 0.04 micrograms per liter (µg L^{-1}). In contrast, selenium concentrations along the lower San Joaquin River are considerably higher, typically ranging from 0.1 to 3.0 µg L^{-1}. Concentrations across the Delta reflect mixing of these two selenium sources, along with in-Delta sources where relevant. Based on a combination of monitoring and DSM2 modeling completed by Tetra Tech[1], dissolved selenium concentrations at Antioch are estimated to range from 0.025 µg L^{-1} to 0.45 µg L^{-1} under existing conditions, with a median concentration of approximately 0.15 µg L^{-1}. These values are in compliance with the North Bay Selenium TMDL water column target of 0.5 µg L^{-1}. The commenter correctly notes that the US EPA is in the process of updating selenium targets in the Delta; however, this update is still in process and is not expected to be in effect prior to completion of Delta Diablo's updated NPDES permit.

As discussed on page 3.11-25 of the Draft EIR and as noted by the commenter, the proposed desalination system could result in a fourfold concentration of ambient background constituents present in river source water, including selenium. However, as noted on page 3.11-38 of the Draft EIR, the proposed project would not result in an increased mass load of selenium in Delta waters; the proposed discharge would simply return to the Delta the same mass of selenium that was removed from the Delta at the intake. Within the spatially limited Zone of Initial Dilution (ZID) concentrations of TDS and other background constituents would be expected to be increased within proximity to the diffuser. Modelled brine discharge across different operation scenarios showed relatively small increases in salinities in the effluent plume under the proposed project versus existing conditions (see also also Appendix D, Table 8 of the Near-Field modeling results). In addition to small differences in plume salinities between the proposed project and existing conditions, the maximum ZID along the channel over the tidal cycle for all operating scenarios under the proposed project ranged from 53 to 881 feet, resulting in an extremely small area of increased concentrations. Outside the area of ZID, conditions would return to near-ambient levels. Dilution outside of the ZID would preclude far-field effects. As described in response to comment 5-2, a detailed NPDES-level evaluation of

[1] Tetra Tech, 2017. Water Column Selenium Concentrations in the San Francisco Bay-Delta: Recent Data and Recommendations for Future Monitoring. August, 2017. Available at: https://www.sfei.org/sites/default/files/biblio_files/Water%20Column%20Selenium%20Concentrations%20in%20the%20San%20Francisco%20Bay-Delta.pdf. Accessed September 4, 2018.

potential changes in individual constituents (including selenium) to demonstrate compliance with the CTR and SIP would be completed during the application process for Delta Diablo's updated NPDES permit. Results of that evaluation will be considered by the SFRWQCB in order to ensure that beneficial uses would not be deleteriously affected by localized changes in selenium concentration that have the potential to occur under the proposed project. In the event that the SFRWQCB determines that additional management of selenium concentrations in the proposed project's discharge would be required in order to meet SFRWQCB requirements, the City would request intake credits for selenium concentration in a process that is consistent with precedents set by other regional facilities that operate reverse osmosis or similar water purification systems.

7-2 The commenter states that the Draft EIR fails to respond to the concerns raised by Delta Diablo during the NOP scoping process. The City has, however, met with Delta Diablo several times in 2018 to coordinate regarding the brine discharge and both parties acknowledge that because Delta Diablo's NPDES permit is due for renewal in 2019, including the brine discharge for coverage in the scheduled permit renewable is the preferred method over amending the existing permit. The City acknowledges the concerns stated by Baykeeper regarding Delta Diablo's NPDES permit, and has responded to Delta Diablo's comment letter (see Letter 6 in this chapter).

The City recognizes that the SFRWQCB will require amendment of Delta Diablo's existing NPDES discharge permit, in order to accommodate the Project. As noted by the commenter, the SFRWQCB would require discharge water quality compliance with relevant standards for all water quality pollutants as identified / determined by the SFRWQCB. Identified, updated discharge standards for the NPDES permit will be selected by the SFRWQCB in order to ensure that applicable water quality standards protecting beneficial use are met by the proposed project. Therefore, the forthcoming permitting process would further ensure that the project would not result in water quality degradation. As discussed on pages 3.11-24 through 3.11-29 of the Draft EIR, the proposed project would concentrate pollutants carried by intake water from the Delta, but generally would not increase total pollutant loads in the Delta. In some instances, pollutant loads would decrease. For example, ammonia that is present in the intake water would be removed by conventional pretreatment upstream of the reverse osmosis process and would not be carried back to the Delta in the brine stream.

As discussed in responses to comments 5-2 and 5-3, Delta Diablo's NPDES permit would be updated as needed to reflect brine discharge from the completed Project, combined with existing discharges. The City anticipates that the NPDES permitting process will consider revised limitations for various constituents, likely including but not necessarily limited to biochemical oxygen demand (BOD), total suspended solids (TSS), oil and grease, pH, total residual chlorine, copper, cyanide, dioxin-TEQ, and total ammonia. Detailed assessments of these constituents would be completed during the permitting process, pending approval of the Project, and as part of due and required process for the update to Delta Diablo's NPDES permit. Under the current relevant schedule, a permit application is due to the SFRWQCB on February 1, 2019, with a target SFRWQCB

permit adoption date of October 10, 2019. The City will work with Delta Diablo and the SFRWQCB to complete all permitting requirements in accordance with this schedule.

Please refer to response to comment 7-1 for a discussion regarding selenium in the Delta.

7-3 The comment states that the EIR did not analyze the effectiveness of the fish screen based on the location of the intake structure and whether the screens would meet NMFS criterion. The comment references text in the cumulative impact analysis and seems to conflate the proposed project intake with that of the proposed WaterFix diversion, a reasonable foreseeable future project included in the cumulative impact analysis. The Draft EIR is only referring to WaterFix as part of the cumulative analysis, and states that similar NMFS and CDFW fish screen criteria applicable to the WaterFix intake would also be applicable to the proposed project, which can be expected to protect juvenile and adult sizes of sturgeon and Chinook Salmon. Also, the commenters state that intake velocities may not be protective for juvenile Chinook salmon, however, the NMFS criteria explicitly provides intake velocity guidelines to avoid impingement of juvenile salmon. As stated in Impact 3.3-7, the proposed intake structure is designed to minimize the potential for entrainment and impingement. It would include a fish screen designed to meet or exceed applicable NMFS and CDFW criteria (and USFWS recommended guidelines for tidal waters), which would minimize the potential for fish entrainment and impingement for most species and life stages.

7-4 The comment states that the analysis does not indicate why the City could not (or should not) go forward with the raw water pipeline connection option. The shorter raw water pipeline connection option was carried forward and considered in the alternatives analysis. As acknowledged on page 5-13 of the Draft EIR, the shorter raw water pipeline connection option "would result in fewer impacts associated with excavation and construction, compared to construction of the proposed project". The shorter raw water pipeline option was combined into Alternative B, representing a reduced footprint alternative. The comment suggests that the alternative was dismissed, which is incorrect. Alternative B (which includes the shorter pipeline connect) is identified as the environmentally superior alternative on page 5-23 as required by Section 15126.6(e)(2) of the CEQA Guidelines.

The Draft EIR does not reflect that the City has dismissed Alternative B. The purpose of the alternatives analysis is to identify and evaluate alternatives that could meet most of the basic project objectives and lessen or avoid significant, which was presented in Chapter 5 of the EIR. The shorter raw water pipeline connection was analyzed as part of Alternative B on page 5-20 to 5-23 of the Draft EIR. Under CEQA, alternatives are not analyzed at the same level of detail as the proposed project. The alternatives analysis is consistent with CEQA Statute and Guidelines Section 15126.6(d), which calls for an EIR to include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed project. If an alternative would cause one or more significant impacts in addition to those that would be caused by the project as proposed, the significant impacts of the alternative should be discussed in the EIR, but in less detail than the significant impacts of the project as proposed.

7-5 The comment states that the EIR failed to analyze alternatives to brine discharge other than discharge via Delta Diablo's outfall and provided examples of two California-based projects that are using or evaluating used engineered wetlands for the treatment of RO concentrate. The comment further states that the EIR does not analyze conservation, stormwater capture, recycling, or any combination of these water supply options in the alternatives analysis.

Alternative brine disposal options were considered in the screening (page 5-8 of the Draft EIR). The primary screening criteria for this option included whether it was: technically feasible and capable of receiving the 2 mgd brine flow; and due to cost and viability for the City, the option should be a single, reliable brine management method. The City evaluated wetlands creation/restoration as a surface water discharge option in a technical memorandum (Carollo, 2016). An engineered wetland would require a system similar to an evaporation pond and multiple 'cells' such that volume reduction would occur by evaporation and transpiration of salt tolerant plants. This option would also require a final brine disposal step via an alternative means (e.g. evaporation pond, crystalizer). The technical memorandum acknowledged that although wetland creation is a potentially feasible brine disposal/management option in the greater San Francisco Bay Area, the limited land available at or near the City's proposed desalination facility is insufficient for constructing a wetland large enough to reduce the brine produced. This option was determined not feasible as a standalone disposal/management option and was not carried forward (Carollo, 2016). Please also refer to the response to comment 5-1 regarding the consideration of brine disposal options.

CEQA requires that an EIR analyze a reasonable range of alternatives that would lessen project impacts *while meeting most of the project objectives* (emphasis added), but does not require that every possible alternative or permutation of an alternative be analyzed in an EIR [CEQA Guidelines Section 15126.6(a)]. In describing the requirements for the project description in an EIR, State CEQA Guidelines section 15124(b) states that the project description must include "[a] statement of objectives sought by the proposed project. A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding considerations, if necessary. The statement of objectives should include the underlying purpose of the project."

The project objectives are presented in Chapter 2 of the EIR as follows:

- Improve water supply reliability and water quality for customers.
- Develop a reliable, and drought-resistant water source to reduce dependency on purchased water supplies by maximizing the use of the City's pre-1914 water rights.
- Maximize the use of existing infrastructure to maintain economic feasibility.
- Provide cost effective operational flexibility to allow the City to respond to changes in source water quality, emergencies, changes in climate and Delta conditions.
- Preserve the value of the City's pre-1914 water rights.

Under CEQA, the EIR is not required to identify and analyze alternatives that would not meet most of the basic project objectives. The conservation options listed by the comment would not meet the project objectives to maximize the use and value of the City's pre-1914 water rights or having facilities in place that would provide operational flexibility as it relates to potable water supply.

Nevertheless, the City already invests in and has a robust water management planning effort in place. The following information is provided to describe the City's water management and various options that are currently implemented, or will be implemented as described in the Urban Water Management Plan. These efforts already include the various water conservation strategies suggested by the comment as described below.

- The City utilizes recycled water from Delta Diablo to irrigate parks and its municipal golf course. The volume of recycled water use is projected to increase through 2035.
- The City passed new drought management measures in 2015 which required 28 percent water reductions from 2013 monthly water usage.
- The City is required to meet the Water Conservation Act of 2009 (SB X7-7) targets which require agencies to establish water use targets for 2015 and 2020 that would result in statewide water savings of 20 percent by 2020.
- New developments are required to install recycled water facilities as part of their improvements.
- The City operates under the State's Water Efficient Landscape Ordinance
- Ordinance No. 2026-C-S was codified as Chapter 10 of Title 6 of the Antioch Municipal Code for
- Adoption of Resolution 2014/79 which contains restrictions and prohibitions on end users for nonessential purposes. These include mandatory irrigation restrictions and fines, and prohibitions on commercial, industrial, and institutional water use.
- The City's wholesaler, CCWD, provides rebate and incentive programs to help customers improve water use efficiency and reduce water consumption (e.g., residential or commercial high-efficiency clothes washer rebates, water-efficient landscape rebates, smart sprinkler timer rebates, and commercial irrigation equipment rebates).

7-6 The comment states that it is unclear if there is any reason to leave the existing pier once the pump station is removed. This was initially considered as a possibility, however it is not proposed for removal as part of this project as there is a walkway for the boat ramp that is structurally connected to the pier. The City may consider removing the pier in the future, however it is not currently planned at this time.

MS. SKAGGS: Good evening --

CHAIRPERSON PARSONS: Good evening.

MS. SKAGGS: -- Chair Parsons and Commissioners. My name is Denise Skaggs. I'm a citizen of Antioch. I've lived at 3133 View, which is impacted by the water treatment plant.

First of all, I've got to say as a citizen, I am thrilled that this desalinization project is being considered. And hopefully I'll live to see it happen because it's using our resources that we've always had.

Just a couple things I want to be considered is that the noise receptors that were in the EIR that were located down on Terra Nova are behind the homes, and these folks live on Terra Nova, so it's right behind their house, that really doesn't show what that noise impact is going to be for us on View. I just think that there needs to be some consideration, you know, for all of us on that. It's a valley there. And you're welcome, anyone is welcome to come to my home, and from my back yard see and experience what's happened there in the last 11 years that I've been there. It's increased.

PC-1

These homes were built in the late '60s,

early '70s. The plant at that time was just a small, little building with a pond, you know? And now it's probably ten times bigger. And all of us that have lived there for a long time, my neighbors have been there for over 45 years, 40 years, and it's huge.

So I just think there might be some consideration for possibly a sound wall or something to kind of lessen the impact of that new facility.

PC-1 cont.

Oh, plus we have terrible water pressure up there. So if that could be improved? I've been canvassing the neighborhood.

Emergency plan and evacuation, we've got a lot of stuff going on up there.

So, thank you.

CHAIRPERSON PARSONS: Any other speaker cards?

MS. EIDEN: None others received.

CHAIRPERSON PARSONS: Okay. I'm just going to make one comment. Denise, I think you should put it in writing because it's probably more involved, and get it to Scott.

Now I'm going to close the public hearing. And I think that takes care of us.

Letter PC Response — Planning Commission Public Hearing – Summary of Comments
August 1, 2018

The City's Planning Commission took public comments on the project at a regularly scheduled meeting on August 1, 2018. One speaker provided comments on the project, and a response is provided below. The transcript of this hearing is presented in **Appendix A** of this document.

PC-1 The comment is from a resident who states that noise impacts on View Drive residents were not shown. The comment notes that the size of the Antioch WTP has increased over the years and requested that a sound wall be considered to lessen the impact of the new desalination facility. Construction and operational noise impacts are addressed in Section 3.13 of the Draft EIR. The Draft EIR analyzed noise at the nearest sensitive receptors to the desalination facility, which are rear yards of residential uses on Terranova and View Drives (identified as ST-1 and ST-2 on Figure 3.13-1, page 3.13-7 of the Draft EIR). These receptors represent the most conservative assumption. Impact 3.13-1 in the Draft EIR determined that construction noise impact would be less than significant with the implementation of Mitigation Measure 3.13-1, which would require noise controls for construction equipment and installation of temporary noise barriers along the southern and western property boundary of the WTP. With regard to the desalination facility operation, Impact 3.13-3 determined that operational noise would be less than significant with the implementation of Mitigation Measure 3.13-3. This mitigation measure would require that the desalination plant be designed with adequate noise screening to maintain noise levels no greater than 5 dBA above the existing monitored ambient noise at the property line of nearby residences.

For purposes of clarification, item (b) under Mitigation Measure 3.13-1 on page ES-19 and 3.13-18 is revised to read:

b) To reduce potential daytime construction noise impacts to residential uses immediately south <u>and west</u> of the desalination facility contractors shall employ temporary noise curtains or barriers along the southern and western property boundary of the WTP to shield daytime construction noise impacts to residential uses to the south and west. To reduce potential daytime construction noise impacts to residential uses immediately east of the proposed new pump station, contractors shall employ temporary noise curtains or barriers along the eastern property boundary of the pump station worksite to shield daytime construction noise impacts to residential uses to the east. Implementation of this measure will ensure that daytime construction activities do not exceed noise criteria for daytime construction at residential uses (70 dBA L_{eq}). These barriers shall be installed prior to the start of construction.

CHAPTER 3
Revisions to the Draft EIR

3.1 Introduction

This section summarizes text changes made to the Draft EIR either in response to a comment letter or initiated by City staff or in response to a modification to the proposed project.

New text is indicated in double underline and text to be deleted is reflected by a ~~strike through~~. Text changes are presented in the page order in which they appear in the Draft EIR. The text revisions provide clarification, amplification, and corrections that have been identified since publication of the Draft EIR. The revisions in this chapter do not constitute "significant new information" and it is therefore not necessary for the Lead Agency to recirculate the EIR for public comment prior to certification of the Final EIR (CEQA *Guidelines* Section 15088.5).

3.2 Staff-Initiated Changes to the Draft EIR

Table of Contents

Page i is revised to correct the titles of Sections 3.10 and 3.11 of the EIR:

Section 3.6, Geology, Soils, and Paleontological Resources

The third bullet point on page 3.6-24 is revised as follows to correct the cross reference to Section 3.11:

- ***Have soils incapable of adequately supporting use of septic tanks or alternative wastewater disposal systems.*** The project would not use septic tanks or other onsite wastewater disposal systems; therefore, there would be no impact related to the adequacy of soils to support such systems. This significance criterion is not applicable to the proposed project and is not discussed further. Disposal of the brine is discussed in Section 3.11, ~~*Brine Disposal*~~*Delta Hydrology and Water Quality*.

The second paragraph under the subheading *Cumulative Impacts* on page 3.6-28 is revised as follows to correct the cross reference to Section 3.11:

> As previously discussed, the proposed project would have no impact with respect to fault rupture, landslides, subsidence or collapse, loss of topsoil, septic tanks or paleontological

or unique geological resources. Accordingly, the proposed project could not contribute to cumulative impacts related to these topics and are not discussed further. Disposal of the brine is discussed in Section ~~3.10b, *Water Quality*~~3.11, *Delta Hydrology and Water Quality*.

Section 3.9, Hazards and Hazardous Materials

The last sentence of the paragraph under subheading *Operations* on page 3.9-19 is revised as follows to correct the cross reference to Section 3.11:

> The disposal of brine into the San Joaquin River is analyzed in Section 3.11, ~~*Water Quality*~~*Delta Hydrology and Water Quality*.

Section 3.15, Public Services and Utilities

The first bullet point on page 3.15-8 is revised as follows to correct the cross reference to Section 3.10:

- ***Require or result in the construction of new stormwater drainage facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects.*** The potential for the proposed project to change drainage patterns and increase stormwater runoff is addressed in Section 3.10, *Local Hydrology and Water Quality*. That analysis indicates that, due to the negligible increase in impervious surfaces associated with the proposed aboveground facilities, the proposed project would have a less than significant impact associated with potential changes in drainage patterns and the rate and amount of surface runoff. As a result, the proposed project would not require or result in the need for new or expanded stormwater drainage facilities. No impact would result and this impact is not discussed further.

Chapter 4, Other CEQA Considerations

The paragraph under subheading 4.1, *Significant and Unavoidable Adverse Impacts* is revised as follows:

> Potentially significant environmental impacts that would result from the proposed project are evaluated in Chapter 3.0, *Environmental Setting, Impacts, and Mitigation Measures*, of this EIR. With implementation of the project design features, standard conditions and requirements, and mitigation measures identified for each resource area significantly impacted, ~~many of~~ the potentially significant impacts resulting from the proposed project would be reduced to a less-than-significant level. No significant and unavoidable impacts were identified. ~~The proposed project impacts listed below would remain significant and unavoidable even after mitigation.~~

3.3 Changes to the Draft EIR in Response to Comments

Chapter 2, Project Description

The first paragraph on page 2-7 of the Draft EIR is revised to read:

> As a municipal customer of CCWD, the City is provided raw water service under CCWD's Code of Regulations. In addition, the City and CCWD currently have two supplemental agreements. The July 2000 Raw Water Service Agreement governs the City of Antioch's purchase of raw water from CCWD diverted from the Contra Costa Canal. The 2000 agreement includes a provision for a minimum take of raw water that must be taken and/or paid for by the City annually. The December 2001 Treated Water Service Agreement provides the City with up to 10 mgd capacity in the Randall-Bold Water Treatment Plant. The City's current capacity right in Randall-Bold WTP is approximately 6 mgd. ~~The City's current agreement with CCWD is for a peak demand of 25,000 gallons per minute (gpm) (36.0 mgd).~~ Between 2005 and 2010, the City purchased an average of approximately 4,000 MG per year (12,325 AFY) from CCWD (City of Antioch, 2016).

Section 3.3, Aquatic Biological Resources

The Draft EIR, page 3.3-19 is revised as follows:

> ***Delta Stewardship Council – Delta Plan***
>
> The Delta Stewardship Council is a State agency created through the Delta Reform Act of 2009 to develop and implement a legally enforceable long-term management plan for the Delta and Suisun Marsh. The Delta Plan, adopted by the Delta Stewardship Council in 2013, is a comprehensive, long-term management plan for the Delta. It creates new rules and recommendations to further the state's coequal goals for the Delta: Improve statewide water supply reliability, and protect and restore a vibrant and healthy Delta ecosystem, all in a manner that preserves, protects and enhances the unique agricultural, cultural, and recreational characteristics of the Delta.
>
> The following policy from the Delta Plan is relevant to aquatic biological resources:
>
> **ER P5** (a) The potential for new introductions of, or improved habitat conditions for, nonnative invasive species, striped bass, or bass must be fully considered and avoided or mitigated in a way that appropriately protects the ecosystem.
>
> (b) For purposes of Water Code Section 85057.5(a)(3) and Section 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that has the reasonable probability of introducing, or improving habitat conditions for, nonnative invasive species.

The Draft EIR, page 3.3-34 is revised as follows in order to appropriately caveat the use of results from Tenera (2010):

> It is important to note that Tenera (2010) was a pilot analysis examining potential entrainment and was not conducted as part of this, or any other, CEQA analysis EIR. Tenera (2010) concluded that operations of a regional desalination facility at the Mallard Slough Pump Station would require USFWS and CDFW review. The results of the pilot analyses on entrainment for larval fish and fish eggs show the following (Tenera, 2010):

Section 3.4, Terrestrial Biological Resources

The Draft EIR, pages ES-11 and 3.3-24 are revised as follows:

Mitigation Measure 3.4-1a: Pre-construction Nesting Bird Surveys

c) Burrowing owl Take Avoidance Surveys shall be conducted according to the methodologies prescribed in the CDFW *Staff Report on Burrowing Owl Mitigation* (CDFG, 2012) for annual grasslands located north of the Pittsburg-Antioch Highway. Take Avoidance Surveys shall be conducted 14 days prior or less to initiating ground disturbance. As burrowing owls may recolonize a site after only a few days, time lapses greater than 14 days between project activities require subsequent surveys, including but not limited to a final survey conducted within 24 hours prior to ground disturbance to ensure absence. Surveys are intended to identify burrows and burrowing owls outside of the study area, which may be impacted by factors such as noise and vibration (heavy equipment) during project construction. As no access is available to grasslands north of the highway, a pedestrian surveys transect shall be performed from the northern edge of the public right-of-way.

   i. If burrowing owls are detected during surveys, the following restricted activity dates and setback distances derived from the 2012 Staff Report on Burrowing Owl Mitigation (CDFG 2012) shall apply, or as otherwise coordinated with the CDFW:

      1. Occupied burrows shall not be disturbed during the nesting season, from February 1 through August 31;

      2. No disturbance shall occur within 50 meters (approximately 160 feet) of occupied burrows during October 16 through March 31 or within 200 meters (approximately 660 feet) April 1 through October 15;

      3. No earth-moving activities or other disturbance shall occur within the aforementioned buffer zones of occupied burrows. These buffer zones shall be well-marked. If burrowing owls were found in the study area, a qualified biologist shall also delineate the extent of burrowing owl habitat on the site; and

      4. Buffers may be modified by a qualified burrowing owl biologist that is knowledgeable enough to establish buffer sizes that are commensurate with the acclimation of western burrowing owls to disturbance. These buffers if modified over that prescribed above, shall be coordinated with the CDFW.

5. Because no burrowing owl habitat occurs on-site, passive relocation of owls is not anticipated. Information regarding the occurrence of burrowing owls near the project site shall be reported to the CNDDB.

d) Preconstruction Surveys for Swainson's hawk and white-tailed kite. If construction activities occur between February 1 and August 31, the Project Applicant shall retain a qualified biologist to conduct surveys for Swainson's hawk and white-tailed kite in accordance with the Swainson's Hawk Technical Advisory Committee 2000 guidelines (SHTAC 2000), or current guidance. Surveys shall cover a minimum of a 0.5-mile radius around the construction area. If nesting Swainson's hawks or white-tailed kites are detected, the qualified biologist shall establish a 0.5-mile no-disturbance buffer. Buffers shall be maintained until the qualified biologist has determined that the young have fledged and are no longer reliant upon the nest or parental care for survival. No habitat loss would occur for either species; hence, compensatory mitigation is not necessary.

Section 3.11, Delta Hydrology and Water Quality

The Draft EIR, page 3.11-16 is revised as follows:

The following policies and recommendations from the Delta Plan are relevant to water quality:

WR P1 Reduce reliance on the Delta through improved regional water self reliance.

~~Policy~~ Recommendation WQ R1: Water quality in the Delta should be maintained at a level that supports, enhances, and protects beneficial uses identified in the applicable State Water Resources Control Board or regional water quality control board water quality control plans.

~~Policy~~ Recommendation WQ R2: Covered actions should identify any significant impacts to water quality.

ER P1 (a) The State Water Resources Control Board's Bay Delta Water Quality Control Plan flow objectives shall be used to determine consistency with the Delta Plan. If and when the flow objectives are revised by the State Water Resources Control Board, the revised flow objectives shall be used to determine consistency with the Delta Plan.

(b) For purposes of Water Code section 85057.5(a)(3) and Section 50031(j)(1)(E) of this Chapter, the policy set forth in subsection (a) covers a proposed action that could significantly affect flow in the Delta.

Section 3.13, Noise

For purposes of clarification, item (b) from Mitigation Measure 3.13-1 on page ES-19 and 3.13-18 is revised to read:

b) To reduce potential daytime construction noise impacts to residential uses immediately south and west of the desalination facility contractors shall employ

temporary noise curtains or barriers along the southern and western property boundary of the WTP to shield daytime construction noise impacts to residential uses to the south and west. To reduce potential daytime construction noise impacts to residential uses immediately east of the proposed new pump station, contractors shall employ temporary noise curtains or barriers along the eastern property boundary of the pump station worksite to shield daytime construction noise impacts to residential uses to the east. Implementation of this measure will ensure that daytime construction activities do not exceed noise criteria for daytime construction at residential uses (70 dBA L_{eq}). These barriers shall be installed prior to the start of construction.

Chapter 5, Alternatives

Section 5.3.2, *Brine Disposal Options Screening Results* (pages 5-8 and 5-9 of the EIR), is revised as follows to provide clarification:

This analysis considers an alternative disposal option for brine generated by the desalination plant and is summarized in **Table 5-2** below.

TABLE 5-2
BRINE DISPOSAL OPTIONS SCREENING RESULTS

Brine Disposal Option	Description	Screening Results
Surface water discharge	This option would discharge brine directly to a local or remote water body, and would require construction of an engineered solution (e.g., new outfall and diffuser).	*This option would discharge brine without dilution to local surface waters. Not carried forward because the California Ocean Plan Amendments[1] encourage co-location with a wastewater treatment plant outfall to dilute brine with wastewater effluent before it is discharged.*
Combine brine with CCCSD WWTP or Mirant power plant effluent	This option would discharge brine with effluent produced by CCCSD or Mirant power plant, and would require a combination of slip-lining abandoned or non-critical pipelines and new brine pipeline construction to complete the connections to these facilities.	*The Mirant and CCCSD facilities are located an additional 4 to 11-miles west of the proposed brine disposal pipeline and would require a greater amount of excavation and construction. This option is not carried forward because other discharge locations offer no advantages to the proposed project. It would not reduce, avoid, or eliminate potential impacts of the proposed project.*

NOTE:
1. The California Ocean Plan Amendments apply to coastal desalination plants using ocean water and are not directly applicable to the proposed desalination facility treating water from the San Joaquin River. However, these amendments are used as a guideline for this project.

The primary screening criteria for these options were:

- Technically feasible and capable of receiving the entire brine flow (2 mgd) from the brackish water desalination facility;
- Due to cost and viability for the City, the option should be a single, reliable brine management method;
- Must not require capital costs that would surpass additional revenue gained from implementation.

As described in Section 2.4, *Project Component Selection and Considerations*, a previous study for a Pilot Plant concluded that several opportunities for managing desalination concentrate would be available in the east Contra Costa region. Mixing the concentrate with wastewater effluent produced by Delta Diablo and/or the Central Contra Costa Sanitary District (CCCSD) were identified as opportunities for further consideration. Comingling with spent cooling water from the Mirant power plant, which is located east of the Mallard Slough Pump Station, or discharges into the power plant's intake itself, were also identified as potentially acceptable low cost options. The previous pilot plant study was the source of measured water quality data used in developing the conceptual design of the proposed project to model future water quality at the City's intake. Project-specific brine management and disposal options were evaluated in a separate technical memorandum (Carollo, 2016). ~~The City subsequently evaluated brine disposal alternatives for their site-specific application using information from the study.~~

Land-based brine discharge options were not considered or evaluated in this analysis for several reasons, including: the impacts associated with the truck trips required to move 2 mgd of liquid brine to a processing facility or other disposal or treatment area; the infeasibility of developing a substantially large area that would be needed for the use of evaporation ponds; the lack of a market for the salt product in California (e.g., as a de-icing agent); the infeasibility of using the very saline brine as irrigation water or for dust control; and the infeasibility of deep well injection due to regulations requiring a 30 mile setback from known fault lines.

Based on this initial screening, no brine disposal alternative options were retained for valuation in the second step of the process.

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CHAPTER 4
Mitigation Monitoring and Reporting Program

4.1 Introduction

The California Environmental Quality Act (CEQA) requires that when a public agency makes findings pursuant to Public Resource Code Section 21081 before approving a project that would result in one or more significant impacts on the environment, the agency must adopt a reporting or monitoring program for mitigation measures incorporated into a project or imposed as conditions of approval. The program must be designed to ensure compliance during project implementation (Public Resource Code Section 21081.6).

This Mitigation Monitoring and Reporting Plan (MMRP) for the Brackish Water Desalination Facility (project) will be in place through all phases of the project, including design and construction, and will help ensure that project objectives are achieved. As the CEQA Lead Agency, the City of Antioch (City) is responsible for verifying that the provisions of the MMRP as a whole are carried out, pursuant to Section 15097(a) of the CEQA Guidelines. The City may delegate reporting or monitoring responsibilities to a subsidiary public agency or to a private entity such as a project contractor who accepts the delegation; however, until mitigation measures have been completed, the City remains responsible for ensuring that implementation of the mitigation measures occurs in accordance with the program. The City will ensure that monitoring is documented through periodic reports and that deficiencies are promptly corrected.

4.2 Format

Table 4-1 below lists all mitigation measures for the proposed project identified in the EIR by resource area. The components of the MMRP include:

Impact Number: This column presents the impact number identified in the EIR.

Impact Statement: This column presents the impact statement identified in the EIR.

Mitigation Measure: This column presents the mitigation measure identified in the EIR.

Implementation Responsibility: This column identifies the person/group responsible for implementation of the migration measure.

Monitoring Responsibility: This column contains an assignment of responsibility for the monitoring and reporting tasks.

Monitoring and Reporting Action(s): This column refers to the outcome from implementing the mitigation measure.

Timing: The general schedule for conducting each mitigation task, identifying where appropriate both the timing and the frequency of the action.

Verification of Compliance: This column may be used by the lead agency to document the person who verified the implementation of the mitigation measure and the date on which this verification occurred.

The following abbreviations are used in the table:

City	City of Antioch
BAAQMD	Bay Area Air Quality Management District
CDFW	California Department of Fish and Wildlife
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

TABLE 4-1
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Air Quality							
3.2-1	Construction of the project would result in criteria pollutant emissions that could exceed air quality standards or contribute substantially to an existing or projected air quality violation.	**3.2-1: BAAQMD Basic Construction Measures.** To limit air pollutant emissions associated with construction, the City of Antioch and/or its construction contractor(s) shall implement and include in all contract specifications for the project the following BAAQMD-recommended Basic Construction Measures (BCM): • All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. • All haul trucks transporting soil, sand, or other loose material off-site shall be covered. • All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. • All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph). • All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. • Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. • All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation. • Post a publicly visible sign with the telephone number and persons to contact at the City of Antioch regarding dust complaints. These persons shall respond and take corrective action within 48 hours. The BAAQMD's phone number shall also be visible to ensure compliance with applicable regulations.	1. City 2. City/Contractor	1. City 2. City	1. Incorporate all listed BAAQMD-recommended BCMs into the contract specifications. 2. Monitor to verify implementation of BCMs.	1. Preconstruction 2. Construction	
3.2-3	Construction of the project would result in emissions that could conflict with the 2017 Clean Air Plan.	**Implement Mitigation Measure 3.2-1: BAAQMD Basic Construction Measures (see details above)**					
3.2-4	Construction of the project could expose sensitive receptors to toxic air contaminants, including diesel particulate matter emissions.	**3.2-4: Construction Emissions Minimization.** The City of Antioch (and/or its construction contractor(s)) shall ensure that all diesel-powered equipment to be operated during construction activities at the river pump station and desalination facility sites meet USEPA-certified Tier 4 standards, the highest USEPA-certified tiered emission standards. An Exhaust Emissions Equipment inventory shall be prepared prior to the commencement of construction and maintained throughout construction that identifies each off-road unit's certified tier specification status to be operated at the river pump station and desalination facility sites.	1. City/Contractor 2. Contractor	1. City 2. City	1. Prepare Exhaust Emissions Equipment inventory for river pump station and desalination facility sites. 2. Maintain Exhaust Emissions Equipment inventory	1. Preconstruction 2. Construction	
3.2-C-1	Construction of the proposed project, in combination with other cumulative development, could result in criteria pollutant emissions that would exceed air quality standards or contribute substantially to an existing or projected air quality violation.	**Implement Mitigation Measure 3.2-1: BAAQMD Basic Construction Measures (see details above)**					
3.2-C-3	Construction of the proposed project, in combination with other cumulative development, could expose sensitive receptors to toxic air contaminants, including diesel particulate matter emissions.	**Implement Mitigation Measure 3.2-4: Construction Emissions Minimization (see details above)**					

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Aquatic Biological Resources							
3.3-3	Construction of the proposed intake facility could result in direct disturbance and mortality of fish from installation of cofferdams and dewatering.	**3.3-3a: Conduct Worker Awareness Training.** A worker awareness training program shall be conducted for construction crews before the start of construction activities at the river intake pump station site. The program shall include a brief overview of sensitive fisheries and aquatic resources (including riparian habitats) on the project site, measures to minimize impacts on those resources, and conditions of relevant regulatory permits.	1. City (Biologist)	1. City	1. Conduct worker awareness training for construction at river intake pump station site.	1. Preconstruction	
		3.3-3b: Implement In-water Work Windows. Any in-water construction activities (e.g., construction of the sheetpile cofferdam) shall be conducted during months when special-status fish species/sensitive life stages are least likely to be present or less susceptible to disturbance (e.g., August 1 to October 31; anadromous salmonids and smelts). If any in-water work is to be conducted, a qualified biologist or resource specialist shall be present during such work to monitor construction activities and ensure compliance with terms and conditions of permits issued by regulatory agencies (see Mitigation Measure 3.3-3d below).	1. City 2. City (Biologist)	1. City 2. City	1. Limit in-water construction to August 1 to October 31. 2. Retain qualified biologist or resource specialist during in-water work at river intake pump station site.	1. Construction 2. Construction	
		3.3-3c: Develop and Implement Fish Rescue Plan. To reduce the potential for fish stranding or minimize the potential for harm during cofferdam dewatering activities, the City or its contractor shall develop and implement a fish rescue plan. Prior to the closure of the cofferdam in the Delta, seining by a qualified fisheries biologist shall be conducted within the cofferdam using a small-mesh seine to direct and move fish out of the cofferdam area. Upon completion of seining, the entrance to the cofferdam shall be blocked with a net to prevent fish from entering the cofferdam isolation area before the cofferdam is completed. Once the cofferdam is completed and the area within the cofferdam is closed and isolated, additional seining shall be conducted within the cofferdam to remove any remaining fish, if present. Once all noticeable fish have been removed from the isolated area, portable pumps with intakes equipped with 1.75 mm mesh screen shall be used to dewater to a depth of 1.5-2 feet. A qualified biologist shall implement further fish rescue operations using electrofishing and dip nets. All fish that are captured shall be placed in clean 5-gallon buckets and/or coolers filled with Delta water, transported downstream of the construction area, and released back into suitable habitat in the Delta with minimal handling. After all fish have been removed using multiple seine passes, electrofishing, and dip nets (as necessary), portable pumps with screens (see above) shall be used for final dewatering. NMFS, USFWS, and CDFW shall be notified at least 48 hours prior to the fish rescue.	1. City/Contractor 2. City 3. City (Biologist)	1. City 2. City 3. City	1. Develop fish rescue plan 2. Notify NMFS, USFWS, and CDFW at least 48 hours prior to fish rescue 3. Retain qualified biologist to conduct activities according to the protocol described in the mitigation measure.	1. Preconstruction 2. Preconstruction 3. Construction	
		3.3-3d: Consult with Resources Agencies and Implement Additional Measures. The City shall also consult with NMFS, USFWS, and CDFW (as part of obtaining permit approvals (e.g., FESA Section 7, CESA [Fish and Game Code Sections 2080.1, 2081]) to determine necessary impact minimization actions, which may include surveying the intake site to determine fish presence prior to installation. The City shall implement any additional measures developed through the FESA Section 7 and Fish and Game Code Sections 2080.1, 2081 permit processes, to ensure that impacts are avoided and/or minimized.	1. City 2. City	1. City 2. City/NMFS, USFWS, and CDFW	1. Consult with NMFS, USFWS, and CDFW. 2. Implement additional measures identified through consultation process.	1. Preconstruction 2. Construction	
3.3-4	Construction of the proposed intake facility could result in a short-term degradation of aquatic habitat caused by an increase in hydrostatic pressure, underwater noise, and vibrations.	**3.3-4: Underwater Sound Levels.** The City shall implement the following measures to avoid and minimize potential adverse effects that could otherwise result from in-water pile-driving activities: • The City shall develop a plan for pile-driving activities to minimize impacts on fish and will allow sufficient time in the schedule for coordination with regulatory agencies. Measures will be implemented to minimize underwater sound pressure to levels below thresholds for peak pressure and accumulated sound exposure levels. Threshold levels established by NMFS are: – peak pressure = 206 dBpeak – accumulated sound exposure levels = 183 dBSEL • Underwater sound monitoring shall be performed during pile-driving activities. A qualified acoustician, biologist, and/or natural resource specialist shall be present during such work to monitor construction activities and compliance with terms and conditions of permits.	1. City 2. City (Acoustician, Biologist, and/or Natural Resource Specialist) 3. City/Contractor	1. City 2. City 3. City	1. Develop plan for pile-driving activities. 2. Retain qualified acoustician, biologist, and/or natural resource specialist to monitor pile-driving activities. 3. Conduct construction activities according to the protocol described in the mitigation measure.	1. Preconstruction 2. Construction 3. Construction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Aquatic Biological Resources (cont.)							
3.3-4 (cont.)		• Pile driving shall occur during the established/approved work window (August 1 through October 31, or other as approved by NMFS, USFWS, and CDFW). • Sheet piling shall be driven by vibratory or nonimpact methods (i.e., hydraulic) that result in sound pressures below threshold levels to the extent feasible. • Pile driving activities may occur during periods of reduced currents as needed to meet the threshold limits. Pile-driving activities shall be monitored and if any stranding, injury, or mortality to fish is observed, CDFW, NMFS, and/or USFWS shall be immediately notified and in-water pile driving shall cease. • Pile driving shall be conducted only during daylight hours and initially will be used at low energy levels and reduced impact frequency. Applied energy and frequency shall be gradually increased until the force and frequency necessary to advance the pile is achieved. • If it is determined that impact hammers are required and/or underwater sound monitoring demonstrates that thresholds are being exceeded, the contractor shall implement sound dampening or attenuation devices to reduce levels to the extent feasible; these may include the following: – water bladder cofferdam; – confined or unconfined air bubble curtain.					
3.3-5	Construction of the proposed intake facility would result in a loss of shallow water habitat.	**3.3-5: Purchase Mitigation Credits.** The City shall purchase mitigation credits from a public or private mitigation bank approved by USFWS, NMFS, and/or CDFW. The final number of credits to be purchased shall be determined in consultation with USFWS, NMFS, and CDFW. Mitigation credit purchase shall be conducted either before or as soon as possible after construction of the intake commences.	1. City	1. City	1. Purchase mitigation credits in consultation with USFWS, NMFS, and/or CDFW.	1. Preconstruction/ Construction	
Terrestrial Biological Resources							
3.4-1	The proposed project could result in significant impacts, either directly or through habitat modifications, on species identified as sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service.	**3.4-1a: Pre-construction Nesting Bird Surveys.** The general raptor and passerine bird nesting period cited by CDFW is often cautiously interpreted as the period between February 1 and August 31. Breeding birds are protected under Section 3503 of the California Fish and Game Code (Code), and raptors are protected under Section 3503.5. In addition, both Section 3513 of the Code and the Federal Migratory Bird Treaty Act (16 USC, Sec. 703 Supp. I, 1989) prohibit the killing, possession, or trading of migratory birds. Finally, Section 3800 of the Code prohibits the taking of non-game birds, which are defined as birds occurring naturally in California that are neither game birds nor fully protected species. In general, CDFW recommends a 250-foot construction exclusion zone around the nests of active passerine songbirds during the breeding season, and a 500-foot buffer for nesting raptors. These buffer distances are considered initial starting distances once a nest has been identified, and are sometimes revised downward to 100 feet and 250 feet, respectively, based on site conditions and the nature of the work being performed. These buffer distances may also be modified if obstacles such as buildings or trees obscure the construction area from active bird nests, or existing disturbances create an ambient background disturbance similar to the proposed disturbance. a) Avian surveys shall be performed during breeding bird season (February 1 to August 31) no more than 14 days prior to ground disturbing or in-water construction activities in order to locate any active passerine nests within 250 feet of the project footprint and any active raptor nests within 500 feet of the project footprint. Building demolition, trenching, pipeline installation, and new construction activities performed between September 1 and January 31 avoid the general nesting period for birds and therefore would not require pre construction surveys. b) If active nests are found on either the proposed construction site, no-work buffer zones shall be established around the nests (100 to 150 feet for passerine birds and 150 to 250 feet for raptors, depending upon species sensitivity to disturbance) in coordination with CDFW. No staging, ground-disturbing, or construction activities shall occur within a buffer zone until young have fledged or the nest is otherwise abandoned as determined by the qualified biologist. If work during the nesting season stops for 14 days or more and then resumes, then nesting bird surveys shall be repeated, to ensure that no new birds have begun nesting in the area.	1. City (Biologist) 2. City (Biologist) 3. City (Biologist) 4. City (Biologist)	1. City 2. City/CDFW if required 3. City/CDFW if required 4. City	1. Retain qualified biologist to conduct preconstruction avian surveys for active nests in accordance with CDFW protocols and reporting requirements. 2. Conduct construction activities according to the protocol described in the mitigation measure. 3. Retain qualified biologist to conduct preconstruction burrowing owl surveys in accordance protocol described in the mitigation measure. 4. Retain qualified biologist to conduct preconstruction surveys for Swainson's hawk in accordance protocol described in the mitigation measure.	1. Preconstruction 2. Preconstruction/ Construction 3. Preconstruction/ Construction 4. Preconstruction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Terrestrial Biological Resources (cont.)							
3.4-1 (cont.)		c) Burrowing owl Take Avoidance Surveys shall be conducted according to the methodologies prescribed in the CDFW Staff Report on Burrowing Owl Mitigation (CDFG, 2012) for annual grasslands located north of the Pittsburg-Antioch Highway. Take Avoidance Surveys shall be conducted 14 days prior or less to initiating ground disturbance. As burrowing owls may recolonize a site after only a few days, time lapses greater than 14 days between project activities require subsequent surveys, including but not limited to a final survey conducted within 24 hours prior to ground disturbance to ensure absence. Surveys are intended to identify burrows and burrowing owls outside of the study area, which may be impacted by factors such as noise and vibration (heavy equipment) during project construction. As no access is available to grasslands north of the highway, a pedestrian surveys transect shall be performed from the northern edge of the public right-of-way. i. If burrowing owls are detected during surveys, the following restricted activity dates and setback distances derived from the 2012 Staff Report on Burrowing Owl Mitigation (CDFG 2012) shall apply, or as otherwise coordinated with the CDFW: 1. Occupied burrows shall not be disturbed during the nesting season, from February 1 through August 31; 2. No disturbance shall occur within 50 meters (approximately 160 feet) of occupied burrows during October 16 through March 31 or within 200 meters (approximately 660 feet) April 1 through October 15; 3. No earth-moving activities or other disturbance shall occur within the aforementioned buffer zones of occupied burrows. These buffer zones shall be well-marked. If burrowing owls were found in the study area, a qualified biologist shall also delineate the extent of burrowing owl habitat on the site; and 4. Buffers may be modified by a qualified burrowing owl biologist that is knowledgeable enough to establish buffer sizes that are commensurate with the acclimation of western burrowing owls to disturbance. These buffers if modified over that prescribed above, shall be coordinated with the CDFW. 5. Because no burrowing owl habitat occurs on-site, passive relocation of owls is not anticipated. Information regarding the occurrence of burrowing owls near the project site shall be reported to the CNDDB. d) Preconstruction Surveys for Swainson's hawk and white-tailed kite. If construction activities occur between February 1 and August 31, the Project Applicant shall retain a qualified biologist to conduct surveys for Swainson's hawk and white-tailed kite in accordance with the Swainson's Hawk Technical Advisory Committee 2000 guidelines (SHTAC 2000), or current guidance. Surveys shall cover a minimum of a 0.5-mile radius around the construction area. If nesting Swainson's hawks or white-tailed kites are detected, the qualified biologist shall establish a 0.5-mile no-disturbance buffer. Buffers shall be maintained until the qualified biologist has determined that the young have fledged and are no longer reliant upon the nest or parental care for survival. No habitat loss would occur for either species; hence, compensatory mitigation is not necessary.					
		3.4-1b: Pre-construction Bat Survey. To minimize impacts on special-status bats, a preconstruction survey shall be performed from accessible lands, and no-disturbance buffers shall be created around active bat roosting sites, if found. Prior to ground disturbing construction activities (i.e., ground clearing, trenching, and grading) within 200 feet of trees that could support special-status bats, a qualified bat biologist shall survey for special-status bats. If no evidence of bats (i.e., direct observation, guano, staining, or strong odors) is observed, no further mitigation shall be required. If evidence of bats is observed, the following measures shall be implemented to avoid potential impacts on breeding populations: a) A no-disturbance buffer of 200-feet shall be created around active bat roosts during the breeding season (April 15 through August 15). Bat roosts initiated during construction are presumed to be unaffected by the indirect effects of noise and construction disturbances. However, the direct take of individuals will be prohibited.	1. City (Biologist) 2. City (Biologist)	1. City 2. City	1. Retain qualified biologist to conduct preconstruction surveys for active bat roosting sites or evidence of special status bats. 2. Conduct construction activities according to the protocol described in the mitigation measure.	1. Preconstruction 2. Construction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Terrestrial Biological Resources (cont.)							
3.4-1 (cont.)		b) In the case that removal of trees showing evidence of bat activity is needed, tree removal shall occur during the period least likely to affect bats, as determined by a qualified bat biologist (generally between February 15 and October 15 for winter hibernacula, and between August 15 and April 15 for maternity roosts). Bat exclusion activities (e.g., installation of netting to block roost entrances) shall also be conducted during these periods. The qualified biologist shall be present during any tree trimming and disturbance, if trees containing or suspected of containing bat roosts are present. Trees with roosts shall be disturbed only when no rain is occurring or is forecast to occur for 3 days and when daytime temperatures are at least 50 degrees Fahrenheit (°F). Branches and limbs not containing cavities or fissures in which bats could roost shall be cut only using chainsaws. Branches or limbs containing roost sites shall be trimmed the following day, under the supervision of the qualified biologist, also using chainsaws.					
3.4-3	The proposed project could have a substantial adverse effect on state or federally-protected wetlands, 'other waters', and navigable waters through direct removal, filling, hydrological interruption, or other means.	**3.4-3: Recontour Aquatic Habitat and Remove Debris Following In-Water Construction.** To mitigate impacts on waters of the U.S. in the San Joaquin River, it is estimated that the City will remove debris (e.g., concrete, the existing pipeline, and piers) and structures from the work area in an amount that is equal to or greater than the area of new facilities that will be introduced into the water. Because no wetlands (i.e., vegetated aquatic habitat) is present in the project footprint, the City need only restore the bottom contours of the San Joaquin River bed to emulate existing aquatic conditions at the site and no further shoreline restoration is needed. Specific water quality requirements during construction are identified in Section 3.10, Local Hydrology and Water Quality.	1. City/Contractor	1. City/USACE	1. Verify bottom of the San Joaquin River in the work area is recontoured.	1. Post-construction	
3.4-5	Development facilitated by the proposed project would not conflict with local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.	**Implement Mitigation Measure 3.4-1a: Pre-construction Nesting Bird Surveys (see details above)** **Implement Mitigation Measure 3.4-1b: Pre-construction Bat Survey (see details above)**					
3.4-C-1	Implementation of the proposed project, in combination with past, present, and reasonably foreseeable future development could result in a cumulatively significant impact related to terrestrial biological resources.	**Implement Mitigation Measure 3.4-1a: Pre-construction Nesting Bird Surveys (see details above)** **Implement Mitigation Measure 3.4-1b: Pre-construction Bat Survey (see details above)**					
Cultural Resources							
3.5-2	The project could cause a substantial adverse change in the significance of an archaeological resource.	**3.5-1: Inadvertent Discovery of Archaeological Resources.** If prehistoric or historic-era archaeological resources are encountered by construction personnel during project implementation, all construction activities within 100 feet shall halt until a qualified archaeologist, defined as one meeting the Secretary of the Interior's Professional Qualification Standards for archaeology, can assess the significance of the find. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil (midden) containing heat-affected rocks, artifacts, or shellfish remains; stone milling equipment (e.g., mortars, pestles, hand stones, or milling slabs); and battered stone tools, such as hammer stones and pitted stones. Historic-era materials might include stone, concrete, or adobe footings and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse. If a find is evaluated and determined to be significant, a mitigation plan shall be developed that recommends preservation in place as a preference or, if preservation in place is not feasible, data recovery through excavation. The mitigation plan will be developed in consultation with the affiliated Native American tribe(s), as appropriate. If preservation in place is feasible, this may be accomplished through one of the following means: (1) modifying the construction plan to avoid the resource; (2) incorporating the resource within open space; (3) capping and covering the resource before building appropriate facilities on the resource site; or (4) deeding the resource site into a permanent conservation easement. If preservation in place is not feasible, a qualified archaeologist shall prepare and implement a detailed treatment plan to	1. City (Archaeologist) 2. City	1. City 2. City	1. Retain qualified archaeologist in the event prehistoric or historic-era archaeological resources are discovered 2. Comply with the protocol described in the mitigation measure.	1. Preconstruction 2. Construction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Cultural Resources (cont.)							
3.5-2 (cont.)		recover scientifically consequential information from the resource prior to any excavation at the site. Treatment for most resources would consist of (but would not necessarily be limited to) sample excavation, artifact collection, site documentation, and historical research, with the aim to target the recovery of important scientific data contained in the portion(s) of the significant resource to be impacted by the project. The treatment plan shall include provisions for analysis of data in a regional context; reporting of results within a timely manner; curation of artifacts and data at an approved facility; and dissemination of reports to local and state repositories, libraries, and interested professionals. Should the project include federal funding or oversight or otherwise qualify as a federal undertaking, the archaeological study shall be prepared in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended.					
3.5-3	The proposed project could disturb human remains, including those interred outside of dedicated cemeteries.	**3.5-2: Inadvertent Discovery of Human Remains.** In the event human remains are uncovered during construction activities for the project, the City shall immediately halt work, contact the Contra Costa County Coroner to evaluate the remains, and follow the procedures and protocols pursuant to Section 15064.5(e)(1) of the CEQA Guidelines. State Health and Safety Code Section 7050.5 requires that no further disturbance shall occur until the County Coroner has made the necessary findings as to origin and disposition pursuant to PRC Section 5097.98. If the remains are determined to be of Native American descent, the coroner has 48 hours to notify the Native American Heritage Commission (NAHC). The NAHC will then identify the person thought to be the Most Likely Descendent of the deceased Native American. The Most Likely Descendent will make recommendations for means of treating, with appropriate dignity, the human remains and any associated grave goods as provided in PRC Section 5097.98.	1. City/Contractor	1. City	1. Comply with the protocol described in the mitigation measure if human remains are found.	1. Construction	
3.5-C-1	Implementation of the proposed project, in combination with other cumulative development, could contribute to cumulative impacts to archaeological resources.	**Implement Mitigation Measure 3.5-2: Inadvertent Discovery of Human Remains (see details above)**					
3.5-C-2	Implementation of the proposed project, in combination with other cumulative development, could contribute to cumulative impacts to human remains.	**Implement Mitigation Measure 3.5-2: Inadvertent Discovery of Human Remains (see details above)**					
Energy Conservation							
3.7-1	The project would not use large amounts of fuel or energy in an unnecessary, wasteful, or inefficient manner.	**3.7-1: Construction Equipment Efficiency.** The City shall retain a qualified professional (i.e., construction planner/energy efficiency expert) to identify the specific measures that the City (and its construction contractors) will implement as part of project construction and decommissioning to increase the efficient use of construction equipment to the maximum extent feasible. Such measures shall include, but not necessarily be limited to: procedures to ensure that all construction equipment is properly tuned and maintained at all times; a commitment to utilize existing electricity sources where feasible rather than portable diesel-powered generators; and identification of procedures (including the routing of haul trips) that will be followed to ensure that all materials and debris hauling is conducted in a fuel-efficient manner. The measures shall be incorporated into construction specifications and implemented throughout the construction and decommissioning periods. **Implement Mitigation Measure 3.2-1: Idling Restrictions (see details under Air Quality, above)**	1. City/ Contractor	1. City	1. Retain qualified construction planner/energy efficiency expert and incorporate construction equipment efficiency measures in the construction specifications. 2. Verify implementation of equipment efficiency measures.	1. Design 2. Construction/ Decommissioning	
3.7-C-1	Implementation of the project, in combination with past, present, and reasonably foreseeable future development, would not use large amounts of fuel or energy in an unnecessary, wasteful, or inefficient manner.	**Implement Mitigation Measure 3.2-1: Idling Restrictions (see details under Air Quality, above)** **Implement Mitigation Measure 3.7-1: Construction Equipment Efficiency (see details above)**					

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Hazards and Hazardous Materials							
3.9-2	The proposed project could emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.	**Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details under Transportation and Circulation, below)**					
3.9-3	The proposed project would be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, could create a significant hazard to the public or the environment.	**3.9-3a: Health and Safety Plan.** The construction contractor(s) shall prepare and implement site-specific Health and Safety Plans (HASP) in accordance with 29 CFR 1910.120 to protect construction workers and the public during all excavation and grading activities. This HASP shall be submitted to the City of Antioch for review prior to commencement of demolition and construction activities and as a condition of the grading, construction, and/or demolition permit(s). The HASP shall include, but is not limited to, the following elements: • Designation of a trained, experienced site safety and health supervisor who has the responsibility and authority to develop and implement the site HASP; • A summary of all potential risks to demolition and construction workers and maximum exposure limits for all known and reasonably foreseeable site chemicals; • Specified personal protective equipment and decontamination procedures, if needed; • Emergency procedures, including route to the nearest hospital; and • Procedures to be followed in the event that evidence of potential soil or groundwater contamination (such as soil staining, noxious odors, debris or buried storage containers) is encountered. These procedures shall be in accordance with hazardous waste operations regulations and specifically include, but are not limited to, the following: immediately stopping work in the vicinity of the unknown hazardous materials release, notifying Contra Costa Health Services - Hazardous Materials Programs, and retaining a qualified environmental firm to perform sampling and remediation.	1. Contactor 2. Contractor	1. City 2. City	1. Prepare and submit site-specific HASP to the City for review and approval. 2. Verify implementation of HASP.	1. Preconstruction 2. Construction	
		3.9-3b: Soil Management Plan. In support of the HASP described above in Mitigation Measure 3.9-3a, the contractor shall develop and implement a Soil Management Plan (SMP) that includes a materials disposal plan specifying how the construction contractor(s) will remove, handle, transport, and dispose of all excavated materials in a safe, appropriate, and lawful manner. This SMP shall be submitted to the City of Antioch for review prior to commencement of demolition and construction activities and as a condition of the grading, construction, and/or demolition permit(s). The SMP must identify protocols for soil testing and disposal, identify the approved disposal site, and include written documentation that the disposal site can accept the waste. Contract specifications shall mandate full compliance with all applicable local, state, and federal regulations related to the identification, transportation, and disposal of hazardous materials, including those encountered in excavated soil. In addition, the City or its contractor shall contact the Fulton Shipyards to acquire the most current information regarding chemicals in sediments around the proposed intake pump station. The contact is Deltech, LLC, c/o Mr. Shannon Creson, 2200 Wymore Way, Antioch, California 94509, shannon@drilltechdrilling.com.	1. Contractor 2. City 3. Contractor	1. City 2. City 3. City	1. Prepare and submit SMP to the City for review and approval and incorporate requirements into the contract specifications. 2. Contact Fulton Shipyards to acquire sediment quality information. 3. Verify implementation of SMP.	1. Preconstruction 2. Preconstruction 3. Construction	
		3.9-3c: ACM Management Plan. Prior to commencement of demolition and construction activities and as a condition of the grading, construction, and/or demolition permit(s), the contractor that would be excavating at the location of the oil pipes that may be covered with asbestos-containing materials (ACM) shall conduct a survey to determine if the oil pipes are present and if they are coated with ACM. In the event that the abandoned petroleum pipelines are coated with ACM and in support of the HASP described above in Mitigation Measure 3.9-3a, the contractor shall develop and implement an ACM Management Plan (ACMMP) that includes a materials disposal plan specifying how the construction contractor will remove, handle, transport, and dispose of all ACM-insulated pipe materials in a safe, appropriate, and lawful manner. The ACMMP must identify protocols for worker protection, ACM testing and disposal, identification of the approved disposal site, and include written documentation that the disposal site can accept the waste. The ACMMP shall be submitted to the BAAQMD for their review and approval. Contract specifications shall mandate full compliance with all applicable local, state, and federal regulations related to the identification, transportation, and disposal of ACM.	1. Contractor 2. Contractor 3. Contractor	1. City 2. BAAQMD 3. City	1. Conduct survey to determine presence of ACM. 2. Prepare and submit ACMMP in accordance with specifications in Mitigation Measure 3.9-3c to BAAQMD for review and approval and incorporate requirements into the contract specifications. 3. Verify implementation of ACMMP.	1. Preconstruction 2. Preconstruction 3. Construction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Hazards and Hazardous Materials (cont.)							
3.9-4	The proposed project could impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.	**Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details under Transportation and Circulation, below)**					
Noise and Vibration							
3.13-1	Construction of facilities under the proposed project could generate noise levels that exceed the applicable county or city noise standards or result in a substantial temporary increase in ambient noise levels at nearby sensitive receptors.	**3.13-1: General Noise Controls for Construction Equipment and Activities.** a) The construction contractor(s) shall assure that construction equipment with internal combustion engines have sound control devices at least as effective as those provided by the original equipment manufacturer. No equipment shall be permitted to have an unmuffled exhaust. b) To reduce potential daytime construction noise impacts to residential uses immediately south and west of the desalination facility contractors shall employ temporary noise curtains or barriers along the southern and western property boundary of the WTP to shield daytime construction noise impacts to residential uses to the south and west. To reduce potential daytime construction noise impacts to residential uses immediately east of the proposed new pump station, contractors shall employ temporary noise curtains or barriers along the eastern property boundary of the pump station worksite to shield daytime construction noise impacts to residential uses to the east. Implementation of this measure will ensure that daytime construction activities do not exceed noise criteria for daytime construction at residential uses (70 dBA Leq). These barriers shall be installed prior to the start of construction. c) Impact tools (i.e., jack hammers, pavement breakers, and rock drills) used for project construction shall be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler shall be placed on the compressed air exhaust to lower noise levels by up to approximately 10 dBA. External jackets shall be used on impact tools, where feasible, in order to achieve a further reduction of 5 dBA. Quieter procedures shall be used, such as drills rather than impact equipment, whenever feasible.	1. Contractor 2. City	1. City 2. City	1. Incorporate requirement to use best available noise control techniques into contract specifications. 2. Verify implementation of noise control measures.	1. Design/ Preconstruction 2. Construction	
3.13-3	Operation of the project would generate traffic, stationary source, and area source noise similar to existing noise levels and would not exceed City noise requirements.	**3.13-3: Stationary-Source Noise Controls.** The City shall retain an acoustical professional to design stationary-source noise controls and ensure the applicable noise standards are met. At a minimum, all stationary noise sources (e.g., RO pumps) shall be located within enclosed structures and with adequate noise screening, as needed, to maintain noise levels to no greater than 5 dBA above the existing monitored ambient values and 60 CNEL, at the property lines of nearby residences. Once the stationary noise sources have been installed, the contractor(s) shall monitor noise levels to ensure compliance with local noise standards.	1. City/Contractor 2. Contractor	1. City 2. City	1. Retain an acoustical professional to design stationary-source noise controls and incorporate requirements into contract specifications. 2. Monitor and verify compliance with local noise standards.	1. Design/ Preconstruction 2. Construction	
3.13-C-1	Implementation of the proposed project, in combination with other cumulative development could result in a significant noise impact for which the proposed project would make a considerable contribution.	**Implement Mitigation Measure 3.13-1: General Noise Controls for Construction Equipment and Activities (see details above)**					
Public Services and Utilities							
3.15-1	The proposed project could disrupt operations or require relocation of regional or local utilities.	**3.15-1a: Locate and Confirm Utility Lines.** Before excavation begins, the City of Antioch or its contractor(s) shall locate all overhead and underground utility lines (such as natural gas, electricity, sewage, telephone, fuel, and water lines) that are reasonably expected to be encountered during excavation. When a project excavation is within the approximate location of a subsurface utility, the City of Antioch or its contractor shall determine the exact location of the underground utility by safe and acceptable means, including the use of hand tools and modern techniques. Information regarding the size, color, and location of existing utilities shall be confirmed before construction activities begin. These utilities shall be highlighted on all construction drawings.	1. City/Contractor	1. City	1. Identify utility lines in the project area that could be encountered during excavation and include locations on construction drawings.	1. Design/ Preconstruction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Public Services and Utilities (cont.)							
3.15-1 (cont.)		**3.15-1b: Coordinate Final Construction Plans with Affected Utilities.** The City of Antioch or its contractor(s) shall coordinate final construction plans, schedule, and specifications with affected utilities with utility providers and affected jurisdictions (e.g., the City of Pittsburg). Arrangements shall be made with these entities regarding the appropriate protection, relocation, or temporary disconnection of services. If any interruption of service is required, the City of Antioch or its contractor(s) shall notify residents and businesses in the project corridor of any planned utility service disruption at least 2 working days and up to 14 calendar days in advance.	1. City/Contractor	1. City	1. Implement protocol described in the mitigation measure.	1. Preconstruction 2. Preconstruction	
		3.15-1c: Safeguard Employees from Potential Accidents Related to Underground Utilities. When any excavation is open, the construction contractor(s) shall protect, support, or remove underground utilities as necessary to safeguard employees. The contractor(s) shall be required to provide weekly updates to the City of Antioch and construction workers regarding the planned excavations for the upcoming week, and to specify when construction will occur near a high-priority utility (i.e., pipelines carrying petroleum products, oxygen, chlorine, or toxic or flammable gases; natural gas pipelines greater than 6 inches in diameter or with normal operating pressures greater than 60 pounds per square inch gauge; and underground electric supply lines, conductors, or cables that have a potential to ground more than 300 volts that do not have effectively grounded sheaths). Construction managers shall hold regular tailgate meetings with construction staff on days when work near high-priority utilities will occur to review all safety measures regarding such excavations, including measures identified in the Mitigation Monitoring and Reporting Program and in construction specifications. The contractor shall designate a qualified Health and Safety Officer who shall specify a safe distance to work near high-priority utilities. Excavation near such utility lines shall not be authorized until the designated Health and Safety Officer confirms and documents in the construction records that: (1) the line was appropriately located in the field by the utility owner using as-built drawings and a pipeline-locating device; and (2) the location was verified by hand by the construction contractor.	1. Contractor	1. City	1. Provide weekly updates to the City and comply with protocol described in the mitigation measure.	1. Preconstruction/Construction	
		3.15-1d: Emergency Response Plan. Before commencement of construction, the City of Antioch or its contractor(s) shall develop an emergency response plan that outlines procedures to follow in the event of a leak or explosion. The emergency response plan shall identify the names and phone numbers of staff at the potentially affected utilities that would be available 24 hours per day in the event that construction activities cause damage to or rupture of a high-risk utility. The plan shall also detail emergency response protocols, including notification, inspection, and evacuation procedures; any equipment and vendors necessary to respond to an emergency (such as an alarm system); and routine inspection guidelines.	1. City/Contractor	1. City	1. Develop emergency response plan.	1. Preconstruction	
		3.15-1e: Notify Local Fire Departments. The City of Antioch or its contractor(s) shall notify local fire departments in advance of any time work that is to be performed in close proximity to a gas utility line, or any time damage to a gas utility line results in a leak or suspected leak, or whenever damage to any utility results in a threat to public safety.	1. City/Contractor	1. City	1. Notify fire department in advance of work near or when work affects a gas utility line.	1. Preconstruction/ Construction	
		3.15-1f: Ensure Prompt Reconnection of Utilities. The City of Antioch or its contractor(s) shall promptly contact utility providers to reconnect any disconnected utility lines as soon as it is safe to do so.	1. City/Contractor	1. City	1. Contact utility providers when it is safe to reconnect disconnected utility lines.	1. Construction	
3.15-C-1	The proposed project, in combination with other cumulative development, could disrupt operations or require relocation of regional or local utilities.	**Implement Mitigation Measures 3.15-1a through f (see details above)**					
Recreation							
3.16-1	Project construction activities could temporarily disrupt access to recreational resources in the vicinity of the project components.	**Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details under Transportation and Circulation, below)**					

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Transportation and Circulation							
3.17-1	Construction of the proposed project would have temporary and intermittent effects on traffic and transportation conditions in the project area.	**3.17-1a: Encroachment Permits.** The construction contractor shall obtain any necessary road encroachment permits prior to constructing each project component and shall comply with the conditions of approval attached to all project permits and approval. In addition, the Construction Traffic Control/Traffic Management Plan (subject to local jurisdiction review and approval) required by Mitigation Measure 3.17-1b, would include safety measures for traffic flow and circulation during project construction.	1. Contractor	1. City	1. Obtain road encroachment permits.	1. Preconstruction	
		3.17-1b: Construction Traffic Control/Traffic Management Plan. The construction contractor shall prepare a Construction Traffic Control/Traffic Management Plan and submit it to the appropriate local jurisdiction prior to construction (i.e., City of Antioch, City of Pittsburg) for review and approval prior to construction. The plan shall include the following components: • Identify hours of construction (between 8:00 AM and 5:00 PM; no construction shall be permitted between 10:00 PM and 7:00 AM); • Schedule truck trips outside of peak morning and evening commute hours to minimize adverse impacts on traffic flow (i.e., if agencies with jurisdiction over the affected roads identify highly congested roadway segments during their review of the encroachment permit applications). Haul routes that minimize truck traffic on local roadways and residential streets shall be used. • Develop circulation and detour plans to minimize impact to local street circulation. This may include the use of signing and flagging to guide vehicles, bicyclists, and pedestrians through and/or around the construction zone. • Control and monitor construction vehicle movements by enforcing standard construction specifications through periodic onsite inspections; • Install traffic control devices where traffic conditions warrant, as specified in the applicable jurisdiction's standards (e.g., the California Manual of Uniform Traffic Controls for Construction and Maintenance Work Zones); • Perform construction that crosses on-street and off-street bikeways, sidewalks, and other walkways in a manner that allows for safe access for bicyclists and pedestrians. Alternatively, provide safe detours to reroute affected bicycle/pedestrian traffic. • Consult with the Tri Delta Transit at least one month prior to construction to coordinate bus stop relocations (as necessary) and to reduce potential interruption of transit service; • Comply with roadside safety protocols to reduce the risk of accidents. Provide "Road Work Ahead" warning signs and speed control (including signs informing drivers of state-legislated double fines for speed infractions in a construction zone) to achieve required speed reductions for safe traffic flow through the work zone. • Identify all access and parking restrictions, pavement markings and signage requirements (e.g., speed limit, temporary loading zones); • Store all equipment and materials in designated contractor staging areas; • Encourage construction crews to park at staging areas to limit lane closures in the public ROW; • Include a plan and implementation process for notifications and a process for communication with affected residents, businesses, and recreational users (public boat launch ramp and Contra Costa County Fairground) prior to the start of construction. Advance public notification shall include posting of notices and appropriate signage of construction activities at least one week in advance. The written notification shall include the construction schedule, the exact location and duration of activities within each street (i.e., which lanes and access point/driveways would be blocked on which days and for how long), and a toll-free telephone number for receiving questions or complaints;	1. Contractor	1. City	1. Prepare and submit a Construction Traffic Control/Traffic Management Plan to the appropriate local jurisdiction for review and approval. 2. Verify implementation of a Construction Traffic Control/Traffic Management Plan measures.	1. Preconstruction 2. Construction	

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Transportation and Circulation (cont.)							
3.17-1 (cont.)		• Include a plan and implementation process to coordinate all construction activities with emergency service providers in the area at least one month in advance. Emergency service providers shall be notified of the timing, location, and duration of construction activities. All roads shall remain passable to emergency service vehicles at all times; • Include a plan and implementation process to coordinate all construction activities with the Antioch Unified School District at least two months in advance. The School District shall be notified of the timing, location, and duration of construction activities. The City shall coordinate with the School District to identify peak circulation periods at schools along the alignment(s) (i.e., the arrival and departure of students), and require their contractor to avoid construction and lane closures during those periods. The construction contractor for each project component shall be required to maintain vehicle, bicycle, pedestrian, and school bus service during construction through inclusion of such provisions in the construction contract. The assignment of temporary crossing guards at designated intersections may be needed to enhance pedestrian safety during project construction; • Identify all roadway locations where special construction techniques (e.g., trenchless pipeline installation or night construction) will be used to minimize impacts to traffic flow. Include the requirement that all open trenches be covered with metal plates at the end of each workday to accommodate traffic and access; and • Specify the street restoration requirements pursuant to agreements with the local jurisdictions (i.e., City of Antioch, City of Pittsburg).					
3.17-2	Construction of the proposed project would temporarily disrupt circulation patterns near sensitive land uses (schools, hospitals, fire stations, police stations, and other emergency providers).	**Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details above)**					
3.17-3	Construction of the proposed project would have temporary effects on alternative transportation or alternative transportation facilities in the project area.	**Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details above)**					
3.17-4	Construction of the proposed project would temporarily increase the potential for accidents on project area roadways.	**Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details above)**					
3.17-5	Construction of the proposed project would increase wear-and-tear on the designated haul routes used by construction vehicles to access the project area work sites.	**3.17-5: Roadway Repairs.** The City shall repair any roads damaged by project construction to a structural condition equal to that which existed prior to construction activity. Prior to project construction, City of Antioch Public Works Department shall document road conditions for all routes that would be used by project-related vehicles. The City shall also document road conditions after project construction is completed. Roads damaged by project construction shall be repaired to a structural condition equal to that which existed prior to construction activity.	1. City	1. City	1. Document road conditions for all routes that would be used by project-related vehicles. 2. Repair roads damaged by project-related vehicles.	1. Preconstruction/ Post-construction 2. Post-construction	
3.17-C-1	Construction of the proposed project, in combination with other cumulative development, could result in cumulative effects relating to transportation and circulation conditions in the project study area.	**Implement Mitigation Measure 3.17-1a: Encroachment Permits (see details above)** **Implement Mitigation Measure 3.17-1b: Construction Traffic Control/Traffic Management Plan (see details above)** **Implement Mitigation Measure 3.17-5: Roadway Repairs (see details above)**					

TABLE 4-1 (CONTINUED)
MITIGATION AND MONITORING AND REPORTING PROGRAM

Impact No.	Impact Summary	Mitigation Measure	Implementing Responsibility	Monitoring Responsibility	Monitoring and Reporting Action(s)	Timing	Verification of Compliance
Tribal Cultural Resources							
3.18-1	The project could cause a substantial adverse change in the significance of a tribal cultural resource.	**Implement Mitigation Measure 3.5-1: Inadvertent Discovery of Archaeological Resources (see details under Cultural Resources, above)** **Implement Mitigation Measure 3.5-2: Inadvertent Discovery of Human Remains (see details under Cultural Resources, above)**					
3.18-C-1	Implementation of the proposed project, in combination with other cumulative development, could contribute to cumulative impacts to tribal cultural resources.	**Implement Mitigation Measure 3.5-1: Inadvertent Discovery of Archaeological Resources (see details under Cultural Resources, above)** **Implement Mitigation Measure 3.5-2: Inadvertent Discovery of Human Remains (see details under Cultural Resources, above)**					

APPENDIX A

Public Hearing Transcript, August 1, 2018 Planning Commission Hearing

ANTIOCH PLANNING COMMISSION

In the Matter of:

Regular Meeting)
_____

ANTIOCH CITY HALL

COUNCIL CHAMBERS

200 "H" STREET

ANTIOCH, CALIFORNIA

Item 3 - Brackish Water Desalination

WEDNESDAY, AUGUST 1, 2018

6:30 P.M.

Reported by:

Gigi Lastra

APPEARANCES

COMMISSIONERS

Martha Parsons, Chairperson

Kerry Motts, Commissioner

Robert Martin, Commissioner

Janet Zacharatos, Commissioner

STAFF

Kitty Eiden

Zoe Meredith

Alexis Morris, Community Development Department

Scott Buenting, Public Works Department

PRESENTERS

Scott Weddle, Carollo Engineers

Jim O'Toole, Environmental Science Associates

PUBLIC COMMENT

Denise Skaggs

P R O C E E D I N G S

6:44 P.M.

ANTIOCH, CALIFORNIA, WEDNESDAY, AUGUST 1, 2018

CHAIRPERSON PARSONS: -- to item three, Brackish Water Desalinization. Staff recommends the Planning Commission receive public comments on the Draft Environmental Impact Report for the Antioch Brackish Water Desalinization Project. This meeting is not to debate or discuss the merits of the project to be -- but receive verbal comments that will be responded to in the Final EIR. An action from the Planning Commission is not needed at this time, just for receiving public comments.

If I -- can the Staff have a report please?

MR. BUENTING: Sure. My name is Scott Buenting. I'm a Project Manager in the Capital Improvements Division within the Public Works Department. We put together a presentation regarding the project. With our design consultant, as well as our environmental consultant, we'll present that to you prior to us receiving public comments.

CHAIRPERSON PARSONS: Thank you.

MR. BUENTING: The presentation will begin with Carollo Engineers. Scott Weddle with Carollo is here. And then we'll move into ESA when we get into the bulk of the environmental aspects of it.

Scott?

CHAIRPERSON PARSONS: Thank you.

MR. WEDDLE: Thanks, Scott.

I'm Scott Weddle with Carollo Engineers. I'm the Project Manager for Carollo. I've been working with the City for years now on this project.

As far as an overview of our presentation tonight, I'm going to describe the project background and objectives, do an overview of the project, the CEQA process, the environmental impact analysis, discuss next steps, and then open it up to public comments.

As far as the background of the project, this has to do with drinking water supply. The City has two main sources of water supply. The primary source that the City uses since dating back to the 1860s is the San Joaquin River. The City has senior water rights known as pre-1914

Water Rights to withdraw water from the river at no cost. We have an intake that's permitted to withdraw up to 16 million gallons per day.

The City also has a water supply contract with Contra Costa Water District that dates back several years, quite a while, to supplement the water supply from the river. And during certain times of the years, as I'll show you, it's the primary, the only supply that's available to the City.

So the challenges that the City currently faces with the water supply is that the river water is -- has become more and more salty at the intake due to more diversions being pumped down to Southern California, more diversions out of the delta for -- that's the primary diversion. What happens then is more saltwater moves in from the bay and increases the salinity of the districts -- or of the City's intake. During certain times of the year the water is too salty to use. And the City, therefore, has to rely entirely on the CCWD intakes, which are further east in the delta and are less susceptible to the saltwater that intrudes from the Bay.

So what this does, as far as the

challenge to the City, is it really limits the operational flexibility that the City has. Your City is pretty much obligated to use water that's supplied by CCWD. They can't use the river water when the water is too salty. And this is especially pronounced during drought years. Times of the year where the water coming through the delta is limited, saltwater intrudes more and it limits the amount of water that the City can use. It also limits the diversification of the supply. As I mentioned, we're pretty much obligated to use CCWD water.

So to combat that issue -- and just to actually illustrate that issue, first, during wet years the City can use, normal years and wet years, up to 40 to 50 percent of its water supply from the river. In dry years, however, you can see -- by the way, this graph shows the river water, it shows water purchased from CCWD. And you can see in later times of the year, summertime, fall time, the use of CCWD water really escalates. And during dry years, it's even more pronounced. There's times of the year, staring as early as June, where the City has to rely entirely on the supply from CCWD.

This graph shows the actual water usage from the two supplies, CCWD versus river water. And you can see that in a wet year the vast majority of water can be pumped at no cost from the City's intake. And as the level of drought increases and the saltwater intrusion from the bay increases, the amount of water the City can take from the river decreases proportionately.

So there's a process known as desalination. It's a water treatment process that uses a membrane treatment system that removes salts from water. You might have heard of the seawater desalination. It's used in many countries around the world. It can also be used for semi-salty water known as brackish water, which you have out here in the San Joaquin River during summer and fall months. So this membrane process would allow the City to use the water year-round. So the objectives of this project that the City has developed with this in mind is to improve the water supply reliability and water quality, especially during the summer and fall months. It also is developing a reliable drought-resistant supply that maximizes the use of the City's existing pre-1914 Water Right.

But also what makes this project very attractive and feasible is that it utilizes many of the City's existing infrastructure, for instance, its existing intake pier, pipelines. It uses an existing water treatment plant, an existing distribution system, whereas other projects, similar types of desalination projects, would have to build brand new facilities to do the same type of treatment, the City is in a position to reuse existing facilities, which reduces the cost of the project and also just makes it more cost effective.

The last objective, and maybe one of the more important ones, is that it preserves the rights and the value that the City currently has over withdrawing water from the river. Water rights, you could almost call it use it or lose it. If you don't continue using your water right the state will eventually decrease the amount of water you're allowed to take from the river.

So in terms of the facilities that are involved with this project, we've got an existing intake facility here at the end of Fulton Shipyard Drive. We would replace the existing pumps at that intake facility, replace the

existing fish screens to make it more environmentally friendly, reuse the existing raw water pipeline that currently supplies -- conveys water from the intake to the treatment plant here, located just off of Putnam Avenue. By the way, I'm sorry, this is a map of the area. This is Highway 4 right here.

So at the treatment plant, there would be new facilities constructed utilizing much of the existing infrastructure of the plant, and distributing water out through the existing distribution system. So it would supplement the existing supply from CCWD during times of the year when you currently rely entirely on CCWD water. That water would be blended with the water from CCWD and then put out into the distribution for consumer -- for customer consumption.

There's also a new pipeline that would take water from the desalination process. There's salts that are removed from the water that need to be disposed. They'd be piped through a new pipeline down to the Delta Diablo Wastewater Treatment Plant and discharged through their outfall back into the delta. We've done a

lot of modeling studies on what the potential impacts might be of this discharge. And keep it in mind that it's river water that's being taken in and then river water that's concentrated that's then being put back into the river. So there's no new contaminants or any pollutants that would be of concern, and the EIR addresses a lot of this.

Part of the project also involves constructing some new pipelines that would allow the City to pump water directly from the river into the water treatment plant, whereas currently the river water gets pumped up to a municipal reservoir, and then from there, down to the treatment plant. So this is one of the nuances of the project.

So at the treatment plant, this is the existing site layout. The plant is actually divided into two treatment trains. The original treatment train here is known as Plant A. It's rated for 16 million gallons per day. Plant B was constructed back in the late '80s or early '90s and provides another 16 to 20 mgd. The new desalination facilities would be located within the fence line of the existing plant in a new

building here, approximately 11,000 square feet, house the membranes, I mentioned the reverse osmosis membranes, as well as some other pumping and appurtenant facilities. There's also a small chemical storage facility that would be located in the same vicinity that would be used as part of the treatment process.

There's pipeline alignments that we've evaluated or are continuing to evaluate, some that come in here through the main gate of the treatment plant. We also are looking at pipeline alignments that go out to Lone Tree Way to the east.

COMMISSIONER MARTIN: Where is Putnam on that? Where's Putnam on that drawing?

MR. BUENTING: Oh, I'm sorry. You can't see Putnam, but Putnam would be down --

COMMISSIONER MARTIN: Okay.

MR. BUENTING: -- a little further north of the photo here. I'm sorry. I didn't cover all of that.

In terms of the schematic of the process, this is the pump station at the river. It will pump water to the treatment plant. We also have the ability to divert water up to the reservoir.

During normal times of the year when water is fresh, you would pump water up to the reservoir and then from the reservoir, release it back to the water treatment plant. That's the current operation.

When the desalination facility is in operation, you just pump directly into the treatment plant. And these treatment boxes here are the existing facility. You have flocculation, sedimentation, filtration. We've reused all those existing treatment processes, which really helps make this a cost effective project. And then from there, water would be pumped through cartridge filters and into the reverse osmosis membranes. There would be some post-membrane treatment that would occur. And then as I mentioned earlier, the water would be blended with the CCWD water and then pumped out into the distribution system.

I also want to mention that during certain times of the year -- so the river water salinity, it varies daily and seasonally. So during the times of the year where the water is not as salty, we have the ability to bypass around the RO membranes and then blend it before

it then is subsequently blended with the water from CCWD. So this is a cost-saving measure. It's less water that you need to send through the RO membranes.

So with the facility, the project in operation, these graphs show what the intake or the use of the various supplies look like without the project. So here you have river water. Here's CCWD water. In a wet year, it's not a whole lot different because the river water is -- has good quality. You don't need to use the reverse osmosis process as much.

Where it really comes into play is during a dry year. Currently in a dry year, you can see, this is the river water in blue and the CCWD water in the red, you can see how much water needs to be purchased. And by the way, didn't mention, the water that gets purchased from CCWD costs about $740 per acre foot, whereas water that's pumped out of the river is essentially free. So during dry years it's -- the amount of water that needs to be purchased from CCWD, you can see, is significantly reduced and relying more on the river water, using the desalination process.

So as mentioned earlier, there is a saltwater stream that is part of the desalination process. You have the fresh water that's pushed through the membranes. You have the salt water that is concentrated and remains that needs to be disposed. That's the water that would be disposed at the Delta Diablo Wastewater Treatment Plant outfall. We estimate that up to about 2 million gallons per day would be produced from the reverse osmosis process and disposed to the outfall. And in a wet year, remember that the desalination facility wouldn't be used all that often until in August through December, January, we would contribute about 2 mgd to the treatment plant effluent stream.

These graphs show historical average flows from the wastewater treatment plant, so you can see the contribution here in purple of the brine stream that would be sent to Delta Diablo. And in dry years, you'd have about the same quantity of flow per month, but it would be stretched out over a longer period of time, over more months of the year.

As I mentioned, the water quality, we've been working with Delta Diablo and have been

studying the impacts of discharging this water through their outfall. We're continuing to work with them.

So that's sort of my portion of the presentation. I'm going to turn it over to ESA now to talk about more of the CEQA process and the environmental process. But I'd be happy to answer any questions about the topic itself.

CHAIRPERSON PARSONS: Commissioner Martin?

COMMISSIONER MARTIN: In looking over the project, and as you were describing it, and reading the Staff Report, I noticed that, according to the Staff Report, we will be getting about 10 mgd out of the plant versus 16 is what we would normally pull from the river.

Is that 16 the guarantee number or could we pull more than that out of the river without superior water rights?

MR. BUENTING: Well, right now your water right is capped at 16 mgd --

COMMISSIONER MARTIN: Yes.

MR. BUENTING: -- so it wouldn't really allow you to take more than that.

COMMISSIONER MARTIN: And maybe it's

something that should be discussed under the EIR, but I -- and maybe you could explain it. When you start extracting water from a source, let's say, and I don't know how much this desalination plant is going to take it, but if I've got a five-gallon bucket here and I take one gallon of water out of that bucket, which is pure, and I leave four gallons in there, that four gallons is going to have a higher concentration of minerals that were existing in the water ahead of time.

My concern is will we be taking into consideration that increased concentration of whatever it is in there? What chemicals are in the water are in the water. We take it out right now through the process of the tanks and the filtering that we do. But now we're taking water that's already brackish and you're going to take the clean amount out of it and leaving even dirtier water, if I want to look at it from that point of view, and dumping it back into the river. And my question is, is that something that has been taken into account when we build this so that we are not doing damage to the environment by that dumping of this heavier brackish water than what we took out?

MR. BUENTING: Right. The brine stream.

COMMISSIONER MARTIN: The brine stream.

MR. BUENTING: Yeah. Yes, sir, we've studied that, done some very detailed modeling to see what happens to that stream of water when it's discharged into the river, how it is dispersed, the concentration gradient, so to speak. Really one of the benefits of where the outfall is located is that there's such a high volume of water that sloshes back and forth that the small amount of water that is being added from this brine stream is really insignificant in the grand scheme of things. And I'll let ESA speak to this more, but it really does not have any environmental impact or an impact to the salinity of the river, let's say.

COMMISSIONER MARTIN: That's what I was really concerned about, is just how much impact we were going to have by putting dirtier water back in --

MR. BUENTING: Okay.

COMMISSIONER MARTIN: -- and that's what I consider it. Brackish water is dirtier than what we got out of it. It's a heavier concentration of the chemicals that are in there.

MR. BUENTING: Correct, but it's the same chemicals, same constituents that were in the river to start with, it's just a more concentrated stream than gets diluted when it's --

COMMISSIONER MARTIN: Let's say I have this much that has one part per million of something in it and I boil it down, I've got -- that's still one part per million but it's more concentrated. That's the part that was concerning me.

MR. BUENTING: Right.

COMMISSIONER MARTIN: And I think you have explained it to me, because I haven't looked at the outfall at CCWD -- I mean at Delta Diablo, so I don't know what that end looks like. And if I had gone out there and looked at it, I probably would have not had the question.

MR. BUENTING: It's okay.

COMMISSIONER MARTIN: But thank you for that explanation.

MR. BUENTING: You're welcome.

COMMISSIONER MOTTS: One more question?

CHAIRPERSON PARSONS: I'm sorry. Yes.

COMMISSIONER MOTTS: Yeah. It was my

understanding with the new water intakes, you're going to have more advanced protections for aquatic life; is that true as far as, you know, for fish kill, that type of --

MR. BUENTING: Yes, sir. Yes, sir. There will be new fish screens that will be installed as part of the project to replace the existing fish screens. And they are designed and constructed in accordance with the most recent technology that minimizes the impact to sensitive fish species, especially Delta smelt and other fish, so we've studied that. And we've designed -- well, a conceptual design of it has multiple fish screens that would allow lower, what they call, approach philosophy, so there's less pull towards the intake streams which allows the fish to pass by without being entrained into the screens.

COMMISSIONER MOTTS: And was there some kind of like a proximity, not alarm, but I had heard that it would actually -- could actually shut down the pumps if there was a large presence of fish near the intake.

MR. BUENTING: That would certainly be an option, yeah. That is one thing that the project

provides is flexibility in operations. The City always has the operation -- the option of going back to CCWD water if there is fish or some other event in the river that would prevent intaking the water from the river. So that's one of the flexibility benefits that's provided by the project. So we could turn off the pumps and revert back to using the CCWD water.

COMMISSIONER MOTTS: All right. Thank you.

MR. BUENTING: Sure.

CHAIRPERSON PARSONS: Thank you.

MR. O'TOOLE: Good evening, Members of the Commission. My name is Jim O'Toole. I'm with Environmental Science Associates. And I'm the Project Director for the preparation of the EIR. And as Scott has described, the project here, from an engineering perspective, we're now just going to provide an overview of the impact analysis and our process for CEQA. And then we'll open it up for the public hearing.

CHAIRPERSON PARSONS: Thank you.

MR. O'TOOLE: Just stepping back a bit for the -- to the purposes of both CEQA and the EIR process, of course, is to inform decision

makers, like yourselves, and the general public of a projects potential environmental effects, to engage the public in the environmental review process, to disclose potential impacts on the environment as part of that process, and to, where possible, avoid or reduce those impacts of individual projects by reviewing alternatives and mitigation measures for implementation.

Taking a look at our -- the process that we're in right now, back in August of 2017, we circulated a Notice of Preparation and provided a 30-day public comment period for agencies and individual members of the public. We had a public hearing as part of -- or as part of that process. We have then since prepared the Draft EIR, which was circulated in June on the 29th of this year. And we're currently in our 45-day public review period, which closes on August 13th. We'll then be considering the comments received tonight and the written comments provided by the public or agencies in preparing a Final EIR and bringing that back for City Council consideration.

The EIR covers the full range or resource topics identified in the CEQA guidelines.

They're listed here and we'll talk through a number of them this evening. We've sorted them in terms of their levels of environmental impact as identified in the EIR. Fortunately, we conclude that there's no impact related to the project implementation, that those impacts are less than significant relevant to thresholds identified in the analysis, that those impacts can be reduced to a less than significant level through the implementation of mitigation measures, and we'll talk about those issue areas where we've identified mitigation measures in the EIR, and then there's the option for concluding that those impacts are significant and unavoidable, even with the implementation of mitigation measures.

Just running through the impact areas that were identified as having a less than significant impact or having no impact, they include analysis of aesthetics, geology and soils, and paleontological resources, greenhouse gases, local hydrology and water quality, delta hydrology and water quality, land use and planning, and population and housing. So these are issue areas where analysis indicates that the

potential for impact is below the identified threshold for that analysis.

Turning now to impacts that were identified as potentially significant and requiring mitigation to reduce them to a less-than- significant level, first it uses air quality relating to temporary construction emissions related to the project. This is a pretty typically mitigated impact under CEQA by conforming with the Bay Area AQMD Construction Measures. They include things like use of less polluting engines, and have some specific requirements for dust control. These are kind of standard best management practices that are implemented and included in projects of this nature.

The second issue area requiring mitigation relates to aquatic biological resources. This is really focused on the construction-related impacts associated with installation improvements at the pump station and the fish screens which will include some in-water work, so there's a potential for aquatic habitat impacts as part of that work. And so we have a suite of mitigation measure identified there that

include worker training, seasonal avoidance of the construction to avoid potential impacts to sensitive species. The work would include a fish rescue plan, underwater construction measures. And, of course, all of this would be implemented in compliance and in coordination with regulatory permits that we would need to acquire as part of the project. So you can anticipate permits from U.S. Army Corps of Engineers for work within the waterway, U.S. Fish and Wildlife Service, CDFW, Regional Water Quality Control Board, all asserting their authority over construction that affects waters and wetlands of the U.S.

Now the next impact we have identified are impacts to terrestrial biological resources. This relates to construction impacts along the pipeline that have the potential to affect listed avian species, listed bat species. These are primarily clearance-type surveys, pre-construction surveys where we would move along the alignment checking for raptor nests or other regulated species' nests. Often times there will be, and we've included in this EIR, seasonal limitations on work in proximity to these nests. So this is a pretty standard way to really

minimize impacts to these species associated with construction.

The next issue area relates to cultural resources and tribal resources. This is a standard mitigation measure related to the discovery of unknown sources. We've done a cultural resources survey of the pipeline route and at the treatment plant. There were no identified resources, either in the historical database or related to the survey of the alignment. But this type of mitigation measure is a standard measure in the event of discovery of unknown resources. And we have specific protocols to be followed in the event of such a discovery.

Energy conservation includes mitigation measures, again related to Bay Area AQMD for Construction Measures, really advocating the use of efficient equipment during construction activities.

For hazardous materials, Scott mentioned there is some treatment, standard treatment-type chemicals utilized at the plant. They would be handled, stored in compliance with specific requirements for hazardous materials, health and

safety. The plant's existing Hazardous Materials Management Plan would be updated to address these additional facilities and chemicals.

The next impact area relates to noise and vibration, really associated with the temporary construction, related to implementation of the project. There's some specific measures for stationary noise sources associated with the plant itself, some of the pump locations, so we factored into the design of the facility to ensure that these impacts are reduced to a less than significant level.

Public services and utilities has standard mitigation regarding potential conflicts with underground utilities, including notification and pre-construction survey and pot-holing, as appropriate.

There is some temporary potential of impact to recreational resources along the pipeline route, so we have integrated these two measures, impacts to recreation and impacts to transportation, to include a Construction Management Plan that controls traffic, identifies haul routes, provides notification to recreational facilities. It tries to really

minimize the traffic related to construction of these linear-type corridors through urbanized areas.

So that identifies the impact areas that were identified as significant and requiring mitigation. There were no impact areas that were identified as significant and unavoidable.

Our comment period, as I mentioned, closes August 13th. And we invite the public to provide verbal comments this evening and to provide written comments addressed to Scott Buenting, the Project Manager, here at the City. We really encourage folks to put their comments in writing because that's kind of the most effective way to get those comments into the administrative record.

So that concludes our presentation. I'd be happy to answer any questions.

CHAIRPERSON PARSONS: It sounds like we have no questions. Thank you.

MR. O'TOOLE: Thank you.

CHAIRPERSON PARSONS: Do we have any speakers?

I'm going to open the public hearing.

Can we have Denise Skaggs?

MS. SKAGGS: Good evening --

CHAIRPERSON PARSONS: Good evening.

MS. SKAGGS: -- Chair Parsons and Commissioners. My name is Denise Skaggs. I'm a citizen of Antioch. I've lived at 3133 View, which is impacted by the water treatment plant.

First of all, I've got to say as a citizen, I am thrilled that this desalinization project is being considered. And hopefully I'll live to see it happen because it's using our resources that we've always had.

Just a couple things I want to be considered is that the noise receptors that were in the EIR that were located down on Terra Nova are behind the homes, and these folks live on Terra Nova, so it's right behind their house, that really doesn't show what that noise impact is going to be for us on View. I just think that there needs to be some consideration, you know, for all of us on that. It's a valley there. And you're welcome, anyone is welcome to come to my home, and from my back yard see and experience what's happened there in the last 11 years that I've been there. It's increased.

PC-1

These homes were built in the late '60s,

early '70s. The plant at that time was just a small, little building with a pond, you know? And now it's probably ten times bigger. And all of us that have lived there for a long time, my neighbors have been there for over 45 years, 40 years, and it's huge.

So I just think there might be some consideration for possibly a sound wall or something to kind of lessen the impact of that new facility.

PC-1 cont.

Oh, plus we have terrible water pressure up there. So if that could be improved? I've been canvassing the neighborhood.

Emergency plan and evacuation, we've got a lot of stuff going on up there.

So, thank you.

CHAIRPERSON PARSONS: Any other speaker cards?

MS. EIDEN: None others received.

CHAIRPERSON PARSONS: Okay. I'm just going to make one comment. Denise, I think you should put it in writing because it's probably more involved, and get it to Scott.

Now I'm going to close the public hearing. And I think that takes care of us.

Thank you for being here.

Let's go to our oral communication. No? No? Okay.

Commissioner Martin?

REPORTER'S CERTIFICATE

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 10th day of August, 2018.

_____

Eduwiges Lastra
CER-915

CERTIFICATE OF TRANSCRIBER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.

August 10, 2018

MARTHA L. NELSON, CERT**367