ABOVE AND BEYOND
200–year Flood Protection for Sacramento’s Future

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City of Sacramento
April, 2017
Jim McDonald
Presentation Overview
Presentation Overview

- City of Sacramento’s Flood History & Levee System
- Comprehensive Flood Management Plan (CFMP)
- State of California’s new 200-year Flood Standard
- Next Steps
Sacramento River Flood Control System
Folsom Dam upstream on American River
Sacramento Flood History

1956 Record Flood: Though engineers had been predicting it would take a year to fill the nearly completed upstream Folsom Dam, the second record storm filled the dam in a week and Sacramento is saved from flooding.

1964 Record Flood: The 3rd record flood in less than 15 years. Engineers concluded that Folsom Dam was only designed to handle is a 120-yr storm, not a 500-yr storm.

1986 Record Flood: 10 in. of rain in 11 days. Folsom Dam downgraded to about a 60-year storm. Corps determines that a majority of the city does not have 100-year protection.
Historical FIRMs

CITY OF SACRAMENTO FLOODPLAIN HISTORY

1986 - 1989
- 1986 STORMS
- ARMY CORPS DETERMINES SACRAMENTO FLOOD CONTROL SYSTEM DOES NOT PROVIDE 100-YEAR PROTECTION
- CONGRESS AUTHORIZES A99 ZONE FOR CITY (1989)
- SACRAMENTO AREA FLOOD CONTROL AGENCY (SAFCA) FORMED (1989)

1989
- Zone A99

1990 - 1998
- CONGRESS AUTHORIZES (1992): NATOMAS LEVEE FEATURES PROJECT (NLFP) AND REIMBURSEMENT
- FOLSOM DAM REGENERATION
- CORPS REPORTS ON AMERICAN RIVER WATERSHED STUDIES (1992 & 1996)
- CONGRESS AUTHORIZES (1996): EUSLAM FOR AMERICAN RIVER COMON FEATURES PROJECT
- SAFCA COMPLETES NLFP (1998)
- FEMA REMAPS NORTH NATOMAS AND NORTH SACRAMENTO TO SHAD ED X ZONE (1998)
- FEDRA REMAPS SACRAMENTO TO AR ZONE (1998)

1999 - 2000
- CORPS INITIATES COMMON FEATURES PROJECT (1998)
- CORPS COMPLETES SO. SAC. CO. STREAM GROUP (SSSG) STUDY (1998)
- CONGRESS AUTHORIZES (1999): INCREASE TO $100M FOR COMMON FEATURES PROJECT
- $85M FOR SSSG
- $130M FOR FOLSOM DAM MODIFICATIONS
- CITY COMPLETES NATOMAS COMPREHENSIVE DRAINAGE PLAN; FEMA REMAPS NATOMAS INTERNAL DRAINAGE AREA TO ZONE X (1999)
- FEMA DETERMINES ADEQUATE PROGRESS ON SACRAMENTO FLOOD CONTROL SYSTEM; REMAPS MOST OF SACRAMENTO TO A99 ZONE (2000)

2000
- Zone A99

2001 - 2005
- CONGRESS AUTHORIZES (2003): INCREASE TO $125M FOR COMON FEATURES PROJECT
- $272M FOR FOLSOM DAM MINI RAISE
- FEMA REMAPS REMAINDER OF AMERICAN RIVER FLOOD-PLAIN TO SHAD ED X ZONE
- SSSG CONSTRUCTION STARTS (20

2004/2005
- Zone X

2006 - 2007
- WORK COMPLETED ON:
  - COMMON FEATURES PROJECT (2004)
  - SACRAMENTO RIVER
  - MORRISON CREEK
  - NORTH BEACH LAKE LEVEE PROJECT (SSSG)
  - FOLSOM DAM MODIFICATION
  - REMAP PARTS OF SSSG AND POCKET AREA FLOODPLAIN TO ZONE X (2007)

2007 - 2008
- CORPS DETERMINES NATOMAS LEVEES PROVIDE 33-YEAR PROTECTION
- FEMA REMAPS NATOMAS TO AN AE ZONE (2008)

2009 - 2015
- FEMA REMAPS SSSG "WEST SIDE OF MORRISON CREEK" (2010)
- FEMA REMOVES MAJORITY OF SSSG FROM A99 ZONE; REMAINING AH ZONE AROUND FLOREN CREEK (2014)
- ARMY CORPS EXPRESSES LEVEE CERTIFICATION (2012 & 2013)
- WRDRA BILL AUTHORIZED BY CONGRESS TO IMPROVE NATOMAS LEVEES (2014)
- NATOMAS REMAPPEO TO A99 ZONE (2015)

2016 - CURRENT
- WORK TO CONTINUE:
  - FLOREN CREEK WIDENING AND DETENTION BIRGS
  - FOLSOM DAM RAISE AND JOINT FEDERAL PROJECT
  - COMMON FEATURES PROJECT
  - SAFCA LEVEE ACREDIATION
  - MODERNIZATION PROGRAM
  - STATE OF CALIFORNIA 200-YR FLOOD PROTECTION REQUIREMENT EFFECTIVE (JULY 2016)

Legend
- OUTSIDE SPECIAL FLOOD HAZARD ZONE
- A, AE, AH, AO ZONES
- A99 ZONE
- AR ZONE

PRE-1986
- Zone X

1989
- Zone A99

1998
- Zone AR

2000
- Zone A99

2004/2005
- Zone X

2007
- Zone A99

2009
- Zone AE

2016
- Zone A99
Current Flood Insurance Rate Map

City Boundary
- 100 yr Floodplain, Magpie Creek
- A
- AE
- AE - Floodway
- AH
- A99
- AO
- Shaded X, Protected by Levees
- X

Flood Zone Definitions
- Zone A: No base flood elevations determined.
- Zone AE: Base flood elevations determined.
- Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.
- Zone A99: Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no base flood elevations determined.
- Shaded Zone X: Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with rainfall areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- Zone X: Areas determined to be outside 0.2% annual chance flood.
California Extreme Super Flood

Can It Happen Again?

And what was it anyway?

I figured I'd get a jump on the inevitable stories to come about how this is extreme weather and therefor caused by Global Warming!!

(We really need a sound effect whenever AGW is mentioned, like in Young Frankenstein when the horses would always sound off at Frau Blucher being mentioned. Perhaps thunder or a 'dun duun Dun DUUNNN' on the piano...)

At any rate, we're going to get rain. LOTS of rain. I'm on the lower edge of it, so hopefully will just get modest rain. Crosspatch in T8 deserves a h/t for the pointer.
Climate Change...It’s Getting Real!
Climate Change

- From The City’s Climate Actions Plan:
  - Extreme weather is expected to become more common in the Sacramento region
  - Shifts in seasonal timing of raining and snowpack runoff
  - Causing increase water runoff to streams and rivers during the winter months
Climate Change

- City of Sacramento is protected by a system of pipelines, pump stations, levees/floodwalls and dams that may be strained by climate change.

- The City and partner agencies will prepare for adverse climate change impacts by improving the resiliency of the infrastructure systems.

- State of California requires
January 7–10, 2017 Storm
January 7–10, 2017 Storm
January 7–10, 2017 Storm

Oroville Dam
Higher Regulatory Standards in the City’s Comprehensive Flood Management Plan
Need for a Comprehensive Flood Management Plan

- City’s strategic plan to reduce flood risk over the next 5 years with implementation goals

- A comprehensive management document that will guide the City’s flood risk reduction and mitigation efforts.

- Help increase the City’s Community Rating System (CRS) Class

- Sacramento Countywide Local Hazard Mitigation Plan
Flood risk reduction is best achieved by employing a suite of structural and non-structural risk reduction tools.
Comprehensive Flood Management Plan Overview

- Purpose
- Historical Perspective
- Land Use Planning and Development Guidelines
- Emergency Preparation
- Levee and Other Structural Improvements
- Internal Drainage
- Risk Communication
- National Flood Insurance Program/Community Rating System Program
- Levee Security
Land Use & Development Guidelines

- Relation to City’s 2035 General Plan
- Floodplain Management Ordinance & Enforcement
- Limited development in Natomas floodplain
- Special Restrictions in Areas Next to Levees
Rescue Zone: An area of the City that would flood to a depth of 1 foot in 2 hours.

Evacuation Zone: An area protected by levees that would flood slowly, allowing for adequate time to evacuate.
Rescue Zones

- Evacuation Plans for special needs facilities (schools, hospitals etc.);
- Identification of refuge or evacuation locations for special needs facilities, new residential developments, large commercial and public buildings

Rescue and Evacuation Zones

- Identification of emergency vehicle access to subdivisions
- Provision of infrastructure to protect on-site fuel storage.
SB5/Central Valley Flood Protection Plan (CVFPP) Requirements

- 200-year flood protection
- Levee clearance and maintenance requirements
Emergency Preparation

- Reviewing and summarizing all emergency response documents
- List of flood maps available
- City’s Exercises & Training Schedule
- Recording High Water Marks
- Recovery Plan
  - Damage Assessment
  - Recovery Ordinance
  - Sample Emergency Broadcasts/Press Releases
2016 Rescue & Evacuation Maps

- 22 Levee Break Scenarios
- Based on new 200-year flood State requirement
- Animated levee break scenarios (FERIX)
Rescue & Evacuation Maps

MAXIMUM FLOOD DEPTH MAP

Potential Evacuation Routes:

Highways:
- Highway 50
- Highway 60
- Highway 100

Collections:
- 5th St
- 15th St
- 16th St
- 05th St
- 10th St
- Ardenbine Blvd
- B St
- Bradshaw Rd
- Broadway
- Capitol Ave
- Elm Ave
- Florin Rd
- Franklin Blvd
- Frontage Rd
- Freeport Blvd
- Plumas Rd
- Gr쇠 Rd

Critical Facilities:

- Hospital
- School
- Fire Station

SOURCE: Facilities from Sacramento County

City/County of Sacramento
Flood Emergency Evacuation Plan
Sacramento County, California
American River South Study Area

DECEMBER 2015

AMERICAN RIVER SOUTH STUDY AREA
MAXIMUM FLOOD DEPTHS
BREACH #21 AT SACRAMENTO RIVER RM 51.344
POST-POLSON JFX

ARS_B21A
Rescue & Evacuation Maps

TIME CONTOURS IN HOURS TO APPROXIMATE DEPTH OF ONE FOOT

Hypothetical Levee Failure Location
- Flood Flow Direction
- Airport
- State Capitol
- SPFC Levee Location
- Evacuation Routes
- Time to Approximate 1 foot
- Depth Contour (Hours)
- County Boundaries
- City Boundary
- Flood Gate Location
- Breach Failure Limits

Primary Evacuation Area:
The water has the potential of reaching a depth of 1 foot after 2 hours from the
time of levee failure within breach failure limits.

POTENTIAL EVACUATION ROUTES:
Highways:
- Highway 50
- Highway 99
- Highway 180
Collections:
- 6th St
- 1st St
- 18th St
- 60th St
- Alhambra Blvd
- B St
- Broadway
- Capitol Ave
- Rhea Ave
- Piorn Rd
- Franklin Blvd
- Fireport Blvd
- Football Rd
- Grolley Rd
- 2nd St

SOURCE: Facilities from Sacramento County.

City/County of Sacramento
Flood Emergency Evacuation Plan
Sacramento County, California

AMERICAN RIVER SOUTH STUDY AREA
TIME CONTOURS TO APPROXIMATE DEPTH OF 1 FT
BREACH #21 AT SACRAMENTO RIVER RM 51.344
POSTFLOOD.PDF

DECEMBER 2016

ARS_B21B
Rescue & Evacuation Maps

RECOMMENDED EVACUATION ROUTES

- Hypothetical Levee Failure Location
- Estimated time for evacuation route subject to 1 foot of flood inundation after breach.
- Evacuation route is outside flood inundation area.
- Airport
- State Capitol
- SPFC Levee Location
- Evacuation Routes
- County boundaries
- City Boundary
- Flood Gate Location
- Breach Failure Limits

Primary Evacuation Area:
The water has the potential of reaching a depth of 1 foot after 2 hours from the time of levee failure within breach failure limits.

Secondary Evacuation Area:
After 7 days from the time of levee failure, the depth is estimated to range from 16 feet at the deepest point to 1 foot at the flood boundary.

POTENTIAL EVACUATION ROUTES:
- Highway 50
- Highway 99
- Highway 65
- Interstate 5
- Interstate 80
- State Route 65
- State Route 99
- State Route 160
- State Route 16
- State Route 80
- State Route 99
- State Route 160
- State Route 16
- State Route 80
- State Route 99
- State Route 16
- State Route 80
- State Route 99

SOURCE: Facilities from Sacramento County.

City/County of Sacramento
Flood Emergency Evacuation Plan
Sacramento County, California

American River South Study Area

AMERICAN RIVER SOUTH STUDY AREA
EVACUATION ROUTES MAP
BREACH #21 AT SACRAMENTO RIVER RM 61,344
POSTOFOLSON JFF

DECEMBER 2015
ARS_B21D
Internal Drainage

- City/County Watershed Management Plan (WMP)
- CRS Activity 450
- Reducing the increased flooding from development on watershed-wide basis
Risk Communication

- Brochure in City’s Utility Bill annually
- Mailing to Repetitive Loss properties
- State of CA’s Flood Risk Notice to SFHA properties
- Billboards, advertisements on buses, community meetings and events
- High Water Mark Signs
Risk Communication

- Program For Public Information
  - Flood Response Plan
  - Flood Insurance Coverage Improvement Plan
  - Repetitive Loss Area Analysis

- CRS Credit
General Plans, Zoning Ordinances, and the Central Valley Flood Protection Plan – HELP!

General Plan update
Zoning Code Update
Figure 7.3
200 Year Floodplain

Legend
- 200-year Floodplain
- 2030 General Plan Opportunity Areas
- City Limits
- Policy Area

Data Source: City of Sacramento, 2013 and GHEP, 2013/20 April
<table>
<thead>
<tr>
<th>Safety elements must identify information regarding flood hazards per GC 65302(g)(2)(A)</th>
<th>Jurisdiction’s Notes for CVFPB Reviewer</th>
<th>Location in the Safety Element/Page #</th>
<th>CVFPB Use Only</th>
<th>Score</th>
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<tbody>
<tr>
<td>ii. Does the new or updated safety element include National Flood Insurance Program (NFIP) maps, published by FEMA?</td>
<td>Yes. Figure 7-2 (p. 7-15) shows the FIRM hazard area zones.</td>
<td>Background Report, Section 7 Page 7-15</td>
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<td>iii. Does the new or updated safety element contain information about flood hazards available from the U.S. Army Corps of Engineers including the Corps Sacramento and San Joaquin River Basins Comprehensive Study?</td>
<td>Yes. The 200-year floodplain is based, in large part, on information provided to DWR from USACE. See Figure 7-3 (p. 7-23) in the Background Report.</td>
<td>Background Report, Section 7 Page 7-23</td>
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<tr>
<td>iv. Does the new or updated safety element include dam failure inundation maps, available from CalEMA (prepared pursuant to GC Section 8589.5)?</td>
<td>Yes. Page 7-18, 7-19, and 7-22 provide a discussion of potential dam failure and link to the Sacramento County Local Hazard Mitigation Plan, which shows inundation areas within the City.</td>
<td>Background Report, Section 7 Pages 7-18 and 21</td>
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</tbody>
</table>
New flood protection goals, policies, and implementation measures in the 2035 General Plan ensure that:

- New developments in flood hazard zones will be evaluated to ensure they are safe from flooding, and
- Prohibits approval of new development unless the adequacy of flood protection specific to the area in which the development is proposed has been demonstrated.

www.sacgp.org
ULOP Findings required for:
1. Development Agreements
2. Discretionary permits, entitlements, or ministerial permits resulting in construction of a new residence.
3. Approving a tentative map or parcel map
Flood Control Infrastructure

[Map of flood control infrastructure in the Sacramento region, including key features such as Natomas Levees, Folsom Dam Joint Federal Project (Auxiliary Spillway), and others labeled in the map.]
Findings

There is substantial evidence that the project has met one of the following conditions:

- Currently have 200-year flood protection;
- Imposed conditions (flood proofing or elevated structures);
- Making adequate progress (the urban level of flood protection shall be achieved by 2025);
- Within an undetermined risk area.
Next Steps

- Coordination
- Education
- Zoning Code Implementation
- Annual Reports
Questions?

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