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Engineers and

Scientists

# Lopez Dam Breach Inundation Study Comparison – 1999 Vs 2017

San Luis Obispo County, California

**Submitted to:**
San Luis Obispo County Public Works
976 Osos St #207
San Luis Obispo, CA 93408

**Submitted by:**
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May 2019
Project 1705077

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## Tables

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## Abbreviations and Acronyms

| | |
|---|---|
| AF | acre-feet |
| cfs | cubic feet per second |
| DSOD | California Division of Safety of Dams |
| DWR | California Department of Water Resources |
| ft | feet |
| GEI | GEI Consultants, Inc. |
| HEC-RAS | Hydrologic Engineering Center's River Analysis System |
| NAVD 88 | North American Vertical Datum of 1988 |
| NGVD 29 | National Geodetic Vertical Datum of 1929 |
| USGS | United States Geological Survey |

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# 1 Introduction

## 1.1 Purpose

GEI Consultants, Inc. (GEI) was retained by San Luis Obispo County Department of Public Works to perform a dam breach and inundation mapping study for Lopez Dam located in San Luis Obispo County in December 2017.  Results from the 2017 inundation maps were compared to the previously performed dam breach inundation study (URS Greiner Woodward Clyde, 1999) showing differences in inundation extents.  GEI was asked to compare the two studies and write a technical memorandum describing the differences in inundation mapping.

# 2  Dam Breach Inundation Study for 1999

## 2.1  Topographic Data

Hydraulic models are highly dependent upon input topography and can influence results significantly.  The dam breach inundation model produced in 1999 utilized multiple sources of topographic data including USGS quadrangle maps (7.5 minute) and local topographic maps between Fair Oaks Avenue in Arroyo Grande, CA and the Pacific Ocean (SLO County 1962).  The equivalent resolution of a 7.5-minute quad is approximately a 33 x 33 ft. grid averaging to a single elevation over that area.

## 2.2  Hydraulic Model and Assumptions

The models generated for the 1999 inundation study were developed using National Weather Service (NWS) software.  The BREACH model (Fread 1988) software was used to develop breach outflow hydrographs and the DAMBRK model (NWS 1988) software was used to route the breach hydrograph through 1-dimensional cross sections developed from the topographic data.

The breach model utilized a "sunny-day" failure model assuming that the dam crest had been degraded due to a seismic event, eventually eroding and failing the dam due to overtopping.  The breach scenario with the highest discharge was selected for mapping, this scenario utilized a full reservoir at the spillway crest (Elevation 520, NGVD29).  The storage elevation curve used in the model was based on a San Luis Obispo County topographic map (1967), having a storage capacity of 51,800 ac-ft.  The bottom breach width was 2 ft with a top of breach width of 444 ft, having a total breach depth of 150 ft.  This breach produced a peak outflow of 738,000 cfs.

The routing model utilized a 1-Dimensional (1D) routing methodology.  The 1D methodology routes inflow hydrographs through modeled cross sections using Manning's Flow Equation.  This methodology allows flows to be routed upstream to downstream based on the cross-section locations and allows flow spreading through increased depth in each cross section but does not allow for 2-dimensional spreading of flows.

The model extent is from Lopez Dam to the Pacific Ocean.  The model consisted of 39 cross sections over the 12-mile span.  Field observations were made to classify channel roughness coefficients.  Model roughness values ranged from 0.045 (natural stream bed) to 0.1 (trees and heavy vegetation) in the main channel and ranged from 0.035 (cultivated crops) to 0.09 (heavy residential) in the floodplain overbanks.  Bridges were not included in the routing model because they occupy such a small portion of the flow conveyance area during a dam breach scenario and would not significantly impact water surface elevations.  Peak flows are attenuated by 60% by the time the flood wave reaches the Pacific Ocean.  Table 1 summarizes the 1999 dam breach results.

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Table 1: 1999 Dam Breach Study - Results

| Station | Milepost | Peak Discharge | Peak | Maximum | Peak | Location |
|---------|----------|---------------|------|---------|------|----------|
| | (MP) | (cfs) | WSEL (ft - NGVD) | Depth (ft) | Time (hr) | |
| 0+00 | 0 | 738,000 | 520 | 150 | 1.05 | Lopez Dam |
| 135+17 | 2.56 | 686,000 | 331.9 | 46.9 | 1.18 | Tally Farms Road |
| 404+61 | 7.663 | 573,000 | 116.3 | 46.1 | 1.61 | Highway 101 NB |
| 405+35 | 7.677 | 573,000 | 115.5 | 45.4 | 1.61 | Highway 101 SB |
| 493+68 | 9.35 | 533,000 | 58.4 | 23.4 | 1.82 | Highway 1 |
| 630+96 | 11.95 | 297,000 | 18.7 | 15.7 | 2.71 | Outlet to Pacific |

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# 3  Dam Breach Inundation Study for 2017

## 3.1  Topographic Data

The dam breach inundation study performed in 2017 (GEI) utilized multiple datasets to develop the 2-Dimensional dam breach model terrain.  LiDAR data from NOAA and PG&E were obtained through a San Luis Obispo County data request, two surveys were obtained from 2011 and 2013 with 1 x 1 ft grid cell resolution.  USGS National Elevation Data was utilized to fill in gaps where the existing LiDAR surveys did not cover, this data is classified as 1/3-arc-second and is approximately the same resolution as the 7.5-minute quads at a 33 x 33 ft grid cell size.

## 3.2  Hydraulic Model and Assumptions

The breach model utilized a "sunny-day" failure model, this scenario utilized a reservoir full to the spillway crest (Elevation 520, NGVD29), HEC-RAS was used to perform the breach analysis.  The storage elevation curve used in the model was based on a San Luis Obispo County survey performed in 2002, having a full storage capacity of 49,388 ac-ft.  The bottom breach width was 500 ft with a top of breach width of 650 ft, having a total breach depth of 150 ft.  This breach produced a peak outflow of 833,330 cfs.

The models generated by GEI for the 2017 dam breach and inundation study were developed using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) Version 5.0.3.  Two-Dimensional (2D) hydraulic routing has been available within HEC-RAS software since the release of HEC-RAS 5.0 (2015).  This routing methodology was utilized for the dam breach and inundation analysis in the 2017 study.  Each 2D cell is comprised of a storage-elevation curve (similar to a reservoir) and multiple cell face cross sections which have similar hydraulic properties as 1D cross sections.  This methodology allows for directional spreading of flows based on topographic elevation and hydraulic roughness.  The 2D modeling characteristics are very important for dam breach modeling due to the likelihood of the flood wave rising outside of river or stream banks and spreading overland.  The 2D routing model also used the Full Momentum (Saint Venant) equations available in RAS to account for local and convective accelerations of a rapidly varied flood wave, for a dam breach.

The model extent ranges from Lopez Dam to the Pacific Ocean, the model consisted of a single 2D flow area with an average grid cell size of 100 ft x 100 ft.  The cell size does not diminish the detail of the terrain data, this is utilized in the cell face and volume characteristics.  Break lines were also included in the 2-D Flow area to align cell faces with grade breaks in the model terrain, these break lines prevent water from artificially traveling through high ground based on the cell face alignments.  USGS National Land Cover Database (2011) shapefiles were used to classify manning's roughness coefficients for the model.  The land-use classifications available from USGS were assigned roughness coefficients based on values reported for natural stream channels (Chow 1959) and best engineering judgement.  Model roughness values ranged from 0.03 (natural stream bed) to 0.1 (trees and heavy vegetation) in the main channel and ranged from 0.035 (cultivated

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crops) to 0.2 (heavy residential) in the floodplain overbanks.  Bridges were included in the routing model but these structures occupy such a small portion of the flow conveyance area during a dam breach scenario, they will not significantly impact water surface elevations. Peak flows are attenuated by 70% by the time the flood wave reaches the Pacific Ocean. Table 2 summarizes the 2017 dam breach results.

Table 2: 2017 Dam Breach Study - Results

| Station | Milepost | Peak Discharge | Peak | Maximum | Peak | Location |
|---------|----------|----------------|------|---------|------|----------|
| | (MP) | (cfs) | WSEL (ft - NGVD) | Depth (ft) | Time (hr) | |
| 0 | 0 | 833,330 | 520 | 150 | 1 | Lopez Dam |
| 153+20 | 2.9 | 820,185 | 326.18 | 35.7 | 1.01 | Tally Farms Road |
| 467+83 | 8.9 | 745,518 | 134.18 | 47.2 | 1.35 | Highway 101 NB |
| 467+83 | 8.9 | 745,518 | 134.18 | 47.2 | 1.35 | Highway 101 SB |
| 560+97 | 10.6 | 712,253 | 66.18 | 23 | 1.5 | Highway 1 |
| 667+86 | 12.6 | 243,239 | 28.18 | 22.7 | 2.3 | Outlet to Pacific |

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# 4 Model Results Comparison

Tabulated below in table 3 is a comparison of peak discharge for both models. Overall the peak discharge at the dam is around 10% different. As the flow is routed downstream the difference in peak flow is approximately 20% different.

Tabulated below in table 4 is a comparison of peak water surface elevation for both models. As the flow is routed downstream the difference in peak water surface elevation is approximately 12% different.

Tabulated below in table 5 is a comparison of peak depth for both models. As the flow is routed downstream the difference in maximum depth is approximately 20% different.

Tabulated below in table 6 is a comparison of time to peak water surface elevation for both models. Overall the time to peak at the dam is around 5% different. As the flow is routed downstream the difference in time to peak is approximately 20% different.

Table 3: Cross Sectional Results Comparison - Peak Discharge

| Peak Discharge 1999 | Peak Discharge 2017 | Difference | % Difference | Location |
|---|---|---|---|---|
| (cfs) | (cfs) | (cfs) | (%) | |
| 738,000 | 833,330 | -95,330 | -11.4 | Lopez Dam |
| 686,000 | 820,185 | -134,185 | -16.4 | Tally Farms Road |
| 573,000 | 745,518 | -172,518 | -23.1 | Highway 101 NB near City of Arroyo Grande |
| 573,000 | 745,518 | -172,518 | -23.1 | Highway 101 SB near City of Arroyo Grande |
| 533,000 | 712,253 | -179,253 | -25.2 | Highway 1 near Oceano |
| 297,000 | 243,239 | 53,761 | 22.1 | Outlet to Pacific |

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Table 4: Cross Sectional Results Comparison - Peak WSE

| Peak WSEL 1999 | Peak WSE 2017 | Difference | % Difference | Location |
|---|---|---|---|---|
| (ft -NGVD) | (ft -NGVD) | (ft) | (%) | |
| 520 | 520 | 0 | 0.0 | Lopez Dam |
| 331.9 | 326.18 | 6 | 1.8 | Tally Farms Road |
| 116.3 | 134.18 | -18 | -13.3 | Highway 101 NB near City of Arroyo Grande |
| 115.5 | 134.18 | -19 | -13.9 | Highway 101 SB near City of Arroyo Grande |
| 58.4 | 66.18 | -8 | -11.8 | Highway 1 near Oceano |
| 18.7 | 28.18 | -9 | -33.6 | Outlet to Pacific |

Table 5: Cross Sectional Results Comparison – Peak Depth

| Maximum Depth 1999 | Maximum Depth 2017 | Difference | % Difference | Location |
|---|---|---|---|---|
| (ft) | (ft) | (ft) | (%) | |
| 150 | 150 | 0 | 0.0 | Lopez Dam |
| 46.9 | 35.7 | 11 | 31.4 | Tally Farms Road |
| 46.1 | 47.2 | -1 | -2.3 | Highway 101 NB near City of Arroyo Grande |
| 45.4 | 47.2 | -2 | -3.8 | Highway 101 SB near City of Arroyo Grande |
| 23.4 | 23 | 0 | 1.7 | Highway 1 near Oceano |
| 15.7 | 22.7 | -7 | -30.8 | Outlet to Pacific |

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Table 6: Cross Sectional Results Comparison – Time to Peak

| Peak Time 1999 | Peak Time 2017 | Difference | % Difference | Location |
|---|---|---|---|---|
| (hr) | (hr) | (hr) | (%) | |
| 1.05 | 1 | 0 | 5.0 | Lopez Dam |
| 1.18 | 1.01 | 0 | 16.8 | Tally Farms Road |
| 1.61 | 1.35 | 0 | 19.3 | Highway 101 NB near City of Arroyo Grande |
| 1.61 | 1.35 | 0 | 19.3 | Highway 101 SB near City of Arroyo Grande |
| 1.82 | 1.5 | 0 | 21.3 | Highway 1 near Oceano |
| 2.71 | 2.3 | 0 | 17.8 | Outlet to Pacific |

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# 5 Conclusion

While there have been significant improvements to available data resolution and modeling sophistication since the 1999 dam breach inundation study was performed the results are generally comparable within a margin of error that would be caused by these computing improvements and data resolution.
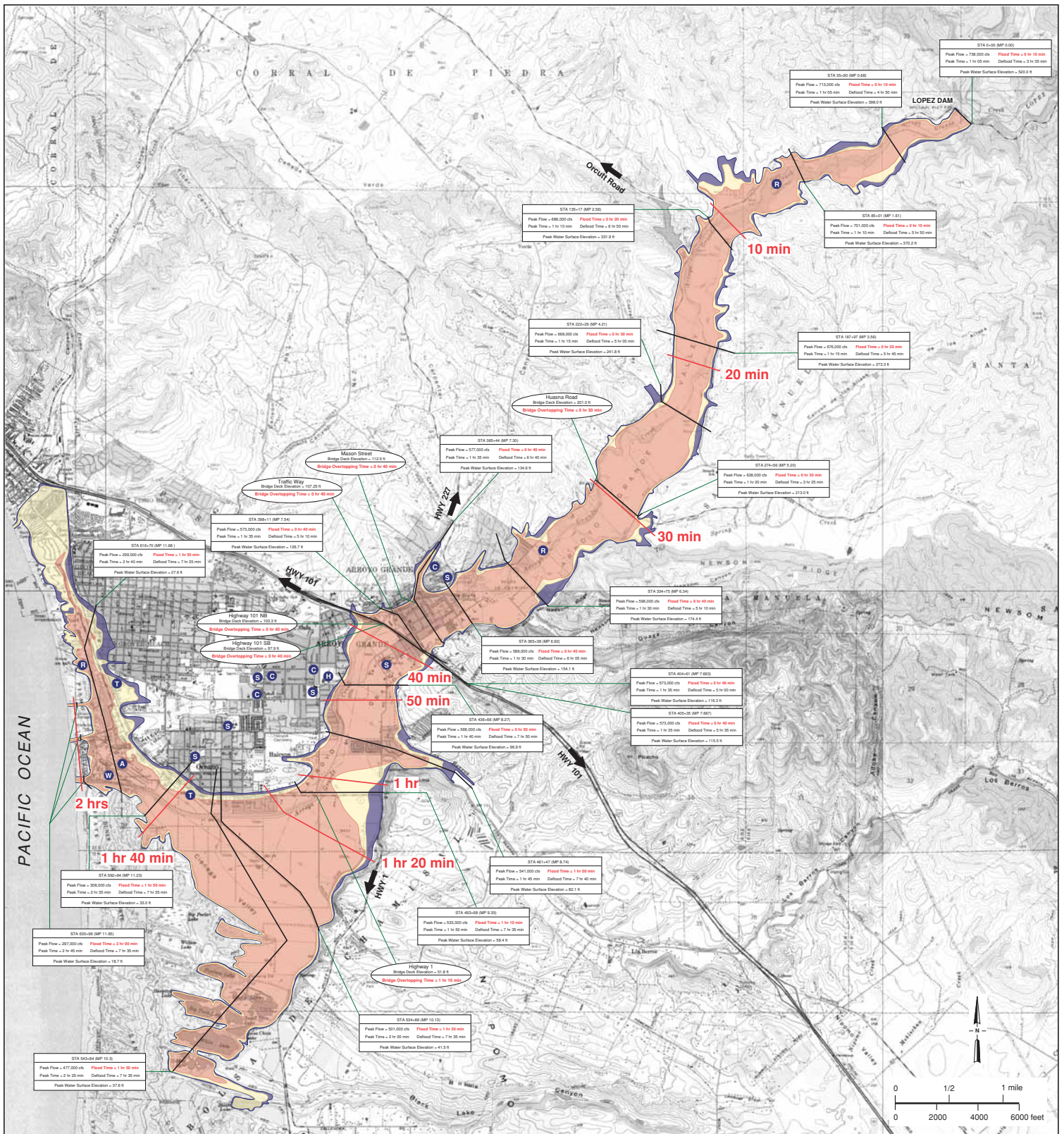
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# 6 References

URS Greiner Woodward Clyde (1999). Downstream Flooding Due to the Hypothetical Failure of Lopez Dam, Final Report.

GEI Consultants (2017). Lopez Dam Inundation Technical Study.

# 7  Attachments

- 1999 Dam Breach Inundation Study Map

- 2017 Dam Breach Inundation Study Map

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CORRAL DE PIEDRA

PACIFIC OCEAN

**LOPEZ DAM**

Orcutt Road

**10 min**

**20 min**

**30 min**

**40 min**

**50 min**

**1 hr**

**2 hrs**

**1 hr 40 min**

**1 hr 20 min**

HWY 227

HWY 101

HWY 1

ARROYO GRANDE

STA 0+00 (MP 0.00)
Peak Flow = 738,000 cfs | Flood Time = 0 hr 00 min
Peak Time = 1 hr 05 min | Deflood Time = 3 hr 35 min
Peak Water Surface Elevation = 520.0 ft

STA 35+90 (MP 0.68)
Peak Flow = 715,000 cfs | Flood Time = 0 hr 10 min
Peak Time = 1 hr 05 min | Deflood Time = 4 hr 50 min
Peak Water Surface Elevation = 398.0 ft

STA 85+01 (MP 1.61)
Peak Flow = 701,000 cfs | Flood Time = 0 hr 10 min
Peak Time = 1 hr 05 min | Deflood Time = 5 hr 50 min
Peak Water Surface Elevation = 370.2 ft

STA 135+17 (MP 2.56)
Peak Flow = 686,000 cfs | Flood Time = 0 hr 20 min
Peak Time = 1 hr 10 min | Deflood Time = 6 hr 50 min
Peak Water Surface Elevation = 331.9 ft

STA 187+97 (MP 3.56)
Peak Flow = 676,000 cfs | Flood Time = 0 hr 20 min
Peak Time = 1 hr 15 min | Deflood Time = 5 hr 45 min
Peak Water Surface Elevation = 273.3 ft

STA 222+29 (MP 4.21)
Peak Flow = 668,000 cfs | Flood Time = 0 hr 30 min
Peak Time = 1 hr 15 min | Deflood Time = 5 hr 00 min
Peak Water Surface Elevation = 241.8 ft

STA 274+56 (MP 5.20)
Peak Flow = 638,000 cfs | Flood Time = 0 hr 30 min
Peak Time = 1 hr 20 min | Deflood Time = 3 hr 25 min
Peak Water Surface Elevation = 213.0 ft

Huasna Road
Bridge Deck Elevation = 201.0 ft
Bridge Overtopping Time = 0 hr 30 min

STA 385+44 (MP 7.30)
Peak Flow = 577,000 cfs | Flood Time = 0 hr 40 min
Peak Time = 1 hr 35 min | Deflood Time = 6 hr 40 min
Peak Water Surface Elevation = 134.6 ft

Mason Street
Bridge Deck Elevation = 112.5 ft
Bridge Overtopping Time = 0 hr 40 min

Traffic Way
Bridge Deck Elevation = 107.25 ft
Bridge Overtopping Time = 0 hr 40 min

STA 308+11 (MP 7.54)
Peak Flow = 573,000 cfs | Flood Time = 0 hr 40 min
Peak Time = 1 hr 35 min | Deflood Time = 5 hr 10 min
Peak Water Surface Elevation = 126.7 ft

STA 616+70 (MP 11.68)
Peak Flow = 259,000 cfs | Flood Time = 1 hr 50 min
Peak Time = 2 hr 40 min | Deflood Time = 7 hr 35 min
Peak Water Surface Elevation = 27.6 ft

Highway 101 NB
Bridge Deck Elevation = 100.3 ft
Bridge Overtopping Time = 0 hr 40 min

Highway 101 SB
Bridge Deck Elevation = 97.9 ft
Bridge Overtopping Time = 0 hr 40 min

STA 334+75 (MP 6.34)
Peak Flow = 596,000 cfs | Flood Time = 0 hr 40 min
Peak Time = 1 hr 30 min | Deflood Time = 6 hr 10 min
Peak Water Surface Elevation = 174.4 ft

STA 365+38 (MP 6.92)
Peak Flow = 589,000 cfs | Flood Time = 0 hr 40 min
Peak Time = 1 hr 30 min | Deflood Time = 6 hr 05 min
Peak Water Surface Elevation = 154.1 ft

STA 404+61 (MP 7.663)
Peak Flow = 573,000 cfs | Flood Time = 0 hr 40 min
Peak Time = 1 hr 35 min | Deflood Time = 5 hr 00 min
Peak Water Surface Elevation = 116.3 ft

STA 405+35 (MP 7.667)
Peak Flow = 573,000 cfs | Flood Time = 0 hr 40 min
Peak Time = 1 hr 35 min | Deflood Time = 5 hr 35 min
Peak Water Surface Elevation = 115.5 ft

STA 435+66 (MP 8.27)
Peak Flow = 566,000 cfs | Flood Time = 0 hr 50 min
Peak Time = 1 hr 40 min | Deflood Time = 7 hr 50 min
Peak Water Surface Elevation = 96.9 ft

STA 461+47 (MP 8.74)
Peak Flow = 541,000 cfs | Flood Time = 1 hr 00 min
Peak Time = 1 hr 40 min | Deflood Time = 7 hr 40 min
Peak Water Surface Elevation = 82.1 ft

STA 592+94 (MP 11.23)
Peak Flow = 308,000 cfs | Flood Time = 1 hr 50 min
Peak Time = 2 hr 35 min | Deflood Time = 7 hr 35 min
Peak Water Surface Elevation = 33.0 ft

STA 493+68 (MP 9.35)
Peak Flow = 533,000 cfs | Flood Time = 1 hr 10 min
Peak Time = 1 hr 50 min | Deflood Time = 7 hr 35 min
Peak Water Surface Elevation = 58.4 ft

STA 630+96 (MP 11.95)
Peak Flow = 297,000 cfs | Flood Time = 2 hr 00 min
Peak Time = 2 hr 45 min | Deflood Time = 7 hr 35 min
Peak Water Surface Elevation = 18.7 ft

Highway 1
Bridge Deck Elevation = 51.8 ft
Bridge Overtopping Time = 1 hr 10 min

STA 534+86 (MP 10.13)
Peak Flow = 501,000 cfs | Flood Time = 1 hr 30 min
Peak Time = 2 hr 00 min | Deflood Time = 7 hr 35 min
Peak Water Surface Elevation = 41.5 ft

STA 543+84 (MP 10.3)
Peak Flow = 477,000 cfs | Flood Time = 1 hr 30 min
Peak Time = 2 hr 25 min | Deflood Time = 7 hr 35 min
Peak Water Surface Elevation = 37.6 ft

0   1/2   1 mile
0   2000   4000   6000 feet

N

**LIMITATIONS/ASSUMPTIONS:**

1. The flood characteristics presented on this map are based on the methodology, assumptions and limitations presented in the accompanying report (Downstream Flooding due to the Hypothetical Failure of Lopez Dam, February 1999 - URS Greiner Woodward Clyde).

2. Inundation depths are provided for informational purposes only.

3. Inundation depths may vary ±5 feet upstream of Station 85+01.

4. Inundation depths may vary ±2 feet downstream of Station 85+01.

5. Peak, flood and bridge overtopping times may vary ±5 minutes.

6. Deflood times may vary ±15 minutes.

7. Initial reservoir storage is 100% full (reservoir elevation 520.0 ft).

**STA (MP)** [Distance in feet (miles) downstream from Lopez Dam]

**Peak Flow** (maximum discharge rate in cubic feet per second)

**Peak Time** (time of maximum flood inundation)*

**Flood Time** (time when flood flows overtop channel banks, levees or flood walls)*

**Deflood Time** (time when flows recede to channel banks)*

**Peak Water Surface Elevation** (maximum water elevation)

*Breach begins at time = 0.0 hour

**Lopez Dam Inundation Area Special/Unique Institutions in Urban Locations**

A  Airport (Non-Commercial)
C  Residential Care Facilities
H  Hospital
R  Recreation Area
S  School (Public)
T  Railroad Tracks
W  Wastewater Treatment Plant

Bridge Name
Bridge Deck Elevation[1]
**Bridge Overtopping Time** (time when flood flows overtop the deck of a bridge)[2]

[1] Approximate elevation
[2] Breach begins at time = 0.0 hour

**Flood Time**
Time when flood flows overtop channel banks, levees or flood walls

Evacuation Route

**INUNDATION DEPTHS**
0 – 5 feet
5 – 10 feet
> 10 feet

**Evacuation Routes** →
• Orcutt Road
• Highway 227 North
• Highway 101 North
• Highway 101 South
• Highway 1 South

**OWNER:** Zone 3 (Lopez Water) of the San Luis Obispo County Flood Control and Water Conservation District
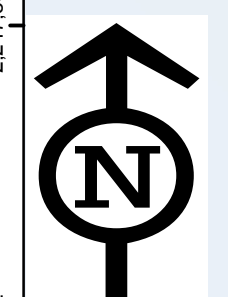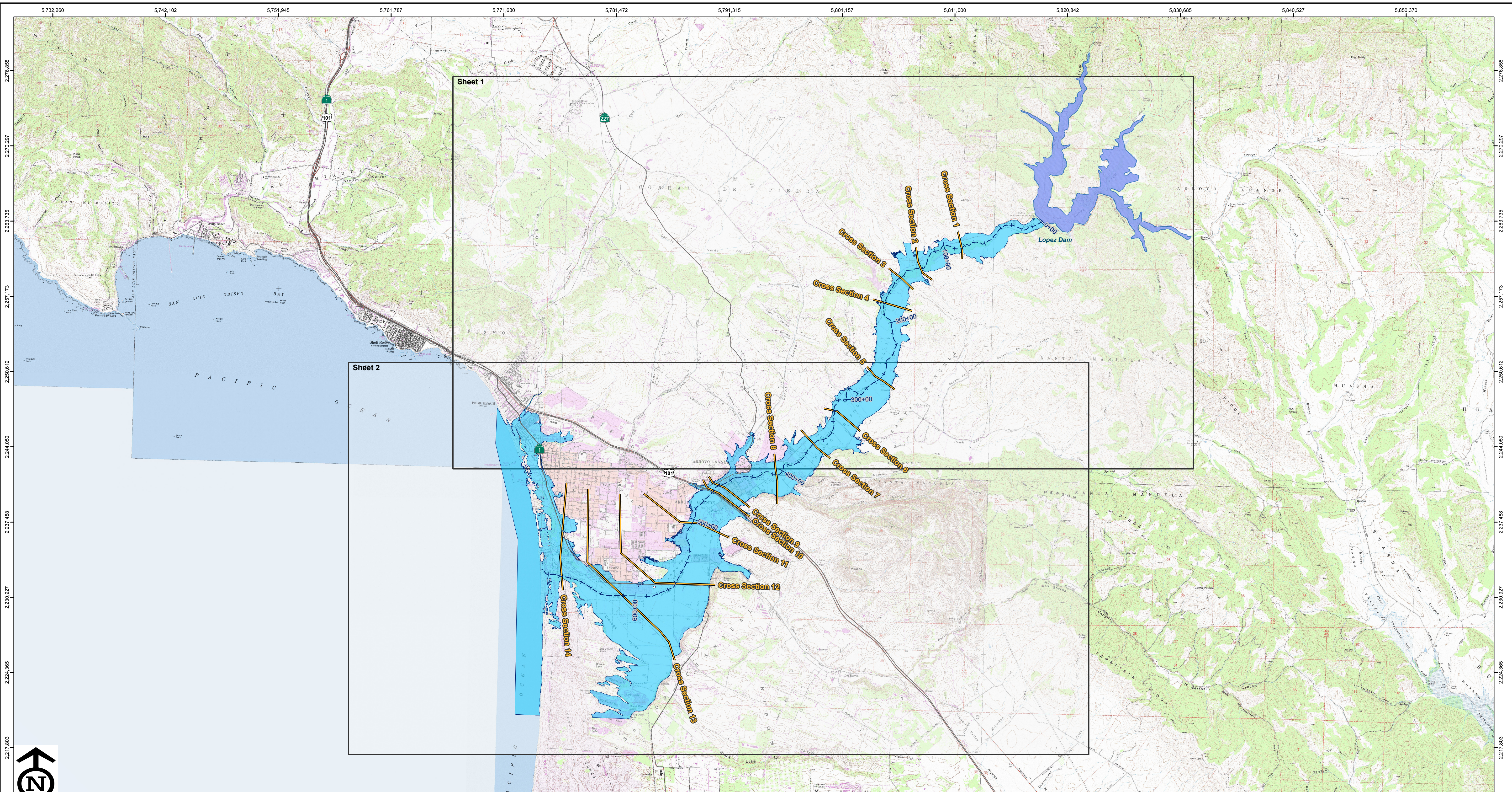County Government Center, Room 207
San Luis Obispo, CA 93408

County Representative  Dave O'Halloran, P.E.
Phone No.  (805) 781-5252
Date  February 1999

**URS Greiner Woodward Clyde**
500 12th Street, Suite 200, Oakland, CA 94607

Engineer  Max Ramos, P.E.
Phone No.  (510) 893-3600

**INUNDATION MAP**
**1999**
**GIVEN THE HYPOTHETICAL FAILURE OF LOPEZ DAM**

California Dam No. 1055-000
DWR Registry No. CA 00887

SAN LUIS OBISPO COUNTY   Sheet No. 1 of 1

# Inundation Depth Map for Fair Weather Hypothetical Failure of Lopez Dam

**Lopez Dam**

Federal Dam ID: CA00887   State Dam ID: 1055.000

**Overview Sheet**

San Luis Obispo County

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**Notes:**
1. This map is part of the emergency action plan for Lopez Dam.
2. The inundation map meets all applicable state and federal standards and has been prepared in consideration of all potential downstream hazards by a licensed civil engineer.
3. The results presented herein do not reflect the structural integrity of the dam and are not a statement of the dam's safety. The analysis presented is based on a hypothetical dam failure using 2D modeling software with a 100' grid.
4. Cross Section Values:
   **Distance from Dam** and **Stationing** are reckoned from the centerline of Lopez Dam along the displayed Flow Path.
   **Distance from Dam** is in miles and **Stationing** is in feet (Stationing 12+34 = 1,234').
   **Initial Wave Arrival Time, 1 Foot** is the time to achieve 1 foot of water depth after initiation of the dam break.
   **Time to Peak** is the time to achieve the maximum water depth after initiation of the dam break.
   **Deflood Time, 1 Foot** is the time elapsed from the flood wave arrival time until water recedes to within one foot of its preflood water elevation.
   **Peak Inundation Depth** is the maximum water depth.
   **Peak Velocity** is the maximum velocity.
   **Peak Discharge** is an estimate of the maximum flow rate integrated over the entire cross section line.
   **Peak Water Elevation** is the maximum water surface elevation.
   **Time Above 1 Foot** is the time water depth is above 1 foot.
   **Location Description** indicates major roads that cross, or are near, the Flow Path at that cross section.
5. The values displayed in the table for each cross section are the maximum for that parameter along each cross section line, except for the **Initial Wave Arrival Time, 1 Foot** and **Time to Peak** which are the minimum for that parameter along each cross section line. The minimum time values associated with 1D channels embedded in the 2D model are excluded.
6. For other details refer to the supporting report "Lopez Dam Failure and Inundation Study" 31 December 2017.
7. Map projection: California State Plane, Zone 5, Feet, North American Datum 1983. **Reference Points** and border tics display these coordinate values. All elevations are referenced to North American Vertical Datum 1988.

| Cross Section | Distance from Dam (mi) | Station | Initial Wave Arrival Time, 1 Foot (hh:mm) | Time to Peak (hh:mm) | Deflood Time, 1 Foot (hh:mm) | Peak Inundation Depth (ft) | Peak Velocity (fps) | Peak Discharge (cfs) | Peak Water Elevation (ft) | Location Description |
|---|---|---|---|---|---|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 833,330 | N/A | At Lopez Dam |
| 1 | 1.6 | 83+22 | 0:15 | 0:58 | 4:19 | 39.7 | 37.6 | 825,491 | 380 | Downstream of Lopez Lake |
| 2 | 2.5 | 131+49 | 0:21 | 1:00 | 4:49 | 43.5 | 38.6 | 822,973 | 344 | Camino Las Ventanas |
| 3 | 2.9 | 153+20 | 0:24 | 5:22 | 5:22 | 35.7 | 37.1 | 820,185 | 329 | Talley Farms Road |
| 4 | 3.4 | 179+80 | 0:27 | 1:02 | 5:37 | 28.5 | 25.7 | 819,320 | 301 | Downstream of Terminal Reservoir |
| 5 | 4.8 | 255+54 | 0:35 | 1:05 | 6:35 | 37.3 | 32.3 | 815,789 | 251 | Cecchetti Road |
| 6 | 6.1 | 320+24 | 0:41 | 1:08 | 7:29 | 51.3 | 21.0 | 810,902 | 218 | Upstream of Huasna Road |
| 7 | 6.8 | 359+57 | 0:46 | 1:11 | 8:18 | 55.9 | 22.6 | 800,646 | 193 | Downstream of Tar Spring Creek |
| 8 | 7.7 | 406+81 | 0:51 | 1:15 | 11:05 | 55.9 | 23.2 | 778,847 | 172 | |
| 9 | 8.7 | 460+77 | 1:00 | 1:20 | 13:28 | 54.2 | 15.4 | 747,274 | 143 | |
| 10 | 8.9 | 467+83 | 1:01 | 1:21 | 13:42 | 47.2 | 13.6 | 745,518 | 137 | US 101 Highway |
| 11 | 9.5 | 503+18 | 1:07 | 1:24 | 14:51 | 42.9 | 23.5 | 738,637 | 104 | Fair Oaks Avenue |
| 12 | 10.6 | 560+97 | 1:17 | 1:30 | 16:58 | 23.0 | 19.3 | 712,253 | 69 | Cabrillo Highway (Hwy 1) |
| 13 | 11.6 | 610+70 | 1:23 | 1:35 | 18:50 | 18.2 | 17.1 | 687,619 | 42 | Railroad Bridge downstream of 22nd Street |
| 14 | 12.6 | 667+86 | 1:39 | 2:18 | >24:00 | 22.7 | 13.6 | 243,239 | 31 | Outlet of Arroyo Grande Creek into Ocean |

**Legend:**
- Flow Path
- Cross Section
- Detailed Sheet Extent
- Approx. Inundation Extent
- Approx. Limits of Fair Weather Dam-Failure Inundation

Scale 1:48,000 or 1 " = 4,000 feet

0   2,000   4,000   8,000 Feet

**COUNTY of SAN LUIS OBISPO**

**NOTICE**
San Luis Obispo County deems this information to be Confidential. Do not share the information unless prior approval is obtained from SLO County's Dam Safety Officer at (805) 781-5252.

Dam Owner:
San Luis Obispo County Flood Control and Water Conservation District
County Government Center, Room 206
San Luis Obispo, CA 93408

Information Contact: John Diodati, (805) 781-5252
Emergency Contact: (805) 781-5252

Inundation Analysis Performed by and Inundation Maps Created By:
GEI Consultants, Inc.
Mark Fortner, PE 48266

| Rev | Date | Description | Prepared By | Accepted By |
|---|---|---|---|---|
| | 28 December 2017 DRAFT | Description DRAFT | GEI Consultants | |

Sheet 1

Sheet 2

Lopez Dam

Cross Section 1
Cross Section 2
Cross Section 3
Cross Section 4
Cross Section 6
Cross Section 8
Cross Section G
Cross Section 7
Cross Section 9
Cross Section 10
Cross Section 11
Cross Section 12
Cross Section 14
Cross Section 13

100+00
200+00
300+00
400+00
500+00
600+00

PACIFIC OCEAN

SAN LUIS OBISPO BAY

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