

CALIFORNIA DEPARTMENT OF WATER RESOURCES

# Floodplain Maps Ought to Be “Colorful”

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Yiguo Liang  
California Department of Water Resources  
Flood Planning Office

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# What Is A Floodplain Map?

- Floodplain: An Area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.
- Should at least show the flooded boundary, and in some cases the depth information.
- A tool in flood management for flood risk identification.
- The public's perception: if I'm outside of the boundary, I will be **SAFE**.



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## But It's Not Always True, When...



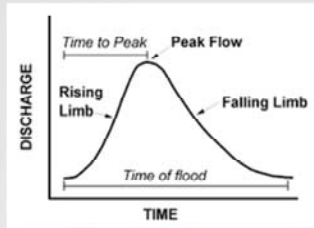
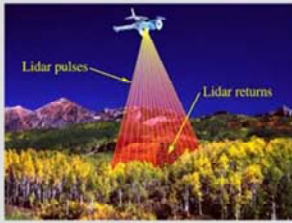
## Public Confusion about Floodplain Maps

- I am not in the floodplain, but why did I get flooded?
- How reliable is the floodplain map?
- Why was my area flooded twice by the 100-yr flood in the last few years?
- How can Agency C's 200-yr floodplain area be smaller than that from Agency F's 100-yr map?
- Why is my property shown "dry" on Agency F's map but "wet" on Agency D's map?
- Which one is the greatest and latest floodplain map for my area?

## Black-and-White vs. Colorful

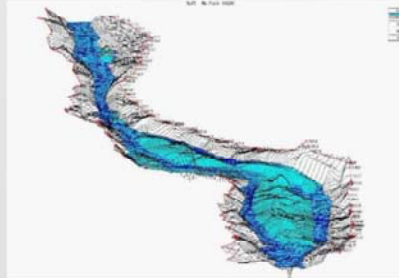
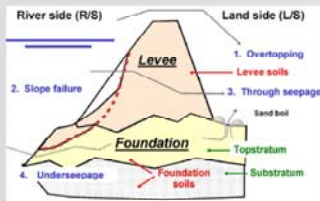
- Neither boundary nor depth can be determined in black-and-white. There are a lot of gray areas, or “it depends”.
- Floodplain maps ought to be “colorful” because
  - Uncertainty in Map Development
  - Various Mapping Purposes

# Factors Determine the Look of a Floodplain Map



Criteria/  
Assumptions

Professional  
Judgment



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## Ranking Factors: Least to Greatest

1. Professional judgment
2. Analytical tools (computer models, mapping software, etc.)
3. Topographic data (LiDAR, bathymetry, structures, etc.)
4. Hydrology (flood system operation, w/wo climate change)
5. Criteria/assumptions
6. Levees

# Purpose-Driven Floodplain Maps



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## Common Questions to Address

- Is flood insurance needed?
- Does the area meet flood safety standards for development?
- How can flood risk be reduced in the area?
- If the levee breaks in this event, which areas will be inundated and require residents to evacuate?

## Different Purposes -> Different Floodplain Maps

- Regulatory Use – FEMA Flood Insurance Rate Maps
- Land Use Planning – 200-yr Informational Urban Flood Inundation Maps
- Flood Planning & Awareness – DWR's Levee Flood Protection Zone (LFPZ), Best Available Maps (BAM), Awareness Floodplain Maps, USACE Comp Study Floodplain Maps
- Flood Emergency Preparedness/Responses
  - DWR's Searchable Flood Inundation Maps for Simulated Levee Breaches
  - Dam Owners' Dam Failure Flood Inundation Maps (Emergency Action Plan)

## Levees

- Levee Procedures in Floodplain Mapping
- Levee Geotech Data – Levee performance curve

# FEAM Levee Approaches –

## Non-Accredited Levees

- Sound Reach
- Freeboard Deficiency
- Overtopping
- **Structure-based Inundation**
- Natural Valley



Analysis and Mapping  
Procedures for Non-Accredited  
Levee Systems

New Approach  
July 2013

RiskMAP

## Accredited Levees

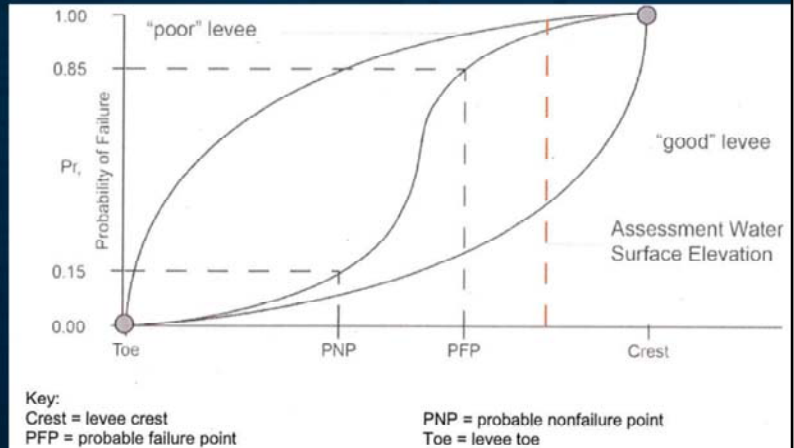
- “... FEMA will “accredit” the levee system ... and the levee impacted area will be shown as a moderate-risk area, labeled Zone X (shaded).
- Levee Impacted Area – Natural Valley / without levee



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## Levee Geotech Data – Performance Curve

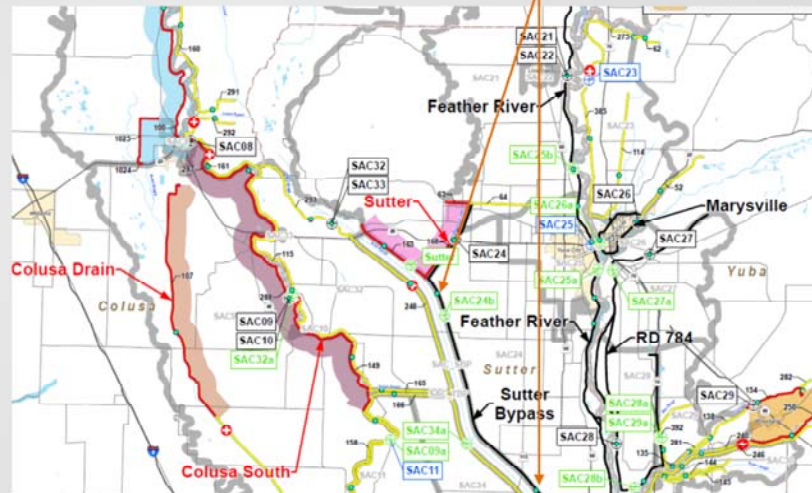
- Defines probability of levee failure vs. the stage of water surface elevation
- Composite curve from four dominant failure mechanisms (under/through seepage, structure stability, and erosion)
- Commonly used to deterministically model levee failure and map floodplain



## Levee Geotech Data – Performance Curve (Cont'd)

- Index point represents a physical linear feature
- Index points can be miles apart

Levee Geotech Data



CVFPP Index Points, ULE & NULE Study Areas, Northern Area

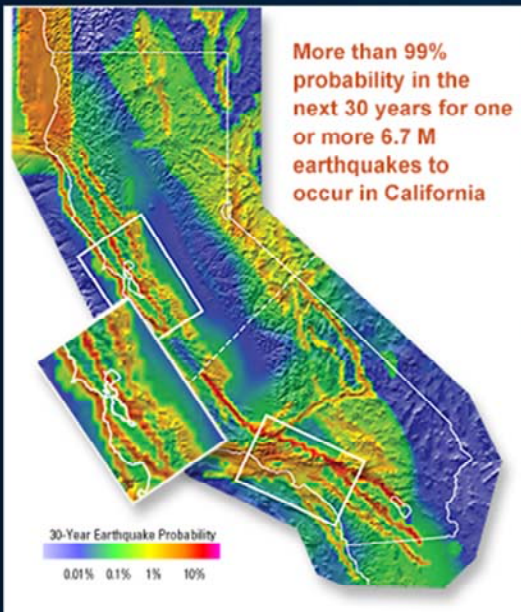


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## Levee Geotech Data – Uncertainties

- Both in Levee Geotech Data and Its Use in Floodplain Mapping
  - Development of levee performance curves at Index Points
  - Index Point to represent linear levee
  - Deterministically fail levee at certain water surface elevation
- **How to convey the uncertainty information in floodplain maps?**

# Probability in Forecasts

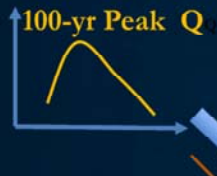


- Disclose quantifiable uncertainty
- Inform decisions



# Probability Use in Floodplain Maps

100-yr Peak Q



85%: Breach 1 Only

70%: Composite Breach 1 & Breach 2

Breach 1:  
85% Probability of Failure

Breach 2:  
70% Probability of Failure



## Take Home Messages

- Many common ways of displaying flood risk information in floodplain maps are prone to misleading the public/users
- Floodplain boundary and depth information is not a black-and-white matter
- Floodplain maps ought to be colorful (more informative):
  - Clearly presenting purposes, assumptions, and limitations
  - Disclosing quantifiable uncertainty information (topo data, hydrology, levee failure condition)
  - Perhaps color code maps with various probabilities of failure

Floodplain Maps Ought Not to Be  
*Black-and-White*

*Thank You!*

Yiguo Liang  
[Yiguo.liang@water.ca.gov](mailto:Yiguo.liang@water.ca.gov)  
916-574-1408

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# Occurrence Probability in the Context of a Period

Period (Years)	10-yr Event	25-yr Event	50-yr Event	100-yr Event	200-yr Event	500-yr Event
1	10%	4%	2%	1%	0.5%	0.2%
10	65%	34%	18%	10%	5%	2%
20	88%	56%	33%	18%	10%	4%
30	96%	71%	45%	<b>26%</b>	14%	6%
50	99%	87%	64%	39%	22%	10%
100	100%	98%	87%	63%	39%	18%

