VOLUME II
APPENDICES

Lower Mokelumne River Hydroelectric Project FERC Project No. 2916

October 2025

East Bay Municipal Utility District
375 11th Street
Oakland, California 94607

Volume II
Appendices

Appendix A – Consultation Log / Proof of Publication

Appendix B –Joint Settlement Agreement (JSA)

Appendix C – JSA Non-Flow Partnership Projects

Appendix D – FERC License Articles 1-32

Appendix E – Flow Duration Curves

Appendix F – Water Quality Data

Appendix G – Supporting Information for Wildlife and Botanical Species

VOLUME II
Appendix A

Consultation Log / Proof of Publication

Appendix A – Consultation Log

Date	Interested Parties	Correspondence/Consultation Event Description
7/16/2024	General	EE Meetings Interest Form and Responses
8/13/2024	General	EE Meetings Invitation
8/21/2024	Tribal Resource Group	Tribal EE Meeting Invitations
9/18/2024	Fisheries & Wildlife Resource Group	Fisheries & Wildlife EE Meeting Agenda
9/18/2024	Fisheries & Wildlife Resource Group	Fisheries & Wildlife EE Meeting Attendance
9/18/2024	Fisheries & Wildlife Resource Group	Fisheries & Wildlife EE Meeting Presentation
9/18/2024	Extreme Hydrology & Climate Change Resource Group	Extreme Hydrology & Climate Change EE Meeting Agenda
9/18/2024	Extreme Hydrology & Climate Change Resource Group	Extreme Hydrology & Climate Change EE Meeting Attendance
9/18/2024	Extreme Hydrology & Climate Change Resource Group	Extreme Hydrology & Climate Change EE Meeting Presentation
9/19/2024	System Operations & Hydro Generation Resource Group	System Operations & Hydro Generation EE Meeting Agenda
9/19/2024	System Operations & Hydro Generation Resource Group	System Operations & Hydro Generation EE Meeting Attendance
9/19/2024	System Operations & Hydro Generation Resource Group	System Operations & Hydro Generation EE Meeting Presentation
9/19/2024	Recreation & Watershed Resource Group	Recreation & Watershed EE Meeting Agenda
9/19/2024	Recreation & Watershed Resource Group	Recreation & Watershed EE Meeting Attendance
9/19/2024	Recreation & Watershed Resource Group	Recreation & Watershed EE Meeting Presentation
10/1/2024	General	Relicensing Interest Form and Responses
10/2/2024	Tribal Resource Group	Tribal EE Meeting Agenda
10/2/2024	Tribal Resource Group	Tribal EE Meeting Attendance
10/2/2024	Tribal Resource Group	Tribal EE Meeting Presentation
10/11/2024	General	Open House Invitation
10/11/2024	General	Open House Flyer
10/11/2024	NMFS, CDFW	Relicensing Questionnaire and Responses

Date	Interested Parties	Correspondence/Consultation Event Description
10/16/2024	Relicensing Team	Updates regarding dissemination of Open House Invitation
10/29/2024	General	Open House Fact Sheets
10/29/2024	General	Open House Attendance
10/29/2024	General	Open House Presentation
4/29/2025	General	TWG Kickoff Meeting Invitation
5/23/25	General	TWG Resource Meetings Interest Form and Responses
6/3/2025	General	TWG Kickoff Meeting Agenda
6/3/2025	General	TWG Kickoff Meeting Attendance
6/3/2025	General	TWG Kickoff Meeting Presentation
6/4/2025	NMFS	NMFS TWG Kickoff Meeting Notes
7/2/2025	Botanical, Wildlife, & RTE TWG	Botanical, Wildlife, & RTE TWG Meeting 1 Presentation
7/2/2025	Water Resources TWG	Water Resources TWG Meeting 1 Presentation
7/2/2025	Recreation & Land Use TWG	Recreation & Land Use TWG Meeting 1 Presentation
7/2/2025	Fish & Aquatic Resources TWG	Fish & Aquatic Resources TWG Meeting 1 Presentation
7/9/2025	Botanical, Wildlife, & RTE TWG	Request for Comments on Botanical, Wildlife, & RTE Preliminary Draft Study Plans
7/9/2025	Recreation & Land Use TWG	Request for Comments on Recreation & Land Use Preliminary Draft Study Plans
7/11/2025	Fish & Aquatic Resources TWG	Request for Comments on Fish & Aquatic Preliminary Draft Study Plans
7/21/2025	CDFW	CDFW Comments on Fish & Aquatic Resources Preliminary Draft Study Plans
7/21/2025	CDFW	CDFW Comments on Botanical, Wildlife, & RTE Preliminary Draft Study Plans
7/21/2025	CDFW	CDFW Comments 1 on Water Resources Preliminary Draft Study Plans
7/22/2025	Foothill Conservancy	Foothill Conservancy Comments on Fish & Aquatic Resources Preliminary Draft Study Plans
7/24/2025	Recreation & Land Use TWG	Cancellation of Recreation & Land Use TWG Meeting 2 due to no new comments
7/28/2025	Water Resources TWG	Request for Comments on Water Resources Preliminary Draft Study Plans
8/5/2025	Fish & Aquatic Resources TWG	Fish & Aquatic Resources TWG Meeting 2 Presentation

Date	Interested Parties	Correspondence/Consultation Event Description
8/5/2025	Botanical, Wildlife, & RTE TWG	Botanical, Wildlife, & RTE TWG Meeting 2 Presentation
8/7/2025	Tribal & Cultural TWG	Tribal & Cultural TWG Meeting Invitations
8/18/2025	NMFS	NMFS Comments on Fish & Aquatic Resources Preliminary Draft Study Plans
8/19/2025	Tribal & Cultural TWG	Tribal & Cultural TWG Meeting Reminders and Preliminary Draft Study Plans
8/22/2025	CDFW	CDFW Comments 2 on Water Resources Preliminary Draft Study Plans
8/29/2025	Tribal & Cultural TWG	Tribal & Cultural TWG Meeting Presentation
9/3/2025	USFWS	USFWS Comments on Botanical, Wildlife, & RTE Preliminary Draft Study Plans
9/10/2025	Water Resources TWG	Water Resources TWG Meeting 2 Presentation
9/19/2025	California Valley Miwok Tribe	California Valley Miwok Tribe Comments on Tribal & Cultural Preliminary Draft Study Plans
10/9/2025	Calaveras Enterprise - Proof of Publication	Proof of publication for the notice of the Pre-Application Document (PAD) filing in the Calaveras Enterprise newspaper
10/9/2025	Lodi-News Sentinel - Proof of Publication	Proof of publication for the notice of the Pre-Application Document (PAD) filing in the Lodi-News Sentinel newspaper
10/10/2025	Ledger Dispatch - Proof of Publication	Proof of publication for the notice of the Pre-Application Document (PAD) filing in the Ledger Dispatch newspaper
10/10/2025	Oakland Tribune - Proof of Publication	Proof of publication for the notice of the Pre-Application Document (PAD) filing in the Oakland Tribune newspaper

CDFW = California Department of Fish and Wildlife; EE = Early Engagement; NMFS = National Marine Fisheries Service; TWG = Technical Working Group; USFWS = U.S. Fish and Wildlife Service

FERC Relicense Early Engagement Meetings

30	07:15	Active
Responses	Average time to complete	Status

1. Please provide your first and last name:

30
Responses

Latest Responses
"Steve Edmondson"
"Beth Lawson"
"Jason Julienne`"

2. What organization/agency do you represent?

30
Responses

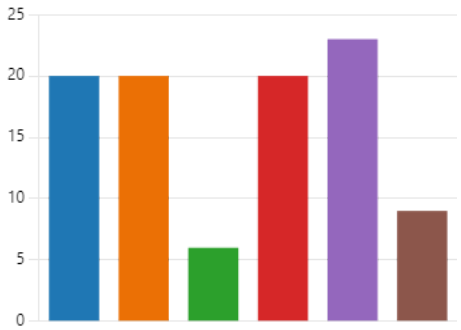
Latest Responses
"NMFS"
"California Department of Fish and Wildlife"
"California Department Of Fish and Wildlife"

3. Please mark the subject area(s) for which you would like to provide feedback during the in-person early engagement meeting(s):

Recreation	12
Fisheries/Wildlife	25
Operations/Energy Generation	11
Hydrology/Climate Change	18

4. Please select dates/times that you would be able to attend an in-person meeting in Lodi. You may select multiple options that work for you:

Wednesday, Sept 18, 9:30 AM ...	20
Wednesday, Sept 18, 1:30 PM ...	20
Wednesday, Sept 18, 5:00 PM ...	6
Thursday, Sept 19, 9:30 AM - 1...	20
Thursday, Sept 19, 1:30 PM – 3:...	23
Thursday, Sept 19, 5:00 PM – 7:...	9



5. What other organizations or contacts should we include in this invitation?

26 Responses

Latest Responses

"*Tribes*"

" "

"*Nick Bauer, Nick.Bauer@wildlife.ca.gov*"

ID	Completion time	Please provide your first	What organization/agency do you represent?	Please mark the subject area(s) for which you would like to provide feedback during the in-person early engagement meeting(s):	Please select dates/times that you would be able to attend an in-person meeting in Lodi. You may select multiple options that work for you:	What other organizations or contacts should we include in this invitation?
1	7/16/24 16:03:04	Steve Schwabauer	North San Joaquin Water Conservation District	Hydrology/Climate Change;Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	City of Lodi. SJ county
2	7/16/24 16:21:00	Stephanie Millsap	USFWS	Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	Aside from typical state/federal agencies, reps from following NGOs: CSPA, American Rivers, American Whitewater
3	7/16/24 16:21:08	Geoff Steinhart	US Fish and Wildlife Service, Anadromous Fish Restoration Program	Fisheries/Wildlife;Hydrology/Climate Change;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	Not sure who it was sent to, but I know the relevant people in the FWS have received the invitation.
4	7/16/24 16:32:38	Robert Fujimura	Delta Fly Fishers	Fisheries/Wildlife;Recreation;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	NCCFFI Mark Rockwell
5	7/16/24 16:47:54	Heinrich Albert	ratepayer, Sierra Club	Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Wednesday, Sept 18, 5:00 PM – 7:00 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	California Sportsfishing Protective Alliance, Golden State Salmon Association
6	7/17/24 10:30:43	Heather Swinney	USFWS	Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 5:00 PM – 7:00 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	N/A
7	7/17/24 12:03:29	Michael Maher	CA Department of Fish and Wildlife	Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;Recreation;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;	Bri Seapy and Beth Lawson also from CDFW
8	7/18/24 7:56:21	Bradley Booker	Amador Trail Stewardship	Recreation;Fisheries/Wildlife;	Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	Mother Lode Land Trust, Foothill Conservancy,
9	7/18/24 10:53:57	Chris Shutes	California Sportfishing Protection Alliance	Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	Foothill Conservancy
10	7/18/24 13:00:18	Ellie Routt	Mother Lode Land Trust	Recreation;Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Wednesday, Sept 18, 5:00 PM – 7:00 PM;	none
11	7/18/24 13:34:07	Lauren Estenson	USFWS	Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Thursday, Sept 19, 9:30 AM - 11:30 AM;	
12	7/18/24 15:58:45	Kathy Grant	City of Lodi	Hydrology/Climate Change;Recreation;	Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	Lower Mokelumne River Stewardship Steering Committee
13	7/18/24 17:01:56	Nick Bauer	CDFW	Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;	

14	7/19/24 17:36:43	Jonathan Ambrose	NMFS	Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Wednesday, Sept 18, 5:00 PM – 7:00 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	Steve Edmondson - NMFS - FERC Branch lead
15	7/19/24 19:53:33	Brett Watson	Amador Trail Stewardship	Recreation;	Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	N/A
16	7/22/24 10:11:40	Monica Gutierrez	NMFS	Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	none at this time
17	7/22/24 10:20:35	Craig Baracco	Foothill Conservancy	Recreation;Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Thursday, Sept 19, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 9:30 AM - 11:30 AM;	Brian Jobson <jobsonbrian@hotmail.com>
18	7/22/24 14:12:47	Skyler Burson	CDFW	Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Wednesday, Sept 18, 5:00 PM – 7:00 PM;	No comment
19	7/22/24 14:28:21	Kristen Hiatt	Bureau of Reclamation - Bay Delta Office	Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Thursday, Sept 19, 1:30 PM – 3:30 PM;	n/a
20	7/24/24 12:05:19	Mary Boblet	The Mokelumne Coast to Crest Trail Council	Recreation;	Thursday, Sept 19, 5:00 PM – 7:00 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;	none
21	7/25/24 7:23:26	Rob Williams	Motherlode Bicycle Coalition	Recreation;	Thursday, Sept 19, 1:30 PM – 3:30 PM;	California Bicycle Coalition
22	7/25/24 13:27:35	Eric Bradbury	State Water Resources Control Board	Hydrology/Climate Change;Operations/Energy Generation;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	
23	7/25/24 15:13:12	Alessandra Rigo de Righi	State Water Resources Control Board	Fisheries/Wildlife;Hydrology/Climate Change;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	No suggestions.
24	7/29/24 9:44:38	Tom Holley	NOAA Fisheries	Fisheries/Wildlife;Hydrology/Climate Change;	Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;	thomas.holley@noaa.gov
25	7/30/24 10:28:44	William Foster	NOAA Fisheries	Fisheries/Wildlife;Hydrology/Climate Change;	Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	California Department of Fish and Game; US Fish and Wildlife Service
26	7/31/24 8:46:11	Nathan Fisch	State Water Resouces Control Board	Hydrology/Climate Change;Recreation;Fisheries/Wildlife;Operations/Energy Generation;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	Eric Bradbury Eric.Bradbury@waterboards.ca.gov
27	7/31/24 13:45:52	Brian Jobson	Foothill Conservancy	Recreation;Fisheries/Wildlife;Operations/Energy Generation;Hydrology/Climate Change;	Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	Friends of the River, California Sportfishing Alliance, American Whitewater, Hydro Reform Coalition
28	8/1/24 8:16:21	Jason Julienne`	California Department Of Fish and Wildlife	Recreation;Fisheries/Wildlife;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	Nick Bauer, Nick.Bauer@wildlife.ca.gov
29	8/2/24 13:21:28	Beth Lawson	California Department of Fish and Wildlife	Operations/Energy Generation;Fisheries/Wildlife;Hydrology/Climate Change;	Wednesday, Sept 18, 1:30 PM – 3:30 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;	

30	8/9/24 14:06:13	Steve Edmondson	NMFS	Fisheries/Wildlife;Hydrology/Climate Change;	Wednesday, Sept 18, 9:30 AM - 11:30 AM;Wednesday, Sept 18, 1:30 PM – 3:30 PM;Wednesday, Sept 18, 5:00 PM – 7:00 PM;Thursday, Sept 19, 9:30 AM - 11:30 AM;Thursday, Sept 19, 1:30 PM – 3:30 PM;Thursday, Sept 19, 5:00 PM – 7:00 PM;	Tribes

From: Cheng, Sabrina
To: Shannon Luoma; Fatima Oswald; Olivia Smith; Kelly Larimer
Subject: FW: FERC Relicense Project – Early Engagement Meetings, Sept 18-19
Date: Tuesday, August 13, 2024 1:01:20 PM
Attachments: image001.png
FERC Relicense - Fisheries-Wildlife.ics
FERC Relicense - Extreme Hydrology-Climate Change.ics
FERC Relicense - Operations-Energy Generation.ics
FERC Relicense - Recreation.ics

Hi Kleinschmidt team,
FYI, the Early Engagement meeting invitations were sent to internal and external interested parties.

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Tuesday, August 13, 2024 11:24 AM
Subject: FERC Relicense Project – Early Engagement Meetings, Sept 18-19

This message is from Priyanka Jain, Senior Civil Engineer in the Water Resources Planning Division:

EBMUD seeks to renew its FERC license for Pardee and Camanche (Project 2916) so we can continue to operate the hydropower facilities and provide other commitments. In preparation for starting the formal relicense process, early engagement meetings are being held to gather information and feedback from external interested parties on a few different topics.

As technical lead and/or liaison, your attendance is requested at the appropriate meeting(s) to meet & greet and listen in to the feedback that may be provided. This information can inform the studies that may be needed and any narrative that should be included in future submittals to pre-empt concerns or issues.

Fisheries/Wildlife
Wednesday, Sept 18, 2024 - 9:30 am to 11:30 am

Extreme Hydrology/Climate Change:
Wednesday, Sept 18, 2024 - 1:30 pm to 3:30 pm

Operations/Energy Generation
Thursday, Sept 19, 2024 - 9:30 am to 11:30 am

Recreation
Thursday, Sept 19, 2024 - 1:30 pm to 3:30 pm

All meeting will be held at:
Hutchins Street Square, Cottage Hall
125 S. Hutchins Street
Lodi, CA

You are welcome to attend multiple meetings. Attached are the meeting notices for all four,

covering the various subject matters. Please RSVP to mokrelicense@ebmud.com by **August 30, 2024**.

If you need overnight lodging, please contact Virginia.Marcus@ebmud.com for details on where others are staying so you can make arrangements to stay there as well. (Note that Pardee Center is not available; lodging will be in Lodi.)

Your support as part of the FERC Relicense Project team is appreciated.
Priya

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: MokRelicense@ebmud.com

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Katherine Perez, Chairperson
North Valley Yokuts Tribe
P. O. Box 717
Linden, CA 95236

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Katherine,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

EBMUD is looking to conduct initial outreach with tribal representatives in the form of in-person early engagement meetings this fall to help inform the data gathering phase of the relicensing process. This meeting will include an overview of the relicensing process and then provide an opportunity for you to share initial feedback or any additional information (reports, studies, etc.) that may supplement existing data.

You are invited to join us in this in-person early engagement meeting.

- **Date:** October 2, 2024
- **Time:** 10:00 am to 11:30 am
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

We look forward to your participation as EBMUD prepares to formally start the multi-year relicensing process. For more information and to stay up to date with the Project, please see our project website at: https://www.ebmud.com/mokrelicense.

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Gene Whitehouse, Chairperson
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, CA 95603

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Gene,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

EBMUD is looking to conduct initial outreach with tribal representatives in the form of in-person early engagement meetings this fall to help inform the data gathering phase of the relicensing process. This meeting will include an overview of the relicensing process and then provide an opportunity for you to share initial feedback or any additional information (reports, studies, etc.) that may supplement existing data.

You are invited to join us in this in-person early engagement meeting.

- **Date:** October 2, 2024
- **Time:** 10:00 am to 11:30 am
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

We look forward to your participation as EBMUD prepares to formally start the multi-year relicensing process. For more information and to stay up to date with the Project, please see our project website at: https://www.ebmud.com/mokrelicense.

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Serrell Smokey, Chairperson
Washoe Tribe of Nevada and California
919 Highway 395 North
Gardnerville, NV 89410

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Serrell,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

EBMUD is looking to conduct initial outreach with tribal representatives in the form of in-person early engagement meetings this fall to help inform the data gathering phase of the relicensing process. This meeting will include an overview of the relicensing process and then provide an opportunity for you to share initial feedback or any additional information (reports, studies, etc.) that may supplement existing data.

You are invited to join us in this in-person early engagement meeting.

- **Date:** October 2, 2024
- **Time:** 10:00 am to 11:30 am
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

We look forward to your participation as EBMUD prepares to formally start the multi-year relicensing process. For more information and to stay up to date with the Project, please see our project website at: https://www.ebmud.com/mokrelicense.

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Neil Peyron, Chairperson
Tule River Indian Tribe
PO Box 589
Porterville, CA 93258

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Neil,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

EBMUD is looking to conduct initial outreach with tribal representatives in the form of in-person early engagement meetings this fall to help inform the data gathering phase of the relicensing process. This meeting will include an overview of the relicensing process and then provide an opportunity for you to share initial feedback or any additional information (reports, studies, etc.) that may supplement existing data.

You are invited to join us in this in-person early engagement meeting.

- **Date:** October 2, 2024
- **Time:** 10:00 am to 11:30 am
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

We look forward to your participation as EBMUD prepares to formally start the multi-year relicensing process. For more information and to stay up to date with the Project, please see our project website at: https://www.ebmud.com/mokrelicense.

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Jesus Tarango, Chairperson
Wilton Rancheria
9728 Kent Street
Elk Grove, CA 95624

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Jesus,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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You are invited to join us in this in-person early engagement meeting.

- **Date:** October 2, 2024
- **Time:** 10:00 am to 11:30 am
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

We look forward to your participation as EBMUD prepares to formally start the multi-year relicensing process. For more information and to stay up to date with the Project, please see our project website at: https://www.ebmud.com/mokrelicense.

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Lloyd Mathiesen, Chairperson
Chicken Ranch Rancheria of Me-Wuk Indians
PO Box 1159
Jamestown, CA 95327

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Lloyd,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Cosme Valdez, Chairperson
Nashville Enterprise Miwok-Maidu-Nishinam Tribe
PO Box 580986
Elk Grove, CA 95758

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Cosme,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Regina Cuellar, Chairwoman
Shingle Springs Band of Miwok Indians
PO Box 1340
Shingle Springs, CA 95682

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Regina,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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Sincerely,

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Adam Dalton, Chairman
Jackson Rancheria Band of Me-Wuk Indians
P. O. Box 1090
Jackson, CA 95642

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Adam,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Sara Dutschke Setshwaelo, Chairperson
Ione Bank of Miwok Indians
P. O. Box 699
Plymouth, CA 95669

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Sara,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Gloria Grimes, Chairperson
Calaveras Band of Mi-Wuk Indians
P. O. Box 899
West Point, CA 95255

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Gloria,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria of Me-Wuk Indians
1418 20th Street, Suite 200
Sacramento, CA 95811

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Rhonda,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 27, 2024

Antoinette Del Rio, Chairwoman
California Valley Mi-Wuk Tribe
PO Box 695
San Andreas CA 95249

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Antoinette,

East Bay Municipal Utility District (EBMUD) is seeking to **renew** its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams. As part of renewing the license, EBMUD will review existing commitments (e.g., recreation, environmental, and dam safety), while working with you to identify cultural and tribal resources.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Lawrence Willson Jr.
California Valley Mi-Wuk Tribe
PO Box 395
West Point, CA 95244

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Lawrence,

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 21, 2024

Clyde Prout
Colfax-Todds Valley Consolidated Tribe of the Colfax Rancheria
PO Box 4884
Auburn, CA 95604

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Clyde,

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15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

East Bay Municipal Utility District
Lower Mokelumne River Project Relicensing
FERC Project No. 2916

EARLY ENGAGEMENT MEETING

FISHERIES AND WILDLIFE

September 18, 2024
9:30am – 11:30am
Hutchins Center - Cottage Room
125 S Hutchins Street, Lodi

AGENDA

9:30 a.m. Welcome, Meeting Ground Rules, Introductions
Meeting Goals and Objectives
EBMUD: Kathryn Horn & Priyanka Jain

9:45 a.m. FERC Relicensing, ILP Schedule, and Opportunities for Engagement
Kleinschmidt Associates: Shannon Luoma & Fatima Oswald

10:05 a.m. Project 2916 – Lower Mokelumne River Overview

- Camanche and Pardee Project Overview
  EBMUD: Joe Tam
- Resource Specific Overview
  EBMUD: Michelle Workman

10:55 a.m. Discussion and Questions

- Existing Resource Management Information (Plans/Reports/Data)
- Relevant resource information for the Pre-Application Document (PAD)
- Engagement Opportunities
  Shannon Luoma & Priyanka Jain w/input from Attendees

11:25 a.m. Next Steps
EBMUD: Kathryn Horn & Priyanka Jain

Scan QR code to connect to the website and submit interest form.

Attendees at Early Engagement Meetings

Meeting date	Topic	Type	Organization	First name	Last name	Title/Role
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Nick	Bauer	Senior Environmental Scientist Supervisor, Regional Program Coordinator
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Skyler	Burson	Environmental Scientist - District Biologist
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Beth	Lawson	Associate Hydraulic Engineer
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Michael	Maher	Region 2 FERC Coordinator, North Central Water Program Supervisor
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Chris	McKibbin	Environmental Scientist
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Briana	Seapy	Water Program Supervisor
9/18/24 - 9:30AM	Fisheries & Wildlife	Non-Governmental Organization	Foothill Conservancy	Craig	Baracco	Director
9/18/24 - 9:30AM	Fisheries & Wildlife	Federal Government	National Oceanic & Atmospheric Admin/National Marine Fisheries Service (NOAA/NMFS)	Jon	Ambrose	San Joaquin River Branch Chief
9/18/24 - 9:30AM	Fisheries & Wildlife	Federal Government	National Oceanic & Atmospheric Admin/National Marine Fisheries Service (NOAA/NMFS)	William	Foster	Fishery Biologist
9/18/24 - 9:30AM	Fisheries & Wildlife	Federal Government	National Oceanic & Atmospheric Admin/National Marine Fisheries Service (NOAA/NMFS)	Monica	Gutierrez	Fishery Biologist
9/18/24 - 9:30AM	Fisheries & Wildlife	N/A	none (member of the public)	Bob	Fujimura	Retired CDFW employee
9/18/24 - 9:30AM	Fisheries & Wildlife	Local utility district	North San Joaquin Water Conservation District (NSJWCD)	Steve	Schwabauer	General Manager
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	State Water Resources Control Board (SWRCB)	Alessandra	Rigo	Environmental Scientist
9/18/24 - 9:30AM	Fisheries & Wildlife	State govt	State Water Resources Control Board (SWRCB)	Andrea	Sellers	Environmental Scientist
9/18/24 - 9:30AM	Fisheries & Wildlife	Federal Government	US Fish & Wildlife Service	Lauren	Estenson	F/W Biologist, Technical lead on Lower Moke relicensing
9/18/24 - 9:30AM	Fisheries & Wildlife	Federal Government	US Fish & Wildlife Service	Stephanie	Millsap	Watershed Planning Division Manager
9/18/24 - 9:30AM	Fisheries & Wildlife	Federal Government	US Fish & Wildlife Service	Geoff	Steinhart	Habitat Restoration Coordinator
9/18/24 - 9:30AM	Fisheries & Wildlife	Local utility district	Woodbridge Irrigation District (WID)	Keith	Bussman	General Manager
9/18/24 - 9:30AM	Fisheries & Wildlife	Local utility district	Woodbridge Irrigation District (WID)	Jaime	Cantu	Superintendent

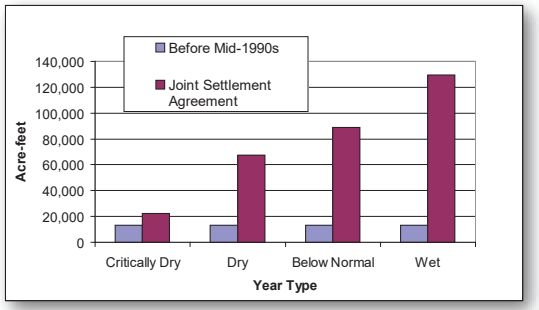
Fisheries & Wildlife

EBMUD Fisheries & Wildlife Programs

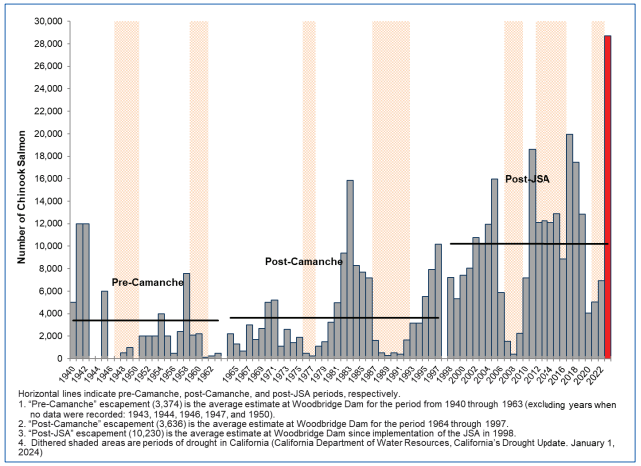
Fisheries Management, Science and Monitoring, Habitat Restoration, Fish Hatchery Programs

EBMUD's Mokelumne River Fish Restoration Program

- Integrated approach to ecosystem management
- Codified in 1998 Joint Settlement Agreement
- 10-fold increase in dry-year flows from early 1990s
- A portion of newly acquired supplies provided to further increase Mokelumne flows
- Formal collaboration with resource agencies and stakeholders to optimize river management
- $2 million endowment for habitat improvements
- $12.5 million in improvements to upgrade hatchery



Chinook Salmon Returns 1940-2023

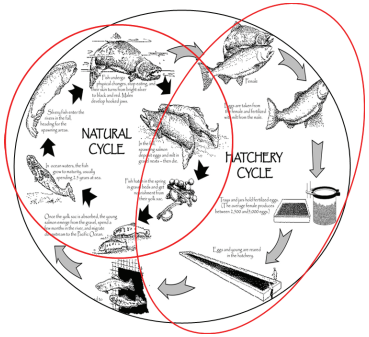


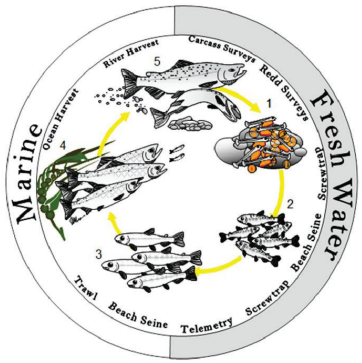
Horizontal lines indicate pre-Camanche, post-Camanche, and post-JSA periods, respectively.
1. "Pre-Camanche" escapement (3,374) is the average estimate at Woodbridge Dam for the period from 1940 through 1963 (excluding years when no data were recorded: 1943, 1944, 1946, 1947, and 1950).
2. "Post-Camanche" escapement (3,636) is the average estimate at Woodbridge Dam for the period 1964 through 1997.
3. "Post-JSA" escapement (10,230) is the average estimate at Woodbridge Dam since implementation of the JSA in 1998.
4. Dithered shaded areas are periods of drought in California (California Department of Water Resources, California's Drought Update. January 1, 2024)

Collaboration & Coordination

Woodbridge Irrigation District
CDFW
USFWS AFRP
NMFS
USBR
Many Landowners Along Mokelumne
UC Davis
UC Santa Cruz
Golden Gate Salmon Association
California Sportfish Protection Alliance
Foothill Conservancy
Delta Fly Fishers
Cal Fire
Upper Mokelumne River Watershed Authority
Amador Calaveras Consensus Group

Monitoring and Management to meet Salmon Lifecycle Stages





Fish Passage and Video Monitoring at Woodbridge Irrigation District Dam

Since fall 1990, EBMUD has been monitoring fall-run Chinook salmon escapement at WIDD.

Escapement Monitoring

Redd Surveys

- Count salmon redds (nests)
- Distribution
- Habitat use and preferences
- In-river escapement estimate when needed

Carcass Surveys

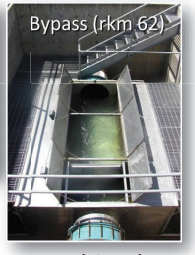
- CWT recovery
- Pre-spawn mortality
- Collect biological samples
- In-river escapement estimate when needed

9

Juvenile Salmon Outmigration

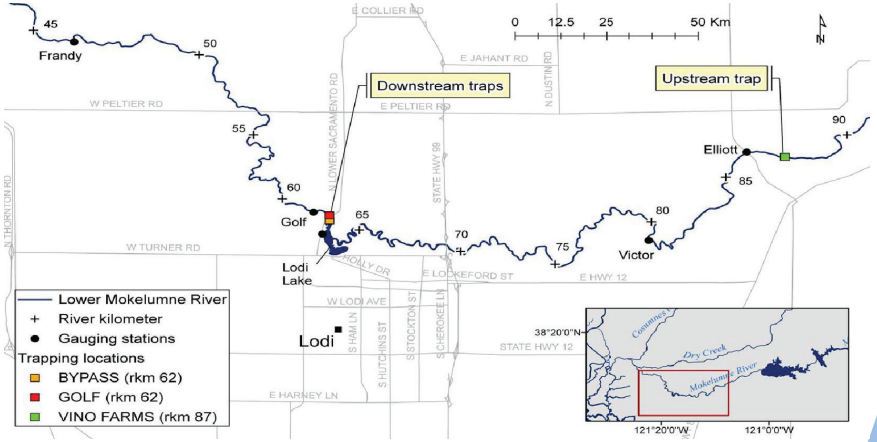
8 ft RST

8 ft and 5ft RST



Screened Smolt Trap

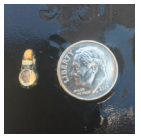
Outmigration Survey Locations



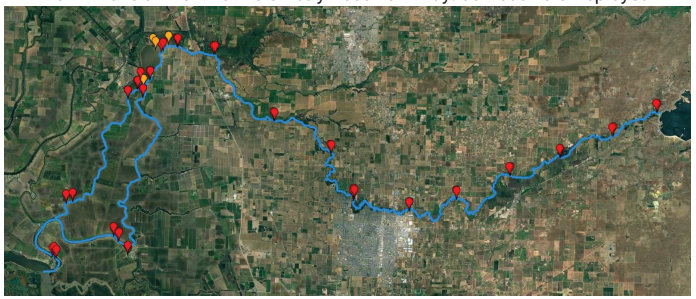
Acoustic Telemetry

85 mm Chinook salmon smolt tagged

Telemetry Tag

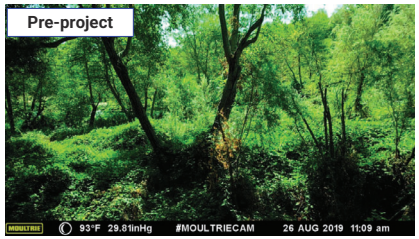


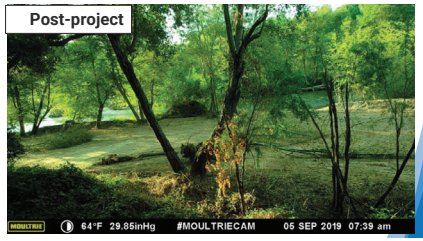
2024 Mokelumne River Telemetry Receiver Array: 56 Receivers Deployed



Evolution of Habitat Restoration Program

- 1990-2000 Annual site-specific spawning gravel restoration projects
- 2001-present- Reach scale spawning habitat restoration design and implementation
- 2005 Side Channel Construction for juvenile chinook and steelhead rearing
- 2015-2022 Shift focus to improve floodplain habitat while continuing to maintain spawning habitat
- Total placed gravel = 56,537 cubic yards since 1990

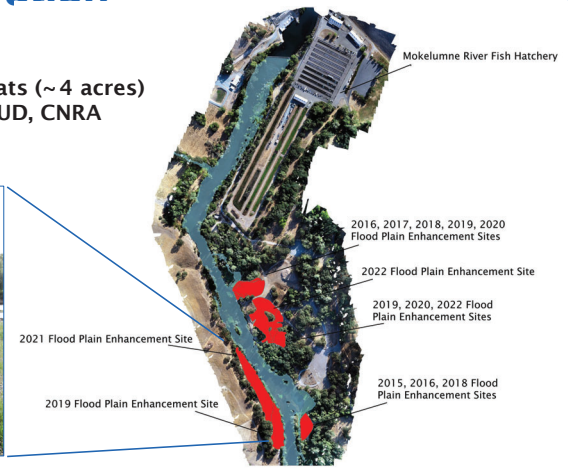




4-13

Floodplain Restoration

2015- 2022: 5 floodplain habitats (~4 acres)
Funding from: USFWS, EBMUD, CNRA

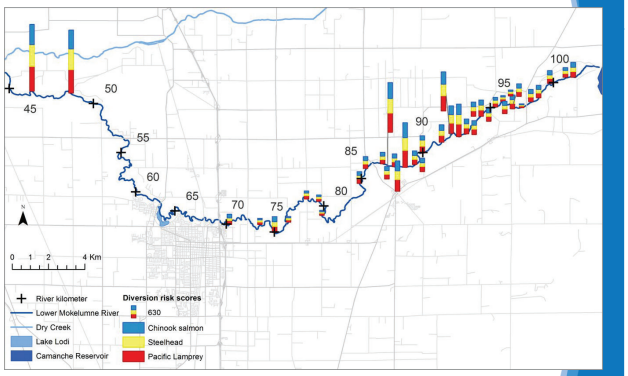


Rearing – Screening Private Riparian Diversions

- 2019 Relative Risk Model of Surface Water Diversions
- 270 water diversions along the LMR
- 3 screened in 2021
  - RRM rank: 3rd, 4th, and unranked
- 3 screened in 2024
  - RRM rank: 1st, 2nd, and unranked

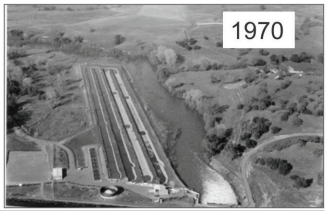
Unscreened Diversion

Screened Diversion



Predicted risk at surface water diversions on LMR for CS, STH, and PLAM.

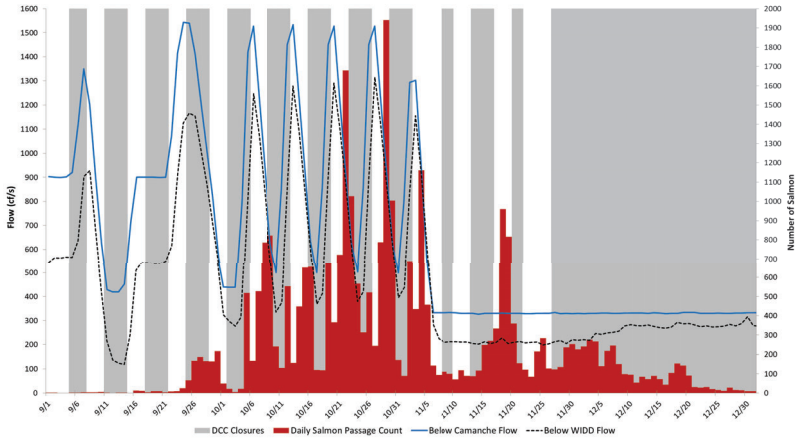
Mokelumne River Fish Hatchery



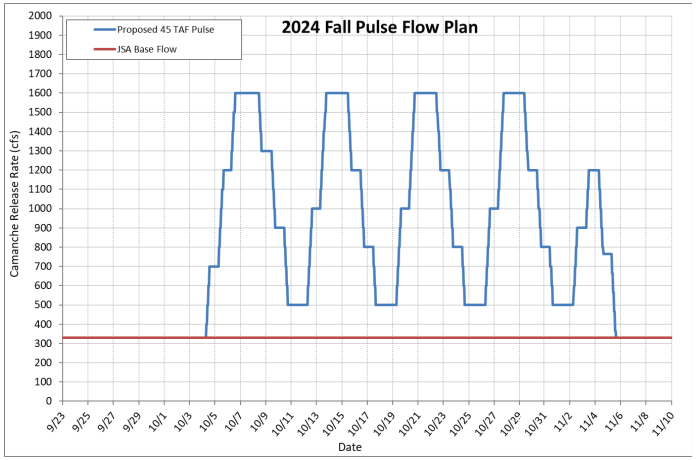
Hatchery Improvements

- Chillers for the Hatchery water supply cool water up to 8°C
- Sand filters to remove unwanted particulate matter
- Ultraviolet light water treatment system to eliminate pathogenic organisms
- Hypolimnetic Oxygenation System (HOS) system in response to hydrogen sulfide problem
- These improvements have resulted in a 92% to 95% egg to trucked fish survival rate, which is extremely high for hatchery production.
- We've also improved management practices to balance natural and hatchery production

Management Actions to Support Fisheries

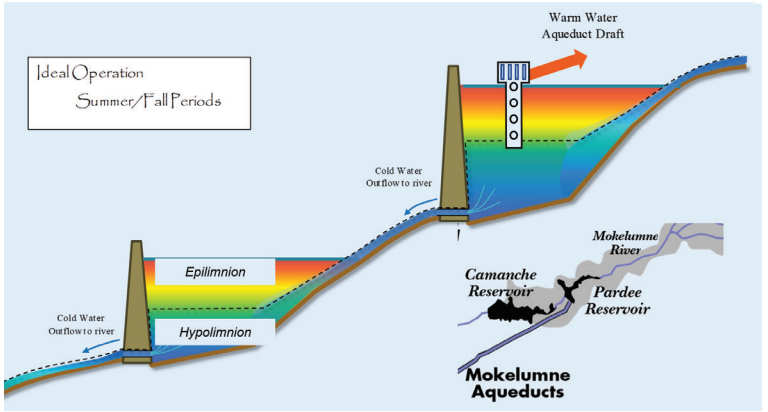


Adaptive Management: Pulse Flows



Temperature Management for Fisheries

Operate Pardee and Camanche to deliver cold water to Mokelumne River Downstream



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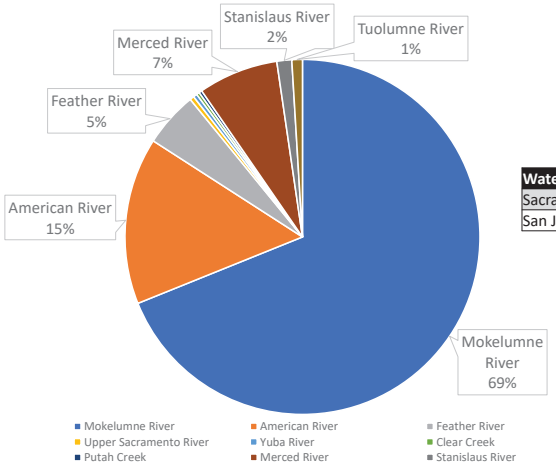
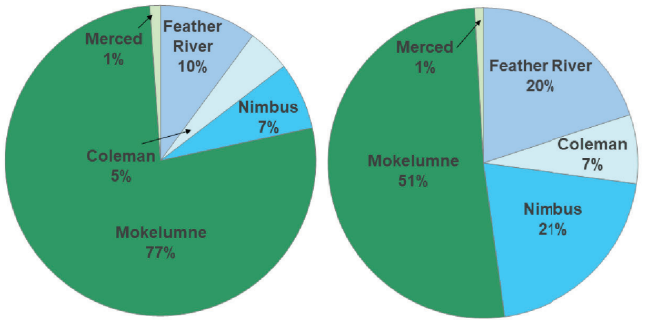
2023-2024 Straying Rates (Preliminary)



Watershed	Straying Rate
Sacramento River	21.49%
San Joaquin River	9.61%

21

Hatchery Contribution to 2022 CA Ocean Fisheries



Summary

- EBMUD manages the lower Mokelumne River in partnership with CA Department of Fish and Wildlife, US Fish and Wildlife Services, National Marine Fisheries Service, and other river partners
- EBMUD provides flows and habitat to create a hospitable natural environment for native fishes
- Science, monitoring, adaptive management are key to successful outcomes
- Leverage long-term datasets to refine and improve management of the LMR

Wildlife Management and Conservation Agreements

Safe Harbor Agreement

Between EBMUD and USFWS

Purpose:

- **to promote the enhancement and management of habitat for CTS, CRLF and VELB on EBMUD watershed lands.**
- **to provide certain regulatory assurances to EBMUD.**

EBMUD: maintain baseline habitat, implement and maintain specific conservation management activities

USFWS: authorizes incidental take through a 30 year enhancement of survival permit (TE-213311-0)

USFWS Safe Harbor Agreement

Conservation Management Actions:

- Restore and maintain healthy, contiguous native plant communities that include elderberry bushes for VELB
- Restore and maintain suitable breeding ponds, moist refuge habitat, and upland dispersal habitat for CTS and CRLF
- Manage vegetation and grazing appropriate to the conservation needs of the covered species, consistent with water quality protection and fire management
- Control non-native predators
- Implement related protection and conservation measures

California Tiger Salamander

California Red-Legged Frog

Valley Elderberry Longhorn Beetle

Upcountry Watershed RMA

- Agreement with the California Department of Fish and Wildlife
- Required because our routine maintenance could substantially impact fisheries and wildlife resources on District lands
- Protects fish and wildlife resources by incorporating reasonable measures (BMPs) to protect these resources
- Signed November 21, 2022

Stewards of the Source

Mokelumne River : Wild & Scenic Designation

- Signed into law June 27, 2018
- State Wild and Scenic Designation
- Protects 37 miles upstream of Pardee Reservoir
- Preserves the wild and scenic values of the Upper Mokelumne River
- Supported by broad group of environmental and water agency stakeholders

Overview *Recap*

- Water Temperature Projections Follow Water Supply Projections
- Flexible Management Approach Leads to Positive Fisheries Outcomes
- Monitoring Program Allows Understanding & Guides adaptation

East Bay Municipal Utility District
Lower Mokelumne River Project Relicensing
FERC Project No. 2916

EARLY ENGAGEMENT MEETING
EXTREME HYDROLOGY & CLIMATE CHANGE

September 18, 2024
1:30pm – 3:30pm
Hutchins Center - Cottage Room
125 S Hutchins Street, Lodi

AGENDA

1:30 p.m. Welcome, Meeting Ground Rules, and Introductions
Meeting Goals and Objectives
EBMUD: Kathryn Horn & Priyanka Jain

1:45 p.m. FERC Relicensing, ILP Schedule, and Opportunities for Engagement
Kleinschmidt Associates: Shannon Luoma & Fatima Oswald

2:05 p.m. Project 2916 – Lower Mokelumne River Overview

- Camanche and Pardee Project Overview
  EBMUD: Joe Tam
- Resource Specific Overview
  EBMUD: Eric Toth

2:45 p.m. Discussion and Questions

- Existing Resource Management Information (Plans/Reports/Data)
- Relevant resource information for the Pre-Application Document (PAD)
- Engagement Opportunities
  Shannon Luoma & Priyanka Jain w/input from Attendees

3:25 p.m. Next Steps
EBMUD: Kathryn Horn & Priyanka Jain

Scan QR code to
connect to the website
and submit interest form.

Attendees at Early Engagement Meetings

Meeting date	Topic	Type	Organization	First name	Last name	Title/Role
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Beth	Lawson	Associate Hydraulic Engineer
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Michael	Maher	Region 2 FERC Coordinator, North Central Water Program Supervisor
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Briana	Seapy	Water Program Supervisor
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	Local govt	City of Lodi	Kathy	Grant	Director - Watershed Program
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	State govt	State Water Resources Control Board (SWRCB)	Chase	McCormick	Environmental Scientist
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	State govt	State Water Resources Control Board (SWRCB)	Alessandra	Rigo	Environmental Scientist
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	State govt	State Water Resources Control Board (SWRCB)	Andrea	Sellers	Environmental Scientist
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	Federal Government	US Fish & Wildlife Service	Stephanie	Millsap	Watershed Planning Division Manager
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	Federal Government	US Fish & Wildlife Service	Geoff	Steinhart	Habitat Restoration Coordinator
9/18/24 - 1:30PM	Extreme Hydrology/Climate Change	Local utility district	Woodbridge Irrigation District (WID)	Keith	Bussman	General Manager

Extreme Hydrology & Climate Change

Presentation Overview

- Overviews
  - Dam Safety Program
  - Mokelumne Watershed
- Hydrologic Extremes
  - PMP – PMF
  - Other Extreme Events
- Climate Change
- Projects – Programs

Camanche Spillway, February 1986
Peak Spill 1,630 cfs

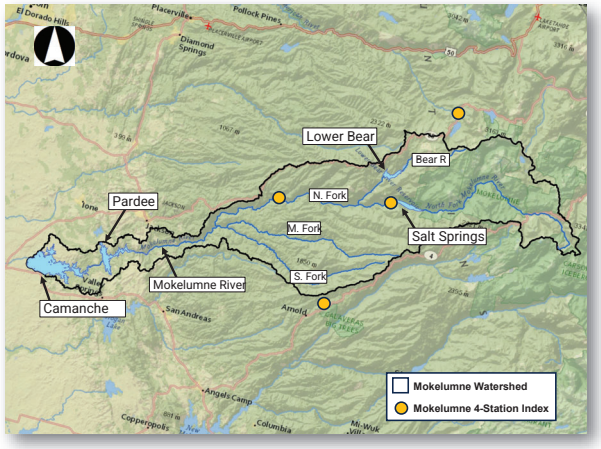
Dam Safety Program Overview

- State & federal requirements
- Proactive management of dams
  - Rigorous monitoring
  - Emergency preparedness
  - Physical & Cyber security
- Periodic evaluations for extreme loading conditions
  - Seismic
  - Hydrologic extremes

Annual FERC Inspection at Camanche Dam in 2023

Seminar/Tabletop/Functional Exercise of Emergency Action Plan in 2023 at Pardee Center

Mokelumne River Watershed Overview



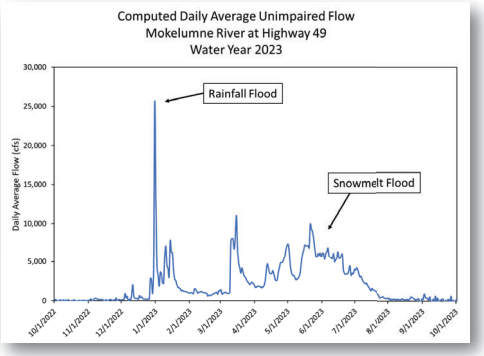
Basin Area
- **621 sq mi**

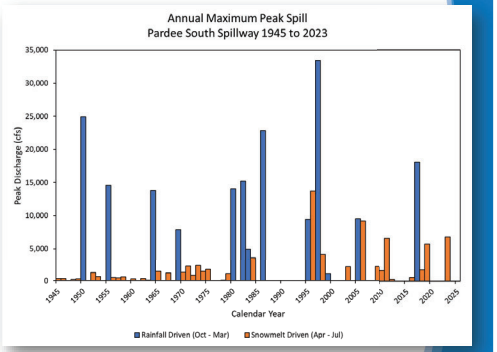
Elevation
- **260' – 10,370'**
- **Snow > 5,000'**

Average Precipitation
- **48" (MOK 4-Sta)**

Flood Types
- **Rainfall (Oct-Mar)**
- **Snowmelt (Apr-Jul)**

Rainfall vs. Snowmelt Driven Floods

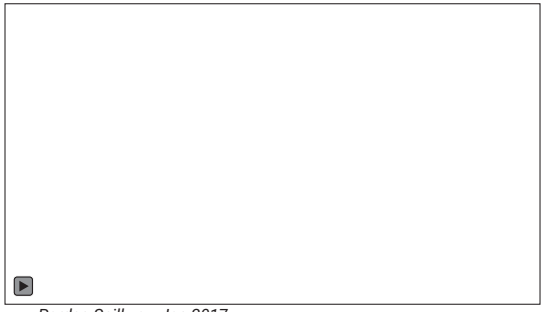




Extreme Hydrology – PMP / PMF

Probable Maximum Flood (PMF) is the flood resulting from the most unlikely, but possible precipitation, termed Probable Maximum Precipitation (PMP)

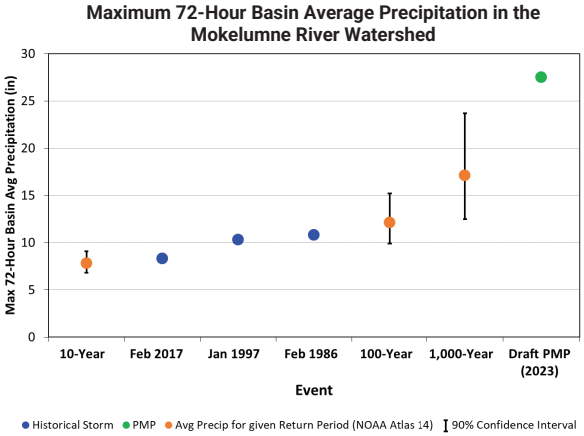
- High hazard dams
- Required by FERC & DSOD
- Prescribed by NOAA's HMR-59
- Provides 72-hour winter storm and resulting runoff



Pardee Spillway, Jan 2017;
Peak spill ~18,000 cfs

FERC: Federal Energy Regulatory Commission
DSOD: Division of Safety of Dams
NOAA: National Oceanic and Atmospheric Administration
HMR: Hydrometeorological Report

Extreme Hydrology – PMP



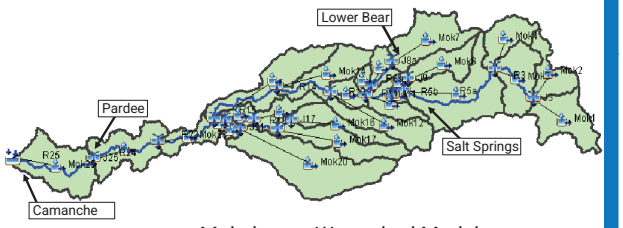
The PMP is a very extreme event intended to be larger than anything the basin will likely experience in the future.

Extreme Hydrology – PMF

Calibrated watershed model used to compute the PMF from the PMP

Modeling assumptions

- 100-year snowpack
- Saturated conditions
- Warm temperatures
- Full reservoirs



Mokelumne Watershed Model

Resulting extreme flood from PMP intended to be larger than any flood experienced in the watershed.

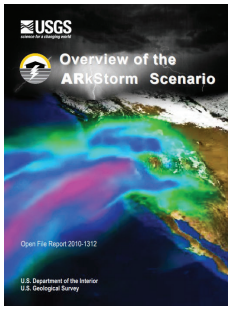
Other Hydrologic Events

The Great Flood of 1862: The biggest flood in modern history that began with upwards of 15 feet of snow falling in the Sierras followed by a series of atmospheric rivers that brought warm rain and high winds.

K Street, Sacramento, looking east 1861-1862

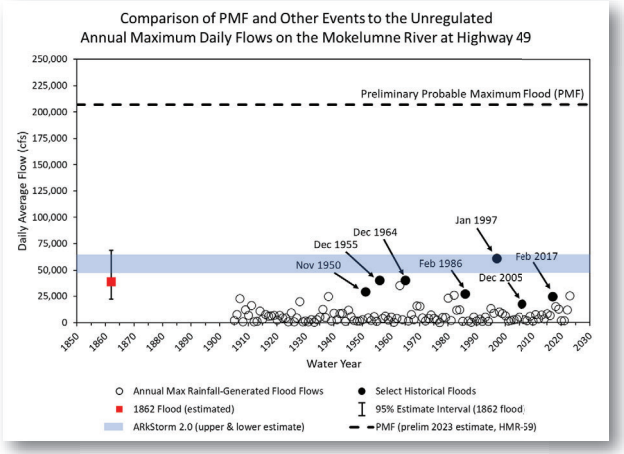
Source of Pictures: USGS Open File Report 2010-1312

ARkStorm 2.0: A hypothetical storm based on the Great Flood of 1862 initially developed by the United States Geologic Survey for emergency planning purposes, and subsequently modified by academic institutions to include climate change.



- Based on 1861-1862 storm pattern
- Incorporates a warmer future climate
- Developed to aid in emergency planning
- Not a regulatory requirement

PMF & Other Hydrologic Events



Similar to PMP, the PMF is intended to be larger than any flood the basin has experienced or will likely experience because of the high hazard classification of the dams.

This theoretical flood event would overwhelm our required flood reservation in a single day and would far exceed the maximum allowable release and downstream channel capacity.

Climate Change

- No State or Federal regulatory requirements currently in place

  National Academies of Sciences, Engineering, and Medicine to make recommendations for the development of an updated approach that can serve as a national standard for estimating probable maximum precipitation in a changing climate.

- EBMUD proactively considering and incorporating into upcoming PMP/PMF analyses

- Need to develop long term adaptive management strategies to offset range of future conditions

- Need to expand data and tools to improve weather forecasting on the Mokelumne watershed

Upcoming and Continuing Studies and Programs

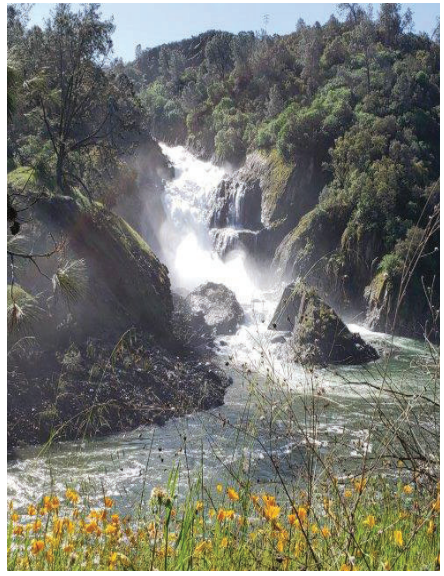
Site Specific PMP/PMF Studies
- Partnering with PG&E on Mokelumne River
- To incorporate climate change

Probabilistic Flood Hazard Analysis

Forecast Informed Reservoir Operations (FIRO)
- Evaluating feasibility of adaptively managed reservoir operations

Data Collection & Monitoring
- Pursuing opportunities to install and maintain instruments to fill in data gaps

Emergency Preparedness Program
- Continuing to engage with emergency management agencies and educate the public
- Reviewing, updating, exercising annually



East Bay Municipal Utility District
Lower Mokelumne River Project Relicensing
FERC Project No. 2916

EARLY ENGAGEMENT MEETING

SYSTEM OPERATIONS & HYDRO GENERATION

September 19, 2024
9:30am – 11:30am
Hutchins Center - Cottage Room
125 S Hutchins Street, Lodi

AGENDA

9:30 a.m. Welcome, Meeting Ground Rules, and Introductions
Meeting Goals and Objectives
EBMUD: Kathryn Horn & Priyanka Jain

9:45 a.m. FERC Relicensing, ILP Schedule, and Opportunities for Engagement
Kleinschmidt Associates: Shannon Luoma & Fatima Oswald

10:05 a.m. Project 2916 – Lower Mokelumne River Overview

- Camanche and Pardee Project Overview
  EBMUD: Joe Tam
- Resource Specific Overview
  EBMUD: Chris Potter & Casey LeBlanc

10:45 a.m. Discussion and Questions

- Existing Resource Management Information (Plans/Reports/Data)
- Relevant resource information for the Pre-Application Document (PAD)
- Engagement Opportunities
  Shannon Luoma & Priyanka Jain w/input from Attendees

11:25 a.m. Next Steps
EBMUD: Kathryn Horn & Priyanka Jain

Scan QR code to
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and submit interest form.

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9/19/24 - 9:30AM	Operations-Energy Generation	State govt	CA Deptartment of Fish & Wildlife (CDFW)	Chris	McKibbin	Environmental Scientist
9/19/24 - 9:30AM	Operations-Energy Generation	Federal Government	US Fish & Wildlife Service	Lauren	Estenson	F/W Biologist, Technical lead on Lower Moke relicensing
9/19/24 - 9:30AM	Operations-Energy Generation	Federal Government	US Fish & Wildlife Service	Stephanie	Millsap	Watershed Planning Division Manager
9/19/24 - 9:30AM	Operations-Energy Generation	Federal Government	US Fish & Wildlife Service	Geoff	Steinhart	Habitat Restoration Coordinator
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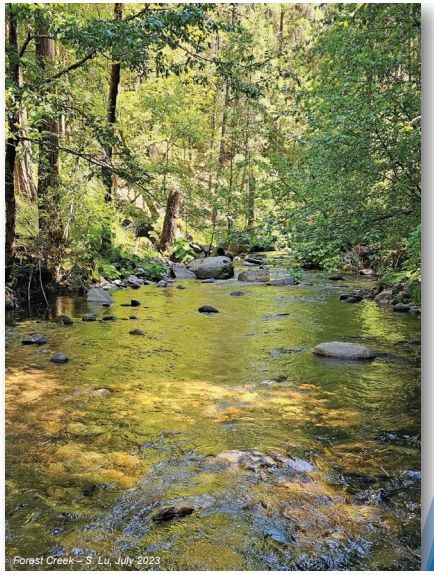
9/19/24 - 9:30AM	Operations-Energy Generation	Local utility district	Woodbridge Irrigation District (WID)	Jaime	Cantu	Superintendent
9/19/24 - 9:30AM	Operations-Energy Generation	Local utility district	Woodbridge Irrigation District (WID)	Brandon	Warmerdam	Deputy/Meter Admin

EBMUD

Project System Operations

System Operations Overview

- Mokelumne River Water Operations Overview
- Resources Management
- Water Year 2024 Review
- Current Water Supply



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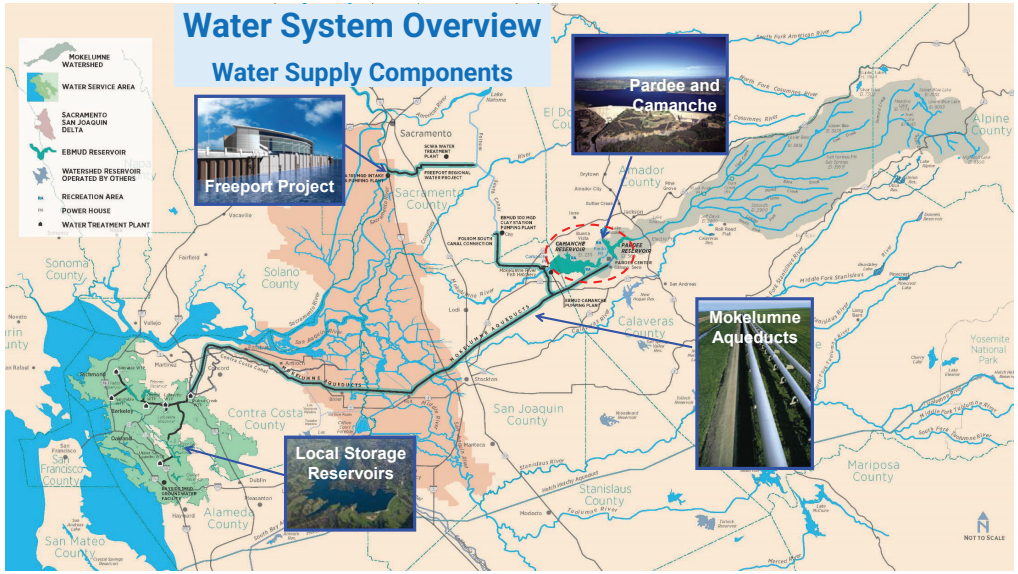


Water Operations Overview

Mokelumne River – Pardee & Camanche Reservoirs

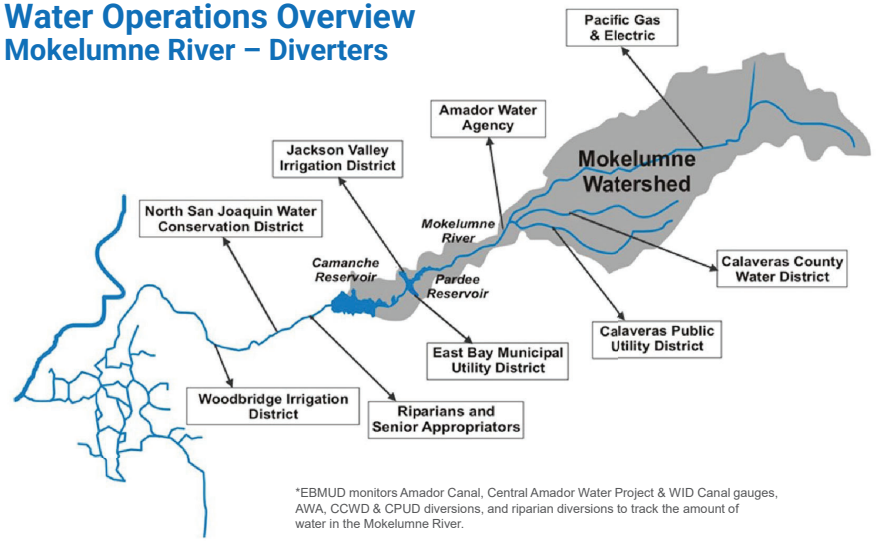
Operated in integrated manner to provide water supply benefits and meet a variety of state, federal, and local obligations

Reservoir	Capacity
Pardee	204 TAF (Elev. 567')
Camanche	417 TAF (Elev. 235')

TAF: Thousand Acre-Feet

- Municipal water supply
- Obligations to downstream diverters
- Fishery requirements
- Water quality (temperature, DO)
- Contribution to Delta inflow/outflow
- Flood control (streamflow regulation)
- Power generation

Water Operations Overview
Mokelumne River – Diverters



*EBMUD monitors Amador Canal, Central Amador Water Project & WID Canal gauges, AWA, CCWD & CPUD diversions, and riparian diversions to track the amount of water in the Mokelumne River.

5

Water Operations Overview
Resource Management & Water Quality

- Conserve and develop fish and wildlife resources
  - EBMUD, California Department of Fish and Game and the US Fish and Wildlife Service jointly signed a Joint Settlement Agreement in 1998 (JSA)
  - Minimum instream flows at Camanche and below Woodbridge (also reinforced with SWRCB action)
- Water Quality
  - Temperature in the reservoir and river (coldwater pool management)
  - Dissolved oxygen in the river

6

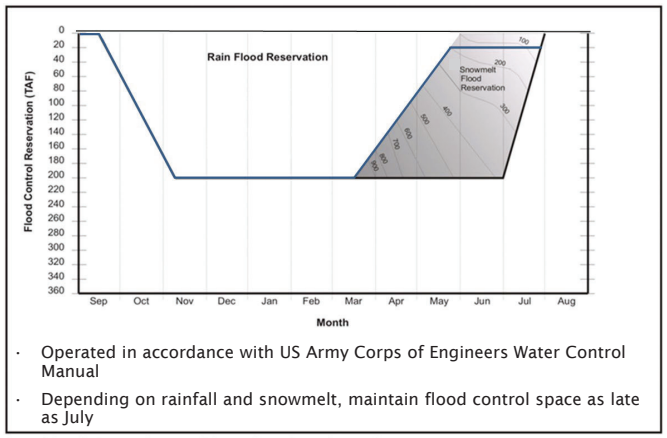
Water Operations Overview
JSA Year Type Basis

WY2024 DWR April 1 Bulletin 120 Median Forecast = 730 TAF

Year Type	Basis	Critically Dry	Dry	Below Normal	Normal and Above
Oct'23-Mar'24	Pardee & Camanche Storage on Nov 5th	269 TAF or Less	270 TAF to 399 TAF	400 TAF To Max Allowable	> Max Allowable
Apr'24-Sep'24	DWR April 1st Unimpaired Runoff Forecast	299 TAF or Less	300 TAF to 499 TAF	500 TAF to 889 TAF	890 TAF or More
Oct'24-Mar'25	Pardee & Camanche Storage on Nov 5th	269 TAF or Less	270 TAF to 399 TAF	400 TAF To Max Allowable	> Max Allowable

7

Water Operations Overview
Flood Control Operations

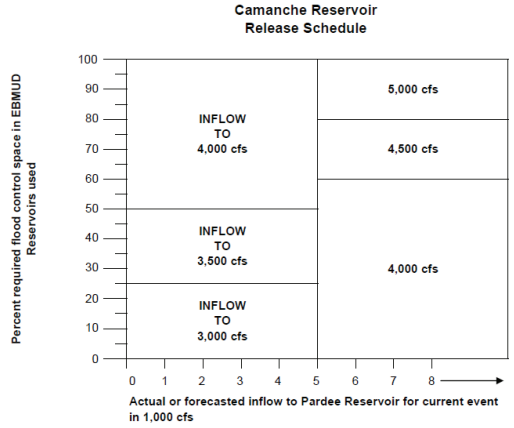


- Operated in accordance with US Army Corps of Engineers Water Control Manual
- Depending on rainfall and snowmelt, maintain flood control space as late as July

Source: US Corps of Engineers Water Control Manual for Camanche Dam and Reservoir, September 1981

8

Water Operations Overview
Flood Control Operations

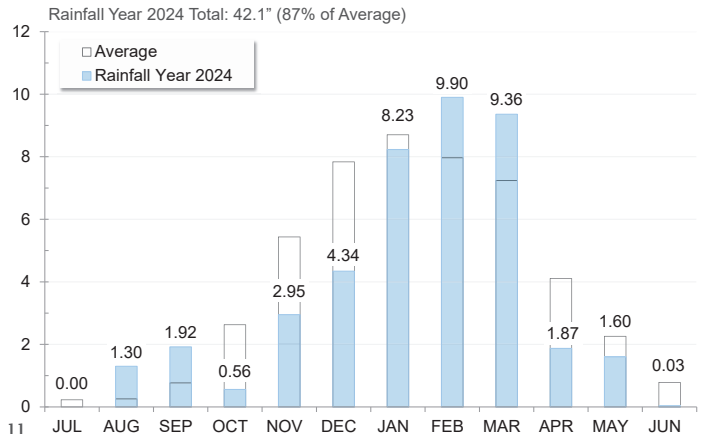


Note:
From the Flood Control Diagram, Camanche Reservoir
US Army Corps of Engineers, 1982

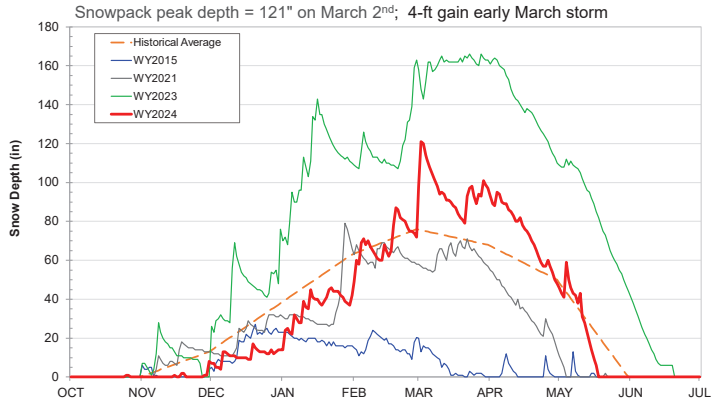
Water Operations Overview
Camanche Reservoir Release Information

- Operational bulletins issued for pending release changes to notify staff of: EBMUD, USACE, resource agencies, and downstream districts.
- Release information and projected release changes are available to the public on the EBMUD Water Supply
  - https://www.ebmud.com/water/about-your-water/water-supply/water-supply-reports/#releases
- Automated phone call notifications are available by request for release changes greater than 1,000 cfs
  - Email watersupply@ebmud.com with full name and phone number

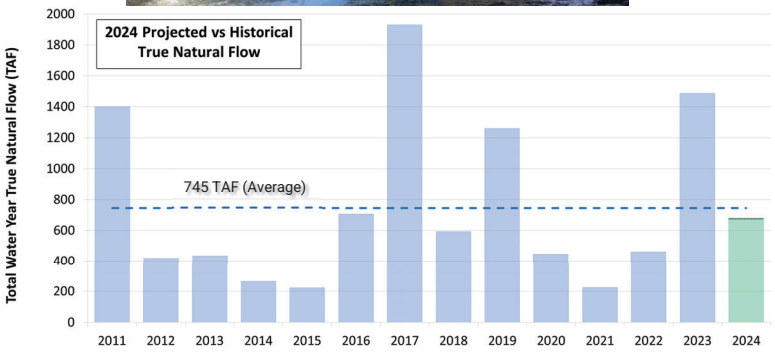
Water Year 2024 Review
Mokelumne Precipitation



Water Year 2024 Review
Caples Lake Snow Depth



Water Year 2024 Review
Historical Runoff Comparison



13

Water Year 2024 Review
Current Reservoir Storage

As of 9/17/2024	Current Storage	Percent of Average	Percent of Capacity
Pardee	192,750 AF	101%	95%
Camanche	361,610 AF	132%	87%
East Bay	124,200 AF	105%	83%
Total System	678,560 AF	116%	88%

Water Year 2024 Review

Upper Mokelumne Precipitation: 42.1" (48.3" avg)
Snowpack water content (max): 34.1" (31.8" avg)
Total unimpaired runoff: 675 TAF* (745 avg)
End of Water Year Storage: 630 TAF*
** Projected values*

15

EBMUD

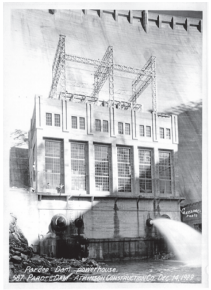
Hydro Generation

Hydro Generation Overview

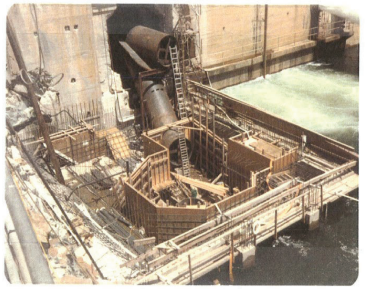
- Pardee and Camanche Powerhouses
  - Chronology
  - Hydropower Generation
- Other Renewable Energy Generation
  - Camanche Area Photovoltaic Systems

17

Pardee Powerhouse Chronology



Original Construction (Units 1 and 2)



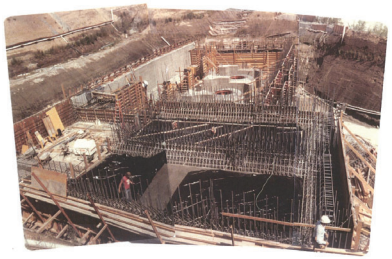
Construction of Unit No. 3

1928 — 1983 — Today

- Provides renewable energy
- 28.6 MW authorized installed capacity

18

Camanche Powerhouse Chronology



Original Construction of Units 1, 2, and 3

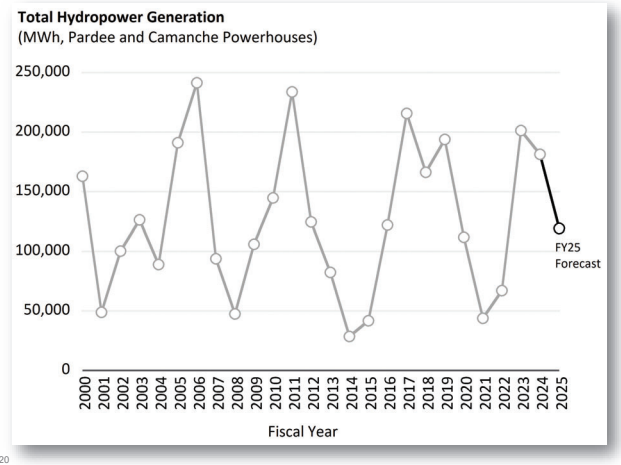
Current Condition (Unit No. 3)

1983 — Today

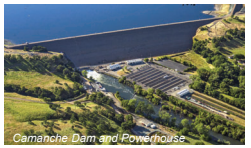
- Provides renewable energy
- 9.45 MW authorized installed capacity

19

Hydropower Generation: Overview



Pardee Dam and Powerhouse



Camanche Dam and Powerhouse

20

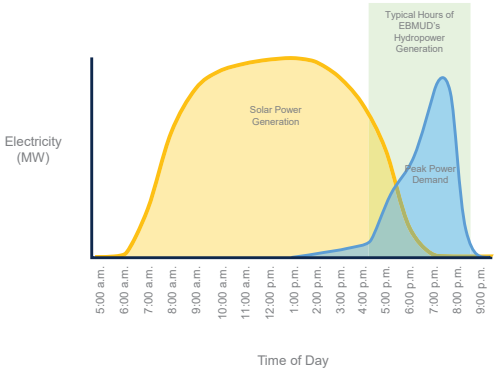
Hydropower Generation: Benefits

- **Renewable Energy**. Pardee and Camanche hydroelectric generation facilities meets the California Energy Commission's Renewable Portfolio Standard for small hydroelectricity.
- **Greenhouse Gas Reductions**. Clean energy produced from Pardee and Camanche powerhouses supports California's requirement for carbon-free electricity by 2045.
- **Electric Grid Reliability**. Generation from Pardee and Camanche powerhouses provide electricity during peak demands in the evening when solar systems are generating less electricity.

21

Hydropower Generation: Electric Grid Reliability

Pardee and Camanche powerhouses support the reliability of the electric grid during the peak demands in the evening.



Source: California Independent System Operator

22

Other Renewable Energy Generation

- Supports District's goal to achieve carbon neutrality by 2030
- Other renewable energy is generated in the Camanche Area
  - Camanche Dam Photovoltaic (PV) System (363 kW)
  - South Shore Wastewater Ponds PV System (49 kW)
  - Recreational Area Water Treatment Plant PV System (150 kW)
  - North Shore Wastewater Ponds PV System (49 kW)


Camanche Dam PV System


Camanche South Shore Wastewater Ponds PV

23

East Bay Municipal Utility District

Lower Mokelumne River Relicensing Project

FERC Project No. 2916

EARLY ENGAGEMENT MEETING

RECREATION & WATERSHED

September 19, 2024

1:30pm – 3:30pm

Hutchins Center - Cottage Room

125 S Hutchins Street, Lodi

AGENDA

1:30 p.m. Welcome, Meeting Ground Rules, and Introductions
Meeting Goals and Objectives
EBMUD: Kathryn Horn & Priyanka Jain

1:45 p.m. FERC Relicensing, ILP Schedule, and Opportunities for Engagement
Kleinschmidt Associates: Shannon Luoma & Fatima Oswald

2:05 p.m. Project 2916 – Lower Mokelumne River Overview

- Camanche and Pardee Project Overview
  EBMUD: Joe Tam
- Resource Specific Overview
  EBMUD: Chuck Beckman, Scott Wiemerslage, Justin Mynk

2:45 p.m. Discussion and Questions

- Existing Resource Management Information (Plans/Reports/Data)
- Relevant resource information for the Pre-Application Document (PAD)
- Engagement Opportunities
  Shannon Luoma & Priyanka Jain w/input from Attendees

3:25 p.m. Next Steps
EBMUD: Kathryn Horn & Priyanka Jain

Scan QR code to connect to the website and submit interest form.

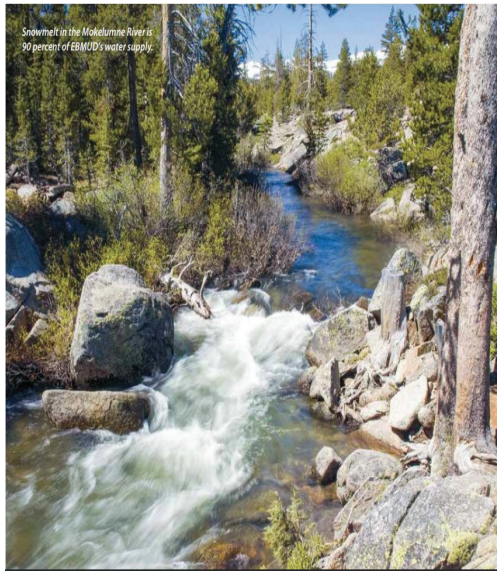
Attendees at Early Engagement Meetings

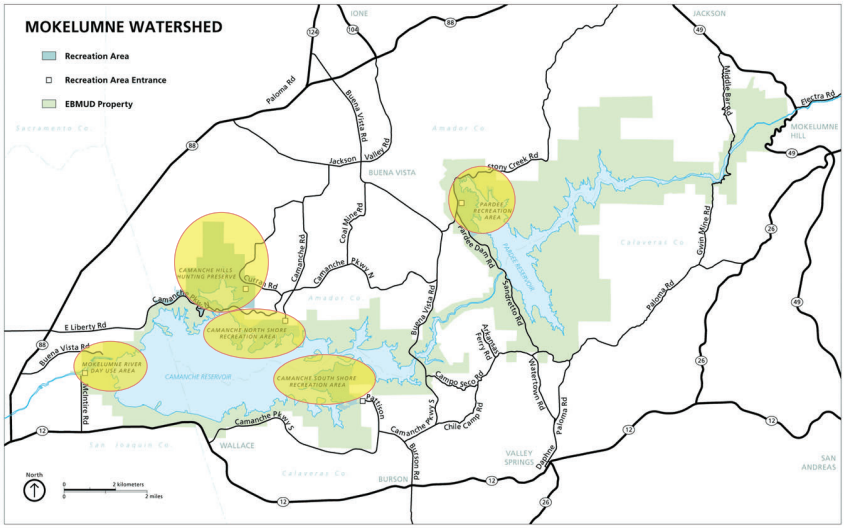
Meeting date	Topic	Type	Organization	First name	Last name	Title/Role
9/19/24 - 1:30PM	Recreation	Non-Governmental Organization	Bike Lodi	Gordon	Mackay	Board Member
9/19/24 - 1:30PM	Recreation	Local govt	San Joaquin County /Camanche Regional Park Advisory Board (CRPAB)	Kent	Lambert	Board Member
9/19/24 - 1:30PM	Recreation	Non-Governmental Organization	Foothill Conservancy	Craig	Baracco	Director
9/19/24 - 1:30PM	Recreation	Non-Governmental Organization	Motherlode Bicycle Coalition	Rob	Williams	Board Member
9/19/24 - 1:30PM	Recreation	Local utility district	North San Joaquin Water Conservation District (NSJWCD)	Steve	Schwabauer	General Manager
9/19/24 - 1:30PM	Recreation	Federal Government	US Fish & Wildlife Service	Geoff	Steinhart	Habitat Restoration Coordinator
9/19/24 - 1:30PM	Recreation	Local utility district	Woodbridge Irrigation District (WID)	Keith	Bussman	General Manager
9/19/24 - 1:30PM	Recreation	Local utility district	Woodbridge Irrigation District (WID)	Brandon	Warmerdam	Deputy/Meter Admin

Recreation

Recreation

- Article 18 of Existing License
- Facilities within the FERC Project Boundary:
  - Mokelumne River Day Use Area (MRDUA)
  - Camanche Hills Hunting Preserve (CHHP)
  - Camanche North Shore Recreation Area
  - Camanche South Shore Recreation Area
  - Pardee Recreation Area
- Recreation Management Plan
- Events & Public Involvement Opportunities





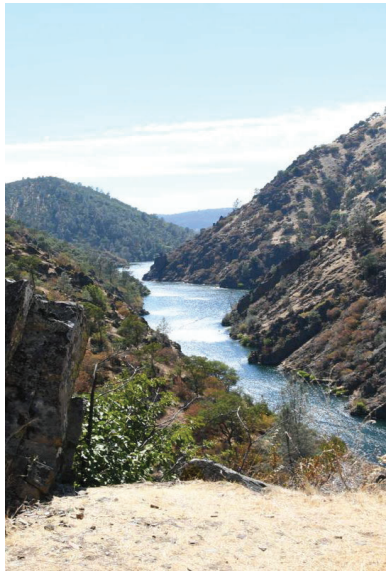
Mokelumne River Day Use Area

Camanche Hills Hunting Preserve

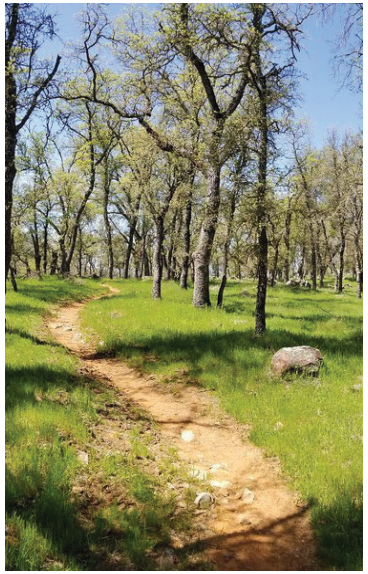
Camanche North Shore Recreation Area

Camanche South Shore Recreation Area

Pardee Recreation Area



Mokelumne Area Trails

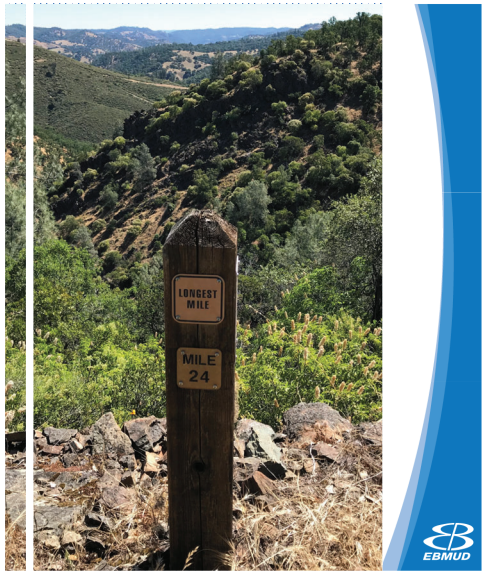


Mokelumne Coast To Crest Trail

- 29-mile hiking and equestrian trail
- John Bull Loop- 2.4-mile segment branching off the MCCT
- Independence Loop- 2-mile segment at MCCT eastern terminus

Trail access points:

- Camanche South Shore Staging Area- Equestrian and Hiking
- Cook Mesa- Hiking
- Campo Seco Staging Area- Equestrian and Hiking
- Rich Gulch- Hiking
- Middle Bar- Hiking



China Gulch Trail

- 4.9 miles trail or 9.8 miles round trip.
- China Gulch loop- 1.5-mile loop segment branching of the main trail.
- The China Gulch Trail system is multi-use for hikers and equestrians.

Lower Mokelumne River (Project 2916) Relicensing Interest Form

* Required

1. What is your name? *

   Enter your answer

2. What organization are you affiliated with? *

   Enter your answer

3. What is your e-mail address? *

   Enter your answer

4. What is your phone number?

   Enter your answer

5. Which resource topic(s) are you interested in being involved with as related to this Relicensing Project? (You may select more than one.) *

   - [ ] Botanical
   - [ ] Cultural and Tribal

   - [ ] Fish and Aquatics
   - [ ] Geology and Soils
   - [ ] Land Use and Aesthetics
   - [ ] Rare, Threatened and Endangered Species
   - [ ] Recreation
   - [ ] Socioeconomic and Environmental Justice
   - [ ] Terrestrial
   - [ ] Water Resources

6. Do you have any relevant studies or reports for one or more of the above topics that you feel may help provide additional relevant information related to this Project?

   Please enter at most 300 characters

7. Do you have any comments or input about this Project you would like to share?

   Please enter at most 300 characters

View results

Respondent

3 Anonymous

01:44
Time to complete

1. What is your name? *

Mary Boblet

2. What organization are you affiliated with? *

The Mokelumne Coast to Crest Trail Council

3. What is your e-mail address? *

mboblet@gmail.com

4. What is your phone number?

2092872268

5. Which resource topic(s) are you interested in being involved with as related to this Relicensing Project? (You may select more than one.) *

- [ ] Botanical
- [x] Cultural and Tribal
- [ ] Fish and Aquatics
- [ ] Geology and Soils
- [ ] Land Use and Aesthetics
- [ ] Rare, Threatened and Endangered Species
- [x] Recreation
- [x] Socioeconomic and Environmental Justice
- [ ] Terrestrial
- [ ] Water Resources

6. Do you have any relevant studies or reports for one or more of the above topics that you feel may help provide additional relevant information related to this Project?

I am aware of the The Mokelumne Avoided Cost Analysis, completed in 2014

Please enter at most 300 characters

7. Do you have any comments or input about this Project you would like to share?

Please enter at most 300 characters

View results

Respondent

4 Anonymous

00:40
Time to complete

1. What is your name? *

Janelle Nolan

2. What organization are you affiliated with? *

JNA Consulting

3. What is your e-mail address? *

janelle@jna-consulting.com

4. What is your phone number?

5. Which resource topic(s) are you interested in being involved with as related to this Relicensing Project? (You may select more than one.) *

- [x] Botanical
- [ ] Cultural and Tribal
- [x] Fish and Aquatics
- [ ] Geology and Soils
- [x] Land Use and Aesthetics
- [x] Rare, Threatened and Endangered Species
- [ ] Recreation
- [ ] Socioeconomic and Environmental Justice
- [x] Terrestrial
- [x] Water Resources

6. Do you have any relevant studies or reports for one or more of the above topics that you feel may help provide additional relevant information related to this Project?

Please enter at most 300 characters

7. Do you have any comments or input about this Project you would like to share?

Please enter at most 300 characters

View results

Respondent

5 Anonymous

01:19
Time to complete

1. What is your name? *

Susan Kester

2. What organization are you affiliated with? *

PG&E

3. What is your e-mail address? *

susan.kester@pge.com

4. What is your phone number?

415-264-7197

5. Which resource topic(s) are you interested in being involved with as related to this Relicensing Project? (You may select more than one.) *

- [x] Botanical
- [x] Cultural and Tribal
- [x] Fish and Aquatics
- [x] Geology and Soils
- [x] Land Use and Aesthetics
- [x] Rare, Threatened and Endangered Species
- [x] Recreation
- [x] Socioeconomic and Environmental Justice
- [x] Terrestrial
- [x] Water Resources

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Please enter at most 300 characters

7. Do you have any comments or input about this Project you would like to share?

Please enter at most 300 characters

View results

Respondent

6 Anonymous

01:07
Time to complete

1. What is your name? *

Tom Holley

2. What organization are you affiliated with? *

NOAA Fisheries

3. What is your e-mail address? *

thomas.holley@noaa.gov

4. What is your phone number?

916.930.5592

5. Which resource topic(s) are you interested in being involved with as related to this Relicensing Project? (You may select more than one.) *

- [ ] Botanical
- [ ] Cultural and Tribal
- [x] Fish and Aquatics
- [x] Geology and Soils
- [ ] Land Use and Aesthetics
- [x] Rare, Threatened and Endangered Species
- [ ] Recreation
- [ ] Socioeconomic and Environmental Justice
- [ ] Terrestrial
- [x] Water Resources

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Please enter at most 300 characters

7. Do you have any comments or input about this Project you would like to share?

Please enter at most 300 characters

View results

Respondent

3 Anonymous

01:44
Time to complete

1. What is your name? *

Mary Boblet

2. What organization are you affiliated with? *

The Mokelumne Coast to Crest Trail Council

3. What is your e-mail address? *

mboblet@gmail.com

4. What is your phone number?

2092872268

1/9/25, 10:52 AM Lower Mokelumne River (Project 2916) Relicensing Interest Form

5. Which resource topic(s) are you interested in being involved with as related to this Relicensing Project? (You may select more than one.) *

- [ ] Botanical
- [x] Cultural and Tribal
- [ ] Fish and Aquatics
- [ ] Geology and Soils
- [ ] Land Use and Aesthetics
- [ ] Rare, Threatened and Endangered Species
- [x] Recreation
- [x] Socioeconomic and Environmental Justice
- [ ] Terrestrial
- [ ] Water Resources

6. Do you have any relevant studies or reports for one or more of the above topics that you feel may help provide additional relevant information related to this Project?

I am aware of the The Mokelumne Avoided Cost Analysis, completed in 2014

Please enter at most 300 characters

7. Do you have any comments or input about this Project you would like to share?

Please enter at most 300 characters

East Bay Municipal Utility District
Lower Mokelumne River Project Relicensing
FERC Project No. 2916

EARLY ENGAGEMENT MEETING

October 2, 2024
10:00am – 11:30am
Mokelumne Watershed Headquarters Office
15083 Camanche Pkwy S. Valley Springs, CA 95252

AGENDA

10:00 a.m. Welcome, Meeting Ground Rules, and Introductions
Meeting Goals and Objectives
EBMUD: Kathryn Horn & Priyanka Jain

10:15 a.m. FERC Relicensing, ILP Schedule, and Opportunities for Engagement
Kleinschmidt Associates: Shannon Luoma

10:30 a.m. Project 2916 – Lower Mokelumne River Overview

- Camanche and Pardee Project Overview
  EBMUD: Joe Tam
- Resource Specific Overview
  Shannon Luoma & EBMUD: Chuck Beckman

11:00 a.m. Discussion and Questions

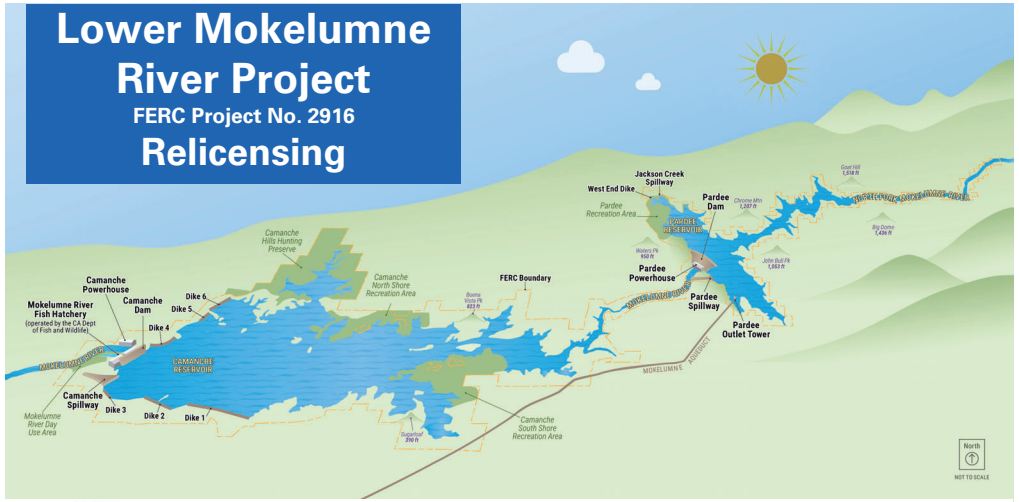
- Existing Resource Management Information (Plans/Reports/Data)
- Relevant resource information for the Pre-Application Document (PAD)
- Engagement Opportunities
  Shannon Luoma & Priyanka Jain w/ input from Attendees

11:25 a.m. Next Steps
Kathryn Horn & Priyanka Jain

Scan QR code to
connect to the website
and submit interest form.

Attendees at Early Engagement Meetings

Meeting date	Topic	Type	Organization	First name	Last name	Title/Role
10/2/24 - 10:00AM	Tribal interests	Tribe	Calaveras Band of Me-Wuk Indians	Debra	Grimes	Vice Chair
10/2/24 - 10:00AM	Tribal interests	Tribe	Central Valley Me-Wuk	Lawrence	Wilson, Jr.	Senior Cultural Resources Specialist



EBMUD

Early Engagement Meeting with Tribes
October 2, 2024

Kleinschmidt

Agenda

Meeting Goals/Objectives, Meeting Ground Rules, and Introductions

FERC Relicensing Process, Schedule, and Engagement Opportunities

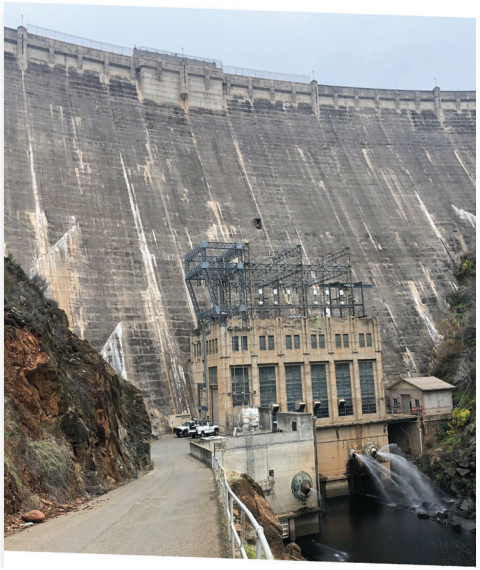
Lower Mokelumne River Project System Overview

Project Component Overview

Request for Relevant Data and Information

Next Steps

EBMUD



Meeting Goals & Objectives

- ✓ To provide an overview of the FERC Relicense Process
- ✓ To provide an overview of the Lower Mokelumne River Project (FERC Project 2916) system and a high-level understanding of the meeting subject matter.
- ✓ To provide an opportunity to hear questions, comments as related to the Lower Mokelumne River Project.
- ✓ To be provided with data relevant to the Lower Mokelumne River Project – either to enhance or fill in data gaps.
- ✓ To meet become familiar and meet with the EBMUD project relicense team and interested parties.

EBMUD

Meeting Ground Rules

1.Meeting will begin and end on time

2.Stay present and turn off/silence cell phones

3.Use common conversational courtesy

4.Hold questions until the end of each section presentation

5.Acknowledge and respect the nature of the discussion as related to cultural resources and the need to keep it confidential.

Lower Mokelumne River Project Relicensing Team

EBMUD Relicensing Team

Priyanka Jain
Project Manager

Brad Ledesma
Manager, Water Resources Planning Division

Kathryn Horn
Community Affairs Rep

Joe Tam
Dam Safety Technical Lead

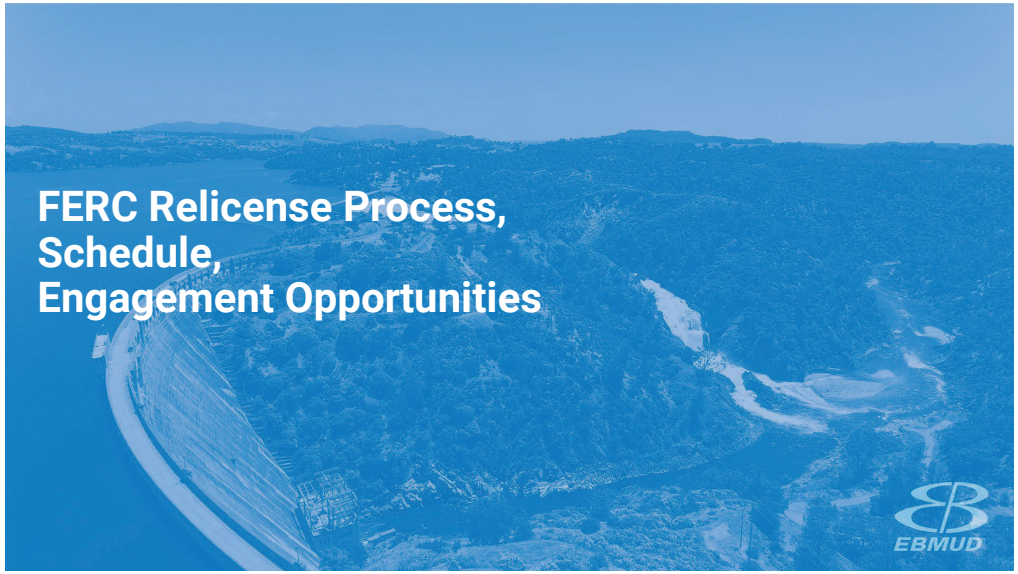
Michelle Workman
Fisheries & Wildlife Technical Lead

Chuck Beckman
Recreation Technical Lead

Consultant Team

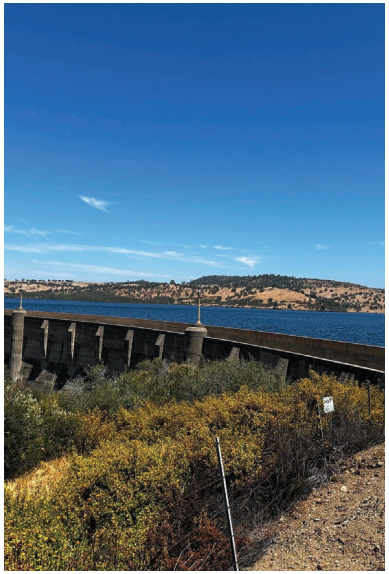
Shannon Luoma
Project Manager

Fatima Oswald
Assistant Project Manager



Federal Energy Regulatory Commission (FERC)

- Federal Power Commission (FPC) - created in 1920 to license hydroelectric projects. FPC replaced by the Federal Energy Regulatory Commission (FERC) in 1977 (under DOE)
- FERC regulates electrical transmission, natural gas, oil transportation, **hydroelectric dam licensing and safety;** and certification of qualifying facilities.
- FERC's Hydro-related authority (i.e., Federal Power Act):
  - Hydro facilities on navigable waters
  - FERC licenses newly constructed hydro projects
  - FERC relicenses existing projects
  - FERC license compliance, including environmental and dam safety



FERC Relicensing

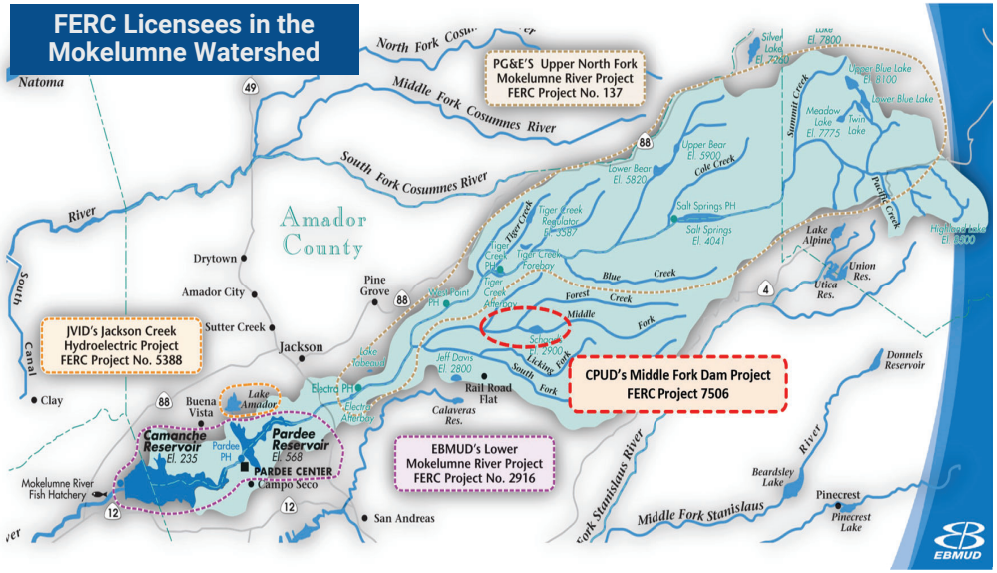
What is a License?

- "Permit to operate"
- Specifies conditions for construction, operation, and maintenance of a project
- Default term is 40 years
- License can be amended during license term

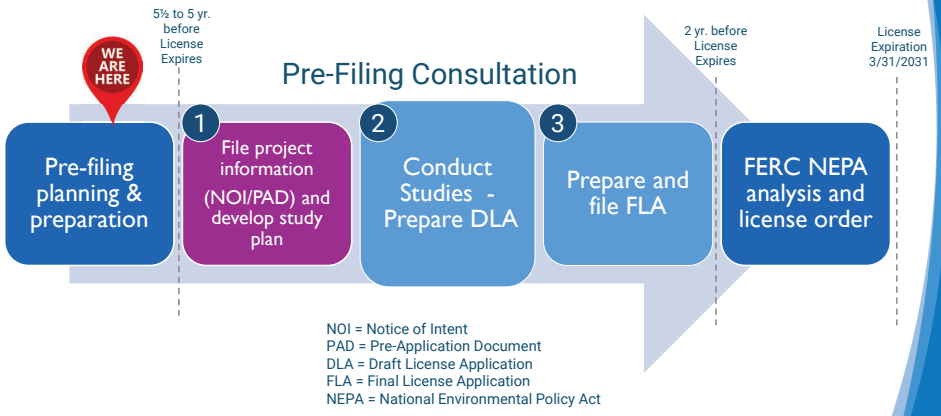
What is a Relicensing?

- 5 to 7-year process
- Setting new (updated) operating conditions for the next 40+ year license
- Brings project in compliance with regulation changes since the previous license
- Involves multiple interested parties with public involvement opportunities
- Opportunity to add capacity, change operations, new construction, etc

FERC Licensees in the Mokelumne Watershed



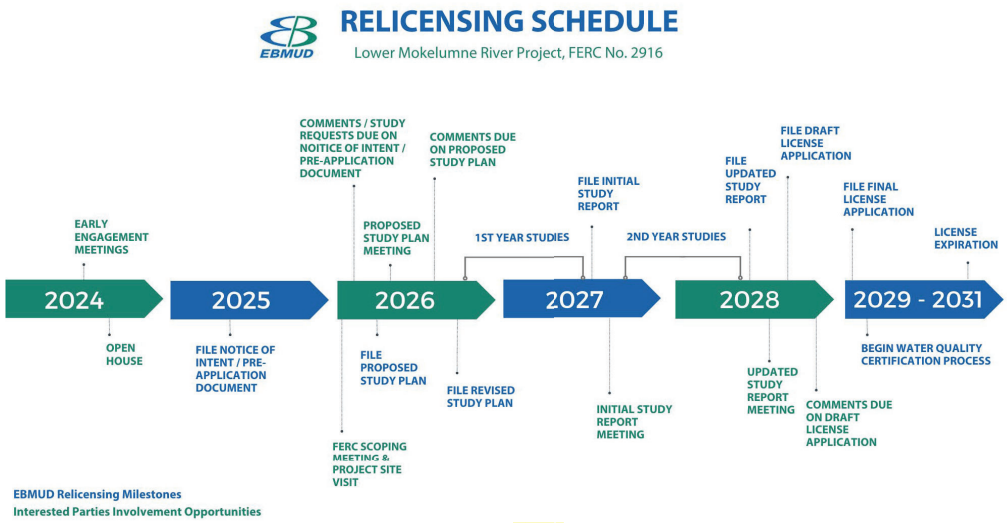
Project Relicensing Schedule



Pre-filing, Planning and Preparation

Call to identify data gaps and share information

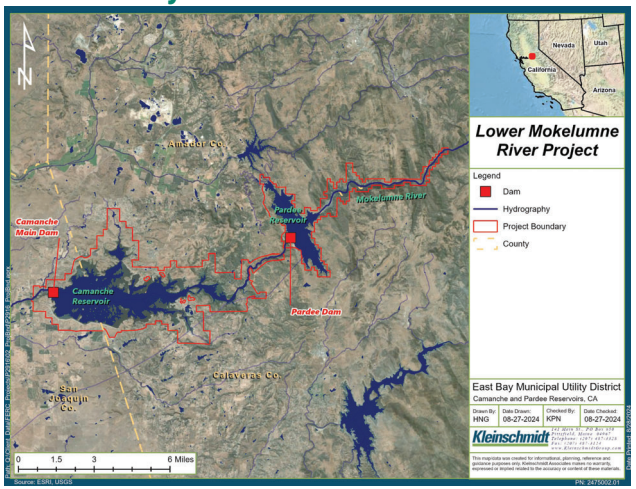
- Focus Group meetings (today!)
- Public Open House (October 29, 2024)
- Technical Working Groups (Summer 2025)



Pre-Application Document and Notice of Intent

- October 2025
- The PAD and NOI are the first steps in the formal FERC process
- Summaries of existing data or studies
- Known data gaps or potential impacts and issues
- Existing and proposed PME measures

FERC Typical Resource Areas Considered for a New Hydroelectric License



- Geology and Soils
- Water Resources
- Fish and Aquatics
- Terrestrial
- Rare, Threatened and Endangered Species
- Cultural and Tribal
- Recreation
- Land Use and Aesthetics
- Socioeconomic and Environmental Justice

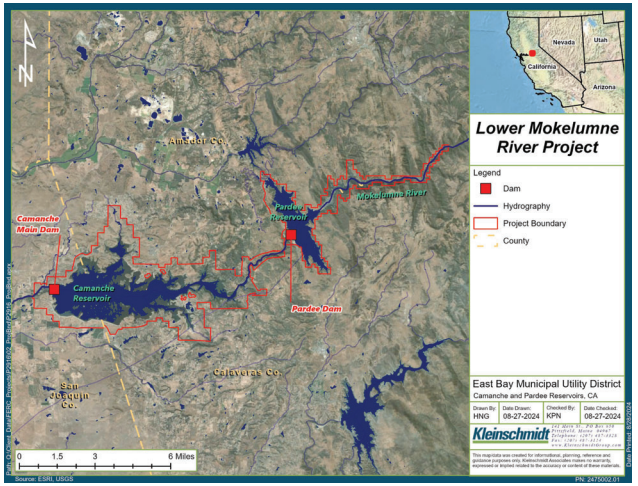
Study Plan Development & Implementation

Content of Study Request (18 CFR § 5.9(b)) - 7 FERC Criteria

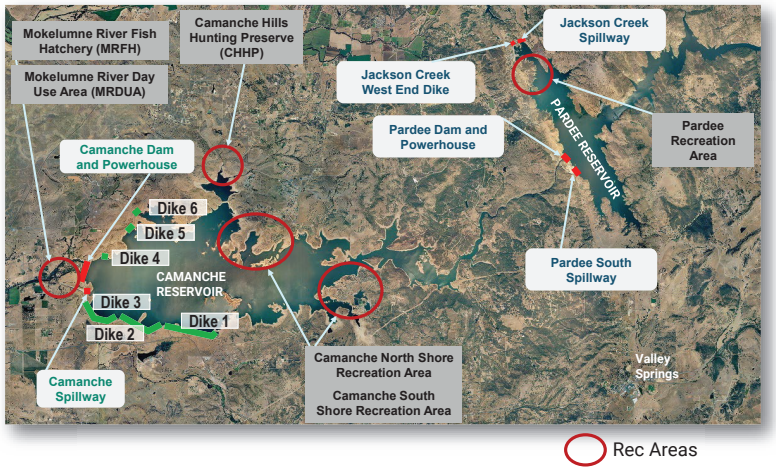
1) Goals and objectives of study proposal
2) Relevant resource management goals
3) Relevant public interest considerations
4) **Existing information, and need for additional information**
5) **Nexus between project operations and effects**
6) Study methodology and generally accepted practice
7) Level of effort and cost

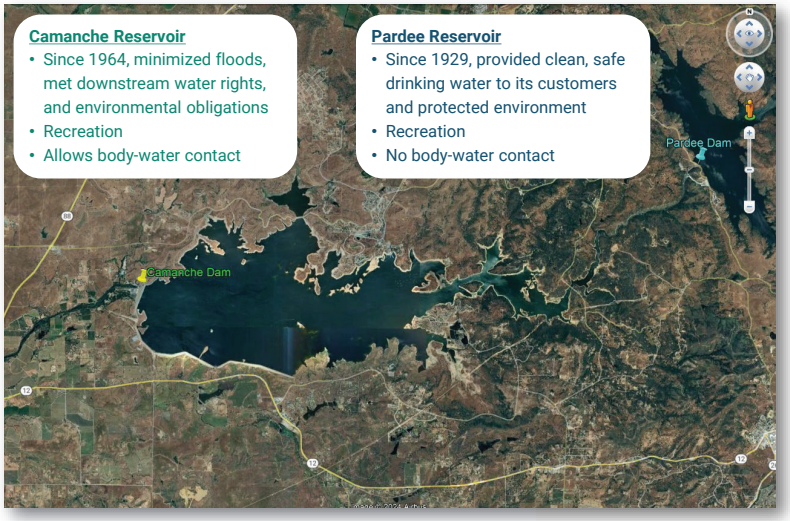
Lower Mokelumne River Project System Overview

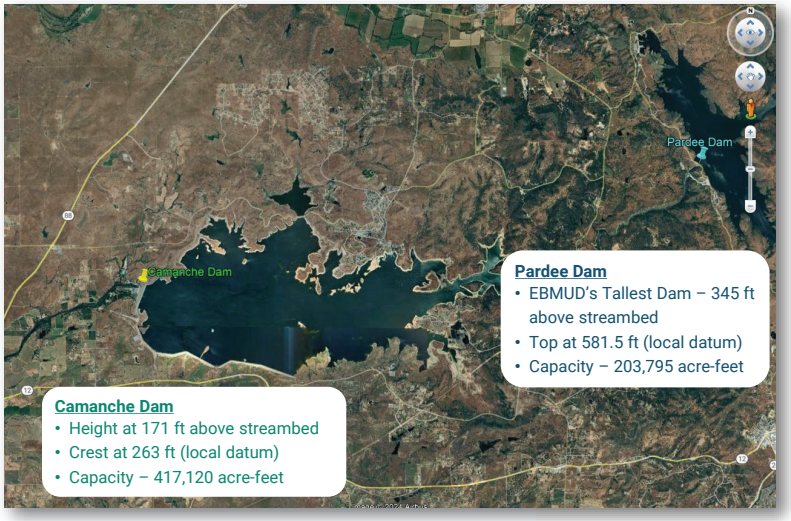
Lower Mokelumne River (P-2916) - FERC Project Boundary



Lower Mokelumne River Project Features







Camanche Dam
- Zoned Earth Dam with Impervious Core
- 34.5 ft wide crest
- 750 ft wide base

Pardee Dam
- Curved Concrete Gravity Dam
- 16 ft wide crest
- 239 ft wide base

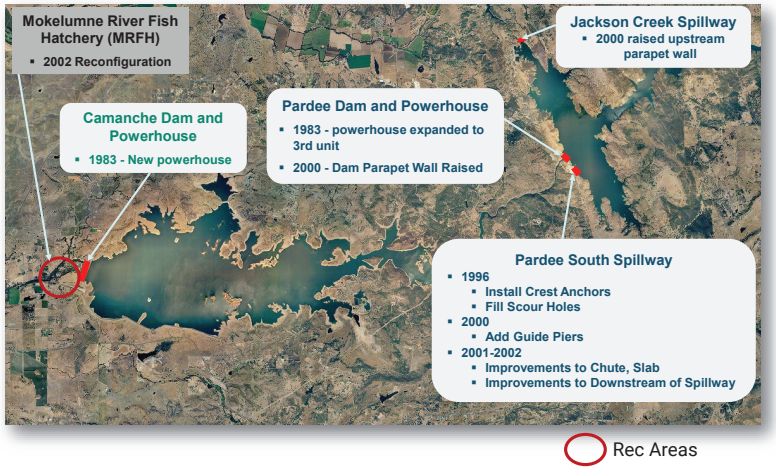
Camanche Dam Power Generation
- 9.45 MW authorized installed capacity

Pardee Dam Power Generation
- 28.6 MW authorized installed capacity

Camanche Spillway
- Ungated crest and concrete channel
- Highest flow – 1,630 cfs (1986)
- Not near flow capacity

Pardee South Spillway
- Ungated crest and concrete channel
- Highest flow – 33,000 cfs (1997)
- Not near flow capacity

Lower Mokelumne River Project Major Upgrades Since Initial Construction



EBMUD

Cultural and Tribal Resources

Existing Cultural Resource Management

- *Camanche and Pardee Reservoirs Cultural Resources Management Plan.*
  - Plan for considering and managing effects of activities associated with operating and maintaining EBMUD's Camanche and Pardee Reservoirs.
  - Ensures EBMUD's compliance under Section 106 of the National Historic Preservation Act (NHPA) and California Environmental Quality Act (CEQA).
- Native American Graves Protection and Repatriation Act (NAGPRA) & CalNAGPRA
  - EBMUD has been working closely with the California State University, Sacramento, in compliance with NAGPRA and CalNAGPRA to repatriate collections that have been removed from the watershed. The items were found to have a connection between the Buena Vista Rancheria of Me-Wuk Indians of California and the Ione Band of Miwok Indians of California.

Historic Properties Management Plan (HPMP)

- Section 106 of the National Historic Preservation Act (NHPA)
- Development and implementation of a Historic Properties Management Plan (HPMP) is required as a license condition.
- The HPMP should provide for the management of properties listed in or eligible for listing in the National Register of Historic Places.

Historic Properties Management Plan (HPMP)

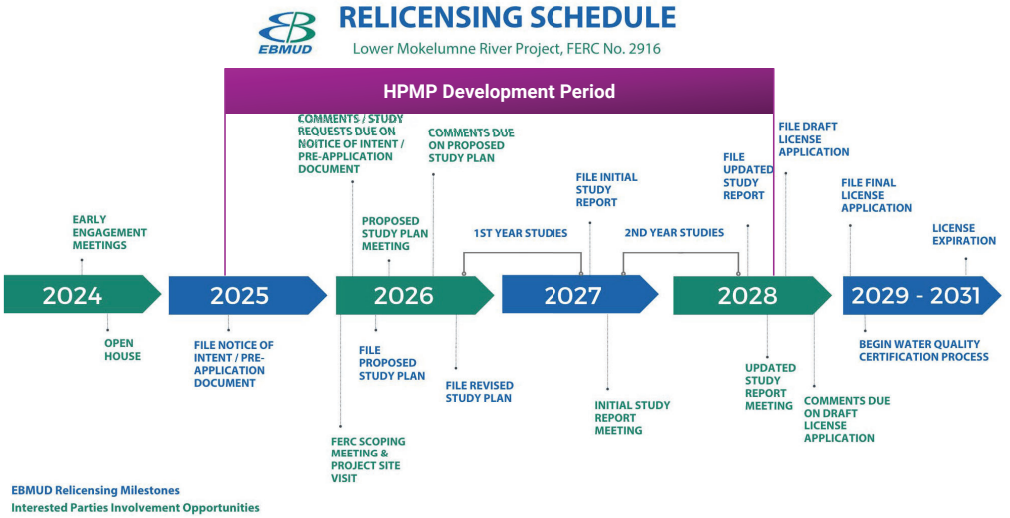
A plan for **considering and managing effects on historic properties** of activities associated with constructing, operating, and maintaining hydropower projects.

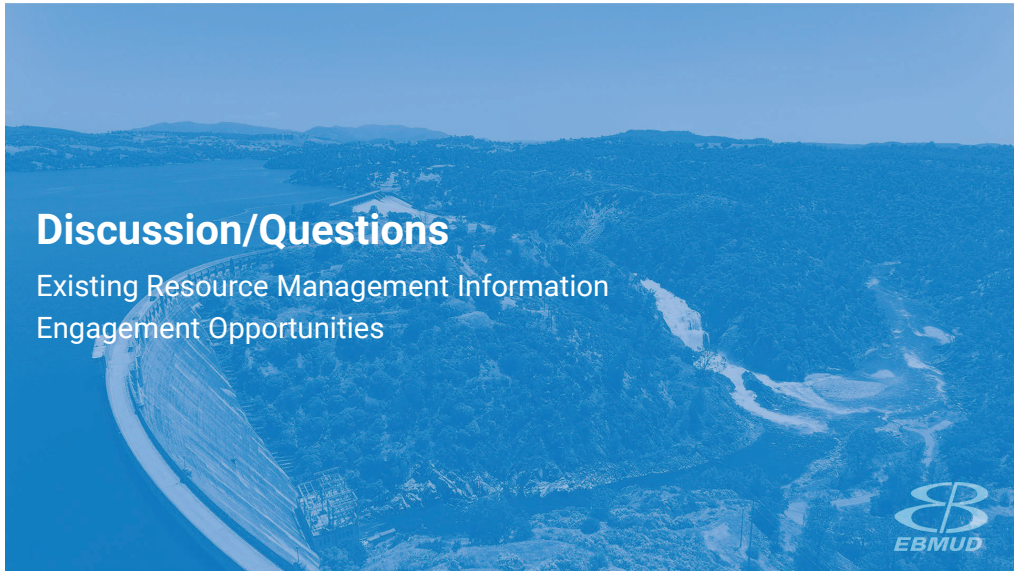
Establishes a decision-making process for considering potential effects on historic properties early in project planning.

- ✓ Properties of traditional religious and cultural significance
- ✓ Project facilities, such as the dam, powerhouse and substations
- ✓ Other kinds of buildings and structures
- ✓ Prehistoric and historic archeological sites

Drafting the HPMP

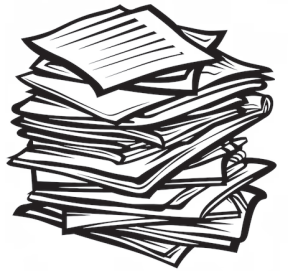
- HPMP to be developed during the prefiling stage--from the notice of intent to filing an application (2025 – 2028).
- Incorporates close coordination and consultation with State and/or Tribal Historic Preservation Officer, local tribes, and other interested parties.
- Prefiling consultation is already required through the Federal Power Act.
- Contents of the HPMP
  - Overview Executive Summary
  - Background Information
  - Project Management and Preservation Goals and Priorities
  - Project Effects and Mitigation/ Management Measures
  - Implementation Procedures





P-2916 Lower Mokelumne River Project:
Existing Constraints

- FERC License
- Water Rights Licenses & Agreements
- Army Corps Water Control Manual
- Joint Settlement Agreement
- *Others*



Existing Resource Management Information

(Plans/Reports/Data)

- Plans/Reports/Data
- Organization Management Objectives or Goals

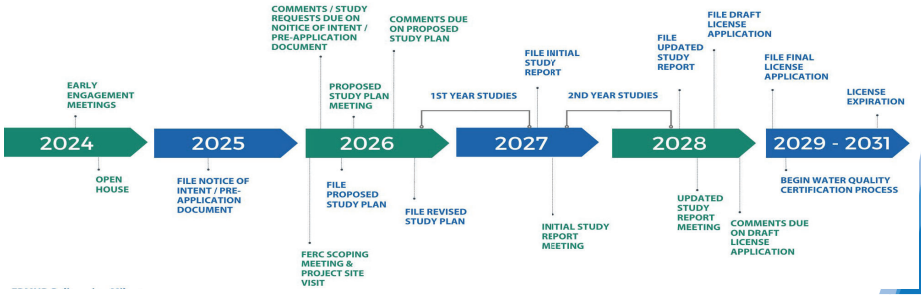
P-2916 Lower Mokelumne River:
Data/Information Relevant to Project

- Existing Interested Parties, Management Plans, Reports, Data, and or New Information?
- Please send information to MokRelicense@ebmud.com by **November 30, 2024**.

Next Steps

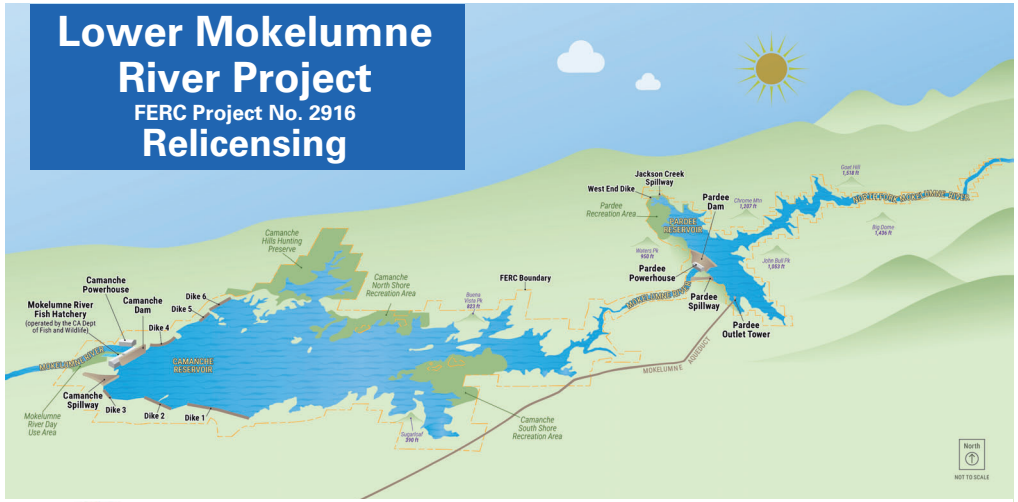
Opportunities to Engage through 2026

- **Open House** (October 29, 2024)
- **Technical Working Groups** (Summer 2025)
- **Scoping Meeting and Site Visit** (January 2026)
- **PAD Comment Period/Study Requests** (October 2025 – mid-February 2026)
- **Proposed Study Plan Meeting** (April 2026)
- **PSP Comment Period** (June 2026)



Stay Engaged:

- Check the Project website for updates and to submit interest form: https://www.ebmud.com/MokRelicense
- Sign up for FERC's e-subscription (docket number "P-2916") at www.FERC.gov
- Email Project email address with questions: MokRelicense@ebmud.com



EBMUD

THANK YOU.

Kleinschmidt

From:	MokRelicense
Cc:	MokRelicense; Jain, Priyanka
Bcc:	faxe@amadorgov.org; mrock@amadorgov.org; info@amadorflyfishers.org; bradleybooker@amadortrailstewardship.com; brettwatson@amadortrailstewardship.com; awillis@americanrivers.org; theresa@americanwhitewater.org; Nick.Bauer@Wildlife.ca.gov; skyler.burson@wildlife.ca.gov; Mike.Healey@wildlife.ca.gov; Jason.Julienne@wildlife.ca.gov; morgan.kilgour@wildlife.ca.gov; Beth.Lawson@wildlife.ca.gov; Duane.Linander@wildlife.ca.gov; Michael.Maher@wildlife.ca.gov; colin.purdy@wildlife.ca.gov; Briana.Seapy@wildlife.ca.gov; JGaramendi@calaverascounty.gov; rdickinson@calcofire.org; kellyg@ccwd.org; calaverascap@gmail.com; travis.small@cpud.org; rob@calbike.org; mike.blankenheim@fire.ca.gov; nick.casci@fire.ca.gov; camhil@camhills.com; hguerrero@golakecamanche.com; Barfield, Lorna; mgaramendi1@hotmail.com; blancapaloma@msn.com; deltaflyfishers@gmail.com; Maria.Perez@parks.ca.gov; kgallino@co.calaveras.ca.us; fhc@foothillconservancy.org; jobsonbrian@hotmail.com; info@goldenstatesalmon.org; steve@jvid.org; Melinda Hammond; jvfd@volcano.net; kgrant@lodi.gov; sjcrcd@outlook.com; mboblet@gmail.com; carolyn.motherlodelandtrust@gmail.com; president@nccffi.org; Jonathan.ambrose@noaa.gov; deon.bryant@noaa.gov; steve.edmondson@noaa.gov; william.foster@noaa.gov; Monica.Gutierrez@noaa.gov; thomas.holley@noaa.gov; Yulia.Lim@noaa.gov; jake.rennert@noaa.gov; catherine_brown@nps.gov; jcvalente@softcom.net; Steve@NSJWCD.com; bburkhalter@goexplorus.com; jvasbinder@sjgov.org; arcinfo@pge.com; CCB0@pge.com; CWHF@pge.com; ROSK@pge.com; A1ZK@pge.com; heinrich.albert@outlook.com; Dyane.Osorio@sierraclub.org; eric.bradbury@waterboards.ca.gov; Nathan.Fisch@waterboards.ca.gov; Robert.McCarthy@Waterboards.ca.gov; alessandra.rigo@waterboards.ca.gov; Nicole.Williamson@waterboards.ca.gov; jennifer.spaletta@stoel.com; bcook@tu.org; rsykes@umrwa.org; khiatt@usbr.gov; jaisrael@usbr.gov; dsumer@usbr.gov; lauren_estenson@fws.gov; richard_kuyper@fws.gov; stephanie_millsap@fws.gov; donald_ratcliff@fws.gov; geoffrey_steinhart@fws.gov; heather_swinney@fws.gov; john_wikert@fws.gov; bussmanwid@gmail.com; jcantuwid@gmail.com; widirrigation@gmail.com; widversteeg@gmail.com; widvandam@gmail.com; rhonda@buenavistatribe.com; sabrina@bvtribe.com; mike@bvtribe.com; matessa@bvtribe.com; meghan@bvtribe.com; Jennifer.Garcia@wildlife.ca.gov; nahc@nahc.ca.gov; l.ewilson@yahoo.com; lmathiesen@crtribal.com; cprout@colfaxrancheria.com; jlfisher@csus.edu; consultation@ionemiwok.net; adalton@jacksoncasino.com; valdezcome@comcast.net; canutes@verizon.net; rcuellar@ssband.org; Neil.Peyron@tulerivertribe-nsn.gov; receptionist@mewuk.com; bguth@auburnrancheria.com; serrell.smokey@washoetribe.us; jtarango@wiltonrancheria-nsn.gov; Chief6100@live.com; Tam, Joe
Subject:	Lower Mokelumne River Project 2916 Relicensing Open House & Pre-PAD Questionnaire
Date:	Friday, October 11, 2024 4:52:00 PM
Attachments:	image001.png Oct2024 FERC Open House Flyer.pdf October 2024 EBMUD Pre-PAD Questionnaire.pdf

East Bay Municipal Utility District (EBMUD) invites interested parties to attend the Lower Mokelumne River (LMR) Project 2916 Relicensing Open House on **Tuesday, October 29**. Please see attached flyer for details. This is an opportunity to learn about the relicensing process, learn about the Lower Mokelumne River project, engage and ask questions of the key EBMUD staff, and enjoy some light refreshments while overlooking Pardee Reservoir.

Tuesday, October 29, 2024 | Anytime between 10:00 am - 3:00 pm
McLean Hall, Pardee Center
3535 Sandretto Road, Valley Springs, CA
Please RSVP to MokRelicense@ebmud.com

Feel free to forward this invitation to others who may be interested.

In addition, we would like to hear from you, as we work towards developing our Pre-Application Document (PAD), on your level of interest and involvement in the relicensing process. Please take a few moments to complete the attached questionnaire. Completed forms can be emailed to us at MokRelicense@ebmud.com

Thank you

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Open House

FERC RELICENSING PROJECT

Tuesday | October 29, 2024 | 10am-3pm

McLean Hall- Pardee Center
3535 Sandretto Road, Valley Springs, CA

You're invited to drop by any time between 10am-3pm for this Open House event to learn more about the FERC relicensing project, provide feedback, meet the team, and get involved! Light refreshments will be available.

EBMUD

RSVP: MokRelicense@ebmud.com

EBMUD.COM/MOKRELICENSE

East Bay Municipal Utility District

Lower Mokelumne River Relicensing Project
FERC Project No. 2916

East Bay Municipal Utility District (EBMUD) operates hydropower facilities at Pardee and Camanche Dams under a 50-year license issued by the Federal Energy Regulatory Commission (FERC). In addition to permitting hydropower generation, the FERC license (Project No. 2916) requires adherence to operational regulations and terms related to public safety, recreation, and environmental protection.

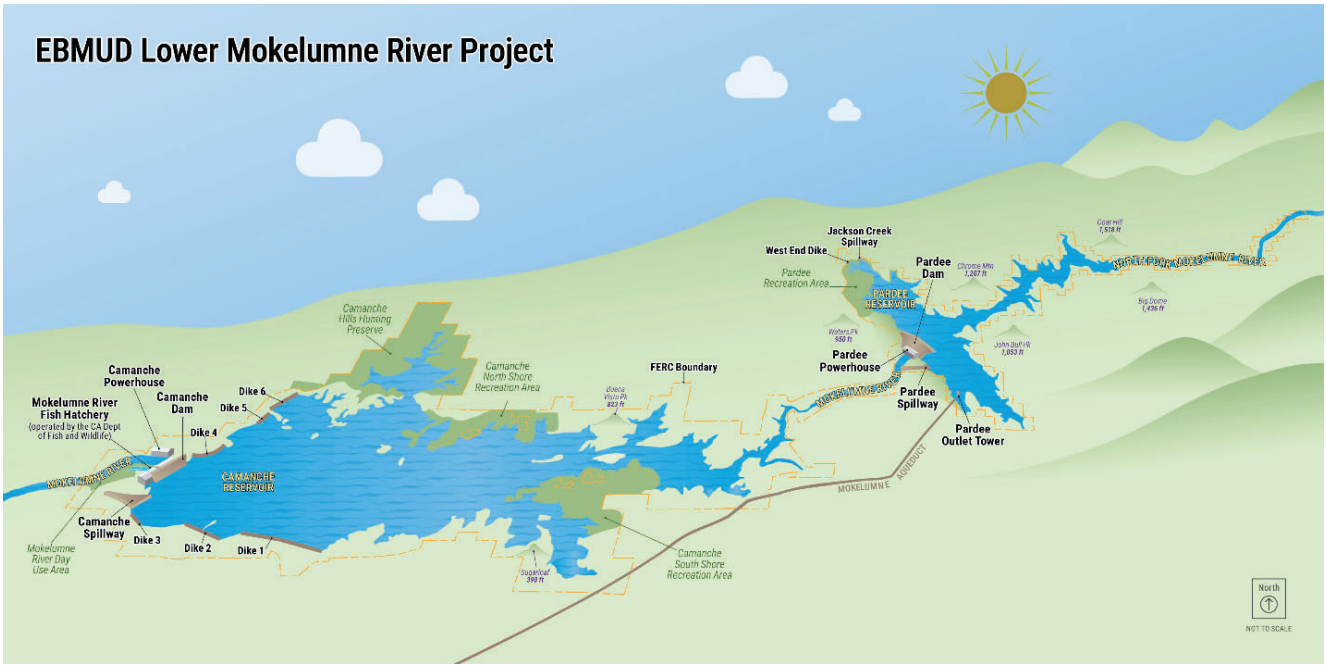
The current license, which took effect April 1, 1981, is set to expire on March 31, 2031. EBMUD seeks the renewal of its license to continue operating the hydropower facilities and has begun the planning for this relicensing process through early engagement activities.

This relicensing process aims to continue to balance EBMUD existing water supply commitments and environmental benefits with hydropower project operations. The Lower Mokelumne River Project serves many needs, such as supplying water to the East Bay, flood control, the protection of fish and wildlife resources, recreation, power generation, and protection of cultural resources. As part of the relicensing process, EBMUD will comply with several environmental and regulatory requirements (e.g., National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and Clean Water Act section 401 Water Quality Certification).

At the conclusion of the relicensing process and upon approval, FERC will issue a new license with conditions that continue to balance the needs of water supply, flood control, power generation, and protection of the environment and cultural resources.

We would like to hear from you in regard to this process; please take a few minutes to complete our brief questionnaire below.

Please visit our website at https://www.ebmud.com/mokrelicense, or contact MokRelicense@ebmud.com or (510) 287-0141 with any questions about the Project.



Lower Mokelumne River Project, FERC No. 2916

1. **Contact Information for person completing the questionnaire:**

Name & Title: _____
Organization: _____
Address: _____
_____
Phone: _____
Email: _____

2. **Are you or your organization planning to participate in this relicensing process?**

◯ Yes ◯ No

3. **Do you know of any available materials or information related to either the existing Project or the Project's environment?**

◯ Yes ***(If yes, please complete 2a thru 2e.)*** ◯ No ***(If no, please skip to 3.)***

2(a) **Please indicate the specific resource area(s) for which you have information:**

☐	a) Geology and soils	☐	g) Recreation and land use
☐	b) Water resources	☐	h) Aesthetic resources
☐	c) Fish and aquatic resources	☐	i) Cultural resources
☐	d) Wildlife and botanical resources	☐	j) Socioeconomic and/or Environmental Justice resources
☐	e) Wetlands, riparian, and littoral habitat	☐	k) Tribal resources
☐	f) Rare, threatened & endangered species		

2(b) **Please briefly describe the information or list citations of available documents:** ***(Additional information may be provided on a separate page.)***

2(c) **Where and how can EBMUD obtain this information?**

2(d) **Please provide the names of other persons in your organization with whom EBMUD could potentially follow-up for information on the resource area(s) checked above. If you know of others outside your organization and who may have relevant information, please provide their name(s) and contact information as well.** ***(Additional contacts may be provided on a separate page.)***

Representative Contact Information

Name & Title: _____
Address: _____
_____
Phone: _____
Email: _____

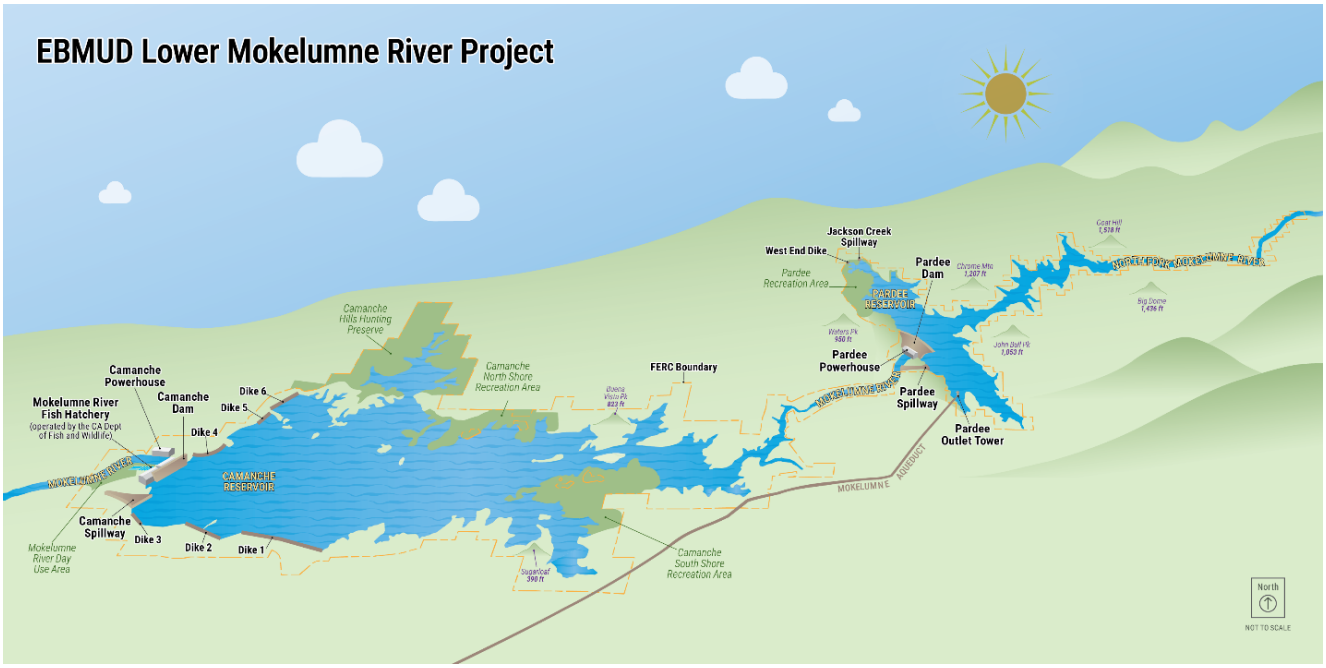
Other Contact Information

Name & Title: _____
Organization: _____
Address: _____
_____
Phone: _____
Email: _____

2(e) **For the resource area(s) identified in 2a, list any specific issues (e.g., impacts on water quality, wildlife habitat, endangered species, or cultural resources) that to your knowledge, may result from the Project's operations. Also if applicable, please identify any additional information needed, to better characterize those issues.** ***(Additional information may be provided on a separate page.)***

Resource Area	Specific Issue/Additional Information Needed

3. ***Thank you for your time.*** **Please provide any additional comments and/or questions regarding the relicensing of the Lower Mokelumne River Project below:**



Lower Mokelumne River Project, FERC No. 2916

1. **Contact Information for person completing the questionnaire:**

Name & Title:	William E. Foster, M.S.; Fishery Biologist, National Marine Fisheries Service (NMFS)
Organization:	NMFS, West Coast Region, California Central Valley Area Office, FERC Branch,
Address:	650 Capitol Mall, Suite 5-100
	Sacramento CA 95814
Phone:	916-844-9836
Email:	William.Foster@noaa.gov

2. **Are you or your organization planning to participate in this relicensing process?**

◯ Yes ◯ No

3. **Do you know of any available materials or information related to either the existing Project or the Project's environment?**

◯ Yes ***(If yes, please complete 2a thru 2e.)*** ◯ No ***(If no, please skip to 3.)***

2(a) **Please indicate the specific resource area(s) for which you have information:**

☐	a) Geology and soils	☐	g) Recreation and land use
☐	b) Water resources	☐	h) Aesthetic resources
☑	c) Fish and aquatic resources	☐	i) Cultural resources
☐	d) Wildlife and botanical resources	☐	j) Socioeconomic and/or Environmental Justice resources
☑	e) Wetlands, riparian, and littoral habitat	☐	k) Tribal resources
☑	f) Rare, threatened & endangered species		

2(b) **Please briefly describe the information or list citations of available documents:** ***(Additional information may be provided on a separate page.)***

NMFS. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley (CV) Spring-run Chinook Salmon and the Distinct Population Segment of California CV Steelhead. California CV Office (CCVO). July 2014. (http://www.nmfs.noaa.gov/pr/recovery/plans.htm).

NMFS. Tech. Memo. #NMFS-SWFSC-706. CV Spring-run Salmon in the San Joaquin River Basin. CCVO. October 2024. (https://doi.org/10.25923/t7c1-3229).

2(c) **Where and how can EBMUD obtain this information?**

Download NMFS CV Valley Recovery Plan at: (http://www.nmfs.noaa.gov/pr/recovery/plans.htm)

Download NMFS Tech. Memo. #NMFS-SWFSC-706 at: (https://doi.org/10.25923/t7c1-3229)

2(d) **Please provide the names of other persons in your organization with whom EBMUD could potentially follow-up for information on the resource area(s) checked above. If you know of others outside your organization and who may have relevant information, please provide their name(s) and contact information as well.** ***(Additional contacts may be provided on a separate page.)***

Representative Contact Information

Name & Title:	Steve Edmondson, FERC Branch Supervisor, NMFS, WCR, Santa Rosa Office
Address:	777 Sonoma Ave, Santa Rosa CA 95404-6515
Phone:	707-575-6052
Email:	Steve.Edmondson@noaa.gov

Other Contact Information

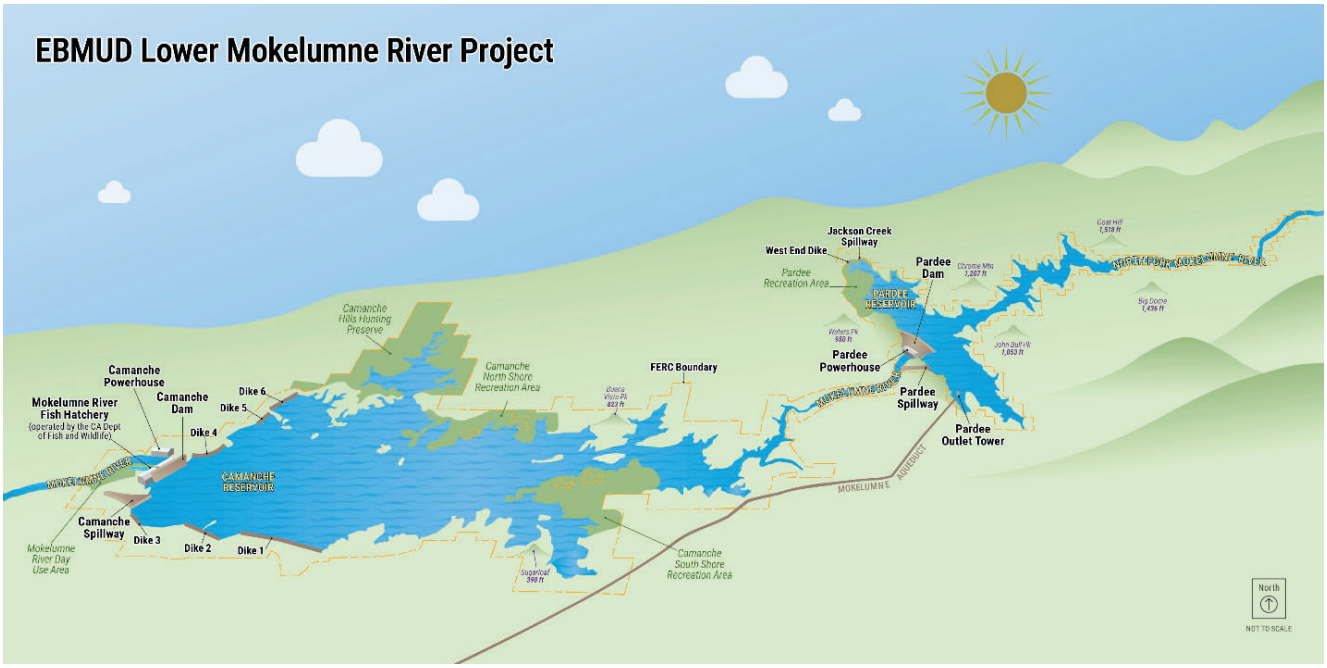
Name & Title: Thomas Holley, Hydrologist
Organization: NMFS, West Coast Region, California Central Valley Area Office, FERC Branch
Address: 650 Capitol Mall, Sacramento CA 95814-4718

Phone: 916-930-5592
Email: thomas.holley@noaa.gov

2(e) **For the resource area(s) identified in 2a, list any specific issues (e.g., impacts on water quality, wildlife habitat, endangered species, or cultural resources) that to your knowledge, may result from the Project's operations. Also if applicable, please identify any additional information needed, to better characterize those issues.** ***(Additional information may be provided on a separate page.)***

Resource Area	Specific Issue/Additional Information Needed
CV Salmonids: Fish Passage	Fish Passage to upper basin: Feasibility/Capacity habitat analysis
CV Salmonids: Water temperature	Water temperatures suitable for all lifestages of CV Salmonids
CV Salmonids: water flows	MIFs & Feb.-June Spring Pulse flows suitable for CV Salmonids
Climate Change	Study climate change's effects on Project and NMFS' resources
CV Salmonids: substrate blocked	spawning gravel and large woody debri suitable for CV Salmonids
Green Sturgeon	Study Project's effects on Green Sturgeon
CV Salmonids: Riparian/Rearing	Riparian/Cover/Rearing habitat suitable for all lifestages of CV Salmonids
CV Salmonids: Predation effects	Study Project's effects on Predation of all lifestages of CV Salmonids
CV Salmonids: Floodplain Habitat	Floodplain access suitable for Juvenile/Adult CV Salmonids

3. ***Thank you for your time.*** **Please provide any additional comments and/or questions regarding the relicensing of the Lower Mokelumne River Project below:**



Lower Mokelumne River Project, FERC No. 2916

1. **Contact Information for person completing the questionnaire:**

Name & Title:	Michael Maher
Organization:	California Department of Fish and Wildlife
Address:	1701 Nimbus Road
	Rancho Cordova, CA 95670
Phone:	(916) 597-5505
Email:	michael.maher@wildlife.ca.gov

2. **Are you or your organization planning to participate in this relicensing process?**

(●) Yes ( ) No

3. **Do you know of any available materials or information related to either the existing Project or the Project's environment?**

(●) Yes ***(If yes, please complete 2a thru 2e.)*** ( ) No ***(If no, please skip to 3.)***

2(a) **Please indicate the specific resource area(s) for which you have information:**

☐	a) Geology and soils	☐	g) Recreation and land use
☑	b) Water resources	☐	h) Aesthetic resources
☑	c) Fish and aquatic resources	☐	i) Cultural resources
☑	d) Wildlife and botanical resources	☐	j) Socioeconomic and/or Environmental Justice resources
☐	e) Wetlands, riparian, and littoral habitat	☐	k) Tribal resources
☑	f) Rare, threatened & endangered species		

2(b) **Please briefly describe the information or list citations of available documents:** ***(Additional information may be provided on a separate page.)***

See the comments below regarding resource studies and information relevant to the relicensing of the Lower Mokelumne River Hydroelectric Project (P-2916).

2(c) **Where and how can EBMUD obtain this information?**

See below

2(d) **Please provide the names of other persons in your organization with whom EBMUD could potentially follow-up for information on the resource area(s) checked above. If you know of others outside your organization and who may have relevant information, please provide their name(s) and contact information as well.** ***(Additional contacts may be provided on a separate page.)***

Representative Contact Information

Name & Title: Chris McKibbin
Address: 1701 Nimbus Road
Rancho Cordova, CA 95670
Phone:
Email: chris.mckibbin@wildlife.ca.gov

Other Contact Information

Name & Title: Jason Julienne
Organization: California Department of Fish and Wildlife
Address: 1701 Nimbus Road
Rancho Cordova, CA 95670
Phone:
Email: jason.julienne@wildlife.ca.gov

2(e) **For the resource area(s) identified in 2a, list any specific issues (e.g., impacts on water quality, wildlife habitat, endangered species, or cultural resources) that to your knowledge, may result from the Project's operations. Also if applicable, please identify any additional information needed, to better characterize those issues.** ***(Additional information may be provided on a separate page.)***

Resource Area	Specific Issue/Additional Information Needed
See below	See below

3. ***Thank you for your time*. Please provide any additional comments and/or questions regarding the relicensing of the Lower Mokelumne River Project below:**

The California Department of Fish and Wildlife submits the following list of issues of concern, existing and recommended surveys and studies, and relevant data considerations and needs intended to help inform the relicensing of the Lower Mokelumne River Hydroelectric Project (P-2916).

Issues of Concern
- Effects of temperature, such as increased fall temperatures, on egg development and timing of spawning
- Spawning runs are not resulting in corresponding outmigrant detections in rotary screw traps
- Need for improvements to hatchery facility based on third party evaluation to counter the effect of climate change on operations
- Need for further investigation into stranding/entrainment of adult Chinook into Woodbridge Irrigation District's water delivery system during the fall.
  - Last year, over 200 dead Chinook were observed in a single irrigation canal off Sycamore Slough. CWT and tissues have been processed from carcasses in the past, all fish were found to be Mokelumne Hatchery origin. This could become a serious issue in the future if the Mokelumne Hatchery is not getting necessary returns. Currently, fish rescue is not a realistic option at most of these stranding areas.
- Early transparency when temperature and/or fish issues arise

Existing and Ongoing Resource Surveys and Studies
- Escapement monitoring surveys
- Redd surveys
- Juvenile outmigration monitoring
- Juvenile rearing habitat surveys

New Resource Surveys and Studies
- Fish community and entrainment risk study
- Special-status amphibian and aquatic reptiles study
- Wildlife study
- Avian community study
- Benthic macroinvertebrate study
- Aquatic invasive species study
- Hydrologic and water temperature operations models

Relevant Data Considerations and Needs
- Effects of habitat improvement and restoration work on fisheries populations
- Need for temperature modeling to determine operational and infrastructure options for providing cooler water temperatures during spawning downstream of Project reservoirs; should consider constraints/opportunities for temperature control based on linkage to upstream FERC project(s)
- Need for an adult hatchery origins return evaluation using coded wire tag recovery and fall returns to meet mitigation targets (marked and unmarked adult returns from Sherman Island)
- Examine the potential for fish passage upstream of Project dams
  - Need results of existing preliminary fish passage study upstream of Project dams from Friends of the Mokelumne River
  - Discussion of gains/opportunities in upstream habitat and future fish passage studies
  - Discussion of potential future fish passage challenges (e.g., pathogen risks, hatchery treatment system upgrades to limit disease, etc.)
- Need for real time access to temperature data by stakeholders to promote fisheries management decisions

The California Department of Fish and Wildlife submits the following list of issues of concern, existing and recommended surveys and studies, and relevant data considerations and needs intended to help inform the relicensing of the Lower Mokelumne River Hydroelectric Project (P-2916).

Issues of Concern

- Effects of temperature, such as increased fall temperatures, on egg development and timing of spawning
- Spawning runs are not resulting in corresponding outmigrant detections in rotary screw traps
- Need for improvements to hatchery facility based on third party evaluation to counter the effect of climate change on operations
- Need for further investigation into stranding/entrainment of adult Chinook into Woodbridge Irrigation District's water delivery system during the fall. Last year, over 200 dead Chinook were observed in a single irrigation canal off Sycamore Slough. CWT and tissues have been processed from carcasses in the past, all fish were found to be Moke hatchery origin. This could become a serious issue in the future if the Mokelumne Hatchery is not getting necessary returns. Currently, fish rescue is not a realistic option at most of these stranding areas.
- Early transparency when temperature and/or fish issues arise

Existing and Ongoing Resource Surveys and Studies

- Escapement monitoring surveys
- Redd surveys
- Juvenile outmigration monitoring
- Juvenile rearing habitat surveys

New Resource Surveys and Studies

- Fish community and entrainment risk study
- Special-status amphibian and aquatic reptiles study
- Wildlife study
- Avian community study
- Benthic macroinvertebrate study
- Aquatic invasive species study
- Hydrologic and water temperature operations models

Relevant Data Considerations and Needs

- Effects of habitat improvement and restoration work on fisheries populations

- Need for temperature modeling to determine operational and infrastructure options for providing cooler water temperatures during spawning downstream of Project reservoirs; should consider constraints/opportunities for temperature control based on linkage to upstream FERC project(s)
- Need for an adult hatchery origins return evaluation using coded wire tag recovery and fall returns to meet mitigation targets (marked and unmarked adult returns from Sherman Island)
- Examine the potential for fish passage upstream of Project dams
    - Need results of existing preliminary fish passage study upstream of Project dams from Friends of the Mokelumne River
    - Discussion of gains/opportunities in upstream habitat and future fish passage studies
    - Discussion of potential future fish passage challenges (e.g., pathogen risks, hatchery treatment system upgrades to limit disease, etc.)
- Need for real time access to temperature data by stakeholders to promote fisheries management decisions

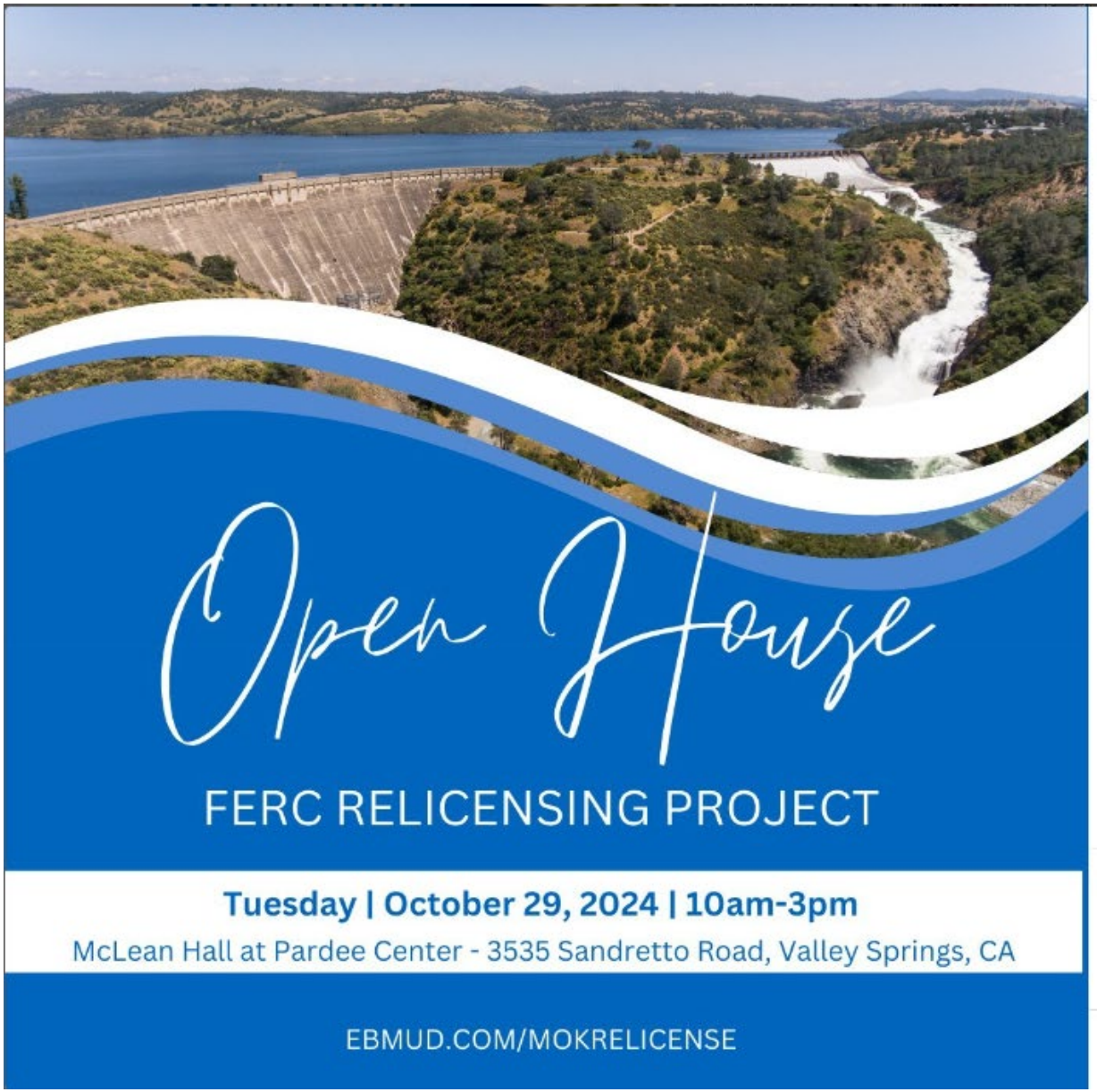
From: Campbell, Mary
To: Cheng, Sabrina
Cc: Jain, Priyanka
Subject: Open House Outreach
Date: Wednesday, October 16, 2024 10:32:56 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image006.png
image007.png
FERC Open House Flyer (Instagram Post).jpg

For your records:
The open house invitation was sent to Amador, Calaveras and Lodi Chamber of Commerce for distribution, as well as the Lodi News Sentinel, Stockton Record, Amador Ledger, and Calaveras Enterprise News.

corissa@calaverasenterprise.com
jmitchell@ledger.news
aleathley@recordnet.com
news@lodinews.com
frontdesk@lodichamber.com
chamber@calaveras.org
amadorcountychamber@gmail.com

Social media graphic attached. It was posted on Monday on our social channels.

Mary Campbell
Community Affairs Representative
C: 209-810-3018
East Bay Municipal Utility District, Lodi Office



ebmud_water

ebmud_water ✨ You're Invited! ✨
Join us for the EBMUD Open House on Tuesday, October 29 and discover how the FERC relicensing process impacts our community! 💧⚡

📅 Date: October 29, 2024
🕒 Time: 10 AM - 3 PM
📍 Location: Pardee Center, Valley Springs, CA

Chat with our team, enjoy light refreshments, and share your thoughts on the future of the Mokelumne River watershed. Your input is essential! 🌿

RSVP at MOKRELICENSE@EBMUD.com
More info at ebmud.com/mokrelicense

Let's shape the future together! 🌟

#EBMUD #CleanEnergy #Hydropower #CommunityEngagement #FERCRelicensing #SustainableFuture #MokelumneRiver

6d

15 likes
6 days ago

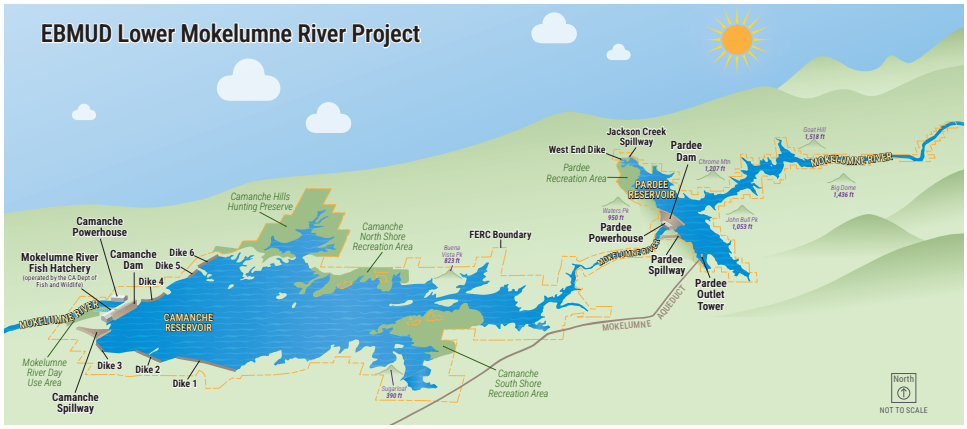
Add a comment... Post

EAST BAY MUNICIPAL UTILITY DISTRICT **FACT SHEET**

Relicensing the Lower Mokelumne River Project

FERC No. 2916

The Lower Mokelumne River (LMR) project is operated by the East Bay Municipal Utility District (EBMUD). The LMR project incorporates the Pardee Reservoir and Dam and the Camanche Reservoir and Dam facilities located in the Lower Mokelumne River watershed.



Operations

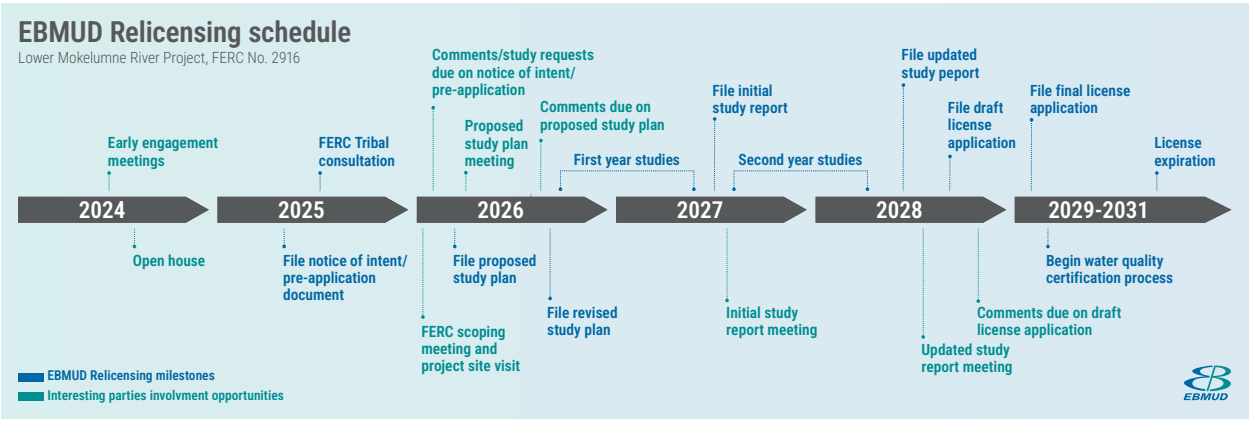
EBMUD operates under a hydroelectric project license issued by the Federal Energy Regulatory Commission (FERC) in March 1981 that expires in 2031. EBMUD is proposing to continue current operations as part of the relicensing process.

Pardee powerhouse

Camanche powerhouse

Relicensing schedule

The relicensing process is expected to take six years and involves numerous engagement opportunities for agencies, Tribes, and other interested parties.



Goals and process

EBMUD's goal for the relicensing process is to obtain a new license for the LMR Project that allows for continued operation to provide reliable drinking water, environmental protection, flood protection, and recreation services, while generating clean energy.

EBMUD will use the Integrated Licensing Process (ILP), FERC's default process. The ILP is a highly structured regulatory process that provides multiple consultation and engagement opportunities for agencies, Tribes, and other interested parties in order to inform on the development of EBMUD's license application to FERC.

Learn more

Learn more, sign up for project updates or contact us:

ebmud.com/MokRelicense

MokRelicense@ebmud.com

EBMUD

EAST BAY MUNICIPAL UTILITY DISTRICT **FACT SHEET**

Camanche

Dam

Camanche Dam allows EBMUD to manage water flows, in tandem with Pardee Reservoir, to minimize floods and meet downstream water rights and environmental obligations on the lower Mokelumne River. Its reservoir is a cherished body of water for recreation.

- **Built:** 1964
- **Type:** Zoned earth dam with impervious core
- **Crest elevation:** 263 ft above local datum
- **Crest length:** 2,640 ft
- **Height:** 171 ft above stream bed
- **Width:** 34.5 ft at crest / 750 ft at base
- **Volume:** 3,700,000 cubic yards (earth fill)

Powerhouse:

Camanche Powerhouse generates renewable energy as we release water into the Mokelumne River. The turbines are connected to generators, which create tens of thousands of megawatt hours of emission-free hydropower each year.

- **Generating units:** 3 (vertical Kaplan turbines)
- **Authorized installed capacity:** 9.45 MW
- **Median annual generation:** 45,000 MWh
- **Power generation:** Sufficient to support approximately 6,000 homes anually

Spillway:

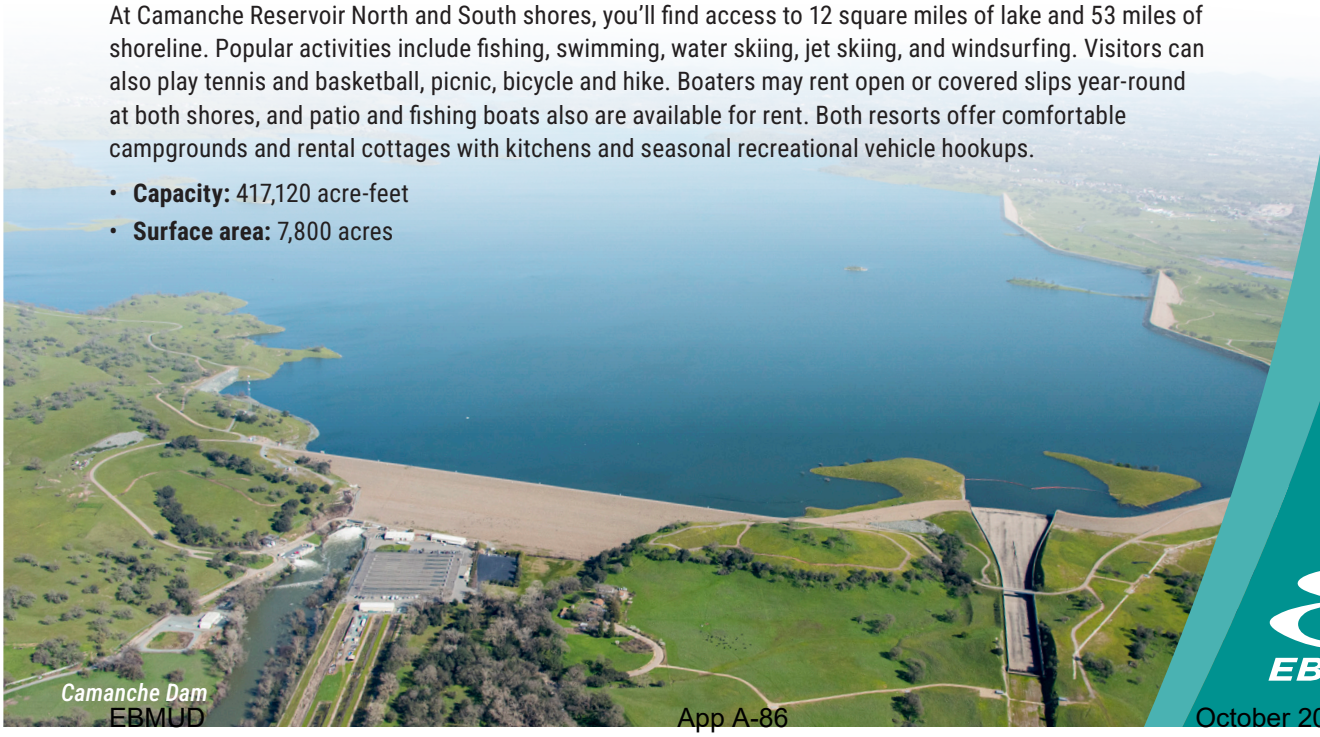
Camanche Spillway is designed to convey water safely downstream into the Lower Mokelumne River. Water spills over the Camanche Spillway when the reservoir reaches the spillway elevation. Camanche Reservoir has only spilled three times since the construction of the dam due to flood control management in the reservoir.

- **Crest elevation:** 235.5 ft above local datum
- **Maximum capacity:** 214,000 cfs (top of dam)
- **Highest flow on record:** 1,630 cfs (1986 flood)
  (Has only spilled two other times in 1979 and 1997.)

Reservoir:

At Camanche Reservoir North and South shores, you'll find access to 12 square miles of lake and 53 miles of shoreline. Popular activities include fishing, swimming, water skiing, jet skiing, and windsurfing. Visitors can also play tennis and basketball, picnic, bicycle and hike. Boaters may rent open or covered slips year-round at both shores, and patio and fishing boats also are available for rent. Both resorts offer comfortable campgrounds and rental cottages with kitchens and seasonal recreational vehicle hookups.

- **Capacity:** 417,120 acre-feet
- **Surface area:** 7,800 acres



Camanche Dam

EBMUD

EAST BAY MUNICIPAL UTILITY DISTRICT **FACT SHEET**

Pardee

Dam

Rainfall and snowmelt from the Sierra Nevada provide about 90% of the water supply for EBMUD's East Bay customers. Pardee Dam is the tallest dam in the EBMUD water storage system and collects rain and snow from the Mokelumne River watershed. When it was built in 1929, it was the largest concrete dam in the world. Today, it stands not just as a vital piece of infrastructure, but also as a symbol of the innovative and forward-thinking strategies EBMUD has relied on for a century to provide clean, safe drinking water to its customers and protect the environment.

- **Type:** Curved concrete gravity dam
- **Crest elevation:** 581.5 ft above local datum (top of upstream parapet wall)
- **Crest length:** 1,337 ft
- **Height:** 345 ft above stream bed
- **Width:** 16 ft at crest / 239 ft at base
- **Volume:** 617,000 cubic yards (concrete)

Powerhouse:

Pardee Powerhouse generates renewable energy as we release water from Pardee Reservoir into Camanche Reservoir. The turbines are connected to generators, which create over one hundred thousand megawatt hours of emission-free hydropower each year.

- **Generating units:** 3 (vertical Francis turbines)
- **Authorized installed capacity:** 28.6 MW
- **Median annual generation:** 140,000 MWh
- **Power generation:** Sufficient to support approximately 20,000 homes anually

Spillway:

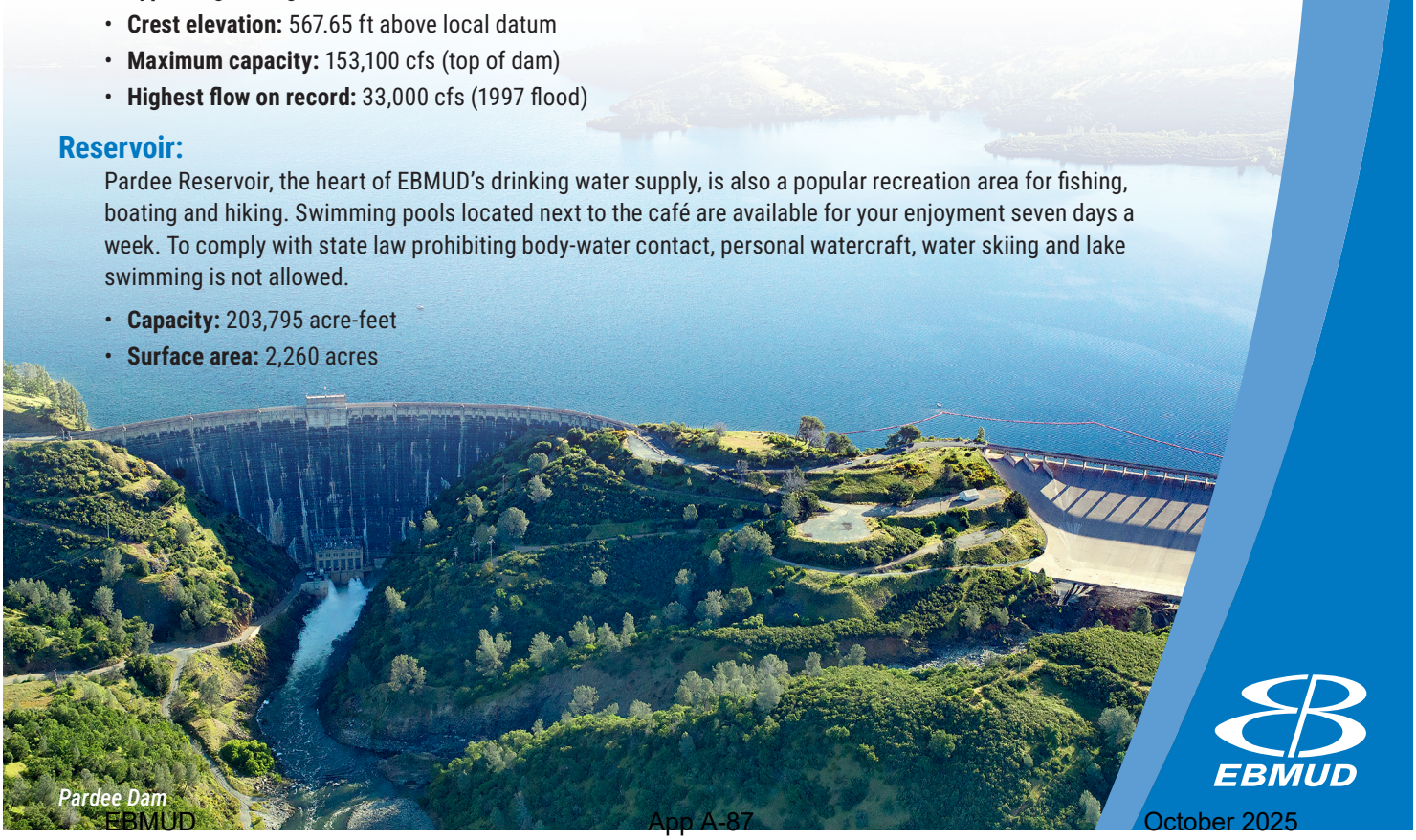
Pardee South Spillway is designed to convey water safely downstream into Camanche Reservoir. Water spills over the Pardee South Spillway when the reservoir reaches the spillway elevation.

- **Type:** Ungated ogee crest and concrete channel
- **Crest elevation:** 567.65 ft above local datum
- **Maximum capacity:** 153,100 cfs (top of dam)
- **Highest flow on record:** 33,000 cfs (1997 flood)

Reservoir:

Pardee Reservoir, the heart of EBMUD's drinking water supply, is also a popular recreation area for fishing, boating and hiking. Swimming pools located next to the café are available for your enjoyment seven days a week. To comply with state law prohibiting body-water contact, personal watercraft, water skiing and lake swimming is not allowed.

- **Capacity:** 203,795 acre-feet
- **Surface area:** 2,260 acres

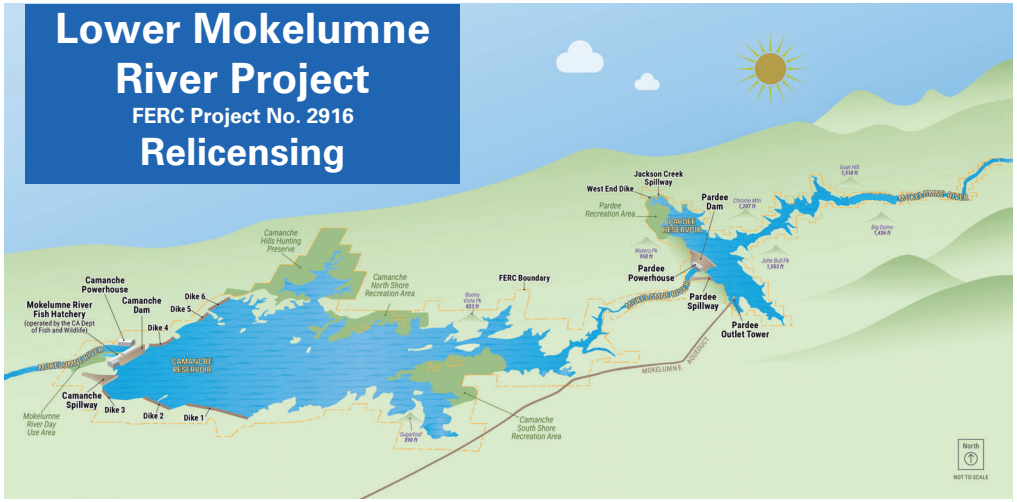


Pardee Dam

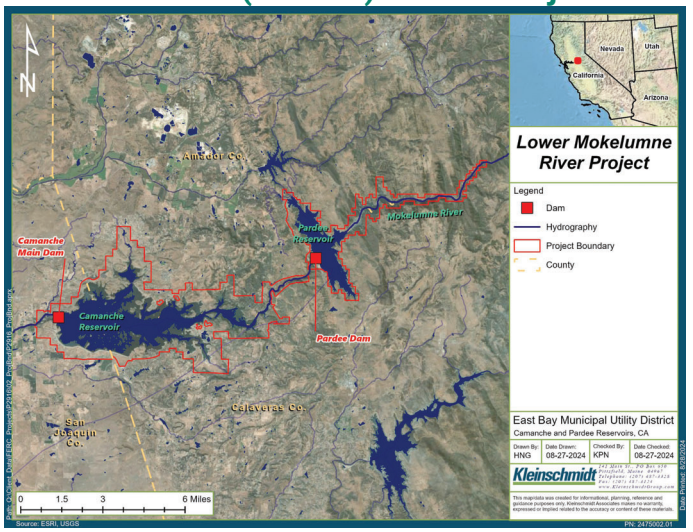
EBMUD

Attendees at FERC Relicense Open House 10/29/24

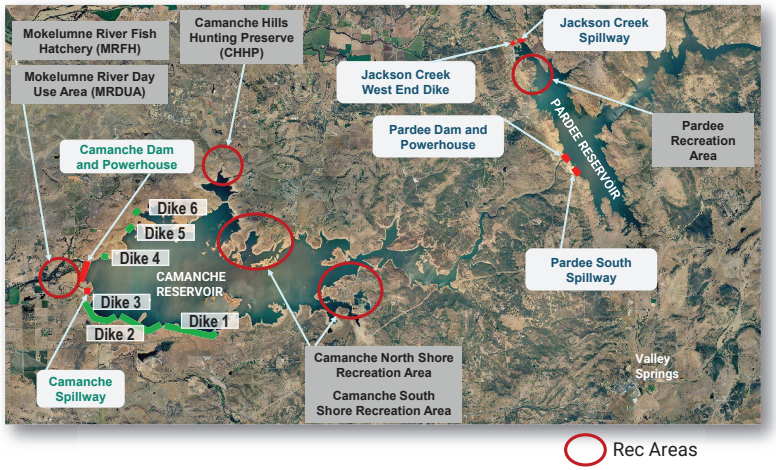
Meeting date	Topic	Type	Organization	First name	Last name	Title/Role
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Calaveras County Water District	Kelly	Gerkensmeyer	External Affairs Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Calaveras County Water District	Michael	Minkler	General Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Tribe	Central Valley Me-Wuk	Lawrence	Wilson, Jr.	Senior Cultural Resources Specialist
10/29/24 - 10:00AM-3:00PM	General (Open House)	Non-Governmental Organization	Foothill Conservancy	Brian	Jobson	Board President
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Jackson Valley Irrigation District	Steve	Fredrick	General Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Jackson Valley Irrigation District	Melinda	Hammond	Office Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Non-Governmental Organization	Mokelumne Coast to Crest Trail Council (MCCTC)	Mary	Boblet	Director
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	North San Joaquin Water Conservation District (NSJWCD)	Steve	Schwabauer	General Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Pacific Gas & Electric (PG&E)	Chris	Bennett	Generation Supervisor
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Pacific Gas & Electric (PG&E)	Clint	Harris	Senior Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Woodbridge Irrigation District (WID)	Keith	Bussman	General Manager
10/29/24 - 10:00AM-3:00PM	General (Open House)	Local utility district	Woodbridge Irrigation District (WID)	Jaime	Cantu	Superintendent

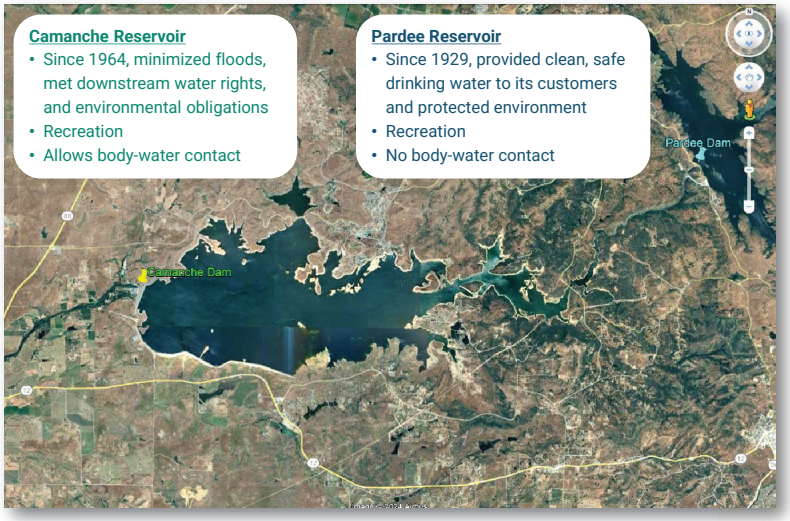


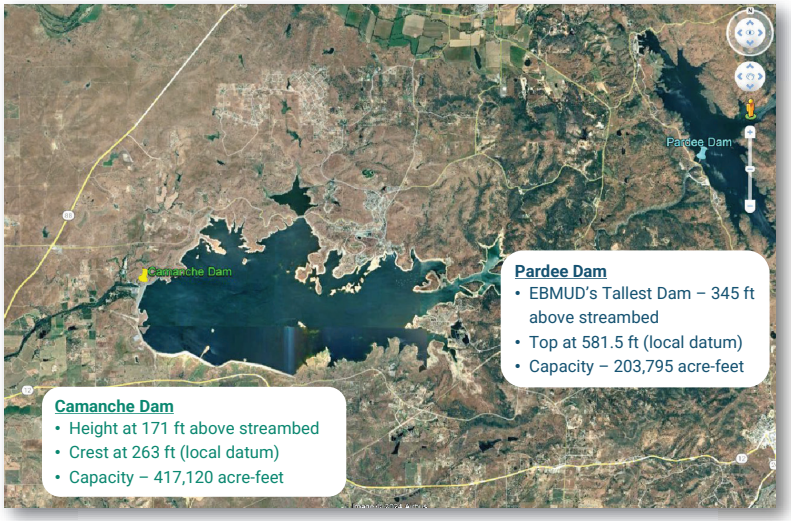
Lower Mokelumne River (P-2916) - FERC Project Boundary



Lower Mokelumne River Project Features







Camanche Dam
- Zoned Earth Dam with Impervious Core
- 34.5 ft wide crest
- 750 ft wide base

Pardee Dam
- Curved Concrete Gravity Dam
- 16 ft wide crest
- 239 ft wide base

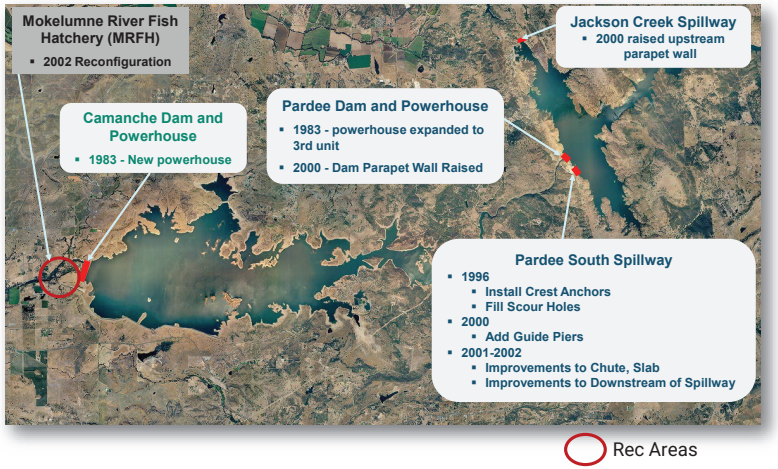
Camanche Dam Power Generation
- 9.45 MW authorized installed capacity

Pardee Dam Power Generation
- 28.6 MW authorized installed capacity

Camanche Spillway
- Ungated crest and concrete channel
- Highest flow – 1,630 cfs (1986)
- Not near flow capacity

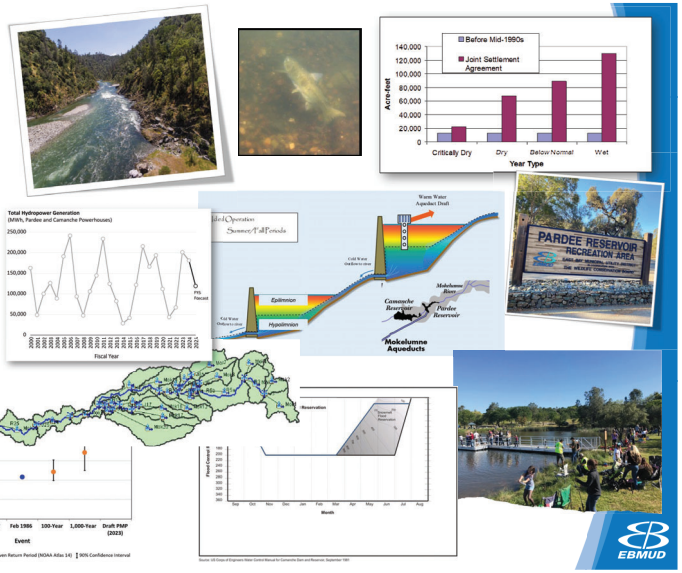
Pardee South Spillway
- Ungated crest and concrete channel
- Highest flow – 33,000 cfs (1997)
- Not near flow capacity

Lower Mokelumne River Project Major Upgrades Since Initial Construction



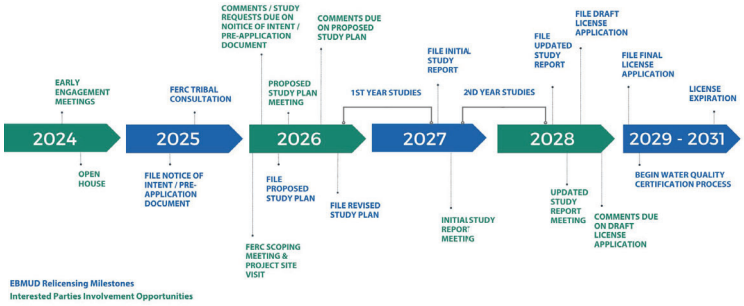
Resource Topics

- Fisheries & Wildlife
- Water Resources
  - Operations
  - Water Quality
  - System Modeling
  - Extreme Hydrology
  - Hydrogeneration
- Recreation & Watershed
- Tribal & Cultural Resources



Opportunities to Engage through 2026

- **Open House** (October 29, 2024)
- **Technical Working Groups** (Summer 2025)
- **Scoping Meeting and Site Visit** (January 2026)
- **PAD Comment Period/Study Requests** (October 2025 – mid-February 2026)
- **Proposed Study Plan Meeting** (April 2026)
- **PSP Comment Period** (June 2026)



Lower Mokelumne River Project

FERC Project No. 2916

Relicensing

How to Stay Up-to-Date:

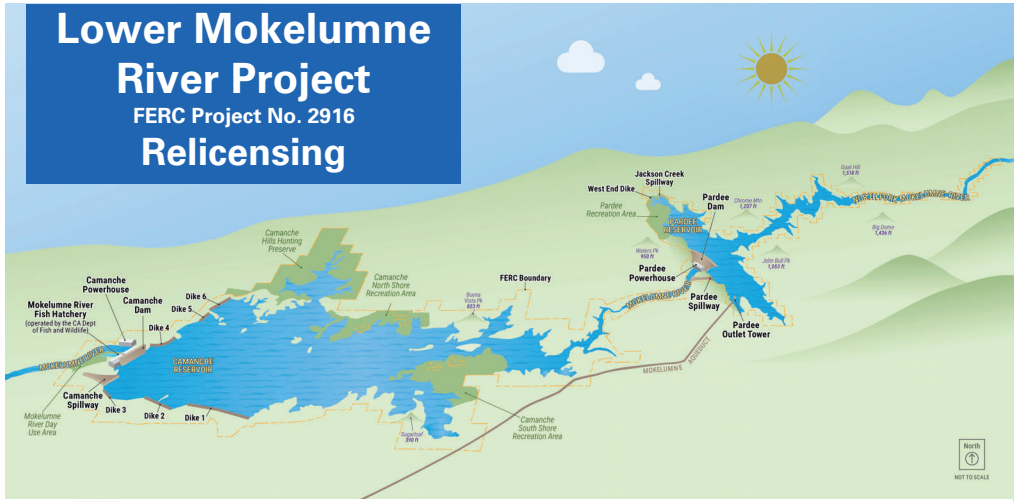
- Check the Project website for updates and to submit interest form: https://www.ebmud.com/MokRelicense
- Sign up for FERC's e-subscription (docket number "P-2916") at www.FERC.gov
- Email Project email address with questions: MokRelicense@ebmud.com

THANK YOU.

Lower Mokelumne River Project

FERC Project No. 2916

Relicensing



EBMUD

Lower Mokelumne River Partnership Steering Committee

December 13, 2024

FERC Relicensing

What is a License?

- "Permit to operate"
- Specifies conditions for construction, operation, and maintenance of a project
- Default term is 40 years
- License can be amended during license term

What is a Relicensing?

- 5 to 7-year process
- Setting new (updated) operating conditions for the next 40+ year license
- Brings project in compliance with regulation changes since the previous license
- Involves multiple interested parties with public involvement opportunities
- Opportunity to add capacity, change operations, new construction, etc

EBMUD

Opportunities to Engage through 2026

- **Technical Working Groups** (Summer 2025)
- **Scoping Meeting and Site Visit** (January 2026)
- **PAD Comment Period/Study Requests** (October 2025 – mid-February 2026)
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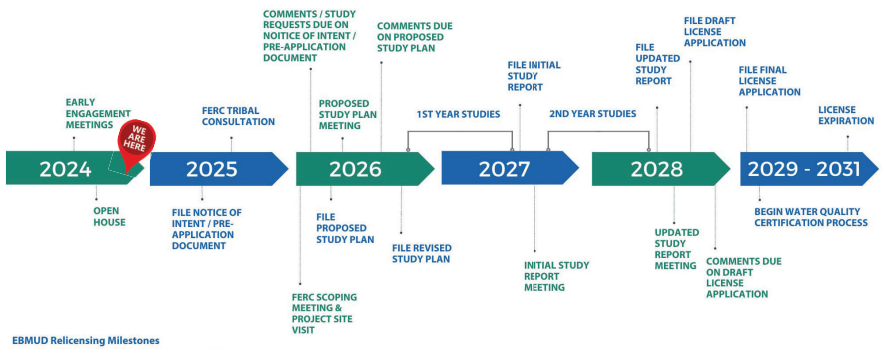


EBMUD Relicensing Milestones
Interested Parties Involvement Opportunities

EBMUD

Pre-Application Document and Notice of Intent

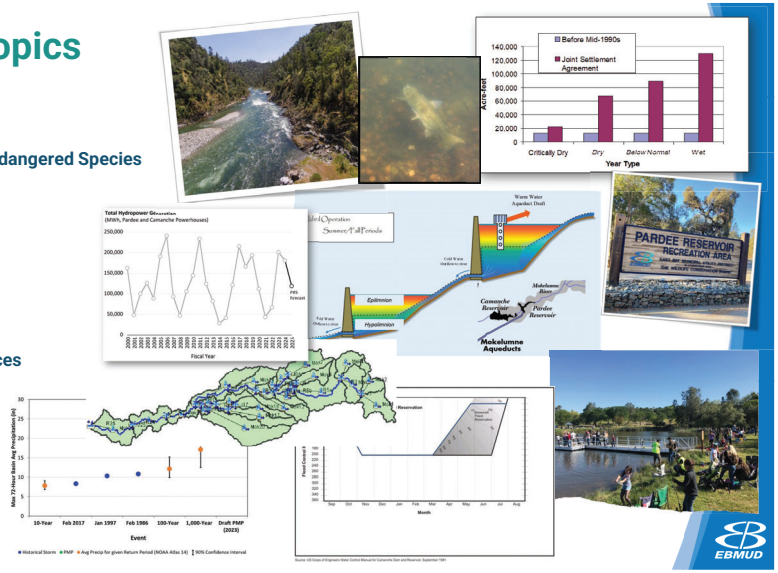
- October 2025
- The PAD and NOI are the first steps in the formal FERC process
- Summaries of existing data or studies
- Known data gaps or potential impacts and issues
- Existing and proposed PME measures

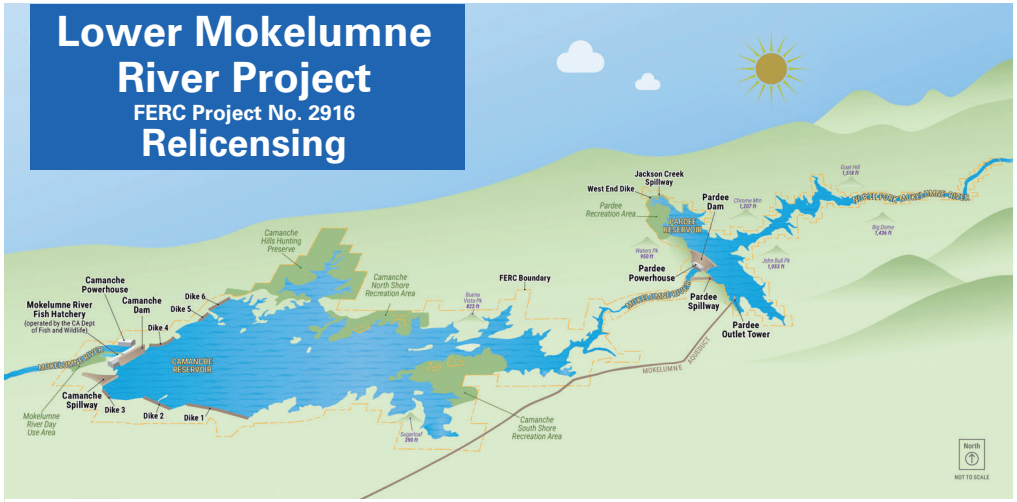
Pre-PAD Questionnaire

EBMUD

Resource Topics

- Fisheries and Aquatics
- Terrestrial
- Rare, Threatened and Endangered Species
- Water Resources
  - Operations
  - Water Quality
  - System Modeling
  - Extreme Hydrology
  - Hydrogeneration
- Recreation & Watershed
- Tribal & Cultural Resources





EBMUD

THANK YOU.

From:	MokRelicense
Cc:	Jain, Priyanka; Cheng, Sabrina; Tam, Joe
Bcc:	Maria.Perez@parks.ca.gov; kgallino@co.calaveras.ca.us; craig@foothillconservancy.org; jobsonbrian@hotmail.com; Randy Makemson; Steve Fredrick; janelle@jna-consulting.com; kgrant@lodi.gov; mboblet@gmail.com; rob@calbike.org; carolyn.motherlodelandtrust@gmail.com; deon.bryant@noaa.gov; jake.rennert@noaa.gov; Jonathan.ambrose@noaa.gov; Monica.Gutierrez@noaa.gov; steve.edmondson@noaa.gov; thomas.holley@noaa.gov; william.foster@noaa.gov; Yulia.Lim@noaa.gov; catherine_brown@nps.gov; jcvalente@softcom.net; Steve Schwabauer; president@nccffi.org; bburkhalter@goexplorus.com; jvasbinder@sjgov.org; A1ZK@pge.com; Chris Bennett; Clint Harris; ROSK@pge.com; susan.kester@pge.com; Dyane.Osorio@sierraclub.org; heinrich.albert@outlook.com; alessandra.rigo@waterboards.ca.gov; Andrea.Sellers@Waterboards.ca.gov; Chase.McCormick@Waterboards.ca.gov; Eric.Bradbury@Waterboards.ca.gov; Nathan.Fisch@Waterboards.ca.gov; Nicole.Williamson@waterboards.ca.gov; parker.thaler@waterboards.ca.gov; Robert.McCarthy@Waterboards.ca.gov; Wilhelmina.Chon@Waterboards.ca.gov; Spaletta, Jennifer L.; bcook@tu.org; rsykes@umrwa.org; dsumer@usbr.gov; jaisrael@usbr.gov; khiatt@usbr.gov; donald_ratcliff@fws.gov; geoffrey_steinhart@fws.gov; heather_swinney@fws.gov; lauren_estenson@fws.gov; stephanie_millsap@fws.gov; john_wikert@fws.gov; richard_kuyper@fws.gov; Keith Bussman; Jaime Cantu; widvandam@gmail.com; widversteeg@gmail.com; Melinda Hammond; jvfd@volcano.net; bikelodica@gmail.com; Chris.McKibbin@wildlife.ca.gov; Beth.Lawson@wildlife.ca.gov; Briana.Seapy@wildlife.ca.gov; Michael.Maher@wildlife.ca.gov; Nick.Bauer@Wildlife.ca.gov; skyler.burson@wildlife.ca.gov; deltaflyfishers@gmail.com; cshutes@calsport.org; ewoodruff@calsport.org; Barfield, Lorna
Subject:	EBMUD Lower Mokelumne River Relicense Project – Technical Working Groups Kickoff Meeting
Date:	Tuesday, April 29, 2025 4:03:51 PM
Attachments:	image002.png

The East Bay Municipal Utility District (EBMUD) seeks to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee Dams and to meet other commitments (e.g., recreation, environmental, and dam safety).

EBMUD is looking to continue outreach with interested parties in the form of Technical Working Group (TWG) meetings this summer. The Kickoff meeting for the TWG process will take place on June 3 from 9am-12pm. We will be meeting in-person in Lodi:

Hutchins Street Square, Crete Hall
125 S. Hutchins Street
Lodi, CA 95240

In this meeting, we plan to:

-provide an overview of the TWG process
-provide an overview of FERC's requirements and timeline
-review existing pertinent studies and identify potential gaps in information
-have breakout sessions for different resource groups

By May 16, 2025, please RSVP to MokRelicense@ebmud.com indicating whether you are planning on attending the meeting, so we may have an estimated headcount.

Additionally, later this summer, there will be two virtual meetings per each TWG topic. Further information and invitations will be provided shorty, but please mark your calendar now for the ones relevant to you.

Water Resources
Weds. June 25 - 1:30-3:30pm
Weds. July 30 - 1:30-3:30pm

Fish & Aquatic Resources

Weds. June 25 - 9-11am
Weds. July 30 - 9-11am

Botanical, Wildlife, RTE (Rare, Threatened, Endangered) Species
Thurs. June 26 - 9-11am
Thurs. July 31 - 9-11am

Recreation & Land Use
Tues. June 24 - 9-11am
Tues. July 29 - 1:30-3:30pm

We look forward to your participation in the relicensing process. For more information and to stay up to date with the Project, please see the project website at: https://www.ebmud.com/mokrelicense.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From:	MokRelicense
Cc:	Jain, Priyanka; Tam, Joe; Cheng, Sabrina; Marcus, Virginia
Bcc:	Barfield, Lorna; "bikelodica@gmail.com"; "angie.montalvo@wildlife.ca.gov"; "Chris.McKibbin@wildlife.ca.gov"; "Beth.Lawson@wildlife.ca.gov"; "Briana.Seapy@wildlife.ca.gov"; "Michael.Maher@wildlife.ca.gov"; "jason.julienne@wildlife.ca.gov"; "Nick.Bauer@Wildlife.ca.gov"; "skyler.burson@wildlife.ca.gov"; "deltaflyfishers@gmail.com"; "cshutes@calsport.org"; "ewoodruff@calsport.org"; "Maria.Perez@parks.ca.gov"; "kgallino@co.calaveras.ca.us"; "craig@foothillconservancy.org"; "jobsonbrian@hotmail.com"; Randy Makemson; "jvfd@volcano.net"; Steve Fredrick; Melinda Hammond; "janelle@jna-consulting.com"; "mboblet@gmail.com"; "rob@calbike.org"; "carolyn.motherlodelandtrust@gmail.com"; "thomas.holley@noaa.gov"; "Jonathan.ambrose@noaa.gov"; "Monica.Gutierrez@noaa.gov"; "catherine_brown@nps.gov"; "jcvalente@softcom.net"; Steve Schwabauer; "president@nccffi.org"; "bburkhalter@goexplorus.com"; "jvasbinder@sjgov.org"; "susan.kester@pge.com"; "A1ZK@pge.com"; Chris Bennett; Clint Harris; "ROSK@pge.com"; "alkb@pge.com"; "Dyane.Osorio@sierraclub.org"; "heinrich.albert@outlook.com"; "alessandra.rigo@waterboards.ca.gov"; "Chase.McCormick@Waterboards.ca.gov"; "Eric.Bradbury@Waterboards.ca.gov"; "Nathan.Fisch@Waterboards.ca.gov"; "parker.thaler@waterboards.ca.gov"; "Wilhelmina.Chon@Waterboards.ca.gov"; "Nicole.Williamson@waterboards.ca.gov"; "Robert.McCarthy@Waterboards.ca.gov"; Spaletta, Jennifer L.; "bcook@tu.org"; "rsykes@umrwa.org"; "dsumer@usbr.gov"; "jaisrael@usbr.gov"; "khiatt@usbr.gov"; "lauren_estenson@fws.gov"; "stephanie_millsap@fws.gov"; "donald_ratcliff@fws.gov"; "heather_swinney@fws.gov"; Keith Bussman; Jaime Cantu; "widvandam@gmail.com"; "widversteeg@gmail.com"; "Vogel, Joshua R"
Subject:	FERC Relicense - Technical Working Group Meetings
Date:	Friday, May 23, 2025 10:58:40 AM
Attachments:	image002.png

As part of EBMUD's FERC Relicensing Project, we are conducting outreach with interested parties in the form of **virtual** Technical Working Group (TWG) meetings this summer. There will be **two** TWG meetings for each of the following four resource topics:

- Water Resources
- Fish & Aquatic Resources
- Botanical, Wildlife, RTE (Rare, Threatened, Endangered) Species
- Recreation & Land Use

The purpose of the ***first*** TWG meeting is to present the Study Plan outline (goals/objectives, methodology) followed by feedback/discussion from the TWG members.

The ***second*** TWG meeting will include a review of comments from members on draft outline/methodology. Any updates or changes based on feedback received from the first TWG meeting will then be presented. Please plan to attend BOTH meetings.

By Friday, May 30, please fill out this **form** indicating which of the resource topic TWG meetings you would like to attend.
After we have received your request(s), we will be in touch with the meeting link(s).

Some of you have already informed us of your meeting preferences; however, we ask that you still fill out this form so we can ensure we have everyone's selections accurately recorded.

We look forward to your participation in the relicensing process. For more information and to stay up to date with the Project, please see the project website at:
https://www.ebmud.com/mokrelicense. Thank you!

East Bay Municipal Utility District

FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

EAST BAY MUNICIPAL UTILITY DISTRICT

FERC Relicense - Technical Working Group Meetings

As part of EBMUD's FERC Relicensing Project, we are conducting outreach with interested parties in the form of Technical Working Group (TWG) meetings. There will be two virtual TWG meetings related to each of our four topics.

The purpose of **Meeting #1** is to present the Study Plan outline (goals/objectives, methodology). The TWG members will then provide feedback/discussion.

The purpose of **Meeting #2** is to review comments from TWG members on draft outline/methodology. Any updates or changes based on feedback received from the first TWG meeting will then be presented.

Please plan to attend **both** meetings.

When you submit this form, it will not automatically collect your details like name and email address unless you provide it yourself.

* Required

1. Please provide your first and last name: *

Enter your answer

2. What organization/agency do you represent? *

Enter your answer

3. If you are interested in attending the **Water Resources** TWG meetings, please indicated which meetings you are able to attend:

   - [ ] Meeting #1: Weds. June 25 - 1:30-3:30pm
   - [ ] Meeting #2: Weds. July 30 - 1:30-3:30pm

4. If you are interested in attending the **Fish & Aquatic Resources** TWG meetings, please indicated which meetings you are able to attend:

   - [ ] Meeting #1: Weds. June 25 - 9-11am
   - [ ] Meeting #2: Weds. July 30 - 9-11am

5. If you are interested in attending the **Botanical, Wildlife, RTE (Rare, Threatened, Endangered) Species** TWG meetings, please indicated which meetings you are able to attend:

   - [ ] Meeting #1: Thurs. June 26 - 9-11am
   - [ ] Meeting #2: Thurs. July 31 - 9-11am

6. If you are interested in attending the **Recreation and Land Use** TWG meetings, please indicated which meetings you are able to attend:

   - [ ] Meeting #1: Tues. June 24 - 9-11am
   - [ ] Meeting #2: Tues. July 29 - 1:30-3:30pm

Please provide your first and last name:	What organization/agency do you represent?	If you are interested in attending the Water Resources TWG meetings, please indicated which meetings you are able to attend:	If you are interested in attending the Fish & Aquatic Resources TWG meetings, please indicated which meetings you are able to attend:	If you are interested in attending the Botanical, Wildlife, RTE (Rare, Threatened, Endangered) Species TWG meetings, please indicated which meetings you are able to attend:	If you are interested in attending the Recreation and Land Use TWG meetings, please indicated which meetings you are able to attend:
Lauren Estenson	USFWS	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	
Mary Boblet	Mokelumne Coast to Crwat Trail Council				Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Rohit Salve	PG&E	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Catherine Brown	NPS				Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Beth Lawson	CDFW	Meeting #1: Weds. June 25 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;		
Monica Gutierrez	NOAA's National Marine Fisheries Service		Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Michael Maher	CA Department of Fish and Wildlife	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	
Ben Ewing	Ca. Fish and Wildlife		Meeting #1: Weds. June 25 - 9-11am;		Meeting #2: Tues. July 29 - 1:30-3:30pm;
Jason Julienne	California Department of Fish and Wildlife	Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #2: Weds. July 30 - 9-11am;		Meeting #2: Tues. July 29 - 1:30-3:30pm;
Eric Woodruff	California Sportfishing Protection Alliance (CSPA)	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Craig Baracco	The Foothill Conservancy	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Skyler Burson	CDFW	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Amy Krisch	Pacific Gas and Electric Company			Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	
Angie Montalvo	CDFW	Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #2: Weds. July 30 - 9-11am;		
Briana Seapy	CDFW	Meeting #1: Weds. June 25 - 1:30-3:30pm;			
Christian McKibbin	California Department of Fish and Wildlife	Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #2: Weds. July 30 - 9-11am;		
Nick Bauer	CDFW		Meeting #2: Weds. July 30 - 9-11am;Meeting #1: Weds. June 25 - 9-11am;		
Susan Kester	PG&E	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Tom Holley	NMFS	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Jon Ambrose	NMFS		Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Heinrich Albert	citizen		Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Chris Shutes	California Sportfishing Protection Alliance	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Michael Maher	CA Department of Fish and Wildlife	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	
Ben Cook	Trout Unlimited		Meeting #1: Weds. June 25 - 9-11am;		
Brian Cates	Foothill Conservancy		Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Joshua Vogel	Bureau of Reclamation	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Annie Zaccarin	PG&E	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;			Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Chase McCormick	California State Water Resources Control Board	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Stephanie Millsap	USFWS	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	

Chris Bennett	Pacific Gas and Electric	Meeting #2: Weds. July 30 - 1:30-3:30pm;			Meeting #2: Tues. July 29 - 1:30-3:30pm;
Eric Bradbury	State Water Resources Control Board	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	Meeting #1: Tues. June 24 - 9-11am;Meeting #2: Tues. July 29 - 1:30-3:30pm;
Alessandra Rigo	Bay-Delta/State Water Board	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Nathalie Niepagen	State Water Resources Control Board	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Nathalie Niepagen	State Water Resources Control Board	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;		
Clare Keane	PG&E	Meeting #1: Weds. June 25 - 1:30-3:30pm;Meeting #2: Weds. July 30 - 1:30-3:30pm;	Meeting #1: Weds. June 25 - 9-11am;Meeting #2: Weds. July 30 - 9-11am;	Meeting #1: Thurs. June 26 - 9-11am;Meeting #2: Thurs. July 31 - 9-11am;	

East Bay Municipal Utility District
Lower Mokelumne River Project Relicensing
FERC Project No. 2916

TECHNICAL WORKING GROUPS KICKOFF MEETING

June 3, 2025
9:00 am – 12:00 pm
Hutchins Center – Crete Hall
125 S Hutchins Street, Lodi

AGENDA

9:00 a.m. **Welcome and Introductions**
Meeting Goals and Objectives
Kleinschmidt Associates: Marie Rainwater

9:20 a.m. **FERC Project No. 2916 Relicensing Overview**
Project 2916 Overview
EBMUD: Joe Tam
FERC Process and Schedule
Kleinschmidt Associates: Shannon Luoma & Fatima Oswald

Resource Areas Overview - Review existing info, data gaps & discussion

9:40 a.m. **Water Resources** (20 minutes presentation; 10 minutes Q&A)
EBMUD: Christopher Potter & Benjamin Bray

10:10 a.m. **Fish & Aquatic Resources** (20 minutes presentation; 10 minutes Q&A)
EBMUD: Michelle Workman

10:40 a.m. **Terrestrial Resources** (20 minutes presentation; 15 minutes Q&A)
EBMUD: Michelle Workman

11:15 a.m. **Recreation & Land Use** (10 minutes presentation; 15 minutes Q&A)
EBMUD: Charles Beckman

11:40a.m. **Next Steps and Q&A**
Kleinschmidt Associates: Marie Rainwater

12:00 p.m. **Adjourn**

Scan QR code to
connect to the website.

Technical Working Groups Kickoff Meeting

Tuesday, June 3, 2025 - 9:00am to 12:00pm

#	First Name	Last Name	E-mail	Phone	Affiliation
1	Virginia	Marcus	vmarcus@ebmud.com	510-847-9394	EBMUD
2	Sabrina	Cheng	sabrina.cheng@ebmud.com		EBMUD
3	Joe ~~Fo~~	TAM	jgtam@ebmud.com	5102871369	EBMUD
4	Sami	Harpur	sami.harpur@ebmud.com		EBMUD
5	Angela	Whelpley	angela.whelpley@kleinschmidtgroup.com	2074917629	Kleinschmidt
6	Deborah	Preciado	dpreciad@ebmud.com		EBMUD
7	Michelle	Workman	Michelle.workman@ebmud.com	209-256-4987	EBMUD
8	Ben	Bray	ben.bray@ebmud.com	510-910-1206	EBMUD
9	SARATH	RATHINAM	sarath.rathinam-aradhya@ebmud.com	510-287-0345	EBMUD
10	Chase	McCormick	Chase.mccormick@waterboards.ca.gov	925-550-6472	SWB
11	Eric	Bradbury	Eric.Bradbury@waterboards.ca.gov	916 3279401	SWB
12	Priya	Jain	priyanka.jain@ebmud.com	510.287.1153	EBMUD
13	Susan	Kester	susan.kester@pge.com	4152647197	PG&E
14	Annie	Zaccarin	a1zk@pge.com		PG&E
15	Clare	Keane	c1kp@pge.com		PG&E
16	Eric	Woodruff	ewoodruff@calspa.org	415-960-7366	CSPA
17	Casey	Del Real	casey.delreal@ebmud.com		EBMUD
18	CHRIS	BENNETT	CCB9@PGE.COM	2096027728	PG&E
19	Michael	Maher	michael.maher@wildlife.ca.gov	916 595-5505	CDFW
20	Joshua	Vogel	jvogel@usbr.gov		USBR

Lower Mokelumne River Project Relicensing

Technical Working Groups Kickoff Meeting

Tuesday, June 3, 2025 - 9:00am to 12:00pm

#	First Name	Last Name	E-mail	Phone	Affiliation
21	ANA	ULLOA	ana.ulloa@ebmud.com		EBMUD
22	Ginger	Chen	ginger.chen@ebmud.com		EBMUD
23	ERIC	TOTH	eric.toth@ebmud.com		EBMUD
24	CHUCK	BECKMAN	charles.beckman@ebmud.com		EBMUD
25	THOM	HARDIE	thardie@ebmud.com		EBMUD
26	Dillon	Cowan	dillon.cowan@ebmud.com		EBMUD
27	KAREN	DONALD			EBMUD
28	Beth	Lawson	beth.lawsm@wildlife.ca.gov		CDFW
29	Robyn	Smith	robyn@jna-consulting.com	916-765-6450	JNA Consulting
30	Janelle	Nolan	janelle@jna-consulting.com		JNA Consulting
31	Marie	Rainwater			Kleinschmidt
32	Shannon	Lyons			Kleinschmidt Assoc
33	Fatima	Oswald			Kleinschmidt Assoc
34	Chris	Potter			EBMUD
35					
36					
37					
38					
39					
40					

Lower Mokelumne River Project Relicensing

Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
June 3, 2025

EBMUD Kleinschmidt

AGENDA

- **Welcome and Introductions**
  - TWG Purpose & Objectives
- **FERC Project No. 2916 Relicensing Overview**
  - Project 2916 Overview
  - FERC Process & Schedule
- **Resource Areas Overview**
  - Review existing info, data gaps, discussion
    - Water Resources
    - Fish & Aquatics
    - Terrestrial Resources
    - Recreation & Land Use
- **Questions**

EBMUD

Welcome & Introductions

EBMUD

Lower Mokelumne Relicensing Team

Project Management Team	Resource Leads
Priya Jain	Ana Ulloa
Brad Ledesma	Alice Towey
Joe Tam	Ben Bray
Sabrina Cheng	Casey Del Real
Karen Donovan	Casey Leblanc
	Chris Potter
	Chuck Beckman
	Deborah Preciado
	Eric Toth
	Ginger Chen
	Jason Zhou
	Michelle Workman
	Sami Harper
	Thomas Hardie

Consultant Team

Kleinschmidt
Shannon Luoma
Fatima Oswald
Olivia Smith
Angela Whelpley
Vanessa Martinez
Craig Addley

JNA
Janelle Nolan
Robyn Smith

Facilitator
Marie Rainwater

EBMUD

TWG Meetings Purpose and Objectives

Today's meeting:

- Overview of project and operations
- Overview of existing data/information/data gaps

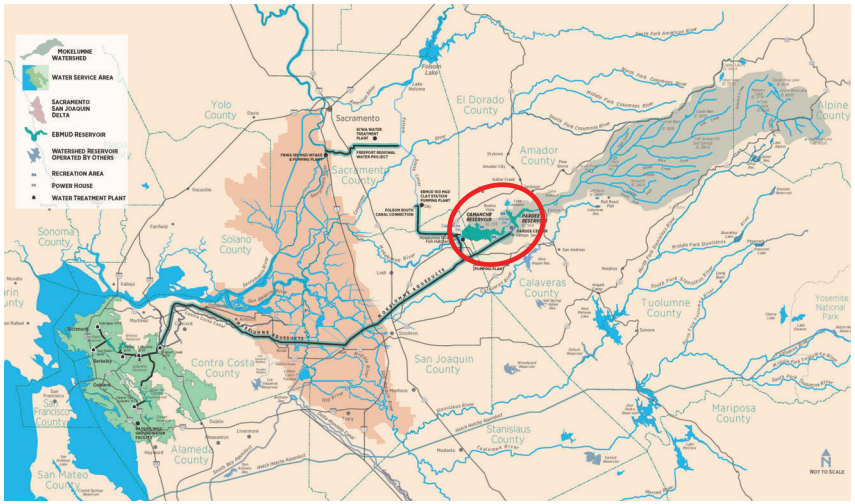
TWG Meetings Purpose and Objectives

Future resource specific TWGs (June & July):

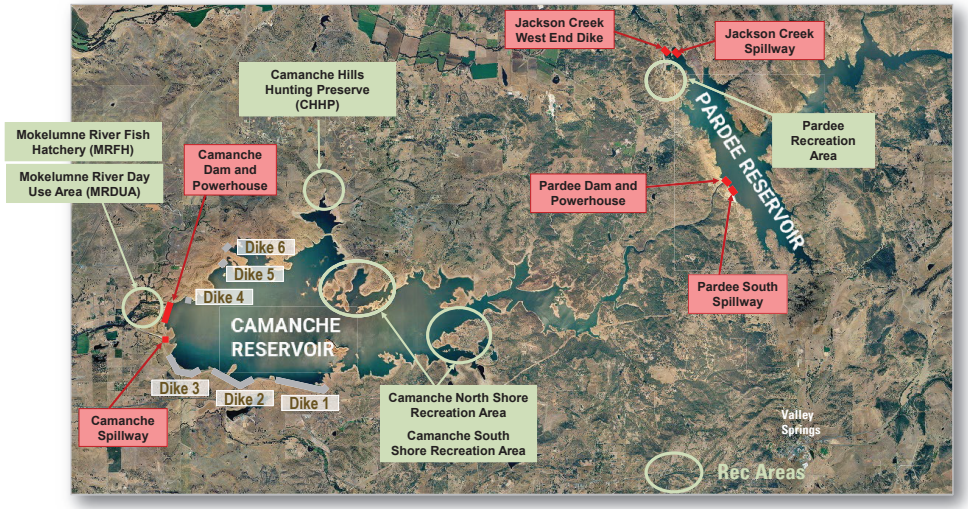
- Ensure EBMUD is aware of relicensing participants interests and objectives as they prepare their study plan proposal for inclusion in the PAD
- Receive additional feedback on any proposed study plans including:
  - Purpose, objectives, and adheres to FERC study plan criteria
  - Project nexus
  - Methods, timing, and scope

Lower Mokelumne River (FERC Project No. 2916) Relicensing Overview

Lower Mokelumne River (P-2916) – Mokelumne Watershed



Lower Mokelumne River (P-2916) – Project Features & Recreation Sites



Pardee Facilities

- **Constructed:** 1927-1929
- **Powerhouse** (authorized installed): 28.6 MW (3 Hydro Units)
- **Reservoir Capacity:** 203,795 acre-feet normal max pool
- **Type of Construction:** curved concrete gravity
- **Dam Elevation:** 581.5 feet / crest 575 feet
- **Max Dam Height:** 345 feet
- **Dam Length:** 1,337 ft
- **South Spillway:** ungated crest and concrete channel

Camanche Facilities

- **Constructed**: 1963-1964
- **Powerhouse** (authorized installed): 9.45 MW
- **Reservoir Capacity**: 417,120 acre-feet normal max pool
- **Type of Construction:** zoned, earth fill, roller compacted embankment
- **Dam Elevation:** 263 feet (Local) 265.2 feet (NAVD88)
- **Max Dam Height:** 171 feet
- **Dam Length :** 2,640 feet
- **Spillway:** ungated crest and concrete channel
- **Dikes:** 6 earthen embankment dikes

FERC Relicensing & Schedule

EBMUD

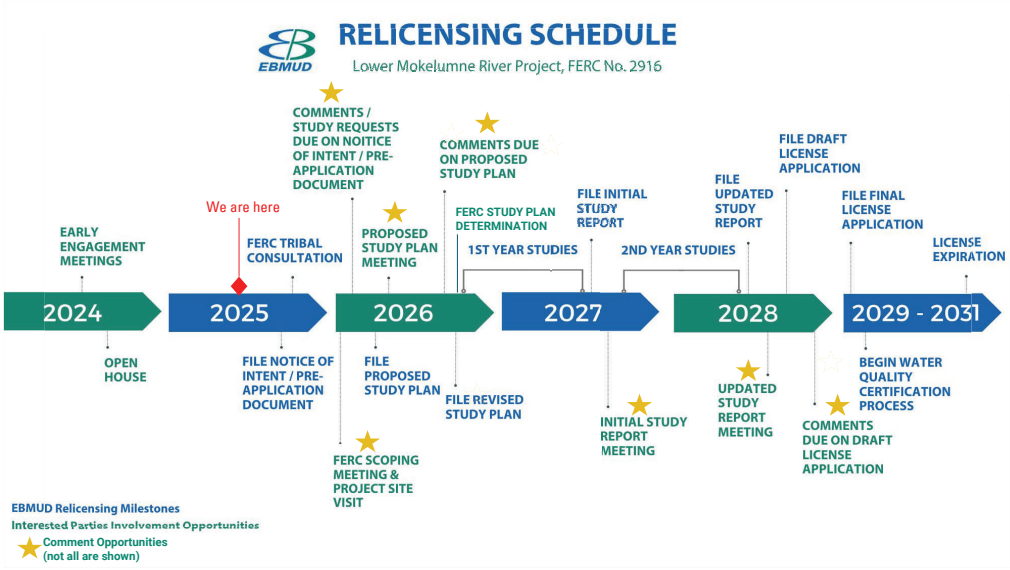
FERC Relicensing - Integrated Licensing Process (ILP)

What is a License?

- "Permit to operate"
- Specifies conditions for construction, operation, and maintenance of a project
- Default term is 40 years
- Can be amended during license term

What is FERC Relicensing?

- 5 to 7-year process
- Setting new (updated) operating conditions for the next 40-year license
- Brings project in compliance with regulation changes since the previous license
- Involves multiple interested parties with public involvement opportunities
- Licensee opportunity to add capacity, change operations, new construction, or in some cases, pursue license surrender



Why Conduct Studies?

- The Proposed Study Plan (PSP) is a FERC requirement under the ILP
- Provide FERC the necessary information to conduct their analysis
- Identify pertinent & preliminary Project issues
- Lay groundwork for future license conditions & PM&Es

18 CFR § 5.11 Potential Applicant's proposed study plan and study plan meetings.

(a) Within 45 days following the deadline for filing of comments on the pre-application document, including information and study requests, the potential applicant must file with the Commission a proposed study plan.

FERC's 7 Study Guide Criteria

1- Goals & Objectives
2&3 - Relevant Resource Management Goals & Public Interest Considerations
4 - Existing Information & Need for Additional Information
5 - Project Nexus
6 - Proposed Methodology
7 - Level of Effort & Costs

Resources Overview

Resource Areas

Water Resources

Fish & Aquatics

Terrestrial Resources

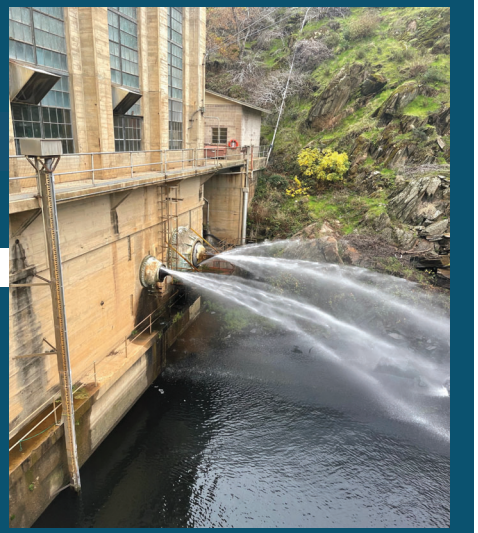
Recreation & Land Use

Cultural & Tribal

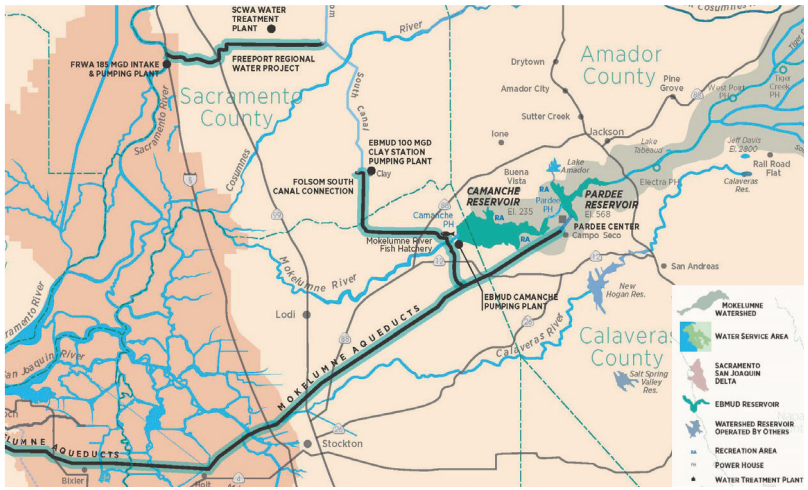
Tribal engagement will occur throughout relicensing separately from the TWG meetings to protect confidentiality

Water Resources

Operations, Hydrology, & Water Quality



Water Resources – Operations, Hydrology, & Water Quality



Water Resources – Operations, Hydrology, & Water Quality

EBMUD Operating Criteria

- USACE Flood Control Manual
- SWRCB Water Rights Licenses and Permit Terms
- Joint Settlement Agreement
- Agreements with other water rights holders

EBMUD Operational Considerations

Reservoirs are operated in tandem to meet:

- Municipal water supply
- Obligations to downstream diverters
- Fishery requirements
- Water quality (temperature, DO)
- Contribution to Delta inflow/outflow
- Flood control (streamflow regulation)
- Power generation

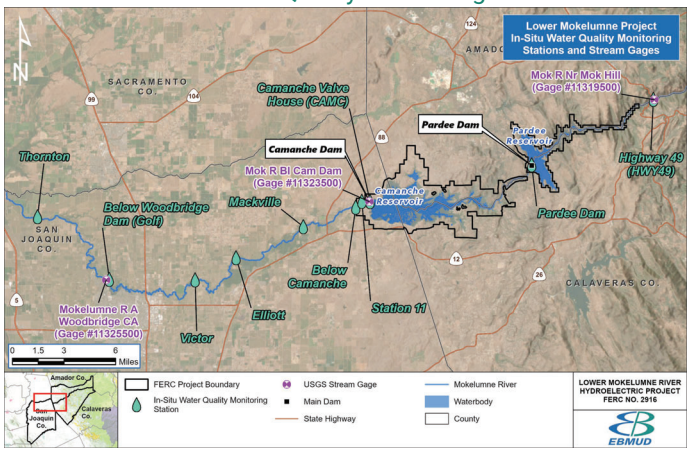
Water Management Reporting

- USACE Daily Reservoir Report
- USGS Annual Data Validation
- FERC Annual Project Operations Report
- California Data Exchange Center (CDEC)
- SWRCB Water Rights Reporting

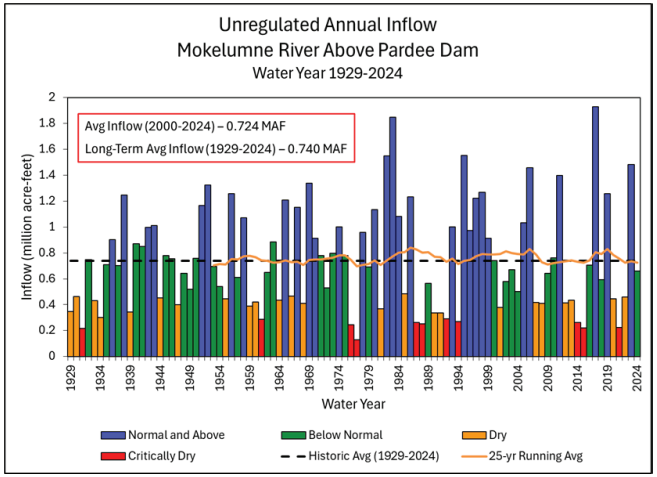
Water Quality Monitoring

- Daily and monthly in-situ water temperature data from 1998-2024
- Semi-continuous; daily spring-fall reservoir water temperature data from 2007-2024
- Manual water quality profile data from Pardee and Camanche

Water Resources – In-Situ Water Quality Monitoring Stations & Stream Gages



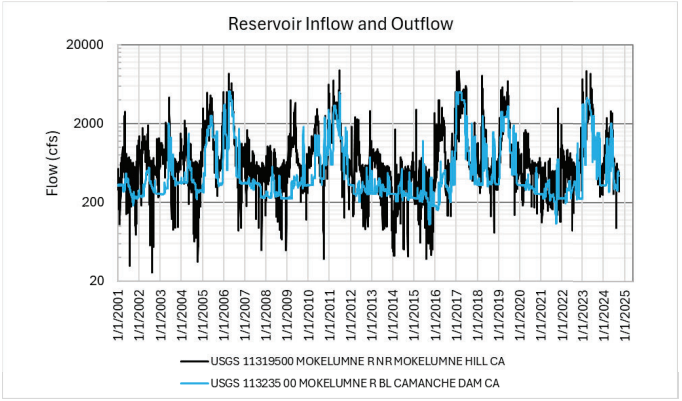
Water Resources – Operations and Hydrology



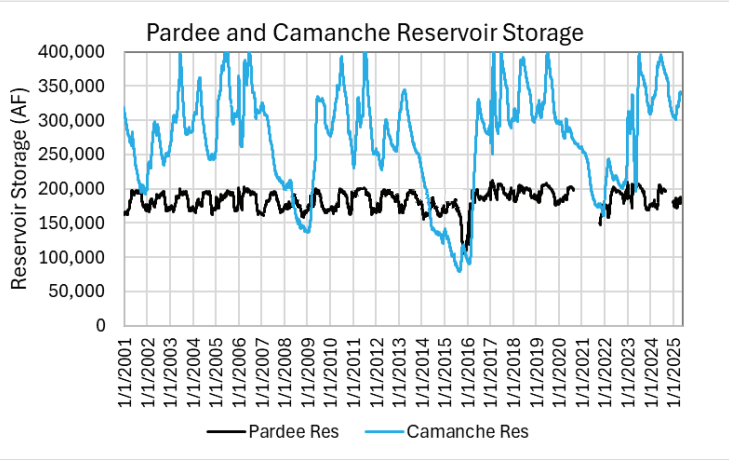
Water Resources – Operations and Hydrology

Inflow (2001-2025) to Pardee Reservoir
- Variable
- Regulated from upstream Projects

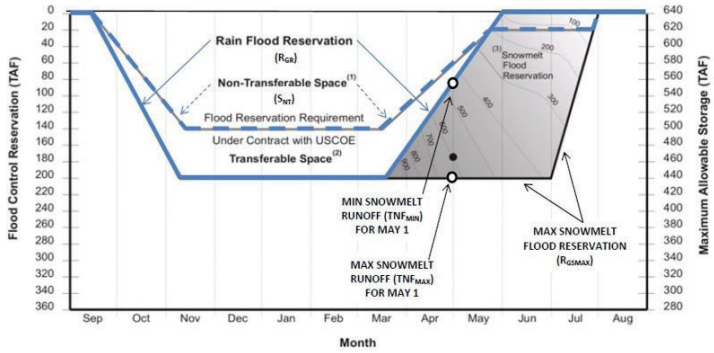
Outflow (2001-2025) from Camanche Reservoir
- Compared to inflow: Less fluctuations, Lower maximum flow values, Higher minimum flow values



Water Resources – Operations and Hydrology



Water Resources – Flood Control Chart



Notes:
(1) Non-transferable Space = minimum flood control space that must be maintained in Pardee and Camanche Reservoirs.
(2) Transferable Space = reduction of flood control space requirement provided by upstream (PG&E) reservoirs.
(3) Snowmelt Flood Reservation is dependent on estimated runoff-to-follow in TAF.

Example shown by ●: If on May 1, 600 TAF or more of runoff is expected through July 31, the portion of the curve above this line is used to estimate minimum transferable space.

Water Resources – JSA Year Type Criteria and Release and Flow Requirements

Table 1. JSA Year Type Criteria

PERIOD	CRITERIA	JSA YEAR TYPE			
		NORMAL AND ABOVE	BELOW NORMAL	DRY	CRITICALLY DRY
Oct – Mar	Pardee & Camanche Reservoir Storage[1]	> Max allowable storage[2]	Max allowable to 400 TAF	399 TAF to 270 TAF	269 TAF to 0 TAF
Apr – Sept	Unimpaired Runoff[3,4]	≥ 890 TAF	889 TAF to 500 TAF	499 TAF to 300 TAF	299 TAF to 0 TAF

[1]Projected Pardee & Camanche Reservoir storage on November 5
[2]Maximum allowable storage on November 5 as determined by Army Corps of Engineer's Water Control Manual for Camanche Dam and Reservoir (Sept 1981) – maximum allowable storage is the EBMUD Requirement line
[3]Water year unimpaired runoff into Pardee Reservoir as forecasted by DWR in the April 1 Bulletin 120 report
[4]April-September shall be critically dry when Pardee and Camanche Reservoir storage on November 5 is projected to be less than 200 TAF based on the DWR April 1 Bulletin 120 report

Table 2. Camanche Reservoir Release Requirements

PERIOD	JSA YEAR TYPE			
	NORMAL & ABOVE	BELOW NORMAL	DRY	CRITICALLY DRY
Oct 1-15	325	250	220	100
Oct 16-31	325	250	220	130
Nov-March	325	250	220	130
April	325*	250*	220	130
May	325*	250*	220	100
June	325*	250*	100	100
July-Sept	100	100	100	100

*Footnote 5 – Additional release is required depending on Pardee and Camanche Reservoir levels relative to maximum allowable storage for the end of the prior month as follows:
- If < 10 TAF below maximum allowable storage, add 200 cfs for subsequent month
- If 10-19 TAF below maximum allowable storage, add 150 cfs for subsequent month
- If 20-29 TAF below maximum allowable storage, add 100 cfs for subsequent month
- If 30-39 TAF below maximum allowable storage, add 50 cfs for subsequent month

Table 3. Flow Below Woodbridge Dam Requirements

PERIOD	JSA YEAR TYPE			
	NORMAL & ABOVE	BELOW NORMAL	DRY	CRITICALLY DRY
Oct 1-15	100	100	80	15
Oct 16-31	100	100	80	75
Nov-March	100	100	80	75
April	150	150	150	75
May	300	200	150	15
June	300	200	20	15
July-Sept	25	20	20	15

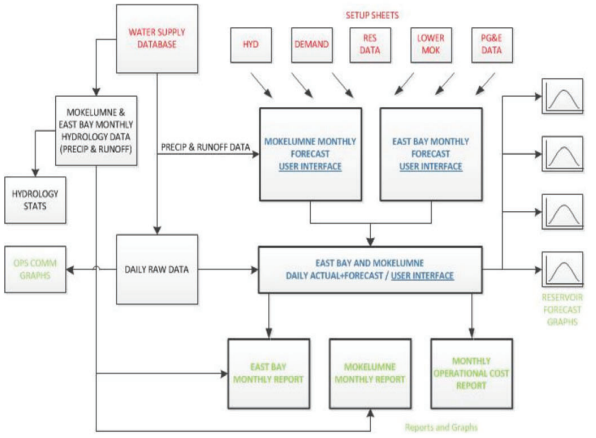
Water Resources – Operations and Hydrology

EBMUD Water Supply Operations Model

MS Excel based mass balance accounting tool

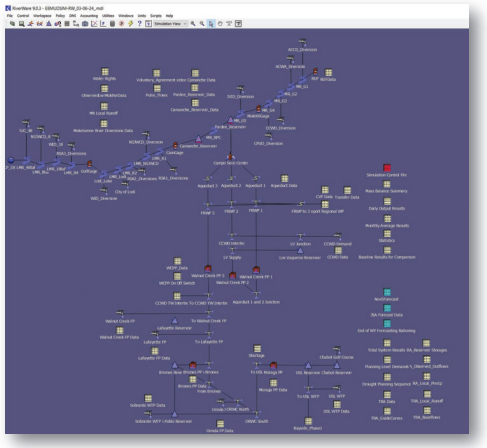
Set up with combination of monthly user inputs and daily time steps

Used to manage water supply reservoir levels for:
- meeting forecasted water treatment plant production needs,
- emergency storage goals,
- flood control,
- water quality limitations,
- In-stream flow requirements
- water rights and agreements,
- power generation goals.



Water Resources – Operations and Hydrology

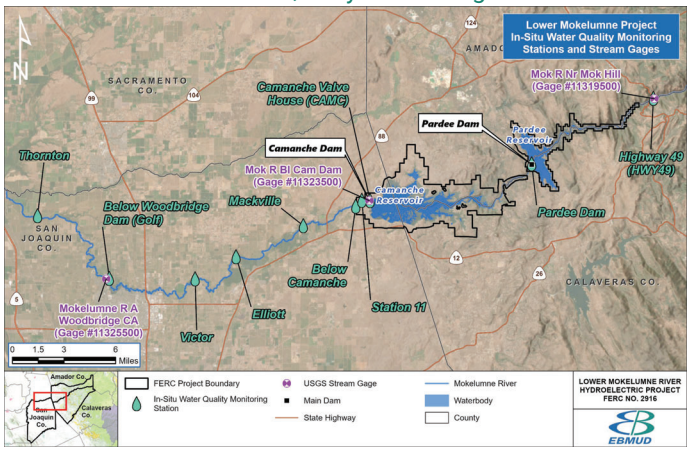
Water Supply System Planning Model



EBMUDSIM-Riverware

- Implemented following the fixed level-of-development approach for water supply planning
- Simulate current conditions and future conditions out to 2050 with the past 100 years of hydrology available for the simulation
- Modeling studies typically utilize monthly timestep output, however, daily timestep data are available for more refined analysis or to use as boundary conditions to drive water temperature model applications

Water Resources – In-Situ Water Quality Monitoring Stations & Stream Gages

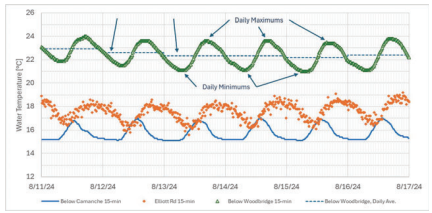


Water Resources –Water Quality

'In-Situ' Water Temperature and Dissolved Oxygen

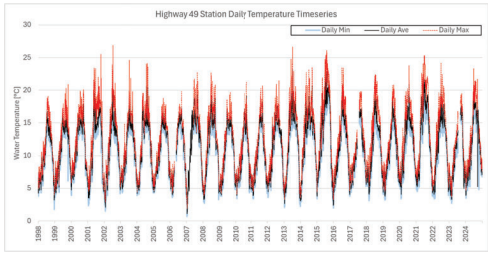
Water Temperature

- 8-Stations
- Automated (SCADA)
- Daily & Monthly Stats (1998-2024)
  - Upstream of Pardee at Highway 49
  - Camanche Dam Valve House (CAMC)
  - Below Camanche Station
  - Mackville Station
  - Elliott Station
  - Victor Station
  - Below Woodbridge (Golf) Station
  - Thornton Station

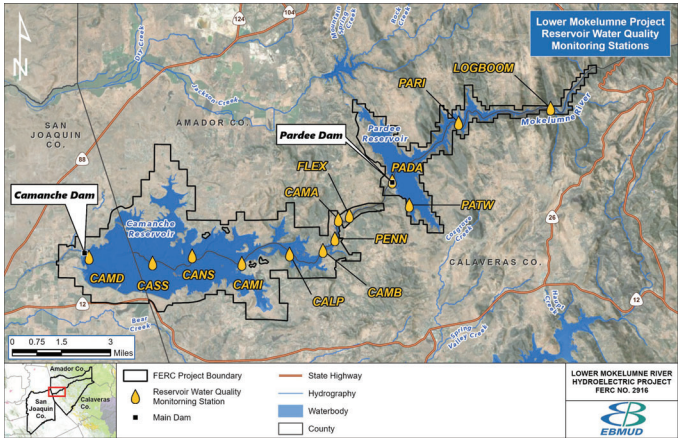


Dissolved Oxygen

- 1-Station
- Automated (SCADA)
- May – Dec (2011-2024)
  - Station 11, Below Camanche Day Use Area



Water Resources –Reservoir Water Quality Monitoring Stations



Water Resources –Water Quality

'Reservoir' Water Temperature and Quality Data (Manual)

13-Stations
Water Quality Sonde (manual measurements)
Measurement intervals vary from a few to a few dozen profiles collected each year (1998-2024)

Parameters Available*:

- Depth, Elevation, Water Temperature, pH, DO
- Specific Conductivity, Chlorophyll, Blue-Green Algae Phycocyanin, Turbidity (2015)

Pardee Reservoir

- LOGBOOM-Pardee Reservoir inlet
- PARI-Pardee Reservoir Interior
- PATW-Pardee Tower
- PADA-Pardee Dam

*Secchi disc readings typically acquired with manual profile measurements

Camanche Reservoir

- FLEX/CAMFLEX-Camanche Reservoir Inlet
- CAMA
- PENN/PENN20-Penn Mine
- CAMB- Buena Vista Rd/Camanche Parkway S. Bridge crossing
- CALP-Lancha Plana
- CAMI
- CASS-South Shore
- CANS-North Shore
- CAMD-Camanche Dam

Water Resources –Water Quality

'Reservoir' Water Temperature and Quality Data (Automated)

3-Automated Water Quality Stations

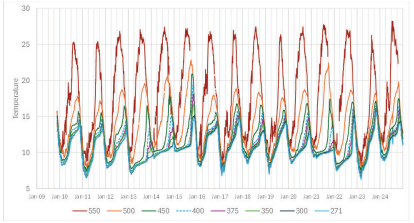
Pardee Reservoir

Pardee Dam (Station: PADA)

- Thermocouple Sensor Array
- Real time; hourly and daily (2009-2024)

Pardee Tower

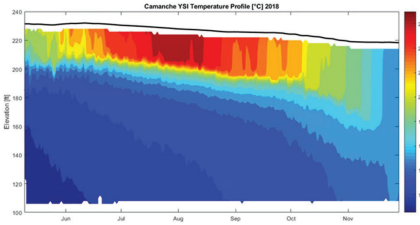
- Water Quality Profiler
- Real time (12-hour); hourly and daily (2023-2024)



Camanche Reservoir

Camanche Dam (Station: CAMD)

- Water Quality Profiler
- Real time (6-hour) (Apr/May – Nov/Dec) (2007-2024)



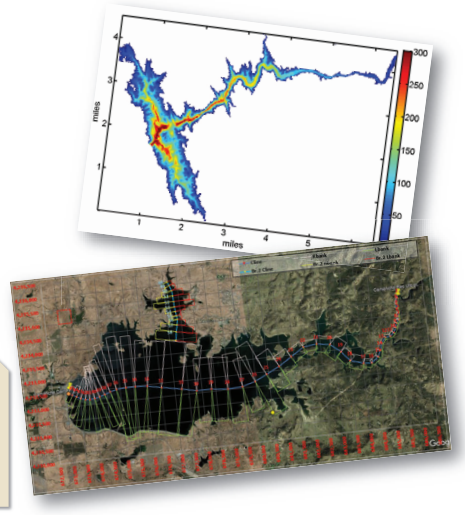
Water Resources –Water Quality

Water Temperature Models

CE-QUAL-W2 ver. 4.5
A two-dimensional hydraulic and water temperature model application for both Pardee and Camanche.

SNTEMP/RMS4
A one-dimensional hydraulic and water temperature model application - RMS4 for hourly timestep resolution and a SNTEMP for daily timestep resolution - for the reach connecting Pardee and Camanche Reservoirs.

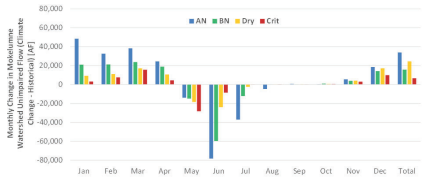
SSTEMP
Monthly timestep model with statistical model application that simulates temperatures for the lower Mokelumne river from Camanche Dam to Station Golf below Woodbridge Dam that allow for a prediction of the monthly maximum of the seven-day average daily maximum water temperature given release temperature and flow from Camanche Dam and meteorological inputs.

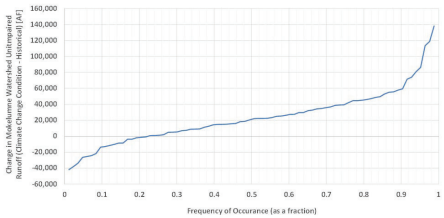


Water Resources – Climate Change

Climate Change

- Understanding effects of climate change hydrology on Project
- Studies typically updated or revisited every 5-years for Urban Water Management Plan
- Most recent study in 2022 in collaboration with USBR
  - Developed regulated undiminished flow into Pardee for future (2035-centered) conditions using top-down methodology





Water Resources – Operations, Hydrology, Water Quality

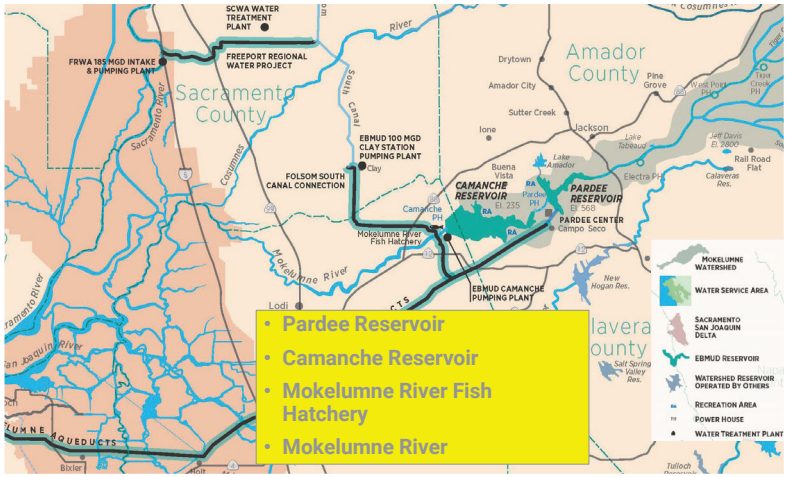
Preliminary Study Objectives

- Model system hydrology
- Characterize existing project water quality and water temperature
- Model aquatic habitat in relation to instream flows for existing and scenarios
- Model water temperature for existing and scenarios

Fish & Aquatics

- **Overview**
- **Fish Habitat**
- **Fish Population**
- **Macroinvertebrates**

Fish & Aquatics



Mokelumne Joint Settlement Agreement and Partnership

- Joint Settlement Agreement signed in 1998 and included in D-1641
- Integrated approach includes flow and non-flow measures
- 10-fold increase in flows from early 1990s
- Flows based on life stage needs and water year type (storage and runoff)
- Formal collaboration with resource agencies and stakeholders to optimize river management
- $2 million Endowment for habitat improvements
- $12.5 million in improvements to upgrade hatchery (2003)

Lower Mokelumne River Partnership
est. 1998

Fish & Aquatics

Existing Data (Sources)

- State and Federal Database Reviews
- Joint Settlement Agreement
- EBMUD Biological Survey Reports
- License Compliance Documents
- EBMUD Data and Publications
- Scientific Literature
- Recovery Plans/Habitat Conservation Plans

Fish & Aquatics – Salmonids/ Amphibians & Reptiles

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes to San Joaquin
Salmonidae: Salmon and Trout Family	Brown Trout	I	X		X		
	Chinook Salmon	N, SSC			X	X	X
	Chum Salmon	N			X		
	Kokanee	N	X*	X*	X	X	
	Rainbow trout	N	X	X			
	Steelhead/rainbow trout	N, FT, SCC			X	X	X

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes to San Joaquin
Ranidae: Trug Frog Family	American Bullfrog	I	X	X			
Salamandridae: True Salamander and Newt Family	Sierra Newt	N	X				
Emydidae: Hard-shelled Turtle Family	Northwestern Pond Turtle	N,FPT	X	X			
	Red-eared Slider	I		X			

Fish & Aquatics – non-salmonids

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes River to San Joaquin River
Atherinopsidae: Silversides Family	Inland Silverside	I				X	X
Catostomidae: Sucker Family	Sacramento Sucker	N	X		X	X	X
Centrarchidae: Sunfish Family	Black Crappie	I	X	X	X	X	X
	Bluegill	I	X	X	X	X	X
	Green Sunfish	I	X	X	X	X	X
	Largemouth Bass	I	X	X	X	X	X
	Redear Sunfish	I	X	X	X	X	X
	Redeye bass	I			X	X	X
	Smallmouth Bass	I	X	X	X	X	X
	Spotted Bass	I	X	X	X	X	X
	Warmouth	I			X	X	X
	White Crappie	I		X	X	X	X
Clupeidae: Herring Family	American Shad	I				X	X
	Threadfin Shad	I	X	X	X	X	X
Cottidae: Sculpin Family	Pacific Staghorn Sculpin	N			X		X
	Prickly Sculpin	N	X	X	X	X	X
Cyprinidae: Minnow Family	California Roach	N	X				
	Common Carp	I	X	X	X	X	X
	Fathead Minnow	I				X	X
	Golden Shiner	I	X	X	X	X	X
	Goldfish	I		X	X	X	X
	Hardhead	N, SSC	X		X		
	Hitch	N, SSC			X	X	X
	Sacramento Blackfish	N, SSC		X	X	X	X
	Sacramento Pikeminnow	N	X	X	X	X	X
	Sacramento Splittail	N, SSC				X	X

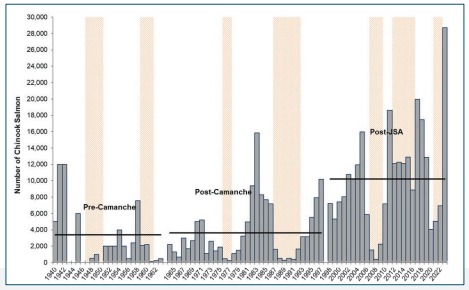
Fish & Aquatics – non-salmonids (cont.)

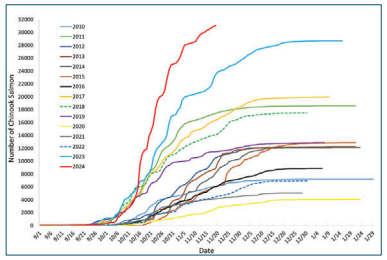
Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes River to San Joaquin River
Embiotocidae: Surfperch Family	Tule Perch	N, SSC			X	X	X
Gobiidae: Goby Family	Yellowfin Goby	I				X	X
Ictaluridae: Catfish Family	Black Bullhead	I			X	X	X
	Brown Bullhead	I			X	X	X
	Channel Catfish	I	X	X	X	X	X
	White Catfish	I	X	X	X	X	X
Moronidae: Striped Bass Family	Striped Bass	I			X	X	X
Osmeridae: Smelt Family	Delta Smelt	N, FT, CE				X	X
	Wakasagi	I				X	
Percidae: Perch Family	Bigscale Logperch	I			X	X	X
Petromyzontidae: Lamprey Family	Pacific Lamprey	N, SSC			X	X	
Poeciliidae: Livebearers	Western mosquitofish	I		X	X	X	X

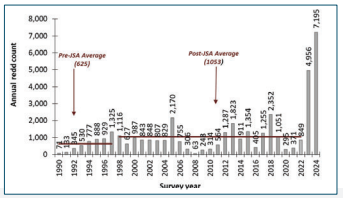
Fish & Aquatics – River Survey Information

Lower Mokelumne River Surveys

- Salmonid Escapement – August – July annually
  - Video monitoring @Woodbridge Dam
- Redd and Carcass surveys – October-March/January – annually – Camanche Dam to Elliott Rd.







Fish & Aquatics – River Survey Information

Lower Mokelumne River Surveys

- Juvenile migration surveys – December –July annually
  - Rotary Screw Trap -Elliott Rd and below Woodbridge Dam
- Fish community surveys – seasonally – annually
  - Backpack and boat electrofishing and seinining - Camanche Dam to Tower Park (Delta Forks)
- Acoustic Telemetry
  - 2021-Present Spring/Summer
  - Camanche Dam – Golden Gate

Brood Year	JSA Water Year Type (Apr. – Sept)	Upstream Abundance Estimate (rkm 87.4)	Downstream Abundance Estimate(rkm 62)	Survival Between Traps
2009	Below Normal	124,279	67,349	54.19%
2010	Normal & Above	842,570	281500	33.41%
2011	Dry	202,772	51,799	25.55%
2012	Dry	1,203,754	147590	12.26%
2013	Dry	595,070	169864	28.55%
2014	Critically Dry	431,677	61,305	14.20%
2015	Below Normal	856,127	134593	15.72%
2016	Normal & Above	No Estimate	326455	NA
2017	Below Normal	456,372	40,117	8.79%
2018	Normal & Above	4,693,253	2,791,209	59.64%
2019	Dry	214,226	24,397	11.25%
2020	Dry	197,004	82,145	41.70%
2021	Dry	107,931	61,115	56.90%
2022	Normal & Above	≥ 842,449*	184242	≤ 21.84%
2023	Below Normal	1,781,298	444117	24.93%

*Incomplete abundance estimate (trap pulled on 3/16/23)

Year	Survival (%)	SE	95% lower C.I.	95% upper C.I.	Detection efficiency (%)	Number Released
2021	0.1	0.1	0	0.7	100	960
2022	0.1	0.1			100	957
2023	14.8	1.1	12.8	17	98.1	1104
2024	0.8	0.3	0.4	1.7	100	913

Fish & Aquatics – Reservoir Survey Information

Pardee Reservoir 2011-2023

- Biennial Night Electrofishing Surveys – 5 standardized sites
- Purpose: species composition, detecting gross shifts in assemblage, early detection of non-natives.

Species Common Name	Total Count	Ave. Length (mm)	Min. Length (mm)	Max. Length (mm)
Black Crappie	6	98	48	176
Bluegill	1835	65	29	174
California Roach	2	109	108	110
Channel Catfish	25	375	72	560
Common Carp	16	541	92	742
Golden Shiner	2	127	90	164
Green Sunfish	610	56	27	172
Hardhead	6	102	62	161
Largemouth Bass	820	144	17	536
Lepomis hybrid	55	66	35	230
Rainbow Trout	2	377	323	431
Redear Sunfish	264	96	35	274
Sacramento Pikeminnow	6	119	86	195
Sacramento Sucker	5	187	81	326
Smallmouth Bass	144	136	25	415
Spotted Bass	33	52	28	242
Threadfin Shad	1	103	103	103
White Catfish	1	48	48	48

Fish & Aquatics – Reservoir Survey Information

Camanche Reservoir 2011-2023

- Biennial Night Electrofishing Surveys – 8 standardized sites
- Purpose: species composition, detecting gross shifts in assemblage, early detection of non-natives.

Species Common Name	Total Count	Ave. Length (mm)	Min. Length (mm)	Max. Length (mm)
Black Crappie	45	98	22	350
Bluegill	1484	73	19	160
Channel Catfish	22	253	45	582
Common Carp	218	436	210	620
Gambusia	1	29	29	29
Golden Shiner	1	101	101	101
Goldfish	44	284	30	390
Green Sunfish	461	74	26	190
Largemouth Bass	965	109	33	513
Lepomis hybrid	37	92	45	189
Prickly Sculpin	2	56	46	66
Rainbow Trout	15	381	256	435
Redear Sunfish	161	102	45	205
Sacramento Pikeminnow	1	127	127	127
Smallmouth Bass	13	97	32	367
Spotted Bass	1014	125	30	522
Threadfin Shad	1512	62	24	129
White Catfish	7	237	61	491
White Crappie	1	56	56	56

Fish & Aquatics – Lower Mokelumne River Macroinvertebrates

- Surveys 1996-2002
- Gravel enhancement sites
- Purpose: determine relationship between gravel enhancement sites, redd densities, and macroinvertebrate community (Chan et al 2003)
  - Results: BMI populations recolonized enhancement areas quickly with no change in species profiles
  - No sensitive species were identified
  - Targeted surveys for New Zealand Mudsnail in 2006
    - study supports previous work indicating NZMS may reduce benthic macroinvertebrate diversity in streams they invade, but normal annual variation and the expansion of the snail's range continue to cloud direct correlations.

Fish & Aquatics – Golden Mussels

Monitor District Reservoirs	Defend – Protect Critical Entry Points with exclusion/inspections	Mitigate

• Visual substrate inspections for adults
• Veliger tows for DNA analysis
• eDNA sampling
	• Camanche/Pardee/San Pablo – boat access closed for summer season
	• USL (protect from imports, Freeport)
	• Fish plants - hatcheries inspected, some fish plants halted
		• Freeport
		  • Vulnerability study underway
		  • Monthly eDNA sampling and substrate monitoring
		• Investigate Engineered solutions
		• Identify and advocate for necessary science

Fish & Aquatics – Habitat Restoration

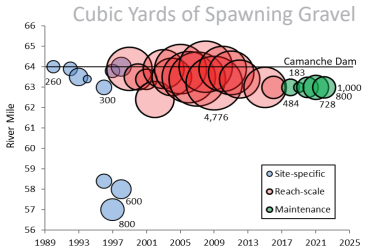
EBMUD Existing Data/Environment

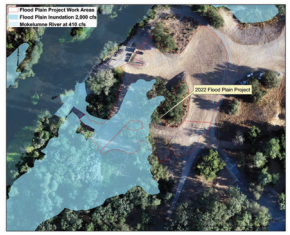
Habitat Restoration

- Gravel Augmentation
- 1990-1998: Site-specific projects
- 1999-2016: SHIRA (reach-scale restoration)
- 2017-present: SHIRA (reach-scale Maintenance)
- Floodplain & Side channels – 2005, 2015-present
- Habitats are surveyed annually
  - Bathymetry, gravel size, WSE, fish use, temperature, DO

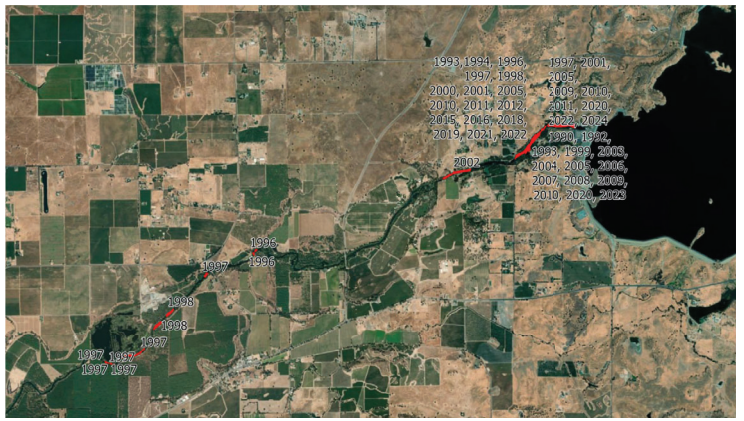
Habitats

- Lower Mokelumne River - HEC-RAS model – simulates flows 100-5,000
- Habitat suitability developed from depth/velocity profiles at each flow for the entire river
- Defines spawning and rearing habitat for salmonids
- Temperatures from Cam Dam to Thornton
- Habitat types include pool, riffles and run





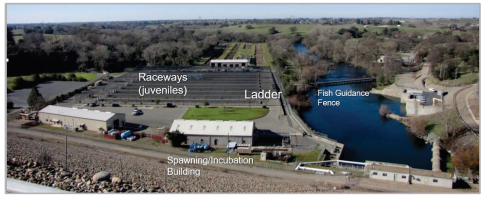
Fish & Aquatics – Habitat Restoration Projects 1990-2024



Fish & Aquatics – Hatchery and Operations

Hatchery

- Built in 1963
- Designed to offset the loss of fish spawning habitat
- Facilities: raceways (juveniles), ladder, spawning/incubation building, and fish guidance fence
- Species raised and released:
  - Fall Run Chinook salmon- spawning mid-October to Late December
  - Steelhead trout- spawning December to March
- Collaboration between EBMUD/CDFW to pinpoint release locations, increase survival, and reduce straying rates
- Goals
  - Promote fish health and survival rates
- Success
  - From 1998-2003, fall-run Chinook salmon escapement (returns) increased by 3,028
  - From 2009-2014, salmon returns exceeded 12,000 (with record run over 18,000 in 2011)
  - 2023 and 2024 over 20,000



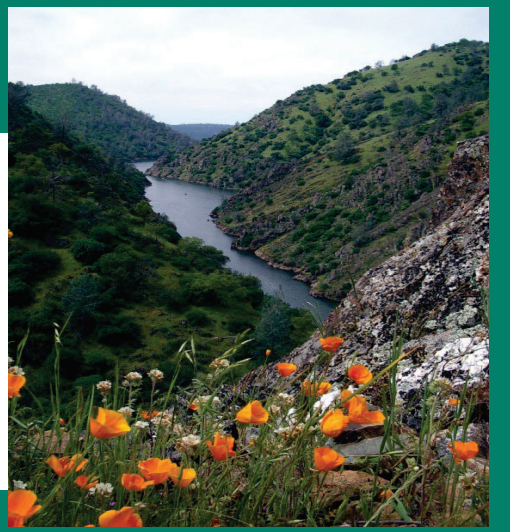
Fish & Aquatics

Preliminary Study Objectives

- Gather information necessary to adequately analyze the potential effects of ongoing operation and maintenance of the Lower Mokelumne River Project
  - Document fish species composition, distribution, and abundance in the river reaches
  - Reservoir Fish Habitat - characterize the management of reservoir water surface elevations and its relationship to availability of fish habitat under existing and proposed Project operations
  - Identify and map potential habitat for NWPT in the study area
  - Model water temperature and dissolved oxygen for existing conditions and proposed Project operations

Terrestrial Resources

- Wildlife / Rare, Threatened, & Endangered (RTE) Species
- Botanical/RTE Species
- Wetlands, Riparian, & Littoral Habitats



Terrestrial – Wildlife / RTE

Existing Data (Sources)

- State and Federal Database Reviews
- EBMUD Biological Survey Reports
- License Compliance Documents
- EBMUD Data and Publications
- Scientific Literature
- Recovery Plans/Habitat Conservation Plans

EBMUD Existing Data/Environment

Amphibians *(CA Tiger Salamander, CA Red-Legged Frog, Western Spadefoot):*

- Dip net surveys (March-April)
- Pit trap surveys (Oct-March)
- Annual surveys since 2009

Invertebrates *(Valley Elderberry Longhorn Beetle/habitat):*

- 804 known shrubs
- Surveys every 3 years since 2008
- Surveyed District property in the Camanche and Pardee Watershed
- Surveyed using transect/visual encounter
- Last survey was 2024

Birds *(Bald Eagle, Swainson's Hawk, Burrowing Owl, Raptors):*

- Annual USFWS Eagle surveys since 1985
- An additional ~20 annual nesting bird surveys
- Surveyed District property in the Camanche and Pardee Watershed
- Surveyed using transect/visual encounter
- Date of Last Survey was May 2025

Monarchs / Bats:

- Five known bat species to occur
- Surveyed District property in the Camanche and Pardee Watershed.
- Survey method was visual encounter
- Surveyed as needed
- Last survey was January 2025

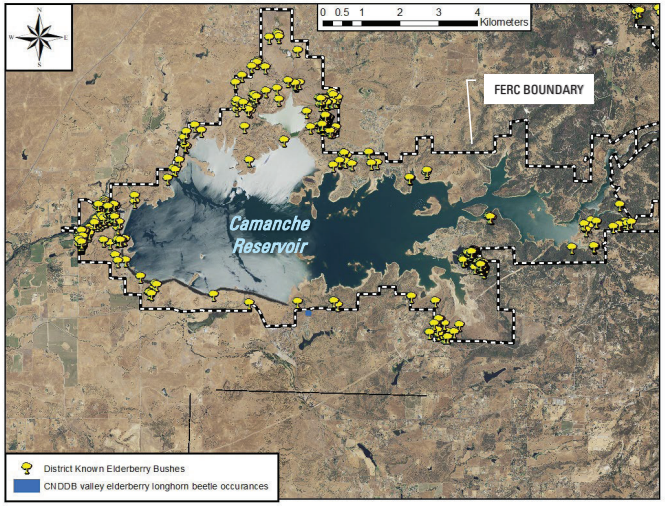
Game species *(Chukar, Pheasants, Valley quail, waterfowl):*

- 41 known species to occur
- Surveyed District property in the Camanche and Pardee Watershed
- Survey method was visual encounter
- Surveyed as needed
- Last survey was January 2025

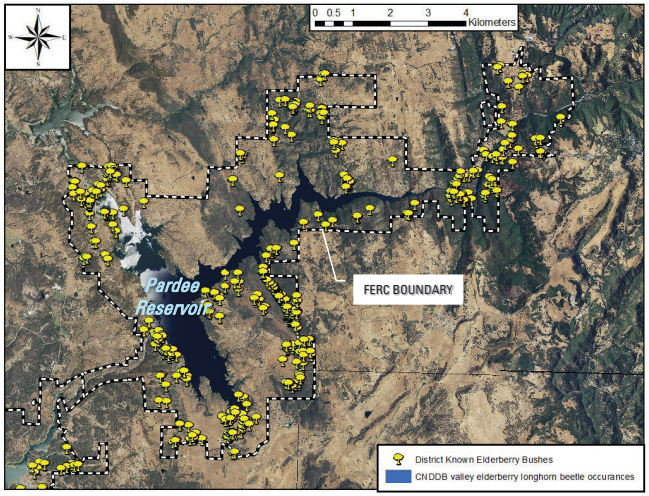
Safe Harbor Agreement

30-year Agreement signed in 2009 between USFWS and EBMUD:

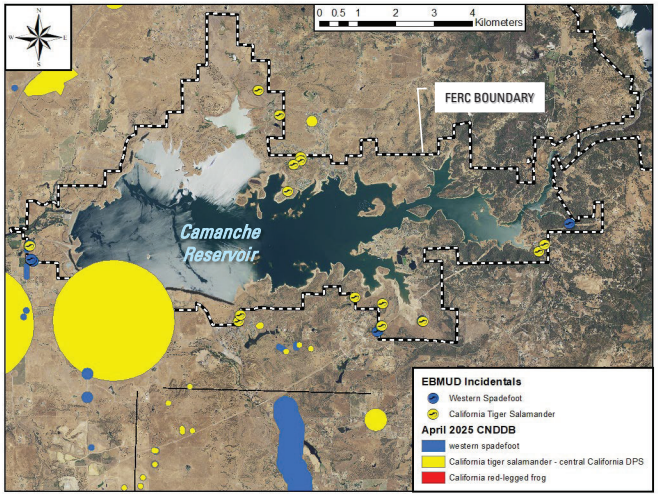
- To promote the enhancement and management of habitat for California tiger salamander, California red legged frog and valley elderberry longhorn beetle on EBMUD watershed lands
- To provide regulatory assurances to EBMUD (ITP) for regular maintenance in exchange for maintaining habitat baseline, and adding conservation measures



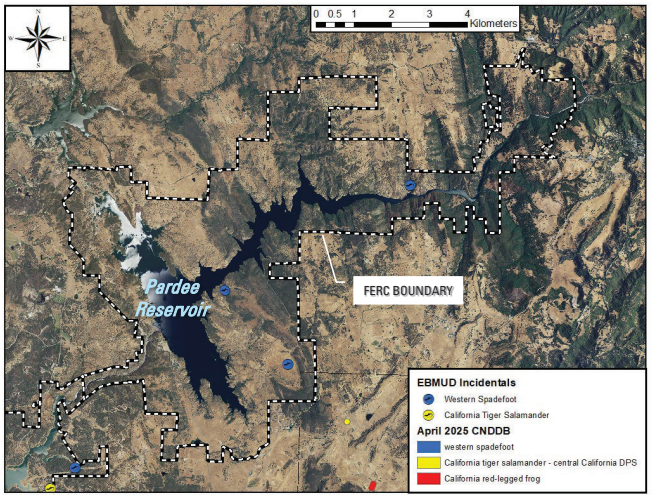
Known elderberries and Valley Elderberry Longhorn Beetle occurrences near Camanche Reservoir



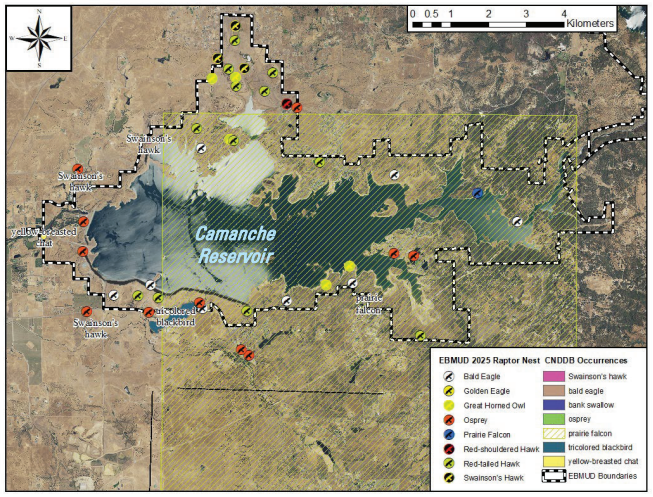
Known elderberries and Valley Elderberry Longhorn Beetle occurrences near Pardee Reservoir



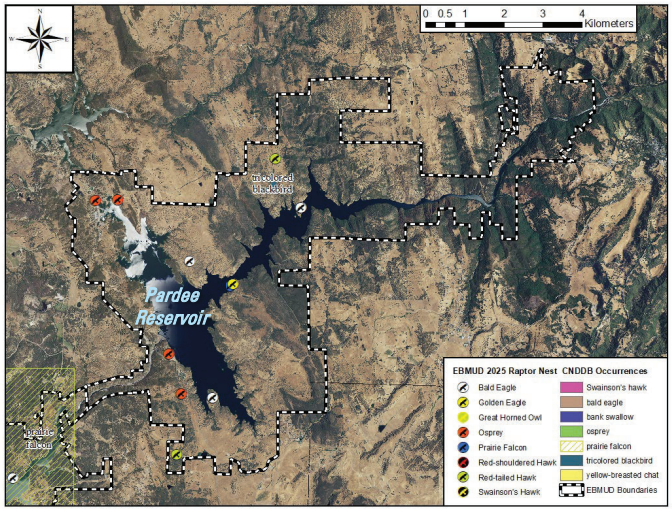
Known California tiger salamanders, California red-legged frog, and western spadefoot known occurrences near Camanche Reservoir.



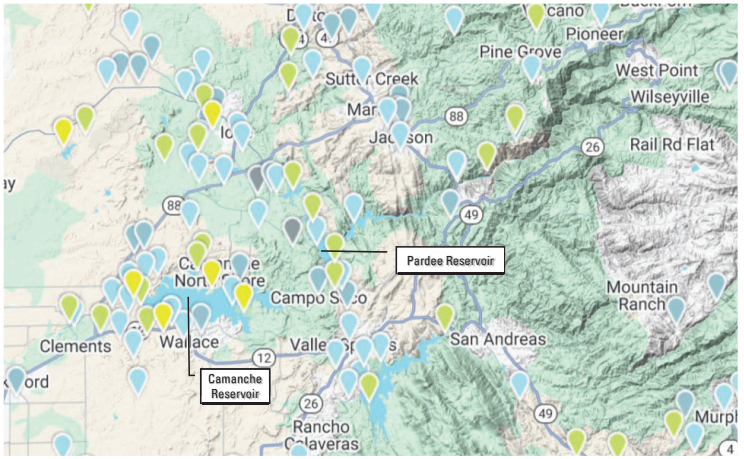
Known California tiger salamanders, California red-legged frog, and western spadefoot known occurrences near Pardee Reservoir



Known Raptor nest and CNDDB SSC occurrences near the Camanche Reservoir.



Known Raptor nest and CNDDB SSC occurrences near the Pardee Reservoir.



There are a potential of 218+ species of birds that may occur near the Project. They are winter, summer, or year-round residents.

Terrestrial – Wildlife / RTE

Data Gaps

- Identify special-status wildlife species known, potentially, and unlikely to exist in Project boundary / habitat suitability
- Define critical wildlife habitat present in the Project boundary
- Updated information on the location of special-status bat roosts in Project facilities
- Identify habitat for wildlife species (milkweed for Monarch butterfly) in conjunction with the special-status plant surveys

Terrestrial – Wildlife / RTE

Preliminary Study Objectives

- Identify protected or managed species present within the Project boundary
- Assess habitat suitability for special status wildlife and plants
- Identify habitat for special status species

Terrestrial – Botanical

Existing Data

- State and Federal Database Reviews
- EBMUD Biological Survey Reports
- License Compliance Documents
- EBMUD Data and Publications
- Scientific Literature

Existing Environment

Vegetation alliances (including riparian communities)

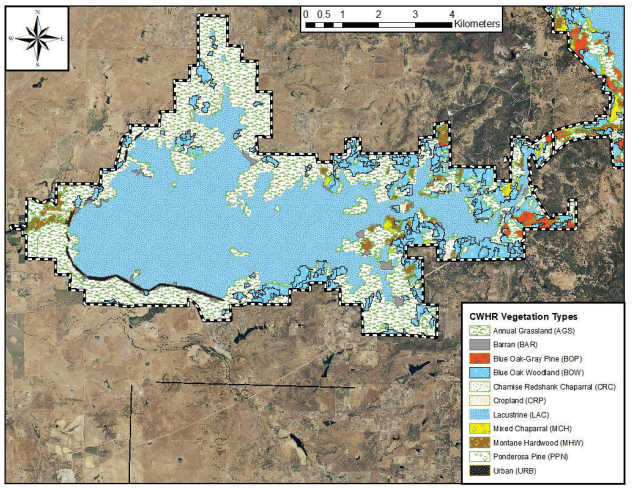
- Residual Dry Matter Surveys
- Surveyed points on District property in the Camanche and Pardee Watershed.
- Weigh and measure
- Annually since 2009
- Last sampled September 2024

Special-status plants

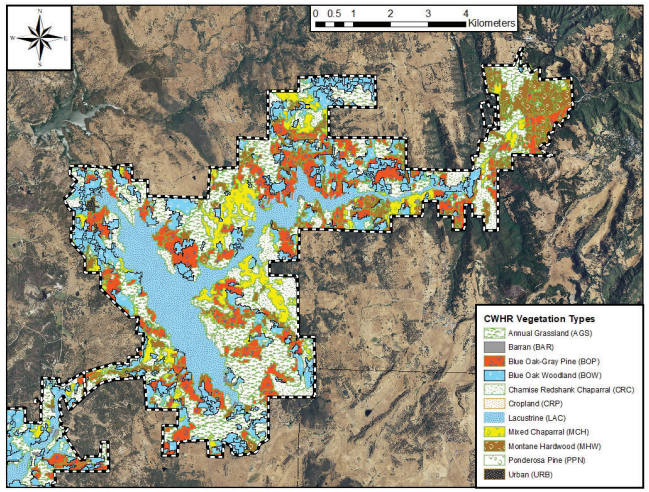
- District Watershed
- CDFW CNDDB

Non-native invasive plants

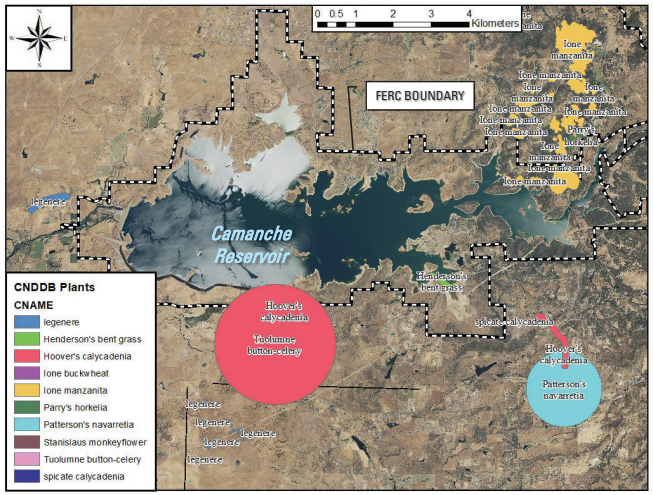
- Surveyed points on District property in the Camanche and Pardee Watershed.
- Visual Encounter Method



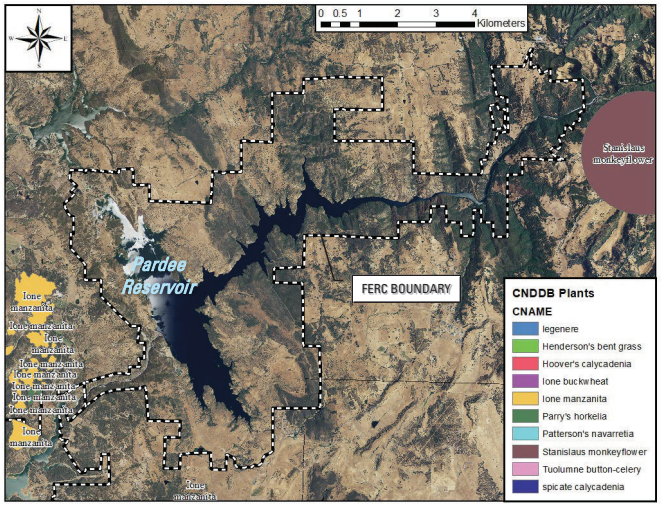
California Wildlife Habitat Relationships Vegetation types near Camanche Reservoir



California Wildlife Habitat Relationships Vegetation types near the Pardee Reservoir



Camanche - April 2025 California Natural Diversity Database plant species of special concern



Pardee - April 2025 California Natural Diversity Database plant species of special concern

Terrestrial – Botanical

Data Gaps

- Updated information on vegetation alliances, including riparian alliances
- Updated information on special-status plant populations
- Updated information on NNIPs

Terrestrial – Botanical

Preliminary Study Objectives

Vegetation Alliances

- Update vegetation alliances mapping

Special-status Plant Species

- Conduct special-status plant surveys

Non-Native Invasive Plants

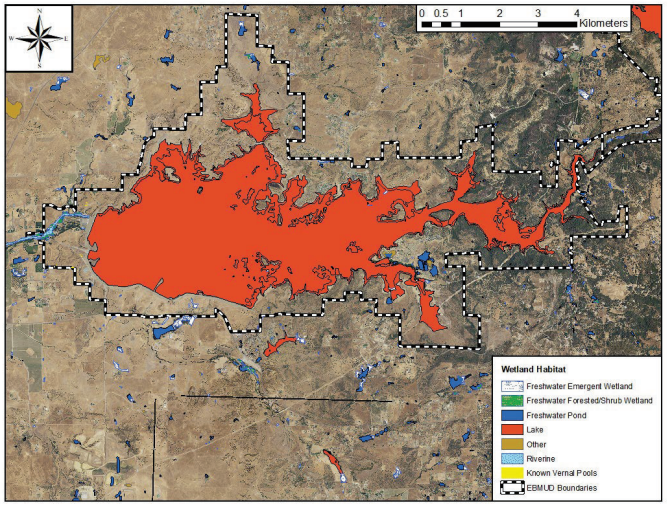
- Conduct survey for NNIPs in conjunction with special-status plant surveys

Terrestrial – Wetlands, Riparian, & Littoral Habitat

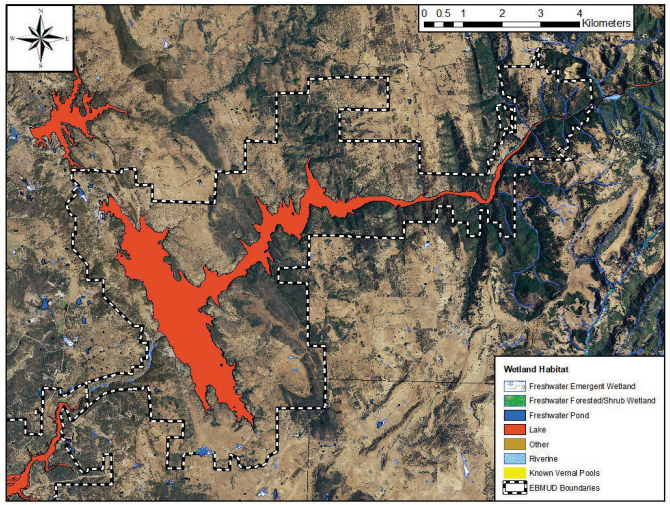
Existing Environment

- 5 types of wetland habitats
- Known wetland plant species identified as part of protocol level botanical inventory surveys

- Fresh Emergent Wetland
- Vernal Pool
- Valley Foothill Riparian
- Lacustrine
- Riverine



Wetlands, ponds, littoral habitat, and vernal pools near Camanche Reservoir.



Wetlands, ponds, littoral habitat, and vernal pools near the Pardee Reservoir.

Terrestrial – Wetlands, Riparian, & Littoral Habitat

Data Gaps

- Wetland type descriptions, floodplain, and wetland function
- Acreage for each type of wetland, riparian, and littoral habitat (including variability)
- Storage functionality

Terrestrial – Wetland, Riparian, & Littoral Habitats

Preliminary Study Objectives

- Identify wetland and floodplain types, including littoral habitat and storage functionality present within the Project boundary
- Assess wetland, riparian, and littoral habitat suitability for wildlife and plants
- Identify wetland, riparian, and littoral habitat for special status species

Recreation and Land Use

- Recreation Resources
- Land Use

Recreation – Facilities & Use

FERC Recreation Project Sites:

- **Camanche Reservoir**
- **Pardee Reservoir**
- **Mokelumne River Day Use Area**
- **Camanche Hills Hunting Preserve**

Existing Data (Sources)

- EBMUD Recreation Management Plan
- State and Federal Database Reviews
- Recreation Inventory Maps
- Visitor Attendance
- Fish Stocking Data
- Recreation Card and QR Code User Experience Surveys
- EBMUD Data and Publications
- FERC Form 80
- Annual maintenance inspections

Recreation – Facilities & Use

Activity	Camanche Reservoir	Pardee Reservoir	Mokelumne River Day Use Area	Camanche Hills Hunting Preserve
Fishing	✓	✓	✓	
Boating and/or Rafting	✓	✓	✓	
Swimming	✓		✓	
Camping	✓	✓		
Day Use (Picnic)	✓	✓	✓	✓
Trails	✓	✓		
Hunting				✓

Recreational Activities Offered

- Fishing (2 docks)
- Boating (3 boat launches)
- Swimming (In Mokelumne River; In Camanche Res.; Pool at Pardee Res.)
- Camping (22 campgrounds)
- Day Use (13 picnicking areas)
- Trails (5 staging areas, 48 miles of trail within Mokelumne Watershed)
- Hunting (Covers 1600 acres)

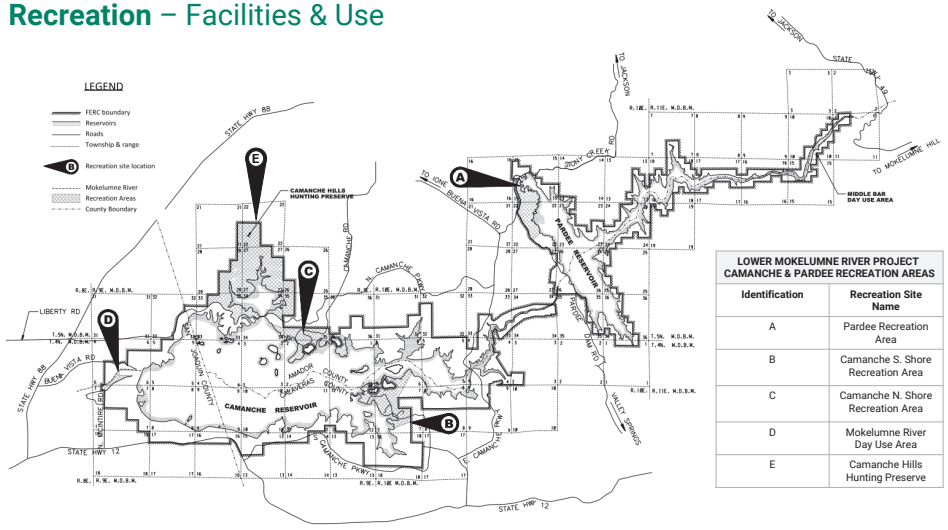
Recreation – Facilities & Use

Fish (Trout) Stocking at Camanche Reservoir

Year	South Pond (lbs)	South Lake (lbs)	North Lake (lbs)	Total (lbs)
2015	14,100	12,400	14,200	40,700
2016	18,350	16,100	15,500	49,950
2017	20,700	20,900	27,400	69,000
2018	23,100	22,800	24,900	70,800
2019	21,600	21,300	21,600	64,500
2020	18,600	17,400	16,200	52,200
2021	25,500	21,000	24,300	70,800
2022	21,100	19,900	20,500	61,500
2023	20,700	22,500	19,900	63,100
2024	18,700	16,900	15,800	51,400

Note: Typically stocked about 7 months of the year; excluding from about June through October.

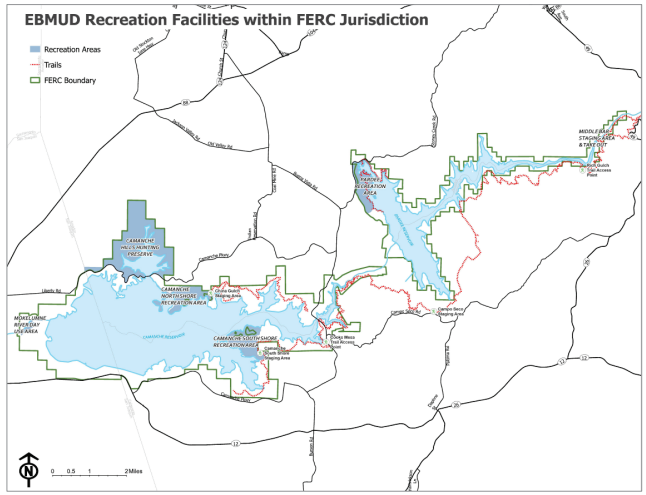
Recreation – Facilities & Use



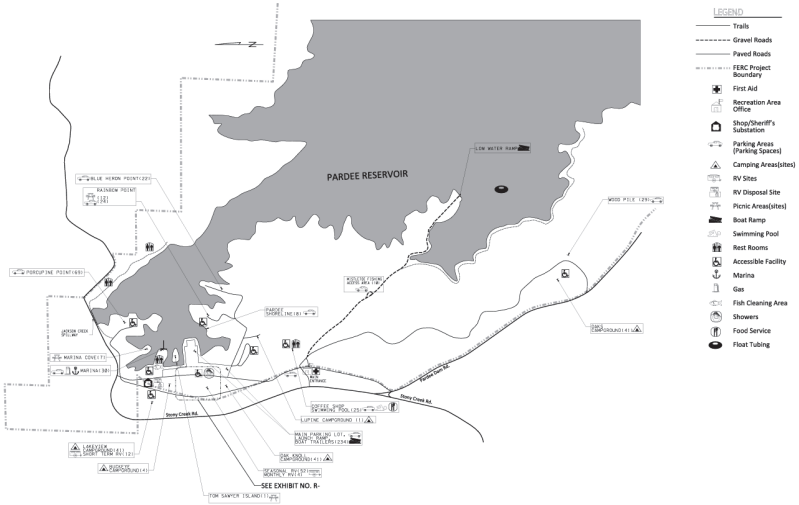
LOWER MOKELUMNE RIVER PROJECT
CAMANCHE & PARDEE RECREATION AREAS

Identification	Recreation Site Name
A	Pardee Recreation Area
B	Camanche S. Shore Recreation Area
C	Camanche N. Shore Recreation Area
D	Mokelumne River Day Use Area
E	Camanche Hills Hunting Preserve

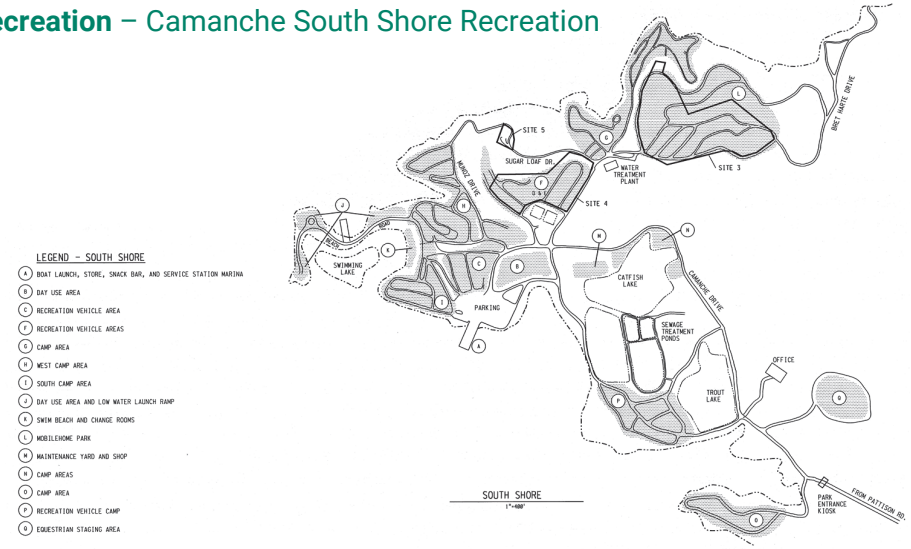
Recreation – Facilities & Use



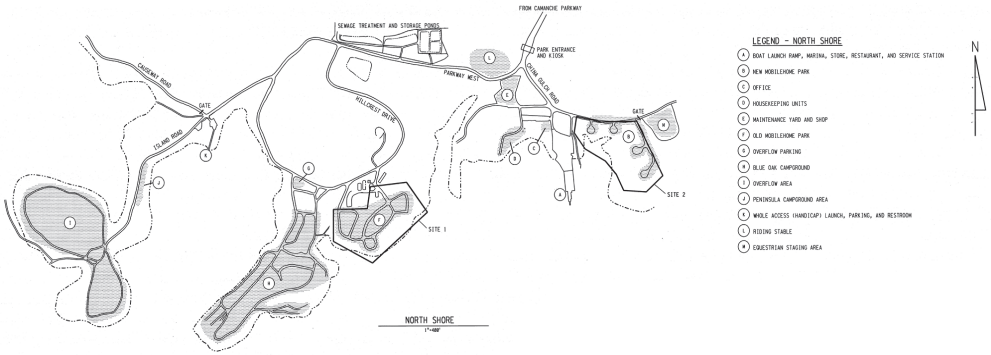
Recreation – Pardee Recreation Area



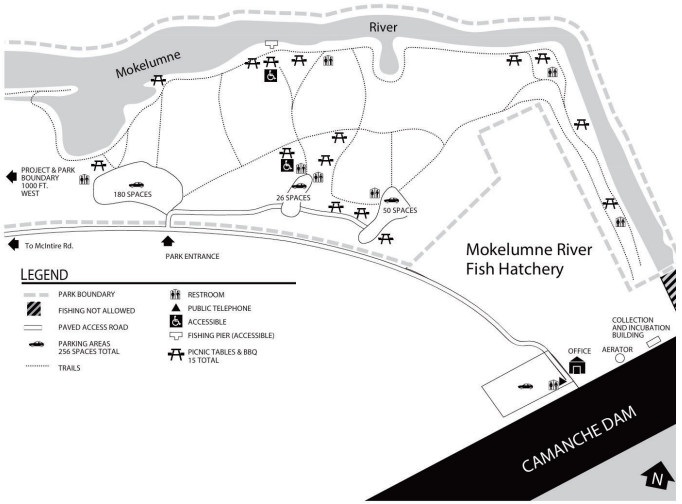
Recreation – Camanche South Shore Recreation



Recreation – Camanche North Shore Recreation



Recreation – Mokelumne Day Use Area



Recreation – Facilities & Use

Data Gaps

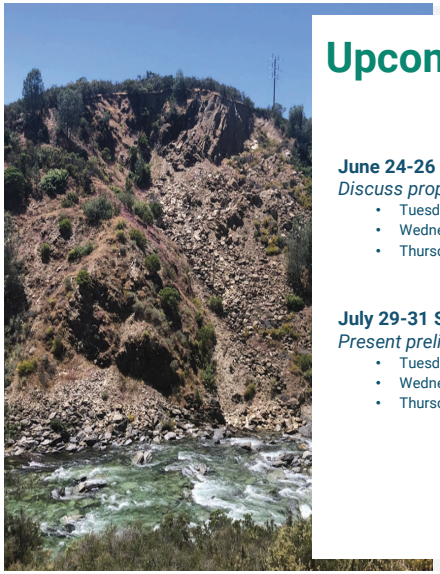
- Updated inventory of the condition of recreation area facilities and amenities i.e. picnic tables, trash receptables, firepits, etc.
- Recreation user demographics i.e. age range, hometown, etc.
- Spot counts of vehicles, recreation activities at recreation areas
- Creel surveys

Recreation – Facilities & Use

Preliminary Study Objectives

- Assess current inventory and condition of facilities/amenities in Project boundary
- Assess use at recreation sites in Project boundary
- Hear from the community what recreation attributes of the Project are most valued, what changes, if any, are suggested, etc.

Schedule & Next Steps



Upcoming TWG Meetings

June 24-26 Initial Virtual TWG meetings:
Discuss proposed studies, develop goals, objectives, & methodology of studies

- Tuesday 6/24, 9-11am Recreation and Land Use
- Wednesday 6/25, 9-11am Fish and Aquatic Resources, 1:30-3:30pm, Water Resources
- Thursday 6/26 9-11am, Wildlife/Botanical/RTE

July 29-31 Secondary Virtual TWG meetings:
*Present preliminary draft study plans**

- Tuesday 7/29 1:30-3:30pm Recreation and Land Use
- Wednesday 7/30 9-11am Fish and Aquatic Resources, 1:30-3:30pm Water Resources
- Thursday 7/31 9-11am, Wildlife/Botanical/RTE

EBMUD

TWG Roles and Participation

- Open to agencies/Tribes/NGOs/interested parties with baseline knowledge of the TWG meeting resource area focus
- Encourage participants to commit to the process and arrive prepared for meetings (review documents, provide technical feedback, etc.)
  - Understand that time commitment may increase once formal relicensing begins (after filing of PAD).
- Join a TWG by emailing MokRelicense@ebmud.com

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EMBUD submittal of the Pre-Application Document (PAD)

TWG kickoff Meeting with NOAA-NMFS
June 4, 2025 - 9a-10a - Virtual

Attendees:
EBMUD: Priya Jain, Joe Tam, Jason Zhou, Casey Del Real, Karen Donovan, Ben Bray, Chris Potter, Sarah Rahimi-Ardabily
Kleinschmidt: Fatima Oswald
NMFS: Jon Ambrose, Monica Gutierrez

NMFS background: FERC relicensing branch, most have retired or left. Jon and Monica – they are stepping in the best they can. Tom Holley will focus on Water Resources and has extensive FERC experience. Jon will defer to Tom. Jon and Monica are interested in F&A.

NMFS asked for project overview and FERC relicensing presentation – Joe Tam and Fatima Oswald gave those presentations. Casey Del Real presented F&A.

Questions/comments from NOAA, Jon Ambrose:

1. Nice to deal w/ a water District that monitors and samples and that is hard to find, thank you EBMUD.
2. Priya: this meeting is to provide an overview of data and what we collect. Happy to have your thoughts. Next meetings June/July will move into specific studies.
3. Jon: For NOAA, they are thinking of where to focus efforts, since they are so limited. His guiding document is the Recovery Plan of 2014. Maybe not all the details but, the overall strategy – will be following that, will fall back on that recovery plan.

a) One of EB's slides was chinook and native species. Outgrowth of efforts from San Joquin Restoration program. Tremendous number of spring run chinook showing up and also straying into other SJR tributaries. And it's a threatened species. So, moving forward, what can we do for spring-run chinook? Like Tuolumne and Stanislaus, probability of them showing up in the Mokelumne is very high.

b) What's suitability of habitat upstream? Per the recovery plan, we cannot get there without establishment of some populations of species upstream. Where is the opportunity and what is habitat like? He wants a study on what that habitat is like – relayed it would help in decision making process where they can recommend if could implement a program there.

c) Per downstream, EB is doing all the right things. NMFS wants to further those improvements through EB work. Loves EB and that EB does the work/monitoring/studies ahead of time.

d) How do we enhance water temperatures in the summertime? Chinook are following snow melt, traditionally they would hold all summer, spawn in fall. Wants to know what those summer temps are.

e) Fall run chinook in Sacramento River basin are not doing well. Third year of closure of commercial fishery. Fall run could be closed too, just know that. We don't know what the long-term status will be. Jon does not know what else NMFS can ask of EB (acknowledges EB is producing big time, but long FERC license so who knows what the situation will be in 20 years.)

4. Monica reiterates: Spring run are listed and some Mokelumne spring run still have their adipose fin intact. Because they can access Moke, will assume they will be there. We need to consider spring run.

5. Monica question: threatened and rare species, is there anything there that covers listed species that is not covered in this species. Fatima covered Terrestrial species list.

- Casey noted: In regard to habitat upstream, in 2013 a salmonid restoration team put together and had a contract with Cramer Fish Scientists. EBMUD role was as technical advisors. Assessment done in 2018 - looked at what upstream barriers were. Historical upstream extent. Bald Rock Falls, low on middle fork, identified rock bolder. Cramer's' work looked at salmonid habitat. They found under 14 miles of historical suitable habitat in the upper watershed, leading up to those historical barriers. EB can share that information.

- Per spring run, video operations, year-round. Feb-July detections can share observations with you, any salmonid passage data into the river.

- Jon – Did they have detections this year?

  ○ Casey - yes: 3 in Feb and 1 in April, all adipose fin clipped.

  ○ Jon – CDFW moved 150 spring run in a pool below. This happened last week. IF EB gets detections they would love to know.

- Jon – They want to look at historical limit. Climate change – looking for opportunities to move fish to suitable habitat, even if it was not historic habitat, above waterfalls. Tuolumne River this is happening. Very early stages of this. But with climate change and winter/spring run that need cold water, sometimes they need to move fish higher.

  ○ Casey – Challenges of collecting juveniles as they move downstream.

  ○ Jon – 3 pilots 1. McCloud winter run, 2. North fork upstream of Lake Almanor by DWR, 3. CDFW released 40 spring run into North Yuba. Looking at different ways to collect juveniles. In PNW 95-98% collection rate. But would be significantly less rates of collection here.

  ○ Casey – concerns of pathology, CDFW determined it was too risky, IN and Worley disease. CDFW decided not to introduce upstream. Would need to discuss with the hatchery.

  ○ Jon – For McCloud that is an issue.

Meeting close out with invite for NMFS to attend late June and July calls. And lines of communication are open.

From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #1 slides
Date: Wednesday, July 2, 2025 5:07:35 PM
Attachments: image002.png
20250626 Wildlife-Botanical-Wetlands TWG Meetings Slides.pdf

Hello,

Thank you to those that were able to attend the first Botanical, Wildlife, & RTE TWG meeting. Attached to this e-mail is the presentation that was shared at that meeting. We will be sharing the study plan outlines next week, the week of July 7. The slide presentation stated that comments/feedback on the study plan outlines are due by July 11; however, we have pushed that out and will be asking for comments/feedback submitted via e-mail by **July 18**.

The second Botanical, Wildlife, & RTE TWG meeting is July 31 from 9:00-11:00am. A meeting notice was sent out, but please let us know if you did not receive it. Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
Wildlife, Botanical, and Rare/Threatened/Endangered Resources
June 25, 2025

EBMUD Kleinschmidt EBMUD

AGENDA

- Welcome and Introductions
- Brief Project and Process Overview
- Identify Potential Studies
- Q&A and Feedback
- Action Items, Schedule and Next Steps

Welcome & Introductions

EBMUD EBMUD

Lower Mokelumne Relicensing Team

Project Management Team	Resource Leads
Priya Jain	Michelle Workman
Brad Ledesma	Casey Del Real
Joe Tam	James Jones
Sabrina Cheng	
Karen Donovan	

Consultant Team

Kleinschmidt	*JNA*
Shannon Luoma	Janelle Nolan
Fatima Oswald	Robyn Smith
Olivia Smith	**Facilitator**
	Marie Rainwater

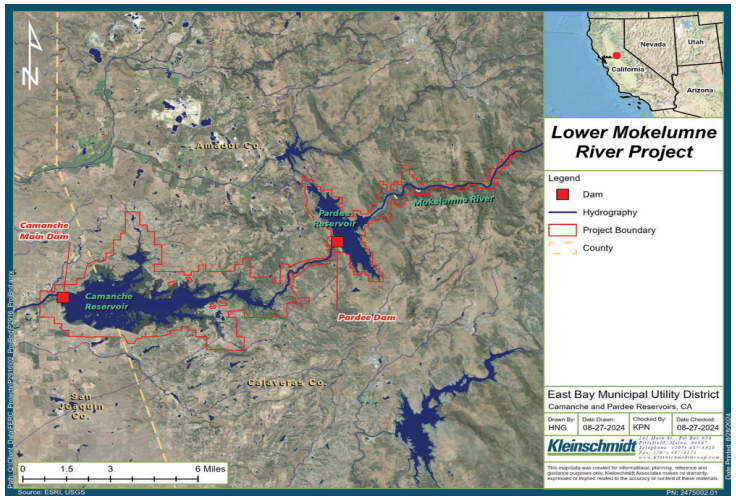
Meeting Purpose and Objectives

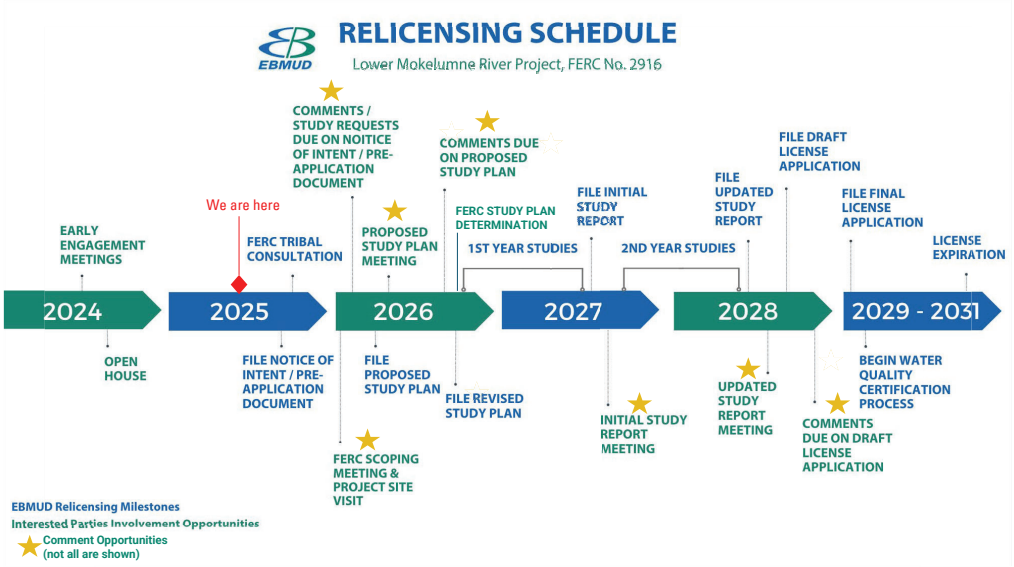
- Ensure EBMUD is aware of relicensing participants interests and objectives as they prepare their draft study plans for inclusion in the PAD
- Receive feedback on potential study plans

Lower Mokelumne River (FERC Project No. 2916) Project Overview

EBMUD

Lower Mokelumne River (P-2916) River Project





Why Conduct Studies?

- The Proposed Study Plan (PSP) is a FERC requirement under the ILP
- Provide FERC the necessary information to conduct their analysis
- Identify pertinent & potential Project issues
- Lay groundwork for future license conditions & PM&Es

18 CFR § 5.11 Potential Applicant's proposed study plan and study plan meetings.

(a) Within 45 days following the deadline for filing of comments on the pre-application document, including information and study requests, the potential applicant must file with the Commission a proposed study plan.

FERC's 7 Study Guide Criteria

1- Goals & Objectives
2&3 - Relevant Resource Management Goals & Public Interest Considerations
4 - Existing Information & Need for Additional Information
5 - Project Nexus
6 - Proposed Methodology
7 - Level of Effort & Costs

Potential Study – Botanical Resources Study

Goals & Objectives

- Document California Wildlife Habitat Relationship (CWHR) habitats and sensitive natural communities adjacent to Project facilities.
- Document special-status plant, lichen, and moss populations adjacent to Project facilities.
- Document NNIPs adjacent to Project facilities.

Potential Methodology: CWHR Habitats and Sensitive Natural Communities:

- Develop habitat maps based on CWHR descriptions.
- Verify accuracy of data and update habitats using recent aerial photos.
- Conduct ground-truthing of habitats surrounding Project facilities concentrating on areas where concerns about habitat identification and boundaries arise.
- Develop a GIS map of habitats and sensitive natural communities and overlay information on Project facilities.

Potential Study – Botanical Resources Study

Potential Methodology Special-status Plants:

- Identify and map known occurrences of special-status plants within the study area.
- Develop list of species potentially occurring in the Project area based on literature review and agency consultation.
- Conduct focused surveys according to the *Protocols for Surveying and Evaluation Impacts to Special Status native Plant Populations and Sensitive Natural Communities* (CDFW 2018).
  - Timing of surveys will be verified based on reference population monitoring.
- Develop GIS Map of special-status plant populations and overlay information on Project facilities.
- Prepare CNDDB forms for all populations identified.

Potential Study – Botanical Resources Study

Potential Methodology Non-Native Invasive Plants (NNIPs):

- Identify and map known occurrences of NNIPs within the study area.
- Develop list of priority NNIPs in consultation with agencies.
- Conduct focused NNIP surveys in conjunction with special-status plant surveys.
- Develop GIS Map of NNIPs and overlay information on Project facilities.

Potential Study – Botanical Resources Study

Q&A and Feedback

Potential Study – Wildlife Resources Study

Goals & Objectives:

- Identify special-status wildlife species potentially occurring in CWHR habitats documented as part of Botanical Resources Study Plan.
- Map potential habitat for monarch butterfly (i.e., milkweed) in conjunction with special-status plant surveys completed as part of the Botanical Resources Study Plan.
- Document bat roosts present on Project facilities and identify bat species present.

Potential Study – Wildlife Resources Study

Potential Methodology Special-status Wildlife Surveys

- Identify and map known occurrences of special-status wildlife in the study area.
- Identify special-status wildlife species potentially occurring in CWHR habitats mapped as part of the Botanical Resources Study Plan.
- Conduct wildlife reconnaissance survey in conjunction with special-status plant surveys.
- Prepare CNDDB forms for special-status species observed.
- Record incidental observations of special-status wildlife during all field surveys conducted in support of relicensing.

Potential Study – Wildlife Resources Study

Potential Methodology Monarch Butterfly Habitat**:**

- Document the location of monarch butterfly habitat (i.e., milkweed) in conjunction with special-status plant surveys conducted as part of the Botanical Resources Study Plan.
- Develop a map and table identifying the location of milkweed in the study area and overlay on Project facilities.

Potential Study – Wildlife Resources Study

Potential Methodology (cont.):
Special-status Bat Roost Surveys
Facility Assessment

- Conduct initial desktop assessment of Project facilities to determine their potential to support bat roosts.
- Conduct preliminary visual assessment of Project facilities during wildlife reconnaissance surveys to determine the potential to support bat roosts.
- Develop list of Project facilities potentially supporting bat roosts (by facility type).

Roost Survey

- Conduct visual roost survey at Project facilities identified as potentially supporting roosting bats.
- If bat roosts are present but the species cannot be determined visually, collect guano for DNA sampling.
- Develop a map and table documenting the location of bat roosts and species present.

Potential Study – Wildlife Resources Study

Potential Methodology (cont.):
Special-status Bat Roost Surveys
Guano DNA Sampling

- Collect DNA samples at roost sites where fresh guano is available and bat species cannot be determined visually during roost survey.
- Compare DNA sequences to species-specific genetic markers developed by Walker et al. 2016 and further verify by comparison to samples at the National Center of Biotechnology Information DNA Sequence Database.
- Develop a map and table identifying the location of guano DNA sampling and species present.

Potential Study – Wildlife Resources Study

Q&A and Feedback

Potential Study – Wetlands, Riparian, and Littoral Habitat Study

Goals & Objectives:

- Document Waters of the U.S./State and riparian habitats adjacent to Project facilities and Project-affected reaches.
- Determine the relationship between riparian habitats and flow conditions in Project-affected reaches.

Potential Methodology:

Preliminary Mapping of Jurisdictional Waters of the U.S./State and Riparian Habitat

- Develop preliminary maps of jurisdictional Waters of the U.S./State and riparian habitat based on NWI mapping.
- Verify the accuracy of data and update information using recent aerial photos.

Ground-truthing/Field Verification

Jurisdictional Waters of the U.S./State

- Conduct ground-truthing concentrating in areas where questions on classification or boundaries arise from review of aerial photographs.
- Develop GIS map of and overlay information Project facilities.

Potential Study – Wetlands, Riparian, and Littoral Habitat Study

Potential Methodology (cont.):

Ground-truthing Field Verification

Riparian

- Map the extent of riparian habitat along Project-affected reaches using a combination of high-resolution aerial imagery and field observation at riparian cross-sections.
- Develop a GIS map of riparian habitat along Project-affected reaches.

Characterize Relationship of Riparian to Flow Conditions

- Establish cross-sections at representative location along Project-affected reaches:
  - Characterize riparian and substrate along the length of each cross-section.
  - Develop stage-discharge relationships over a range of flows (high to low).
- Develop a summary of the relationship between existing inundation characteristics and the distribution of dominant riparian species in Project-affected reaches.
- Compare and contrast existing Project and without Project hydrology in relation to riparian recruitment and maintenance in Project-affected reaches.

Potential Study – Wetlands, Riparian, and Littoral Habitat Study

Q&A and Feedback

Action Items & Next Steps

Next Steps

July 2– Relicensing Team will distribute draft potential study plan outlines to attendees

July 11 – Interested Parties submit feedback on study plans via email

Next meeting: July 31, 9:00 – 11:00 a.m.

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Jason Zhou, EBMUD: 510-287-0263
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

Thank you!

From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Water Resources TWG Meeting #1 slides
Date: Wednesday, July 2, 2025 5:07:44 PM
Attachments: image002.png
20250625 Water Resources TWG Meetings Slides.pdf

Hello,

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Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
Water Resources
June 25, 2025

AGENDA

- Welcome and Introductions
- Brief Project Overview
- Identify Potential Studies
- Q&A and Feedback
- Action Items, Schedule and Next Steps

Welcome & Introductions

Lower Mokelumne Relicensing Team

Project Management Team	Resource Leads
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Priya Jain	Ben Bray
	Casey Del Real
Brad Ledesma	Casey Leblanc
	Chandra Johannesson
Joe Tam	Chris Potter
	Deirdre Mena
Sabrina Cheng	Eric Toth
	Ginger Chen
Karen Donovan	Jason Zhou
	Sami Harper
	Thom Hardie

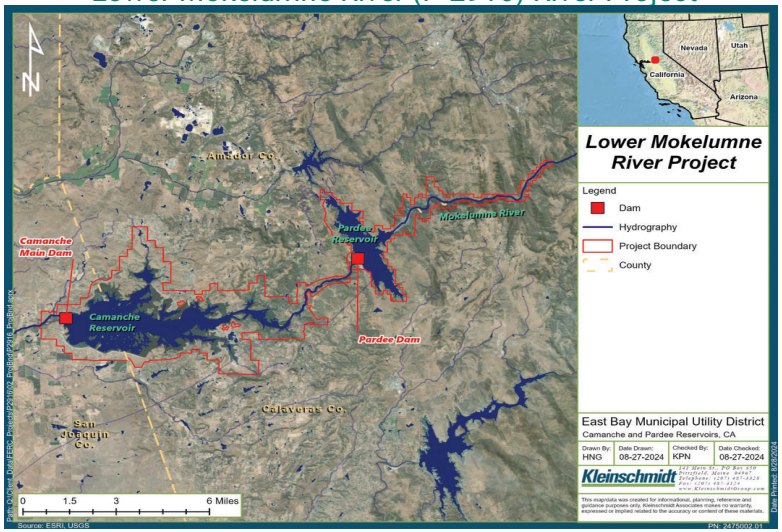
Consultant Team	Facilitator
	Marie Rainwater
Kleinschmidt	
Shannon Luoma	
Fatima Oswald	
Olivia Smith	
Vanessa Martinez	

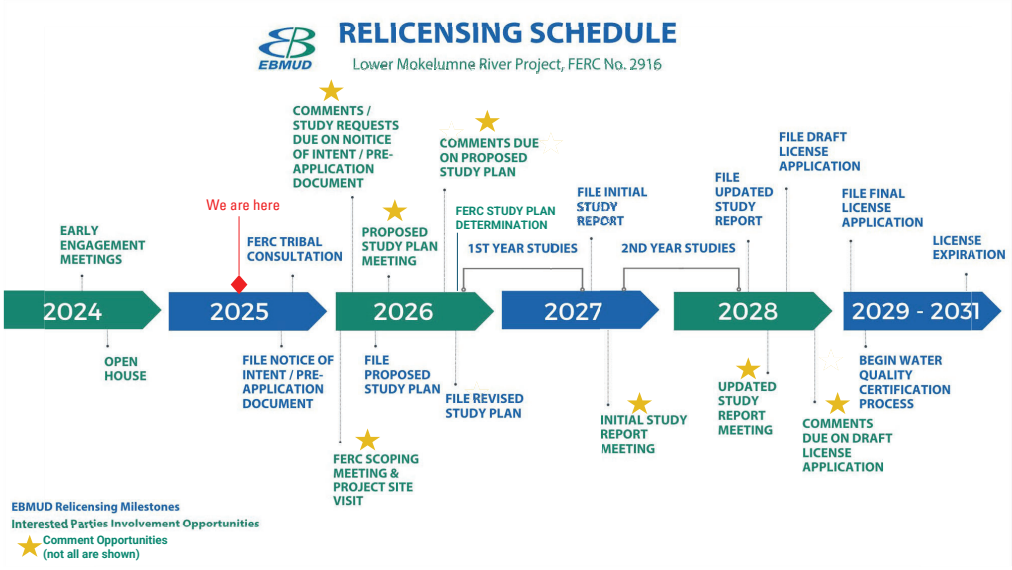
Meeting Purpose and Objectives

- Ensure EBMUD is aware of relicensing participants interests and objectives as they prepare their draft study plans for inclusion in the PAD
- Receive feedback on potential study plans, including:
  - Goals & objectives
  - Project nexus
  - Study area
  - Methodology

Lower Mokelumne River (FERC Project No. 2916) Project Overview

Lower Mokelumne River (P-2916) River Project





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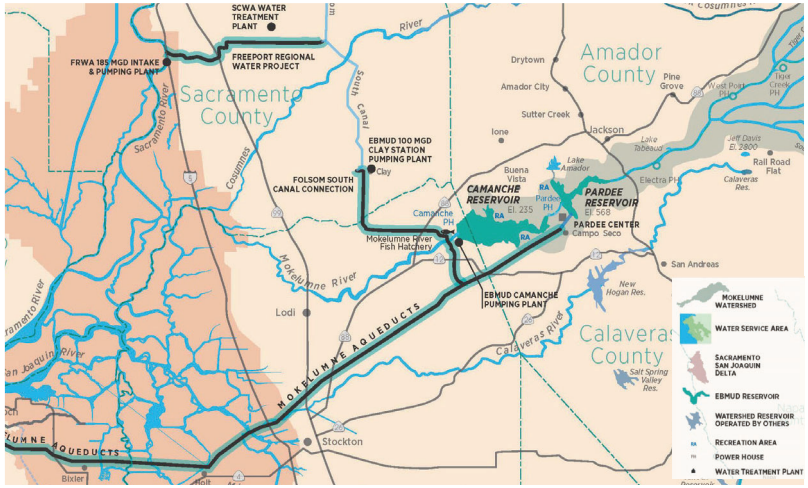
Water Resources

Water Resources – Operations, Hydrology, & Water Quality



Water Resources – Operations, Hydrology, & Water Quality

EBMUD Operating Criteria

- USACE Flood Control Manual
- SWRCB Water Rights Licenses and Permit Terms
- Joint Settlement Agreement
- Agreements with other water rights holders

EBMUD Operational Considerations

Reservoirs are operated in tandem to meet:

- Municipal water supply
- Obligations to downstream diverters
- Fishery requirements
- Water quality (temperature, DO)
- Contribution to Delta inflow/outflow
- Flood control (streamflow regulation)
- Power generation

Water Management Reporting

- USACE Daily Reservoir Report
- USGS Annual Data Validation
- FERC Annual Project Operations Report
- California Data Exchange Center (CDEC)
- SWRCB Water Rights Reporting

Water Quality Monitoring

- Daily and monthly in-situ water temperature data from 1998-2024
- Semi-continuous; daily spring-fall reservoir water temperature data from 2007-2024
- Manual water quality profile data from Pardee and Camanche

Water Resources – Operations and Hydrology

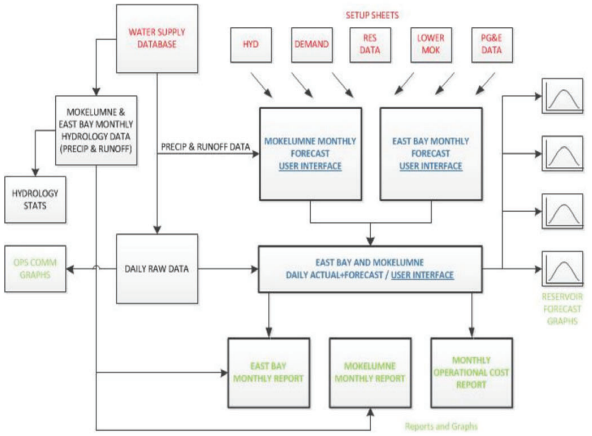
EBMUD Water Supply Operations Model

MS Excel based mass balance accounting tool

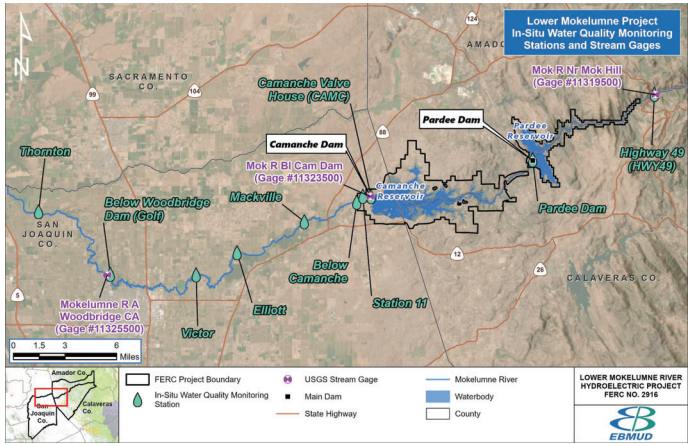
Set up with combination of monthly user inputs and daily time steps

Used to manage water supply reservoir levels for:

- meeting forecasted water treatment plant production needs,
- emergency storage goals,
- flood control,
- water quality limitations,
- In-stream flow requirements
- water rights and agreements,
- power generation goals.



Water Resources – In-Situ Water Quality Monitoring Stations & Stream Gages



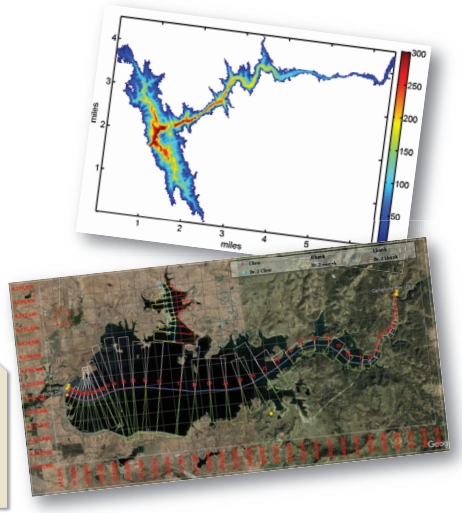
Water Resources –Water Quality

Water Temperature Models

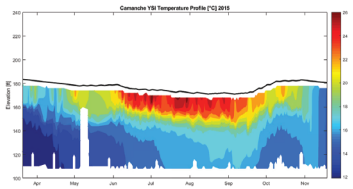
CE-QUAL-W2 ver. 4.5
A two-dimensional hydraulic and water temperature model application for both Pardee and Camanche.

SNTEMP/RMS4
A one-dimensional hydraulic and water temperature model application - RMS4 for hourly timestep resolution and a SNTEMP for daily timestep resolution - for the reach connecting Pardee and Camanche Reservoirs.

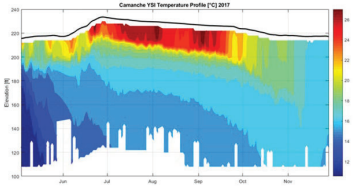
SSTEMP
Monthly timestep model with statistical model application that simulates temperatures for the lower Mokelumne river from Camanche Dam to Station Golf below Woodbridge Dam that allow for a prediction of the monthly maximum of the seven-day average daily maximum water temperature given release temperature and flow from Camanche Dam and meteorological inputs.



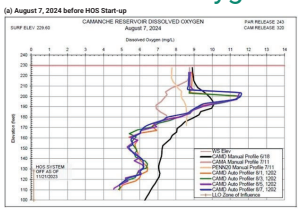
Water Resources– Water Temperature and Dissolved Oxygen

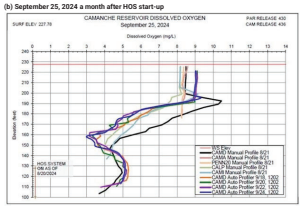


Autoprofiler Temperature (°C) Contour, Station CAMD, 2015 Provisional.



Autoprofiler Temperature (°C) Contour, Station CAMD, 2017 Provisional.





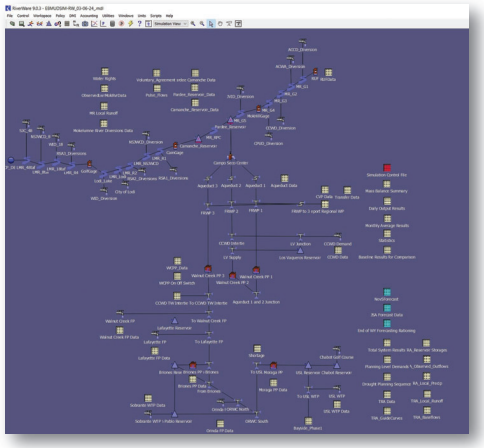
Example of Elevated Dissolved Oxygen within the Camanche Hypolimnion Resulting from the Hypolimnetic Oxygenation System (HOS) Operation.

Water Resources – Operations and Hydrology

Water Supply System Planning Model

EBMUDSIM-Riverware

- Implemented following the fixed level-of-development approach for water supply planning
- Simulate current conditions and future conditions out to 2050 with the past 100 years of hydrology available for the simulation
- Modeling studies typically utilize monthly timestep output, however, daily timestep data are available for more refined analysis or to use as boundary conditions to drive water temperature model applications



Water Resources– Basin Plan Existing Beneficial Uses

(CVRWQCB, 2019)

Water Body	Municipal and Domestic supply	Irrigation	Stock Watering	Power	Contact (Recreation)	Canoeing and Rafting	Warm Water Habitat	Cold Water Habitat	Warm Water Migration	Cold Water Migration	Warm Water Spawning	Cold Water Spawning	Wildlife Habitat
Inflows to Pardee	x			x	x	x	x		x	x			x
Pardee Reservoir	x			x	x		x	x			x	x	x
Camanche Reservoir	x	x	x		x		x	x	x		x	x	x
Camanche to Delta		x	x		x	x	x	x	x	x	x	x	x

Potential Study – Water Quality Study

Goals & Objectives:

- Characterize existing project water quality of Project reservoirs and Project-affected stream reaches
  - Collect water quality data to supplement existing information as needed
- Assess consistency with water quality objectives in the Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (Basin Plan)
- Assess mercury concentration in game fish tissue

Potential Methodology:

- Collect *in situ* data and grab samples spring and fall (high and low flow) in the Project affected area
- Profiles of DO, pH, specific conductivity, and turbidity will be measured and analyzed at the Project during spring, summer, and fall
- Collect 10 edible sized fish of each species during the fish population study and analyze mercury concentration

Water Resources– Basin Plan Water Quality Objectives

(CVRWQCB, 2019)

Parameter	Analysis Method	Sample Hold Times
Water Quality Monitoring Parameter		
***In-Situ* Measurements**		
Water Temperature	Water Quality Meter	Not Applicable
Dissolved Oxygen	Water Quality Meter	Not Applicable
Secchi Depth	Secchi Disk	Not Applicable
Specific Conductance	Water Quality Meter	Not Applicable
Turbidity	Water Quality Meter	Not Applicable
pH	Water Quality Meter	Not Applicable
Laboratory Analysis Parameter		
General Parameter		
Nitrate-Nitrite (NO_3)	EPA 353.2	48 hrs
Total Ammonia	EPA 350.1	28 days
Total Kjeldahl Nitrogen as N	EPA 351.2	28 days
Total Phosphorous	SM 4500	28 days
Total Dissolved Solids	SM 2540C	7 days
Total Suspended Solids	SM 2540D	7 days
Total Alkalinity	SM 2320B	14 days
Dissolved Orthophosphate	SM 4500-PE	48 hrs
Bacteria		
Total Coliform	EPA SM9223B	24 hrs
Fecal Coliform	EPA SM9223B	24 hrs
E. Coli	EPA SM9223B	24 hrs

Potential Study – Water Quality Study

Q&A and Feedback

Potential Study – Hydrology and Operations Modeling Study

Goals & Objectives:

- Model the existing Project hydrology using existing EBMUD tools
- Conduct a high flow/flood-frequency analysis for existing Project

Potential Methodology:

- Conduct up to three stakeholder hydrological modeling working group meetings to review and help provide input to the modeling approach
- Model Using
  - USGS / EBMUD gage data
  - 2001 - 2024 period of record (POR) for hydrological modeling.
  - EBMUD's RiverWare model

Potential Study – Hydrology and Operations Modeling Study

Q&A and Feedback

Potential Study – Water Temperature Study

Goals & Objectives:

- Characterize existing Project water temperature of Project reservoirs and Project-affected stream reaches from 2001-2024

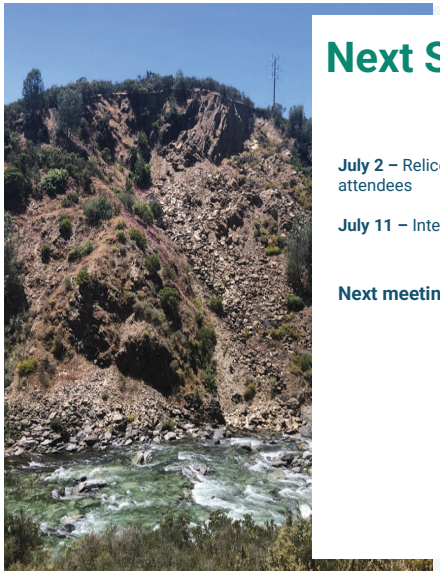
Potential Methodology:

- Conduct up to three stakeholder water temperature modeling working group meetings to review and help provide input to the modeling approach
- Use the following to model water temperature:
  - Water temperature inflow boundary conditions
  - Reservoir profiles of water temperature
  - MET Data including climate change
  - EBMUD CE-QUAL-W2 and SNTEMP/RSM4 models

Potential Study – Water Temperature Study

Q&A and Feedback

Action Items & Next Steps



Next Steps

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Next meeting: July 30, 1:30-3:30pm

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From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Recreation & Land Use TWG Meeting #1 slides
Date: Wednesday, July 2, 2025 5:07:18 PM
Attachments: image002.png
20250624 Recreation and Land Use TWG Meeting Slides.pdf

Hello,

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East Bay Municipal Utility District
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Website: www.ebmud.com/MokRelicense
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Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
Recreation & Land Use
June 24, 2025

EBMUD Kleinschmidt EBMUD

AGENDA

- Welcome and Introductions
- Brief Project Overview
- Identify Potential Studies
- Q&A and Feedback
- Action Items, Schedule and Next Steps

Welcome & Introductions

EBMUD EBMUD

Lower Mokelumne Relicensing Team

PM Team	Resource Leads
Priya Jain	Chuck Beckman
Brad Ledesma	Scott Wiemerslage
Joe Tam	Deborah Preciado
Sabrina Cheng	
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Consultant Team	Facilitator
Shannon Luoma	Marie Rainwater
Fatima Oswald	
Olivia Smith	
Angela Whelpley	

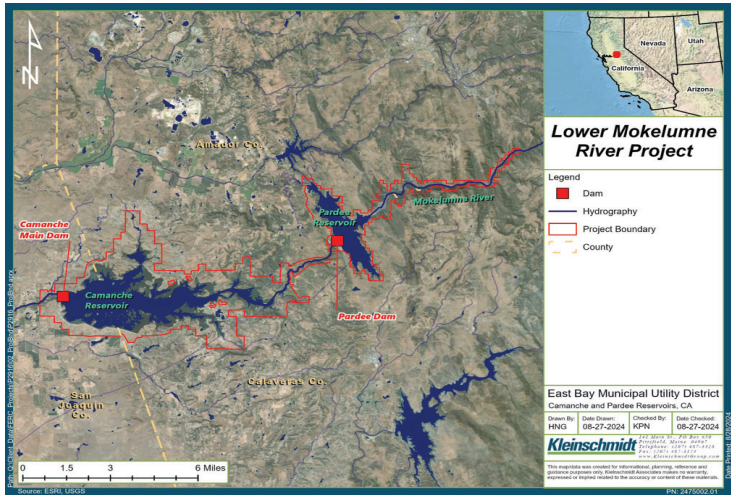
Meeting Purpose and Objectives

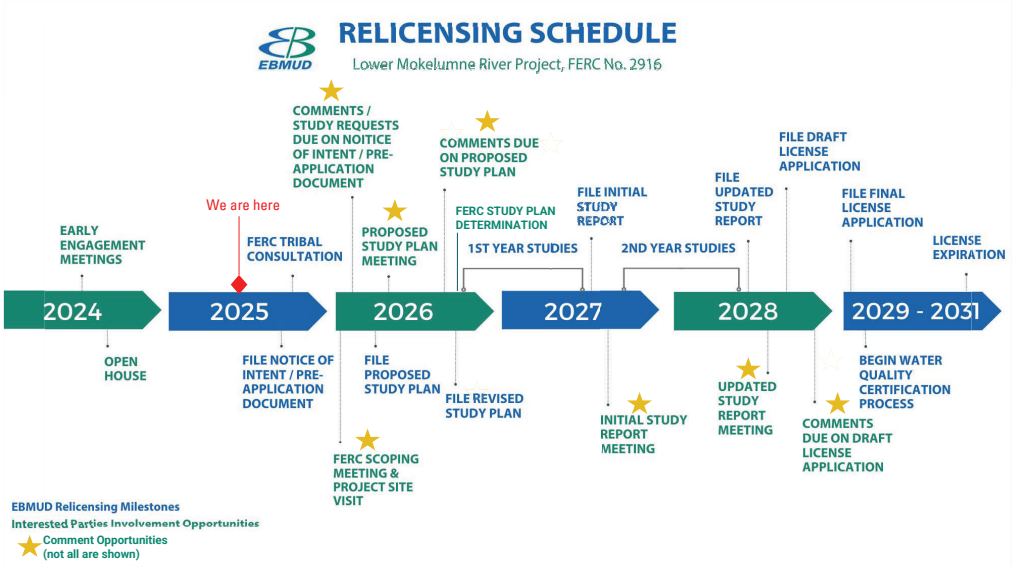
- Ensure EBMUD is aware of relicensing participants interests and objectives as they prepare their draft study plans for inclusion in the PAD
- Receive feedback on potential study plans, including:
  - Goals & objectives
  - Project nexus
  - Study area
  - Methodology

Lower Mokelumne River (FERC Project No. 2916) Project Overview

EBMUD

Lower Mokelumne River (P-2916) River Project FERC Boundary





Why Conduct Studies?

- The Proposed Study Plan (PSP) is a FERC requirement under the ILP
- Provide FERC the necessary information to conduct their analysis
- Identify pertinent & preliminary Project issues
- Lay groundwork for future license conditions & PM&Es

18 CFR § 5.11 Potential Applicant's proposed study plan and study plan meetings.

(a) Within 45 days following the deadline for filing of comments on the pre-application document, including information and study requests, the potential applicant must file with the Commission a proposed study plan.

FERC's 7 Study Guide Criteria

1- Goals & Objectives
2&3 - Relevant Resource Management Goals & Public Interest Considerations
4 - Existing Information & Need for Additional Information
5 - Project Nexus
6 - Proposed Methodology
7 - Level of Effort & Costs

Project Recreation – Recreation Facilities & Use

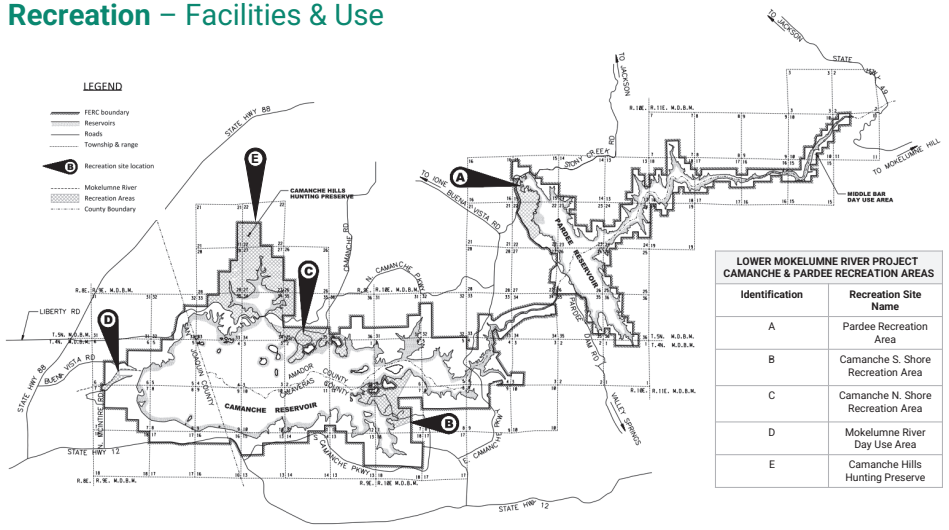
FERC Recreation Project Sites:

- **Camanche North/South Shore Recreation Areas**
- **Pardee Recreation Area**
- **Mokelumne River Day Use Area**
- **Camanche Hills Hunting Preserve**

Existing Data (Sources)

- EBMUD Recreation Management Plan
- State and Federal Database Reviews
- Recreation Inventory Maps
- Visitor Attendance
- Fish Stocking Data
- Recreation Card and QR Code User Experience Surveys
- EBMUD Data and Publications
- FERC Form 80
- Annual maintenance inspections

Recreation – Facilities & Use



LOWER MOKELUMNE RIVER PROJECT CAMANCHE & PARDEE RECREATION AREAS

Identification	Recreation Site Name
A	Pardee Recreation Area
B	Camanche S. Shore Recreation Area
C	Camanche N. Shore Recreation Area
D	Mokelumne River Day Use Area
E	Camanche Hills Hunting Preserve

Project Recreation – Facilities & Use

Activity	Camanche Reservoir	Pardee Reservoir	Mokelumne River Day Use Area	Camanche Hills Hunting Preserve
Fishing	✓	✓	✓	
Boating and/or Rafting	✓	✓	✓	
Swimming	✓		✓	
Camping	✓	✓		
Day Use (Picnic)	✓	✓	✓	✓
Trails	✓	✓		
Hunting				✓

Recreational Activities Offered

- Fishing
- Boating (3 boat launches)
- Swimming (Camanche Reservoir, Pardee Pool)
- Camping (21 campgrounds, 550 Sites)
- RV Camping (3 parks, 263 sites)
- Rental Cabins (21 total)
- Day Use (Picnicking, swimming)
- Trails (6 trail heads, 35 miles of trail)
- Hunting (1,500 acres of upland habitat)

Potential Studies – Recreation Facilities Inventory & Condition Assessment

Goal: Inventory recreation sites within the Project boundary

Objectives:

- Field verify, map, and document recreation facilities and amenities within the Project boundary
- Document the general condition of recreation facilities and amenities and describe their maintenance, inspection and/or management practices

Potential Methodology: Field Surveys of Public Recreation Sites within the Project Boundary

- GPS location of the facilities
- Type, number and condition of amenities provided at each site
- An estimate of parking capacity
- Ownership and management
- Hours/seasons of operation
- Existing safety, security and informational (signage) measures
- Observation of site use and accessibility
- Suitability of facilities to provide opportunities for persons with disabilities to participate in recreation opportunities
- Accompanying photographs

Potential Studies – Recreation Facilities Inventory & Condition Assessment

Q&A and Feedback

Potential Studies – Recreation Use & Needs Study

Goal 1: Characterize the existing use of public recreation sites in the Project boundary

- **Objectives**
  - Estimate the recreation use at each site by day type (i.e. weekday, weekend, peak weekend)
  - Evaluate visitor feedback regarding perception and experience at each site

Goal 2: Identify current and future needs related to public recreation sites in the Project boundary

- **Objectives**:
  - Evaluate whether recreation capacity, and existing facilities and amenities at public recreation sites meet current needs
  - Estimate future recreation use of existing recreation sites
  - Estimate future needs for potential new recreation sites and facilities

Potential Methodology: Spot Counts, Recreation Use Visitor Intercept Surveys, Creel Surveys, Secondary Data (U.S. Bureau of Census Data, EBMUD Visitor Count Data)

Potential Studies – Recreation Use & Needs Study

Q&A and Feedback

Potential Studies – Environmental Justice Study

Goals & Objectives:

- Identify the presence of EJ communities that may be located within the Study Area;
- Develop strategies to conduct outreach to identified EJ communities to ensure meaningful involvement in the relicensing process is achieved; and
- Evaluate whether the EBMUD Project will have disproportionately high and adverse effects on identified EJ communities within the Study Area.

Potential Methodology:

- Data Gathering and Statistics Tables (U.S. Census data)
- Identification of EJ Communities Based on Minority Populations & Low-Income Populations
- Identification of Non-English-Speaking Populations
- Mapping Efforts (ArcGIS)

Potential Studies – Environmental Justice Study

Q&A and Feedback

Next Steps & Action Items

Next Steps

By June 27 – Relicensing Team will distribute meeting materials to attendees

By July 11 – Interested Parties submit feedback on draft potential study plan outlines via email

Next meeting: July 29, 1:30-3:30pm*
*Meeting may be canceled based on feedback received on draft potential study plan outlines

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Deborah Preciado, EBMUD: 510-287-0985
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 2, 2025 5:06 PM
Subject: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources TWG Meeting #1 slides

Hello,

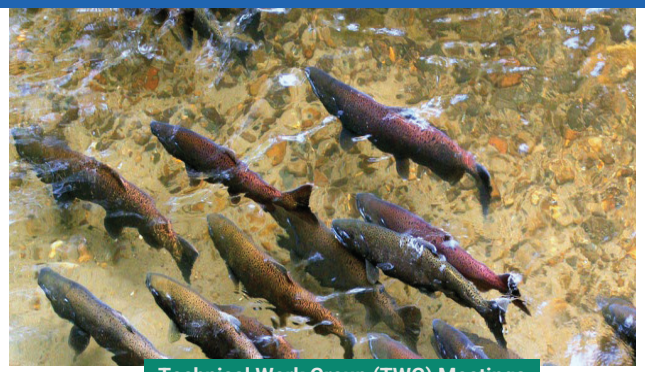
Thank you to those that were able to attend the first Fish & Aquatic Resources TWG meeting. Attached to this e-mail is the presentation that was shared at that meeting. We will be sharing the study plan outlines next week, the week of July 7. The slide presentation stated that comments/feedback on the study plan outlines are due by July 11; however, we have pushed that out and will be asking for comments/feedback submitted via e-mail by **July 18**.

The second Fish & Aquatic Resources TWG meeting is July 30 from 9:00-11:00am. A meeting notice was sent out, but please let us know if you did not receive it. Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Lower Mokelumne River Project

FERC Project No. 2916



Technical Work Group (TWG) Meetings
Fish & Aquatics
June 25, 2025

EBMUD Kleinschmidt EBMUD

AGENDA

- Welcome and Introductions
- Brief Project Overview
- Identify Potential Studies
- Q&A and Feedback
- Action Items, Schedule and Next Steps

Welcome & Introductions

EBMUD EBMUD

Lower Mokelumne Relicensing Team

Project Management Team	Resource Leads
Priya Jain	Casey Del Real
Brad Ledesma	Michelle Workman
Joe Tam	Jason Zhou
Sabrina Cheng	
Karen Donovan	

Consultant Team	Facilitator
Kleinschmidt Shannon Luoma	Marie Rainwater
Fatima Oswald	
Olivia Smith	
Craig Addley	

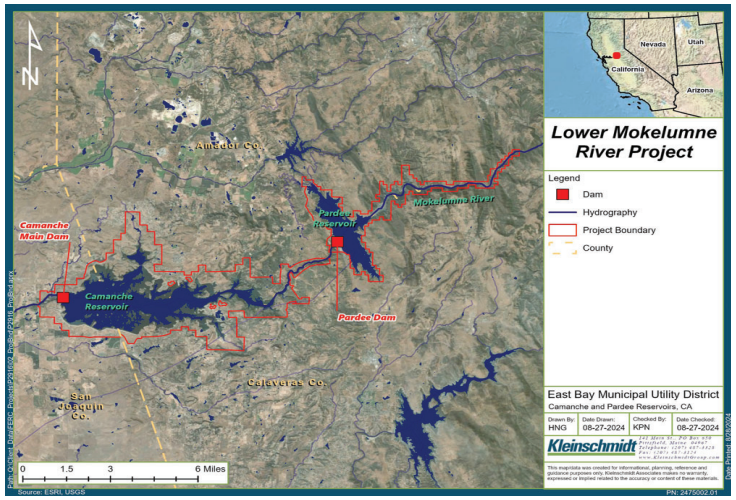
Meeting Purpose and Objectives

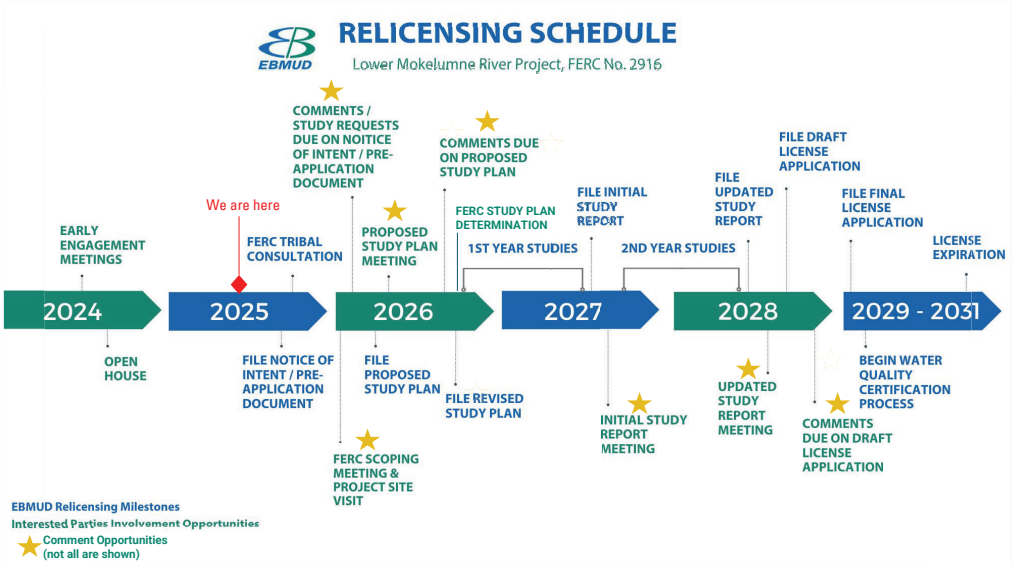
- Ensure EBMUD is aware of relicensing participants interests and objectives as they prepare their draft study plans for inclusion in the PAD
- Receive feedback on potential study plans

Lower Mokelumne River (FERC Project No. 2916) Project Overview

EBMUD

Lower Mokelumne River (P-2916) River Project





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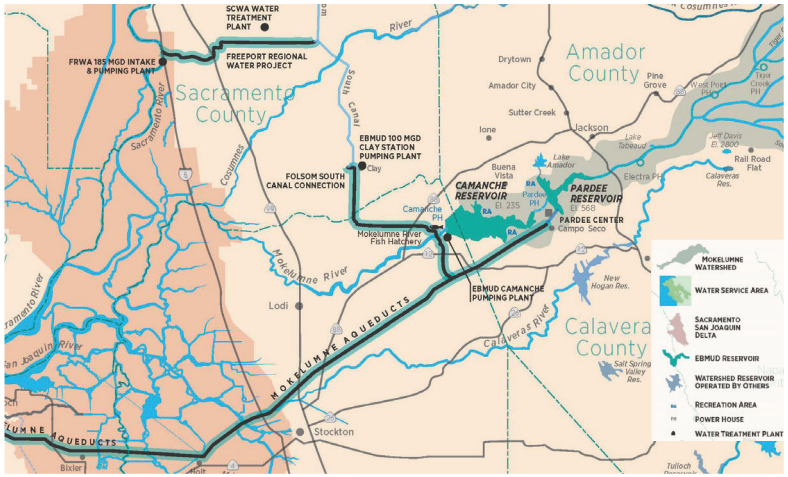
Fish & Aquatics



Fish & Aquatics – Salmonids/ Amphibians & Reptiles

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes to San Joaquin
Salmonidae: Salmon and Trout Family	Brown Trout	I	X		X		
	Chinook Salmon	N, SSC			X	X	X
	Chum Salmon	N			X		
	Kokanee	N	X*	X*	X	X	
	Rainbow trout	N	X	X			
	Steelhead/rainbow trout	N, FT, SCC			X	X	X

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes to San Joaquin
Ranidae: Trug Frog Family	American Bullfrog	I	X	X	X		
Salamandridae: True Salamander and Newt Family	Sierra Newt	N	X				
Emydidae: Hard-shelled Turtle Family	Northwestern Pond Turtle	N,FPT	X	X	X		
	Red-eared Slider	I		X	X		

Fish & Aquatics – non-salmonids

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes River to San Joaquin River
Atherinopsidae: Silversides Family		I				X	X
Catostomidae: Sucker Family	Sacramento Sucker	N	X		X	X	X
Centrarchidae: Sunfish Family	Black Crappie	I	X	X	X	X	X
	Bluegill	I	X	X	X	X	X
	Green Sunfish	I	X	X	X	X	X
	Largemouth Bass	I	X	X	X	X	X
	Redear Sunfish	I	X	X	X	X	X
	Redeye bass	I			X	X	X
	Smallmouth Bass	I	X	X	X	X	X
	Spotted Bass	I	X	X	X	X	X
	Warmouth	I			X	X	X
	White Crappie	I		X	X	X	X
Clupeidae: Herring Family	American Shad	I				X	X
	Threadfin Shad	I	X	X	X	X	X
Cottidae: Sculpin Family	Pacific Staghorn Sculpin	N			X		X
	Prickly Sculpin	N	X	X	X	X	X
Cyprinidae: Minnow Family	California Roach	N	X				
	Common Carp	I	X	X	X	X	X
	Fathead Minnow	I				X	X
	Golden Shiner	I	X	X	X	X	X
	Goldfish	I		X	X	X	X
	Hardhead	N, SSC	X		X		
	Hitch	N, SSC			X	X	X
	Sacramento Blackfish	N, SSC		X	X	X	X
	Sacramento Pikeminnow	N	X	X	X	X	X
	Sacramento Splittail	N, SSC				X	X

Fish & Aquatics – non-salmonids (cont.)

Family	Species	Status	Pardee Reservoir	Camanche Reservoir	Camanche Dam to WIDD	WIDD to Cosumnes River	Cosumnes River to San Joaquin River
Embiotocidae: Surfperch Family	Tule Perch	N, SSC			X	X	X
Gobiidae: Goby Family	Yellowfin Goby	I				X	X
Ictaluridae: Catfish Family	Black Bullhead	I			X	X	X
	Brown Bullhead	I			X	X	X
	Channel Catfish	I	X	X	X	X	X
	White Catfish	I	X	X	X	X	X
Moronidae: Striped Bass Family	Striped Bass	I			X	X	X
Osmeridae: Smelt Family	Delta Smelt	N, FT, CE				X	X
	Wakasagi	I				X	
Percidae: Perch Family	Bigscale Logperch	I			X	X	X
Petromyzontidae: Lamprey Family	Pacific Lamprey	N, SSC			X	X	
Poeciliidae: Livebearers	Western mosquitofish	I		X	X	X	X

Potential Study – Reservoir Fish Habitat Study

Goals & Objectives:

- Summarize current fish species assemblage data, stocking records, and fishing success for Project reservoirs.
- Characterize existing Project daily water surface elevation patterns and pool habitat volumes (cold water, warm water, dissolved oxygen) at each reservoir.

Potential Methodology:

- Quantify cold and warm water reservoir habitat over the period of record (POR) (2001 -2024)
  - Use the hydrology model to characterize reservoir operations.
  - Use the water temperature model to characterize reservoir water temperatures.
  - Quantify cold water habitat (water temperature ≤20°C and DO ≥7 mg / l).
  - Quantify warm water habitat (water temperature >20°C and DO ≥5 mg / l).

Potential Study – Reservoir Fish Habitat Study

Q&A and Feedback

Potential Study – Instream Flow Study

Goals & Objectives:

- Summarize the historical instream flow modeling
- Use the current HEC-RAS hydraulics / habitat model to characterize habitat versus flow relationships to develop a time series analysis of aquatic habitat under existing conditions.
- Identify the time periods, flow conditions, and life stages when habitat may be a limiting factor for fish, benthic macroinvertebrates, other aquatic species, and riparian vegetation.

Potential Methodology:

- Establish an Aquatic TWG to provide input and technical review of modeling procedures.
- Identify the target species and life stages for modeling based on management importance and/or sensitivity to Project operations.
- Use the current HEC-RAS hydrodynamic and habitat model
  - Use existing modeling reaches
- Develop a time series analysis of habitat for existing conditions.

Potential Study – Instream Flow Study

Q&A and Feedback

Potential Study – Fish Population Study

Goals & Objectives:

- Document fish species composition, distribution, and abundance in the reservoirs and river reaches.
- Characterize fish growth, condition factor, and population age structure in the reservoirs and river reaches.
- Collect fish for mercury tissue analysis

Potential Methodology:

- Use the existing reservoir and river sampling / monitoring program (2027).
- Document fish species composition, distribution, and abundance in the reservoirs and river reaches using historical and recently collected data.
- Characterize fish growth, condition factor, and population age structure in the reservoirs and river reaches using historical and recently collected data.
- Collect fish for mercury tissue analysis in the Water Quality Study

Potential Study – Fish Population Study

Q&A and Feedback

Potential Study – Special Status Amphibians & Aquatic Reptiles Study

Goals & Objectives:

- Identify and map potential habitat for Northwest Pond Turtle (NWPT) in the study area.
- Document the distribution and abundance of NWPT populations in the study area.
- Document the presence of potential NWPT nesting habitat near Project facilities.
- Sample eDNA for foothill yellow-legged frog, red legged-frog, and giant garter snake.
  - Note: Tiger salamander and western spadefoot toad are addressed in the wildlife study plan.

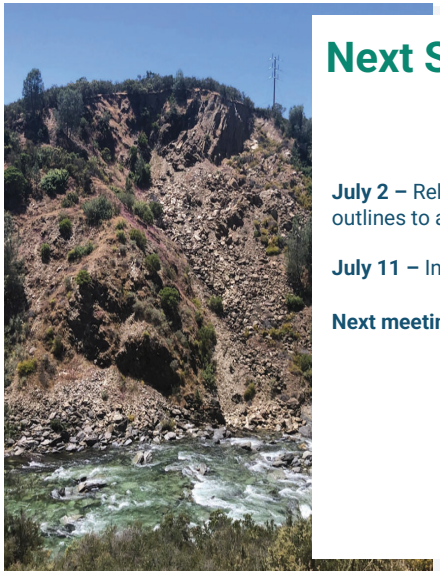
Potential Methodology:

- Develop NWPT habitat suitability criteria in cooperation with relicensing participants.
- Use GIS to characterize NWPT habitat within the study area.
- Conduct distribution and abundance surveys for NWPT in the study area.
- Document the presence of potential NWPT nesting habitat near Project facilities (GIS and field).
- Sample eDNA for foothill yellow-legged frog, red legged-frog, and giant garter snake.

Potential Study – Special Status Amphibians & Aquatic Reptiles Study

Q&A and Feedback

Action Items & Next Steps



Next Steps

July 2 – Relicensing Team will distribute draft potential study plan outlines to attendees

July 11 – Interested Parties submit feedback on study plans via email

Next meeting: July 30, 9:00 – 11:00 a.m.

EBMUD

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Jason Zhou, EBMUD: 510-287-0263
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

THANK YOU!

From: MokRelicense
Subject: RE: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #1 slides
Date: Friday, July 18, 2025 3:24:41 PM
Attachments: image001.png

Good afternoon,

If you haven't already, please review the previously attached preliminary draft Study Plans for Botanical, Wildlife, & RTE. Should you have any feedback, please provide it to us (MokRelicense@ebmud.com) by close of business on **Tuesday July 22**. Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 9, 2025 8:23 PM
To: MokRelicense <MokRelicense@ebmud.com>
Subject: RE: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #1 slides

Hello,

Attached are the preliminary draft Study Plans for Botanical, Wildlife, & RTE. The preliminary draft Study Plans outline some of the initial information on objectives/goals as well as scope and methodologies being considered. We'd appreciate your review and feedback by **Tuesday July 22**.

This will help us have a more constructive discussion at the next Technical Working Group Meeting scheduled for July 31 from 9:00-11:00am. Please let us know if you did not receive a meeting notice and would like to be sent one. If we do not receive any feedback, we will proceed in cancelling this second TWG meeting.

Thank you.

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Website: www.ebmud.com/MokRelicense
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From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 2, 2025 5:06 PM
Subject: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #1 slides

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East Bay Municipal Utility District
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Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense
To: MokRelicense
Bcc: Jain, Priyanka; Cheng, Sabrina; Tam, Joe; Shannon Luoma; Fatima Oswald; Olivia Smith; craig@foothillconservancy.org; Chase.McCormick@Waterboards.ca.gov; Eric.Bradbury@Waterboards.ca.gov; Vogel, Joshua R; mboblet@gmail.com; catherine_brown@nps.gov; A1ZK@pge.com; susan.kester@pge.com; Angela Whelpley
Subject: RE: EBMUD Lower Mokelumne River Project Recreation & Land Use TWG Meeting #1 slides
Date: Wednesday, July 9, 2025 8:22:43 PM
Attachments: image001.png
EBMUD Recreation Use and Needs Study Plan Prelim Draft.pdf
EBMUD Environmental Justice Study Plan Prelim Draft.pdf
EBMUD Recreation Facilities Inventory & Condition Assessment Study Plan Prelim Draft.pdf

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Hello,

Attached are the preliminary draft Study Plans for Recreation & Land Use. The preliminary draft Study Plans outline some of the initial information on objectives/goals as well as scope and methodologies being considered. We'd appreciate your review and feedback by **Tuesday July 22**.

This will help us have a more constructive discussion at the next Technical Working Group Meeting scheduled for July 29 from 1:30pm-3:30pm. Please let us know if you did not receive a meeting notice and would like to be sent one. If we do not receive any feedback, we will proceed in cancelling this second TWG meeting.

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Email: *MokRelicense@ebmud.com*

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 2, 2025 5:06 PM
Subject: EBMUD Lower Mokelumne River Project Recreation & Land Use TWG Meeting #1 slides

Hello,

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East Bay Municipal Utility District

From: MokRelicense
Subject: RE: UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans
Date: Friday, July 18, 2025 3:24:42 PM
Attachments: image001.png

Good afternoon,

If you haven't already, please review the most recently attached preliminary draft Study Plans for Fish & Aquatic Resources. Should you have any feedback, please provide it to us (MokRelicense@ebmud.com) by close of business on **Tuesday July 22**. Thank you.

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Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Friday, July 11, 2025 10:04 AM
To: MokRelicense <MokRelicense@ebmud.com>
Subject: UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans

Hello all.
We are resending the preliminary draft study plans – these attached plans have been updated to the most recent version, **please use these for your review and comment**. Thank you.

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 9, 2025 8:23 PM
To: MokRelicense <MokRelicense@ebmud.com>
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Thank you.

From: Maher, Michael@Wildlife
To: MokRelicense
Subject: RE: UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans
Date: Monday, July 21, 2025 2:51:58 PM
Attachments: image001.png

Hello EBMUD relicensing staff,

California Department of Fish and Wildlife (CDFW) staff have reviewed the preliminary draft fish study plans provided for the relicensing of the lower Mokelumne Hydroelectric Project (P-2916; Project) and have the following comments:

Fish Population Study Plan (FPSP)

The FPSP should be revised to include the following:

- The number of water temperature and dissolved oxygen (DO) monitoring locations in the FPSP should be increased and the data collected used to conduct egg survival estimates for instream spawning. The temperature and DO data collected should be made available publicly in a real-time manner, similar to real-time data provided by the California Data Exchange Center (CDEC).
- Fry emergence trapping should be added as a component of the FPSP to determine egg survival and compared with egg survival estimates.
- The FSPS should be revised to include locations where out-migrating fall run Chinook salmon smolt mortality is occurring. This information should be recorded and reported to Project stakeholders as they move downstream. Additional rotary screw trap monitoring sites, juvenile salmon acoustic telemetry system, or passive integrated responder antenna monitoring should be added in consultation with Project stakeholders to narrow down location specifics as appropriate. Solutions to address the high mortality rate in these locations should be developed for stakeholder approval.
- The FPSP should be revised to allow for the investigation and modeling of an installed cold-water release device/system in Camanche Reservoir to allow for cooler water temperatures and improved fishery conditions in the Mokelumne River.
- Please provide the results of the most recent fish population study to inform comments on the draft Reservoir Fish Habitat Study Plan. CDFW staff may have additional comments or suggested revisions on the draft Reservoir Fish Habitat Study Plan once we have had the opportunity to review this data.

Instream Flow Study Plan

- Although habitat is a crucial factor for salmonid success, temperature and flow are of equal or greater importance. They are necessary components that should be included in the Instream Flow Study Plan to determine potential Project impacts on egg survival and juvenile rearing and migration.

It is the understanding of CDFW staff that the early stages of the study plan process is an ongoing process involving the drafting and review of multiple interim versions until a final study plan is developed that satisfies the relicensing participants. We look forward to continued collaboration with staff from EBMUD and other Project stakeholders in this effort.

Thank you,

Michael Maher
Region 2 FERC Coordinator | ☎ Cell: 916-597-5505
California Department of Fish & Wildlife | **North Central Region**
1701 Nimbus Road, Rancho Cordova | michael.maher@wildlife.ca.gov

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From: MokRelicense <MokRelicense@ebmud.com>
Sent: Friday, July 11, 2025 10:04 AM
To: MokRelicense <MokRelicense@ebmud.com>
Subject: UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans

Hello all.
We are resending the preliminary draft study plans – these attached plans have been updated to the most recent version, please use these for your review and comment.
Thank you.

From: Maher, Michael@Wildlife
To: MokRelicense
Subject: RE: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #1 slides
Date: Monday, July 21, 2025 3:11:59 PM
Attachments: image001.png

Hello EBMUD relicensing staff,

California Department of Fish and Wildlife (CDFW) staff have reviewed the preliminary draft wildlife study plan provided for the relicensing of the lower Mokelumne Hydroelectric Project (P-2916; Project) and have the following comments:

- CDFW staff recommend the use of trail cameras in addition to the wildlife transect surveys proposed by EBMUD. Trail cameras are an effective and low-effort method that can be used to complement data gathered during transect surveys and can also be used to record nocturnal wildlife activity that may be otherwise missed.
- For the same reasons described in our trail camera recommendation, CDFW staff recommend the use of audio recording devices and bird call identification software to complement the avian survey methods described in the draft study plan.
- CDFW staff recommend setting up a short preliminary meeting with our wildlife specialists to discuss the potential for Project operations, facilities, and maintenance activities to affect wildlife migration, daily movement, or feeding.

It is the understanding of CDFW staff that the early stages of the study plan process is an ongoing process involving the drafting and review of multiple interim versions until a final study plan is developed that satisfies the relicensing participants. We look forward to continued collaboration with staff from EBMUD and other Project stakeholders in this effort.

Thank you,

Michael Maher
Region 2 FERC Coordinator | ☎ Cell: 916-597-5505
California Department of Fish & Wildlife | **North Central Region**
1701 Nimbus Road, Rancho Cordova | michael.maher@wildlife.ca.gov

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 9, 2025 8:23 PM
To: MokRelicense <MokRelicense@ebmud.com>
Subject: RE: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #1

From: Maher, Michael@Wildlife
To: MokRelicense
Subject: RE: EBMUD Lower Mokelumne River Project Water Resources TWG Meeting #1 slides
Date: Monday, July 21, 2025 4:42:30 PM
Attachments: image001.png

Hello EBMUD Relicensing Staff,

California Department of Fish and Wildlife staff have reviewed the preliminary draft Water Resources Study Plan for the relicensing of the lower Mokelumne Hydroelectric Project (P-2916; Project) and have the following comments:

For the instream flow study plan, it is proposed to use hydrology from 2000-2024. It is standard to use at least a 30-year hydrologic record to develop these type of analyses to include more different water years and sequences of water year types. Is a longer hydrologic record available? If so CDFW would recommend at least 30 years of hydrologic record be used, or more if readily available.

It is the understanding of CDFW staff that the early stages of study plan development is an ongoing process involving the drafting and review of multiple interim versions until a final study plan is developed that satisfies the relicensing participants. We look forward to continued collaboration with staff from EBMUD and other Project stakeholders in this effort.

Thank you,

Michael Maher
Region 2 FERC Coordinator | ☎ Cell: 916-597-5505
California Department of Fish & Wildlife | **North Central Region**
1701 Nimbus Road, Rancho Cordova | michael.maher@wildlife.ca.gov

From:	MokRelicense
To:	Shannon Luoma; Fatima Oswald; Olivia Smith
Cc:	Donovan, Karen; Tam, Joe; Ledesma, Bradley; Marcus, Virginia
Subject:	FW: Fish & Aquatic Resources Comments
Date:	Tuesday, July 22, 2025 6:27:08 PM
Attachments:	FC Comments on Preliminary Draft Aquatic Study Plans .docx

From: Craig Baracco <craig@foothillconservancy.org>
Sent: Tuesday, July 22, 2025 4:38 PM
To: MokRelicense <MokRelicense@ebmud.com>
Subject: Fish & Aquatic Resources Comments

Attached are Comments on the Fish & Aquatic Resources study plans.

--
Craig Baracco
Executive Director
Foothill Conservancy
209-223-3508

Foothill Conservancy Comments on Preliminary Draft Aquatic Study Plans for the Lower Mokelumne River Hydroelectric Project- FERC Project No. 2916

Fish Population Study Plan: Section 7.5 Hatchery Operations indicates that EBMUD plans to identify limiting factors related to successful hatchery operations. Some of these key factors should be identified in the study plan, such as water supply issues, water temperature changes, fish disease threats and hatchery structure deficiencies etc. The ability of the hatchery to successfully continue its salmon and steelhead mitigation is important and impacts both recreational fishing, and potentially using hatchery fish to help restore some native aquatic ecosystems upstream of the project. This is something that had considerable support, but has been delayed due to fish disease concerns that have been overcome at some projects elsewhere on the west coast. **Section 8.0** indicates that this is a single year study. Elsewhere in the plan it indicates that it will include river sampling over several years (2026 and 2027).

Reservoir Fish Habitat Study Plan and Instream Flow Study Plan: I am a little confused as to what EBMUD is actually proposing in these two studies. Are these studies a reanalysis of data collected in 2020-2024 or an expanded analysis of data collected during those years? Or both?

Special Status Amphibians and Aquatic Reptiles Study Plan: No additional comments on this plan.

Question: There haven't been anything in these plans about addressing the threat from invasive golden mussels which are impacting recreational fishing and boating in the project area. Will this be part of the Aquatic TWG activities or another relicensing group?

From: MokRelicense
Subject: RE: UPDATED: EBMUD Lower Mokelumne River Project Recreation & Land Use Prelim Draft Study Plans
Date: Thursday, July 24, 2025 9:48:47 AM
Attachments: image001.png

Good morning,

Thank you for your engagement in the relicensing process so far. Per our earlier e-mail, since we did not receive any feedback concerning the Recreation & Land Use preliminary draft study plans, we will be **canceling** the second Technical Working Group meeting on July 29. We will be incorporating the preliminary draft study plans and what was discussed in the first TWG meeting into the PAD. We look forward to continuing to work with you over the course of this multi-year process.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Friday, July 18, 2025 3:25 PM
Subject: RE: UPDATED: EBMUD Lower Mokelumne River Project Recreation & Land Use Prelim Draft Study Plans

Good afternoon,

If you haven't already, please review the most recently attached preliminary draft Study Plans for Recreation & Land Use. Should you have any feedback, please provide it to us (MokRelicense@ebmud.com) by close of business on **Tuesday July 22**. Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Water Resources Prelim Draft Study Plans
Date: Monday, July 28, 2025 11:54:05 AM
Attachments: image001.png
EBMUD Water Quality Preliminary Draft Study Plan.pdf
EBMUD Water Temperature Preliminary Draft Study Plan.pdf
EBMUD Hydrology Operations Modeling Preliminary Draft Study Plan.pdf

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Hello,

Attached are the preliminary draft Study Plans for Water Resources. The preliminary draft Study Plans outline some of the initial information on objectives/goals as well as scope and methodologies being considered. We'd appreciate your review and feedback by **Friday August 22**.

This will help us have a more constructive discussion at the next Technical Working Group Meeting. In order to provide adequate time between the review deadline and the meeting, this second Water Resource TWG meeting will be scheduled for **September 3 from 9:00am-11:00am**. Please let us know if you did not receive a meeting notice and would like to be sent one. If we do not receive any feedback, we will proceed in cancelling this second TWG meeting.

Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Wednesday, July 2, 2025 5:06 PM
Subject: EBMUD Lower Mokelumne River Project Water Resources TWG Meeting #1 slides

Hello,

Thank you to those that were able to attend the first Water Resources TWG meeting. Attached to this e-mail is the presentation that was shared at that meeting. We will be sharing the study plan outlines next week, the week of July 7. The slide presentation stated that comments/feedback on the study plan outlines are due by July 11; however, we have pushed that out and will be asking for comments/feedback submitted via e-mail by **July 18**.

The second Water Resources TWG meeting is July 30, from 1:30-3:30pm. A meeting notice was sent out, but please let us know if you did not receive it. Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense

From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources TWG Meeting #2 slides
Date: Tuesday, August 5, 2025 12:21:47 PM
Attachments: image002.png

Hello,

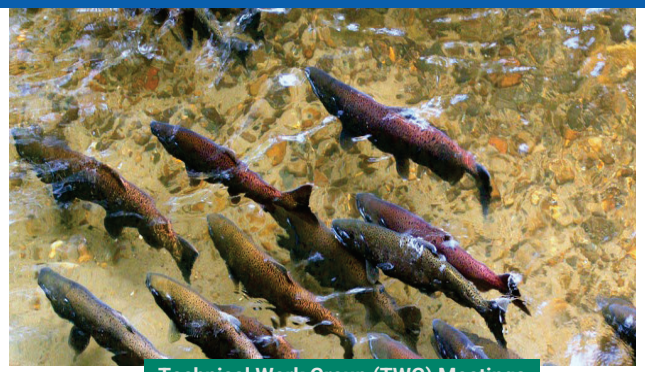
Thank you to those that were able to attend the second Fish & Aquatic Resources TWG meeting. The presentation that was shared at that meeting can be found here on our website Lower Mokelumne River Project Relicensing (FERC). We keep our site updated with meeting documents and upcoming events, so please reference it for updates. We also have Fisheries and Wildlife Division Reports available for you to access.

We will be incorporating the preliminary draft study plans and what was discussed in both TWG meetings into the Pre-Application Document (PAD) being submitted in October 2025. We look forward to continuing to work with you over the course of this multi-year process.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Lower Mokelumne River Project

FERC Project No. 2916



Technical Work Group (TWG) Meetings
Fish & Aquatics
July 30, 2025

EBMUD Kleinschmidt EBMUD

AGENDA

- Welcome and Introductions
- Schedule Recap
- Review Preliminary Draft Study Plans
- Review TWG member comments and questions
- Action Items, Schedule and Next Steps

Welcome & Introductions

EBMUD EBMUD

Lower Mokelumne Relicensing Team

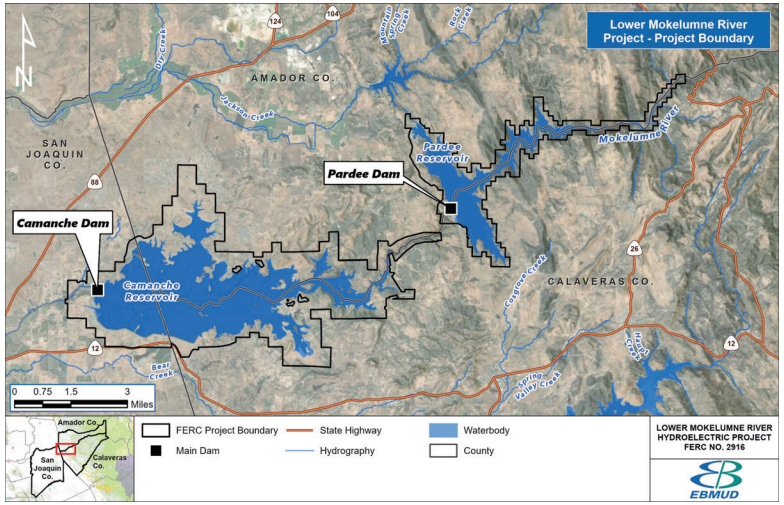
Project Management Team	Resource Leads
Priya Jain	Michelle Workman
Brad Ledesma	James Jones
Joe Tam	Casey Del Real
Karen Donovan	Jason Zhou
	Alice Towey
	Ben Bray
	I-Pei Hsiu

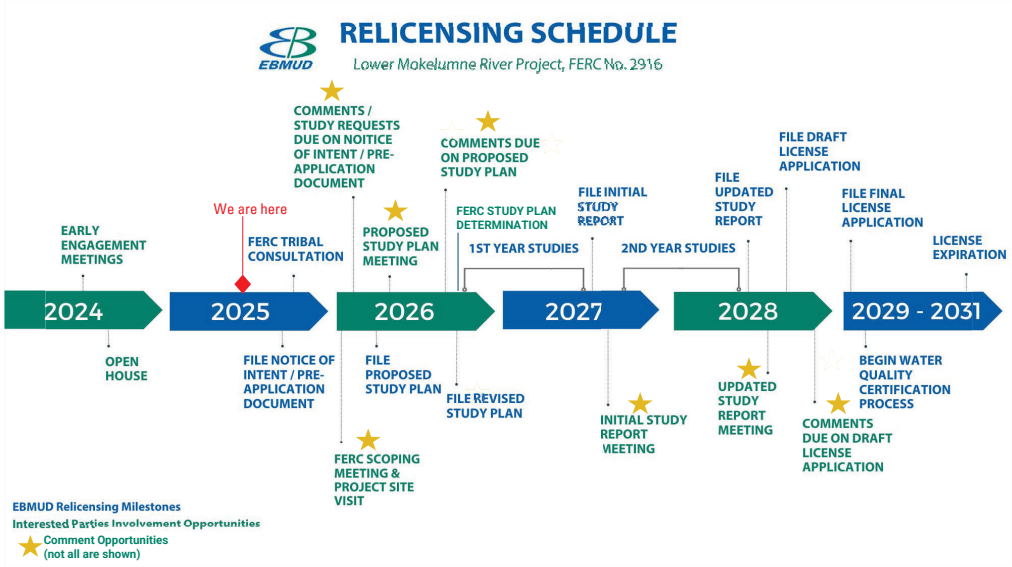
Consultant Team	Facilitator
Kleinschmidt	Marie Rainwater
Shannon Luoma	
Fatima Oswald	
Olivia Smith	
Craig Addley	

Meeting Purpose and Objectives

- Review preliminary draft study plans
- Review TWG Comments/Questions

Lower Mokelumne River Project (P-2916)





Potential Study – Reservoir Fish Habitat Study

Goals & Objectives:

- Summarize current fish species assemblage data, stocking records, and fishing success for Project reservoirs.
- Characterize existing Project daily water surface elevation patterns and pool habitat volumes (cold water, warm water, dissolved oxygen) at each reservoir.

Potential Methodology:

- Quantify cold and warm water reservoir habitat over the period of record (POR) (2001 -2024)
  - Use the hydrology model to characterize reservoir operations.
  - Use the water temperature model to characterize reservoir water temperatures.
  - Quantify cold water habitat (water temperature ≤20°C and DO ≥7 mg / l).
  - Quantify warm water habitat (water temperature >20°C and DO ≥5 mg / l).

Comments Received – Reservoir Fish Habitat Study

Comments from Foothills Conservancy:

- **Are these studies a reanalysis of data collected in 2020-2024 or an expanded analysis of data collected during those years? Or both?**
  - *The Reservoir Fish Habitat Study is an analysis of the availability of physical reservoir habitat (temperature, dissolved oxygen, reservoir volume) for the entire hydrologic model period of record (2020-2024)*

Potential Study – Instream Flow Study

Goals & Objectives:

- Summarize the historical instream flow modeling
- Use the current HEC-RAS hydraulics / habitat model to characterize habitat versus flow relationships to develop a time series analysis of aquatic habitat under existing conditions.
- Identify the time periods, flow conditions, and life stages when habitat may be a limiting factor for fish, benthic macroinvertebrates, other aquatic species, and riparian vegetation.

Potential Methodology:

- Establish an Aquatic TWG to provide input and technical review of modeling procedures.
- Identify the target species and life stages for modeling based on management importance and/or sensitivity to Project operations.
- Use the current HEC-RAS hydrodynamic and habitat model
  - Use existing modeling reaches
- Develop a time series analysis of habitat for existing conditions.

Comments Received – Instream Flow Study

Comment from CDFW:

- **Although habitat is a crucial factor for salmonid success, temperature and flow are of equal or greater importance. They are necessary components that should be included in the Instream Flow Study Plan to determine potential Project impacts on egg survival and juvenile rearing and migration.**
  - *Comment noted. The instream flow study will include flow and incorporate water temperature as developed in the Water Temperature Study.*

Potential Study – Fish Population Study

Goals & Objectives:

- Document fish species composition, distribution, and abundance in the reservoirs and river reaches.
- Characterize fish growth, condition factor, and population age structure in the reservoirs and river reaches.
- Collect fish for mercury tissue analysis

Potential Methodology:

- Use the existing reservoir and river sampling / monitoring program (2027).
- Document fish species composition, distribution, and abundance in the reservoirs and river reaches using historical and recently collected data.
- Characterize fish growth, condition factor, and population age structure in the reservoirs and river reaches using historical and recently collected data.
- Collect fish for mercury tissue analysis in the Water Quality Study

Comments Received– Fish Population Study

Comments from CDFW:

- **The number of water temperature and dissolved oxygen (DO) monitoring locations in the FPSP should be increased and the data collected used to conduct egg survival estimates for instream spawning. The temperature and DO data collected should be made available publicly in a real-time manner, similar to real-time data provided by the California Data Exchange Center (CDEC).**
- **Fry emergence trapping should be added as a component of the FPSP to determine egg survival and compared with egg survival estimates.**
  - *EBMUD is developing an egg survival study which includes water quality monitoring such as temperature and dissolved oxygen (DO). At this time, EBMUD is not committing to providing data real-time as part of the study plan however, the study will include collection of temperature and DO.*
- **The FSPS should be revised to include locations where out-migrating fall run Chinook salmon smolt mortality is occurring. This information should be recorded and reported to Project stakeholders as they move downstream. Additional rotary screw trap monitoring sites, juvenile salmon acoustic telemetry system, or passive integrated responder antenna monitoring should be added in consultation with Project stakeholders to narrow down location specifics as appropriate. Solutions to address the high mortality rate in these locations should be developed for stakeholder approval.**
  - *EBMUD will develop a juvenile mortality study.*
- **The FPSP should be revised to allow for the investigation and modeling of an installed coldwater release device/system in Camanche Reservoir to allow for cooler water temperatures and improved fishery conditions in the Mokelumne River.**
  - *EBMUD is proposing a Water Temperature Study plan where this comment will be addressed.*
- **Please provide the results of the most recent fish population study to inform comments on the draft Reservoir Fish Habitat Study Plan. CDFW staff may have additional comments or suggested revisions on the draft Reservoir Fish Habitat Study Plan once we have had the opportunity to review this data.**
  - *Recent information on fish populations can be found online. All interested parties will have another opportunity to review study plans as part of the ILP following PAD filing.*

Comments Received– Fish Population Study

Comment from Foothills Conservancy:

- ***Hatchery Operations indicates that EBMUD plans to identify limiting factors related to successful hatchery operations. Some of these key factors should be identified in the study plan, such as water supply issues, water temperature changes, fish disease threats and hatchery structure deficiencies etc. The ability of the hatchery to successfully continue its salmon and steelhead mitigation is important and impacts both recreational fishing, and potentially using hatchery fish to help restore some native aquatic ecosystems upstream of the project. This is something that had considerable support, but has been delayed due to fish disease concerns that have been overcome at some projects elsewhere on the west coast. Section 8.0 indicates that this is a single year study. Elsewhere in the plan it indicates that it will include river sampling over several years (2026 and 2027).***
  - *Comment noted.*

Comments Received– Fish Population Study

Comment from Foothills Conservancy:

- **There haven't been anything in these plans about addressing the threat from invasive golden mussels which are impacting recreational fishing and boating in the project area. Will this be part of the Aquatic TWG activities or another relicensing group?**
  - *EBMUD is actively working on golden mussel monitoring, including eDNA monitoring.*

Potential Study – Special Status Amphibians & Aquatic Reptiles Study

Goals & Objectives:

- Identify and map potential habitat for Northwest Pond Turtle (NWPT) in the study area.
- Document the distribution and abundance of NWPT populations in the study area.
- Document the presence of potential NWPT nesting habitat near Project facilities.
- Sample eDNA for foothill yellow-legged frog, red legged-frog, and giant garter snake.
  - Note: Tiger salamander and western spadefoot toad are addressed in the wildlife study plan.

Potential Methodology:

- Develop NWPT habitat suitability criteria in cooperation with relicensing participants.
- Use GIS to characterize NWPT habitat within the study area.
- Conduct distribution and abundance surveys for NWPT in the study area.
- Document the presence of potential NWPT nesting habitat near Project facilities (GIS and field).
- Sample eDNA for foothill yellow-legged frog, red legged-frog, and giant garter snake.

Comments Received – Special Status Amphibians & Aquatic Reptiles

Comments from CDFW:

- **Before the meeting can you please send me a copy of the following documents referenced in the study plan? (Lower Mokelumne River Project Pre-Application Document (PAD) (EBMUD 2025) and CRLF and CTS Safe Harbor Agreement).**
  - *Documents have or will been shared when available.*
- **The plan notes that FYLF have not been observed in the project study area—have formal visual encounter surveys been conducted or is this based on incidental observations during other project work? If formal surveys have not been conducted, I strongly recommend conducting visual encounter surveys for multiple life stages along the NF Mokelumne River inflow, river between the reservoirs, and below Camanche Dam.**
  - *The study plan methodology includes eDNA sampling for FYLF and visual encounter surveys based on the results of that sampling. We will include a FYLF desktop habitat component to the study plan.*
- **I recommend adding additional eDNA sampling locations for FYLF in the NF Mokelumne inflow and below Camanche Dam as FYLF are a stream-obligate species and unlikely to be present at the sites in the reservoirs.**
  - *The study plan methodology includes eDNA sampling for FYLF and visual encounter surveys based on the results of that sampling. A desktop habitat analysis portion will be added to this study.*
- **How were the NWPT survey sites selected?**
  - *Sites were selected based on representing typical habitat where NWPT may occur and are generally co-located with electrofishing locations. The exact pool locations will be selected in the field.*
- **What is the proposed survey frequency and timing? The time of year can greatly impact the detectability of both NWPT and FYLF.**
  - *EBMUD is proposing a single study season. The sampling will occur between late May and the end of July.*

Action Items & Next Steps

EBMUD

Next Steps

By August 6 – Relicensing Team will distribute meeting materials to attendees

October 2025 – EBMUD submittal of Pre-Application Document (PAD)

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Jason Zhou, EBMUD: 510-287-0263
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Wildlife, Botanical, and RTE TWG Meeting #2 slides
Date: Tuesday, August 5, 2025 12:22:07 PM
Attachments: image002.png

Hello,

Thank you to those that were able to attend the second Wildlife, Botanical, and RTE TWG meeting. The presentation that was shared at that meeting can be found here on our website Lower Mokelumne River Project Relicensing (FERC). We keep our site updated with meeting documents and upcoming events, so please reference it for updates. We also have Fisheries and Wildlife Division Reports available for you to access.

We will be incorporating the preliminary draft study plans and what was discussed in both TWG meetings into the Pre-Application Document (PAD) being submitted in October 2025. We look forward to continuing to work with you over the course of this multi-year process.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
Wildlife, Botanical, and Rare/Threatened/Endangered Resources
July 31, 2025

EBMUD Kleinschmidt EBMUD

AGENDA

- Welcome and Introductions
- Early Engagement & Schedule Recap
- Review Preliminary Draft Study Plans
- Review TWG member comments and questions
- Action Items, Schedule and Next Steps

Welcome & Introductions

Lower Mokelumne Relicensing Team

Project Management Team	Resource Leads
Priya Jain	Michelle Workman
Brad Ledesma	Casey Del Real
Joe Tam	James Jones
Sabrina Cheng	
Karen Donovan	

Consultant Team

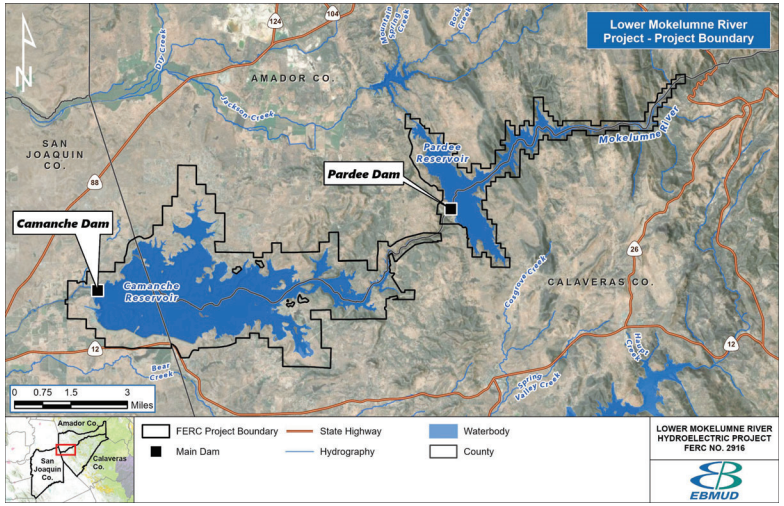
Kleinschmidt	*JNA*
Shannon Luoma	Janelle Nolan
Fatima Oswald	Robyn Smith
Olivia Smith	**Facilitator**
	Marie Rainwater

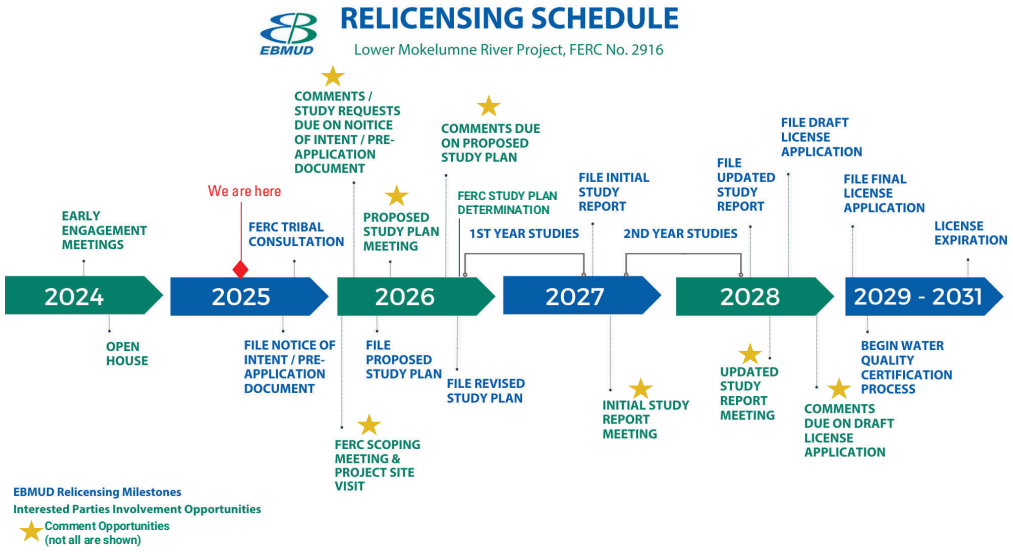
EBMUD EBMUD

Meeting Purpose and Objectives

- Review preliminary draft study plans
- Review TWG Comments/Questions

Lower Mokelumne River Project (P-2916)





Potential Study – Botanical Resources Study

Goals & Objectives

- Document California Wildlife Habitat Relationship (CWHR) habitats and sensitive natural communities adjacent to Project facilities.
- Document special-status plant, lichen, and moss populations adjacent to Project facilities.
- Document NNIPs adjacent to Project facilities.

Geographic Scope:

- CWHR Habitats and Sensitive Natural Communities: 1 mile of the FERC Project Boundary
- Special-Status Plants and Non-Native Invasive Plants: For the purposes of the special-status plants and NNIP studies, the study area includes lands within the FERC Project boundary where operations and/or maintenance activities are conducted, plus a protective buffer.

Potential Study – Botanical Resources Study Area (SSP and NNIP)

Project Facility Type	Survey Area
Dams, Dikes, and Spillways	
Pardee Dam	100 feet
Pardee South Spillway	100 feet
Jackson Creek Dike and Spillway	100 feet
West End Dike	100 feet
Camanche Dam	100 feet
Camanche Spillway	100 feet
Dikes 1 – 6	100 feet
Penstocks	
Pardee Penstock	15 feet on either side
Camanche Penstock	15 feet on either side
Powerhouses and Switchyards	
Pardee Powerhouse and Switchyard	15 feet around the perimeter fence
Camanche Powerhouse and Switchyard	15 feet around the perimeter fence
Powerlines and Communication Lines	
Poles	30 feet on either side
Ancillary and Support Facilities	
Poles	15 feet around the perimeter
Stream Gages	
Poles	10 feet around gages
Project Access Roads	
Poles	20 feet on either side
Project Trails	
Poles	15 feet on either side
Project Recreation Facilities	
Pardee Recreation Area	150 feet around recreation facilities
Camanche North Shore Recreation Area	150 feet around recreation facilities
Camanche South Shore Recreation Area	150 feet around recreation facilities
Camanche Hills Hunting Preserve	150 feet around recreation facilities
Mokelumne River Fish Hatchery	150 feet around hatchery and associated facilities
Mokelumne Day Use Area	150 feet around recreation facilities

Potential Study – Botanical Resources Study

Potential Methodology: <u>CWHR Habitats and Sensitive Natural Communities:</u>

- Develop habitat maps based on CWHR descriptions.
- Verify accuracy of data and update habitats using recent aerial photos.
- Conduct ground-truthing of habitats surrounding Project facilities concentrating on areas where concerns about habitat identification and boundaries arise.
- Develop a GIS map of habitats and sensitive natural communities and overlay information on Project facilities.

Potential Study – Botanical Resources Study

Potential Methodology <u>Special-status Plants:</u>

- Identify and map known occurrences of special-status plants within the study area.
- Develop list of species potentially occurring in the Project area based on literature review and agency consultation.
- Conduct focused surveys according to the *Protocols for Surveying and Evaluation Impacts to Special Status native Plant Populations and Sensitive Natural Communities* (CDFW 2018).
  - ➢ Timing of surveys will be verified based on reference population monitoring.
- Develop GIS Map of special-status plant populations and overlay information on Project facilities.
- Prepare CNDDB forms for all populations identified.

Potential Study – Botanical Resources Study

Potential Methodology <u>Non-Native Invasive Plants (NNIPs):</u>

- Identify and map known occurrences of NNIPs within the study area.
- Develop list of priority NNIPs in consultation with agencies.
- Conduct focused NNIP surveys in conjunction with special-status plant surveys.
- Develop GIS Map of NNIPs and overlay information on Project facilities.

Comments Received: Botanical Resources Study

- **No comments received on Botanical Resources Study**

Potential Study – Wildlife Resources Study

Goals & Objectives:

- Identify special-status wildlife species potentially occurring in CWHR habitats documented as part of Botanical Resources Study Plan.
- Map potential habitat for monarch butterfly (i.e., milkweed) in conjunction with special-status plant surveys completed as part of the Botanical Resources Study Plan.
- Document bat roosts present on Project facilities and identify bat species present.

Potential Study – Wildlife Resources Study

Geographic Scope:

- For identification of special-status species potentially occurring in CWHR habitats, the study area is 1 mile around the FERC Project boundary.
- For wildlife reconnaissance surveys, the study area is the area where operations and/or maintenance occurs around Project facilities, plus a protective buffer.
- For monarch butterfly habitat surveys, the study area is lands within the FERC Project boundary where operations and/or maintenance activities are conducted, plus a protective buffer. Milkweed host plants (*Asclepias* spp.) will be documented in conjunction with special-status plant surveys conducted under the Botanical Resource TSP.
- For special-status bat roost surveys, the study area is Project facilities.
- For wildlife mortality, the study area is Project facilities.
- For deer migration routes and important areas, the study area is 1 mile around the FERC Project boundary

Potential Study – Wildlife Resources Study

Potential Methodology Special-status Wildlife Surveys

- Identify and map known occurrences of special-status wildlife in the study area.
- Identify special-status wildlife species potentially occurring in CWHR habitats mapped as part of the Botanical Resources Study Plan.
- Conduct wildlife reconnaissance survey in conjunction with special-status plant surveys.
- Prepare CNDDB forms for special-status species observed.
- Record incidental observations of special-status wildlife during all field surveys conducted in support of relicensing.

Potential Study – Wildlife Resources Study

Potential Methodology Monarch Butterfly Habitat**:**

- Document the location of monarch butterfly habitat (i.e., milkweed) in conjunction with special-status plant surveys conducted as part of the Botanical Resources Study Plan.
- Develop a map and table identifying the location of milkweed in the study area and overlay on Project facilities.

Potential Study – Wildlife Resources Study

Potential Methodology (cont.):
Special-status Bat Roost Surveys
Facility Assessment

- Conduct initial desktop assessment of Project facilities to determine their potential to support bat roosts.
- Conduct preliminary visual assessment of Project facilities during wildlife reconnaissance surveys to determine the potential to support bat roosts.
- Develop list of Project facilities potentially supporting bat roosts (by facility type).

Roost Survey

- Conduct visual roost survey at Project facilities identified as potentially supporting roosting bats.
- If bat roosts are present but the species cannot be determined visually, collect guano for DNA sampling.
- Develop a map and table documenting the location of bat roosts and species present.

Potential Study – Wildlife Resources Study

Potential Methodology (cont.):
Special-status Bat Roost Surveys
Guano DNA Sampling

- Collect DNA samples at roost sites where fresh guano is available and bat species cannot be determined visually during roost survey.
- Compare DNA sequences to species-specific genetic markers developed by Walker et al. 2016 and further verify by comparison to samples at the National Center of Biotechnology Information DNA Sequence Database.
- Develop a map and table identifying the location of guano DNA sampling and species present.

Comments Received: Wildlife Resources Study

Comments from CDFW:

- **CDFW staff recommend the use of trail cameras in addition to the wildlife transect surveys proposed by EBMUD. Trail cameras are an effective and low-effort method that can be used to complement data gathered during transect surveys and can also be used to record nocturnal wildlife activity that may be otherwise missed.**
  - *EBMUD would like to further discuss CDFW's concerns and target resources.*
- **CDFW staff recommend setting up a short preliminary meeting with our wildlife specialists to discuss the potential for Project operations, facilities, and maintenance activities to affect wildlife migration, daily movement, or feeding.**
  - *EBMUD would be happy to set up a meeting with the CDFW wildlife specialists to discuss potential Project effects on wildlife migration, daily movements, and feeding.*

Comments Received: Wildlife Resources Study

Comments from CDFW:

- **For the same reasons described in our trail camera recommendation, CDFW staff recommend the use of audio recording devices and bird call identification software to complement the avian survey methods described in the draft study plan.**
  - *EBMUD is not proposing to use audio recording devices. Information on avian resources known or potentially occurring in the Project area will be obtained from extensive ongoing surveys and monitoring, habitat mapping, and reconnaissance surveys.*

Potential Study – Wetlands, Riparian, and Littoral Habitat Study

Goals & Objectives:

- Document Waters of the U.S./State and riparian habitats adjacent to Project facilities and Project-affected reaches.
- Determine the relationship between riparian habitats and flow conditions in Project-affected reaches.

Geographic Scope:

- For documentation of Waters of the U.S./State the survey area is lands within the FERC Project boundary where operations and/or maintenance activities are conducted, plus a protective buffer.
- For documentation of riparian habitats, the survey area is Project-affected reaches and riparian cross-section locations.
- For the relationship between riparian habitats and flow conditions the study area is riparian cross-section locations on Project-affected stream reaches.

Potential Study – Wetlands, Riparian, and Littoral Habitat Study

Potential Methodology:

Preliminary Mapping of Jurisdictional Waters of the U.S./State and Riparian Habitat

- Develop preliminary maps of jurisdictional Waters of the U.S./State and riparian habitat based on NWI mapping.
- Verify the accuracy of data and update information using recent aerial photos.

Ground-truthing/Field Verification

Jurisdictional Waters of the U.S./State

- Conduct ground-truthing concentrating in areas where questions on classification or boundaries arise from review of aerial photographs.
- Develop GIS map of and overlay information Project facilities.

Potential Study – Wetlands, Riparian, and Littoral Habitat Study

Potential Methodology (cont.):

Ground-truthing Field Verification

Riparian

- Map the extent of riparian habitat along Project-affected reaches using a combination of high-resolution aerial imagery and field observation at riparian cross-sections.
- Develop a GIS map of riparian habitat along Project-affected reaches.

Characterize Relationship of Riparian to Flow Conditions

- Establish cross-sections at representative location along Project-affected reaches:
  - Characterize riparian and substrate along the length of each cross-section.
  - Develop stage-discharge relationships over a range of flows (high to low).
- Develop a summary of the relationship between existing inundation characteristics and the distribution of dominant riparian species in Project-affected reaches.
- Compare and contrast existing Project and without Project hydrology in relation to riparian recruitment and maintenance in Project-affected reaches.

Comments Received: Wetlands, Riparian, and Littoral Habitat Study

- **No comments received on Wetlands, Riparian, and Littoral Habitat Study**

Action Items & Next Steps

Next Steps

By August 6 – Relicensing Team will distribute meeting materials to attendees

October 2025 – EMBUD submittal of Pre-Application Document (PAD)

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Jason Zhou, EBMUD: 510-287-0263
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Jessalynn Pastran, Chairperson
Buena Vista Rancheria of Me-Wuk Indians
1418 20th Street, Suite 200
Sacramento, CA, 95811

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Pastran,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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- **Date:** August 25, 2025
- **Time:** 1:30 pm - 3:30 pm
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

Please RSVP by calling 209-772-8204 or emailing lorna.barfield@ebmud.com

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15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

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Phone conference ID: 944 475 908#

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Gloria Grimes, Chairperson
Calaveras Band of Mi-Wuk Indians
P.O. Box 899
West Point, CA, 95255

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Grimes,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Manager
Mokelumne Watershed & Recreation Division

CB:lb

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Antoinette Del Rio, Chairperson
California Valley Miwok Tribe
P.O. Box 695
San Andreas, CA, 95249

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Del Rio,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Michelle St. Clair, Executive Director of Cultural Preservation
Wilton Rancheria
9728 Kent Street
Elk Grove, CA, 95624

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Director St. Clair,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Serrell Smokey, Chairperson
Washoe Tribe of Nevada and California
919 Highway 395 North
Gardnerville, NV, 89410

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairpeson Smokey,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Josef Fore
Tribal Historic Preservation Officer
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road Attn: Tribal Preservation
Auburn, CA, 95603

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Officer Fore,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Neil Peyron, Chairperson
Tule River Indian Tribe
P.O. Box 589
Porterville, CA, 93258

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Peyron,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Manager
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Arian Hart, Chairperson
Susanville Indian Rancheria
745 Joaquin Street
Susanville, CA, 96130

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Hart,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Regina Cuellar, Chairperson
Shingle Springs Band of Miwok Indians
5281 Honpie Road
Placerville, CA, 95667

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Cuellar,

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Cosme Valdez, Chairperson
Nashville Enterprise Miwok-Maidu-Nishinam Tribe
P.O. Box 580986
Elk Grove, CA, 95758-0017

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Valdez,

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+1 510-871-5755,,944475908# United States, Oakland
Phone conference ID: 944 475 908#

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Adam Dalton, Chairperson
Jackson Rancheria Band of Miwuk Indians
P.O. Box 1090
Jackson, CA, 95642

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Dalton,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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- **Date:** August 25, 2025
- **Time:** 1:30 pm - 3:30 pm
- **Location:** Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252

Please RSVP by calling 209-772-8204 or emailing lorna.barfield@ebmud.com

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If you would prefer to schedule a one-on-one meeting with EBMUD, please contact our office at 209-772-8204 as soon as possible.

15083 CAMANCHE PARKWAY SOUTH . VALLEY SPRINGS . CA 95252 . (209) 772-8204

Sincerely,

CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

CB:lb

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Sara Dutschke, Chairperson
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, CA, 95669

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Dutschke,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Stephanie Suess, Community & Resources Development Director
Chicken Ranch Rancheria of Me-Wuk Indians
P.O. Box 1159
Jamestown, CA, 95327

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Director Suess,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Manager
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Clyde Prout, Chairperson
Colfax-Todds Valley Consolidated Tribe of the Colfax Rancheria
PO Box 4884
Auburn, CA 95604

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Goodwin,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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Manager
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 7, 2025

Tina Goodwin, Chairperson
Pakan'yani Maidu of Strawberry Valley Rancheria
P.O. Box 984
Marysville, CA, 95901

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Goodwin,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

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CHARLES BECKMAN
Manager
Mokelumne Watershed & Recreation Division

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+1 510-871-5755,,944475908# United States, Oakland
Phone conference ID: 944 475 908#

From: Monica Gutierrez - NOAA Federal <monica.gutierrez@noaa.gov>
Sent: Monday, August 18, 2025 4:24 PM
To: MokRelicense <MokRelicense@ebmud.com>
Cc: Jonathan Ambrose - NOAA Federal <jonathan.ambrose@noaa.gov>
Subject: Re: UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans

Good afternoon,

Thank you for the opportunity to review the preliminary drafts and providing us with an extension to review/provide comments.

We understand that the study plans are preliminary drafts, but we found them to be very general. More detailed information would be helpful for providing comprehensive feedback. We have reviewed the Fish Population, Instream Flow, and Reservoir Fish Habitat Study Plans and we have some minor but specific comments to the following plans:

Fish Population Study Plan Preliminary Drafts
7.1 Reservoir Sampling
-Specify which species will be sampled
-Will sampling occur everyday? How many days/week?
-What happens after electrofishing? How will species be recorded/documented after electrofishing?
-Is sampling, in addition to fish handling protocols as stated in section 7.3? If so, we

recommend stating that.

Instream Flow Study Plan
-The study methodology is a very general outline, but will there be a more detailed version in a revised study plan?

8.0 Schedule and Deliverables
-Why is only a single year for desktop study being proposed?

Reservoir Fish Habitat Study Plan
-The plan is very general and not detailed enough.

Thanks again for the opportunity to review and we look forward to continuing working with you on the FERC relicensing process. Please let us know if you have any questions regarding the feedback provided above.

Best Regards,
Monica

On Tue, Jul 22, 2025 at 6:58 PM MokRelicense <MokRelicense@ebmud.com> wrote:

> Hello Monica.
>
> Yes, understand and okay about providing feedback by August 19th.
> We will meet next week for TWG Mtg 2 and can share some initial comments then if have any.
> Thank you!
>
> ---
>
> **From:** Monica Gutierrez - NOAA Federal <monica.gutierrez@noaa.gov>
> **Sent:** Monday, July 21, 2025 2:46 PM
> **To:** MokRelicense <MokRelicense@ebmud.com>
> **Cc:** Jonathan Ambrose - NOAA Federal <jonathan.ambrose@noaa.gov>
> **Subject:** Re: UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans
>
> EXTERNAL EMAIL - This email was sent by a person from outside your organization. Exercise caution when clicking links, opening attachments or taking further action, before validating its authenticity.
>
> Secured by Check Point
>
> Good afternoon,
>
> Due to our reduction in staff and workload prioritization, NMFS would like to request an extension to review the

preliminary draft study plans. **Can we request an extension to review by August 19th?** NMFS is committed to review the preliminary drafts, however, we require more time for review. Thank you for your consideration.

-Monica

On Fri, Jul 18, 2025 at 3:24 PM MokRelicense <MokRelicense@ebmud.com> wrote:

> Good afternoon,
>
> If you haven't already, please review the most recently attached preliminary draft Study Plans for Fish & Aquatic Resources. Should you have any feedback, please provide it to us (MokRelicense@ebmud.com) by close of business on **Tuesday July 22**. Thank you.
>
> East Bay Municipal Utility District
> FERC Relicense Project – Lower Mokelumne River P2916
> Website: www.ebmud.com/MokRelicense
> Email: *MokRelicense@ebmud.com*
>
> ---
>
> **From:** MokRelicense <MokRelicense@ebmud.com>
> **Sent:** Friday, July 11, 2025 10:04 AM
> **To:** MokRelicense <MokRelicense@ebmud.com>
> **Subject:** UPDATED: EBMUD Lower Mokelumne River Project Fish & Aquatic Resources Preliminary Draft Study Plans
>
> Hello all.
> We are resending the preliminary draft study plans – these attached plans have been updated to the most recent version, please use these for your review and comment.
> Thank you.

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Jessalynn Pastran, Chairperson
Buena Vista Rancheria of Me-Wuk Indians
1418 20th Street, Suite 200
Sacramento, CA, 95811

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Pastran,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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-Tribal Ethnography Study Plan

Please RSVP to the TWG, if you haven't already, by calling 209-772-8204 or e-mailing loma.barfield@ebmud.com. Meeting details are below – it will be held in-person with an option for joining virtually.

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Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

15083 CAMANCHE PARKWAY SOUTH • VALLEY SPRINGS • CA 95252 • (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Gloria Grimes, Chairperson
Calaveras Band of Mi-Wuk Indians
P.O. Box 899
West Point, CA, 95255

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Grimes,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Antoinette Del Rio, Chairperson
California Valley Miwok Tribe
P.O. Box 695
San Andreas, CA, 95249

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Del Rio,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Stephanie Suess, Community & Resources Development Director
Chicken Ranch Rancheria of Me-Wuk Indians
P.O. Box 1159
Jamestown, CA, 95327

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Director Suess,

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Sara Dutschke, Chairperson
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, CA, 95669

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Adam Dalton, Chairperson
Jackson Rancheria Band of Miwuk Indians
P.O. Box 1090
Jackson, CA, 95642

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Cosme Valdez, Chairperson
Nashville Enterprise Miwok-Maidu-Nishinam Tribe
P.O. Box 580986
Elk Grove, CA, 95758-0017

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Valdez,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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-Archaeology Resources Study Plan
-Tribal Ethnography Study Plan

Please RSVP to the TWG, if you haven't already, by calling 209-772-8204 or e-mailing loma.barfield@ebmud.com. Meeting details are below – it will be held in-person with an option for joining virtually.

- Date: August 25, 2025
- Time: 1:30 pm - 3:30 pm
- Location: Mokelumne Watershed Headquarters Office
  15083 Camanche Pkwy S. Valley Springs, CA 95252
- Microsoft Teams:
  - Meeting ID: 267 891 009 104 8
  - Passcode: X6wT36tw
  - Phone dial-in: +1 510-871-5755 .. 944475908# United States, Oakland

Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

15083 CAMANCHE PARKWAY SOUTH • VALLEY SPRINGS • CA 95252 • (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Tina Goodwin, Chairperson
Pakan'yani Maidu of Strawberry Valley Rancheria
P.O. Box 984
Marysville, CA, 95901

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Goodwin,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Regina Cuellar, Chairperson
Shingle Springs Band of Miwok Indians
5281 Honpie Road
Placerville, CA, 95667

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Cuellar,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

15083 CAMANCHE PARKWAY SOUTH • VALLEY SPRINGS • CA 95252 • (209) 772-8204

EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Arian Hart, Chairperson
Susanville Indian Rancheria
745 Joaquin Street
Susanville, CA, 96130

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Hart,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Michelle St. Clair, Executive Director of Cultural Preservation
Wilton Rancheria
9728 Kent Street
Elk Grove, CA, 95624

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Director St. Clair,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Neil Peyron, Chairperson
Tule River Indian Tribe
P.O. Box 589
Porterville, CA, 93258

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Peyron,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Josef Fore
Tribal Historic Preservation Officer
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road Attn: Tribal Preservation
Auburn, CA, 95603

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Officer Fore,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Serrell Smokey, Chairperson
Washoe Tribe of Nevada and California
919 Highway 395 North
Gardnerville, NV, 89410

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairpeson Smokey,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Clyde Prout, Chairperson
Colfax-Todds Valley Consolidated Tribe of the Colfax Rancheria
PO Box 4884
Auburn, CA 95604

Subject: EBMUD Lower Mokelumne River Relicense Project – Draft Study Plans

Dear Chairperson Prout,

East Bay Municipal Utility District (EBMUD) is following up on our previous correspondence, dated August 7, 2025, in which we invited you to participate in a Technical Working Group (TWG). This is part of the renewal of our Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. EBMUD will review existing license commitments and would like to conduct this upcoming TWG to meet with you and other Tribal leaders to get feedback on the information shared.

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Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

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EAST BAY MUNICIPAL UTILITY DISTRICT

NATURAL RESOURCES DEPARTMENT
MOKELUMNE AREA

August 19, 2025

Katherine Erolinda Perez, Chairperson
North Valley Yokuts Tribe
P.O. Box 717
Linden, CA 95236

Subject: EBMUD Lower Mokelumne River Relicense Project

Dear Chairperson Perez,

East Bay Municipal Utility District (EBMUD) has begun the process to renew its Federal Energy Regulatory Commission (FERC) license (Project 2916) to operate hydropower facilities at Camanche and Pardee dams located in San Joaquin, Calaveras, and Amador counties. As part of the renewal process, EBMUD will review existing license commitments (e.g., recreation, environmental, and dam safety), and we would like to meet with you and other Tribal leaders to discuss tribal interests in the project area.

EBMUD will conduct a Technical Working Group (TWG) meeting to address Tribal resources during the data gathering phase of relicensing. This meeting will allow you to share feedback or any additional information on the enclosed preliminary draft study plans.

- Archaeology Resources Study
- Tribal Ethnography Study

Please RSVP to the TWG by calling 209-772-8204 or e-mailing loma.barfield@ebmud.com. Meeting details are below – it will be held in-person with an option for joining virtually.

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We look forward to your participation as EBMUD continues the multi-year relicensing process. For further details and to stay updated with the Project, please visit our project website: https://www.ebmud.com/mokrelicense.

If you would prefer to schedule a one-on-one meeting with EBMUD, please contact our office at 209-772-8204 as soon as possible.

Sincerely,

Lorna Barfield
Senior Administrative Clerk
Mokelumne Watershed & Recreation Division

15083 CAMANCHE PARKWAY SOUTH • VALLEY SPRINGS • CA 95252 • (209) 772-8204

From: MokRelicense
To: Jain, Priyanka; Shannon Luoma; Fatima Oswald; Olivia Smith
Subject: FW: EBMUD Lower Mokelumne River Project Water Resources Prelim Draft Study Plans
Date: Friday, August 22, 2025 3:53:54 PM
Attachments: image001.png
image003.png

I'm forwarding along CDFW's below comments re: the Water Resources Preliminary Draft Study Plans.

Virginia Marcus
Administrative Clerk | Water Resources Planning Division
375 11th Street, MS 901, Oakland, CA 94607
(510) 287-0107
virginia.marcus@ebmud.com

EAST BAY MUNICIPAL UTILITY DISTRICT
stewardship integrity respect teamwork

From: Maher, Michael@Wildlife <Michael.Maher@wildlife.ca.gov>
Sent: Friday, August 22, 2025 3:39 PM
To: MokRelicense <MokRelicense@ebmud.com>
Cc: Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>; Bauer, Nicolas(Nick)@Wildlife <Nick.Bauer@Wildlife.ca.gov>; Burson, Skyler@Wildlife <Skyler.Burson@wildlife.ca.gov>; McKibbin, Chris@Wildlife <Chris.McKibbin@wildlife.ca.gov>
Subject: RE: EBMUD Lower Mokelumne River Project Water Resources Prelim Draft Study Plans

Hello EBMUD Relicensing Team,

California Department of Fish and Wildlife (CDFW) staff have reviewed the Preliminary Draft Water Resources Study Plans for the relicensing of the Lower Mokelumne Hydroelectric Project and have the following questions and comments:

General Questions

1. It is the understanding of CDFW staff that the Lower Mokelumne Project (Project) has obligations under the Healthy Rivers and Landscapes (HRL) Program. How will the Water Resources Study Plans (Plans) incorporate these into the study design?

2. What is the format of the HRL Program as it applies to the Project area? Does the HRL have separate plans for which the Project is one or is there one overarching plan implemented separately?

3. Will the variable elevation intake tower and thermal curtain options intended for temperature control presented at the recent MRTAC meeting be incorporated into the Plans and if so, what will be the metrics used and how will they be analyzed?

4. CDFW staff recommend that there are sufficient dissolved oxygen and temperature monitoring stations in the lower Mokelumne River to help establish temperature dependent egg mortality modeling. CDFW staff are available to consult with EBMUD staff to determine appropriate locations for monitoring stations to meet these modeling goals.

Hydrology Operations Modeling

1. Section 3.0, Bullet #1: This bullet should be modified to include not just additional hydrology scenarios, but also the ability to model additional operational scenarios that relicensing participants request. This may be what you intended already in that bullet, but because the study plan does include looking at potential future climate change scenarios, it should be specified that the study plan will include both.

2. Section 7.1, Bullet #2: If available, the hydrology modeled in this project should include a longer period of record. Using at least 30 years of hydrologic record is pretty standard for FERC relicensings. CDFW staff agree that the period from 2000-2024 does include several periods of drought and also very high flow years, and is a useful time series for comparison, but because we want to use this to consider range of variability that may be observed, a longer record is better. If there is a reason to include a shorter record, we can discuss this in the stakeholder meetings.

Water Temperature

1. Section 6.0, Bullet #3: As stated above in our comments on the hydrology modeling (comment #2), if available, the hydrology modeled in this project should include a longer period of record.

2. The study goals and objectives should be expanded to include not just assessment of alternative scenario operations, but additional alternative infrastructure components to better access cold water available in the Project.

Please let me know if you have any questions regarding these questions or comments.

Thank you,

Michael Maher
Region 2 FERC Coordinator | ☎ Cell: 916-597-5505
California Department of Fish & Wildlife | **North Central Region**
1701 Nimbus Road, Rancho Cordova | michael.maher@wildlife.ca.gov

---

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Monday, July 28, 2025 11:53 AM
Subject: EBMUD Lower Mokelumne River Project Water Resources Prelim Draft Study Plans

Hello,

Attached are the preliminary draft Study Plans for Water Resources. The preliminary draft Study Plans outline some of the initial information on objectives/goals as well as scope and methodologies being considered. We'd appreciate your review and feedback by **Friday August 22**.

This will help us have a more constructive discussion at the next Technical Working Group Meeting. In order to provide adequate time between the review deadline and the meeting, this second Water Resource TWG meeting will be scheduled for **September 3 from 9:00am-11:00am**. Please let us know if you did not receive a meeting notice and would like to be sent one. If we do not receive any feedback, we will proceed in cancelling this second TWG meeting.

Thank you.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

From:	MokRelicense
Bcc:	Jain, Priyanka; Tam, Joe; Cheng, Sabrina; Shannon Luoma; Fatima Oswald; Olivia Smith; jennifer.polardino@kleinschmidtgroup.com; jesus@bvtribe.com; CalaverasMiwukPreservation@gmail.com; l.ewilson@yahoo.com; jereme@ionemiwok.net; consultation@ionemiwok.net; adalton@jacksoncasino.com; valdezcome@comcast.net; serrell.smokey@washoetribe.us; cprout@colfaxrancheria.com; antoinette.cvmt@gmail.com; rcuellar@ssband.org; Neil.Peyron@tulerivertribe-nsn.gov; SSuess@crtribal.com; tinagoodwin@washoetanf.org; jfore@auburnrancheria.com; cpd@wiltonrancheria-nsn.gov; calaverasband.miwukindians@gmail.com; adam2191983@gmail.com; tribaloffice@sir-nsn.gov
Subject:	EBMUD Lower Mokelumne River Project Tribal/Cultural Resources TWG Meeting slides
Date:	Friday, August 29, 2025 3:14:51 PM
Attachments:	image001.png

Hello,

Thank you to those that were able to attend the Tribal/Cultural Resources Technical Working Group (TWG) meeting on August 25. The presentation that was shared at that meeting can be found here on our website Lower Mokelumne River Project Relicensing (FERC). We keep our site updated with meeting documents and upcoming events, so please reference it for updates.

We will take into account what was discussed at the TWG meeting and then incorporate the preliminary draft study into the Pre-Application Document (PAD) being submitted in October 2025.

If there any reports/write-ups/information you can share with us for the lands around Pardee and Camanche Reservoirs, that would be helpful as it would inform our study plans. Please let us know and we'll figure out how to get that information from you.

We look forward to continuing to work with you over the course of this multi-year process.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
Cultural Resources
August 25, 2025

EBMUD Kleinschmidt EBMUD

AGENDA

- Welcome and Introductions
- FERC Schedule Review
- Review Preliminary Draft Study Plans
- Review TWG member comments and questions
- Action Items, Schedule and Next Steps

Welcome & Introductions

EBMUD EBMUD

Lower Mokelumne Relicensing Team

EBMUD Project Management Team	EBMUD Resource Leads	Consultant Team
Priya Jain	Chuck Beckman	*Kleinschmidt* Shannon Luoma
Brad Ledesma	Deborah Preciado	Fatima Oswald
Joe Tam	Sami Harper	Jennifer Polardino
Karen Donovan		

Meeting Purpose and Objectives

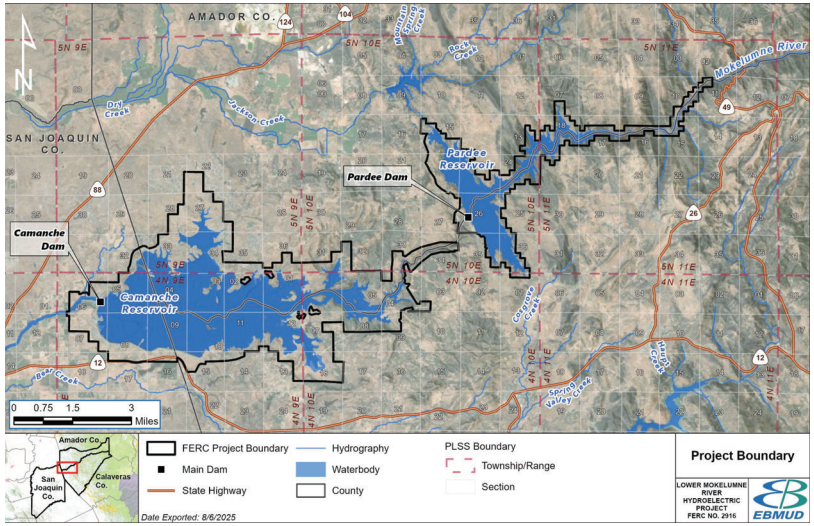
Review the preliminary draft study plans related to Cultural and Tribal resources:

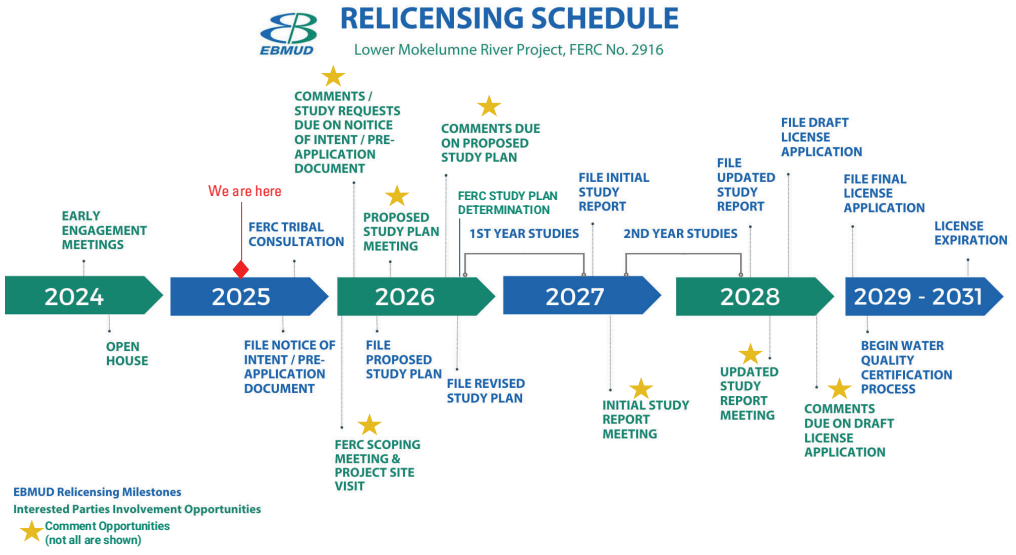
- Cultural Resources Study Plan
- Tribal Ethnography Study Plan

Lower Mokelumne River (FERC Project No. 2916) Project Overview

EBMUD

Lower Mokelumne River Project (P-2916)





Cultural Participation Opportunities

- FERC will initiate Tribal Consultation within 30 days of filing the PAD and NOI
- Comment opportunities throughout the FERC relicensing process
- Informal communication with EBMUD anytime – phone, email, meetings
- Specific information relating to traditional cultural properties (TCPs), historic properties, or other privileged data will be maintained as confidential

Why Conduct Studies?

- The Proposed Study Plan (PSP) is a FERC requirement under the ILP
- Provide FERC the necessary information to conduct their analysis
- Identify pertinent & potential Project issues
- Lay groundwork for future license conditions & PM&Es

18 CFR § 5.11 Potential Applicant's proposed study plan and study plan meetings.

(a) Within 45 days following the deadline for filing of comments on the pre-application document, including information and study requests, the potential applicant must file with the Commission a proposed study plan.

FERC's 7 Study Guide Criteria

1- Goals & Objectives
2&3 - Relevant Resource Management Goals & Public Interest Considerations
4 - Existing Information & Need for Additional Information
5 - Project Nexus
6 - Proposed Methodology
7 - Level of Effort & Costs

Cultural Resources Study

Cultural Resources – Archaeology & Built-Environment Resources Study

Existing Data

- State and Federal Database Reviews
- License Compliance Documents
- EBMUD Data and Publications
- Scientific Literature
- 1950/1960's Reconnaissance Surveys and Excavations
- 2019 Cultural Resources Management Plan (CRMP; DeBaker and Siskin)
- 2023 Historic Property Survey (Demarais et al.)

Existing Environment (Archaeology)

- 175 archaeological sites within the study area (122 within the FERC Project Boundary).
- The 175 sites include:
  - 114 precontact sites
  - 25 dating to the historic period
  - 8 w/precontact and historic-period components, and
  - 28 w/no info avail - studies in progress at time of records searches.

Existing Environment (Built-Environment)

- 54 formally recorded built-environment resources
- 43 additional unrecorded potential properties
- Two National Register-listed historic properties:
  1. Middle Bar Bridge, 2. Main Pardee Dam and Powerhouse, Jackson Creek Spillway, Pardee South Spillway

To the extent feasible, archaeological and built-environment resources field studies will be coordinated with each other and with other Project-related studies, in particular the Tribal resources study and, information shared as appropriate.

Potential Study – Cultural Resources Study

Goals & Objectives

1. To meet FERC compliance requirements under Section 106 of the National Historic Preservation Act (NHPA), as amended, by determining if Project-related activities and public access will have an adverse effect on historic properties; and

2. To identify all archaeological sites and built environment resources within the Area of Potential Effects (APE) and assess for eligibility under NHPA.

Potential Study – Cultural Resources Study

Geographic Scope

The Area of Potential Effect (APE) is the same as the FERC Project Boundary. Additionally, the archaeological study area includes a 0.25-mile buffer around the APE to provide background on a wider range of archaeological resources.

Potential Methodology

- Archaeological Inventory
- Records Search Update and Additional Background Research
- Field Survey
- National Register Evaluation

Tribal Ethnography Resources Study

Cultural Resources – Tribal Ethnography Resources Study

Existing Data

- State and Federal Database Reviews
- License Compliance Documents
- EBMUD Data and Publications
- Scientific Literature
- 1950/1960's Reconnaissance Surveys and Excavations
- 2019 Cultural Resources Management Plan (CRMP; DeBaker and Siskin)

Existing Environment

- No TCPs or other places of religious or cultural significance to Indian Tribes have yet been formally recorded in the study area. These must be identified via Tribal consultation.
- NHPA regulations require that consultation provides the Tribe(s):
  - an opportunity to identify concerns about historic properties;
  - advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance (TCP);
  - Tribe(s) to articulate views on the undertaking's effects on TCPs; and
  - participate in the resolution of adverse effects.

Native American TCPs, while a type of historic property subject to Section 106 of the NHPA, will be documented via consultation, as described in the Tribal Resources study. (Any non-Native TCPs will be documented as part of the built-environment and/or archaeological inventories.)

Potential Study – Tribal Ethnography Resources Study

Goals & Objectives

- Assist FERC, as its non-federal representative, in meeting its compliance requirements under Section 106 of the NHPA, by determining if relicensing of the Project will have an adverse effect on historic properties, in this case Tribal resources.
- Identify Tribal resources that may be affected by Project O&M.

Potential Study – Tribal Ethnography Resources Study

Geographic Scope

The Area of Potential Effect (APE) is the same as the FERC Project Boundary. The overall proposed Tribal Ethnography Resources Study area, however, encompasses a larger area comprising a 0.25-mile buffer around the APE.

Potential Methodology

- ***Archival Research*** will 1) provide primary data to create a background American Indian ethnohistory of the Study area; and 2) inform the Tribal resources historic context for the National Register.
- ***Meetings with Tribal Governments*** Meetings with Tribal governments, administrators or representatives is proposed to provide Project data to Tribal groups, elicit areas of interest, identify appropriate Tribal informants, and establish protocols for conveying information.
- ***Interviews*** are proposed with Tribal experts to gain an understanding of what is important to them and why.
- ***Documentation and Evaluation*** Three main categories of Tribal resources are anticipated: 1) Tribal places; 2) TCPs; and 3) Tribal government matters.
- ***Coordination with Other Studies*** As needed, the Tribal resource expert will assist other resource experts in identifying Tribal resources with connections to their technical study.

Action Items & Next Steps

Next Steps

October 2025 – EBMUD files Pre-Application Document (PAD) with FERC

November 2025 – FERC initiates Tribal Consultation

January 2026 – FERC Project Scoping Meeting

February 2026 – Comments/Study Requests due to FERC (for PAD/Studies)

March 2026 – EBMUD files Proposed Study Plan (PSP) with FERC

June 2026 – Comments due to FERC on PSP

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Sami Harper, EBMUD: 510-287-2068
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

From: Millsap, Stephanie D
To: MokRelicense; Cheng, Sabrina; Jain, Priyanka; Tam, Joe
Cc: Estenson, Lauren; Holcombe, Erika F
Subject: RE: [EXTERNAL] RE: FWS input on preliminary draft Study Plans for EMBUD Lower Moke River Project
Date: Wednesday, September 3, 2025 4:06:28 PM
Attachments: image001.png

Dear EBMUD relicensing team:

Below are the Service's informal comments on the preliminary draft Study Plans for EBMUD's Lower Mokelumne River Project. In an effort to get these to you sooner, they are informal comments rather than fully fleshed out and written in full sentences. In some instances, we're just trying to understand the underlying rationale better rather than making recommendations. Please let us know if you have questions about any of the comments below. We also anticipate participating during upcoming TWG meetings.

Sincerely,
-Stephanie

Botanical Resources:

- Section 5.2 Geographic Scope: only lists project facilities and recreational facilities, appears to exclude the reservoirs. Recommend including surveying within 100' upland from the reservoirs' high water mark. Project operations affects habitat, and plant communities, around the reservoir.
- Study plan notes three surveys to be conducted (March, May, July). March timing does not seem to align with the bloom periods for all three flowering plants that appear on the Service's IPaC species list for the project area (Fleshy owl's-clover/succulent owl's-clover, Ione buckwheat, and Ione manzanita). Specifically, the study plan surveys appear to miss the bloom period of Jan-Feb for Ione Manzanita noted in Service's 2010 5-year review.

Fish Population:

- Will the data be adjusted for differences in fish capture efficiency to address assumptions such as equal availability of all species and life stages to the survey methods?
- Figure 7.2 is missing from the study plan.

Hydrology & Operations Modeling (discussed comments during Technical Working Group meeting on 9/3/25):

- Section 3: Study Goals and Objectives: is one of the potential hydrology scenarios proposed for modeling a "Without Project" scenario?
- Section 4: Relevant Resource Management Goals: how does the Moke fit into VA/HRL?

Instream Flow:

- Habitat Suitability Criteria (HSC): what existing data will be used to determine ideal habitat for various life stages of Chinook and steelhead (from LMR or other similar systems)? Is availability of habitat accounted for in analysis of use by priority species and life stages? Can the studies on egg survival and juvenile mortality be used to inform HSC for spawning and fry/juvenile rearing? Other variables such as substrate and cover should be used in creating HSC in addition to velocity and depth. Will any biological validation be done once HSCs are developed?
- How will time-series data be classified as habitat-limiting? Will habitat availability be rated relative to average levels during the period of record (2020-2024), or compared to some other minimum level?
- How many years is it typical for an operations model to utilize? What the pros and cons of using more than 24 years' worth of data? Why was 2000 chosen as the last year of flow data for modeling? *(These questions were satisfactorily addressed during discussion of the Hydrology & Operations Modeling plan on 9/3/25)*.
- Has there been longstanding agreement among EBMUD and resource agencies about the existing HEC-RAS model and its ability to model hydraulics over wide range of flows?

- Does the instream flow study also evaluate how much spawning gravel and other materials are being blocked by dams?

Reservoir Fish Habitat:

- It would be beneficial to explicitly state why the categories of "cold-water" versus "warm-water" habitat types are delineated by temperatures of 20ºC and dissolved oxygen at 7 mg/L, as well as the effects of cold- versus warm-water habitat availability in the reservoirs (i.e. what species or life stages are dependent on or negatively affected by these conditions?).
- How will time-series data be classified as habitat-limiting? Will habitat availability be rated relative to average levels during the period of record (2020-2024), or compared to some other minimum level?

Wetland, Riparian, and Littoral Habitats:

- How were survey area distances selected (ex: 100 feet for dams, dikes, spillways, 150 feet around project recreation facilities, etc.)?
- Section 5 Geographic Scope: incomplete, should include project-affected reaches. The SS Amphibian SP has a better description. A map may also be helpful.
- In section 7.2.3, what are "representative locations" and how selected?
- Other river systems have had riparian habitat studies with a focus on cottonwood/willow recruitment and survival that may be helpful, lessons learned, etc. (McBain and Associates has recently been doing some on Tuolumne within the last 2 years)

Special Status Amphibians & Aquatic Reptiles:

- In multiple sections within the document the existing Safe Harbor Agreement with the Service is referenced. Service biologists are coordinating with biologists from the office that oversees the SHA. Will need to figure out the regulatory landscape of how SHA and FERC licensing overlap, especially as the timeline of the SHA and FERC license are different.
- In section 6.0, list of potential information gaps, does EBMUD have information on the presence/absence of predators that could impact listed species and how project operations could impact those predator populations? (ex: bullfrogs in potential CRLF habitat)
- In section 7.1.1, Habitat Characterization for NWPT, proposed GIS selection criteria, how were these criteria selected?
  -Understanding that WPT are less likely to nest on slopes greater than 60 degrees, why is the proposed criteria a narrower window of 2 to 15 degrees?
  -Bury et al. (2012, pg.77-78) recommends a 500m buffer from aquatic habitat based on a wide variation of distances between aquatic habitat and overwintering or nest site selection (proposed distance in EBMUD study plan is 400m).
- Figure 7-2 also missing in this study plan, perhaps a copy and paste error as List of Figures displays an "Error!"
- Focused VES for NWPT/FYLF relies on results of eDNA, i.e., VES only occur if eDNA detections occur. Service does not rely on eDNA results alone for species absence and echoes CDFW's comment recommending VES surveys for FYLF. Service encourages the use of initial combined eDNA and VES for amphibian surveys (rather than only doing VES if eDNA detects amphibians).
- Note that study plan proposes one single study season between late May and end of July, which is towards the end of typical FYLF breeding period (late March to early July), but does include time within NWPT's typical active season (March 1 to October 31).

Water Quality (discussed comments during Technical Working Group meeting on 9/3/25):

- Will methylmercury bioaccumulation in fish be included to identify potential ecological concerns (e.g. piscivorous wildlife) as well as human health (e.g. fish consumption advisories).
- Note that looking at calcium content can be useful for tracking invasives, like some mussels.

Water Temperature (discussed comments during Technical Working Group meeting on 9/3/25)

No written comments.

Wildlife Resources:

- The Service requests that EBMUD include nesting surveys for western and Clark's Grebes on both reservoirs: both species will nest on larger lakes, and the Project area is within their range. Fluctuating water levels during

nesting season have been shown to result in nest failure at another reservoir in CA. The Service can provide additional details regarding survey methods and frequency upon request.

- Implementation of bald eagle surveys are currently voluntary, but in other licenses, surveys are part of the license along with LOPs.
- Similar as for SS Amphibians Study, will need to figure out the regulatory landscape of how SHA and FERC licensing overlap, especially as the timeline of the SHA and FERC license are different.
- Note that an advantage of utilizing acoustic recordings, as recommended by CDFW to accompany avian survey methods proposed in the study plan, is that they can be reviewed multiple times by multiple experts, potentially yielding improved estimates of species abundance and community richness.

****
Stephanie Millsap, Ph.D.
Assistant Field Supervisor; Watershed Planning Division
stephanie_millsap@fws.gov
916-930-2658
U.S. Fish and Wildlife Service
SF Bay Delta Fish and Wildlife Office
650 Capital Mall, Suite 8-300
Sacramento, CA 95814
****

From: Millsap, Stephanie D
Sent: Sunday, July 20, 2025 9:15 PM
To: MokRelicense <MokRelicense@ebmud.com>
Cc: Estenson, Lauren <lauren_estenson@fws.gov>; Holcombe, Erika F <erika_holcombe@fws.gov>; Cheng, Sabrina <sabrina.cheng@ebmud.com>; Tam, Joe <joe.tam@ebmud.com>; Jain, Priyanka <priyanka.jain@ebmud.com>
Subject: RE: [EXTERNAL] RE: FWS input on preliminary draft Study Plans for EMBUD Lower Moke River Project

We anticipate it'll be mid-August as the entire FWS review team is currently, or will soon be, on leave.

Take care,
-Stephanie

****
Stephanie Millsap, Ph.D.
Assistant Field Supervisor; Watershed Planning Division
stephanie_millsap@fws.gov
916-930-2658
U.S. Fish and Wildlife Service
SF Bay Delta Fish and Wildlife Office
650 Capital Mall, Suite 8-300
Sacramento, CA 95814
****

From: MokRelicense <MokRelicense@ebmud.com>
Sent: Friday, July 18, 2025 10:26 AM
To: Millsap, Stephanie D <stephanie_millsap@fws.gov>
Cc: Estenson, Lauren <lauren_estenson@fws.gov>; Holcombe, Erika F <erika_holcombe@fws.gov>; Cheng, Sabrina <sabrina.cheng@ebmud.com>; Tam, Joe <joe.tam@ebmud.com>; Jain, Priyanka <priyanka.jain@ebmud.com>
Subject: [EXTERNAL] RE: FWS input on preliminary draft Study Plans for EMBUD Lower Moke River Project

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Good morning Stephanie,

Thank you again for letting us know about the anticipated delay in reviewing the Study Plans. Do you have an estimated date of when you might be able to provide feedback on those?

Virginia Marcus
Administrative Clerk | Water Resources Planning Division
375 11th Street, MS 901, Oakland, CA 94607
(510) 287-0107
virginia.marcus@ebmud.com

EAST BAY MUNICIPAL UTILITY DISTRICT
stewardship integrity respect teamwork

From: Jain, Priyanka <priyanka.jain@ebmud.com>
Sent: Tuesday, July 15, 2025 3:40 PM
To: Millsap, Stephanie D <stephanie_millsap@fws.gov>; MokRelicense <MokRelicense@ebmud.com>
Cc: Estenson, Lauren <lauren_estenson@fws.gov>; Holcombe, Erika F <erika_holcombe@fws.gov>; Cheng, Sabrina <sabrina.cheng@ebmud.com>; Tam, Joe <joe.tam@ebmud.com>
Subject: RE: FWS input on preliminary draft Study Plans for EMBUD Lower Moke River Project

Hi Stephanie. Hope you had a nice time off. Backlog of emails are definitely not fun to return to.

Thank you for letting us know in regard to the timeline issue.
Is there any estimated date of when we can expect to receive feedback?

Thanks,
Priya

From: Millsap, Stephanie D <stephanie_millsap@fws.gov>
Sent: Tuesday, July 15, 2025 5:08 PM
To: MokRelicense <MokRelicense@ebmud.com>
Cc: Estenson, Lauren <lauren_estenson@fws.gov>; Holcombe, Erika F <erika_holcombe@fws.gov>; Jain, Priyanka <priyanka.jain@ebmud.com>; Cheng, Sabrina <sabrina.cheng@ebmud.com>; Tam, Joe <joe.tam@ebmud.com>
Subject: FWS input on preliminary draft Study Plans for EMBUD Lower Moke River Project

Dear EBMUD relicensing team:

The Service has received several preliminary draft study plans associated with relicensing of the Lower Mokelumne River Project. I was out last week and am catching up on my emails, including forwarding study plans to other Service biologists. Unfortunately, we will be unable to review and provide feedback by your requested date of Tuesday, July 22 due to balancing other workload deliverables.

I appreciate your team's patience.

Take care,
-Stephanie

****
Stephanie Millsap, Ph.D.
Assistant Field Supervisor; Watershed Planning Division
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916-930-2658
U.S. Fish and Wildlife Service
SF Bay Delta Fish and Wildlife Office
650 Capital Mall, Suite 8-300
Sacramento, CA 95814
****

From: MokRelicense
Subject: EBMUD Lower Mokelumne River Project Water Resources TWG Meeting #2 slides
Date: Wednesday, September 10, 2025 1:34:18 PM
Attachments: image002.png

Hello,

Thank you to those that were able to attend the second Water Resources TWG meeting. The presentation that was shared at that meeting can be found here on our website Lower Mokelumne River Project Relicensing (FERC). We keep our site updated with meeting documents and upcoming events, so please reference it for updates.

We will be incorporating the preliminary draft study plans and what was discussed in both TWG meetings into the Pre-Application Document (PAD) being submitted in October 2025. We look forward to continuing to work with you over the course of this multi-year process.

East Bay Municipal Utility District
FERC Relicense Project – Lower Mokelumne River P2916
Website: www.ebmud.com/MokRelicense
Email: *MokRelicense@ebmud.com*

Lower Mokelumne River Project

FERC Project No. 2916

Technical Work Group (TWG) Meetings
Water Resources
September 3, 2025

AGENDA

- Welcome and Introductions
- Early Engagement & Schedule Recap
- Review Preliminary Draft Study Plans
- Review TWG member comments and questions
- Action Items, Schedule and Next Steps

Welcome & Introductions

Lower Mokelumne Relicensing Team

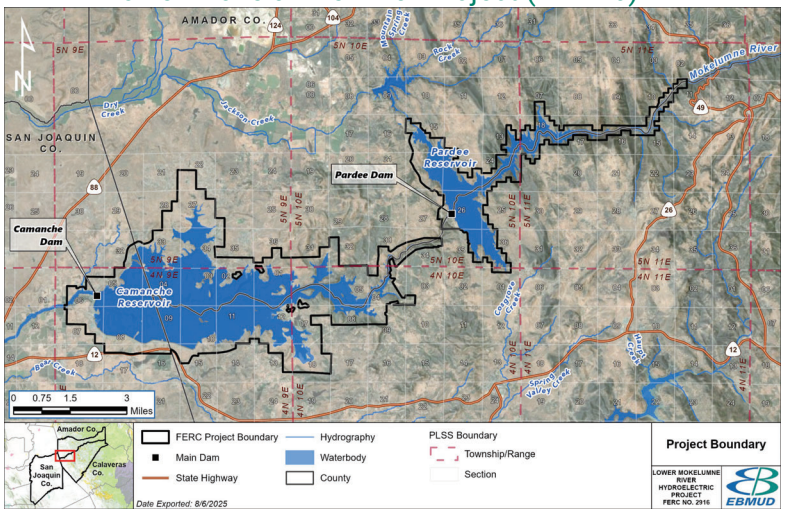
Project Management Team	Resource Leads
	Ana Ulloa
Priya Jain	Ben Bray
	Casey Del Real
Brad Ledesma	Casey Leblanc
	Chandra Johannesson
Joe Tam	Chris Potter
	Deirdre Mena
Karen Donovan	Eric Toth
	Ginger Chen
	Jason Zhou
	Sami Harper
	Thom Hardie

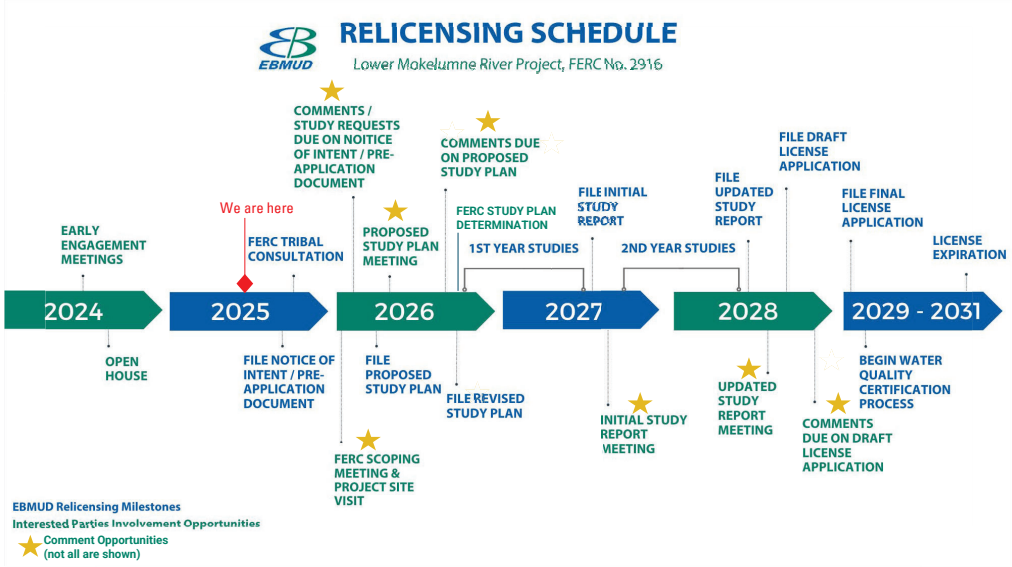
Consultant Team	
Kleinschmidt	**Facilitator**
Shannon Luoma	Marie Rainwater
Fatima Oswald	
Olivia Smith	
Vanessa Martinez	
Craig Addley	

Meeting Purpose and Objectives

- Review relicensing participants interests and objectives, as EBMUD prepares draft study plans for inclusion in the PAD
- Review preliminary draft study plans
- Review TWG Comments/Questions

Lower Mokelumne River Project (P-2916)





Proposed Water Resource Studies

Proposed Studies:

1. Water Quality Study
2. Hydrology and Operations Modeling Study
3. Water Temperature Study

General Water Resource Studies – Comments

General Comments and Questions from CDFW:

1. It is the understanding of CDFW staff that the Lower Mokelumne Project (Project) has obligations under the Healthy Rivers and Landscapes (HRL) Program. How will the Water Resources Study Plans (Plans) incorporate these into the study design?

- *The HRL is still being finalized. The study plans will incorporate all flow obligations.*

2. What is the format of the HRL Program as it applies to the Project area? Does the HRL have separate plans for which the Project is one or is there one overarching plan implemented separately?

- *There is one overarching plan - the Bay Delta Plan - which is still being finalized and, includes the HRL. The Mokelumne Watershed would be part of the HRL.*

3. Will the variable elevation intake tower and thermal curtain options intended for temperature control presented at the recent MRTAC meeting be incorporated into the Plans and if so, what will be the metrics used and how will they be analyzed?

- *The results of the proposed study plans (e.g., egg survival) will be used to define specific objectives to improve downstream salmon health. If improvements are necessary, various alternatives would be evaluated for meeting those objectives, including infrastructure options (e.g., outlet tower at Camanche).*

Draft Study – Water Quality Study

Goals & Objectives:

- Characterize existing project water quality of Project reservoirs and Project-affected river reaches
  - Collect water quality data to supplement existing information as needed
- Assess water quality conditions in relation to the objectives/criteria of the Basin Plan (CRWQCB 2019) and other water quality standards.

Geographic Scope:

- The Mokelumne River inflow to Pardee Reservoir, through the outflow of Camanche Reservoir downstream to the Woodbridge Irrigation District Dam (WIDD).

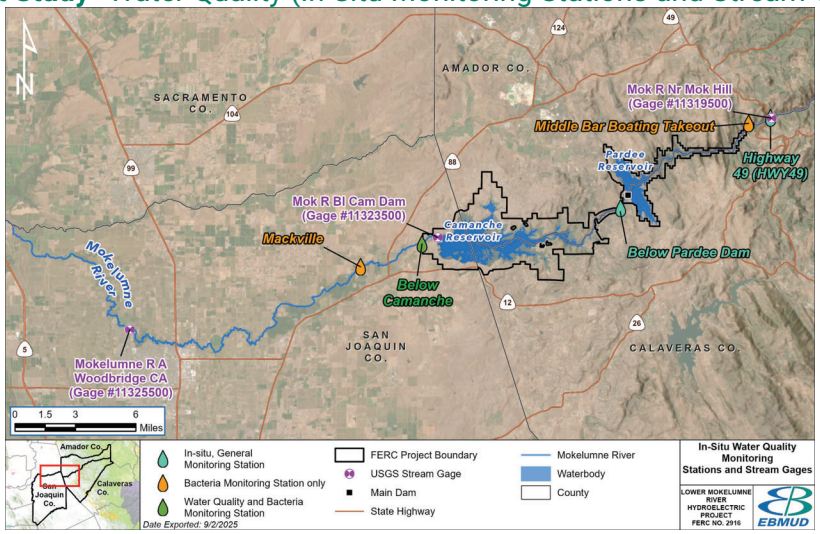
Draft Study – Water Quality Study

Methodology:

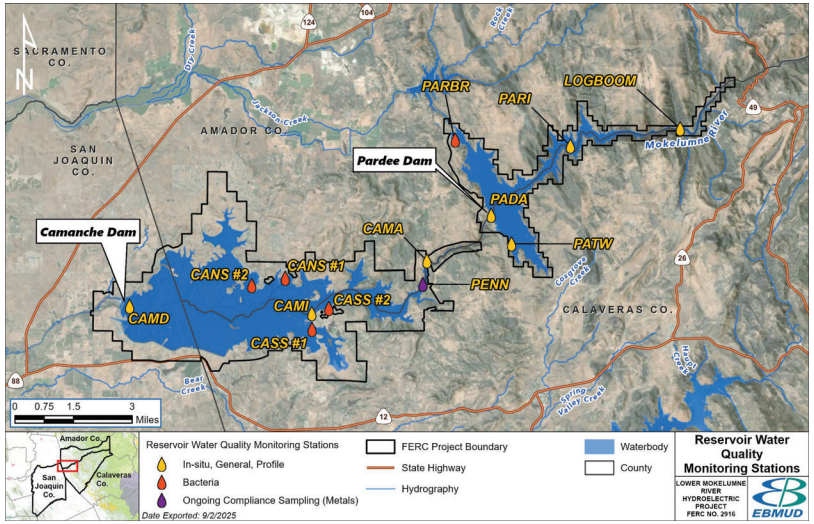
Spring/Fall in-situ water quality measurements; seasonal water quality grab sampling; reservoir/lake profiles; laboratory analysis and reporting.

- Water Quality Sampling Locations
- Spring/Fall In-situ Field Measurements
  - River Reaches
  - Reservoirs
- Spring/Fall Water Quality Grab Samples
- Bacterial Sampling
- Laboratory Analysis
- Additional Sampling (if needed)
- Reporting

Draft Study–Water Quality (In-Situ Monitoring Stations and Stream Gages)



Draft Study–Water Quality (Reservoir Monitoring Stations)



Draft Study – Water Quality Study

Comments and Questions from CDFW:

CDFW staff recommend that there are sufficient dissolved oxygen and temperature monitoring stations in the lower Mokelumne River to help establish temperature dependent egg mortality modeling. CDFW staff are available to consult with EBMUD staff to determine appropriate locations for monitoring stations to meet these modeling goals.

- *EBMUD is in the process of drafting an egg mortality study which will be included in the PAD where agencies can review and provide comments during the formal comment period.*

Draft Study – Water Quality Study

Q&A, Clarifications, and Feedback

Draft Study – Hydrology and Operations Modeling Study

Goals & Objectives:

- Model the existing Project hydrology and other potential hydrology scenarios
- Perform a hydrologic alteration analysis
- Conduct a high flow frequency analysis for hydrology scenarios

Geographic Scope:

- The Mokelumne River inflow to Pardee Reservoir, through the outflow of Camanche Reservoir downstream to the Woodbridge Irrigation District Dam (WIDD).

Draft Study – Hydrology and Operations Modeling Study

Methodology:

- Hydrology Model Development
- Hydrologic Alteration Analysis
- High Flow Frequency Analysis
- Reporting

Draft Study – Hydrology and Operations Modeling Study

Comments from CDFW:

"Model the existing Project hydrology and other potential hydrology scenarios"

Section 3.0, Bullet #1: This bullet should be modified to include not just additional hydrology scenarios, but also the ability to model additional operational scenarios that relicensing participants request. This may be what you intended already in that bullet, but because the study plan does include looking at potential future climate change scenarios, it should be specified that the study plan will include both.

- *Noted, this bullet will be updated to include relevant additional operational scenarios.*

"Use the 2000-2024 period of record (POR) for hydrological modeling based on data availability (historical gage data)."

Section 7.1, Bullet #2: If available, the hydrology modeled in this project should include a longer period of record. Using at least 30 years of hydrologic record is pretty standard for FERC relicensing's. CDFW staff agree that the period from 2000-2024 does include several periods of drought and also very high flow years, and is a useful time series for comparison, but because we want to use this to consider range of variability that may be observed, a longer record is better. If there is a reason to include a shorter record, we can discuss this in the stakeholder meetings.

- *EBMUD has digital hydrology and meteorological data back to 1997 and can extend the hydrologic record (1997-2024).*

Draft Study – Hydrology and Operations Modeling Study

Q&A, Clarifications, and Feedback

Draft Study – Water Temperature Study

Goals & Objectives:

- Review existing water temperature model applications for Pardee and Camanche reservoirs
- Use water temperature models of the existing Project operations and other potential scenarios that accurately represent water temperature under existing climate conditions and future climate change conditions.
- Compare the existing Project operations water temperature and other potential scenario water temperature model results using existing climate conditions and future climate change conditions.

Geographic Scope:

- The Mokelumne River inflow to Pardee Reservoir, through the outflow of Camanche Reservoir downstream to the Woodbridge Irrigation District Dam (WIDD).

Draft Study – Water Temperature Study

Methodology:

- Water Temperature Model Review
- Compile Existing Data
- Water Temperature Modeling and Analysis
- Reporting

Draft Study – Water Temperature Study

Comments and Questions from CDFW:

"Flood frequency information data developed by the U.S. Army Corps of Engineers (USACE) (USACE 1981)."

Section 6.0, Bullet #3: As stated above in our comments on the hydrology modeling (comment #2), if available, the hydrology modeled in this project should include a longer period of record.

- *EBMUD has digital hydrology and meteorological data back to 1997 and can extend the hydrologic record (1997-2024).*

The study goals and objectives should be expanded to include not just assessment of alternative scenario operations, but additional alternative infrastructure components to better access cold water available in the Project.

- *The results of the proposed study plans (e.g., egg survival) will be used to define specific objectives to improve downstream salmon health. If improvements are necessary to achieve objectives, various alternatives would be evaluated for meeting those objectives, including infrastructure options (e.g., outlet tower at Camanche).*

Draft Study – Water Temperature Study

Q&A, Clarifications, and Feedback

Action Items & Next Steps

Next Steps

By September 10 – Relicensing Team will distribute meeting materials to attendees

October 2025 – EBMUD submittal of Pre-Application Document (PAD)

Stay Informed

- Lower Mokelumne Website: EBMUD.com/MokRelicense
- Email: MokRelicense@ebmud.com
- Eric Toth, EBMUD: 510-287-0277
- FERC e-Subscription (docket number "P-2916") at www.ferc.gov
  - Formal Relicensing begins October 2025 with EBMUD submittal of the Pre-Application Document (PAD)

From: Fatima Oswald
To: Olivia Smith
Subject: FW: Study feedback from California Valley
Date: Thursday, September 18, 2025 12:08:53 PM
Attachments: GuidetoWorkingwithNon-FederallyRecognizedTribesintheSection106Process.pdf
ARCHAEOLOGY RESOURCES STUDY PLAN PRELIMINARY DRAFT.pdf
TRIBAL ETHNOGRAPHY RESOURCES STUDY PLAN PRELIMINARY DRAFT.pdf

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Fatima Oswald, MPA
Project Manager/Licensing & Regulatory Section Manager
p: 971-337-3841 c: 503-319-1623
Kleinschmidt
Hydropower. *Our focus*. *Our passion*.

From: Jain, Priyanka <priyanka.jain@ebmud.com>
Sent: Thursday, September 18, 2025 11:40 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Fatima Oswald <Fatima.Oswald@Kleinschmidtgroup.com>
Subject: FW: Study feedback from California Valley

FYA

From: Beckman, Charles <charles.beckman@ebmud.com>
Sent: Friday, September 12, 2025 12:23 PM
To: Jain, Priyanka <priyanka.jain@ebmud.com>; Tam, Joe <joe.tam@ebmud.com>; Preciado, Deborah <deborah.preciado@ebmud.com>; Harper, Sami <sami.harper@ebmud.com>
Subject: Study feedback from California Valley

Greetings everyone,

Lawrence Wilson from the California Valley Miwok Tribe visited our office this morning to share feedback on the draft study plans. Lawrence also wanted to share the attached guide to working with non-federally recognized tribes as he thought it would be helpful to us during relicensing and other tribal engagement work. There may be additional comments from CVMT on both documents which I will share as soon as Lawrence can provide them.

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Preserving America's Heritage

GUIDE TO WORKING WITH NON-FEDERALLY RECOGNIZED TRIBES IN THE SECTION 106 PROCESS

Table of Contents

Introduction and Purpose

The National Historic Preservation Act of 1966 (NHPA) established a comprehensive program to preserve the historical and cultural foundations of the nation. Section 106 of the NHPA is central to that program and requires federal agencies to consider the effects of projects they carry out, assist, fund, permit, license, or approve (undertakings) on historic properties.[1] As part of this review process, federal agencies consult with interested parties to identify and evaluate historic properties, assess the effects of the undertakings on these properties, and attempt to negotiate an outcome that will balance project needs and historic preservation values. Federal agencies must consult with certain parties who have concerns about historic properties that may be affected by undertakings (discussed in more detail below). Federal agencies should also consider reaching out as broadly as possible when gathering information about potential historic properties in the project area and to obtain views from all interested parties about historic properties that may be important to them. This guide focuses on one such interested party: non-federally recognized tribes.

This document provides information and guidance for federal agencies regarding engagement with non-federally recognized tribes in the Section 106 process. The question of whether to invite non-federally recognized tribes to participate in the review process can be both complicated and sensitive and thus deserves careful consideration. State-recognized tribes and other tribal entities often have interests in undertakings within their homelands, just as federally recognized Indian tribes do. Non-federally recognized tribes may be invited by federal agencies to participate in the Section 106 process as parties with demonstrated interests in projects or they may seek to participate through collaboration with federally recognized Indian tribes already engaged in the process.

The Section 106 process is designed to ensure inclusiveness of those parties who may have an interest in historic resources that may be affected by proposed federal undertakings. The regulations at 36 C.F.R. Part 800 outline the review process and discuss the parties that must be invited to participate as well as those parties that may be invited. Agency officials with jurisdiction over undertakings are required to

[1] Historic properties are defined as those properties that are listed, or are eligible for listing, on the National Register of Historic Places.

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consult with state historic preservation officers (SHPOs), Indian tribes (meaning federally recognized Indian tribes), Native Hawaiian organizations (NHOs), tribal historic preservation officers (THPOs), local governments, and project applicants. Additional consulting parties may be invited to participate in the process. The Advisory Council on Historic Preservation (ACHP) may participate in the process and must be notified of adverse effects. As members of the public and American citizens, both non-federally recognized tribes and their individual members are entitled to the same consideration all citizens of the U.S. have in the Section 106 process. This guidance provides background and information on the participation of these citizens, and clarifies how those rights differ from those of Indian tribes and NHOs.

The indigenous populations in Puerto Rico, Guam, American Samoa, the Virgin Islands, the Northern Mariana Islands, Republic of the Marshall Islands, the Federated States of Micronesia, and the Republic of Palau, like non-federally recognized tribes, also do not have formal government-to-government relationships with the U.S. government, as federally recognized Indian tribes do, but they may have important information to contribute to the Section 106 process.

The United Nations Declaration on the Rights of Indigenous Peoples (U.N. Declaration), which has been supported by the U.S. since 2010, encourages recognition of the special status and rights of indigenous peoples globally. While not legally binding, it is acknowledged by the U.S. as having "both moral and political force."[2] In 2013, the ACHP adopted a plan to support the U.N. Declaration, acknowledging intersections between Section 106 and the Declaration. While many articles in the U.N. Declaration relate to or intersect with Section 106, Article 18 which addresses the rights of indigenous peoples to have a role in decision-making processes, most closely aligns with the consultation rights afforded to Indian tribes and NHOs in the Section 106 process. Article 18 states that, "Indigenous peoples have the right to participate in decision making in matters which would affect their rights, through representatives chosen by themselves in accordance with their own procedures, as well as to maintain and develop their own indigenous decision-making institutions." The fact that the Declaration includes a provision regarding the rights of indigenous peoples to participate in decision making underscores the importance of federal agency consultation with all indigenous peoples in the U.S. in the Section 106 process when historic properties of significance to them may be affected by proposed undertakings.[3]

The ACHP, in its work to build a more inclusive preservation program, explains that

> "The diversity of cultures in our country shape and enrich the American experience, and the federal government can continue to encourage wider involvement and representation in determining what historic sites are worthy of recognition and preservation; how history and cultural heritage should be valued, interpreted, and preserved; and how we can ensure the American public as a whole can take advantage of the programs and tools created under the National Historic Preservation Act."[4]

This guidance, therefore, supports such goals to broaden the involvement and representation of interested citizens in historic preservation reviews.

Terminology

It should be understood at the outset that the term "Indian tribe" is defined in the NHPA as "…an Indian tribe, band, nation, or other organized group or community, including a Native village, Regional Corporation or Village Corporation (as those terms are defined in section 3 of the Alaska Native Claims Settlement Act (43 U.S.C 1602)), that is recognized as eligible for the special programs and services

[2] http://www.achp.gov/docs/US%20Support%20for%20Declaration%2012-10.pdf
[3] For a more detailed discussion of Article 18 and Section 106: http://www.achp.gov/docs/UNDeclaration106.pdf
[4] http://www.achp.gov/inclusiveness.html

provided by the United States to Indians because of their status as Indians." Therefore, the term "Indian tribe" refers to federally recognized Indian tribes. The federal government has a unique political and legal relationship with Indian tribes not shared by non-federally recognized tribes. The federal government has a trust responsibility to Indian tribes that it does not have with non-federally recognized tribes. And, the federal government works with Indian tribes on a nation-to-nation basis but does not do so with any other indigenous groups, including NHOs.

Therefore, in this guidance, the term "Indian tribe" means those tribes that are federally-recognized. While the term "non-federally recognized tribe" is not defined in federal laws, it can include state-recognized tribes and tribal entities without state or federal recognition. State-level Indian Commissions and organizations also often include non-federally recognized tribes in their membership. Many Indian tribes have strong and long-standing relationships—as well as kinship ties—with non-federally recognized tribes and recognize them as tribes.

Involving Non-Federally Recognized Tribes in the Section 106 Process

In carrying out Section 106, a federal agency may invite state-recognized tribes or tribes with neither federal nor state recognition to participate in the review process as "additional consulting parties" based on a "demonstrated interest" in an undertaking's effects on historic properties.[5]

The decision to invite a non-federally recognized tribe to participate in the Section 106 process is a discretionary decision by the federal agency.[6] While the NHPA provides Indian tribes and NHOs the right to be consulted in Section 106, the inclusion of non-recognized tribes is completely discretionary and is not done on a government-to-government basis. Only Indian tribes have a government-to-government relationship with the federal government. Inviting non-federally recognized tribes to participate in the process does not in any way diminish or alter the unique legal and political relationship between federal agencies and Indian tribes.

While non-federally recognized tribes do not have a statutory right to be included in the Section 106 process, an agency may invite them to participate, as noted above, if they have a demonstrated interest in a project. They may also have important information about historic properties in the project area.[7] For example, some non-federally recognized tribes still have ancestral ties to an area or still occupy their aboriginal territory. Members of non-federally recognized tribes may be direct descendants of indigenous peoples who once occupied an area affected by an undertaking, or can provide additional information regarding historic properties that should be considered in the review process.

While federal agencies should consider whether a non-federally recognized tribe has a demonstrated interest in a historic property, their inclusion may raise objections from some Indian tribes. Other Indian tribes, however, routinely support the inclusion of non-recognized tribes in the consultation process, recognizing their interests. In some areas, members of Indian tribes and non-federally recognized tribes are related through both kinship and socio-political connections. One potential difficulty is when groups or individuals claim to represent Indian tribes or present themselves as Indian (federally or non-federally recognized) when they cannot substantiate these claims. When questions arise concerning such situations,

[5] 36 C.F.R. §§ 800.2(c)(5) and 800.3(f)(3)
[6] For purposes of this guide's discussion of consulting party status, the assumption is made that the non-federally recognized tribe is not the applicant for the relevant federal assistance, permit, license, or approval in the undertaking. Such applicants are entitled to be consulting parties in the Section 106 process regardless of whether they are a non-federally recognized tribe or any other type of entity. 36 C.F.R. § 800.3(c)(4).
[7] 36 C.F.R. § 800.2(c)(5)

Indian tribes, the state Indian commission (or similar agency), the SHPO, or other state office designated to handle Section 106 review, could all be of assistance with these questions.

Non-federally recognized tribes can also facilitate their involvement in the Section 106 process a number of ways. In addition to ensuring that all federal agencies know the tribe's areas of interest (areas where the tribe has had a presence over time), SHPOs and Indian tribes could keep a non-federally recognized tribe informed of projects being undertaken by federal agencies. Non-federally recognized tribes can also delegate a representative (similar to a THPO) as a primary point of contact for historic preservation, who can develop relationships and maintain contact with federal agencies.

The ultimate decision about whether to invite non-federally recognized tribes to participate in the Section 106 process rests with the federal agency. The decision should be given careful consideration and take into account relevant information provided by Indian tribes (or the THPO or designated tribal official) or the SHPO. If the federal agency decides it is inappropriate to invite non-federally recognized tribes to consult as "additional consulting parties," those tribes can still provide views and information to the federal agency as members of the public.

Not granting consulting party status to parties that have a demonstrated interest in affected historic properties is legally allowable but may defeat the ultimate intent of Section 106. The process is intended to ensure federal agencies make informed decisions on undertakings that could affect historic properties and reasonably attempt to resolve adverse effects to them. Because non-federally recognized tribes may have information that assists the Section 106 process, consulting with them can enhance agencies' decision-making processes.

Rather than denying a party the opportunity to participate in consultation, there may be ways in which every party can be accommodated. For instance, separate consultation meetings can be held, with information and views shared amongst all consulting parties, as appropriate. Sometimes, Indian tribes are only willing to share sensitive information with the federal agency (as part of the government-to-government relationship) and not with other consulting parties, including other tribes (federally recognized or non-federally recognized). If confidentiality concerns are anticipated, the federal agency should have a plan in place for handling these concerns in accordance with applicable law. Such a plan would also provide parties with clear expectations about how these issues will be handled. Confidentiality of sensitive information is a very important issue in Section 106 tribal consultation, and for all stakeholders in the process.

Why Some Tribes Are Not Federally Recognized

In at least 14 states, tribal entities are recognized at the state level as having self-government authority outside of federal processes: Alabama, Connecticut, Delaware, Georgia, Louisiana, Maryland, Massachusetts, Montana, New Jersey, New York, North Carolina, Vermont, Virginia, and Washington.[8] As a result of historical circumstances, some states have complicated situations. It is important to note that, unlike the limited number of pathways to federal recognition, states have their own unique processes for recognizing tribes. The U.S. Government Accountability Office has identified approximately 400 non-federally recognized tribal entities in the U.S.[9] Some non-federally recognized tribes lost their recognition as a result of federal government actions in the 1950s and 1960s that terminated government-to-government relationships with Indian tribes, making them now ineligible to apply to the Bureau of Indian Affairs (BIA) for recognition.

[8] http://www.acf.hhs.gov/programs/ana/resource/american-indians-and-alaska-natives-what-are-state-recognized-tribes
9 http://www.gao.gov/assets/600/590102.pdf

State-recognized tribes have existed since the end of the Colonial period, beginning in New England and the East Coast, and have had important roles in the development of policy over the centuries. Virginia, for example, had 11 state-recognized tribes until recently when seven gained federal recognition. One of the earliest reservations in the country was established in 1666 in Connecticut for the Pequot Indians, a portion of which is occupied today by the state-recognized Eastern Pequot Tribal Nation.[10] In California, while the state does not formally recognize tribes, there are at least 45 tribal communities that were either terminated by the U.S. government as part of the federal termination policy of the 1950s-60s or never formally recognized.[11]

If not already recognized by the federal government through treaties or Presidential executive orders, tribes can become federally recognized in one of three ways: judicially (a federal court decision), congressionally (Congress passes law) or administratively (a determination by the Assistant Secretary of Indian Affairs) through a process outlined in 25 C.F.R. part 83 and evaluated by the BIA.[12] Since the establishment of these regulations in 1978, many tribes have applied for acknowledgement, submitting documentation to demonstrate they meet the criteria outlined in the process. For tribes impacted by colonial settlement, Christianization, and other acculturation factors for 400 years, providing uninterrupted documentation of their continued presence to satisfy the regulations can be a difficult or impossible task. While a number of tribes remain unrecognized because they could not provide sufficient evidence to demonstrate continued existence (without gaps) as a tribal entity throughout time, a number do retain status as state-recognized entities.

Examples of Non-Federally Recognized Tribes

EXAMPLE 1:
Some tribes have consciously chosen not to pursue federal recognition for varying reasons. For example, the Wanapum Tribe of Washington has chosen this path, remaining independent from the federal government. However, the Tribe, along with Indian tribes in the region, is regularly invited to participate in Section 106 reviews and other processes such as the Native American Graves Protection and Repatriation Act (NAGPRA). The Tribe also maintains a heritage center.[13]

EXAMPLE 2:
Other tribes have spent decades unsuccessfully working toward federal acknowledgement through the administrative process (25 C.F.R. part 83). The Nipmuc Nation of Massachusetts began federal acknowledgment efforts in 1980; two years after the regulations were established. The tribe had to demonstrate a continued presence (without gaps) through written documentation dating back to the early 1600s to satisfy requirements in the regulations. The tribe is state recognized with a tax-free reservation and tuition-free education at state institutions for tribal members, but cannot take advantage of most federally-funded programs reserved for Indian tribes with federal acknowledgment due to an unsuccessful 30-plus year attempt to gain recognition.

EXAMPLE 3:
The Brothertown Indian Nation in Wisconsin is also not recognized by the federal government. The tribe has roots in New England and New York, with historical connections to the Mohegan, Montauk, Narragansett, Niantic, Pequot and Tunxis peoples, in addition to the Oneida and Stockbridge-Munsee. After several moves westward from New England between the late 1700s and late 1820s, the tribe settled on the eastern shore of Lake Winnebago in Wisconsin. The tribe did not want to relocate again when

10 http://www.mashantucket.com/tribalhistory.aspx; http://www.easternpequottribalnation.com/history.html
11 http://www.courts.ca.gov/3066.htm
12 For more information on tribal acknowledgment, see https://www.bia.gov/as-ia/ofa
13 http://wanapum.org

Congress enacted the Indian Removal Act in 1830 and sought to move it to the Kansas Territory. Congress eventually granted the tribe's request for allotment of reservation land and U.S. citizenship, passing an Act on March 3, 1839, and preventing tribal members from being removed from their Wisconsin land base.[14]

Like the Nipmuc Nation, the Brothertown Indian Nation filed a letter of intent to seek recognition under the acknowledgment regulations in 1980, after the government stopped extending benefits to the tribe and reclassified it as no longer federally acknowledged. In 1990, the Department of the Interior informed the tribe that the 1839 Congressional Act granting citizenship and allotment of the reservation was *not* a form of termination, but then in 2012 reversed this decision and stated that the 1839 Act *was* an act of termination, which therefore excluded the tribe from being eligible for modern-day recognition through the regulations.[15] From the perspective of the Brothertown Indian Nation, federal acknowledgement will be a "re-recognition" of what it once had as a reservation tribe, firmly established in Wisconsin for generations. The tribe asserts that it did not in any way see accepting citizenship and allotment of reservation land in the 1830s as forfeiting acknowledgement as Indian or as a tribe.[16]

EXAMPLE 4:
Attempts to achieve federal recognition by the Lumbee Tribe of North Carolina began more than 125 years ago, with efforts to obtain federal funding for an Indian school in Robeson County. The tribe has had a continuous presence in and around this area since the early 18th century. In 1885, the tribe was recognized by the state and has sought federal recognition since 1888. In 1956, Congress passed the Lumbee Act, also recognizing the tribe as Indian but withholding full benefits received by other recognized tribes. In 1987, the tribe petitioned the U.S. Department of the Interior for acknowledgment, which was denied due to language in the 1956 Lumbee Act. The tribe continues efforts to get legislation passed granting federal recognition but in the meantime retains status as a state-recognized tribe in North Carolina.[17]

These are just a few examples that demonstrate the various circumstances under which non-federally recognized tribal entities can exist in the 21st century, either from having lost federal acknowledgement through previous laws or actions; failing to satisfy the federal acknowledgement criteria;[18] or, choosing not to pursue acknowledgment by the federal government as an assertion of genuine sovereignty.

Conclusion

While a statutory requirement exists to consult with Indian tribes and NHOs in the Section 106 review process when historic properties of religious and cultural significance to them may be affected, federal agencies should remember that non-federally recognized tribes can and often should also be involved. Their contributions to the process can include a deep knowledge of the history of and resources in their homelands including historic properties that should be considered in the Section 106 process. For

14 http://www.brothertownindians.org/heritage/tribal-alliance/; Kathleen Brown-Perez (personal communication)
15 Criterion (g) of the mandatory criterion for federal acknowledgment at 25 CFR § 83.7 states that: "Neither the petitioner nor its members are the subject of congressional legislation that has expressly terminated or forbidden the Federal relationship." https://www.gpo.gov/fdsys/pkg/CFR-2011-title25-vol1/pdf/CFR-2011-title25-vol1-sec83-7.pdf
16 http://www.brothertownindians.org/government/recognition-restoration/; Kathleen Brown-Perez (personal communication)
17 http://www.lumbeetribe.com/#!history--culture/c20mm
18 Recently revised so tribes do not have to document continuity back to colonial times but only to 1900; http://www.ecfr.gov/cgi-bin/text-idx?SID=64048aabd80c642ca2ec39623166d704&mc=true&node=pt25.1.83&rgn=div5

example, the Wanapum of Washington and Nipmuc of Massachusetts have lived in their homelands for thousands of years, and the Lumbee of North Carolina has occupied their present-day homelands for generations.

Additionally, many non-recognized tribes are currently going through the acknowledgement process, and may become recognized in the future. The Pamunkey Tribe of Virginia had been one of 11 state-recognized tribes until it received federal recognition through the administrative process. On January 29, 2018, the President signed into law the Thomasina E. Jordan Indian Tribes of Virginia Federal Recognition Act which extends federal recognition to six of the tribes in Virginia. An invitation to these tribes to participate in the Section 106 process will now be required when an undertaking may affect historic properties of religious and cultural significance to them. Including non-federally recognized tribes that sometimes become federally recognized, can only strengthen the Section 106 process. Some state laws and regulations include special provisions for non-recognized tribes that need to be factored into planning for projects that require compliance with state laws.

Members of non-recognized tribes are also American citizens, entitled to the same considerations all citizens have in the Section 106 process. The ACHP's regulations provide that participants in the process may include individuals and organizations with a demonstrated interest in federal undertakings. Additionally, the views of the public must be considered. Non-recognized tribes may fall into either of these categories.

The U.N. Declaration encourages recognition of the special status and rights of indigenous peoples, and the ACHP acknowledges intersections of the U.N. Declaration and Section 106. Federal agencies may invite state-recognized tribes or tribes with neither federal nor state recognition to participate in consultation as "additional consulting parties" based on a demonstrated interest in an undertaking's effects on historic properties. Many non-federally recognized tribes still have ancestral ties to an area or still occupy their aboriginal territory, or can contribute to identification and documentation of historic properties in other ways through their knowledge and expertise.

The historical reasons for which many tribes are not federally recognized should also be considered in making decisions regarding Section 106 consultation with these tribes. The four examples discussed above illustrate the range of circumstances that can result in tribal entities not being federally recognized regardless of their long histories. Lack of federal recognition, however, does not invalidate the valuable information or legitimate interests of state recognized tribes that should be considered by federal agencies in the Section 106 process.

In encouraging federal agencies to consider including non-federally recognized tribes in the Section 106 process, the ACHP is not suggesting that federal agencies ignore the unique legal and political status of or federal obligations to Indian tribes. The involvement of non-recognized tribes in the Section 106 process could not be on the same basis as Indian tribes. The federal government and Indian tribes have a government-to-government relationship; federal agencies have trust responsibilities to Indian tribes; and, federal agencies are required to uphold the treaty rights of Indian tribes. There are also numerous federal statutes that establish additional legal obligations of the federal government to Indian tribes.

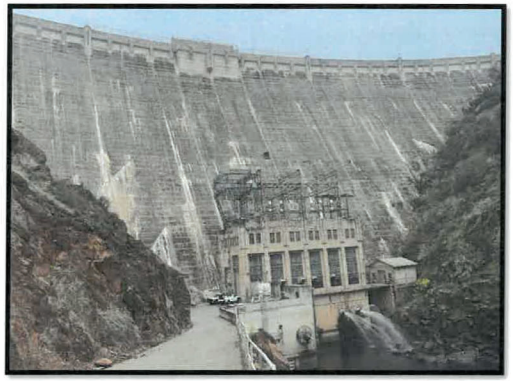
Information about non-federally recognized tribes can be found through a number of sources, including state historic preservation and archaeology offices, state Indian Commission Offices, and the National Conference of State Legislators at http://www.ncsl.org/research/state-tribal-institute/list-of-federal-and-state-recognized-tribes.aspx#State. More information about Section 106 can be found at www.achp.gov.

February 2018

EBMUD

ARCHAEOLOGY RESOURCES STUDY PLAN (PRELIMINARY DRAFT)

Lower Mokelumne River Hydroelectric Project
FERC Project No. 2916



August 2025

East Bay Municipal Utility District
375 11th Street
Oakland, California 94607

Table of Contents

Terms and Abbreviations

A	
APE	Area of Potential Effects
ARSR	Archaeology Resources Study Report
C	
CFR	Code of Federal Regulations
CRMP	Cultural Resources Management Plan
E	
EBMUD	East Bay Municipal Utility District
F	
FERC	Federal Energy Regulatory Commission
G	
GIS	Geographic Information System
GPS	Global Positioning System
H	
HPMP	Historic Properties Management Plan
N	
National Register	National Register of Historic Places
NHPA	National Historic Preservation Act of 1966
NPS	National Park Service
O	
OHP	Office of Historic Preservation
P	
Project	Lower Mokelumne River Hydroelectric Project (FERC Project No. 2916)
T	
TCP	Traditional Cultural Property
TCR	Tribal Cultural Resource

1.0 Introduction

The East Bay Municipal Utility District (EBMUD) has identified the need to conduct cultural resource studies, including inventories of archaeological sites, built environment resources, Traditional Cultural Properties (TCPs), and Tribal Cultural Resources (TCRs). The CUL-1 Cultural Resources Study will consider archaeological sites and built environment resources. (American Indian TCPs and TCRs will be considered within the Tribal Ethnography Resources Study Plan.)

The relicensing of the Lower Mokelumne River Hydroelectric Project (Federal Energy Regulatory Commission [FERC] Project No. 2916) (Project) is a federal undertaking that requires compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA). Therefore, the Project's relicensing requires consideration of the effects on historic properties (i.e., sites, buildings, structures, objects, or districts that are listed or eligible for listing on the National Register of Historic Places [National Register]) within the Project boundary or where the Project may have effects outside of the Project boundary.

Accordingly, as part of the relicensing effort, studies will be required to identify known and potential historic properties, to evaluate their eligibility for listing on the National Register, and to develop measures for avoiding or resolving adverse Project effects.

This Archaeology Resources Study Plan details the objectives, geographic extent, and methods for proposed cultural resources inventories to be completed as part of the relicensing effort. These studies will in turn inform the future development of a Historic Properties Management Plan (HPMP), which will consider the effects of continued Project operations and maintenance on the historic properties of the Project area. Effects may be direct (e.g., result of ground-disturbing activities), indirect (e.g., public access to Project areas), or cumulative (e.g., caused by a Project activity or public access in combination with other past, present, and reasonably foreseeable future projects).

Among the effects to be considered in the Section 106 compliance process are those on cultural and religious significance to Native American Tribes. These effects and their potential resolutions are identified by formal consultation and are described further in Section 5.3 of this Study Plan below.

2.0 Study Goals and Objectives

This cultural resources study has the following goals: 1) to meet FERC compliance requirements under Section 106 of the NHPA, as amended, by determining if Project-related activities and public access will have an adverse effect on historic properties; and 2) to identify all archaeological sites and built environment resources within the Area of Potential Effects (APE), determine historic properties and cultural resources, and develop the HPMP based on those results.

3.0 Geographic Scope

Under 36 Code of Federal Regulations (CFR) 800.16(d), the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." For cultural resources, the Project boundary equates to the APE.

The archaeological study area also encompasses a 0.25-mile buffer around the Project boundary/APE to provide background on a wider range of archaeological resources. This range would include potentially significant resources that may be located just outside the Project boundary that would be affected by Project operation and maintenance.

4.0 Existing Information and Need for Additional Information

The primary information sources for this summary are the Camanche and Pardee Reservoirs Cultural Resources Management Plan (CRMP; DeBaker and Siskin 2019) and the recent historic property survey by Demarais et al. (2023). As part of the background research for the 2019 CRMP, cultural resources records searches were conducted at the Northern California Information Center of the California Historical Resources Information System (for portions of the study area within Amador County) and the Central California Information Center (for Calaveras and San Joaquin counties). An updated records search was requested in 2021 as part of the 2023 built-environment survey, though it was not discussed in the main text. This review presents the updated records search data, with some modifications to remove redundant entries.

4.1. Previous Studies

Formal archaeological study of the area began in the 1950s through early 1960s, with reconnaissance surveys and excavations conducted in advance of the construction of Camanche Reservoir (Payen 1962; Johnson 1967). These studies predated the advent of the NHPA, and there was no expectation of systematic inventory nor consultation over effects on cultural resources. These early studies provide the bulk of information about the precontact archaeological resources of the area. Many of the archaeological sites then recorded have since been inundated by the filling of Camanche Reservoir.

Subsequent cultural resources studies began in the early 1980s and continue to the present day. These studies have been driven by compliance with cultural resources law, many on behalf of EBMUD, but also the Bureau of Land Management, Pacific Gas and Electric Company (PG&E), and other agencies. Some 40 archaeological studies have taken place within the study area. Most of these are small surveys, which in aggregate cover only a small fraction of the study area.

Surveys of built-environment resources include the Penn Mine project (Nilsson et al. 1999) and, in advance of the current relicensing effort, a built-environment survey of the FERC boundary was recently conducted (Demarais et al. 2023), as discussed below, providing an essentially complete inventory of these resources.

4.2. Previously Recorded Resources

Cultural resources of the Project area include built-environment resources (historic properties), archaeological sites, and (potentially) Tribal cultural resources.

4.2.1. Built-Environment Resources

The 2023 built-environment inventory formally recorded 54 built-environment resources within the FERC boundary and identified 43 more potential properties that were not formally recorded, mostly because their ages could not be determined. Most of the recorded resources are associated with EBMUD's development of the Pardee and Camanche reservoirs and with recreational development. (Demarais et al. 2023)

There are two National Register-listed historic properties in the APE, including the Middle Bar Bridge at the upstream end of Pardee Reservoir and the Pardee Dam and Reservoir System District, the latter including the main Pardee Dam and Powerhouse, the Jackson Creek Spillway, Pardee South Spillway, and the Pardee Outlet Tower as contributing elements. Demarais et al. (2023) also recommended the portion of the Mokelumne Aqueduct within the FERC boundary as eligible. The Penn Mine Historic District has been determined National Register-eligible, but Demarais et al. recommended re-evaluation due to the time elapsed since that determination.

Demarais et al. (2023) recommended 46 other recorded resources not eligible for the National Register, or not suitable for evaluation because they were not of sufficient age. Some resources, such as the system of dikes on Camanche Reservoir, were recommended individually ineligible, but potentially eligible as contributing elements of a district not yet formally recorded.

4.2.2. Archaeological Sites

There are 175 recorded archaeological sites within the study area, of which 122 are within the FERC boundary. The 175 sites include 114 precontact sites, 25 dating to the historic period, 8 with both precontact and historic-period components, and 28 for which no information was available because the studies were in progress at the time of the records searches.

4.2.3. Religious and Cultural Significance to Tribes

In addition to this study, a separate Tribal Ethnography Resources specific study will take place. To date, no TCPs or other places of religious or cultural significance to Indian Tribes have yet been formally recorded in the study area. These must be identified via Tribal consultation which will take place during the Tribal Ethnography Resources study. NHPA regulations require that consultation provides the Tribe(s) with a reasonable

opportunity to identify their concerns about historic properties; advise on the identification and evaluation of historic properties, including those of traditional religious and cultural importance; articulate their views on the undertaking's effects on such properties; and participate in the resolution of adverse effects.

5.0 Study Methodology

Based on the existing data described above, a reasonable and good-faith effort is required to identify historic properties that may be affected by the Project. As described in 36 CFR § 800.4(b)(1), this may be accomplished through sample field investigations and/or field surveys that are implemented in accordance with the Secretary of the Interior's Standards and Guidelines for Identification (National Park Service [NPS] 1983). FERC is required to consider any other applicable professional standards and Tribal, state, or local laws or procedures to complete the identification of historic properties.

5.1. Archaeological Inventory

To assist FERC in meeting its compliance obligations, and to develop appropriate management measures for historic properties within the APE, EBMUD will complete an archaeological inventory.

The general standard for archaeological inventories in the region is pedestrian surface survey, with systematic, complete coverage via controlled transects. While surface survey alone may fail to identify deeply buried sites, most subsurface deposits do have some surface indications, such as cultural materials in rodent burrow backdirt.

5.1.1. Records Search Update and Additional Background Research

As part of the inventory, an up-to-date accounting of all previously recorded archaeological sites within the APE will be required as all such sites must be accounted for during the field survey. The archaeological records search for the APE was last updated in 2021. This search should be updated to include more recent work as part of this study.

Additional background research should also be conducted as part of a more complete records search effort, primarily to provide context for historic-period sites discovered during survey. This would include searches of land patents; Government Land Office plats; historical maps and aerial photos; census records; newspaper accounts; scholarly research; and any relevant maps or other materials at EBMUD offices.

5.1.2. Field Survey

The field survey will be supervised by one or more qualified professional archaeologists (i.e., individuals who meet the Secretary of the Interior's Professional Qualifications Standards for Archaeology at 36 CFR Part 61 [NPS 2021]) who will participate in all field work. Field surveys ~~may also~~ include Tribal ~~observers~~, at the Tribe's option.

MUST Cultural Representative

During the survey, archaeologists will walk parallel transects spaced at no more than 20 meters (approximately 22 yards), as vegetation and terrain allow within the Project's APE. If conditions allow, lands typically inundated by Project reservoirs will be examined if they become accessible during the survey season. Areas within the APE that cannot be accessed in a safe manner (e.g., locations with dense vegetation or unsafe slopes) will not be included within the survey or recording of archaeological resources; these areas will be identified in the resulting survey report, and an explanation for variations in survey coverage will be provided.

Locations of previously recorded archaeological sites will be verified, and their site records will be updated when the existing documentation does not meet current standards for recording or if the condition and/or integrity of the property has changed since its previous recording. The archaeologists will determine if sketch maps for previously documented sites require revision to describe current site conditions more accurately.

Newly discovered archaeological resources, including isolated finds, will be documented following the documentation procedures outlined in *Instructions for Recording Historical Resources* (Office of Historic Preservation [OHP] 1995), which utilizes California Department of Parks and Recreation DPR523 forms. Sketch maps will be drawn to scale. All site constituents, including artifacts and features, will be described, photographed, and mapped.

Field personnel will use Global Positioning System (GPS) receivers to document the location of cultural resources, including site boundaries, artifacts (including isolates), and features. These data will be compiled in a Project-wide geographic information system (GIS) and provided to EBMUD at the conclusion of the survey to assist with future management of these resources.

Detailed protocols for field survey, including Tribal involvement, and procedures to follow in the event of discovery of human remains, are laid out in the 2019 CRMP.

5.1.3. National Register Evaluation

National Register evaluations will be completed where applicable and where sufficient information is available. However, archaeological sites often cannot be evaluated at the survey phase, unless they can be found to contain National Register-eligible qualities based on surface features alone (e.g., pictographs) or ineligible due to a clear lack of physical integrity (e.g., redeposited materials). Some sites will therefore remain unevaluated and treated as eligible for the National Register until further formal evaluations can take place. Detailed, site-specific recommendations, as part of relicensing, for formal evaluations will be developed in the HPMP.

Archaeological site locations are considered highly sensitive due to the potential for intentional or accidental damage, and looting should these locations become known to the general public. All site records and figures depicting site locations will be contained in confidential appendices in the inventory report and must be treated as confidential throughout the relicensing process.

5.2. Built-Environment Inventory

Inasmuch as a detailed built-environment survey of the APE has recently been completed (Demarais et al. 2023), EBMUD has already met its mandate to make a reasonable and good-faith effort to identify these resources. The 2023 survey made a number of recommendations that EBMUD will address via a supplementary built-environment study.

5.3. Coordination with Other Studies

To the extent feasible, archaeological and built-environment resources field studies will be coordinated with each other and with other Project-related studies, in particular the Tribal resources study, and information shared as appropriate. Native American TCPs, while a type of historic property subject to Section 106 of the NHPA, will be documented via consultation, as described in the Tribal Resources study. (Any non-Native TCPs will be documented as part of the built-environment and/or archaeological inventories.)

Cultural field studies should be conducted in a manner that does not affect other sensitive natural resources. Project sponsors and/or their contractors should not violate other federal or state laws or regulations protecting natural resources, including but not limited to the Endangered Species Act and Clean Water Act. Project sponsors should consider that Tribes may use natural resources for subsistence or specific ceremonial uses and should avoid affecting those uses or events while conducting studies.

6.0 Reporting and Historic Properties Management Plan

The results of the study will be reported in Exhibit E of the License Application, which will include a summary of the information and findings of the technical studies. Figures and other pertinent data supporting the summary in Exhibit E will be appended to the License Application. The archaeological records and other sensitive information will be included in a confidential appendix withheld from public disclosure, in accordance with Section 304 (16 United States Code 4702-3) of the NHPA.

It is anticipated that FERC will enter into a programmatic agreement with the Advisory Council on Historic Preservation, OHP, and any other agencies or entities FERC elects to include. One of the programmatic agreement stipulations will be the completion and implementation of an HPMP to be included with the License Application.

The HPMP will consider direct and indirect effects of continued Project operation and maintenance on National Register-listed or eligible archaeological and built-environment resources and will require avoidance and protection of specified resources, whenever possible. Processes and procedures will be developed for general and site-specific treatment measures, including minimization and mitigation measures to be taken should license implementation create unavoidable adverse effects to historic properties. The HPMP will include an Evaluation Plan and schedule for evaluating unevaluated resources.

7.0 Schedule and Deliverables

This is proposed as a single year study; it includes a draft and final Archaeology Resources Study Report (ARSR). The ARSR will include text, summary tables, figures and maps, as appropriate. A Draft ARSR will be provided for review and comment following study completion. Comments will be incorporated as appropriate and a Final ARSR will be included with the DLA. A draft study schedule based on the Study Plan Determination (SPD) issuance of August 26, 2026, is outlined below in Table 7-1.

Table 7-1. Potential Archaeology Study Schedule

DATE	ACTIVITY
08/26/2026	FERC Study Plan Determination (SPD)
09/01/2026	Conduct First Year Studies
08/26/2027	File Initial Study Report (ISR)
08/25/2028	File Updated Study Report (USR)
10/25/2028	File Draft License Application (DLA) (Final Technical Study Report)
03/30/2029	File Final License Application

8.0 Level of Effort and Cost

The methods and approach described in this study were selected as representing an appropriate balance between cost effectiveness and level of effort while meeting the study objectives. The study schedule and materials have been developed to streamline time and effort by building on existing information, filling data gaps, and incorporating stakeholder feedback.

9.0 References

DeBaker, C., and B. Siskin. 2019. Camanche and Pardee Reservoirs Cultural Resources Management Plan. Prepared by Far Western Anthropological Research Group, Inc, Davis, California.

Demarais, L., C. van Onna, H. Goldman, R. Krause, C. Longiaru, J. Eddy, N. White, and C. Moffett. 2023. Master Survey Report, East Bay Municipal Utility District, Federal Energy Regulatory Commission Project #2916, Amador, Calaveras, and San Joaquin Counties, California. PaleoWest, LLC, Walnut Creek, California.

Johnson, J.J. 1967. The Archaeology of the Comanche Reservoir Locality, California. Sacramento Anthropological Society Papers 6. Sacramento Anthropological Society, Sacramento, California.

Nilsson, E., et al. 1999. Comprehensive Report: Archaeological Inventory, Recordation, and Evaluation Within the Penn Mine Long-Term Solution Project Area, Calaveras County, California. Dames & Moore, Inc., Sacramento, California.

National Park Service (NPS). 1983.

NPS. 2021.

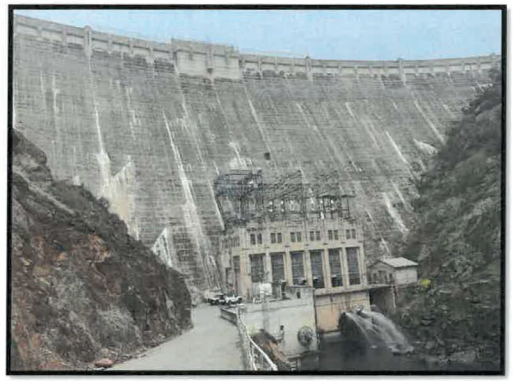
Office of Historic Preservation (OHP). 1995

Payen, L. 1962. Prehistoric Rock Art in the Northern Sierra Nevada, California. Sacramento State College.

EBMUD

TRIBAL ETHNOGRAPHY RESOURCES STUDY PLAN (PRELIMINARY DRAFT)

Lower Mokelumne River Hydroelectric Project
FERC Project No. 2916



August 2025

EBMUD

East Bay Municipal Utility District
375 11th Street
Oakland, California 94607

Table of Contents

Terms and Abbreviations

A	
ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effects
C	
CFR	Code of Federal Regulations
CRMP	Cultural Resources Management Plan
SHPO	California State Office of Historic Preservation
D	
DPR	Department of Parks and Recreation
E	
EBMUD	East Bay Municipal Utility District
F	
FERC	Federal Energy Regulatory Commission
H	
HPMP	Historic Properties Management Plan
N	
NAHC	Native American Heritage Commission
National Register	National Register of Historic Places
NHPA	National Historic Preservation Act of 1966
NRB	National Register Bulletin
P	
PA	programmatic agreement
Project	Lower Mokelumne River Hydroelectric Project (FERC Project No. 2916)
T	
TCP	Traditional Cultural Property
TRS	Tribal Resource Ethnography and Ethnohistoric Research Study or Tribal Ethnography Resources Study

1.0 Introduction

The East Bay Municipal Utility District (EBMUD) has identified the need to conduct a Tribal Resource Ethnographic and Ethnohistoric Research Study (Tribal Ethnography Resources Study or TRS) for the relicensing of the Lower Mokelumne River Hydroelectric Project (Federal Energy Regulatory Commission [FERC] Project No. 2916) (Project). There has been minimal investigation to date of the following: 1) the American Indian ethnography of the Project area, 2) the potential for American Indian Traditional Cultural Properties (TCPs), or 3) the potential for other American Indian resources, some of which may be eligible for listing in the National Register of Historic Places (National Register). This Tribal Ethnography Resources Study is intended to address the need to conduct this research. Potential resource areas include TCPs; Tribal economic ventures; resources of traditional, cultural, or religious importance; and environmental considerations of importance to the American Indian community.

2.0 Study Goals and Objectives

The principal goal of this Study Plan is to assist FERC, as its non-federal representative, in meeting its compliance requirements under Section 106 of the National Historic Preservation Act of 1966 (NHPA, as amended, by determining if licensing of the Project will have an adverse effect upon historic properties, in this case Tribal resources. Following 18 Code of Federal Regulations (CFR) §5.6 (d)(3)(xii) and §5.9(b)(1), the goals and objectives of the Tribal Ethnography Resources Study Plan are to identify Tribal resources that may be affected by operations and maintenance of the Project. Tribal resources will be identified through archival research, oral interviews, and field visits and to ensure that such places are not impacted by ongoing operation and maintenance. Initial archival research has indicated that an ethnographic overview of the Project area has not yet been conducted.

3.0 Geographic Scope

Under 36 CFR 800.16(d), the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." For Tribal resources, the Project boundary is preliminarily assumed to equate to the APE. The overall proposed Tribal Ethnography Resources Study area, however, encompasses a larger area comprising a 0.25-mile buffer around the APE.

4.0 Existing Information and Need for Additional Information

The primary source of information about Tribal resources and interests, which will be gathered via future consultation, is the interested Tribes themselves. In the interim, this review uses existing ethnographic literature (Merriam 1907; Kroeber 1925; Levy 1978) as summarized in the 2019 Cultural Resources Management Plan (CRMP; DeBaker and Siskin 2019).

The state Native American Heritage Commission (NAHC) maintains a list of potentially interested Tribes that project proponents can request at the outset of consultation. EBMUD obtained a list for the current project (see Interested Tribes in Section 4.2 below).

4.1. Ethnography

The Camanche and Pardee reservoirs region is located along an indistinct territorial boundary of the Plains Miwok, the Northern Sierra Miwok, and the Northern Valley Yokuts (Merriam 1907). The Sierra Miwok encompassed the western slopes of the Sierra Nevada between the Fresno River to the south and the Cosumnes River to the north and extended into the lower foothills along the eastern edge of the Central Valley. Kroeber (1925) indicated that the sites fall within the territory of the Northern Sierra Miwok and depicted the ethnographically recorded villages of *Upüsüni*, located approximately 4.5 miles north along Jackson Creek, and *Sakayak-ümni*, located approximately 7 miles west along the Mokelumne River downstream of the Camanche Reservoir. A discussion of the traditional lifeways of these groups is presented in Section 4-10, Cultural Resources, in the Pre-Application Document. Today, these groups are represented politically by a variety of organized Tribes, both federally and state recognized.

4.2. Interested Tribes

EBMUD has identified the following Tribes who may have an interest in the Project area, including both federally-recognized and other NAHC-listed Tribes:

- Buena Vista Rancheria of Me-Wuk Indians
- Calaveras Band of Mi-Wuk Indians ? not a tribe
- California Valley Miwok Tribe
- Chicken Ranch Rancheria of Me-Wuk Indians
- Colfax-Todds Valley Consolidated Tribe of the Colfax Rancheria
- Ione Band of Miwok Indians

- Jackson Rancheria Band of Miwuk Indians
- Nashville Enterprise Miwok-Maidu-Nishinam Tribe
- North Valley Yokuts Tribe
- Pakan'yani Maidu of Strawberry Valley Rancheria
- Shingle Springs Band of Miwok Indians
- Susanville Indian Rancheria
- Tule River Indian Tribe
- United Auburn Indian Community of the Auburn Rancheria
- Washoe Tribe of Nevada and California
- Wilton Rancheria

FEED CRMP

4.3. Current Cultural Resource Management

Working in consultation with the Calaveras Band of Mi-Wuk Indians, EBMUD prepared a CRMP for Camanche and Pardee reservoirs in 2019. The CRMP outlines the regulatory requirements related to protecting and preserving archaeological and Native American resources. It identifies the range of anticipated cultural and Tribal resources that might be found in the vicinity of the two reservoirs and describes protocols and management measures for archaeological and Tribal cultural resources. The CRMP also outlined a decision-making process for determining if activities on the watershed require FERC approval and/or State Historic Preservation Office consultation, and it includes protocols, monitoring, and management guidelines in the event that cultural resources are identified. The CRMP contains confidential culturally privileged information and will be updated continuously in consultation with Tribes and will assist EBMUD in the development of a Historic Properties Management Plan (HPMP).

EBMUD hosted Early Engagement meetings in September and October of 2024 to help inform data gathering and identify interested parties and potential concerns, including a session for Tribes specifically that was held on October 2, 2024. EBMUD also hosted a FERC Relicensing Project "Open House" on October 29, 2024, at Pardee Center and invited community groups, resource agencies, Tribes, and other interested parties.

No TCPs or other Tribal resources are currently documented within the Study area. However, Tribes have a demonstrated interest in preserving the many precontact and ethnohistoric archaeological sites within the Project area.

5.0 Study Methodology

The Study investigation will make a good-faith effort for proper communication with Tribal leaders as laid out in FERC's *Policy Statement on Consultation with Indian Tribes in Commission Proceedings*, issued July 23, 2003 (Docket No. PL03-4-000; Order No. 635). There was also a FERC revision for conducting consultation with Indian Tribes issued on October 17, 2019 (Docket No. PL20-1-000; Order No. 863). The investigation will follow FERC Regulations at 18 CFR § 2.1c, which added a policy statement on consultation with Tribes in FERC proceedings.

All phases of the Study investigation will be conducted in accordance with the American Indian community consultation standards outlined by the implementing Regulations of Sections 101 and 106 of the NHPA and discussed in the 2012 Advisory Council on Historic Preservation (ACHP) publication *Consultation with Indian Tribes in the Section 106 Review Process: A Handbook.*

Potential TCP documentation, consultation, and any necessary fieldwork will be implemented in accordance with Section 106 of the NHPA, as amended, and shall take into consideration National Register Bulletin (NRB) No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural Properties* (Parker and King 1990, 1998).

Study documentation will be implemented in accordance with FERC Regulations and with Section 106 of the NHPA, as amended, if such resources are potential historic properties, and shall take into consideration NRB No. 38 (Parker and King 1998) among other NRBs.

National Register evaluations will be conducted in adherence with NRB No. 15, *How to Apply the National Register Criteria for Evaluation* (National Park Service 1997), and other NRBs as appropriate.

5.1. Archival Research

As needed during the implementation of the Study, archival research will be conducted at most of the repositories identified in the following text to obtain additional information specific to the prehistory, ethnography, and history of the Project area. The results of the archival research will 1) provide primary data to create a background American Indian ethnohistory of the proposed Study area; and 2) inform the Tribal resources historic context against which such resources may be evaluated for the National Register.

The EBMUD ethnographer will conduct background archival research of the Study area; the Tribes are also invited to do so. This will involve visits to many repositories, which may include the following:

- California State Archive, Sacramento
- California State Library, California History Room, Sacramento
- Huntington Library, San Marino
- Merriam (C. Hart) and Harrington (J.P.) notes
- National Archives and Records Administration, San Bruno
- University of California Bancroft Library, Berkeley
- University of California, C. Hart Merriam Collection, Davis

5.2. Meetings with Tribal Governments

During the relicensing, EBMUD will conduct meetings with Tribal governments or administrators and/or attendance at Tribal Council meetings is proposed to provide Project data to Tribal groups, elicit areas of interest, identify appropriate Tribal informants, and establish protocols for conveying information.

All the Tribal groups listed in Section 4.2 above will be contacted via telephone, letter, or email at a minimum to elicit their interest.

5.3. Interviews

Interviews are critical for identification, description of significance, and evaluation of potential effects to Tribal resources. Twenty interviews are proposed with Tribal experts to gain understanding about what is important to them and why. Individuals from each of the participating Tribes will be interviewed. The methods and nature of the interviews are expected to vary from person to person: some may be held in the field Project area, others held in private homes, and still others held via telephone or teleconference. Interview records are similarly likely to be variable regarding confidentiality protocols and the Tribal expert's willingness to share. Recording methods (e.g., handwritten notes, video, audio tape) will be determined by consulting with the informant.

5.4. Documentation and Evaluation

Three main categories of Tribal resources are anticipated, which include 1) Tribal places; 2) TCPs; and 3) Tribal government matters. Each category will be documented in a different manner. Tribal places may be potential historic properties, places associated with the ancestral past, places related to current gathering and/or hunting practices, or

other resource types. Those that qualify as potential historic properties will be documented on California Department of Parks and Recreation (DPR) 523 forms as appropriate and with Tribal permission, while others will be described in the Study. TCPs will be documented on DPR 523 forms, with Tribal community permission, and Tribal government resources may be documented in the Study or may be larger or different resource types (e.g., documentation of Indian allotments in the Study area). All resources will be documented and described according to Tribal values and submitted for review to Tribal representatives. National Register evaluation of Tribal resources suitable for DPR 523 documentation will use site-specific procedures to identify historic context of the resource, boundaries, jurisdiction or land ownership, Tribal significance, integrity from a Tribal perspective, and contributing characteristics. Evaluation of other resource types may occur at the managerial or agency level. After documentation is complete, it will be provided for review and comment to the California State Office of Historic Preservation (SHPO) and the Tribes.

5.5. Coordination with Other Studies

Other resource areas may have a connection to Tribal resources. This includes not only cultural resources, but also biological areas, water, trails, and recreation. As needed, the Tribal resource expert will work to assist other resource experts in identifying Tribal resources with connections to their technical study. Assistance to the cultural resource team is anticipated to aid field identification and documentation of historic American Indian resources, potential gathering areas, and other places that may have value to Indian Tribes.

6.0 Reporting

The results of the Study implementation will be reported in Exhibit E of the License Application, which will include a summary of the information and findings of the technical studies. Figures and other pertinent data supporting the summary in Exhibit E will be appended to the License Application. Tribal resource documentation and other sensitive information will be included in a confidential appendix withheld from public disclosure, in accordance with Section 304 (16 United States Code 4702-3) of the NHPA. The California Public Records Act similarly exempts site data from disclosure while Public Resources Code Section 21082.3(c) contains provisions specific to confidentiality related to any information submitted by an American Indian Tribe during the environmental review process, including, but not limited to, the location, description, and use of the Tribal cultural resources.

A draft detailed technical report will be prepared and provided for review to the SHPO and Tribes to include 1) regulatory, environmental, and cultural contextual statements; 2) discussion of research methods; 3) discussion of Tribal resources that are not also cultural resources; 4) description and evaluation of resources that are assessed as potential historic properties; and 5) conclusions, to include management considerations. Appendices are anticipated to include ethnobiological tables, chronological contact logs, specific historical reference materials, and more. The Study will identify all potential and actual Project effects from a Tribal perspective, provide Tribal suggestions for mitigation or modification of impacts, and provide a structural basis for FERC to conduct their National Environmental Policy Act analysis for this technical resource area.

7.0 Historic Properties Management Plan

It is anticipated that FERC will enter into a programmatic agreement (PA) with the ACHP, California Office of Historic Preservation, and any other agencies or entities FERC elects to include. One of the PA stipulations will be the completion and implementation of an HPMP to be included with the license or License Application.

The HPMP will consider direct and indirect effects of continued Project operation and maintenance on National Register-eligible and unevaluated Tribal resources, and it will require avoidance and protection of specified resources, whenever possible. Processes and procedures will be developed for general and resource-specific treatment measures, including mitigation measures to be taken should license implementation create unavoidable adverse effects to historic properties.

8.0 Schedule and Deliverables

This is proposed as a single year study; includes a draft and final TRS Report. The TRS Report will include text, summary tables, figures and maps, as appropriate. A Draft TRS Report will be provided for review and comment following study completion. Comments will be incorporated as appropriate and a Final TRS Report will be included with the DLA. A draft study schedule based on the Study Plan Determination (SPD) issuance of August 26, 2026, is outlined below in Table 8-1.

Table 8-1. Potential Tribal Ethnography Resources Study Schedule

Date	Activity
08/26/2026	FERC Study Plan Determination (SPD)
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08/26/2027	File Initial Study Report (ISR)
08/25/2028	File Updated Study Report (USR)
10/25/2028	File Draft License Application (DLA) (Final Technical Study Report)
03/30/2029	File Final License Application

9.0 Level of Effort and Cost

The methods and approach described in this study were selected as representing an appropriate balance between cost effectiveness and level of effort while meeting the study objectives. The study schedule and materials have been developed to streamline time and effort by building on existing information, filling data gaps, and incorporating stakeholder feedback.

10.0 References

DeBaker, C., and B. Siskin. 2019. Camanche and Pardee Reservoirs Cultural Resources Management Plan. Prepared by Far Western Anthropological Research Group, Inc, Davis, California.

Kroeber, A.A. 1925 Handbook of the Indians of California. Bulletins of the Bureau of American Ethnology, Volume 78. [Reprinted 1976, New York: Dover Publications, Inc.].

Levy, R. 1978. Eastern Miwok. In: Heizer, R.F. editor. Handbook of North American Indians, Volume 8: California. Smithsonian Institution, Washington, DC. pp. 398–413.

Merriam, C.H. 1907. Distribution and Classification of the Mewan Stock of California. American Anthropologist 9:338–357.

National Park Service. 1997.

Parker and King. 1990.

Parker and King. 1998.

Appendix A – Proof of Publication

Proof of Publication of (2015-5 C.C.P.)

EBMUD
PUBLIC NOTICE

NOTICE OF FILING OF NOTICE OF INTENT AND PRE-APPLICATION DOCUMENT WITH THE FEDERAL ENERGY REGULATORY COMMISSION FOR THE LOWER MOKELUMNE RIVER HYDROELECTRIC PROJECT (FERC PROJECT NO. P-2916)

Please take notice that East Bay Municipal District (EBMUD), of 375 11th Street, Oakland, California, 94607, is filing a Notice of Intent (NOI) and Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC) for a new license to continue to operate the major existing Lower Mokelumne River Hydroelectric Project (FERC No. P-2916) (Lower Mokelumne Project). EBMUD intends to file the NOI and PAD on or about October 15, 2025. The NOI and PAD provide details of EBMUD's proposal to seek a new license from FERC, using the Integrated Licensing Process. The existing license expires on March 31, 2031. The 33-megawatt Lower Mokelumne Project is located on the Lower Mokelumne River in Amador, Calaveras, and San Joaquin counties in California. Interested resource agencies, Tribes, local governments, and members of the public are invited to participate in the relicensing proceeding. Relicensing documents are available on EBMUD's relicensing website at www.ebmud.com/MokRelicense or on FERC's eLibrary system at https://elibrary.ferc.gov, under FERC Docket No. P-2916. A printed copy of the NOI and PAD can also be viewed at the following locations by scheduling an appointment with the EBMUD Relicensing Team at MokRelicense@ebmud.com: EBMUD Administration Building at 375 11th Street, Oakland, CA 94607 EBMUD Lodi Office at 1 Winemaster Way, Lodi, CA 95240 EBMUD Mokelumne Watershed Headquarters at 15083 Camanche Parkway South, Valley Springs, CA 95252 Please direct any questions to MokRelicense@ebmud.com.

Rischa S. Cole
Secretary of the District
October 9, 2025

This space is for the County Clerk's Filing Stamp

STATE OF CALIFORNIA,

County of Calaveras.

I am a citizen of the United States and a resident of the county aforesaid; I am over the age of eighteen years and not a party to or interested in the above matter. I am the principal clerk of the printer of the Calaveras Enterprise, a newspaper of general circulation, printed weekly, in the City of San Andreas, California, County of Calaveras, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court, of the County of Calaveras, State of California; that the notice of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates; to-wit:

October 9, 2025CE

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated the 9th of October, 2025CE

Hollie Garcia

Signature – Hollie Garcia

CALAVERAS ENTERPRISE

15 North Main Street
P.O. Box 1197, San Andreas, CA 95249-1197
(209) 754-3862 - FAX (209) 754-1805

PROOF OF PUBLICATION

PROOF OF PUBLICATION

(2015.5 C.C.C.P.)

STATE OF CALIFORNIA

County of San Joaquin

I am a citizen of the United States and a resident of the County aforesaid: I am over the age of eighteen years and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the Lodi News-Sentinel, a newspaper of general circulation, printed and published daily except Sundays, Mondays and holidays, in the City of Lodi, California, County of San Joaquin and which newspaper had been adjudicated a newspaper of general circulation by the Superior Court, Department 3, of the County of San Joaquin, State of California, under the date of May 26th, 1953. Case Number 65990; that the notice of which the annexed is a printed copy (set in type not smaller than non-pareil) has been published in each regular and entire issue of said newspaper and not in any supplement thereto on the following dates to-wit:

October 9th,

all in the year of 2025.

I certify (or declare) under the penalty of perjury that the foregoing is true and correct.

Dated at Lodi, California, United States of America this 9th day of October in 2025.

Signature

Proof of Publication
Public Notice: Notice of Intent (NOI) and Pre-Application Document (PAD)
See attached doc #LNS_a6_100925

519177

EBMUD

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Please direct any questions to MokRelicense@ebmud.com.

Rischa S. Cole
Secretary of the District
October 9, 2025

FIRE

Continued from Page 1

Two of his passengers later told law enforcement that he appeared agitated and angry that night.

Rinderknecht, who once lived in the neighborhood, parked his car and attempted to contact a former friend via Facebook Messenger at about 11:38 p.m., according to the affidavit.

At the base of the trail, a sign reads "Danger" and "No Fires/Smoking." Rinderknecht walked up a narrow dirt path to an area known as the Hidden Buddha clearing at the top of the hill, a place he had frequently visited before, a former friend told investigators.

Rinderknecht used his iPhone to take videos at the Hidden Buddha clearing and listened to a French rap song "Un Zder, Un The," according to the affidavit. The music video for the song, which the affidavit described as about despair and bitterness, shows a trash can being lit on fire. Rinderknecht had listened to the song nine times in the four days before he allegedly set the fire, the affidavit said.

University of California, San Diego cameras that monitor the area first captured signs of fire at 12:12 a.m. Rinderknecht immediately placed a call to 911, but it did not go through, according to the affidavit.

In the five minutes after he allegedly set the fire, prosecutors said Rinderknecht called 911 several times but didn't get through because he didn't have cell service. When he finally reached 911, he was at the bottom of the hiking trail and reported the fire. By that time, a resident had already reported the blaze.

PARADE

Continued from Page 1

Enhancements included various roadway improvements such as landscaped medians, protected bicycle lanes, and upgraded pedestrian crossings and street lighting between Civic Drive and Sixth Street.

The improvements took two years to complete, and during that time, the parade began at the market, traveled west on Caroline Avenue, then north on 5th Street, west on B Street, south on 4th Street, east on E Street and then south on Chabolla to return to the market.

Galt Police Department recommended the temporary route replace the historic one, stating traffic would flow better once the parade concludes, and congestion would be alleviated as the number of participating floats would be limited.

The department also cited safety concerns such as motorists removing barriers when leaving the Save Mart parking lot.

In addition, the parade in its original state was open to potential criminal activity as the last float passes certain points of the route.

"As time progresses and we move through the years, we have to plan for the possibility of a bad actor, someone who is intent on causing harm to citizens," Corporal Greg Steele said. "Limiting intrusion into our parade route is our biggest priority."

City staff recommended the temporary route as well, as it left C Street and Lincoln Way open to traffic to leave the parade more easily.

But many residents and business owners, like Realtor Becky Roenspie, said limiting parade entries would be detrimental to the event's history and spirit. They also said it was disappointing the city upgraded C Street and did not want to utilize it during parades.

"The whole downtown corridor — C Street and 4th Street — is so nostalgic to me," she said. "That's what this parade feels like. The reason we do (the parade) is to bring the community out so they don't leave our city and spend money somewhere else."

Roenspie added that all six routes staff presented Tuesday had security issues, and that motorists were going to move barricades from parking lot entryways no matter what.

"This corridor has become one of Galt's main gateways leading directly into downtown and old town," Nicole Gross of Chandler Gross Group said. "Extending the route would highlight the investment and revitalization along C Street, encourage patronizing our local businesses, as as provide better parking and accessibility for families."

Mayor Shawn Farmer agreed with speakers, stating those who seek to cause trouble during the parade were going to do so no matter what route was adopted.

He added that he did not like limiting the number of parade entries, as it would deter participants from wanting to join the event in the future.

Farmer said he also wanted the parade to highlight its history, as well as the city's.

"I want old town to be a part of it, because that's where Galt started," he said. "But C Street, I think there's a big piece of nostalgia, because watching these parades for a big part of my life, they'd always end on C Street. It's a big piece of Galt. It's the main corridor and it's beautiful now."

FLORA

Continued from Page 1

has changed in the aftermath. Expense records show he spent over $600,000 given to his political campaign by special interest groups, with a significant portion going to travel, lodging and meals.

While Flora's actions do not appear to be illegal, the revelations make him an odd fit to lead a party that claims to represent family values and often bemoans Democrats' lack of transparency.

Flora's district is solidly red, coming up to the edges of Elk Grove to the north, Stockton to the west and Modesto to the south. It encompasses vast acres of grape and almond farmland to the east. Since the early 1930s, Flora's family has farmed in the region.

For years, his home base was in Ripon, a conservative city of about 16,000 along Highway 99 with a one-street downtown.

After he and his ex-wife sold their Ripon home in 2022, Flora registered to vote at a Modesto property owned by his parents, the same address as their longtime farming equipment business, a little over 70 miles from the Capitol. A 2018 law clarified that where a lawmaker registers to vote is their "legal domicile."

A recent visit to that property found the actual resident is a woman who identified herself as the wife of Flora's nephew. The woman said she thought Flora lived in Sacramento.

Melodie Flora, Heath Flora's ex-wife, confirmed her daughters stay with the lawmaker every other weekend — including when the legislature is not in session — at a home in Sacramento's Arden neighborhood.

Flora collects per diem living expenses

Despite his proximity to the Capitol, public documents from the state Assembly show Flora collects "per diem," a taxpayer-funded stipend for the food and lodging legislators use while away from home. The income is tax-free unless the lawmaker lives within 50 miles of the Capitol, a distinction determined by where they are registered to vote.

The Assembly's expenditure records show Flora received $46,256 in stipends the first nine months of the 2025 legislative session, and $42,416 during the 2024 session. The money is on top of his regular salary of $142,656.

Several Sacramento-based lawmakers opted not to receive per diem in 2025. Assembly members Maggy Krell and Stephanie Nguyen and state Senators Angelique Ashby and Roger Niello, all of whom live in Sacramento County, forwent the roughly $47,000 in pretax funds they could have collected. Folsom-based Assemblymember Josh Hoover and West Sacramento state Sen. Christopher Cabaldon accepted that amount of per diem.

Flora did not respond to several emailed requests for comment about where he lives and why he collects per diem. When asked at the Capitol about his living situation, he said he had no comment and would not be responding to The Bee's emails before walking away.

Most lawmakers have homes in their districts, but no law requires them to do so. They must have been a resident of their district for at least one year before running to represent the community.

That lawmakers would be able to live outside of their districts and still represent the people who live there is certainly not what the writers of the California Constitution had in mind, said Dan Schnur, a politics and communications professor at UC Berkeley and USC.

"The state Legislature has done everything it possibly can to give its members a loophole that allows them to avoid what seemed to be the original intent of the state Constitution," Schnur said.

He also questioned why Flora would not respond to clarifying questions about his residency.

"When it appears that you may have violated campaign and election law, intentionally or unintentionally, it seems a pretty good idea to explain yourself."

Flora co-authored Assembly Bill 1392, which would keep the addresses where lawmakers are registered to vote, already relatively privileged, even more guarded. Only people with a true governmental or journalistic purpose would be able to request a lawmaker's address, and journalists who want to do so would need to submit an application, a letter of authorization, and a declaration under penalty of perjury to an elections office.

According to co-author Assemblymember LaShae Sharp-Collins, D-San Diego, the bill is intended to protect lawmakers in a climate of increased political violence. It passed both the state Senate and Assembly during a marathon last day of session this year, and is awaiting the governor's signature.

Affair with a lobbyist and a divorce

Flora has been able to bypass questions about his behavior in the past.

In 2022, California Medical Association lobbyist Emily Hughes sent a series of tweets that caused a buzz in the Capitol, alleging she had an affair with the assemblyman.

News outlets, including the San Joaquin Valley Sun and The Bee wrote about the alleged affair. At the time, Flora said he would be releasing a statement – but it never materialized.

Hughes, who showed The Bee letters and photos to corroborate the two-year affair, said she's still waiting for that statement.

In an interview, Hughes, 37, said she sent the tweets to extricate herself from her relationship with Flora.

She described a deteriorating relationship that was causing extensive stress, and necessitated her taking an action to end it in a way that she couldn't "walk back."

"It was a way of, like, stopping myself when I knew that I didn't have the ability to," she said of her social media posts.

In the years following, Hughes left California politics and started a second career as a mortician in Oregon. She said she loves the work and helping families find closure, but still thinks about her years at the Capitol. She says she feels she was blacklisted in the Capitol after she posted the tweets.

"I could have absolutely spent my entire career (lobbying)," she said. "It impacted my life so drastically and impacted his none at all."

At the time of the affair, Flora was still with his longtime partner, Melodie Flora, whom he married when he was 24, and with whom he had two daughters.

In the years since, Hughes and Melodie Flora have become friends.

"I'm proud of Emily for bringing to light the moral integrity of (the) representative," Melodie Flora wrote in a text.

Melodie Flora filed for divorce in the aftermath of the affair, and a year later, filed to receive child support from her former husband. Court documents show the two parties came to an agreement for Heath Flora to begin paying $2,000 per month in June 2023.

But two months later, her lawyer filed a request to the Assembly for Heath Flora's income to be withheld from the state for lack of payment of child support.

A San Joaquin County superior court later ordered that, in addition to one-half of the proceeds from the sale of their shared house, Melodie Flora was to receive over $16,000 in past due payments for child support and uncovered healthcare expenses for the girls.

PROOF OF PUBLICATION (2015-5 C.C.P.)

STATE OF CALIFORNIA
COUNTY OF AMADOR

I am a citizen of the United States and a resident of the said County. I am over the age of eighteen years; and not a party to or interested in the above matter. I am the principal Clerk of the Printer and Publisher of the Amador Ledger Dispatch. A newspaper of general circulation, published once a week in the City of Jackson, California, County of Amador, and which newspaper has been adjudicated a newspaper of general circulation by the Superior Court, of the County of Amador, State of California dated June 19, 1953, Court decree numbers; 5575/5551; that the notice of which the annexed is a printed copy (set in type not smaller than nonpereil) has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates; to wit:

October 03

—

all in the year: 2025

I certify (or declare) under Penalty of perjury that the foregoing is true and correct.

Date at Jackson, California this

03 of October 2025

Jack Mitchell
SIGNATURE

Amador Ledger Dispatch
P.O. Box 1240
106 Water Street
Jackson, CA 95642
(209) 223-8761

PUBLIC NOTICE

EBMUD

NOTICE OF FILING OF NOTICE OF INTENT AND PRE-APPLICATION DOCUMENT WITH THE FEDERAL ENERGY REGULATORY COMMISSION FOR THE LOWER MOKELUMNE RIVER HYDROELECTRIC PROJECT (FERC PROJECT NO. P-2916)

Please take notice that East Bay Municipal District (EBMUD), of 375 11th Street, Oakland, California, 94607, is filing a **Notice of Intent (NOI)** and **Pre-Application Document (PAD)** with the Federal Energy Regulatory Commission (FERC) for a new license to continue to operate the major existing Lower Mokelumne River Hydroelectric Project (FERC No. P-2916) (Lower Mokelumne Project).

EBMUD intends to file the NOI and PAD on or about October 15, 2025. The NOI and PAD provide details of EBMUD's proposal to seek a new license from FERC, using the Integrated Licensing Process. The existing license expires on March 31, 2031.

The 33-megawatt Lower Mokelumne Project is located on the Lower Mokelumne River in Amador, Calaveras, and San Joaquin counties in California.

Interested resource agencies, Tribes, local governments, and members of the public are invited to participate in the relicensing proceeding. Relicensing documents are available on EBMUD's relicensing website at www.ebmud.com/MokRelicense or on FERC's eLibrary system at https://elibrary.ferc.gov, under FERC Docket No. P-2916.

A printed copy of the NOI and PAD can also be viewed at the following locations by scheduling an appointment with the EBMUD Relicensing Team at MokRelicense@ebmud.com:

EBMUD Administration Building at 375 11th Street, Oakland, CA 94607
EBMUD Lodi Office at 1 Winemaster Way, Lodi, CA 95240
EBMUD Mokelumne Watershed Headquarters at 15083 Camanche Parkway South, Valley Springs, CA 95252

Please direct any questions to MokRelicense@ebmud.com.

Rischa S. Cole
Secretary of the District
October 10, 2025

PUBLISHED: AMADOR, LEDGER DISPATCH, OCTOBER 03, 2025-Y554

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Secretary of the District

October 10, 2025

PUBLISHED: AMADOR, LEDGER DISPATCH, OCTOBER 03, 2025-Y554

Oakland Tribune
(510) 723-2850

Legal No. **0006925375**

2006239

EAST BAY MUD
ATTN: SEC OFFICE
MS 806
PO BOX 24055
OAKLAND, CA 94623

PROOF OF PUBLICATION

FILE NO. NOI FERC Proj P-2916 PAD

Oakland Tribune

The Oakland Tribune

I am a citizen of the United States; I am over the age of eighteen years, and not a party to or interested in the above-entitled matter. I am the Legal Advertising Clerk of the printer and publisher of The Oakland Tribune, a newspaper published in the English language in the City of Oakland, County of Alameda, State of California.

I declare that The Oakland Tribune is a newspaper of general circulation as defined by the laws of the State of California as determined by this court's order, dated December 6, 1951, in the action entitled In the Matter of the Ascertainment and Establishment of the Standing of The Oakland Tribune as a Newspaper of General Circulation, Case Number 237798. Said order states that "The Oakland Tribune is a newspaper of general circulation within the City of Oakland, and the County of Alameda, and the State of California, within the meaning and intent of Chapter 1, Division 7, Title 1 [§§ 6000 et seq.], of the Government Code of the State of California." Said order has not been revoked, vacated, or set aside.

I declare that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

10/10/2025

I certify (or declare) under the penalty of perjury that the foregoing is true and correct.

Executed at Rio Vista, California.
On this 10th day of October, 2025.

Public Notice Advertising Clerk

EBMUD

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Rischa S. Cole
Secretary of the District
October 10, 2025

OT 6925375; Oct. 10, 2025

r.BP316-07/17/17

Volume II
Appendix B

Joint Settlement Agreement

LOWER MOKELUMNE RIVER PROJECT

FERC Project No. 2916-004

JOINT SETTLEMENT AGREEMENT

Table of Contents

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LOWER MOKELUMNE RIVER
JOINT SETTLEMENT AGREEMENT

This Lower Mokelumne River Joint Settlement Agreement ("Agreement") for the Lower Mokelumne River Project, FERC No. 2916, regarding flow and non-flow measures appropriate for the lower Mokelumne River is entered into by and between East Bay Municipal Utility District ("EBMUD") and the U.S. Fish & Wildlife Service ("the Service"), and California Department of Fish & Game ("CDF&G"), collectively referred to as the "Resource Agencies." EBMUD, the Service and CDF&G are each referred to herein individually as "Party" and together as the "Parties."

WITNESSETH

WHEREAS, on March 10, 1981, the Federal Energy Regulatory Commission ("FERC") issued a license to EBMUD for the Lower Mokelumne River Project No. 2916.

WHEREAS, on July 1, 1991, the staff of the FERC initiated a license modification proceeding, Lower Mokelumne River Project No. 2916-004, to determine if modifications to the Lower Mokelumne River Project facilities or operations were appropriate for the conservation and development of fish and wildlife resources in the Mokelumne River.

WHEREAS, in 1992, the Service intervened in the FERC's license modification proceeding and proposed certain flow and non-flow measures to conserve and restore the anadromous fishery and improve other ecosystem values.

WHEREAS, on July 16, 1993, EBMUD made an Offer of Settlement in the FERC license modification proceeding, Lower Mokelumne River Project No. 2916-004.

WHEREAS, the Parties have engaged in extensive discussions in an effort to resolve issues in dispute in the license modification proceeding before the FERC and the differences between them regarding the flow and non-flow needs of the lower Mokelumne River, and to establish a more cooperative and mutually beneficial working relationship for the future.

WHEREAS, each of the Parties has separately concluded that greater protection and enhancement of the anadromous fishery resources of the lower Mokelumne River will result if EBMUD implements new instream flows and the Parties variously undertake certain non-flow measures.

WHEREAS, in February 1996, the Parties executed a Principles of Agreement setting forth elements of settlement, including flow and non-flow measures, to be reflected in a Joint Settlement Agreement.

WHEREAS, EBMUD has separately concluded that the flows and non-flow measures specified herein can be undertaken without unacceptably jeopardizing the Lower Mokelumne River Project as a reliable, high quality water supply.

WHEREAS, because EBMUD lacks authority to control diversions by other appropriators and riparians downstream of Camanche Dam, this Joint Settlement Agreement sets forth EBMUD's minimum water releases from Camanche Dam and non-flow related measures for the Mokelumne River Ecosystem (Pardee Reservoir to the Delta). The parties also recognize there are important resource management issues and opportunities downstream of Woodbridge Dam that will be considered by the Partnership Steering Committee for non-flow habitat measures.

WHEREAS, EBMUD has agreed to provide flows and the Parties have agreed to undertake certain non-flow measures as specified in this Joint Settlement Agreement.

WHEREAS, EBMUD acknowledges that it is subject to the terms of the Clean Water Act and the Porter-Cologne Act, including the water quality provisions of said acts.

WHEREAS, each of the Resource Agencies agrees to support this Joint Settlement Agreement including the flow and non-flow measures specified herein, believing they will provide reasonable protection and enhancement from current conditions with respect to EBMUD's contribution for the fish and wildlife resources of the lower Mokelumne River.

NOW, THEREFORE, EBMUD, the Service and CDF&G agree as follows:

A. Purpose and Scope.

The Parties intend this Agreement to resolve (1) the pending FERC Proceeding No. 2916-004; and (2) the pending Mokelumne River Water Rights Proceeding before the California State Water Resources Control Board (SWRCB). The Parties agree not to oppose the flows or non-flow measures set forth in this Agreement in any regulatory proceeding, or portion thereof, directed at EBMUD's obligation to protect the fish resources of the Mokelumne River Ecosystem. The Parties further agree that these resolutions are accomplished in a manner which:

- protects and maintains EBMUD's Lower Mokelumne River Project as a reliable, high quality water supply for EBMUD;
- contributes to EBMUD's ability to protect and maintain its water rights attendant to the Lower Mokelumne River Project;
- provides reasonable protection and enhancement from current conditions for the anadromous fishery and ecosystem of the lower Mokelumne River and constitutes

a reasonable contribution on the part of EBMUD toward state and federal fishery restoration goals for the River set forth in the California Salmon, Steelhead Trout, and Anadromous Fisheries Program Act and the CVPIA; and

- encourages cooperative action to achieve and to maintain these objectives over time.

B. Effective and Termination Dates.

This Agreement shall be effective on the date FERC issues a final order in License Modification Proceeding No. 2916-004, and shall remain in effect for the duration of the term of the FERC License No. 2916.

This Agreement shall terminate upon withdrawal from the Agreement of a Party pursuant to Section C below.

C. Action of the FERC.

Within 30 days after all Parties have initialed this Agreement, the Parties agree to submit jointly this Agreement as an Offer of Settlement to the FERC to resolve FERC License Modification Proceeding No. 2916-004 and jointly to request, as a fair and reasonable resolution of that proceeding, that following and subject to compliance with the Endangered Species Act (ESA) as described in Section J hereof, FERC amend EBMUD's existing license to include, in its entirety and without modification, Attachment 1 (pages 1-5) of this Agreement as the flow requirements for the Lower Mokelumne River Project No. 2916. Within 30 days of receiving notification of compliance with the ESA as described in Section J, each Party shall sign the Agreement and jointly submit it to FERC for final action.

In the event that the FERC does not by final, non-appealable Order implement without modification the flow requirements specified in Attachment 1 (pages 1-5) of this Agreement, then each Party shall have 30 days after the FERC Order becomes final and non-appealable to provide notice to the other Parties of its intent to withdraw from the Agreement or to accept the Agreement subject to the provisions reflected in the final, non-appealable Order of the FERC. A failure to provide such notice shall be deemed an acceptance of the Agreement.

D. Support of This Agreement.

The Parties agree that the provisions of this Agreement are in the public interest and represent EBMUD's reasonable obligation under FERC License No. 2916 and the Mokelumne River Water Rights Proceeding pending before the SWRCB to protect and enhance the fishery resources of the lower Mokelumne River and maintain the Lower Mokelumne River Project as a reliable, high quality water supply.

The Parties individually and collectively agree to support this Agreement and to work cooperatively to implement the terms of this Agreement. The Parties agree not to oppose the flows or non-flow measures set forth in this Agreement in any regulatory proceeding, or portion thereof, directed at EBMUD's obligation to protect the fish resources of the Mokelumne River Ecosystem. The Parties also agree that no Party shall take any action which has the purpose or effect of frustrating the accomplishment of the purposes and provisions of this Agreement.

The Parties agree that nothing in this Agreement is intended to nor shall be construed to abrogate, modify or waive any rights, duties or responsibilities of any Party under any federal or state law, order, license or permit, contract, or water rights determination.

E. Establishment of a Lower Mokelumne River Partnership.

EBMUD, the Service and CDF&G will establish a Lower Mokelumne River Partnership (the "Partnership") to develop joint action plans to protect the Mokelumne River Ecosystem (Pardee Reservoir to the Delta). The objectives of the Partnership shall include the:

- Protection and enhancement of the anadromous fishery;
- Protection and improvement of the Mokelumne River Ecosystem;
- Encouragement of stakeholder participation and cooperation; and
- Integration of Mokelumne River strategies with the Bay Delta Accord, CVPIA implementation, or similar measures.

1. Partnership Steering Committee.

One representative each from EBMUD, CDF&G , and the Service will serve as the Partnership Steering Committee responsible for guiding the Partnership, defining and developing annual action programs, schedules and cost estimates for projects and funding strategies to achieve them. EBMUD will chair the Steering Committee for the first year with the option for the Service, CDF&G and District to chair the Committee on an annual rotating basis in subsequent years. Actions of the Steering Committee are intended to be taken with full consideration of input from the Stakeholders Group (described below) and shall only be taken upon the unanimous approval of the Steering Committee. The Steering Committee will coordinate efforts to achieve the objectives of the Partnership through the flow requirements and anadromous fishery protection measures set forth in Section F below, the Ecosystem Protection measures set forth in Section G below, and the Technical Cooperation measures set forth in Section H below.

2. Establishment of a $2 million Partnership Fund.

Within 45 days of the FERC Order implementing this Agreement becoming final and non-appealable, EBMUD will establish, manage and maintain a $2 million fund (the "Partnership Fund") for the life of this Agreement, the annual income from which will provide operating support for the partnership programs. EBMUD will manage the Fund in a manner consistent with law and with an objective of maximizing its annual income. Annual interest earnings that remain unspent from year to year shall accrue in the fund and remain available for use of the Steering Committee during the term of the partnership agreement. The principal and any unspent earnings of the fund shall remain the property of EBMUD and will revert to EBMUD upon the expiration of this agreement or upon the withdrawal of any party to the agreement. EBMUD will report quarterly to the Steering Committee regarding the income earned and current balance of the Fund. Any expenses of administration of the Partnership Fund shall be paid separately by EBMUD and shall not be deducted from the Partnership Fund. The Resource Agencies will seek federal, state and other sources of funds ("Other Funds") to supplement the objectives of the Partnership. The Steering Committee will also solicit the financial participation and involvement of other public agencies, interest groups and private property owners along the lower Mokelumne River to advance the objectives of the Partnership.

EBMUD intends to provide this $2 million Partnership Fund in addition to its current level of effort in funding fishery studies, water quality and biological monitoring, habitat protection, and other operating support for its ongoing operations and responsibilities on the lower Mokelumne River.

It is not EBMUD's intention to reduce its current level of effort. EBMUD, however, reserves the right, at its sole discretion, to reprioritize and reprogram its efforts that are undertaken outside the Partnership Fund based upon improving science, information collected and its operational needs.

3. Water Quality And Resource Management Program.

Within 30 days of the signature of this Agreement in accordance with Section C, the Partnership Steering Committee agrees to begin development of a Water Quality and Resource Management Program. Within six (6) months of the FERC Order implementing this Agreement becoming final and non-appealable, the Partnership Steering Committee will finalize the Water Quality and Resource Management Program. EBMUD agrees to provide $200,000 to support the Partnership efforts in developing the final Water Quality and Resource Management Program. The Water Quality and Resource Management Program will define reasonable goals, measures, performance criteria, and responsive actions.

4. Additional Voluntary Participation.

The Resource Agencies recognize that aside from the upper one-half mile of the lower Mokelumne River corridor owned by EBMUD and included in its FERC project lands, the majority

of the riparian area and associated uplands are privately owned and not subject to the control of EBMUD. The Parties agree that the voluntary participation of these other property owners will be necessary to achieve certain long term objectives for protecting the lower Mokelumne River ecosystem. For actions involving access to the property of, and agreements with, other property owners along the lower Mokelumne River, the Resource Agencies will take the lead and EBMUD and other stakeholders will provide support.

5. Establishment of a Lower Mokelumne River Stakeholders Group.

A Stakeholders Group will be established consisting of EBMUD, the Service, CDF&G, and other stakeholders in the lower Mokelumne River invited to participate including but not limited to Amador, Calaveras and San Joaquin Counties, Woodbridge Irrigation District, the City of Lodi, North San Joaquin Water Conservation District, the Committee to Save the Mokelumne and other interested environmental groups, Native Americans, and private property owners along the river.

The role of the Stakeholders Group will be to:

- Encourage the voluntary participation and cooperation of other stakeholders along the river to contribute financial and in-kind resources, provide access to the river for enhancement work and participate in implementing the Partnership action plans and objectives;

- Recommend ecosystem protection and improvement priorities and measures to the Partnership Steering Committee for annual action plans in conjunction with additional resources available from other stakeholders; and

- Serve as a communications and coordination forum for stakeholders in discussing common concerns and developing joint action plans to address issues.

F. Flow Requirements and Anadromous Fishery Protection.

The Parties agree that water demands in the Mokelumne River basin during the planning horizon of 1996 to 2020 and until the expiration of the FERC license (year 2031) will increase. The Parties also agree that the frequency of critically dry year flows may increase. In order to ensure that protection of the fishery resource continues in the future to be reasonably balanced with other demands, the Parties agree that additional measures are needed and agree that the following additional actions will be implemented. Upon the FERC Order implementing this Agreement becoming final and non-appealable, EBMUD agrees to operate its Lower Mokelumne River Project in accordance with the flow requirements specified in Attachment 1 (pages 1-5) attached hereto and incorporated herein in its entirety by this reference.

1. Adaptive Management of River Operations.

The Parties agree that the flows specified in Attachment 1 and the other elements of the Agreement provide reasonable protection and enhancement from current conditions for the anadromous fishery and ecosystem of the lower Mokelumne River and meet EBMUD's obligation to protect the anadromous fishery and other resources in the lower Mokelumne River pursuant to FERC License No. 2916-004 and the pending SWRCB Water Rights Proceeding. To increase opportunity for optimizing fishery habitat and other ecosystem values consistent with this Agreement, the parties agree to implement an adaptive management approach with operations of the Lower Mokelumne River Project. This could require responsive actions based on changing river conditions. To accomplish this, the Parties agree that, with the prior written concurrence of CDF&G and the Service, EBMUD may reschedule or modify the flows specified in Attachment 1, provided the total quantity of water released in any given year will not be less than the quantity of water provided by the flow requirements specified on Attachment 1 for that type of water year.

2. Gainsharing Increases in Flows.

EBMUD agrees to increase instream flows beyond the flows specified in Attachment 1 by an amount equal to 20% of the actual yield of additional water supplies developed by EBMUD from new facilities until reaching a maximum quantity of 20 TAF[1] which will be available at the joint written request of CDF&G and the Service. Gainsharing water will be available in any year in which carryover storage in EBMUD's storage at the Lower Mokelumne River Project on November 5th is projected to be at the maximum allowable levels according to the US Corps of Engineers permit. But when carry-over storage on November 5th is less than the maximum allowable, such gainsharing water may be used only once during any drought sequence.[2] Such gainsharing water for flow augmentation will be provided upon the completion of construction and initial fill of EBMUD's

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[1] EBMUD estimates its need for water to be 160 TAF by 2020 not counting gainsharing. The District anticipates that conservation and reclamation projects will be implemented sufficient to meet 75 TAF of that need for water in order to manage customer demand so it does not exceed 230 MGD through 2020. EBMUD would provide 20% of the yield from future water storage or conjunctive use projects needed to meet this remaining estimated 85 TAF need for water by 2020 up to a maximum of 20 TAF when such storage projects come on line and water from such projects is available to District customers. This gainsharing water could then be used annually if carry-over storage in the EBMUD Mokelumne storage on November 5th is at maximum allowable levels but may be used only once in each drought sequence.

[2] "Drought sequence" is defined as beginning whenever November 5th carry-over storage levels in Pardee and Camanche Reservoirs are projected to be less than maximum allowable levels under terms of the U.S. Army Corps of Engineers flood control manual, and ending when carry-over levels recover to maximum allowable storage levels.

share of any new reservoir on the Mokelumne River or the expansion of any existing EBMUD reservoir on the Mokelumne River or when EBMUD begins to take stored ground water into its system from any conjunctive use program. Water available to the Resource Agencies in any year under this gainsharing program may be added to carry over storage but shall not affect subsequent water year type determination. This additional gainsharing water will be available from any source other than conservation, reclamation projects, and the Amador Canal pipeline project, and shall be available only once during each drought sequence.

The Parties understand that EBMUD makes no guarantee regarding the timing for the development of new water storage facilities or projects eligible for gainsharing. The Parties, nevertheless, remain optimistic that such efforts will occur, at least partially, during EBMUD's water supply management program current planning period running through 2020 in order to meet the reasonable water supply needs of EBMUD. EBMUD understands that it is important to the Resource Agencies that the non-flow and the gainsharing measures outlined in this Agreement be planned and coordinated to meet agreed resource goals.

3. Surplus Water.

EBMUD agrees to notify the Resource Agencies of the availability for sale of surplus Mokelumne River water.

4. Ramping Rates.

The Parties agree that when flood control releases are not being made, river flow changes should be gradual but should not decrease by more that 50 cfs per day during the October 16 through March 31 spawning and incubation period and by not more than 100 cfs per day at other times except in the case of emergencies.

5. Managing Camanche Reservoir Hypolimnion.

The Parties agree that EBMUD will use its best efforts to maintain Pardee and Camanche Reservoir stratification with a minimum of 28 TAF of hypolimnetic volume in Camanche Reservoir through October whenever Pardee Reservoir volume exceeds 100 TAF. The Parties also agree that EBMUD will strive to maintain dissolved oxygen and to reduce hydrogen sulfide levels in the Camanche Reservoir hypolimnion during the period from May through October by using its Hypolimnetic Oxygenation System (HOS). This provision shall be incorporated into the Water Quality and Resource Management Program.

6. Expansion and Upgrade of the Mokelumne River Fish Hatchery.

The Parties agree that EBMUD will provide funding to expand and upgrade the Mokelumne River Fish Hatchery in accordance with the EBMUD Hatchery Master Plan (1996), up to a maximum of $12.5 million. The Parties agree to support the expansion and upgrade of the fish

hatchery as an integral part of a strategy to supplement the natural production of and to meet the mitigation requirement for anadromous fish in the lower Mokelumne River. EBMUD will construct the fish hatchery in accordance with final design plans and final construction cost estimates approved by CDF&G. During construction, EBMUD and CDF&G will meet at the request of either party to discuss actual construction costs and jointly develop modifications as needed. EBMUD and CDF&G will jointly work to ensure that total project costs do not exceed $12.5 million. EBMUD agrees that it will continue its existing financial support for operations and maintenance actions at the Mokelumne River Fish Hatchery. CDF&G agrees that it will continue to be responsible for the operation and maintenance of the fish hatchery as well as for hatchery production during construction of the hatchery expansion and upgrade.

7. Integration of Natural Production Strategies.

The Parties agree that CDF&G will, to the extent feasible, integrate natural production strategies when implementing its hatchery management operations. The parties agree that a trap and truck program, predator management practices and angling regulations, including provisions to prevent damage to redds from wading, could have some benefit to the fishery resource. However, the amount of such benefit is currently unknown. Trapping and trucking of anadromous salmonids shall take place during critical years with approval of the Partnership Steering Committee. Predator management activities shall only take place with the approval of the Partnership Steering Committee. The California Fish & Game Commission has the authority to adopt angling regulations in California. Upon approval of the Partnership Steering Committee, the Committee may request the Commission to adopt angling regulations for the lower Mokelumne River to prevent damage from redds from wading.

8. Satisfaction of EBMUD's Contribution Toward State and Federal Restoration Goals.

The Parties agree that implementation of the flow requirements and non-flow measures set forth in this Agreement constitutes a reasonable contribution by EBMUD to provide reasonable protection and enhancement from current conditions for the anadromous fishery and ecosystem of the lower Mokelumne River, and constitutes a reasonable contribution on the part of EBMUD toward state and federal fishery restoration goals for the River set forth in the California Salmon, Steelhead Trout, and Anadromous Fisheries Program Act and the CVPIA.

G. Ecosystem Protection.

The Parties agree to establish a Lower Mokelumne River Ecosystem Protection Program to encourage cooperative joint action to protect and to improve the natural production of anadromous fish and the natural resource habitat of the lower Mokelumne River ecosystem.

1. Ecosystem Action Priorities.

The Parties agree to work cooperatively through the Steering Committee using income from the Partnership Fund and Other Funds to develop and to implement measures, which will be consistent with the principles of this Agreement, to protect and enhance the natural production of anadromous fish and the habitat of the lower Mokelumne River corridor ecosystem. Such measures may include:

- **Identify riparian values and biological diversity** in the Mokelumne River Ecosystem. Support riparian management actions which improve the lower Mokelumne River Ecosystem, including: Planting trees and shrubs along the river corridor to provide shade cover for moderating instream temperatures, and selective removal of undesirable vegetation to improve habitat conditions. These efforts will be made in cooperation with the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) and property owners.

- **Improve spawning gravels** in the lower Mokelumne River above tidewater to correct compaction of existing gravels, adding new gravels and creating gravel berms, cleaning gravels, and measures to reduce sediments to improve instream spawning habitat.

- **Encourage fencing and barriers to prevent cattle and livestock from reaching the banks of the river** to enhance bank stability and to protect riparian corridor values. Upon approval of the Partnership Steering Committee, CDF&G would assume the lead in working in cooperation with private property owners along the river corridor, subject to available funding.

- **Identify, design and install screens on diversion facilities** to prevent unintended fish losses in cooperation with diverters. Upon approval of the Partnership Steering Committee, CDF&G would assume the lead for these activities, subject to available funding.

- **Encourage cooperative action and enforcement to reduce poaching** on the lower Mokelumne River.

- **Cooperative actions to improve fish passage at Woodbridge Dam.** The Parties will work cooperatively with Woodbridge Irrigation District and other parties to improve the coordination of efforts to ensure that the natural resources of the lower Mokelumne River below Camanche Dam are protected. While no commitments of funds for improvements to Woodbridge Dam have been made nor implied by any Party to this Agreement, each Party agrees to work cooperatively with Woodbridge Irrigation District to seek CVPIA Restoration Fund, Category III or other funds to implement agreed improvements.

- **Expand coded-wire tagging to include all fish released from the Mokelumne River Fish Hatchery,** if it is part of a statewide strategy to coded-wire tag all salmon released in California fish hatcheries in cooperation with commercial salmon trawlers, the Resource Agencies, and the California Fish and Game Commission.

- **Update and maintain database on biological diversity and habitat characteristics of aquatic resources at various instream flows.**

- **Other ecosystem improvement actions to be determined by the Steering Committee.**

- **Develop and implement a Water Quality and Resource Management Program.**

H. Mokelumne River Technical Cooperation

The Parties agree to coordinate their respective fishery and habitat studies, monitoring programs, and research efforts to advance the shared knowledge and science about the Mokelumne River. The following actions will be undertaken to support this objective:

1. Mokelumne River Technical Advisory Committee (MRTAC).

The Parties agree that for the interim, the MRTAC will remain the key forum for sharing technical information about the fishery, river operations and other data about the current conditions and planned actions affecting the river. EBMUD, the Service and CDF&G will continue actively to support the MRTAC as a technical information sharing forum.[3]

2. Mokelumne River Science Database.

The Parties agree to convert the technical notebook developed during the negotiation of this Agreement into a Mokelumne River Science Database to be available to the Parties (under the guidance of the Partnership Steering Committee). The database will be jointly maintained by the parties and will summarize existing science, data and research efforts and will be updated and maintained over time by adding new data, studies and research efforts undertaken by any Party using a standard agreed upon format and protocol. EBMUD agrees to provide a one time contribution of up to $50,000 toward establishing this Mokelumne River Science Database.

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[3] The need for the MRTAC will be reviewed periodically by the Steering Committee with input from the Stakeholders Group.

3. Mokelumne River Symposium.

The Parties agree to sponsor periodic symposiums to provide opportunities for scientists, biologists and other professionals who have conducted studies or research on the Mokelumne River Ecosystem to present their papers and participate in peer group discussions about the river corridor and its ecosystem. These papers will be published and become part of the growing Mokelumne River Science Database. A growing professional partnership between EBMUD, the Resource Agencies and others interested in the Mokelumne River will be supported by each agency to build shared values, objectives and agreed upon strategies to protect and enhance the ecosystem of the Mokelumne River corridor. EBMUD will provide up to $10,000 per year for ten years to support the establishment of this Symposium.

4. Adaptive Management Changes in Water Operations Plans.

EBMUD will inform and regularly consult with the Resource Agencies about anticipated changes in its real-time Lower Mokelumne River Project operations to discuss issues or points of concern. The parties intend for this communication to be informal, candid and focused on protecting the environmental resources while assuring water supply reliability.

5. Measuring Progress.

The Parties agree through the Partnership Steering Committee to engage in an ongoing process to measure the success of the flow requirements, non-flow measures and other actions contained in this Agreement. Measures of success shall be developed as a part of the Water Quality and Resource Management Program, and shall be based upon agreed criteria including counts of returning anadromous fish, redd surveys, fry/smolt condition factors, fry and smolt outmigration, and habitat quality taking into account different water year types or other criteria agreed to by the Parties.

The Parties agree that progress must be assessed annually and over time. Assessment of salmonids will be based on successive multi-year cycles to match the life cycle of the anadromous fishery. (E.g.: The first assessment is anticipated to take place in six years after two consecutive life cycles with subsequent future review to be determined by the Steering Committee.)

The Parties agree that in the event that the flow and non-flow measures employed during the first six year evaluation period fail to achieve the goals identified by the Partnership Steering Committee in the Water Quality and Resource Management Program, they will meet and attempt to reach consensus on new strategies for accomplishing the goals and objectives.

The Parties agree that after ten years following the effective date of this Agreement, they shall cooperate in the preparation of a report that describes the successes and failures with respect to agreed upon short and long-term goals and milestones reached. This report shall include findings that relate to protection of the anadromous fishery and ecosystem values of the Mokelumne River

based on the scientific data gathered during and prior to the ten year period. This report shall include the joint and or independent views of the Parties and recommendation for continued or new flow and non-flow measures. This ten year report shall be completed within six months following the ten year period end date.

6. EBMUDSIM.

EBMUD agrees, upon execution of appropriate non-disclosure agreements, to make EBMUDSIM computer runs available to the Parties for the purpose of facilitating a common understanding of river operations, hydrology, and the assessment of alternative approaches.

7. Inter-Agency Communication and Coordination.

The Parties agree to encourage a healthy interchange between their technical staff to build trust and professional respect, to share technical information and views, and to coordinate their efforts on issues related to the lower Mokelumne River to avoid surprises, misunderstandings and miscommunications in the future.

The Parties agree to develop a protocol to inform each other in a timely manner when they become aware of any situation that they believe constitutes an ecological or operational emergency. Such protocol shall be developed within three months of execution of this Agreement.

8. Permits.

The Resource Agencies and/or EBMUD, as appropriate, will seek and secure any permits or regulatory authorization needed to implement the programs or measures contained in this Agreement.

I. Settlement of Outstanding Issues.

The Parties agree that this Agreement resolves the outstanding issues between and among them regarding EBMUD's obligations to lower Mokelumne River flows and Mokelumne River Ecosystem non-flow measures needed to provide reasonable protection and enhancement beyond current conditions for the anadromous fishery and riparian habitat for purposes of:

- **FERC Proceeding 2916-004.** The Parties will jointly submit an initialed copy of this Agreement to the FERC and, in accordance with Section C hereof, recommend and support in writing acceptance of the flow and non-flow measures set forth in this Agreement as a just and reasonable resolution of the issues raised in the pending FERC matter *Lower Mokelumne River Project Proceeding # 2916-004.*

- **Submission to the SWRCB.** Following signature of this Agreement by all Parties as provided in Section C and following a FERC Order consistent with this

Agreement in Lower Mokelumne River Project Proceeding No. 2916-004 becoming final and non-appealable, EBMUD will submit this Agreement to the State Water Resources Control Board as satisfaction of EBMUD's lower Mokelumne River flow and non-flow obligations in the pending Mokelumne River Water Rights Proceeding. The Resource Agencies agree that they will not recommend to the State Water Resources Control Board flows or non-flow measures affecting EBMUD for the lower Mokelumne River in the Mokelumne River Water Rights Proceeding which are inconsistent with those set forth in this Agreement.

- **Fish Guidance Fence Improvement.** The Parties agree that the improvements made by EBMUD to the fish guidance fence in 1995 satisfied the FERC license requirements in 1995 based on available information, and may satisfy the FERC license requirements for permanent improvements, provided EBMUD demonstrates to FERC that the improvements now in place are reasonably effective in preventing fish movements past the fish guidance fence during the period in which the panels are in place.[4] The Resource Agencies agree that the fish guidance fence panels will be installed on or before October 1 of each year and removed on or about January 1 of each year.

J. Section 7 Consultation

To ensure that ESA compliance is accomplished, the Parties will continue to engage in informal Section 7 consultation for those species over which the Service exercises program responsibilities in accordance with Section 3 of the ESA (16 U.S.C. 1532). Pursuant to Section C of this Agreement, upon initialing of the Settlement Agreement, the parties will submit the Agreement to the FERC and the FERC will be requested by the Parties to make its final determination of affect as required by the Interagency Cooperative Regulations (50 CFR 402.14) for those species over which the Service exercises program responsibilities, and to confer as appropriate with the National Marine Fisheries Service (NMFS) in accordance with 50 C.F.R. 402.10 for the steelhead trout which is currently proposed for listing by the NMFS. Throughout any Section 7 consultation and/or conference process, EBMUD will be involved as a "designated non-Federal representative" and as the "applicant" described in 50 CFR 402.08.

In the event any Section 7 consultation and/or conference referenced above results in recommended conditions or mitigations that are materially different from the terms and conditions of this Agreement, then any Party shall have 30 days after said consultation and/or conference is final and

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[4]EBMUD is developing a monitoring plan (to be available on November 15, 1996) to be coordinated and concurred in by the Resource Agencies. The monitoring plan will address adequate monitoring implementation guidelines and provisions for remedial measures if the guidance fence is not effective. Planning for remedial measures may include a benefits analysis and related studies.

complete or 30 days after the FERC Order becomes final and non-appealable, to provide notice to the other Parties of its intent to withdraw from the Agreement.

K. Dispute Resolution.

In the event any Party to this Agreement believes there is an issue over the interpretation of, or compliance with, any provision of this Agreement, then, prior to that Party initiating a judicial or administrative proceeding, that Party shall provide written notice of said issue to the other Parties.

The Parties shall then meet and confer within (14) days of said written notice, or at a later date by mutual agreement, in an effort to resolve said issue.

If the matter cannot be resolved after 60 days from the date of the meeting, the Parties will enter into a non-binding mediation process. The mediator shall be approved by all Parties and the cost of the mediator borne equally amongst the parties. The non-binding mediation process shall not exceed 60 days without mutual agreement of all Parties.

If non-binding mediation does not resolve the issue, the complainant may file a protest of non-compliance with the FERC.

L. Choice of Law.

This Agreement shall be interpreted under the laws of the State of California and applicable federal law.

M. Authority.

The undersigned representative of each Party certifies that he or she is fully authorized by the Party whom he or she represents to enter into the terms and conditions of this Agreement and legally to bind such Party.

N. Execution in Counterparts.

This Agreement may be executed in counterparts. A copy with all original executed signature pages affixed shall constitute the original Agreement, and shall be retained by EBMUD.

EBMUD shall distribute true copies of the Agreement with the executed signature pages to all Parties to this Agreement.

IN WITNESS WHEREOF, the Parties have caused this Lower Mokelumne River Joint Settlement Agreement to be executed in Oakland, California.

UNITED STATES FISH & WILDLIFE SERVICE

Date: 3/23/98

By: _____
Wayne S. White
State Supervisor
United States Fish & Wildlife Service

CALIFORNIA DEPARTMENT OF FISH & GAME

Date: 3/23/98

By: _____
Banky Curtis
Regional Manager, Region II
California Department of Fish & Game

EAST BAY MUNICIPAL UTILITY DISTRICT

Date: 3/23/98

By: _____
Dennis M. Diemer
General Manager
East Bay Municipal Utility District

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Attachment 1

Normal and Above Year Flows
Mokelumne River Minimum Flow Schedule (1)

Life Stage	Period		Days	Agreed Release From Camanche Dam (cfs)	Expected Flow Below Woodbridge Dam (cfs)
Adult Immigration	10/1-10/15	(2)	15	325	100
Spawn/Incubation	10/16-10/31	(2)	16	325	100
	11/1-11/30	(3)	30	325	100
	12/1-12/31	(3)	31	325	100
Incubation/Alevin	1/1-1/31	(3)	31	325	100
	2/1-2/28	(3)	28	325	100
Fry Rearing	3/1-3/31	(3)	31	325	100
	4/1-4/15	(4),(5)	15	325	150
	4/16-4/30	(4),(5)	15	325	150
Fry Rearing/Juvenile Rearing/ Outmigration	5/1-5/31	(5)	31	325	300
	6/1-6/30	(5)	30	325	300
Oversummer	7/1-9/30		92	100	25
	Total Days		365		

NOTES:

(1) Due to changes in water conditions or to optimize fishery conditions, EBMUD may modify the above Flow Standards upon written concurrence of CDF&G and USFWS, provided the total quantity of water released for fishery purposes in Normal and Above year types is not less than the quantity provided by this flow schedule.

(2) During October, EBMUD will maintain minimum flows of 325 cfs below Camanche Dam and 100 cfs below WID's dam in Normal and Above year types.

(3) During the period when WID dam boards are pulled out and Lodi Lake is empty (approximately Nov. 1 through March 31), EBMUD shall make minimum releases of 325 cfs from Camanche Dam in Normal and Above year types. This release from Camanche dam is expected to provide at least 100 cfs below WID dam during this period. However, EBMUD shall not be obligated to increase releases above 325 cfs during this period in Normal and Above year types.

(4) During April, EBMUD will maintain minimum flows of 325 cfs below Camanche Dam and 150 cfs below WID's dam in Normal and Above year types.

(5) For the months of April, May, and June during Normal and Above year types, additional release of up to 200 cfs is required depending on combined Pardee and Camanche storage levels relative to the maximum allowable for the end of the prior month as follows:

Less than 10 TAF below maximum allowable storage (BMAS), additional release is 200 cfs for subsequent month.
10 TAF <= BMAS < 20 TAF, additional release is 150 cfs for subsequent month.
20 TAF <= BMAS < 30 TAF, additional release is 100 cfs for subsequent month.
30 TAF <= BMAS < 40 TAF, additional release is 50 cfs for subsequent month.

Attachment 1

Below Normal Year Flows
Mokelumne River Minimum Flow Schedule (1)

Life Stage	Period		Days	Agreed Release From Camanche Dam (cfs)	Expected Flow Below Woodbridge Dam (cfs)
Adult Immigration	10/1-10/15	(2)	15	250	100
Spawn/Incubation	10/16-10/31	(2)	16	250	100
	11/1-11/30	(3)	30	250	100
	12/1-12/31	(3)	31	250	100
Incubation/Alevin	1/1-1/31	(3)	31	250	100
	2/1-2/28	(3)	28	250	100
Fry Rearing	3/1-3/31	(3)	31	250	100
	4/1-4/15	(4),(5)	15	250	150
	4/16-4/30	(4),(5)	15	250	150
Fry Rearing/Juvenile Rearing/ Outmigration	5/1-5/31	(5)	31	250	200
	6/1-6/30	(5)	30	250	200
Oversummer	7/1-9/30		92	100	20
	Total Days		365		

NOTES:

(1) Due to changes in water conditions or to optimize fishery conditions, EBMUD may modify the above Flow Standards upon written concurrence of CDF&G and USFWS, provided the total quantity of water released for fishery purposes in Below Normal year types is not less than the quantity provided by this flow schedule.

(2) During October, EBMUD will maintain minimum flows of 250 cfs below Camanche Dam and 100 cfs below WID dam in Below Normal year types.

(3) During the period when WID dam boards are pulled out and Lodi Lake is empty (approximately Nov. 1 through March 31), EBMUD shall make a minimum release of 250 cfs from Camanche Dam in Below Normal year types. This release from Camanche dam is expected to provide at least 100 cfs below WID dam during this period. However, EBMUD shall not be obligated to increase releases above 250 cfs during this period in Below Normal year types.

(4) During April, EBMUD will maintain minimum flows of 250 cfs below Camanche Dam and 150 cfs below WID's dam in Below Normal year types.

(5) For the months of April, May, and June in Below Normal year types, additional release of up to 200 cfs is required depending on combined Pardee and Camanche storage levels relative to the maximum allowable for the end of the prior month as follows:

Less than 10 TAF below maximum allowable storage (BMAS), additional release is 200 cfs for subsequent month.
10 TAF <= BMAS < 20 TAF, additional release is 150 cfs for subsequent month.
20 TAF <= BMAS < 30 TAF, additional release is 100 cfs for subsequent month.
30 TAF <= BMAS < 40 TAF, additional release is 50 cfs for subsequent month.

Attachment 1

Dry Year Flows
Mokelumne River Minimum Flow Schedule (1)

Life Stage	Period		Days	Agreed Release From Camanche Dam (1) (cfs)	Expected Flow Below Woodbridge Dam (cfs)
Adult Immigration	10/1-10/15	(2)	15	220	80
Spawn/Incubation	10/16-10/31	(2)	16	220	80
	11/1-11/30	(3)	30	220	80
	12/1-12/31	(3)	31	220	80
Incubation/Alevin	1/1-1/31	(3)	31	220	80
	2/1-2/28	(3)	28	220	80
Fry Rearing	3/1-3/31	(3)	31	220	80
	4/1-4/15	(4)	15	220	150
	4/16-4/30	(4)	15	220	150
Fry Rearing/Juvenile Rearing/	5/1-5/31		31	220	150
Outmigration	6/1-6/30	(5)	30	100	20
Oversummer	7/1-9/30		92	100	20
	Total Days		365		

NOTES:
(1) Due to changes in water conditions or to optimize fishery conditions, EBMUD may modify the above Flow Standards upon written concurrence of CDF&G and USFWS, provided the total quantity of water released for fishery purposes in Dry year types is not less than the quantity provided by this flow schedule.
(2) During October, EBMUD will maintain minimum flows of 220 cfs below Camanche Dam and 100 cfs below WID dam in Dry year types.
(3) During the period when WID dam boards are pulled out and Lodi Lake is empty (approximately Nov. 1 through March 31), EBMUD shall make minimum releases of 220 cfs from Camanche Dam in Dry year types. This release from Camanche dam is expected to provide at least 80 cfs below WID dam during this period. However, EBMUD shall not be obligated to increase releases above 220 cfs during this period in Dry year types.
(4) During April, EBMUD will maintain minimum flows of 220 cfs below Camanche Dam and 150 cfs below WID's dam in Dry year types.
(5) During June, outmigrating smolts will be trapped, tagged, and transported around the Delta in Dry year types.

Attachment 1

Critically Dry Year Flows
Mokelumne River Minimum Flow Schedule (1)

Life Stage	Period		Days	Agreed Release From Camanche Dam (cfs)	Expected Flow Below Woodbridge Dam (cfs)
Adult Immigration	10/1-10/15	(2)	15	100	15
Spawn/Incubation	10/16-10/31	(2)	16	130	75
	11/1-11/30	(3)	30	130	75
	12/1-12/31	(3)	31	130	75
Incubation/Alevin	1/1-1/31	(3)	31	130	75
	2/1-2/28	(3)	28	130	75
Fry Rearing	3/1-3/31	(3)	31	130	75
	4/1-4/15	(4)	15	130	75
	4/16-4/30	(4)	15	130	75
Fry Rearing/Juvenile Rearing/ Outmigration	5/1-5/31	(5)	31	100	15
	6/1-6/30	(5)	30	100	15
Oversummer	7/1-9/30		92	100	15
	Total Days		365		

NOTES:

(1) Due to changes in water conditions or to optimize fishery conditions, EBMUD may modify the above Flow Standards upon written concurrence of CDF&G and USFWS, provided the total quantity of water released for fishery purposes in Critically Dry year types is not less than the quantity provided by this flow schedule.

(2) During October, EBMUD will maintain minimum flows of 130 cfs below Camanche Dam, and will maintain minimum flows of . 15 cfs from Oct. 1 - 15 and 75 cfs from Oct. 16 - 31 below WID dam in Critially Dry year types.

(3) During the period when WID dam boards are pulled out and Lodi Lake is empty (approximately Nov. 1 through March 31), EBMUD shall make minimum releases of 130 cfs from Camanche Dam in Critically Dry year types. This release from Camanche dam is expected to provide 75 cfs below WID dam during this period. However, EBMUD shall not be obligated to increase releases above 130 cfs during this period in Critically-Dry year types.

(4) During April, EBMUD will maintain minimum flows of 130 cfs below Camanche Dam and 75 cfs below WID's dam in Critically Dry year types.

(5) During May and June outmigrating smolts will be trapped, tagged, and transported around the Delta in Critically Dry year types.

Attachment 1

WATER YEAR TYPE DETERMINATION

Year Type	Normal/Above	Below Normal	Dry	Critically Dry
Oct. - Mar. (1) (Pardee/Camanche Storage)	Max Allowable (2)	Max Allowable to 400 TAF	399 TAF to 270 TAF	269 TAF or Less
Apr. - Sep. (3) (Unimpaired runoff)	890 TAF or More	889 TAF to 500 TAF	499 TAF to 300 TAF	299 TAF or Less (4)

Notes:

(1) October through March minimum flows are determined by total Pardee and Camanche storage on November 5th. Year type storage limits are based on the capacities of Pardee and Camanche Reservoirs in 1995.

(2) Maximum allowable storage on November 5th, shall be determined in accordance with the Army Corps of Engineer's Water Control Manual for Camanche Dam and Reservoir dated September, 1981.

(3) April through September minimum flows are determined by the water year unimpaired runoff into Pardee Reservoir as forecasted by DWR in the April 1st Bulletin 120 Report except when combined Pardee/Camanche Nov. 5 storage is projected to be less than 200 TAF.

(4) April through September minimum flows shall be critically dry whenever Nov. 5 combined Pardee/Camanche storage is projected to be 200 TAF or less based on the runoff forecast in DWR bulletin 120, beginning April 1st.

Volume II
Appendix C

JSA Non-Flow Partnership Projects

Joint Settlement Agreement Partnership Fund Awarded Projects - since inception

As of 1/15/25

Award Date	Name of Project	Awardee	Type	$ Awarded	$ Expended
11/13/2000	2001-2002 Enhanced Enforcement	California Department of Fish and Game	Enforcement	15,000.00	15,000.00
11/13/2000	Riparian Area Enhancement & Restoration	San Joaquin County Resource Conservation District	Habitat Restoration	33,296.00	33,180.92
11/13/2000	Mokelumne / Cosumnes Feasibility Study	U.S. Army of Corps of Engineers, Sacramendo Area Flood Control Agency	Scientific Study	50,000.00	50,000.00
5/31/2001	Mokelumne River Wildife Enhancement Support ("Farm Edges" book)	EBMUD	Education, Awareness	761.53	761.53
5/31/2001	Mokelumne River Day Use Area Habitat Enhancement/Restoration	EBMUD	Habitat Restoration	34,720.00	29,539.95
5/31/2001	Distribution, Abundance & Habitat Association of Swainson's Hawks	San Joaquin County Resource Conservation District	Scientific Study	16,000.00	15,964.91
6/12/2002	Mokelumne River Enforcement - 2	California Department of Fish and Game	Enforcement	45,000.00	25,933.00
6/12/2002	LMR Spawning Gravel Enhancement-2002	EBMUD	Habitat Restoration	26,200.00	24,684.70
8/8/2003	LMR Spawning Gravel Enhancement-2003	EBMUD	Habitat Restoration	29,400.00	28,073.82
8/8/2003	LMR Spawning Gravel Enhancement-2004	EBMUD	Habitat Restoration	29,400.00	29,323.75
11/4/2003	LMR Watershed Coordinator Grant 2004-2006	San Joaquin County Resource Conservation District	Partnerships, Coordination	28,500.00	28,500.00
11/4/2003	All Beeler Awards	Lower Mokelumne River Watershed Stewardship Stakeholder's Committee	Partnerships, Coordination	1,926.61	2,730.05
4/29/2005	LMR Off-Channel Rearing Habitat Enhancement	EBMUD	Habitat Restoration	93,600.00	48,305.90
4/29/2005	2005-08 Gil Creek Riparian Enhancement (with SLEWS)	Al Dentone / Gil Creek Landowners	Habitat Restoration	11,191.00	3,017.86
4/29/2005	2005-09 Calvary Bible Church Riparian Enhancement	Calvary Bible Church	Habitat Restoration	21,408.00	9,205.08
4/29/2005	LMR Spawning Gravel Enhancement-2005-2007 (Pasternak)	EBMUD	Habitat Restoration	35,000.00	32,613.54
3/29/2006	Watershed Open House Sponsorship	San Joaquin County Resource Conservation District	Education, Awareness	500.00	500.00
3/29/2006	LMR Spawning Gravel Enhancement-2006-2010	EBMUD	Habitat Restoration	87,000.00	84,813.04
3/29/2006	Integrating Large Woody Materials into SHIRA for application on the Lower Mokelumne River	U.C. Davis	Scientific Study	25,663.00	25,663.00
9/5/2006	2006-07 Hoffman Property Riparian Enhancement (SLEWS)	Center for Land-Based Learning	Restoration / Education	14,988.00	9,377.55
5/2/2007	2007 Murphy Creek Himalayan Blackberry Removal	Murphy Creek Landowners Group	Habitat Restoration	47,212.00	43,510.11
5/2/2007	Watershed Coordinator 2008-10	San Joaquin County Resource Conservation District	Partnerships, Coordination	30,000.00	30,000.00
5/2/2007	Continuing Education, Outreach, Restoration and Monitoring in the Lower Mokelumne River Watershed (2007 CalFed cash match)	San Joaquin County Resource Conservation District	Restoration / Education	60,000.00	55,990.75
10/11/2007	Steelhead Acoustic Telemetry Study (2007)	EBMUD	Scientific Study	35,000.00	32,702.13
11/4/2008	Steelhead Acoustic Telemetry Study 2 (2008 - 2009(	EBMUD	Scientific Study	45,000.00	42,137.89
11/4/2008	River Parkway Grant 2008 (EBMUD cash match)	EBMUD		42,532.00	cancelled
4/22/2009	Riparian Replacement Mokelumne River Day Use Area (2009)	EBMUD	Habitat Restoration	1,635.00	1,630.97
4/29/2009	LMRWSP 501(c)(3)	Lower Mokelumne River Watershed Stewardship Stakeholder's Committee		2,000.00	cancelled
4/8/2010	JSAT Acoustic Telemetry Study (2010-2011)	EBMUD	Scientific Study	35,000.00	34,730.65
8/24/2010	Lower Mokelumne River Cleanup Supplies (2010)	EBMUD	Education, Awareness	2,000.00	1,996.03
10/21/2010	SHIRA Gravel Design (2011) (Pasternak)	U.C. Davis	Habitat Restoration	27,390.00	27,389.73
4/18/2011	Arundo Removal	Hoffman farms	Habitat Restoration	750.00	708.75
10/4/2011	Watershed Stewards - City of Lodi	City of Lodi	Education, Awareness	4,050.00	3,958.55
12/8/2011	Vino Farms Ranch 5 habitat restoration 2011 (SLEWS involvement)	Vino Farms	Habitat Restoration	1,225.00	1,225.00
4/12/2012	SJCRCD Watershed Coordinator 2012-2014	San Joaquin County Resource Conservation District	Partnerships, Coordination	30,000.00	27,318.55
9/19/2012	Lodi Watershed Education Legacy	City of Lodi	Education, Awareness	5,000.00	4,836.86
11/15/2012	Heritage Oak Winery restore	Heritage Oak Winery		42,001.41	cancelled
4/16/2013	Salmon workshop and tour (Sandhill Crane Festival 2013)	EBMUD	Education, Awareness	2,500.00	2,500.00
10/24/2013	Lodi Watershed Education Legacy 2013	City of Lodi	Education, Awareness	7,150.00	7,150.00
5/21/2014	Great Sierra River Cleanup 2014	EBMUD	Education, Awareness	3,000.00	2,438.01
8/19/2014	Jahant Slough Restoration (SLEWS involvement)	Lange Twins Farm	Habitat Restoration	5,000.00	5,000.00
11/3/2014	Lodi Watershed Education Legacy 2014/15	City of Lodi	Education, Awareness	15,000.00	15,000.00
11/3/2014	Cramer spawn/rear habitat 2015	Cramer Fish Sciences	Scientific Study	59,097.00	34,097.00
10/12/2016	Lodi Watershed Education Legacy 2016/17	City of Lodi	Education, Awareness	7,975.00	7,836.22
9/6/2017	Upper Moke Salmonid Habitat Assessment 2017	Foothill Conservancy	Scientific Study	35,105.00	35,105.00
10/10/2017	Lodi Watershed Education Legacy 2017/18	City of Lodi	Education, Awareness	9,576.00	9,575.50
9/11/2018	Lodi Watershed Education Legacy 2018/19	City of Lodi	Education, Awareness	6,900.00	6,148.22
1/14/2020	Lodi Watershed Education Legacy 2019/20	City of Lodi	Education, Awareness	5,450.00	5,445.00
5/13/2020	Life-Cycle Assessment	Cramer Fish Sciences	Scientific Study	89,316.00	89,183.50
10/27/2020	Lodi Watershed Education Legacy 2020/21	City of Lodi	Education, Awareness	7,040.00	4,950.00
1/31/2022	Lodi Watershed Education Legacy 2021/22	City of Lodi	Education, Awareness	6,930.00	6,930.00
3/3/2022	Hatchery steelhead genetics	U.C. Santa Cruz / National Marine Fisheries Service, Southwest Fisheries Science Center	Scientific Study	99,658.00	in progress
2/7/2023	Native Grasslands Restoration	Lange Twins Farm	Habitat Restoration	51,000.00	51,000.00
2/10/2023	Lodi Watershed Education Legacy 2022/23	City of Lodi	Education, Awareness	6,050.00	4,725.36
12/8/2023	Lodi Watershed Education Legacy 2023/24	City of Lodi	Education, Awareness	8,800.00	in progress
8/9/2024	SLEWS Kramer property in Clements, CA	Center for Land-Based Learning	Habitat Restoration	45,000.00	in progress
			Total awarded	**1,480,896.55**	**1,092,408.38**

Total Number of Projects Awarded 56
Awarded Projects less cancelled Projects 53

Row Labels	Sum of $ spent	Number of Proj
Education, Awareness	84,751	17
Enforcement	40,933	2
Habitat Restoration	453,223	18
Partnerships, Coordination	88,549	4
Restoration / Education	65,368	2
Scientific Study	359,584	10
Grand Total	**1,092,408**	**53**

Excludes (3) cancelled Projects.

Volume II

Appendix D

FERC License Articles 1-32

Project 2916

Form L-2
(Revised October, 1975)

FEDERAL POWER COMMISSION

TERMS AND CONDITIONS OF LICENSE FOR
UNCONSTRUCTED MAJOR PROJECT
AFFECTING LANDS OF THE UNITED STATES

Article 1. The entire project, as described in this order of the Commission, shall be subject to all of the provisions, terms, and conditions of the license.

Article 2. No substantial change shall be made in the maps, plans, specifications, and statements described and designated as exhibits and approved by the Commission in its order as a part of the license until such change shall have been approved by the Commission: Provided, however, That if the Licensee or the Commission deems it necessary or desirable that said approved exhibits, or any of them, be changed, there shall be submitted to the Commission for approval a revised, or additional exhibit or exhibits covering the proposed changes which, upon approval by the Commission, shall become a part of the license and shall supersede, in whole or in part, such exhibit or exhibits theretofore made a part of the license as may be specified by the Commission.

Article 3. The project works shall be constructed in substantial conformity with the approved exhibits referred to in Article 2 herein or as changed in accordance with the provisions of said article. Except when emergency shall require for the protection of navigation, life, health, or property, there shall not be made without prior approval of the Commission any substantial alteration or addition not in conformity with the approved plans to any dam or other project works under the license or any substantial use of project lands and waters not authorized herein; and any emergency alteration, addition, or use so made shall thereafter be subject to such modification and change as the Commission may direct. Minor changes in project works, or in uses of project lands and waters, or divergence from such approved exhibits may be made if such changes will not result in a decrease in efficiency, in a material increase in cost, in an adverse environmental impact, or in impairment of the general scheme of development; but any of such minor changes made without the prior approval of the Commission, which in its judgment have produced or will produce any of such results, shall be subject to such alteration as the Commission may direct.

Project 2916

Upon the completion of the project, or at such other time as the Commission may direct, the Licensee shall submit to the Commission for approval revised exhibits insofar as necessary to show any divergence from or variations in the project area and project boundary as finally located or in the project works as actually constructed when compared with the area and boundary shown and the works described in the license or in the exhibits approved by the Commission, together with a statement in writing setting forth the reasons which in the opinion of the Licensee necessitated or justified variation in or divergence from the approved exhibits. Such revised exhibits shall, if and when approved by the Commission, be made a part of the license under the provisions of Article 2 hereof.

Article 4. The construction, operation, and maintenance of the project and any work incidental to additions or alterations shall be subject to the inspection and supervision of the Regional Engineer, Federal Power Commission, in the region wherein the project is located, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall cooperate fully with said representative and shall furnish him a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of the project and for any subsequent alterations to the project. Construction of the project works or any feature or alteration thereof shall not be initiated until the program of inspection for the project works or any such feature thereof has been approved by said representative. The Licensee shall also furnish to said representative such further information as he may require concerning the construction, operation, and maintenance of the project, and of any alteration thereof, and shall notify him of the date upon which work will begin, as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall allow said representative and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties. The Licensee shall comply with such rules and regulations of general or special applicability as the Commission may prescribe from time to time for the protection of life, health, or property.

Article 5. The Licensee, within five years from the date of issuance of the license, shall acquire title in fee or the right to use in perpetuity all lands, other than lands of the United States, necessary or appropriate for the construction, maintenance, and operation of the project. The Licensee or its successors and assigns shall, during the period of the license, retain the possession of all project property covered by the license as issued or as later amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and none of such properties shall be voluntarily sold, leased, transferred, abandoned, or otherwise disposed of without the prior written approval of the Commission, except that the Licensee may lease or otherwise dispose of interests in project lands or property without specific written approval of the Commission pursuant to the then current regulations of the Commission. The provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear; and mortgage or trust deeds or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article.

Article 6. In the event the project is taken over by the United States upon the termination of the license as provided in Section 14 of the Federal Power Act, or is transferred to a new licensee or to a non-power licensee under the provisions of Section 15 of said Act, the Licensee, its successors and assigns shall be responsible for, and shall make good any defect of title to, or of right of occupancy and use in, any of such project property that is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and shall pay and discharge, or shall assume responsibility for payment and discharge of, all liens or encumbrances upon the project or project property created by the Licensee or created or incurred after the issuance of the license: Provided, That the provisions of this article are not intended to require the Licensee, for the purpose of transferring the project to the United States or to a new licensee, to acquire any different title to, or right of occupancy and use in, any of such project property than was necessary to acquire for its own purposes as the Licensee.

Article 7. The actual legitimate original cost of the project, and of any addition thereto or betterment thereof, shall be determined by the Commission in accordance with the Federal Power Act and the Commission's Rules and Regulations thereunder.

Article 8. The Licensee shall install and thereafter maintain gages and stream-gaging stations for the purpose of determining the stage and flow of the stream or streams on which the project is located, the amount of water held in and withdrawn from storage, and the effective head on the turbines; shall provide for the required reading of such gages and for the adequate rating of such stations; and shall install and maintain standard meters adequate for the determination of the amount of electric energy generated by the project works. The number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission or its authorized representative. The Commission reserves the right, after notice and opportunity for hearing, to require such alterations in the number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, as are necessary to secure adequate determinations. The installation of gages, the rating of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of the project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision, or cooperation for such periods as may be mutually agreed upon. The Licensee shall keep accurate and sufficient records of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as the Commission may prescribe.

Article 9. The Licensee shall, after notice and opportunity for hearing, install additional capacity or make other changes in the project as directed by the Commission, to the extent that it is economically sound and in the public interest to do so.

Article 10. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other projects or power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 11. Whenever the Licensee is directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of the headwater improvement for such part of the annual charges for interest, maintenance, and depreciation thereof as the Commission shall determine to be equitable, and shall pay to the United States the cost of making such determination as fixed by the Commission. For benefits provided by a storage reservoir or other headwater improvement of the United States, the Licensee shall pay to the Commission the amounts for which it is billed from time to time for such headwater benefits and for the cost of making the determinations pursuant to the then current regulations of the Commission under the Federal Power Act.

Article 12. The operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes, and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Commission may prescribe for the purposes hereinbefore mentioned.

Article 13. On the application of any person, association, corporation, Federal agency, State or municipality, the Licensee shall permit such reasonable use of its reservoir or other project properties, including works, lands and water rights, or parts thereof, as may be ordered by the Commission, after notice and opportunity

for hearing, in the interests of comprehensive development of the waterway or waterways involved and the conservation and utilization of the water resources of the region for water supply or for the purposes of steam-electric, irrigation, industrial, municipal or similar uses. The Licensee shall receive reasonable compensation for use of its reservoir or other project properties or parts thereof for such purposes, to include at least full reimbursement for any damages or expenses which the joint use causes the Licensee to incur. Any such compensation shall be fixed by the Commission either by approval of an agreement between the Licensee and the party or parties benefiting or after notice and opportunity for hearing. Applications shall contain information in sufficient detail to afford a full understanding of the proposed use, including satisfactory evidence that the applicant possesses necessary water rights pursuant to applicable State law, or a showing of cause why such evidence cannot concurrently be submitted, and a statement as to the relationship of the proposed use to any State or municipal plans or orders which may have been adopted with respect to the use of such waters.

Article 14. In the construction or maintenance of the project works, the Licensee shall place and maintain suitable structures and devices to reduce to a reasonable degree the liability of contact between its transmission lines and telegraph, telephone and other signal wires or power transmission lines constructed prior to its transmission lines and not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling or obstructing traffic or endangering life. None of the provisions of this article are intended to relieve the Licensee from any responsibility or requirement which may be imposed by any other lawful authority for avoiding or eliminating inductive interference.

Article 15. The Licensee shall, for the conservation and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance, and operation of such reasonable facilities, and comply with such reasonable modifications of the project structures and operation, as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing.

Article 16. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of the Licensee's lands and interests in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be reasonably prescribed by the Commission in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 17. The Licensee shall construct, maintain, and operate, or shall arrange for the construction, maintenance, and operation of such reasonable recreational facilities, including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities, and utilities, giving consideration to the needs of the physically handicapped, and shall comply with such reasonable modifications of the project, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal or State agencies, after notice and opportunity for hearing.

Article 18. So far as is consistent with proper operation of the project, the Licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and for outdoor recreational purposes, including fishing and hunting: Provided, That the Licensee may reserve from public access such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property.

Article 19. In the construction, maintenance, or operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion on lands adjacent to streams or other waters, stream sedimentation, and any form of water or air pollution. The Commission, upon request or upon its own motion, may order the Licensee to take such measures as the Commission finds to be necessary for these purposes, after notice and opportunity for hearing.

Article 20. The Licensee shall consult with the appropriate State and Federal agencies and, within one year of the date of issuance of this license, shall submit for Commission approval a plan for clearing the reservoir area. Further, the Licensee shall clear and keep clear to an adequate width lands along open conduits and shall dispose of all temporary structures, unused timber, brush, refuse, or other material unnecessary for the purposes of the project which results from the clearing of lands or from the maintenance or alteration of the project works. In addition, all trees along the periphery of project reservoirs which may die during operations of the project shall be removed. Upon approval of the clearing plan all clearing of the lands and disposal of the unnecessary material shall be done with due diligence and to the satisfaction of the authorized representative of the Commission and in accordance with appropriate Federal, State, and local statutes and regulations.

Article 21. Timber on lands of the United States cut, used, or destroyed in the construction and maintenance of the project works, or in the clearing of said lands, shall be paid for, and the resulting slash and debris disposed of, in accordance with the requirements of the agency of the United States having jurisdiction over said lands. Payment for merchantable timber shall be at current stumpage rates, and payment for young growth timber below merchantable size shall be at current damage appraisal values. However, the agency of the United States having jurisdiction may sell or dispose of the merchantable timber to others than the Licensee: Provided, That timber so sold or disposed of shall be cut and removed from the area prior to, or without undue interference with, clearing operations of the Licensee and in coordination with the Licensee's project construction schedules. Such sale or disposal to others shall not relieve the Licensee of responsibility for the clearing and disposal of all slash and debris from project lands.

Article 22. The Licensee shall do everything reasonably within its power, and shall require its employees, contractors, and employees of contractors to do everything reasonably within their power, both independently and upon the request of officers of the agency concerned, to prevent, to make advance preparations for suppression of, and to suppress fires on the lands to be occupied or used under the license. The Licensee shall be liable for and shall pay the costs incurred by the United States in suppressing fires caused from the construction, operation, or maintenance of the project works or of the works appurtenant or accessory thereto under the license.

Article 23. The Licensee shall interpose no objection to, and shall in no way prevent, the use by the agency of the United States having jurisdiction over the lands of the United States affected, or by persons or corporations occupying lands of the United States under permit, of water for fire suppression from any stream, conduit, or body of water, natural or artificial, used by the Licensee in the operation of the project works covered by the license, or the use by said parties of water for sanitary and domestic purposes from any stream, conduit, or body of water, natural or artificial, used by the Licensee in the operation of the project works covered by the license.

Article 24. The Licensee shall be liable for injury to, or destruction of, any buildings, bridges, roads, trails, lands, or other property of the United States, occasioned by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. Arrangements to meet such liability, either by compensation for such injury or destruction, or by reconstruction or repair of damaged property, or otherwise, shall be made with the appropriate department or agency of the United States.

Article 25. The Licensee shall allow any agency of the United States, without charge, to construct or permit to be constructed on, through, and across those project lands which are lands of the United States such conduits, chutes, ditches, railroads, roads, trails, telephone and power lines, and other routes or means of transportation and communication as are not inconsistent with the enjoyment

of said lands by the Licensee for the purposes of the license. This license shall not be construed as conferring upon the Licensee any right of use, occupancy, or enjoyment of the lands of the United States other than for the construction, operation, and maintenance of the project as stated in the license.

Article 26. In the construction and maintenance of the project, the location and standards of roads and trails on lands of the United States and other uses of lands of the United States, including the location and condition of quarries, borrow pits, and spoil disposal areas, shall be subject to the approval of the department or agency of the United States having supervision over the lands involved.

Article 27. The Licensee shall make provision, or shall bear the reasonable cost, as determined by the agency of the United States affected, of making provision for avoiding inductive interference between any project transmission line or other project facility constructed, operated, or maintained under the license, and any radio installation, telephone line, or other communication facility installed or constructed before or after construction of such project transmission line or other project facility and owned, operated, or used by such agency of the United States in administering the lands under its jurisdiction.

Article 28. The Licensee shall make use of the Commission s guidelines and other recognized guidelines for treatment of transmission line rights-of-way, and shall clear such portions of transmission line rights-of-way across lands of the United States as are designated by the officer of the United States in charge of the lands; shall keep the areas so designated clear of new growth, all refuse, and inflammable material to the satisfaction of such officer; shall trim all branches of trees in contact with or liable to contact the transmission lines; shall cut and remove all dead or leaning trees which might fall in contact with the transmission lines; and shall take such other precautions against fire as may be required by such officer. No fires for the burning of waste material shall be set except with the prior written consent of the officer of the United States in charge of the lands as to time and place.

Article 29. The Licensee shall cooperate with the United States in the disposal by the United States, under the Act of July 31, 1947, 61 Stat. 681, as amended (30 U.S.C. sec. 601, et seq.), of mineral and vegetative materials from lands of the United States occupied by the project or any part thereof: Provided, That such disposal has been authorized by the Commission and that it does not unreasonably interfere with the occupancy of such lands by the Licensee for the purposes of the license: Provided further, That in the event of disagreement, any question of unreasonable interference shall be determined by the Commission after notice and opportunity for hearing.

Article 30. If the Licensee shall cause or suffer essential project property to be removed or destroyed or to become unfit for use, without adequate replacement, or shall abandon or discontinue good faith operation of the project or refuse or neglect to comply with the terms of the license and the lawful orders of the Commission mailed to the record address of the Licensee or its agent, the Commission will deem it to be the intent of the Licensee to surrender the license. The Commission, after notice and opportunity for hearing, may require the Licensee to remove any or all structures, equipment and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the United States agency having jurisdiction over its lands or the Commission's authorized representative, as appropriate, or to provide for the continued operation and maintenance of nonpower facilities and fulfill such other obligations under the license as the Commission may prescribe. In addition, the Commission in its discretion, after notice and opportunity for hearing, may also agree to the surrender of the license when the Commission, for the reasons recited herein, deems it to be the intent of the Licensee to surrender the license.

Article 31. The right of the Licensee and of its successors and assigns to use or occupy waters over which the United States has jurisdiction, or lands of the United States under the license, for the purpose of maintaining the project works or otherwise, shall absolutely cease at the end of the license period, unless the Licensee has obtained a new license pursuant to the then existing laws and regulations, or an annual license under the terms and conditions of this license.

Article 32. The terms and conditions expressly set forth in the license shall not be construed as impairing any terms and conditions of the Federal Power Act which are not expressly set forth herein.

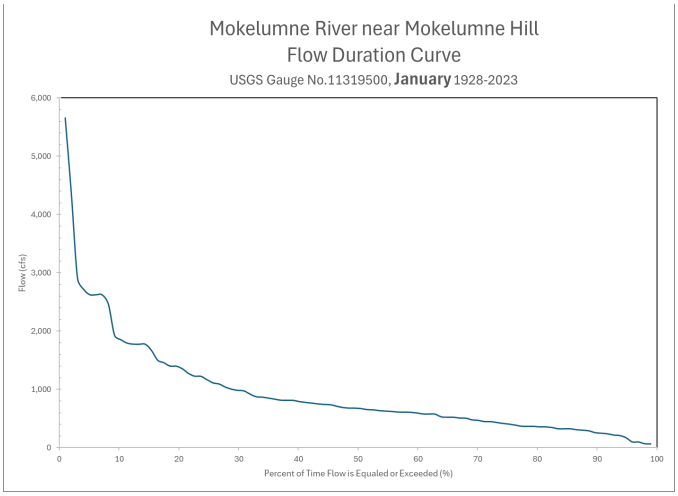
Volume II
Appendix E

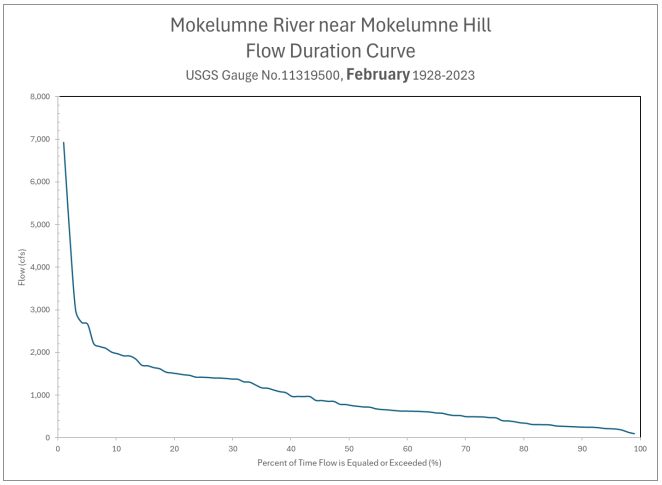
Flow Duration Curves:

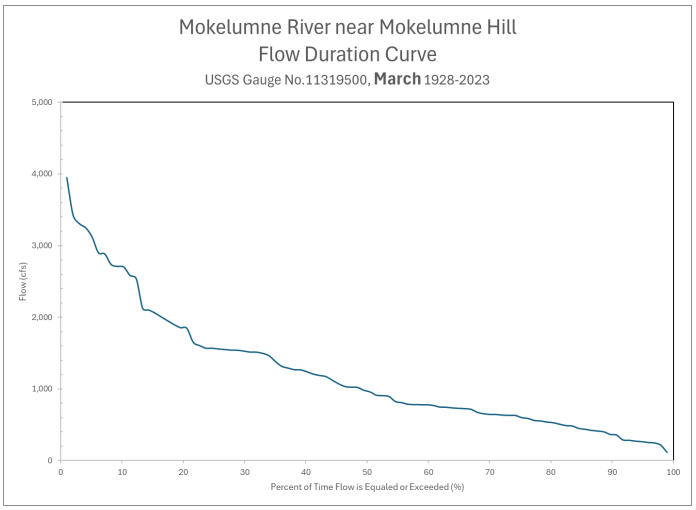
Mokelumne River near Mokelumne Hill

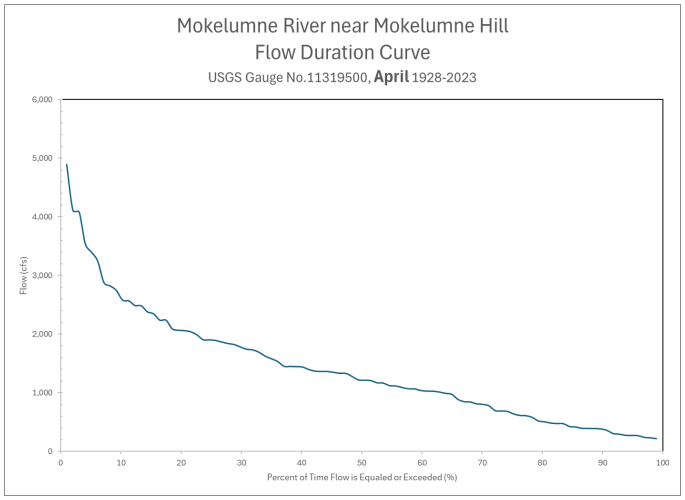
Mokelumne River below Camanche Dam

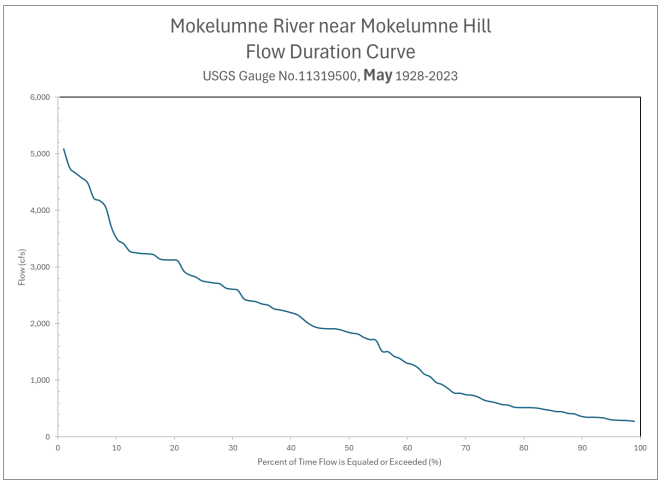
Mokelumne River near Mokelumne Hill

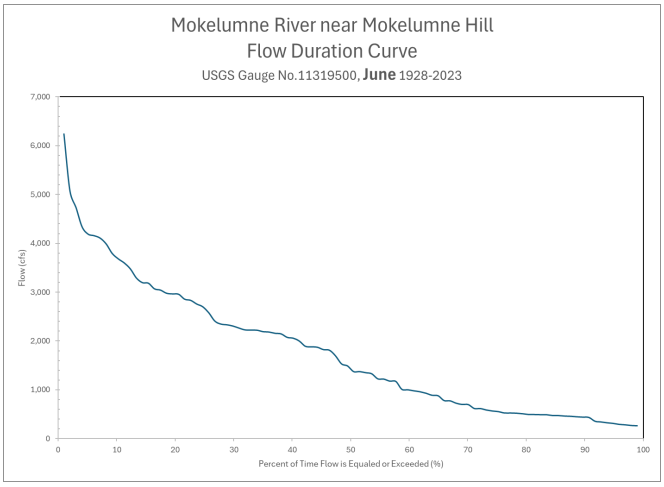


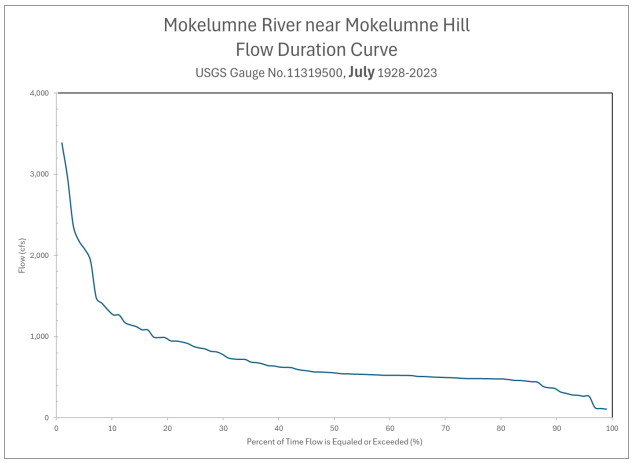


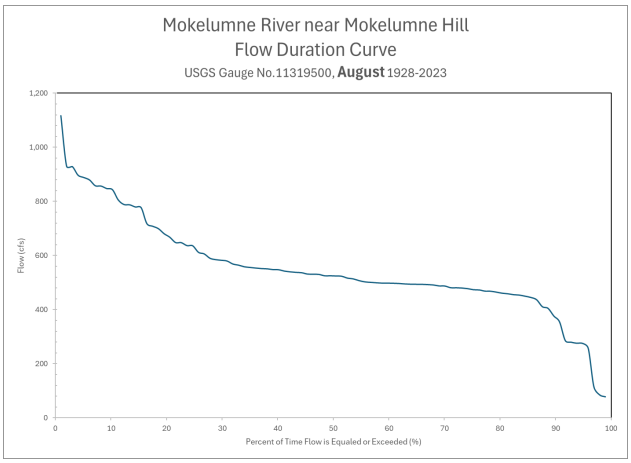


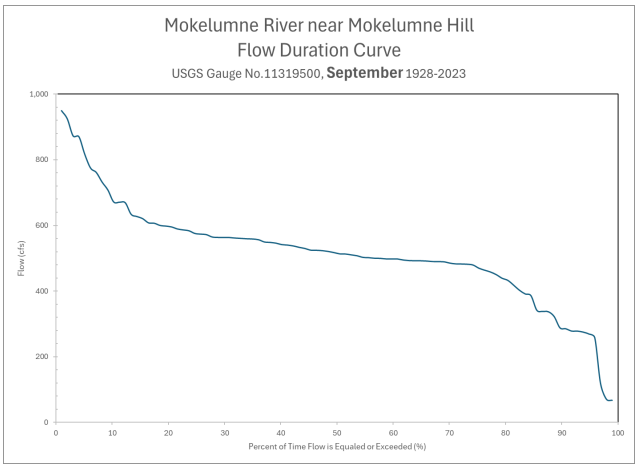


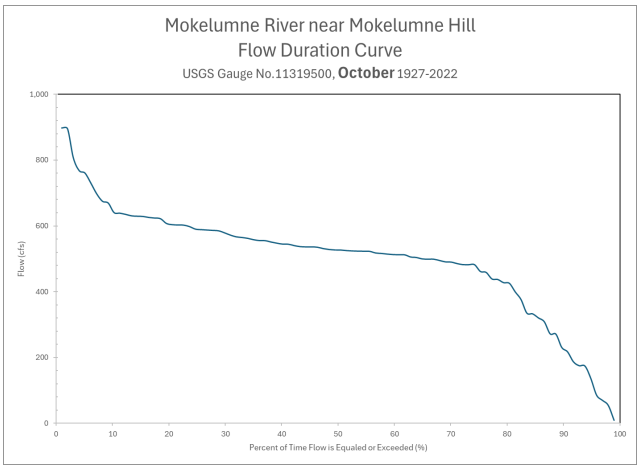

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, May 1928-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)

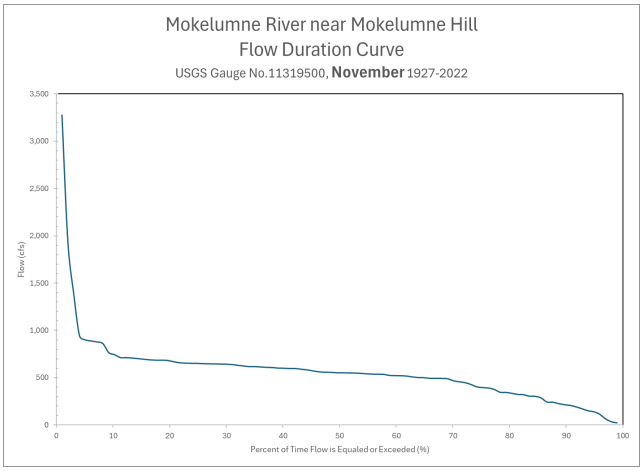

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, June 1928-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)

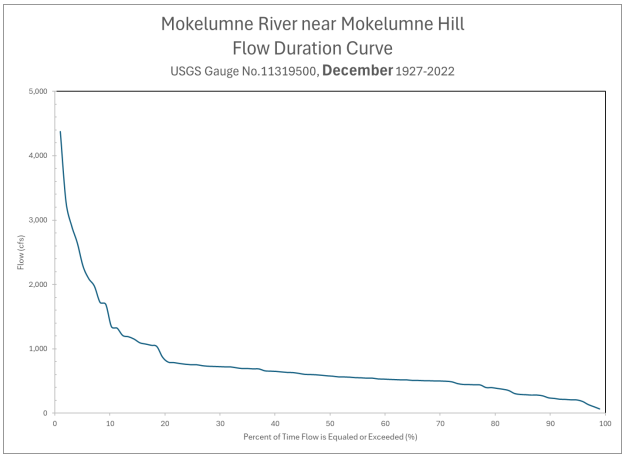

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, July 1928-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)


Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, August 1928-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)

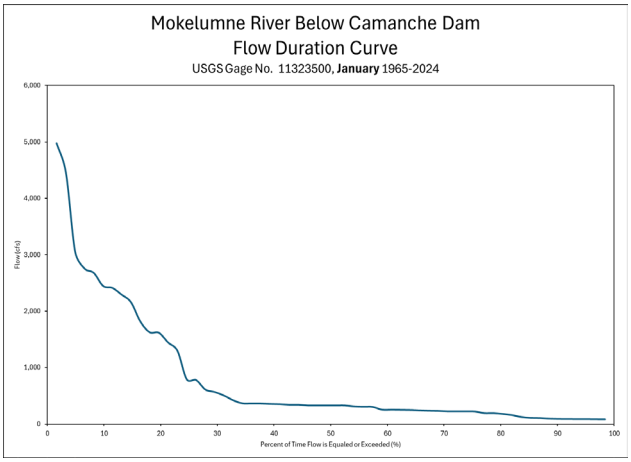

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, September 1928-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)

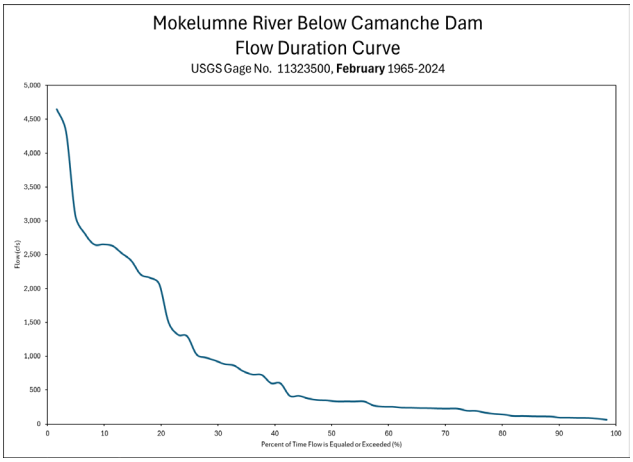

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, October 1927-2022
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)

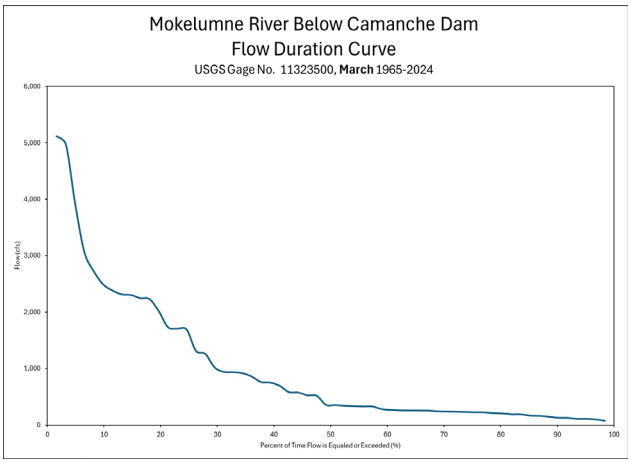

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, November 1927-2022
Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Flow is Equaled or Exceeded (%)

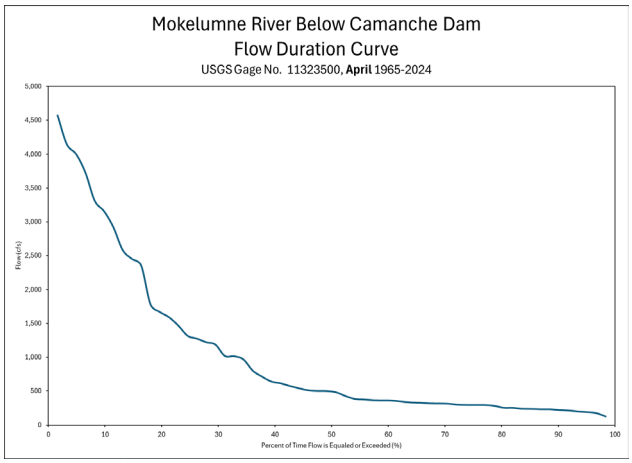

Mokelumne River near Mokelumne Hill
Flow Duration Curve
USGS Gauge No.11319500, December 1927-2022
Flow (cfs)
5,000
4,000
3,000
2,000
1,000
0
0
10
20
30
40
50
60
70
80
90
100
Percent of Time Flow is Equaled or Exceeded (%)

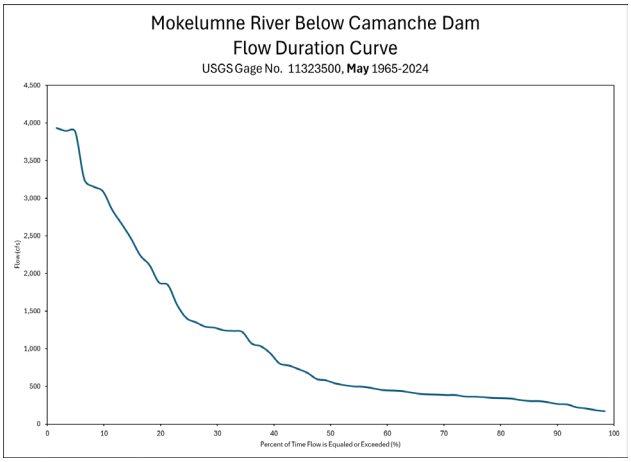
Mokelumne River below Camanche Dam

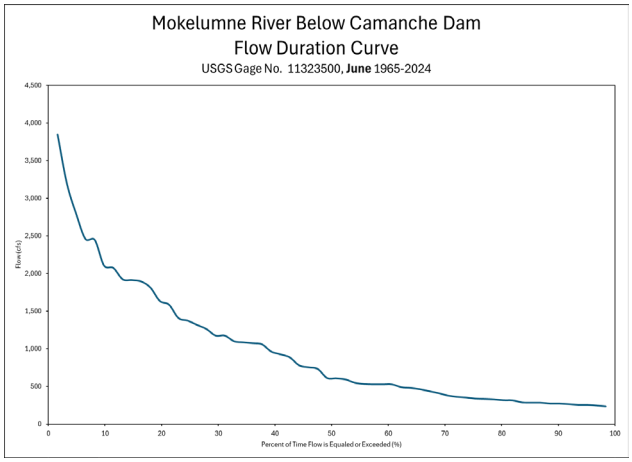


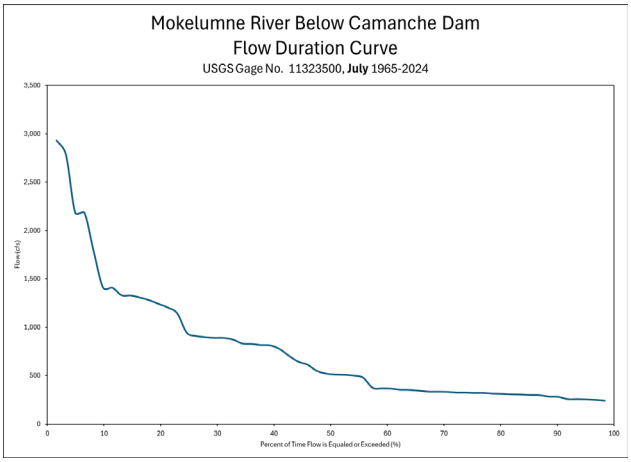


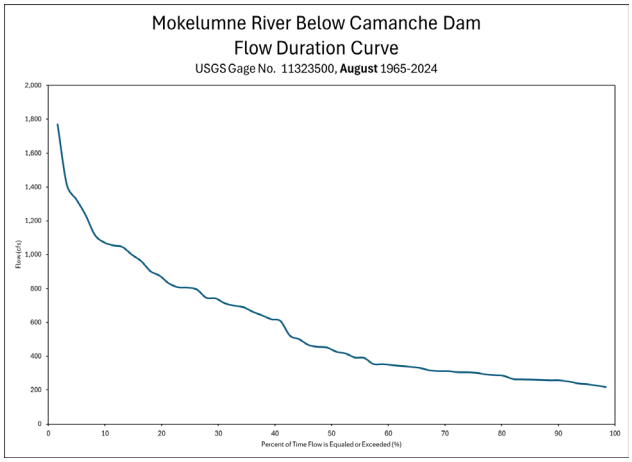


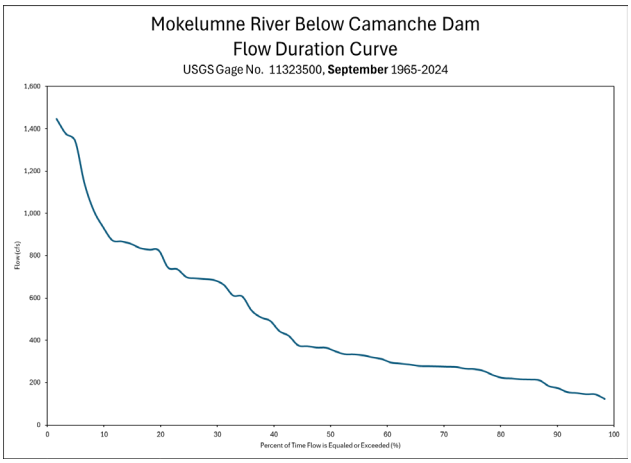


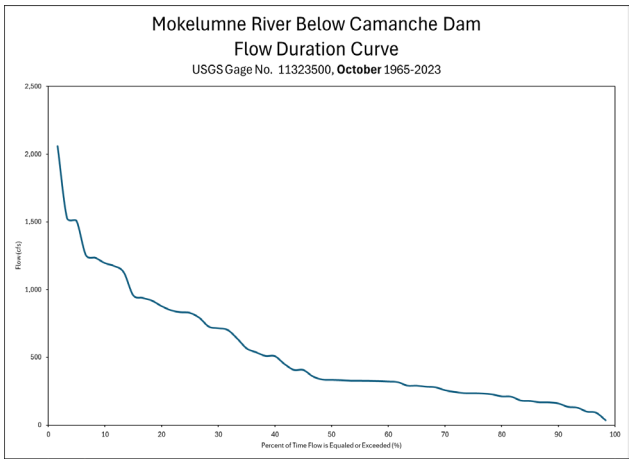


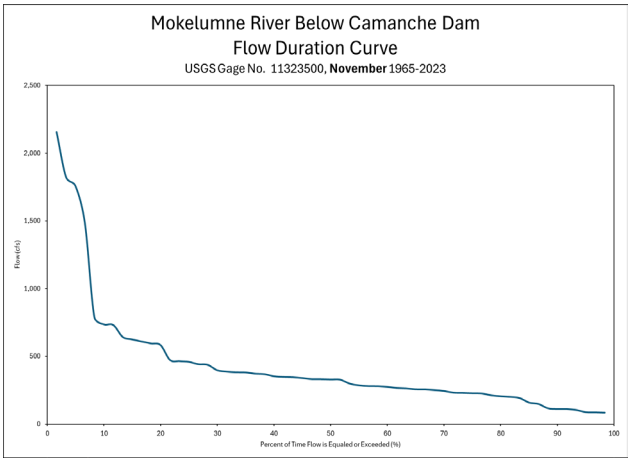


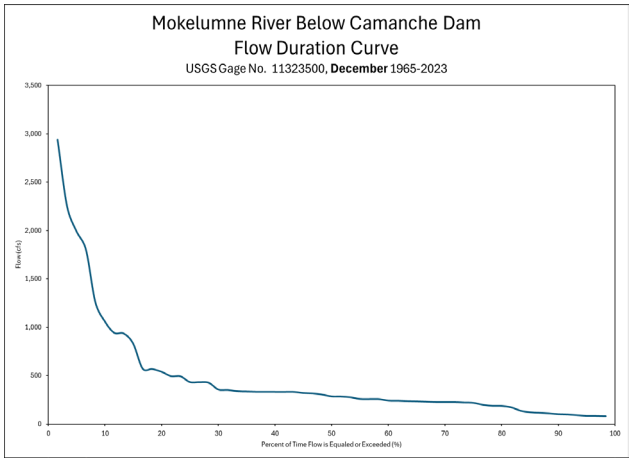

Mokelumne River Below Camanche Dam
Flow Duration Curve
USGS Gage No. 11323500, **July** 1965-2024
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)


Mokelumne River Below Camanche Dam
Flow Duration Curve
USGS Gage No. 11323500, **August** 1965-2024
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)


Mokelumne River Below Camanche Dam
Flow Duration Curve
USGS Gage No. 11323500, **September** 1965-2024
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)


Mokelumne River Below Camanche Dam
Flow Duration Curve
USGS Gage No. 11323500, **October** 1965-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)


Mokelumne River Below Camanche Dam
Flow Duration Curve
USGS Gage No. 11323500, **November** 1965-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)


Mokelumne River Below Camanche Dam
Flow Duration Curve
USGS Gage No. 11323500, **December** 1965-2023
Flow (cfs)
Percent of Time Flow is Equaled or Exceeded (%)

Appendix F

Water Quality Data

Table F-1. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PADA, 1998-2010.

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.06	7.19	7.15	7.13	7.07	6.91	6.90	7.03	6.87	7.00	7.09	7.02	7.35	6.96
		Maximum	7.95	7.66	7.60	7.90	7.40	7.52	7.50	7.30	7.58	7.52	7.31	7.50	7.89	7.05
		Minimum	6.84	6.96	6.95	6.82	6.80	6.16	6.75	6.93	6.70	6.80	6.71	6.84	7.15	6.92
	WSE (ft)	Average	558.45	550.40	556.13	561.89	552.08	556.96	555.34	554.72	558.25	560.96	551.74	556.49	554.52	551.75
		Maximum	558.58	550.40	561.56	565.66	554.35	559.83	556.76	559.13	561.50	567.24	553.83	558.42	555.26	551.75
		Minimum	558.25	550.40	551.67	554.61	550.97	553.14	553.91	552.41	555.12	554.61	549.96	554.80	553.32	551.75
	Temp. (°C)	Average	8.33	8.97	8.15	9.67	9.29	9.25	9.15	9.02	9.00	8.41	8.46	8.87	9.12	9.00
		Maximum	17.05	12.38	10.45	12.67	11.54	13.28	12.67	11.60	14.49	11.80	10.73	12.79	10.93	10.76
		Minimum	6.08	7.56	7.01	8.45	7.93	6.21	7.84	7.58	7.46	6.78	7.10	7.88	7.90	8.49
	DO (mg/L)	Average	10.64	10.89	10.65	10.03	9.79	10.00	9.82	10.27	10.22	10.59	10.75	10.44	10.44	10.73
		Maximum	11.49	11.75	11.20	11.01	10.96	12.41	10.80	11.18	11.05	11.43	11.55	11.77	11.50	11.34
		Minimum	9.82	10.44	10.05	9.22	8.68	6.07	8.53	9.57	9.49	9.62	10.07	9.28	9.21	10.52
	Cond. (µS/cm)	Average	36.60	46.54	37.27	36.87	36.60	40.00	30.17	33.53	37.89	36.63	34.56	44.83	37.07	36.38
		Maximum	40.00	60.00	50.00	50.00	50.00	70.00	40.00	50.00	40.00	40.00	40.00	50.00	41.00	38.00
		Minimum	30.00	40.00	30.00	30.00	30.00	30.00	20.00	30.00	30.00	30.00	30.00	40.00	32.00	31.00
Spring	pH	Average	6.89	7.19	7.47	7.28	7.23	7.14	7.19	7.20	7.06	7.22	7.39	6.99	7.30	7.18
		Maximum	7.52	7.75	8.35	8.53	8.38	8.14	8.31	8.35	8.13	8.44	7.90	8.20	7.99	7.87
		Minimum	6.47	6.78	7.00	6.59	6.47	6.53	6.65	6.49	6.49	6.96	6.82	6.26	6.96	6.76
	WSE (ft)	Average	558.40	568.21	557.19	565.48	563.07	560.30	564.55	559.22	562.72	568.01	562.78	560.01	562.43	559.47
		Maximum	559.33	568.23	565.81	567.53	566.37	563.89	568.54	561.53	564.96	568.04	564.25	564.43	566.23	565.90
		Minimum	557.28	568.18	550.36	561.56	554.80	556.54	558.75	556.72	561.27	567.98	560.68	556.87	558.44	554.18
	Temp. (°C)	Average	10.96	10.56	12.55	12.67	12.20	11.90	13.01	12.04	11.26	10.91	11.34	11.42	11.30	10.61
		Maximum	20.45	18.32	21.74	24.37	24.59	23.97	25.15	21.18	22.69	24.04	20.69	24.07	21.27	19.57
		Minimum	7.60	8.27	7.62	8.83	8.13	7.74	8.29	7.90	8.22	8.89	7.69	8.29	8.52	8.77
	DO (mg/L)	Average	10.02	10.48	9.93	9.63	9.67	9.75	9.47	9.89	9.95	10.06	10.05	9.46	9.98	10.34
		Maximum	10.37	11.08	11.17	11.38	11.42	11.87	10.96	11.74	11.64	11.52	12.17	10.96	11.28	11.22
		Minimum	9.68	9.71	8.60	8.50	7.59	8.38	8.55	8.72	6.36	9.25	8.92	8.03	8.82	9.61
	Cond. (µS/cm)	Average	38.64	47.50	39.61	40.14	43.01	40.90	35.38	37.01	38.91	42.05	41.59	49.96	33.90	41.53
		Maximum	40.00	60.00	50.00	50.00	60.00	150.00	40.00	40.00	50.00	50.00	50.00	58.00	39.00	48.00

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum	30.00	40.00	20.00	20.00	30.00	30.00	20.00	30.00	30.00	30.00	37.00	38.00	24.00	34.00
Summer	pH	Average	6.86	6.96	7.33	7.09	7.09	6.96	6.95	6.93	7.26	6.99	7.00	7.16	7.06	7.33
		Maximum	7.66	7.62	8.19	8.52	8.81	7.95	8.49	7.80	9.01	8.12	8.54	8.21	7.44	7.88
		Minimum	6.25	6.33	6.44	6.32	6.26	6.10	6.23	6.29	6.49	6.51	6.49	6.82	6.74	7.02
	WSE (ft)	Average	566.63	566.74	566.42	565.38	566.43	564.35	565.77	565.98	565.78	566.16	564.20	559.35	564.20	567.19
		Maximum	566.91	567.18	567.29	565.98	567.32	565.36	566.63	566.58	566.55	566.89	566.64	564.17	565.19	568.01
		Minimum	566.09	565.84	565.67	564.16	565.55	563.42	564.72	565.39	564.19	565.79	559.70	556.23	563.31	566.62
	Temp. (°C)	Average	16.60	17.19	17.29	17.49	15.98	16.45	17.09	16.89	17.41	15.83	12.76	12.67	17.02	14.72
		Maximum	26.51	27.71	26.14	26.45	26.50	26.41	27.88	25.88	27.66	28.22	26.73	27.43	26.81	25.16
		Minimum	11.29	12.36	12.79	11.98	9.22	8.97	11.27	9.48	12.39	11.89	8.31	8.96	11.44	11.34
	DO (mg/L)	Average	8.17	8.95	8.61	7.84	8.40	8.33	8.14	7.31	8.54	8.19	7.81	8.04	8.86	9.66
		Maximum	10.35	10.24	11.70	10.75	11.12	10.79	10.48	8.81	11.55	10.40	10.37	9.96	10.52	11.49
		Minimum	5.36	7.81	5.24	4.49	6.18	5.99	5.06	6.35	6.45	5.29	6.07	6.61	7.60	8.72
	Cond. (µS/cm)	Average	35.00	23.10	27.60	31.37	41.20	35.32	30.31	33.08	27.12	23.43	38.83	51.29	27.16	38.07
		Maximum	50.00	30.00	40.00	40.00	100.00	50.00	50.00	40.00	40.00	30.00	50.00	60.00	30.00	44.00
		Minimum	30.00	20.00	20.00	20.00	30.00	20.00	20.00	20.00	20.00	20.00	30.00	32.00	24.00	30.00
Fall/Early Winter	pH	Average	6.86	6.95	6.92	6.90	6.69	6.70	6.72	6.66	6.84	6.80	6.89	6.90	6.92	
		Maximum	7.46	7.79	7.66	7.64	8.35	7.56	8.17	7.26	7.71	7.90	7.65	7.68	7.51	
		Minimum	6.39	6.29	6.20	6.21	6.13	6.20	6.24	6.08	6.09	6.42	6.48	6.59	6.70	
	WSE (ft)	Average	557.20	558.63	556.41	555.56	557.92	557.74	561.46	557.46	558.48	555.48	553.85	551.35	552.78	
		Maximum	564.45	563.17	566.25	565.61	566.80	565.60	565.56	563.83	564.83	562.60	558.68	553.33	552.78	
		Minimum	551.11	551.58	550.16	550.88	553.83	553.70	553.27	554.09	553.55	551.46	551.69	549.72	552.78	
	Temp. (°C)	Average	15.19	15.51	16.22	15.16	14.19	14.73	15.78	14.69	13.79	15.01	13.91	12.26	15.01	
		Maximum	21.10	22.87	23.67	22.35	23.03	22.61	23.40	21.88	20.43	20.34	21.52	23.13	19.78	
		Minimum	11.36	10.65	10.85	11.09	9.53	9.72	11.38	9.67	10.43	12.31	8.56	9.28	12.55	
	DO (mg/L)	Average	7.91	8.71	7.91	7.94	7.44	7.65	7.39	7.16	8.44	7.42	6.96	7.20	7.00	
		Maximum	9.36	10.31	9.30	9.23	10.00	9.21	10.70	8.88	9.63	9.21	9.48	9.82	9.11	
		Minimum	4.10	6.56	4.63	4.20	4.17	2.21	2.04	5.31	5.15	3.85	0.99	4.01	5.25	
	Cond. (µS/cm)	Average	30.20	27.50	27.36	30.24	37.29	28.38	29.38	31.61	28.98	30.00	39.70	46.00	27.74	
		Maximum	40.00	30.00	30.00	40.00	50.00	50.00	70.00	40.00	30.00	30.00	150.00	60.00	29.00	

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum	20.00	20.00	20.00	30.00	30.00	20.00	20.00	20.00	20.00	30.00	30.00	31.00	27.00	

Table F-2. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PADA, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022	2023	2024
Winter	pH	Average	6.99	6.74		6.98	6.93	7.04	7.00		7.37	7.24	7.06		7.09
		Maximum	7.25	7.50		7.43	7.37	7.66	7.22		7.85	7.38	7.40		7.15
		Minimum	6.83	6.48		6.44	6.75	6.92	6.90		7.13	7.03	6.85		7.04
	WSE (ft)	Average	565.40	553.15		551.38	552.43	566.78	569.68		558.01	560.20	551.03		554.55
		Maximum	565.40	553.15		555.40	552.67	566.78	569.68		558.01	560.20	551.03		554.55
		Minimum	565.40	553.15		549.43	552.20	566.78	569.68		558.01	560.20	551.03		554.55
	Temp. (°C)	Average	8.22	8.80		10.04	10.98	9.44	9.55		9.93	10.39	9.10		10.61
		Maximum	9.60	10.26		12.65	12.86	13.75	11.20		10.82	10.81	11.57		11.66
		Minimum	7.61	7.83		9.19	10.20	8.77	8.69		9.00	9.41	7.59		9.50
	DO (mg/L)	Average	11.23	10.73		9.02	9.65	10.23	10.38		10.19	10.12	10.32		10.18
		Maximum	11.46	11.53		11.10	10.66	10.78	10.64		10.46	10.46	10.97		10.48
		Minimum	11.05	10.05		1.38	9.30	10.01	9.97		9.89	9.55	9.80		9.96
	Cond. (µS/cm)	Average	43.24	38.37		42.71	44.52	54.62	41.34		45.41	41.11	43.59		36.28
		Maximum	46.00	45.00		51.00	49.00	56.00	43.60		49.00	52.30	44.70		44.10
		Minimum	40.00	36.00		36.00	42.20	53.30	37.90		42.60	38.40	42.30		33.30
Spring	pH	Average		6.80	6.94	7.06	7.04		7.30	6.75	7.11	7.12	7.12		7.21
		Maximum		7.58	7.35	7.85	7.92		7.77	7.17	7.79	8.08	7.90		7.88
		Minimum		6.59	6.68	6.76	6.54		7.04	6.32	6.59	6.31	6.62		6.40
	WSE (ft)	Average		564.37	565.43	557.94	559.54		563.05	568.71	561.52	558.04	566.02		560.05
		Maximum		564.86	565.43	562.34	560.16		563.77	568.95	561.52	558.69	566.02		568.02
		Minimum		563.82	565.43	553.54	558.97		562.34	568.66	561.52	557.32	566.02		551.93
	Temp. (°C)	Average		10.02	12.02	11.98	12.10		8.72	10.73	11.36	13.40	12.17		12.56
		Maximum		20.71	23.96	23.78	22.86		13.65	18.04	17.50	23.44	20.87		22.64
		Minimum		7.86	8.17	9.72	10.44		7.77	9.89	9.33	9.59	8.64		9.43
	DO (mg/L)	Average		9.77	9.14	7.50	8.05		10.94	10.00	9.72	9.40	9.03		9.80

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022	2023	2024
		Maximum		11.56	9.61	10.47	9.95		11.49	10.70	10.96	11.15	10.39		10.56
		Minimum		8.49	8.88	6.28	7.11		10.70	9.65	8.91	8.24	8.42		9.03
	Cond. (µS/cm)	Average		45.31	42.56	44.71	49.04		40.13	40.41	50.89	46.92	43.63		39.31
		Maximum		56.00	44.00	50.00	50.90		49.20	45.60	61.50	51.10	45.20		51.10
		Minimum		37.00	42.00	39.00	44.00		33.30	30.00	41.80	41.20	41.50		26.70
Summer	pH	Average		6.52	6.70	7.10		7.43		6.31	7.24	6.86		6.59	7.06
		Maximum		7.28	7.89	7.57		8.39		6.87	8.01	7.67		7.41	7.95
		Minimum		6.24	6.04	6.75		6.85		5.86	6.63	6.09		6.28	6.53
	WSE (ft)	Average	567.93	564.37	564.44	553.17		563.10		565.94	567.27	549.24		568.20	564.62
		Maximum	567.93	565.16	565.35	555.52		563.23		566.38	567.27	549.24		568.20	564.62
		Minimum	567.93	563.50	563.75	550.70		562.96		565.47	567.27	549.24		568.20	564.62
	Temp. (°C)	Average	14.50	14.11	12.83	14.33		17.71		16.78	16.47	18.29		12.97	17.92
		Maximum	23.13	24.71	26.00	25.57		26.35		26.32	25.85	23.96		20.17	24.67
		Minimum	11.10	10.55	8.32	9.96		12.57		12.18	10.13	10.07		10.49	12.38
	DO (mg/L)	Average	8.99	7.44	7.87	6.08		8.13		8.40	8.44	7.40		9.76	7.65
		Maximum	10.60	10.03	10.22	9.00		11.28		9.48	10.23	8.93		10.37	9.14
		Minimum	0.00	6.01	6.61	3.78		6.30		7.35	7.47	5.04		8.94	6.29
	Cond. (µS/cm)	Average	28.59	41.76	39.94	44.21		36.55		28.94	46.66	42.81		23.83	31.50
		Maximum	35.00	54.00	43.00	49.00		41.40		32.60	56.70	50.20		32.10	35.50
		Minimum	24.00	36.00	33.00	36.00		30.90		25.50	37.10	33.30		21.80	27.70
Fall/Early Winter	pH	Average			6.85		6.60	7.06				6.86	6.61	7.06	6.75
		Maximum			7.53		7.10	7.58				6.97	8.15	7.66	7.07
		Minimum			6.21		6.20	6.60				6.25	6.16	6.51	6.04
	WSE (ft)	Average			559.50	554.26	522.10	560.81				553.80	561.36	553.77	541.09
		Maximum			559.69	556.93	525.86	562.12				553.80	561.36	553.77	541.09
		Minimum			559.37	551.73	518.20	559.54				553.80	561.36	553.77	541.09
	Temp. (°C)	Average			11.81	13.76	17.47	15.86				12.15	15.34	17.61	17.50
		Maximum			15.58	17.21	22.22	22.92				12.67	21.52	20.13	19.12
		Minimum			8.97	10.72	11.46	12.93				10.47	10.37	13.93	13.57
	DO (mg/L)	Average			7.63	6.31	4.84	7.29				8.48	6.29	7.72	6.59

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022	2023	2024
		Maximum			10.06	9.07	8.29	9.02				9.01	9.13	9.20	8.21
		Minimum			3.18	0.27	0.20	3.18				2.38	3.98	4.57	1.78
	Cond. (µS/cm)	Average			43.10	45.73	47.76	36.29				43.12	38.17	27.11	31.79
		Maximum			51.00	60.60	68.80	39.60				56.60	46.90	29.30	37.20
		Minimum			38.00	38.40	42.20	31.50				41.50	31.90	25.10	29.30

Table F-3. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PATW, 1998-2010.

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.03	7.26	7.26	7.07	7.03	6.92	6.87	7.03	6.86	6.93	7.03	7.03	7.19	6.85
		Maximum	7.78	7.89	7.66	7.95	7.33	7.43	7.91	8.16	7.45	7.37	7.44	7.56	7.40	7.91
		Minimum	6.89	6.96	6.98	6.71	6.58	6.18	6.48	6.86	6.67	6.58	5.60	6.78	6.82	6.41
	WSE (ft)	Average	558.53	551.54	556.49	562.21	552.03	556.95	555.36	555.53	559.09	560.83	552.87	556.48	556.05	554.97
		Maximum	558.78	558.52	561.56	566.63	554.35	559.83	556.76	559.13	561.50	567.24	557.31	558.42	560.65	555.07
		Minimum	558.25	550.32	551.67	553.36	550.97	553.14	553.91	552.41	555.12	554.61	549.96	554.80	553.32	554.91
	Temp. (°C)	Average	8.25	9.10	8.63	10.06	9.64	9.69	9.55	9.47	9.14	9.04	8.88	9.34	9.51	9.85
		Maximum	14.17	13.18	10.27	13.41	11.29	13.11	13.89	19.31	15.03	12.69	12.53	12.57	12.68	12.78
		Minimum	6.69	7.76	7.34	8.72	8.26	7.55	8.19	7.99	7.79	7.42	7.31	8.05	8.01	8.62
	DO (mg/L)	Average	10.44	10.46	10.56	9.91	9.70	9.72	9.80	10.18	10.23	10.37	10.85	10.42	10.32	10.54
		Maximum	11.18	11.89	11.34	11.00	11.00	11.84	11.16	11.92	11.18	11.48	11.88	11.82	11.63	11.49
		Minimum	9.75	9.23	10.07	8.08	8.46	8.50	8.81	9.45	9.41	9.55	10.02	9.64	8.16	9.73
	Cond. (µS/cm)	Average	35.91	46.06	33.81	35.90	33.51	38.99	30.40	32.68	38.40	36.26	35.53	41.83	37.10	33.25
		Maximum	40.00	50.00	40.00	50.00	40.00	50.00	40.00	50.00	40.00	40.00	46.00	50.00	44.00	43.00
		Minimum	30.00	30.00	30.00	30.00	20.00	30.00	20.00	30.00	30.00	30.00	30.00	40.00	33.00	28.00
Spring	pH	Average	6.98	7.34	7.42	7.18	7.19	7.07	7.08	7.11	6.99	7.19	7.13	7.02	7.20	7.23
		Maximum	7.90	8.31	8.37	8.52	8.76	8.31	8.27	8.34	8.34	8.59	8.52	8.97	8.01	8.35
		Minimum	6.60	7.00	6.98	6.77	6.51	6.51	6.24	6.51	6.50	6.88	6.56	2.83	6.84	6.82

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	WSE (ft)	Average	560.52	568.42	557.45	565.15	563.40	559.92	563.19	559.27	562.95	567.79	562.95	559.87	560.93	562.35
		Maximum	566.70	568.90	565.81	567.53	566.37	563.89	568.54	561.53	564.96	568.13	566.04	564.43	566.23	568.02
		Minimum	553.71	568.18	550.36	561.56	554.80	556.54	557.29	556.72	561.27	566.88	560.20	556.34	558.29	557.85
	Temp. (°C)	Average	12.06	10.36	11.77	12.26	11.77	11.46	11.96	11.25	11.46	11.52	11.51	12.08	11.48	12.26
		Maximum	23.83	17.62	22.03	23.73	25.23	25.41	25.36	22.15	23.31	23.56	25.00	23.48	21.46	22.44
		Minimum	8.00	8.43	7.62	8.93	8.35	8.02	8.43	8.34	8.34	8.02	7.83	8.53	8.20	9.10
	DO (mg/L)	Average	9.54	10.08	10.02	9.48	9.73	9.78	9.50	9.85	9.76	9.93	9.57	9.70	10.43	10.33
		Maximum	11.02	11.30	11.44	11.32	11.87	11.90	11.09	11.76	11.41	12.49	12.89	11.86	11.90	11.98
		Minimum	8.27	9.27	9.02	8.15	8.10	8.23	7.92	8.82	8.74	8.51	8.16	8.55	9.11	9.31
	Cond. (µS/cm)	Average	33.77	45.82	38.91	39.03	40.85	40.11	35.47	36.12	38.39	35.52	39.85	47.48	34.40	41.39
		Maximum	40.00	50.00	50.00	70.00	60.00	50.00	40.00	40.00	50.00	50.00	42.00	55.00	39.00	45.00
		Minimum	20.00	30.00	20.00	20.00	30.00	30.00	20.00	30.00	30.00	20.00	36.00	40.00	24.00	35.00
Summer	pH	Average	6.76	6.95	7.21	6.94	7.04	6.83	6.75	6.75	6.99	7.00	7.08	7.18	7.12	6.99
		Maximum	7.83	7.75	8.18	8.55	10.46	8.15	8.53	7.80	9.23	8.17	8.60	8.33	7.74	8.20
		Minimum	6.22	6.36	6.49	6.36	6.23	6.08	6.16	5.68	6.40	6.50	6.41	6.76	6.60	6.35
	WSE (ft)	Average	566.50	566.71	566.42	565.19	566.36	564.51	565.79	565.99	565.62	565.93	564.20	559.26	564.42	566.42
		Maximum	567.15	567.18	567.29	565.98	567.32	566.08	566.63	566.58	566.55	566.89	566.64	564.17	566.62	568.01
		Minimum	565.45	565.84	565.67	562.90	565.55	563.33	564.72	565.39	564.19	565.13	559.70	556.23	560.96	565.01
	Temp. (°C)	Average	16.40	16.52	16.86	17.14	14.47	16.39	16.74	16.61	16.60	16.58	15.89	14.46	15.69	15.50
		Maximum	26.46	27.24	26.99	27.34	26.78	26.68	28.52	25.50	27.30	28.09	26.70	26.65	26.62	26.75
		Minimum	12.99	13.00	13.51	13.40	6.36	10.34	12.26	9.82	12.93	12.81	8.34	9.08	11.96	11.98
	DO (mg/L)	Average	8.30	8.88	8.64	7.81	7.45	8.12	7.96	7.00	8.19	8.48	7.73	8.11	8.89	9.15
		Maximum	15.26	10.64	11.71	11.29	12.84	11.32	10.74	8.99	12.63	10.81	11.48	10.70	11.10	11.52
		Minimum	5.84	7.80	6.47	2.63	0.03	6.21	6.28	6.00	6.44	6.53	5.58	6.42	7.95	7.54
		Average	28.09	22.34	25.97	28.07	77.90	32.88	26.98	31.39	26.35	22.14	37.94	48.27	26.29	36.49

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Cond. (µS/cm)	Maximum	40.00	30.00	40.00	40.00	557.00	40.00	50.00	40.00	40.00	30.00	50.00	57.00	30.00	44.00
		Minimum	20.00	20.00	20.00	20.00	30.00	20.00	20.00	20.00	20.00	20.00	30.00	32.00	23.00	30.00
Fall/Early Winter	pH	Average	6.74	6.93	6.88	6.84	6.65	6.67	6.72	6.61	6.71	6.72	6.84	6.85	6.90	6.89
		Maximum	7.50	8.04	7.69	7.65	8.55	7.63	8.08	7.27	7.78	8.00	7.59	7.77	7.49	8.01
		Minimum	6.23	6.31	6.31	6.24	6.09	6.27	6.20	6.04	6.17	6.43	6.51	6.46	6.50	6.31
	WSE (ft)	Average	556.01	555.48	555.12	555.97	557.69	556.93	558.57	557.79	557.22	555.45	554.89	551.63	553.30	556.19
		Maximum	564.45	563.17	566.25	565.61	566.80	565.60	565.56	564.88	564.83	562.60	558.68	553.33	553.71	563.08
		Minimum	551.11	551.58	550.16	550.88	553.83	553.70	553.27	550.45	553.55	551.46	551.69	549.72	552.78	551.23
	Temp. (°C)	Average	15.49	14.23	15.73	15.65	15.20	15.17	16.12	16.42	15.81	15.90	16.13	14.02	15.70	15.63
		Maximum	21.18	22.91	23.52	22.89	23.14	23.18	23.37	21.85	20.63	20.13	21.62	16.96	19.67	25.28
		Minimum	11.82	10.24	11.15	11.41	9.61	11.02	11.88	10.32	10.71	12.83	9.29	10.68	13.35	12.11
	DO (mg/L)	Average	7.63	8.86	8.02	7.68	7.17	7.74	7.30	7.08	7.43	7.51	7.19	7.74	7.90	8.15
		Maximum	9.15	10.41	12.50	9.10	10.05	9.52	10.46	8.74	9.57	9.35	9.06	9.26	9.08	10.65
		Minimum	5.71	7.18	5.53	5.20	3.63	4.85	5.36	4.72	5.68	5.78	2.75	5.05	6.23	6.29
	Cond. (µS/cm)	Average	30.54	29.64	27.26	29.86	34.17	25.00	26.49	30.35	28.16	30.00	35.51	39.24	27.86	34.10
		Maximum	40.00	30.00	40.00	30.00	50.00	40.00	30.00	40.00	30.00	30.00	80.00	54.00	29.00	40.00
		Minimum	30.00	20.00	20.00	20.00	30.00	20.00	20.00	20.00	20.00	30.00	30.00	33.00	27.00	31.00

Table F-4. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PATW, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Winter	pH	Average	6.83	6.60	7.03	6.87	6.78	6.98	7.17	6.83	7.06	6.82	6.85	6.57	6.60	6.90
		Maximum	7.40	6.96	7.67	8.20	7.90	7.92	8.02	7.27	13.36	7.26	7.36	7.11	6.96	7.31
		Minimum	6.37	6.38	6.50	6.42	6.32	6.77	6.81	6.49	5.77	6.51	6.26	6.20	6.34	6.48
	WSE (ft)	Average	565.44	553.76	554.85	551.38	555.57	553.94	565.10	559.48	560.33	557.77	560.18	551.79	565.30	555.29
		Maximum	568.35	554.94	557.44	555.40	558.40	566.78	569.68	561.73	562.91	560.06	561.30	554.58	565.30	558.24
		Minimum	563.45	553.00	552.18	549.43	552.20	537.43	558.48	557.14	558.09	555.83	559.07	547.53	565.30	553.06
	Temp. (°C)	Average	9.70	9.13	9.01	10.59	11.44	9.43	9.76	10.11	9.23	10.43	10.63	9.79	10.07	10.66
		Maximum	20.26	11.27	15.04	14.88	17.33	14.53	11.34	13.17	13.78	13.52	11.58	12.94	10.88	14.78
		Minimum	6.81	7.89	7.53	9.60	10.32	8.18	7.52	8.84	6.88	8.90	9.69	7.95	9.46	9.45
	DO (mg/L)	Average	10.57	10.60	10.67	9.49	9.31	10.10	10.34	10.11	10.41	9.94	9.90	9.79	10.16	10.10
		Maximum	12.14	11.63	11.76	11.11	10.79	11.30	11.36	11.10	11.30	10.99	10.85	11.06	10.32	10.84
		Minimum	3.25	10.04	10.12	7.40	8.45	9.69	9.39	9.43	5.14	9.37	9.25	8.86	10.01	9.49
	Cond. (µS/cm)	Average	44.08	35.35	43.23	41.12	44.90	56.97	44.63	39.60	50.94	42.65	42.04	44.31	40.06	38.19
		Maximum	49.00	39.00	75.00	45.00	48.40	70.50	55.70	43.20	59.50	48.00	52.40	48.90	41.00	46.00
		Minimum	36.00	34.00	34.00	36.00	42.40	48.00	37.50	34.50	39.60	38.50	37.50	42.50	39.30	32.70
Spring	pH	Average	6.75	6.87	6.86	6.95	7.01	7.28	6.81	7.08	7.01	6.88	6.80	6.84	7.08	6.97
		Maximum	7.95	8.81	7.88	8.19	8.51	8.68	7.47	8.01	9.34	7.80	7.95	8.32	7.77	8.29
		Minimum	6.36	6.33	6.20	6.28	6.36	6.82	5.77	6.76	6.36	6.43	6.09	6.31	6.98	6.28
	WSE (ft)	Average	568.34	565.13	562.71	554.50	558.93	563.87	564.52	566.03	566.26	562.35	557.94	563.61	568.65	562.67
		Maximum	568.66	567.87	566.08	562.34	560.98	565.37	568.85	568.48	568.95	565.67	560.00	566.22	568.65	568.23
		Minimum	568.05	560.33	557.19	550.23	556.23	562.35	559.75	563.11	561.82	559.44	555.49	557.61	568.65	551.93
	Temp. (°C)	Average	9.61	11.38	11.69	12.77	13.68	12.23	11.30	11.76	10.18	12.21	12.93	11.50	9.42	12.61
		Maximum	20.96	24.25	24.22	23.44	25.78	22.71	25.56	24.79	19.00	23.58	24.35	23.63	16.46	23.72
		Minimum	7.18	7.94	7.91	9.66	10.51	9.24	7.52	8.76	8.22	9.23	9.72	8.40	8.48	9.60
	DO (mg/L)	Average	10.98	10.12	9.66	8.53	8.14	9.58	10.24	22.44	10.30	9.31	9.26	9.13	10.43	9.59
		Maximum	13.05	12.81	11.80	11.45	10.70	12.45	11.29	119.40	11.21	11.04	11.38	11.03	11.41	11.07
		Minimum	9.83	8.35	8.24	6.20	6.15	8.06	7.50	8.30	7.52	8.12	7.92	8.02	10.18	8.49
	Cond. (µS/cm)	Average	46.63	42.32	41.07	44.06	48.23	51.52	43.03	39.98	47.94	47.32	47.12	43.58	54.23	40.35
		Maximum	56.00	48.00	91.00	47.00	51.00	57.50	55.70	49.60	55.30	56.70	51.60	45.60	58.20	46.50

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Minimum	37.00	36.00	39.00	39.00	43.50	39.10	25.90	33.50	31.60	41.30	40.60	32.70	45.00	28.90
Summer	**pH**	**Average**	6.57	6.77	6.91	7.05	6.75	7.48	6.79	7.16	6.39	7.17	6.72	7.05	6.80	6.79
		Maximum	7.75	8.28	8.66	8.26	8.19	8.79	7.57	8.38	7.76	8.22	8.45	8.81	8.32	8.40
		Minimum	6.14	5.98	5.96	6.35	6.05	6.84	6.53	3.88	5.68	6.65	5.82	6.33	6.21	6.11
	WSE (ft)	**Average**	566.30	565.73	565.40	555.89	554.02	562.76	563.43	565.15	566.19	566.44	553.05	564.12	565.70	564.55
		Maximum	568.81	567.22	567.23	560.85	556.14	563.61	564.87	565.74	567.58	567.27	555.38	565.44	568.20	565.43
		Minimum	563.23	563.50	563.75	550.70	552.84	561.64	561.97	564.44	564.58	565.56	549.24	563.09	563.58	563.46
	Temp. (°C)	**Average**	14.21	15.88	15.16	16.01	17.55	16.48	17.23	16.25	16.12	16.31	16.67	15.73	15.38	16.58
		Maximum	25.32	25.67	27.23	26.31	26.95	26.66	27.55	27.15	26.57	27.80	27.09	27.26	26.84	28.72
		Minimum	9.86	10.59	8.36	9.92	10.86	13.02	12.06	11.21	12.23	10.26	10.06	9.06	11.50	12.39
	DO (mg/L)	**Average**	9.29	8.20	8.11	6.81	6.89	8.48	8.16	7.88	8.51	7.83	7.17	7.88	8.84	8.11
		Maximum	11.47	11.55	11.84	10.85	10.79	12.08	10.73	10.73	10.35	10.57	10.10	11.27	11.04	10.25
		Minimum	7.28	6.16	6.22	3.45	4.51	6.71	6.42	4.29	7.42	6.17	4.77	5.82	7.23	6.57
	Cond. (µS/cm)	**Average**	29.25	41.34	40.31	44.00	41.91	35.39	28.93	36.74	28.00	45.14	44.76	40.14	22.25	31.50
		Maximum	42.00	48.00	46.00	49.00	52.00	46.90	32.80	100.00	32.40	53.60	50.80	46.10	26.50	38.80
		Minimum	23.00	37.00	33.00	36.00	34.80	30.50	25.40	33.10	25.30	35.50	33.00	31.70	17.00	27.00
Fall/Early Winter	**pH**	**Average**	6.59	6.64	6.75	6.85	6.77	7.15	6.84	6.62	6.86	6.67	6.56	6.80	6.85	6.74
		Maximum	7.84	7.60	7.98	7.78	7.49	8.96	7.28	7.43	7.85	7.56	7.25	8.09	7.87	8.29
		Minimum	6.13	5.82	5.74	5.85	6.01	6.69	6.55	5.77	6.50	6.08	5.78	6.32	6.38	5.96
	WSE (ft)	**Average**	555.01	561.81	560.24	551.37	520.95	561.24	561.35	559.93	559.10	562.09	548.00	561.74	552.61	551.00
		Maximum	560.24	564.16	562.36	556.93	525.19	562.80	564.69	560.42	563.97	564.34	553.80	565.40	553.77	561.25
		Minimum	552.35	560.07	559.21	549.09	518.20	560.68	558.99	559.56	554.58	559.56	543.91	557.93	551.43	541.09
	Temp. (°C)	**Average**	14.42	15.07	14.54	16.75	17.24	16.10	15.94	15.71	15.73	17.05	15.41	15.57	16.06	17.15
		Maximum	21.93	23.48	21.51	22.40	21.72	23.49	19.65	19.21	21.19	23.20	22.13	21.28	20.34	23.85
		Minimum	11.98	11.93	8.65	11.81	12.69	13.01	12.69	12.94	13.52	12.63	10.33	11.87	12.97	12.95
	DO (mg/L)	**Average**	8.28	7.63	7.80	7.07	7.47	7.48	7.81	7.40	7.97	6.94	6.94	7.75	7.74	6.97
		Maximum	10.02	11.07	9.95	9.14	9.58	9.08	9.44	9.31	9.39	8.75	9.02	9.47	9.31	9.11
		Minimum	6.84	4.16	3.59	2.61	2.74	5.68	6.43	5.14	6.40	5.54	3.99	4.08	5.87	4.27
	Cond. (µS/cm)	**Average**	31.16	37.46	40.79	40.31	47.16	35.18	31.98	39.59	31.34	38.84	42.30	35.45	28.70	31.69
		Maximum	35.00	43.00	49.00	50.00	50.10	39.70	35.60	46.90	33.30	49.30	48.80	39.00	34.20	35.30

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Minimum	24.00	35.00	33.00	36.00	43.00	31.30	28.10	32.90	25.30	33.00	33.20	31.60	23.60	28.70

Table F-5. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PARI, 1998-2010.

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Winter	pH	Average	7.01	7.19	7.22	7.21	7.11	7.09	7.00	7.08	6.97	7.10	7.07	7.13
		Maximum	7.36	7.66	7.57	7.82	7.43	7.63	7.84	7.49	7.61	7.98	7.40	7.57
		Minimum	6.85	6.96	7.08	6.89	6.84	6.68	6.73	6.93	6.77	6.89	6.73	6.94
	WSE (ft)	Average	558.42	550.40	556.11	562.44	552.09	557.08	555.37	555.83	557.89	561.03	551.64	556.65
		Maximum	558.58	550.40	561.56	565.66	554.35	559.83	556.76	559.13	561.06	567.24	553.83	558.42
		Minimum	558.25	550.40	551.67	554.61	550.97	553.14	553.91	552.41	555.12	554.61	549.96	554.80
	Temp. (°C)	Average	8.52	9.10	8.43	9.84	9.54	9.41	9.63	9.23	9.06	8.74	9.12	9.33
		Maximum	15.41	12.56	10.76	13.74	11.29	12.61	13.51	11.59	12.72	11.89	10.84	13.25
		Minimum	5.64	7.74	6.91	8.48	7.93	7.18	8.05	7.56	7.17	6.92	7.40	7.76
	DO (mg/L)	Average	10.47	10.96	10.78	10.18	9.90	10.18	10.09	10.41	10.51	10.70	10.96	10.45
		Maximum	11.20	11.75	11.57	11.16	10.90	11.72	10.84	11.34	11.45	11.74	11.94	11.28
		Minimum	9.72	10.45	10.10	9.07	8.89	8.57	8.89	9.45	9.43	9.53	10.30	9.21
	Cond. (µS/cm)	Average	36.03	50.62	38.33	37.03	35.76	41.41	30.35	33.92	40.09	37.38	35.48	43.28
		Maximum	40.00	60.00	50.00	50.00	60.00	50.00	40.00	40.00	50.00	40.00	49.00	50.00
		Minimum	30.00	40.00	30.00	30.00	30.00	30.00	20.00	30.00	30.00	30.00	30.00	40.00
Spring	pH	Average	6.98	7.28	7.36	7.22	7.13	7.11	7.12	7.08	7.13	7.21	7.41	6.87
		Maximum	7.46	7.64	8.03	8.03	8.34	7.92	7.88	8.00	8.27	7.99	7.89	7.69
		Minimum	6.60	6.93	6.86	6.61	0.00	6.60	3.78	6.47	6.53	6.95	6.92	6.35
	WSE (ft)	Average	556.62	568.21	557.23	565.25	563.38	560.32	564.64	559.56	562.92	568.01	562.66	558.66
		Maximum	559.33	568.23	565.81	567.53	566.37	563.89	568.54	561.53	564.96	568.04	564.25	559.53
		Minimum	553.71	568.18	550.36	561.56	554.80	556.54	558.75	556.72	561.27	567.98	560.68	557.68
	Temp. (°C)	Average	10.66	10.31	12.54	12.37	12.65	12.24	13.05	11.35	11.82	11.60	11.53	12.60
		Maximum	20.34	16.72	22.09	23.49	25.45	24.09	25.21	21.89	23.23	23.29	21.59	24.11
		Minimum	7.73	8.37	7.75	8.90	0.00	8.02	8.42	8.27	8.31	9.26	7.90	8.59
	DO (mg/L)	Average	9.93	10.86	9.98	9.87	9.57	9.72	9.59	9.96	10.18	10.20	10.17	9.60

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
		Maximum	10.65	11.17	11.23	11.11	11.27	11.89	10.96	11.06	13.33	10.58	12.14	10.69
		Minimum	7.83	10.17	7.81	8.09	0.00	7.93	7.88	8.46	8.71	8.85	8.65	8.38
	Cond. (µS/cm)	Average	34.37	46.67	37.31	38.32	43.11	39.79	34.62	37.22	37.24	34.17	47.46	49.30
		Maximum	40.00	60.00	60.00	50.00	60.00	50.00	50.00	50.00	50.00	50.00	55.00	59.00
		Minimum	30.00	40.00	20.00	20.00	0.00	20.00	20.00	30.00	20.00	30.00	40.00	35.00
Summer	pH	Average	6.78		7.24	6.92	6.84	6.82	6.75	6.93	7.00	6.91	6.92	6.98
		Maximum	7.55		8.00	7.95	8.08	7.74	7.81	7.61	8.05	7.66	8.27	7.35
		Minimum	6.22		6.16	6.18	6.04	6.12	6.11	6.43	6.35	6.49	6.48	6.69
	WSE (ft)	Average	566.62		566.45	565.40	566.36	564.35	565.68	565.39	565.69	565.76	563.79	556.23
		Maximum	566.91		567.29	565.98	567.11	565.36	566.51	565.39	566.55	566.89	566.64	556.23
		Minimum	566.09		565.67	564.16	565.55	563.42	564.72	565.39	564.19	565.13	559.70	556.23
	Temp. (°C)	Average	16.91		17.24	17.73	16.46	17.29	17.43	17.53	16.96	17.25	16.51	15.30
		Maximum	26.40		26.62	26.30	25.96	27.54	28.38	25.69	26.93	27.86	27.09	26.00
		Minimum	12.73		13.35	13.34	9.35	10.43	12.40	9.79	12.98	12.80	8.46	9.34
	DO (mg/L)	Average	7.80		8.41	7.49	7.59	7.80	7.70	6.38	8.33	8.03	7.13	6.78
		Maximum	10.74		10.22	10.06	9.17	9.52	10.25	7.51	9.65	9.87	8.75	8.60
		Minimum	3.47		2.75	2.50	3.54	4.02	4.07	4.01	3.01	4.88	3.92	4.96
	Cond. (µS/cm)	Average	35.33		25.71	30.20	38.49	31.69	26.20	29.38	24.64	23.78	39.90	45.35
		Maximum	50.00		40.00	40.00	50.00	40.00	50.00	40.00	40.00	30.00	50.00	59.00
		Minimum	20.00		20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	30.00	32.00
Fall/Early Winter	pH	Average	6.83	7.03	6.93	6.95	6.78	6.81	6.77	6.76	6.94	6.90	7.08	7.55
		Maximum	7.48	7.65	7.70	7.58	7.77	7.49	7.54	7.21	7.67	7.60	7.62	9.84
		Minimum	6.02	6.24	6.04	6.12	6.03	6.25	6.10	5.89	6.34	6.56	6.63	6.48
	WSE (ft)	Average	557.06	557.56	557.76	555.48	557.89	558.05	560.29	554.65	559.48	555.88	554.51	551.35
		Maximum	564.45	563.17	566.25	565.61	566.80	565.60	565.56	555.24	564.83	562.60	558.68	553.33
		Minimum	551.11	551.58	550.16	550.88	553.83	553.70	553.27	554.09	553.55	551.46	551.69	549.72
	Temp. (°C)	Average	15.35	14.85	16.57	15.41	15.54	15.47	16.94	16.14	14.27	15.77	16.97	13.06
		Maximum	21.06	23.29	23.21	22.28	23.27	23.10	23.07	18.99	20.45	20.20	21.69	22.80
		Minimum	11.06	10.11	11.73	10.50	9.63	10.92	12.84	12.45	10.07	12.04	11.92	7.24
	DO (mg/L)	Average	7.69	9.15	8.15	8.01	7.51	8.10	7.46	7.57	8.49	7.98	8.02	13.91

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
		Maximum	9.60	10.47	9.27	9.53	10.16	9.51	9.06	8.69	9.90	9.26	9.35	38.00
		Minimum	0.25	4.26	1.26	0.70	0.20	2.86	1.96	1.77	3.90	3.77	1.69	0.64
	Cond. (µS/cm)	Average	30.46	30.00	27.45	29.94	34.03	25.43	26.46	31.51	31.05	30.00	32.52	93.81
		Maximum	40.00	30.00	30.00	40.00	80.00	40.00	40.00	40.00	40.00	30.00	50.00	900.00
		Minimum	30.00	30.00	20.00	20.00	30.00	20.00	20.00	30.00	30.00	30.00	30.00	1.00

Table F-6. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PARI, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2017	2019	2020	2021	2022	2023	2024
Winter	pH	Average	6.93	6.84		7.24		7.07		7.26	7.29	7.15		7.20
		Maximum	7.19	7.05		7.38		7.31		7.71	7.45	7.44		7.27
		Minimum	6.77	6.70		7.20		6.96		7.15	7.21	7.03		7.13
	WSE (ft)	Average	566.43	553.15		550.45		569.68		558.01	560.20	551.03		554.55
		Maximum	568.35	553.15		550.45		569.68		558.01	560.20	551.03		554.55
		Minimum	565.45	553.15		550.45		569.68		558.01	560.20	551.03		554.55
	Temp. (°C)	Average	8.37	8.87		10.19		9.60		9.86	10.47	9.23		10.51
		Maximum	12.96	10.91		11.58		11.45		10.80	11.08	11.61		11.81
		Minimum	7.22	7.96		9.39		8.77		8.63	9.69	7.94		9.39
	DO (mg/L)	Average	11.60	11.24		10.55		10.80		10.25	9.97	10.61		10.26
		Maximum	12.45	11.74		11.02		11.22		10.55	10.54	10.97		10.80
		Minimum	10.87	10.77		10.02		9.85		9.84	9.72	9.88		9.82
	Cond. (µS/cm)	Average	45.10	44.61		39.24		35.61		45.45	41.45	43.71		40.50
		Maximum	52.00	52.00		43.00		38.70		48.60	52.60	45.10		48.00
		Minimum	41.00	36.00		36.00		33.80		42.80	37.50	42.10		34.90
Spring	pH	Average	6.86	6.87		7.28	7.12	7.18	6.91	7.15	7.12	7.10		7.21
		Maximum	7.00	7.98		7.92	7.87	7.40	7.21	8.14	7.91	7.90		7.65

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2017	2019	2020	2021	2022	2023	2024
		Minimum	6.65	6.60		6.88	6.71	7.05	6.78	6.64	6.64	6.71		6.82
	WSE (ft)	Average	568.24	563.74		553.94	558.97	563.77	568.95	563.60	558.01	566.02		560.53
		Maximum	568.40	567.28		558.52	558.97	563.77	568.95	565.67	558.69	566.02		568.02
		Minimum	568.07	560.33		551.25	558.97	563.77	568.95	561.52	557.32	566.02		551.93
	Temp. (°C)	Average	8.64	10.58		13.00	12.08	9.25	11.84	12.47	12.66	11.68		12.59
		Maximum	16.55	21.48		23.11	18.13	13.57	17.29	23.70	23.96	21.96		24.54
		Minimum	7.19	7.78		9.79	10.51	8.09	10.33	8.64	9.82	8.72		9.79
	DO (mg/L)	Average	11.76	10.71		8.05	8.71	11.35	10.53	9.52	8.80	8.91		10.08
		Maximum	12.35	11.94		10.10	10.22	11.48	10.72	10.91	10.27	9.75		10.72
		Minimum	10.95	9.20		5.35	7.53	10.95	9.44	7.20	6.84	8.05		8.83
	Cond. (µS/cm)	Average	53.65	47.25		50.60	50.55	45.99	31.15	53.14	54.05	43.16		38.11
		Maximum	65.00	61.00		58.00	52.20	54.20	34.90	66.50	62.40	46.70		51.10
		Minimum	45.00	37.00		36.00	47.00	44.30	26.00	35.80	40.90	35.60		24.70
Summer	pH	Average	7.10			7.09			6.41		6.57	7.01	6.82	
		Maximum	7.33			7.75			6.89		7.66	8.01	7.62	
		Minimum	6.93			6.58			5.77		5.91	6.47	6.19	
	WSE (ft)	Average	568.77			556.98			565.92		549.24	564.21	568.20	
		Maximum	568.77			558.14			566.38		549.24	564.21	568.20	
		Minimum	568.77			555.82			565.47		549.24	564.21	568.20	
	Temp. (°C)	Average	11.52			15.84			17.51		17.08	15.53	13.07	
		Maximum	21.64			26.57			25.94		24.09	27.16	22.83	
		Minimum	9.67			10.02			12.94		10.35	9.37	11.44	
	DO (mg/L)	Average	10.64			6.46			7.76		5.05	7.74	9.93	
		Maximum	10.90			9.11			8.82		9.04	9.04	10.05	
		Minimum	9.56			2.88			4.36		0.34	5.70	8.97	

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2017	2019	2020	2021	2022	2023	2024
	Cond. (µS/cm)	Average	33.30			47.94			30.29		46.44	38.91	22.57	
		Maximum	39.00			58.00			35.80		63.90	47.50	25.30	
		Minimum	27.00			34.00			26.90		30.60	31.00	22.00	
Fall/Early Winter	pH	Average			7.06		6.93				6.90	7.06	7.08	7.03
		Maximum			7.82		7.19				6.99	8.17	7.67	7.26
		Minimum			6.04		6.68				6.77	6.24	6.56	6.85
	WSE (ft)	Average			560.63	555.07	520.82				553.80	561.36	553.77	541.09
		Maximum			562.36	556.93	523.44				553.80	561.36	553.77	541.09
		Minimum			559.37	553.35	518.20				553.80	561.36	553.77	541.09
	Temp. (°C)	Average			14.16	13.03	19.97				12.47	17.84	17.59	17.98
		Maximum			21.32	14.61	21.30				12.73	21.58	20.24	19.12
		Minimum			8.69	10.38	18.29				10.46	14.61	15.75	16.67
	DO (mg/L)	Average			8.63	9.38	6.67				9.02	7.69	7.20	7.82
		Maximum			10.33	10.05	7.61				9.70	9.18	9.18	8.26
		Minimum			3.34	8.91	0.78				8.87	1.90	2.58	7.21
	Cond. (µS/cm)	Average			40.08	42.11	49.60				42.09	34.99	30.07	34.57
		Maximum			50.00	45.20	54.60				43.20	39.30	32.10	34.90
		Minimum			33.00	40.40	45.30				41.90	32.30	26.90	34.20

Table F-7. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station LOGBOOM, 1998-2010.

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.33	7.24	7.33	7.26	7.20	7.27	7.25	7.25	7.01	7.24	6.92	7.26	7.58	
		Maximum	7.37	7.44	7.46	7.64	7.50	9.40	7.60	7.37	7.22	7.46	7.08	7.73	7.68	
		Minimum	7.30	7.07	7.22	6.97	6.64	6.87	6.99	7.11	6.79	7.09	6.65	7.01	7.51	

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	WSE (ft)	Average	558.58	553.37	557.05	563.69	552.08	557.17	555.29	555.07	558.69	561.02	551.71	556.56	554.40	
		Maximum	558.58	558.52	561.56	566.63	554.35	559.83	556.76	559.13	561.50	567.24	553.83	558.42	555.26	
		Minimum	558.58	550.32	551.67	554.61	550.97	553.14	553.91	552.41	555.12	554.61	549.96	554.80	553.32	
	Temp. (°C)	Average	8.72	7.09	6.18	7.15	5.48	5.82	6.57	5.60	6.48	6.37	5.31	5.21	5.00	
		Maximum	8.88	8.11	7.76	8.58	7.59	10.48	8.46	6.89	8.14	7.11	6.77	6.94	5.25	
		Minimum	8.65	5.57	4.19	6.03	3.39	2.92	5.08	4.21	4.90	4.84	4.27	3.18	4.67	
	DO (mg/L)	Average	12.06	11.97	12.26	11.62	11.78	12.45	12.16	12.58	12.01	12.34	12.53	12.88	12.72	
		Maximum	12.23	12.46	13.82	13.48	12.17	14.36	12.95	13.24	12.60	13.46	13.67	13.96	13.26	
		Minimum	11.98	11.73	11.22	11.02	11.43	11.62	11.40	12.12	11.47	11.98	11.37	12.17	12.16	
	Cond. (µS/cm)	Average	30.00	53.68	43.75	47.14	66.11	43.25	34.41	45.65	47.93	40.00	54.40	60.45	44.44	
		Maximum	30.00	60.00	50.00	60.00	90.00	60.00	40.00	50.00	60.00	50.00	70.00	70.00	50.00	
		Minimum	30.00	50.00	30.00	40.00	40.00	0.00	30.00	40.00	40.00	30.00	40.00	50.00	38.00	
Spring	pH	Average	7.22	7.32	7.53	7.26	7.34	7.30	7.27	7.36	7.09	7.23	7.43	7.03	7.32	
		Maximum	7.49	7.49	8.04	7.62	7.83	7.57	7.63	8.22	7.60	7.46	7.59	7.46	7.53	
		Minimum	7.03	7.25	7.20	6.90	6.89	6.96	6.78	7.15	6.74	6.96	7.20	6.12	7.26	
	WSE (ft)	Average	561.15	568.45	558.61	565.36	563.71	559.94	563.64	559.59	562.97	567.94	561.90	560.26	566.23	
		Maximum	566.70	568.90	565.81	567.53	566.37	563.89	568.54	561.53	564.96	568.13	564.25	564.43	566.23	
		Minimum	553.71	568.18	550.36	561.56	554.80	556.54	557.29	556.72	561.27	567.80	560.20	557.68	566.23	
	Temp. (°C)	Average	11.98	10.26	11.21	11.84	15.87	12.51	12.01	12.25	9.79	10.28	13.65	14.72	17.77	
		Maximum	21.38	11.77	13.30	21.65	24.43	21.93	21.06	19.97	13.06	12.52	20.07	20.63	21.19	
		Minimum	7.44	8.91	7.78	7.20	6.29	7.93	7.43	9.19	7.08	7.90	9.28	9.99	14.13	
	DO (mg/L)	Average	10.70	11.14	10.98	10.46	9.83	10.66	10.52	10.81	11.12	11.13	10.37	10.11	9.57	
		Maximum	11.94	11.43	12.05	11.39	11.88	12.43	11.84	11.77	12.95	11.72	11.78	10.91	9.98	
		Minimum	8.81	10.98	10.00	8.60	8.29	8.59	8.76	8.54	9.81	10.47	8.91	9.26	9.25	
		Average	25.85	32.16	30.67	33.33	39.25	34.46	32.89	32.57	31.30	30.00	42.38	37.82	28.71	

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Cond. (µS/cm)	Maximum	30.00	40.00	50.00	50.00	70.00	50.00	50.00	40.00	50.00	50.00	50.00	50.00	29.00	
		Minimum	20.00	20.00	20.00	20.00	30.00	20.00	20.00	30.00	20.00	20.00	30.00	30.00	28.00	
Summer	pH	Average	7.24	7.21	7.57	7.37	7.27	7.25	7.09	7.32	7.30	7.06	7.63	7.49	7.24	6.83
		Maximum	7.60	7.35	8.00	7.71	7.91	7.57	7.55	7.50	7.61	7.33	8.10	7.78	7.32	6.94
		Minimum	7.06	7.04	6.90	6.99	6.72	6.84	6.06	7.02	6.93	6.85	7.11	7.18	7.15	6.72
	WSE (ft)	Average	566.54	566.74	566.44	565.39	566.25	564.55	565.82	566.02	565.64	566.21	565.11	559.15	565.85	567.92
		Maximum	567.15	567.18	567.29	565.98	567.11	566.08	566.63	566.58	566.55	566.89	566.64	564.17	566.62	567.92
		Minimum	565.45	565.84	565.67	564.16	565.55	563.33	564.72	565.39	564.19	565.79	559.70	556.23	565.19	567.92
	Temp. (°C)	Average	20.03	17.52	19.09	20.43	22.91	22.62	21.14	22.22	18.75	19.16	24.14	21.99	23.09	14.40
		Maximum	25.44	25.07	24.82	25.90	25.41	25.90	27.74	24.98	25.84	26.18	26.19	25.86	25.79	14.77
		Minimum	14.25	14.01	13.88	13.95	15.07	14.94	13.27	17.02	13.68	13.82	17.28	15.23	16.26	14.31
	DO (mg/L)	Average	9.04	9.44	9.27	8.61	8.31	8.55	8.45	8.07	8.86	8.97	8.17	8.75	8.54	10.06
		Maximum	11.26	9.95	10.78	10.40	10.00	9.88	10.07	9.65	9.79	10.65	9.04	10.16	9.32	10.10
		Minimum	8.08	8.37	7.36	7.70	7.51	7.58	7.49	6.88	7.74	7.60	7.75	8.13	8.31	10.01
	Cond. (µS/cm)	Average	30.61	28.46	28.33	29.53	37.74	33.08	23.94	28.00	25.48	25.00	38.18	40.51	28.15	29.00
		Maximum	40.00	40.00	30.00	40.00	40.00	40.00	30.00	30.00	30.00	30.00	40.00	49.00	29.00	29.00
		Minimum	20.00	20.00	20.00	20.00	20.00	20.00	0.00	20.00	20.00	20.00	30.00	27.00	24.00	29.00
Fall/Early Winter	pH	Average	7.12	7.31	7.13	7.24	7.02	7.00	7.11	7.02	8.18	7.12	7.31	7.37	7.15	7.78
		Maximum	7.37	7.50	7.51	7.44	7.55	7.38	7.32	7.38	11.59	7.32	8.22	7.49	7.18	7.86
		Minimum	6.75	7.10	6.21	7.06	6.61	6.62	6.80	6.62	6.95	6.87	6.99	7.29	7.13	7.71
	WSE (ft)	Average	557.34	556.30	556.95	558.45	557.92	557.64	559.05	558.91	558.81	557.67	555.17	551.55	553.67	555.24
		Maximum	564.45	563.17	566.25	565.61	566.80	565.60	565.56	564.88	564.83	562.60	558.68	553.33	553.67	555.24
		Minimum	551.11	551.58	550.16	551.26	553.83	553.70	553.27	550.45	553.55	551.46	551.69	549.72	553.67	555.24
	Temp. (°C)	Average	12.51	10.63	13.42	15.04	12.99	12.10	14.76	15.52	12.25	12.94	13.98	10.49	11.86	14.63
		Maximum	19.60	21.54	21.72	21.53	22.67	21.73	22.13	21.21	19.16	19.07	20.94	12.55	11.97	17.30

SEASON	PARAMETER	STAT	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum	6.81	3.69	6.41	7.31	4.87	4.14	6.19	8.41	7.28	7.55	5.74	7.07	11.75	12.11
	DO (mg/L)	**Average**	10.15	11.11	10.27	9.60	10.17	10.57	9.88	9.26	7.87	10.29	10.06	10.94	10.85	10.21
		Maximum	11.97	13.73	11.61	11.22	15.05	12.47	12.64	11.03	11.51	12.21	12.23	11.45	11.11	10.90
		Minimum	8.58	8.69	8.37	8.13	6.93	8.31	7.81	8.14	0.04	9.08	8.58	10.36	10.11	9.52
	Cond. (µS/cm)	**Average**	38.79	35.68	31.79	31.11	39.70	25.83	26.48	37.50	122.97	36.92	32.61	38.95	31.50	32.00
		Maximum	80.00	50.00	50.00	40.00	60.00	40.00	40.00	80.00	447.00	60.00	40.00	52.00	32.00	34.00
		Minimum	30.00	30.00	20.00	30.00	30.00	20.00	20.00	20.00	20.00	30.00	30.00	31.00	31.00	30.00

Table F-8. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station LOGBOOM, 2011-2017.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2017
Winter	pH	Average	6.92			7.44	6.98
		Maximum	7.14			7.59	7.21
		Minimum	6.76			7.29	6.87
	WSE (ft)	Average	566.90			553.42	569.68
		Maximum	568.35			555.40	569.68
		Minimum	565.45			550.13	569.68
	Temp. (°C)	Average	6.81			8.63	9.36
		Maximum	8.04			10.75	11.18
		Minimum	5.68			5.30	8.18
	DO (mg/L)	Average	12.54			11.67	11.18
		Maximum	12.99			12.33	11.92
		Minimum	11.61			11.05	10.16
	Cond. (µS/cm)	Average	45.22			53.50	35.68
		Maximum	51.00			71.00	38.70
		Minimum	41.00			43.00	33.80
Spring	pH	Average		7.08		7.46	7.16
		Maximum		7.16		7.48	7.35
		Minimum		7.01		7.43	7.11
	WSE (ft)	Average		560.33		558.52	563.41
		Maximum		560.33		558.52	563.41
		Minimum		560.33		558.52	563.41
	Temp. (°C)	Average		7.59		17.52	6.77
		Maximum		7.75		21.00	6.81
		Minimum		7.47		13.66	6.74
	DO (mg/L)	Average		12.00		9.69	12.06
		Maximum		12.02		10.29	12.09
		Minimum		11.95		9.22	11.99
	Cond. (µS/cm)	Average		58.00		37.60	45.66
		Maximum		58.00		43.00	46.00
		Minimum		58.00		32.00	45.50
Summer	pH	Average			7.04	7.43	
		Maximum			7.10	7.49	
		Minimum			6.96	7.41	

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2017
	WSE (ft)	Average			565.31	560.85	
		Maximum			565.31	560.85	
		Minimum			565.31	560.85	
	Temp. (°C)	Average			24.77	23.22	
		Maximum			24.99	24.98	
		Minimum			24.47	16.09	
	DO (mg/L)	Average			8.42	8.68	
		Maximum			8.43	9.51	
		Minimum			8.39	8.51	
	Cond. (µS/cm)	Average			42.00	44.33	
		Maximum			42.00	46.00	
		Minimum			42.00	38.00	
Fall/Early Winter	pH	Average			7.39		
		Maximum			7.76		
		Minimum			7.02		
	WSE (ft)	Average			560.55		
		Maximum			562.36		
		Minimum			559.37		
	Temp. (°C)	Average			11.52		
		Maximum			20.77		
		Minimum			4.04		
	DO (mg/L)	Average			11.02		
		Maximum			13.41		
		Minimum			9.27		
	Cond. (µS/cm)	Average			39.74		
		Maximum			46.00		
		Minimum			32.00		

Table F-9. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMD, 1998-2010.

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.23	7.22	7.27	7.43	7.05	7.20	7.04	7.23	6.73	7.10	7.77	7.08
		Maximum	7.39	8.01	7.86	8.16	8.05	7.43	7.53	7.67	7.25	7.39	8.54	8.11
		Minimum	7.07	6.90	6.46	6.66	6.33	6.91	6.48	6.75	6.38	6.82	7.08	6.91
	WSE (ft)	Average	213.68	219.11	217.21	207.41	216.67	220.01	220.49	217.92	220.77	202.80	191.67	218.87
		Maximum	213.68	220.28	220.52	210.64	219.64	220.52	225.00	224.84	222.52	202.96	198.92	218.87
		Minimum	213.68	215.48	215.16	202.80	212.64	219.40	213.44	212.96	219.84	202.64	187.72	218.87
	Temp. (°C)	Average	11.35	11.32	10.19	10.19	10.65	10.42	10.07	10.78	10.52	9.92	9.86	10.76
		Maximum	12.02	13.85	12.80	12.47	14.10	10.87	15.02	12.12	16.22	13.10	13.58	13.32
		Minimum	10.10	10.07	9.18	8.86	9.58	10.03	8.61	9.25	9.55	8.73	9.20	9.64
	DO (mg/L)	Average	10.52	10.04	10.46	17.78	9.70	9.88	10.26	10.05	10.50	10.77	10.95	10.66
		Maximum	11.60	11.12	11.42	99.30	11.24	10.60	11.61	11.10	11.53	11.94	11.84	11.59
		Minimum	10.08	8.94	9.17	7.86	7.56	9.09	8.42	9.31	9.19	9.24	9.73	9.65
	Cond. (µS/cm)	Average	40.00	34.36	38.51	44.28	41.81	40.00	40.00	40.00	30.46	40.00	52.01	39.79
		Maximum	40.00	50.00	40.00	60.00	50.00	40.00	40.00	40.00	40.00	40.00	60.00	42.00
		Minimum	40.00	30.00	20.00	40.00	40.00	40.00	40.00	40.00	30.00	40.00	46.00	39.00
Spring	pH	Average		7.02	7.00	6.95	6.99	7.08	6.91	7.31	7.04	6.99	7.11	7.02
		Maximum		8.07	7.99	7.95	8.32	7.98	7.72	8.08	8.01	7.86	7.66	7.95
		Minimum		6.50	6.25	6.30	5.03	6.26	6.41	6.88	6.34	6.44	6.77	6.49
	WSE (ft)	Average		219.01	213.47	216.50	224.09	225.29	231.47	229.37	216.95	199.85	212.13	225.84
		Maximum		226.64	215.76	217.96	232.60	227.88	233.00	233.68	219.24	203.12	212.13	230.06
		Minimum		214.92	210.32	213.20	218.40	221.08	229.60	226.36	213.04	196.60	212.13	221.61
	Temp. (°C)	Average		13.18	13.06	12.44	13.42	12.85	12.88	12.98	13.33	14.33	13.06	12.93
		Maximum		23.65	24.22	23.65	23.92	21.28	22.39	21.72	22.03	20.26	19.88	22.48

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum		10.22	10.01	9.53	9.99	9.71	9.90	9.81	9.87	10.23	10.53	10.36
	DO (mg/L)	Average		8.43	8.71	7.91	7.98	8.68	8.79	9.80	9.01	7.98	8.13	9.29
		Maximum		10.39	10.79	11.01	10.50	10.87	10.51	10.84	10.77	10.41	10.22	11.52
		Minimum		5.61	5.33	4.15	4.62	5.44	5.71	7.86	5.86	3.98	6.18	6.71
	Cond. (µS/cm)	Average		40.16	38.49	49.88	42.51	40.76	42.49	40.43	32.54	43.33	45.97	44.18
		Maximum		50.00	40.00	50.00	50.00	50.00	50.00	50.00	40.00	53.00	49.00	50.00
		Minimum		30.00	20.00	40.00	40.00	40.00	40.00	0.00	30.00	40.00	44.00	39.00
Summer	pH	Average		6.87	6.86	6.93	6.91	6.79	6.93	7.02	6.89	7.14	7.13	7.13
		Maximum		8.15	8.39	8.41	8.69	8.48	8.48	8.31	8.42	9.42	8.59	8.34
		Minimum		6.12	6.08	5.98	6.11	6.00	6.25	6.39	5.85	6.50	6.40	6.16
	WSE (ft)	Average		222.69	205.20	212.70	221.21	211.30	227.02	226.45	208.37	191.47	223.15	227.60
		Maximum		227.08	209.44	216.80	229.52	213.52	234.08	231.72	211.28	192.62	223.36	232.19
		Minimum		219.56	200.96	208.20	215.32	209.32	220.16	223.88	205.49	189.09	222.89	223.88
	Temp. (°C)	Average		16.40	16.96	16.13	17.63	17.57	16.45	16.90	17.83	18.36	16.25	16.59
		Maximum		26.94	25.99	27.36	27.27	26.57	27.31	30.28	26.65	27.22	25.55	25.26
		Minimum		11.99	11.22	10.74	11.91	12.46	11.43	12.78	12.08	12.19	11.51	12.32
	DO (mg/L)	Average		7.39	6.49	6.29	6.80	5.52	7.35	7.68	6.44	5.33	6.26	7.05
		Maximum		10.69	10.44	11.87	11.18	9.34	16.54	11.98	9.60	10.98	11.73	11.36
		Minimum		3.72	0.71	1.86	1.77	1.56	1.26	1.09	1.14	0.20	0.63	2.75
	Cond. (µS/cm)	Average		40.09	43.89	47.89	43.33	42.84	40.81	31.91	40.00	56.31	42.58	48.98
		Maximum		60.00	270.00	50.00	60.00	50.00	100.00	40.00	40.00	72.00	49.00	54.00
		Minimum		30.00	40.00	40.00	40.00	40.00	30.00	30.00	40.00	52.00	36.00	45.00
Fall/Early Winter	pH	Average		6.91	6.82	6.70	6.85	6.77	6.76	6.78	6.82	7.18	6.86	7.27
		Maximum		8.23	8.00	8.23	8.01	8.57	7.93	7.86	7.70	9.38	7.36	8.50

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum		6.26	6.08	5.91	6.19	5.93	6.18	6.24	6.19	6.58	6.36	6.50
	WSE (ft)	Average		220.72	201.20	209.95	215.88	209.82	219.29	220.34	203.55	189.08	218.27	219.06
		Maximum		221.68	202.24	211.28	216.76	210.60	220.08	221.44	204.38	189.54	222.07	221.26
		Minimum		218.80	199.92	207.88	215.24	209.04	217.92	219.20	202.62	188.26	216.53	215.43
	Temp. (°C)	Average		15.18	15.35	15.34	17.47	16.11	16.59	16.15	16.04	15.94	16.44	17.13
		Maximum		23.01	23.07	24.98	24.02	23.03	23.28	21.98	22.56	23.28	22.29	23.74
		Minimum		12.13	11.44	12.64	13.83	12.22	13.24	12.36	12.83	13.16	13.57	14.14
	DO (mg/L)	Average		7.93	7.84	7.30	6.54	6.97	6.68	7.21	7.01	7.14	6.75	5.58
		Maximum		9.90	10.65	10.15	9.49	10.12	9.36	10.52	9.60	10.21	9.59	9.49
		Minimum		3.30	1.87	1.21	1.31	1.04	2.93	3.08	1.97	0.38	1.72	2.14
	Cond. (µS/cm)	Average		37.98	48.56	44.34	45.48	45.81	38.68	32.62	39.91	57.33	42.34	47.25
		Maximum		40.00	50.00	60.00	50.00	50.00	50.00	40.00	40.00	60.00	48.00	51.00
		Minimum		20.00	40.00	40.00	40.00	40.00	30.00	30.00	30.00	56.00	38.00	44.00

Table F-10. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMD, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2018	2019	2020	2021	2022	2023	2024
Winter	pH	Average	6.83	6.93	7.21	7.29	7.59	6.83		7.04	7.07		7.75		7.34
		Maximum	7.08	7.21	7.82	7.52	8.59	6.95		7.08	7.77		8.22		7.71
		Minimum	6.54	6.79	6.83	6.91	6.69	6.56		7.01	6.57		7.14		7.04
	WSE (ft)	Average	214.97	210.25	223.02	203.48	186.80	188.85		220.20	216.89		201.25		223.76
		Maximum	219.05	210.25	224.80	205.87	188.17	188.85		220.20	218.05		201.25		223.76
		Minimum	209.85	210.25	220.41	200.90	185.53	188.85		220.20	215.24		201.25		223.76
	Temp. (°C)	Average	9.49	10.10	10.31	11.16	11.67	11.99		11.36	11.37		10.38		11.83
		Maximum	12.98	10.75	14.91	14.04	14.20	13.13		11.54	14.27		10.86		12.65

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2018	2019	2020	2021	2022	2023	2024
		Minimum	8.46	9.50	9.25	10.42	10.73	10.35		11.32	10.38		10.03		10.93
	DO (mg/L)	Average	11.41	10.91	10.69	10.35	9.72	9.81		10.11	10.24		10.86		10.10
		Maximum	12.23	11.59	11.91	11.17	11.74	10.07		10.30	11.22		11.64		10.83
		Minimum	10.57	9.78	9.45	8.02	6.72	9.52		9.97	8.82		9.48		9.75
	Cond. (µS/cm)	Average	47.63	38.06	39.61	47.40	55.21	61.42		41.97	43.22		50.38		36.42
		Maximum	50.00	39.00	49.00	49.00	58.50	61.60		42.00	48.10		50.50		41.50
		Minimum	46.00	37.00	36.00	45.00	54.10	60.80		41.90	40.90		50.30		34.10
Spring	pH	Average	6.83	6.75	6.90	7.07	7.43				6.89	6.95	7.00		
		Maximum	7.50	7.50	8.71	8.06	9.02				8.00	7.81	7.76		
		Minimum	6.41	6.27	6.09	6.25	6.42				6.14	6.06	6.27		
	WSE (ft)	Average	219.62	213.12	222.16	194.71	179.74				217.74	204.52	204.32		
		Maximum	223.10	218.71	224.76	198.72	183.45				218.79	206.82	204.32		
		Minimum	217.39	206.81	218.72	190.41	175.62				216.19	202.07	204.32		
	Temp. (°C)	Average	13.32	13.12	13.43	15.63	15.84				14.43	15.07	15.83		
		Maximum	21.94	22.55	23.37	22.60	24.97				23.74	21.52	21.99		
		Minimum	9.24	10.66	9.80	11.74	11.87				11.51	11.86	12.33		
	DO (mg/L)	Average	9.72	9.25	8.52	7.38	6.32				7.95	8.27	6.67		
		Maximum	11.60	11.42	12.32	10.89	11.02				10.37	10.31	9.05		
		Minimum	8.11	6.78	4.41	2.69	2.33				5.89	5.35	4.43		
	Cond. (µS/cm)	Average	48.60	44.48	43.48	47.99	57.15				42.86	48.93	50.27		
		Maximum	51.00	48.00	52.00	50.00	63.20				46.10	51.30	52.30		
		Minimum	46.00	40.00	40.00	47.00	54.20				35.30	47.80	49.40		
Summer	pH	Average	6.70	6.73	7.20	7.34	6.65			6.86	7.24	6.91	7.20	6.96	6.91
		Maximum	7.19	7.81	8.03	8.70	7.57			8.73	8.35	8.98	8.75	8.02	8.05
		Minimum	6.36	5.97	6.36	6.42	6.17			6.03	6.39	5.73	6.22	6.04	6.14

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2018	2019	2020	2021	2022	2023	2024
	WSE (ft)	Average	230.73	215.56	214.33	187.76	173.04			229.60	214.97	196.23	203.20	230.40	228.86
		Maximum	233.59	218.55	215.48	188.72	174.38			231.60	216.61	196.53	203.20	232.47	228.86
		Minimum	227.87	212.79	213.20	187.17	171.64			227.55	213.39	195.92	203.20	228.28	228.86
	Temp. (°C)	Average	16.98	15.49	16.44	18.89	19.14			18.11	17.36	19.09	17.74	17.09	18.38
		Maximum	24.82	24.54	25.12	26.78	24.62			25.92	26.86	25.58	25.08	24.93	25.48
		Minimum	13.32	11.28	11.33	14.80	15.81			15.00	12.49	14.57	13.64	14.37	13.86
	DO (mg/L)	Average	8.69	6.72	6.11	5.67	4.08			7.24	6.18	5.43	5.61	7.63	6.59
		Maximum	11.80	10.85	11.25	9.55	8.46			10.18	9.59	9.89	9.18	10.01	10.45
		Minimum	5.22	1.46	1.81	0.58	0.20			4.38	2.54	1.56	3.03	4.60	3.68
	Cond. (µS/cm)	Average	41.80	47.16	44.26	52.23	57.72			40.11	46.38	50.35	52.46	35.46	42.57
		Maximum	50.00	51.00	48.00	57.00	64.60			48.80	50.40	52.90	56.00	45.90	44.90
		Minimum	36.00	45.00	41.00	50.00	48.40			36.40	43.30	47.40	50.40	30.50	40.80
Fall/Early Winter	pH	Average	7.02	6.78	6.76	7.09	6.82	7.04	6.97	6.86	7.28		6.66	6.66	6.95
		Maximum	8.68	7.54	7.76	7.28	7.19	8.54	7.56	7.71	8.27		7.94	7.37	8.02
		Minimum	6.28	5.66	6.11	6.95	6.56	6.38	6.39	6.55	6.53		6.06	6.35	5.99
	WSE (ft)	Average	216.19	212.05	210.15	185.10	179.25	216.24	219.61	218.61	213.02		202.42	226.26	223.44
		Maximum	220.78	213.01	211.32	185.10	179.25	217.50	221.11	218.76	213.02		203.13	226.26	226.63
		Minimum	211.58	211.31	208.57	185.10	179.25	215.71	218.82	218.46	213.02		201.70	226.26	220.07
	Temp. (°C)	Average	17.11	15.01	14.69	15.99	17.22	15.59	15.62	16.52	17.93		16.24	17.32	15.97
		Maximum	24.55	22.80	20.72	16.02	21.19	22.64	19.96	17.15	24.31		22.53	21.43	24.17
		Minimum	14.69	12.51	11.88	15.81	15.35	12.85	13.85	15.63	14.40		14.60	15.22	13.28
	DO (mg/L)	Average	7.33	6.98	7.09	9.01	6.23	4.78	6.38	7.45	4.91		5.87	5.26	7.31
		Maximum	10.88	9.69	9.70	9.39	8.84	9.10	9.72	9.62	9.23		8.84	9.01	9.73
		Minimum	3.79	1.50	1.37	7.65	2.98	0.25	1.35	5.36	1.58		1.52	2.62	1.75
	Cond. (µS/cm)	Average	39.05	45.08	47.89	53.70	55.57	55.76	44.14	39.14	49.42		49.61	32.72	41.14

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2018	2019	2020	2021	2022	2023	2024
		Maximum	46.00	51.00	50.00	54.00	61.70	61.30	47.10	41.10	51.20		57.40	39.50	44.60
		Minimum	32.00	42.00	45.00	53.00	51.70	48.80	39.30	35.70	48.10		42.10	29.00	39.60

Table F-11. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CASS, 2001-2015.

SEASON	PARAMETER	STAT	2001	2002	2003	2007	2008	2009	2010	2011	2014	2015
Winter	pH	Average						7.63				
		Maximum						7.84				
		Minimum						6.96				
	WSE (ft)	Average						188.38				
		Maximum						188.38				
		Minimum						188.38				
	Temp. (°C)	Average						9.55				
		Maximum						9.89				
		Minimum						9.34				
	DO (mg/L)	Average						11.48				
		Maximum						12.05				
		Minimum						10.37				
	Cond. (µS/cm)	Average						47.44				
		Maximum						48.00				
		Minimum						47.00				
Spring	pH	Average						7.25		7.32		7.53
		Maximum						7.71		7.38		9.03
		Minimum						6.93		7.14		6.40
	WSE (ft)	Average						212.13		219.58		178.81
		Maximum						212.13		219.58		181.77

SEASON	PARAMETER	STAT	2001	2002	2003	2007	2008	2009	2010	2011	2014	2015
		Minimum						212.13		219.58		175.62
	Temp. (°C)	Average						13.56		16.41		16.79
		Maximum						21.26		17.15		25.96
		Minimum						10.74		12.91		12.39
	DO (mg/L)	Average						8.70		9.98		5.91
		Maximum						10.50		10.22		9.85
		Minimum						6.97		9.14		2.33
	Cond. (µS/cm)	Average						45.00		47.87		57.94
		Maximum						49.00		48.00		63.60
		Minimum						43.00		47.00		55.10
Summer	pH	Average	6.84	7.18	6.83		7.19		7.63		7.48	7.17
		Maximum	7.99	8.22	7.71		9.27		7.86		8.58	8.58
		Minimum	6.21	6.35	6.25		6.35		7.21		6.82	6.47
	WSE (ft)	Average	203.84	209.60	216.70		191.75		225.36		187.37	173.90
		Maximum	203.84	209.60	217.04		194.08		225.36		187.40	174.38
		Minimum	203.84	209.60	216.32		189.09		225.36		187.32	173.38
	Temp. (°C)	Average	17.99	17.96	19.67		18.83		21.18		19.62	19.44
		Maximum	25.87	25.67	26.09		28.76		25.09		25.93	26.74
		Minimum	13.29	12.65	14.33		13.20		15.27		15.94	15.97
	DO (mg/L)	Average	7.00	5.57	5.96		5.06		8.51		4.88	3.83
		Maximum	9.87	8.94	8.10		10.53		10.80		9.11	8.66
		Minimum	4.28	2.74	3.70		0.41		5.17		0.37	0.52
	Cond. (µS/cm)	Average	49.06	43.10	40.00		56.04		51.22		52.35	62.20
		Maximum	50.00	50.00	40.00		64.00		54.00		57.00	67.10
		Minimum	40.00	40.00	40.00		50.00		47.00		50.00	59.10

SEASON	PARAMETER	STAT	2001	2002	2003	2007	2008	2009	2010	2011	2014	2015
Fall/Early Winter	pH	Average				6.79	7.05				7.34	7.34
		Maximum				7.23	8.00				8.49	7.98
		Minimum				6.31	6.62				6.79	6.87
	WSE (ft)	Average				203.84	189.34				187.39	182.04
		Maximum				203.84	189.54				187.39	182.04
		Minimum				203.84	189.12				187.39	182.04
	Temp. (°C)	Average				16.49	16.02				18.21	17.84
		Maximum				18.25	19.17				23.15	23.05
		Minimum				14.19	13.88				14.84	15.63
	DO (mg/L)	Average				6.73	6.22				5.02	5.59
		Maximum				8.69	9.64				10.01	10.12
		Minimum				3.63	0.71				0.40	0.95
	Cond. (µS/cm)	Average				40.00	56.30				51.59	55.24
		Maximum				40.00	57.00				55.00	62.80
		Minimum				40.00	55.00				50.00	50.50

Table F-12. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMI, 1998-2010.

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.14	7.22	7.27	7.59	7.16	7.30	7.08	7.29	6.85	7.13	7.46	
		Maximum	7.26	7.41	7.37	8.10	7.67	7.69	7.40	7.54	7.25	7.27	7.84	
		Minimum	7.05	7.11	7.10	7.17	6.80	6.95	6.76	6.92	6.47	6.94	6.95	
	WSE (ft)	Average	213.68	218.96	215.96	208.35	217.95	219.94	220.35	217.90	221.18	202.96	193.91	
		Maximum	213.68	218.96	216.80	210.64	219.64	220.52	225.00	224.84	222.52	202.96	198.92	
		Minimum	213.68	218.96	215.16	206.44	213.48	219.40	213.44	212.96	219.84	202.96	188.38	
	Temp. (°C)	Average	11.28	11.01	10.14	10.40	11.15	10.27	10.11	10.84	10.65	10.97	10.41	

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Maximum	12.05	11.16	12.54	12.75	15.58	10.73	15.36	12.67	16.54	14.62	14.88	
		Minimum	9.72	10.90	9.36	8.92	9.22	9.15	8.18	8.20	9.33	9.31	9.01	
	DO (mg/L)	Average	10.52	10.29	10.77	10.48	9.88	10.14	10.66	10.32	10.46	10.63	11.12	
		Maximum	10.69	10.80	11.34	11.47	11.07	10.76	11.39	11.02	11.14	11.47	11.97	
		Minimum	10.29	9.90	10.26	9.60	8.49	9.43	9.88	9.77	9.87	10.14	10.02	
	Cond. (µS/cm)	Average	40.40	30.00	39.73	43.42	41.80	40.00	40.00	40.00	31.54	43.18	45.60	
		Maximum	50.00	30.00	40.00	50.00	50.00	40.00	40.00	40.00	40.00	50.00	51.00	
		Minimum	40.00	30.00	30.00	40.00	30.00	40.00	40.00	40.00	30.00	40.00	41.00	
Spring	pH	Average		7.13	7.07	7.12	7.17	7.13	7.09	7.37	7.17	7.15	7.31	
		Maximum		7.71	7.52	8.08	8.11	7.94	7.74	8.43	7.98	8.01	7.53	
		Minimum		6.77	6.36	6.39	6.62	6.59	6.66	6.98	6.51	6.66	7.05	
	WSE (ft)	Average		226.64	213.43	217.04	225.37	225.34	231.47	229.34	213.04	199.66	212.13	
		Maximum		226.64	215.76	217.96	232.60	227.88	233.00	233.68	213.04	203.12	212.13	
		Minimum		226.64	210.32	215.12	218.40	221.08	229.60	226.36	213.04	196.60	212.13	
	Temp. (°C)	Average		15.77	16.09	14.09	14.94	13.89	13.97	13.55	17.51	15.86	14.34	
		Maximum		25.13	24.70	26.55	26.42	23.28	25.22	23.61	24.29	22.42	23.00	
		Minimum		12.43	11.01	9.80	10.46	9.91	10.20	9.82	12.42	10.79	11.00	
	DO (mg/L)	Average		8.90	8.78	8.57	9.02	8.92	9.48	10.23	7.35	8.80	9.50	
		Maximum		9.85	9.91	10.64	11.00	11.04	10.49	11.81	9.52	10.23	10.21	
		Minimum		8.30	6.52	5.42	6.85	6.85	8.21	8.10	4.88	6.09	8.37	
	Cond. (µS/cm)	Average		40.00	35.09	49.92	42.59	40.00	40.85	39.40	40.00	48.56	43.30	
		Maximum		40.00	50.00	50.00	50.00	40.00	50.00	50.00	40.00	54.00	49.00	
		Minimum		40.00	20.00	40.00	40.00	40.00	40.00	30.00	40.00	40.00	40.00	
Summer	pH	Average		6.95	6.99	7.11	6.92	6.98	6.94	7.00	7.05	7.55	7.38	7.35
		Maximum		8.00	8.14	8.34	7.96	8.13	8.12	8.19	7.92	9.32	8.19	8.43

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum		6.22	6.16	6.10	6.24	6.07	6.33	6.41	6.19	6.45	6.56	6.77
	WSE (ft)	Average		222.34	204.17	211.46	221.25	211.29	228.25	228.45	208.93	191.78	223.16	225.36
		Maximum		225.08	206.44	215.36	229.52	213.52	234.08	231.72	211.44	194.08	223.16	225.36
		Minimum		219.88	201.64	208.20	215.32	209.32	222.20	224.92	204.84	189.09	223.16	225.36
	Temp. (°C)	Average		18.31	19.56	18.69	19.74	20.34	18.11	18.36	19.90	21.33	18.36	18.50
		Maximum		26.70	27.08	28.78	29.26	28.46	29.36	31.11	28.15	28.13	25.99	25.59
		Minimum		13.00	12.93	11.85	13.02	12.80	12.68	13.49	13.08	14.15	13.54	13.86
	DO (mg/L)	Average		6.91	5.78	6.14	6.46	5.69	7.53	7.85	6.88	6.66	6.53	7.03
		Maximum		9.39	9.19	11.00	10.01	8.66	10.18	10.59	9.49	10.14	10.12	10.15
		Minimum		3.10	1.70	1.32	1.45	0.60	4.34	4.98	2.96	1.01	2.34	3.91
	Cond. (µS/cm)	Average		38.61	45.68	47.94	44.27	44.91	38.06	32.38	40.00	56.36	39.23	49.31
		Maximum		40.00	50.00	50.00	60.00	50.00	50.00	40.00	40.00	62.00	47.00	54.00
		Minimum		30.00	40.00	40.00	40.00	40.00	30.00	30.00	40.00	51.00	32.00	46.00
Fall/Early Winter	pH	Average		6.98	6.99	6.94	7.04	6.97	6.90	6.98	6.92	7.51		7.28
		Maximum		7.25	7.40	7.65	7.83	8.33	7.70	7.71	7.44	8.84		7.45
		Minimum		6.32	6.33	6.20	6.29	6.04	6.23	6.37	6.38	6.73		7.09
	WSE (ft)	Average		220.71	201.45	210.00	215.87	209.85	219.27	220.04	203.81	189.37		215.43
		Maximum		221.68	201.88	210.56	216.76	210.60	220.08	220.68	204.38	189.54		215.43
		Minimum		219.20	201.12	208.92	215.24	209.04	217.92	219.20	203.16	189.12		215.43
	Temp. (°C)	Average		15.49	15.91	16.56	18.48	17.14	17.53	17.86	17.07	17.91		16.95
		Maximum		21.08	22.08	21.78	24.86	23.73	24.27	23.37	22.79	24.08		18.99
		Minimum		12.55	11.29	13.62	13.44	11.65	12.46	14.74	13.37	13.86		15.32
	DO (mg/L)	Average		7.95	8.27	7.57	7.25	7.49	7.12	6.87	7.43	7.52		8.41
		Maximum		10.78	10.47	9.31	9.44	9.96	9.73	9.72	9.25	9.37		9.31
		Minimum		1.46	4.46	1.75	0.27	0.16	2.28	2.40	3.58	2.64		7.93

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Cond. (µS/cm)	Average		33.17	48.64	45.24	44.27	45.78	36.94	34.19	40.00	57.34		43.69
		Maximum		40.00	50.00	50.00	50.00	50.00	50.00	40.00	40.00	59.00		49.00
		Minimum		20.00	40.00	40.00	40.00	40.00	30.00	30.00	40.00	56.00		39.00

Table F-13. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMI, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2019	2020	2021	2022	2023	2024
Winter	pH	Average				7.45			7.26		7.30		7.45
		Maximum				7.54			7.73		7.49		7.65
		Minimum				7.32			6.74		7.15		7.28
	WSE (ft)	Average				205.87			217.72		201.25		223.76
		Maximum				205.87			218.05		201.25		223.76
		Minimum				205.87			217.41		201.25		223.76
	Temp. (°C)	Average				10.35			11.07		10.10		12.26
		Maximum				10.66			12.55		10.67		13.55
		Minimum				10.03			10.23		9.27		10.51
	DO (mg/L)	Average				11.11			10.57		10.49		10.45
		Maximum				11.46			11.30		10.96		10.81
		Minimum				10.66			9.76		10.05		10.01
	Cond. (µS/cm)	Average				49.14			44.37		49.73		36.14
		Maximum				50.00			49.80		50.80		43.00
		Minimum				49.00			40.90		46.20		34.40
Spring	pH	Average	7.22	7.00	7.12	7.17	7.73		7.47	7.25	7.21		7.29
		Maximum	7.31	7.66	7.66	7.84	9.05		7.93	7.72	7.82		7.70
		Minimum	7.15	6.51	6.67	6.36	6.58		6.93	6.59	6.71		6.82
	WSE (ft)	Average	219.58	214.78	220.13	193.34	178.94		218.58	202.07	205.28		230.10

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2019	2020	2021	2022	2023	2024
		Maximum	219.58	218.57	220.13	196.28	181.77		218.58	202.07	206.23		232.33
		Minimum	219.58	210.69	220.13	189.18	175.62		218.58	202.07	204.32		227.71
	Temp. (°C)	Average	14.49	14.24	15.46	17.95	17.96		14.89	18.00	15.36		15.69
		Maximum	17.51	22.10	22.47	26.37	26.80		21.73	22.84	24.02		27.06
		Minimum	11.73	11.10	11.39	12.83	12.84		12.03	13.57	11.05		11.19
	DO (mg/L)	Average	10.20	9.62	8.02	6.75	7.10		9.14	7.80	8.21		9.18
		Maximum	10.40	11.41	11.36	10.34	9.87		10.35	9.02	9.65		10.32
		Minimum	10.07	7.76	5.60	0.27	2.05		7.80	5.74	6.72		7.32
	Cond. (µS/cm)	Average	45.58	46.75	44.52	50.34	58.06		45.17	50.61	49.33		40.58
		Maximum	48.00	50.00	46.00	55.00	64.80		48.00	51.40	53.00		46.40
		Minimum	43.00	43.00	44.00	48.00	52.90		41.40	49.90	47.10		35.70
Summer	pH	Average		7.13		7.54	8.23	6.70	7.38	7.35	7.63	7.32	7.04
		Maximum		7.71		8.56	8.71	7.51	8.12	8.89	8.58	8.31	7.70
		Minimum		6.50		6.85	7.82	6.34	6.76	6.32	6.65	6.43	6.52
	WSE (ft)	Average		214.16		188.00	174.38	231.60	215.50	196.91	203.20	230.45	228.86
		Maximum		214.16		188.80	174.38	231.60	215.50	197.25	203.20	232.47	228.86
		Minimum		214.16		187.32	174.38	231.60	215.50	196.53	203.20	228.28	228.86
	Temp. (°C)	Average		18.23		21.25	20.86	19.19	19.02	21.21	19.46	17.99	19.62
		Maximum		25.85		26.69	25.77	28.48	26.60	27.88	26.54	26.92	26.70
		Minimum		12.53		14.77	16.32	15.50	13.49	14.89	14.14	14.84	14.78
	DO (mg/L)	Average		6.40		6.77	7.69	8.52	6.25	5.84	6.92	8.18	6.56
		Maximum		10.10		9.17	8.65	10.40	8.80	9.34	8.64	9.56	9.15
		Minimum		2.90		1.17	5.17	8.14	2.39	0.62	3.37	7.02	4.10
	Cond. (µS/cm)	Average		49.48		52.67	61.96	39.95	49.11	53.46	52.64	33.15	40.46
		Maximum		51.00		57.00	67.20	49.80	52.10	57.00	57.40	47.20	42.50

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2019	2020	2021	2022	2023	2024
		Minimum		47.00		48.00	56.70	36.10	45.10	50.20	49.40	27.80	37.40
Fall/Early Winter	pH	Average	7.27		6.97	7.65	7.40	7.13			6.90	7.16	7.14
		Maximum	7.85		7.60	8.20	7.93	7.27			7.03	7.81	7.96
		Minimum	6.63		6.10	7.25	7.02	6.89			6.75	6.62	6.50
	WSE (ft)	Average	216.36		210.73	187.39	182.04	218.46			203.13	226.26	223.41
		Maximum	220.78		211.32	187.39	182.04	218.46			203.13	226.26	226.63
		Minimum	211.58		209.80	187.39	182.04	218.46			203.13	226.26	220.07
	Temp. (°C)	Average	17.49		16.44	19.36	17.98	16.86			15.46	18.12	16.69
		Maximum	25.11		21.20	22.58	22.83	17.56			15.60	22.22	24.96
		Minimum	14.33		13.37	15.06	15.74	16.48			15.38	15.75	13.08
	DO (mg/L)	Average	7.91		7.48	6.77	6.93	8.28			7.84	7.84	8.29
		Maximum	9.90		9.65	9.62	10.19	8.96			8.24	9.07	9.56
		Minimum	5.11		1.06	2.56	5.81	7.19			6.74	6.37	3.52
	Cond. (µS/cm)	Average	39.42		47.68	52.28	52.91	40.90			49.39	31.66	39.00
		Maximum	46.00		49.00	54.00	61.80	41.50			49.60	39.90	42.40
		Minimum	34.00		46.00	49.00	47.80	40.00			48.60	27.60	32.40

Table F-14. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CALP, 1998-2012.

SEASON	PARAMETER	STAT	2000	2001	2002	2007	2008	2009	2010	2011	2012
Winter	pH	Average	7.25	7.32	7.26			7.49		7.05	
		Maximum	7.78	7.48	7.80			7.65		7.13	
		Minimum	7.04	7.05	6.84			7.22		6.98	
	WSE (ft)	Average	218.35	217.45	206.11			188.38		219.05	
		Maximum	220.28	220.52	207.40			188.38		219.05	
		Minimum	215.48	215.36	204.88			188.38		219.05	
	Temp. (°C)	Average	11.01	10.26	10.14			9.24		9.55	

SEASON	PARAMETER	STAT	2000	2001	2002	2007	2008	2009	2010	2011	2012
		Maximum	14.93	11.49	11.08			9.81		12.61	
		Minimum	9.61	9.68	9.37			8.53		7.83	
	DO (mg/L)	Average	10.12	10.33	52.76			11.92		11.80	
		Maximum	10.79	11.26	99.90			12.14		12.17	
		Minimum	9.52	9.63	9.60			11.63		11.36	
	Cond. (µS/cm)	Average	40.71	40.50	42.16			37.86		49.26	
		Maximum	50.00	60.00	50.00			41.00		51.00	
		Minimum	30.00	40.00	40.00			33.00		48.00	
Spring	pH	Average	7.27	7.23	7.24		7.33			7.27	6.98
		Maximum	7.97	7.81	7.84		7.88			7.48	7.34
		Minimum	6.75	6.48	6.59		6.74			7.09	6.77
	WSE (ft)	Average	218.63	213.63	216.85		196.60			221.38	210.69
		Maximum	225.80	214.76	217.96		196.60			223.10	210.69
		Minimum	214.92	211.48	214.76		196.60			219.58	210.69
	Temp. (°C)	Average	14.35	14.37	15.24		18.92			15.40	14.28
		Maximum	25.11	25.59	25.74		22.61			24.51	21.38
		Minimum	10.05	10.21	9.81		13.07			11.69	11.12
	DO (mg/L)	Average	9.74	9.38	9.20		8.89			10.01	10.72
		Maximum	10.95	11.07	10.85		9.66			10.61	11.44
		Minimum	8.33	6.68	6.75		7.64			9.14	10.10
	Cond. (µS/cm)	Average	40.95	41.36	49.94		53.81			45.12	46.57
		Maximum	50.00	50.00	50.00		54.00			51.00	48.00
		Minimum	40.00	40.00	40.00		53.00			42.00	43.00
Summer	pH	Average	7.03	7.01	7.21	7.11	7.67	7.35	7.19		7.04
		Maximum	7.98	8.11	8.22	7.81	9.25	7.99	7.62		7.63
		Minimum	6.19	6.28	6.32	6.63	6.55	6.59	6.77		6.42
	WSE (ft)	Average	222.59	205.17	212.76	204.84	191.86	223.16	225.36		214.16
		Maximum	227.08	209.44	215.36	204.84	194.08	223.16	225.36		214.16
		Minimum	219.56	200.96	210.16	204.84	189.09	223.16	225.36		214.16
	Temp. (°C)	Average	19.03	20.27	20.28	21.72	22.15	18.52	18.74		18.53

SEASON	PARAMETER	STAT	2000	2001	2002	2007	2008	2009	2010	2011	2012
		Maximum	28.13	26.83	27.79	27.04	28.23	25.83	25.73		25.93
		Minimum	12.93	12.81	12.67	15.52	13.08	14.04	14.27		12.95
	DO (mg/L)	**Average**	7.13	6.26	6.88	6.93	7.34	6.67	6.64		6.21
		Maximum	9.77	9.76	10.41	8.11	10.12	9.17	8.94		9.09
		Minimum	2.13	1.01	1.45	5.97	1.01	2.92	4.16		2.47
	Cond. (µS/cm)	**Average**	39.51	47.61	47.54	40.00	57.91	38.65	49.40		49.57
		Maximum	50.00	60.00	50.00	40.00	79.00	47.00	54.00		52.00
		Minimum	30.00	40.00	40.00	40.00	51.00	32.00	46.00		48.00
Fall/Early Winter	**pH**	**Average**	7.17	7.10	7.16	7.04	7.54	6.71	7.43	6.98	
		Maximum	7.88	7.73	7.65	7.45	7.79	6.77	7.51	7.07	
		Minimum	6.36	6.21	6.44	6.43	7.14	6.64	7.23	6.85	
	WSE (ft)	**Average**	220.52	201.28	209.69	204.04	189.28	217.10	215.43	211.58	
		Maximum	221.36	202.24	210.56	204.38	189.43	217.10	215.43	211.58	
		Minimum	218.80	199.92	207.88	203.64	189.12	217.10	215.43	211.58	
	Temp. (°C)	**Average**	16.09	16.44	17.60	18.34	16.90	16.36	17.53	15.45	
		Maximum	23.76	23.74	24.06	22.45	18.55	17.75	18.88	15.83	
		Minimum	11.50	10.82	14.03	13.08	14.96	14.71	15.17	14.00	
	DO (mg/L)	**Average**	8.33	8.42	8.03	8.42	8.98	8.24	8.94	8.96	
		Maximum	10.38	10.63	9.53	9.51	9.37	9.61	9.33	9.21	
		Minimum	2.60	0.85	0.51	4.20	8.17	7.25	8.28	8.43	
	Cond. (µS/cm)	**Average**	39.13	49.49	46.23	40.00	57.50	38.25	45.48	40.30	
		Maximum	40.00	60.00	50.00	40.00	58.00	42.00	49.00	41.00	
		Minimum	30.00	40.00	40.00	40.00	57.00	31.00	38.00	35.00	

Table F-15. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CALP, 2013-2024.

SEASON	PARAMETER	STAT	2013	2014	2015	2019	2020	2021	2022	2023	2024
Winter	pH	Average		7.67			7.49		7.56		7.46
		Maximum		7.97			8.10		7.93		7.62
		Minimum		7.41			6.59		7.20		7.30
	WSE (ft)	Average		204.30			217.72		201.25		223.76
		Maximum		204.30			218.05		201.25		223.76
		Minimum		204.30			217.41		201.25		223.76
	Temp. (°C)	Average		9.93			10.98		9.72		12.16
		Maximum		10.34			12.62		10.50		13.67
		Minimum		9.68			10.14		9.09		10.37
	DO (mg/L)	Average		11.84			10.76		11.30		10.52
		Maximum		12.48			11.69		11.83		10.80
		Minimum		11.19			10.16		10.83		9.90
	Cond. (µS/cm)	Average		48.32			44.61		47.86		37.41
		Maximum		49.00			50.30		50.20		43.60
		Minimum		48.00			41.10		45.50		34.70
Spring	pH	Average		7.31	7.81		7.51	7.18	7.33		7.45
		Maximum		7.78	9.02		8.03	7.67	7.82		7.94
		Minimum		6.60	6.51		6.88	6.20	6.72		7.06
	WSE (ft)	Average		192.73	178.96		218.58	204.51	205.33		230.02
		Maximum		196.28	181.77		218.58	206.82	206.23		232.33
		Minimum		189.18	175.62		218.58	202.07	204.32		227.71
	Temp. (°C)	Average		19.90	19.06		15.55	17.44	16.26		15.71
		Maximum		26.33	26.74		22.04	22.86	24.06		27.12
		Minimum		13.88	13.31		12.33	12.74	11.40		11.02

SEASON	PARAMETER	STAT	2013	2014	2015	2019	2020	2021	2022	2023	2024
	DO (mg/L)	Average		7.14	7.63		9.43	8.55	8.65		9.43
		Maximum		9.87	9.74		10.19	10.50	9.83		10.32
		Minimum		1.47	1.05		8.42	5.40	6.29		7.36
	Cond. (µS/cm)	Average		53.13	60.99		45.59	50.83	49.69		40.86
		Maximum		56.00	66.00		49.30	52.90	52.40		46.90
		Minimum		50.00	52.20		42.10	49.00	46.50		35.80
Summer	pH	Average		7.72	8.60	6.64		7.59	7.82	7.21	7.02
		Maximum		8.47	8.82	7.12		8.92	8.55	8.12	7.71
		Minimum		7.14	8.15	6.36		6.67	7.04	6.40	6.47
	WSE (ft)	Average		188.00	174.38	231.60		196.57	203.20	230.46	228.86
		Maximum		188.80	174.38	231.60		197.25	203.20	232.47	228.86
		Minimum		187.32	174.38	231.60		195.92	203.20	228.28	228.86
	Temp. (°C)	Average		21.71	21.98	18.97		22.22	20.11	18.09	19.78
		Maximum		26.56	26.02	27.88		27.90	26.58	26.69	26.73
		Minimum		13.40	14.91	15.12		15.96	14.89	14.95	15.22
	DO (mg/L)	Average		8.30	8.50	8.53		7.54	8.25	8.55	6.50
		Maximum		9.08	8.89	9.45		9.22	8.72	9.30	8.25
		Minimum		4.46	7.78	7.90		5.31	7.33	7.89	3.94
	Cond. (µS/cm)	Average		53.22	63.85	40.08		52.87	52.28	32.34	40.03
		Maximum		58.00	68.10	50.10		57.30	56.60	46.40	43.10
		Minimum		48.00	56.20	36.50		49.20	48.80	26.70	36.50

Table F-16. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMB, 1999-2005.

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005
Winter	pH	Average	7.12	7.28	7.22	7.38	7.29	7.27	7.05
		Maximum	7.23	7.37	7.40	7.73	7.62	7.98	7.38
		Minimum	7.03	7.09	7.04	7.19	6.95	7.00	6.84
	WSE (ft)	Average	213.68	218.96	217.17	208.37	217.23	220.02	220.87
		Maximum	213.68	218.96	219.40	210.64	219.60	220.52	225.00
		Minimum	213.68	218.96	215.16	206.44	213.48	219.40	213.44
	Temp. (°C)	Average	10.01	10.95	10.02	9.65	10.91	9.68	9.57
		Maximum	11.98	11.38	13.38	13.33	15.96	11.09	16.15
		Minimum	8.90	10.74	9.09	8.13	8.42	8.80	7.74
	DO (mg/L)	Average	10.88	10.46	10.64	10.15	10.44	10.20	10.84
		Maximum	10.95	11.05	10.98	10.90	11.11	10.72	11.21
		Minimum	10.75	9.74	10.06	9.74	9.80	9.83	10.04
	Cond. (µS/cm)	Average	46.11	33.53	39.81	44.35	39.06	38.75	43.09
		Maximum	50.00	50.00	60.00	50.00	50.00	40.00	50.00
		Minimum	40.00	30.00	30.00	40.00	30.00	30.00	40.00
Spring	pH	Average		7.21	7.02	7.19	7.24	7.25	7.19
		Maximum		7.79	7.39	7.77	7.68	7.89	7.58
		Minimum		6.77	6.49	6.55	6.79	6.79	6.93
	WSE (ft)	Average		221.83	213.34	216.91	225.39	225.11	231.73
		Maximum		226.64	215.76	217.80	232.24	227.76	233.00
		Minimum		215.88	210.32	216.00	218.40	222.28	230.40
	Temp. (°C)	Average		15.87	16.32	15.78	15.98	14.88	14.11
		Maximum		28.11	25.31	25.66	25.46	23.56	20.58
		Minimum		11.63	10.78	9.59	10.85	9.98	9.87

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005
	DO (mg/L)	Average		9.24	8.59	9.18	9.21	9.18	10.08
		Maximum		10.49	9.73	10.42	10.49	10.26	10.64
		Minimum		7.77	6.15	7.75	7.59	7.84	8.62
	Cond. (µS/cm)	Average		41.05	38.57	50.00	43.33	41.33	40.00
		Maximum		50.00	50.00	50.00	50.00	50.00	40.00
		Minimum		40.00	20.00	50.00	40.00	40.00	40.00
Summer	pH	Average		7.08	7.24	7.22	7.08	7.27	
		Maximum		8.11	8.08	7.86	7.77	7.93	
		Minimum		6.27	6.36	6.10	6.41	6.51	
	WSE (ft)	Average		222.35	204.29	211.18	221.69	210.70	
		Maximum		225.08	206.44	214.64	227.40	212.08	
		Minimum		219.88	201.64	208.20	215.60	209.32	
	Temp. (°C)	Average		20.39	22.62	22.22	21.55	23.04	
		Maximum		28.15	27.52	28.14	28.31	27.29	
		Minimum		13.82	16.45	13.24	14.29	17.73	
	DO (mg/L)	Average		7.33	7.34	6.97	7.34	7.94	
		Maximum		8.49	9.13	8.80	8.89	8.69	
		Minimum		3.07	3.40	2.23	3.95	6.73	
	Cond. (µS/cm)	Average		36.79	48.14	50.00	47.74	47.14	
		Maximum		40.00	60.00	60.00	60.00	50.00	
		Minimum		30.00	40.00	40.00	40.00	40.00	
Fall/Early Winter	pH	Average		7.18	7.24	7.17	7.25	7.26	
		Maximum		7.41	7.63	7.59	7.76	7.91	
		Minimum		6.76	6.72	6.82	6.68	6.71	
	WSE (ft)	Average		220.82	201.43	210.01	215.83	209.65	

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005
		Maximum		221.68	201.88	210.68	216.20	209.80	
		Minimum		219.20	201.12	208.92	215.44	209.48	
	Temp. (°C)	Average		15.08	15.18	15.54	16.66	15.18	
		Maximum		21.33	22.58	21.95	23.24	22.01	
		Minimum		11.72	10.51	12.24	12.77	11.20	
	DO (mg/L)	Average		9.01	8.99	9.18	8.50	9.03	
		Maximum		10.63	10.54	10.47	9.64	9.75	
		Minimum		6.96	8.03	7.86	7.24	8.32	
	Cond. (µS/cm)	Average		31.75	48.50	39.32	42.55	37.93	
		Maximum		40.00	50.00	50.00	50.00	50.00	
		Minimum		10.00	40.00	30.00	30.00	30.00	

Table F-17. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMB, 2007-2015.

SEASON	PARAMETER	STAT	2007	2008	2010	2011	2012	2014	2015
Winter	pH	Average						7.59	
		Maximum						8.12	
		Minimum						7.24	
	WSE (ft)	Average						205.11	
		Maximum						205.87	
		Minimum						204.30	
	Temp. (°C)	Average						9.83	
		Maximum						10.37	
		Minimum						9.37	
	DO (mg/L)	Average						11.78	
		Maximum						12.74	
		Minimum						9.90	
	Cond. (µS/cm)	Average						50.29	

SEASON	PARAMETER	STAT	2007	2008	2010	2011	2012	2014	2015
		Maximum						53.00	
		Minimum						48.00	
Spring	pH	Average		7.48		7.16	7.23		
		Maximum		7.95		7.25	7.69		
		Minimum		6.78		7.08	6.93		
	WSE (ft)	Average		196.60		219.58	210.69		
		Maximum		196.60		219.58	210.69		
		Minimum		196.60		219.58	210.69		
	Temp. (°C)	Average		18.83		14.53	14.30		
		Maximum		23.19		18.21	22.30		
		Minimum		13.07		11.80	10.43		
	DO (mg/L)	Average		9.19		10.27	10.46		
		Maximum		9.55		10.59	10.63		
		Minimum		8.96		9.87	10.03		
	Cond. (µS/cm)	Average		54.45		44.28	47.38		
		Maximum		55.00		48.00	50.00		
		Minimum		54.00		42.00	43.00		
Summer	pH	Average		7.64	7.33		7.33	7.70	
		Maximum		8.51	7.71		7.61	8.36	
		Minimum		6.82	6.85		6.82	7.19	
	WSE (ft)	Average		191.73	225.36		214.16	187.35	
		Maximum		192.62	225.36		214.16	187.38	
		Minimum		189.09	225.36		214.16	187.32	
	Temp. (°C)	Average		20.99	19.74		21.39	18.28	
		Maximum		29.33	26.14		26.32	25.52	
		Minimum		11.57	14.69		14.08	12.91	
	DO (mg/L)	Average		8.38	6.77		7.97	9.00	
		Maximum		9.37	8.56		8.66	9.21	
		Minimum		3.95	3.69		4.18	8.79	

SEASON	PARAMETER	STAT	2007	2008	2010	2011	2012	2014	2015
	Cond. (µS/cm)	Average		58.54	50.05		48.80	52.44	
		Maximum		66.00	55.00		51.00	58.00	
		Minimum		40.00	46.00		48.00	49.00	
Fall/Early Winter	pH	Average	7.31	7.67	7.42	6.67			6.94
		Maximum	7.58	7.93	7.54	6.79			7.01
		Minimum	6.90	7.22	7.22	6.54			6.89
	WSE (ft)	Average	204.13	189.25	215.43	211.58			182.04
		Maximum	204.38	189.43	215.43	211.58			182.04
		Minimum	203.64	189.12	215.43	211.58			182.04
	Temp. (°C)	Average	18.21	14.47	17.00	15.27			16.88
		Maximum	22.57	17.71	18.82	15.74			20.70
		Minimum	12.13	10.86	14.43	13.74			14.93
	DO (mg/L)	Average	8.71	9.49	8.97	9.24			9.08
		Maximum	9.21	10.01	9.54	9.53			9.36
		Minimum	8.17	8.91	8.15	8.30			8.97
	Cond. (µS/cm)	Average	40.00	56.63	44.06	40.24			51.44
		Maximum	40.00	59.00	49.00	42.00			58.40
		Minimum	40.00	55.00	36.00	35.00			47.80

Table F-18. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PENN, 1998-2010.

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.13	7.35	7.20	7.35	7.30	7.27	7.03	7.37	7.09	7.11	7.63	6.93
		Maximum	7.23	7.47	7.43	7.61	7.58	7.88	7.34	8.10	7.30	7.26	8.10	7.58
		Minimum	7.05	7.16	7.05	7.12	6.97	7.04	6.86	6.99	6.87	6.98	7.23	6.52
	WSE (ft)	Average	213.68	218.96	217.11	208.38	217.42	220.03	220.62	218.13	220.73	202.80	188.05	217.84
		Maximum	213.68	218.96	219.40	210.64	219.60	220.52	225.00	224.84	222.52	202.96	188.38	220.05
		Minimum	213.68	218.96	215.16	206.44	213.48	219.40	213.44	212.96	219.84	202.64	187.72	215.29
	Temp. (°C)	Average	9.90	10.93	10.04	9.66	11.09	9.74	9.52	9.41	10.23	10.70	8.62	10.27
		Maximum	12.00	11.33	13.77	12.97	16.18	11.50	15.76	12.78	16.40	15.40	9.13	12.57

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Minimum	8.89	10.77	9.04	8.00	8.53	8.66	7.63	7.23	8.51	8.22	8.27	8.71
	DO (mg/L)	Average	11.01	10.45	10.64	10.20	10.51	10.26	10.83	10.89	11.11	11.09	11.30	11.32
		Maximum	11.06	10.99	11.05	10.80	11.29	10.83	11.35	11.11	11.63	12.14	11.85	11.84
		Minimum	10.96	9.65	10.02	9.77	9.90	9.78	10.07	10.64	10.12	10.37	10.73	10.97
	Cond. (µS/cm)	Average	46.00	36.88	44.78	44.86	39.74	38.44	42.95	40.00	36.22	50.00	35.60	38.61
		Maximum	50.00	70.00	70.00	60.00	50.00	50.00	50.00	40.00	50.00	50.00	40.00	43.00
		Minimum	40.00	30.00	30.00	40.00	30.00	30.00	40.00	40.00	30.00	50.00	32.00	32.00
Spring	pH	Average		7.30	7.08	7.28	7.28	7.25	7.27	7.45	7.23	7.35	7.38	7.25
		Maximum		7.80	7.48	7.77	7.63	7.96	7.57	7.79	7.54	7.95	7.70	7.53
		Minimum		6.90	6.53	6.71	6.88	6.74	7.10	7.26	6.77	6.72	6.66	6.97
	WSE (ft)	Average		219.51	213.44	216.92	225.92	225.18	230.71	229.51	217.36	198.87	207.13	227.84
		Maximum		226.64	215.76	217.80	232.24	227.76	231.04	233.68	217.36	203.12	212.13	229.62
		Minimum		214.92	210.32	216.00	218.40	222.28	230.40	226.36	217.36	195.97	200.42	226.24
	Temp. (°C)	Average		15.38	17.21	16.58	17.04	15.72	13.33	14.69	15.88	19.60	14.63	15.96
		Maximum		27.14	25.23	25.67	25.52	24.55	20.37	24.54	19.02	24.20	22.45	25.18
		Minimum		9.61	11.01	9.42	10.81	10.00	9.68	9.13	12.64	11.26	8.75	10.61
	DO (mg/L)	Average		9.57	8.67	9.34	9.39	9.15	10.44	10.56	9.33	9.24	10.44	9.79
		Maximum		10.68	9.56	10.59	10.52	10.49	11.58	11.89	9.73	10.74	11.58	10.38
		Minimum		8.05	6.22	8.08	7.89	7.75	8.86	7.95	8.11	8.25	9.18	8.64
	Cond. (µS/cm)	Average		41.22	38.25	50.00	44.26	42.50	40.29	39.61	40.00	52.79	43.12	45.53
		Maximum		50.00	50.00	50.00	50.00	50.00	50.00	50.00	40.00	59.00	50.00	54.00
		Minimum		40.00	20.00	50.00	40.00	40.00	40.00	30.00	40.00	50.00	39.00	44.00
Summer	pH	Average		7.29	7.43	7.43	7.22	7.47	7.13	7.12	7.45	7.79	7.53	7.35
		Maximum		8.05	8.07	7.80	7.98	7.91	7.89	7.77	8.14	8.06	8.01	7.91
		Minimum		6.67	6.55	6.34	6.70	6.87	6.47	6.64	6.58	7.33	7.10	6.88
	WSE (ft)	Average		222.38	204.10	211.22	221.13	210.76	226.68	227.00	207.39	191.31	223.14	226.28
		Maximum		225.08	206.44	214.64	227.40	212.08	232.92	231.72	211.44	192.60	223.63	229.89
		Minimum		219.88	201.64	208.20	215.60	209.32	220.16	223.88	204.40	189.09	222.63	223.38
	Temp. (°C)	Average		21.82	23.34	24.07	22.93	23.81	20.53	20.20	23.37	21.95	20.07	20.79

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
		Maximum		28.12	27.89	28.26	27.86	28.07	29.28	29.02	27.77	29.25	27.11	28.95
		Minimum		14.26	16.55	15.48	15.60	16.80	14.04	14.23	12.45	10.51	13.42	14.65
	DO (mg/L)	Average		7.98	8.08	7.94	7.87	8.17	7.82	7.96	7.98	8.72	8.76	8.13
		Maximum		8.52	9.36	9.16	9.16	8.80	8.79	8.79	9.11	9.32	9.51	9.18
		Minimum		6.78	3.45	4.46	7.13	7.70	5.68	5.35	4.74	7.37	8.20	5.19
	Cond. (µS/cm)	Average		35.95	49.74	51.91	47.86	47.83	38.40	33.20	40.70	58.87	39.96	48.44
		Maximum		50.00	70.00	60.00	60.00	50.00	50.00	40.00	50.00	65.00	49.00	55.00
		Minimum		30.00	40.00	40.00	40.00	40.00	30.00	20.00	40.00	56.00	29.00	42.00
Fall/Early Winter	pH	Average		7.16	7.17	7.09	7.34	7.39	7.13	7.05	7.37	7.68		7.35
		Maximum		7.40	7.55	7.36	7.76	8.00	7.31	7.32	7.60	7.99		8.02
		Minimum		6.90	6.77	6.69	6.78	6.64	6.92	6.82	6.95	7.29		6.87
	WSE (ft)	Average		220.81	201.47	209.95	215.85	209.58	219.78	220.53	203.62	188.69		215.80
		Maximum		221.68	201.88	210.68	216.20	209.80	220.08	221.44	204.38	189.12		219.51
		Minimum		219.20	201.12	208.92	215.44	209.48	219.48	219.56	202.62	188.26		212.59
	Temp. (°C)	Average		14.70	15.05	15.76	15.65	15.35	13.24	15.65	16.53	13.93		16.67
		Maximum		21.34	22.17	21.71	23.16	22.22	14.54	21.07	22.57	16.65		23.33
		Minimum		10.69	10.44	12.13	11.41	11.40	11.80	10.95	11.00	11.30		11.70
	DO (mg/L)	Average		9.35	9.18	9.15	8.98	9.15	9.53	9.27	9.31	10.09		9.56
		Maximum		12.06	10.48	10.37	10.61	9.70	9.98	10.92	10.87	10.26		10.84
		Minimum		7.00	8.49	8.04	7.59	8.67	9.03	7.56	8.38	10.03		8.20
	Cond. (µS/cm)	Average		28.80	48.06	38.18	41.43	39.12	35.67	34.09	40.59	51.00		44.84
		Maximum		40.00	50.00	50.00	50.00	50.00	40.00	40.00	50.00	57.00		51.00
		Minimum		10.00	40.00	20.00	30.00	30.00	30.00	30.00	40.00	45.00		36.00

Table F-19. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station PENN, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Winter	pH	Average	6.87	8.23	7.26	7.43	7.13	7.22	7.26		8.86	7.49		7.03	6.79	7.54
		Maximum	7.06	9.66	7.64	8.45	7.43	7.53	7.62		11.98	8.09		7.38	6.83	7.61

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Minimum	6.67	6.91	6.97	6.89	6.95	7.06	7.17		7.40	6.82		6.75	6.70	7.42
	WSE (ft)	Average	209.47	211.11	220.74	202.50	186.97	182.05	219.87		221.48	216.88		205.30	219.44	223.76
		Maximum	211.97	211.45	221.77	204.30	188.17	188.85	222.10		221.48	218.05		208.95	219.44	223.76
		Minimum	206.97	210.77	219.64	200.90	185.53	175.00	217.32		221.48	215.24		201.25	219.44	223.76
	Temp. (°C)	Average	7.77	8.31	9.10	12.10	11.63	9.59	8.27		8.67	11.88		11.09	9.41	11.84
		Maximum	9.33	10.90	10.78	15.50	12.93	11.34	8.80		15.72	15.54		14.35	9.41	13.89
		Minimum	7.12	7.21	7.86	9.63	10.62	8.59	7.83		7.31	10.04		8.76	9.40	10.00
	DO (mg/L)	Average	11.83	11.96	11.31	10.41	10.65	11.00	12.57		22.38	10.63		10.91	11.77	10.81
		Maximum	12.01	12.34	11.83	13.06	10.77	11.63	12.75		80.10	11.54		11.00	11.80	10.96
		Minimum	11.59	11.53	10.76	6.32	10.54	10.35	12.39		11.36	7.27		10.73	11.71	10.75
	Cond. (µS/cm)	Average	43.92	41.21	40.00	53.94	55.95	94.51	44.84		55.03	45.42		47.50	34.19	40.07
		Maximum	49.00	42.00	45.00	64.00	66.80	188.00	49.00		59.10	51.20		50.10	34.20	44.00
		Minimum	43.00	39.00	35.00	49.00	48.40	57.50	41.30		39.70	37.90		45.00	34.10	35.60
Spring	pH	Average	7.10	6.99	7.39	7.49	7.14	7.15	7.00	7.51	8.11	7.55	7.54	7.63		7.48
		Maximum	7.49	7.51	7.80	7.69	7.43	7.28	7.15	7.85	10.04	7.85	7.66	7.82		7.77
		Minimum	6.70	6.61	6.69	7.16	6.96	6.99	6.87	7.18	7.00	7.17	7.23	7.37		7.31
	WSE (ft)	Average	220.58	211.78	222.91	194.82	178.21	207.88	217.08	228.14	224.77	218.58	204.44	204.78		228.16
		Maximum	223.36	218.72	225.06	198.72	178.95	212.10	217.08	230.87	229.04	218.58	206.82	206.23		232.33
		Minimum	218.41	206.89	218.83	189.18	176.69	202.90	217.08	225.07	222.37	218.58	202.07	203.62		224.20
	Temp. (°C)	Average	13.66	14.37	16.56	20.89	14.23	14.94	9.30	15.17	16.23	17.23	20.87	20.09		14.78
		Maximum	24.57	24.57	26.93	27.44	21.31	23.04	9.36	23.56	24.18	22.42	23.29	24.60		27.56
		Minimum	7.69	8.99	9.93	15.01	11.18	9.88	9.28	9.93	12.88	12.22	15.58	12.83		10.10
	DO (mg/L)	Average	10.88	10.08	9.61	9.02	9.80	9.35	12.28	10.27	9.92	9.50	9.01	9.25		9.96
		Maximum	12.71	10.84	11.49	10.16	10.09	10.30	12.33	11.47	10.41	9.68	9.37	10.22		10.84
		Minimum	8.97	8.81	5.55	7.16	9.25	8.10	12.23	9.30	8.64	9.19	8.30	8.67		8.30

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	Cond. (µS/cm)	Average	48.75	48.31	43.27	58.04	59.86	59.07	44.40	41.24	44.14	46.53	53.46	52.31		42.34
		Maximum	67.00	56.00	49.00	62.00	86.60	66.90	44.50	47.90	50.90	49.40	59.00	56.00		48.40
		Minimum	41.00	45.00	40.00	54.00	50.30	54.50	44.30	37.40	34.40	42.60	50.30	49.60		36.80
Summer	pH	Average	6.93	7.30	7.26	7.58	7.62	7.37	7.29	7.58	6.99	7.60	8.46	8.05	7.43	7.18
		Maximum	7.17	7.65	7.71	8.22	7.68	7.56	7.86	7.69	8.39	7.82	8.95	8.53	7.75	7.89
		Minimum	6.65	6.88	6.57	6.86	7.56	7.04	6.87	7.40	6.38	7.20	7.66	7.55	7.15	6.69
	WSE (ft)	Average	228.82	214.91	213.59	188.00	173.86	220.85	226.15	225.51	230.40	215.00	196.60	203.92	230.50	230.04
		Maximum	233.49	215.42	216.12	188.80	173.86	223.16	226.15	225.51	232.81	216.61	197.25	204.50	232.47	231.09
		Minimum	222.12	214.16	212.38	187.32	173.86	218.04	226.15	225.51	227.55	213.39	195.92	203.20	228.28	228.86
	Temp. (°C)	Average	20.31	21.63	23.17	16.33	21.93	19.49	21.77	20.97	20.11	22.05	26.30	24.51	19.30	21.58
		Maximum	27.38	27.04	27.84	27.11	24.87	27.46	27.41	25.21	28.48	26.84	28.42	27.49	26.98	29.56
		Minimum	14.97	14.21	14.83	10.73	18.99	13.35	16.44	14.81	14.59	14.83	23.40	14.73	15.51	15.61
	DO (mg/L)	Average	8.55	8.60	8.43	9.08	8.70	7.61	8.03	92.26	8.59	8.54	8.79	8.48	8.79	8.27
		Maximum	9.56	9.05	9.11	9.53	8.83	8.87	8.26	103.10	9.06	8.81	9.16	8.81	9.25	8.61
		Minimum	5.81	7.74	6.61	8.55	8.56	1.80	7.19	77.90	8.05	8.19	8.28	8.19	8.22	7.75
	Cond. (µS/cm)	Average	40.22	48.73	46.86	50.82	64.55	51.12	40.64	45.21	38.77	48.06	54.56	55.29	33.34	38.38
		Maximum	53.00	52.00	50.00	57.00	69.60	62.30	47.10	100.00	49.00	52.40	57.90	56.80	46.80	42.70
		Minimum	33.00	48.00	43.00	47.00	59.50	40.30	34.80	39.70	11.30	44.50	52.50	50.20	26.60	34.60
Fall/Early Winter	pH	Average	7.17	7.35	7.37	7.13	7.11	7.26	7.41	7.35	7.33	7.62		7.06	7.38	7.25
		Maximum	7.71	7.74	7.64	7.84	7.70	7.79	7.77	7.39	7.42	7.75		7.67	7.62	7.78
		Minimum	6.53	6.55	6.72	6.67	6.77	7.13	6.88	7.26	7.21	7.30		6.29	6.99	6.89
	WSE (ft)	Average	213.91	211.84	210.04	185.55	180.33	216.12	219.99	221.11	218.46	213.02		203.37	226.26	223.79
		Maximum	217.44	212.38	211.04	187.39	182.04	216.57	222.22	221.11	218.46	213.02		205.09	226.26	226.63
		Minimum	210.83	211.35	208.57	183.71	178.51	215.70	217.61	221.11	218.46	213.02		201.70	226.26	220.07
	Temp. (°C)	Average	14.91	17.11	14.97	13.96	12.80	16.24	18.33	19.10	16.47	22.05		16.14	19.51	17.28

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Maximum	21.26	21.95	20.45	20.76	14.77	21.04	21.24	20.04	17.03	23.82		24.08	22.34	24.43
		Minimum	10.08	12.46	10.71	11.86	11.15	11.75	15.35	15.89	15.23	16.62		11.76	16.15	12.06
	DO (mg/L)	Average	9.67	9.27	10.03	9.79	10.41	9.05	9.13	8.80	9.16	8.55		9.12	8.45	8.98
		Maximum	11.24	10.09	11.00	10.54	11.85	10.42	9.54	9.10	9.27	8.80		10.13	8.91	9.82
		Minimum	8.01	7.70	9.00	9.31	8.65	7.43	8.13	7.97	8.96	8.00		8.26	7.86	7.82
	Cond. (µS/cm)	Average	37.54	43.48	48.06	51.77	56.38	49.17	40.36	44.15	40.95	48.38		46.27	34.89	38.94
		Maximum	43.00	45.00	50.00	56.00	62.20	60.00	42.60	44.60	41.40	50.10		56.40	40.00	42.30
		Minimum	29.00	41.00	43.00	49.00	45.80	37.80	33.90	41.70	38.00	47.50		39.90	28.10	33.30

Table F-20. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMA, 1998-2010.

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter	pH	Average	7.17	7.18	7.25	7.13	7.26	7.13	7.05	7.19	7.05	7.12	8.15	6.65
		Maximum	7.28	7.37	7.50	7.56	7.58	7.25	7.28	7.50	7.12	7.23	8.22	7.49
		Minimum	7.12	7.06	6.96	6.70	6.91	7.03	6.93	7.00	6.96	7.03	8.09	6.00
	WSE (ft)	Average	213.68	219.04	217.36	206.92	217.93	219.96	220.72	218.31	222.52	202.80	187.72	217.73
		Maximum	213.68	219.12	220.52	210.64	219.64	220.52	225.00	224.84	222.52	202.96	187.72	220.05
		Minimum	213.68	218.96	215.16	202.80	213.48	219.40	213.44	212.96	222.52	202.64	187.72	215.29
	Temp. (°C)	Average	9.15	10.45	9.97	9.60	10.80	9.47	9.41	8.52	9.06	9.95	9.26	9.27
		Maximum	9.94	11.61	14.09	12.37	16.04	11.53	16.63	11.07	9.90	15.17	9.26	11.72
		Minimum	8.90	9.59	8.47	7.06	8.25	8.28	7.67	7.21	8.45	8.28	9.26	8.50
	DO (mg/L)	Average	11.18	11.82	10.48	22.48	10.41	10.21	11.02	10.95	10.98	11.37	10.98	11.16
		Maximum	11.23	14.09	11.12	94.10	11.06	11.07	12.09	11.28	11.49	11.73	10.99	11.35
		Minimum	11.10	10.21	9.65	9.55	9.96	9.48	10.00	10.73	10.56	10.38	10.98	11.00
	Cond. (µS/cm)	Average	48.33	41.38	46.70	47.80	39.27	35.00	41.28	40.00	30.00	50.00	39.00	37.07
		Maximum	50.00	70.00	70.00	80.00	50.00	40.00	50.00	40.00	30.00	50.00	39.00	43.00

		Minimum	40.00	30.00	30.00	0.00	30.00	30.00	40.00	40.00	30.00	50.00	39.00	31.00
Spring	**pH**	**Average**		7.34	7.30	7.30	7.22	7.24	7.18	7.37	7.36	7.01	7.26	7.18
		Maximum		7.78	9.14	7.78	7.72	8.20	7.56	7.51	7.72	7.30	7.86	7.46
		Minimum		6.89	6.42	6.87	6.81	6.59	6.90	7.24	6.98	6.56	6.77	6.90
	WSE (ft)	**Average**		218.60	213.52	216.46	225.33	225.33	231.19	230.25	213.04	199.77	206.69	227.82
		Maximum		226.64	215.76	217.96	232.60	227.88	232.88	233.68	213.04	203.12	212.13	229.62
		Minimum		214.92	210.32	213.20	218.40	221.08	229.60	226.36	213.04	196.60	200.42	226.24
	Temp. (°C)	**Average**		14.78	17.04	15.15	16.11	16.55	14.24	15.34	19.96	15.70	11.32	15.77
		Maximum		26.44	27.06	26.89	26.93	24.63	26.10	24.35	25.26	23.80	18.24	24.70
		Minimum		9.57	9.63	8.71	9.28	9.71	9.65	10.99	13.57	9.75	8.43	9.98
	DO (mg/L)	**Average**		9.81	9.13	9.64	9.25	8.91	10.03	10.44	8.83	9.77	10.99	9.87
		Maximum		11.01	11.27	10.80	10.62	10.42	11.62	11.70	9.61	11.04	11.79	10.57
		Minimum		8.01	4.84	7.97	7.56	5.72	7.95	8.22	8.18	8.64	9.71	8.54
	Cond. (µS/cm)	**Average**		41.13	45.43	48.69	42.65	43.98	39.17	40.00	40.00	51.70	39.62	45.47
		Maximum		50.00	60.00	50.00	50.00	50.00	50.00	50.00	40.00	56.00	47.00	51.00
		Minimum		30.00	30.00	40.00	30.00	40.00	30.00	30.00	40.00	50.00	38.00	44.00
Summer	**pH**	**Average**		7.21	7.35	7.43	7.16	7.44	7.11	7.01	7.15	7.15	7.58	7.09
		Maximum		8.13	8.19	8.02	7.92	8.00	7.82	7.35	7.61	7.92	7.82	7.95
		Minimum		6.43	6.18	6.37	6.23	6.63	6.21	6.85	6.71	6.20	7.24	6.35
	WSE (ft)	**Average**		222.58	205.24	212.14	221.75	211.29	228.40	231.72	210.04	191.48	223.14	226.31
		Maximum		227.08	209.44	216.80	229.52	213.52	234.08	231.72	210.04	192.62	223.63	229.89
		Minimum		219.56	200.96	208.20	215.32	209.32	222.20	231.72	210.04	189.09	222.63	223.38
	Temp. (°C)	**Average**		21.15	23.10	23.23	23.15	23.63	20.83	18.77	24.56	15.10	21.29	21.43
		Maximum		28.86	28.81	29.19	30.07	29.00	30.29	28.91	28.21	29.66	26.92	29.13
		Minimum		13.94	14.00	13.29	15.33	14.79	14.03	14.71	21.58	9.66	13.90	14.92
	DO (mg/L)	**Average**		7.95	7.96	7.92	7.55	8.21	8.07	8.50	7.51	9.01	8.60	8.05

		Maximum		9.48	10.47	10.06	8.99	9.48	8.99	8.93	8.08	9.49	9.33	9.06
		Minimum		4.15	3.19	2.59	2.78	5.97	6.88	7.57	6.70	8.21	8.18	3.45
	Cond. (µS/cm)	**Average**		36.40	49.76	49.30	46.56	45.37	37.67	27.06	40.00	57.13	41.28	49.04
		Maximum		50.00	70.00	60.00	60.00	50.00	50.00	40.00	40.00	62.00	49.00	55.00
		Minimum		30.00	0.00	40.00	0.00	40.00	30.00	20.00	40.00	55.00	31.00	42.00
Fall/Early Winter	**pH**	**Average**		7.16	7.20	7.01	7.18	7.23	7.16	7.15	7.21	7.53		7.26
		Maximum		7.78	8.07	7.66	7.75	8.51	7.88	7.67	7.71	8.01		8.03
		Minimum		6.36	6.49	6.62	6.57	6.49	6.50	6.76	6.82	7.03		6.59
	WSE (ft)	**Average**		220.62	201.22	209.95	215.88	209.83	219.27	220.06	203.85	188.84		215.78
		Maximum		221.68	202.24	211.28	216.76	210.60	220.08	220.68	204.38	189.43		219.51
		Minimum		218.80	199.92	207.88	215.24	209.04	217.92	219.20	203.16	188.26		212.59
	Temp. (°C)	**Average**		15.31	14.86	14.58	17.25	15.84	17.73	18.03	15.17	12.99		15.38
		Maximum		24.26	24.07	24.19	24.79	23.46	24.82	23.55	22.03	16.39		22.88
		Minimum		10.94	10.36	11.58	11.44	11.43	11.53	15.17	9.36	10.12		11.53
	DO (mg/L)	**Average**		8.58	9.05	8.96	8.52	9.03	8.41	8.34	8.87	9.94		9.45
		Maximum		10.68	10.73	9.98	10.07	9.84	9.55	9.50	9.50	10.30		10.84
		Minimum		4.16	7.37	7.76	7.52	8.16	5.77	7.08	7.54	9.13		8.25
	Cond. (µS/cm)	**Average**		32.36	48.12	35.26	39.46	42.95	36.79	34.92	40.00	51.10		41.38
		Maximum		50.00	60.00	50.00	50.00	50.00	50.00	40.00	40.00	57.00		51.00
		Minimum		10.00	40.00	20.00	30.00	30.00	30.00	30.00	40.00	44.00		34.00

Table F-21. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station CAMA, 2011-2024.

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Winter	**pH**	**Average**	6.72	7.97	6.75	7.39	7.33	7.18	7.20		7.34	7.58		6.84	6.88	7.48
		Maximum	6.91	9.36	7.00	8.15	7.40	7.53	7.73		7.75	8.39		7.75	6.97	7.59
		Minimum	6.57	6.64	6.54	6.65	7.21	7.05	6.93		7.21	6.79		5.83	6.82	7.38
	WSE (ft)	**Average**	213.06	211.14	220.67	202.76	186.85	183.18	219.71		221.48	216.88		205.78	219.44	223.76
		Maximum	219.05	211.45	221.77	204.30	188.17	188.85	222.10		221.48	218.05		208.95	219.44	223.76
		Minimum	206.97	210.77	219.64	200.90	185.53	175.00	217.32		221.48	215.24		201.25	219.44	223.76
	Temp. (°C)	**Average**	7.88	7.60	8.46	11.68	11.55	9.43	8.30		8.07	11.96		11.03	9.39	11.09
		Maximum	8.27	9.90	10.09	15.39	13.22	10.68	8.80		8.13	15.64		14.42	9.40	13.65
		Minimum	7.42	6.90	7.46	9.28	10.54	8.57	7.82		8.05	9.90		8.74	9.38	9.54
	DO (mg/L)	**Average**	12.01	11.87	11.20	10.16	10.66	11.23	12.59		11.95	10.34		10.95	11.82	10.79
		Maximum	12.12	12.22	11.94	12.94	10.81	11.59	12.74		12.02	11.65		11.12	11.85	10.87
		Minimum	11.83	11.66	10.63	1.51	10.56	11.04	12.43		11.91	6.19		10.33	11.76	10.70
	Cond. (µS/cm)	**Average**	45.56	40.71	35.48	56.11	53.56	71.75	44.73		59.10	46.62		47.10	33.81	41.40
		Maximum	49.00	42.00	37.00	72.00	62.30	115.00	48.40		59.10	51.10		50.00	33.90	44.70
		Minimum	43.00	39.00	35.00	47.00	46.70	57.30	41.10		59.10	41.70		44.50	33.80	35.80
Spring	**pH**	**Average**	6.74	6.91	7.30	7.45	7.24	7.02	6.90	7.48	8.35	7.46	7.61	7.60		7.51
		Maximum	7.07	7.36	7.89	7.67	7.47	7.54	7.10	7.74	9.93	7.65	7.69	7.77		7.92
		Minimum	6.40	6.45	6.70	7.05	7.03	6.64	6.75	7.17	6.78	7.18	7.51	7.38		7.28
	WSE (ft)	**Average**	220.12	212.43	223.00	194.86	178.02	207.96	217.08	228.38	224.67	218.58	202.07	204.46		228.25
		Maximum	223.36	218.72	225.06	198.72	178.95	212.10	217.08	230.87	229.04	218.58	202.07	206.23		232.33
		Minimum	218.41	206.89	218.83	189.18	176.69	202.90	217.08	225.07	222.37	218.58	202.07	203.62		224.20
	Temp. (°C)	**Average**	11.97	14.38	17.40	20.28	13.56	12.04	9.31	15.33	14.89	18.50	22.94	21.10		14.21
		Maximum	19.53	24.51	26.88	27.69	20.31	22.04	9.36	23.14	21.85	22.25	23.29	24.50		27.65
		Minimum	7.76	8.29	9.87	15.04	11.07	9.80	9.29	9.63	12.65	13.42	21.75	16.35		9.66

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	DO (mg/L)	Average	11.12	10.10	9.55	9.10	9.78	9.98	12.31	10.21	10.24	9.40	8.78	9.04		9.93
		Maximum	12.71	11.01	10.83	10.20	10.03	10.91	12.35	11.52	10.61	9.57	8.87	9.91		10.72
		Minimum	9.88	8.71	5.68	7.31	9.26	8.60	12.27	9.33	9.25	9.25	8.70	8.64		8.18
	Cond. (µS/cm)	Average	47.04	47.89	43.69	60.15	57.00	56.35	44.29	41.25	43.20	45.34	54.56	51.86		43.11
		Maximum	60.00	52.00	50.00	68.00	77.70	64.20	44.30	48.20	49.50	48.50	56.00	52.50		48.90
		Minimum	40.00	45.00	40.00	57.00	49.80	54.00	44.20	37.70	33.90	42.70	54.00	48.70		37.20
Summer	pH	Average	6.77	7.31	6.98	7.64	7.38	7.13	7.18	6.97	7.05	7.57	8.39	8.02	7.43	7.31
		Maximum	6.97	7.64	7.37	8.03	7.39	7.41	7.65	7.46	8.33	7.83	8.85	8.48	7.79	7.90
		Minimum	6.54	6.85	6.23	7.31	7.36	6.68	6.86	0.70	6.38	7.17	7.57	7.53	7.11	6.57
	WSE (ft)	Average	229.04	214.89	213.54	188.11	173.86	220.98	226.15	225.51	230.46	215.27	196.57	203.85	230.38	230.04
		Maximum	233.49	215.42	216.12	188.80	173.86	223.16	226.15	225.51	232.81	216.61	197.25	204.50	232.47	231.09
		Minimum	222.12	214.16	212.38	187.78	173.86	218.04	226.15	225.51	227.55	213.39	195.92	203.20	228.28	228.86
	Temp. (°C)	Average	20.17	21.21	23.24	12.77	19.03	19.76	22.69	20.63	20.39	22.75	25.91	25.24	19.00	20.94
		Maximum	27.27	26.94	27.82	24.91	19.14	27.27	27.36	25.04	28.32	26.77	28.26	27.39	27.15	26.89
		Minimum	14.50	13.27	13.15	10.78	18.92	13.55	16.85	15.32	14.69	15.08	22.33	20.39	15.27	14.04
	DO (mg/L)	Average	8.47	8.66	8.29	9.33	8.96	7.79	8.00	90.49	8.57	8.48	8.75	8.41	8.77	8.06
		Maximum	9.78	9.01	8.92	9.61	8.98	9.30	8.08	101.70	9.21	8.73	9.27	8.69	9.36	8.75
		Minimum	4.16	8.41	5.67	8.87	8.95	3.82	7.83	73.70	7.52	8.26	8.29	8.10	7.98	6.90
	Cond. (µS/cm)	Average	40.64	48.55	47.90	48.08	56.90	51.46	41.61	55.91	40.13	47.53	54.44	55.41	32.98	46.63
		Maximum	49.00	51.00	54.00	54.00	56.90	61.70	46.90	300.00	49.50	52.30	58.00	57.50	46.30	57.30
		Minimum	34.00	48.00	45.00	47.00	56.90	39.40	35.00	40.10	31.60	44.50	52.00	51.10	26.20	34.90
Fall/Early Winter	pH	Average	6.77	6.88	7.27	7.26	6.75	7.19	7.51	7.29	7.35	7.36		7.07	7.40	7.27
		Maximum	7.58	7.46	7.78	7.63	7.36	7.40	7.71	7.43	7.58	7.46		7.59	7.60	7.67
		Minimum	6.40	6.31	6.10	6.70	6.27	6.98	7.27	7.07	7.15	7.22		6.68	7.05	6.96
	WSE (ft)	Average	213.89	211.96	210.34	185.55	180.22	216.12	220.12	219.99	218.46	213.02		203.30	226.26	223.58

SEASON	PARAMETER	STAT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Maximum	217.44	212.38	211.32	187.39	182.04	216.57	222.22	221.11	218.46	213.02		205.09	226.26	226.63
		Minimum	210.83	211.35	208.57	183.71	178.51	215.70	217.61	218.87	218.46	213.02		201.70	226.26	220.07
	Temp. (°C)	**Average**	13.44	15.46	15.25	12.71	12.12	15.74	18.96	18.27	16.31	22.22		16.00	18.95	17.00
		Maximum	21.01	21.54	21.09	14.80	14.74	21.10	20.93	20.01	16.92	23.29		24.18	22.30	24.26
		Minimum	9.53	12.23	8.96	11.45	10.36	11.71	16.67	15.38	14.99	18.92		11.73	15.45	11.97
	DO (mg/L)	**Average**	9.58	9.04	9.92	9.88	10.23	8.93	9.28	8.73	9.14	8.61		8.82	8.36	9.05
		Maximum	10.97	9.98	11.30	10.62	11.22	9.94	9.50	9.02	9.29	8.91		10.15	8.82	9.83
		Minimum	8.64	8.21	9.02	9.38	8.57	7.64	8.77	7.74	8.83	8.20		7.88	7.76	7.80
	Cond. (µS/cm)	**Average**	34.39	43.29	47.98	51.08	55.30	46.81	41.74	42.05	40.54	48.22		43.59	34.28	38.84
		Maximum	43.00	45.00	51.00	58.00	61.70	60.00	42.60	45.50	41.40	49.60		56.50	40.00	42.70
		Minimum	27.00	42.00	43.00	48.00	45.50	37.50	40.00	37.90	37.30	47.80		38.30	27.10	32.60

Table F-22. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station FLEX, 1998-2010.

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2009	2010
Winter	**pH**	**Average**	7.16	6.74	7.23	7.13	7.14	7.15	7.01				
		Maximum	7.18	6.77	7.48	7.42	7.24	7.26	7.08				
		Minimum	7.13	6.69	7.03	6.71	6.98	7.03	6.92				
	WSE (ft)	**Average**	213.68	218.96	217.74	208.25	217.10	220.01	221.44				
		Maximum	213.68	218.96	219.40	210.64	219.60	220.52	225.00				
		Minimum	213.68	218.96	215.16	206.44	213.48	219.40	213.44				
	Temp. (°C)	**Average**	8.95	10.79	9.10	9.03	9.05	8.70	8.29				
		Maximum	8.97	10.93	10.25	10.33	9.36	9.17	8.53				
		Minimum	8.95	10.62	8.31	7.99	8.29	8.30	7.74				
	DO (mg/L)	**Average**	11.42	10.87	11.08	10.79	10.93	10.50	11.30				
		Maximum	11.56	10.99	11.46	12.72	11.19	11.10	11.68				

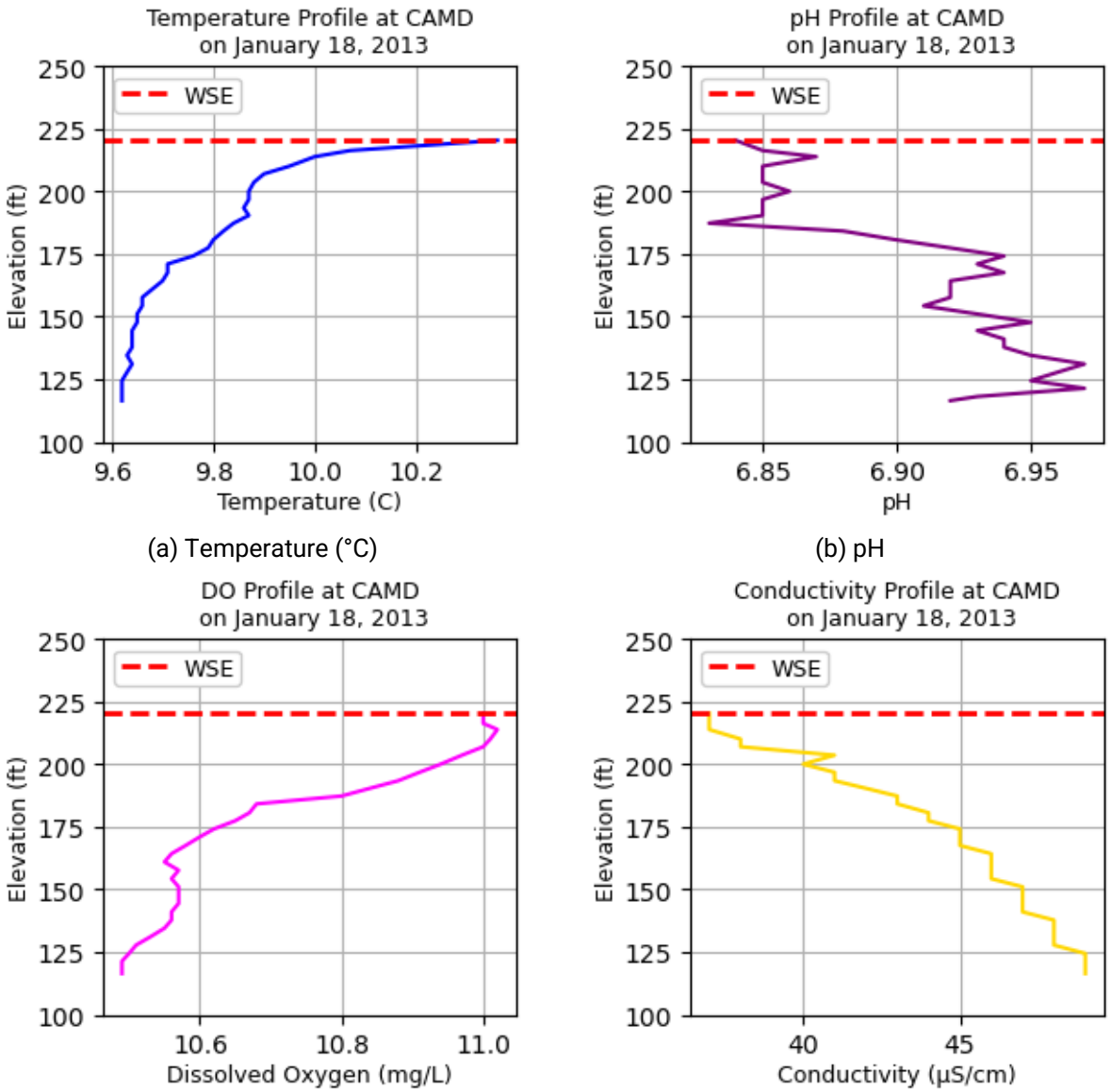
SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2009	2010
		Minimum	11.35	10.77	10.96	10.16	10.52	9.74	10.99				
	Cond. (µS/cm)	Average	50.00	40.00	46.11	47.62	34.09	35.45	40.00				
		Maximum	50.00	40.00	70.00	60.00	40.00	40.00	40.00				
		Minimum	50.00	40.00	40.00	40.00	30.00	30.00	40.00				
Spring	pH	Average		7.18	7.16	7.48	7.19	7.33	7.17	7.31			
		Maximum		7.51	7.84	7.75	7.59	8.23	7.31	7.39			
		Minimum		6.97	6.38	6.95	6.75	6.56	7.00	7.25			
	WSE (ft)	Average		223.05	213.38	217.17	225.61	225.24	230.67	227.27			
		Maximum		226.64	215.76	217.80	232.24	227.76	231.04	227.72			
		Minimum		215.88	210.32	216.96	218.40	222.28	230.40	226.36			
	Temp. (°C)	Average		11.88	14.42	18.44	14.62	13.88	9.71	9.61			
		Maximum		12.85	26.37	22.99	25.44	24.63	10.38	10.85			
		Minimum		9.96	8.96	10.07	9.78	8.58	9.20	9.00			
	DO (mg/L)	Average		10.20	9.68	9.25	9.86	9.51	11.55	12.25			
		Maximum		11.75	10.92	10.88	10.82	10.94	12.02	12.47			
		Minimum		9.42	5.59	8.50	7.95	4.24	11.25	12.00			
	Cond. (µS/cm)	Average		43.33	46.29	47.50	43.44	44.00	40.00	43.33			
		Maximum		50.00	70.00	50.00	50.00	60.00	40.00	50.00			
		Minimum		40.00	30.00	40.00	40.00	40.00	40.00	40.00			
Summer	pH	Average		7.01	7.02	7.42	7.25	6.82		7.06	7.30	7.18	7.54
		Maximum		7.82	7.56	8.02	7.81	7.07		7.62	7.49	7.50	7.76
		Minimum		6.57	6.72	6.37	6.97	6.65		6.81	7.07	6.86	7.00
	WSE (ft)	Average		222.25	204.51	211.57	220.64	210.57		228.48	204.66	223.38	225.36
		Maximum		225.08	206.44	214.64	227.40	212.08		228.48	204.84	223.63	225.36
		Minimum		219.88	201.64	208.20	215.60	209.32		228.48	204.40	223.16	225.36

SEASON	PARAMETER	STAT	1999	2000	2001	2002	2003	2004	2005	2006	2007	2009	2010
	Temp. (°C)	Average		17.53	13.36	23.93	20.68	11.14		21.27	13.89	22.32	25.31
		Maximum		28.25	21.44	28.96	28.31	11.50		31.73	25.84	26.19	26.38
		Minimum		14.51	10.97	13.22	15.12	10.78		17.09	9.28	14.38	22.54
	DO (mg/L)	Average		8.15	9.88	7.86	8.54	10.07		8.44	9.05	8.65	8.58
		Maximum		8.93	10.43	9.64	9.58	10.71		8.91	9.73	9.03	8.69
		Minimum		7.25	8.40	2.10	7.07	9.56		7.33	7.86	8.10	8.51
	Cond. (µS/cm)	Average		31.60	51.67	53.85	44.00	40.00		32.67	40.00	42.90	53.88
		Maximum		40.00	70.00	70.00	60.00	40.00		40.00	40.00	47.00	55.00
		Minimum		20.00	40.00	40.00	30.00	40.00		30.00	40.00	30.00	51.00
Fall/Early Winter	pH	Average		6.95	6.79	6.66	6.77	6.78			7.19		
		Maximum		7.11	7.33	7.62	6.94	7.27			7.60		
		Minimum		6.70	6.48	6.16	6.61	6.47			6.90		
	WSE (ft)	Average		220.89	201.50	209.97	215.74	209.68			203.99		
		Maximum		221.68	201.88	210.68	216.20	209.80			204.24		
		Minimum		219.20	201.12	208.92	215.44	209.48			203.64		
	Temp. (°C)	Average		13.49	10.79	12.57	14.27	11.33			10.72		
		Maximum		14.53	11.96	15.82	15.08	11.87			17.81		
		Minimum		11.66	10.21	11.09	13.73	10.99			9.07		
	DO (mg/L)	Average		8.72	9.09	9.45	8.06	9.44			9.67		
		Maximum		10.46	9.90	10.17	8.31	9.77			10.44		
		Minimum		6.26	8.11	8.43	7.97	9.18			9.30		
	Cond. (µS/cm)	Average		24.48	46.67	33.81	30.00	36.15			43.33		
		Maximum		30.00	60.00	50.00	30.00	40.00			50.00		
		Minimum		10.00	40.00	20.00	30.00	30.00			40.00		

Table F-23. Seasonal Summary Statistics (Period Average, Minimum and Maximum), Station FLEX, 2011-2013.

SEASON	PARAMETER	STAT	2011	2012	2013
Winter	pH	Average			
		Maximum			
		Minimum			
	WSE (ft)	Average			
		Maximum			
		Minimum			
	Temp. (°C)	Average			
		Maximum			
		Minimum			
	DO (mg/L)	Average			
		Maximum			
		Minimum			
	Cond. (µS/cm)	Average			
		Maximum			
		Minimum			
Spring	pH	Average	6.52		7.29
		Maximum	7.15		7.34
		Minimum	6.36		7.22
	WSE (ft)	Average	220.17		220.13
		Maximum	223.10		220.13
		Minimum	219.58		220.13
	Temp. (°C)	Average	11.65		21.77
		Maximum	14.64		23.72
		Minimum	11.04		18.58
	DO (mg/L)	Average	10.86		9.17
		Maximum	10.93		9.60
		Minimum	10.58		9.00
	Cond. (µS/cm)	Average	41.00		46.00
		Maximum	41.00		46.00
		Minimum	41.00		46.00
Summer	pH	Average		6.93	

SEASON	PARAMETER	STAT	2011	2012	2013
		Maximum		7.13	
		Minimum		6.84	
	WSE (ft)	Average		214.16	
		Maximum		214.16	
		Minimum		214.16	
	Temp. (°C)	Average		12.16	
		Maximum		13.29	
		Minimum		11.68	
	DO (mg/L)	Average		9.09	
		Maximum		9.11	
		Minimum		8.99	
	Cond. (µS/cm)	Average		49.00	
		Maximum		49.00	
		Minimum		49.00	
Fall/Early Winter	pH	Average			7.53
		Maximum			7.58
		Minimum			7.45
	WSE (ft)	Average			209.80
		Maximum			209.80
		Minimum			209.80
	Temp. (°C)	Average			12.80
		Maximum			13.78
		Minimum			11.46
	DO (mg/L)	Average			10.32
		Maximum			10.38
		Minimum			10.25
	Cond. (µS/cm)	Average			53.00
		Maximum			58.00
		Minimum			50.00



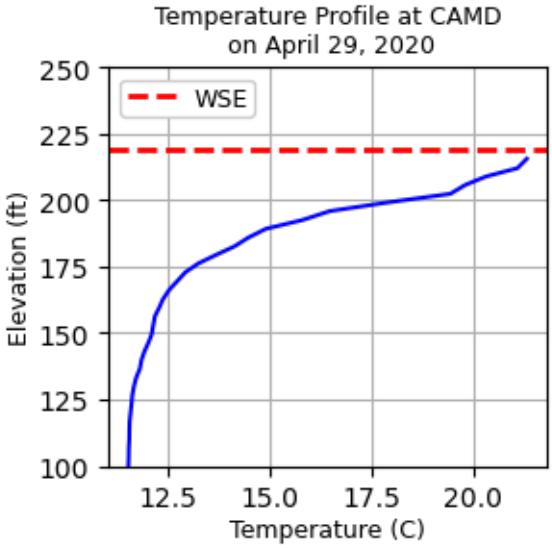
(a) Temperature (°C)

(b) pH

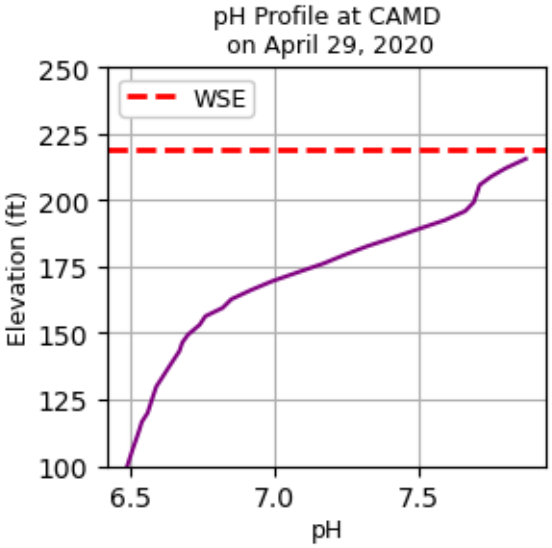
(c) Dissolved Oxygen (mg/L)

(d) Specific Conductivity (µS/cm)

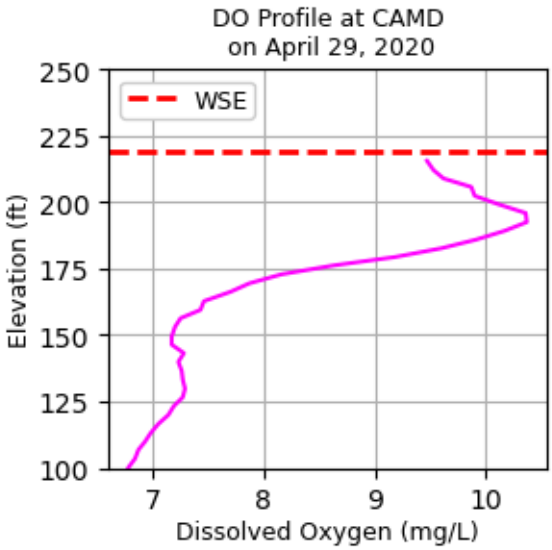
Figure F-1. Example Profile Measurement, Station CAMD, Winter January 18, 2013.



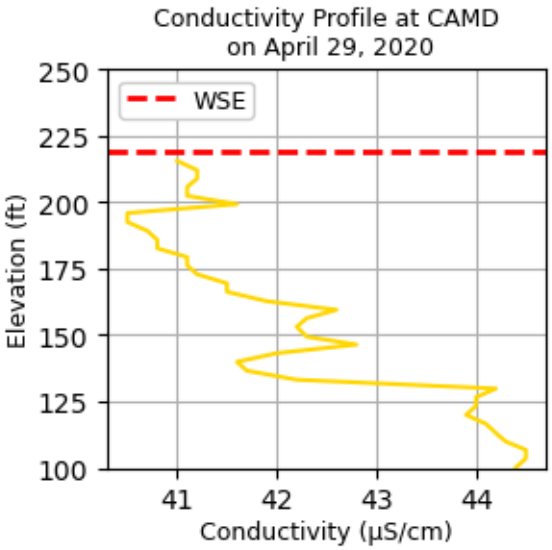
(a) Temperature (°C)



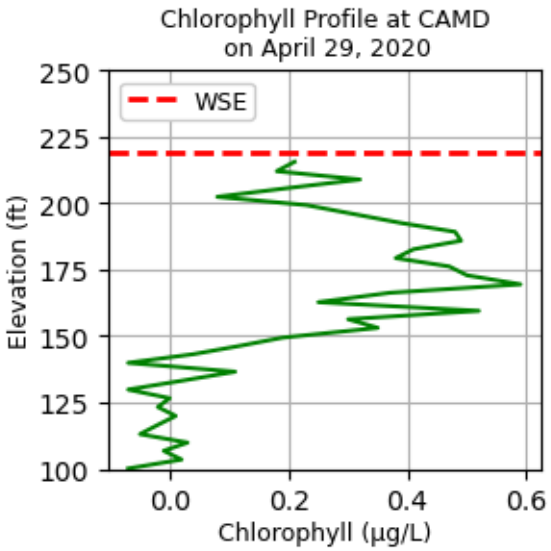
(b) pH



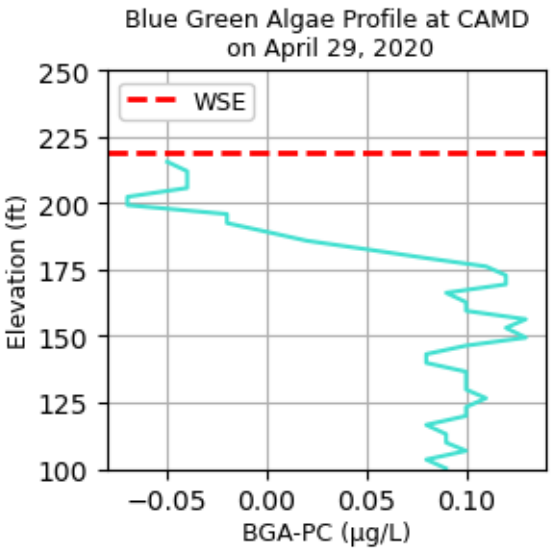
(c) Dissolved Oxygen (mg/L)



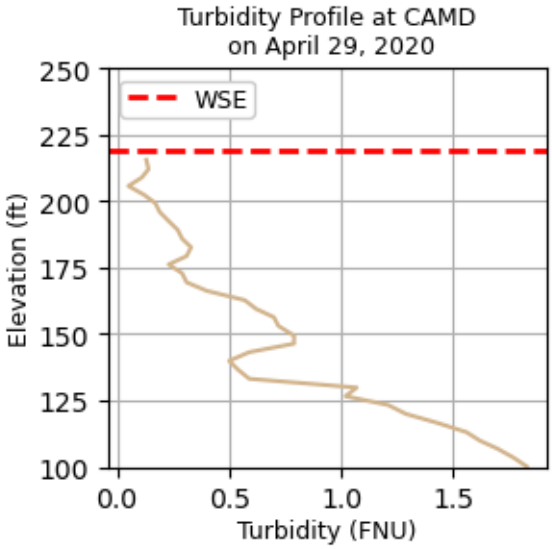
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)

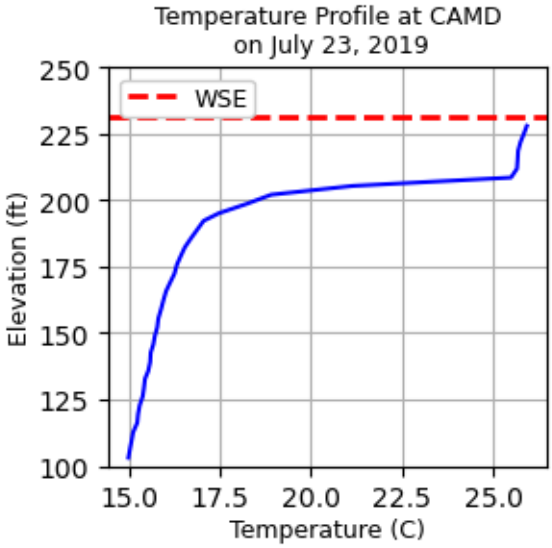


(f)BGA-PC (µg/L)

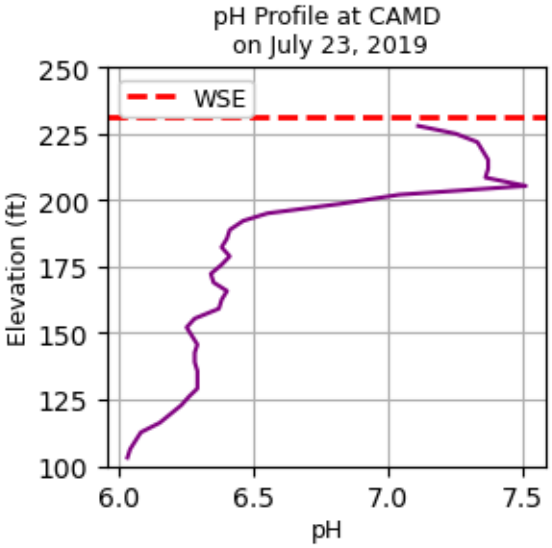


(g) Turbidity (FNU)

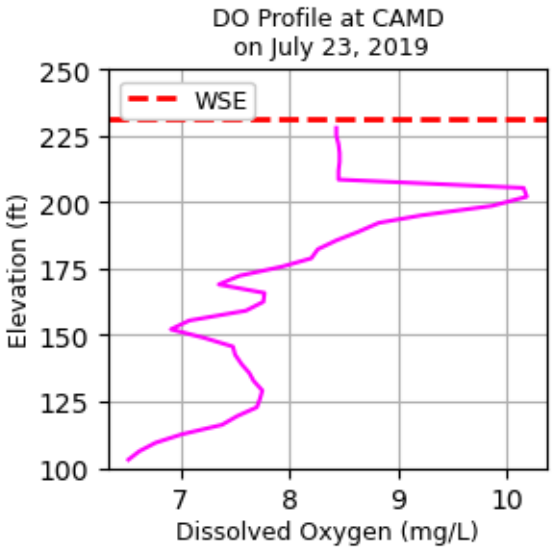
Figure F-2. Example Profile Measurement, Station CAMD, Spring April 29, 2020.



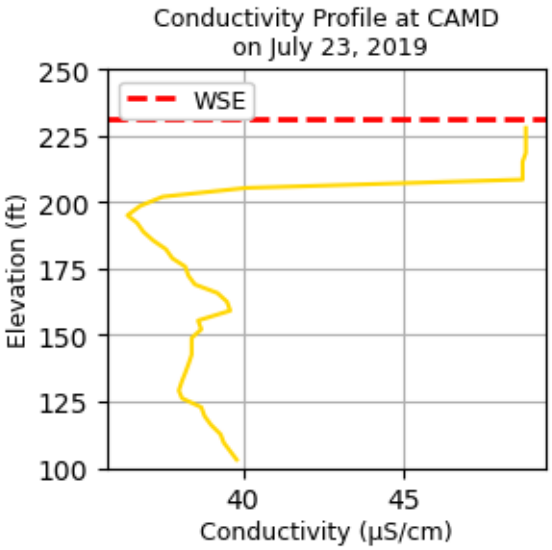
(a) Temperature (°C)



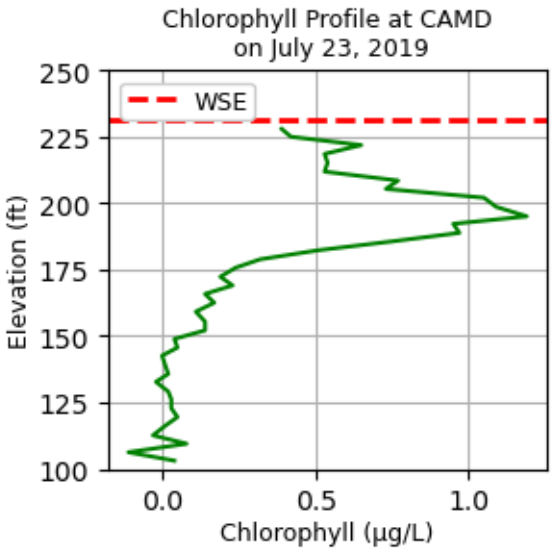
(b) pH



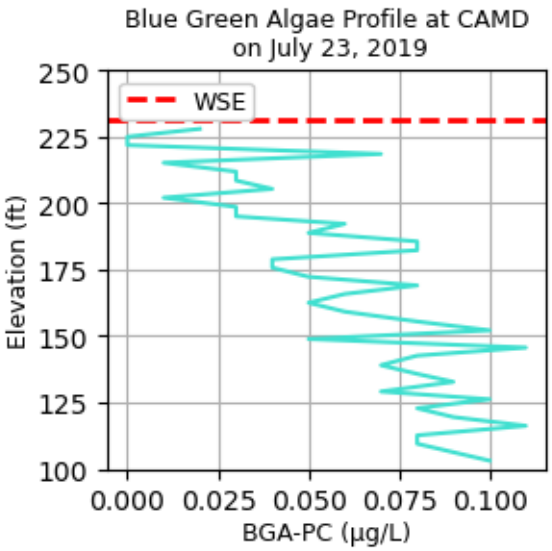
(c) Dissolved Oxygen (mg/L)



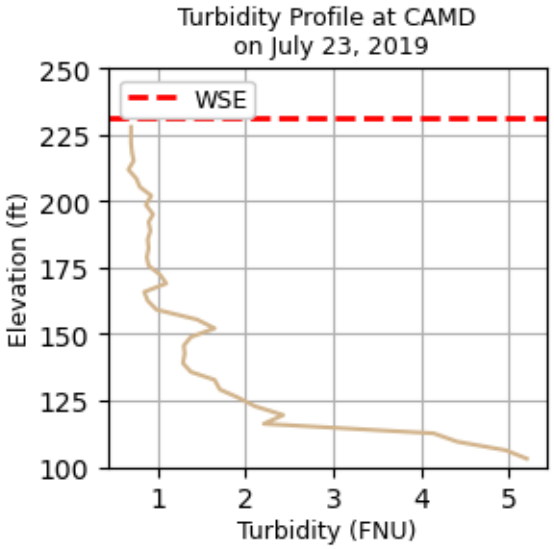
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)

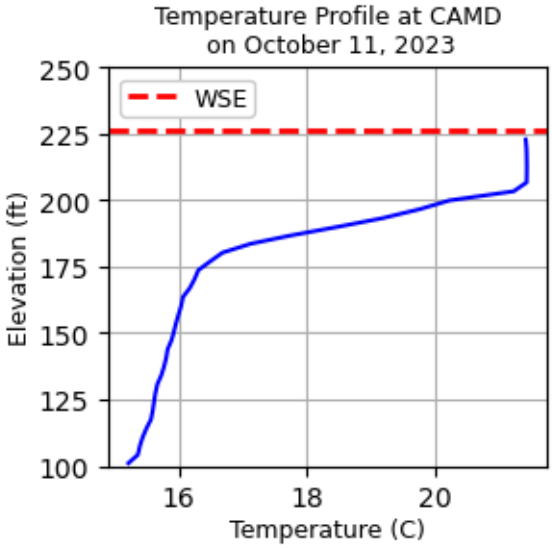


(f)BGA-PC (µg/L)

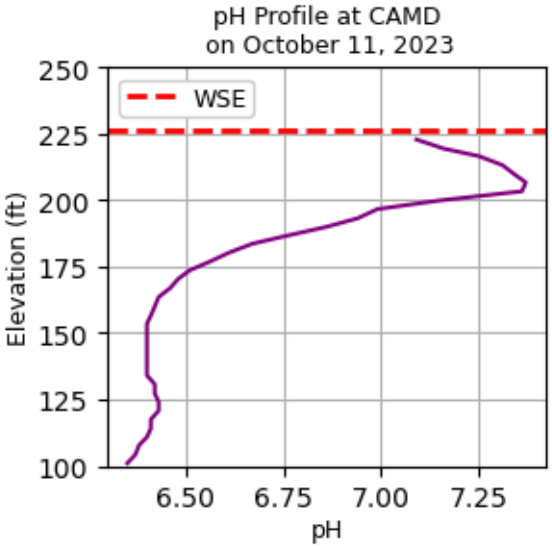


(g) Turbidity (FNU)

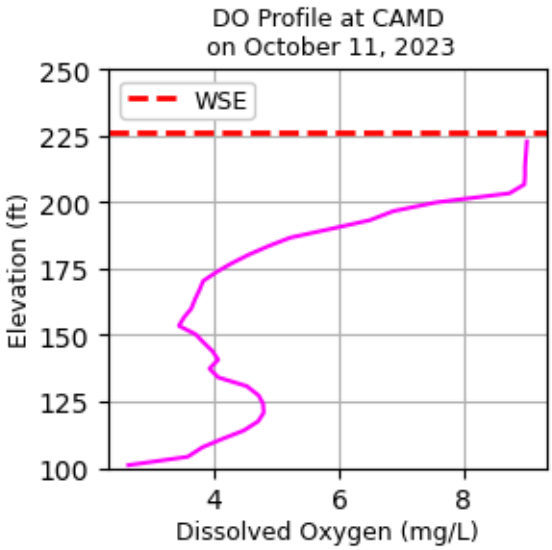
Figure F-3. Example Profile Measurement, Station CAMD, Summer July 23, 2019.



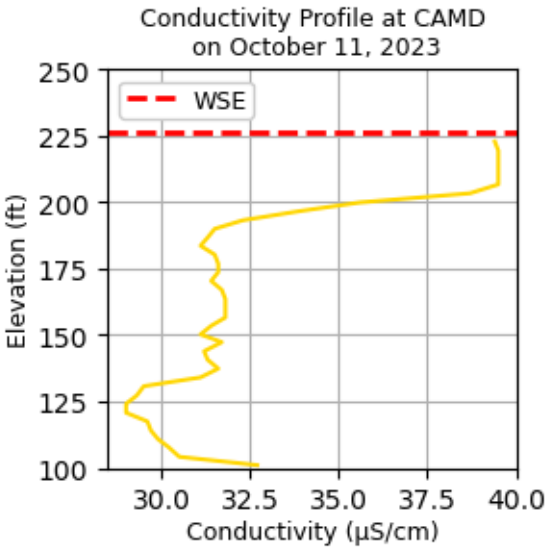
(a) Temperature (°C)



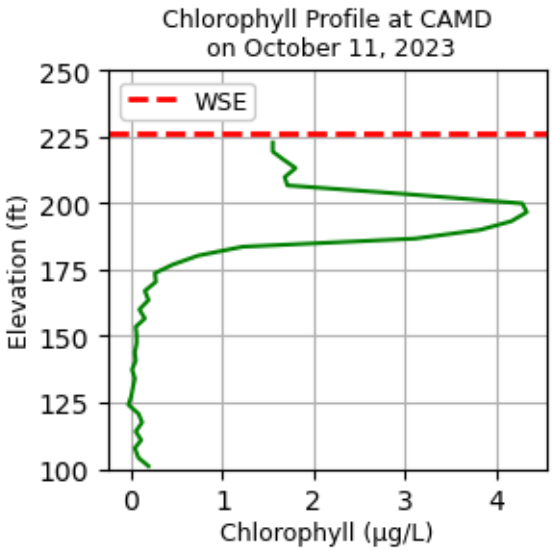
(b) pH



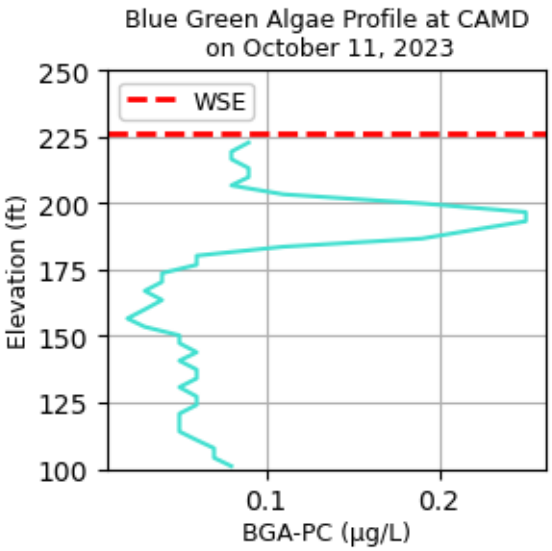
(c) Dissolved Oxygen (mg/L)



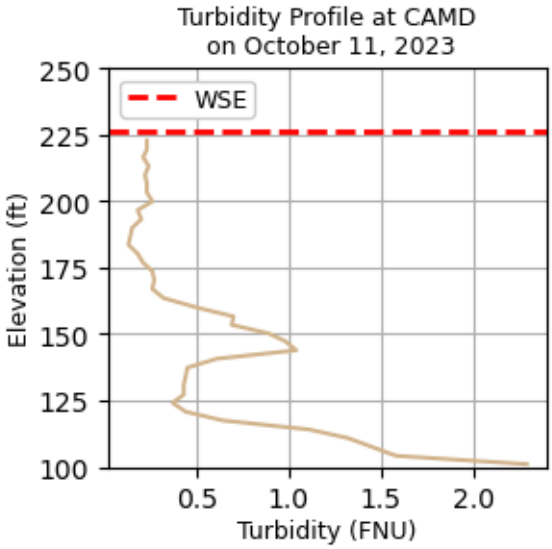
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)

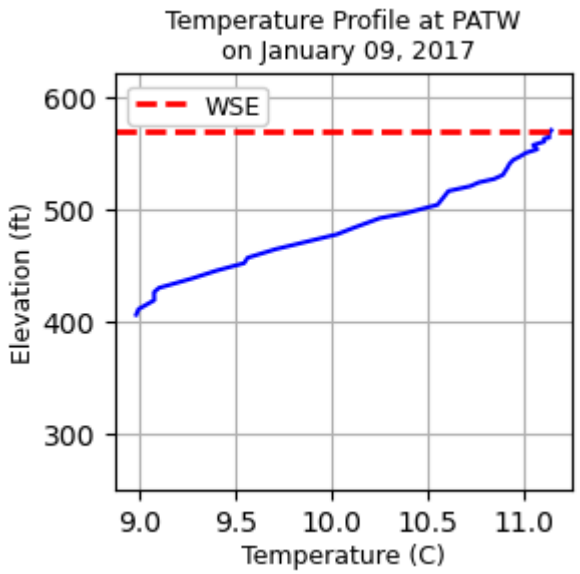


(f)BGA-PC (µg/L)

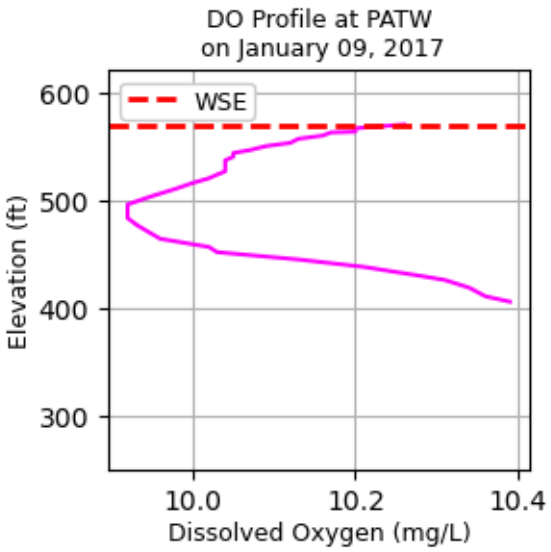


(g) Turbidity (FNU)

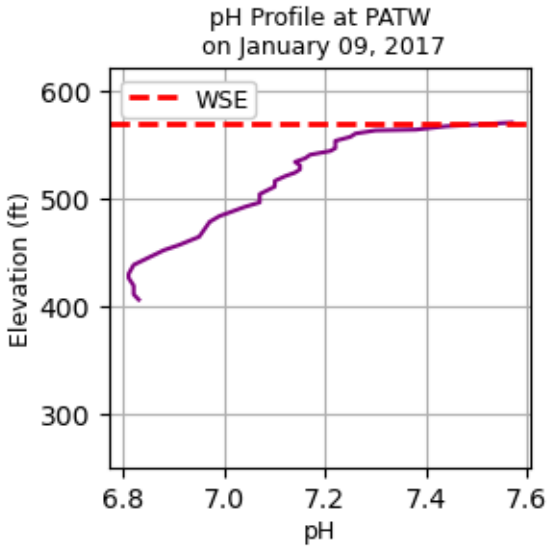
Figure F-4. Example Profile Measurement, Station CAMD, Fall October 11, 2023.



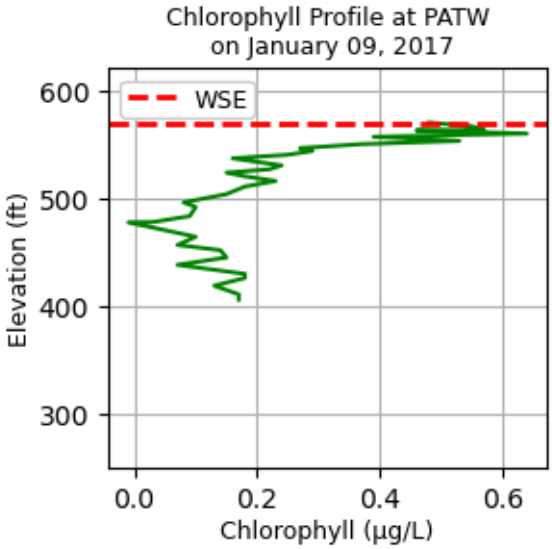
(a) Temperature (°C)



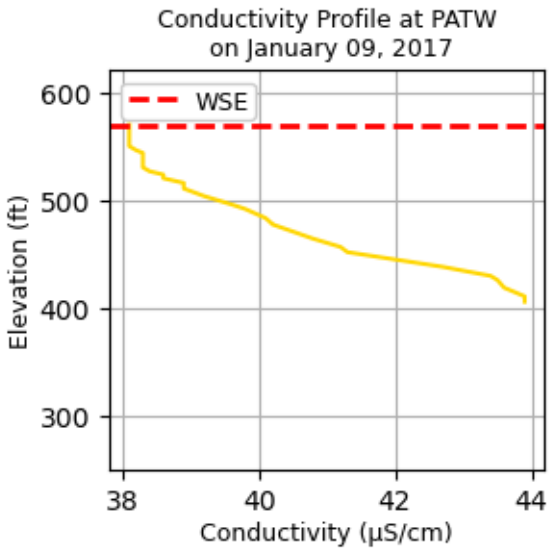
(b) pH



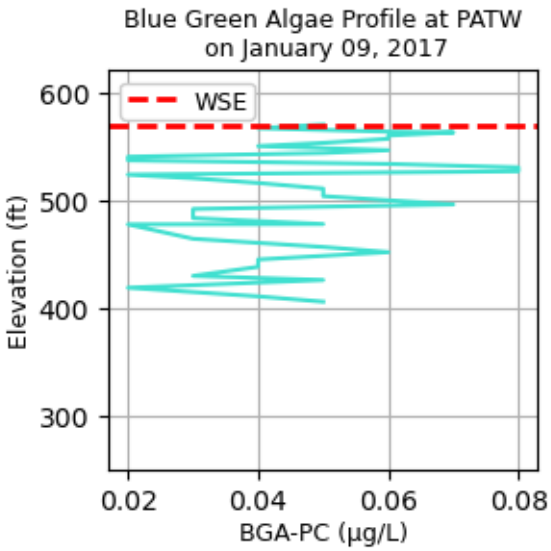
(c) Dissolved Oxygen (mg/L)



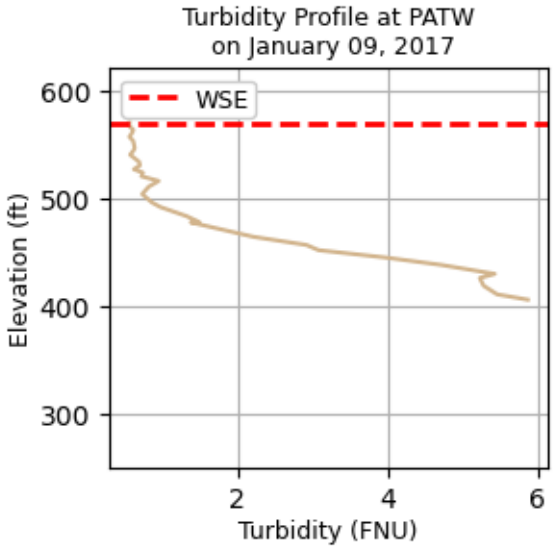
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)

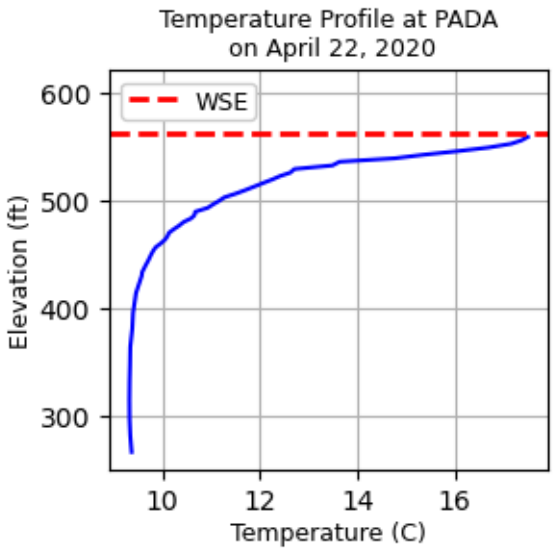


(f)BGA-PC (µg/L)

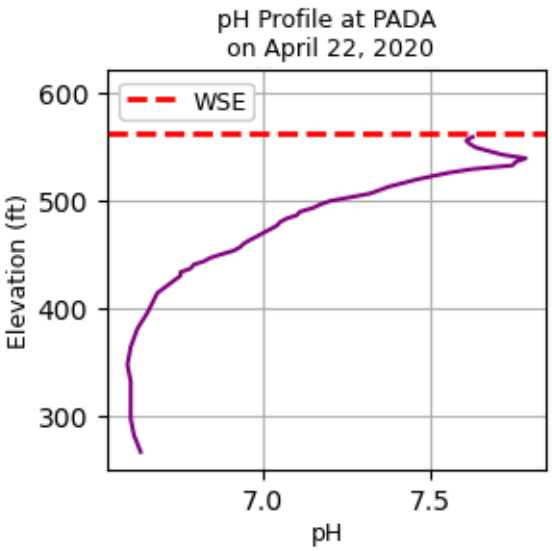


(g) Turbidity (FNU)

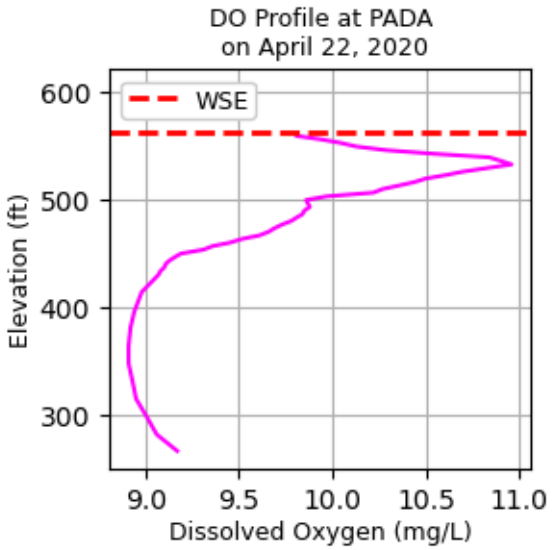
Figure F-5. Example Profile Measurement, Station PATW, Winter January 9, 2017.



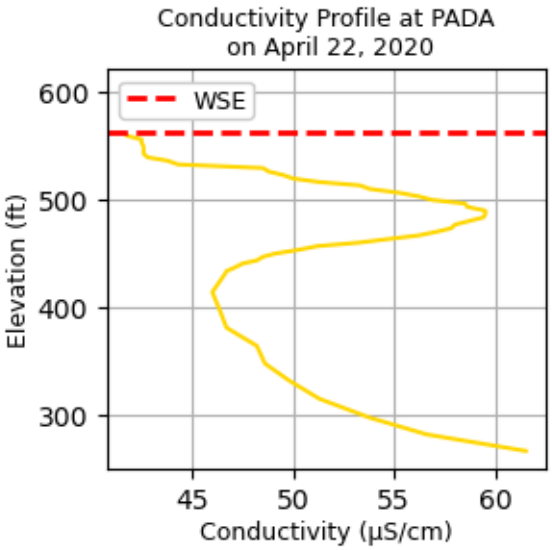
(a) Temperature (°C)



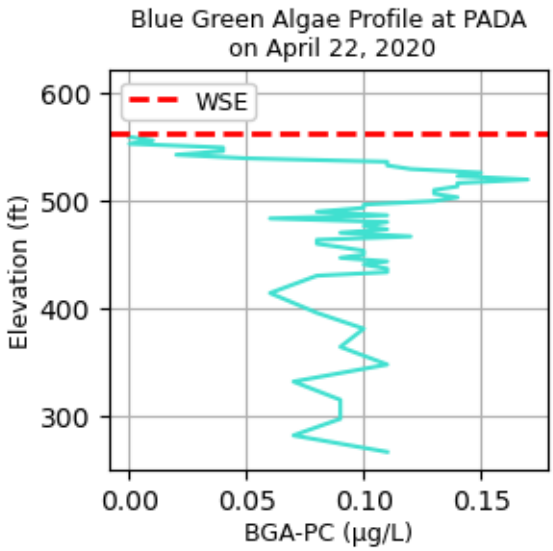
(b) pH



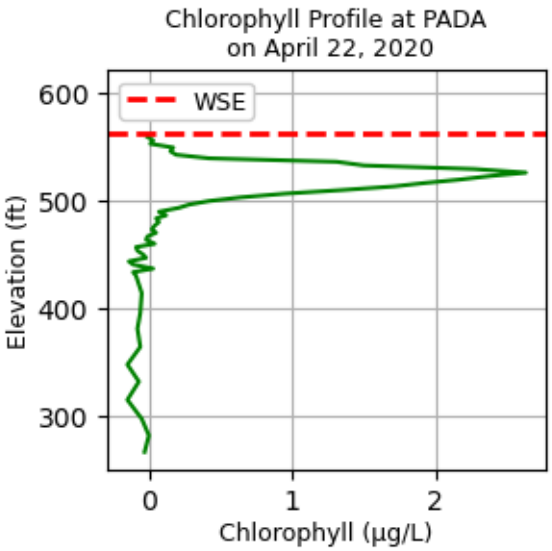
(c) Dissolved Oxygen (mg/L)



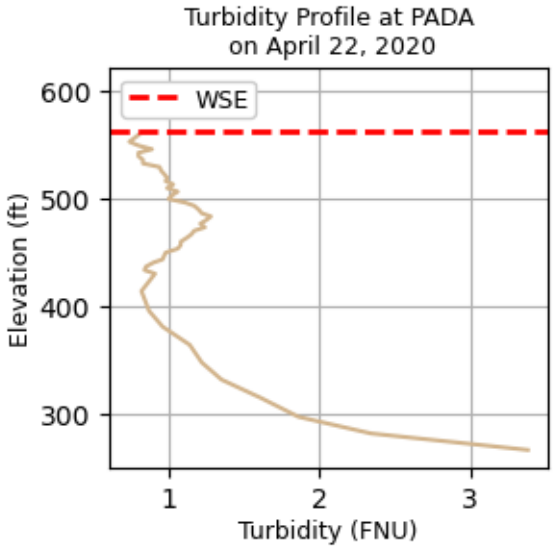
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)

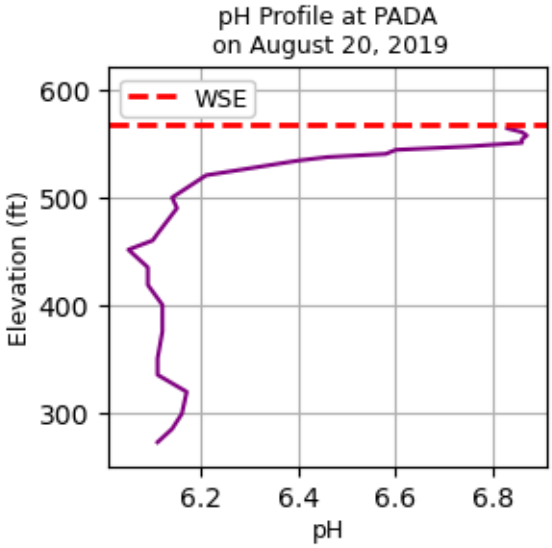


(f)BGA-PC (µg/L)

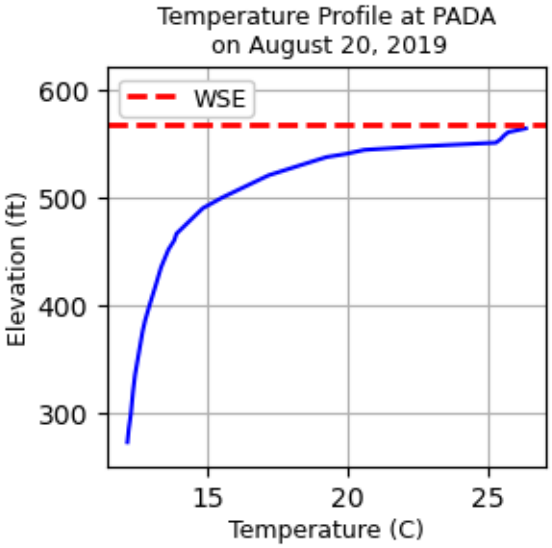


(g) Turbidity (FNU)

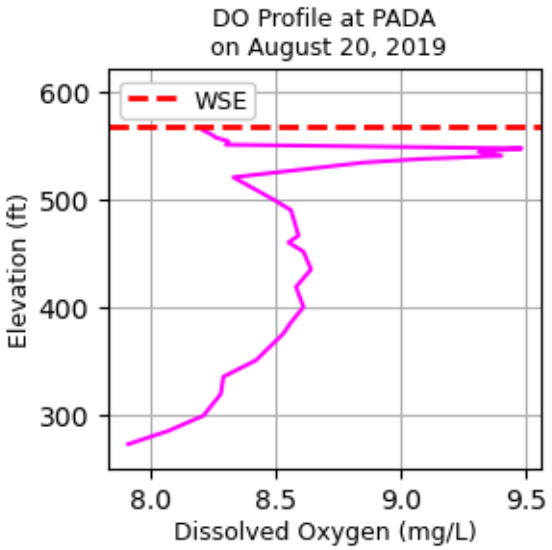
Figure F-6. Example Profile Measurement, Station PADA, Spring April 22, 2020.



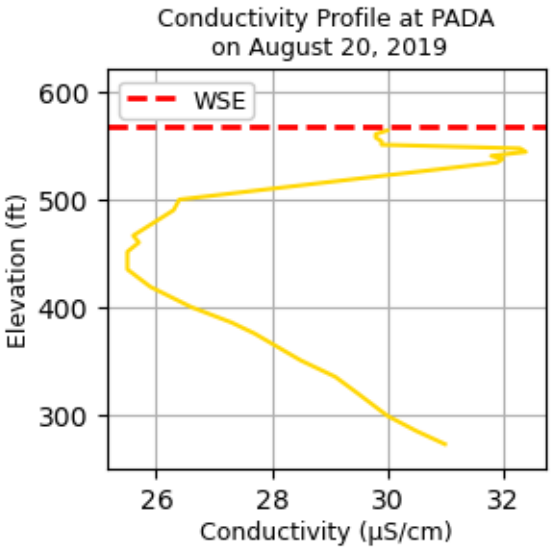
(a) Temperature (°C)



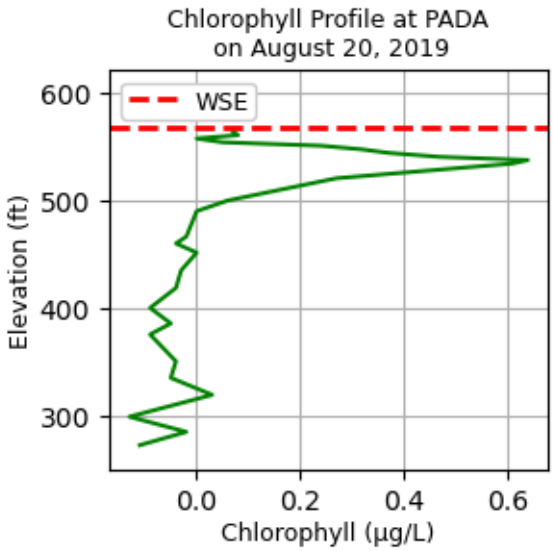
(b) pH



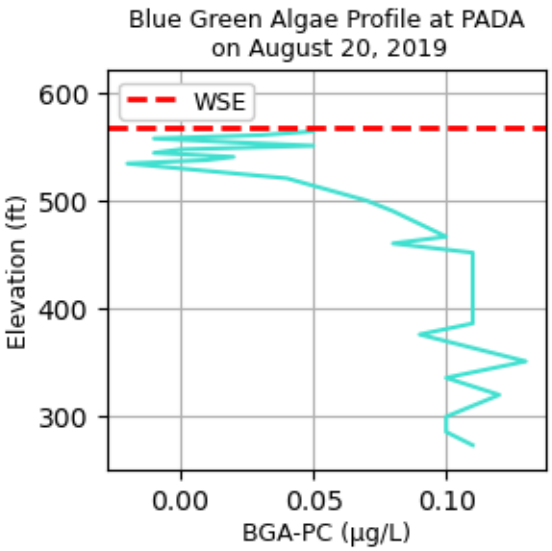
(c) Dissolved Oxygen (mg/L)



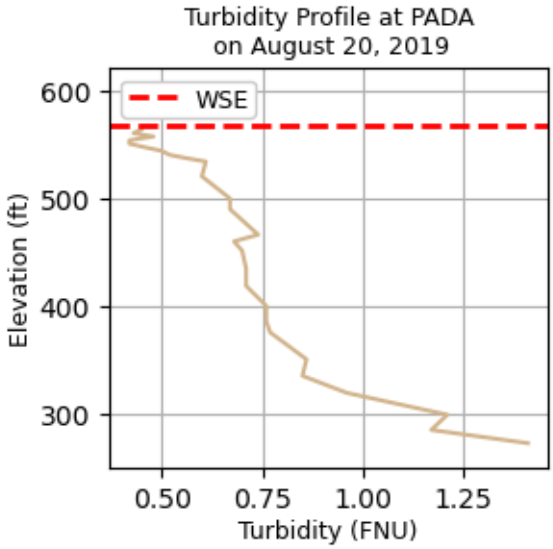
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)

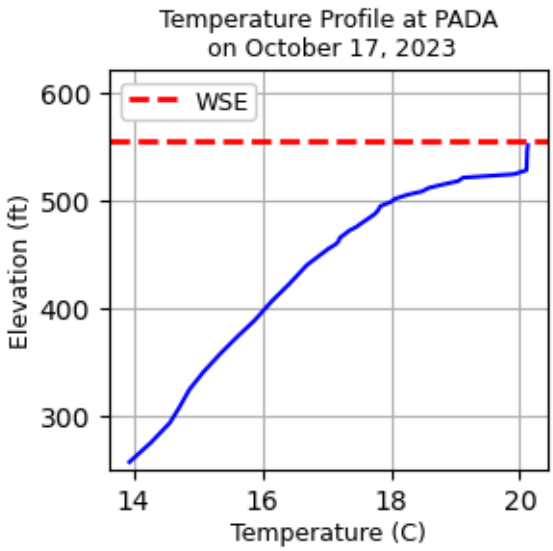


(f)BGA-PC (µg/L)

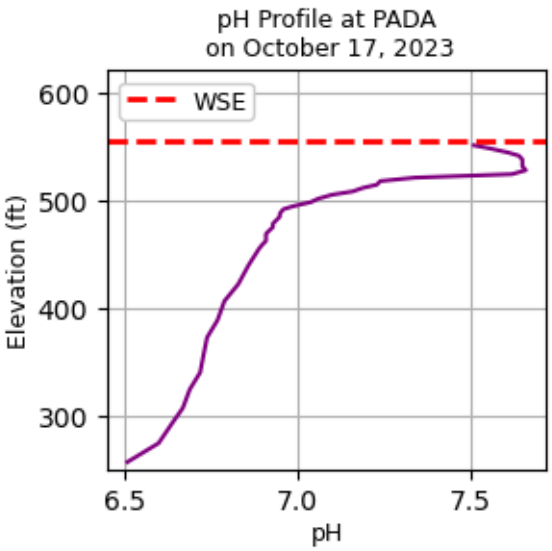


(g) Turbidity (FNU)

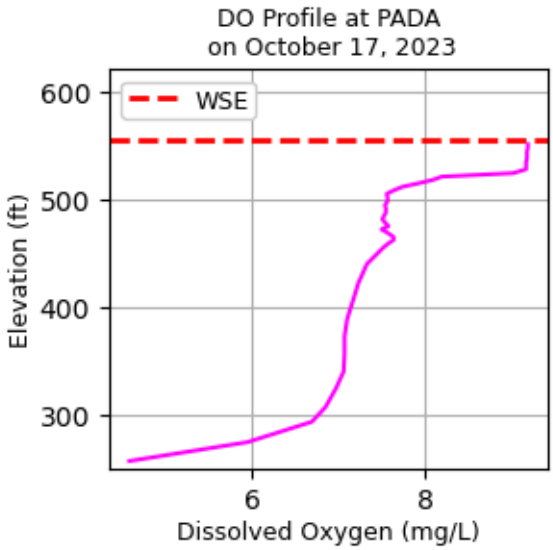
Figure F-7. Example Profile Measurement, Station PADA, Summer August 20, 2019.



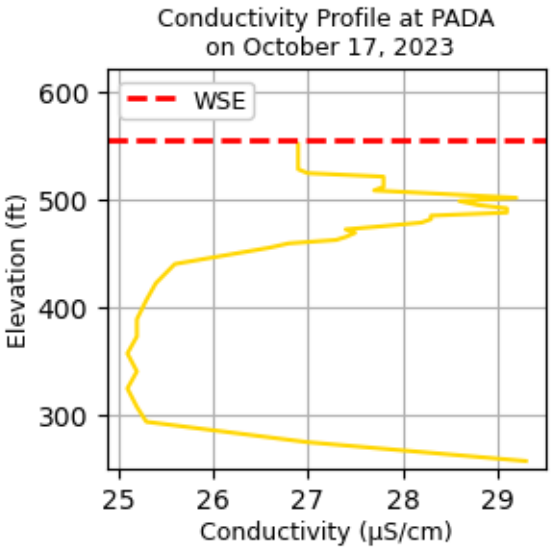
(a) Temperature (°C)



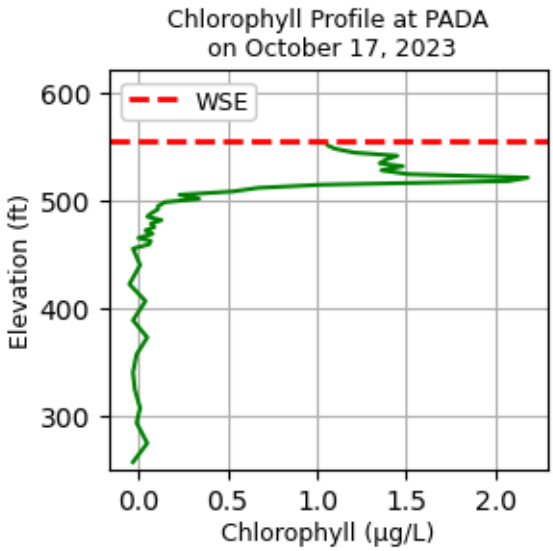
(b) pH



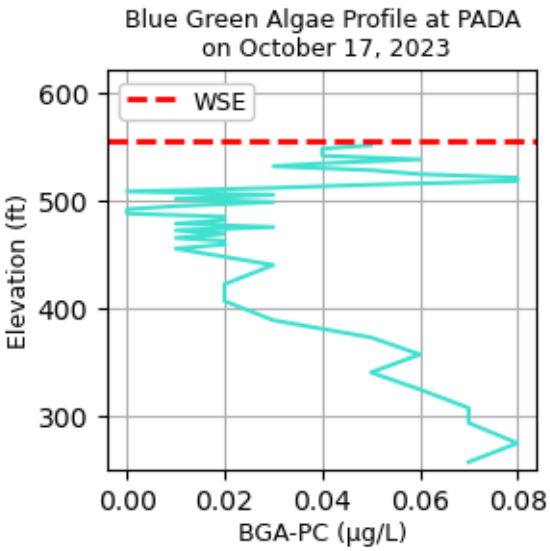
(c) Dissolved Oxygen (mg/L)



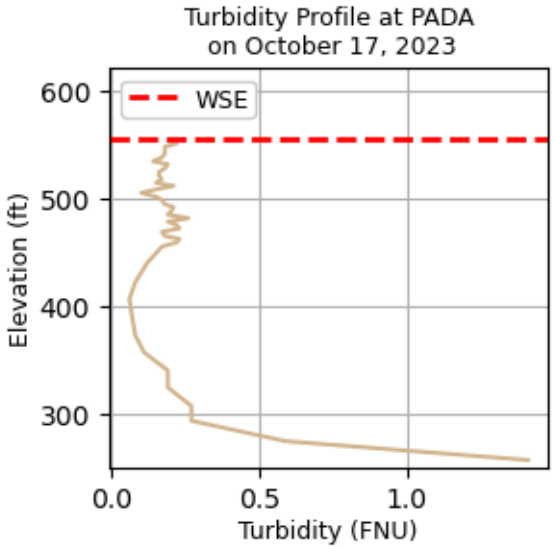
(d) Specific Conductivity (µS/cm)



(e) Chlorophyll (µg/L)



(f)BGA-PC (µg/L)



(g) Turbidity (FNU)

Thermocouple temperature records extend from November 17, 2009, to the current date. Table 4.3-29 through 4.3-36 provide the monthly average temperature for each sensor elevation over the period of data available.

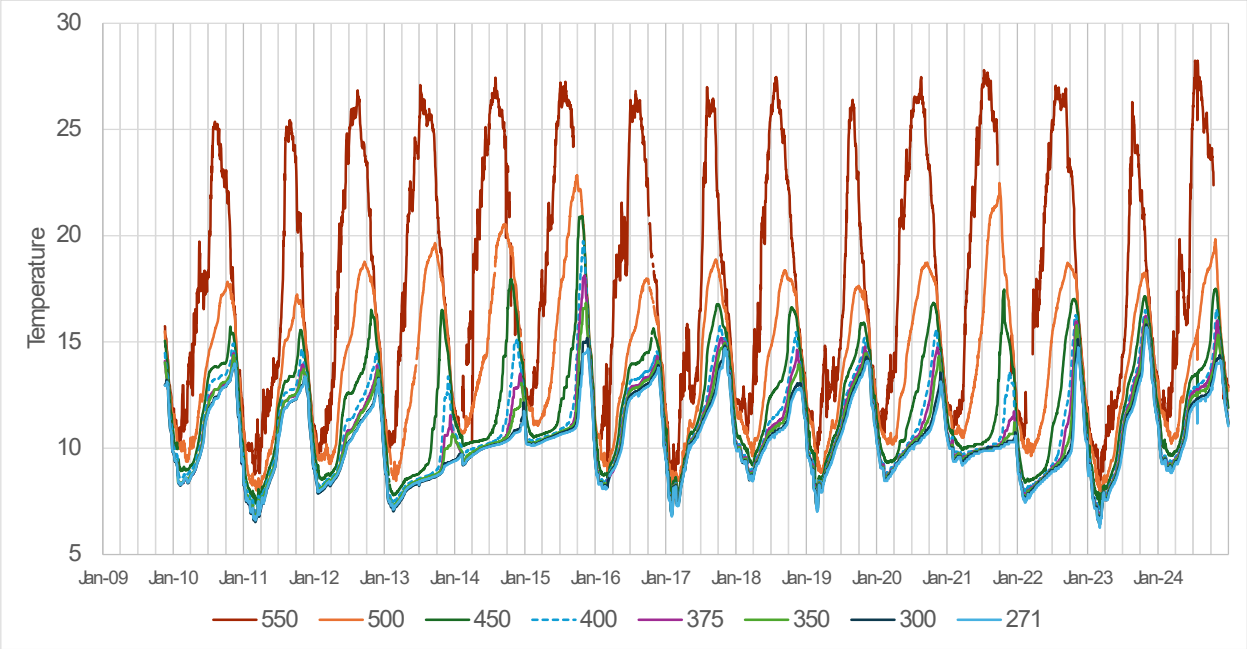


Figure F-8. PADA Temperature Sensor Timeseries Sensor Elevations Spanning 550 through 271 ft msl.

Table F-24. Monthly Average Water Temperature, Thermocouple at Elevation 550 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	15.1	12.8
2010	11.0	11.3	12.6	14.6	17.7	17.7	21.9	24.9	23.1	20.9	16.3	12.8
2011	10.2	9.7	9.8	11.2	12.4	13.6	16.6	24.5	24.4	20.7	15.8	12.3
2012	10.3	10.5	11.5	14.3	19.4	22.9	25.4	26.0	24.1	21.0	17.0	13.7
2013	10.8	10.5	13.8	17.4	21.4	23.8	26.2	25.6	24.2	19.8	16.4	13.0
2014	11.4	12.5	14.8	17.9	21.6	24.2	26.4	26.3	24.5	20.6	16.5	14.6
2015	12.3	12.9	15.7	17.9	21.1	24.7	26.6	26.2	25.0	N/A	N/A	N/A
2016	10.5	11.8	12.4	17.8	19.5	21.3	25.9	25.9	23.7	19.9	17.0	13.4
2017	10.2	9.3	11.5	14.3	12.8	14.5	21.4	26.2	24.5	19.4	16.7	13.6
2018	12.0	11.9	12.0	14.8	18.9	23.7	26.6	25.9	23.6	20.3	16.6	13.8
2019	11.7	10.4	11.6	13.2	12.9	13.9	17.9	25.0	24.0	19.4	16.3	13.3
2020	11.6	11.6	13.3	16.4	21.2	23.8	26.2	26.6	24.4	21.3	16.6	13.4
2021	11.7	11.4	12.4	17.6	21.5	24.8	27.3	26.5	25.0	N/A	13.8	13.6
2022	11.3	11.2	16.3	16.9	20.1	23.6	26.2	26.4	24.9	21.6	16.2	12.9
2023	10.7	9.6	9.2	10.9	11.7	13.1	16.1	23.4	23.6	20.9	17.0	14.1
2024	12.2	11.8	13.5	16.9	17.2	20.6	27.3	26.3	24.6	23.5	N/A	13.2

Table F-25. Monthly Average Water Temperature, Thermocouple at Elevation 500 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	14.8	12.6
2010	10.8	10.0	9.7	10.3	11.8	13.4	14.8	15.9	17.2	17.6	15.9	12.4
2011	9.6	8.4	8.2	8.7	9.8	11.3	13.6	15.2	16.2	16.9	15.3	12.2
2012	10.1	9.6	9.6	9.9	12.6	14.5	15.5	17.7	18.6	18.1	16.6	13.6
2013	10.5	8.9	9.1	10.6	12.2	14.1	16.9	18.8	19.4	18.4	16.3	12.9
2014	11.1	10.8	11.4	12.4	13.6	14.7	17.3	19.7	20.4	19.5	17.3	14.5
2015	12.1	11.4	11.3	11.9	13.2	15.9	18.1	20.3	22.2	21.8	17.9	13.5
2016	10.6	9.4	9.4	10.9	12.7	14.3	15.4	16.7	17.8	17.4	16.0	13.4
2017	9.8	8.7	8.8	10.2	11.1	12.0	15.4	18.0	18.7	17.5	15.9	13.4
2018	11.6	10.9	10.1	10.4	11.8	14.1	15.4	17.4	18.2	17.8	16.3	13.8
2019	11.5	10.2	9.0	9.9	10.9	11.9	14.0	15.7	17.4	17.3	15.9	13.2
2020	11.3	10.5	10.4	11.0	12.8	14.9	16.5	18.0	18.6	18.1	16.3	13.3
2021	11.5	10.8	10.7	11.3	12.7	14.6	17.7	20.8	21.6	20.0	16.9	13.6
2022	10.8	10.0	10.0	10.5	11.6	13.9	16.2	17.5	18.5	18.3	16.0	12.8
2023	10.3	8.9	8.2	8.8	9.8	11.6	13.3	15.1	17.0	18.0	16.7	13.9
2024	12.0	11.1	10.5	11.2	12.7	14.2	15.2	17.0	18.3	19.2	16.5	13.5

Table F-26. Monthly Average Water Temperature, Thermocouple at Elevation 450 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	14.6	12.3
2010	10.1	9.0	9.0	9.4	10.6	12.3	13.7	13.8	14.0	14.8	14.8	11.5
2011	8.6	7.8	7.7	8.2	9.1	10.3	12.5	13.2	13.5	14.9	14.3	11.8
2012	9.3	8.6	8.8	9.0	10.4	12.4	12.6	13.2	13.8	15.5	15.5	12.8
2013	9.5	7.9	8.0	8.4	8.6	8.8	9.0	9.4	11.1	14.7	15.2	12.5
2014	10.9	10.3	10.2	10.3	10.4	10.4	10.8	11.9	14.2	17.4	16.5	14.0
2015	11.3	10.6	10.6	10.7	10.8	11.2	12.4	13.7	15.8	20.6	17.9	13.3
2016	9.7	8.8	9.0	9.9	11.7	13.2	14.0	14.1	14.4	15.0	15.0	12.5
2017	9.0	8.2	8.3	9.7	10.7	11.2	12.6	15.1	16.4	16.3	15.0	12.4
2018	10.5	10.0	9.4	9.7	10.6	12.0	12.7	13.1	14.0	16.4	15.7	13.3
2019	10.6	9.0	8.6	9.4	10.3	11.0	12.7	13.7	14.5	15.8	15.0	12.7
2020	10.5	9.5	9.4	9.7	10.4	11.3	12.3	13.6	15.1	16.6	15.6	12.9
2021	10.9	10.4	10.0	10.1	10.1	10.2	10.3	10.7	12.1	16.0	15.1	12.8
2022	9.5	8.5	8.5	8.7	9.0	9.9	11.4	13.0	15.5	16.8	15.6	12.3
2023	9.4	7.9	7.7	8.3	9.1	10.7	12.2	13.5	15.0	16.8	16.0	13.2
2024	10.9	9.9	9.7	10.1	11.5	13.1	13.4	13.8	14.4	16.9	15.9	13.1

Table F-27. Monthly Average Water Temperature, Thermocouple at Elevation 400 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	14.0	11.8
2010	9.6	8.7	8.8	9.1	10.0	11.7	13.0	13.3	13.4	13.9	14.3	10.9
2011	8.2	7.4	7.3	8.0	8.8	9.8	12.0	12.7	12.8	13.7	13.8	11.1
2012	8.7	8.3	8.5	8.8	9.6	11.1	11.4	12.0	12.5	13.2	14.1	12.0
2013	8.7	7.5	7.7	8.1	8.4	8.5	8.6	8.7	8.9	9.6	12.3	11.6
2014	10.4	9.8	9.9	10.0	10.1	10.2	10.3	10.5	11.1	12.8	14.8	13.2
2015	10.7	10.3	10.4	10.5	10.6	10.8	11.0	11.3	12.7	17.8	17.4	12.7
2016	9.0	8.5	8.8	9.5	11.0	12.6	13.2	13.3	13.6	13.8	14.3	11.7
2017	8.4	7.8	8.0	9.4	10.5	10.9	11.8	13.2	14.7	15.5	14.5	11.7
2018	10.1	9.6	9.0	9.4	10.2	11.0	11.4	11.8	12.5	14.1	14.8	12.5
2019	9.9	8.3	8.3	9.1	9.9	10.7	11.9	13.0	13.6	14.5	14.5	12.1
2020	9.9	9.0	9.0	9.4	9.8	10.2	10.7	11.4	12.5	14.3	14.8	12.2
2021	10.5	9.8	9.7	9.8	9.9	10.0	10.0	10.1	10.3	11.1	13.1	11.9
2022	8.8	8.1	8.2	8.5	8.7	9.0	9.4	10.5	12.1	14.8	15.0	11.6
2023	8.8	7.4	7.3	8.0	8.7	10.0	11.6	12.8	13.9	15.8	15.3	12.5
2024	10.2	9.5	9.4	9.8	10.8	12.5	12.9	13.1	13.5	15.0	15.1	12.5

Table F-28. Monthly Average Water Temperature, Thermocouple at Elevation 375 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	13.6	11.3
2010	9.3	8.4	8.5	8.9	9.7	11.3	12.5	12.8	13.0	13.3	13.8	10.5
2011	7.8	7.1	7.0	7.7	8.5	9.5	11.6	12.3	12.4	13.1	13.4	10.8
2012	8.5	8.1	8.4	8.6	9.2	10.5	10.9	11.5	11.9	12.5	13.4	11.7
2013	8.3	7.3	7.5	8.0	8.2	8.4	8.5	8.6	8.7	9.0	10.5	10.9
2014	10.2	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.5	11.5	12.8	12.8
2015	10.4	10.2	10.3	10.4	10.5	10.6	10.8	10.9	11.7	16.2	16.7	12.3
2016	8.8	8.2	8.7	9.3	10.7	12.3	12.9	13.0	13.3	13.5	14.0	11.5
2017	8.2	7.7	7.9	9.4	10.4	10.8	11.6	12.6	14.0	15.0	14.3	11.5
2018	10.0	9.5	8.8	9.3	10.0	10.7	11.1	11.3	12.0	13.4	14.1	12.3
2019	9.7	8.1	8.1	9.0	9.8	10.6	11.7	12.7	13.4	14.1	14.3	11.8
2020	9.7	8.8	8.9	9.3	9.7	10.1	10.4	10.9	11.7	13.2	14.3	12.0
2021	10.3	9.7	9.6	9.7	9.8	9.9	10.0	10.0	10.1	10.4	11.1	11.1
2022	8.6	7.9	8.1	8.4	8.6	8.9	9.2	9.7	11.1	13.7	14.8	11.4
2023	8.7	7.2	7.2	7.9	8.6	9.7	11.5	12.5	13.5	15.4	15.2	12.4
2024	10.0	9.3	9.3	9.7	10.6	12.3	12.7	12.9	13.2	14.3	14.9	12.3

Table F-29. Monthly Average Water Temperature, Thermocouple at Elevation 350 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	13.6	11.3
2010	9.2	8.4	8.6	8.9	9.7	11.2	12.4	12.8	13.1	13.4	13.8	10.5
2011	7.9	7.1	7.1	7.8	8.6	9.6	11.6	12.3	12.5	13.0	13.4	10.7
2012	8.5	8.2	8.4	8.7	9.2	10.3	10.8	11.3	11.8	12.3	13.1	11.6
2013	8.3	7.3	7.6	8.0	8.3	8.4	8.6	8.6	8.7	8.9	9.9	10.4
2014	10.2	9.6	9.7	9.9	10.0	10.1	10.2	10.3	10.5	10.9	11.8	12.3
2015	10.4	10.3	10.3	10.5	10.6	10.7	10.8	10.9	11.3	15.0	16.0	12.2
2016	8.7	8.3	8.7	9.4	10.5	12.2	12.8	12.9	13.2	13.4	13.8	11.3
2017	8.2	7.7	7.9	9.3	10.3	10.8	11.5	12.2	13.4	14.6	14.2	11.3
2018	9.9	9.4	8.8	9.2	9.9	10.6	10.9	11.1	11.5	12.9	13.7	12.2
2019	9.6	8.0	8.1	8.9	9.7	10.5	11.5	12.5	13.2	13.8	14.2	11.7
2020	9.6	8.7	8.9	9.2	9.7	10.0	10.3	10.6	11.2	12.3	13.8	11.9
2021	10.2	9.6	9.6	9.6	9.8	9.9	10.0	10.0	10.1	10.3	10.6	10.6
2022	8.5	7.8	8.0	8.3	8.6	8.9	9.1	9.4	10.2	12.6	14.6	11.3
2023	8.6	7.1	7.2	7.9	8.5	9.5	11.3	12.2	13.3	15.0	15.0	12.2
2024	9.9	9.3	9.2	9.6	10.5	12.1	12.5	12.7	12.9	13.9	14.6	12.2

Table F-30. Monthly Average Water Temperature, Thermocouple at Elevation 300 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	13.1	11.2
2010	9.2	8.3	8.5	8.8	9.6	11.0	12.0	12.4	12.8	13.1	13.5	10.4
2011	7.7	7.0	6.9	7.6	8.4	9.4	11.2	12.0	12.2	12.6	13.0	10.6
2012	8.3	8.0	8.3	8.5	9.0	9.9	10.5	11.0	11.4	11.8	12.6	11.5
2013	8.2	7.2	7.4	7.8	8.2	8.3	8.4	8.5	8.6	8.8	9.2	9.4
2014	9.6	9.4	9.5	9.7	9.9	10.0	10.1	10.2	10.3	10.5	10.8	11.4
2015	10.3	10.2	10.3	10.4	10.5	10.6	10.7	10.8	11.0	13.3	14.9	11.9
2016	8.7	8.2	8.7	9.3	10.2	12.0	12.6	12.7	13.0	13.2	13.6	11.3
2017	8.2	7.7	7.9	9.3	10.2	10.7	11.3	12.0	12.8	14.1	14.1	11.3
2018	9.8	9.3	8.7	9.1	9.8	10.4	10.7	10.9	11.2	12.4	13.0	12.0
2019	9.5	8.0	8.0	8.8	9.6	10.4	11.2	12.2	13.0	13.6	14.0	11.6
2020	9.6	8.7	8.8	9.2	9.6	9.9	10.2	10.4	10.8	11.4	12.7	11.8
2021	10.1	9.5	9.5	9.5	9.7	9.8	10.0	10.0	10.0	10.2	10.3	10.4
2022	8.5	7.7	8.0	8.3	8.5	8.8	9.0	9.3	9.7	11.4	14.2	11.2
2023	8.6	7.1	7.2	7.8	8.4	9.3	11.1	11.9	12.9	14.5	14.9	12.2
2024	9.9	9.2	9.1	9.5	10.3	11.8	12.2	12.4	12.6	13.5	14.1	12.1

Table F-31. Monthly Average Water Temperature, Thermocouple at Elevation 271 ft msl.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009	-	-	-	-	-	-	-	-	-	-	13.0	11.2
2010	9.2	8.4	8.5	8.9	9.6	10.9	11.9	12.4	12.8	13.1	13.5	10.5
2011	7.8	7.0	7.0	7.6	8.4	9.4	11.2	12.0	12.3	12.6	13.0	10.6
2012	8.4	8.1	8.3	8.6	9.1	9.9	10.5	10.9	11.4	11.8	12.5	11.5
2013	8.3	7.3	7.5	7.9	8.2	8.4	8.5	8.6	8.7	8.8	9.2	9.3
2014	9.5	9.4	9.5	9.7	9.9	10.0	10.1	10.2	10.3	10.5	10.7	11.1
2015	10.3	10.1	10.2	10.4	10.5	10.6	10.7	10.8	10.9	12.7	14.5	11.9
2016	8.6	8.2	8.8	9.2	10.1	11.8	12.4	12.6	12.8	13.1	13.5	11.2
2017	8.1	7.6	7.8	9.3	10.2	10.6	11.2	11.8	12.6	13.8	14.1	11.2
2018	9.8	9.3	8.6	9.1	9.7	10.3	10.6	10.8	11.1	12.1	12.7	12.0
2019	9.5	7.9	7.9	8.8	9.5	10.3	11.1	12.0	12.8	13.4	13.9	11.5
2020	9.5	8.6	8.8	9.2	9.5	9.9	10.1	10.4	10.6	11.1	12.2	11.8
2021	10.1	9.4	9.4	9.4	9.7	9.8	9.9	9.9	10.0	10.1	10.2	10.3
2022	8.4	7.6	7.9	8.2	8.5	8.8	9.0	9.2	9.5	11.0	14.0	11.2
2023	8.5	7.0	7.1	7.7	8.3	9.2	10.9	11.7	12.7	14.2	14.8	12.1
2024	9.8	9.1	9.0	9.4	10.2	11.6	12.1	12.3	12.5	13.3	14.0	12.0

While a significant portion of 2006 are missing, contours of water temperature, pH, dissolved oxygen, and specific conductivity for each year from 2007 through 2024 filtering for the mid-day reading are plotted in Figure F-9 through F-80.

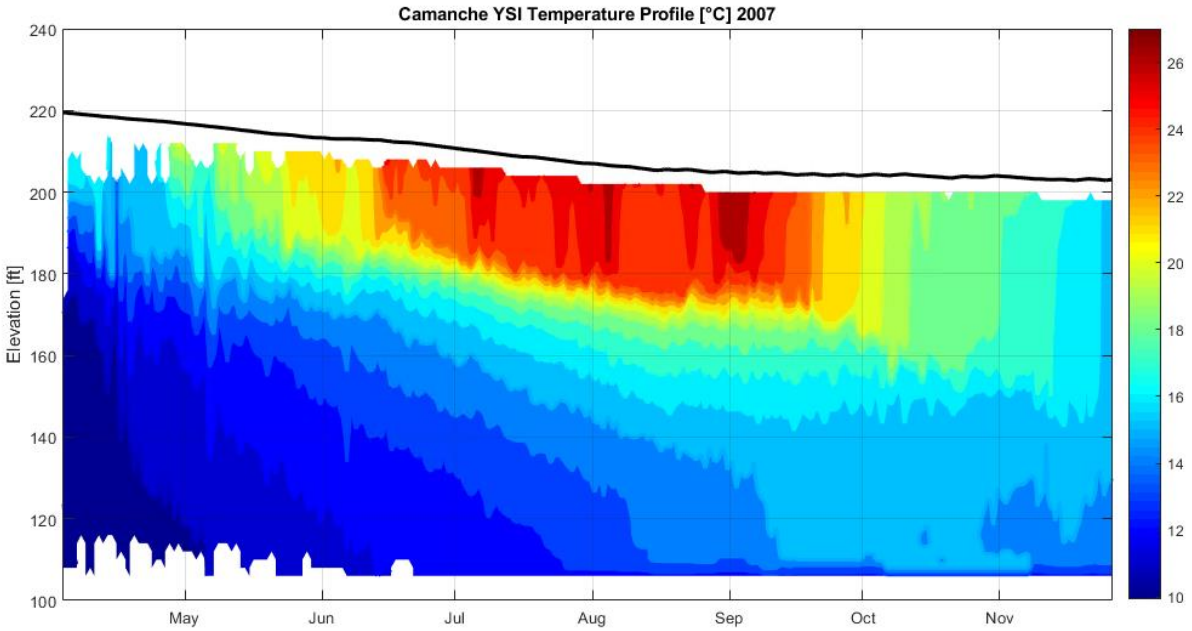


Figure F-9. Autoprofiler Temperature (°C) Contour, Station CAMD, 2007 Provisional.

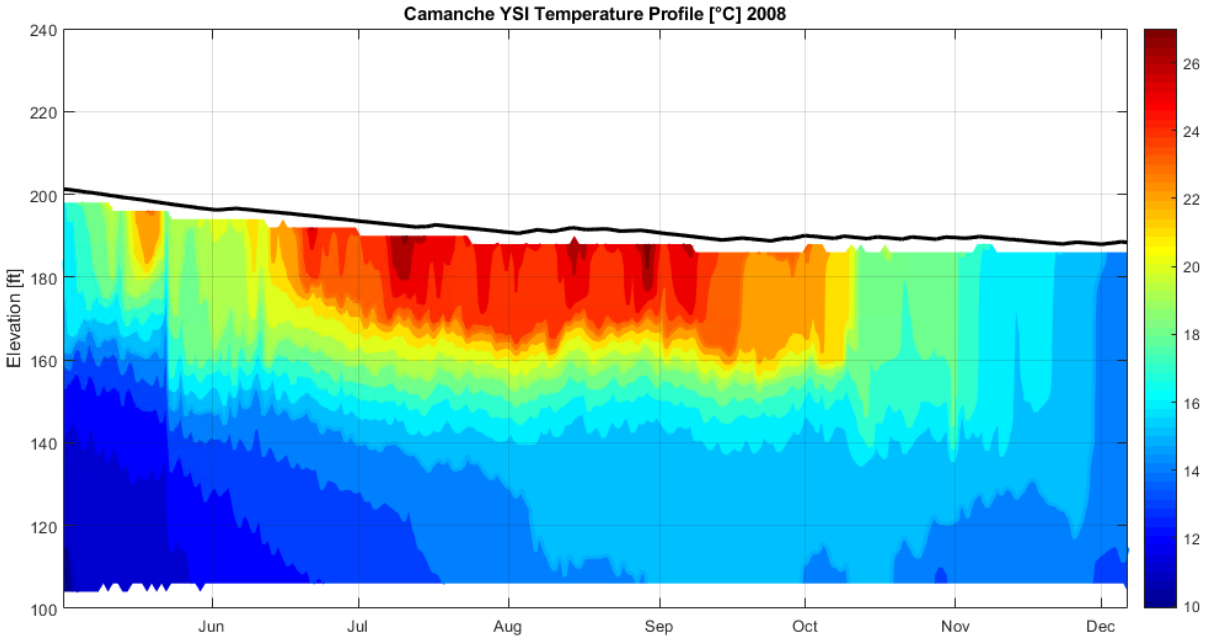


Figure F-10. Autoprofiler Temperature (°C) Contour, Station CAMD, 2008 Provisional.

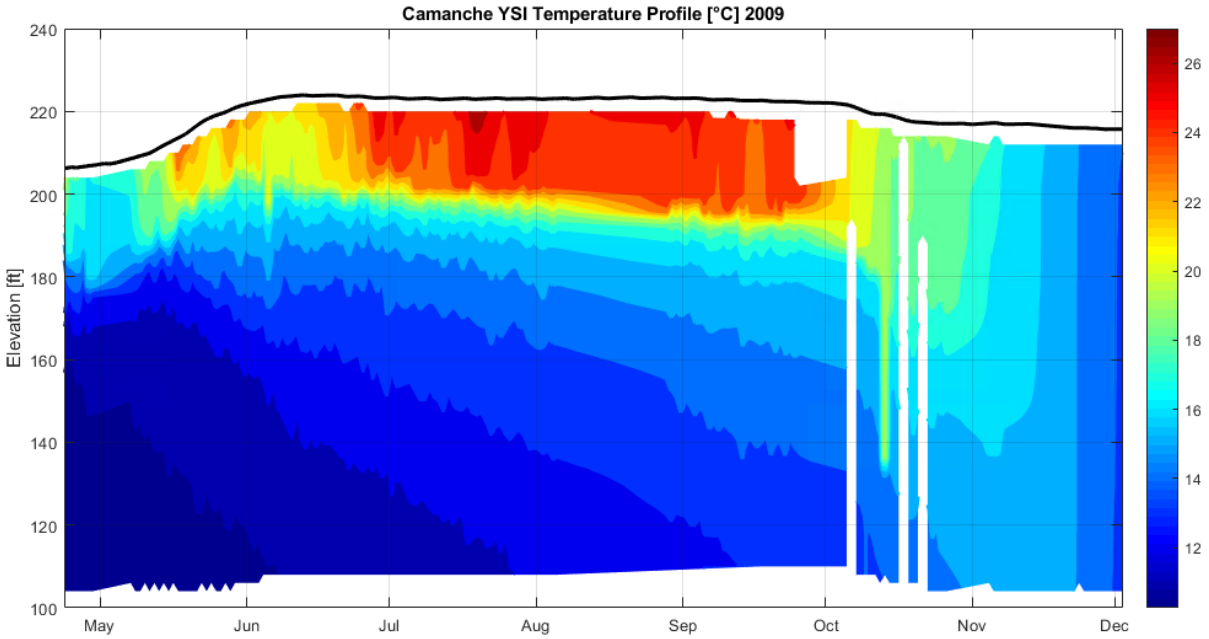


Figure F-11. Autoprofiler Temperature (°C) Contour, Station CAMD, 2009 Provisional.

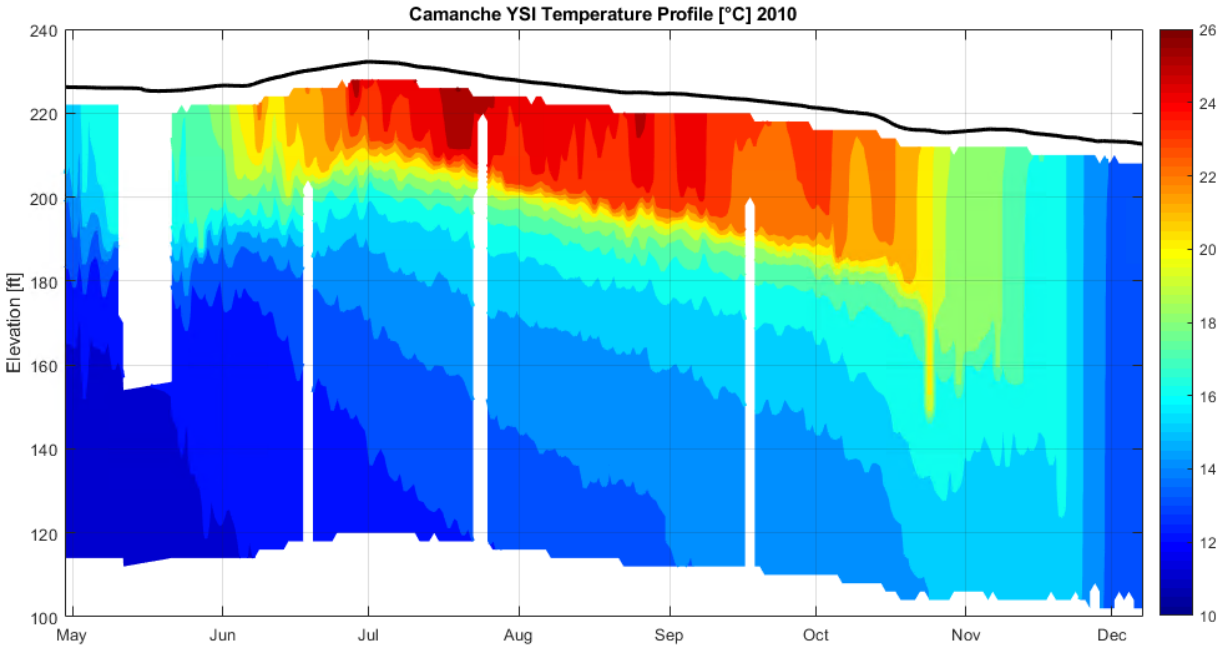


Figure F-12. Autoprofiler Temperature (°C) Contour, Station CAMD, 2010 Provisional.

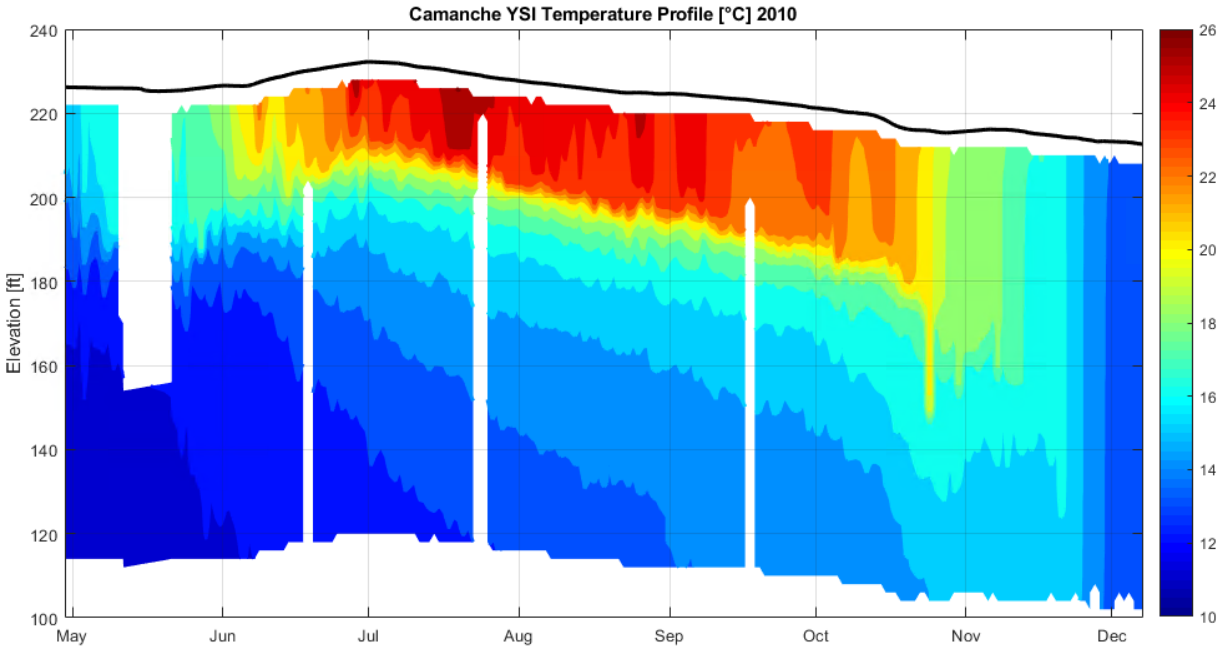


Figure F-13. Autoprofiler Temperature (°C) Contour, Station CAMD, 2011 Provisional.

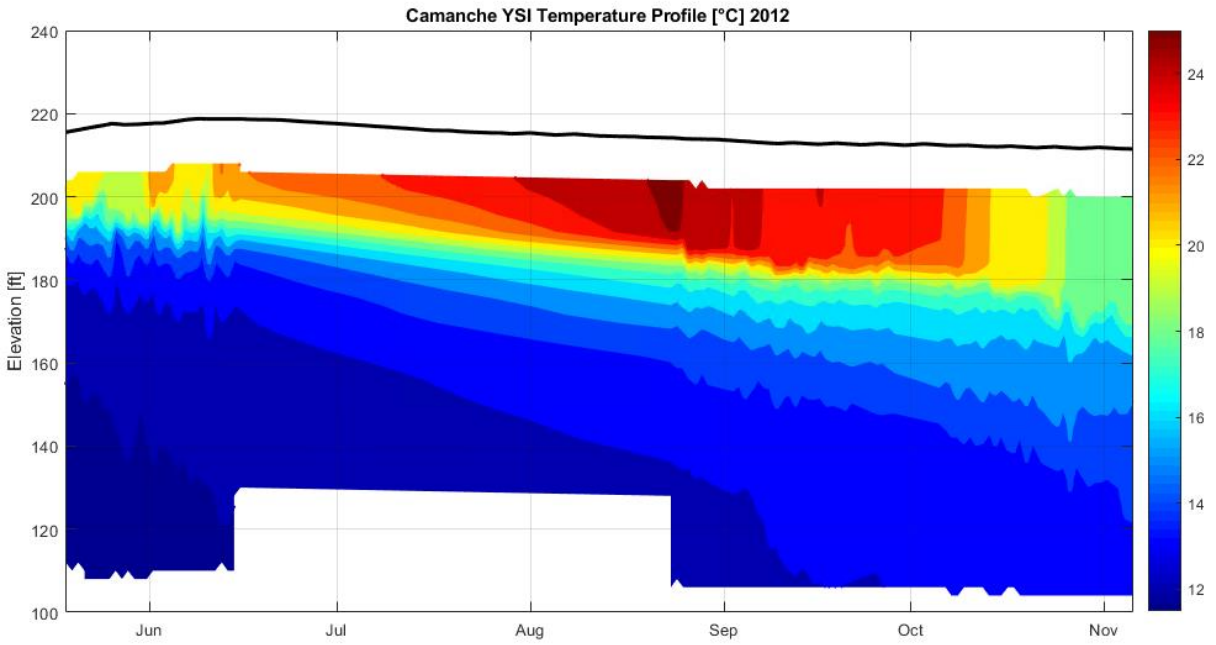


Figure F-14. Autoprofiler Temperature (°C) Contour, Station CAMD, 2012 Provisional.

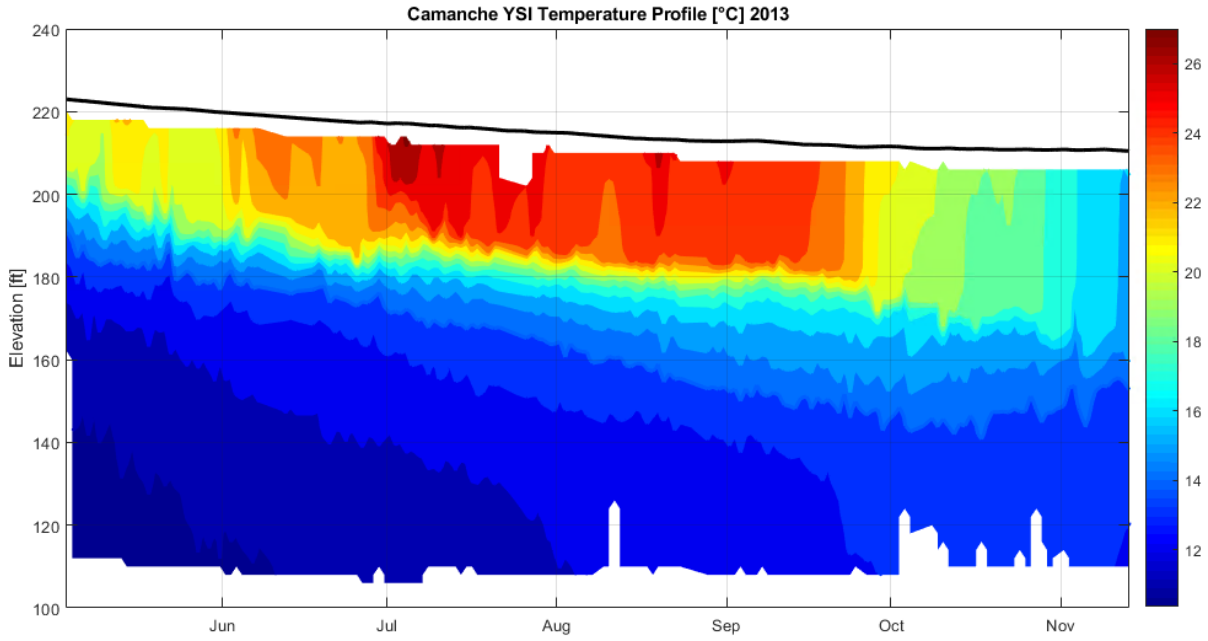


Figure F-15. Autoprofiler Temperature (°C) Contour, Station CAMD, 2013 Provisional.

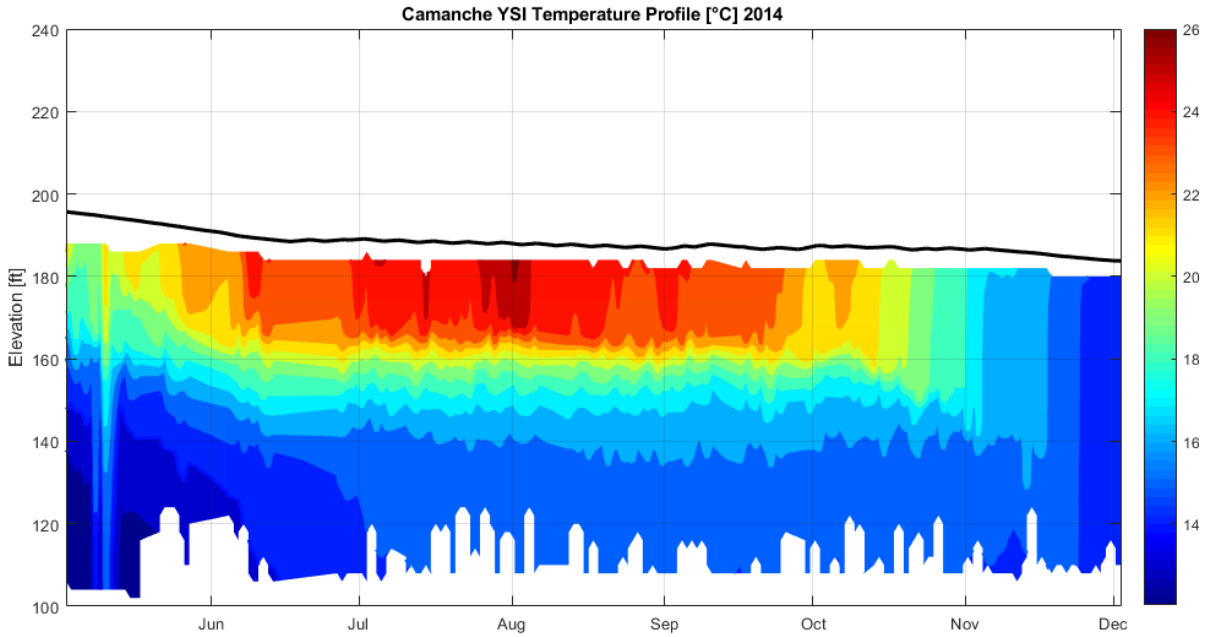


Figure F-16. Autoprofiler Temperature (°C) Contour, Station CAMD, 2014 Provisional.

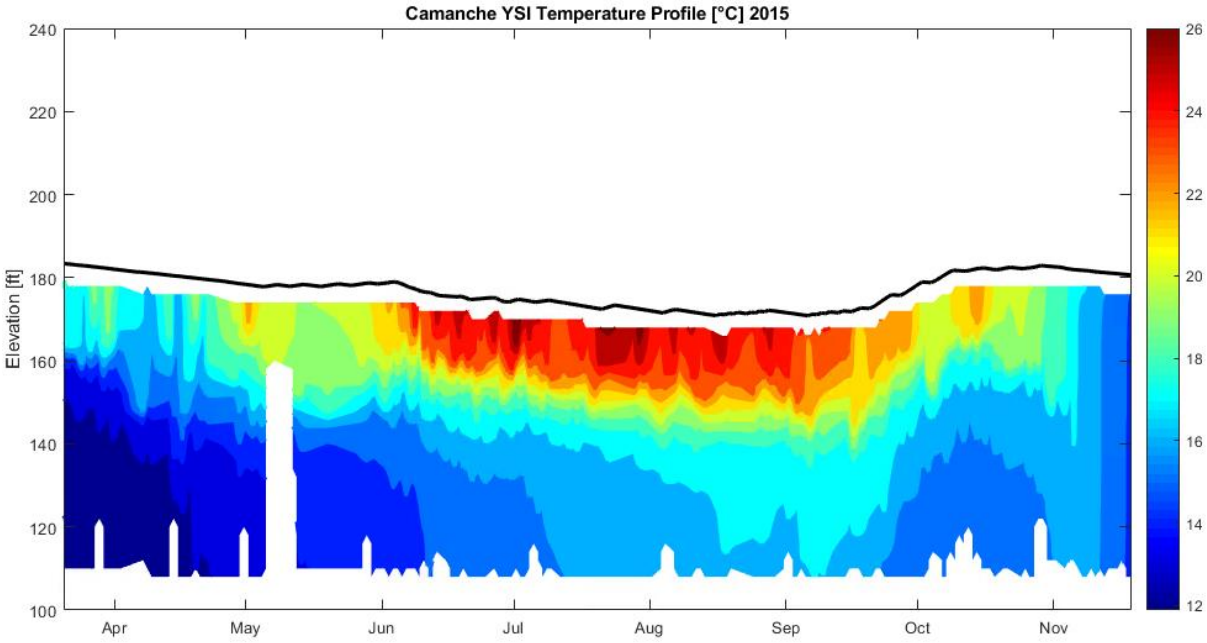


Figure F-17. Autoprofiler Temperature (°C) Contour, Station CAMD, 2015 Provisional.

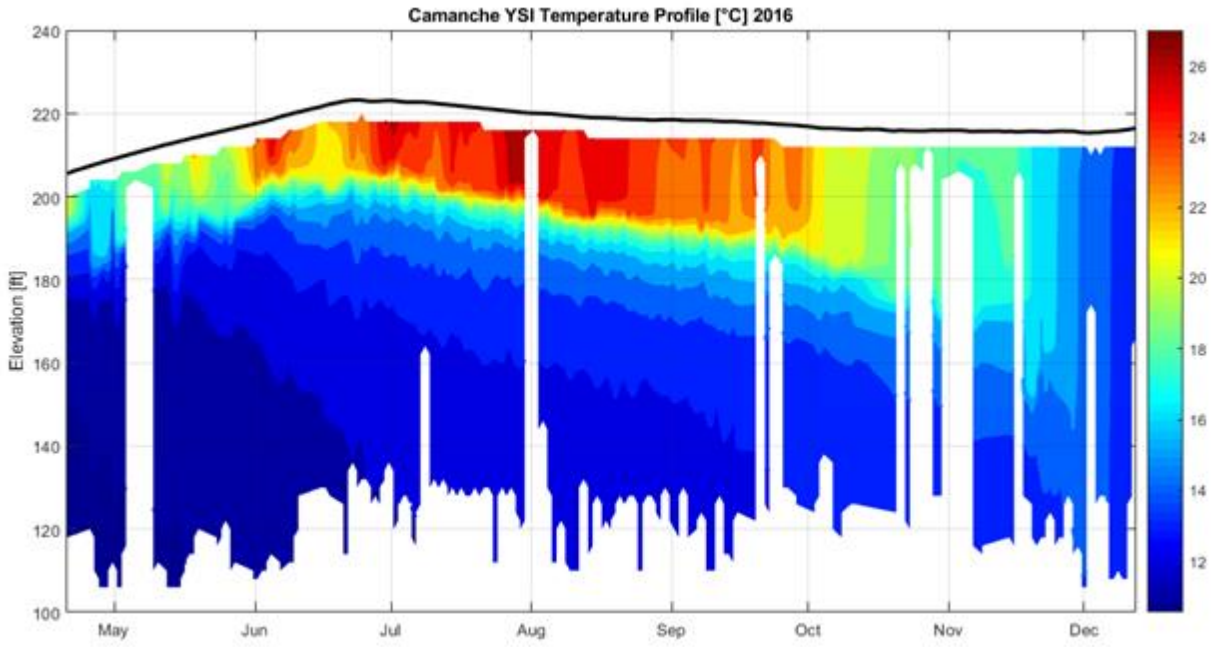


Figure F-18. Autoprofiler Temperature (°C) Contour, Station CAMD, 2016 Provisional.

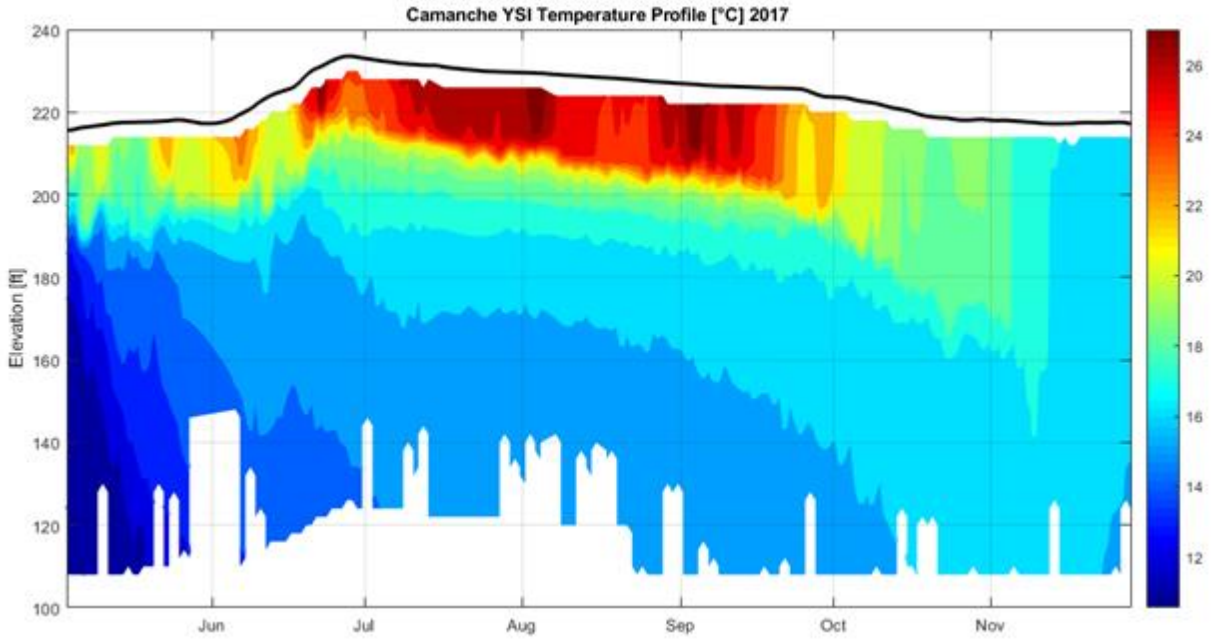


Figure F-19. Autoprofiler Temperature (°C) Contour, Station CAMD, 2017 Provisional.

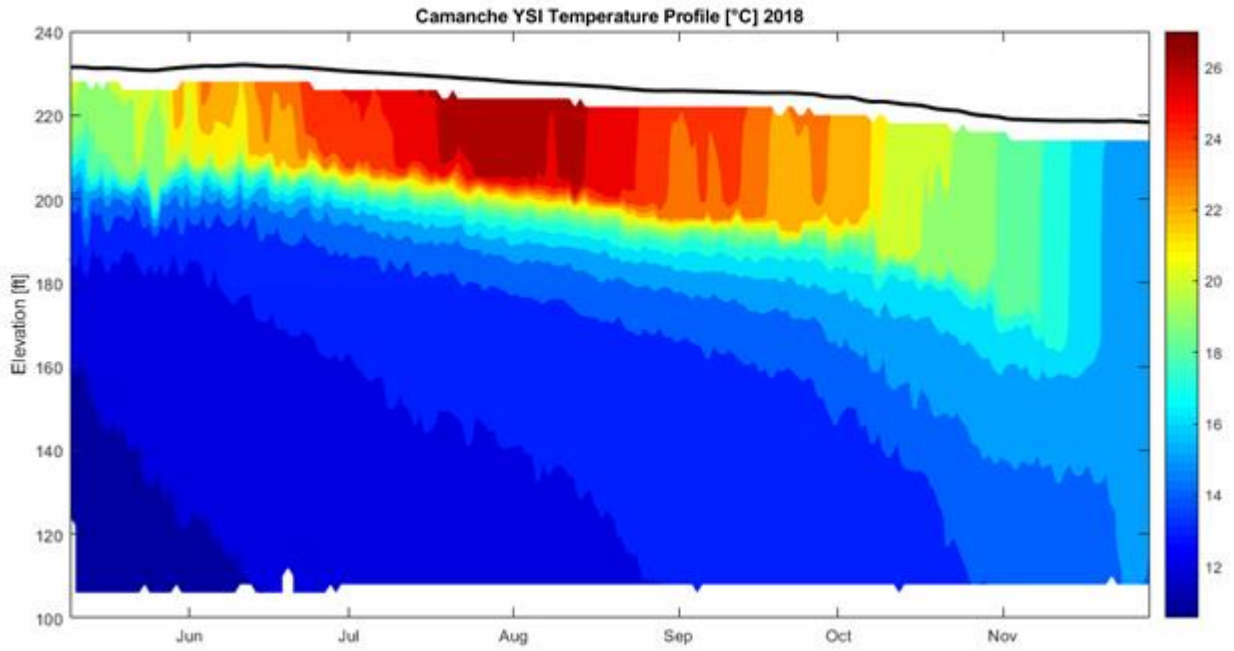


Figure F-20. Autoprofiler Temperature (°C) Contour, Station CAMD, 2018 Provisional.

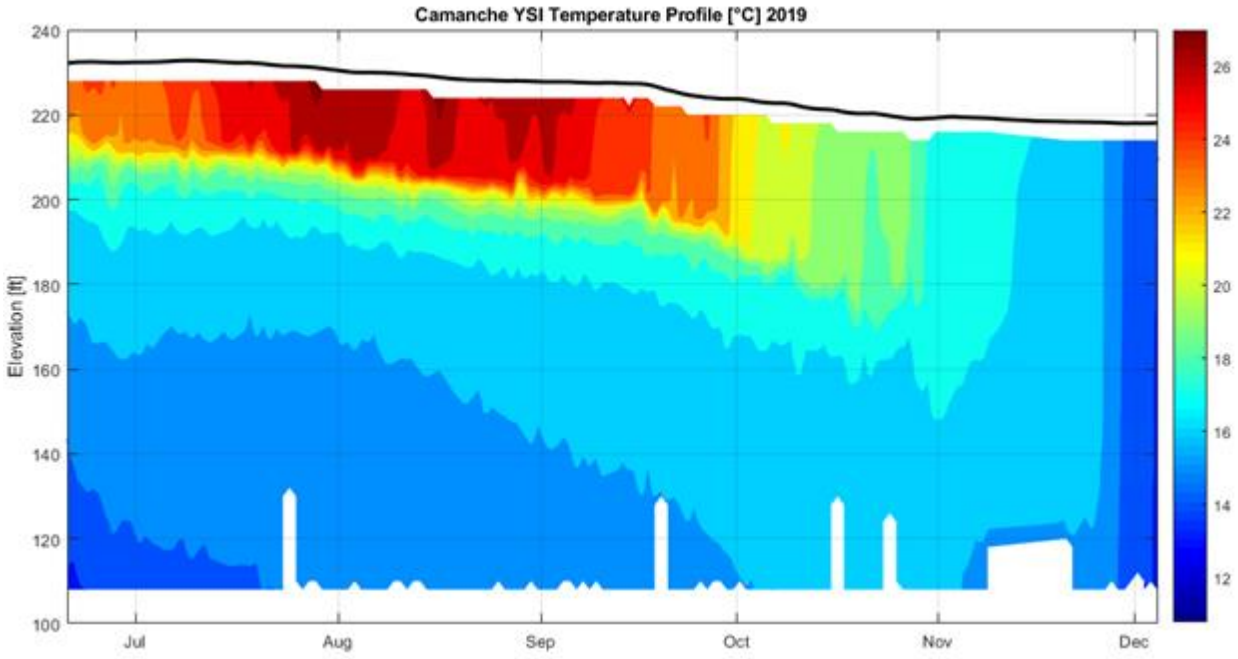


Figure F-21. Autoprofiler Temperature (°C) Contour, Station CAMD, 2019 Provisional.

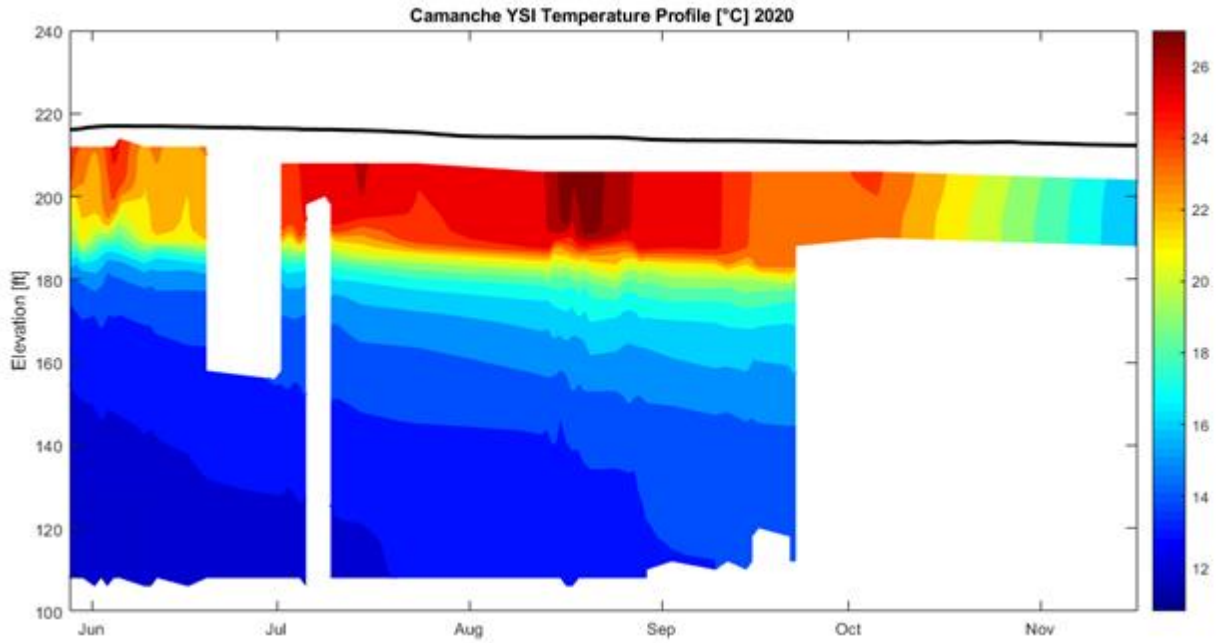


Figure F-22. Autoprofiler Temperature (°C) Contour, Station CAMD, 2020 Provisional.

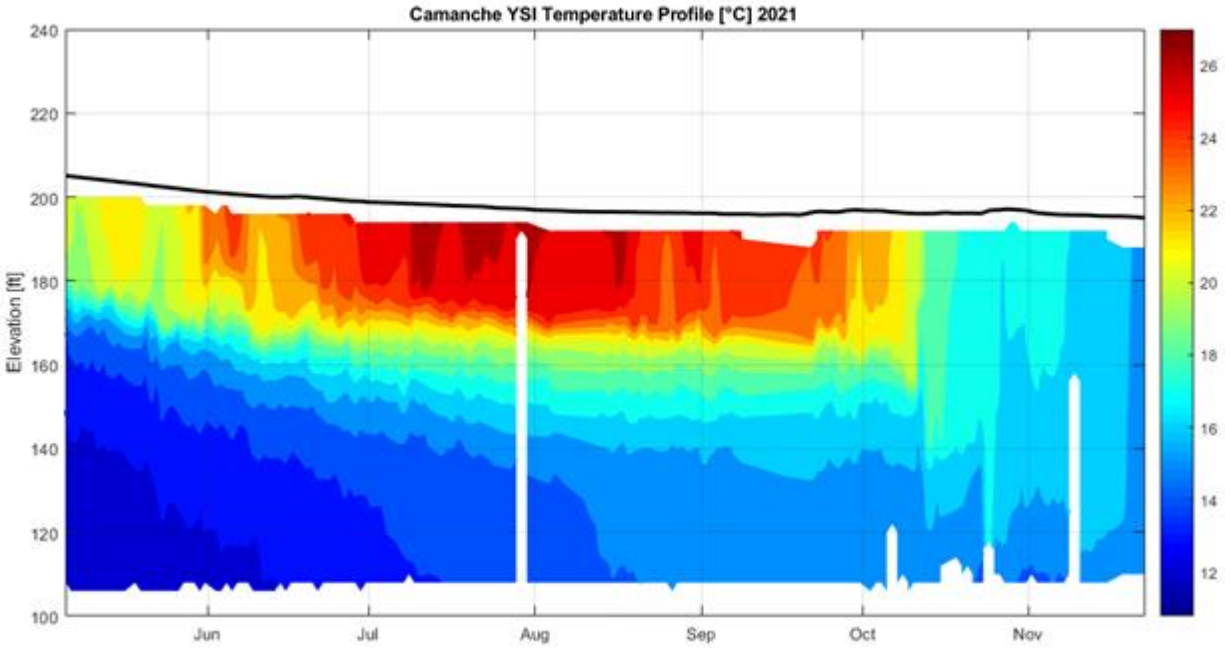


Figure F-23. Autoprofiler Temperature (°C) Contour, Station CAMD, 2021 Provisional.

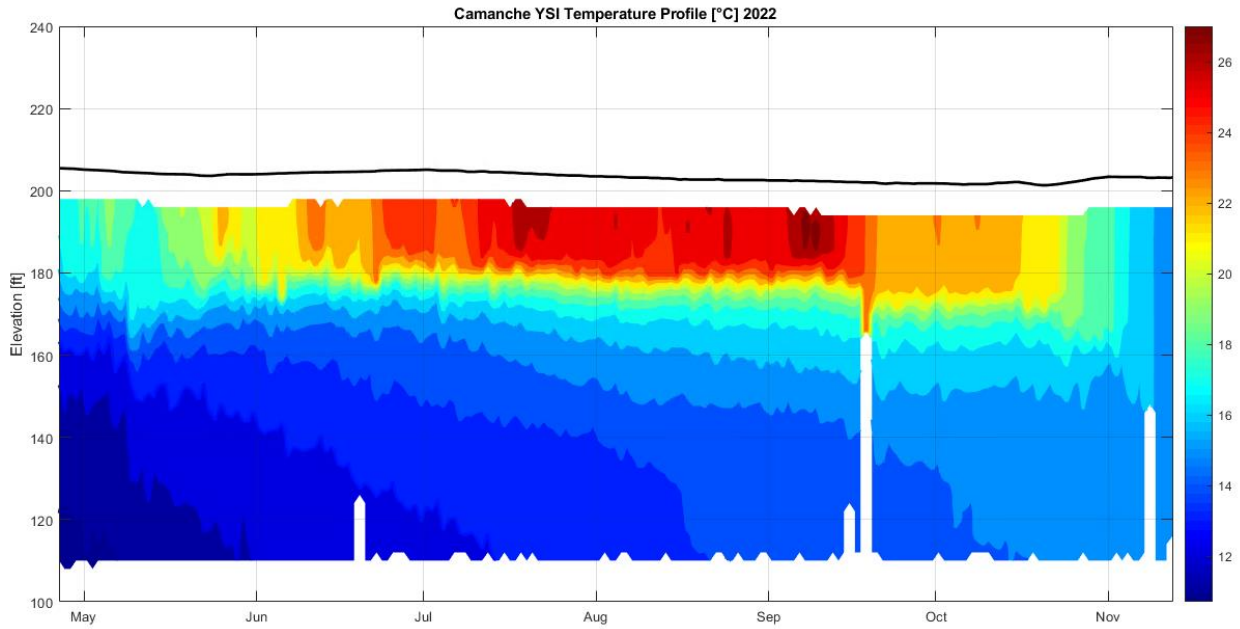


Figure F-24. Autoprofiler Temperature (°C) Contour, Station CAMD, 2022 Provisional.

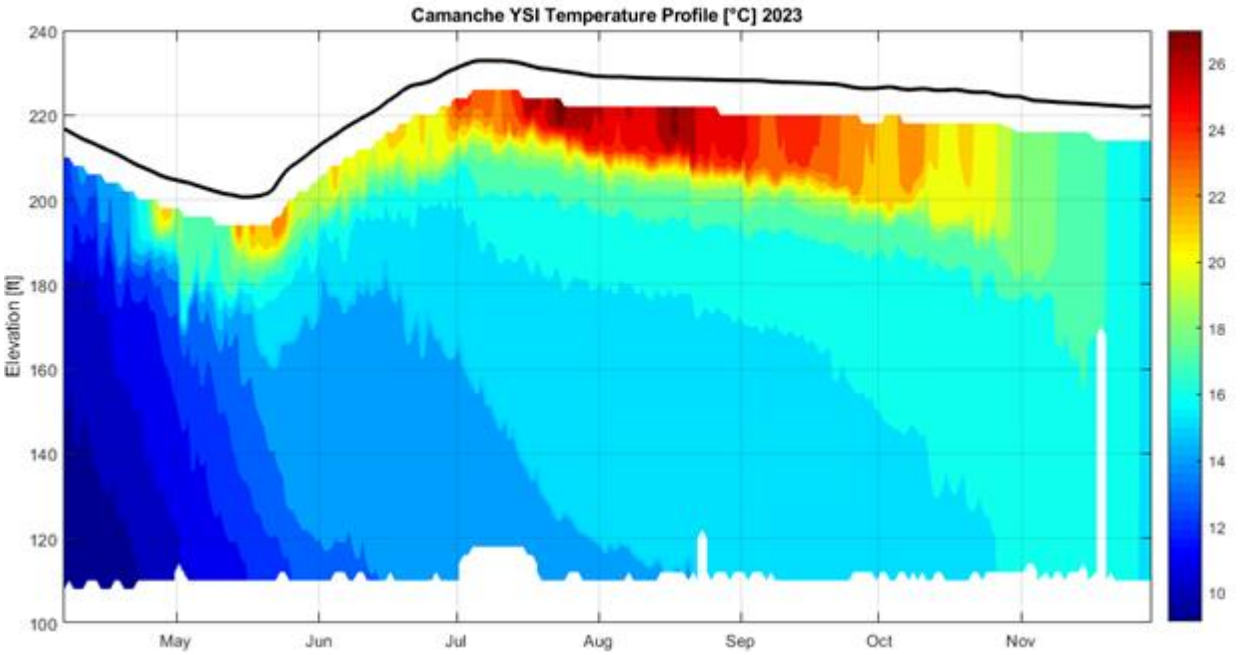


Figure F-25. Autoprofiler Temperature (°C) Contour, Station CAMD, 2023 Provisional.

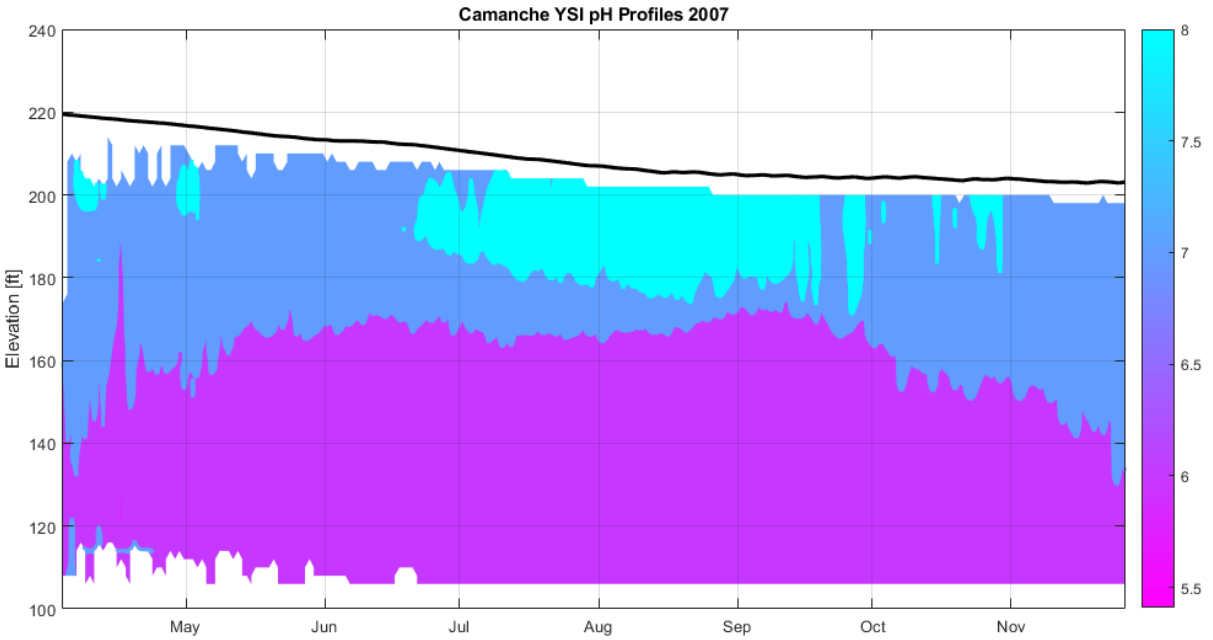


Figure F-26. Autoprofiler pH Contour, Station CAMD, 2007 Provisional.

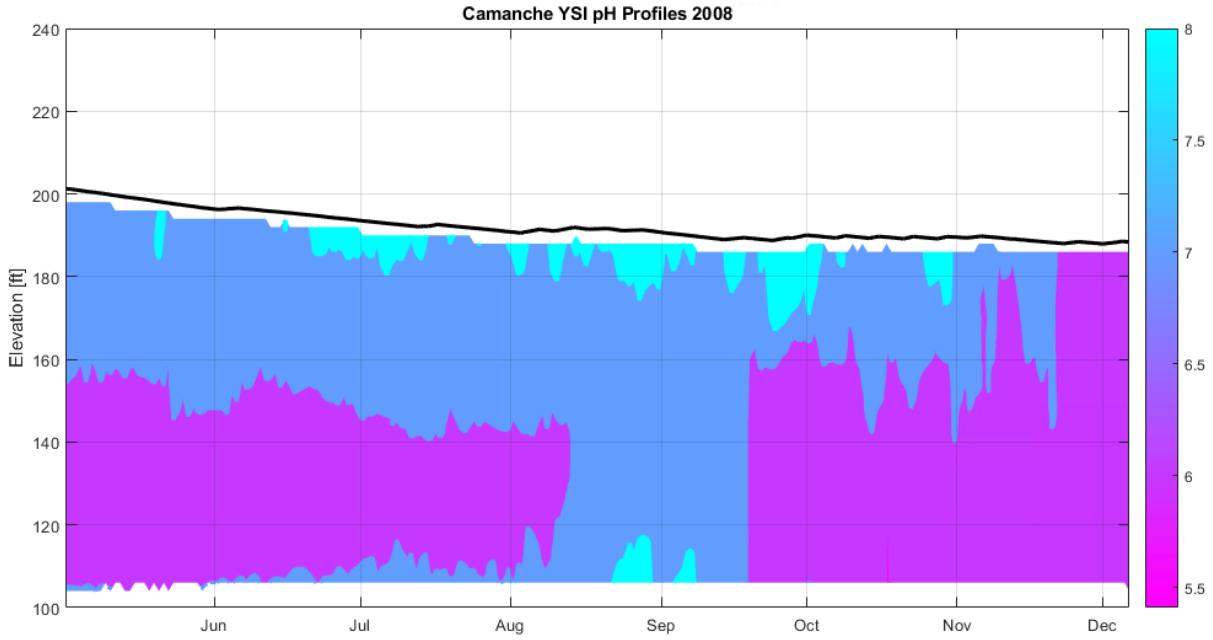


Figure F-27. Autoprofiler pH Contour, Station CAMD, 2008 Provisional.

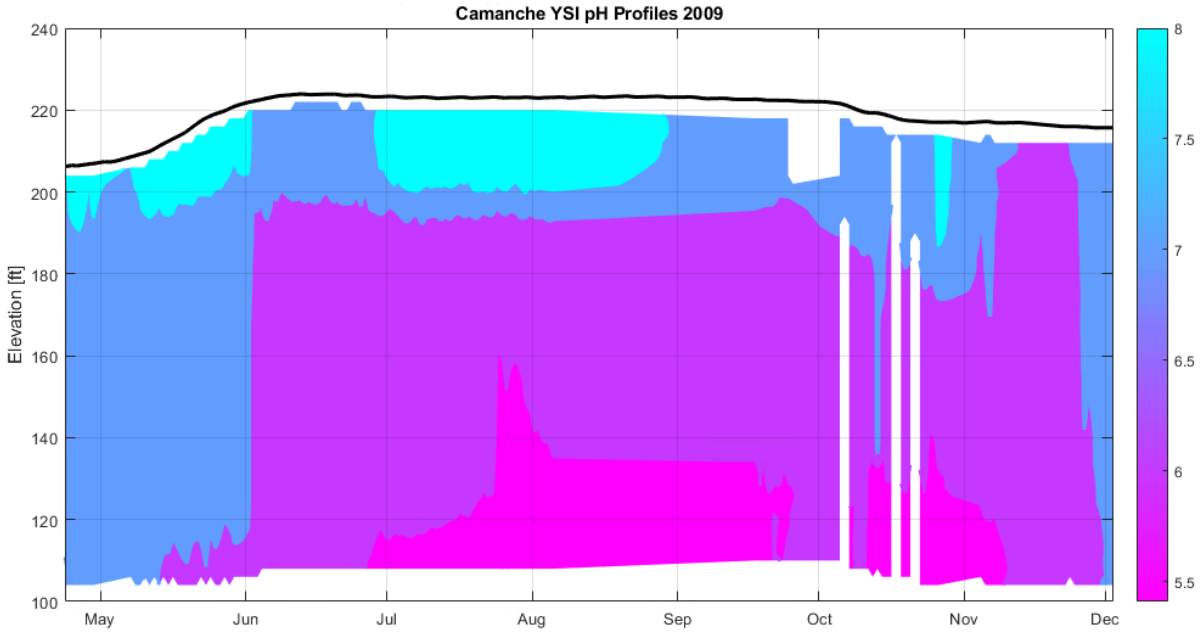


Figure F-28. Autoprofiler pH Contour, Station CAMD, 2009 Provisional.

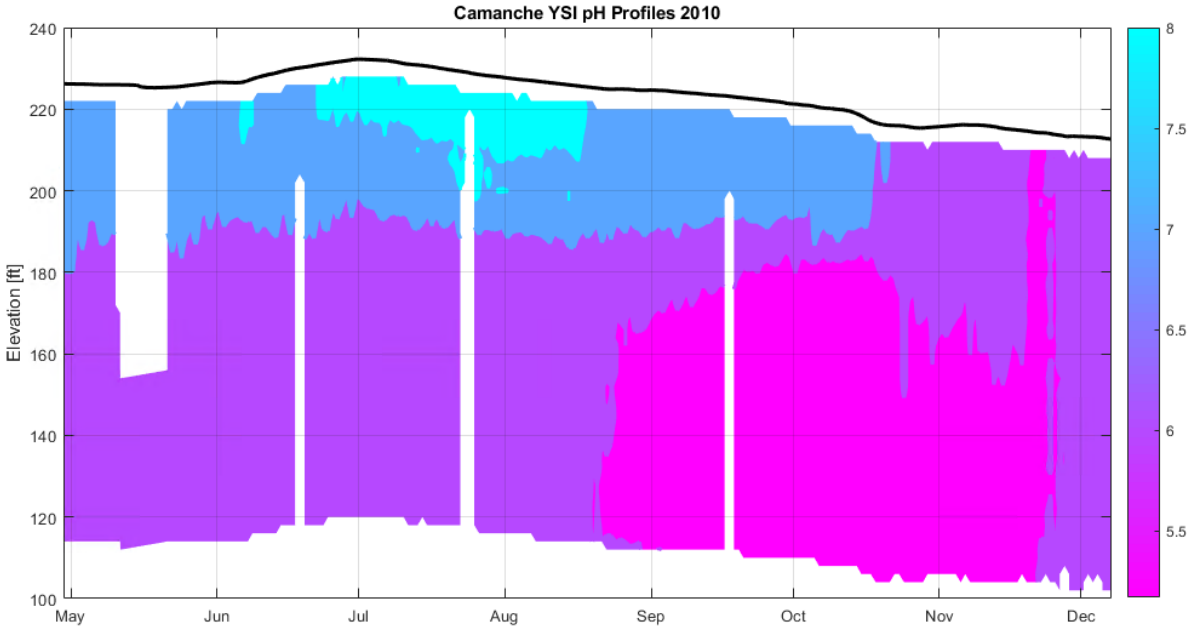


Figure F-29. Autoprofiler pH Contour, Station CAMD, 2010 Provisional.

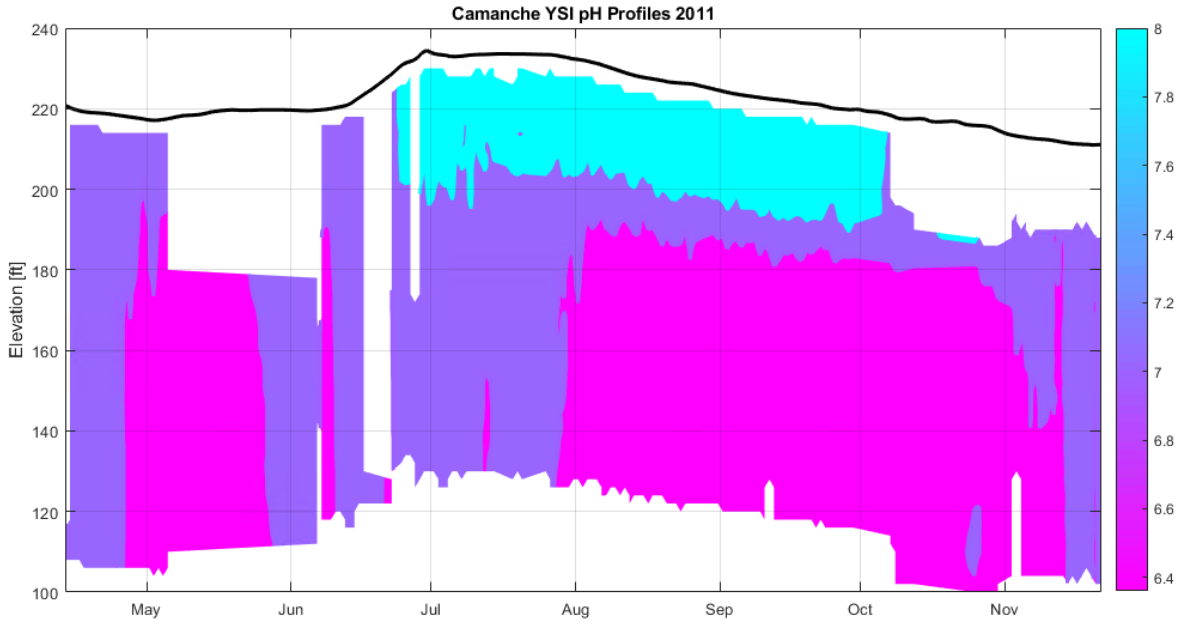


Figure F-30. Autoprofiler pH Contour, Station CAMD, 2011 Provisional.

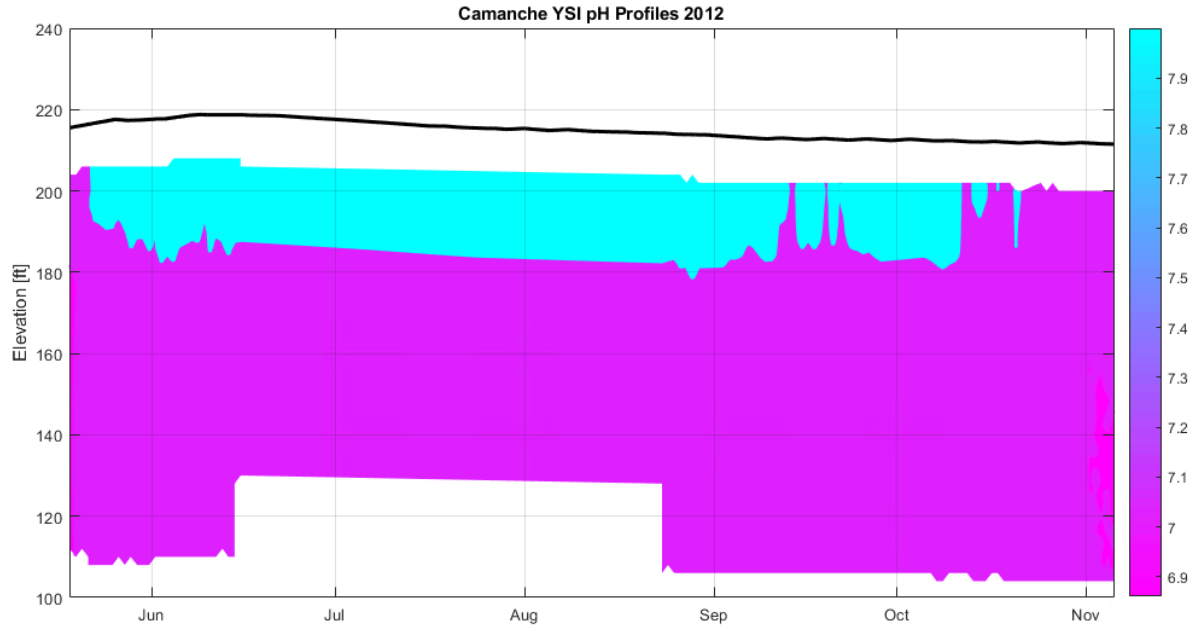


Figure F-31. Autoprofiler pH Contour, Station CAMD, 2012 Provisional.

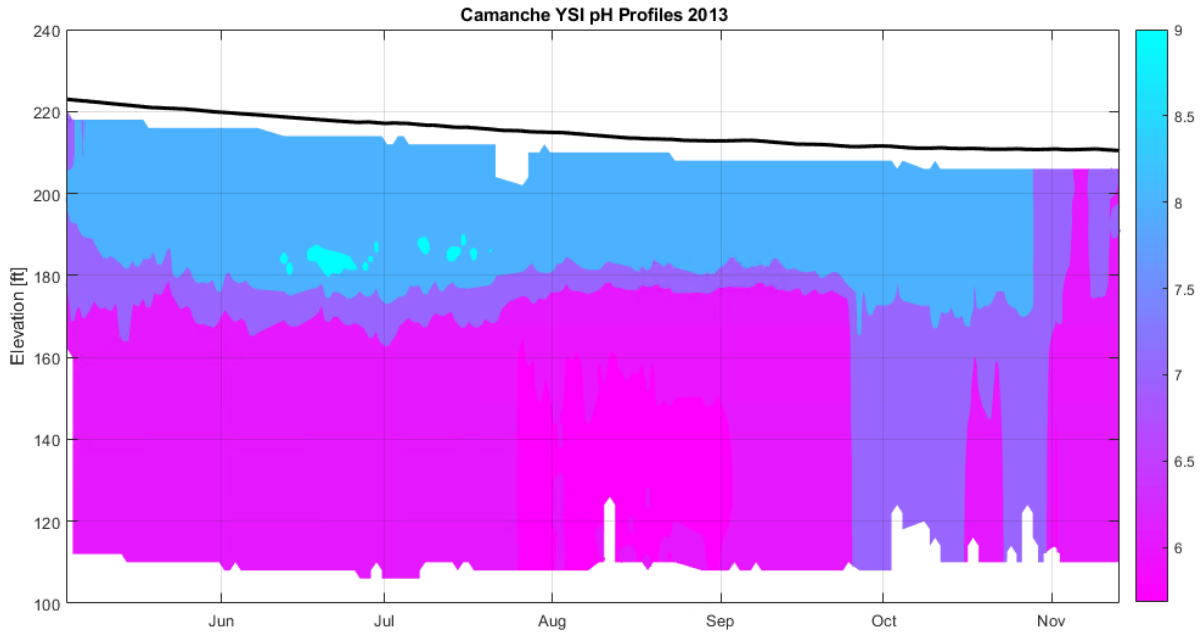


Figure F-32. Autoprofiler pH Contour, Station CAMD, 2013 Provisional.

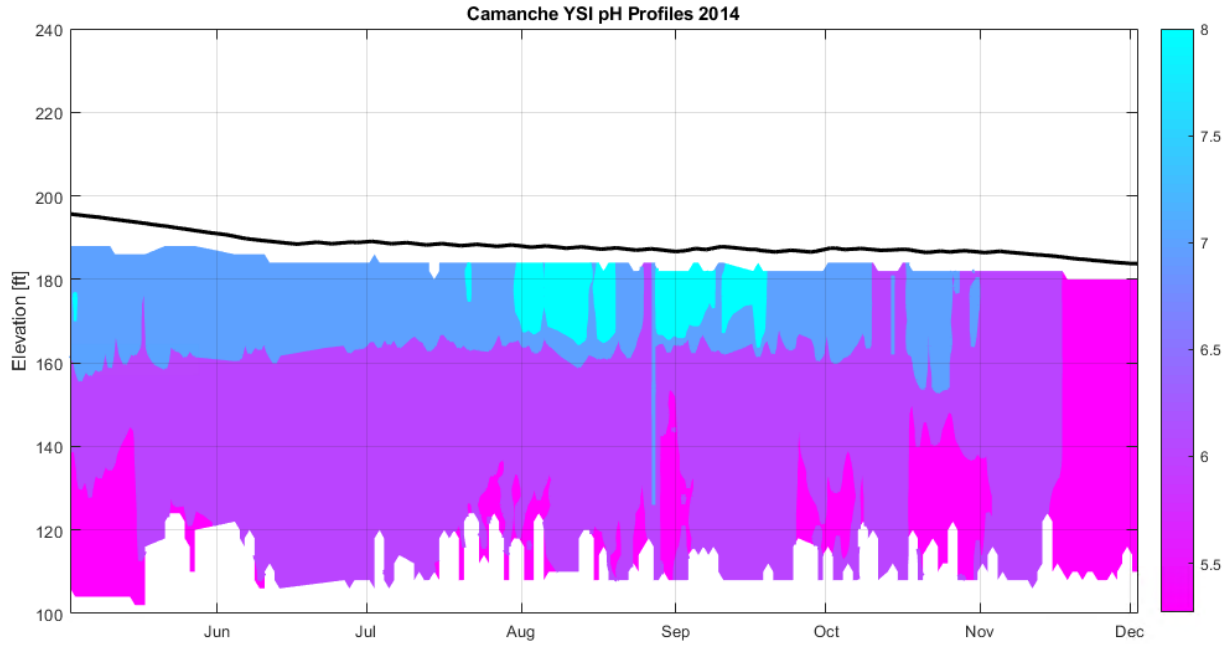


Figure F-33. Autoprofiler pH Contour, Station CAMD, 2014 Provisional.

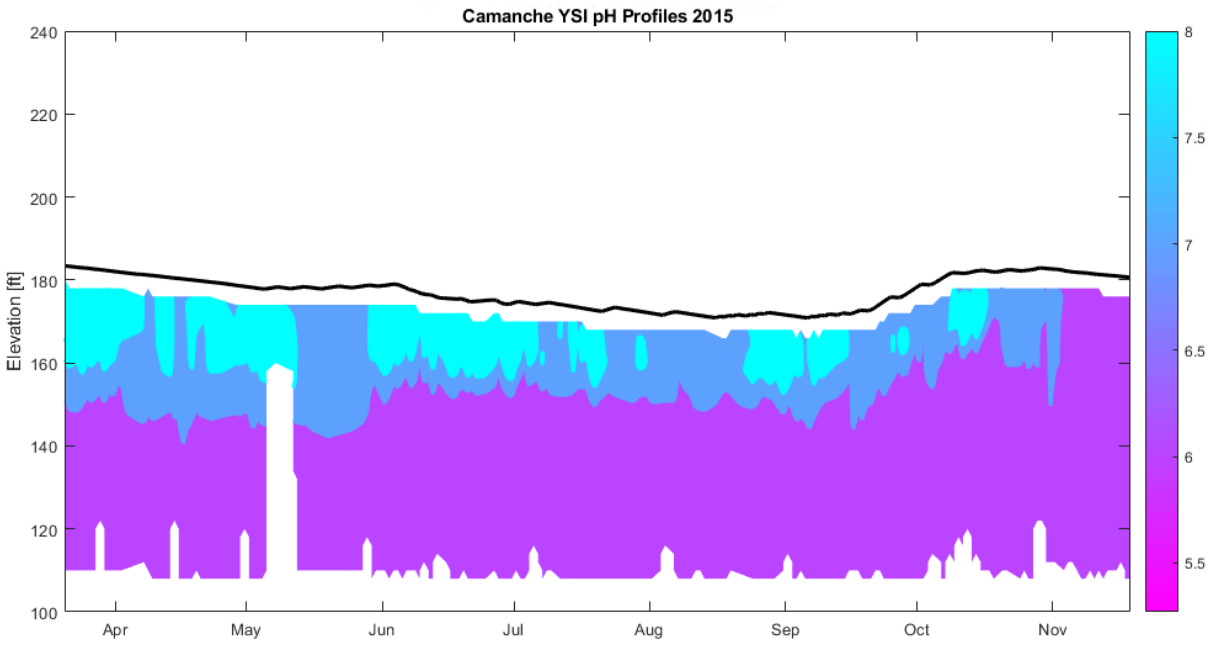


Figure F-34. Autoprofiler pH Contour, Station CAMD, 2015 Provisional.

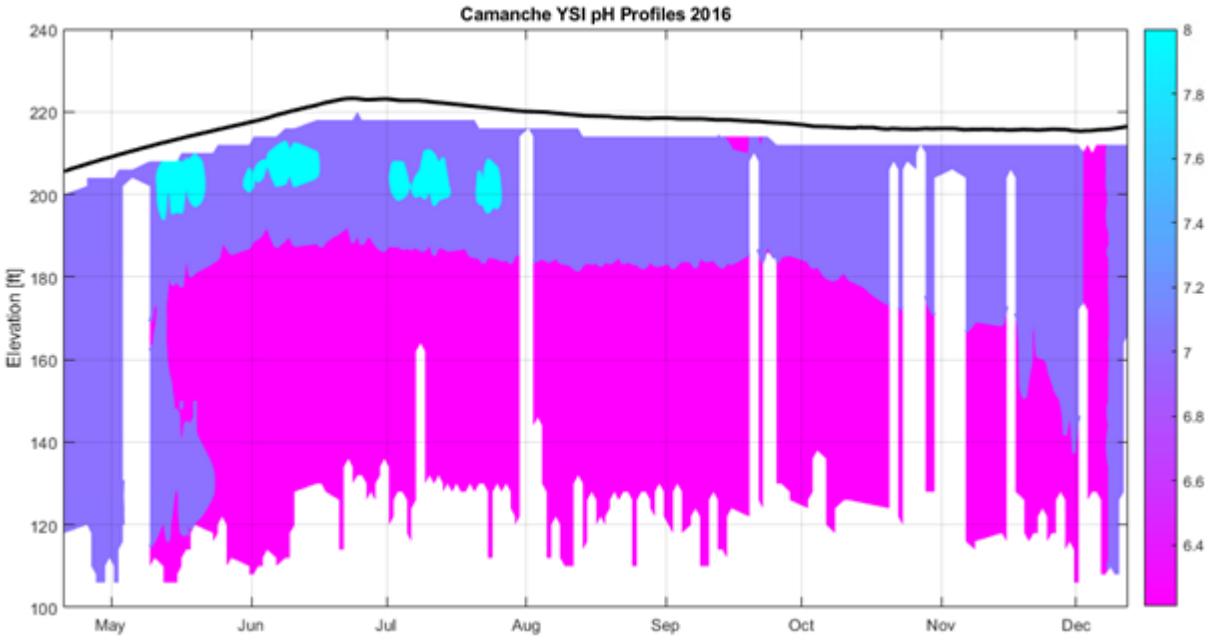


Figure F-35. Autoprofiler pH Contour, Station CAMD, 2016 Provisional.

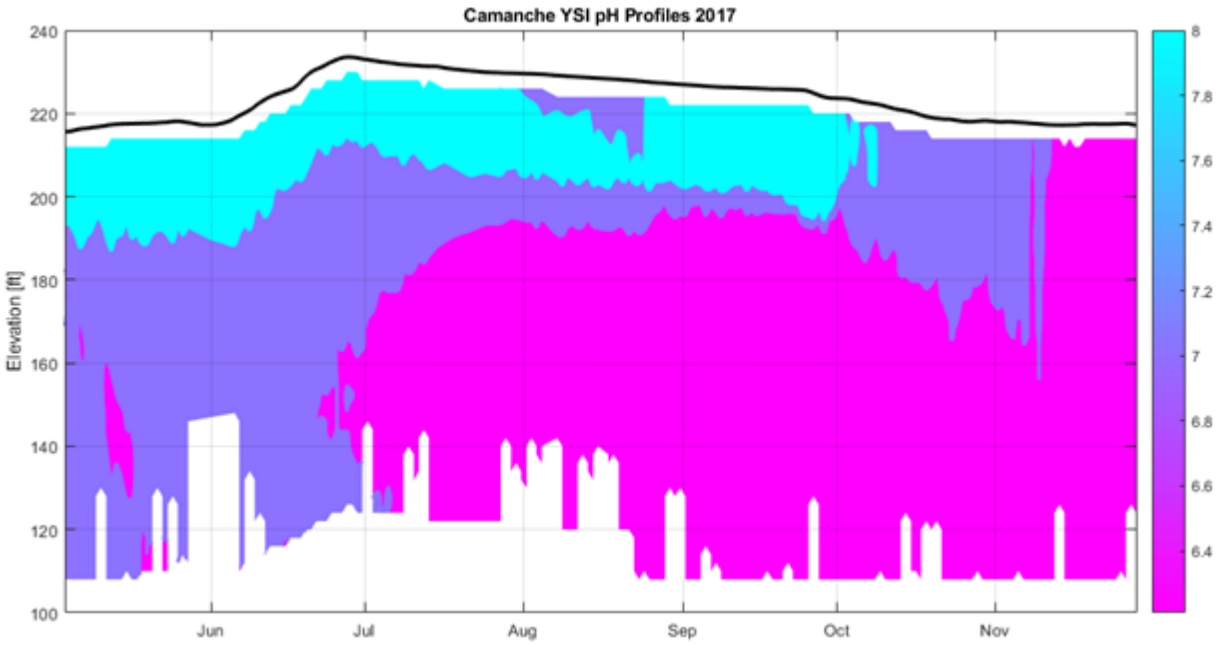


Figure F-36. Autoprofiler pH Contour, Station CAMD, 2017 Provisional.

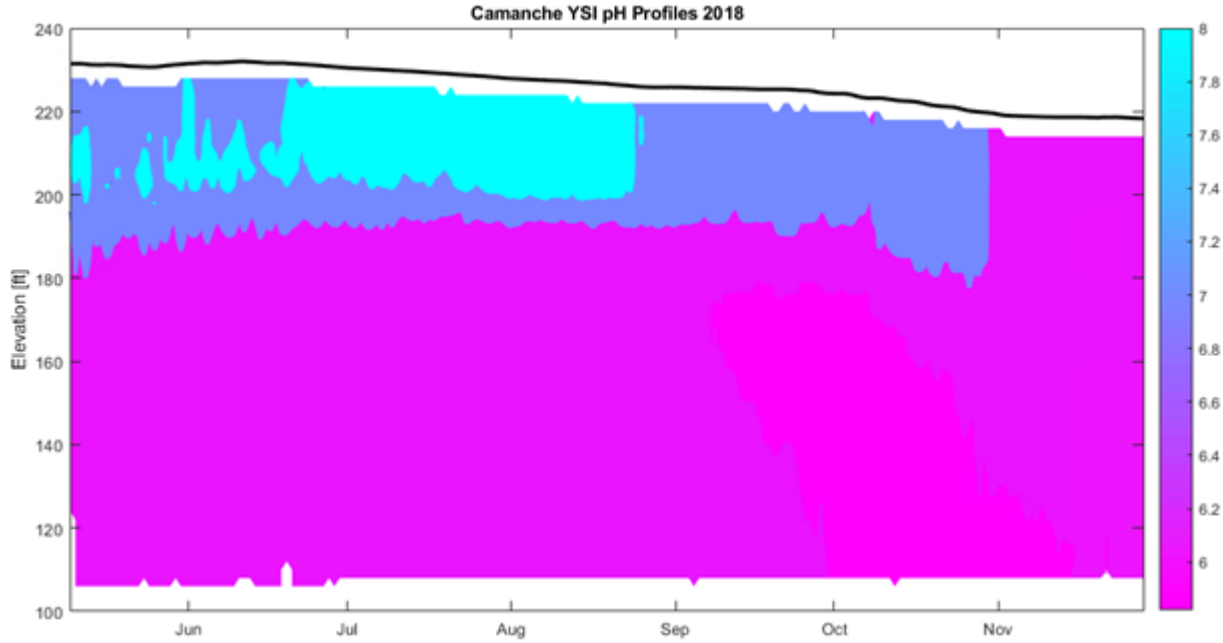


Figure F-37. Autoprofiler pH Contour, Station CAMD, 2018 Provisional.

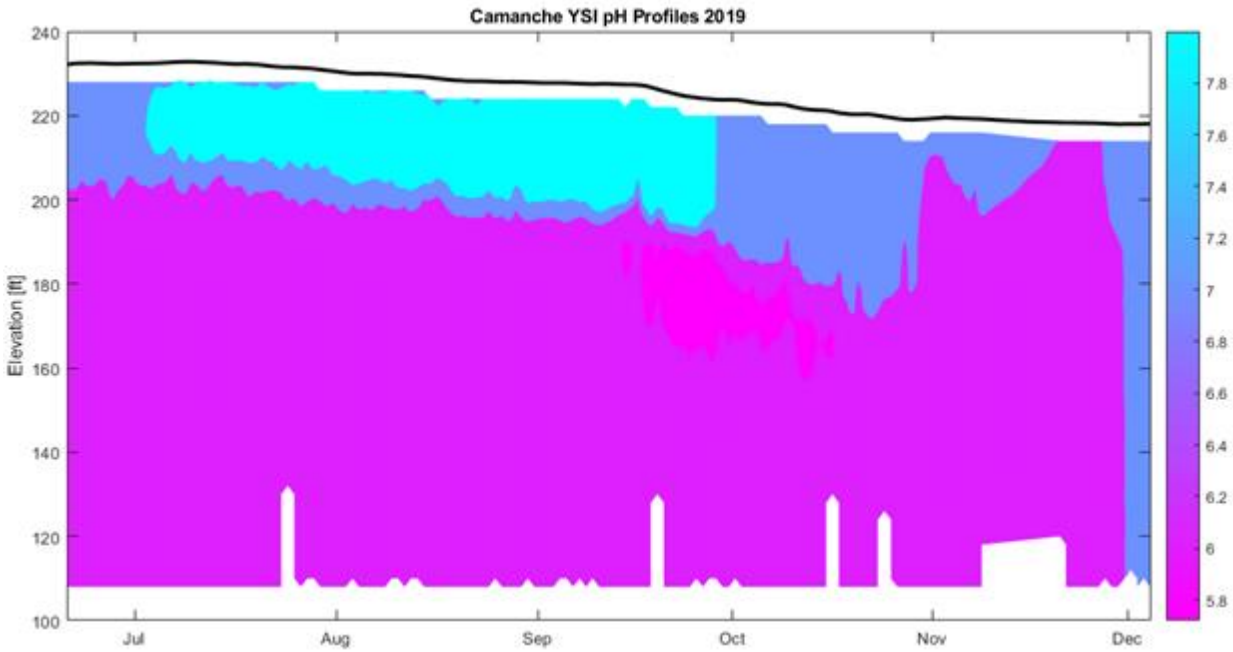


Figure F-38. Autoprofiler pH Contour, Station CAMD, 2019 Provisional.

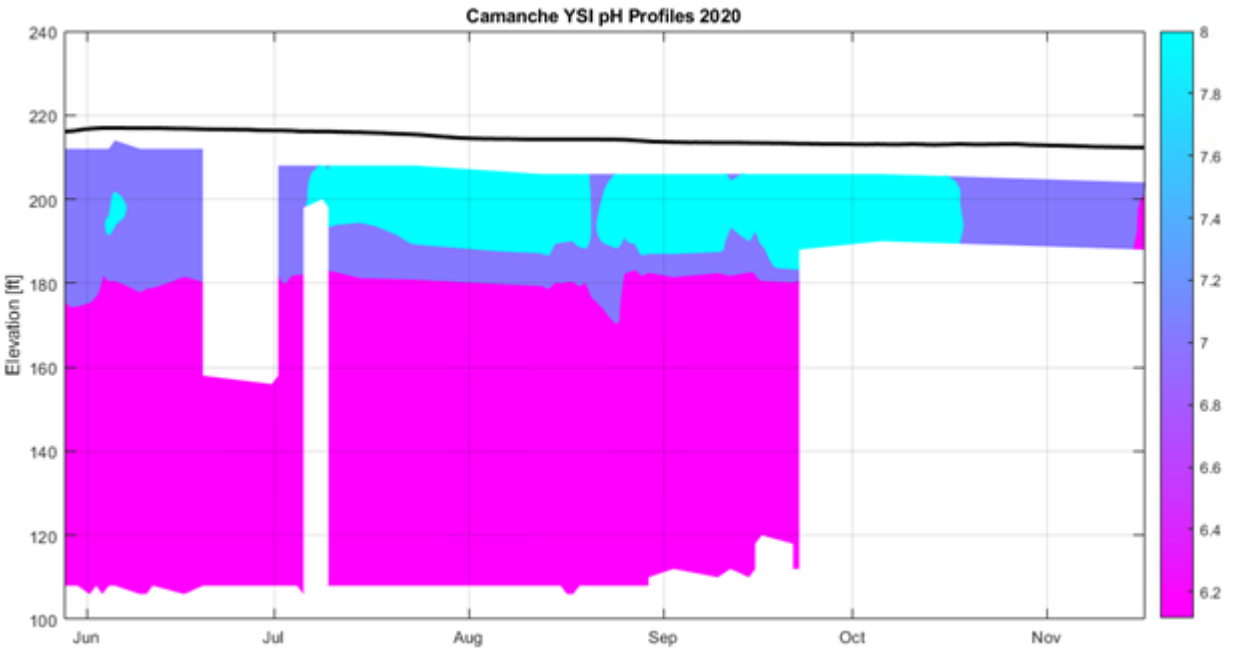


Figure F-39. Autoprofiler pH Contour, Station CAMD, 2020 Provisional.

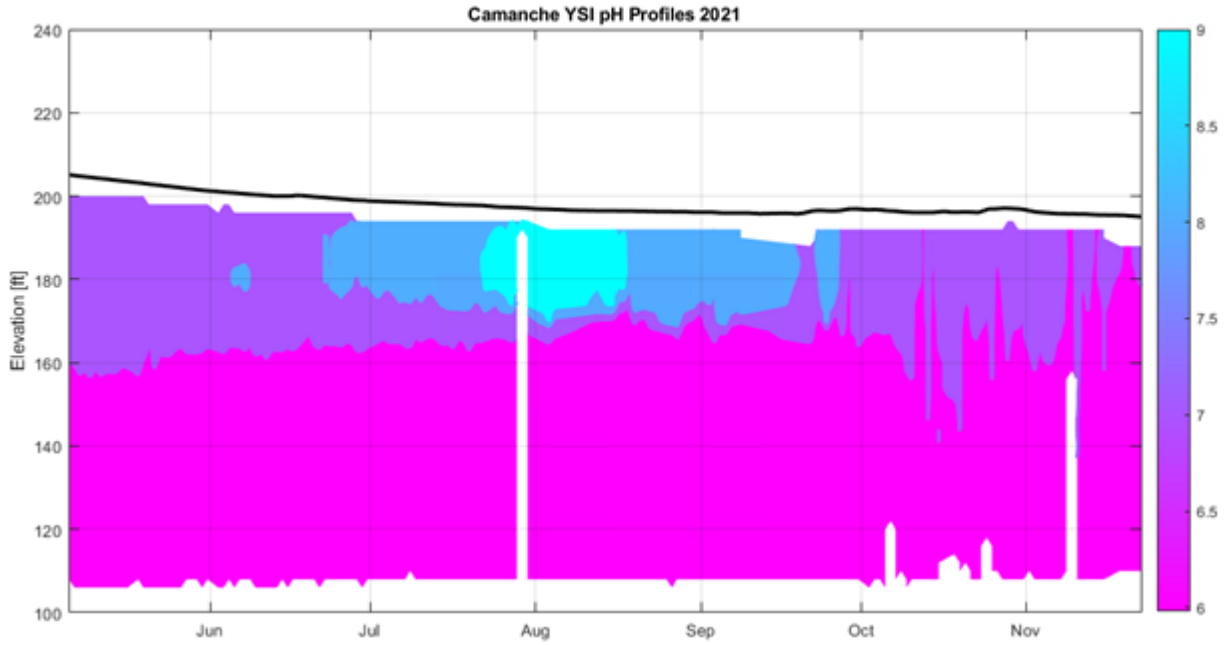


Figure F-40. Autoprofiler pH Contour, Station CAMD, 2021 Provisional.

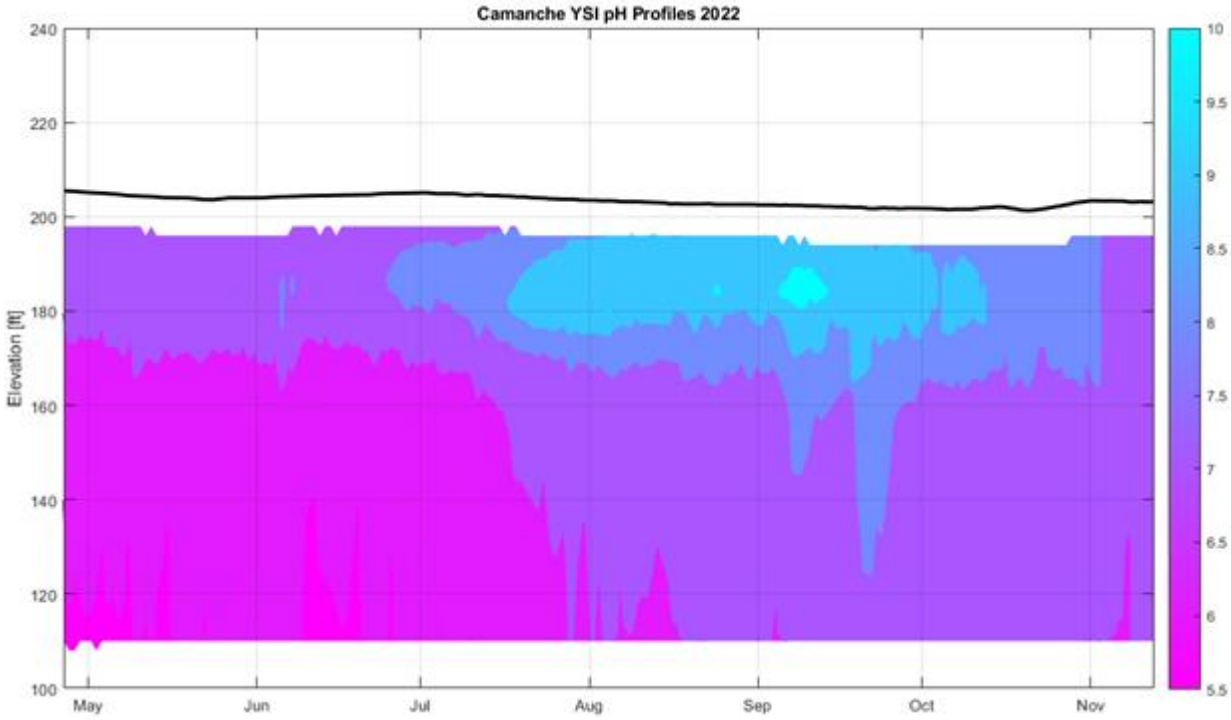


Figure F-41. Autoprofiler pH Contour, Station CAMD, 2022 Provisional.

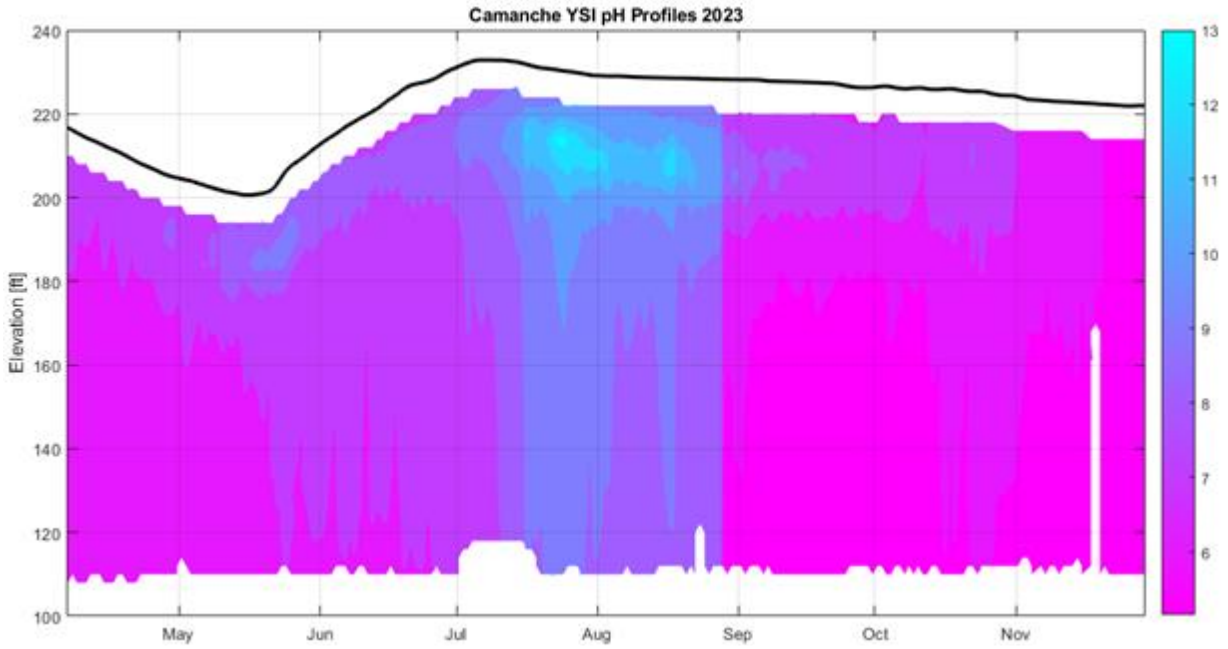


Figure F-42. Autoprofiler pH Contour, Station CAMD, 2023 Provisional.

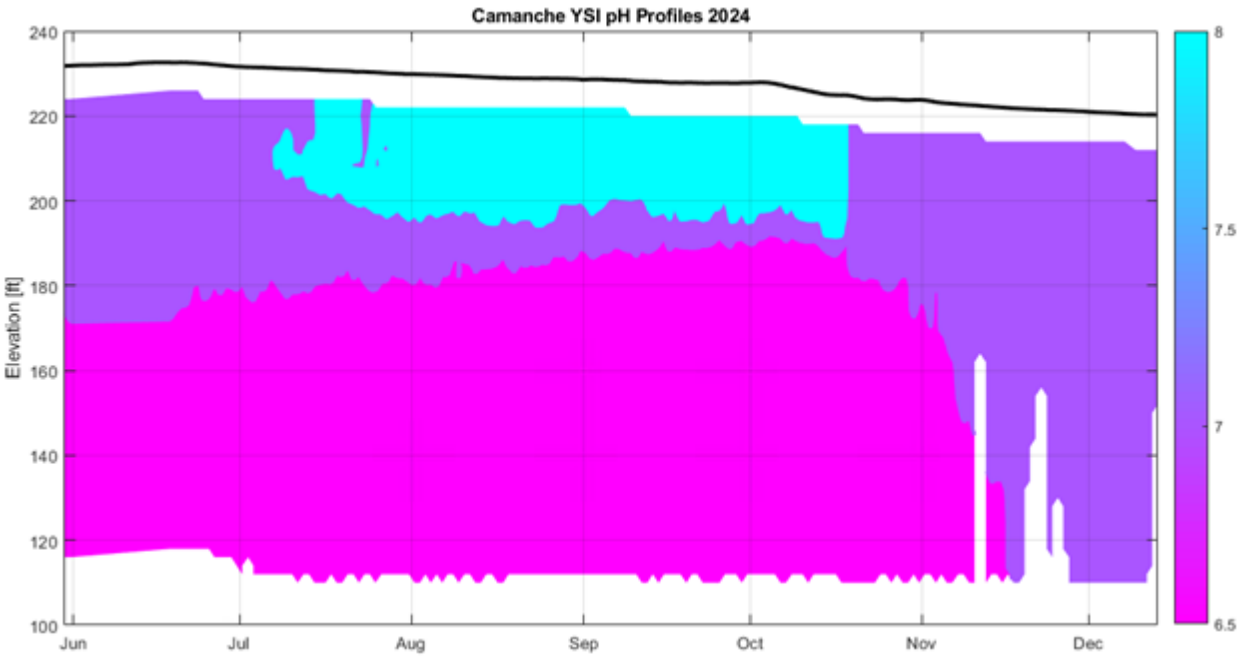


Figure F-43. Autoprofiler pH Contour, Station CAMD, 2024 Provisional.

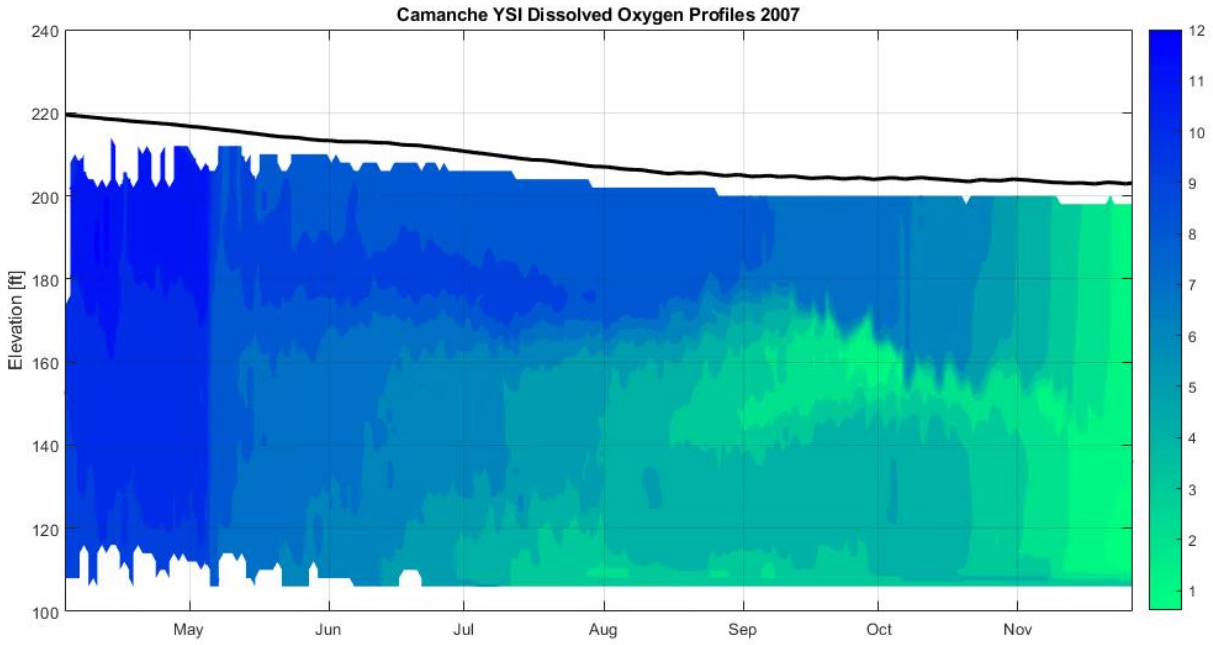


Figure F-44. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2007 Provisional.

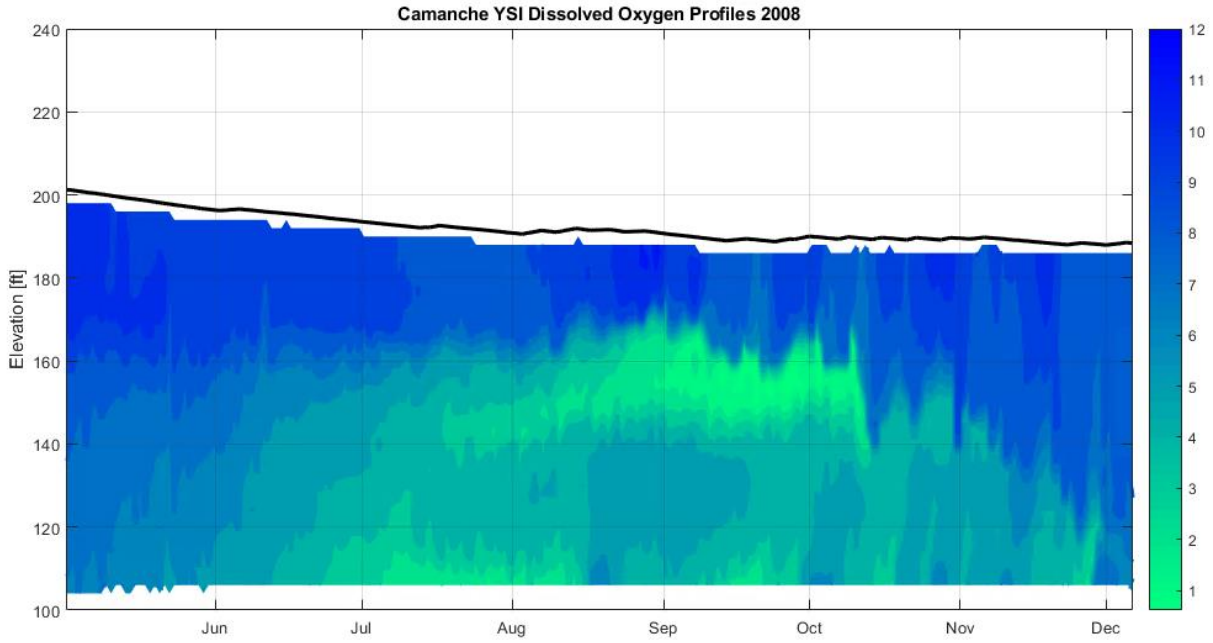


Figure F-45. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2008 Provisional.

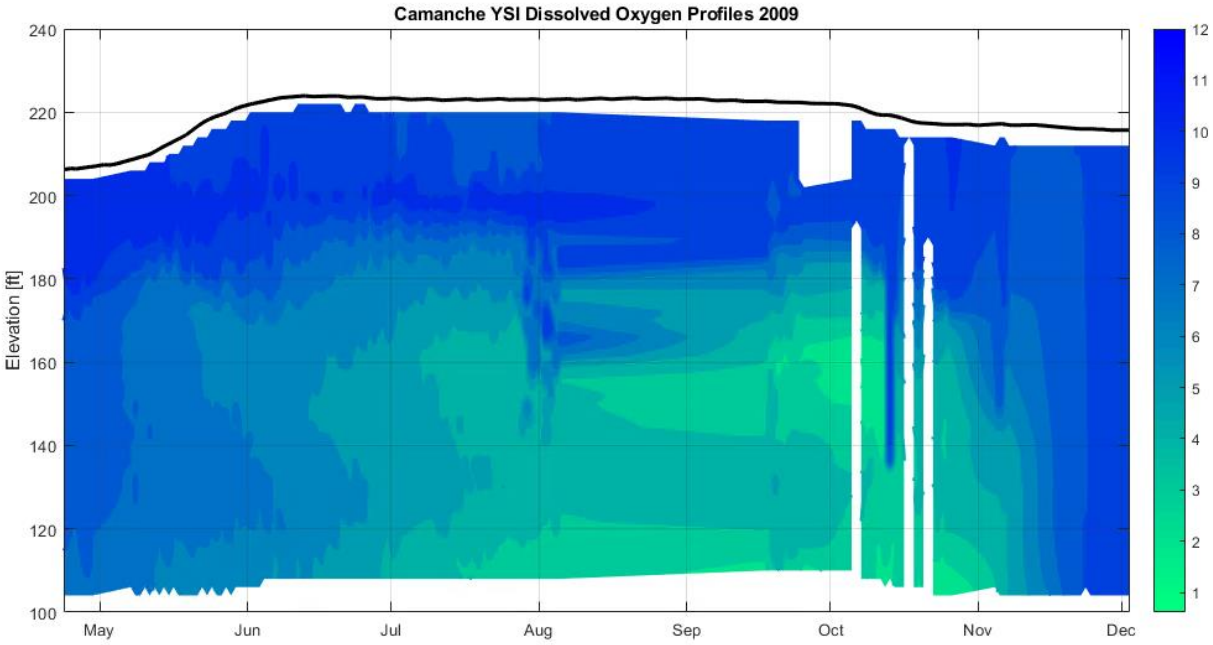


Figure F-46. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2009 Provisional.

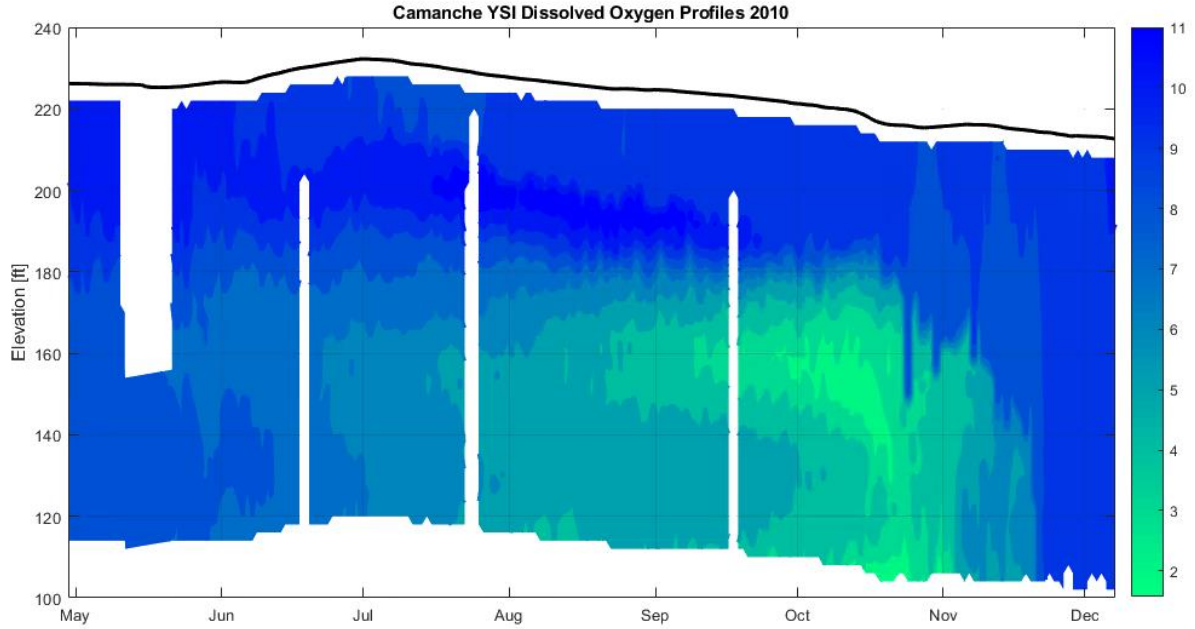


Figure F-47. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2010 Provisional.

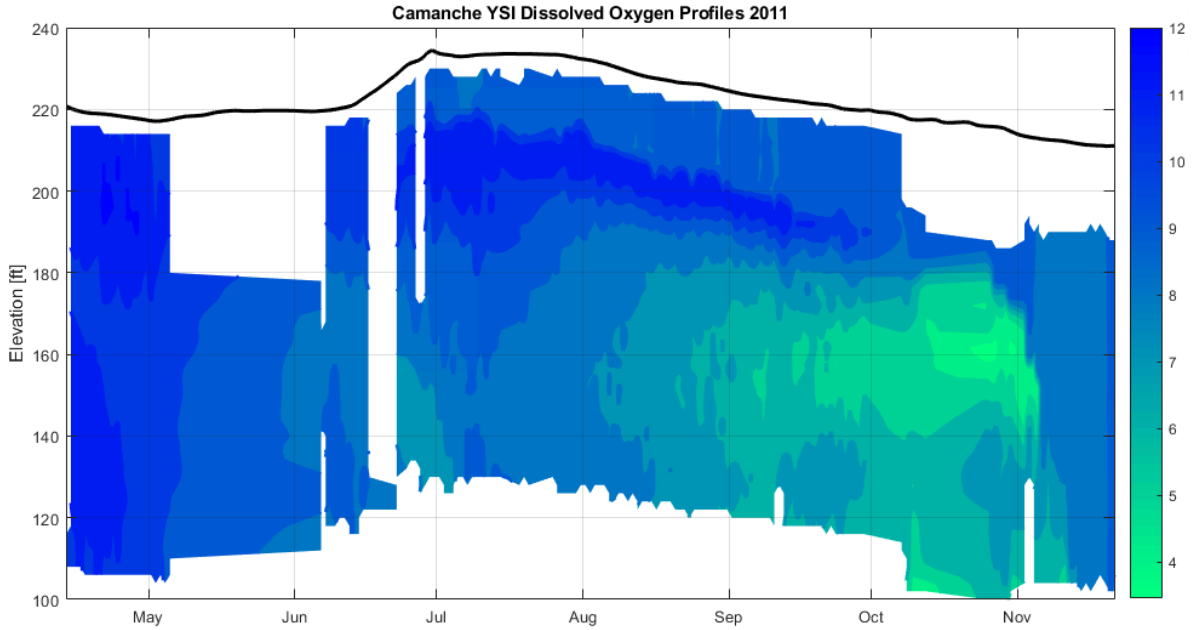


Figure F-48. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2011 Provisional.

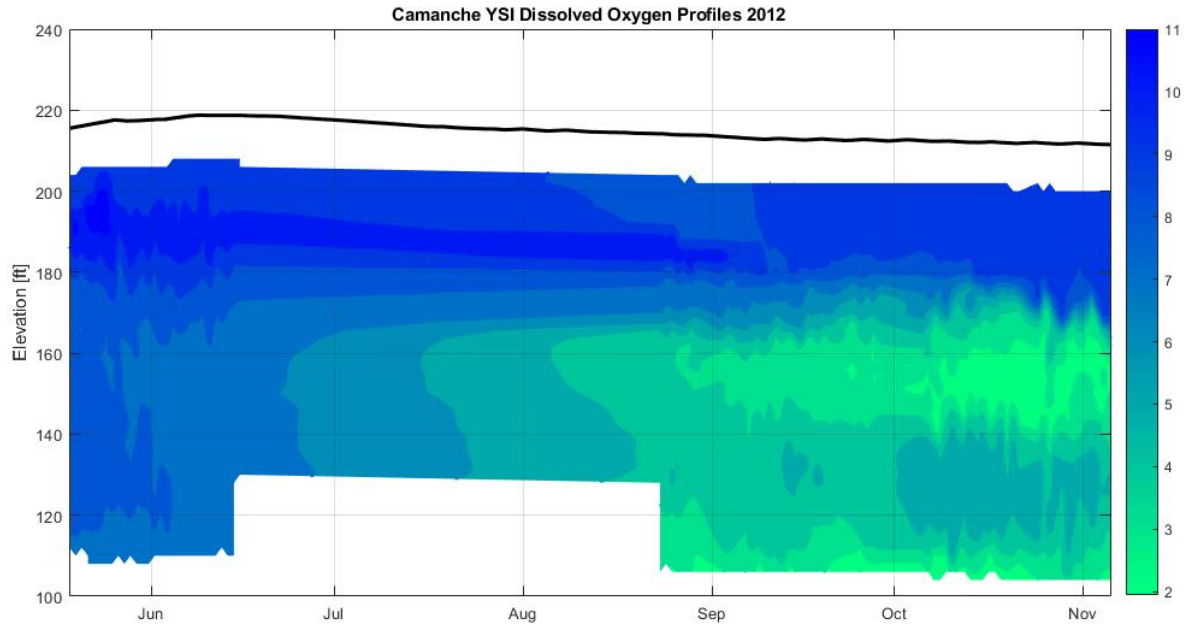


Figure F-49. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2012 Provisional.

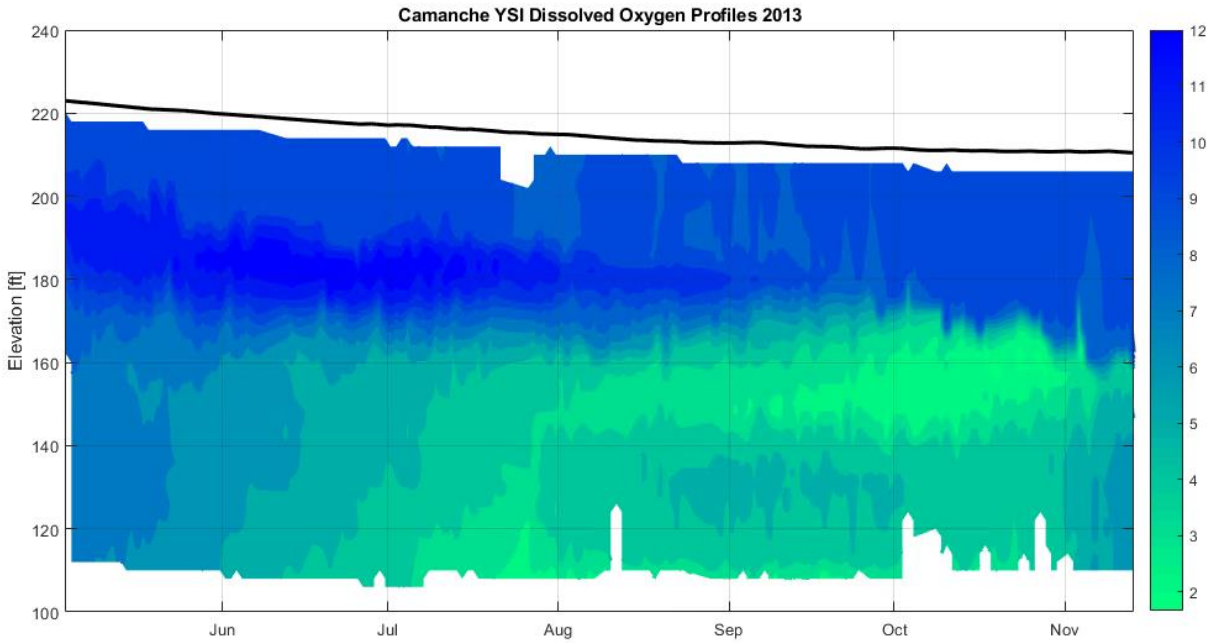


Figure F-50. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2013 Provisional.

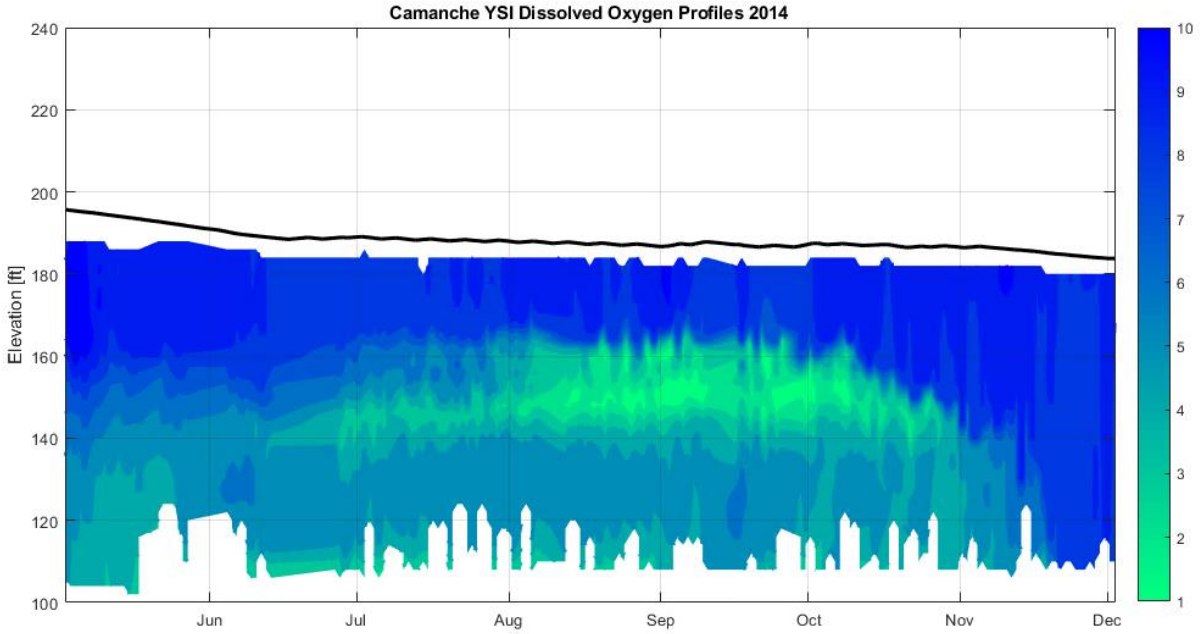


Figure F-51. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2014 Provisional.

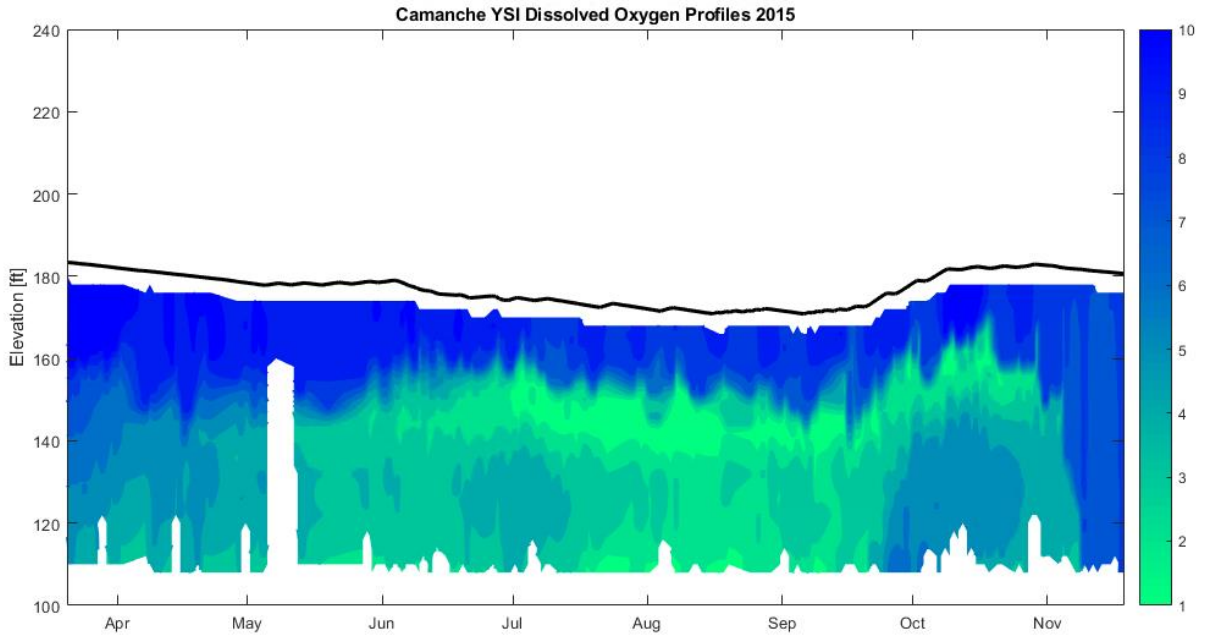


Figure F-52. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2015 Provisional.

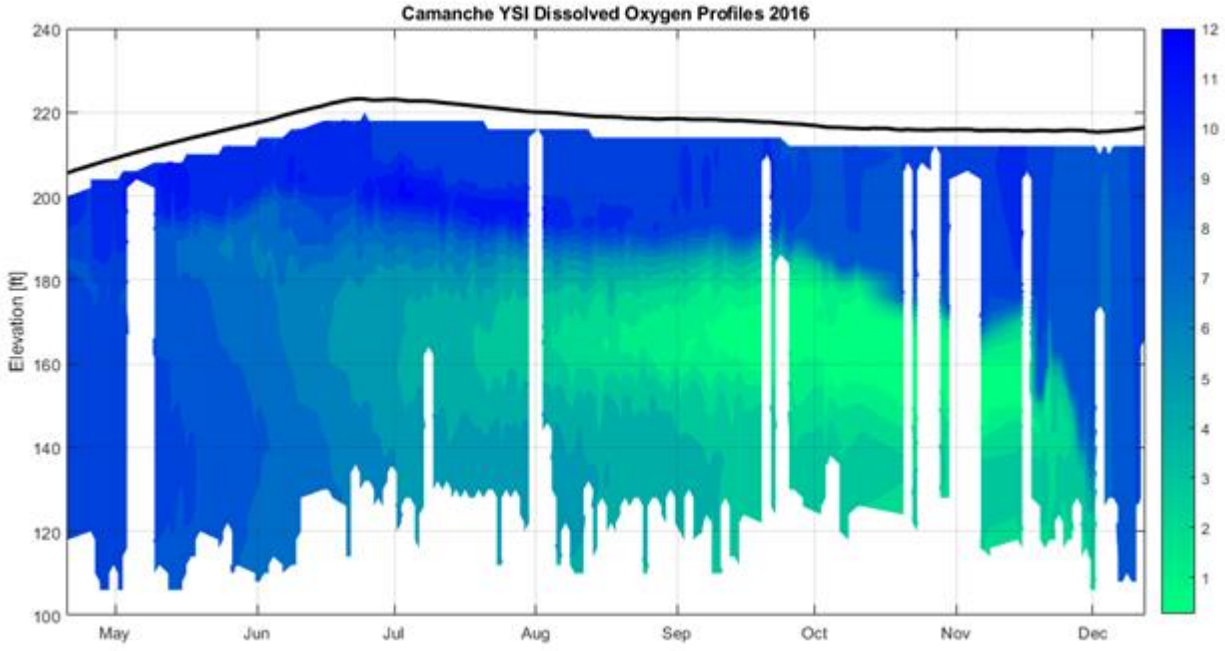


Figure F-53. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2016 Provisional.

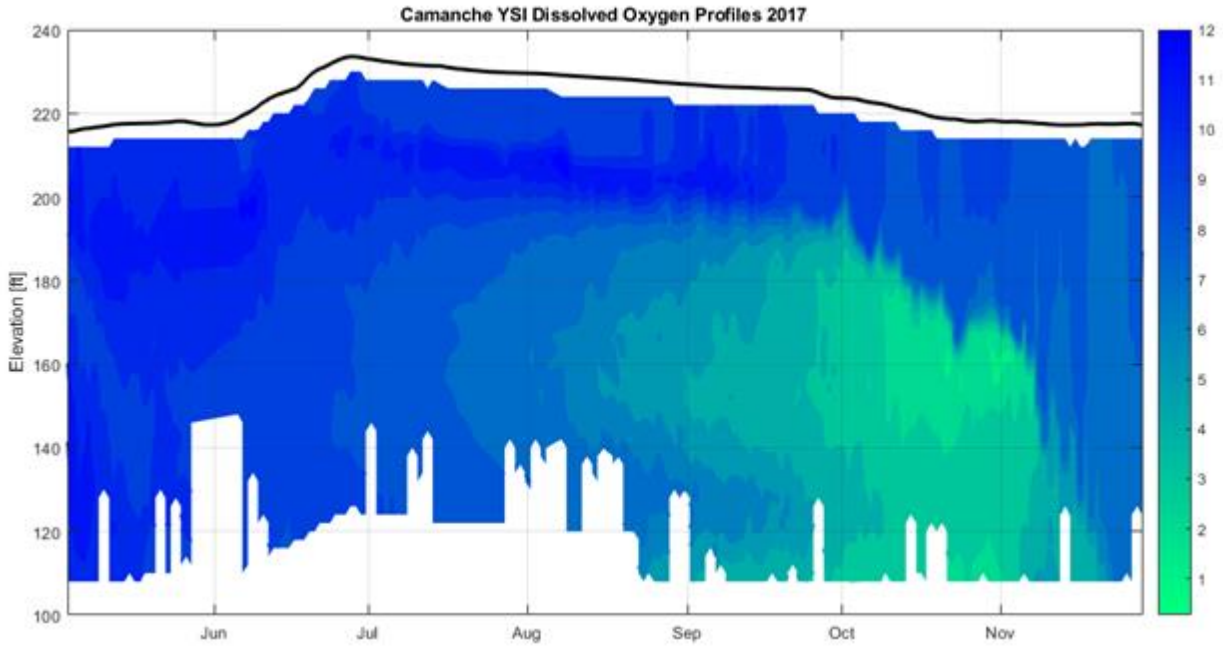


Figure F-54. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2017 Provisional.

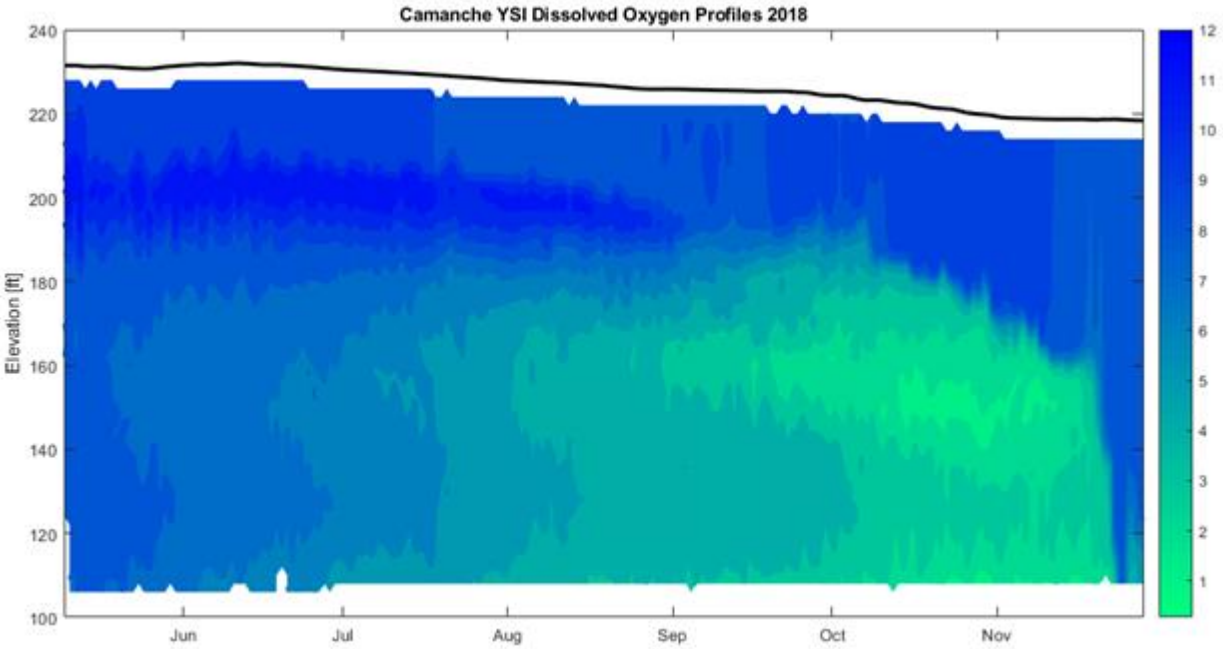


Figure F-55. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2018 Provisional.

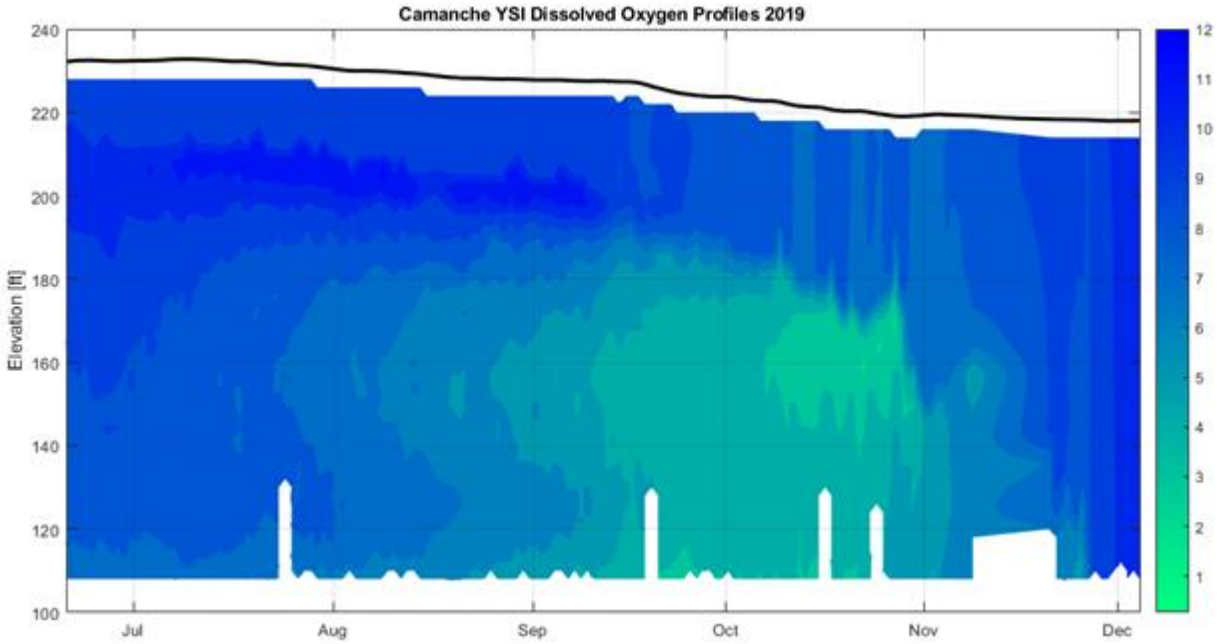


Figure F-56. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2019 Provisional.

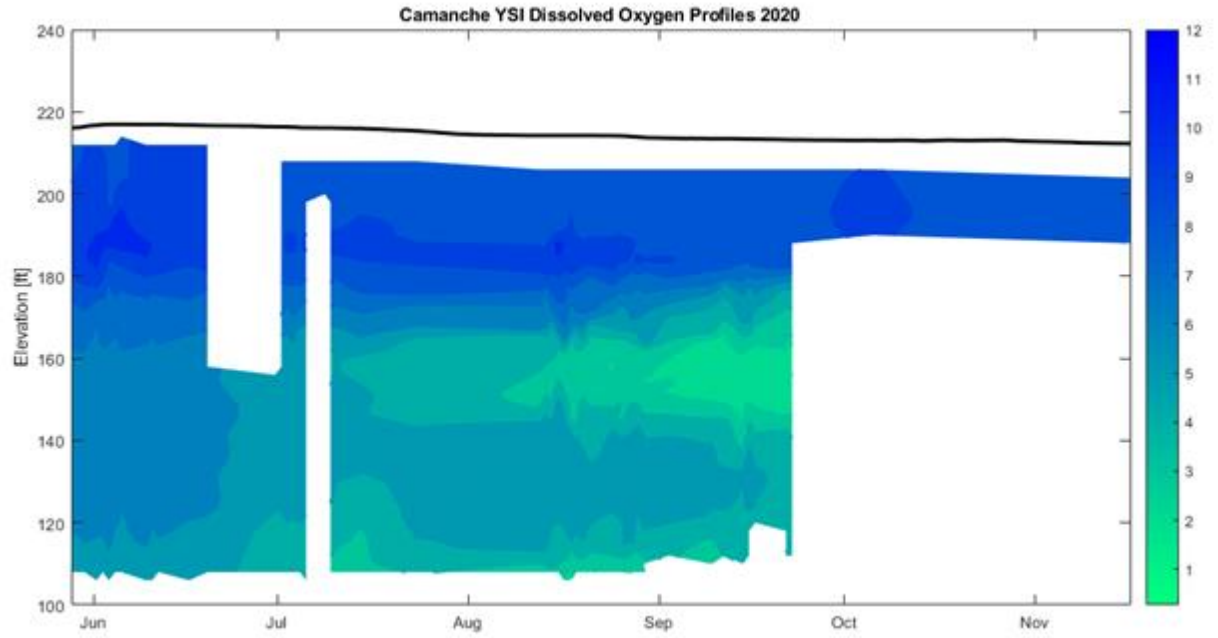


Figure F-57. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2020 Provisional.

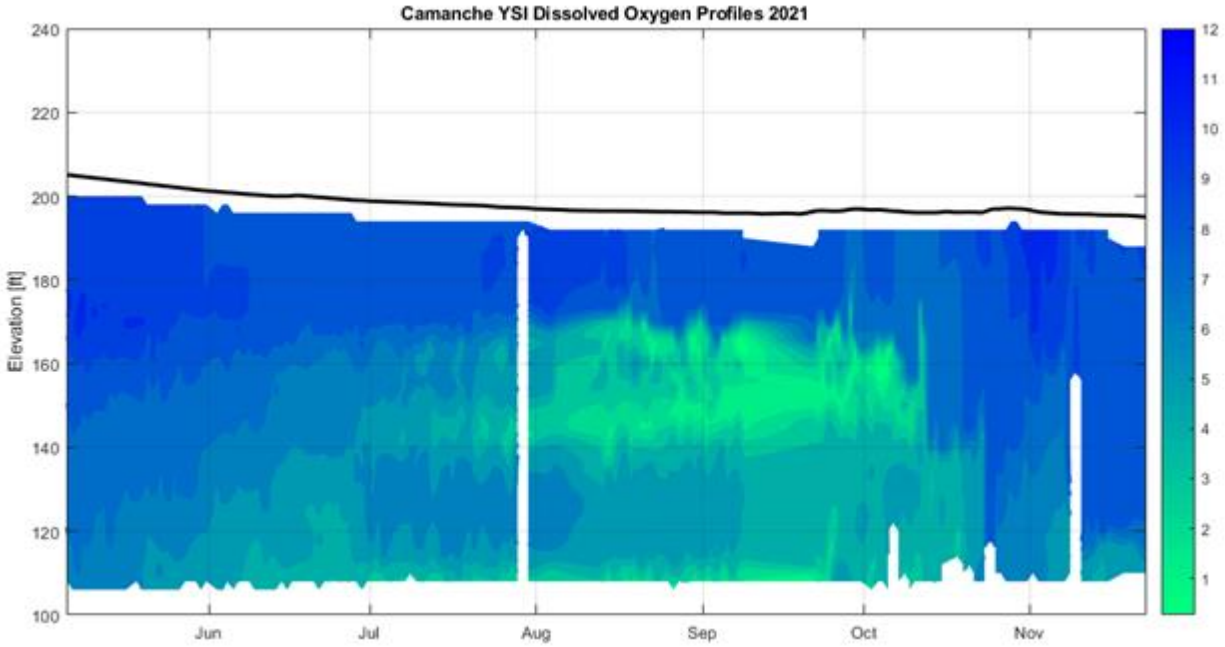


Figure F-58. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2021 Provisional.

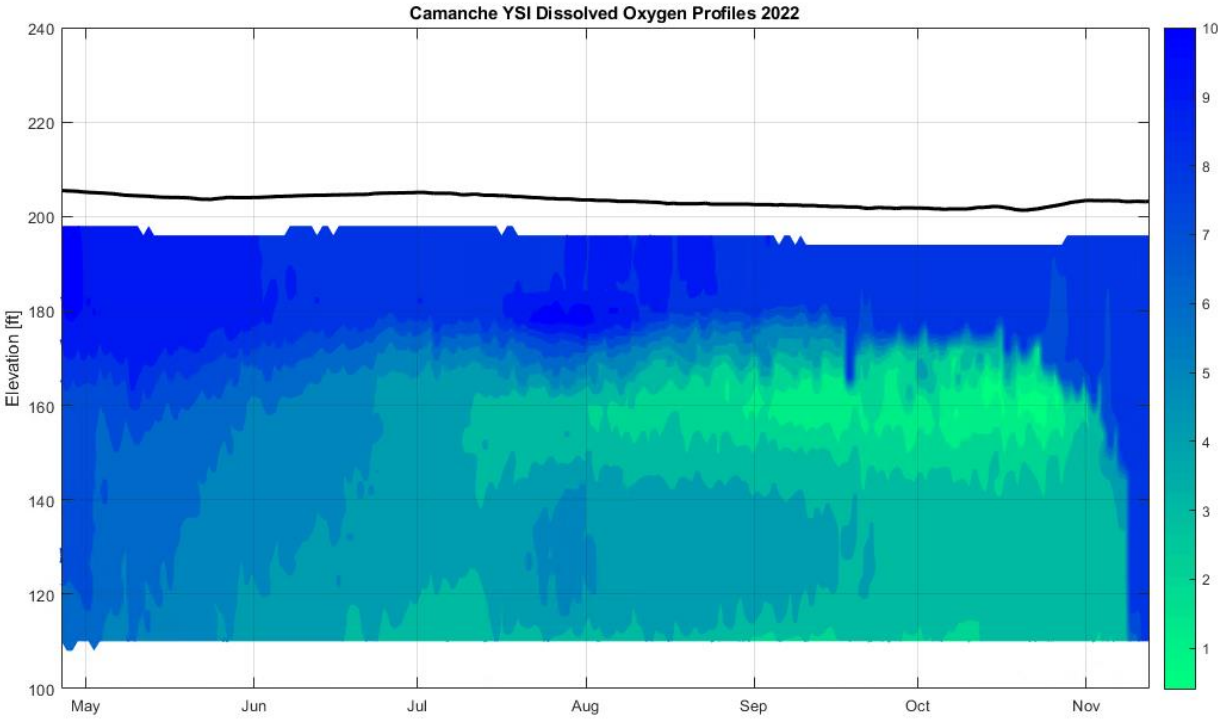


Figure F-59. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2022 Provisional.

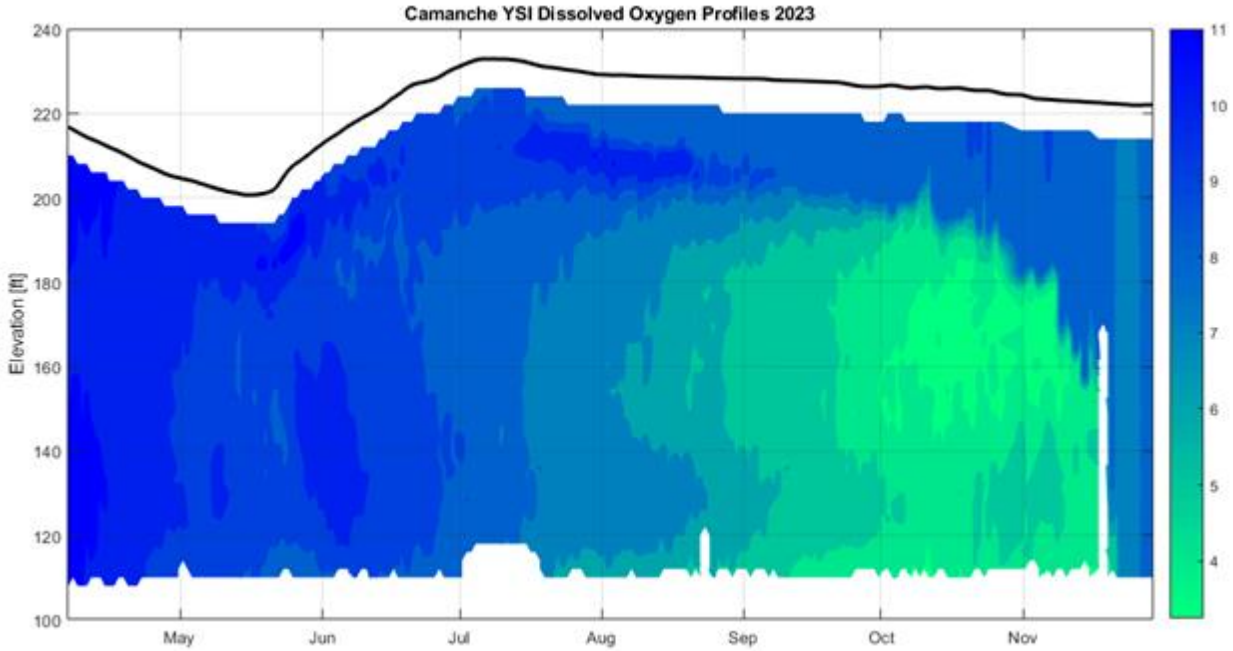


Figure F-60. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2023 Provisional.

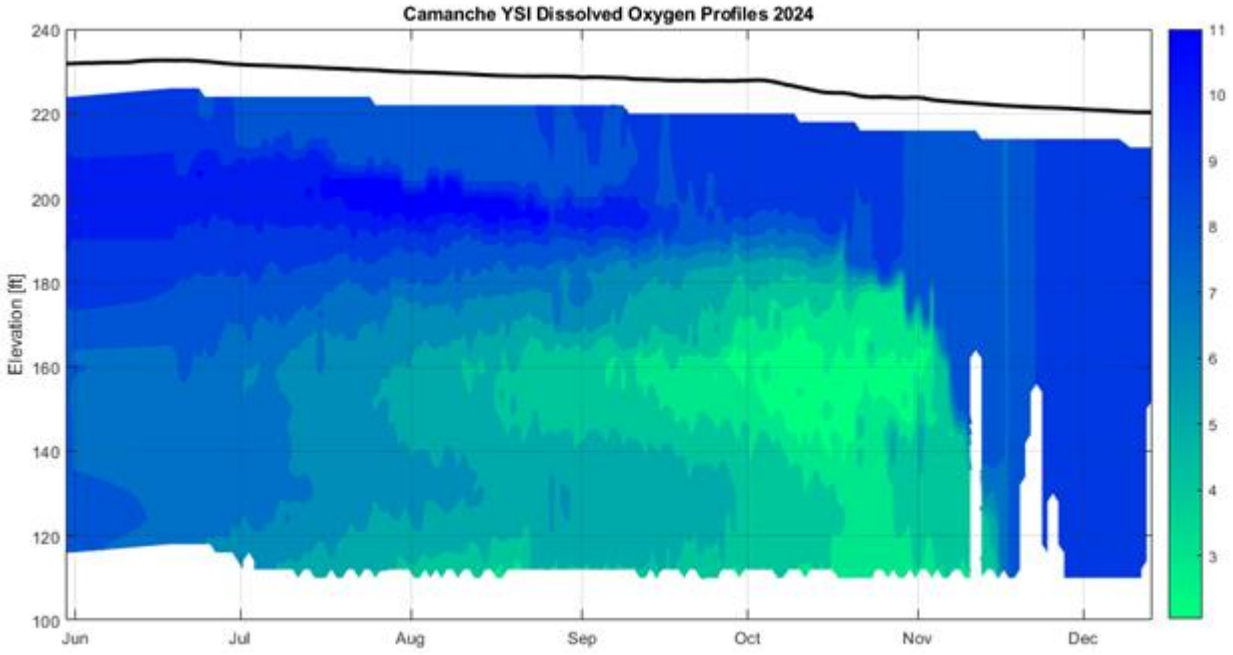


Figure F-61. Autoprofiler Dissolved Oxygen (mg/L) Contour, Station CAMD, 2024 Provisional.

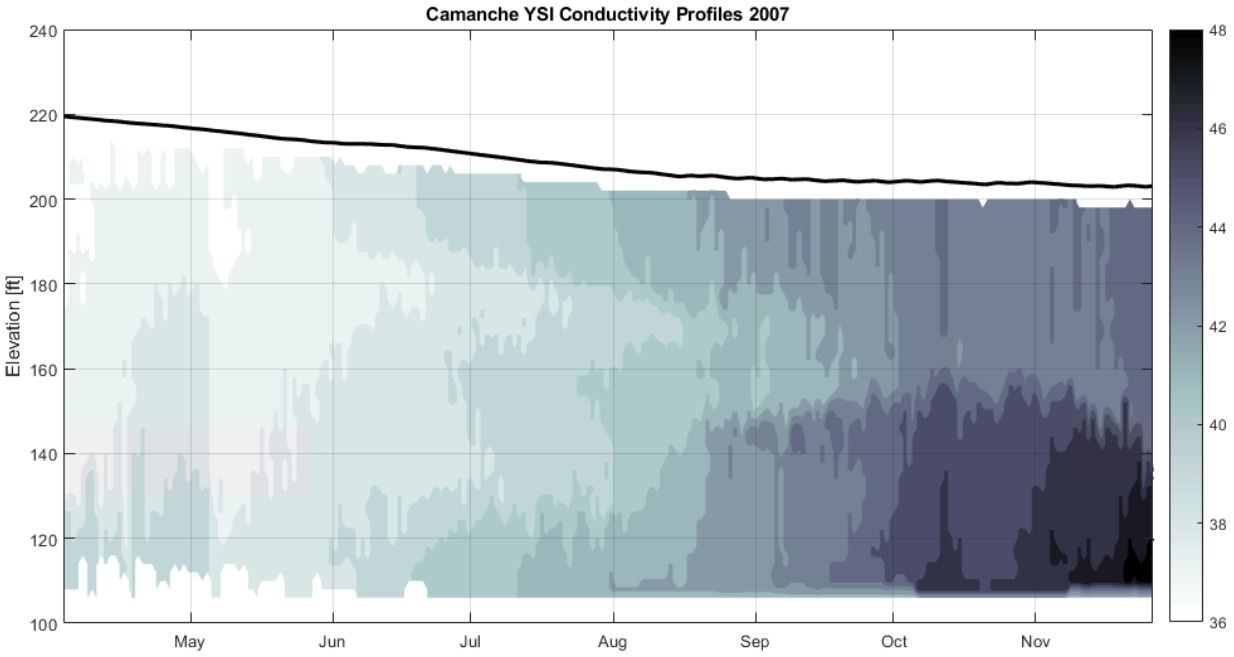


Figure F-62. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2007 Provisional.

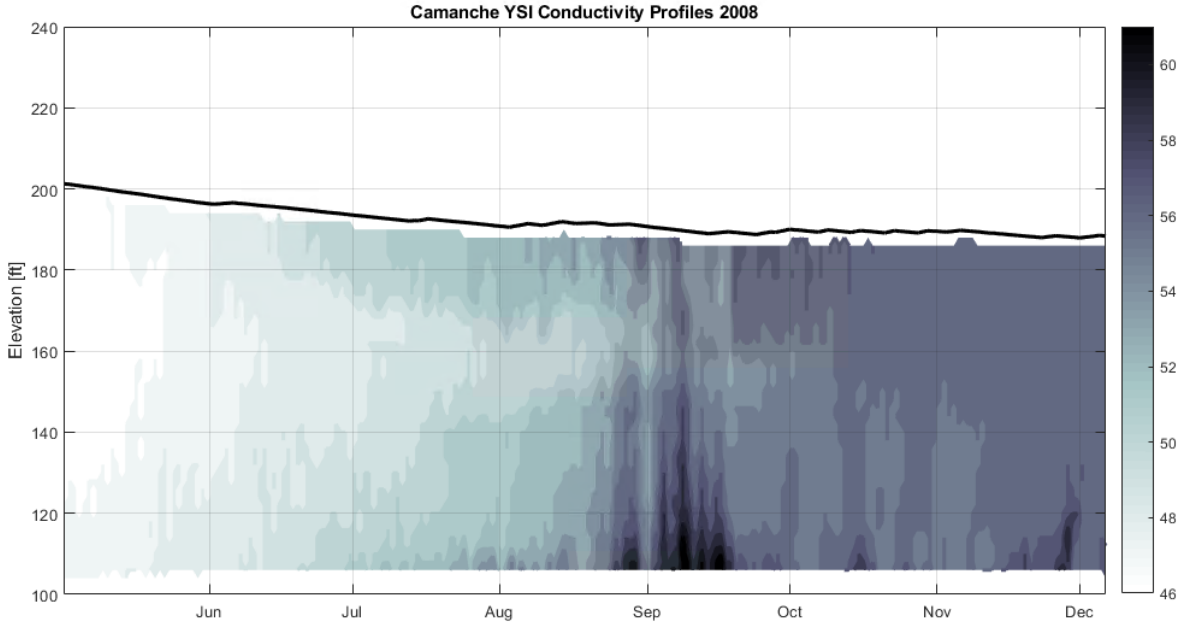


Figure F-63. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2008 Provisional.

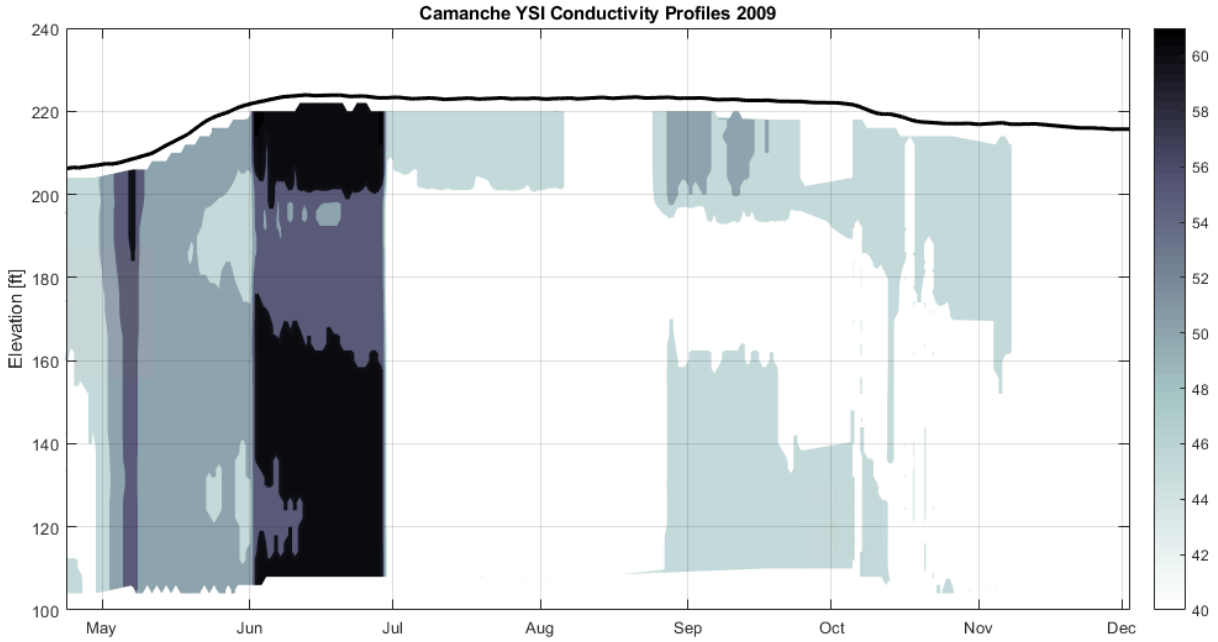


Figure F-64. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2009 Provisional.

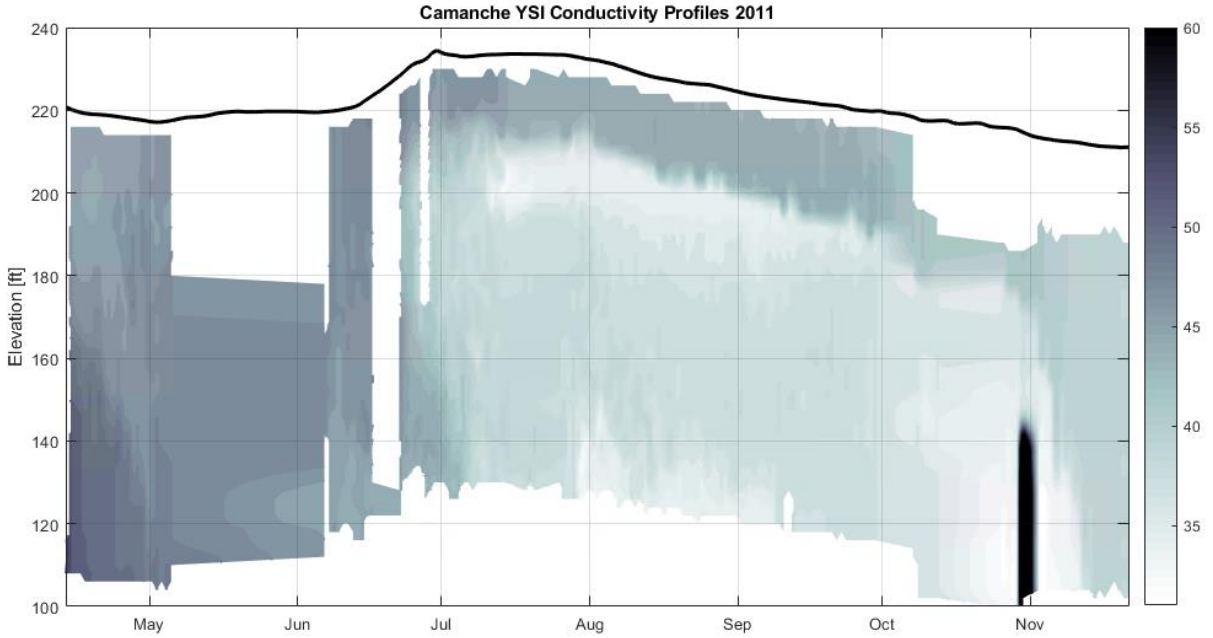


Figure F-65. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2011 Provisional.

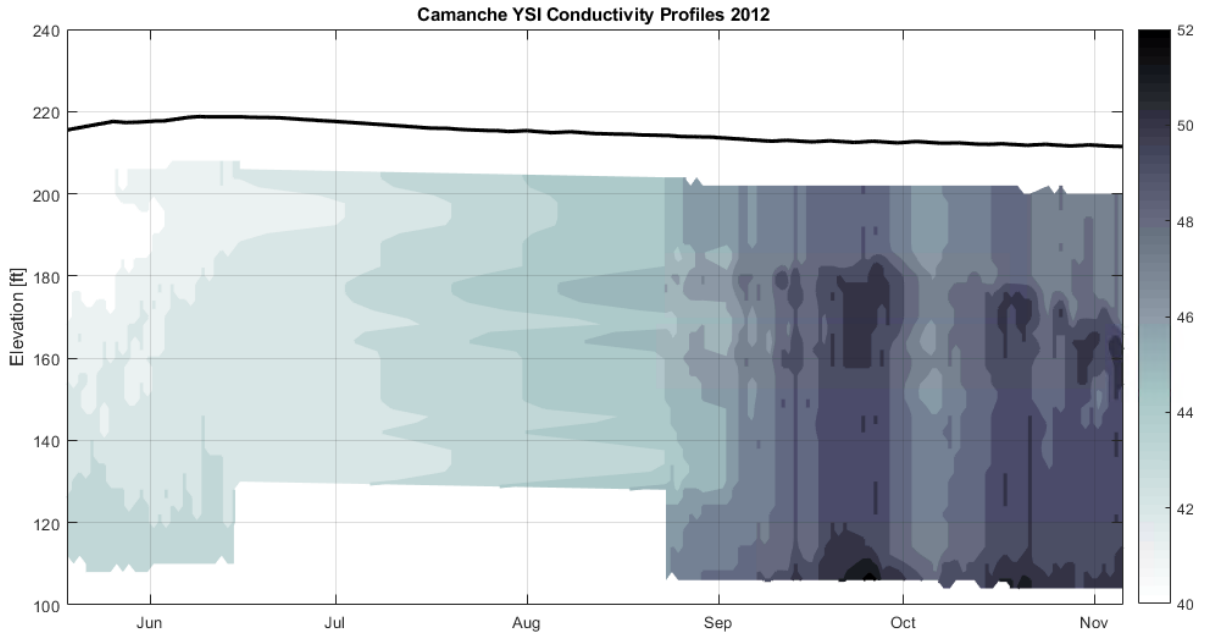


Figure F-66. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2012 Provisional.

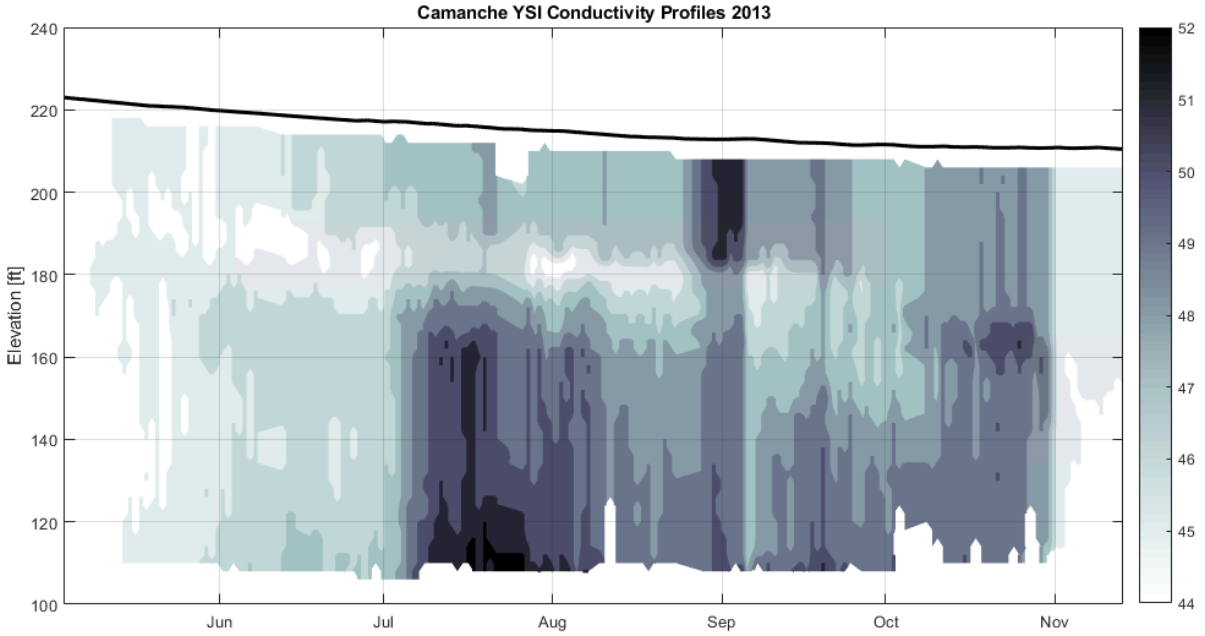


Figure F-67. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2013 Provisional.

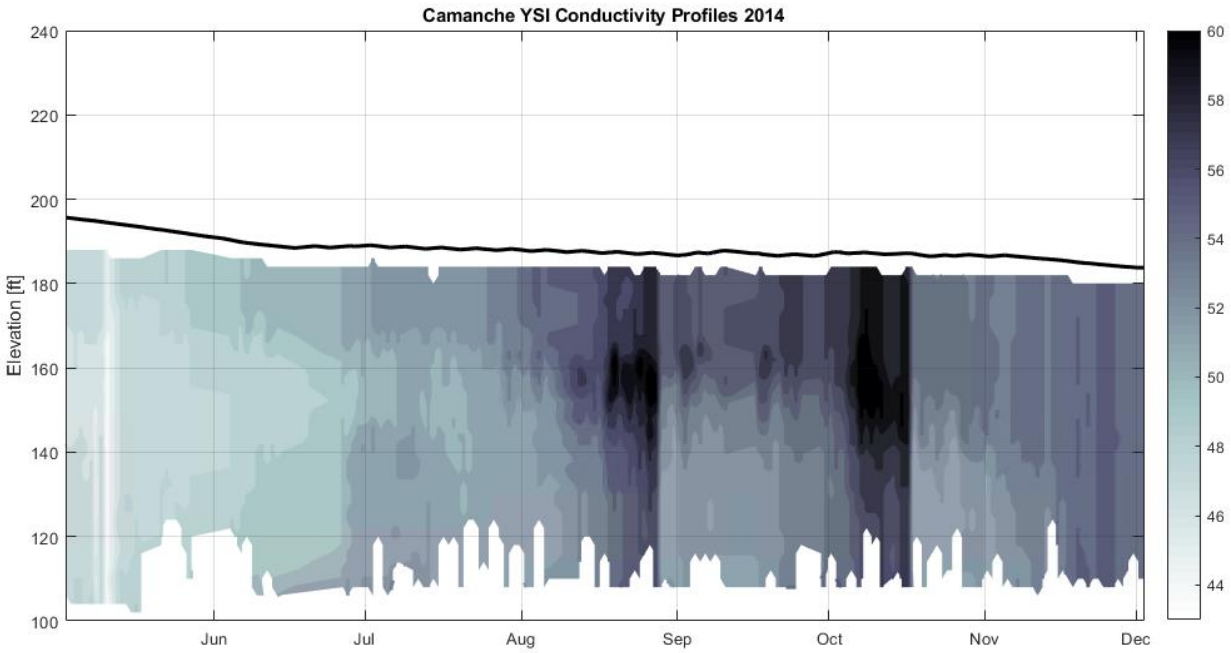


Figure F-68. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2014 Provisional.

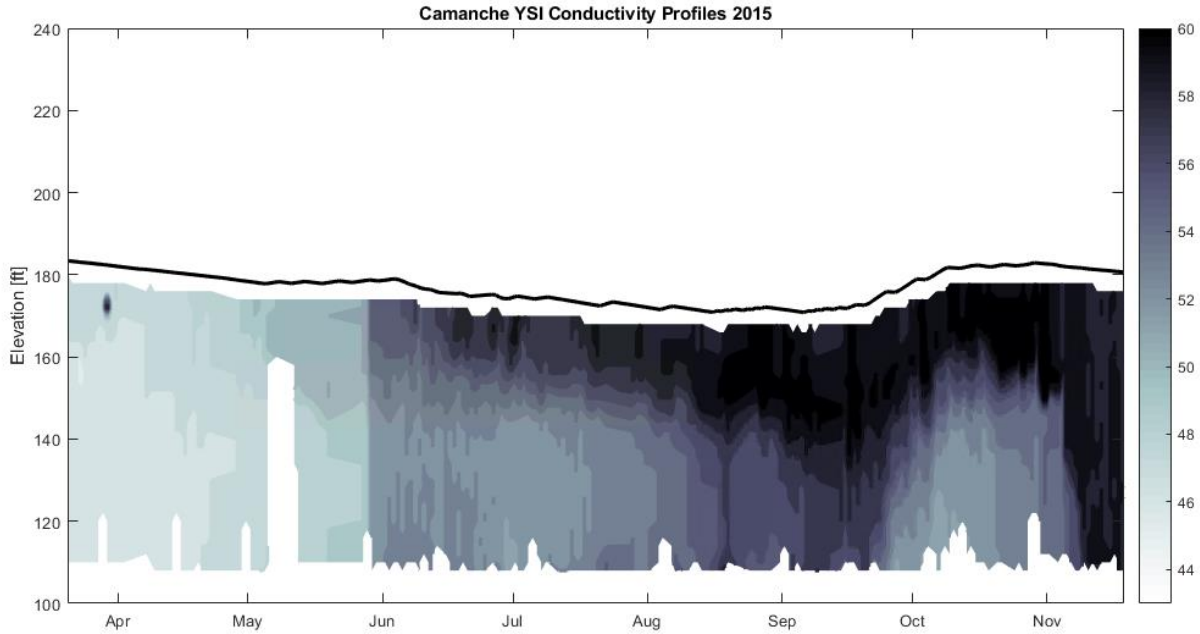


Figure F-69. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2015 Provisional.

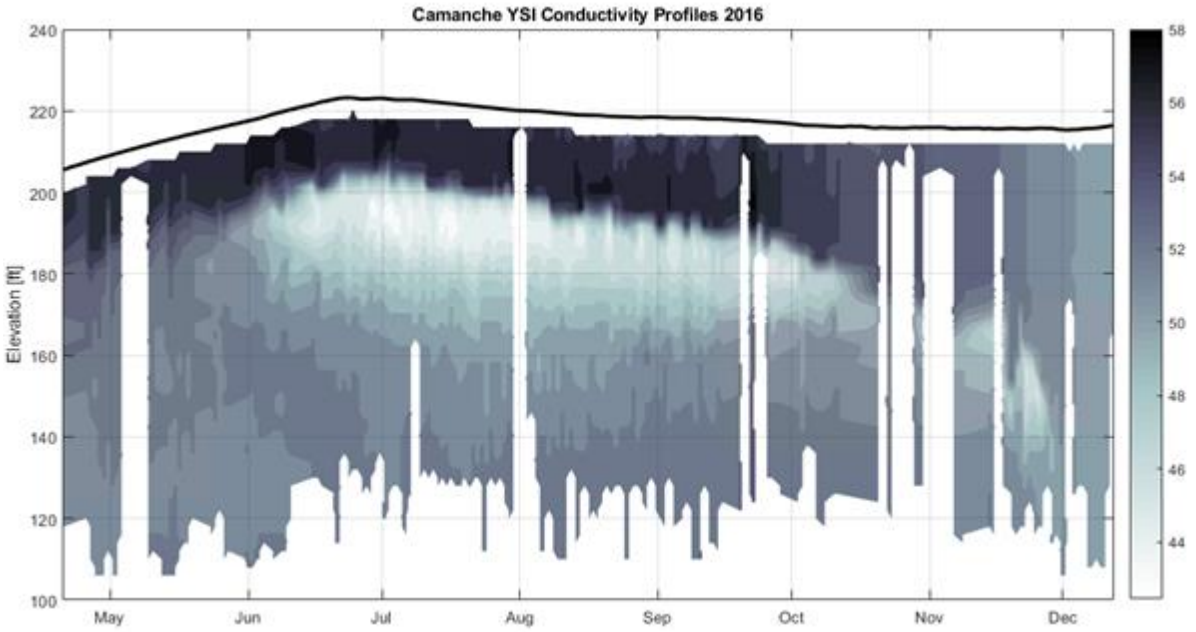


Figure F-70. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2016 Provisional.

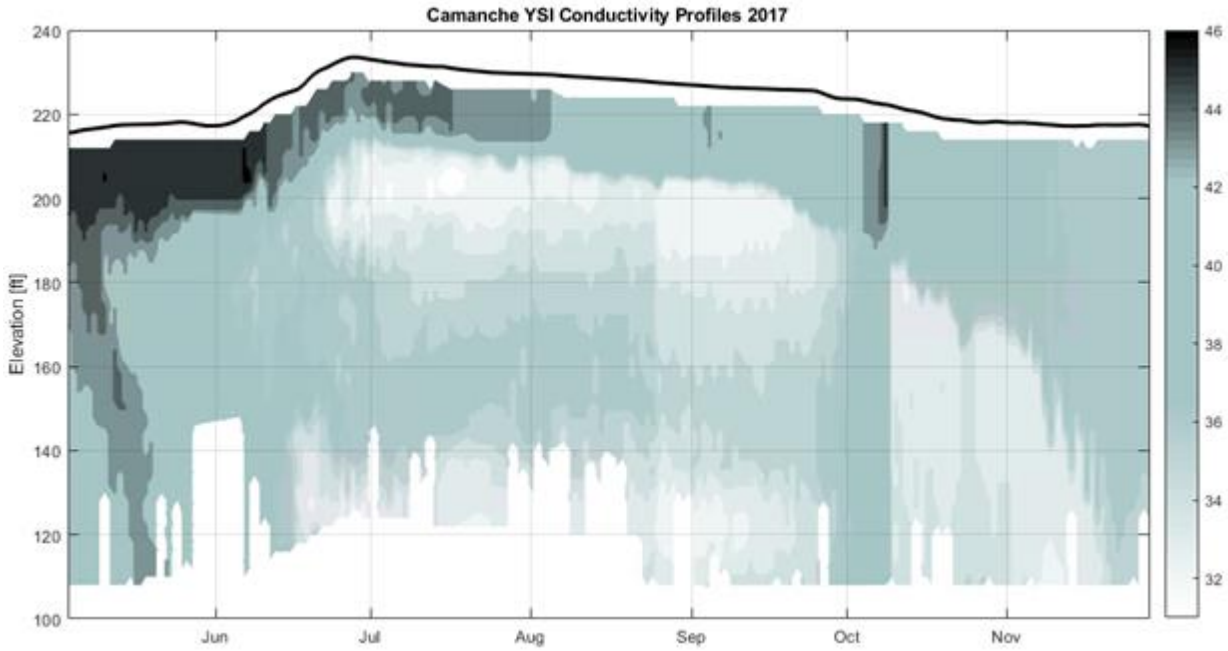


Figure F-71. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2017 Provisional.

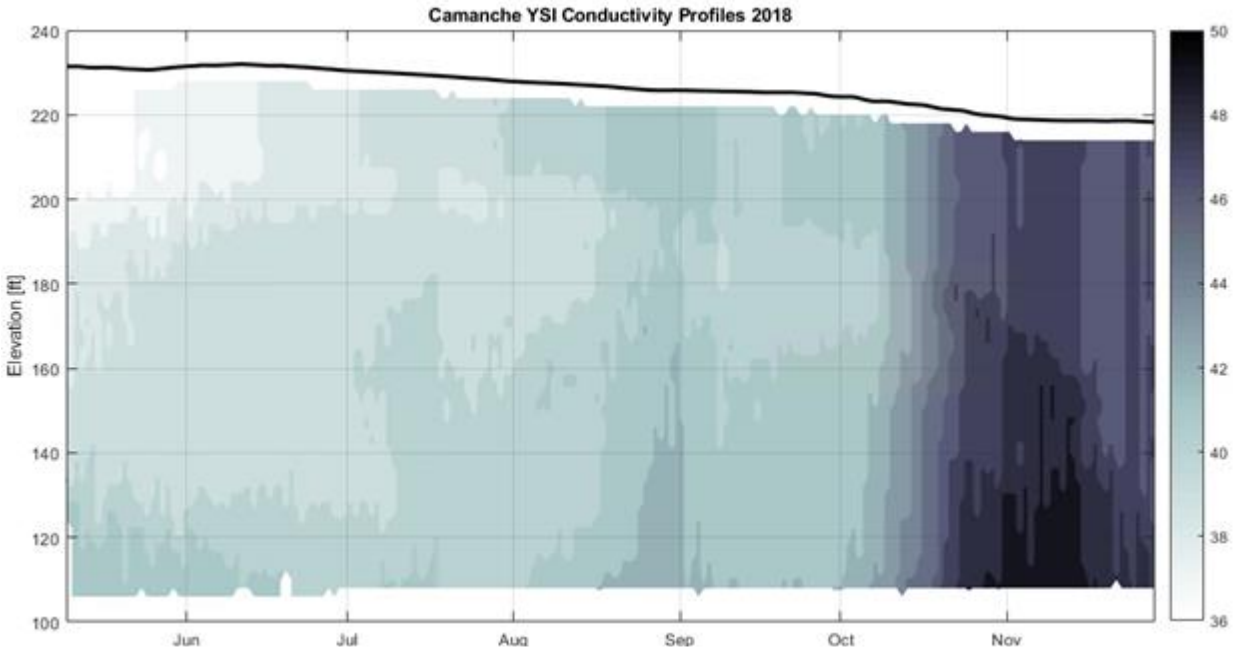


Figure F-72. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2018 Provisional.

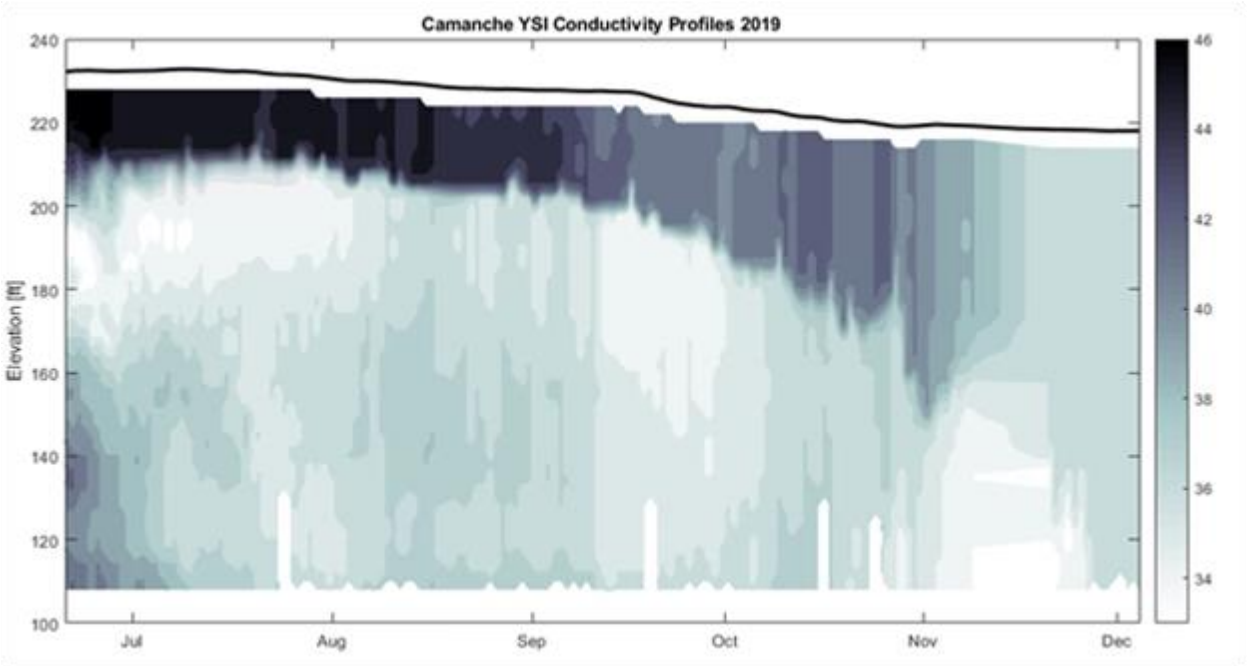


Figure F-73. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2019 Provisional.

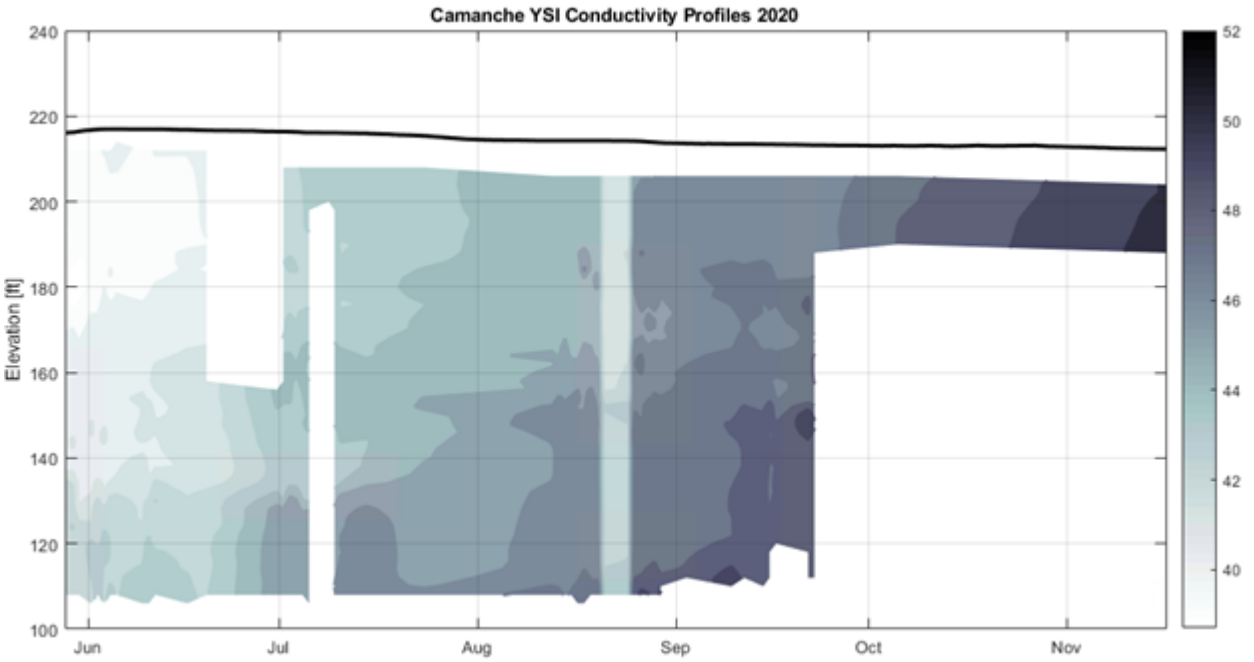


Figure F-74. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2020 Provisional.

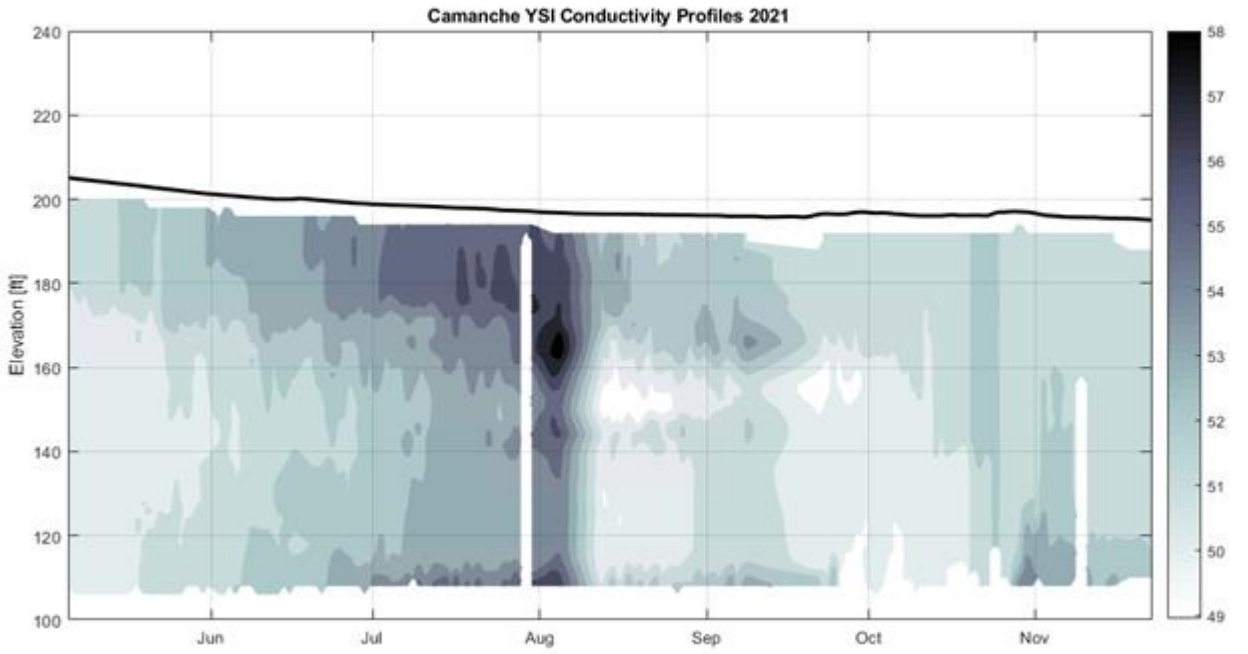


Figure F-75. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2021 Provisional.

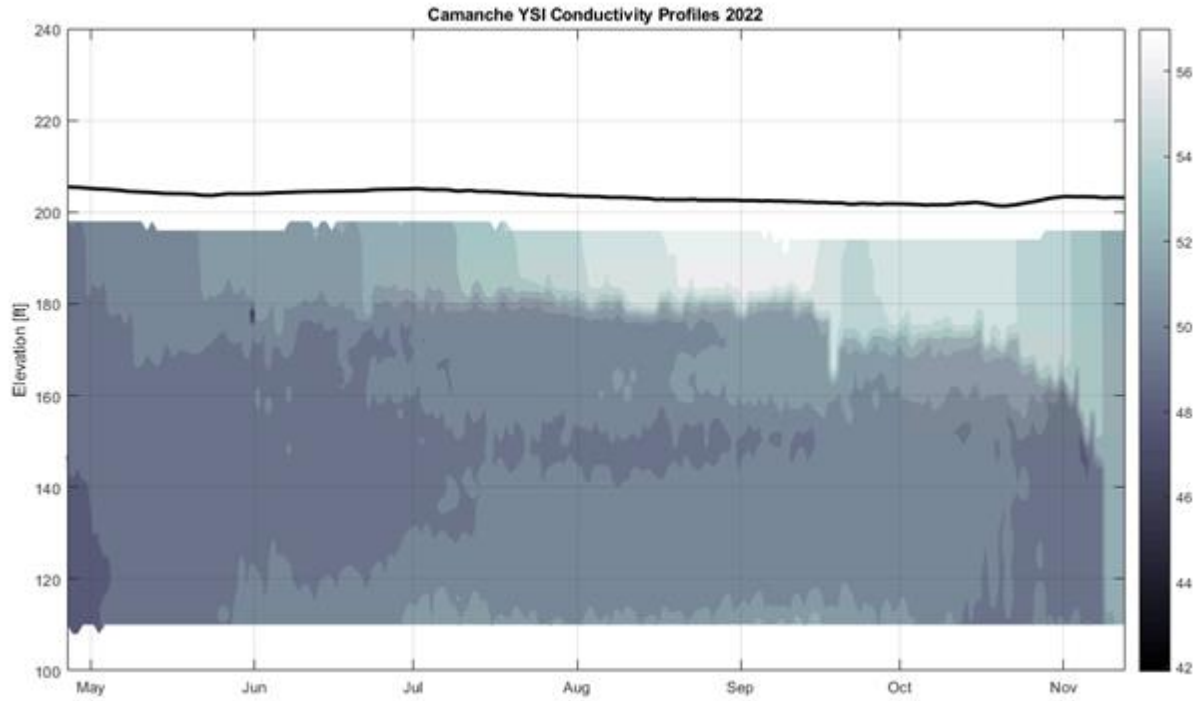


Figure F-76. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2022 Provisional.

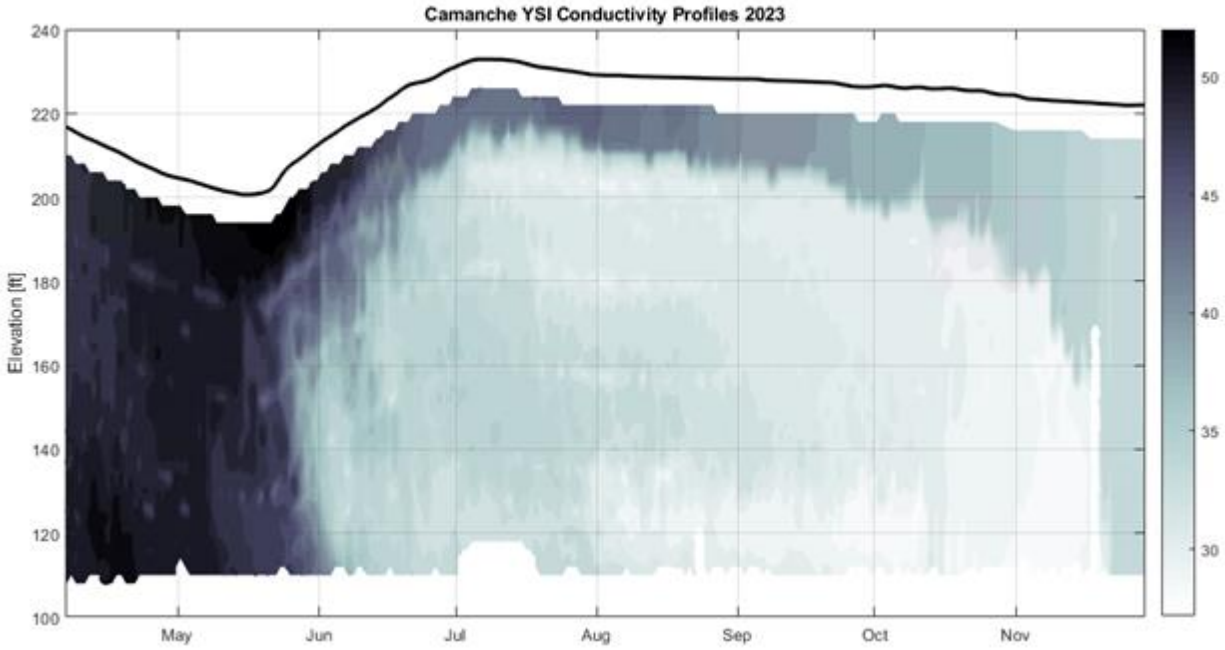


Figure F-77. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2023 Provisional.

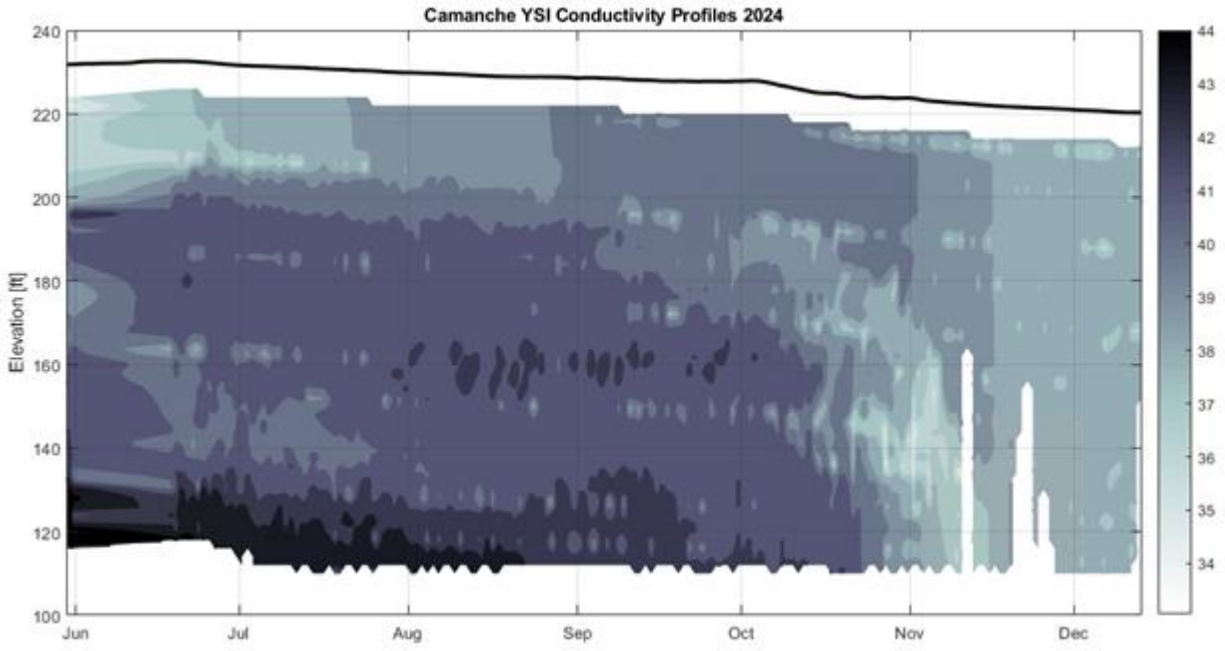


Figure F-78. Autoprofiler Specific Conductivity (mg/L) Contour, Station CAMD, 2024 Provisional.

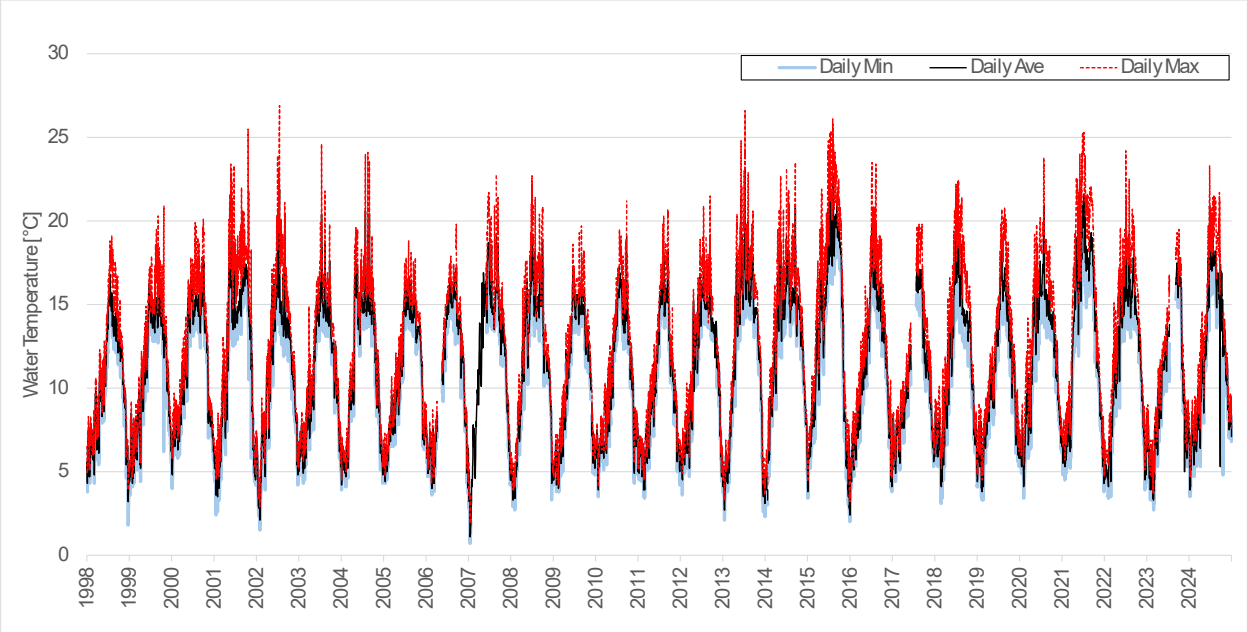


Figure F-79. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station HWY49, 1998-2024.

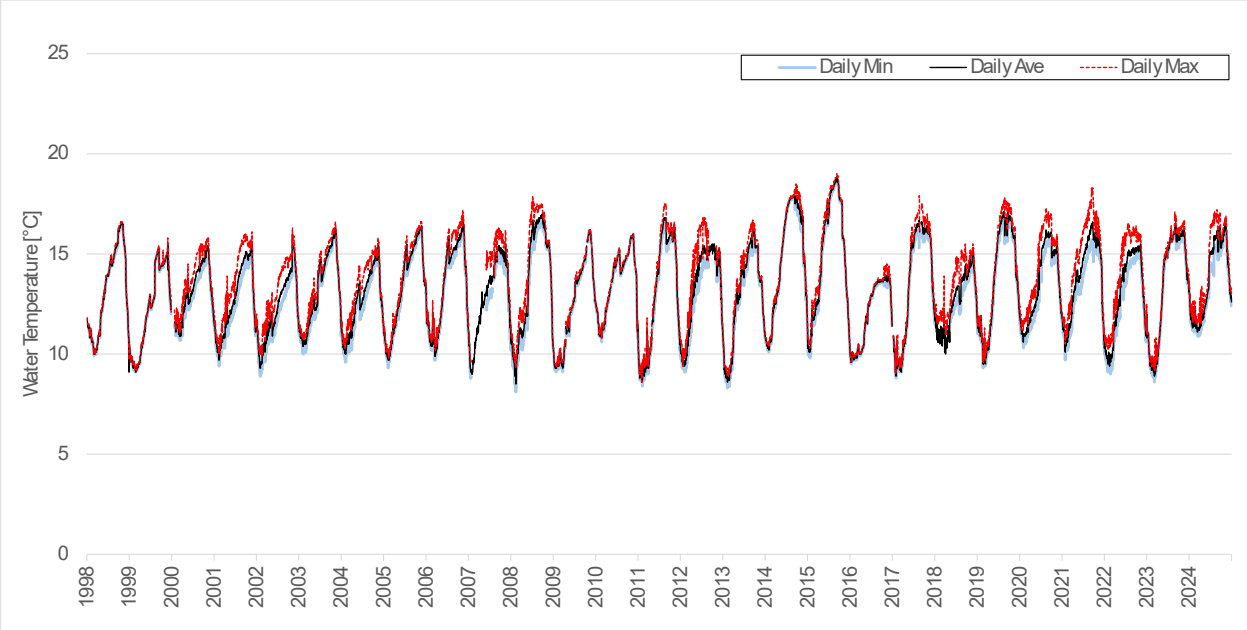


Figure F-80. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station Below Camanche, 1998-2024.

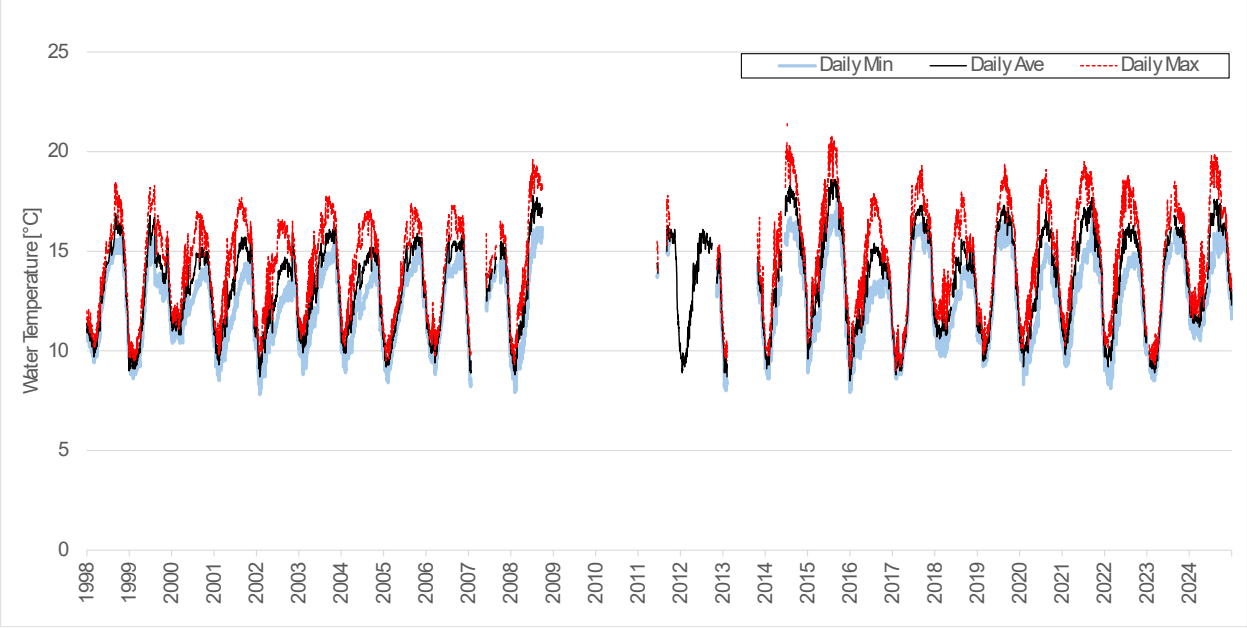


Figure F-81. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station Mackville, 1998-2024.

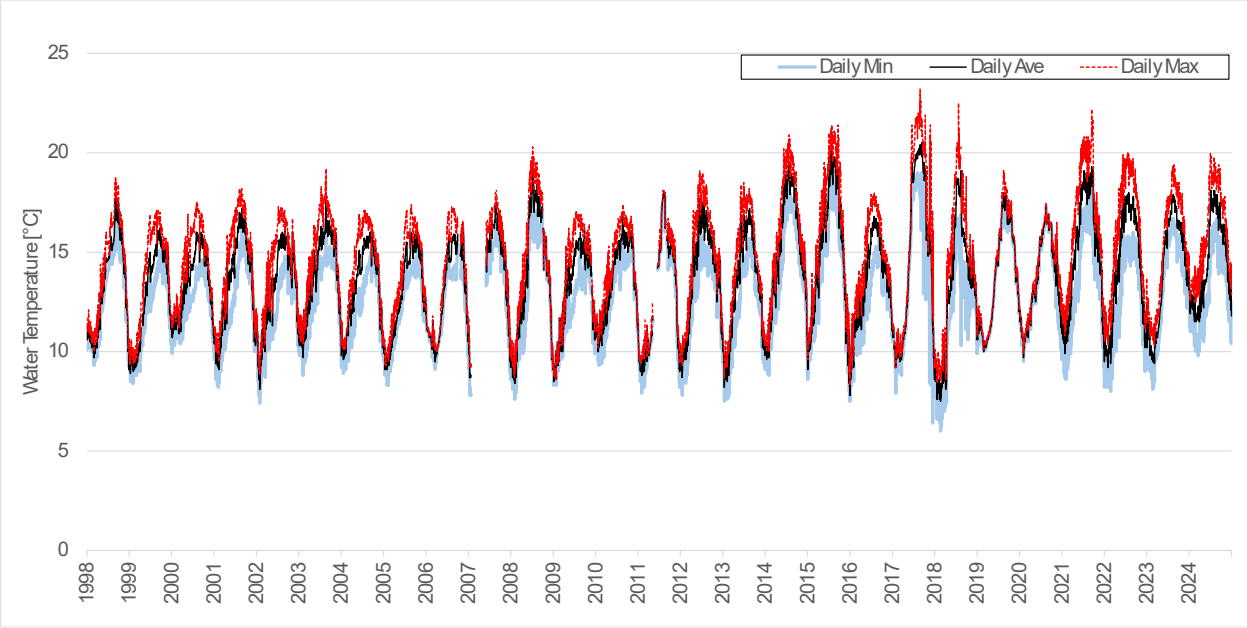


Figure F-82. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station Elliott, 1998-2024.

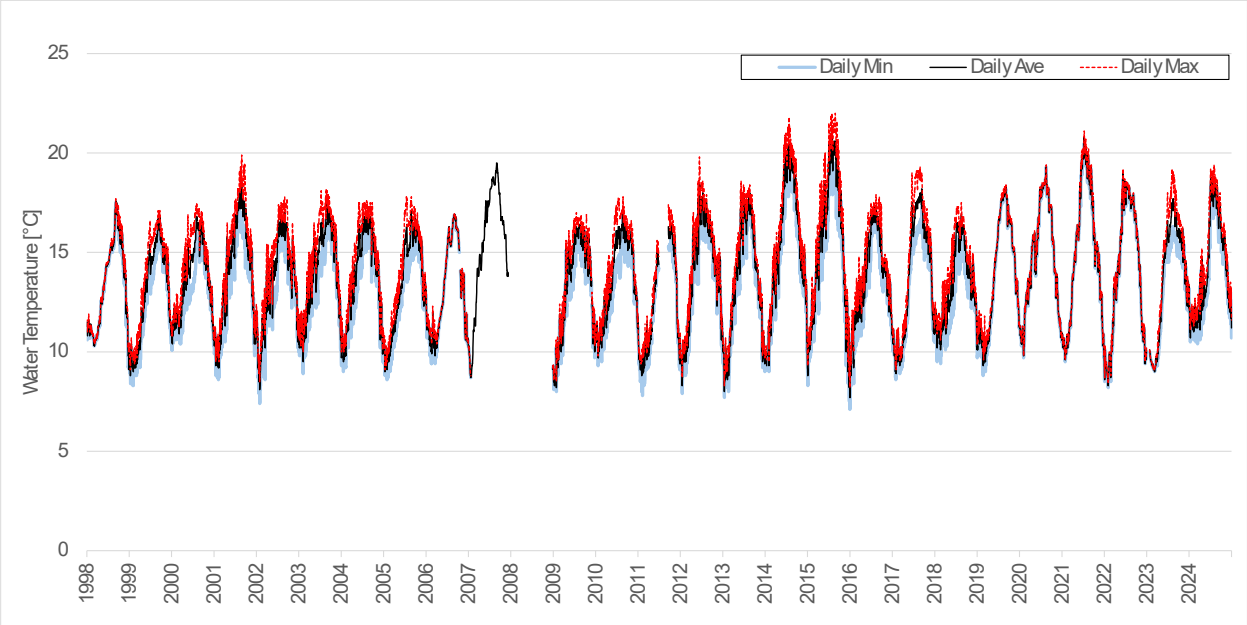


Figure F-83. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station Victor, 1998-2024.

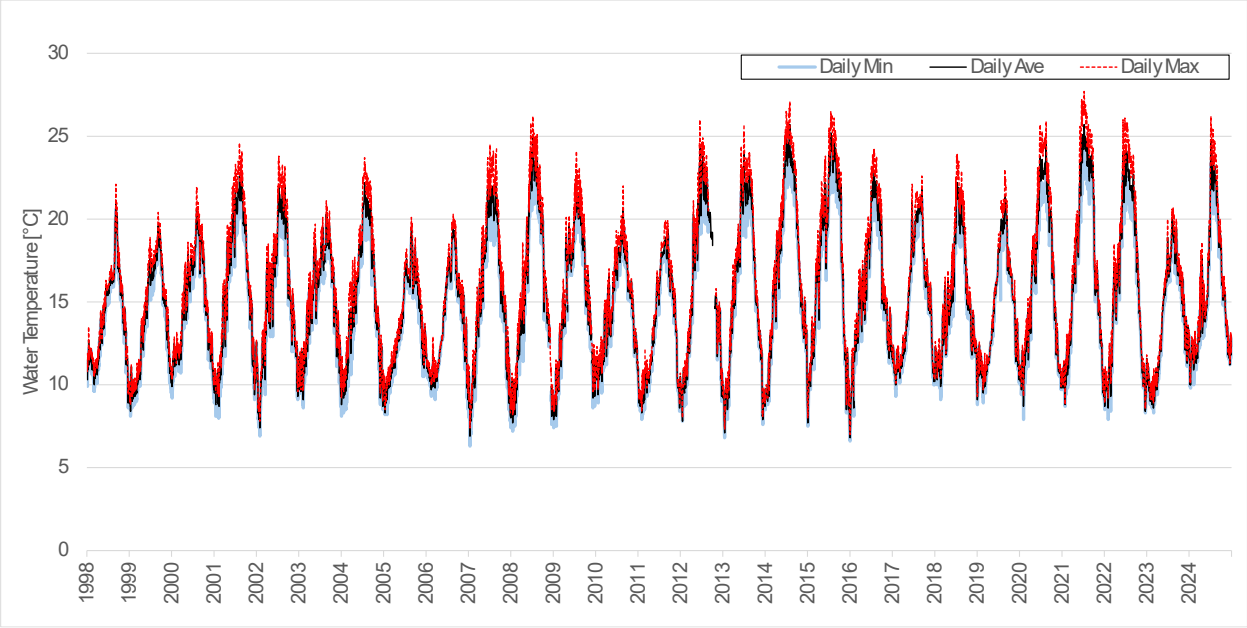


Figure F-84. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station Below Woodbridge (Golf), 1998-2024.

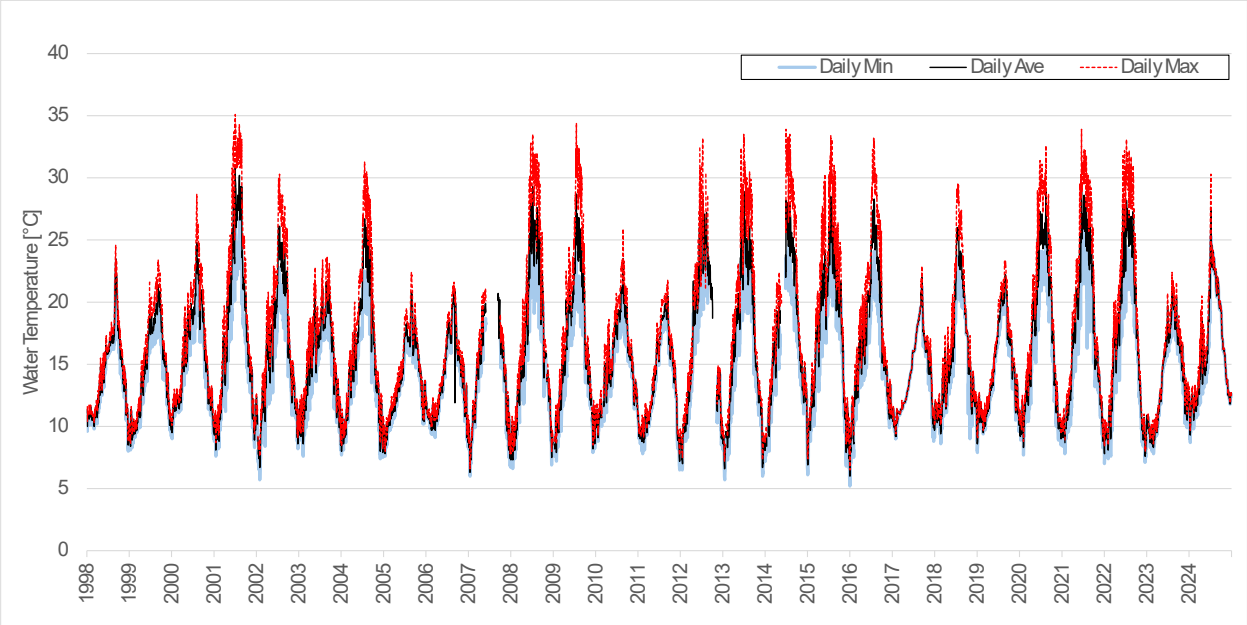


Figure F-85. Daily Average, Daily Maximum, and Daily Minimum Water Temperature (°C) Station Thornton, 1998-2024.

Table F-32. Monthly Average of Daily Average Water Temperatures (°C), Station HWY49, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1998	5.7	6.6	7.8	8.8	9.6	11.9	15.4	14.0	13.5	12.3	10.1	5.5	10.1
1999	5.6	6.3	7.8	8.7	11.7	14.0	14.4	14.5	14.8	13.6	12.0	8.2	11.0
2000	6.5	7.6	8.3	10.7	12.7	15.2	14.7	15.1	15.5	14.3	9.5	7.4	11.5
2001	4.9	5.2	9.0	9.8	16.3	15.1	14.3	15.3	16.5	16.2	11.9	5.8	11.7
2002	4.2	5.7	7.1	10.2	13.3	15.4	16.5	14.2	14.2	12.9	10.5	6.8	10.9
2003	6.6	5.9	8.4	9.1	11.7	14.9	15.8	14.9	14.8	12.6	10.7	7.6	11.1
2004	5.7	5.7	8.9	11.6	16.0	14.6	15.7	15.3	15.0	12.7	9.9	6.0	11.4
2005	5.4	6.7	8.0	9.4	10.7	13.1	15.4	14.9	14.5	13.5	12.4	7.7	11.0
2006	6.1	5.9	6.2	7.9	11.0	13.2	15.3	15.4	15.3	13.6	11.3	6.7	10.6
2007	3.0	5.9	8.6	12.4	15.2	17.0	15.5	15.2	15.4	13.4	11.7	7.0	11.7
2008	4.3	5.0	8.0	11.6	14.1	15.3	16.4	15.1	16.1	12.8	11.3	7.3	11.4
2009	5.2	5.4	7.1	9.3	11.8	15.0	15.0	14.7	15.0	12.7	11.1	6.4	10.7
2010	6.0	6.5	7.8	8.4	10.4	13.3	15.5	15.3	15.0	12.8	9.3	7.4	10.6
2011	6.1	5.1	6.8	8.4	9.9	12.0	15.3	15.7	15.4	11.6	9.4	6.3	10.2
2012	5.7	6.6	7.6	10.6	12.4	14.7	15.9	15.2	14.9	13.3	11.8	6.9	11.3
2013	4.3	5.2	8.5	12.7	15.4	17.4	17.3	16.2	16.1	14.4	11.3	5.0	12.0
2014	4.9	8.1	10.8	13.7	15.7	15.2	16.9	15.1	15.7	14.8	12.5	8.3	12.6
2015	5.7	8.1	11.0	14.0	15.2	17.1	19.6	19.7	19.8	17.3	9.0	5.0	13.5
2016	5.3	6.6	8.3	10.5	12.0	14.4	17.6	16.3	15.4	13.5	10.5	6.4	11.4
2017	6.3	7.4	7.8	9.1	10.8	12.1	16.4	16.4	15.1	11.7	10.9	7.0	10.9
2018	7.1	6.4	6.9	9.8	12.5	15.3	17.7	16.1	14.1	14.0	11.3	7.0	11.5
2019	6.0	5.3	7.6	9.5	10.2	12.7	15.4	16.4	15.1	12.5	10.4	7.3	10.7
2020	6.3	6.5	8.7	11.0	14.5	15.2	17.0	15.5	14.8	13.7	11.3	7.9	11.9
2021	6.2	7.1	8.0	14.3	16.8	18.5	19.5	17.5	18.3	13.9	10.3	6.7	13.1
2022	5.1	5.7	9.2	11.4	13.8	15.3	16.2	15.7	16.1	13.7	10.8	6.4	11.6
2023	6.2	4.7	6.3	9.0	10.4	12.3	13.3	N/A	16.7	16.0	9.1	7.3	10.1
2024	5.8	6.9	8.0	10.2	11.7	16.3	17.7	16.8	15.4	14.1	11.3	8.5	11.9

Table F-33. Monthly Minimum of Daily Minimum Water Temperatures (°C), Station HWY49, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	3.8	5.2	4.3	5.4	7.9	9.4	12.7	12.3	11.4	10.6	7.7	1.8
1999	3.6	4.3	5.1	4.4	7.8	9.8	12.8	12.8	12.7	6.2	8.8	5.5
2000	4.0	5.8	6.0	8.2	9.2	12.5	13.1	13.3	12.4	11.5	7.0	5.7
2001	2.4	2.9	5.0	6.0	11.1	12.5	12.9	13.2	14.8	10.5	5.8	4.2
2002	1.5	1.9	3.9	6.4	8.8	12.8	13.2	11.9	12.0	9.7	8.0	4.2
2003	4.8	4.3	5.4	6.3	7.5	12.8	13.4	13.1	13.1	10.9	8.5	5.0
2004	3.9	4.1	5.2	8.3	12.5	11.9	13.5	13.6	12.5	8.3	6.0	4.3
2005	4.3	4.9	6.5	6.6	7.8	10.3	13.5	13.4	13.1	12.0	9.8	6.3
2006	4.7	3.6	3.8	7.0	9.2	11.0	13.3	13.4	12.6	9.4	7.6	3.7
2007	0.7	N/A	N/A	N/A	N/A	13.3	13.5	13.4	12.6	11.3	9.0	4.2
2008	2.9	2.7	6.0	8.0	10.2	12.5	13.1	13.6	12.8	10.1	10.2	3.3
2009	3.8	3.8	4.7	7.0	9.1	11.4	13.3	13.2	13.2	10.9	8.1	4.8
2010	3.5	5.0	5.1	5.4	7.8	11.6	12.8	12.3	12.4	10.0	4.3	4.7
2011	4.5	3.4	4.0	5.2	7.1	9.0	12.6	13.6	12.2	9.9	7.7	4.2
2012	3.6	4.9	4.7	6.8	10.0	11.7	13.8	13.6	12.9	12.8	8.9	4.2
2013	2.1	3.8	5.8	8.9	12.3	13.8	14.2	14.1	13.0	11.8	8.5	2.3
2014	2.9	4.7	7.7	8.7	11.8	13.0	13.9	13.1	12.5	13.1	9.7	4.4
2015	3.4	6.1	6.9	9.0	10.8	14.0	16.3	16.2	17.8	12.5	4.6	2.3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	2.0	4.7	6.4	7.9	10.0	11.5	15.0	13.6	12.8	11.9	7.6	3.8
2017	4.4	5.3	5.1	6.7	8.3	10.2	14.9	14.3	11.5	9.8	8.5	5.3
2018	5.3	3.1	3.4	6.6	8.5	11.0	14.2	12.8	12.4	11.3	8.8	4.7
2019	4.1	3.3	5.5	7.0	7.8	9.9	12.7	13.8	13.0	8.5	6.1	5.3
2020	4.9	3.4	5.8	6.4	10.4	11.7	13.9	13.0	12.9	10.7	8.6	6.3
2021	4.5	4.9	5.2	10.5	11.9	13.6	14.8	15.3	14.7	10.7	7.7	3.8
2022	4.2	3.4	5.8	8.3	8.8	12.8	13.5	13.0	13.5	11.5	7.9	3.9
2023	3.5	2.9	2.7	5.3	7.7	9.8	10.4	N/A	14.8	11.5	5.7	5.3
2024	3.5	4.7	5.3	5.3	7.9	12.6	15.5	13.6	9.1	4.8	8.1	6.8

Table F-34. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station HWY49, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	8.3	8.3	10.6	12.3	12.8	15.0	18.8	19.1	17.6	15.3	12.7	8.4
1999	9.2	9.1	10.7	12.2	14.9	17.2	17.9	19.5	20.3	20.9	14.3	11.3
2000	9.7	9.3	11.5	13.5	16.5	17.8	19.9	19.0	20.1	19.8	13.3	9.1
2001	6.9	8.5	13.1	15.2	23.4	23.3	19.1	22.0	20.6	25.5	18.3	8.5
2002	7.3	9.4	11.2	12.9	17.4	20.3	26.9	20.3	21.1	15.2	12.2	9.2
2003	8.6	8.0	14.9	12.0	15.0	17.0	24.6	21.8	19.8	16.0	12.8	10.6
2004	7.1	7.6	11.6	18.5	19.6	18.3	24.0	24.1	19.1	16.6	12.3	7.8
2005	7.3	8.4	10.7	12.1	13.8	17.3	17.8	18.8	17.8	16.4	14.5	10.2
2006	8.5	8.7	8.1	9.2	12.9	15.7	17.5	17.9	19.8	15.5	13.3	8.9
2007	5.6	N/A	N/A	N/A	N/A	21.7	20.3	22.7	21.4	16.3	14.5	9.7
2008	6.2	8.9	10.8	16.7	17.6	22.2	22.7	18.1	20.8	20.8	12.6	11.2
2009	7.3	7.5	10.1	13.3	14.3	18.6	16.6	19.3	19.7	15.4	13.8	9.1
2010	7.9	8.4	10.3	11.9	13.1	16.6	19.5	19.1	21.2	17.9	12.7	8.9
2011	7.2	7.0	9.6	10.8	12.6	14.4	17.4	20.3	20.7	14.8	11.4	8.7
2012	7.6	10.3	11.0	15.9	14.6	18.9	20.9	19.0	21.5	15.5	13.0	11.4
2013	6.9	7.5	11.9	19.8	20.4	24.8	26.6	22.9	20.6	16.8	13.9	9.7
2014	9.4	11.3	16.2	19.5	22.7	20.7	23.2	19.9	23.5	17.2	14.9	11.3
2015	8.2	10.8	17.6	21.3	21.9	24.8	25.4	26.1	23.4	21.3	15.4	8.1
2016	8.6	9.3	11.0	13.4	16.1	19.1	23.5	23.4	19.1	16.2	13.2	10.5
2017	8.6	8.9	9.9	11.1	13.4	13.9	18.5	19.8	19.8	15.4	13.3	9.5
2018	9.4	10.1	11.2	15.4	16.6	21.2	22.4	21.4	19.2	17.0	15.2	9.1
2019	9.1	8.7	9.7	12.1	12.5	15.0	20.3	20.8	20.1	15.6	12.7	9.9
2020	9.1	11.8	14.2	16.6	19.8	20.2	23.8	20.3	18.5	16.4	14.4	9.8
2021	8.1	9.3	14.7	20.2	22.6	25.3	25.3	22.0	22.1	18.8	13.5	9.7
2022	6.9	8.9	15.1	15.6	19.6	19.5	24.2	22.5	20.3	16.8	13.7	8.9
2023	9.0	6.9	8.9	11.7	12.8	14.8	16.8	N/A	19.3	19.5	12.6	9.3
2024	9.3	9.5	11.4	14.6	14.5	23.3	21.4	21.5	21.7	14.6	14.1	10.1

Table F-35. Monthly Average of Daily Average Water Temperatures (°C), Station Below Camanche, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1998	11.3	10.7	10.1	10.9	12.4	13.6	14.4	14.7	15.5	16.4	15.7	12.2	13.2
1999	9.8	9.4	9.4	10.2	11.3	12.4	12.5	14.3	14.7	14.5	14.9	13.4	12.2
2000	11.6	11.5	11.3	12.2	12.9	12.9	13.6	14.2	14.6	14.9	14.8	12.6	13.1
2001	10.8	10.1	10.8	11.6	12.0	12.5	13.3	14.2	14.7	14.9	15.0	12.1	12.7
2002	10.5	9.7	10.6	11.3	11.5	11.8	12.7	13.2	13.7	14.1	15.0	13.0	12.3
2003	11.0	10.5	11.1	12.0	12.4	13.4	14.1	14.5	15.2	15.6	15.7	13.2	13.2
2004	10.6	10.4	10.8	11.7	12.8	12.7	13.0	13.6	14.2	14.7	14.8	12.4	12.7
2005	10.5	9.9	10.8	11.6	12.6	13.7	14.8	14.8	15.3	15.9	16.2	14.0	13.3
2006	11.7	10.7	10.5	10.9	12.3	14.2	15.1	15.1	15.4	15.8	16.2	13.2	13.4
2007	9.8	9.6	11.0	12.1	12.7	13.4	13.7	14.6	15.2	15.1	14.8	12.8	12.9
2008	10.2	9.4	10.9	11.1	12.2	15.1	16.2	16.6	16.8	16.3	15.4	13.0	13.6
2009	9.6	9.6	9.6	10.6	11.7	12.4	13.5	13.9	14.4	15.3	15.9	13.6	12.5
2010	11.9	11.0	11.5	12.6	13.5	14.4	14.9	14.2	14.7	15.2	15.7	13.3	13.6
2011	9.4	9.1	9.8	10.1	12.3	13.8	15.5	16.7	15.7	16.0	15.6	11.8	13.0
2012	9.8	9.7	11.1	12.8	13.8	14.6	15.2	15.1	15.2	15.2	14.6	13.3	13.4
2013	9.6	8.8	9.5	12.0	12.9	14.1	14.4	15.4	15.9	15.4	13.8	12.1	12.8
2014	10.6	10.6	12.2	13.0	14.6	16.2	17.4	17.8	17.8	17.3	16.2	13.4	14.8
2015	10.4	11.6	12.4	13.4	15.8	16.9	17.8	18.4	18.6	17.4	15.0	12.0	15.0
2016	9.9	9.9	10.1	10.2	11.5	12.5	13.1	13.5	13.6	13.7	13.8	13.0	12.1
2017	10.0	9.6	9.4	10.6	12.6	15.2	16.0	16.4	16.3	16.2	16.0	13.3	13.5
2018	11.3	11.0	10.9	10.7	11.8	12.8	13.3	13.2	14.1	14.0	14.7	13.4	12.6
2019	11.3	10.5	10.0	10.8	12.7	14.9	16.3	16.8	16.7	16.7	15.7	13.3	13.8
2020	11.4	10.9	11.4	12.0	12.5	13.9	15.2	15.9	15.9	15.1	15.0	12.9	13.5
2021	11.2	10.7	11.7	13.1	13.8	14.2	15.1	15.8	16.3	15.9	15.5	12.7	13.8
2022	10.0	9.8	10.5	11.9	13.0	14.1	14.7	15.1	15.2	15.3	14.5	11.9	13.0
2023	10.5	9.4	9.4	10.5	13.1	14.9	15.6	15.9	15.9	15.9	15.9	14.1	13.4
2024	12.1	11.7	11.3	11.8	12.3	13.7	15.1	15.8	15.8	15.8	15.8	13.5	13.7

Table F-36. Monthly Minimum of Daily Minimum Water Temperature (°C), Station Below Camanche, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	10.8	10.1	9.9	10.5	11.8	13.0	13.9	14.4	15.0	16.0	14.8	10.5
1999	9.5	9.1	9.2	9.5	10.7	11.8	12.2	12.7	14.1	14.3	14.5	12.0
2000	11.3	10.9	10.7	10.9	12.2	12.3	12.8	13.6	13.8	14.3	13.4	11.5
2001	9.9	9.4	10.0	10.3	11.0	11.7	12.3	13.2	13.9	14.3	13.7	10.9
2002	9.0	8.9	9.6	10.4	10.6	10.9	11.7	12.4	12.9	13.3	13.8	11.1
2003	10.5	10.0	10.1	11.1	11.7	12.1	13.4	13.9	14.7	15.1	14.5	10.9
2004	9.9	9.6	10.1	10.3	12.1	11.7	12.1	12.8	13.5	14.2	13.2	11.1
2005	9.7	9.3	10.0	11.1	11.7	12.7	13.9	14.2	14.7	15.3	15.5	13.2
2006	10.7	10.2	9.7	10.0	11.3	13.2	14.3	14.3	14.8	15.4	14.5	10.9
2007	8.8	0.0	0.0	0.0	0.0	12.2	12.8	13.7	14.5	14.3	13.9	10.5
2008	9.2	8.1	9.6	10.2	11.1	12.9	15.2	15.7	16.3	15.4	15.0	10.3
2009	9.1	9.2	9.1	9.6	10.9	12.0	12.6	13.5	14.0	14.5	15.1	12.5
2010	10.9	10.6	11.1	12.1	12.9	14.0	14.4	13.9	14.4	14.9	14.9	10.8
2011	8.7	8.4	8.9	9.1	10.8	12.9	14.2	15.9	15.1	15.6	14.1	10.2
2012	9.3	9.1	9.9	11.1	12.6	13.1	14.1	14.3	N/A	N/A	13.6	11.0
2013	8.6	8.3	8.8	10.0	12.2	12.9	13.4	14.2	14.9	15.1	13.4	10.8

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	10.2	10.1	10.9	12.4	13.5	15.4	16.9	17.7	17.2	16.6	14.4	11.1
2015	9.8	10.6	11.5	12.1	14.9	16.2	16.7	18.1	17.8	15.7	13.3	10.2
2016	9.5	9.7	9.8	10.0	10.5	11.5	12.8	13.3	13.5	13.4	13.3	11.4
2017	8.8	8.8	9.1	9.9	11.1	14.0	15.2	15.3	15.6	15.6	15.2	11.7
2018	11.0	10.7	10.6	0.0	10.9	12.0	12.1	12.0	13.2	13.5	14.1	11.7
2019	10.7	9.3	9.4	10.1	11.3	13.8	15.6	15.5	15.6	15.8	14.0	11.9
2020	10.7	10.3	10.6	11.2	11.6	12.2	13.6	14.9	15.4	14.4	13.9	11.8
2021	9.7	10.1	10.8	12.0	13.0	13.0	13.9	14.7	14.6	15.0	14.6	10.2
2022	9.2	9.0	9.2	10.8	11.7	12.7	13.4	14.3	14.5	14.7	13.0	10.6
2023	9.3	8.9	8.6	9.4	11.4	14.5	15.1	15.6	15.2	15.3	15.0	13.2
2024	11.2	11.1	10.9	11.0	11.5	12.6	14.0	13.9	14.7	15.1	14.3	12.4

Table F-37. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station Below Camanche, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	11.8	11.3	10.5	12	13.2	14	15	15.4	16.3	16.6	16.6	14.8
1999	10.5	9.7	9.6	10.8	12	13	12.8	15.1	15.4	15.2	15.8	15.4
2000	12.2	12.3	12.4	13.8	14.5	13.8	14.9	15.3	15.5	15.7	15.8	13.9
2001	12	11	12	13.9	13.2	13.9	14.9	15.7	16	15.9	16.1	14.1
2002	12	11.5	12.7	12.7	13.1	13.2	14.1	14.6	14.9	15	16.3	14.9
2003	11.6	11.1	12.6	13.2	13.8	14.9	15.2	15.3	15.7	16.3	16.6	14.7
2004	11.7	11.7	12.1	13	14.2	14.4	14.4	14.7	15.2	15.4	15.8	13.7
2005	11.4	10.5	12.1	12.4	13.8	15	15.9	15.6	15.9	16.4	16.6	15.6
2006	13.3	12.7	11.8	11.7	13.7	15.5	16.3	16.2	16.2	16.6	17.2	15.2
2007	11.6	N/A	N/A	N/A	N/A	15.2	15.2	16.2	16.3	16.2	16.2	15
2008	11.4	11	12.3	12.7	14.7	17.3	17.9	17.5	17.5	17.2	15.7	15.1
2009	10.4	10.3	10.3	11.7	12.3	12.9	14.1	14.3	14.9	16	16.2	15.1
2010	12.6	11.6	12.3	13.1	14.1	14.8	15.3	14.6	15	15.8	16	14.9
2011	11	10	11.8	11.6	13.5	14.6	16.7	17.5	16.6	16.6	16.6	14.4
2012	10.8	11	13.1	15.2	15.6	16.5	16.8	16.7	0	0	15.4	15.3
2013	11.2	9.3	10.8	13.6	13.8	15.2	15.3	16.5	16.7	16.5	15.4	13.9
2014	11	11.1	12.9	13.7	15.5	17	17.8	17.9	18.5	18.4	17.5	15
2015	11.5	12.7	13.4	15.7	17	17.8	18.4	18.8	19	18	15.9	13.4
2016	10.2	10.1	10.5	10.6	12	13	13.5	13.8	13.8	14.4	14.5	14.4
2017	10.9	11	10.3	11.6	14.4	16.4	16.9	17.9	17.5	17	16.6	15.6
2018	12.5	12.2	13.9	12.1	13.3	14.1	14.9	15.2	15.5	15	15.5	15.1
2019	12.3	12	11.3	11.8	14.2	16.5	17.2	17.8	17.7	17.5	16.7	14.5
2020	12.5	11.9	12.7	13.2	13.7	16.1	16.6	17.3	17.1	16.8	16	14.5
2021	12	12.3	13.8	14.8	15.3	16.1	16.8	17.6	18.3	17.2	16.8	15.7
2022	11	11	12.8	13.7	15	16.1	16.5	16.4	16.4	16.4	16	13.5
2023	11.5	9.9	10.8	11.7	14.8	15.4	16.4	17.1	16.9	16.4	16.7	15.4
2024	13.6	12.7	12.2	13.4	13.1	15.8	16.7	17.2	17.1	16.6	16.9	15.0

Table F-38. Monthly Average of Daily Average Water Temperatures (°C), Station Mackville, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1998	11.0	10.5	10.1	11.2	12.9	14.1	14.9	15.3	16.4	16.1	15.0	11.7	13.3
1999	9.6	9.4	9.7	11.0	13.2	15.6	15.9	15.1	14.7	13.8	14.2	12.7	12.9
2000	11.3	11.4	11.2	12.5	13.2	13.3	14.0	14.7	14.9	14.7	14.2	12.1	13.1
2001	10.4	9.9	11.0	12.0	12.7	13.4	14.3	15.3	15.4	15.0	14.6	11.7	13.0
2002	10.1	9.8	10.9	11.7	12.2	12.6	13.8	14.3	14.4	14.1	14.6	12.5	12.6
2003	10.8	10.4	11.4	12.4	13.0	13.9	14.8	15.2	15.8	15.8	15.3	12.8	13.5
2004	10.4	10.5	11.4	12.2	13.3	13.6	14.2	14.7	15.0	14.9	14.1	11.5	13.0
2005	9.8	9.5	10.5	11.3	12.3	13.5	14.6	14.8	15.2	15.5	15.3	13.1	12.9
2006	11.2	10.3	10.1	10.6	12.0	13.9	15.0	15.2	15.2	15.3	15.3	12.5	13.0
2007	9.7	N/A	N/A	N/A	N/A	13.1	13.8	14.3	N/A	15.1	14.5	12.0	13.2
2008	9.7	9.7	10.9	11.6	13.1	16.1	17.1	17.2	17.1	N/A	N/A	N/A	13.6
2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2011	N/A	N/A	N/A	N/A	N/A	14.2	N/A	16.3	15.9	15.9	15.2	11.2	14.8
2012	9.5	9.7	11.2	13.2	14.1	15.3	15.8	15.5	15.3	N/A	14.1	12.8	13.3
2013	9.5	9.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.6	13.3	11.3	11.6
2014	9.7	10.4	12.6	13.8	14.7	17.4	17.8	17.9	17.4	16.3	14.9	13.0	14.6
2015	10.3	11.9	12.7	13.8	15.5	16.4	18.0	18.3	17.8	16.3	14.0	10.8	14.7
2016	9.8	11.0	11.5	11.7	13.1	14.3	15.0	15.0	14.7	14.1	14.0	12.6	13.1
2017	10.1	9.7	9.3	10.5	12.7	15.6	16.4	17.0	16.8	16.2	15.8	12.9	13.6
2018	11.3	11.0	11.4	11.3	11.9	13.4	14.5	14.9	15.1	14.3	14.5	13.2	13.1
2019	11.2	10.5	10.1	11.0	13.1	15.7	16.5	17.0	16.7	16.3	15.1	12.4	13.8
2020	10.4	10.0	10.7	11.7	12.5	14.6	15.9	16.4	15.9	14.5	14.0	12.2	13.2
2021	10.7	10.7	12.0	13.9	15.1	16.1	16.8	16.8	17.2	15.7	15.0	12.3	14.4
2022	9.9	9.9	11.2	12.6	13.9	15.5	16.0	16.0	15.9	15.2	13.9	11.4	13.4
2023	9.6	9.4	9.4	10.7	13.1	15.0	15.7	16.7	16.2	15.9	15.6	13.8	13.4
2024	12.1	11.8	11.6	12.4	12.8	14.6	16.7	17.3	16.8	16.2	15.6	13.4	14.3

Table F-39. Monthly Minimum of Daily Minimum Water Temperatures (°C), Station Mackville, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	10.2	9.6	9.4	10.2	12.0	13.1	14.0	14.4	14.9	14.9	13.6	9.7
1999	8.8	8.6	9.0	9.2	11.4	13.5	14.3	13.2	12.9	12.5	12.6	10.8
2000	10.4	10.7	10.4	10.4	11.7	11.9	12.4	13.1	13.3	13.5	12.4	10.5
2001	8.8	8.5	9.2	9.5	10.5	11.3	12.2	13.0	13.5	13.4	13.0	10.1
2002	7.8	7.9	8.7	9.9	10.3	10.7	11.6	12.2	12.5	12.5	12.5	10.1
2003	9.7	8.8	9.1	10.3	11.2	11.9	13.2	13.8	14.3	14.4	13.4	10.4
2004	9.2	8.9	9.6	9.9	12.0	11.6	12.1	12.7	13.2	13.3	11.3	10.0
2005	8.5	8.4	9.3	10.4	11.3	12.1	13.3	13.6	13.8	14.0	14.1	12.1
2006	10.1	9.4	8.8	9.5	10.8	12.7	13.7	13.7	13.9	14.1	13.2	10.3
2007	8.2	N/A	N/A	N/A	N/A	12.0	12.7	13.5	N/A	13.4	12.9	9.3
2008	8.6	7.9	9.1	9.6	10.8	13.2	14.7	15.3	15.4	N/A	N/A	N/A
2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2011	N/A	N/A	N/A	N/A	N/A	13.7	N/A	16.2	14.8	N/A	N/A	N/A
2012	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.7	10.3
2013	8.0	8.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.9	12.4	9.5
2014	8.6	8.6	10.8	11.3	12.8	15.4	15.3	16.0	15.6	14.2	13.1	9.7

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	8.9	10.2	10.5	11.0	12.9	14.3	15.8	16.2	15.8	14.3	10.7	7.9
2016	7.9	8.9	9.6	10.1	10.8	11.5	12.4	12.8	12.7	12.7	12.9	10.8
2017	8.6	8.6	8.8	9.6	10.9	14.0	15.2	15.8	15.1	14.9	14.7	10.8
2018	10.1	9.7	9.7	9.9	10.7	11.2	12.4	12.6	13.6	13.2	13.2	11.2
2019	10.4	9.2	9.3	10.1	11.4	14.3	15.1	15.2	15.3	14.7	12.9	10.3
2020	9.4	8.3	8.8	9.5	10.4	11.2	13.1	14.2	14.4	12.7	12.4	10.4
2021	9.3	9.2	10.1	11.8	13.0	13.2	14.5	14.4	15.0	14.0	13.4	9.9
2022	8.5	8.1	8.6	10.3	11.3	12.7	13.4	14.2	14.1	13.7	11.8	9.8
2023	8.9	8.6	8.5	9.2	11.4	14.0	14.4	15.4	14.9	14.9	13.9	12.6
2024	10.9	10.6	10.7	10.5	11.3	12.4	13.9	14.5	14.7	15.1	13.5	11.6

Table F-40. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station Mackville, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	12.1	11.9	11.4	13.7	14.4	15.5	16.4	18.4	18.5	17.8	17.1	14.6
1999	10.6	10.3	11.1	13.2	15.7	18.2	17.8	18.3	16.8	15.8	16.0	15.2
2000	12.3	12.4	13.2	15.4	15.9	15.2	16.7	17.0	16.9	16.4	15.9	13.6
2001	11.9	11.8	13.5	15.7	15.4	16.3	17.2	17.7	17.4	17.2	16.5	13.6
2002	11.9	12.2	14.2	14.8	14.9	15.5	16.6	16.6	16.5	15.8	16.5	14.6
2003	11.7	12.0	14.5	15.1	16.0	16.1	17.0	17.8	17.8	17.4	17.0	15.1
2004	11.7	12.4	13.8	14.9	16.1	16.4	16.9	17.0	17.1	16.6	15.6	12.8
2005	10.9	10.8	11.9	12.7	14.5	15.7	16.5	17.4	17.2	17.1	16.6	14.9
2006	12.6	12.5	11.7	11.7	13.7	16.1	16.9	17.3	17.3	16.8	16.8	14.5
2007	11.7	N/A	N/A	N/A	N/A	15.9	15.0	15.3	N/A	16.5	15.8	14.2
2008	10.7	12.3	13.0	14.2	16.5	18.8	19.6	19.3	18.8	N/A	N/A	N/A
2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2011	N/A	N/A	N/A	N/A	N/A	15.5	N/A	16.5	17.8	N/A	N/A	N/A
2012	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.2	15.3
2013	11.3	10.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.9	16.7	14.3
2014	10.6	12.5	16.5	16.9	17.0	20.0	21.4	20.3	19.6	18.4	16.3	15.2
2015	12.0	13.7	15.1	17.2	18.6	20.0	20.8	20.6	20.2	17.5	17.2	12.8
2016	11.5	12.6	13.6	14.2	15.9	17.1	17.9	17.7	17.0	15.7	15.2	14.2
2017	11.2	11.3	10.4	11.8	15.0	18.3	18.4	19.1	19.3	17.6	16.9	15.8
2018	12.6	12.6	14.1	14.0	14.5	16.4	17.1	18.0	17.7	15.7	15.9	14.9
2019	12.4	12.1	11.8	12.5	15.2	17.4	18.5	19.4	19.2	18.1	16.8	14.1
2020	11.7	12.0	13.0	14.7	15.5	18.3	18.6	19.1	18.1	17.0	16.1	14.0
2021	11.9	12.7	15.5	17.0	17.7	19.0	19.5	19.0	19.0	17.7	16.4	15.1
2022	11.0	11.8	14.4	15.6	17.1	18.6	18.8	18.6	18.2	17.1	15.5	13.2
2023	10.3	10.4	10.9	12.3	15.2	17.6	17.9	18.5	18.3	17.4	17.0	15.5
2024	13.6	13.2	13.6	15.5	14.9	17.9	19.8	19.9	19.3	17.8	17.2	15.2

Table F-41. Monthly Average of Daily Average Water Temperatures (°C), Station Elliott, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1998	**10.9**	10.5	10.2	11.4	13.0	14.4	15.1	15.6	17.2	16.2	14.7	11.4	13.4
1999	**9.5**	9.4	9.8	10.8	12.6	14.1	14.1	15.1	15.8	15.0	14.7	12.3	12.8
2000	**11.2**	11.5	11.5	13.1	13.8	14.0	14.8	15.6	15.5	14.8	13.8	11.9	13.5
2001	**10.1**	10.0	11.6	12.7	13.7	14.6	15.7	16.6	16.4	15.2	14.4	11.4	13.5
2002	**9.8**	9.9	11.3	12.3	13.0	13.7	15.3	15.6	15.4	14.5	14.5	12.4	13.1
2003	**11.0**	10.6	12.1	13.0	14.0	14.8	15.6	16.3	16.3	15.8	14.9	12.5	13.9
2004	**10.2**	10.5	11.9	12.7	13.7	14.3	15.3	15.6	15.6	14.9	13.7	11.2	13.3
2005	**9.6**	9.6	10.6	11.4	12.3	13.5	14.8	15.0	15.3	15.4	14.8	12.6	12.9
2006	**11.2**	10.6	10.1	10.3	11.9	13.7	15.0	15.4	15.4	15.1	15.1	12.2	13.0
2007	**9.4**	N/A	N/A	N/A	N/A	15.2	15.9	16.8	16.5	15.5	14.0	11.3	14.3
2008	**9.3**	9.6	11.4	12.4	13.9	17.3	18.0	17.6	17.1	15.3	14.2	11.1	13.9
2009	**9.1**	10.2	11.1	12.7	13.7	14.0	15.2	15.4	15.3	14.9	14.6	11.7	13.2
2010	**10.7**	10.9	11.9	12.6	13.3	14.6	15.0	15.7	15.7	15.5	15.1	12.7	13.6
2011	**9.6**	9.3	10.0	10.3	11.6	14.3	15.8	17.5	15.4	15.1	14.2	10.3	12.8
2012	**9.6**	10.1	11.8	13.9	15.0	16.6	16.9	16.4	15.7	14.8	13.7	12.3	13.9
2013	**9.3**	9.3	11.1	12.8	14.1	16.1	16.2	16.7	16.0	14.2	13.1	10.7	13.3
2014	**10.2**	11.2	13.1	14.1	15.7	17.8	18.8	18.6	17.9	16.2	14.7	13.0	15.1
2015	10.3	11.8	13.4	14.7	16.7	16.9	19.2	19.3	18.5	16.4	13.4	10.4	15.1
2016	9.8	11.0	11.9	12.2	13.7	15.0	16.3	16.3	15.7	14.3	13.8	12.6	13.6
2017	10.4	10.0	9.8	11.0	13.4	17.8	19.4	20.0	19.7	17.6	15.4	11.5	14.7
2018	8.6	8.1	9.0	10.9	13.2	15.4	18.3	17.2	15.6	14.2	14.1	12.9	13.1
2019	11.2	10.8	10.4	10.9	12.2	14.3	15.7	17.6	17.3	16.7	15.2	13.3	13.8
2020	11.3	10.5	11.4	12.4	13.2	14.6	15.9	16.7	16.4	15.1	14.1	12.1	13.6
2021	10.9	11.1	12.4	14.6	15.9	17.6	18.4	18.3	18.4	16.1	15.1	12.2	15.1
2022	10.1	10.2	12.0	13.6	15.1	17.2	17.6	17.3	17.0	15.8	13.5	11.2	14.2
2023	11.0	9.9	10.3	11.4	13.6	15.7	16.7	17.6	16.8	16.2	15.4	13.9	14.0
2024	12.5	12.1	11.9	13.1	13.4	15.1	17.5	17.6	16.9	16.1	15.1	13.2	14.6

Table F-42. Monthly Minimum of Daily Minimum Water Temperatures (°C), Station Elliott, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	10.1	9.5	9.3	10.2	12.0	13.1	14.0	14.4	15.1	14.5	13.1	9.3
1999	8.5	8.4	8.8	9.0	10.8	11.9	12.0	13.2	14.0	13.4	13.2	10.3
2000	9.9	10.6	10.4	10.6	11.6	12.0	12.6	13.6	13.8	13.3	11.9	10.0
2001	8.3	8.2	9.3	10.1	11.1	11.9	13.2	14.5	14.8	13.7	12.4	10.0
2002	7.4	7.9	8.7	10.1	10.6	11.0	12.5	13.3	13.2	12.6	12.4	10.0
2003	9.8	8.8	9.7	10.7	12.0	12.4	13.6	14.3	14.4	14.2	13.1	10.2
2004	8.9	9.1	9.5	10.2	11.9	11.8	12.8	13.4	13.5	13.3	10.9	9.8
2005	8.3	8.3	9.2	10.3	11.3	12.0	13.2	13.4	13.8	13.7	13.0	11.5
2006	10.5	9.7	9.1	9.8	10.8	12.5	13.7	13.6	13.6	13.7	12.5	9.8
2007	7.8	N/A	N/A	N/A	N/A	13.3	13.9	15.3	15.0	14.0	12.0	8.6
2008	8.1	7.6	9.6	9.9	10.7	14.1	15.5	15.2	15.4	14.1	13.4	9.0
2009	8.3	9.0	9.6	10.5	11.2	11.6	12.8	13.3	13.1	12.9	12.4	9.9
2010	9.3	9.4	9.7	10.7	11.9	13.3	13.1	13.1	14.1	14.3	12.9	11.0
2011	8.5	7.9	8.4	9.7	10.9	14.1	14.3	16.0	14.1	14.3	12.7	8.2
2012	7.8	8.4	9.4	11.3	12.5	13.2	14.3	13.8	13.9	13.1	11.7	9.6
2013	7.5	7.6	8.8	10.2	11.4	13.3	13.8	14.6	14.1	12.6	11.8	9.2
2014	8.9	8.8	10.9	11.4	13.1	14.5	16.6	17.0	15.6	14.3	13.0	9.0
2015	8.6	10.1	10.7	11.4	13.5	14.8	17.2	17.1	15.5	14.6	10.0	7.6

2016	7.5	8.5	9.8	10.3	10.9	11.9	13.8	14.2	13.5	12.8	12.1	10.8
2017	7.9	8.8	8.8	10.0	11.7	14.8	17.7	17.8	12.9	12.6	8.3	6.4
2018	6.6	6.0	6.6	7.2	11.2	12.0	14.6	10.3	11.1	10.6	12.2	10.4
2019	9.9	10.0	10.1	10.6	11.3	13.5	14.3	16.2	16.0	15.6	13.5	11.9
2020	10.3	9.5	10.5	11.1	12.4	13.2	15.1	16.1	16.0	13.6	11.4	9.6
2021	8.7	8.6	9.8	11.3	12.5	14.5	16.1	16.0	14.4	13.6	12.6	9.2
2022	8.2	8.0	8.6	10.0	10.7	14.0	14.5	14.3	14.6	13.1	10.3	9.0
2023	9.0	8.1	8.2	9.8	11.4	14.1	15.3	15.9	14.5	14.0	12.9	12.2
2024	11.0	10.0	9.8	10.7	10.5	12.3	14.4	15.5	13.9	13.9	12.1	10.4

Table F-43. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station Elliott, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	12.1	11.5	11.9	14.4	14.9	16.0	17.0	18.5	18.8	17.7	16.5	14.3
1999	10.6	10.2	11.5	13.5	15.0	16.9	16.3	17.1	17.1	16.3	15.7	14.5
2000	12.4	12.9	13.9	15.7	16.9	16.3	17.3	17.5	17.0	16.3	15.4	13.2
2001	11.3	11.6	13.8	15.9	16.2	17.1	17.7	18.2	17.9	17.2	16.0	13.4
2002	12.0	12.2	14.5	15.1	15.6	16.3	17.3	17.3	17.1	15.9	16.7	14.2
2003	11.9	12.2	14.8	15.1	16.4	17.4	18.3	19.2	17.7	16.9	16.2	14.4
2004	11.5	11.8	13.6	15.3	16.7	16.9	17.1	17.0	16.7	16.0	15.0	12.7
2005	10.6	10.8	12.3	13.1	14.6	16.2	17.1	17.4	16.9	16.5	15.9	14.4
2006	12.3	11.8	11.4	11.0	13.8	16.0	17.1	17.3	17.1	16.5	16.6	14.4
2007	11.7	N/A	N/A	N/A	N/A	16.6	17.3	18.1	17.8	17.1	15.5	14.1
2008	10.6	12.3	13.5	15.0	17.0	19.6	20.3	19.5	18.6	17.0	15.8	13.8
2009	10.1	11.7	12.6	15.3	16.2	16.6	17.1	16.9	16.7	16.1	16.4	13.5
2010	11.9	12.4	13.9	15.3	15.5	16.2	16.7	17.4	17.1	16.6	16.8	14.0
2011	11.3	10.7	11.6	11.7	12.4	14.5	17.7	18.1	16.7	16.2	15.7	12.8
2012	10.8	11.5	13.8	17.1	17.4	19.1	19.0	18.4	17.1	16.4	15.0	15.2
2013	10.8	11.0	13.8	15.6	16.6	18.5	18.3	18.2	17.7	16.0	14.3	13.4
2014	11.9	12.7	15.0	16.7	18.3	20.2	20.9	20.7	19.6	17.9	15.9	15.6
2015	11.7	14.0	15.7	17.5	19.5	20.0	21.4	21.1	21.4	19.5	17.1	12.9
2016	11.9	13.4	14.1	14.4	16.3	17.5	18.0	17.8	17.1	15.6	14.9	14.3
2017	11.4	11.2	10.9	12.2	15.6	21.4	21.8	23.2	22.6	21.9	21.4	17.1
2018	10.1	9.6	11.2	15.2	16.9	19.0	22.5	20.3	19.0	16.5	15.9	14.6
2019	12.3	11.9	10.8	11.5	13.7	15.1	17.3	19.1	18.5	17.6	15.9	14.3
2020	12.2	11.3	12.2	13.5	14.3	15.8	16.5	17.5	17.0	16.5	16.5	14.3
2021	12.9	13.3	15.7	17.5	18.3	20.5	20.8	20.8	22.2	18.1	17.2	15.9
2022	12.3	12.6	15.8	16.7	18.5	19.9	20.0	19.7	19.7	18.3	16.8	13.9
2023	12.8	11.7	12.2	13.4	15.8	17.8	18.1	19.4	18.8	18.5	18.0	15.6
2024	14.2	14.3	14.2	15.8	15.8	19.2	20.0	19.8	19.4	18.0	17.8	15.6

Table F-44. Monthly Average of Daily Average Water Temperatures (°C), Station Victor, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1998	11.1	11.0	10.6	11.4	12.8	14.1	14.9	15.5	17.0	16.0	14.5	11.2	13.3
1999	9.5	9.4	9.9	11.3	12.9	14.4	14.5	15.5	16.3	15.1	14.6	12.0	13.0
2000	11.2	11.6	11.6	13.5	14.2	14.5	15.3	16.3	16.0	15.0	13.6	11.8	13.7
2001	10.2	10.2	12.2	13.4	14.6	15.7	16.8	17.7	17.2	15.6	14.4	11.5	14.1
2002	9.8	10.3	11.9	13.0	13.7	14.4	16.1	16.3	16.0	14.4	14.3	12.1	13.5
2003	11.0	10.7	12.4	13.3	14.4	14.8	15.9	16.3	16.9	16.1	14.8	12.5	14.1
2004	10.3	10.7	12.5	13.4	14.5	15.3	16.4	16.5	16.2	15.1	13.6	11.1	13.8
2005	9.7	9.8	10.8	11.7	12.8	14.1	15.6	15.8	16.1	16.0	15.1	13.1	13.4
2006	11.4	10.4	10.5	11.0	12.2	13.9	15.6	16.1	16.5	14.9	13.2	10.9	13.1
2007	9.4	10.7	13.2	14.6	16.0	17.2	18.3	18.7	18.6	16.8	15.5	13.9	15.2
2008	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.3	9.3
2009	8.9	10.2	11.1	13.1	14.5	14.6	15.9	16.0	15.7	15.0	14.3	11.3	13.4
2010	10.5	10.8	11.9	12.7	13.3	15.1	15.7	16.2	16.0	15.5	14.9	12.6	13.8
2011	9.7	9.4	10.2	10.5	12.7	14.3	N/A	N/A	16.0	16.0	14.8	10.8	12.4
2012	9.5	10.1	11.9	14.2	15.4	17.2	17.3	16.8	16.1	14.9	13.7	12.3	14.1
2013	9.3	9.5	11.5	13.3	14.6	16.7	17.0	17.3	16.5	14.4	12.7	10.2	13.6
2014	10.0	11.1	13.4	14.4	16.2	18.6	19.7	19.4	18.4	16.4	14.5	12.8	15.4
2015	10.2	11.9	13.8	15.4	17.0	17.4	20.0	20.0	18.9	16.9	13.3	10.4	15.4
2016	10.0	11.4	12.4	12.8	14.3	15.5	16.8	16.7	16.0	14.3	13.7	12.2	13.8
2017	10.2	9.9	9.7	10.9	13.1	16.0	16.9	17.6	17.2	16.0	15.4	12.2	13.8
2018	11.3	10.9	11.9	11.9	12.8	14.5	16.1	15.9	15.5	14.1	13.6	12.4	13.4
2019	10.8	10.3	10.0	11.0	12.8	15.0	16.9	17.9	17.5	16.4	14.7	12.7	13.8
2020	10.9	11.4	13.1	14.7	15.1	16.7	18.2	18.5	17.5	15.5	13.2	11.3	14.7
2021	10.3	10.4	11.8	14.4	16.0	18.8	20.0	19.2	17.9	15.4	14.1	11.4	15.0
2022	9.2	9.2	11.4	13.5	15.1	17.9	18.2	17.7	17.2	15.4	12.3	10.3	13.9
2023	10.0	9.4	9.3	10.6	13.2	15.4	16.1	17.3	16.4	15.8	14.8	13.1	13.4
2024	11.7	11.5	11.5	13.0	13.0	14.9	18.1	18.2	17.0	15.7	14.5	12.6	14.3

Table F-45. Monthly Minimum of Daily Minimum Water Temperatures (°C), Station Victor, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	11.4	11.3	10.8	12.4	13.4	14.4	15.4	16.4	17.5	16.2	15.6	13.2
1999	10.2	9.7	9.9	11.4	13	14.4	13.9	15.6	16.5	15.6	14.9	13.6
2000	11.9	12	11.4	13.5	14.1	13.4	15.5	16	15.8	15.6	14.6	13.1
2001	11	10.6	12.8	15.3	14.1	15.4	16.7	17.3	17	16.4	15.1	12.7
2002	12	11	13.2	13.7	13.2	13.6	15.9	16.1	16.1	15	15.2	13
2003	11.6	11.5	13.7	13.8	14.9	14.4	15.6	16.7	16.8	16.1	15.8	14.1
2004	11.1	11.1	12.6	13.4	14.2	15.1	16.3	16.1	16.2	15.6	14.6	12.5
2005	10.3	9.6	10.9	11.7	12.6	14.3	15.2	16	16.2	16.4	15.7	13.9
2006	12.4	11.4	11.1	11.6	12.7	14.8	16.2	16.8	16.9	16.1	14.1	11.9
2007	10.2	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A
2008	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	N//A	9.3
2009	10.2	11.6	11.9	15.1	14.5	14.4	15.6	16.3	16.1	15.6	15.3	12.2
2010	11.2	11.1	12.5	13.1	13.2	14.6	14.9	17	15.8	15.6	15.5	13.2
2011	11.2	9.6	10.6	10.7	13	14.4	N//A	N//A	15.4	16	15.5	12.4
2012	10.2	10.4	12.4	15.7	15.1	17.5	17.5	17.2	16.3	15.8	14.7	14.8

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	10.2	9.8	12.9	13.6	14.3	17.3	17.1	17.6	17.2	15.6	13.4	11.9
2014	11	11.8	13.2	15.1	16.8	18.9	19.5	19.2	18.4	16.7	15.1	14.7
2015	10.8	12.6	14.4	16.4	17.1	18.1	20.3	19.5	19	17.6	15.8	12.3
2016	11.1	11.6	12.3	13.4	14.3	15	17.1	16.5	15.9	14.5	14.1	13.5
2017	11.1	10.6	9.8	11.1	14	15.9	16	16.6	17.4	15.9	15.7	14.5
2018	11.9	11	12.6	11.6	12.3	14.7	15.8	16.1	15.9	14.1	14.4	13.5
2019	11.3	11.2	10.3	11.5	14	15.9	17.6	18.1	18.2	16.7	15.2	13.5
2020	11.3	12.7	13.8	15.8	15.9	18.1	18.4	19.3	18.2	17.3	14	11.9
2021	10.8	10.7	13.4	15.1	16.3	19.7	20.5	19.8	19.2	16.2	15.3	12.8
2022	10.1	9.9	13.2	14.2	16.1	18.7	18.4	18.2	17.9	16.5	14.3	11.2
2023	10	9.7	9.6	11.1	14.1	15.3	15.5	16.3	16	15.6	16	14.3
2024	12.5	12.0	11.7	14.2	12.7	15.4	18.4	18.1	17.3	15.8	15.4	13.3

Table F-46. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station Victor, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	11.9	11.4	10.9	12.6	13.6	14.5	15.6	16.7	17.7	16.9	16.0	14.1
1999	10.7	10.2	11.4	13.2	14.7	16.6	15.8	16.6	17.1	16.2	15.5	14.2
2000	12.5	12.9	13.9	15.5	16.9	16.4	17.4	17.5	17.1	16.4	15.2	13.3
2001	11.3	11.7	14.0	16.5	16.4	17.2	18.2	19.9	19.5	17.9	16.2	13.3
2002	12.3	12.6	15.4	15.4	15.6	16.3	17.4	17.8	17.8	15.8	16.5	13.8
2003	12.1	12.1	15.0	15.1	16.5	17.1	18.1	18.2	18.1	17.2	16.5	14.5
2004	11.7	12.1	14.0	15.5	17.4	17.5	17.5	17.6	17.5	16.6	15.1	13.0
2005	10.8	11.0	12.5	13.3	14.9	17.0	17.8	17.8	17.3	17.0	16.3	14.8
2006	13.0	12.3	11.9	11.7	12.8	14.9	16.3	16.8	17.0	16.1	14.2	12.0
2007	10.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2008	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.3
2009	10.6	12.4	12.8	15.6	16.1	16.6	17.0	16.9	16.6	16.9	16.3	12.8
2010	11.6	12.0	13.4	14.9	15.9	17.4	17.8	17.8	17.3	16.5	16.6	13.9
2011	11.3	10.5	11.8	12.3	14.0	15.6	N/A	N/A	17.4	17.2	16.3	13.4
2012	10.6	11.3	13.9	17.0	16.8	19.8	18.6	17.9	17.1	16.6	14.9	15.2
2013	10.7	10.9	13.7	15.4	16.4	18.6	18.3	18.4	17.9	16.3	13.8	12.9
2014	11.6	12.7	15.4	16.4	18.0	21.0	21.8	21.3	20.1	18.3	15.7	15.4
2015	11.8	13.8	16.4	18.5	19.9	20.0	22.0	22.0	21.6	19.1	17.2	13.2
2016	12.1	13.7	14.8	14.3	16.1	17.2	17.5	17.9	17.8	14.9	14.7	13.9
2017	11.2	11.2	10.9	12.7	15.5	19.0	19.1	19.3	19.0	17.3	16.7	15.4
2018	12.5	12.0	13.6	14.3	15.7	16.8	17.3	17.5	16.8	15.4	15.4	14.1
2019	12.1	11.9	11.8	12.2	14.3	16.2	17.9	18.3	18.4	16.9	15.3	13.7
2020	11.3	12.9	13.9	15.9	16.1	18.3	18.5	19.4	18.3	17.4	14.1	12.0
2021	10.9	10.9	13.5	15.4	16.4	20.2	21.1	20.3	19.4	16.5	15.4	13.1
2022	10.3	10.0	13.8	14.4	16.3	19.2	18.6	18.4	18.0	16.7	14.4	11.4
2023	10.1	9.8	9.9	12.4	15.6	18.0	18.3	19.2	18.2	16.9	16.3	14.6
2024	13.0	12.7	12.9	15.2	14.4	17.9	19.2	19.4	18.4	16.8	16.1	14.0

Table F-47. Monthly Average of Daily Average Water Temperatures (°C), Station Below Woodbridge, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1998	11.5	11.4	10.8	12.1	13.7	15.3	16.0	16.7	19.1	16.3	14.0	10.7	14.0
1999	9.5	9.6	10.3	12.1	14.1	16.1	16.6	17.6	18.7	16.3	14.3	11.3	13.9
2000	11.1	11.8	12.0	15.1	15.9	16.8	17.8	19.5	18.2	15.8	13.0	11.3	14.9
2001	9.8	10.2	13.6	15.2	17.8	19.7	21.0	21.8	20.2	16.9	14.2	10.9	15.9
2002	9.4	10.8	13.0	15.4	16.2	17.6	20.8	20.8	19.6	15.4	13.7	11.3	15.3
2003	10.8	10.8	13.5	14.6	16.7	16.2	17.8	18.3	19.0	16.9	13.9	11.8	15.0
2004	9.9	10.7	13.4	14.8	15.9	18.1	21.0	20.6	19.3	15.9	12.9	10.4	15.2
2005	9.4	10.1	11.1	12.1	13.3	14.7	16.8	17.2	17.0	16.2	14.2	12.2	13.7
2006	11.1	10.4	10.6	11.1	12.8	15.2	17.0	18.3	17.5	15.6	14.4	11.2	13.8
2007	8.5	10.2	13.2	15.6	17.6	20.2	21.3	21.0	18.9	15.8	13.2	10.2	15.5
2008	8.8	9.8	12.9	14.4	17.1	21.8	23.3	22.3	20.4	16.8	13.9	9.5	15.9
2009	8.9	10.8	13.0	15.4	17.8	18.1	20.8	20.5	18.8	15.4	13.8	10.8	15.4
2010	10.5	11.2	13.0	14.0	14.0	16.7	17.5	18.9	18.2	15.9	14.5	12.2	14.7
2011	9.3	9.3	10.5	10.9	13.2	15.3	17.0	18.3	18.0	16.3	14.2	9.9	13.5
2012	9.6	10.4	12.6	16.4	18.5	21.6	22.4	21.5	19.7	16.7	13.6	11.7	16.2
2013	8.8	9.8	13.5	16.1	17.7	21.4	22.0	21.8	19.8	15.4	12.8	9.2	15.7
2014	9.6	11.8	15.3	16.9	19.2	22.5	24.4	23.6	22.0	17.9	14.5	12.8	17.5
2015	9.9	12.3	15.7	17.3	20.3	20.0	23.9	23.8	22.6	19.6	12.7	9.5	17.3
2016	9.7	12.0	14.2	15.2	16.7	18.5	21.9	21.3	20.2	15.6	13.8	12.6	16.0
2017	11.1	11.1	11.2	12.4	14.8	18.3	19.3	20.5	19.8	16.5	15.3	11.5	15.2
2018	11.3	11.1	13.3	13.9	15.0	17.5	21.2	20.0	18.2	15.0	13.3	12.1	15.2
2019	10.9	10.6	10.6	11.8	13.7	16.1	18.7	19.9	19.1	16.6	14.4	12.2	14.6
2020	10.8	11.3	13.2	16.1	17.8	21.4	22.8	22.8	20.5	16.9	12.9	10.6	16.4
2021	10.2	11.2	13.2	16.8	19.1	23.3	24.7	23.4	22.9	17.0	14.6	11.0	17.3
2022	9.8	10.3	14.0	16.1	18.1	22.3	23.1	21.9	20.8	16.8	12.2	9.9	16.3
2023	10.4	9.4	9.8	11.3	13.9	16.5	17.3	19.1	17.6	16.4	14.4	12.5	14.1
2024	11.6	11.8	12.3	14.9	14.5	17.1	23.0	22.3	19.3	16.3	13.9	12.2	15.8

Table F-48. Monthly Minimum of Daily Minimum Water Temperatures (°C), Station Below Woodbridge, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	9.9	10.2	9.6	10.6	12.4	13.8	14.9	15.9	16.7	15.0	12.5	8.6
1999	8.1	8.7	9.0	9.9	11.8	13.5	15.1	16.0	17.4	14.7	12.1	9.5
2000	9.2	11.1	10.7	13.2	13.7	15.0	15.8	16.5	16.6	13.9	11.3	9.2
2001	8.1	8.0	10.0	11.7	15.8	17.1	19.0	20.0	18.4	15.0	10.8	9.1
2002	6.9	7.9	9.4	12.9	12.9	15.9	18.2	18.8	16.1	12.9	12.0	9.1
2003	9.5	8.6	10.6	12.5	13.7	14.3	16.2	16.1	17.6	13.8	11.1	8.7
2004	8.1	8.5	9.9	11.5	13.7	17.1	17.5	18.7	16.0	13.4	9.2	8.5
2005	8.2	8.6	9.9	10.6	12.1	13.1	15.8	15.5	15.2	13.8	11.6	10.5
2006	10.2	9.3	9.1	9.8	11.7	13.8	15.8	15.8	15.3	13.9	11.0	8.5
2007	6.3	8.1	9.1	13.7	14.6	17.1	18.7	18.4	16.5	13.8	10.4	7.8
2008	7.2	7.5	10.6	11.4	14.2	18.0	20.7	20.1	18.5	13.9	12.3	7.6
2009	7.4	9.1	10.4	13.1	13.9	16.6	18.6	18.6	16.9	13.3	11.3	8.6
2010	8.9	9.5	10.8	11.2	12.3	15.0	15.9	17.3	17.0	15.0	11.8	10.8
2011	8.4	7.9	9.1	9.6	11.5	13.4	14.8	17.4	15.9	14.8	12.7	8.4
2012	7.8	8.7	10.0	13.6	16.4	19.0	19.8	19.2	N/A	N/A	11.5	9.0
2013	6.8	7.9	11.1	14.1	16.2	18.5	18.9	19.6	16.7	13.5	11.4	7.6

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	8.5	9.0	12.6	13.4	17.4	19.3	21.9	21.6	19.1	15.3	12.6	8.4
2015	7.5	10.9	12.4	13.4	18.2	16.3	21.1	21.6	20.7	15.9	8.7	6.7
2016	6.6	8.1	12.1	12.6	13.7	16.5	18.9	19.0	18.1	13.9	11.9	11.3
2017	9.3	9.8	10.1	11.4	13.0	16.0	17.3	18.9	17.5	15.2	14.1	10.0
2018	10.0	9.1	10.5	11.7	13.1	14.1	18.6	18.3	15.1	13.9	11.6	9.6
2019	8.8	8.9	9.5	11.2	12.4	14.9	15.1	18.1	16.4	15.3	11.4	10.1
2020	9.4	7.9	11.1	12.7	15.5	17.4	20.8	20.4	18.4	13.4	10.7	9.7
2021	8.7	9.4	10.8	15.1	17.3	19.8	22.4	20.9	20.3	15.0	12.2	9.1
2022	8.5	7.9	10.7	13.7	15.1	18.3	20.5	19.9	18.3	14.0	10.4	8.3
2023	8.8	8.4	8.3	9.4	11.7	15.0	16.2	17.4	16.1	14.5	11.9	11.1
2024	9.8	10.0	10.9	12.4	12.9	14.5	19.6	19.9	17.7	14.8	11.7	11.2

Table F-49. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station Below Woodbridge, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	13.5	12.2	11.6	14.5	15.2	16.3	17.2	19.2	22.1	18.0	16.0	13.7
1999	11.2	10.4	11.6	14.1	15.9	18.9	18.4	18.8	20.4	18.4	15.8	13.9
2000	12.9	13.2	14.5	17.4	18.6	18.6	20.6	21.9	19.7	18.7	15.1	13.2
2001	11.0	12.0	16.4	19.7	19.8	22.6	23.5	24.6	22.8	20.3	16.0	12.9
2002	12.7	13.3	18.1	18.5	19.2	19.5	23.8	23.3	23.2	17.7	15.8	12.8
2003	12.2	12.6	16.7	16.8	19.7	17.6	20.1	21.1	20.8	18.6	15.9	14.5
2004	11.7	12.9	16.2	17.7	17.9	19.7	23.7	22.8	22.3	18.8	14.8	13.0
2005	10.5	11.2	12.4	13.3	14.3	17.4	18.2	20.1	19.8	18.1	16.3	14.1
2006	12.7	12.9	12.9	12.1	14.3	17.1	18.5	20.3	19.9	16.8	16.3	14.1
2007	11.2	12.1	15.9	19.5	19.6	23.7	24.5	24.3	22.9	17.9	15.4	13.5
2008	10.7	13.7	15.6	18.6	20.2	25.8	26.2	25.1	23.3	21.0	15.8	13.5
2009	11.5	13.7	16.4	20.1	20.2	20.7	24.1	23.1	21.8	17.2	16.0	12.5
2010	12.3	12.9	15.1	17.0	16.9	19.3	19.2	22.0	20.0	17.5	16.4	13.4
2011	11.1	10.9	12.2	12.1	14.2	16.9	18.6	19.9	19.9	17.5	15.9	12.7
2012	11.1	11.9	14.6	21.1	20.6	26.0	24.9	23.9	N/A	N/A	15.8	15.0
2013	10.4	11.5	17.3	18.2	19.7	25.1	25.7	24.0	22.9	18.2	14.5	12.3
2014	11.9	13.7	17.5	19.3	21.5	26.5	27.0	27.1	24.6	20.9	16.4	15.3
2015	11.7	14.1	19.3	20.7	23.6	23.8	26.5	26.1	25.0	22.9	17.3	12.3
2016	12.2	14.4	17.0	17.5	19.2	20.7	24.2	23.8	22.2	19.0	15.5	14.7
2017	12.4	12.4	12.3	13.9	16.7	22.1	21.6	21.7	22.6	18.5	16.5	15.0
2018	12.6	12.8	16.5	16.9	18.0	20.8	23.9	22.9	21.7	17.0	15.6	14.1
2019	12.6	11.9	11.9	12.6	15.7	18.4	21.2	23.0	22.4	18.1	16.3	14.0
2020	12.4	14.0	15.3	19.0	21.0	25.7	25.3	25.9	23.4	20.5	15.1	11.3
2021	11.5	13.1	17.1	19.2	20.9	27.2	27.7	26.4	25.2	21.9	17.2	13.4
2022	11.1	12.7	18.5	18.5	20.8	26.1	25.8	24.5	23.9	20.3	14.6	11.7
2023	11.8	10.5	11.1	13.0	15.8	20.0	18.7	20.7	20.0	17.9	16.8	14.2
2024	13.2	13.3	14.1	18.6	16.3	20.1	26.2	24.7	22.1	18.9	15.9	13.2

Table F-50. Monthly Average of Daily Average Water Temperatures (°C), Station Thornton, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1998	10.9	10.8	11.0	12.5	14.1	15.7	16.6	17.4	20.5	16.3	13.9	10.5	14.2
1999	9.5	9.8	10.6	12.6	14.8	17.1	18.0	19.1	20.3	16.7	14.2	10.9	14.5
2000	11.1	12.0	12.4	16.0	17.1	18.5	20.0	22.5	19.8	16.2	12.8	11.2	15.8
2001	9.6	10.5	14.5	16.4	20.6	25.7	28.0	27.6	21.4	16.9	13.8	10.4	17.9
2002	8.9	10.6	13.1	16.1	17.3	19.4	24.1	23.1	21.1	15.4	13.2	10.7	16.1
2003	10.6	10.6	13.8	15.0	17.7	16.8	18.7	19.0	20.1	16.7	13.2	11.2	15.3
2004	9.5	10.5	13.8	15.4	16.5	19.6	24.4	24.0	21.0	15.7	12.2	9.7	16.0
2005	9.1	10.2	11.3	12.3	13.6	15.0	17.5	17.9	17.6	16.4	13.8	11.9	13.9
2006	11.1	10.4	10.8	11.4	13.2	15.3	17.7	19.0	18.0	15.3	13.9	10.6	13.9
2007	8.2	10.5	13.8	16.4	19.0	19.2	N/A	N/A	19.0	16.7	13.0	9.5	14.5
2008	8.6	9.9	13.3	15.3	18.5	24.1	26.0	25.5	21.9	16.6	13.5	9.8	16.9
2009	9.0	10.8	13.5	16.2	19.8	20.2	25.0	24.5	21.6	15.3	13.1	10.2	16.6
2010	10.3	11.3	13.9	14.5	14.4	17.6	18.5	20.7	19.4	16.2	14.4	12.4	15.3
2011	9.7	9.5	10.7	11.2	13.5	15.8	17.7	19.2	18.7	16.2	13.7	8.8	13.7
2012	8.8	10.4	12.7	17.1	19.9	23.8	25.5	24.6	21.6	19.9	12.6	11.2	17.3
2013	8.3	9.6	14.0	17.1	19.1	24.0	25.1	23.4	21.2	15.0	12.1	8.5	16.4
2014	9.4	11.8	15.3	17.5	19.4	24.3	26.5	25.1	22.7	17.7	13.9	12.3	18.0
2015	9.6	12.5	16.3	18.4	21.7	21.2	25.8	24.5	21.0	19.2	12.0	9.0	17.6
2016	9.7	12.4	14.9	16.4	18.2	20.5	25.8	24.5	21.8	15.8	13.6	11.6	17.1
2017	10.3	10.6	11.3	12.0	13.1	14.9	16.7	18.7	19.5	16.5	15.1	11.1	14.1
2018	11.0	10.8	13.1	13.9	15.1	18.6	24.5	22.9	20.0	15.9	12.8	11.7	15.9
2019	10.7	10.6	10.8	12.2	14.0	16.6	19.2	20.7	19.6	16.5	13.9	11.9	14.7
2020	10.4	11.1	13.4	16.9	19.2	24.1	25.6	25.6	22.1	17.0	12.1	9.8	17.3
2021	9.8	11.1	13.3	17.5	20.3	25.3	26.8	24.8	22.7	16.5	13.8	10.3	17.7
2022	9.2	10.0	14.5	16.7	19.3	24.6	26.0	25.3	23.0	16.7	11.3	9.2	17.2
2023	10.1	9.2	9.7	11.4	14.0	16.7	17.7	19.9	18.0	16.4	13.8	12.0	14.1
2024	11.3	11.7	12.5	15.5	14.9	18.0	24.0	22.1	20.5	17.2	14.3	12.4	16.2

Table F-51. Monthly Minimum of Daily Minimum Water Temperatures (°C), Station Thornton, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	11.7	11.7	12.2	15.5	16.0	17.3	18.4	21.7	24.6	18.7	16.0	13.9
1999	11.6	10.6	12.3	15.4	17.4	21.6	20.4	22.0	23.4	20.0	15.9	13.6
2000	13.0	13.1	14.9	19.7	20.8	21.6	25.5	28.7	23.2	20.9	15.6	13.3
2001	11.3	12.9	19.7	22.5	25.4	33.7	35.1	34.3	27.6	22.5	15.9	12.5
2002	12.7	14.4	20.1	20.8	22.9	22.7	30.3	28.6	27.8	18.9	15.4	12.3
2003	12.6	13.1	18.4	18.8	22.8	19.7	23.4	23.6	23.6	19.9	15.5	13.9
2004	11.4	12.7	16.1	20.0	20.2	22.7	31.3	30.5	28.3	19.9	14.5	12.7
2005	10.7	11.5	12.7	14.0	15.2	18.8	19.5	22.4	21.6	19.0	15.3	13.8
2006	12.3	12.3	12.3	13.4	14.6	18.0	19.3	21.6	21.2	17.0	16.0	13.5
2007	10.5	12.2	16.0	20.5	21.1	20.1	N/A	N/A	N/A	19.0	15.7	12.8
2008	10.8	14.3	16.7	20.3	23.8	32.8	33.5	32.0	29.6	22.3	15.6	13.0
2009	11.8	14.6	18.1	22.5	24.5	25.1	34.4	32.4	30.2	18.3	15.9	12.1
2010	11.9	12.9	16.7	18.6	17.6	20.7	21.1	25.9	23.3	18.5	17.0	13.8
2011	11.1	10.9	11.9	12.4	14.9	18.4	20.2	20.7	21.8	17.5	15.8	11.8
2012	10.9	12.8	16.0	22.2	23.2	32.4	33.2	30.3	N/A	N/A	14.9	14.8
2013	10.2	12.7	19.0	21.7	23.1	33.5	33.3	30.5	28.7	19.2	14.0	12.2
2014	12.3	14.7	19.4	21.6	22.4	33.9	33.3	33.5	29.0	21.5	16.2	15.3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	12.0	15.2	20.9	24.6	30.3	29.5	33.4	31.0	26.4	24.8	18.0	12.3
2016	12.5	15.8	19.4	20.6	22.8	23.9	33.3	30.8	27.4	20.0	15.9	13.8
2017	11.6	11.5	12.1	12.3	14.0	16.1	17.8	19.6	22.9	17.7	17.2	15.4
2018	12.2	12.7	17.4	18.0	19.9	23.1	29.5	27.4	23.7	17.8	17.3	13.7
2019	12.8	12.0	12.4	13.8	16.0	19.3	21.6	23.3	23.4	18.4	15.5	14.3
2020	12.5	14.4	16.6	22.2	24.8	31.4	31.1	32.6	28.7	22.5	14.9	11.0
2021	11.5	12.9	18.8	21.2	25.1	33.9	32.3	30.4	29.2	22.1	16.9	12.6
2022	10.6	12.5	20.0	20.6	24.3	32.2	33.1	32.2	31.0	22.8	14.4	11.0
2023	11.0	10.5	11.0	13.1	16.0	20.7	20.2	22.4	21.6	18.9	16.8	13.9
2024	13.3	13.3	14.8	20.5	18.3	23.2	30.3	23.7	22.1	19.5	15.9	12.9

Table F-52. Monthly Maximum of Daily Maximum Water Temperatures (°C), Station Thornton, 1998-2024.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	9.6	10.1	9.8	10.7	12.5	14.1	15.7	16.2	16.9	14.0	12.3	8.0
1999	8.1	8.6	9.5	9.9	12.0	13.6	16.3	16.6	17.2	13.7	11.7	9.2
2000	9.0	11.2	11.1	13.3	14.3	15.7	16.7	17.3	16.7	13.1	11.3	9.0
2001	7.6	8.2	10.5	11.2	15.2	18.5	21.8	19.8	16.7	13.5	9.9	8.3
2002	5.7	6.6	8.4	11.8	12.6	15.5	19.4	17.9	15.1	11.5	10.8	8.2
2003	8.9	7.6	9.9	11.3	13.6	14.1	15.9	16.9	16.9	12.3	10.3	8.1
2004	7.7	8.7	10.5	12.4	13.4	16.9	17.9	19.0	13.5	11.6	7.8	7.4
2005	7.6	9.0	9.9	10.8	12.4	13.3	15.9	15.7	15.1	14.2	11.4	10.2
2006	10.4	9.4	9.1	10.1	12.3	13.9	15.9	15.9	14.9	13.3	10.5	8.3
2007	6.0	8.7	10.1	14.0	15.3	18.3	N/A	N/A	N/A	14.6	9.4	6.8
2008	6.6	7.4	10.3	11.8	13.7	17.6	19.1	20.0	16.8	12.4	11.3	6.9
2009	7.2	8.3	9.6	12.1	15.3	16.5	19.0	18.0	15.3	12.4	10.5	7.9
2010	8.8	10.0	10.4	11.1	12.4	15.2	16.0	17.3	16.4	14.8	11.4	10.7
2011	8.6	7.8	8.9	10.0	11.8	13.5	15.7	17.6	15.8	14.5	11.8	6.5
2012	6.5	8.8	9.1	12.8	15.8	18.0	19.4	19.9	N/A	N/A	10.3	8.5
2013	5.7	7.3	9.9	12.9	15.6	17.9	19.1	19.1	14.2	12.3	10.0	6.0
2014	7.2	8.0	12.1	12.5	15.8	21.1	20.9	19.8	16.9	13.9	11.0	6.7
2015	6.1	10.0	11.1	12.8	15.6	16.7	20.4	19.6	17.7	14.7	6.8	5.5
2016	5.2	7.5	11.9	13.3	14.0	16.7	19.6	19.0	15.6	13.8	10.6	9.9
2017	9.0	9.2	10.9	11.6	12.3	13.9	16.0	17.8	16.4	15.6	12.9	8.8
2018	9.5	8.6	9.8	11.1	12.6	14.0	19.1	19.5	17.4	11.0	9.0	8.7
2019	7.9	9.4	9.7	10.9	12.4	15.2	17.2	19.0	16.5	13.1	10.5	9.6
2020	8.9	7.7	10.4	11.8	15.1	17.7	20.9	20.8	18.4	12.0	9.0	8.5
2021	7.8	9.0	10.1	13.9	15.8	18.1	21.4	16.3	15.1	13.2	10.7	8.2
2022	7.0	7.4	9.6	12.7	13.7	17.6	19.2	20.4	17.5	12.3	8.5	7.1
2023	8.3	8.0	7.8	9.7	11.8	15.1	16.0	17.4	15.8	13.9	10.2	9.9
2024	8.7	9.8	10.7	11.8	13.1	14.3	19.2	20.4	19.4	15.8	12.8	11.8

Volume II
Appendix G

II-G.1 Supporting Information for Wildlife and Botanical Resources

- G.1.1 California Wildlife Habitat Relationships Descriptions
- G.1.2 Life History Information for California Rare Plant Rank Plants
- G.1.3 Life History Information for Birds of Conservation Concern and California Species of Special Concern Known or Potentially Occurring in the Project Vicinity

II-G.2 Common Wildlife Species, CWHR Wildlife Habitats, and Game Species

- Table II-G.2-1. Common wildlife species and CWHR wildlife habitats.
- Table II-G.2-2. Game species potentially occurring in the vicinity of the Lower Mokelumne River Project.

II-G.3 Supporting Information for Riparian and Wetlands Habitat Resources

- G.3.1 Riparian and Wetland Habitat Types Mapped along Project-affected Stream Reaches, Project Reservoirs, and within the FERC Project Boundary

II-G.4 Special-Status Plant and Wildlife Species That Could Potentially Use Wetland, Riparian, and Littoral Habitats

II-G.5 Common Wildlife Species using Wetland, Riparian, and Littoral Habitats

G.1 SUPPORTING INFORMATION FOR WILDLIFE AND BOTANICAL RESOURCES

G.1.1 CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS DESCRIPTIONS

G.1.1.1 HERB-DOMINATED HABITATS

Annual Grassland (AGS)

California annual grassland is a common land cover type in the FERC Project boundary. This land cover is dominant throughout the hillslopes surrounding Camanche Reservoir and becomes codominant with woodland and chaparral vegetation communities at higher elevations in the eastern extent of the FERC Project boundary. Dominant plant species in this land cover generally include non-native grasses such as ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), wild oats (*Avena* spp.), Italian rye (*Festuca perennis*), and barley (*Hordeum murinum*). Associated herbaceous species include non-native forbs such as prickly lettuce (*Lactuca serriola*), Italian thistle (*Carduus pycnocephalus*), yellow star thistle (*Centaurea solstitialis*), bull thistle (*Cirsium vulgare*), stinkwort (*Dittrichia graveolens*), bristly ox-tongue (*Helminthotheca echioides*), and shortpod mustard (*Hirschfeldia incana*).

A variety of wildlife species use annual grasslands for breeding and/or foraging. Reptiles that breed in annual grassland include western fence lizard (*Sceloporus occidentalis*) and valley garter snake (*Thamnophis sirtalis fitchi*). Mammals typical of this habitat include California ground squirrel (*Otospermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), and coyote (*Canis latrans*). Annual grasslands provide foraging habitat for raptors, including barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), and American kestrel (*Falco sparverius*).

Rare, threatened, and endangered species typically associated with grasslands include federally threatened California tiger salamander (*Ambystoma californiense)* and federally proposed threatened western spadefoot (*Spea hammondii*)*,* if near a seasonal wetland, and California candidate for listing as endangered burrowing owl (*Athene cunicularia*). California threatened Swainson's hawks (*Buteo swainsoni*) are commonly found in grasslands and nest in scattered trees. Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Pasture (PAS)

Pastures are typically a mixture of perennial grasses and legumes that are managed for livestock grazing. Pastures are usually found in areas with flat or rolling terrain. Plant species vary geographically, but in northern California ryegrasses (*Festuca* and *Lolium*

spp.), tall fescue (*Festuca arundinacea*), Dallissgrass (*Paspalum dilatutum*), clovers (*Trifolium* spp.), and trefoils (*Lotus* spp.) are often preferred planting species. Species found in annual grasslands, as described above, are often common.

Wildlife species that use pastures include a variety of ground-nesting birds such as waterfowl, ring-necked pheasants (*Phasianus colchicus*), western meadowlark (*Sturnella neglecta*), and the northern harrier (*Circus hudsonicus,* California Species of Special Concern [SSC]). Flooded pastures provide important feeding and roosting sites for many wetland-associated birds, including shorebirds, gulls (*Larus* spp.), and sandhill cranes (*Grus canadensis*). Mule deer (*Odocoileus hemionus*) will also graze in pastures that have nearby tree or shrub cover.

Wet Meadow (WTM)
Wet meadows, which are found in poorly drained areas that contain saturated soils for most of the year, are characterized by a diverse mix of herbaceous plants, sometimes with sparse growth of willow (*Salix* spp.) intermixed or along the edges. The most common plant genera typically include monocots such as bentgrasses (*Agrostis* spp.), sedges (*Carex* spp.), oatgrasses (*Danthonia* spp.), rushes (*Juncus* spp.), and bulrushes (*Scirpus* spp.). The most common forb species include shootingstars (*Dodecatheon* spp.), monkeyflowers (*Erythranthe* spp.), and cow's clover (*Trifolium wormskioldii*).

Wildlife is typically abundant in wet meadows. Mule deer graze on herbaceous vegetation. Red-winged blackbirds (*Agelaius phoeniceus*) will often nest in tall vegetation near water sources. Many warbler species can be found in wet meadows as well. Garter snakes (*Thamnophis* spp.) can often be found hunting for Sierra tree frogs (*Pseudacris sierrae*) and fish.

Rare, threatened, and endangered species that can be found in these habitats includes tricolored blackbird (*Agelaius tricolor*). Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

G.1.1.2 SHRUB-DOMINATED HABITATS

Chamise-Redshank Chaparral (CRC)
Chamise-redshank chaparral is located along mid- to high-elevation, xeric slopes and ridges throughout the FERC Project boundary. This vegetation community is found along the Mokelumne River upstream of the Camanche Reservoir to the easternmost extent of the FERC Project boundary. Chamise (*Adenostoma fasciculatum*) is a dominant shrub; other associated species include whiteleaf manzanita (*Arctostaphylos viscida*), California buckwheat (*Erigonum fasciculatum*), and squirreltail (*Elymus elymoides*). Canyon live oak (*Quercus chrysolepis*), foothill pine (*Pinus sabiniana*), and ponderosa pine (*Pinus*

ponderosa) often appear in proximity to this vegetation community, as is seen within the Watershed.

Wildlife species typically found in this habitat type include reptiles such as western fence lizards and gopher snakes (*Pituophis catenifer*); birds such as wrentit (*Chamaea fasciata*, Bird of Conservation Concern [BCC]), fox sparrow (*Passerella iliaca*), and California quail (*Callipepla californica*); and mammals such as mule deer and coyote. Within chamise-redshank chaparral communities, several associations in Southern California and coastal areas are considered sensitive, when chamise co-occurs with sage (*Salvia* spp.), bigpod ceanothus (*Ceanothus megacarpus*), or sugar bush (*Rhus ovata*). These species do not occur in the vicinity of the Lower Mokelumne River Project.

Mixed Chaparral (MCH)

Mixed chaparral occurs along mid to high elevation, xeric slopes within the FERC Project boundary. Mixed chaparral is located north of the eastern portion of Camanche Reservoir through the easternmost extent of the FERC Project boundary. The mixed chaparral vegetation community is typically dominated by *Ceanothus* species with a mixture of other chaparral shrubs such as silktassel (*Garrya* spp.), manzanitas (*Arctostaphylos* sp.), and hoary coffeeberry (*Frangula californica* ssp. *tomentella*). Wildlife species in mixed chaparral habitats are similar to those in chamise-redshank chaparral communities described above.

The Project area also supports Ione chaparral, a sensitive natural community (State Sensitive Rank of S1) associated with mixed chaparral habitats.

Rare, threatened, and endangered species within this habitat include federally threatened Ione manzanita (*Arctostaphylos myrtifolia*). Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

G.1.1.3 TREE-DOMINATED HABITATS

Blue Oak-Foothill Pine (BOP)

Blue oak-foothill pine is found within several mid- to higher elevation uplands within the FERC Project boundary. This vegetation community is located on hills along the Mokelumne River upstream of Camanche Reservoir and is dominant at higher elevations along the eastern extent of Pardee Reservoir. This land cover type represents a codominant mix of blue oak (*Quercus douglasii*) and foothill pine trees. The tree canopy of this land cover type is relatively open. Associated species in blue oak-foothill pine woodland include ponderosa pine (*Pinus ponderosa*), canyon live oak (*Quercus chrysolepis*), and interior live oak (*Quercus wislizenii*) in the overstory. Shrubs commonly

found in these sites include wedgeleaf ceanothus (*Ceanothus cuneatus*), whiteleaf manzanita (*Arctostaphylos viscida*), and poison oak (*Toxicodendron diversilobum*).

Amphibians associated with this land cover include California slender salamander (*Batrachoseps attenuatus*) and California toad (*Anaxyrus boreas halophilus*). Typical bird species include Nuttall's woodpecker (*Picoides nuttallii*), acorn woodpecker (*Melanerpes formicivorus*), California scrub-jay (*Aphelocoma californica*), Hutton's vireo (*Vireo huttoni*), oak titmouse (*Baeolophus inornatus*), violet-green swallow (*Tachycineta thalassina*), orange-crowned warbler (*Leiothlypis celata*), and bushtit (*Psaltriparus minimus*). Raptors, including red-shouldered hawk (*Buteo lineatus*) and Cooper's hawk (*Accipiter cooperii*) may also occur. Small mammals common to oak woodlands include California mouse (*Peromyscus californicus*), western gray squirrel (*Sciurus griseus*), and the non-native eastern fox squirrel (*Sciurus niger*). Larger mammals typically found in this land cover include bobcat (*Lynx rufus*), coyote, and mule deer.

Rare, threatened, and endangered species found in this habitat type in the FERC Project boundary include California fully protected golden eagle (*Aquila chrysaetos*) and California endangered and fully protected bald eagle (*Haliaeetus leucocephalus*). Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Blue Oak Woodland (BOW)

Blue oak woodland occurs in many mid-elevation upland locations within the FERC Project boundary. It is one of the dominant vegetation communities on slopes surrounding Camanche Reservoir and is also scattered throughout the hills at higher elevations surrounding Pardee Reservoir. Blue oak woodland communities include blue oak as the dominant or codominant tree in the canopy. Other species associated with blue oak woodlands include California buckeye (*Aesculus californica*), foothill pine, valley oak (*Quercus lobata*), and interior live oak. The understory typically consists of shrubs and/or California annual grassland species when the canopy is relatively open.

Wildlife species in this habitat type are similar to the species described in the blue oak-foothill pine habitat above.

Montane Hardwood (MHW)

Montane hardwood is found in several low- to mid-elevation upland portions of the FERC Project boundary. This vegetation community is located on hillslopes along the eastern half of the Camanche Reservoir and scattered in small clusters along the Pardee Reservoir. This land cover type is dominated by interior live oak trees that form various degrees of canopy cover ranging from open to nearly entire.

Other associated tree species observed in this land cover type include blue oak, valley oak, foothill pine, California bay (*Umbellaria californica*), and California buckeye. Other species found in this land cover type include coyote brush (*Baccharis pilularis*), California blackberry (*Rubus ursinus*), poison oak, California sagebrush (*Artemisia californica*), goldback fern (*Pentagramma triangularis*), and California wood fern (*Dryopteris arguta*).

Many of the wildlife species found in blue oak-foothill pine habitat type, as described above, are also found in montane hardwood. Other common species found in this habitat type include mountain quail (*Oreortyx pictus*).

Montane Riparian (MRI)

Montane riparian is typically distributed along streambanks and is characterized by deciduous trees with a sparse understory. Montane riparian habitats are often structurally as well as biologically diverse. Common species in montane riparian communities include black cottonwood (*Populus trichocarpa*), dogwood (*Cornus* spp.), alders (*Alnus* spp.), and willows. Understory species often include azaleas (*Rhododendron* spp.) and crimson columbine (*Aquilegia formosa*).

Common mammals include raccoon (*Procyon* lotor) and beaver (*Castor canadensis*). Breeding birds include warbling vireo (*Vireo gilvus*), MacGillivray's warbler (*Geothlpyis tolmiei*), and song sparrows (*Melospiza melodia*). Sierra newt (*Taricha sierrae*) and gartersnakes are common reptiles in these habitats.

SSC species found in montane riparian habitats include Sierra Nevada mountain beavers (*Aplodontia rufa californica*) and yellow warblers (*Setophaga petechia*).

Valley Foothill Riparian (VRI)

Valley foothill riparian habitats are found in low elevation areas of California along rivers and streams. Canopy height is taller than other riparian types, with an average height of 98 feet in a mature forest, with high canopy cover. Most trees are winter deciduous and are typically characterized by Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak. White alder (*Alnus rhombifolia*) and Oregon ash (*Fraxinus latifolia*) are often found in the subcanopy. Understory cover is typically low but can include plants such as wild grape (*Vitus californicus*), elderberry (*Sambucus* spp.), poison oak, buttonbrush (*Cephalanthus occidentalis*), and willows. Herbaceous layers typically contain sedges, rushes, grasses, miner's lettuce (*Claytonia* spp.), and mugwort (*Artemisia douglasiana*). Non-native Himalayan blackberry (*Rubus armeniacus*) is commonly found in this habitat.

Valley foothill riparian habitats provide important cover for common mammals such as brush rabbits (*Sylvilagus bachmani*), woodrats (*Neotoma*), and special-status mammals such as ringtail. Bird diversity in valley foothill riparian habitats are high and include species such as wood ducks (*Aix sponsa*), vireos, warblers, sparrows, swallows, and woodpeckers. Amphibians such as California toad and Sierra treefrog are often found in this habitat type.

Rare, threatened, and endangered birds that use valley foothill riparian habitats include state threatened Swainson's hawk and tricolored blackbird. Rare, threatened, and endangered mammals that are found in this habitat type include California fully protected ringtail (*Bassariscus astutus*). Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Valley Oak Woodland (VOW)

Valley oak woodland are dominated by valley oak that can grow as savanna or forested stands with closed canopies, typically below El. 2,000 feet. This habitat type is typically found in broad valleys along natural drainages, and tree density is highest in the bottom of the valley. Co-dominant tree species often include California sycamore, northern California black walnut (*Juglans hindsii*), interior live oak, and blue oak. Understory plants often include poison oak, toyon (*Heteromeles arbutifolia*), and coffeeberries (*Frangula* spp.). Ground cover is typically dominated by annual grasses and forbs.

Wildlife species found in valley oak woodlands are often similar to the species found in blue oak woodland and valley foothill riparian habitats. Acorn woodpecker, red-shouldered hawk, oak titmouse, and western gray squirrel are often particularly common.

G.1.1.4 NON-VEGETATED OR HUMAN-AFFECTED AREAS

Barren (BAR)

Barren areas containing ruderal vegetation are found in multiple upland locations within the FERC Project boundary near developed areas, along Highway 49 and other roads, and near the Camanche Reservoir Dam. This vegetation type is characterized by early colonizing species of disturbed and degraded areas. Community composition includes non-native annual grasses such as barley, ripgut brome, and red brome (*Bromus madritensis* ssp. *rubens*). Other species present within this community type include non-native, often invasive thistle species such as spiny sow's thistle (*Sonchus asper*), milk thistle (*Silybum marianum*), star thistle, and Italian thistle. East Bay Municipal Utility District (EBMUD) actively manages ruderal vegetation to reduce non-native invasive plant species where they occur.

Due to sparse vegetative cover and frequent disturbance, ruderal habitats provide limited value to wildlife. Wildlife species such as mourning dove (*Zenaida macroura*) and killdeer (*Charadrius vociferus*) may forage and nest in this habitat type.

Cropland (CRP)

Croplands include managed agricultural lands that produce row crops, typically composed of annual plants. Sometimes crops are grown in rotation. Planting times vary based on the plant species. Croplands have been established on California's most fertile soils and have agricultural activities have overall reduced the diversity of native plant and wildlife species. Within the Project vicinity, cropland is limited to native pasture (dry), irrigated pasture, small grains such as wheat and barley, and field crops such as sugar beets, alfalfa, safflower, beans, and corn. Croplands are typically placed in flat or rolling terrain.

Wildlife species typically found in croplands include the special-status Swainson's hawk, and common wildlife species such as waterfowl, ring-necked pheasant, deer, and wild pigs (*Sus scrofa*).

Rare, threatened, and endangered species found in croplands include the state threatened Swainson's hawk. Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Deciduous Orchard (DOR)

Deciduous orchards are typically characterized by a fruiting tree species that is planted in rows, with open understories to facilitate harvesting. The most common crops in California include almonds, apples, apricots, cherries, figs, nectarines, peaches, pears, pecans, pistachios, plums, pomegranates, and walnuts. Deciduous orchards usually drop their leaves during the winter. Often, orchards are planted in areas with deep native soils.

Wildlife are often treated as agricultural pests, but species such as mule deer, rabbits, squirrels, European starlings (*Sturnus vulgaris*), and house finches (*Haemorhous mexicanus*) may use these habitats. Many orchards have placed nest boxes for barn owls to control rodent populations.

Evergreen Orchard (EOR)

Evergreen orchards are typically characterized by a fruiting tree species that are planted in rows, with open understories to facilitate harvesting. In California, these tree species typically include avocados, dates, grapefruit, lemons, limes, olives, oranges, tangerines, tangelos, and tangors. Usually there is some herbaceous growth in the understory, but often the rows are treated with herbicides.

Wildlife species in evergreen orchards are similar to those in deciduous orchards.

Irrigated Grain Crops (IGR)

Irrigated grain crops are typically grown in rows and depending on the crop may have closed canopies or bare rows. Species typically include corn, wheat, barley, safflower, and beans. Often irrigated grain crops are managed in a crop rotation system. Irrigated grain crops are typically grown in the most fertile soils.

Wildlife species include rodents and birds that have adapted to the agricultural matrix. Hawks and owls often prey on these rodents along the edges of these areas. Irrigated grain crops, particularly rice, can be important foraging areas for waterfowl, shorebirds, and sandhill cranes.

Irrigation water can also provide habitat for species during the dry season, and some rare, threatened, and endangered species such as the federally threatened giant garter snake (*Thamnophis gigas*) will use the irrigation canals and fields as habitat. Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Irrigated Hayfield (IRH)

Irrigated hayfields, particularly alfalfa, are grown with dense vegetative cover and are typically monocultures. After harvesting, these areas often contain bare ground. Alfalfa is often grown as a crop rotation to return nitrogen back into the soil.

Irrigated hayfields can provide seasonal resources for a variety of common bird species, such as red-winged blackbirds, doves, egrets, hawks, owls, sandhill cranes, and waterfowl. Common mammals include mule deer, gophers, and voles. Reptiles such as garter snakes, gopher snakes, and California king snakes (*Lampropeltis californiae*) may use these habitats.

State threatened tricolored blackbirds often nest in these habitats, if alfalfa is left growing long enough. State threatened Swainson's hawks often forage in these habitats. Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Urban (URB)

Developed areas are found at limited locations within the FERC Project boundary. The primary developed areas include the western margins of the Pardee and Camanche Reservoirs where dams, small towns, recreational trails, access roads, and campgrounds exist. Developed cover includes paved and unpaved roads, trails, buildings, electric transmission infrastructure, median strips, lawns, yards, and landscaped parks. This cover type consists of a mosaic of different vegetation types. Species composition and vegetative cover, where vegetated, in this habitat varies.

A variety of bird species may use this habitat, including mourning dove, Anna's hummingbird (*Calypte anna*), American robin (*Turdus migratorius*), California scrub-jay, northern mockingbird (*Mimus polyglottos*), house finch (*Haemorhous mexicanus*), bushtit, and oak titmouse. Common mammals in these areas includes raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), and striped skunk (*Mephitis mephitis*). Mule deer may also be found in this habitat in rural settings. Owls and other raptors forage over areas of low vegetation, such as landscaped areas and mowed lawns.

Vineyards (VIN)
Vineyards are composed of a single species planted in rows, supported on wood or wire trellises. Grapes are the most common vineyard species planted in northern California. Between the vineyard rows, grasses or other herbaceous plants may be planted or grown as a cover crop to control erosion. Vineyards are often planted in rolling hills rather than completely flat terrain.

Many wildlife species are actively discouraged from using vineyards, but species such as deer, rabbits, squirrels, rodents, and mourning doves may be abundant. Many vineyards have built perches for hawks and nest boxes for barn owls to encourage rodent predation. Non-native species such as European starlings and house sparrows (*Passer domesticus*) may be pests.

G.1.1.5 AQUATIC HABITATS

Fresh Emergent Wetland (FEW)
Fresh emergent wetlands are characterized by herbaceous vegetation that is inundated by water for all or most of the year. Dominant vegetation typically includes monocots such as bulrushes, tules (*Schoenoplectus* spp.), or cattails (*Typha* spp.) that prefer flooded roots. Many fresh emergent wetlands in California have been drained and converted into agricultural lands.

Biodiversity in fresh emergent wetlands is high, with many species depending on this habitat for their entire life cycle.

Rare, threatened, and endangered species found in this habitat type include federally threatened giant garter snake and state threatened tricolored blackbird. California fully protected and state threatened bald eagles often forage in this habitat in the winter. Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Lacustrine (LAC)
Lacustrine (i.e., lake) habitat occurs in a large portion of the FERC Project boundary. Lacustrine is the dominant cover type in the Camanche and Pardee reservoirs. Lacustrine

features are flooded with standing water exceeding 2 meters (6.6 feet) at low water and also include ponds within the study area. Floating and/or submerged vegetation is often found in lacustrine features. Duckweeds (*Lemna* spp.) and mosquito fern (*Azolla* spp.) may be found floating on the water surface, and rooted plants with floating leaves, such as smartweed (*Persicaria* sp.) may also be found. Submerged plants include algae and pondweeds (*Potamogeton* spp.).

Project reservoirs and ponds within the FERC Project boundary provide habitat for a variety of wildlife species. Common resident birds that occur in these features include double-crested cormorant (*Phalacrocorax auritus*), Canada goose (*Branta canadensis*), and mallard (*Anas platyrhynchos*). Many species of wintering ducks, such as the common merganser (*Mergus merganser*), northern shoveler (*Anas clypeata*), lesser scaup (*Aythya affinis*), and bufflehead (*Bucephala clangula*) typically occur in lacustrine features. Amphibian species that may be found in lacustrine features include the Sierra tree frog, American bullfrog (*Lithobates catesbianus*), Sierra newt, and California toad.

Lacustrine habitats are important foraging habitats for California fully protected and state threatened bald eagles. Refer to Section 4.7, *Rare, Threatened, and Endangered Species*, for more information.

Riverine (RIV)

Riverine habitat in the FERC Project boundary is dominated by the Mokelumne River, as well as tributary streams. Riverine habitats vary depending on their gradient, and include riffles, runs, pools, and edgewater habitats. Rivers tend to have high velocities at high elevations and transition to slow, meandering channels at lower elevations. The channel of the rivers tend to be free of vegetation, but mosses and algae may be present on the rocks.

A detailed description of the Mokelumne River and other riverine habitats in the Project vicinity can be found in Section 4.6, *Wetland, Riparian, and Littoral Habitats*.

A description of wildlife species using riverine habitats in the Project vicinity can be found in Section 4.4, *Fish and Aquatic Resources*.

G.1.2 LIFE HISTORY INFORMATION FOR CALIFORNIA RARE PLANT RANK PLANTS

G.1.2.1 KNOWN TO OCCUR IN THE VICINITY OF THE LOWER MOKELUMNE RIVER PROJECT

Henderson's bent grass (*Agrostis hendersonii*) –CRPR 3.2
Henderson's bent grass is an annual herb in the Poaceae (grass) family that grows in mesic valley and foothill grasslands and vernal pools. This species can be found at elevations between El. 230 and 1,000 feet. It blooms from April to June.

Hoover's calycadenia (*Calycadenia hooveri*) – CRPR 1B.3
Hoover's calycadenia is an annual herb in the Asteraceae (sunflower) family that grows in rocky areas within cismontane woodland and valley and foothill grassland. This species can be found at elevations between El. 215 and 985 feet. It blooms from July to September.

Spicate calycadenia (*Calycadenia spicata*) –CRPR 1B.3
Spicate calycadenia is an annual herb in the Asteraceae (sunflower) family that grows in cismontane woodland and valley and foothill grassland. The species is associated with adobe, clay, dry, gravelly, or rocky soils in disturbed areas, openings, and roadsides. This species can be found at elevations between El. 130 and 4,595 feet. It blooms from May to September.

Tuolumne button-celery (*Eryngium pinnatisectum*) – CRPR 1B.2
Tuolumne button-celery is an annual or perennial herb in the Apiaceae (carrot) family that grows in mesic areas within cismontane woodland, lower montane coniferous forest, and vernal pools. This species can be found at elevations between El. 230 and 3,000 feet. It blooms from May to August.

Stanislaus monkeyflower (*Erythranthe marmorata*) –CRPR 1B.1
Stanislaus monkeyflower is an annual herb in the Phrymaceae (lopseed) family that grows in cismontane woodland and lower montane coniferous forest. This species can be found between El. 330 and 2,955 feet. It blooms from March to May.

Legenere (*Legenere limosa*) –CRPR 1B.1
Legene is an annual herb in the Campanulaceae (bellflower) family that grows in vernal pools. The species can also be found in vernal marshes, artificial ponds, and floodplains of intermittent streams (United States Fish and Wildlife Service [USFWS] 2005). Soils underlying vernal pools typically are shallow, acidic clays with few stones (USFWS 2005). The most common associates are smooth goldfields (*Lasthenia glaberrima*) and common spikerush (*Eleocharis macrostachya*). This species can be found with other rare vernal pool species such as state-endangered Boggs Lake hedge-hyssop (*Gratiola heterosepala*), dwarf downingia, and federally threatened, state-endangered Sacramento

Orcutt grass (*Orcuttia tenuis*) (USFWS 2005). This species can be found between El. 5 to 2,885 feet. It blooms from April to June.

Patterson's navarretia (*Navarretia paradoxiclara*) –CRPR 1B.3
Patterson's navarretia is an annual herb in the Polemoniaceae (phlox) family that grows in meadows and seeps. This species can also grow in drainages and is found in vernally mesica and serpentine soils in openings. This species can be found between El. 490 and 1,410 feet. It blooms from May to June (sometimes July).

G.1.2.2 MAY POTENTIALLY OCCUR IN THE VICINITY OF THE LOWER MOKELUMNE RIVER PROJECT

Big-scale balsamroot (*Balsamorhiza macrolepis*) –CRPR 1B.2
Big-scale balsamroot is a perennial herb in the Asteraceae (sunflower) family that grows in chaparral, cismontane woodland, and valley and foothill grassland, sometimes on serpentine soils. This species can be found at elevations between El. 150 and 5,100 feet. It blooms from March to June.

Bisbee Peak rush-rose (*Crocanthemum suffrutescens*) –CRPR 3.2
Bisbee Peak rush-rose is a perennial evergreen shrub in the Cistaceae (rock-rose) family that grows in chaparral habitats. It is often found in burned, disturbed, or gabbroic areas on Ione soils. This species can be found at elevations between El. 245 and 2,220 feet. It blooms from April to August.

Mariposa cryptantha (*Cryptantha mariposae*) –CRPR 1B.3
Mariposa cryptantha is an annual herb in the Boraginaceae (borage) family that grows in rocky, serpentinite areas in chaparral habitats. This species can be found between El 655 and 2,135 feet. It blooms from April to June.

Dwarf downingia (*Downingia pusilla*) –CRPR 2B.2
Dwarf downingia is an annual herb in the Campanulaceae (bellflower) family that grows in mesic valley and foothill grassland and vernal pools. This species can be found between El. 5 and 1,460 feet. It blooms from March to May.

Parry's horkelia (*Horkelia parryi*) –CRPR 1B.2
Parry's horkelia is a perennial herb in the Rosaceae (rose) family that grows in chaparral and cismontane woodland, often on Ione formation soils. This species can be found between El. 260 to 3,510 feet. It blooms from April to September.

Ahart's dwarf rush (*Juncus leiospermus var. ahartii*) –CRPR 1B.2
Ahart's dwarf rush is an annual herb in the Juncaceae (rush) family that grows in mesic valley and foothill grasslands. Larger populations are typically found in wet than dry years. This species is found in microhabitats at the edges of vernal pools, bottoms of intermittent drainages, and on pocket gopher mounds (USFWS 2005). This species can

be found between El. 100 to 750 feet. It blooms from March to May and most frequently associates with inch high dwarf rush (*Juncus uncialis*) (USFWS 2005).

Pinchusion navarretia (*Navarretia myersii ssp. myersii*) –CRPR 1B.1
Pincushion navarretia is an annual herb in the Polemoniaceae (phlox) family that grows in vernal pools, often in acidic conditions. This species can be found between El. 65 and 1,085 feet. It blooms from April to May.

Sanford's arrowhead (*Sagittaria sanfordii*) –CRPR 1B.2
Sanford's arrowhead is a perennial, emergent rhizomatous herb in the Alismataceae (water-plantain) family that grows in shallow freshwater marshes and swamps. This species can be found from sea level up to El. 2,135 feet. It blooms from May to October (sometimes November).

G.1.2.3 REFERENCES

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G.1.3 LIFE HISTORY INFORMATION FOR BIRDS OF CONSERVATION CONCERN AND CALIFORNIA SPECIES OF SPECIAL CONCERN KNOWN OR POTENTIALLY OCCURRING IN THE PROJECT VICINITY

G.1.3.1 KNOWN TO OCCUR IN THE VICINITY OF THE LOWER MOKELUMNE RIVER PROJECT

Common Loon (*Gavia immer*) –SSC
EBMUD biologists have observed this species on Camanche and Pardee reservoirs (EBMUD 2025).

Common loons are fairly abundant in coastal marine habitats and less common on large, deep lakes in the valleys and foothills throughout the state of California (Dobkin and Granholm 1990). Adults are black and checkered white with red eyes during breeding, but this species molts to a drab gray-brown body with a whitish belly during wintering. Common loons are not known to breed in California but are present on winter and migration between September to May (Dobkin and Granholm 1990). This species feeds on fish and crustacean prey and is almost entirely aquatic when not breeding (Palmer 1962).

Clark's Grebe (*Aechmophorus clarkii*) and Western Grebe (*A. occidentalis*) –BCC
EBMUD biologists have observed both Clark's and western grebes on Camanche and Pardee reservoirs (EBMUD 2025).

Habitat requirements for these species are similar. The species can be distinguished by how far their black crowns extend in relation to their eyes. In Clark's grebes, the crown does not extend to the eye, which is surrounded by white plumage. In western grebes, the crown extends to the eye such that it is surrounded by black plumage. Clark's and western grebes are common winter migrants along the coast south of the San Francisco Bay region and uncommon to fairly common on large inland lakes at low elevations (Cogswell 1977). Both species breed on large, marshy lakes with emergent vegetation (Garrett and Dunn 1981) and build nest platforms on floats in deep water (Lindvall and Low 1982). These species nest in colonies between April and August. The young are tended by parents until 4 to 5 weeks of age. These grebes hunt by diving and pursuing fish, insects, and other invertebrates.

American White Pelican (*Pelecanus erythrorhynchos*) – SSC
EBMUD biologists have observed this species on Camanche and Pardee reservoirs (EBMUD 2025).

The American white pelican breeds in northeastern California and western Nevada, and winters on large lowland lakes and wetlands in California's Central Valley and foothills

(Shuford 2008). This species often forages for fish cooperatively by pushing fish into shallower waters to be captured in their large bills. Suitable wintering habitat is present on Camanche and Pardee reservoirs.

Northern Harrier (*Circus hudsonius*) – BCC, SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The northern harrier occurs from annual grassland up to lodgepole pine and alpine meadow habitats, as high as El. 10,000 feet (3,000 meters). This species breeds from sea level to El. 5,700 feet (1,700 meters) in the Central Valley and Sierra Nevada, and up to El. 3,600 feet (800 meters) in northeastern California (California Department of Fish and Wildlife [CDFW] 2021). The northern harrier frequents meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands and are seldom found in wooded areas.

This species is a permanent resident of the northeastern plateau and coastal areas and a less common resident of the Central Valley. The California population has decreased in recent decades (Grinnell and Miller 1944; Remsen 1978) but can be locally abundant where suitable habitat remains free of disturbance, especially from intensive agriculture. The breeding population has shown a decline, especially in southern coastal district. Destruction of wetland habitat, native grassland, and moist meadows, and burning and plowing of nesting areas during early stages of breeding cycle, are major reasons for the decline (Remsen 1978). Northern harriers feed on small mammals, birds, frogs, small reptiles, insects, and crustaceans. The species makes low, quartering flights 3 to 30 feet (1 to 9 meters) above open ground. Northern harriers dive from flight or hover and rarely perches and pounces on prey.

Nests are located on the ground in shrubby vegetation, usually at marsh edge (Brown and Amadon 1968). The nest is built of a large mound of sticks on wet areas, and a smaller cup of grasses on dry sites. Northern harriers mostly nest in emergent wetland or along rivers or lakes, but may nest in grasslands, grain fields, or on sagebrush flats several miles from water. They breed from April to September, with peak activity June through July.

Marbled Godwit (*Limosa fedoa*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity along the north shore of Camanche Reservoir (EBMUD 2025).

Marbled godwits are a common migrant and winter visitor in estuarine habitats, less frequently freshwater emergent wetlands and wet upland fields (Cogswell 1977). This

species nests in the prairie regions of central North America and only winters in California (Palmer 1967). Marbled godwits forage on invertebrate prey captured by probing into the substrates in shallow water. Migrants are typically present between mid-July to May in California (Kelly and Cogswell 1979).

Willet (*Tringa semipalmata*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity along the north shore of Camanche Reservoir (EBMUD 2025).

This species is commonly found in estuarine, emergent wetland, and salt pond habitat along the California coast, and is less commonly found in freshwater wetland habitat in the Central Valley (Cogswell 1977). Willets breed east of the Sierra Nevada in Modoc, Lassen, and Plumas counties in wet meadows. This species forages on invertebrate prey captured by probing into the substrates in shallow water. Migrants are typically present between July and April in California (Kelly and Cogswell 1979).

California Gull (*Larus californicus*) – BCC
EBMUD biologists have observed this species on Camanche and Pardee reservoirs (EBMUD 2025).

California gulls nest on alkali and freshwater lacustrine habitats east of the Sierra Nevada, and the species is a common visitor to coastal and interior lowland areas in the non-breeding season (Cogswell 1977). The largest breeding colony in California is on Mono Lake (Gaines 1981). In the Central Valley and foothills, this species is most common at lakes, reservoirs, rivers, croplands, landfills, and open lawns in cities (Grinnell and Miller 1944). California gulls feed on a variety of natural prey such as carrion, earthworms, and insects, but also feed extensively on human garbage.

Short-eared Owl (*Asio flammeus*) – BCC, SSC
EBMUD biologists have observed this species near Camanche Reservoir (EBMUD 2025).

The shore-eared owl is a widespread winter migrant, found primarily in the Central Valley, in the western Sierra Nevada foothills, and along the coastline. It is an uncommon winter migrant in southern California, including the Channel Islands (Garrett and Dunn 1981). Short-eared owls are usually found in open areas with few trees, such as annual and perennial grasslands, prairies, dunes, meadows, irrigated lands, and saline and fresh emergent wetlands. These species occasionally still breeds in northern California (McCaskie et al. 1979). The breeding range includes coastal areas in Del Norte and Humboldt counties, the San Francisco Bay Delta, northeastern Modoc plateau, the east side of the Sierra from Lake Tahoe south to Inyo County, and the San Joaquin Valley.

Short-eared owl numbers have declined over most of the range in recent decades because of destruction and fragmentation of grassland and wetland habitats, and grazing (Remsen 1978). Increased levels of predation on this ground nester may also contribute to its decline (Holt and Leasure 1996). Short-eared owl feeds primarily on voles and other small mammals (Bent 1938; Earhart and Johnson 1970). Birds are an important food source in coastal wintering areas, and in nesting season, but it also eats reptiles, amphibians, and arthropods. Foraging short-eared owls frequently search in low, gliding flight 1 to 6 meters (3.3 to 20 feet) above the ground by swooping and pouncing, but sometimes they also hunt from a perch. Short-eared owls are commonly found in treeless areas using fence posts and small mounds as perches. The species requires dense vegetation; tall grasses, brush, ditches, and wetlands are used for resting and roosting cover (Grinnell and Miller 1944). Nests on dry ground in a depression concealed in vegetation, and lined with grasses, forbs, sticks, and feathers; occasionally nests in a burrow. One record nest was recorded on bare soil with no nest material (Holt 1992). Short-eared owl have been observed drinking in the wild (Dixon and Bond 1937) and in captivity (Clark 1975), but it is not known if water is essential. Found in open, treeless areas with elevated sites for perches, and dense vegetation for roosting and nesting.

Western Screech-Owl (*Megascops kennicottii cardonensis*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

This species is a resident of open oak, pinyon-juniper, riparian, redwood, and mixed conifer habitats up to El. 8,000 feet in California. It is often found in close vicinity of people in small towns, suburbs, farms, ranches, and meadows. This species hunts nocturnally and preys on small mammals, birds, fish, reptiles, amphibians, and arthropods. Small birds are most frequently taken during the nesting season (Van Camp and Henny 1975), while insects are important in the summer and fall (Ross 1969). This species requires cavities in trees (less commonly nest boxes) that are usually 15 to 60 feet off the ground. This species breeds during early February through June. Incubation is typically 21 to 30 days, and nestlings fledge at 28 to 35 days (Van Camp and Henny 1975). Adults often remain paired throughout the year (Call 1978), and pairs are often found together in nest cavities outside the breeding season (Ehrlich et al. 1988).

Nuttall's Woodpecker (*Dryobates nuttallii*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

Nuttall's woodpeckers are fairly common in low-elevation riparian deciduous and oak woodland habitats in the Central Valley, Sierra Nevada foothills, and coast ranges of

California. This species excavates cavity nests from between 2 and 60 feet above the ground. Nests are usually located in dead trunks or limbs in riparian habitats, but sometimes oaks (Bent 1939; Miller and Bock 1972). Breeding is from late March to early July (Miller and Bock 1972), and interestingly the male does much of the incubating and nestling care. This species drills into bark and gleans insects from twigs and foliage (Block 1991). Adult and larval insects comprise the majority of the diet, but berries, nuts, fruits, and sap may also be eaten (Bent 1939).

Yellow-billed Magpie (*Pica nuttallii*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

Yellow-billed magpie is a common, yearlong resident of the Central Valley and interior coastal mountain ranges. This species is most commonly found in valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, orchard, cropland, pasture, and urban habitats (Green 1990). This species constructs large, bulky twig nests that form a dome structure (Harrison 1978), typically between 30 to 80 feet above the ground (Verbeek 1973). This species is an omnivorous, opportunistic feeder and will eat insects, soil invertebrates, carrion, and is a common nest predator (Green 1990). Plant prey is typically acorns, seeds, grains, berries, or fruits.

In the early 2000s, yellow-billed magpie populations declined in California because of the spread of West Nile virus and populations were reduced by between 20 and 40 percent (Crosbie et al. 2008), and populations had not recovered by 2013 (Pandolfino 2013).

Loggerhead Shrike (*Lanius ludovicianus*) – SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The loggerhead shrike is widespread throughout the United States, Mexico, and portions of Canada (Humple 2008). They are a yearlong resident species in most of the United States, including from California east to Virginia and south to Florida, and in Mexico. They also summer and breed in portions of southern Alberta, Saskatchewan, in Canada (Humple 2008). The largest populations are concentrated in Texas and Louisiana (Humple 2008). Northerly breeding populations migrate to warmer locations during winter, including to the Atlantic and south Pacific coasts in Mexico (Small 1994; Yosef 1996). In California, while shrikes are widespread at the lower elevations in the State, the largest breeding populations are located in portions of the Central Valley, the Coast Ranges, and the southeastern deserts (Humple 2008).

Preferred habitats for the loggerhead shrike are open areas that include scattered shrubs, trees, posts, fences, utility lines, or other structures that provide hunting perches with views of open ground, as well as nearby spiny vegetation or human-made structures (such as the top of chain link fences or barbed wire) that provide a location to impale prey items for storage or manipulation (Humple 2008). Loggerhead shrikes occur most frequently in riparian areas along the woodland edge, grasslands with sufficient perch and butcher sites, scrublands, and open canopied woodlands, although they can be quite common in agricultural and grazing areas, and can sometimes be found in mowed roadsides, cemeteries, and golf courses. Loggerhead shrikes occur only rarely in heavily urbanized areas. For nesting, the height of shrubs and presence of canopy cover are most important (Yosef 1996).

Loggerhead shrikes prey mainly on arthropods (primarily grasshoppers, crickets, beetles, and caterpillars), but also take reptiles, amphibians, fish, small birds, and rodents (Humple 2008). In the west, their diet consists mostly of insects (Yosef 1996). They are opportunistic feeders and adjust their diet based on prey availability.

The loggerhead shrike's breeding territory is usually the same as its winter territory and it may defend territories year-round (Yosef 1996). In Contra Costa and Kern counties in California, territories averaged 18.7 acres (Yosef 1996). Loggerhead shrikes are monogamous, and individuals may remain paired during the winter in sedentary populations. In California, they lay four to eight eggs from March into May (Yosef 1996). Eggs hatch in 14 to 15 days and young are fledged after 18 to 19 days (Yosef 1996). Nest sites are chosen based more on the cover than the particular vegetation species. They are usually constructed in a dense shrub or tree well below the crown and are well concealed (Yosef 1996). The heights of nests vary depending on the shrub or tree used for nesting, but the heights of nests increase as the breeding season progresses, probably due to weather conditions (Yosef 1996).

Oak Titmouse (*Baelophus inornatus*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The oak titmouse is a common resident in a variety of habitats in California but is associated with oak trees (*Quercus* spp.). The oak titmouse can be found in montane hardwood-conifer; montane hardwood; blue, valley, and coastal oak woodlands; and valley and foothill riparian habitats. It is found in the foothills of the coastal ranges and the Sierra Nevada from the Mexican border to Shasta County. This species nests in cavities and sometimes nest boxes (Harrison 1978), often breeding near water. Oak titmice feed on insects, spiders, berries, acorns, and seeds by gleaning off foliage,

hammering seeds, or hovering flycatching (Hertz et al. 1976; Wagner 1981). It nests from March to July, and young remain in the nest for about 20 days before fledging and being tended by parents for 3 to 4 weeks (Harrison 1978; Ehrlich et al. 1988).

Wrentit (*Chamaea fasciata*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The wrentit is a common resident of California chaparral habitats and understory of coniferous forest habitats along the coast, coast ranges, and lower elevations of California's mountain ranges (Grinnell and Miller 1944). It is the only bird species in its family (Paradoxornithidae) in North America. Compared to other species, wrentits are sedentary and remain within their territory year-round (Erickson 1938). The species breeds from March through mid-September, and young leave the nest at around 15 to 16 days (Harrison 1978). The species prefers dense stands of chaparral and makes short flights between shrubs. The species is mostly insectivorous but also feeds on berries or other small fruits.

California Thrasher (*Toxostoma redivivum*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

California thrashers are common in foothill habitats in California in dense chaparral habitats, or thickets in valley foothill riparian habitat. California thrashers can be found up to El. 6,600 feet in southern California (Dobkin and Granholm 1990). This species avoids areas with dense tree canopy. Breeding can occur between December to August, and pairs are monogamous, often raising two broods per year. Fledging occurs at 12 to 14 days (Harrison 1978). This species is mostly a sedentary resident and remains on the territory year-round (Gaines 1975). California thrashers are omnivorous and feed on invertebrates, fruit, acorns, and seeds, often probing in the leaf litter with its long, curved bill.

Yellow-breasted Chat (*Icteria virens*) – SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The yellow-breasted chat is the largest warbler, with an approximate length of 6.25 inches. This species requires dense, brushy thickets and tangles near water, and thick understory in riparian woodland. The nest is usually 2 to 8 feet above ground in dense shrubs along a stream or river. Breeding occurs from early May into early August, with

peak activity in June. The species is monogamous and lays 3 to 6 eggs. Incubation lasts 11 to 15 days, and chicks apparently fledge in 8 to 11 days. Altricial young are tended by both parents until fledging.

The yellow-breasted chat is an uncommon summer resident and migrant in coastal California and in the foothills of the Sierra Nevada up to El. 4,800 feet in valley foothill riparian and up to El. 6,500 feet east of the Sierra Nevada in desert riparian habitats. It is uncommon along the coast of northern California and occurs only locally south of Mendocino County. In southern California, it breeds locally on the coast and very locally inland. During migration, it may be found in lower elevations of mountains in riparian habitat.

Within the Central Sierra west slope mountains and foothills, the yellow-breasted chat occurs in valley foothill riparian habitats of the Sierra Nevada up to 4,800 feet.

Lawrence's goldfinch (*Spinus lawrencei*) – BCC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The Lawrence's goldfinch has unpredictable migration patterns and is not loyal to territories unlike other bird species (Kaiser 1976). It is found on the edges of the southern California deserts, on coast slopes from the San Francisco Bay south to Baja California, and in the foothills surrounding the Central Valley. The Lawrence's goldfinch breeds in open oak woodlands and chaparral near water sources and requires foraging habitat dominated by herbaceous vegetation. Wintering habitat is unpredictable (Grinnell and Miller 1944, Garrett and Dunn 1981). This species nests in dense foliage in trees and shrubs, near a water source for drinking (Linsdale 1950). The breeding season begins in late March or early April, and incubation lasts 12 to 13 days, with young fledged after about 11 days (Coutlee 1966). Lawrence's goldfinch primarily feed on seeds, with favored species being pigweed (*Amaranthus* spp.), fiddleneck (*Amsinckia* spp.), starthistle (*Centaurea solstitialis*), and chamise (*Adenostoma fasciculatum*) (Martin et al. 1961).

Pallid bat (*Antrozous pallidus*) – SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The pallid bat is a locally common species of low elevations in California. It occurs throughout California except for the high Sierra Nevada from Shasta to Kern counties, and the northwestern corner of the state from Del Norte and western Siskiyou counties to northern Mendocino County. The pallid bat occupies a wide variety of habitats,

including grasslands, shrublands, woodlands, and forests from sea level up through mixed conifer forests. The species is most common in open, dry habitats with rocky areas for roosting. This species is a yearlong resident in most of the range. The pallid bat takes a wide variety of insects and arachnids, including beetles, orthopterans, homopterans, moths, spiders, scorpions, solpugids, and Jerusalem crickets. The stout skull and dentition of this species allows it to take large, hard-shelled prey.

The pallid bat forages over open ground, usually 1.6 to 8 feet (0.5 to 2.5 meters) above ground level. Foraging flight is slow and maneuverable with frequent dips, swoops, and short glides. Many prey of the pallid bat are taken on the ground. Gleaning is frequently used, and a few prey are taken aerially. This species can maneuver well on the ground and may carry large prey to a perch or night roost for consumption. The pallid bat uses echolocation for obstacle avoidance, and possibly utilizes prey-produced sounds while foraging.

Their day roosts are in caves, crevices, mines, and occasionally in hollow trees and buildings. Their roost must protect them from high temperatures. Bats move deeper into cover if temperatures rise. Night roosts may be in more open sites, such as porches and open buildings. There are few hibernation sites that are known, but pallid bat possibly use rock crevices. Maternity colonies form in early April and may have a dozen to 100 individuals. Males may roost separately or in the nursery colony. This species prefers rocky outcrops, cliffs, and crevices with access to open habitats for foraging.

Townsend’s big-eared bat (*Corynorhinus townsendii*) – SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

Townsend's big-eared bat is found throughout California, but the details of its distribution are not well known. This species prefers mesic habitats and is found in all but subalpine and alpine habitats and may be found at any season throughout its range. Once considered common, Townsend's big-eared bat now is considered uncommon in California. It is most abundant in mesic habitats. Small moths are the principal food of this species. Beetles and a variety of soft-bodied insects also are taken. Townsend’s big-eared bat captures their prey in flight using echolocation, or by gleaning from foliage. Their flight is slow and maneuverable. This species is capable of hovering and requires caves, mines, tunnels, buildings, or other human-made structures for roosting. This species may use separate sites for night, day, hibernation, or maternity roosts. Hibernation sites are cold but not below freezing. Individuals may move within the hibernaculum to find suitable temperatures. Maternity roosts are warm and found in caves, tunnels, mines, and buildings. Roosting sites are the most important limiting

resource. Small clusters or groups (usually fewer than 100 individuals) of females and young form the maternity colony (CDFW 2021).

Western Mastiff Bat (*Eumops perotis californicus*) – SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The western mastiff bat occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban. This species catches and feeds on insects in flight. Ross (1961) found that it fed primarily (58 percent) on night-flying hymenopterous insects. The insects consumed were relatively small, low-flying and weak-flying forms, and Ross concluded that the bats were feeding from ground to tree-level. However, over rugged terrain these bats typically forage at much greater heights (195 feet, 60 meters) above the ground (Krutzsch 1955; Vaughan 1959; Cockrum 1960). Crevices in cliff faces, high buildings, trees, and tunnels are required for roosting (Howell 1920; Dalquest 1946; Barbour and Davis 1969). When roosting in rock crevices, this species needs vertical faces to drop off to take flight. Nursery roosts are described as tight rock crevices at least 35 inches (90 centimeters) deep and 2 inches (5 centimeters) wide, or crevices in buildings (Howell and Little 1924). Suitable habitat consists of extensive open areas with abundant roost locations provided by crevices in rock outcrops and buildings.

Western Red Bat (*Lasiurus frantzii*) – SSC
EBMUD biologists have observed this species in the Lower Mokelumne River Project vicinity (EBMUD 2025).

The western red bat occurs in California from Shasta County and Mendocino County in the north, and through the central coastal region and the Central Valley west of the Sierra Nevada/Cascade ranges to coastal southern California (Cryan 2003; Zeiner et al. 1990), east into Arizona and New Mexico, and south into Baja California and mainland Mexico to South America (Cryan 2003). The species does not occur in desert regions. The western red bat had been considered a subspecies of the red bat (*L. borealis teliotis*) (Shump and Shump 1982), but more recent genetic studies separated the red bat into two species: the western red bat and the eastern red bat (*L. borealis*) (Baker et al. 1988; Morales and Bickham 1995). Morales and Bickham (1995) used mitochondrial DNA (mtDNA) to support the separation of the two species. The western red bat is considered locally common. The species inhabits California year-round but makes seasonal movements within the state and, possibly, to Arizona and New Mexico (Cryan 2003).

There is little ecological information specifically for the western red bat; most studies are based on the red bat before it was separated into the western and eastern species. This species account is, therefore, based primarily on information for the red bat before it was separated into the two species.

Red bats (*Lasiurus* spp.) typically roost in trees, occasionally in shrubs, and even on the ground (Shump and Shump 1982). They are usually solitary, but different bats may use different roosts on different days, and they occasionally form nursery colonies. Day roosts are commonly located in edge habitats adjacent to streams, open fields, and urban areas (Shump and Shump 1982).

Red bats take a variety of prey, including moths, crickets, flies, true bugs, beetles, and cicadas (Shump and Shump 1982). They generally forage in grasslands, shrublands, open woodlands, and croplands, but they also take advantage of congregations of insects attracted to streetlights and building floodlights.

Births occur in about mid-June and young develop rapidly, with flight occurring by 21 to 42 days of age (Shump and Shump 1982).

G.1.3.2 MAY POTENTIALLY OCCUR IN THE VICINITY OF THE LOWER MOKELUMNE RIVER PROJECT

Coast horned lizard (*Phrynosoma blainvillii*) – SSC

The coast horned lizard occurs in valley foothill hardwood, conifer and riparian habitats, as well as in pine-cypress, juniper and annual grassland habitats. It is found in the Sierra Nevada foothills from Butte County to Kern County and throughout the central and southern California coast. Coast horned lizards forage on the ground in open area, usually between shrubs and often near ant nests. The species relies on camouflage for protection. Predators and extreme heat are avoided by burrowing into loose soil. Periods of inactivity and winter hibernation are spent in the soil buried under surface objects such as logs or rocks, in mammal burrows, or in crevices (CaliforniaHerps 2022).

The coast horned lizard inhabits mostly open country, especially sandy areas, washes, flood plains and wind-blown deposits in a wide variety of habitats and can be found at elevations up to 8,000 feet (2,438 meters) (CaliforniaHerps 2022).

Redhead (*Aythya americana*) – SSC

The Project vicinity contains suitable nesting and foraging habitat for this species.

The redhead is a large duck with a red head and gray back. Redheads mainly breed east of the Sierra Crest in lake habitats but can breed locally in emergent wetland habitats in the Central Valley (Cogswell 1977; USFWS 1979). From October to March, redheads migrate to the Central Valley, coastal areas, and the Colorado river.

Redhead nests are built in tall, emergent vegetation with open water nearby, usually in shallow water but sometimes on dry ground or in deep water (Miller and Collins 1954; Palmer 1976). Redheads often lay their eggs in the nests of other ducks before laying a clutch in their own nests. Pairs form during winter and on migratory routes, and egg laying and young rearing occurs between April and August (Cogswell 1977). Redhead bests are susceptible to predation by raccoons, skunks, crows, magpies, and gulls. Incubation lasts for 23 to 29 days. After hatching, the young are precocial and are tended by the mother for three to five weeks.

Long-eared Owl (*Asio otus*) – SSC
The Project vicinity contains suitable nesting and foraging habitat for this species.

The long-eared owl is an uncommon year-round resident throughout the state of California. Long-eared owls require riparian habitat, live oak thickets, and other dense stands of conifer trees for nesting (Grinnell and Miller 1944; Shuford and Gardali 2008). Populations are still relatively abundant in the Great Basin regions of California (Shuford and Fitton 1998). This species feeds on voles and other rodents and hunts in open areas, occasionally in woodlands and forests and uses old crow, magpie, hawk, heron, and squirrel nests in dense canopy. Nests are usually 10 to 50 feet (3 to 15 meters) above ground (Karalus and Eckert 1974). Breeding typically occurs from early March into late July, and the species may nest in loose colonies. Long-eared owls likely exhibit nomadism to track fluctuating prey numbers, rather than maintaining long-term territories (Shuford and Gardali 2008).

Mountain Plover (*Charadrius montanus*) – SSC
The Project vicinity contains suitable wintering habitat for this species.

The mountain plover is a winter resident in California's short grassland and plowed field habitats below El. 3,200 feet. The species breeds in inland North American between northern Montana south to the New Mexico and Texas. Mountain plovers forage on the ground for large insects, especially grasshoppers (Graul 1976) and avoids areas with dense cover. When not foraging, the species is found roosting in depressions in the ground such as hoof prints of cows and in plow furrows (Knopf and Rupert 1995).

Black Swift (*Cypseloides niger*) – BCC, SSC
The Project vicinity contains suitable foraging habitat for this species.

Black swifts breed very locally in the Sierra Nevada and Cascade Range, the San Gabriel, San Bernardino, and San Jacinto Mountains, and in coastal bluffs and mountains from San Mateo County south probably to San Luis Obispo County. This species forages widely

over many habitats. In migration, it is rare and irregular outside the breeding range; and it does not winter in the state (Grinnell and Miller 1944; Remsen 1978; McCaskie et al. 1979; Garrett and Dunn 1981). Black swifts feed exclusively on flying insects, captured in sustained, long-distance foraging flights, usually high in the air. Individuals often pursues insects in updrafts associated with cliffs or storm fronts. Apparently the only regular resting places are on steep, rocky, often moist, cliffs such as those used for nesting (Bent 1940). Black swifts build nests in moist location on sea cliff above surf, or on cliff behind, or adjacent to, waterfall in deep canyon. Nests are constructed of mud mixed with moss, ferns, seaweed, or other plant materials; located in deep, dark crevice, in cave, or under overhang (Bent 1940). The species nests in colonies of only a few pairs. The nest is usually kept moist by mist from the surf or waterfall. It is not known whether drinking water is required other than during roosting and nesting. If there are suitable nest sites for breeding, black swifts will forage over almost any terrain and habitat. This species seems to avoid arid regions, however, such as the Great Basin, southern deserts, and Central Valley. The breeding season lasts from early June to late August. This species lays only 1 large egg per year (Harrison 1978) and incubation lasts 24 to 27 days. Altricial young leave the nest at about 45 days (Hunter and Baldwin 1962), but the nestling period probably highly variable as in other swifts. Young can go without food for long periods (Terres 1980).

White-headed Woodpecker (*Dryobates albolarvatus gravirostris*) – BCC
The Project vicinity contains suitable nesting and foraging habitat for this species.

White-headed woodpeckers are year-long residents of montane coniferous forests in the Sierra Nevada, Cascade, Klamath, Transverse and Peninsular Ranges. Nests are constructed in open conifer habitats, often near edges. White-headed woodpeckers excavate their nest cavities in large snags or stumps at least 6 to 50 feet off the ground (Raphael and White 1984), and pairs often excavate multiple cavities (Thomas 1979). Nesting occurs from mid-April to August, and both parents incubate the eggs. White-headed woodpeckers feed on cones and insects from live conifer trees and snags (Koch et al. 1970; Ligon 1973). The species may migrate downslope in the winter.

Olive-sided Flycatcher (*Contopus cooperi*) – BCC, SSC
The Project vicinity contains suitable foraging habitat for this species.

The olive-sided flycatcher is a summer resident and migrant in California. It is found in woodland and conifer forest in mountain ranges throughout the state and is associated with primarily late-successional conifer forests with open canopies (Shuford and Gardali 2008). Olive-sided flycatchers prefer unobstructed airspace within openings and exposed perches for foraging (Altman and Sallabanks 2000). The olive-sided flycatcher is primarily

insectivorous. Nests are located in the tops of conifer trees, well away from the trunk (Harrison 1979). This species nests in a variety of tree species in California. Olive-sided flycatchers migrate to Central and South America in the winter.

Purple Martin (Progne subis) – SSC
The Project vicinity contains suitable nesting and foraging habitat for this species.

The purple martin is the largest swallow, with an approximate length of 7 inches, and inhabits open forests, woodlands, and riparian areas in the breeding season. It is found in a variety of open habitats during migration, including grassland, wet meadow, and fresh emergent wetland, usually near water. It usually nests in an old woodpecker cavity, sometimes in a human-made structure (e.g., nesting box, bridge, or culvert). Nests are often located in a tall, old, isolated tree or snag in open forest or woodland. Nesting occurs from April to August, with peak activity in June. The pair nests colonially or singly and lays three to eight eggs. It may raise two broods per year. Altricial young are tended by both parents and leave the nest at 24 to 31 days.

The purple martin is an uncommon to rare, local summer resident in a variety of wooded, low-elevation habitats throughout the state, a rare migrant in spring and fall, and absent in winter. The breeding range extends east to Modoc and Lassen counties.

The purple martin uses valley foothill and montane hardwood, valley foothill and montane hardwood-conifer, and riparian habitats, and also occurs in coniferous habitats, including ponderosa pine and Douglas-fir. It is absent from higher slopes of the Sierra Nevada.

Yellow Warbler (*Setophaga petechia*) – SSC
The Project vicinity contains suitable nesting and foraging habitat for this species.

Yellow warbler breeding distribution includes from the coast range in Del Norte County, east to Modoc plateau, south along coast range to Santa Barbara and Ventura counties and along western slope of Sierra Nevada south to Kern County. This species also breeds along eastern side of California from the Lake Tahoe area south through Inyo County, as well as several southern California mountain ranges and throughout most of San Diego County. The yellow warbler winters in Imperial and Colorado River valleys and breeds in riparian woodlands from coastal and desert lowlands up to El. 8,000 feet (2,500 meters) in the Sierra Nevada. Yellow warbler also breed in montane chaparral, and in open ponderosa pine and mixed conifer habitats with substantial amounts of brush. The numbers of breeding pairs have declined dramatically in recent decades in many lowland areas (southern coast, Colorado River, San Joaquin and Sacramento valleys). They are now rare to uncommon in many lowland areas where formerly common (McCaskie et al.

1979; Garrett and Dunn 1981). This species is a common migrant on Channel and Farallon Islands in spring and fall (DeSante and Ainley 1980; Garrett and Dunn 1981). Yellow warblers mostly eat insects and spiders. They glean and hover in upper canopy of deciduous trees and shrubs and occasionally hawk insects from air, or eat berries (Bent 1953; Ehrlich et al. 1988). Yellow warblers are usually found in riparian deciduous habitats in summer: cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland. This species also breeds in montane shrubbery in open conifer forests, which is perhaps a recent phenomenon (Gaines 1977). In migration, this species visits woodland, forest, and shrub habitats. The yellow warbler's nest is an open cup placed 2 to 16 feet (0.6 to 5 meters) above ground in a deciduous sapling or shrub. Their territory often includes tall trees for singing and foraging and a heavy brush understory for nesting (Ficken and Ficken 1966). Yellow warblers frequent open to medium-density woodlands and forests with a heavy brush understory in breeding season. In migration, they can be found in a variety of sparse to dense woodland and forest habitats. This species breeds from mid-April into early August with peak activity in June. A pair breeds solitarily. The yellow warbler lays three to six eggs (usually four or five), incubated by female for 11 days. Altricial young are tended by both parents until fledging at 9 to 12 days (Harrison 1978). The young breed the following year.

Grasshopper Sparrow (*Ammodramus savannarum*) – SSC
The Project vicinity contains suitable nesting and foraging habitat for this species.

The grasshopper sparrow is an uncommon and local summer resident and breeder along the western edge of the Sierra Nevada and most coastal counties south to Baja California. This species occurs in dry, dense grasslands with tall forbs and scattered scrubs for singing perches. In southern California, grasshopper sparrows occur mainly on hillsides and mesas in coastal districts but has bred up to El. 5,000 feet (1,500 meters) in San Jacinto Mountains. They have also has been found in Shasta Valley, Siskiyou County.

Grasshopper sparrows feed on insects and other invertebrates, as well as grass and forb seeds. They forage on the ground within relatively dense grasslands. Dense grasslands are also essential for concealment for this species, as well as nesting habitat. Grasshopper sparrows breed from early April to mid-July, with peak in May and June. A pair nests solitarily and clutch size is about four to five eggs.

Bullock's Oriole (*Icterus bullockii*) – BCC
The Project vicinity contains suitable nesting and foraging habitat for this species.

The Bullock's oriole is a summer resident in California, nesting mostly in valley foothill riparian, valley foothill hardwood and montane-conifer habitats, and other montane

habitats. Riparian deciduous trees and oaks are often the preferred species in which to build nests. Bullock's orioles migrate to Mexico and Central America during the fall. The breeding season spans from early April to late July. Nests are constructed in tree foliage, either solitarily or sometimes in colonies (Pleasants 1979; Airola 1980). Incubation lasts about 14 days and young also fledge in 14 days (Terres 1980). Bullock's orioles feed on insects and spiders, but also forage on berries, fruits, and nectar (Martin et al. 1961). This species is sometimes seen at hummingbird feeders.

Cassin's Finch (*Haemorhous cassinii*) – BCC
The Project vicinity contains suitable foraging habitat for this species.

Cassin's finches breed in the higher mountain ranges of California in tall, open lodgepole pine, red fir, and subalpine conifer habitats. The species is often seen near wet meadows and grassy openings. Cassin's finches commonly winter on relatively arid eastern slopes. This species feeds on grasses and forbs, conifer buds and seeds, and insects and berries (Salt 1952). Pairs build a nest high in tall conifers near the end of branches. A social species, the Cassin's finch is often seen in loose flocks all year.

Spotted Bat (*Euderma maculatum*) – SSC
The Project vicinity contains suitable roosting and foraging habitat for this species.

The spotted bat is found mostly in foothills, mountains, and desert regions of southern California (Watkins 1977). Other habitats include arid deserts, grasslands, and mixed conifer forests. Elevational range extends from below sea level in California to above El. 10,000 feet (3,000 m) in New Mexico (Black and Cosgriff 1999).

This species mainly feeds on moths and occasionally beetles. The spotted bat feeds in flight, over water, and near the ground, using echolocation to find prey. Spotted bats prefer to roost in rock crevices and are occasionally found in caves and buildings. Cliffs provide optimal roosting habitat for spotted bats.

This species mates in autumn. Most births occur before mid-June. Females lactate from June to August, with one young produced per year.

Sierra Nevada Mountain Beaver (*Aplodontia rufa californica*) – SSC
The Project vicinity contains suitable habitat for this species.

Sierra Nevada mountain beavers are found throughout the Sierra Nevada, often in scattered populations within dense riparian-deciduous and open, brushy stages of forests. This species prefers areas with a dense understory near water, with deep, friable soils for burrowing. Sierra Nevada mountain beaver feeds on a variety of vegetation types,

which is then stored near a burrow entrance or underground (Maser et al. 1981). This species breeds from December through March.

American Badger (*Taxidea taxus*) – SSC
The Project vicinity contains suitable habitat for this species.

The American badger is an uncommon, permanent resident found throughout most of the state, except in the northern North Coast area (Grinnell et al. 1937). They are most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Badgers are carnivorous. They eat fossorial rodents: rats, mice, chipmunks, and especially ground squirrels and pocket gophers. This species also eats some reptiles, insects, earthworms, eggs, birds, and carrion. Their diet shifts seasonally and yearly in response to availability of prey.

Badgers dig burrows in friable soil for cover. American badgers frequently reuse old burrows, although some may dig a new den each night, especially in summer (Messick and Hornocker 1981). Their young are born in burrows dug in relatively dry, often sandy, soil, usually in areas with sparse overstory cover. Suitable habitat for badgers is characterized by herbaceous, shrub, and open stages of most habitats with dry, friable soils.

Figure II-G.1-1 shows the location of special-status plants and Figure II-G.1-2 the location of special-status wildlife that occur in the vicinity of the Project and within 1 mile of the FERC Project boundary.

G.1.3.3 REFERENCES

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G.2. COMMON WILDLIFE SPECIES, CWHR WILDLIFE HABITATS, AND GAME SPECIES

Table II-G.2-1. Common wildlife species and CWHR wildlife habitats.

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Amphibians																						
Aneides lugubris Arboreal salamander					X	X	X	X		X	X											
Batrachoseps attenuatus California slender salamander	X				X	X	X		X	X	X										X	
Batrachoseps diabolicus Hell hollow slender salamander	X	X		X	X	X	X	X	X	X	X		X									
Ensatina eschscholtzii Ensatina			X		X	X	X	X	X	X	X											
Taricha sierrae Sierra newt	X		X		X	X	X	X	X	X	X	X	X									
Anaxyrus boreas halophilus California toad	X		X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X
Lithobates catesbeianus American bullfrog	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Pseudacris (Hyla) sierra Sierran treefrog	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X
Reptiles																						
Trachemys scripta elegans Red-eared slider												X		X								
Sceloporus occidentalis Western fence lizard	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X
Plestiodon gilberti Gilbert's skink	X	X	X	X	X	X	X	X	X	X	X						X	X				X
Aspidoscelis tigris Tiger whiptail	X			X	X	X	X	X	X	X	X											
Elgaria multicarinata Southern alligator lizard	X	X	X	X	X	X	X	X		X	X						X	X	X		X	X
Elgaria coerulea Northern alligator lizard	X		X				X	X	X	X												
Diadophis punctatus Ring-necked snake	X	X		X	X	X	X	X	X	X	X										X	
Contia tenuis Common sharp-tail snake			X		X	X	X	X	X	X	X											

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Coluber constrictor North American racer	X	X	X	X	X	X	X	X	X	X	X						X	X		X		
Masticophis lateralis California whipsnake			X	X	X	X	X	X	X	X	X											
Pituophis catenifer Gopher snake	X	X		X	X	X	X	X	X	X	X		X				X	X	X	X	X	X
Lampropeltis californiae California kingsnake	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X
Lampropeltis zonata California mountain kingsnake	X		X		X	X	X	X	X	X	X											
Thamnophis couchii Sierra garter snake	X		X	X	X	X	X	X	X	X	X	X	X									
Thamnophis elegans Terrestrial garter snake	X		X		X	X	X	X	X	X	X	X	X	X								

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Thamnophis sirtalis Common garter snake	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X		X
Crotalus oreganus oreganus Northern Pacific rattlesnake	X	X	X	X	X	X	X	X	X	X	X				X						X	
Birds																						
Podilymbus Podiceps Pied-billed grebe												X	X	X								
Podiceps auritus Horned grebe												X	X	X								
Podiceps nigricollis Eared grebe												X										
Nannopterum auritum Double-crested cormorant										X		X	X	X	X							
Ardea alba Great egret	X		X			X	X		X	X	X	X	X	X					X	X	X	X
Ardea herodias Great blue heron	X		X			X	X	X	X	X	X	X	X	X					X	X	X	
Botaurus lentiginosus American bittern												X	X	X								

Common Wildlife	CWHR Wildlife Habitat																			
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other					
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Bubulcus ibis Cattle egret	X					X	X			X	X	X	X						X	X	X	
Egretta thula Snowy egret			X							X		X	X	X					X	X	X	
Butorides virescens Green heron						X	X	X	X	X	X	X	X	X			X				X	
Nycticorax nycticorax Black-crowned night heron			X		X	X	X	X	X			X	X	X							X	
Plegadis chihi White faced ibis	X		X									X	X	X					X	X		
Grus canadensis Sandhill crane	X		X							X		X	X						X	X		
Cygnus columbianus Tundra swan	X		X									X	X	X					X	X		
Cygnus olor Mute swan			X									X	X									
Anser albifrons Greater white-fronted goose	X		X									X	X	X					X	X		
Anser caerulescens Snow goose	X		X									X	X	X					X	X		
Anser rossii Ross's goose	X		X									X	X	X					X	X		

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Branta canadensis Canada goose	X		X									X	X	X					X	X	X	
Branta hutchinsii Cackling goose	X		X									X	X	X					X	X	X	
Aix sponsa Wood duck						X	X	X	X	X	X	X	X	X					X		X	
Anas acuta Northern pintail	X		X									X	X	X					X	X	X	
Anas crecca Green-winged teal	X		X									X	X	X					X	X	X	
Anas cyanoptera Cinnamon teal	X		X									X	X	X					X	X		
Anas platyrhynchos Mallard	X		X						X	X		X	X	X					X	X	X	
Mareca americana American wigeon	X		X									X	X	X					X	X	X	
Mareca penelope Eurasian wigeon	X											X	X	X							X	
Mareca strepera Gadwall	X		X									X	X	X					X	X		
Spatula clypeata Northern shoveler	X		X									X	X						X	X		
Spatula discors Blue-winged teal	X		X									X	X						X	X		

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Aythya affinis Lesser scaup	X		X									X	X	X					X	X		
Aythya collaris Ring-necked duck												X	X									
Aythya marila Greater scaup												X										
Aythya valisineria Canvasback												X	X	X								
Bucephala albeola Bufflehead										X		X	X									
Bucephala clangula Common goldeneye												X		X								
Lophodytes cucullatus Hooded merganser										X		X	X	X							X	
Mergus merganser Common merganser			X							X		X	X	X							X	
Mergus serrator Red-breasted merganser												X										
Oxyura jamaicensis Ruddy duck										X		X	X									

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Cathartes aura Turkey vulture	X		X	X	X	X	X	X	X	X	X	X		X	X					X	X	
Pandion haliaetus Osprey	X		X		X	X	X	X	X	X	X	X	X	X	X				X	X		
Accipiter striatus Sharp-shinned hawk	X		X	X	X	X	X	X	X	X	X								X	X	X	
Astur cooperii Cooper's hawk	X			X	X	X	X	X	X	X	X						X	X	X	X	X	X
Buteo jamaicensis Red-tailed hawk	X	X	X	X	X	X	X	X	X	X	X		X		X					X	X	
Buteo lagopus Rough-legged hawk	X	X	X			X	X			X	X		X		X					X		
Buteo lineatus Red-shouldered hawk	X		X			X	X	X	X	X	X		X				X			X	X	
Buteo regalis Ferruginous hawk	X	X	X	X		X	X			X	X		X		X					X		
Falco columbarius Merlin	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X
Falco mexicanus Prairie falcon	X		X	X	X	X	X	X	X	X	X		X		X				X	X	X	X
Falco peregrinus Peregrine falcon	X		X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	

Common Wildlife	CWHR Wildlife Habitat																			
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other					
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Falco sparverius American kestrel	X		X	X	X	X	X	X	X	X	X				X		X	X	X	X	X	X
Alectoris chukar Chukar	X								X	X										X		
Phasianus colchicus Ring-necked pheasant	X		X		X	X				X			X				X		X	X	X	X
Dendragapus fuliginosus Sooty grouse	X							X	X													
Meleagris gallopavo Wild turkey	X		X	X	X	X	X	X	X	X	X									X		
Callipepla californica California quail	X		X	X	X	X	X	X	X	X	X						X	X	X	X	X	X
Oreortyx pictus Mountain quail	X		X	X	X	X		X	X		X											
Porzana carolina Sora			X										X									
Rallus limicola Virginia rail			X						X	X			X									
Fulica americana American coot	X		X									X	X	X					X	X	X	
Gallinula galeata Common gallinule												X	X	X					X		X	

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Charadrius vociferus Killdeer	X		X			X	X					X	X	X	X				X	X	X	
Pluvialis squatarola Black-bellied plover	X		X									X	X	X	X				X	X		
Himantopus mexicanus Black-necked stilt			X									X	X	X	X				X	X		
Recurvirostra americana American avocet			X									X	X	X	X				X	X		
Actitis macularius Spotted sandpiper	X		X							X		X	X	X	X					X		
Calidris alba Sanderling												X		X								
Calidris alpina Dunlin			X									X	X	X	X				X	X		
Calidris mauri Western sandpiper			X									X	X	X	X				X	X		
Calidris minutilla Least sandpiper			X									X	X	X	X				X	X		
Gallinago delicata Wilson's snipe			X							X		X	X	X					X	X		

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Limnodromus griseus Short-billed dowitcher			X									X	X	X	X				X	X		
Limnodromus scolopaceus Long-billed dowitcher			X									X	X	X	X				X			
Numenius americanus Long-billed curlew	X		X							X		X	X	X	X					X		
Numenius phaeopus Whimbrel	X		X									X	X	X	X				X	X		
Phalaropus tricolor Wilson's phalarope	X		X									X		X								
Tringa melanoleuca Greater yellowlegs			X							X		X	X	X					X	X		
Chroicocephalus philadelphia Bonaparte's gull												X	X	X					X	X		
Larus argentatus Herring gull												X		X	X				X	X		
Larus canus Mew gull												X		X	X				X	X	X	

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Larus delawarensis Ring-billed gull	X		X									X	X	X					X	X	X	
Larus glaucescens Glaucous-winged gull															X				X	X		
Larus glaucoides thayeri Thayer's gull												X			X							
Hydroprogne caspia Caspian tern												X	X	X	X							
Sterna forsteri Forster's tern										X		X	X	X	X							
Sterna hirundo Common tern												X	X	X	X							
Columba livia Rock pigeon	X																X		X	X	X	X
Patagioenas fasciata Band-tailed pigeon						X	X	X	X	X	X							X	X		X	X
Streptopelia decaocto Eurasian collared-dover	X																		X	X	X	
Zenaida macroura Mourning dove	X			X	X	X	X	X	X	X	X						X	X	X	X	X	X

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Geococcyx californianus Greater roadrunner				X	X	X	X				X						X		X	X	
Aegolius acadicus Northern saw-whet owl			X		X	X	X	X	X	X	X						X			X	X	
Bubo virginianus Great horned owl	X		X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X
Glaucidium gnoma Northern pygmy-owl			X	X	X	X	X	X	X	X	X						X			X	X	
Psiloscops flammeolus Flammulated owl								X	X													
Tyto alba Barn owl	X		X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X
Chordeiles acutipennis Lesser nighthawk	X		X			X	X			X	X	X	X	X	X		X	X	X	X		X
Chordeiles minor Common nighthawk	X		X	X	X	X	X	X		X	X		X		X				X	X	X	
Phalaenoptilus nuttallii Common poorwill	X		X	X		X	X				X			X	X		X		X	X		

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Aeronautes saxatalis White-throated swift	X		X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X
Archilochus alexandri Black-chinned hummingbird				X	X	X	X			X	X						X				X	
Calypte anna Anna's hummingbird				X	X	X	X	X	X	X	X						X	X			X	X
Selasphorus rufus Rufous hummingbird			X	X	X	X	X	X	X	X	X										X	
Megaceryle alcyon Belted kingfisher			X							X		X	X	X	X							
Colaptes auratus Northern flicker	X			X	X	X	X	X	X	X	X						X	X			X	X
Dryobates pubescens Downy woodpecker	X		X	X	X	X	X	X	X	X	X						X				X	
Dryocopus pileatus Pileated woodpecker						X		X	X													
Melanerpes lewis Lewis' woodpecker	X		X		X	X	X	X	X	X	X						X					

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Melanerpes formicivorus Acorn woodpecker						X	X	X	X	X	X										X	
Leuconotopicus villosus Hairy woodpecker				X	X	X	X	X	X	X	X											
Sphyrapicus ruber Red-breasted sapsucker				X		X	X	X	X	X	X						X				X	
Contopus sordidulus Western wood-pewee					X	X	X	X	X	X	X						X			X	X	
Empidonax difficilis Pacific-slope flycatcher					X	X	X	X	X	X	X						X				X	
Empidonax hammondii Hammond's flycatcher						X	X	X	X	X	X										X	
Empidonax oberholseri Dusky flycatcher				X	X	X	X	X	X	X	X											
Myiarchus cinerascens Ash-throated flycatcher				X	X	X	X	X		X	X									X		

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Sayornis nigricans Black phoebe	X			X	X	X	X	X				X	X		X		X	X	X	X	X	X
Sayornis saya Say's phoebe	X			X	X	X	X	X		X	X				X					X		
Tyrannus verticalis Western kingbird	X		X	X	X	X	X	X		X	X		X				X			X	X	X
Eremophila alpestris Horned lark	X		X			X	X			X	X				X					X		
Hirundo rustica Barn swallow	X		X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X
Petrochelidon pyrrhonota Cliff swallow	X		X	X	X	X	X		X	X		X	X	X			X		X	X	X	X
Stelgidopteryx serripennis Northern rough-winged swallow	X		X		X	X	X	X	X	X	X	X	X	X	X				X	X	X	X
Tachycineta bicolor Tree swallow	X		X		X	X	X	X	X	X	X		X	X			X		X	X	X	
Tachycineta thalassina Violet-green swallow	X		X	X	X	X	X	X	X	X	X		X	X	X				X	X	X	X

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Aphelocoma californica California scrub jay				X	X	X	X	X	X	X	X						X			X	X	
Cyanocitta stelleri Steller's jay					X	X	X	X	X	X	X						X				X	
Corvus brachyrhynchos American crow	X					X	X	X	X	X	X	X					X	X	X	X	X	X
Corvus corax Common raven	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	
Poecile gambeli Mountain chickadee					X	X	X	X	X	X	X						X				X	
Poecile rufescens Chestnut-backed chickadee					X	X	X	X	X	X	X										X	
Psaltriparus minimus Bushtit				X	X	X	X	X	X	X	X										X	
Sitta canadensis Red-breasted nuthatch						X	X	X	X	X	X										X	
Sitta carolinensis White-breasted nuthatch				X		X	X	X	X	X	X										X	
Sitta pygmaea Pygmy nuthatch																					X	

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Certhia americana Brown creeper						X	X	X	X	X	X										X	
Catherpes mexicanus Canyon wren					X	X				X					X							
Cistothorus palustris Marsh wren			X						X	X			X							X		
Salpinctes obsoletus Rock wren				X	X	X	X	X		X	X				X							
Thryomanes bewickii Bewick's wren				X	X	X	X	X	X	X	X						X				X	
Troglodytes aedon Northern house wren			X	X	X	X	X	X	X	X	X						X				X	
Troglodytes pacificus Pacific wren									X	X											X	
Cinclus mexicanus American dipper									X	X		X			X						X	
Regulus calendula Ruby-crowned kinglet				X	X	X	X	X	X	X	X						X			X	X	

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Regulus satrapa Golden-crowned kinglet				X	X	X	X	X													X	
Polioptila caerulea Blue-gray gnatcatcher				X	X	X	X	X		X	X											
Sialia currucoides Mountain bluebird			X			X	X		X	X	X								X	X		
Sialia mexicana Western bluebird	X		X	X	X	X	X	X	X	X	X						X			X	X	
Myadestes townsendi Townsend's solitaire				X	X	X		X	X													
Catharus guttatus Hermit thrush				X	X	X	X	X	X	X	X						X				X	
Catharus ustulatus Swainson's thrush			X	X	X	X	X	X	X	X	X						X				X	
Ixoreus naevius Varied thrush			X	X	X	X	X	X	X	X	X										X	
Turdus migratorius American robin	X		X	X	X	X	X	X	X	X	X						X		X	X	X	

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Mimus polyglottos Northern mockingbird	X			X	X	X	X			X	X						X	X	X	X	X	X
Anthus rubrescens American pipit	X		X							X		X	X	X	X					X	X	
Bombycilla cedrorum Cedar waxwing				X	X	X	X	X	X	X	X						X	X			X	X
Phainopepla nitens Phainopepla				X	X	X	X	X		X	X										X	X
Sturnus vulgaris European starling	X		X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Vireo cassinii Cassin's vireo					X	X	X	X	X	X	X										X	
Vireo gilvus Warbling vireo				X	X	X	X	X	X	X	X						X				X	
Vireo huttoni Hutton's vireo				X	X	X	X	X	X	X	X						X				X	
Cardellina pusilla Wilson's warbler				X	X	X	X	X	X		X	X									X	X
Geothlypis tolmiei MacGillivray's warbler			X	X	X	X		X	X	X											X	
Leiothlypis celata Orange-crowned warbler				X	X	X	X	X	X	X	X						X				X	

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Leiothlypis ruficapilla Nashville warbler				X	X	X	X	X	X	X	X						X				X	
Setophaga coronata Yellow-rumped warbler	X		X	X	X	X	X	X	X	X	X		X				X		X	X	X	X
Setophaga nigrescens Black-throated gray warbler				X	X	X	X	X	X	X	X						X				X	
Setophaga occidentalis Hermit warbler						X	X	X	X	X	X										X	
Setophaga townsendi Townsend's warbler				X	X	X	X	X	X	X	X						X				X	
Piranga ludoviciana Western tanager				X	X	X	X	X	X	X	X						X				X	
Passerina amoena Lazuli bunting			X	X	X	X	X	X	X	X	X						X					
Passerina caerulea Blue grosbeak	X								X								X		X	X		

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Pheucticus melanocephalus Black-headed grosbeak				X	X	X	X	X	X	X	X						X				X	
Pipilo maculatus Spotted towhee				X	X	X	X	X	X	X	X						X				X	
Melozone crissalis California towhee				X	X	X	X	X	X	X	X						X				X	
Aimophila ruficeps Rufous-crowned sparrow	X			X	X	X				X												
Chondestes grammacus Lark sparrow	X		X	X	X	X	X	X		X	X						X			X		
Melospiza lincolnii Lincoln's sparrow	X		X			X	X	X	X	X	X		X				X		X	X	X	
Melospiza melodia Song sparrow	X		X	X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	
Passerella iliaca Fox sparrow				X	X	X	X	X	X	X	X						X				X	
Pooecetes gramineus Vesper sparrow	X				X	X	X				X									X		
Spizella passerina Chipping sparrow	X		X	X	X	X	X	X	X	X	X						X					

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Zonotrichia albicollis White-throated sparrow			X	X	X	X	X	X	X		X	X						X			X	X
Zonotrichia atricapilla Golden-crowned sparrow	X		X	X	X	X	X	X	X	X	X						X			X	X	
Zonotrichia leucophrys White-crowned sparrow	X		X	X	X	X	X	X	X	X	X						X			X	X	X
Junco hyemalis Dark-eyed junco			X	X	X	X	X	X	X	X	X						X			X	X	
Agelaius phoeniceus Red-winged blackbird	X		X						X	X			X				X			X	X	
Euphagus cyanocephalus Brewer's blackbird	X		X			X	X	X	X	X	X	X	X	X			X		X	X	X	X
Molothrus ater Brown-headed cowbird	X		X	X	X	X	X	X	X	X	X		X				X		X	X	X	
Quiscalus mexicanus Great-tailed grackle												X	X	X					X	X	X	

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Sturnella neglecta Western meadowlark	X		X	X	X	X	X	X		X	X								X	X	X	
Icterus cucullatus Hooded oriole										X							X	X			X	
Haemorhous mexicanus House finch	X		X	X	X	X	X	X	X	X	X						X		X	X	X	X
Haemorhous purpureus Purple finch			X		X	X	X	X	X	X							X				X	
Spinus pinus Pine siskin	X		X	X	X	X	X	X	X	X	X						X			X	X	
Spinus psaltria Lesser goldfinch	X		X	X	X	X	X	X	X	X	X						X			X	X	X
Spinus tristis American goldfinch	X		X		X	X	X	X	X	X	X						X			X	X	
Passer domesticus House sparrow						X	X			X	X						X		X	X	X	
Mammals																						
Didelphis virginiana Virginia opossum	X	X	X		X	X	X	X	X	X	X						X	X	X	X	X	X
Scapanus latimanus Broad-footed mole	X	X	X			X	X	X	X	X	X						X	X	X	X		X

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Eptesicus fuscus Big brown bat	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X
Lasiurus cinereus Hoary bat	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X
Myotis californicus California myotis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Myotis ciliolabrum Western small-footed myotis	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X
Myotis thysanodes Fringed myotis	X	X		X	X	X	X	X	X	X	X	X		X	X				X	X	X	
Myotis volans Long-legged myotis	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X
Myotis yumanensis Yuma myotis	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X
Parastrellus hesperus Canyon bat	X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X	X	X
Tadarida brasiliensis Brazilian free-tailed bat	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X

Common Wildlife	CWHR Wildlife Habitat																			
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other					
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Sylvilagus audubonii Audubon's cottontail	X	X	X	X	X	X	X	X	X								X	X	X	X	X	X
Sylvilagus bachmani Brush rabbit	X	X		X	X	X	X	X	X	X	X						X	X	X	X	X	X
Lepus californicus Black-tailed jackrabbit	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X
Ostospermophilus beecheyi California ground squirrel	X	X	X	X	X	X	X	X	X	X	X				X		X	X	X	X	X	X
Sciurus carolinensis Eastern gray squirrel										X							X	X			X	
Sciurus griseus Western gray squirrel					X	X	X	X	X	X	X						X	X				X
Sciurus niger Eastern fox squirrel							X			X							X	X			X	X
Dipodymys heermanni Heermann's kangaroo rat	X	X	X		X	X	X	X	X		X											

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Thomomys bottae Botta's pocket gopher	X	X	X	X	X	X	X	X	X	X	X				X		X	X	X	X	X	X
Chaetodipus californicus California pocket mouse	X			X	X	X	X	X			X											
Perognathus inornatus San Joaquin pocket mouse	X	X			X		X				X				X							
Castor canadensis American beaver	X		X				X	X		X	X	X	X	X								
Mus musculus House mouse	X	X	X	X	X	X	X			X	X		X				X	X	X	X	X	X
Peromyscus boylii Brush mouse	X			X	X	X	X	X	X	X	X											
Peromyscus maniculatus Deer mouse	X	X	X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X
Peromyscus truei Pinyon mouse	X		X	X	X			X	X	X												
Reithrodontomys megalotis Western harvest mouse	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X		X

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Neotoma fuscipes Dusky-footed woodrat			X	X	X	X	X	X	X	X	X											
Neotoma macrotis Big-eared woodrat			X	X	X	X	X	X	X	X	X											
Microtus californicus California vole	X	X	X		X	X	X	X	X	X	X		X				X	X	X	X	X	X
Ondatra zibethicus Common muskrat			X						X	X		X	X	X								
Rattus norvegicus Norway rat		X				X	X		X	X	X						X	X	X	X	X	X
Rattus rattus Black rat						X	X			X	X						X	X	X	X	X	X
Erethizon dorsatum Common porcupine			X		X	X	X	X	X	X	X		X				X	X	X	X		X
Canis latrans Coyote	X	X	X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X
Vulpes vulpes Red fox	X	X	X	X	X				X								X	X	X	X		X
Urocyon cinereoargenteus Gray fox	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X

Common Wildlife	CWHR Wildlife Habitat																				
	Herb-Dominated Habitats			Shrub-Dominated Habitats		Tree-Dominated Habitats						Aquatic Habitats			Other						
Scientific Name/ Common Name	Annual Grassland	Pasture	Wet Meadow	Chamise Redshank Chaparral	Mixed Chaparral	Blue Oak-Foothill Pine	Blue Oak Woodland	Montane Hardwood	Montane Riparian	Valley Foothill Riparian	Valley Oak Woodland	Lacustrine	Fresh Emergent Wetland	Riverine	Barren	Cropland	Deciduous Orchard	Evergreen Orchard	Irrigated Grain Crops	Irrigated Hayfield	Urban	Vineyard
Ursus americanus Black bear	X	X	X	X	X	X		X	X	X		X		X			X	X	X	X		X
Procyon lotor Raccoon	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X
Mustela frenata Long-tailed weasel	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X
Neogale vison American mink									X	X		X	X	X								
Mephitis mephitis Striped skunk	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X
Spilogale gracilis Western spotted skunk	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X
Lontra canadensis Northern river otter			X						X	X		X	X	X								
Puma concolor Mountain lion	X	X	X	X	X	X	X	X	X	X	X						X	X				X
Lynx rufus Bobcat	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X		X
Sus scrofa Wild pig	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X		X
Odocoileus hemionus Mule deer	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X

Table II-G.2-2. Game species potentially occurring in the vicinity of the Lower Mokelumne River Project.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Resident Game Birds						
Phasianus colchicus Ring-necked pheasant	—	Common to uncommon introduced species. Occurs in scattered locations throughout the state, centered in the Central Valley. Dependent on crop lands with adjacent herbaceous and woody cover; also in perennial grasslands with sufficient cover.	General: November 8 – December 21	2 males per day for first two days of the season; 3 males per day after the first two days of the season.	Triple the daily bag limit	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Meleagris gallopavo Wild turkey	—	Found mostly in deciduous riparian, oak, and conifer-oak woodlands. Prefers rugged, hilly terrain with low to intermediate canopy, interspersed with numerous grass/forb openings, near water.	Fall season: November 8 – December 7 Spring Season : March 28 – May 3	Fall Season: 1 either-sex turkey per day. Spring Season: 1 bearded turkey per day	Fall Season: 2 per season Spring Season: 3 per season, combined	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Callipepla californica California quail	—	Common, permanent resident of low and middle elevations. Found in shrub, scrub, and brush, open stages of conifer and deciduous habitats, and margins of grasslands and croplands.	Zones Q3: October 18 – January 25	10 per day	Triple the daily bag limit	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Alectoris chukar Chukar	—	Chukar naturally inhabit high elevation scrublands between 4,000 and 13,000 ft on rocky hillsides, barren plateaus or deserts. Within the project area Chukar are released as a game species at the Camanche Hills Hunting Preserve.	General: October 18 – January 25	6 per day	Triple the daily bag limit	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Migratory Game Birds						
Gallinago delicata Wilson's snipe	—	Fairly common winter visitor from October to April on wet meadow and short, emergent wetland habitats throughout much of California.	October 18 – February 1	8 per day	Triple the daily bag limit	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Columba fasciata Band-tailed pigeon	—	Common resident in hardwood and hardwood-conifer habitats. Inhabits lower slopes of major mountain ranges of the state.	The third Saturday in December extending for 9 consecutive days	2 per day	Triple the daily bag limit	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Zenaida macroura Mourning dove	—	Open woodlands, grasslands, croplands, open hardwood, hardwood-conifer, riparian, low-elevation conifer, and deserts all provide adequate habitat. Requires a nearby water source.	September 1–15 and November 8–December 22	15 doves, up to 10 may be white winged	Triple the daily bag limit	Hunting license and upland game bird tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Streptopelia decaocto Eurasian collard dove	—	A common non-native dove that inhabits primarily residential areas and farmlands but may also be found on the edges of woodlands or open fields.	All year	No limit	No limit	Hunting license is required. Exotic game may only be taken by rifles using centerfire cartridges with softnose or expanding projectiles; bow and arrow; or wheellock, matchlock, flintlock or percussion type, including "in-line" muzzleloading rifles using black powder or equivalent black powder substitute, including pellets, with a single projectile loaded from the muzzle and at least .40 caliber in designation. Shotguns holding three shells or less may also be used.
Dendragapus fuliginosus Sooty grouse	—	Uncommon to common permanent resident at middle to high elevations. Occurs in open, medium to mature-aged stands of fir, Douglas-fir, and other conifer habitats, interspersed with medium to large openings, and available water. Inhabits North Coast Ranges in northwestern California, and the Klamath, Sierra Nevada, and portions of the Warner and White Mts.	General: September 13 – October 13	2 per day	Triple the daily bag limit	Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used. Only arrows or crossbow bolts with flu-flu fletching may be used. Dogs may be used to take and retrieve migratory game birds.
Aix sponsa Wood duck	—	An uncommon yearlong resident, occurring mainly in Central Valley, and in Coast Ranges of central California. Inhabits lacustrine and slow-moving riverine habitats bordered by trees or other tall vegetation, and preferably by emergent vegetation as well. Prefers aquatic habitats bordered by deciduous trees such as willows, cottonwoods, and oaks.	October 18 – January 28	7 per day	Triple the daily bag limit	Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used. Only arrows or crossbow bolts with flu-flu fletching

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Anas acuta Northern pintail	—	An abundant waterfowl species in California, using lacustrine, estuarine, fresh and salt emergent wetlands, croplands, pastures, grasslands, and meadows. Breeds in small numbers in California. Prefers open habitats for nesting with cover of low vegetation.	October 18 – January 28	3 per day	Triple the daily bag limit	may be used. Dogs may be used to take and retrieve migratory game birds.
Anas crecca Green-winged teal	—	Common winter resident of the Central Valley, northeastern, and coastal California. Found in lacustrine and slow-moving riverine habitats, with borders of fresh emergent wetlands, grasslands, wet meadows, croplands, or pastures. Breeding only recorded I northeastern California.	October 18 – January 28	7 per day	Triple the daily bag limit	
Anas cyanoptera Cinnamon teal	—	Common breeding and migratory resident of California. Nests in lowlands in freshwater habitats with dense emergent vegetation or grass. Forages in lacustrine, slow riverine, and fresh emergent wetland habitats on small bodies of water with marshy borders	October 18 – January 28	7 per day	Triple the daily bag limit	
Anas platyrhynchos Mallard	—	Common resident and migrant, found throughout the state in fresh emergent wetlands, estuarine, lacustrine, riverine, ponded, pastures, croplands, and park habitats. Nests in dense herbaceous vegetation within walking distance of aquatic habitat.	October 18 – January 28	7 per day, no more than 2 females	Triple the daily bag limit	

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Mareca americana American wigeon	—	Common migrant and winter resident in lacustrine and fresh emergent wetland habitat with adjacent grassland and cropland habitats. Nesting in the Central Valley is rare, with nests being placed in dense vegetation near open water.	October 18 – January 28	7 per day	Triple the daily bag limit	Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used. Only arrows or crossbow bolts with flu-flu fletching may be used. Dogs may be used to take and retrieve migratory game birds.
Spatula clypeata Northern shoveler	—	Common winter resident and migrant, but a rare nester, in California. Found in shallow freshwater lacustrine habitats, less commonly on the coasts. Nests on dry sites near water in low grasses.	October 18 – January 28	7 per day	Triple the daily bag limit	
Spatula discors Blue-winged teal	—	An uncommon winter resident and migrant in the Central Valley and southern California coastal areas. A rare breeder in the Central Valley. Prefers lacustrine, estuarine, and emergent wetland habitats and nests in agricultural fields.	October 18 – January 28	7 per day	Triple the daily bag limit	
Aythya affinis Lesser scaup	—	Found on estuarine and lacustrine habitats in California during winter and on migration. Does not breed in California.	October 18 – January 28	2 per day	Triple the daily bag limit	
Aythya americana Redhead	SSC	Found in lacustrine habitats during the summer, also found in Central Valley foothills and coastal lowlands. Nests in freshwater emergent wetlands bordering open water.	October 18 – January 28	2 per day	Triple the daily bag limit	
Aythya collaris Ring-necked duck	—	A fairly common winter resident throughout most of California, preferring freshwater lacustrine habitats; breeds rarely in northeastern California.	October 18 – January 28	2 per day	Triple the daily bag limit	

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Aythya marila Greater scaup	—	Common winter resident on bays, estuaries, and emergent wetlands, most abundant on the coast, but can be found on inland lakes in the Central Valley on migration.	October 18 – January 28	2 per day	Triple the daily bag limit	
Aythya valisinera Canvasback	—	A winter resident and migrant on estuarine and lacustrine habitats along the coast and in the Central Valley. Rare breeder in northeastern California on aquatic vegetation within ponds, wetlands, or lakes.	October 18 – January 28	2 per day	Triple the daily bag limit	
Buchephala albeola Bufflehead	—	A common winter resident in coastal California and the Central Valley. Prefers estuarine and lacustrine habitats. Breeds in the Cascade ranges and nests are placed in tree cavities or nest boxes	October 18 – January 28	7 per day	Triple the daily bag limit	
Bucephala clangula Common goldeneye	—	A winter resident in coastal California and the Central Valley. Prefers estuarine and lacustrine waters, sometimes riverine habitats. This species does not nest in California.	October 18 – January 28	7 per day	Triple the daily bag limit	
Oxyura jamaicensis Ruddy duck	—	A common to abundant yearlong resident throughout much of California, excluding the southern deserts and the Sierra Nevada. Prefers estuarine (bays, salt ponds) and lacustrine habitats, and occasionally found on marine waters near shore. Nests in fresh emergent wetland bordering lacustrine habitats.	October 18 – January 28	7 per day, which may include: 7 mallards (no more than 2 females), 3 pintail, 2 canvasback, 2 redheads, 2 scaup.	Triple the daily bag limit	

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Lophodytes cucullatus Hooded merganser	—	Fairly common October through April in the Central Valley, Coast, Transverse, Peninsular, Klamath, and Cascade Ranges, and Modoc Plateau, and locally along the Colorado River and Salton Sea. Occurs usually on fresh or brackish water.	October 18 – January 28	7 per day, which may include: 7 mallards (no more than 2 females), 3 pintail, 2 canvasback, 2 redheads, 2 scaup.	Triple the daily bag limit	Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used. Only arrows or crossbow bolts with flu-flu fletching may be used. Dogs may be used to take and retrieve migratory game birds.
Mergus merganser Common merganser	—	Uncommon to locally common breeder on lakes, ponds, and large streams of the Coast, Klamath, Cascade, and Sierra Nevada Ranges. Winters in small flocks on large, fresh waters in the Coast, Klamath, and Cascade Ranges, and foothills of the Sierra Nevada. Also occurs in the Central Valley, Modoc Plateau, Transverse, and Peninsular Ranges in nonbreeding seasons. Found commonly on the Colorado River November through April, and uncommonly on the Salton Sea.	October 18 – January 28	7 per day, which may include: 7 mallards (no more than 2 females), 3 pintail, 2 canvasback, 2 redheads, 2 scaup.	Triple the daily bag limit	
Mergus serrator Red-breasted merganser	—	Common resident October through April on coastal bays, estuaries, and along rocky inshore coastal areas. Occurs in smaller numbers near offshore islands and, primarily in April, on large inland lakes and rivers below 1200 m (3900 ft). Rare to uncommon in California May to September. Common along Colorado River April and October (Cogswell 1977). Occurs erratically on Salton Sea at any season.	October 18 – January 28	7 per day, which may include: 7 mallards (no more than 2 females), 3 pintail, 2 canvasback, 2 redheads, 2 scaup.	Triple the daily bag limit	

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Anser albifrons Greater white-fronted goose	—	A common winter visitor to the Central Valley of California. It is found in moist and wet grasslands, pastures, croplands, meadows, fresh emergent wetlands, lacustrine habitat and, less commonly, in estuarine and saline (brackish) emergent habitats. In the Central Valley, abundant October to March and fairly common September, April, and early May.	Early Season: (Large Canada geese only) September 27 – 29 Regular Season: October 18 – January 25 Late Season: Canadian Geese February 14 – 15 Whitefronts and White geese February 14 – 18	30/day, which may include: 20 white geese, 10 dark geese	Triple the daily bag limit	
Anser caerulescens Snow goose	—	An abundant winter resident found primarily in the Central Valley. Preferred habitats are fresh emergent wetlands, adjacent lacustrine waters, and nearby wet croplands, pastures, meadows, and grasslands. Occasionally found in saline (brackish) emergent wetlands and adjacent estuarine waters.	Early Season: (Large Canada geese only) September 27 – 29 Regular Season: October 18 – January 25 Late Season: Canadian Geese February 14 – 15 Whitefronts and White geese February 14 – 18	30/day, which may include: 20 white geese, 10 dark geese	Triple the daily bag limit	Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used. Only arrows or crossbow bolts with flu-flu fletching may be used. Dogs may be used to take and retrieve migratory game birds.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Anser rossii Ross's goose	—	A locally common fall and winter resident (November to March) of the Central Valley. Preferred habitats include fresh emergent wetlands, adjacent lacustrine waters, and nearby wet croplands, pastures, meadows, and grasslands.	Early Season: (Large Canada geese only) September 27 – 29 Regular Season: October 18 – January 25 Late Season: Canadian Geese February 14 – 15 Whitefronts and White geese February 14 – 18	30/day, which may include: 20 white geese, 10 dark geese	Triple the daily bag limit	
Branta canadensis Canada goose	—	A widespread migrant and common to abundant winter (October or November to March or April) resident through out Central Valley, Salton Sea, and northeastern California. Preferred habitats include lacustrine, fresh emergent wetlands, and moist grasslands, croplands, pastures, and meadows. In California, breeds on northeastern plateau, but also in lakes of northern Sierra Nevada and Cascades.	Early Season: (Large Canada geese only) September 27 – 29 Regular Season: October 18 – January 25 Late Season: Canadian Geese February 14 – 15 Whitefronts and White geese February 14 – 18	30/day, which may include: 20 white geese, 10 dark geese	Triple the daily bag limit	

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Branta hutchinsii Cackling goose	—	Preferred habitats include lacustrine, fresh emergent wetlands, and moist grasslands, croplands, pastures, and meadows. This species occurs mainly in these habitats during winter in Del Norte county, the San Francisco bay-delta, and southern Central Valley.	Early Season: (Large Canada geese only) September 27 – 29 Regular Season: October 18 – January 25 Late Season: Canadian Geese February 14 – 15 Whitefronts and White geese February 14 – 18	30/day, which may include: 20 white geese, 10 dark geese	Triple the daily bag limit	Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used. Only arrows or crossbow bolts with flu-flu fletching may be used. Dogs may be used to take and retrieve migratory game birds.
Mammals						
Mustela frenata Long-tailed weasel	—	This species is considered a nongame mammal under the California Fish and Wildlife Code. Common to uncommon, permanent resident of most habitats, except xeric brush, shrub, and scrub in the Mojave and Colorado deserts. Mostly uses intermediate cover stages of conifer and deciduous habitats, interspersed with lower seral stages and open forest, woodland areas and shrubs, from sea level to alpine meadows.	All Year	No limit	No limit	Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Sus scrufa Wild pig	—	This species is considered an exotic game mammal under the California Fish and Wildlife Code. Wild pigs currently exist in 56 of the state's 58 counties and can be found in a variety of habitats ranging from woodland, chaparral, meadow and grasslands. Wild pigs are omnivorous, consuming both plant and animal matter. In general, wild pigs feed on: grasses and forbs in the spring; mast and fruits in the summer and fall; and roots, tubers and invertebrates throughout the year.	All Year	No limit	No limit	Requires possession of a hunting license and Pig Validations. Wild pigs may only be taken using archery equipment, rifles, .40 caliber or greater muzzleloaders, shotguns and pistols, or revolvers.
Ursus americanus Black bear	—	This species is considered a big game mammal under the California Fish and Wildlife Code. Widespread, common to uncommon resident occurring from sea level to high mountain regions. Occurs in fairly dense, mature stands of many forest habitats, and feeds in a variety of habitats including brushy stands of forest, valley foothill riparian, and wet meadow.	Opening day of deer season through December 28	1 adult/season/tag	1 adult/season/tag	Requires hunting license and hunting tags. May use approved rifles, bow and arrow, and approved shotguns. Cubs and females accompanied by cubs may not be taken. Use of dogs is prohibited.
Odocoileus hemionus Mule deer	—	This species is considered a big game mammal under the California Fish and Wildlife Code. Common to abundant, yearlong resident or elevational migrant with a widespread distribution throughout most of California, except in deserts and intensively farmed areas without cover. Prefer a mosaic of vegetation, providing an interspersion of herbaceous openings, dense brush or tree thickets, riparian areas, and abundant edge.	The season for zones for D-3 through D-5 shall open on the fourth Saturday in September and extend for 37 consecutive days.	1 buck/ tag	1 buck/ tag	Requires hunting license and hunting tags. May use approved rifles, bow and arrow, approved shotguns, and crossbows. Only bucks with antlers with demonstrable forks (or greater) may be taken.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Urocyon cinereoargenteus Gray fox	—	This species is considered a furbearing mammal under the California Fish and Wildlife Code. Uncommon to common permanent resident of low to middle elevations throughout most of the state. Frequents most shrublands, valley foothill riparian, montane riparian, and brush stages of many deciduous and conifer forest and woodland habitats. Also found in meadows and cropland areas. Suitable habitat consists of shrublands, brushy and open-canopied forests, interspersed with riparian areas, providing water.	November 24 – the last day of February	No limit	No limit	Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted.
Procyon lotor Raccoon	—	This species is considered a furbearing mammal under the California Fish and Wildlife Code. Widespread, common to uncommon permanent resident throughout most of the state. Occurs in all habitats except alpine, and desert types without water; marginal in Great Basin shrub types. Most abundant in riparian and wetland areas at low to middle elevations.	November 16 – March 31	No limit	No limit	Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted. When taking raccoon after dark, pistols and rifles not larger than.22 caliber rimfire and shotguns using shot no larger than No. BB may be used.
Neogale vison American mink	—	This species is considered a furbearing mammal under the California Fish and Wildlife Code. Uncommon permanent resident, generally occurring in the northern half of the state. Semiaquatic, inhabiting most aquatic habitats, including some coastal areas. Occurs at elevations up to about 2,700 m (9,000 ft).	November 16 – March 31	No limit	No limit	Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Sciurus griseus Western gray squirrel	—	This species is considered resident small game under the California Fish and Wildlife Code. Fairly common locally in mature stands of most conifer, hardwood, and mixed hardwood-conifer habitats in the Klamath, Cascade, Transverse, Peninsular, and Sierra Nevada Ranges. Dependent upon mature stands of mixed conifer and oak habitats. Closely associated with oaks. Require large trees, mast, and snags.	September 13 - January 25	4 per day	4 in possession	Hunting license is required. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Sciurus carolinensis Eastern gray squirrel	—	This species is considered an exotic game mammal under the California Fish and Wildlife Code. The eastern gray squirrel has been introduced from eastern U.S. to cities, campuses, and large private estates in the vicinity of San Francisco Bay and in Sacramento, San Joaquin, Calaveras, and Stanislaus cos. Populations of eastern gray squirrels are found in orchard-vineyard, urban, and possibly valley foothill riparian habitats.	All year	No limit	No limit	Hunting license is required. Exotic game may only be taken by rifles using centerfire cartridges with softnose or expanding projectiles; bow and arrow; or wheellock, matchlock, flintlock or percussion type, including “in-line” muzzleloading rifles using black powder or equivalent black powder substitute, including pellets, with a single projectile loaded from the muzzle and at least .40 caliber in designation. Shotguns holding three shells or less may also be used.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Sciurus niger Eastern fox squirrel	—	This species is considered an exotic game mammal under the California Fish and Wildlife Code. The eastern fox squirrel is an introduced species with many localized populations in urban areas and nearby rural settings. The eastern fox squirrel is common in urban and orchard-vineyard habitats, and in eucalyptus groves. Individuals are moving into the edges of valley foothill riparian, redwood, and valley foothill hardwood habitats in Santa Cruz Co. and possibly elsewhere.	All year	No limit	No limit	Hunting license is required. Exotic game may only be taken by rifles using centerfire cartridges with softnose or expanding projectiles; bow and arrow; or wheellock, matchlock, flintlock or percussion type, including "in-line" muzzleloading rifles using black powder or equivalent black powder substitute, including pellets, with a single projectile loaded from the muzzle and at least .40 caliber in designation. Shotguns holding three shells or less may also be used.
Lepus californicus Black-tailed jackrabbit	—	This species is considered resident small game under the California Fish and Wildlife Code. Common throughout the state, except at the highest elevations. Abundant at lower elevations in herbaceous and desert-shrub areas and open, early stages of forest and chaparral habitats.	All year	No limit	No limit	Hunting license is required. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.
Sylvilagus audubonii Audubon's cottontail	—	This species is considered resident small game under the California Fish and Wildlife Code. Inhabits most of the southern two-thirds of the state, excluding the higher elevations. Range extends north into the Sacramento Valley and surrounding foothills. Abundant to common in grasslands, open forests, and desert shrub habitats. Found in more open habitats than brush rabbits.	July 1 – January 25	5 per day	10 in possession	Hunting license is required. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.

Species	Status	Habitat	General Season	Bag Limit	Possession Limit	Hunting Restrictions
Sylvilagus bachmani Brush rabbit	—	This species is considered resident small game under the California Fish and Wildlife Code. This species is an abundant, yearlong resident of dense, brushy areas, and of early successional stages of oak and conifer habitats. Occurs throughout the length of the state west of the Sierra Nevada, excluding the dry Central Valley and southern arid regions. Its elevational range extends from sea level to about 3000 ft.	July 1 – January 25	5 per day	10 in possession	Hunting license is required. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.

SSC = California species of special concern.

G.3. SUPPORTING INFORMATION FOR RIPARIAN AND WETLANDS HABITAT RESOURCES

G.3.1. RIPARIAN AND WETLAND HABITAT TYPES MAPPED ALONG PROJECT-AFFECTED STREAM REACHES, PROJECT RESERVOIRS, AND WITHIN THE FERC PROJECT BOUNDARY

CWHR Habitat Types
HERB-DOMINATED HABITATS
Wet Meadow (WTM) Wet meadows, which are found in poorly drained areas that contain saturated soils for most of the year, are characterized by a diverse mix of herbaceous plants, sometimes with sparse growth of willow (*Salix* spp.) intermixed or along the edges. The most common plant genera typically include monocots such as bentgrasses (*Agrostis* spp.), sedges (*Carex* spp.), oatgrasses (*Danthonia* spp.), rushes (*Juncus* spp.), and bulrushes (*Scirpus* spp.). The most common forb species include shootingstars (*Dodecatheon* spp.), monkeyflowers (*Erythranthe* spp.), and cow's clover (*Trifolium wormskioldii*).
TREE-DOMINATED HABITATS
Montane Riparian (MRI) Montane riparian is typically distributed along streambanks and is characterized by deciduous trees with a sparse understory. Montane riparian habitats are often structurally as well as biologically diverse. Common species in montane riparian communities include black cottonwood (*Populus trichocarpa*), dogwood (*Cornus* spp.), alders (*Alnus* spp.), and willows. Understory species often include azaleas (*Rhododendron* spp.) and crimson columbine (*Aquilegia formosa*).
Valley Foothill Riparian (VRI) Valley foothill riparian habitats are found in low elevation areas of California along rivers and streams. Canopy height is taller than other riparian types, with an average height of 98 feet in a mature forest, with high canopy cover. Most trees are winter deciduous and are typically characterized by Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata).* White alder (*Alnus rhombifolia*) and Oregon ash (*Fraxinus latifolia*) are often found in the subcanopy. Understory cover is typically low, but can include plants such as wild grape (*Vitus californicus),* elderberry (*Sambucus* spp.), poison oak (*Toxicodendron diversilobum*), buttonbrush (*Cephalanthus occidentalis*), and willows. Herbaceous layers typically contain sedges, rushes, grasses, miner's lettuce (*Claytonia* spp.), and mugwort (*Artemisia douglasiana*). Non-native Himalayan blackberry (*Rubus armeniacus*) is commonly found in this habitat.
AQUATIC HABITATS
Fresh Emergent Wetland (FEW) Fresh emergent wetlands are characterized by herbaceous vegetation that is inundated by water for all or most of the year. Dominant vegetation typically includes monocots such as bulrushes, tules (*Schoenoplectus* spp.), or cattails (*Typha* spp.) that prefer flooded roots. Many fresh emergent wetlands in California have been drained and converted into agricultural lands. Biodiversity in fresh emergent wetlands is high, with many species depending on this habitat for their entire life cycle.

USFWS NWI Cowardin Wetland or Riparian Type	
FRESHWATER EMERGENT WETLAND	
PEM1A	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **EM Class EMERGENT:** Characterized by erect, rooted, herbaceous vegetation, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. **1 Subclass PERSISTENT:** Dominated by species that normally remain standing at least until the beginning of the next growing season. **Modifier:** **A Water Regime Temporary Flooded:** Surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season. Plants that grow both in uplands and wetlands may be characteristic of this water regime.
PEM1Ah	Same as PEM1A, with additional special modifier. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PEM1Ax	Same as PEM1A, with additional special modifier. **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.
PEM1B	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **EM Class EMERGENT:** Characterized by erect, rooted, herbaceous vegetation, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. **1 Subclass PERSISTENT:** Dominated by species that normally remain standing at least until the beginning of the next growing season. **Modifier:** **B Water Regime Seasonally Saturated:** Surface water may occur for a few days after heavy rain and upland runoff, but the soil substrate is saturated at or near the surface for extended periods during the growing season, with unsaturated conditions by the end of the dry season.

PEM1C	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **EM Class EMERGENT:** Characterized by erect, rooted, herbaceous vegetation, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. **1 Subclass PERSISTENT:** Dominated by species that normally remain standing at least until the beginning of the next growing season. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years.
PEM1Ch	Same as PEM1C, with additional special modifier. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PEM1Cx	Same as PEM1C, with additional special modifier. **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.
PEM1Fh	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **EM Class EMERGENT:** Characterized by erect, rooted, herbaceous vegetation, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. **1 Subclass PERSISTENT:** Dominated by species that normally remain standing at least until the beginning of the next growing season. **Modifier:** **F Water Regime Semipermanently Flooded:** Surface water is present throughout the growing season in most years. The water table is at or near the land surface when not flooded. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PEM1Fx	Same as PEM1Fh, except with the following special modifier replaced: **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.

PONDS	
PUBF	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **UB Class Unconsolidated Bottom:** Wetlands and deepwater habitats with at least 25 percent cover of particles smaller than 6 to 7 centimeters and vegetative cover less than 30 percent. **Modifier:** **F Water Regime Semipermanently Flooded:** Surface water is present throughout the growing season in most years. The water table is at or near the land surface when not flooded.
PUBFh	Same as PUBF, with additional special modifier. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PUBFx	Same as PUBF, with additional special modifier. **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.
PUBHh	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **UB Class Unconsolidated Bottom:** Wetlands and deepwater habitats with at least 25 percent cover of particles smaller than 6 to 7 centimeters and vegetative cover less than 30 percent. **Modifier:** **H Water Regime Permanently Flooded:** Water covers the substrate throughout the season in all years. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PUBHx	Same as PUBHh, except with the following special modifier replaced: **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.

PUBK	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **UB Class Unconsolidated Bottom:** Wetlands and deepwater habitats with at least 25 percent cover of particles smaller than 6 to 7 centimeters and vegetative cover less than 30 percent. **Modifier:** **K Water Regime Artificially Flooded:** The amount and duration of flooding are controlled by means of pumps or siphons in combination with dikes, berms, or dams. Vegetation indicators often do not match natural flooding regimes. Examples include agricultural lands managed under a rotation or a wildlife management area where forests, crops, or pioneer plants may be flooded and/or dewatered to specifically attract wildlife. Humans intentionally manage the flooding within this water regime.
PUSAx	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **US Unconsolidated Shore**: Includes wetland habitats with unconsolidated substrates with less than 75 percent cover of stones, boulders, or bedrock and less than 30 percent cover of vegetation. **Modifier:** **A Water Regime Temporary Flooded:** Surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season. Plants that grow both in uplands and wetlands may be characteristic of this water regime. **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.
PUSCh	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, and persistent emergent and emergent mosses or lichens. **US Unconsolidated Shore**: Includes wetland habitats with unconsolidated substrates with less than 75 percent cover of stones, boulders, or bedrock and less than 30 percent cover of vegetation. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PUSCx	Same as PUBCh, except with the following special modifier replaced: **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.

FRESHWATER FORESTED/SCRUB-SHRUB WETLAND	
PFOA	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **FO Class FORESTED**: Characterized by woody vegetation that is 6 meters (20 feet) tall or taller. **Modifier:** **A Water Regime Temporary Flooded:** Surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season. Plants that grow both in uplands and wetlands may be characteristic of this water regime.
PFOB	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **FO Class FORESTED**: Characterized by woody vegetation that is 6 meters (20 feet) tall or taller. **Modifier:** **B Water Regime Seasonally Saturated:** Surface water may occur for a few days after heavy rain and upland runoff, but the soil substrate is saturated at or near the surface for extended periods during the growing season, with unsaturated conditions by the end of the dry season.
PFOC	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **FO Class FORESTED**: Characterized by woody vegetation that is 6 meters (20 feet) tall or taller. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years.
PFOCh	Same as PFOC, except with the following special modifier: **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
PFOCx	Same as PFOC, except with the following special modifier: **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.

PFO/EM1C	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **FO Class FORESTED**: Characterized by woody vegetation that is 6 meters (20 feet) tall or taller. **EM Split Class Emergent:** Characterized by erect, rooted, herbaceous vegetation, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. **1 Subclass PERSISTENT:** Dominated by species that normally remain standing at least until the beginning of the next growing season. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season, but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years.
PSSA	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **SS Class SCRUB-SHRUB:** Includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. **Modifier:** **A Water Regime Temporary Flooded:** Surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season. Plants that grow both in uplands and wetlands may be characteristic of this water regime.
PSSAx	Same as PSSA, except with the following special modifier replaced: **Special Modifier:** **x Excavated**: This modifier is used to identify wetland basins that were excavated by humans.
PSSB	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **SS Class SCRUB-SHRUB:** Includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. **Modifier:** **B Water Regime Seasonally Saturated:** Surface water may occur for a few days after heavy rain and upland runoff, but the soil substrate is saturated at or near the surface for extended periods during the growing season, with unsaturated conditions by the end of the dry season.

PSSC	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **SS Class SCRUB-SHRUB:** Includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years.
PSS/EM1C	**P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergent, mosses, or lichens. **SS Class SCRUB-SHRUB:** Includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. **EM Split Class Emergent:** Characterized by erect, rooted, herbaceous vegetation, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. **1 Subclass PERSISTENT:** Dominated by species that normally remain standing at least until the beginning of the next growing season. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years.
PSSCh	Same as PSSC, with additional special modifier. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.

LACUSTRINE	
L2USAh	**L System Lacustrine:** Lacustrine systems are typically deepwater habitats that are situated in a topographic depression or a dammed river channel. Lacustrine habitats typically lack trees, shrubs, and persistent emergent or emergent mosses or lichens. **2 Subsystem Littoral:** Includes wetland habitats within the lacustrine system. This subsystem extends from the shoreward boundary to a depth of at least 8.2 feet below the low water line, or to the maximum extent of persistent emergents growing along the shore. **US Class Unconsolidated Shore:** Typically includes landforms such as beaches, bars, and flats. Substrates must have less than 75 percent cover of stones, boulders, or bedrock and less than 30 percent cover of vegetation. **Modifier:** **A Water Regime Temporary Flooded:** Surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season. Plants that grow both in uplands and wetlands may be characteristic of this water regime. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.
L2USCh	**L System Lacustrine:** Lacustrine systems are typically deepwater habitats that are situated in a topographic depression or a dammed river channel. Lacustrine habitats typically lack trees, shrubs, and persistent emergent or emergent mosses or lichens. **2 Subsystem Littoral:** Includes wetland habitats within the lacustrine system. This subsystem extends from the shoreward boundary to a depth of at least 8.2 feet below the low water line, or to the maximum extent of persistent emergents growing along the shore. **US Class Unconsolidated Shore:** Typically includes landforms such as beaches, bars, and flats. Substrates must have less than 75 percent cover of stones, boulders, or bedrock and less than 30 percent cover of vegetation. **Modifier:** **C Water Regime Seasonally Flooded:** Surface water is present for extended periods (generally for more than a month) during the growing season but is absent by the end of the season in most years. When surface water is absent, the depth to substrate saturation may vary considerably among sites and among years. **Special Modifier:** **h Diked/Impounded:** Wetlands created or modified by a human-made barrier or dam that obstructs the inflow or outflow of water.

G.4. SPECIAL-STATUS PLANT AND WILDLIFE SPECIES THAT COULD POTENTIALLY USE WETLAND, RIPARIAN, AND LITTORAL HABITATS

Scientific Name/ Common Name	Status	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
		Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
		Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Plants							
Castilleja campestris var. *succulenta* Fleshy owl's-clover	FT / CE 1B.2	X				X	X
Gratiola heterosepala Boggs Lake hedge-hyssop	CE / 1B.2	X			X	X	X
Orcuttia viscida Sacramento Orcutt grass	FE / CE 1B.1						X
Eryngium racemosum Delta button-celery	FE / CE 1B.1			X			X
Invertebrates							
Bombus crotchii Crotch's bumble bee	CCE	X	X	X	X	X	X
Bombus occidentalis Western bumble bee	CCE	X	X	X	X	X	X
Branchinecta lynchi Vernal pool fairy shrimp	FT						X
Danaus plexippus Monarch butterfly	FPT	X	X	X	X	X	X
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT			X			
Lepidurus packardi Vernal pool tadpole shrimp	FT						X

Scientific Name/ Common Name	Status	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
		Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
		Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Amphibians							
Ambystoma californiense California tiger salamander – Central California DPS	FT/CT	X		X		X	X
Spea hammondii Western spadefoot – Northern DPS	FPT / SCC	X				X	X
Reptiles							
Actinemys marmorata Northwestern pond turtle	FPT / SCC		X	X	X	X	
Thamnophis gigas Giant garter snake	FT / CT	X		X		X	X
Birds							
Agelaius tricolor Tricolored blackbird	BCC / CT / SSC	X		X	X	X	
Aquila chrysaetos Golden eagle	Eagle Act / CFP	X			X		
Buteo swainsoni Swainson's hawk	CT	X		X			X
Elanus leucurus White-tailed kite	CFP	X		X		X	X
Empidonax traillii Willow flycatcher	CE	X	X				
Haliaeetus leucocephalus Bald eagle	Eagle Act / CE / SSC				X		
Riparia riparia Bank swallow	CT			X	X		

Scientific Name/ Common Name	Status	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
		Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
		Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Mammals							
Bassariscus astutus Ringtail	CFP		X	X			

Federal Status: BCC = Bird of Conservation Concern, FE = Federal Endangered, FT = Federal Threatened, FPD = Federal Proposed for Delisting, FPT = Federal Proposed Threatened

State Status: CFP = California Fully Protected, CCE = State Candidate Endangered, CE = California Endangered, CT = California Threatened, SSC = California Species of Special Concern

CNPS Rare Plant Rank (CNPS RPR): 1B = Rare, threatened or endangered in California and elsewhere, 2B = Rare in California but more common elsewhere, 4 = Plants of limited distribution – a watchlist, _.1 = Seriously threatened in California (over 80 percent of occurrences threatened/high degree and immediacy of threat), _.2 = Moderately threatened in California (20 to 80 percent occurrences threatened), _.3 = Not very threatened in California (< 20 percent of occurrences threatened or no current threats known), CBR = Considered but rejected

Notes:

[a] CWHR is a broad-scale habitat classification that does not capture smaller scale features such as vernal pools that can be important habitats for wildlife at the microhabitat level.

G.5. COMMON WILDLIFE SPECIES USING WETLAND, RIPARIAN, AND LITTORAL HABITATS

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Amphibians						
Aneides lugubris Arboreal salamander			X			
Batrachoseps attenuatus California slender salamander		X	X			
Batrachoseps diabolicus Hell hollow slender salamander		X	X		X	
Ensatina eschscholtzii Ensatina	X	X	X			
Taricha sierrae Sierra newt	X	X	X	X	X	
Anaxyrus boreas halophilus California toad	X	X	X	X	X	X
Lithobates catesbeianus American bullfrog	X	X	X	X	X	
Pseudacris (Hyla) sierra Sierran treefrog	X	X	X	X	X	X
Reptiles						
Trachemys scripta elegans Red-eared slider				X		
Sceloporus occidentalis Western fence lizard	X	X	X			
Plestiodon gilberti Gilbert's skink	X	X	X			X

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Aspidoscelis tigris Tiger whiptail		X	X			
Elgaria multicarinata Southern alligator lizard	X		X			
Elgaria coerulea Northern alligator lizard	X	X	X			
Diadophis punctatus Ring-necked snake		X	X			
Contia tenuis Common sharp-tail snake	X	X	X			
Coluber constrictor North American racer	X	X	X			
Masticophis lateralis Striped racer	X	X	X			
Pituophis catenifer Gophersnake		X	X		X	
Lampropeltis californiae California kingsnake	X	X	X		X	X
Lampropeltis zonata California mountain kingsnake	X	X	X			
Thamnophis couchii Sierra gartersnake	X	X	X	X	X	X
Thamnophis elegans Terrestrial gartersnake	X	X	X	X	X	X
Thamnophis sirtalis Common gartersnake	X	X	X	X	X	X

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Crotalus oreganus oreganus Northern Pacific rattlesnake	X	X	X			
Birds						
Podilymbus Podiceps Pied-billed grebe				X	X	
Podiceps auritus Horned grebe				X	X	
Podiceps nigricollis Eared grebe				X		
Nannopterum auritum Double-crested cormorant			X	X	X	
Ardea alba Great egret	X	X	X	X	X	X
Ardea herodias Great blue heron	X	X	X	X	X	X
Botaurus lentiginosus American bittern				X	X	
Bubulcus ibis Cattle egret			X	X	X	X
Egretta thula Snowy egret	X		X	X	X	X
Butorides virescens Green heron		X	X	X	X	
Nycticorax nycticorax Black-crowned night heron	X	X		X	X	
Plegadis chihi White-faced ibis	X			X	X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Grus canadensis Sandhill crane	X		X	X	X	X
Cygnus columbianus Tundra swan	X			X	X	X
Cygnus olor Mute swan	X			X	X	X
Anser albifrons Greater white-fronted goose	X			X	X	X
Anser caerulescens Snow goose	X			X	X	X
Anser rossii Ross's goose	X			X	X	X
Branta canadensis Canada goose	X			X	X	X
Branta hutchinsii Cackling goose	X			X	X	X
Aix sponsa Wood duck		X	X	X	X	
Anas acuta Northern pintail	X			X	X	X
Anas crecca Green-winged teal	X			X	X	X
Anas cyanoptera Cinnamon teal	X			X	X	X
Anas platyrhynchos Mallard	X	X	X	X	X	X

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Mareca americana American wigeon	X			X	X	X
Mareca penelope Eurasian wigeon				X	X	
Mareca strepera Gadwall	X			X	X	X
Spatula clypeata Northern shoveler	X			X	X	X
Spatula discors Blue-winged teal	X			X	X	
Aythya valisineria Canvasback				X	X	
Aythya affinis Lesser scaup	X			X	X	
Aythya collaris Ring-necked duck				X	X	
Aythya marila Greater scaup				X		
Aythya valisineria Canvasback				X	X	
Bucephala albeola Bufflehead			X	X	X	
Bucephala clangula Common goldeneye				X		
Lophodytes cucullatus Hooded merganser			X	X	X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Mergus merganser Common merganser	X		X	X	X	
Mergus serrator Red-breasted merganser				X		
Oxyura jamaicensis Ruddy duck			X	X	X	
Cathartes aura Turkey vulture	X	X	X	X		
Pandion haliaetus Osprey	X	X	X	X	X	
Accipiter striatus Sharp-shinned hawk	X	X	X			
Astur cooperii Cooper's hawk		X	X			
Buteo jamaicensis Red-tailed hawk	X	X	X		X	
Buteo lagopus Rough-legged hawk	X		X		X	
Buteo lineatus Red-shouldered hawk	X	X	X		X	
Buteo regalis Ferruginous hawk	X		X		X	
Falco columbarius Merlin	X	X	X	X	X	
Falco mexicanus Prairie falcon	X	X	X		X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Falco peregrinus Peregrine falcon	X	X	X	X	X	
Falco sparverius American kestrel	X	X	X			
Alectoris chukar Chukar		X	X			
Phasianus colchicus Ring-necked pheasant	X		X		X	
Dendragapus fuliginosus Sooty grouse		X				
Meleagris gallopavo Wild turkey	X	X	X			
Callipepla californica California quail	X	X	X			
Porzana carolina Sora	X				X	
Rallus limicola Virginia rail	X	X	X		X	
Fulica americana American coot	X			X	X	X
Gallinula galeata Common gallinule				X	X	
Charadrius vociferus Killdeer	X			X	X	X
Pluvialis squatarola Black-bellied plover	X			X	X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Himantopus mexicanus Black-necked stilt	X			X	X	
Recurvirostra americana American avocet	X			X	X	
Actitis macularius Spotted sandpiper	X		X	X	X	
Calidris alba Sanderling				X		
Calidris alpina Dunlin	X			X	X	
Calidris mauri Western sandpiper	X			X	X	
Calidris minutilla Least sandpiper	X			X	X	
Gallinago delicata Wilson's snipe	X		X	X	X	
Limnodromus griseus Short-billed dowitcher	X			X	X	
Limnodromus scolopaceus Long-billed dowitcher	X			X	X	
Numenius americanus Long-billed curlew	X		X	X	X	
Numenius phaeopus Whimbrel	X			X	X	
Phalaropus tricolor Wilson's phalarope	X			X		

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Tringa melanoleuca Greater yellowlegs	X		X	X	X	X
Chroicocephalus philadelphia Bonaparte's gull				X	X	
Larus argentatus Herring gull				X		
Larus canus Mew gull				X		
Larus delawarensis Ring-billed gull	X			X	X	
Larus glaucoides thayeri Thayer's gull				X		
Hydroprogne caspia Caspian tern				X	X	
Sterna forsteri Forster's tern			X	X	X	
Sterna hirundo Common tern				X	X	
Patagioenas fasciata Band-tailed pigeon		X	X			
Zenaida macroura Mourning dove		X	X			
Aegolius acadicus Northern saw-whet owl	X	X	X			
Bubo virginianus Great horned owl	X	X	X		X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Glaucidium gnoma Northern pygmy- owl	X	X	X			
Psiloscops flammeolus Flammulated owl		X				
Tyto alba Barn owl	X	X	X		X	
Chordeiles acutipennis Lesser nighthawk	X		X	X	X	
Chordeiles minor Common nighthawk	X		X		X	
Phalaenoptilus nuttallii Common poorwill	X					
Aeronautes saxatalis White-throated swift	X	X	X	X	X	
Archilochus alexandri Black-chinned hummingbird			X			
Calypte anna Anna's hummingbird		X	X			
Selasphorus rufus Rufous hummingbird	X	X	X			
Megaceryle alcyon Belted kingfisher	X		X	X	X	
Colaptes auratus Northern flicker		X	X			
Dryobates pubescens Downy woodpecker	X	X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Dryocopus pileatus Pileated woodpecker		X				
Melanerpes lewis Lewis' woodpecker	X	X	X			
Melanerpes formicivorus Acorn woodpecker		X	X			
Leuconotopicus villosus Hairy woodpecker		X	X			
Sphyrapicus ruber Red-breasted sapsucker		X	X			
Contopus sordidulus Western wood-pewee		X	X			
Empidonax difficilis Pacific-slope flycatcher		X	X			
Empidonax hammondii Hammond's flycatcher		X	X			
Empidonax oberholseri Dusky flycatcher		X	X			
Myiarchus cinerascens Ash-throated flycatcher			X			
Sayornis nigricans Black phoebe				X	X	
Sayornis saya Say's phoebe			X			
Tyrannus verticalis Western kingbird	X		X		X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Eremophila alpestris Horned lark	X		X			
Hirundo rustica Barn swallow	X	X	X	X	X	
Petrochelidon pyrrhonota Cliff swallow	X	X	X	X	X	
Stelgidopteryx serripennis Northern rough-winged swallow	X	X	X	X	X	
Tachycineta bicolor Tree swallow	X	X	X		X	
Tachycineta thalassina Violet-green swallow	X	X	X		X	
Aphelocoma californica California scrub jay		X	X			
Cyanocitta stelleri Steller's jay		X	X			
Corvus brachyrhynchos American crow		X	X	X		
Corvus corax Common raven	X	X	X	X	X	
Poecile gambeli Mountain chickadee		X	X			
Poecile rufescens Chestnut-backed chickadee		X	X			
Psaltriparus minimus Bushtit		X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Sitta canadensis Red-breasted nuthatch		X	X			
Sitta carolinensis White-breasted nuthatch		X	X			
Certhia americana Brown creeper		X	X			
Catherpes mexicanus Canyon wren			X			
Cistothorus palustris Marsh wren	X	X	X		X	
Salpinctes obsoletus Rock wren			X			
Thryomanes bewickii Bewick's wren		X	X			
Troglodytes aedon Northern house wren	X	X	X			
Troglodytes pacificus Pacific wren		X	X			
Cinclus mexicanus American dipper		X	X	X		
Regulus calendula Ruby-crowned kinglet		X	X			
Polioptila caerulea Blue-gray gnatcatcher			X			
Sialia currucoides Mountain bluebird	X	X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Sialia mexicana Western bluebird	X	X	X			
Myadestes townsendi Townsend's solitaire		X				
Catharus guttatus Hermit thrush		X	X			
Catharus ustulatus Swainson's thrush	X	X	X			
Ixoreus naevius Varied thrush	X	X	X			
Turdus migratorius American robin	X	X	X			
Mimus polyglottos Northern mockingbird			X			
Anthus rubrescens American pipit	X		X	X	X	X
Bombycilla cedrorum Cedar waxwing		X	X			
Phainopepla nitens Phainopepla			X			
Sturnus vulgaris European starling	X	X	X		X	
Vireo cassinii Cassin's vireo		X	X			
Vireo gilvus Warbling vireo		X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Vireo huttoni Hutton's vireo		X	X			
Cardellina pusilla Wilson's warbler		X		X		
Geothlypis tolmiei MacGillivray's warbler	X	X	X			
Leiothlypis celata Orange-crowned warbler		X	X			
Leiothlypis ruficapilla Nashville warbler		X	X			
Setophaga coronata Yellow-rumped warbler	X	X	X		X	
Setophaga nigrescens Black-throated gray warbler		X	X			
Setophaga occidentalis Hermit warbler		X	X			
Setophaga townsendi Townsend's warbler		X	X			
Piranga ludoviciana Western tanager		X	X			
Passerina amoena Lazuli bunting	X	X	X			
Passerina caerulea Blue grosbeak		X				
Pheucticus melanocephalus Black-headed grosbeak		X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Pipilo maculatus Spotted towhee		X	X			
Melozone crissalis California towhee		X	X			
Aimophila ruficeps Rufous-crowned sparrow			X			
Chondestes grammacus Lark sparrow	X		X			
Melospiza lincolnii Lincoln's sparrow	X	X	X		X	
Melospiza melodia Song sparrow	X	X	X	X	X	X
Passerella iliaca Fox sparrow		X	X			
Spizella passerina Chipping sparrow	X	X	X			
Zonotrichia albicollis White-throated sparrow	X	X		X		
Zonotrichia atricapilla Golden-crowned sparrow	X	X	X			
Zonotrichia leucophrys White-crowned sparrow	X	X	X			
Junco hyemalis Dark-eyed junco	X	X	X			
Agelaius phoeniceus Red-winged blackbird	X	X	X		X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Euphagus cyanocephalus Brewer's blackbird	X	X	X	X	X	
Molothrus ater Brown-headed cowbird	X	X	X		X	
Quiscalus mexicanus Great-tailed grackle				X	X	
Sturnella neglecta Western meadowlark	X		X			
Icterus cucullatus Hooded oriole			X			
Haemorhous mexicanus House finch	X	X	X			
Haemorhous purpureus Purple finch	X	X	X			
Spinus pinus Pine siskin	X	X	X			
Spinus psaltria Lesser goldfinch	X	X	X			
Spinus tristis American goldfinch	X	X	X			
Passer domesticus House sparrow			X			
Mammals						
Didelphis virginiana Virginia opossum	X	X	X			
Scapanus latimanus Broad-footed mole	X	X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Eptesicus fuscus Big brown bat	X	X	X	X		
Lasiurus cinereus Hoary bat	X	X	X	X	X	
Myotis californicus California myotis	X	X	X	X	X	
Myotis ciliolabrum Western small-footed myotis	X	X		X	X	
Myotis thysanodes Fringed myotis		X	X	X		
Myotis volans Long-legged myotis	X	X	X	X		
Myotis yumanensis Yuma myotis	X	X	X	X	X	
Parastrellus hesperus Canyon bat	X	X	X			
Tadarida brasiliensis Brazilian free-tailed bat	X	X	X		X	
Sylvilagus audubonii Audubon's cottontail	X	X				
Sylvilagus bachmani Brush rabbit		X	X			
Lepus californicus Black-tailed jackrabbit	X	X	X			
Ostospermophilus beecheyi California ground squirrel	X	X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Sciurus carolinensis Eastern gray squirrel			X			
Sciurus griseus Western gray squirrel		X	X			
Sciurus niger Eastern fox squirrel			X			
Dipodymys heermanni Heermann's kangaroo rat	X	X				
Thomomys bottae Botta's pocket gopher	X	X	X			
Castor canadensis American beaver	X		X	X	X	
Mus musculus House mouse	X		X		X	
Peromyscus boylii Brush mouse		X	X			
Peromyscus maniculatus Deer mouse	X	X	X		X	
Peromyscus truei Pinyon mouse	X	X	X			
Reithrodontomys megalotis Western harvest mouse	X	X	X		X	
Neotoma fuscipes Dusky-footed woodrat	X	X	X			
Neotoma macrotis Big-eared woodrat	X	X	X			

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Microtus californicus California vole	X	X	X		X	
Ondatra zibethicus Common muskrat	X	X	X	X	X	
Rattus norvegicus Norway rat		X	X			
Rattus rattus Black rat			X			
Erethizon dorsatum Common porcupine	X	X	X		X	
Canis latrans Coyote	X	X	X		X	
Vulpes vulpes Red fox	X	X				
Urocyon cinereoargenteus Gray fox	X	X	X		X	
Ursus americanus Black bear	X	X	X	X		
Procyon lotor Raccoon	X	X	X	X	X	
Mustela frenata Long-tailed weasel	X	X	X			
Neogale vison American mink		X	X	X	X	
Mephitis mephitis Striped skunk	X	X	X		X	

Common Wildlife	CWHR– Wetland, Riparian, or Littoral Wildlife Habitat Type					Habitat Not Categorized by CWHR[a]
Scientific Name/ Common Name	Herb-Dominated Habitats	Tree-Dominated Habitats		Aquatic Habitats		Ephemeral Wetland Habitat
	Wet Meadow	Montane Riparian	Valley Foothill Riparian	Lacustrine	Fresh Emergent Wetland	Vernal Pool
Spilogale gracilis Western spotted skunk	X	X	X			
Lontra canadensis Northern river otter	X	X	X	X	X	
Puma concolor Mountain lion	X	X	X			
Lynx rufus Bobcat	X	X	X		X	
Sus scrofa Wild pig	X	X	X			
Odocoileus hemionus Mule deer	X	X	X		X	

Notes:

[a] CWHR is a broad-scale habitat classification that does not capture smaller scale features such as vernal pools that can be important habitats for wildlife at the microhabitat level.