Attachment 1

DAVID W. STEINDORF

4 Baroni Drive • Chico, California • (530) 518-2729 • dave@americanwhitewater.org

I have been an active river advocate in California since 1997. Through that advocacy, I have been able to gain the respect of Agencies, NGOs, and Utilities, while successfully achieving the goals of my constituents and influencing policy. My success is derived from my ability to dive whole heartedly into the interest of other stakeholders to find solutions that address the broadest set of issues on any hydroelectric project. In addition, I have negotiated improved flows on more than 20 hydroelectric projects in California. These agreements have restored rivers, while providing reliable power to the grid and protecting water supply. I have been in a leadership role in the hydropower community for almost twenty years. I chaired the California Hydropower Reform Coalition from 2007 to 2021. This coalition, which includes American Rivers, Trout Unlimited, Friends of the River, Cal Trout and several other state and national NGOs, work on hydropower relicensing and decommissioning, as well as the development and implementation of 21st century energy policy solutions that help to make hydropower green. For instance, I and my partners have participated in the Uncommon Dialogue – a policy forum that has connected more than 300 professionals representing a cross-section of hydropower interests from state and federal resource agencies, the Department of Energy, Tribes, environmental and river conservation communities, the hydropower industry, academia, and national laboratories. I have presented at gatherings for conservation groups, resource agencies, and numerous hydropower industry conferences. With a background in Economics, I have been keenly interested in the changing energy landscape. In 2017, I was invited to testify before the House of Representative's Energy and Commerce Committee to educate members on the role of hydropower in energy markets and how to optimize power generation in a way that has the least impact on rivers.

EMPLOYMENT

2016- Present	American Whitewater -Hydropower Specialist
2005 - 2016	American Whitewater-California Stewardship Director
2007 – 2021	California Hydro Power Reform Coalition – Chair
2002- 2005	Louis Berger Group-Consultant
2000	California State University Chico- Economics
1995-1996	Paradise Charter Middle School
1989-1994	Willows Highschool

LEGISLATIVE / POLICY

2021- Present **Federal Power Act Reform Package**
This package was developed Jointly with National Hydropower Association, Tribes, and other NGOs. Legislation introduced in 2023.

2018- Present **Uncommon Dialogue**
This effort was initiated by Stanford University's Woods Institute for the Environment, through its Uncommon Dialogue process. I was the lead in this process for the Hydropower Reform Coalition. Two and a half years of discussion and negotiation between the Hydropower Industry, agencies and conservation groups lead to a significant collaborative outcome. In October of 2020, the group released a *Joint Statement of Collaboration on U.S. Hydropower: Climate Solution and Conservation Challenge"* this statement outlined important steps to help address climate change by both advancing the renewable energy and storage benefits of hydropower and the environmental and economic benefits of healthy rivers.

2021 **Bipartisan Infrastructure Act**
As an outgrowth of the Uncommon Dialogue, I assisted with the development of language to support and fund, dam removal, grid resiliency, and recreation river access.

2017 **Energy and Commerce Committee, House of Representatives**
Invited to testify before the House of Representatives Energy and Commerce Committee to educate members on the role of hydropower in energy markets and how to optimize power generation in a way that has the least impact on rivers.

ARTICLES

2022 *Hydropower flexibility valuation tool for flow requirement evaluation*
Co-authored a paper and developed a tool with the Department of Energy's Idaho National Lab, that would provide more accurate valuations of hydropower projects and informs decision making regarding hydropower flows.
https://www.sciencedirect.com/science/article/pii/S2352484722025574

2022 *Watershed Moment -Dams help us. Dams harm us. Now, longtime adversaries are coming together to bridge that uncomfortable divide.*
Featured in a Stanford Magazine article by Tracie White which details the formation of the Uncommon Dialogue process between the Hydropower Industry, agencies and conservation groups.
https://stanfordmag.org/contents/watershed-moment

2017 *Overlooked trade-offs of environmentally protective hydropower operation: Impacts to ancillary services and greenhouse gas emissions.*
Collaborated with staff from Lawrence Berkeley National Laboratory to develop a case study that demonstrated changing energy markets have modified the way in which hydropower should be valued. The increasing value of ancillary services has in effect decoupled generation and revenue, bringing about the possibility of improving streamflow in hydro-impacted rivers with little impact to hydroelectric project revenue.
https://onlinelibrary.wiley.com/doi/abs/10.1002/rra.3354

2010 *Ecology and Management of the Spring Snowmelt Recession*
Assisted in the conceptual development and science surrounding the understanding and quantification of flows associated with the snowmelt recession. These concepts have been used to develop license conditions across California and will enhance aquatic resource protection for the next fifty years.
https://watershed.ucdavis.edu/project/recession

FERC RELICENSING/ IMPLEMENTATION

2018- Present	Kerckhoff Project (Pacific Gas & Electric)
2016- Present	South State Water Project (California Department of Water Resources)
2014- Present	Bucks Creek Project (Pacific Gas & Electric)
2013- Present	New Don Pedro Project (Modesto and Turlock Irrigation Districts)
2012- Present	Middle Fork American River Project (Placer County Water Agency)
2012- Present	Merced River Project (Merced Irrigation District)
2012- Present	Kern River #3 Project (Southern California Edison)
2009- Present	Big Creek #4 Project (Southern California Edison)
2009- Present	Borel Project (Southern California Edison)
2008- Present	Yuba River Development Project (Yuba Water Agency)
2007- Present	McCloud/ Pit Project (Pacific Gas & Electric)
2006- Present	Yuba Bear/ Drum Spaulding Project (Pacific Gas & Electric, Nevada Irrigation District))
2004- Present	South Fork Feather Project (South Feather Water and Power)
2004- Present	Spring Gap/ Stanislaus Project (Pacific Gas & Electric)
2003- Present	Pit 1 Project (Pacific Gas & Electric)
2003- Present	DeSabla/ Centerville Project (Pacific Gas & Electric)
2003- Present	Upper American River Project (Sacramento Municipal Utility District)
2000- Present	Oroville Project (California Department of Water Resources)
2000- Present	Pit 3-4 -5 Project (Pacific Gas & Electric)
2000- Present	Poe Project (Pacific Gas & Electric)
1999- Present	Mokelumne River Project (Pacific Gas & Electric)

1999- Present	Upper North Fork Feather River Project (Pacific Gas & Electric)
1997- Present	Rock Creek/ Cresta Project (Pacific Gas & Electric)

EDUCATION

May 1998	Masters Degree in Education California State University, Chico, CA
January 1989	Single subject credential (social science) California State University, Chico, CA
December 1985	BA Economics California State University, Chico, CA

Attachment 2

PACIFIC GAS AND ELECTRIC COMPANY
Section 851 Transfer of Non-Nuclear Generation Portfolio and Sale of Minority Interest
Application 22-09-018
Data Response

PG&E Data Request No.:	CHRC_001-Q014		
PG&E File Name:	S851TransferofNonNuclearGenerationPortfolio_DR_CHRC_001-Q014		
Request Date:	April 26, 2023	Requester DR No.:	001
Date Sent:	May 10, 2023	Requesting Party:	California Hydropower Reform Coalition
PG&E Witness:	Mike Schonherr	Requester:	Julie Gantenbein

SUBJECT: PG&E GENERATION ASSET TRANSFER, A.22.09.018 CALIFORNIA HYDROPOWER REFORM COALITION DATA REQUEST NO. 1

QUESTION 014

Table 2-1 of the TESTIMONY ("Generation Assets to be Transferred") describes the "nominal operating capacity" of each of the hydroelectric generation assets. However, at least one of the assets - the POTTER VALLEY PROJECT - is known to have a nonfunctional transformer, which prevents that project from generating power at the nominal capacity. Please provide information regarding the actual power generating capacity of each listed hydroelectric project, including those that are unable to generate power or have reduced power generating capacity due to inoperable equipment or reservoir drawdowns.

ANSWER 014

The nominal operating capacity, as shown in Table 2-1, represents the intended full-load sustained output of each hydroelectric facility to be transferred to Pacific Generation. The actual day-to-day output from each generating facility will vary based on a variety of factors, including out-of-service equipment or other local environmental factors, such as the availability of water or compliance with FERC license flow requirements. However, these variations do not alter the nominal operating capacity of the generating units themselves.

The generating units that are currently out-of-service and mothballed under CAISO and NERC regulations include Potter Valley, Inskip, Centerville, Hamilton Branch, Kilarc U1, Lime Saddle, San Joaquin #3, and Kerckhoff #1 U1 & U3. The retired units include Kilarc U2, Kerckhoff #1 U2, Alta U2, and Coal Canyon.

PACIFIC GAS AND ELECTRIC COMPANY
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Request Date:	April 26, 2023	Requester DR No.:	001
Date Sent:	May 10, 2023	Requesting Party:	California Hydropower Reform Coalition
PG&E Witness:	Mike Schonherr	Requester:	Julie Gantenbein

SUBJECT: PG&E GENERATION ASSET TRANSFER, A.22.09.018 CALIFORNIA HYDROPOWER REFORM COALITION DATA REQUEST NO. 1

QUESTION 018

The REVISED TESTIMONY includes an OSA that describes the circumstances under which PG&E may perform "additional service." (See 4-AtchA-13, -14.) The OSA states,

> "[i]f PG&E determines, in its sole discretion, that the provision of additional service is not necessary to fulfill PG&E's obligations to operate, maintain or otherwise provide Services to and for the Generation Assets, if mutually agreed by PG&E and PacGen, then PG&E will provide such service, and such service shall become hereunder or a service pursuant to an Intercompany Service Agreement." (Ibid.)

Please explain which, if any, entity has the authority to authorize and provide proactive hydroelectric facilities maintenance.

ANSWER 018

As articulated in the revised Chapter 4 Testimony, the OSA will encompass all services required to run Pacific Generation's business and the Generation Assets in substantially the same manner as today - including those Generation Facility support services related to Operations and Maintenance (O&M) and those related to corporate functions. The list of services provided is intended to be representative but is not exhaustive.

As noted, Pacific Generation and PG&E may propose additional services that are not already being provided as of such time if either of them determines such services to be necessary or desirable for the operation and maintenance of the Generation Facilities, and any such proposed additional service shall become a service provided under the OSA if (1) PG&E determines the provision of such proposed additional service is necessary for PG&E to fulfill its obligations under the proposed intercompany agreements (including the OSA) to operate, maintain and otherwise provide services to and for the Generation Facilities in accordance with the standards of performance and other terms set forth in the OSA, or (2) the parties mutually agree for PG&E to provide

such service. Should PG&E determine a proposed additional service is not necessary, nothing in the OSA or any other proposed intercompany agreement would preclude Pacific Generation from obtaining such proposed service from a third party at its discretion.

PACIFIC GAS AND ELECTRIC COMPANY
Section 851 Transfer of Non-Nuclear Generation Portfolio and Sale of Minority Interest
Application 22-09-018
Data Response

PG&E Data Request No.:	CHRC_001-Q019		
PG&E File Name:	S851TransferofNonNuclearGenerationPortfolio_DR_CHRC_001-Q019		
Request Date:	April 26, 2023	Requester DR No.:	001
Date Sent:	May 10, 2023	Requesting Party:	California Hydropower Reform Coalition
PG&E Witness:	Mike Schonherr	Requester:	Julie Gantenbein

SUBJECT: PG&E GENERATION ASSET TRANSFER, A.22.09.018 CALIFORNIA HYDROPOWER REFORM COALITION DATA REQUEST NO. 1

QUESTION 019

As stated in question 18, PG&E appears to have significant authority over proactive and discretionary maintenance of generation assets. (See also 4-AtchA-13, -14.) However, under the terms of the OSA, PG&E is legally responsible for liabilities arising from PG&E services provided for these generation facilities ***only*** if PG&E personnel (or PG&E subcontractors) engage in "intentional misconduct" or in "knowing and material non-compliance with applicable Law." (See 4-AtchA-23, §§ 8.1 -8.2 (emphasis added).) If "additional service," as that term is used in the OSA (see 4-AtchA-13, -14), is not a legal obligation, please explain which entity has responsibility for such repairs, and whether that entity would be appropriately capitalized to cover such costs.

ANSWER 019

Under the OSA, PG&E is required to perform the services in accordance with Good Utility Practice (as defined in the OSA) and is contractually responsible to Pacific Generation for any failure to do so. This is separate from the OSA provision quoted above, whereby PG&E will indemnify Pacific Generation for third party claims that result from or arise from intentional misconduct of PG&E personnel or the knowing and material non-compliance with applicable law of PG&E personnel, subject to the terms of the OSA.Pacific Generation and PG&E will each be capitalized in compliance with its respective authorized regulatory capital structure which, as discussed in [Chapter 6 of the Testimony], will each be equal to PG&E's authorized regulatory capital structure prior to the transaction until the next cost of capital proceeding. Please refer to Chapter 6 of the Testimony for further details regarding capital structure.

PACIFIC GAS AND ELECTRIC COMPANY
Section 851 Transfer of Non-Nuclear Generation Portfolio and Sale of Minority Interest
Application 22-09-018
Data Response

PG&E Data Request No.:	CHRC_001-Q020		
PG&E File Name:	S851TransferofNonNuclearGenerationPortfolio_DR_CHRC_001-Q020		
Request Date:	April 26, 2023	Requester DR No.:	001
Date Sent:	May 10, 2023	Requesting Party:	California Hydropower Reform Coalition
PG&E Witness:	Mike Schonherr	Requester:	Julie Gantenbein

SUBJECT: PG&E GENERATION ASSET TRANSFER, A.22.09.018 CALIFORNIA HYDROPOWER REFORM COALITION DATA REQUEST NO. 1

QUESTION 020

As stated in question 18, PG&E appears to have significant authority over proactive maintenance and improvements to generation assets. (See also 4-AtchA-13, -14.) For instance, under the OSA, PG&E appears to have authority to either veto or authorize "additional services." (Ibid.) On April 14, 2023, PG&E submitted to FERC an Extension of Time Request related to necessary inspections that are condition precedent to identifying proactive maintenance for several hydroelectric facilities. Please explain whether PG&E will conduct safety inspections for each dam, failure mode analyses, and any necessary repairs identified during the inspections as "Services," (as defined in the OSA; see p. 4-AtchA-11), or as an "additional service" (see 4-AtchA-13, -14) over which PG&E appears to have veto authority.

ANSWER 020

PG&E considers inspection of facilities and attendant repairs to be a "Service" that PG&E will provide to Pacific Generation under the OSA and to be incorporated within those services identified in the revised Chapter 4 Testimony as services required to run Pacific Generation and the Generation Assets in substantially the same manner as today.

Attachment 3

Document Accession #: 20191210-5211 Filed Date: 12/10/2019

Pacific Gas and Electric Company

Power Generation

245 Market Street
San Francisco, CA 94105

Mailing Address:
Mail Code N11D
P.O. Box 770000
San Francisco, CA 94177

December 10, 2019

Via Electronic Submittal (E-File)

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE. Room I-A
Washington, D.C. 20426

RE: McCloud-Pit Project, FERC No. 2106-000
P-2106 Environmental Inspection
Hawkins Creek Road near McCloud Spillway

ENCLOSURE CONTAINS CRITICAL ENERGY INFRASTRUCTURE INFORMATION (CUI//CEII) – DO NOT RELEASE

Dear Secretary Bose:

This letter provides an update to Pacific Gas and Electric Company's (PG&E) May 14, 2019 correspondence to the Federal Energy Regulatory Commission (FERC) regarding the 2018 Environmental Inspection of the McCloud-Pit Hydroelectric Project, FERC No. 2106 (Project). In the May 14, 2019 filing, PG&E committed to completing a geologic assessment of the landslide areas above and below a section of United States – Forest Service's (USFS) Road 38N11 (Hawkins Creek Road) near McCloud Dam. Please find attached the geologic report, McCloud Plunge Pool Slide(s) – Slope Evaluation (Report), prepared by Gannett-Fleming Inc., and dated November 6, 2019 (Enclosure A).

This letter also provides an update to FERC's December 9, 2019 letter to PG&E.

The Report found the slope failures above and below Hawkins Creek Road are two separate features not connected by an underlying failure plane. As described in the text of the report; the lower slide appears to be a result of plunge pool enlargement following large storm events and spillway operations, whereas the upper slide appears to be a result of road realignment performed by/for USFS in 1997 following major storm events that year. The Report proposes that Hawkins Road be closed during large storm events and during operations of the spillway. If PG&E and USFS elect to open the road to vehicle traffic, the Report suggests installing signage and barricades to keep vehicle traffic off the outboard edge of the road. PG&E plans to consult with USFS about a short-term plan to safely reopen Hawkins Creek Road in the interim as a long-term repair and road management plan is discussed. PG&E will provide FERC an update on the discussions with USFS by April 30, 2020.

PG&E is anticipating FERC to issue a new License for the Project in 2020. As part of potential infrastructure improvements associated with a new Project License, PG&E is

investigating alternative designs for the McCloud spillway. PG&E will incorporate this slide area and section of Hawkins Creek Road into the planning and redesign of the McCloud spillway. PG&E will consult with FERC and USFS about long-term repairs Hawkins Road and the slide area as part of on-going discussions about the McCloud Spillway redesign.

Should you have any technical questions concerning this matter, please contact PG&E's Facilities Safety Engineer, Robert Ellis, at (415) 973-4268. For general questions, please contact PG&E's License Coordinator, Sean Murphy, at (415) 973-5629.

Sincerely,

Neil J. Wong
Supervisor, Hydro Licensing

Enclosure: **(CUI//CEII – DO NOT RELEASE)**
A – McCloud Plunge Pool Slide(s) – Slope Evaluation, dated November 6, 2019

cc: Tristan Leong, USFS
Frank Blackett, FERC SFRO
John Aedo, FERC DHAC

Attachment 4

Document Accession #: 20200529-3090 Filed Date: 05/29/2020

FEDERAL ENERGY REGULATORY COMMISSION
Office of Energy Projects
Division of Dam Safety and Inspections – San Francisco Regional Office
100 First Street, Suite 2300
San Francisco, CA 94105-3084
(415) 369-3300 Office – (415) 369-3322 Facsimile

May 29, 2020

In reply refer to:
Project Nos. 233, 1121, 2106,
and 2687

Mr. Jan Nimick, Vice President
Pacific Gas and Electric Company
Mail Code: N11E
PO Box 770000
San Francisco, CA 94177-0001

Re: Revised Probable Maximum Flood and Wind-Wave Studies for Selected Dams in the McCloud River, Pit River, and Battle Creek Watersheds

Dear Mr. Nimick:

This is in response to a letter dated February 1, 2019 from Mr. David Ritzman that submitted revised Probable Maximum Flood (PMF) and wind-wave studies for selected dams in the McCloud River, Pit River, and Battle Creek watersheds. The dams included in the revised studies are: Pit No. 3 and Pit No. 5 Open Conduit Dams (FERC No. 233); North Battle Creek and Macumber Dams (FERC No. 1121); McCloud and Iron Canyon Dams (FERC No. 2106); and Pit No. 1 Forebay Dam (FERC No. 2687).

We have reviewed the revised PMF and wind-wave studies and find that they satisfactorily address our previous review comments; however, we have the following additional comment:

- The revised studies indicate that several of the dams would likely be overtopped during the PMF. However, PG&E's submittal does not discuss any potential dam safety implications that would result from the overtopping at these dams, nor any proposed actions to address this issue. Please evaluate the potential impacts that overtopping would have on these dams, and provide a plan and schedule to mitigate against any adverse effects that the overtopping could have on dam safety and/or the safety of downstream populations.

Within 45 days of the date of this letter, please address our comment or provide a plan and schedule to address our comment. Additionally, for future reference, please note our additional comments in the enclosure and incorporate them in future analyses, as appropriate.

We appreciate your continued cooperation in this aspect of the Commission's dam safety program. If you have questions, please contact Mr. Michael Vail at (415) 369-3346.

Sincerely,

Frank L. Blackett, P.E.
Regional Engineer

Enclosure

PMF Comments for Future Consideration **Enclosure**
FERC Project Nos. 233, 1121, 2106, and 2687

1. As an over-arching comment for future PMF studies, the submittal did not provide the expected level of methodology explanation, or component calculations (either for verification or as new) as is necessary for a flood study of record. In some instances, the implication was that these steps had occurred but were omitted from the submittal as unimportant or for brevity. Additionally, while there may be some utility to the use of the 1980s vintage PMF studies as a baseline, any reused parameters and calculations from those studies should be newly verified, justified, and documented, since the responsible personnel and background information for those original studies are mostly unavailable.

2. The U.S. Army Corps of Engineers (USACE) no longer supports the HEC-1 software. In future submittals, PG&E should develop HEC-HMS simulations (either new or using imported HEC-1 data) for hydrology and flow routing analyses.

3. Future submittals should describe how the critical PMPs for the local and general storms were spatially distributed over the entire contributing drainage area for each applicable dam in the study. Note that if the total drainage area for a particular dam was divided into subbasins, calculating separate PMPs for each subbasin and applying a single average areal reduction factor should be avoided since this technique assumes multiple PMP level storms occurring simultaneously within the same study area. Although this technique fundamentally follows the HMR 59 recommendation of developing an isopercental analysis that is based on the 100-year frequency map, the simultaneous occurrence of multiple PMPs is remote. Instead, we recommend:

    a. For General Storms: develop the spatial distribution using either the successive-subtractive method or an analysis of historical storms.

    b. For Local Storms: develop the spatial distribution using either the successive-subtractive method, an analysis of historical storms, or an HMR 59 elliptical pattern.

4. For future PMF studies, a sensitivity analysis should be conducted for each dam in order to determine the critical PMF. The sensitivity analysis should include both the local and general storms and document the depth, area, duration, orientation, temporal distribution, and center location that creates the greatest PMF (operational conditions) should be selected per Section 8-9.2 of our Engineering Guidelines.

5. For future submittals, the Exponential Loss Method should not be used for continuous simulations because it is a function of cumulative infiltration and does

not include any type of recovery (HEC-HMS User's Manual). Instead future models should use the Initial and Uniform Loss Method (which is the preferred method described in Chapter 8 of our Engineering Guidelines) or the Soil Moisture Accounting Method for continuous simulations with multi-peak rainfall events.

6. Future PMF studies should continue to include an analysis of wind-generated setup and wave runup to assess the available freeboard and any potential adverse consequences resulting from overtopping due to wave action. The combination of wind-generated setup and wave runup should be added to the PMF level-pool elevation to determine freeboard adequacy. A description of the methodology used and any supporting calculations and assumptions (e.g. fetch lengths, average water depths, wind speeds, etc.) should be provided. If historical wind data is available, a sensitivity analysis of wind speeds and directions should be performed in order to determine the wind velocity that produces the critical setup and runup heights during the PMF level pool elevation. The PMF level pool elevations determined through this analysis are not to be considered the PMF maximum reservoir elevation. The PMF reservoir elevation used for stability analyses is the level-pool elevation of the PMF inflow hydrograph routed through the reservoir, not including coincident wind setup and wave runup.

Attachment 5

Document Accession #: 20200601-5213 Filed Date: 06/01/2020

Pacific Gas and Electric Company

Power Generation

245 Market Street
San Francisco, CA 94105

Mailing Address:
Mail Code N11D
P.O. Box 770000
San Francisco, CA 94177

June 1, 2020

Via Electronic Submittal (E-File)

Mr. Frank Blackett, P.E., Regional Engineer
San Francisco Regional Office
Federal Energy Regulatory Commission
Division of Dam Safety and Inspections
100 First Street, Suite 2300
San Francisco, CA 94105-3084

RE: McCloud-Pit Project, FERC No. 2106-CA
2019 Dam Safety Inspection Follow-up Plan and Schedule

Dear Mr. Blackett:

This letter presents Pacific Gas and Electric Company's (PG&E) responses to action items identified during the 2019 annual Federal Energy Regulatory Commission (FERC) inspection of PG&E's McCloud-Pit Hydroelectric Project (FERC No. 2106). FERC and PG&E engineers visited the project facilities on September 18 and 19, 2019. Action items from the inspection were provided in a letter from FERC to PG&E dated November 18, 2019.

For reference, action items identified in FERC's November 18, 2019 letter are repeated below, followed by PG&E's responses and proposed plans and schedules for addressing the action items (if applicable), in italics.

McCloud Dam

1. Deficiencies with the McCloud Dam spillway chute were observed. Several spillway chute concrete floor slab and wall joints were observed with deteriorated or missing joint sealant. Concrete spalling and deterioration was observed adjacent to several spillway floor slab and wall joints. PG&E staff reported that several spillway joints were repaired in 2018, but the observed deficiencies were not included in the repairs. PG&E submitted the final construction report for the 2018 repairs by May 29, 2019 letter and stated that PG&E discovered more extensive damage to the spillway during implementation of the 2018 repairs. A 2018 follow-up investigation was conducted. PG&E has developed a detailed plan to address recommendations from the 2017 spillway assessment report and is currently updating its plan based on the results of the 2018 follow-up investigation. As stated in PG&E's May 29, 2019 letter, PG&E will provide FERC with an update on results

of the studies, along with an update on the status of PG&E's efforts to evaluate potential mitigation alternatives by March 31, 2020. The deficiencies identified above should be included in PG&E's updated spillway chute repair plan.

PG&E plans to address the spillway deficiencies identified during the 2018 follow-up investigation and noted in the 2019 FERC annual inspection as part of the overall scope of planned improvements to address recommendations from the 2017 detailed spillway assessment for McCloud Dam. PG&E's May 29, 2019 letter to FERC identified several studies that are currently underway to investigate and address the spillway deficiencies. The studies are listed below, followed by a status update after each.

- *Re-evaluating the inflow design flood (IDF) to determine the required spillway capacity based on current FERC guidance:*

  The current IDF for McCloud Dam, developed in 2012, is 70,000 cubic feet per second (cfs), which is approximately 50% of the probable maximum flood (PMF), based on the results of a 1988 dam failure study. In February 2020, PG&E completed an initial screening-level IDF evaluation, which indicates that a hypothetical failure of McCloud dam at the peak reservoir elevation under PMF conditions would produce a peak discharge of approximately 2.1 million cfs at the dam, which is about 16 times the peak non-failure PMF spillway discharge of approximately 133,000 cfs.

  The peak discharge estimated during the 2020 study is about 43 percent higher than that computed in the 2012 IDF model. The increase can be attributed to a larger assumed breach size and use of the full PMF inflow hydrograph rather than the 50 percent inflow hydrograph. Based on the screening-level evaluation, PG&E believes that a full IDF analysis, as described in Chapter 2 of the FERC Engineering Guidelines (2015a), would not result in an IDF lower than the PMF.

  The 2020 IDF screening identified habitable structures that may be impacted under a hypothetical failure of McCloud dam under PMF conditions. Therefore, it appears that the PMF should be recognized as the IDF for the dam. Based on the 2020 IDF screening, the required spillway capacity is therefore approximately 133,000 cfs.

- *Collecting data to support spillway hydraulic analyses and development of mitigation alternatives:*

  PG&E has retained GEI Consultants (GEI) to gather and review available information from PG&E's historic archives and California Department of Water Resources, Division of Safety of Dams (DSOD) files to support hydraulic analyses and development of mitigation alternatives for the McCloud Dam spillway. Documents collected for GEI's review included, but were not limited to, past Independent Consultant (IC) reports, supporting technical information documents, potential failure modes analyses, past historic modeling and studies, FERC relicensing documents, geologic studies, erodibility studies, LiDAR and bathymetry

data, as-built drawings and specifications, and environmental reports. Based on their review of the collected information, GEI developed ten potential screening level alternatives for providing the necessary flood routing capacity at McCloud Dam.

- *Analyzing and developing concept-level mitigation alternatives based on apparent deficiencies, changes in IDF loading conditions, and spillway performance expectations:*

  GEI is currently performing preliminary structural, geotechnical and hydraulic evaluations of the spillway structure at McCloud Dam, and developing up to four concept-level mitigation alternatives to address the deficiencies and capacity limitations identified by recent investigations and studies. All the alternatives currently under consideration involve major rehabilitation or reconstruction of the existing spillway structure and expansion or development of additional spill capacity at the reservoir.

  PG&E originally intended to complete its evaluation of potential mitigation alternatives in the spring of 2020. However, because of the recent COVID-19 pandemic and mandated shelter-in -place orders throughout the State of California, GEI has encountered delays in completing the alternatives analysis. PG&E respectfully requests an extension of time, until August 31, 2020, to submit the results of the alternatives evaluation, and a plan and schedule for further phases of analysis and design.

Pit 6 and Pit 7 Dam

2. Vehicle access to the toe of Pit No. 6 and Pit No. 7 dams and powerhouses may be critical for emergency response during a high flow dam safety event. Based on conversations with PG&E staff and observations of recent road erosion repairs, it is possible that the access roads located immediately downstream of Pit No. 6 and Pit No. 7 dams may be impassable due to erosion during a high flow event. Vehicle access to the dams during a flood event should be evaluated and an alternate vehicle access route should be developed, as necessary.

   As part of an emergency response study completed in 2012, PG&E evaluated the need and potential alternatives for secondary vehicle access routes to Pit 6 and Pit 7 Dams and their associated powerhouses. The study found that the remote location and rugged geography around the Pit No. 6 and No. 7 developments make alternative vehicle access routes impractical. There are no other nearby roads to which a new access road could be connected. Additionally, designing and constructing another road in the steep river canyon surrounding the dams would be challenging, if not impossible, in terms of engineering and erosion control. Any other road constructed to access the dams would be susceptible to the same flooding and erosion hazards as the current road.

   PG&E believes that maintaining the current access roads and improving the reliability and redundancy of the dam's remote monitoring and operation systems are more

effective approaches to reducing dam safety risks during high flow events. PG&E's recent project to install a second, automated backup power system for the dams' spillway gates is an example of such measures. Although vehicle access is desirable during an emergency event, PG&E crews are able to access the site by other means, if needed. Even with road failures during the historic water year of 2016/2017, PG&E still maintained access to the facilities via helicopter and on foot.

Pit 6 Dam

3. As reported in the Pit No. 6 2017 and 2018 Dam Safety Surveillance and Monitoring Reports (DSSMRs), Piezometer 6C has exceeded the established Threshold Level. During the 2019 dam safety inspection, project staff reported erratic readings associated with Piezometer 6C. The instrument should be investigated and the results of the investigation should be included in the next DSSMR.

   As discussed in PG&E's combined Dam Safety Surveillance and Monitoring Plan and Report (DSSMP/R) for the 2018 record year, which was filed with FERC on March 31, 2019, Piezometer 6C readings exceed the threshold Level between January and March and again in December of 2018. As reported in the 2019 DSSMP/R, which was submitted to FERC on April 1, 2020, the instrument's readings continued to exceed the threshold level in 2019.

   Based on the results of data analysis, field inspection, and calibration performed in 2019 and reported in the recently submitted DSSMP/R, PG&E believes Piezometer 6C is working properly and maintenance of the dam's drainage system is warranted. PG&E plans to inspect and clean the gallery drains in 2020 and will evaluate the post-cleaning piezometer readings to determine the effectiveness of the effort in reducing foundation pressures.

4. Seepage flow monitoring Weir PH-58A is located near the right toe of Pit No. 6 dam and measures seepage from the right dam/abutment contact. During the 2019 dam safety inspection, the weir was not visible due to excessive vegetation growth. Based on conversations with PG&E staff, access to clean the weir is available by helicopter only. The instrument is normally read by viewing the weir through binoculars from the crest of the dam. Access to the weir should be improved to ensure consistent and accurate seepage flow measurements are obtained. One option would involve extending the existing stairway access located along the upper right abutment contact, to allow for proper maintenance and up-close reading of Weir PH-58A.

   PG&E will discuss the need and consider potential alternatives for improving access to Weir PH-58A with the IC during the next five-year Part 12D safety review of Pit 6 dam in 2021. Results of the discussions and any recommendations for further action, if needed, will be presented in the IC's eleventh Part 12D Safety Inspection Report, which is scheduled for submittal to FERC by November 1, 2021.

   PG&E notes that vegetation has not impaired routine data collection at Weir PH-58A. PG&E will continue its routine vegetation management activities to ensure clear

readings at the weir. Per the 2019 DSSMP/R for Pit 6 Dam, filed with FERC on April 1, 2019, there were no recorded instances in 2018 or 2019 where Weir PH-58A exceeded threshold or action levels.

Should you have any technical questions concerning this matter, please call PG&E dam safety engineer, Mr. Ben Fontana, at (530) 762-9459. For general questions, please contact PG&E license coordinator, Mr. Sean Murphy, at (415) 973-5629.

Sincerely,



David L. Ritzman, P.E., G.E.
Chief Dam Safety Engineer

Attachment 6

Document Accession #: 20140917-5002 Filed Date: 09/17/2014

September 16, 2014

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington DC. 20426

Re: Safety Concerns at the Pit 7 Afterbay Dam on the McCloud-Pit Hydroelectric Project (P-2106)

Dear Secretary Bose,

American Whitewater, California Trout and Trout Unlimited write regarding our safety concerns at the Pit 7 Afterbay Dam on the Pit River at PG&E's McCloud-Pit Hydroelectric Project (P-2106). This structure continues to pose a significant safety hazard to the recreating public. To date, FERC has marked information relating to the structure as "classified" and failed to provide an opportunity for the public to provide input on this important safety issue. The current methods of protecting the public from the hazards posed by this "safety feature," which involve improving fences and signs, are inadequate. Several people have died at this location, and without meaningful changes, more are likely to perish during the term of this license. Regardless of the county codes or federal laws in place, history will not be kind if this happens. We request that FERC require PG&E to take a harder look at ways to improve the safety at the dam and to provide the public an opportunity to provide feedback.

American Whitewater, California Trout and Trout Unlimited have been involved with the McCloud-Pit Hydroelectric Project since the beginning of relicensing negotiations. American Whitewater first expressed concern over the safety of the Pit 7 Afterbay Dam in September 2010[1] on the Draft Environmental Impact Statement. In April 2011, American Whitewater again expressed concern regarding the safety of the dam, and requested the opportunity to meet with FERC staff before the Project's schedule safety inspection.[2] FERC denied the request.[3]

Water safety is an important part of American Whitewater's mission. The organization's river accident database,[4] which is housed on its website, is the most comprehensive source for river related accidents in the country. The database shows that low head dams, such as the Pit 7 Afterbay Dam, have been responsible for 8.6 percent of all river fatalities from 1975 through 2011. Often referred to as

[1] FERC eLibrary Accession No. 20100928-5404.
[2] FERC eLibrary Accession No. 20110411-5017.
[3] FERC eLibrary Accession No. 20110427-0342.
[4] http://www.americanwhitewater.org/content/Accident/view/

"drowning machines," low head dams are generally considered to be the most dangerous type of dam. This is due to several factors. First, these dams do not appear to be dangerous to the untrained eye. Water above the dams is typically calm and moving at a relatively low velocity. Second, the drop over the top of the dam down to the pool below is often not that great, and the whitewater below the dam does not look that significant. Unfortunately, the hydraulics created below low head dam features is extremely dangerous because once boats or individuals are trapped in this hydraulic it is extremely difficult, if not impossible, to escape. A video from the Bureau of Reclamation does an excellent job of illustrating the potential hazards at low head dams, and can be found at:
http://www.usbr.gov/watersafety/images/lowheaddam.swf.

The safety issues at the Pit 7 Afterbay Dam are exacerbated by the fact that this dam creates enhanced angling opportunities below the dam, attracting anglers. Because the Pit 7 Afterbay Dam acts as a barrier to upstream fish migration, fish tend to concentrate below the dam, creating excellent fishing opportunities. It is our understanding that all of the fatalities that have occurred at this dam have been associated with boat-based anglers attempting to fish immediately below the dam, which is of particular importance to Trout Unlimited and California Trout.



An angler fishes dangerously close to the Pit 7 Afterbay Dam.

In addition to the drowning hydraulic that exists below the dam, the rock crib structure of the main dam is also a hazard. The main dam is essentially large rocks covered with a wire mesh, creating a high probability that individuals could experience a foot entrapment and not be able to exit when water comes over the top of the dam.

What is most perplexing about this feature is that its primary purpose is to improve pubic safety. According to FERC's FEIS for this project (P-2106), "Pit 7 Afterbay serves to attenuate changes in the water flow from Pit 7 Dam and Powerhouse before entering Shasta Lake, which abuts and sometimes inundates the afterbay."[5] While we recognize that the Pit 7 Powerhouse can release substantial flows into the river channel, it is unclear if this attenuation function is actually necessary. It is important to note that we do not know of any public safety incidents that have occurred in the 1.7 miles between the Pit 7 Powerhouse and the Afterbay Dam. This is despite potential flow fluctuations from 150 to 7,440 cfs below the Pit 7 Powerhouse. We are also unaware of any incidents at other peaking facilities that do not have attenuation structures. An attenuation weir structure was removed in 2012 below the Stanislaus Powerhouse on the Spring Gap-Stanislaus Hydroelectric Project (P-2130) because it was deemed to be a safety hazard.[6] We have found no record of safety incidents related to flow ramping since this attenuation weir was removed.

In November 2012, PG&E released a report on its study of the feasibility of modifications to the existing V-notch weir.[7] The report is classified as CEII, however the cover letter for the document states that report finds that regardless of dam modifications, velocities will remain too high for safe boating immediately downstream of the Pit 7 Afterbay Dam, and that the best alternative is to keep the boating public a safe distance away from the high velocity water by improving existing barriers and warning signs.[8] On January 17, 2014, FERC concurred with PG&E's finding that none of the alternatives studied can remove the potential hazards to water recreationists close to the dam.[9]

On July 21, 2014, the Forest Service responded, stating that the study "did not analyze a sufficient range of alternatives because it only looked at modifying the existing weir in place. PG&E's conclusion to continue operation of the facility, without any modifications to reduce unsafe hydraulics, will continue to put the public at significant and unnecessary risk."[10]

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[5] Final Environmental Impact Statement for Hydropower License, McCloud-Pit Hydroelectric Project, FERC Project No. 2106, February 2011, page 36. FERC eLibrary Accession No. 20110225-4001.
[6] Order Issuing New License for the Spring Gap-Stanislaus Hydroelectric Project, April 24, 2009, FERC Project No. P-2130-033, 127 FERC ¶ 62,070, page 19.
[7] FERC eLibrary Accession No. 20121130-5462.
[8] FERC eLibrary Accession No. 20121130-5461.
[9] FERC eLibrary Accession No. 20140124-0203.
[10] FERC eLibrary Accession No. 20140721-0018.

We concur with the Forest Service's conclusion that building stronger and taller fences is not a workable solution, and that further analysis is required. We encourage FERC and PG&E to consider alternative measures for improving safety at the Pit 7 Afterbay Dam. We recommend that those managing this project consider engineering techniques, such as developing an abrupt drop to eliminate the dangerous recirculation patterns created at the dam itself, or a boat-chute with abrupt drops to allow for safe bypass. These techniques have been used nationally to reduce recreational hazards. After modeling both techniques, researchers found that "for boating safety, experience has demonstrated that, a series of chutes and pools is preferable to one greater drop."[11]

In addition to the above recommendation, American Whitewater, California Trout and Trout Unlimited request the following in the process to improve public safety at the Pit 7 Afterbay Dam.

1. FERC should make available to the public PG&E's 2012 report evaluating alternatives for modifying the Pit 7 Afterbay Dam.
2. If not already contained in the aforementioned study, PG&E should conduct an analysis of whether/how the Pit 7 Afterbay Dam improves safety by attenuating flows. This should also include examples of how flow attenuation is achieved, or deemed unnecessary, at other peaking facilities.
3. FERC should schedule a meeting with all interested stakeholders and resource agencies to discuss the results of this study and to receive public input on a full range of options, beyond just modifying the existing structure, to improve public safety.

Thank you for your consideration on this important topic. We look forward to having an opportunity to discuss this matter with you in more depth.

Sincerely,





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[11] McLaughlin, Richard E, and Grenier, Roger R, Low-Head Drop Structure Hazards: Modeling of an Abrupt Drop Boat Chute, *Hydraulic Engineering* Volume I, pp. 714-721, at 715.



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Attachment 7

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Pacific Gas and Electric Company) Upper NF Feather Hydroelectric Project No. P-2105

AMERICAN WHITEWATER'S COMMENTS ON CANYON DAM SPILLWAY SAFETY AND REQUEST FOR ADDITIONAL INFORMATION

American Whitewater respectfully submits these comments regarding our concerns related to the safety of the spillway at Canyon Dam (Lake Almanor) of Pacific Gas & Electric Company's Upper North Fork Feather River Hydroelectric Project, P-2105. A combination of factors and events have led us to be seriously concerned about the integrity and functionality of the spillway as well as the potential for its use to inundate the town of Chester, California on the banks of Lake Almanor. We believe that the public should be able to access information that provides a meaningful understanding of dam safety at Canyon Dam, including that of its spillway, and respectfully request that the Commission provide additional information to this end.

Known Issues With Canyon Dam Spillway Are Cause for Immediate Concern

On May 2, 2023, Pacific Gas & Electric Company (PG&E) filed an extension of time request to address recommendations from the 11th 5-year Part 12D safety inspection report (dated January 2021) and focused spillway assessment report (dated December 27, 2017) for Canyon Dam.[1] Enclosure 1 of PG&E's request details ten safety recommendations related to deficiencies in the spillway's design and condition.

Each of these recommendations take on a greater significance in light of this year's historic snowpack and associated runoff in the basin, which increases the likelihood of using Canyon Dam's spillway for the first time. Future climate variability may result in more frequent and severe flood potential and increase the need for a properly functioning spillway.

Recommendations from the Focused Spillway Assessment[2] include repair of damaged concrete in multiple areas of the spillway. Specifically identified issues with the spillway include concrete

[1] Upper North Fork Feather River Hydroelectric Project, FERC No. 2105-CA Lake Almanor Dam, NATDAM No. CA00327 11th Part 12D Safety Inspection Report – Recommendations 3, 4, and 48 2017 Focused Spillway Assessment – Recommendations 1, 2, 3, 5, 8, 9, and 12 Extension of Time Request (May 2, 2023), eLibrary no. 20230502-5097.
[2] Project Safety-Related Submission to SFRO of Pacific Gas and Electric Company under P-2105, Upper North Fork Feather River Proj, FERC NO. 2105, Re: Spillway Assessment Reports, Lake Almanor Dam, NATDAM# CA00327 (January 2, 2018), eLibrary no. 20180102-5077.

delamination, cracks, failed repairs, voids, exposed wire mesh and reinforcements, and over 4,000 linear feet of joints that need repair and/or sealing (see recommendations 1, 2, 3, 4, and 9).

Recommendations from the 11th Part 12D Safety Inspection Report[3] focus on design issues with the spillway and include performing a hydraulic analysis of the spillway for flows up to probable maximum flood (PMF),[4] performing a geologic reconnaissance of the slope opposite the spillway to evaluate erosion and slope instability from spillway operation, and structural analyses for the spillway walls including for seismic loading (see recommendations 3, 4, and 48).

Two earthquakes with magnitudes of 5.4 and 5.1 occurred on May 11, 2023 with epicenters beneath Lake Almanor in the immediate vicinity of Canyon Dam. Numerous aftershocks and smaller earthquakes persisted for the following week. These highlight the need to promptly analyze spillway structure, ensure seismic integrity, and evaluate possible damage from the recent earthquakes particularly in relation to the previously identified issues in the spillway assessment and safety inspection report.

Based on these previously identified deficiencies and needs for repair, maintenance, and structural analyses, we are concerned that the spillway may not function as intended. In addition to severe damage to the integrity of the spillway, which may occur during use as a result of known issues with its concrete and joints, we are especially concerned that use of the spillway may erode the western bank of the North Fork Feather River and trigger slope failures and tailwater erosion that could directly affect the integrity of Canyon Dam itself.

During a site visit on April 28, 2023, we were able to easily see many of these issues with the spillway (see Enclosure 1: Canyon Dam Spillway Photos). Even a layperson can determine that the spillway is in poor condition with spalled concrete and vegetation growing in wide joints. The orientation of the flip bucket clearly points toward the western bank of the river and an area that would be unprotected from erosion from spillway discharges. It is difficult to imagine the spillway passing the PMF of 29,856 cfs or the stated design capacity of 68,000 cfs[5] without extensive damage, failure, and/or the collapse of the hillslope on the western bank of the North Fork Feather River near the base of the dam.

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[3] Pacific Gas and Electric Company submits the 11th Part 12D Safety Inspection Report for the Upper North Fork River Hydroelectric Project under P-2105, (January 29, 2021), eLibrary no. 20210129-5215.
[4] The probable maximum flood is the theoretically largest flood resulting from a combination of the most severe meteorological and hydrologic conditions that could conceivably occur in a given area. *See* United States Federal Energy Regulatory Commission. (2001). Determination of the probable maximum flood (Chap. VIII). Engineering guidelines for the evaluation of hydropower projects, 121.
[5] For PMF and spillway capacity values, *see* Letter requesting Pacific Gas and Electric Company to provide a plan and schedule within 30 days re the review of probable maximum flood estimate revisions for the Bucks Creek Project et al under P-803 et al., (December 21, 2015), eLibrary no. 20151221-0206 (PMF Revision Letter).

The Spillway Has Never Been Tested and Its Use May Inundate Chester, California

Since Canyon Dam was raised to its current elevation in 1962, there have been numerous flood events in the Feather River watershed including 1964, 1983, 1997, and 2017. The dams throughout the watershed used their flood control structures during these events, with the exception of Canyon Dam. In fact, the spillway at the dam has never been tested or used.

For most reservoirs, the maximum pool elevation is defined by the height of the dam's spillway crest. However, for Lake Almanor, FERC has stated that the maximum operating pool is six feet *below* Canyon Dam's spillway crest.[6] In our search of the project docket, we could find no explanation as to why the maximum operating pool for the reservoir is below the spillway crest.

A quick look at a topographic map reveals that the spillway crest elevation is roughly the same elevation as portions of Chester, California on the northern shore of Lake Almanor. It seems plausible, if not likely, that the maximum operating pool of Lake Almanor is defined as six feet below the spillway crest because use of the spillway would raise Lake Almanor enough to inundate portions of the town.

To investigate this possibility with greater precision, we used a geographic information system to analyze a high resolution bare earth digital elevation model derived from the U.S. Geological Survey's 2018 LiDAR data[7] to compare Canyon Dam's spillway crest elevation with elevations of land in the town of Chester. The USGS acquired this LiDAR data for use in conservation planning, design, research, floodplain mapping, dam safety assessments and elevation modeling.[8] It has a verified three-dimensional accuracy of 2.5 centimeters, which allowed us to perform an exceptionally accurate analysis and produce a detailed inundation map.[9]

Our analysis found that the spillway crest is higher than low-lying parts of Chester and, when factoring in the additional height of water passing over the spillway crest, a significant portion of Chester may be inundated if the spillway is used (see Enclosure 2: Chester, CA Inundation Map and Table 1). The first homes in Chester will begin to inundate when just 0.8 feet of water depth flows over the top of the spillway crest. Entire neighborhoods will inundate when 3.8 feet of water depth flows over the spillway crest.

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[6] Draft Environmental Impact Statement, Upper North Fork Feather River Project, California (December 2004), eLibrary no. 20040913-0296.
[7] OCM Partners, 2023: 2018 - 2019 USGS Lidar: Northern California Wildfire - QL1, https://www.fisheries.noaa.gov/inport/item/59131.
[8] Ibid.
[9] Per standard geospatial practices, the elevations in the LiDAR data and our analysis are reported in the North American Vertical Datum of 1988 (NAVD88) that is used by the U.S. Geological Survey. However, PG&E uses its own datum, the "PG&E datum," that is 10.2 vertical feet lower than the NAVD88. Subtract 10.2 feet from NAVD88 elevations to convert to PG&E datum elevations.

While most dam safety inundation assessments and emergency action plans focus on flooding downstream of a dam, Canyon Dam, via use of its spillway, may also flood Chester, upstream of the dam by raising the level of Lake Almanor to an elevation that is higher than developed areas in the town. This possibility is not disclosed in publicly accessible portions of the project's docket or publicly accessible dam safety information.

Location: impact	**Elevation, feet (NAVD88)**	**Elevation, feet (converted to PG&E datum)**	**Height above spillway crest, feet**
Canyon Dam spillway crest: reservoir reaches crest	4510.2	4500	0
Chester: first homes inundated	4511	4500.8	0.8
Chester: neighborhoods inundated	4514	4503.8	3.8
Chester: 3rd & 4th Ave neighborhoods inundated	4518	4507.8	7.8
Chester: downtown inundated	4521	4510.8	10.8
Chester: most of town inundated	4527	4516.8	16.8

Table 1: LiDAR digital elevation model analysis results indicate that use of Canyon Dam's spillway will inundate portions of the town of Chester, California by raising the level of Lake Almanor to an elevation that is higher than some developed areas in the town.

Essential Dam Safety Information Is Not Publicly Available

Following the September 11, 2001 terrorist attacks, the Commission removed from public viewing certain documents detailing the specifications of licensed or certified energy facilities that it had previously made available to the public through various means. On February 21, 2003 with its Order 630, the Commission adopted a Critical Energy/Electric Infrastructure Information (CEII) process to determine what information submitted to the Commission may be kept from public viewing and to withhold qualifying information from the public.

CEII is defined as information related to or proposed to critical electric infrastructure, generated by or provided to the Commission or other Federal agency other than classified national security information, and that is designated as critical electric infrastructure information by the Commission or the Secretary of the Department of Energy pursuant to section 215A(d) of the Federal Power Act.

CEII is limited to specific engineering, vulnerability, or detailed design information about proposed or existing critical infrastructure (physical or virtual) that:

1. Relates details about the production, generation, transmission, or distribution of energy;
2. Could be useful to a person planning an attack on critical infrastructure;
3. Is exempt from mandatory disclosure under the Freedom of Information Act; and
4. Gives strategic information beyond the location of the critical infrastructure.

As the Commission is well aware, many of its licensees have used the CEII process to withhold from public access information that does not properly meet these criteria. The Commission's Order 683, issued on September 21, 2006, addressed this situation by more specifically defining the types of information that qualify for CEII designation. However, many licensees, including PG&E, have continued to use the CEII process to withhold essentially all dam safety information from public access. As explained in more detail below, information commonly designated CEII is well out of bounds of specific engineering, vulnerability, or detailed design information that could be useful to a person in planning an attack on critical infrastructure.[10] This has left the American public in the dark and unknowledgeable about the risks that dams may pose to their personal safety, families, livelihoods, and property.

The Commission's regulation at 18 CFR § 388.112(b)(1) requires that filers provide a justification for CEII treatment. The filer also must submit to the Commission a public version with the information that is claimed to be privileged material redacted, to the extent practicable, as required by 18 CFR § 388.113(d)(2). We are unable to locate these justifications for CEII treatment on the docket, suggesting that they too are withheld from the public. Nor are we able to locate public versions of CEII filings with redactions as required by regulation.

As an example that relates to Canyon Dam, it appears that the PMF value is dated and may have last been calculated in 2010.[11] Several filings on the docket appear to address revision of the PMF;[12] however, these filings are designated CEII so there is no way for the public, including those that would be directly affected by a flood, to know what the current PMF is expected to be. For clear and obvious reasons, this basic information should be publicly available.

Similarly, the 2010 PMF the stated PMF inflow is 161,603 cfs while the PMF outflow is 29,856 cfs, 5.4 times less than the inflow.[13] We have been unable to find public information on the

[10] *See* 18 CFR § 388.113.
[11] *See* PMF Revision Letter.
[12] For example, Memo dated 12/15/15 from San Francisco Regional Office re the Review of the Revised Probable Maximum Flood Estimate for Selected Dams in the Feather River Watershed, eLibrary no. 20151221-0244; Pacific Gas and Electric Company's CD containing their report entitled Probable Maximum Flood Estimate Revisions for Selected Dams in the Feather River Watershed, eLibrary no. 20110103-4007.
[13] PMF Revision Letter.

docket that explains how the PMF outflow can be less than 20% of the PMF inflow considering that the project can pass a total of only approximately 4,118 cfs through its generators and the Prattville Tunnel combined. This would leave the remaining 127,629 cfs of PMF inflow to exit the reservoir via another pathway such as the spillway. We presume that this explanation has also been kept from the public due to CEII designation.

Request for Additional Information Related to Canyon Dam Safety and CEII Filings

Given the known deficiencies in Canyon Dam's spillway design and condition, we respectfully request that the Commission provide additional information to the public regarding the current safety of the dam and its spillway. Specifically, we request that the Commission provide information sufficient to answer, or direct answers, to the following questions:

1. What is the latest calculated value of the probable maximum flood?
2. Can PMF flows be passed without using the spillway?
3. Is the Canyon Dam spillway capable of safely passing PMF flows or its stated design capacity flows?
4. How is the five-fold difference in PMF inflow and PMF outflow explained?
5. From a dam safety perspective, is 4,118 cfs of combined low level outlet and power generation flows adequate for a 1.3 million acre-foot reservoir?
6. How do the known issues with Canyon Dam's spillway affect its ability to safely pass runoff or storm event flows?
7. Is the inundation of Chester, California considered in the project's CEII-designated Emergency Action Plan?
8. Are PG&E's proposed delays in their May 2, 2023 request for extension of time acceptable given the significance of the identified dam safety issues and the significant amount of time that has already passed since the 2017 and 2021 safety recommendations were first made?
9. Will the Commission make PG&E's responses to address the January 2021 safety inspection report and December 2017 spillway assessment report recommendations available to the public?

Additionally, we request that the Commission make public filers' CEII justification statements that are required by 18 CFR § 388.112(b)(1) and uphold 18 CFR § 388.113(d)(2) by requiring filers to submit public versions of CEII filings with privileged CEII material redacted.

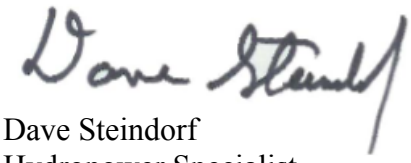
Conclusion

There is justification for considerable concern about the safety and functionality of Canyon Dam's spillway and the potential for flooding of Chester, California that its use presents.

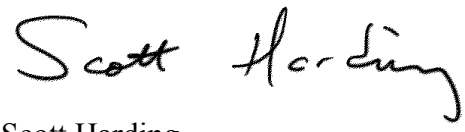
Unfortunately and unjustifiably, most of the information related to these issues is kept from the public via inappropriate use of CEII designations. American Whitewater has participated in the relicensing of the Upper North Fork Feather River project since it began 23 years ago, and in that time, there has never been a public dialogue regarding the dam safety issues that we highlight in this filing.

Given the known issues with the spillway, the abundance of runoff from this year's historic snowpack, the recent seismic activity near the dam, and PG&E's continued requests for delaying action related to dam safety, we believe that it is time for the Commission to act in the best interest of the public by providing relevant dam safety information to which CEII designations do not legitimately apply under regulations and by expediting necessary actions to secure the safety of the spillway and its operation.

Respectfully submitted June 7, 2023,



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Scott Harding
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Enclosure 1: Canyon Dam Spillway Photos - April 28, 2023



Canyon Dam spillway panorama



Cracked, spalled, and poorly maintained concrete



Cracked, spalled, and poorly maintained concrete



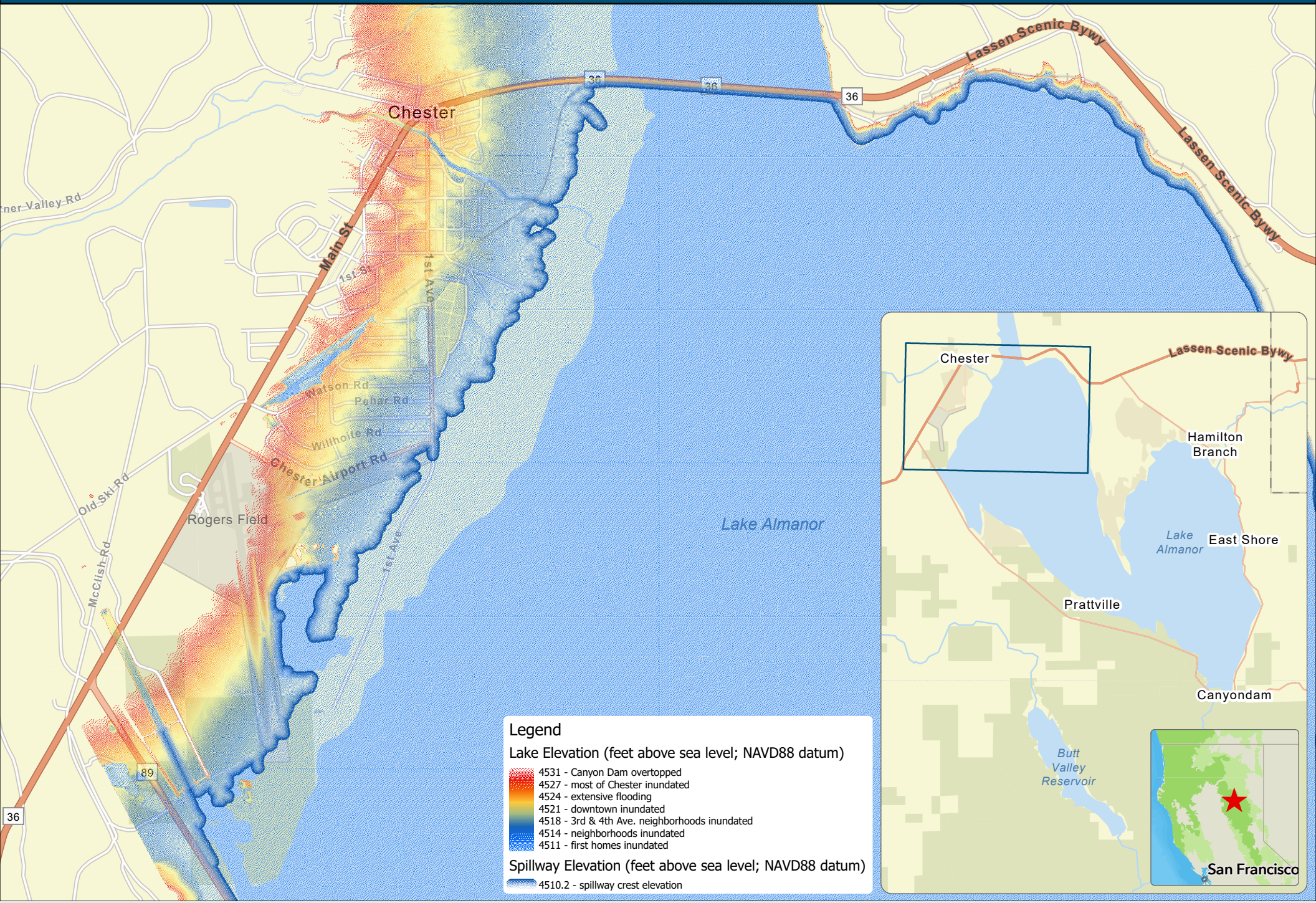
Spillway outlet with tipping bucket directs flow toward an unprotected hillslope near base of dam

Enclosure 2: Chester, California Inundation Map from Lake Almanor / Canyon Dam Spillway

See map on following page.

Chester, California Inundation from Lake Almanor / Canyon Dam Spillway

Document Accession #: 20230616-5243 Issued Date: 06/17/2023



AMERICAN Whitewater

N

0 0.5 1 2 Miles

Elevations are derived from USGS LiDAR data and are referenced to the NAVD88 datum. To convert NAVD88 elevations to the PG&E datum, subtract 10.2 feet. (LiDAR data source: 2018 - 2019 USGS Lidar: Northern California Wildfire - QL1)

CERTIFICATE OF SERVICE

I, Scott Harding, hereby certify that I have this day served these American Whitewater's Comments on Canyon Dam Spillway Safety and Request for Additional Information upon each person on the official service list compiled by the Secretary for the Upper North Fork Feather River Hydroelectric Project P-2015 docket, by e-mail or postal mail as directed on the service list.

Dated this 7th day of June 2023 at Forks of Salmon, California.



Scott Harding
Stewardship Associate
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Attachment 8(a)

Document Accession #: 20230502-5097 Filed Date: 05/02/2023

Pacific Gas and Electric Company

Power Generation

300 Lakeside Drive
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Mailing Address:
Mail Code N11D
P.O. Box 770000
San Francisco, CA 94177

May 1, 2023

Via Electronic Submittal (E-File)

Frank L. Blackett, P.E., Regional Engineer
Federal Energy Regulatory Commission
Division of Dam Safety and Inspections
100 First Street, Suite 2300
San Francisco, CA 94105-3084

RE: Upper North Fork Feather River Hydroelectric Project, FERC No. 2105-CA
Lake Almanor Dam, NATDAM No. CA00327
11th Part 12D Safety Inspection Report – Recommendations 3, 4, and 48
2017 Focused Spillway Assessment – Recommendations 1, 2, 3, 5, 8, 9, and 12
Extension of Time Request

Dear Frank L. Blackett:

This letter presents Pacific Gas and Electric Company's (PG&E) request for extensions of time to address recommendations from the 11th 5-year Part 12D safety inspection report (dated January 2021) and focused spillway assessment report (dated December 27, 2017) for Lake Almanor Dam, which is part of PG&E's Upper North Fork Feather River Hydroelectric Project, Federal Energy Regulatory Commission (FERC) No. 2105-CA. Included with PG&E's extension of time request is our reasoned basis for the request, per Title 18 of the Code of Federal Regulations, Section 12.40(d). PG&E submitted its original plans and schedules for addressing Recommendations 3, 4, and 48 (R-3, R-4, and R-48) from the 11th Part 12D safety inspection report and Recommendations 1, 2, 3, 5, 8, 9, and 12 (R-1, R-2, R-3, R-5, R-8, R-9, and R-12) from the 2017 focused spillway assessment report in letters to your office dated March 30, 2021, November 24, 2021, and June 30, 2022.

PG&E retained an engineering consultant as part of its Spillway Assessment and Improvement Program (SAIP) to perform the required spillway evaluations. As presented in detail in the enclosed extension of time request (Enclosure 1), PG&E respectfully requests an extension of time to review the results of the spillway evaluations.

Should you have technical questions concerning this matter, please contact Chris Duffey, dam safety engineer for PG&E, at (530) 513-9559. For general questions, please contact Holly Tarr, license coordinator for PG&E, at (530) 789-7653.

Sincerely,



Matthew Joseph
Supervisor, Hydro License Compliance

Enclosure:
1. Extension of Time Request for Recommendations from the 11th Part 12D Safety Inspection Report and 2017 Focused Spillway Assessment Report

Attachment 8(b)

ENCLOSURE 1

Upper North Fork Feather River Hydroelectric Project, FERC No. 2105-CA
Lake Almanor Dam, NATDAM No. CA00327
Extension of Time Request for
Recommendations 3, 4, and 48 from the 11th Part 12D Safety Inspection Report and
Recommendations 1, 2, 3, 5, 8, 9, and 12 from the 2017 Focused Spillway Assessment Report

No.	Recommendations	PG&E's Plan and Schedule	Proposed Schedule
Recommendations from the 11th Part 12D Safety Inspection Report (Dated January 2021)			
3	We recommend PG&E perform hydraulic analysis of the spillway for flows up to PMF to evaluate the freeboard at the spillway walls, flow velocities, and flow trajectory from the flip bucket. The evaluation should include tailwater condition effects. (PFMs 4, 11, and 13).	**Ongoing:** As part of PG&E's SAIP, PG&E retained an engineering consultant to perform hydraulic evaluations of the spillway and develop an AoA for repair and/or rehabilitation of the spillway, as needed. PG&E is currently reviewing the results of the evaluations; therefore, PG&E respectfully requests an extension of time to July 31, 2023, to provide the results of the AoA. As part of the SAIP, PG&E is establishing a long-term CIP to address deficiencies at its spillways. PG&E plans to evaluate and prioritize potential long-term spillway improvements at Lake Almanor Dam within the overall CIP portfolio. By July 31, 2023, PG&E will report to FERC on the results of the evaluation and provide a plan and schedule for further actions to improve the spillway.	7/31/2023
4	We recommend PG&E perform a geologic reconnaissance of the western canyon slope opposite the spillway flip bucket to evaluate the potential for erosion of the slope if discharge from the spillway flip bucket were to impact the base of the slope, as well as evaluate the potential impacts to slope instability. (PFM 18).		
48	We recommend existing structural analyses for the spillway walls be located, or new analyses performed, for the seismic load case, at a minimum. We recommend these analyses be performed concurrently with evaluation of the spillway hydraulics (Recommendation R-3). If the hydraulic evaluation suggests walls unsupported by soil backfill (freestanding walls) are heavily loaded during the flood condition, these		

Notes: AoA = analysis of alternatives; CIP = Capital Improvement Program; FCR = final construction report; FERC = Federal Energy Regulatory Commission; PFM = potential failure mode; PMF = probable maximum flood; PG&E = Pacific Gas and Electric Company; SAIP = Spillway Assessment and Improvement Program.

No.	Recommendations	PG&E's Plan and Schedule	Proposed Schedule
	walls should be evaluated for outward flood loading as well.		
Recommendations from the Focused Spillway Assessment (Dated December 27, 2017)			
1	Repair damage to the chute slab concrete (downstream of the spillway crest) at joint separations, spalls, voids, and areas adjacent to joints where reinforcement is exposed.	**Ongoing:** PG&E requests an extension of time to complete spillway repairs. PG&E plans to begin joint repairs in 2023 and is currently developing a construction package to submit to FERC in an upcoming filing with a planned construction start date of August 15, 2023. PG&E plans to complete approximately 4,000 linear feet of joint repair this construction season, depending on the actual start date. PG&E plans to continue joint repair in the spring/summer of 2024 with a planned completion date for all joint repairs by October 31, 2024. PG&E will submit an FCR to FERC within 90 days of completion of the project. PG&E will report on the completion of these maintenance efforts by January 31, 2025.	1/31/2025
2	Apply joint sealant or perform concrete repair for cracks in the concrete chute slab (downstream of the spillway crest), with more than 1/2-inch of separation.	**Ongoing:** PG&E requests an extension of time to complete spillway repairs. PG&E plans to complete crack repairs in summer 2024, with a planned completion date for all repairs by October 31, 2024. PG&E is currently developing a construction package to submit to FERC in an upcoming filing. PG&E will submit an FCR to FERC within 90 days of completion of the project. PG&E will report on the completion of these maintenance efforts by January 31, 2025.	1/31/2025
3	Restore transverse joint seals by cleaning the joints and applying sealer material.	**Ongoing:** PG&E requests an extension of time to complete spillway repairs. PG&E plans to install joint sealant in the transverse joint in summer 2024, with a planned completion date for all joint repairs by October 31, 2024. PG&E will submit an FCR to FERC within 90 days of completion of the project. PG&E will report on the completion of these maintenance efforts by January 31, 2025.	1/31/2025
5	Perform concrete patching of the inside faces of chute walls in areas of failed concrete repairs and concrete delamination. Near-term repairs should focus on lower half of the walls.	**Ongoing:** PG&E requests an extension of time to complete spillway repairs. PG&E is currently developing a construction package to submit to FERC in an upcoming filing and plans to complete patching of the spillway chute by December 15, 2025. PG&E will submit an FCR to FERC within 90 days of completion of the project. PG&E will report on the completion of these maintenance efforts by March 15, 2026.	3/15/2026

Notes: AoA = analysis of alternatives; CIP = Capital Improvement Program; FCR = final construction report; FERC = Federal Energy Regulatory Commission; PFM = potential failure mode; PMF = probable maximum flood; PG&E = Pacific Gas and Electric Company; SAIP = Spillway Assessment and Improvement Program.

No.	Recommendations	PG&E's Plan and Schedule	Proposed Schedule
8	Repair the concrete approach apron to patch voids and address areas of exposed wire mesh.	**Ongoing:** PG&E requests an extension of time to complete spillway repairs. PG&E is currently developing a construction package to submit to FERC in an upcoming filing. PG&E plans to complete patching of the spillway chute by December 15, 2025 and will submit an FCR to FERC within 90 days of completion of the project. PG&E will report on the completion of these maintenance efforts by March 15, 2026.	3/15/2026
9	Patch spalled areas of concrete on top of chute walls.	**Ongoing:** PG&E requests an extension of time to complete spillway repairs. PG&E is currently developing a construction package to submit to FERC in an upcoming filing, PG&E plan to complete patching of the spillway chute by December 15, 2025. Within 90 days of completion of the project, PG&E will submit an FCR. PG&E will report on the completion of these maintenance efforts by March 15, 2026.	3/15/2026
12	Repair and/or reline the concrete chute to protect reinforcing steel, maintain waterstops, minimize crack and joint deterioration and restore loss of the concrete section. Conduct an alternatives analysis to evaluate feasible restoration approaches.	**Ongoing:** As part of PG&E's SAIP, PG&E is evaluating rehabilitation/repair alternatives for the spillway. As noted in R-3 and R-48 from the 11th Part 12D safety inspection report, PG&E plans to submit the results of the spillway AoA to FERC by July 31, 2023, along with a plan and schedule for developing, implementing, and maintaining interim risk-reduction measures, as necessary, until long-term improvements are completed.	7/31/2023

Notes: AoA = analysis of alternatives; CIP = Capital Improvement Program; FCR = final construction report; FERC = Federal Energy Regulatory Commission; PFM = potential failure mode; PMF = probable maximum flood; PG&E = Pacific Gas and Electric Company; SAIP = Spillway Assessment and Improvement Program.

Attachment 9

NOTES FOR OVERVIEW MAP AND CORRESPONDING DETAILED MAP SHEETS:

1. This map is part of the Emergency Action Plan for Lake Almanor Dam prepared in general accordance with FERC Chapter 6 - Emergency Action Plans dated July 2015. The information shown is approximate and should be used as a guideline for emergency preparation and response.

2. Security-sensitive infrastructure may not be shown on these maps.

3. The flooding limits and flood wave travel times are approximate based on the methods and assumptions used to estimate potential downstream impacts from a hypothetical dam failure. These maps should only be used to establish evacuation zones. Areas inundated from an actual dam failure may differ from areas shown on the maps. The results presented herein do not reflect in any way on the structural integrity of the dam and are not to be construed as such.

4. Distances of cross sections are referenced from Lake Almanor Dam. "Time of Arrival" and "Time to Peak" (hours and minutes) at each cross section are referenced to the initiation of the subject dam breach. "Time of Arrival" based on the initial 1-ft water surface elevation increase above the non-failure water surface elevations for each case.

5. For other details refer to reports prepared by GEI Consultants, Inc. titled "Downstream Flooding Due to the Hypothetical Failure of Lake Almanor Dam for the PMF Case" dated June 2011, and "Downstream Flooding Due to the Hypothetical Failure of Lake Almanor Dam for the Sunny Day Case" dated February 2020.

6. Structures depicted on the maps are intended to assist in locating individual structures in rural areas but are not intended to represent all possible structures potentially within the inundation limits.

7. Map projection: North American Datum 1983 California (Teale) Albers (Meters). Reference points display coordinate values in Albers Equal Area Conic projection, North American Datum 1983. Elevations referenced to NGVD 29 Datum. At Lake Almanor Dam, NGVD 29 = NAVD 88 - 3.2 ft.

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
1	0.00	---	---	4,518	---	719,700	---	---	---	4,510	---	810,700	---	Lake Almanor Dam
2	0.20	0:02	0:36	4,490	78	719,700	44	0:02	0:43	4,496	99	810,700	46	Downstream of Lake Almanor Dam
3	4.51	0:14	0:45	3,749	55	723,500	65	0:20	0:52	3,753	73	807,700	67	structures, right bank
4	5.18	0:16	0:47	3,661	49	724,400	55	0:23	0:54	3,664	69	807,400	57	Seneca Road Bridge
5	6.74	0:22	0:53	3,487	47	726,000	57	0:29	1:00	3,490	64	806,200	59	structures, right bank
6	9.01	0:28	1:02	3,275	56	728,700	48	0:36	1:08	3,279	75	804,400	49	China Bar
7	10.82	0:32	1:06	3,085	74	730,800	30	0:41	1:10	3,090	102	803,300	31	[redacted]
8	11.87	0:35	1:08	3,050	48	811,500	---	0:43	1:13	3,055	69	886,900	---	Belden Forebay Dam
9	11.95	0:35	1:32	2,952	68	811,500	44	0:44	1:38	2,955	105	886,900	46	Downstream of Belden Forebay Dam
10	14.13	0:41	1:36	2,790	65	809,400	51	0:52	1:41	2,793	86	879,900	53	Caribou Road
11	16.72	0:49	1:40	2,523	49	810,600	43	1:00	1:45	2,526	67	875,700	44	Queen Lilly Campground
12	17.36	0:51	1:43	2,482	59	809,900	32	1:02	1:47	2,486	79	873,600	32	Caribou Road Bridge
13	18.77	0:55	1:45	2,385	52	809,200	51	1:06	1:50	2,388	70	869,900	53	Gansner Bar Campground
14	19.92	0:58	1:48	2,339	66	807,700	33	1:10	1:53	2,342	92	865,700	34	Haven (structures)
15	21.10	1:01	1:52	2,291	67	805,900	32	1:13	1:58	2,300	84	859,200	29	Belden [redacted] Bridge
16	22.00	1:03	1:53	2,283	64	814,200	27	1:15	1:58	2,293	77	889,200	26	structures, right bank

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

DSOD Note: Dam owner stamped the entire map as CEII/CUI. However, DSOD does not consider information submitted to it, whether it be the entire map or information on the map, to meet the definition of CEII/CUI. DSOD recognizes that the map contains specific security-sensitive information, which is similar in nature to CEII/CUI, and so DSOD has carefully reviewed the map and redacted specific security-sensitive information before making the map available to the public.

DSOD Note: The inundation boundary on this map shows area with flood depths greater than 0ft. Please refer to inundation boundary shapefile for inundation area with 1' or greater water depths found at: https://fmds.water.ca.gov/maps/damim/

X: -2091359.86852
Y: 579995.302493

X: -2129965.77066
Y: 573417.369929

X: -2088843.5836
Y: 560681.197509

Lake Almanor
Belden Forebay Dam
Butt Valley
Round Valley
Philbrook
Philbrook Saddle
SPRING VAL LAKE
Plumas County
Butte County
Caribou
Seneca
Belden
Haven
Twain
Paxton
Indian Falls
Keddie
Bidwell Lake
Old Haun Rd
State Hwy 89
State Hwy 147
State Highway 89
Seneca Rd
Caribou Rd
Humboldt Rd
Humbug Summit Rd
Matchline: Sheet 2
Sheet 1 Canyondam
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10

Imagery: NAIP California 2016 (60 cm)

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Legend

- Reference Points
- City / Town / Unincorporated
- Non-PGE Dam
- Non-EAP Dam
- EAP Dam
- [redacted]
- Direction of Flow
- Cross Section
- County Boundary
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (fair weather [FW] scenario)

0 5,000 10,000 Feet

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
2	7/31/2011	PMF limits added			RKW
3	12/14/2017	Revised format	BP	LR	AF
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REGISTERED PROFESSIONAL ENGINEER
WILLIAM A. RETTBERG
No. C055145
EXP 6-30-20
CIVIL
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GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Overview Map Sheet 1 of 7

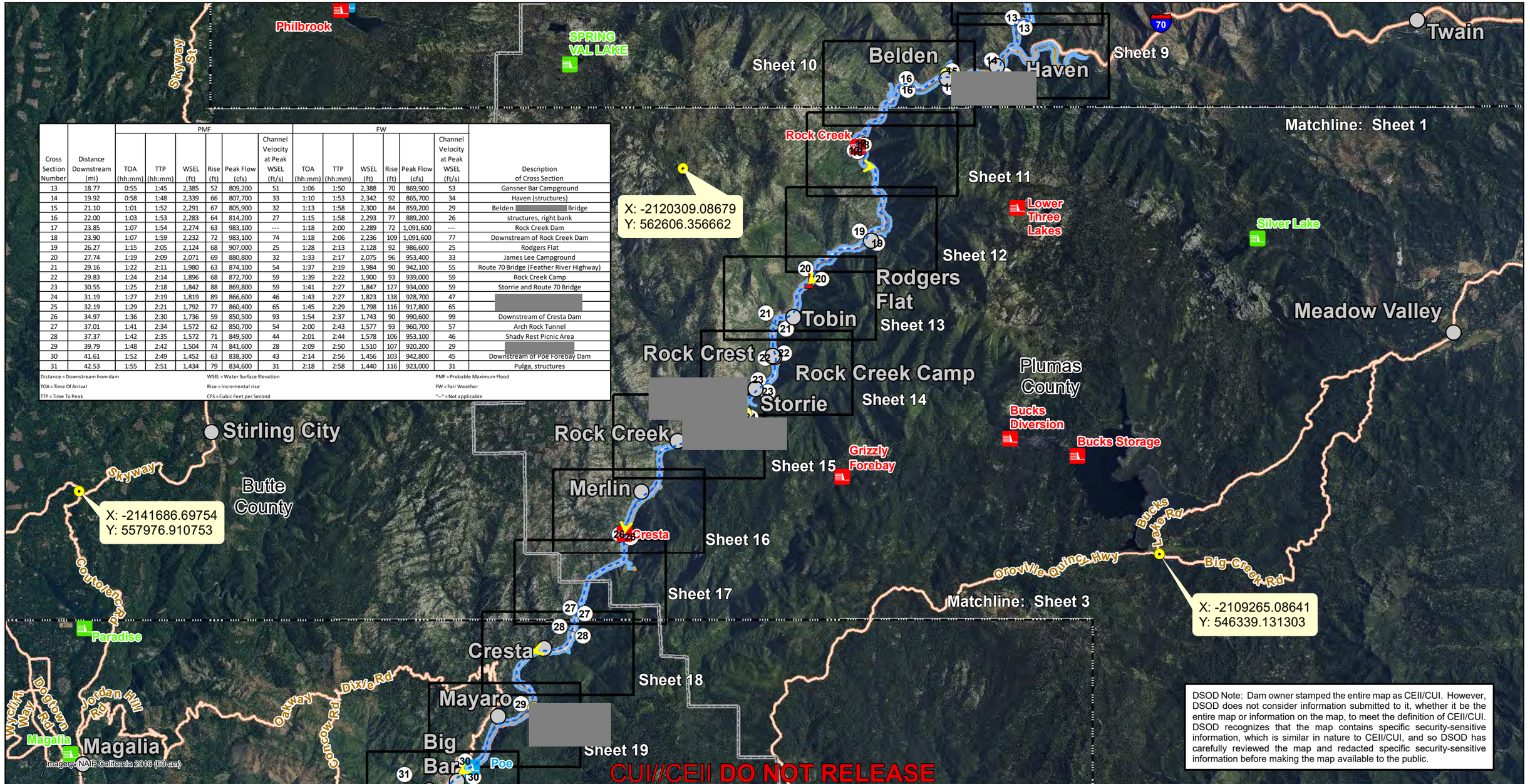
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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
13	18.77	0:55	1:45	2,385	52	809,200	51	1:06	1:50	2,388	70	869,900	53	Gansner Bar Campground
14	19.92	0:58	1:48	2,339	66	807,700	33	1:10	1:53	2,342	92	865,700	34	Haven (structures)
15	21.10	1:01	1:52	2,291	67	805,900	32	1:13	1:58	2,300	84	859,200	29	Belden [redacted] Bridge
16	22.00	1:03	1:53	2,283	64	814,200	27	1:15	1:58	2,293	77	889,200	26	structures, right bank
17	23.85	1:07	1:54	2,274	63	983,100	---	1:18	2:00	2,289	72	1,091,600	---	Rock Creek Dam
18	23.90	1:07	1:59	2,232	72	983,100	74	1:18	2:06	2,236	109	1,091,600	77	Downstream of Rock Creek Dam
19	26.27	1:15	2:05	2,124	68	907,000	25	1:28	2:13	2,128	92	986,600	25	Rodgers Flat
20	27.74	1:19	2:09	2,071	69	880,800	32	1:33	2:17	2,075	96	953,400	33	James Lee Campground
21	29.16	1:22	2:11	1,980	63	874,100	54	1:37	2:19	1,984	90	942,100	55	Route 70 Bridge (Feather River Highway)
22	29.83	1:24	2:14	1,896	68	872,700	59	1:39	2:22	1,900	93	939,000	59	Rock Creek Camp
23	30.55	1:25	2:18	1,842	88	869,800	59	1:41	2:27	1,847	127	934,000	59	Storrie and Route 70 Bridge
24	31.19	1:27	2:19	1,819	89	866,600	46	1:43	2:27	1,823	138	928,700	47	[redacted]
25	32.19	1:29	2:21	1,792	77	860,400	65	1:45	2:29	1,798	116	917,800	65	[redacted]
26	34.97	1:36	2:30	1,736	59	850,500	93	1:54	2:37	1,743	90	990,600	99	Downstream of Cresta Dam
27	37.01	1:41	2:34	1,572	62	850,700	54	2:00	2:43	1,577	93	960,700	57	Arch Rock Tunnel
28	37.37	1:42	2:35	1,572	71	849,500	44	2:01	2:44	1,578	106	953,100	46	Shady Rest Picnic Area
29	39.79	1:48	2:42	1,504	74	841,600	28	2:09	2:50	1,510	107	920,200	29	[redacted]
30	41.61	1:52	2:49	1,452	63	838,300	43	2:14	2:56	1,456	103	942,800	45	Downstream of Poe Forebay Dam
31	42.53	1:55	2:51	1,434	79	834,600	31	2:18	2:58	1,440	116	923,000	31	Pulga, structures

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
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Legend

- Reference Points
- City / Town / Unincorporated
- Non-PGE Dam
- Non-EAP Dam
- EAP Dam
- School
- Direction of Flow
- Cross Section
- County Boundary
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (fair weather [FW] scenario)

0 5,000 10,000
Feet

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
2	7/31/2011	PMF limits added			RKW
3	12/14/2017	Revised format	BP	LR	AF
4	2/10/2020	Extended FW Model, updated notes, added channel velocities, and initial WSEL	BP	LR	AF

REGISTERED PROFESSIONAL ENGINEER
WILLIAM A. RETTBERG
No. C055145
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Overview Map Sheet 2 of 7

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X: -2153529.86409
Y: 555069.21705

X: -2122054.94219
Y: 540028.579184

X: -2161920.10222
Y: 537234.288269

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
28	37.37	1:42	2:35	1,572	71	849,500	44	2:01	2:44	1,578	106	953,100	46	Shady Rest Picnic Area
29	39.79	1:48	2:42	1,504	74	841,600	28	2:09	2:50	1,510	107	920,200	29	[redacted]
30	41.61	1:52	2:49	1,452	63	838,300	43	2:14	2:56	1,456	103	942,800	45	Downstream of Poe Forebay Dam
31	42.53	1:55	2:51	1,434	79	834,600	31	2:18	2:58	1,440	116	923,000	31	Pulga, structures
32	45.22	2:01	2:55	1,161	57	833,200	47	2:26	3:03	1,165	91	910,900	48	Bardees Bar
33	49.28	2:14	3:12	991	58	819,700	41	2:39	3:19	994	86	875,600	42	[redacted]
34	53.15	2:25	3:15	920	19	813,800	38	2:49	3:23	923	23	862,400	39	---
35	54.45	2:28	9:40	918	17	817,000	17	2:51	8:34	917	17	878,900	17	Lake Oroville, near French Creek
36	62.10	2:45	10:20	916	16	870,000	2	3:04	9:24	916	16	1,197,500	2	Goat Ranch Campground

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Matchline: Sheet 2
Matchline: Sheet 4

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CUI//CEII DO NOT RELEASE

Imagery: NAIP California 2016 (60cm)

0 5,000 10,000 Feet

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- Non-EAP Dam
- EAP Dam
- [redacted]
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Plumas County
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Overview Map Sheet 3 of 7

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
37	64.75	2:52	10:21	916	16	832,600	1	3:09	9:25	916	16	1,272,000	1	Bloomer Primitive Recreation Area
38	69.31	2:58	10:21	916	16	634,000	<1	3:15	9:24	916	16	664,000	<1	Bidwell Bar Bridge
39	75.07	---	---	---	---	---	---	3:22	9:47	267	33	577,000	---	Thermalito Diversion Dam
40	79.33	---	---	---	---	---	---	7:57	11:00	193	14	162,000	11	Grand Avenue, Ruddy Creek
41	77.97	---	---	---	---	---	---	3:01	10:10	167	40	595,000	9	Riverbend Park
42	82.03	---	---	---	---	---	---	4:18	11:40	142	30	695,000	5	Just Upstream of Thermalito Afterbay Dam

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

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X: -2153657.51869
Y: 527613.878867

X: -2177382.21786
Y: 518158.564489

X: -2146361.1405
Y: 505985.08579

Matchline: Sheet 3
Matchline: Sheet 5
Sheet 30
Sheet 31
Sheet 32
Sheet 33
Sheet 34

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

0 5,000 10,000
Feet

Legend

- Reference Points
- City / Town / Unincorporated
- Non-PGE Dam
- School
- Healthcare Facility
- Police/Fire
- Direction of Flow
- Cross Section
- County Boundary
- Major Highways
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (fair weather [FW] scenario)

Revisions

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4	2/10/2020	Extended FW Model, updated notes, added channel velocities, and initial WSEL	BP	LR	AF

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam
Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Overview Map Sheet 4 of 7

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
43	91.62	---	---	---	---	---	---	6:40	14:00	103	27	530,000	4	Robinsons Corner
47	102.32	---	---	---	---	---	---	28:23	65:40	57	4	64,000	<1	Drumhill Slough/Putnam Rd

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Legend

- Reference Points
- City / Town / Unincorporated
- Non-PGE Dam
- School
- Healthcare Facility
- Police/Fire
- Prison
- Direction of Flow
- Cross Section
- County Boundary
- Major Highways
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (fair weather [FW] scenario)

0 5,000 10,000 Feet

Revisions

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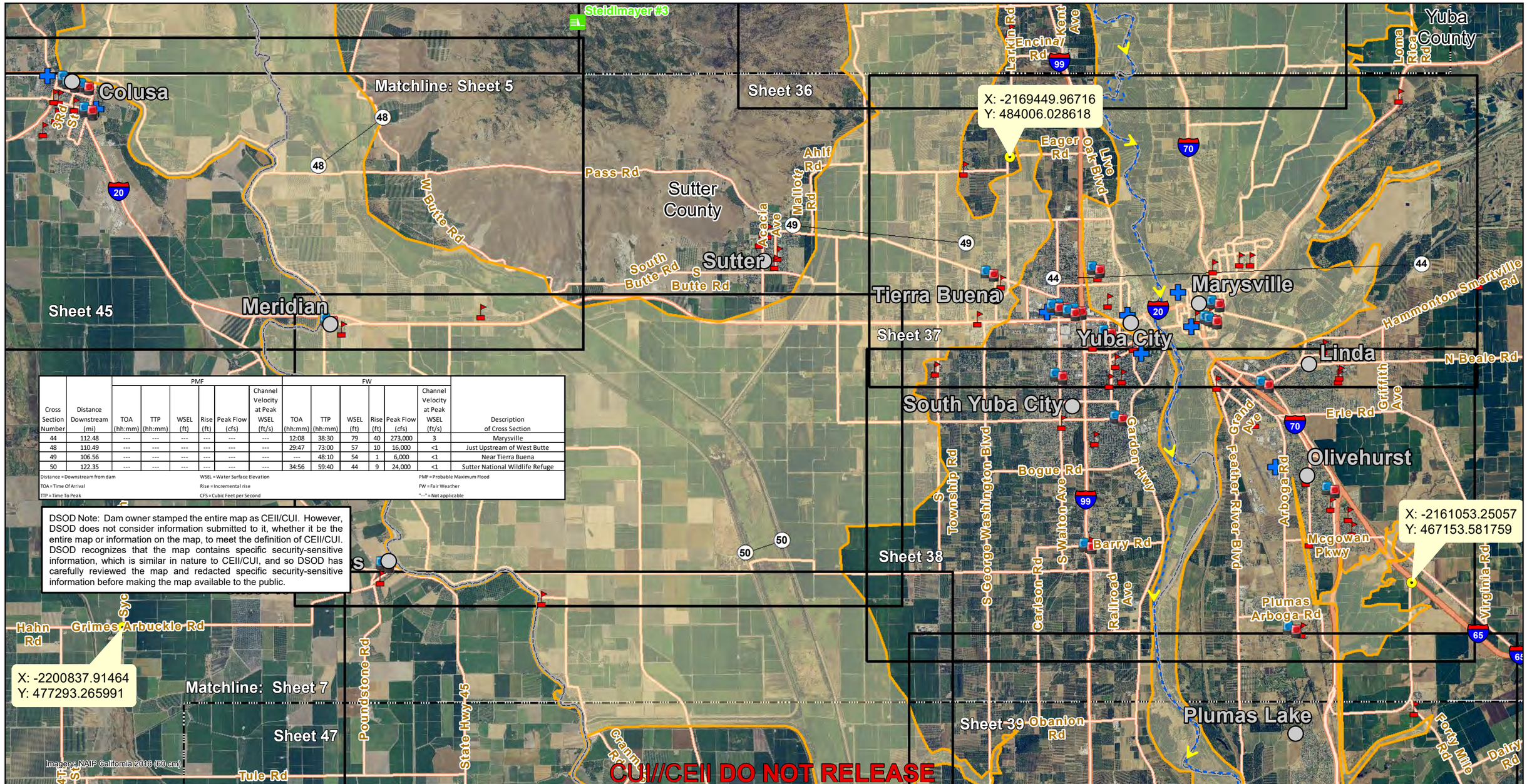
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Overview Map Sheet 5 of 7

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
44	112.48	---	---	---	---	---	---	12:08	38:30	79	40	273,000	3	Marysville
48	110.49	---	---	---	---	---	---	29:47	73:00	57	10	16,000	<1	Just Upstream of West Butte
49	106.56	---	---	---	---	---	---	---	48:10	54	1	6,000	<1	Near Tierra Buena
50	122.35	---	---	---	---	---	---	34:56	59:40	44	9	24,000	<1	Sutter National Wildlife Refuge

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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0 5,000 10,000
Feet

Legend

- Reference Points
- City / Town / Unincorporated
- Non-PGE Dam
- School
- Healthcare Facility
- Police/Fire
- Prison
- Direction of Flow
- Cross Section
- County Boundary
- Major Highways
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (fair weather [FW] scenario)

Revisions

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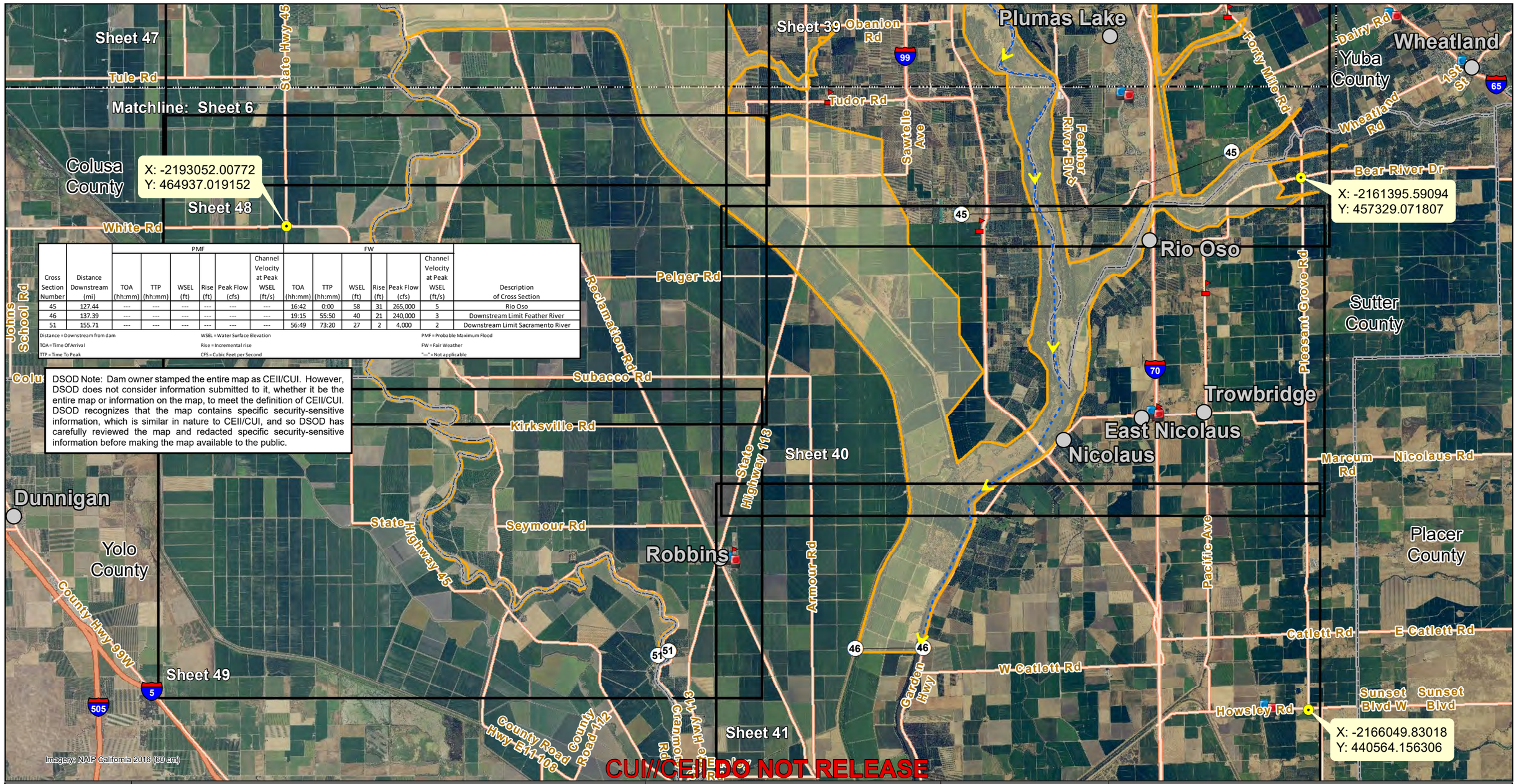
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
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Overview Map Sheet 6 of 7

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
45	127.44	---	---	---	---	---	---	16:42	0:00	58	31	265,000	5	Rio Oso
46	137.39	---	---	---	---	---	---	19:15	55:50	40	21	240,000	3	Downstream Limit Feather River
51	155.71	---	---	---	---	---	---	56:49	73:20	27	2	4,000	2	Downstream Limit Sacramento River

Distance = Downstream from dam
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Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

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Legend

- Reference Points
- City / Town / Unincorporated
- School
- Police/Fire
- Direction of Flow
- Cross Section
- County Boundary
- Major Highways
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (fair weather [FW] scenario)

0 5,000 10,000 Feet

Revisions

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
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Overview Map Sheet 7 of 7

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379979-4

121°7'0"W 121°6'30"W 121°6'0"W 121°5'30"W 121°5'0"W 121°4'30"W 121°4'0"W

40°11'0"N 40°10'30"N 40°10'0"N

X: -2095188.65358
Y: 579634.972413

X: -2091622.33252
Y: 578355.942603

X: -2094905.35182
Y: 577424.621161

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
1	0.00	---	---	4,518	---	719,700	---	---	---	4,510	---	810,700	---	Lake Almanor Dam
2	0.20	0:02	0:36	4,490	78	719,700	44	0:02	0:43	4,496	99	810,700	46	Downstream of Lake Almanor Dam

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

Matchline: Sheet 2

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Canyondam Boat Launch
Plumas County
Lake Almanor
State Hwy 89
State Hwy 147
Canyondam Picnic Area
Almanor
State Highway 89
Canyondam
Camp Almanor
Old State Hwy
Seneca Rd
Canyondam

0 500 1,000 Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- EAP Dam
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Major Roads
- Local Roads
- Other Ramps
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

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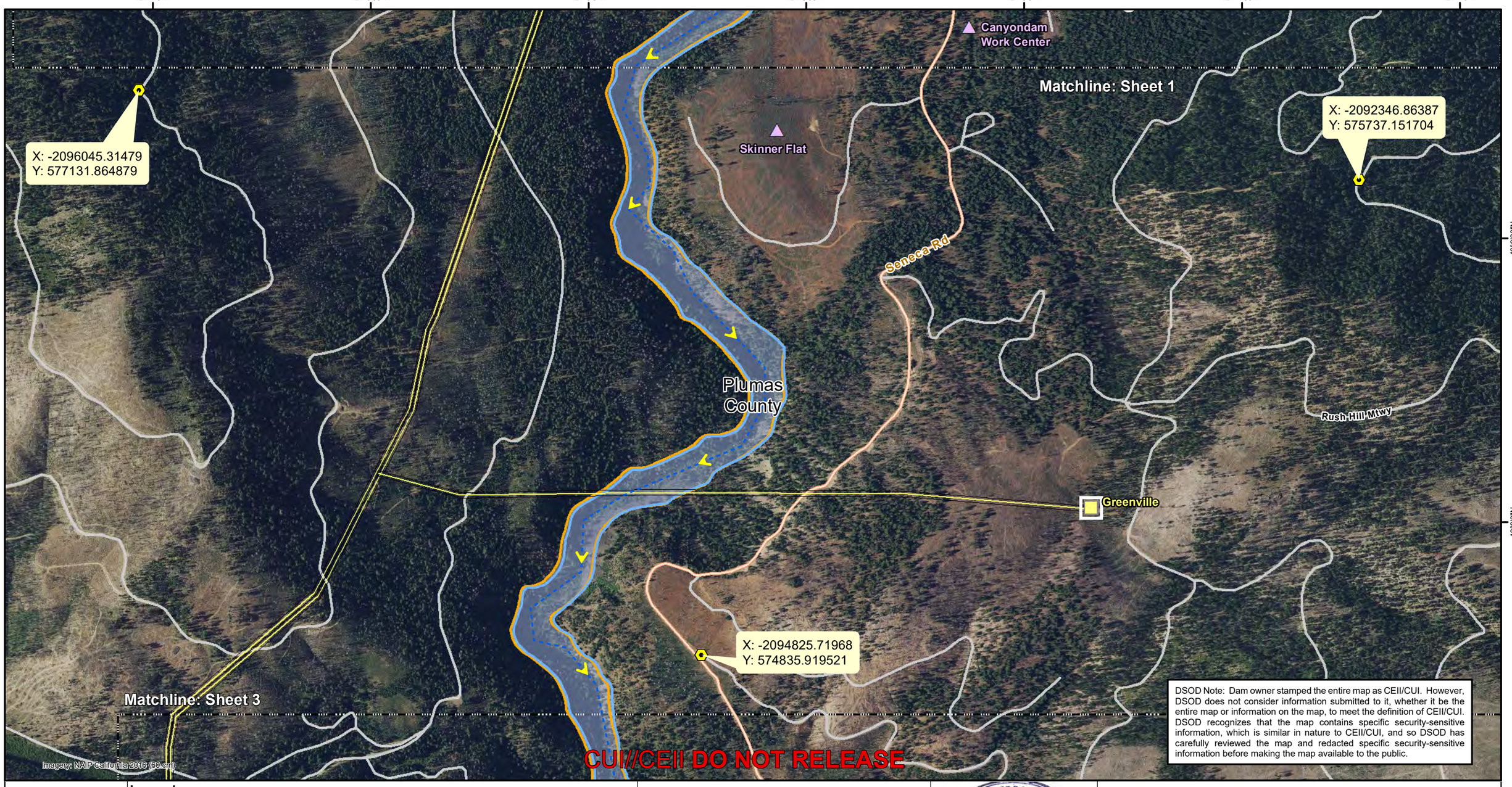
Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 1 of 49

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379980-4



0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Substation
- Recreation
- Transmission Line
- County Boundaries
- Major Roads
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
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Detailed Map Sheet 2 of 49

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379980-4

121°7'0"W 121°6'30"W 121°6'0"W 121°5'30"W 121°5'0"W 121°4'30"W 121°4'0"W

40°8'30"N

40°8'0"N

40°7'30"N

Matchline: Sheet 2

X: -2095653.23292
Y: 574335.456203

Seneca Rd

X: -2093169.03822
Y: 573692.358866

Plumas County

X: -2095884.47383
Y: 572722.224755

Little Seneca Rd

Matchline: Sheet 4

Imagery: NAIP California 2016 (60 cm)

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
3	4.51	0:14	0:45	3,749	55	723,500	65	0:20	0:52	3,753	73	807,700	67	structures, right bank

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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CUI//CEII DO NOT RELEASE

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Building
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Transmission Line
- County Boundaries
- Major Roads
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
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Plumas County
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Detailed Map Sheet 3 of 49

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379980-4

121°7'0"W 121°6'30"W 121°6'0"W 121°5'30"W 121°5'0"W 121°4'30"W 121°4'0"W

40°7'0"N 40°6'30"N 40°6'0"N

X: -2096912.72235
Y: 572255.994222

Matchline: Sheet 3

X: -2093384.31423
Y: 571157.345878

Little Seneca Rd

Seneca Road Bridge

Driveway

Seneca

Plumas County

Matchline: Sheet 5

Seneca Rd

Sunnyside Mine

X: -2094511.78256
Y: 569474.382305

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
4	5.18	0:16	0:47	3,661	49	724,400	55	0:23	0:54	3,664	69	807,400	57	Seneca Road Bridge
5	6.74	0:22	0:53	3,487	47	726,000	57	0:29	1:00	3,490	64	806,200	59	structures, right bank

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Bridge
- Building
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- County Boundaries
- Major Roads
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

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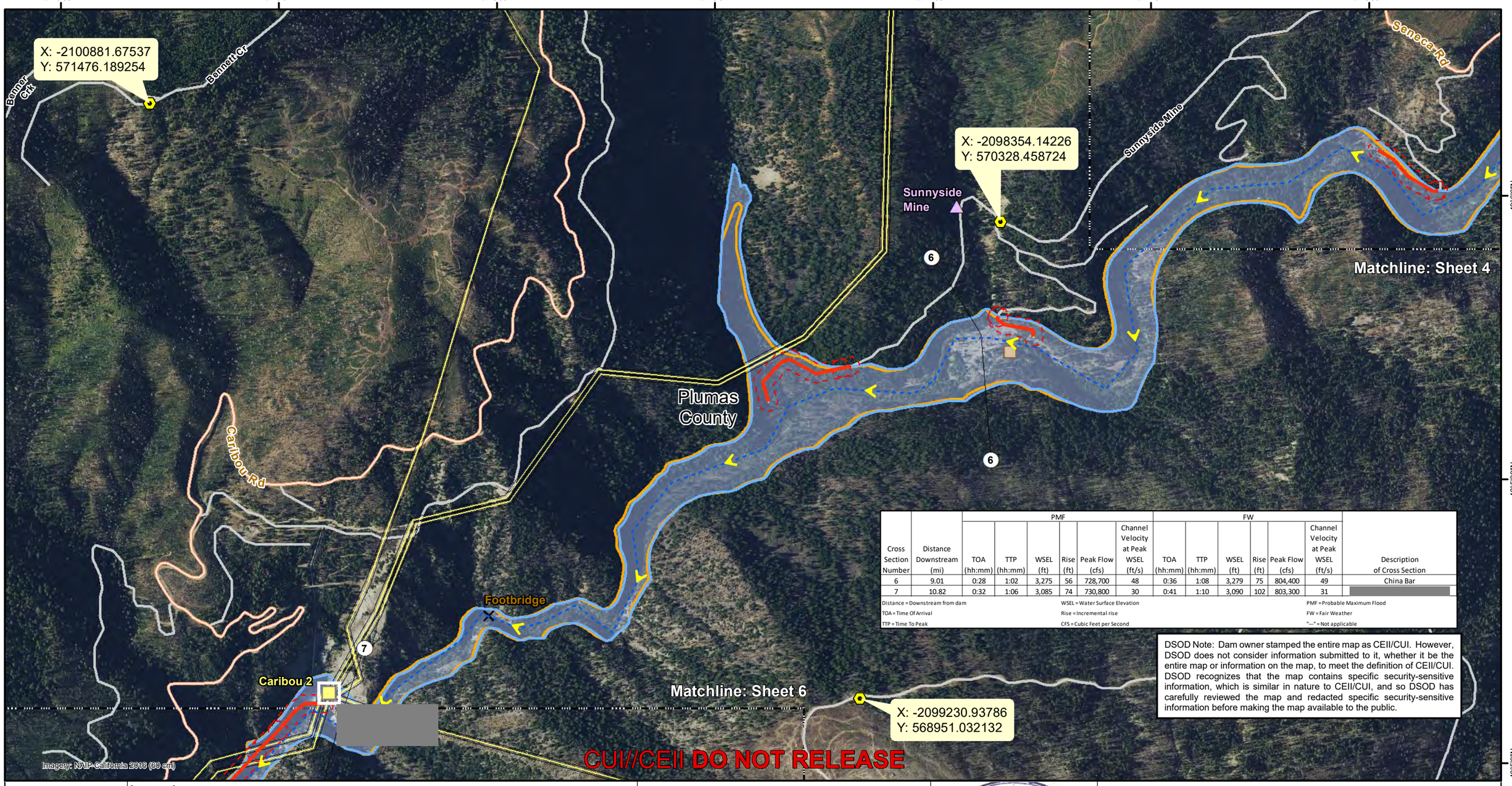
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
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Detailed Map Sheet 4 of 49

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379980-4



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
6	9.01	0:28	1:02	3,275	56	728,700	48	0:36	1:08	3,279	75	804,400	49	China Bar
7	10.82	0:32	1:06	3,085	74	730,800	30	0:41	1:10	3,090	102	803,300	31	

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TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Substation
- Bridge
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Transmission Line
- County Boundaries
- Major Roads
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Revisions

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REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 5 of 49

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379980-4

121°11'0"W | 121°10'30"W | 121°10'0"W | 121°9'30"W | 121°9'0"W | 121°8'30"W | 121°8'0"W

40°5'0"N | 40°4'30"N | 40°4'0"N

X: -2103643.31084
Y: 569827.277701

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
7	10.82	0:32	1:06	3,085	74	730,800	30	0:41	1:10	3,090	102	803,300	31	[redacted]
8	11.87	0:35	1:08	3,050	48	811,500	---	0:43	1:13	3,055	69	886,900	---	Belden Forebay Dam
9	11.95	0:35	1:32	2,952	68	811,500	44	0:44	1:38	2,955	105	886,900	46	Downstream of Belden Forebay Dam

Distance = Downstream from dam | WSEL = Water Surface Elevation | PMF = Probable Maximum Flood
TOA = Time Of Arrival | Rise = Incremental rise | FW = Fair Weather
TTP = Time To Peak | CFS = Cubic Feet per Second | "---" = Not applicable

Matchline: Sheet 5

Caribou

Un-named Rd

PG&E Caribou Camp

X: -2100208.87316
Y: 568407.996324

Belden Forebay Dam
Initial Water Surface Elevation (ft)
FW = 2,985.7 ft, at top of closed radial gates
PMF = 2,991.1 ft, 20.4 ft above spillway crest at El. 2,970.7

Belden Forebay Dam

Plumas County

Caribou Rd

Bridge

Matchline: Sheet 7

Redhill-Al

X: -2102186.04827
Y: 567225.733753

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CUI//CEII DO NOT RELEASE

Imagery: NAIP California 2016 (60 cm)

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- EAP Dam
- Bridge
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
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- Transmission Line
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379980-4

121°13'30"W 121°13'0"W 121°12'30"W 121°12'0"W 121°11'30"W 121°11'0"W 121°10'30"W

40°33'0"N

40°32'30"N

X: -2107897.82333
Y: 568896.303838

Bridge

Bridge

Matchline: Sheet 6

X: -2104580.14088
Y: 567542.261782

10

10

Plumas County

Caribou Rd

Queen Lily Campground

Bridge

11

11

Unnamed Rd

Matchline: Sheet 8

4WD Road

X: -2104436.9558
Y: 565557.486991

Imagery: NAIP California 2016 (60 cm)

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
10	14.13	0:41	1:36	2,790	65	809,400	51	0:52	1:41	2,793	86	879,900	53	Caribou Road
11	16.72	0:49	1:40	2,523	49	810,600	43	1:00	1:45	2,526	67	875,700	44	Queen Lilly Campground

Distance = Downstream from dam
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WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Bridge
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- Recreation
- Road Crossing Inundation
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- Cross Section
- Transmission Line
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Plumas County
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Detailed Map Sheet 7 of 49

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379980-4

121°14'30"W 121°14'0"W 121°13'30"W 121°13'0"W 121°12'30"W 121°12'0"W 121°11'30"W

40°3'0"N

40°2'30"N

40°1'30"N

X: -2109301.97188
Y: 566715.397028

Matchline: Sheet 7

Unnamed Rd

North Fork Campground

12

Caribou Rd Bridge

12

Walters Slide

Belden-Longville Burma Rd

Caribou Rd

Plumas County

X: -2106172.89458
Y: 565078.513937

Belden Siphon

X: -2108537.00712
Y: 564670.972094

Matchline: Sheet 9

13

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
12	17.36	0:51	1:43	2,482	59	809,900	32	1:02	1:47	2,486	79	873,600	32	Caribou Road Bridge
13	18.77	0:55	1:45	2,385	52	809,200	51	1:06	1:50	2,388	70	869,900	53	Gansner Bar Campground

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Bridge
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Transmission Line
- County Boundaries
- Major Roads
- Local Roads
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
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Detailed Map Sheet 8 of 49

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379980-4

121°14'30"W | 121°14'0"W | 121°13'30"W | 121°13'0"W | 121°12'30"W | 121°12'0"W | 121°11'30"W

40°10'0"N

40°9'30"N

Matchline: Sheet 10

Matchline: Sheet 8

X: -2109792.8772
Y: 564186.36215

X: -2107030.5516
Y: 563410.75946

X: -2107030.80902
Y: 561657.747862

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Caribou Rd

Gansner Bar Campground

Gansner Bar Forest Service Facility

Caribou Crossroads RV Park

Bridge

French Bar

Tunnel Twenty Three

Tunnel Twenty Four

Rich Bar

Plumas County

Beldon-Longville Burma Rd

Howells Rd

Haven

Driveway

Rich Bar Rd

East Branch North Fork Feather River

13

14

70

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
13	18.77	0:55	1:45	2,385	52	809,200	51	1:06	1:50	2,388	70	869,900	53	Gansner Bar Campground
14	19.92	0:58	1:48	2,339	66	807,700	33	1:10	1:53	2,342	92	865,700	34	Haven (structures)

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

CUI//CEII DO NOT RELEASE

Imagery: NAIP California 2016 (60 cm)

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Bridge
- Tunnel
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
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Detailed Map Sheet 9 of 49

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379980-4

121°17'30"W 121°17'0"W 121°16'30"W 121°16'0"W 121°15'30"W 121°15'0"W 121°14'30"W

40°0'30"N

40°0'0"N

X: -2114215.73461
Y: 564514.423973

X: -2110958.27223
Y: 563813.950446

X: -2111529.30233
Y: 562156.818757

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
15	21.10	1:01	1:52	2,291	67	805,900	32	1:13	1:58	2,300	84	859,200	29	Belden Bridge
16	22.00	1:03	1:53	2,283	64	814,200	27	1:15	1:58	2,293	77	889,200	26	structures, right bank

Distance = Downstream from dam
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Plumas County

Eby Stamp Mill

Bridge

Belden

North Fork Feather River

Belden Town Resort and Lodge

Belden Campground

15

Howells Rd

Belden Town Rd

Belden-Longville Burma Rd

4WD Road

70

16

Bridge

16

Bridge

Railroad Bridge

Matchline: Sheet 9

Matchline: Sheet 11

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Substation
- Bridge
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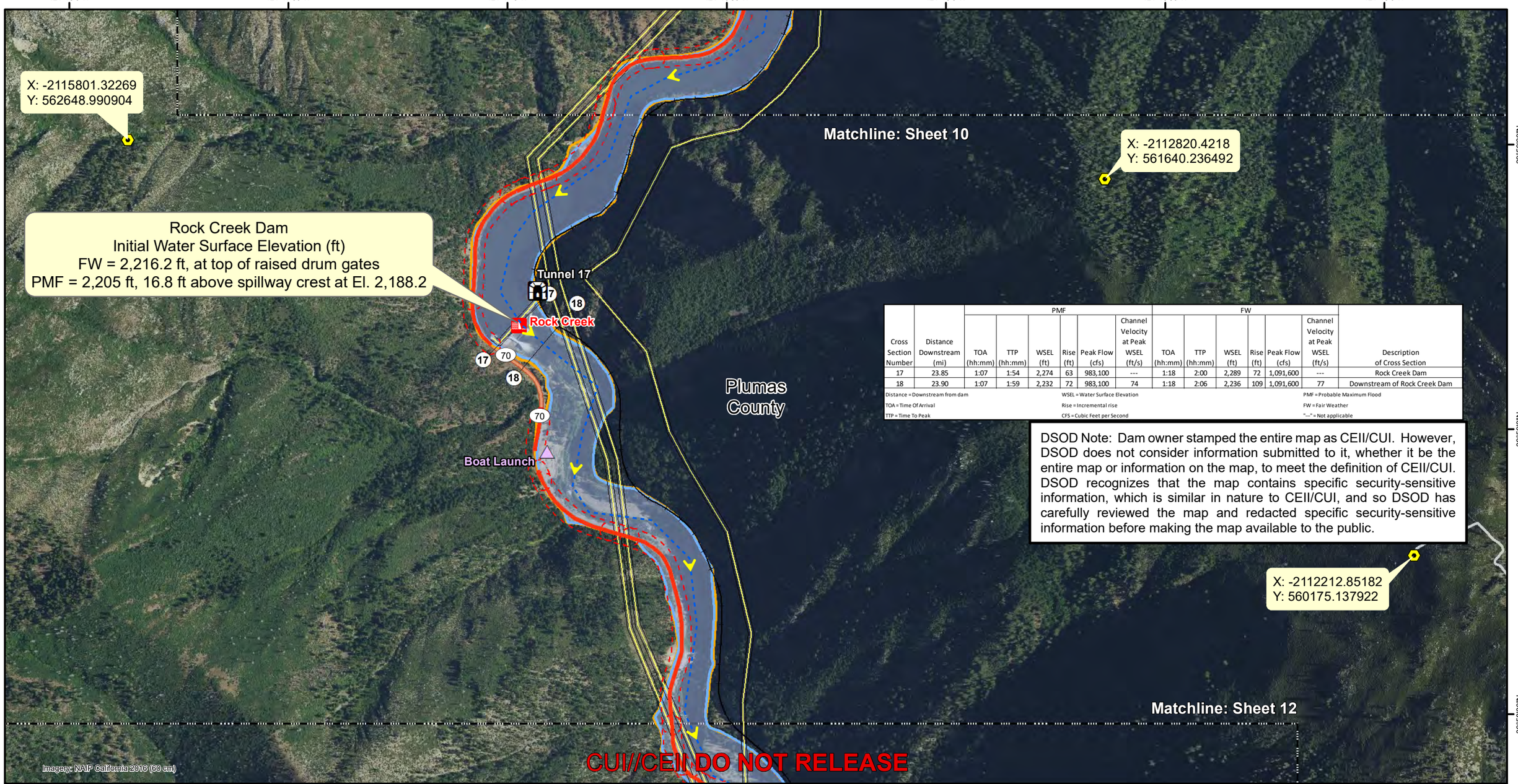
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379980-4



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
17	23.85	1:07	1:54	2,274	63	983,100	---	1:18	2:00	2,289	72	1,091,600	---	Rock Creek Dam
18	23.90	1:07	1:59	2,232	72	983,100	74	1:18	2:06	2,236	109	1,091,600	77	Downstream of Rock Creek Dam

Distance = Downstream from dam
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Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- EAP Dam
- Tunnel
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
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379980-4

121°18'30"W 121°18'0"W 121°17'30"W 121°17'0"W 121°16'30"W 121°16'0"W 121°15'30"W

39°58'0"N

39°57'30"N

Matchline: Sheet 11

X: -2116978.57851
Y: 560430.889277

X: -2113225.83051
Y: 559308.260878

X: -2114875.71678
Y: 558331.877709

Matchline: Sheet 13

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
19	26.27	1:15	2:05	2,124	68	907,000	25	1:28	2:13	2,128	92	986,600	25	Rodgers Flat

Distance = Downstream from dam
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Rodgers Flat Heliport
Plumas County
19
Bridge
Rodgers Flat Heliport
Rodgers Flat PG&E Service Center
Bridge
70
Rodgers Flat PG&E Maintenance St
Rodgers Flat
19
Camp Rodgers
PG&E Main St
Bridge
Indian Jim Campground
Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Bridge
- Airport
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
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EXP. 6/30/20
CIVIL
STATE OF CALIFORNIA

GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 12 of 49

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379980-4

121°20'0"W 121°19'30"W 121°19'0"W 121°18'30"W 121°18'0"W 121°17'30"W 121°17'0"W

39°57'0"N 39°56'30"N 39°56'0"N

X: -2119287.68605
Y: 559072.159866

Indian Jim Campground

20

Matchline: Sheet 12

James Lee Campground

20

Indian Jim Elementary School

X: -2116031.54493
Y: 557680.259602

Plumas County

70

21

Un-named Rd

Tobin

Railroad Bridge

Bridge

Driveway

X: -2119190.93417
Y: 556962.511702

21

Matchline: Sheet 14

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
20	27.74	1:19	2:09	2,071	69	880,800	32	1:33	2:17	2,075	96	953,400	33	James Lee Campground
21	29.16	1:22	2:11	1,980	63	874,100	54	1:37	2:19	1,984	90	942,100	55	Route 70 Bridge (Feather River Highway)

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- School
- Bridge
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
2	7/31/2011	PMF limits added			RKW
3	12/14/2017	Revised format	BP	LR	AF
4	2/10/2020	Extended FW Model, updated notes, added channel velocities, and initial WSEL	BP	LR	AF

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 13 of 49

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379980-4

121°20'30"W 121°20'0"W 121°19'30"W 121°19'0"W 121°18'30"W 121°18'0"W 121°17'30"W

39°55'30"N

Matchline: Sheet 13

X: -2120814.47629
Y: 556649.577959

X: -2117418.79609
Y: 555785.772558

Rock Crest

Rock Crest Camp Rd

Rock Creek Camp

Bridge

Plumas County

22

23

70

Storrie

Storrie Rd

Rt 70 Bridge

Matchline: Sheet 15

Bridge

Un-named Rd

24

Bucks Creek

Grizzly

X: -2119678.67943
Y: 554496.260492

CUI//CEII DO NOT RELEASE

Imagery: NAIP California 2016 (60 cm)

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
22	29.83	1:24	2:14	1,896	68	872,700	59	1:39	2:22	1,900	93	939,000	59	Rock Creek Camp
23	30.55	1:25	2:18	1,842	88	869,800	59	1:41	2:27	1,847	127	934,000	59	Storrie and Route 70 Bridge
24	31.19	1:27	2:19	1,819	89	866,600	46	1:43	2:27	1,823	138	928,700	47	

Distance = Downstream from dam
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TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Substation
- Bridge
- Building
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
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Plumas County
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Detailed Map Sheet 14 of 49

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379980-4

121°22'30"W | 121°22'0"W | 121°21'30"W | 121°21'0"W | 121°20'30"W | 121°20'0"W | 121°19'30"W

39°54'30"N

39°54'0"N

Matchline: Sheet 14

Matchline: Sheet 16

X: -2122339.3121
Y: 554768.373495

X: -2124468.39496
Y: 553985.010236

X: -2120984.15561
Y: 552888.590196

Bridge

Grizzly

Plumas County

Rock Creek

Railroad Bridge

Bridge

Storrie Rd

Unnamed Rd

24

25

70

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
24	31.19	1:27	2:19	1,819	89	866,600	46	1:43	2:27	1,823	138	928,700	47	[redacted]
25	32.19	1:29	2:21	1,792	77	860,400	65	1:45	2:29	1,798	116	917,800	65	

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Substation
- [redacted]
- Bridge
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Local Roads
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

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Detailed Map Sheet 15 of 49

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379980-4

121°24'0"W 121°23'30"W 121°23'0"W 121°22'30"W 121°22'0"W 121°21'30"W 121°21'0"W

39°53'30"N

39°53'0"N

39°52'30"N

Matchline: Sheet 15

Matchline: Sheet 17

Un-named Rd

X: -2126323.02588
Y: 553777.422629

X: -2123169.82513
Y: 552802.762066

Merlin

Garnit

Garnit Spur A

Storrie Rd

Plumas County

70

Railroad Bridge

Cresta Dam
Initial Water Surface Elevation (ft)
FW = 1,681.2 ft, at top of raised drum gates
PMF = 1,675.5 ft, 42.7 ft above spillway crest at El. 1,653.2

X: -2125846.44577
Y: 551873.911651

26

Cresta

Elephant Butte Tunnel

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
26	34.97	1:36	2:30	1,736	59	850,500	93	1:54	2:37	1,743	90	990,600	99	Downstream of Cresta Dam

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- EAP Dam
- Bridge
- Tunnel
- Building
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
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379980-4

121°24'30"W | 121°24'0"W | 121°23'30"W | 121°23'0"W | 121°22'30"W | 121°22'0"W | 121°21'30"W

39°52'0"N

39°51'30"N

X: -2128798.47288
Y: 552081.022157

4Wd Road

Storrie Rd

Grizzly Dome Tunnel

Bridge

Conduit

Boat Launch

Plumas County

Matchline: Sheet 16

X: -2125080.96621

70

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
27	37.01	1:41	2:34	1,572	62	850,700	54	2:00	2:43	1,577	93	960,700	57	Arch Rock Tunnel

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

Butte County

Tunnel Number Thirteen

Pulga Rd

X: -2128136.28203
Y: 550031.168607

27

Matchline: Sheet 18

Arch Rock Tunnel

CUI//CEII DO NOT RELEASE

Imagery: NAIP California 2016 (60 cm)

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Bridge
- Tunnel
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
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Detailed Map Sheet 17 of 49

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379980-4

121°25'30"W 121°25'0"W 121°24'30"W 121°24'0"W 121°23'30"W 121°23'0"W 121°22'30"W

39°51'0"N

39°50'30"N

39°50'0"N

4Wd Road

X: -2130170.99523
Y: 550385.283569

Matchline: Sheet 17

28

Arch Rock Tunnel

Shady Rest Picnic Area

28 Cresta Tunnel

X: -2126693.25647
Y: 548856.223376

Cresta

70

Butte County

Dixie Rd

X: -2130476.27631
Y: 548521.398224

Puiga Rd

Matchline: Sheet 19

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
28	37.37	1:42	2:35	1,572	71	849,500	44	2:01	2:44	1,578	106	953,100	46	Shady Rest Picnic Area

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CFS = Cubic Feet per Second
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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Tunnel
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
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- Highways
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379980-4

121°26'30"W 121°26'0"W 121°25'30"W 121°25'0"W 121°24'30"W 121°24'0"W 121°23'30"W

39°49'30"N

X: -2132243.08428
Y: 548476.321595

4Wd Road

Matchline: Sheet 18

Dixie Rd

Puga Rd

Camp Creek

29

Cresta

X: -2128832.54454
Y: 547107.914314

Mayaro

Mayaro Lodge Rd

Butte County

70

X: -2132057.41916
Y: 546523.441675

Puga Rd

Matchline: Sheet 20

30

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
29	39.79	1:48	2:42	1,504	74	841,600	28	2:09	2:50	1,510	107	920,200	29	
30	41.61	1:52	2:49	1,452	63	838,300	43	2:14	2:56	1,456	103	942,800	45	Downstream of Poe Forebay Dam

Distance = Downstream from dam
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Rise = Incremental rise
CFS = Cubic Feet per Second
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N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Substation
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
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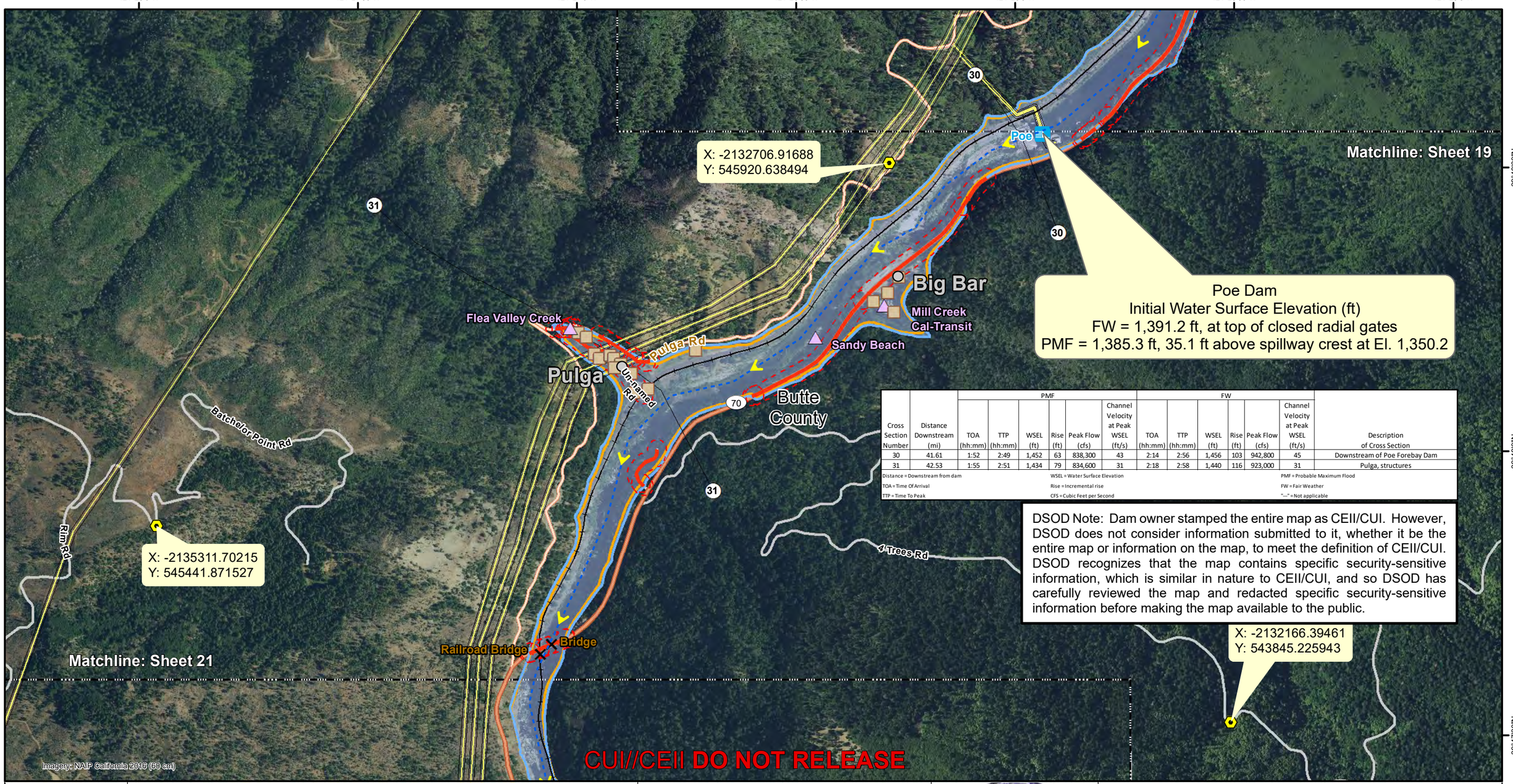
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379980-4



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
30	41.61	1:52	2:49	1,452	63	838,300	43	2:14	2:56	1,456	103	942,800	45	Downstream of Poe Forebay Dam
31	42.53	1:55	2:51	1,434	79	834,600	31	2:18	2:58	1,440	116	923,000	31	Pulga, structures

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Non-EAP Dam
- Bridge
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Major Roads
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
2	7/31/2011	PMF limits added			RKW
3	12/14/2017	Revised format	BP	LR	AF
4	2/10/2020	Extended FW Model, updated notes, added channel velocities, and initial WSEL	BP	LR	AF

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STATE OF CALIFORNIA

GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam
Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 20 of 49

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379980-4

121°29'0"W | 121°28'30"W | 121°28'0"W | 121°27'30"W | 121°27'0"W | 121°26'30"W | 121°26'0"W

39°47'30"N | 39°47'0"N | 39°46'30"N

X: -2136021.71463
Y: 544943.378601

Matchline: Sheet 20

X: -2133561.06841
Y: 543492.56424

Railroad Bridge

Butte County

Tunnel Number Eleven

Poe Tunnel

Tunnel Number Ten

X: -2135463.08939
Y: 542642.193914

Matchline: Sheet 22

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
32	45.22	2:01	2:55	1,161	57	833,200	47	2:26	3:03	1,165	91	910,900	48	Bardees Bar

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "---" = Not applicable

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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Bridge
- Tunnel
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Local Roads
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REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
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Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 21 of 49

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379980-4

121°29'0"W 121°28'30"W 121°28'0"W 121°27'30"W 121°27'0"W 121°26'30"W 121°26'0"W

39°46'0"N 39°45'30"N 39°45'0"N

Rim Rd
Schandoney Ln
Matchline: Sheet 21
Ponderosa Way
X: -2137798.31703
Y: 542306.960209
70
Bardees Bar Rd
Butte County
32
Bridge
Bardees Bar
32
Tunnel Number Nine
X: -2134020.70184
Y: 541474.069982
X: -2136158.59607
Y: 540392.809727
Matchline: Sheet 23
Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
32	45.22	2:01	2:55	1,161	57	833,200	47	2:26	3:03	1,165	91	910,900	48	Bardees Bar

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Bridge
- Tunnel
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Highways
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
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Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 22 of 49

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379980-4

121°30'0"W 121°29'30"W 121°29'0"W 121°28'30"W 121°28'0"W 121°27'30"W 121°27'0"W

39°45'0"N 39°44'30"N 39°44'0"N

Crain Ridge Rd

X: -2138926.53488
Y: 540706.509063

Matchline: Sheet 22

Andy Mountain Rd

70

Deadwood Rd

Poe

X: -2135924.29834
Y: 539298.941884

Chalair Dr

Butte County

Unnamed Rd

X: -2137846.0966
Y: 538729.877163

Utah Construction

Timtam Ln

Driveway

Matchline: Sheet 24

Bardees Bar Rd

Backache Rd

Capricorn Way

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

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0 500 1,000
Feet

Legend

- Reference Points
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- City / Town / Unincorporated
- Road Crossing Inundation
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 23 of 49

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379980-4

121°29'0"W 121°28'30"W 121°28'0"W 121°27'30"W 121°27'0"W 121°26'30"W 121°26'0"W

39°43'30"N 39°43'0"N 39°42'30"N

X: -2138862.30966
Y: 537756.323794

X: -2135087.10217
Y: 537346.76176

X: -2137523.37897
Y: 535697.705311

Utah Construction

Bardees Bar Rd

Bridge

Poe

33

Matchline: Sheet 23

Matchline: Sheet 25

Butte County

Un-named Rd

Windridge Rd

Big Bend Rd

Railroad Bridge

Poe Powerhouse Rd

Big Bend Dam

Donell Rd

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
33	49.28	2:14	3:12	991	58	819,700	41	2:39	3:19	994	86	875,600	42	

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "---" = Not applicable

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0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Non-EAP Dam
- Substation
- Bridge
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- Railroad
- Transmission Line
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REGISTERED PROFESSIONAL ENGINEER WILLIAM A. RETTBERG No. C055145 EXP. 03-20 CIVIL STATE OF CALIFORNIA

GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 24 of 49

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379980-4

121°26'0"W 121°25'30"W 121°25'0"W 121°24'30"W 121°24'0"W 121°23'30"W 121°23'0"W

39°43'0"N

39°42'30"N

X: -2132392.81251
Y: 535862.743475

Pinnacle Rd

Four Trees Spur

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
34	53.15	2:25	3:15	920	19	813,800	38	2:49	3:23	923	23	862,400	39	---

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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34

34

Butte County

Nolton Crk

Matchline: Sheet 24

Morning Glory Rd

Priscilla Spur A

X: -2132062.48999
Y: 533726.462752

Poe Powerhouse Rd

X: -2135235.87141
Y: 534651.579265

Matchline: Sheet 26

Big Bend Rd

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- County Boundaries
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

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REGISTERED PROFESSIONAL ENGINEER
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No. C055145
EXP. 6/30/20
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STATE OF CALIFORNIA

GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 25 of 49

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379980-4

121°25'30"W 121°25'0"W 121°24'30"W 121°24'0"W 121°23'30"W 121°23'0"W

39°42'0"N 39°41'30"N 39°41'0"N

Matchline: Sheet 25

X: -2135159.55152
Y: 533920.7746

X: -2131965.59878
Y: 532922.253437

Big Bend Rd

35

Poe Powerhouse Rd

Butte County

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
35	54.45	2:28	9:40	918	17	817,000	17	2:51	8:34	917	17	878,900	17	Lake Oroville, near French Creek

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

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Matchline: Sheet 27

Kanaka Flats

X: -2132882.15599
Y: 531372.342394

Stephens Ridge Rd

Bonnie Meadow Ln

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Cross Section
- County Boundaries
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

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STATE OF CALIFORNIA

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

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Plumas County
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DWR 93.003, CA00327
Detailed Map Sheet 26 of 49

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379980-4

121°27'30"W | 121°27'0"W | 121°26'30"W | 121°26'0"W | 121°25'30"W | 121°25'0"W | 121°24'30"W

39°41'0"N | 39°40'30"N | 39°40'0"N

Lumberjack Ln

Timber Cove Way

X: -2138006.48232
Y: 532593.621666

Matchline: Sheet 26

X: -2134595.86228
Y: 531041.685329

Butte County

Matchline: Sheet 28

Berry Creek Rd

X: -2136581.47486
Y: 529946.272178

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

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N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- County Boundaries
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
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Plumas County
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Detailed Map Sheet 27 of 49

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379980-4

121°31'0"W 121°30'30"W 121°30'0"W 121°29'30"W 121°29'0"W 121°28'30"W 121°28'0"W

39°41'0"N

39°40'30"N

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Red Eye Rd

Dark Canyon Rd

Bunker Hill Mine Rd

Pine Meadow Rd

Surcease Mine Rd

X: -2138286.76937
Y: 533460.089821

Matchline: Sheet 27

Un-named Rd

Lower Gulch Rd

Butte County

Big Bend

Patton Peak Rd

Encina Grande Rd

X: -2140172.86241
Y: 532047.564126

Matchline: Sheet 29

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Substation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Railroad
- Transmission Line
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EXP. 03-20
CIVIL
STATE OF CALIFORNIA

GEI Consultants, Inc.

Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 28 of 49

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379980-4

121°31'0"W 121°30'30"W 121°30'0"W 121°29'30"W 121°29'0"W 121°28'30"W

39°40'0"N

39°39'30"N

39°39'0"N

X: -2143085.17415
Y: 532132.360122

Matchline: Sheet 28

X: -2140090.5987
Y: 531315.103219

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
36	62.10	2:45	10:20	916	16	870,000	2	3:04	9:24	916	16	1,197,500	2	Goat Ranch Campground

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "---" = Not applicable

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Butte County

Goat Ranch Campground

Goat Ranch Recreation Area

36

Unnamed Rd

Condor Rd

de Rd

Bloomer Hill Rd

X: -2143234.278
Y: 530246.935265

Rocky Top Rd

Matchline: Sheet 30

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Recreation
- Cross Section
- Transmission Line
- County Boundaries
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
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REGISTERED PROFESSIONAL ENGINEER WILLIAM A. RETTBERG No. C055145 EXP 6-30-20 CIVIL STATE OF CALIFORNIA

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
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DWR 93.003, CA00327
Detailed Map Sheet 29 of 49

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379980-4

121°31'0"W 121°30'30"W 121°30'0"W 121°29'30"W 121°29'0"W 121°28'30"W 121°28'0"W

39°38'30"N

39°38'0"N

39°37'30"N

X: -2143548.56386
Y: 529812.053531

Matchline: Sheet 29

X: -2140960.52313
Y: 528899.728542

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Tippy Top Rd

Condor Rd

Butte County

X: -2144249.07149
Y: 528080.955466

Matchline: Sheet 31

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

N

0 500 1,000
Feet

Legend

- Reference Points
- Direction of Flow
- Transmission Line
- County Boundaries
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
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379980-4

121°30'30"W | 121°30'0"W | 121°29'30"W | 121°29'0"W | 121°28'30"W | 121°28'0"W | 121°27'30"W

39°37'0"N

39°36'30"N

Matchline: Sheet 30

Matchline: Sheet 32

X: -2141390.33448
Y: 526367.670306

X: -2144291.11937
Y: 526704.157349

X: -2143275.78813
Y: 525285.548622

Bloomer Primitive Recreation Area

Butte County

Red Tape Rd

Scenic View Dr

Lonesome Dove Cir

Deer Meadow Rd

Oregon City Trl

Un-named Rd

Sunday Dr

37

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
37	64.75	2:52	10:21	916	16	832,600	1	3:09	9:25	916	16	1,272,000	1	Bloomer Primitive Recreation Area

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Legend

- Reference Points
- Direction of Flow
- Building
- Recreation
- Road Crossing Inundation
- 100 ft Road Crossing Inundation Buffer
- Cross Section
- County Boundaries
- Local Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

0 500 1,000 Feet

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 31 of 49

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
38	69.31	2:58	10:21	916	16	634,000	<1	3:15	9:24	916	16	664,000	<1	Bidwell Bar Bridge
39	75.07	---	---	---	---	---	---	3:22	9:47	267	33	577,000	---	Thermalito Diversion Dam

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

X: -2143275.78813
Y: 525285.548622

Matchline: Sheet 31

DOWNSTREAM LIMIT OF PMF STUDY. HIGH FLOWS WOULD BE EXPECTED TO CONTINUE DOWNSTREAM DUE TO CONCURRENT FLOOD FLOWS.

Oroville Dam
Initial Water Surface Elevation (ft)
FW = 900 ft, at gross pool elevation
PMF = 900.8 ft, above gross pool elevation

Thermalito Diversion
Initial Water Surface Elevation (ft)
FW = 226.6 ft, 1.5 ft above top of gates/ flashboards (6.4 ft. below dam crest at El. 233 ft)

X: -2146976.3699
Y: 516574.541204

X: -2140590.56725
Y: 515182.404735

Matchline: Sheet 33

Oroville Quincy Hwy
Schaefer Ranch
Foreman Creek Recreation Area
Canyon Creek Bridge
Sycamore Creek Recreation Area
Lake Oroville Landing Area Seaplane Base
Lake Oroville State Recreation Area
Butte County
Potters Ravine Recreation Area
Spillway Boat Ramp
Craig Recreation Area
Bidwell Bar Bridge
Kelly Ridge Recreation Area
Oroville
Bidwell Canyon Campground
Kelly Ridge Golf Course
State Hwy 162
Loafer Creek Campground
Bidwell Canyon Marina
Kelly Ridge
Loafer Creek Recreation Area
Miners
Oregon Gulch
Cherokee Rd
Thermalito Forebay
North Picnic Area
Garden Dr
Butte County Sheriff-Coroner
Nelson Park
Nelson Ave. Elem. School
Table Mountain Blvd
Nelson Ave
Butte County Fire Dept Sta 63
CA Highway Patrol Valley Division - Oroville
Grand Ave
Thermalito Diversion
Oro Dam Blvd E
Royal Oaks Dr
Kelly Ridge
CANYON DR CREEK
Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

39°36'0"N
39°35'30"N
39°35'0"N
39°34'30"N
39°34'0"N
39°33'30"N
39°33'0"N
39°32'30"N
39°32'0"N
39°31'30"N
39°31'0"N

121°35'30"W 121°35'0"W 121°34'30"W 121°34'0"W 121°33'30"W 121°33'0"W 121°32'30"W 121°32'0"W 121°31'30"W 121°31'0"W 121°30'30"W 121°30'0"W 121°29'30"W 121°29'0"W 121°28'30"W 121°28'0"W 121°27'30"W 121°27'0"W 121°26'30"W 121°26'0"W 121°25'30"W 121°25'0"W 121°24'30"W 121°24'0"W 121°23'30"W 121°23'0"W 121°22'30"W

0 2,000 4,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Non-PGE Dam
- School
- Police/Fire
- Substation
- Bridge
- Tunnel
- Airport
- Building
- Recreation
- Cross Section
- Railroad
- Transmission Line
- County Boundaries
- Major Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (probable maximum flood [PMF] scenario)
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379980-4

X: -2161748.50327
Y: 520733.202209

Thermalito Forebay
Initial Water Surface Elevation (ft)
FW = 225 ft, within sunny day operating range
(6 ft below dam crest at El. 231 ft)

BUILDINGS AND BRIDGES ARE NOT MARKED DOWNSTREAM OF OROVILLE DAM EXCEPT CRITICAL FACILITIES AND COMMUNITY BUILDINGS TO ENABLE DISPLAY OF ROADS AND OTHER IMAGERY.

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
39	75.07	---	---	---	---	---	---	3:22	9:47	267	33	577,000	---	Thermalito Diversion Dam
40	79.33	---	---	---	---	---	---	7:57	11:00	193	14	162,000	11	Grand Avenue, Ruddy Creek
41	77.97	---	---	---	---	---	---	3:01	10:10	167	40	595,000	9	Riverbend Park
42	82.03	---	---	---	---	---	---	4:18	11:40	142	30	695,000	5	Just Upstream of Thermalito Afterbay Dam

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

Thermalito Afterbay
Initial Water Surface Elevation (ft)
FW = 136.5 ft, within sunny day operating range
(5.5 ft below dam crest at El. 142 ft)

X: -2146976.3699
Y: 516574.541204

X: -2152059.84271
Y: 511409.046289

Matchline: Sheet 32

Matchline: Sheet 34

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

0 2,000 4,000 Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- Non-PGE Dam
- School
- Healthcare Facility
- Police/Fire
- Substation
- Airport
- Recreation
- Cross Section
- Railroad
- Transmission Line
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- Major Highways
- Highways
- Major Roads
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379980-4

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X: -2161884.60429
Y: 509726.201346

X: -2153504.29738
Y: 506453.554793

X: -2167978.07123
Y: 506785.394111

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
43	91.62	---	---	---	---	---	---	6:40	14:00	103	27	530,000	4	Robinsons Corner

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "---" = Not applicable

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Imagery: NAIP California 2016 (60 cm)

Legend

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- School
- Healthcare Facility
- Police/Fire
- Substation
- Recreation
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0 2,000 4,000 Feet

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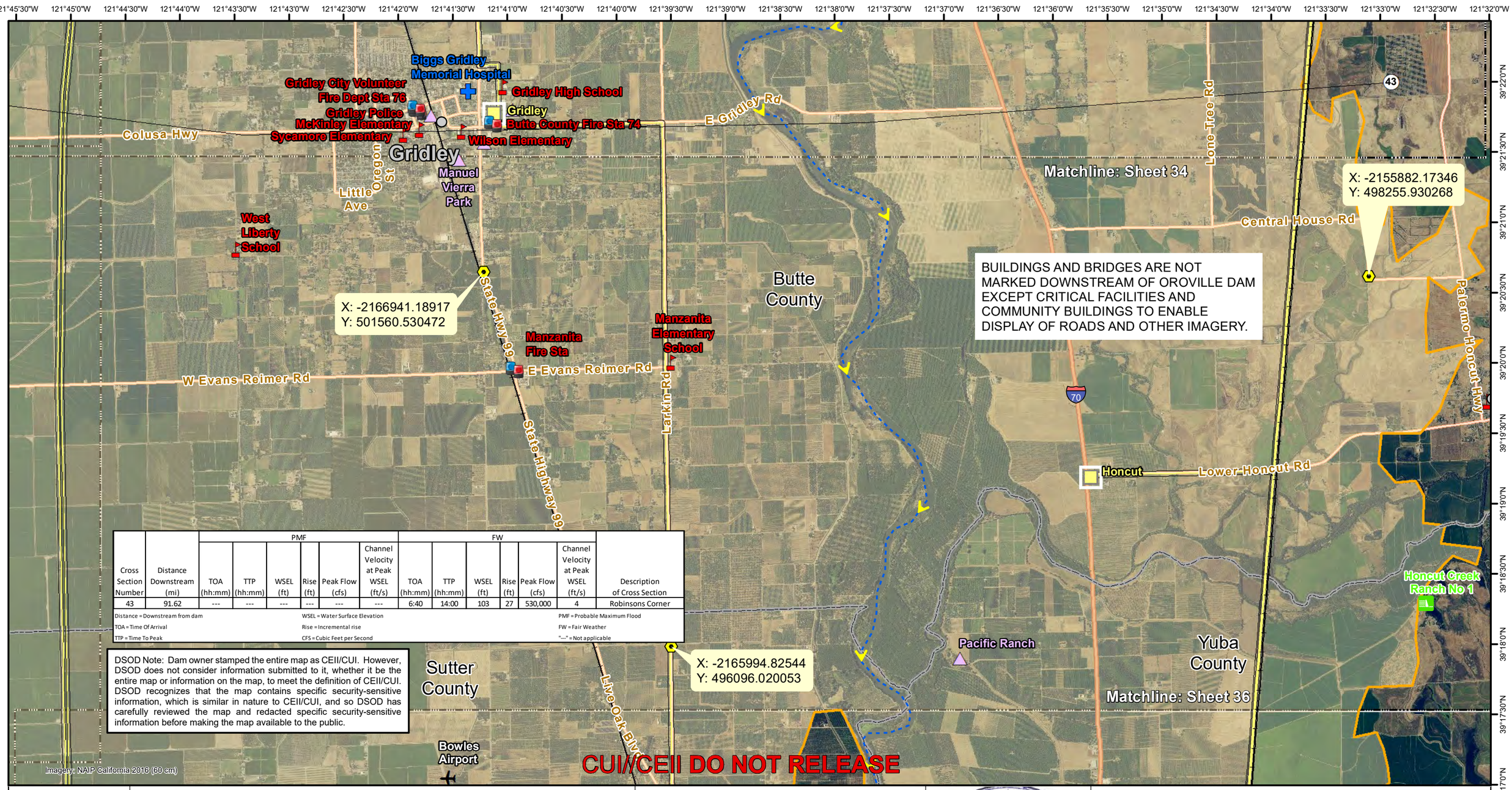
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379980-4



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
43	91.62	---	---	---	---	---	---	6:40	14:00	103	27	530,000	4	Robinsons Corner

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0 2,000 4,000
Feet

Legend

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X: -2175511.30943
Y: 489237.995051

X: -2166701.16599
Y: 494102.492912

X: -2160009.72338
Y: 484987.732824

Bowles Airport
Live Oak Memorial Park
Luther Elementary School
Live Oak
Live Oak High School
Alternative School
Live Oak Middle School
Hedger School
Pennington Rd
Live Oak Fire Dept
Live Oak
Leo Chesney Correctional Center
Live Oak Blvd
Larkin Rd
Kent Ave
Encinal
La Finca Orchards
Matchline: Sheet 35
Section Seven Gun Club
Ramirez Rd
Sutter County
Yuba County
Dist Ten Store
Clark Rd
Encinal Elementary School
Sixmile Sta
Woodruff Ln
Encinal Rd
Matchline: Sheet 37
E Butte Rd
Jack Slough Rd
Kimball Ln
Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

121°45'30"W 121°45'0"W 121°44'30"W 121°44'0"W 121°43'30"W 121°43'0"W 121°42'30"W 121°42'0"W 121°41'30"W 121°41'0"W 121°40'30"W 121°40'0"W 121°39'30"W 121°39'0"W 121°38'30"W 121°38'0"W 121°37'30"W 121°37'0"W 121°36'30"W 121°36'0"W 121°35'30"W 121°35'0"W 121°34'30"W 121°34'0"W 121°33'30"W 121°33'0"W 121°32'30"W

39°17'30"N 39°17'0"N 39°16'30"N 39°16'0"N 39°15'30"N 39°15'0"N 39°14'30"N 39°14'0"N 39°13'30"N 39°13'0"N 39°12'30"N

N

0 2,000 4,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- School
- Police/Fire
- Prison
- Substation
- Airport
- Recreation
- Railroad
- Transmission Line
- County Boundaries
- Major Highways
- Highways
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
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3	12/14/2017	Revised format	BP	LR	AF
4	2/10/2020	Extended FW Model, updated notes, added channel velocities, and initial WSEL	BP	LR	AF

REGISTERED PROFESSIONAL ENGINEER
WILLIAM A. RETTBERG
No. C055145
EXP. 6/30/20
CIVIL
STATE OF CALIFORNIA

GEI Consultants, Inc.

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 36 of 49

DSOD Note: Dam owner stamped the entire map as CEII/CUI. However, DSOD does not consider information submitted to it, whether it be the entire map or information on the map, to meet the definition of CEII/CUI. DSOD recognizes that the map contains specific security-sensitive information, which is similar in nature to CEII/CUI, and so DSOD has carefully reviewed the map and redacted specific security-sensitive information before making the map available to the public.

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
44	112.48	---	---	---	---	---	---	12:08	38:30	79	40	273,000	3	Marysville
49	106.56	---	---	---	---	---	---	---	48:10	54	1	6,000	<1	Near Tierra Buena

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"—" = Not applicable

X: -2169525.79293
Y: 484049.236358

X: -2157145.68565
Y: 482177.456698

X: -2159646.64671
Y: 475380.613698

Matchline: Sheet 36

Matchline: Sheet 38

BUILDINGS AND BRIDGES ARE NOT MARKED DOWNSTREAM OF OROVILLE DAM EXCEPT CRITICAL FACILITIES AND COMMUNITY BUILDINGS TO ENABLE DISPLAY OF ROADS AND OTHER IMAGERY.

CUI//CEII DO NOT RELEASE

Imagery: NAIP California 2016 (60 cm)

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- School
- Healthcare Facility
- Police/Fire
- Prison
- Substation
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0 2,000 4,000 Feet

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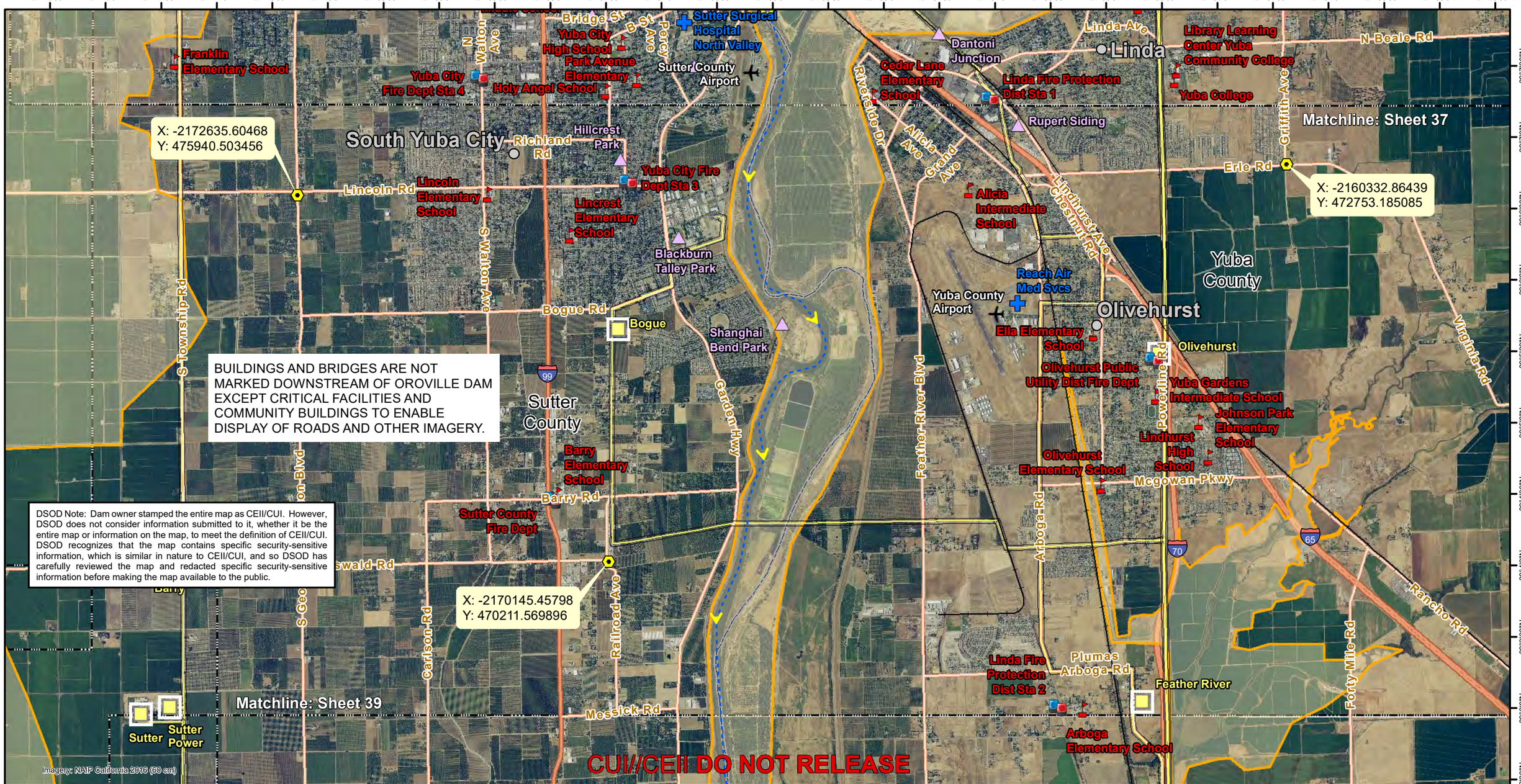
Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 37 of 49

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CUI//CEII DO NOT RELEASE

N

0 2,000 4,000
Feet

Legend

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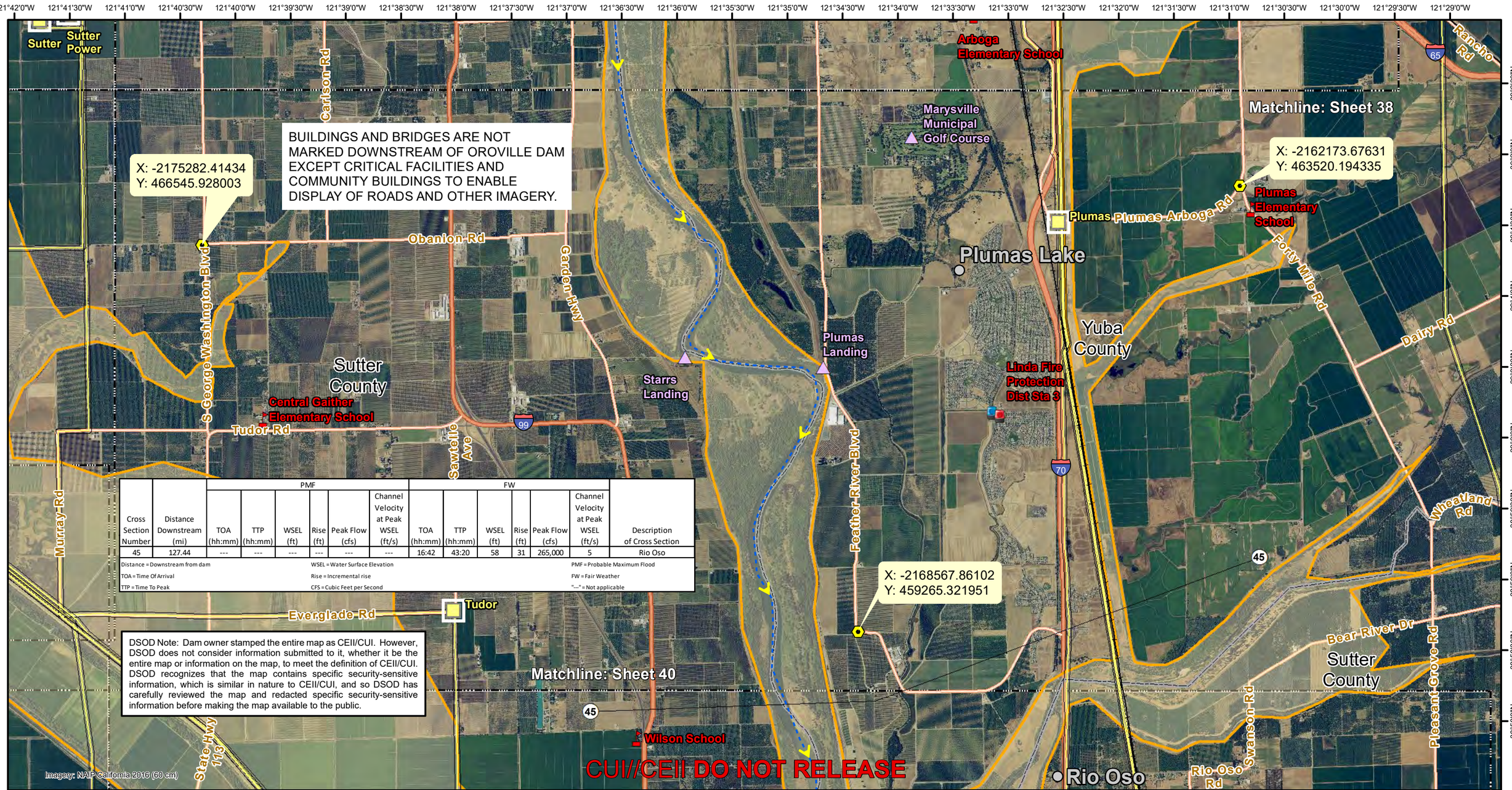
Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 38 of 49

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
45	127.44	---	---	---	---	---	---	16:42	43:20	58	31	265,000	5	Rio Oso

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
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0 2,000 4,000
Feet

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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
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Detailed Map Sheet 39 of 49

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38°58'0"N 38°57'30"N 38°57'0"N 38°56'30"N 38°56'0"N 38°55'30"N 38°55'0"N 38°54'30"N 38°54'0"N 38°53'30"N 38°53'0"N

45 Wilson School

Matchline: Sheet 38

Yuba County

Lake of the Woods State Wildlife Area

Rio Oso

Rio Oso Rd

Swanson Rd

X: -2165187.12095
Y: 455529.386397

Browns Elementary School

Pelger Rd

X: -2177872.98281
Y: 458807.303286

State Hwy 113

Sutter County

Subacco Rd

99

70

Pacific Ave

Pleasant Grove Rd

Marcum - Illinois Union Elementary School

East Nicolaus

East Nicolaus Fire Dept

East Nicolaus High School

Trowbridge

East Nicolaus

Nicolaus Ave

Nicolaus

1st St

X: -2171748.48556
Y: 450842.056381

Armour Rd

State Highway 113

Garden Hwy

BUILDINGS AND BRIDGES ARE NOT MARKED DOWNSTREAM OF OROVILLE DAM EXCEPT CRITICAL FACILITIES AND COMMUNITY BUILDINGS TO ENABLE DISPLAY OF ROADS AND OTHER IMAGERY.

Matchline: Sheet 41

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
45	127.44	---	---	---	---	---	---	16:42	43:20	58	31	265,000	5	Rio Oso

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "---" = Not applicable

0 2,000 4,000 Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- School
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 40 of 49

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38°53'0"N 38°52'30"N 38°52'0"N 38°51'30"N 38°51'0"N 38°50'30"N 38°50'0"N 38°49'30"N 38°49'0"N 38°48'30"N 38°48'0"N

State Highway 113

Matchline: Sheet 40

Robbins

Robbins Elementary School

Robbins Sutter Basin Fire Protection Dist

Matchline: Sheet 49

Armour Rd

Reclamation Rd

Garden Hwy

X: -2170713.31705
Y: 448065.886652

BUILDINGS AND BRIDGES ARE NOT MARKED DOWNSTREAM OF OROVILLE DAM EXCEPT CRITICAL FACILITIES AND COMMUNITY BUILDINGS TO ENABLE DISPLAY OF ROADS AND OTHER IMAGERY.

Sutter County

DOWNSTREAM LIMIT OF FW STUDY ON THE FEATHER RIVER. FOR THE HYPOTHETICAL FW SCENARIO HIGH FLOWS WOULD BE EXPECTED TO CONTINUE DOWNSTREAM BUT FLOWS WOULD BE LESS THAN THE FLOOD CHANNEL DESIGN CAPACITY.

46 46

70 99

Pacific Ave

Frontage Road

Van Dy Strip

Pleasant Grove Rd

Catlett Rd

Scheidel Ranch Airport

James Brothers Airport

W Catlett Rd

Pleasant Grove

Pleasant Grove Fire Dept

Howsley Rd

Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
46	137.39	---	---	---	---	---	---	19:15	55:50	40	21	240,000	3	Downstream Limit Feather River

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
"---" = Not applicable

X: -2170792.54264
Y: 441478.914395

Catlett

X: -2181846.63075
Y: 442897.446873

Ensley Rd

Yolo County

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

0 2,000 4,000
Feet

Legend

- Reference Points
- Direction of Flow
- City / Town / Unincorporated
- School
- Police/Fire
- Substation
- Airport
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 41 of 49

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
43	91.62	---	---	---	---	---	---	6:40	14:00	103	27	530,000	4	Robinsons Corner

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "—" = Not applicable

X: -2177884.07726
Y: 515915.818935

X: -2185481.79357
Y: 511971.487747

X: -2172567.66595
Y: 508480.919651

Glenn County
Butte County
Colusa County
Union School
County Road 67
Afton Rd
Biggs-Princeton Hwy
Aguas Frias Rd
County Road Y
County Hwy Z
County Road Z
Road 70
Road Yy
Farris Rd
Schohr Ranch
Matchline: Sheet 34
Matchline: Sheet 43
43
Colusa Hwy

BUILDINGS AND BRIDGES ARE NOT MARKED DOWNSTREAM OF OROVILLE DAM EXCEPT CRITICAL FACILITIES AND COMMUNITY BUILDINGS TO ENABLE DISPLAY OF ROADS AND OTHER IMAGERY.

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

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39°27'0"N 39°26'30"N 39°26'0"N 39°25'30"N 39°25'0"N 39°24'30"N 39°24'0"N 39°23'30"N 39°23'0"N 39°22'30"N 39°22'0"N

0 2,000 4,000 Feet

Legend

- Reference Points
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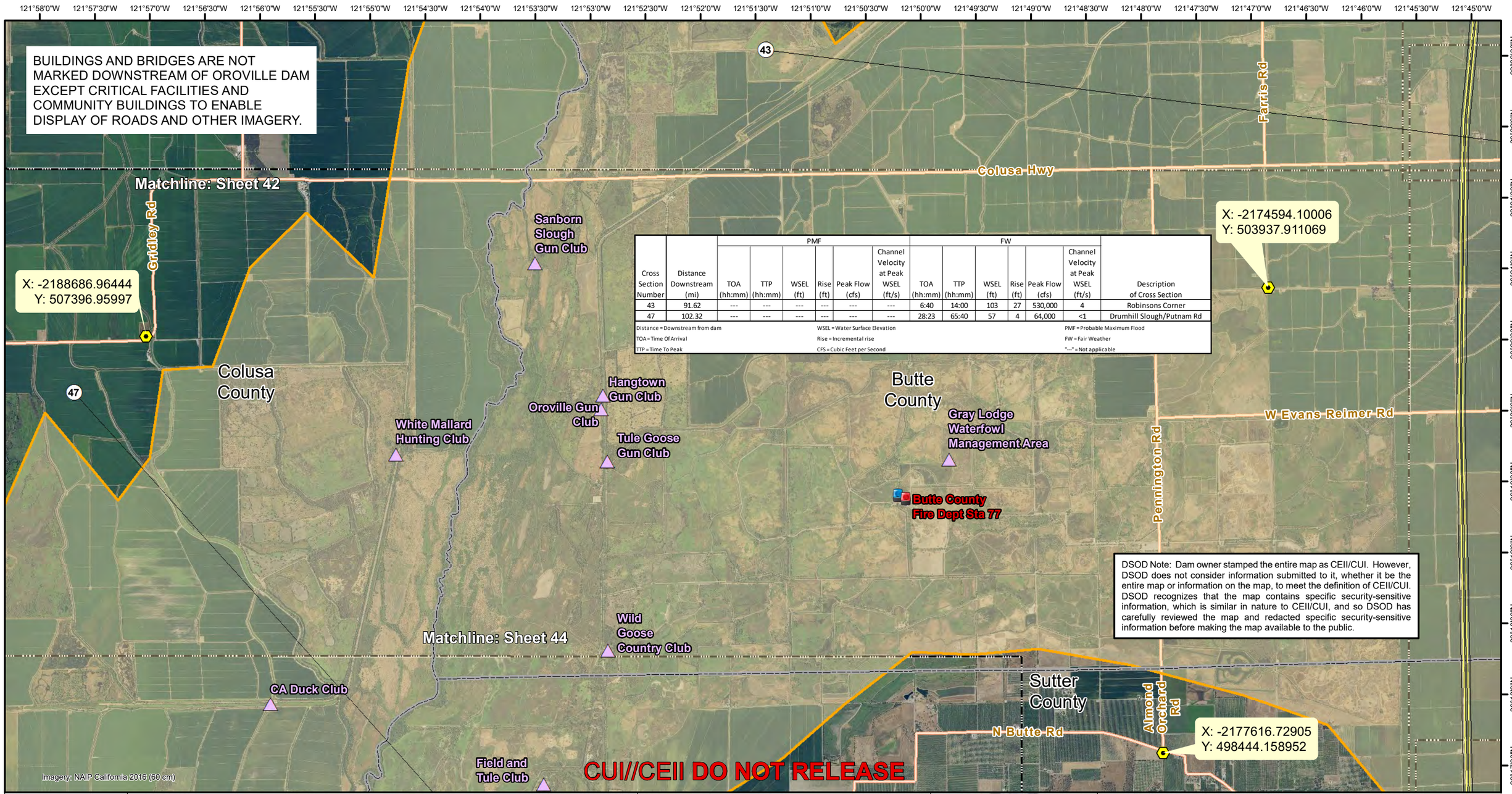
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 42 of 49



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
43	91.62	---	---	---	---	---	---	6:40	14:00	103	27	530,000	4	Robinsons Corner
47	102.32	---	---	---	---	---	---	28:23	65:40	57	4	64,000	<1	Drumhill Slough/Putnam Rd

Distance = Downstream from dam
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Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
FW = Fair Weather
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0 2,000 4,000
Feet

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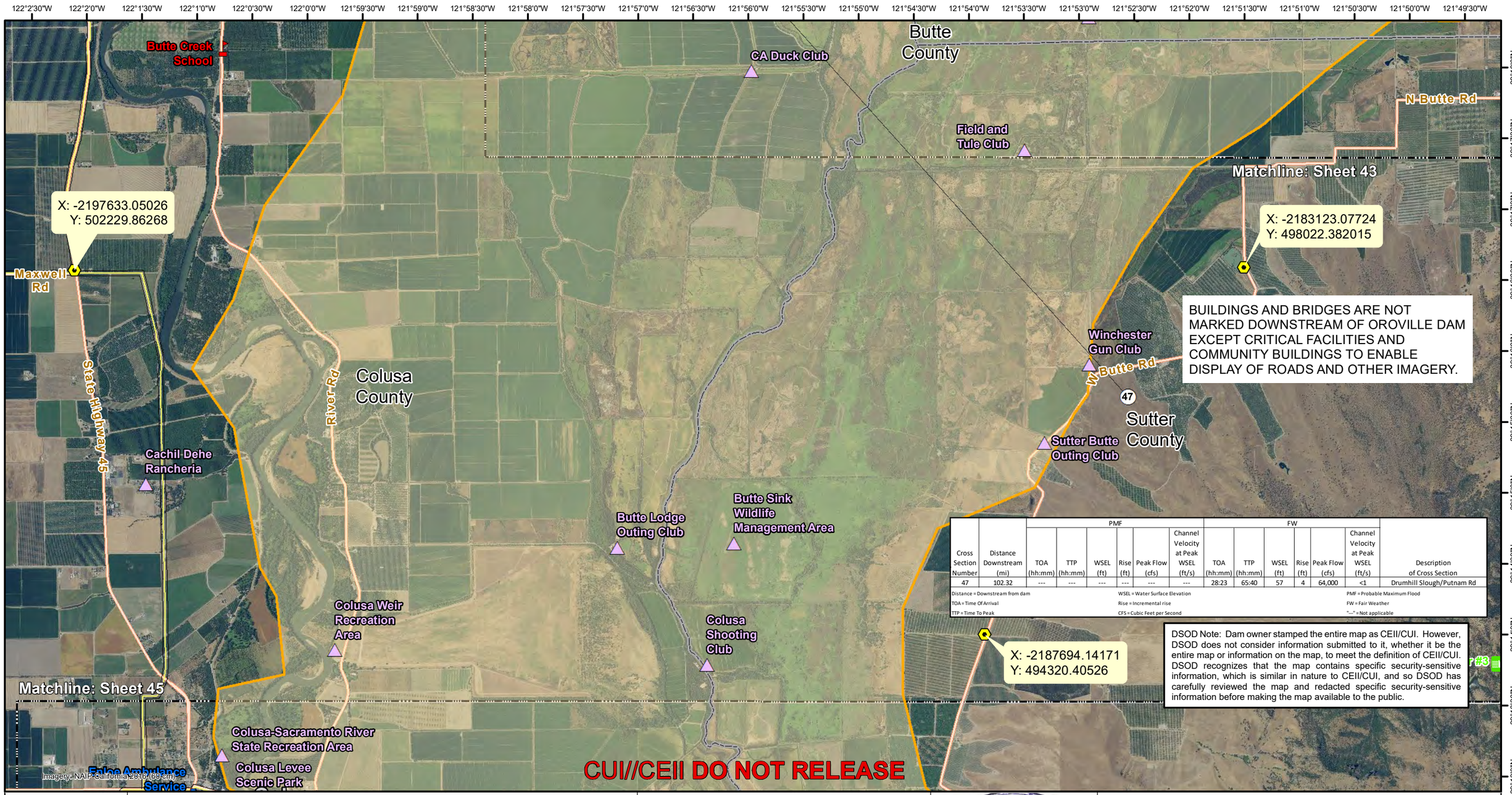
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Detailed Map Sheet 43 of 49

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
47	102.32	---	---	---	---	---	---	28:23	65:40	57	4	64,000	<1	Drumhill Slough/Putnam Rd

Distance = Downstream from dam; TOA = Time Of Arrival; TTP = Time To Peak; WSEL = Water Surface Elevation; Rise = Incremental rise; CFS = Cubic Feet per Second; PMF = Probable Maximum Flood; FW = Fair Weather; "---" = Not applicable

0 2,000 4,000 Feet

Legend

- Reference Points
- Non-PGE Dam
- School
- Healthcare Facility
- Recreation
- Cross Section
- Transmission Line
- County Boundaries
- Major Roads
- Approximate limits of inundation due to hypothetical dam failure (Fair Weather [FW] Scenario)

Revisions

No.	Date	Description	Prepared By	Checked By	Approved
1	8/31/2010	Issued			RKW
2	7/31/2011	PMF limits added			RKW
3	12/14/2017	Revised format	BP	LR	AF
4	2/10/2020	Extended FW Model, updated notes, added channel velocities, and initial WSEL	BP	LR	AF

REGISTERED PROFESSIONAL ENGINEER WILLIAM A. RETTBERG No. C055145 EXP. 6/30/20 CIVIL STATE OF CALIFORNIA

GEI Consultants, Inc.

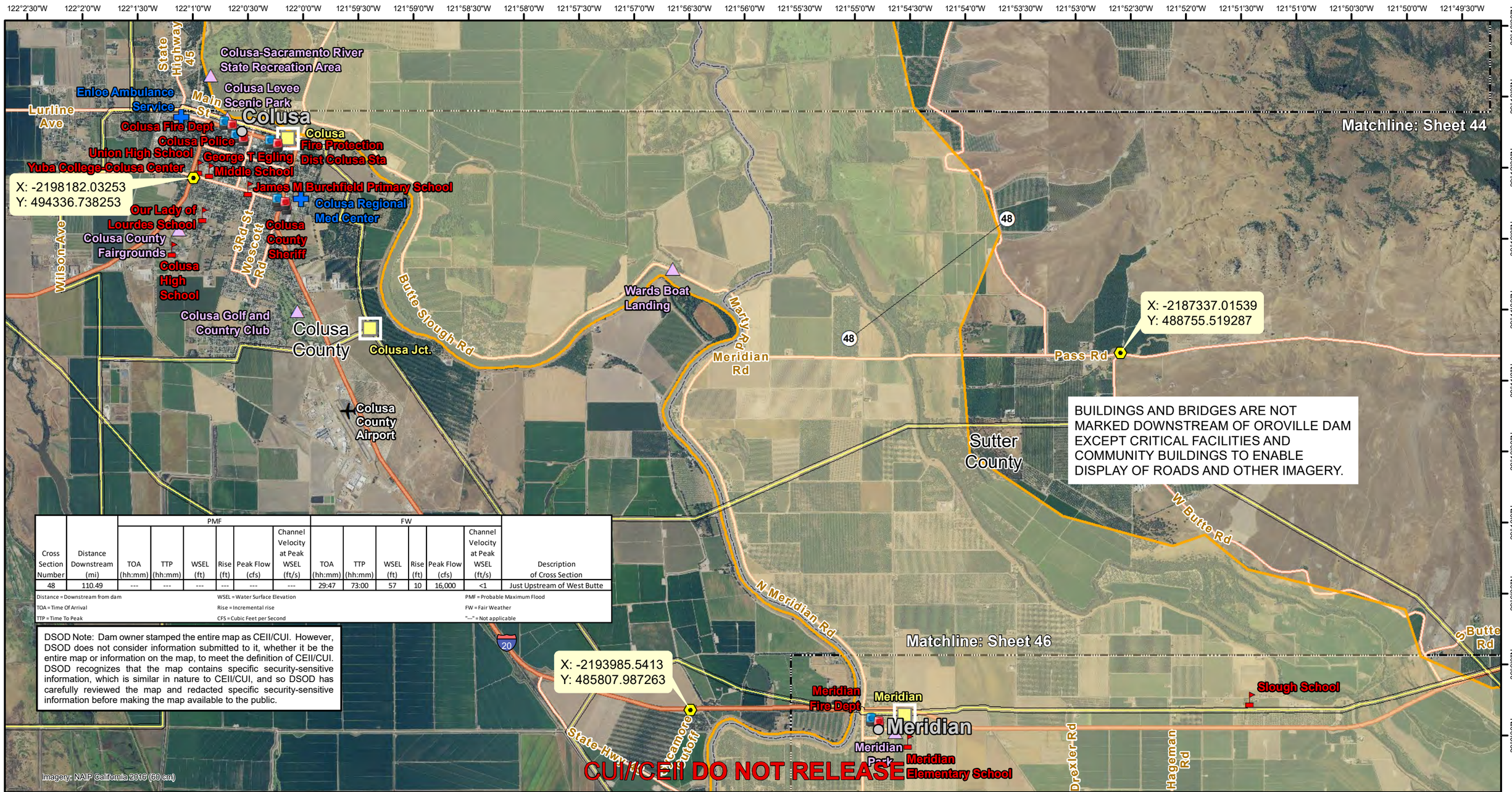
Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of **Lake Almanor Dam**

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 44 of 49

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379980-4



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
48	110.49	---	---	---	---	---	---	29:47	73:00	57	10	16,000	<1	Just Upstream of West Butte

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
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0 2,000 4,000
Feet

Legend

- Reference Points
- City / Town / Unincorporated
- School
- Healthcare Facility
- Police/Fire
- Substation
- Airport
- Recreation
- Cross Section
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- County Boundaries
- Highways
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STATE OF CALIFORNIA

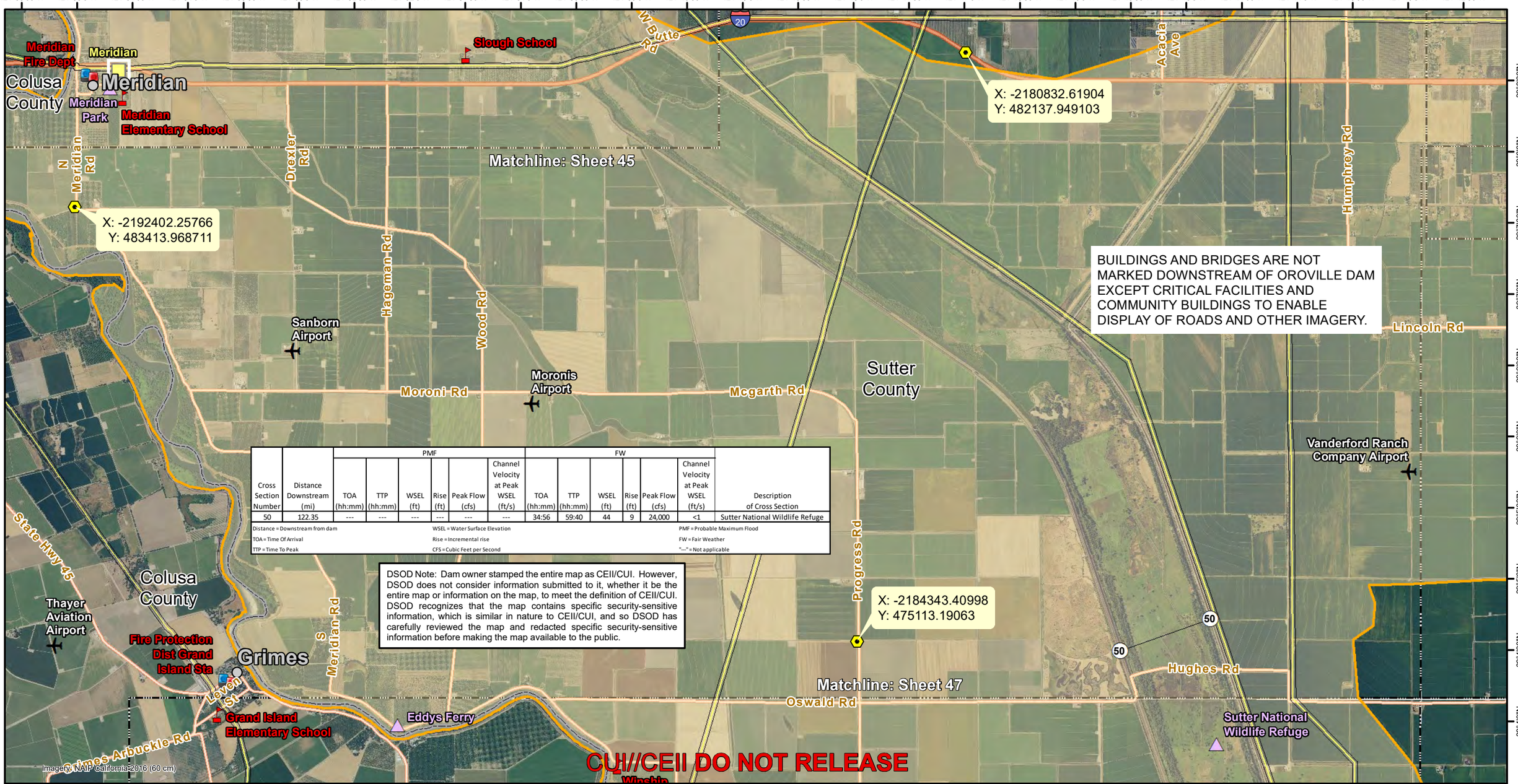
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Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
Lake Almanor Dam
Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 45 of 49

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Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
50	122.35	---	---	---	---	---	---	34:56	59:40	44	9	24,000	<1	Sutter National Wildlife Refuge

Distance = Downstream from dam
TOA = Time Of Arrival
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N

0 2,000 4,000
Feet

Legend

- Reference Points
- City / Town / Unincorporated
- School
- Police/Fire
- Substation
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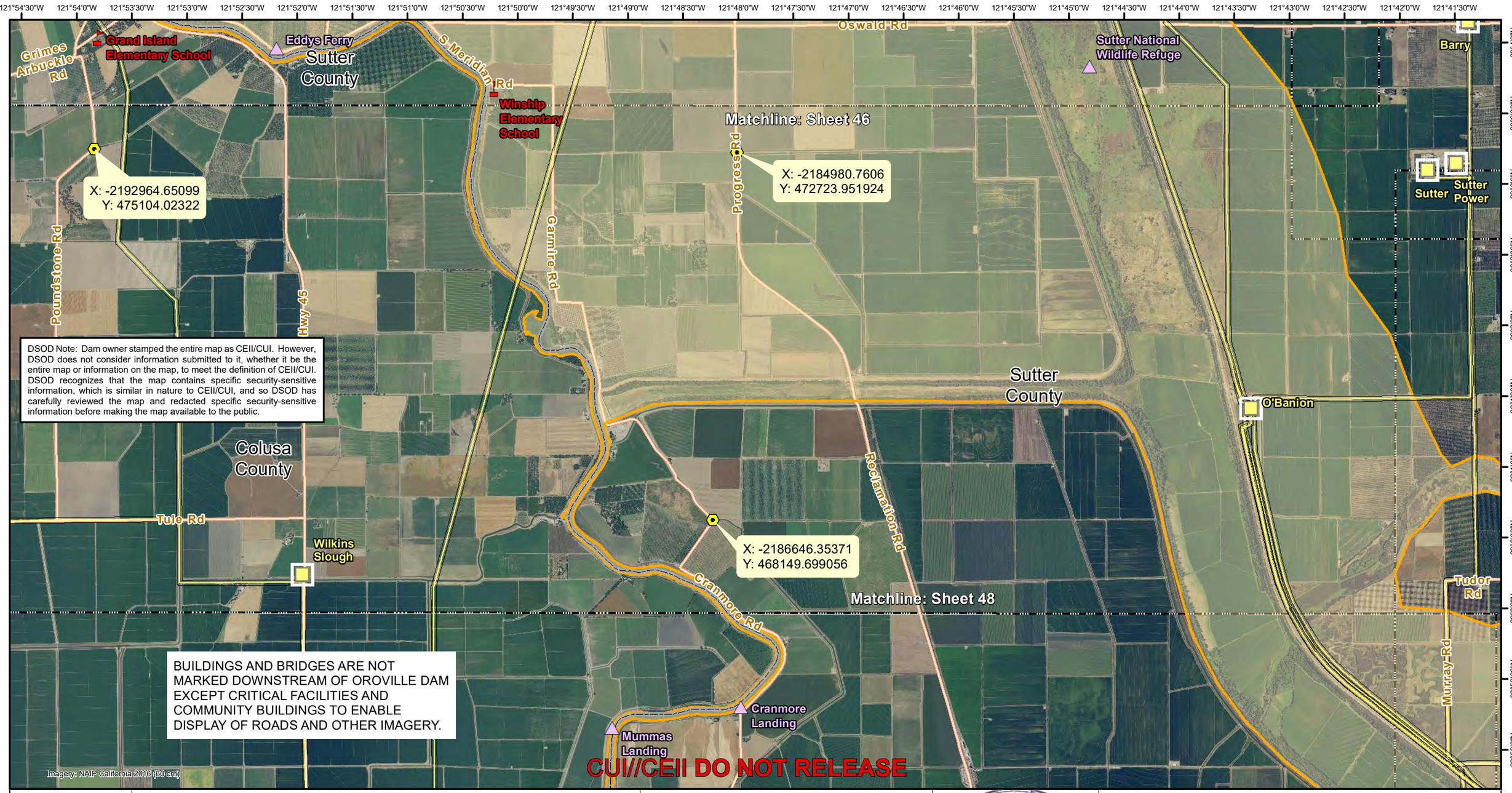
Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of

Lake Almanor Dam

Plumas County
FERC Project No. P-2105-CA,
DWR 93.003, CA00327
Detailed Map Sheet 46 of 49

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N

0 2,000 4,000
Feet

Legend

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Detailed Map Sheet 47 of 49

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BUILDINGS AND BRIDGES ARE NOT MARKED DOWNSTREAM OF OROVILLE DAM EXCEPT CRITICAL FACILITIES AND COMMUNITY BUILDINGS TO ENABLE DISPLAY OF ROADS AND OTHER IMAGERY.

Matchline: Sheet 47

X: -2192944.64544
Y: 464929.589578

White Rd

State Hwy 45

Colusa County

Mummas Landing

Cranmore Landing

Murray Rd

X: -2180656.98802
Y: 462041.921018

Matchline: Sheet 40

Cranmore Rd

Sutter County

Reclamation Rd

Pelger Rd

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X: -2183670.57896
Y: 457067.60012

Subacco Rd

Matchline: Sheet 49

Howells Landing

Colusa County Hwy P9

Yolo County

State Highway 45

Sutter County

State Hwy 113

Imagery: NAIP California 2016 (60 cm)

CUI//CEII DO NOT RELEASE

121°54'30"W 121°54'0"W 121°53'30"W 121°53'0"W 121°52'30"W 121°52'0"W 121°51'30"W 121°51'0"W 121°50'30"W 121°50'0"W 121°49'30"W 121°49'0"W 121°48'30"W 121°48'0"W 121°47'30"W 121°47'0"W 121°46'30"W 121°46'0"W 121°45'30"W 121°45'0"W 121°44'30"W 121°44'0"W 121°43'30"W 121°43'0"W 121°42'30"W 121°42'0"W 121°41'30"W

38°59'30"N 38°59'0"N 38°58'30"N 38°58'0"N 38°57'30"N 38°57'0"N 38°56'30"N 38°56'0"N 38°55'30"N 38°55'0"N

N

0 2,000 4,000
Feet

Legend

- Reference Points
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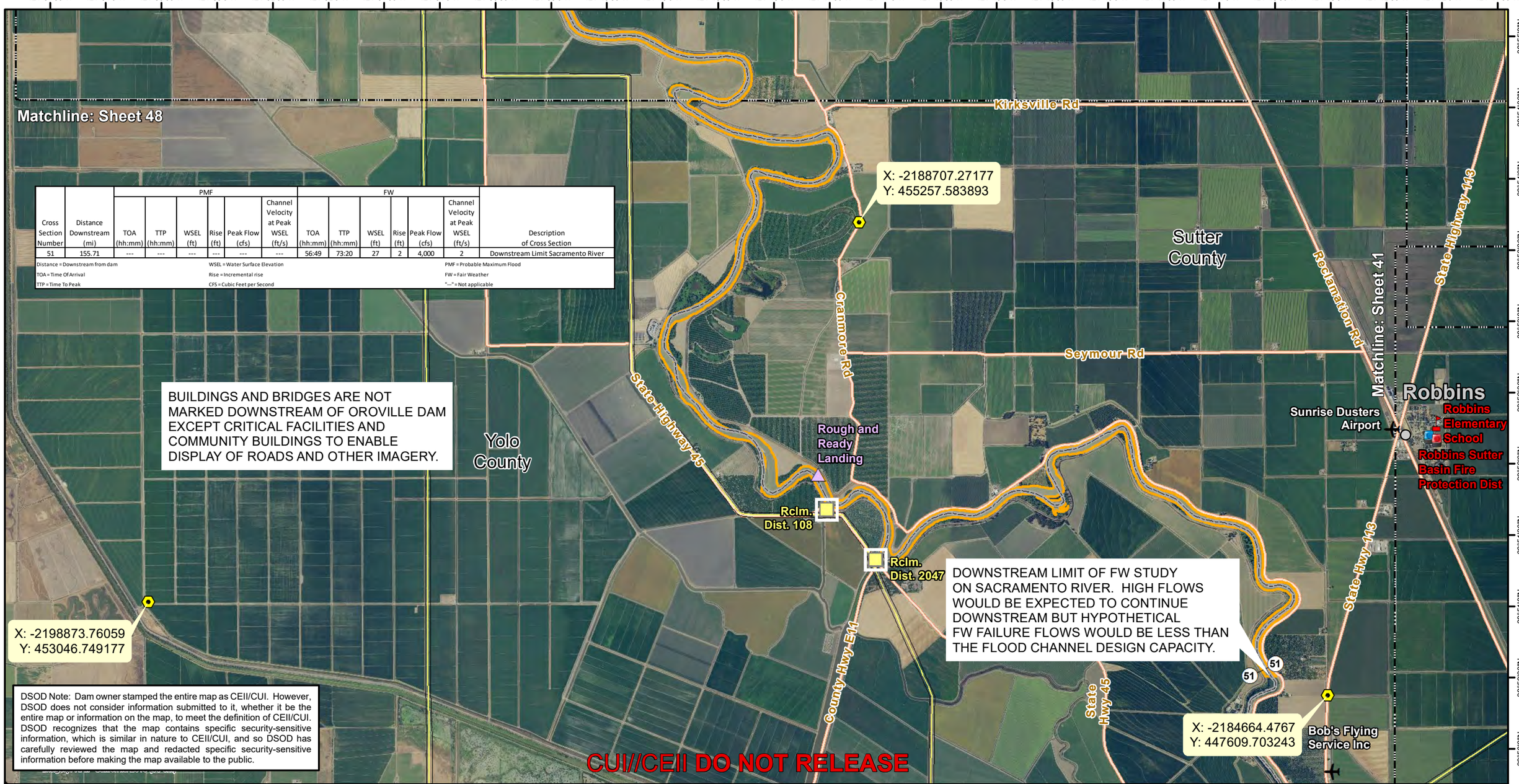
Civil - Hydrologic Engineering Inundation Map for Hypothetical Failure of
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Plumas County
FERC Project No. P-2105-CA,
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Detailed Map Sheet 48 of 49

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379980-4



Cross Section Number	Distance Downstream (mi)	PMF TOA (hh:mm)	PMF TTP (hh:mm)	PMF WSEL (ft)	PMF Rise (ft)	PMF Peak Flow (cfs)	PMF Channel Velocity at Peak WSEL (ft/s)	FW TOA (hh:mm)	FW TTP (hh:mm)	FW WSEL (ft)	FW Rise (ft)	FW Peak Flow (cfs)	FW Channel Velocity at Peak WSEL (ft/s)	Description of Cross Section
51	155.71	---	---	---	---	---	---	56:49	73:20	27	2	4,000	2	Downstream Limit Sacramento River

Distance = Downstream from dam
TOA = Time Of Arrival
TTP = Time To Peak
WSEL = Water Surface Elevation
Rise = Incremental rise
CFS = Cubic Feet per Second
PMF = Probable Maximum Flood
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0 2,000 4,000
Feet

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Plumas County
FERC Project No. P-2105-CA,
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Detailed Map Sheet 49 of 49

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Attachment 10

Document Accession #: 20181025-3103 Filed Date: 10/25/2018

FEDERAL ENERGY REGULATORY COMMISSION
Office of Energy Projects
Division of Dam Safety and Inspections – San Francisco Regional Office
100 First Street, Suite 2300
San Francisco, CA 94105-3084
(415) 369-3300 Office – (415) 369-3322 Facsimile

October 25, 2018

In reply refer to:
Project No. 2100-CA

Mr. Ted Craddock
Oroville Emergency Recovery - Spillways
California Department of Water Resources
P.O. Box 942836
Sacramento, California 94236-0001

Subject: Submittal of Lake Oroville Probable Maximum Flood Update, Spillway Recovery Project

Dear Mr. Craddock:

This letter is in response to your December 27, 2017 letter transmitting the referenced report dated September 29, 2017 for the Oroville Dam, part of the Feather River Project, FERC Project No. 2100. In general, the probable maximum flood (PMF) study was performed in accordance with our Engineering Guidelines. The PMF determination resulted in a peak inflow of 743,800 cfs and a 72-hour volume of 3,092,000 acre-feet using the HEC-ResSim model to route the PMF inflow hydrograph. The updated PMF study fulfils a recommendation from the eighth Part 12D independent consultant safety inspection (GEI 2010) and addresses the recommendations from the 2012 review of the 2003 PMF determination.

We have reviewed the submittal and have the following comments:

1. HMR-59 PMP estimates are derived from NOAA Atlas 2 100-yr precipitation estimates. NOAA Atlas 2 was replaced by NOAA Atlas 14 in California in 2011. Please provide an assessment of how the updated precipitation estimates from NOAA Atlas 14 would influence the precipitation estimates provided in HMR 59 and the PMF for Lake Oroville.

2. The wind wave setup and runup calculations appear to be based upon historical maximum wind speeds over a relatively short period of record of 58 years. Please provide a frequency analysis estimating the return frequency of the wind speeds used in the wind wave analysis.

Within 60 days of the date of this letter, please submit a plan and schedule to address the above two comments as they relate to revisions to the submittal.

Based on the conclusions of the report submittal and the ongoing spillway modification efforts, we have the following additional comments:

3. Given the lessons learned from the 2017 incident, as well as the magnitude of potential adverse consequences, a risk-informed decision making approach should be considered to address a number of uncertainties that factor into the appropriate selection of spillway adequacy for the project. For example, there are operational decision making uncertainties with longer duration inflow volume frequencies beyond the traditional 72-hr PMF determination that should be considered. As noted in your May 16, 2017 Technical Memorandum regarding the Frequency Curves for Long-term Risk Assessment (preliminary information provided for our review), a 500-year, 7-day inflow volume is about 2.9 MAF (Table 3 Page B-16). The 500-year event for a 15-day volume is 3.3 MAF (Table 4 Page B-16). The new PMF determination is 3.1 MAF. Thus, the traditional 72-hour PMF load case may not be the most critical hydrologic load case for the project. This cannot be determined without a full probabilistic flood frequency and reservoir storage analysis, which is beyond the scope of Chapter 8 of the Engineering Guidelines.

4. At the conclusion of the current spillway modifications, the original design capacity of the flood control outlet (FCO) will be restored; however, the design capacity of the emergency spillway is on the order of 100,000 cfs to 300,000 cfs lower than the maximum PMF discharge through the emergency spillway. The emergency spillway and natural discharge channel would likely sustain substantial headcutting erosion downstream of the secant pile wall when passing the expected full peak flow of approximately 420,000 cfs. In addition, it is likely the roller compacted concrete (RCC) apron section would experience moderate to severe damage from flows of this magnitude as well. A more robust and resilient design of the emergency spillway may be required to prevent the possibility of moderate to severe damage to the emergency spillway structure for the expected full peak flow of approximately 420,000 cfs. Further hydraulic and erodibility analyses of the emergency spillway structure should be performed to determine if it can safely pass PMF outflows.

5. Although the new PMF inflow is 18,800 cfs and 0.92 MAF greater than the previous (2003) determination, the resulting still water reservoir surface elevation is 2.9 feet below the top of dam. The wind wave setup and runup study showed that 3.8 feet of overtopping of the Main Dam is possible at the peak of the new PMF determination. Remedial modifications should be evaluated that eliminate overtopping of the embankment.

6. The emergency spillway should be reclassified as an auxiliary spillway since it is a secondary spillway in the project's current configuration and is being relied upon to pass more flow than the primary spillway (flood control outlet (FCO)) during a PMF event.

Within 60 days of the date of this letter, please submit a plan and schedule to address the above additional comments. We understand the Department of Water Resources (DWR) has currently initiated an Oroville project comprehensive needs assessment (CNA) that will be completed in December 2019. Some of the above additional comments may be incorporated into the appropriate tasks identified for the CNA work. Regarding Comment 3, DWR should contact this office within 30 days of the date of this letter to discuss the course of action to determine the appropriate project hydrologic loading.

We appreciate your cooperation in this aspect of the Commission's dam safety program. If you have questions, please contact me at (415) 369-3318.

Sincerely,

Frank L. Blackett, P.E.
Regional Engineer

cc:
Ms. Sharon Tapia, Chief
CA Dept. of Water Resources
Division of Safety of Dams
P.O. Box 942836
Sacramento, CA 94236-0001