Flood risk reduction through regionally coordinated response planning

FMA Conference
Presented by: Elizabeth Avelar, PE
September 6th, 2016
OVERVIEW

1. Background

2. Overview of Deliverables

3. Challenges and Solutions

4. Preliminary Engineering Designs

5. Just in Time Training
Mid-Upper Sacramento River Flood Emergency Response Project

- **Six-County** joint application sponsored by Reclamation District 108 for DWR’s flood emergency response grant
- $1.2 million awarded to improve flood preparedness through regionally consistent and integrated flood emergency response plans, unified flood fight commands, preliminary engineering designs, and a training program.
How do you achieve flood risk reduction?

- Gather information critical to decision making and make it more easily accessible both cognitively and remotely.

- Develop practical response options based on sound engineering and flood experience.

- Make on-going regionally and locally integrated planning the real final product of the Project.
OVERVIEW OF DELIVERABLES

- Emergency Operations Plan
- Flood Contingency Maps
- Preliminary Engineering Designs (PÉDs)

16 LMAs

- GIS Technical Manual
- Standardized GeoDatabase

Levee Maintaining Agencies

- Unified Commands with Map
- Special Case Map
- Flood Response Command and Control

5 Unified Commands

Command and Control

Innovative Training

- Just in Time Training

GIS-Based Map Products
FLOOD SAFETY PLANS

Emergency Operations Plan – Basic Plan
EOP

Flood Contingency Map (FCM)
PUBLIC SAFETY SPECIAL CASE MAPS

- Command Post
- District Boundary
- Elevation Contour
- Waterways/Channels
- Entry/Exit Traffic Control (Staffed)
- Entry/Exit Traffic Control Barricade (Unstaffed)
- Rally Point

To evacuate West:
Take HWY 20 West to Williams to I-5

For more details and specific instructions, refer to the map.
Regional Flood Emergency Response Project

Mid and Upper Sacramento River Unified Flood Fight Command System Operations Manual

April 2015
Achieving Flood Risk Reduction

UNIFIED COMMAND MANUAL

5 Unified Commands in the Region

Streamlined Mutual-Aid process

Increase response efficiency

Brings everyone to the table

April 2015
• Bird’s-eye view of pre-planned response facilities within each county by LMA

• Addresses Area Ingress and Egress System

• Integrates Levee Maintaining Agencies with County and State Operations into the decision-making process
ADVANTAGES OF GIS-BASED MAP PRODUCTS

• Balances the needs of two diverse groups:
  - LMAs
  - County Public Safety Agencies

• Detailed documentation of data sources and GeoDatabase structure

• Lists and explains symbols and feature classes

• Regional repository: Yolo County
CONCERNS AND SOLUTIONS

Challenge

• LMAs were facing loss of critical historical knowledge, as “grey-haired” local experts begin to retire, and no formal documented procedures for flood emergency response

Solution

• Assisted Levee Maintaining Agencies (LMAs) to document and formalize maintenance and emergency operations procedures

• Established formal triggers, spending authorities

• Documented historical knowledge

• Facilitated information sharing

• Introduced LMAs to SEMS/NIMS

• Developed or reinforced relationship between LMA and County OES
Concerns and Solutions

Challenge
- Critical gauges used to prompt emergency actions, such as beginning patrols, use different reference datums (USED, NGVD29, and NAVD88)

Solution
- Identified critical gauges for the region
- Prioritized gauges and conducted field surveys to convert to NAVD88
- Documented conversion factors within Flood Safety Plans
CONCERNS AND SOLUTIONS

Challenge
• Inconsistencies in flood response tools could cause confusion during an event, particularly if Mutual-Aid is requested

Solution
• Established regional standards for symbology
• Consistent format across 9 counties
• Documented methods in GIS Technical Manual
Concerns and Solutions

Challenge
• Independent flood fight efforts could be less efficient

Solution
• Established a locally driven and regionally coordinated approach to addressing a flood emergency
• Process of establishing Unified Commands allowed County, Fire, Law, and LMA staff to consider solutions together
• Gave LMAs confidence to engage in County EOC operations
• Provided tools to secure this as an ongoing regional effort
Preliminary Engineering Designs (PEDs)
PRELIMINARY ENGINEERING DESIGNS

Post Breach Flood Containment and Damage Reduction Engineering Options

- Relief Weir (Relief Cut)
- Use of Dryland Levees
- Emergency Berms
- Sealing Underpasses
- Emergency Pumps
PRELIMINARY ENGINEERING DESIGNS

Post Breach Flood Containment and Damage Reduction Engineering Options

- Relief Weir (Relief Cut)
- Use of Dryland Levees
- Emergency Berms
- Sealing Underpasses
- Emergency Pumps
Achieving Flood Risk Reduction

RELIEF WEIR | PURPOSE

- Practical flood containment options that, under the appropriate conditions, can accomplish the following:

- **Dewatering** – Fully or partially drain a protected floodplain of ponded floodwaters

- **Control Flood Elevations** – Maintain water ponding at a specific elevation that, if otherwise exceeded, would cause additional damage (i.e. critical infrastructure such as pumps)

- **Minimize Damage** - Minimize the depth, extent, and/or duration of ponded floodwater
RELIEF WEIR | PURPOSE

Achieving Flood Risk Reduction

Legend

- Extent of flooding without relief cut
- Extent of flooding with relief cut
- Direction of river flow

- Extent of flooding with relief cut (70,000 acres); elevation 12 feet
- Extent of flooding without relief cut (150,000 acres); elevation 18.5 feet
HISTORIC USE

Relief weirs are an acknowledged expedient method for limiting flood damage

1878 – Grand Island
   Relief Weir was used to prevent flood waters from reaching the more developed northern-end of the island

1986 – Reclamation District 348
   The Town of Thornton was flooded as a result of a breach, a relief weir was executed to reduce ponding damage and extent

1993 – Mississippi River
   Relief weir was made on the left bank of the Mississippi River to return floodwaters to the river and prevent damage from continuing south

1997 – Response to Stewart Tract
   Relief weirs were made in response to breaches along Stewart Tract and the San Joaquin River north of Mossdale

2006 – First Documented and Pre-planned Case
   First instance where pre-planned relief weirs were coordinated and documented. Though not executed, the USACE granted approval within 24-hrs of relief weir locations for PL99 rehabilitation.
RELIEF WEIR | SITE EVALUATION

- Topographic review for selection of candidate sites in close coordination with LMA
RELIEF WEIR | EVALUATION AND ANALYSIS

• Topographic Review for selection of candidate sites in close coordination with LMA personnel

• Field site visit

• Identify fatal flaws

• Use 100-yr BFE as reference

• Develop exhibits and technical memorandum
• Document critical information necessary to make a sound decision in a shorter amount of time
  - Ground, levee crown, infrastructure elevations
  - Pipe penetrations in vicinity of cut
  - Time estimates based on range of relief cut dimensions

• Recommend a range of conditions under which a relief cut is a feasible engineering option

• PED documents are helpful to obtain approval from state or federal agencies
### TABLE 1 | RELIEF CUT SYNOPSIS

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Example: Reclamation District 123</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Commander</td>
<td>First Name, Last Name</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Critical Assumptions</th>
<th>Value</th>
<th>Units</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-yr BFE (at Relief Cut Site)</td>
<td>(NAVD88)</td>
<td>feet</td>
<td>Used as a benchmark</td>
</tr>
<tr>
<td>Levee Crown Elevation (at Relief Cut Site)</td>
<td>(NAVD88)</td>
<td>feet</td>
<td>Levee profile is relatively flat, no major changes in elevation.</td>
</tr>
<tr>
<td>Other</td>
<td>(NAVD88)</td>
<td>feet</td>
<td>Ideal maximum ponding elevation of impounded flood waters within the Basin</td>
</tr>
</tbody>
</table>

<p>| Relief Cut Dimensions | |
|-----------------------||</p>
<table>
<thead>
<tr>
<th>Relief Cut Dimensions</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **Length** | +600 - 1,200 feet | *Recommended range based on previous successful cuts*  
*To be adjusted based on actual conditions* |
| **Depth** | ± ___ feet | *Depth as prescribed by hydraulic models, site visit, and adjusted based on actual conditions.*  
Note: 100-yr BFE is used as reference |
| **Width at Crown** | ± ___ feet | *To be adjusted based on actual conditions* |
| **Waterside Slope** | 3H : 1V | |
| **Landside Slope** | 2H : 1V | |
| **Cut Volume** | ± ___ cu. yd. | |
| | ± ___ tons | @ 1.6 tons/cu. yd. |

| Estimated Time | ± ___ hours | *Adjust as Required*  
(assumes ___ excavators @ 1 min/swing) |

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Initial Actions</th>
<th>Equipment Options to Facilitate Initial Excavation Efforts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dozer # Needed:__________________</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dump Truck # Needed:________</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Explosives (___) Refer to ______ for considerations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scraper # Needed:________</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skip Loader # Needed:________</td>
</tr>
</tbody>
</table>
| | ± ___ cu. yd. | Number of Excavators (max)  
(2 excavators recommended) |
PED | NEXT STEPS

- Agricultural Floodplain Working Group is proposing national guidelines for the evaluation, planning, and execution of Relief Weirs

- Proposal for revision of floodplains and reducing 100-yr Base Flood Elevations in agricultural basins
Regional Just in Time Training Program

Emergency Levee Worker (ELW-1) Course
Regional Training Committee, composed of LMA and County staff, discussed concerns regarding flood emergency response training as required by FEMA.

Common concerns included:
- Extraneous time commitments (up to 40+ hours)
- Limited staff and resources
- Turn over rate and staff changes
- Frequency of use

Regional Training Committee proposed an alternative Training Program that is compliant with the Standardized Emergency Management System and the National Incident Management System (SEMS/NIMS).
FEMA COMPLIANCE – NIMS TRAINING PROGRAM MANUAL

- Current Training Requirements – 40+ **Hours**

<table>
<thead>
<tr>
<th>STANDARD NIMS/SEMS COURSES</th>
<th>SEMS Executive Course (SEMS-E)</th>
<th>ICS 402</th>
<th>IS 100</th>
<th>IS 200</th>
<th>IS 700</th>
<th>DWR Flood Fight Methods (DWR-1)</th>
<th>DWR Levee Threat Monitoring Course (DWR-2)</th>
<th>Review of Local Flood Safety Plan (LMA-1)</th>
</tr>
</thead>
</table>

- Substitute Short Courses – 2 **Hours**

<table>
<thead>
<tr>
<th>JUST IN TIME FLOOD RESPONSE COURSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Emergency Levee Worker (ELW - 1) or Basic Flood Responder Course (BFR - 1)</td>
</tr>
<tr>
<td>ELW/FR Incident Commander Module (ELW-IC)</td>
</tr>
<tr>
<td>Flood Fight Methods Short Course (DWR-1A)</td>
</tr>
<tr>
<td>Local FSP and Unified Flood Fight Command Review Short Course (LMA-1A)</td>
</tr>
<tr>
<td>Substitutes for IS100, IS200, and DWR-2</td>
</tr>
<tr>
<td>Substitutes for IS700</td>
</tr>
<tr>
<td>Substitutes for DWR-1</td>
</tr>
<tr>
<td>Substitutes for LMA-1</td>
</tr>
</tbody>
</table>
BASIC EMERGENCY LEVEE WORKER COURSE MODULES

0100 The Emergency Levee Worker

0101 Basic Duties, Safety, and Workers’ Comp
0102 Levee Patrol Equipment and Procedures
0103 Helping Document Response Costs

0200 Levee Threat Monitoring Guidelines

0201 Levee Terms and Preparing Lathes
0202 Seepage
0203 Boils
0204 Wave Wash
0205 Slope Instability
0206 Cracking
0207 Sink Hole
0208 Erosion

0300 Basic Flood Fight Methods

0301 Basic Flood Fight Methods

0400 Flood Response Organization

0401 National Incident Management System & Standardized Emergency Management System
0402 Regional Multi-Agency Coordination
0403 Incident Command System (ICS)
0404 ICS for the Levee Maintaining Agency
0405 Understanding ICS Tactical Facilities
0406 The Incident Commander Position

0500 The Flood Safety Plan

0501 Purpose, Content, and Use
0502 Understanding Datum and Elevations

Flood Safety Plan Lookup Module

Click on this link to look up information for your levee maintaining agency for subjects discussed in the videos.
1. Compliant with SEMS/NIMS requirements;

2. 2 hours to complete course;

3. Can complete training in anticipation of flood event for new staff, emergency volunteers, or a refresher course for seasoned flood fighters; and

4. Accessible via the web, mobile device, and distributed on CDs.
SHORT VIDEO PREVIEWS
SUMMARY

• Anticipating potential issues and developing solutions ahead of time;

• A locally-driven regional coordinated approach is critical for successful flood emergency response;

• Creation process of FSPs and FCMs allow for improvements of existing plans, documentation of historical knowledge, and information sharing;

• Standardized manuals and GIS-based map products greatly facilitate decision making and information sharing across jurisdictional lines; and

• Develop practical training program.
Thank you

Questions?
NAMING CONVENTION

- Multiple counties and unified commands
- Unique designators for each tactical facility
- Numbered consecutively from South to North

YDP-02

First letter of County (Yolo)  
Facility  
Number of Specific Facility
DOCUMENTED METHODOLOGY

- Common technical approach to plan development
  - Guide to Developing Flood Safety Plans (AB156 Compliant)

- Common GIS mapping technical approach
  - GIS Flood Contingency and Evacuation Map
  - Technical Memorandum

- Standardized Regional Systems

- On-Going Integrated Planning physically occurring at the lowest local level
1. Organizations tailor their training to the level of incident complexity that their staff would manage.

2. LMAs will manage **Type 4** Incidents, as described in the NIMS Training Program Manual (pg. 16)

<table>
<thead>
<tr>
<th>Type 4</th>
</tr>
</thead>
</table>
| • Command staff and general staff functions are activated only if needed.  
• Several resources are required to mitigate the incident, including a task force or strike team.  
• The incident is usually limited to one operational period in the control phase.  
• The agency administrator may have briefings, and ensure the complexity analysis and delegation of authority is updated.  
• No written IAP is required but a documented operational briefing will be completed for all incoming resources.  
• The role of the agency administrator includes operational plans including objectives and priorities. |
1. Organizations tailor their training to the level of incident complexity that their staff would manage.

2. LMAs will manage **Type 4** Incidents, as described in the NIMS Training Program Manual (pg. 16)
   - Levee patrols
   - Response to levee threats

3. The proposed training program meets NIMS Training Program requirements as described (pg. 17 and 18)
EXPANSION OF METHODS

Achieving Flood Risk Reduction

Map showing regions such as Tehama, Glenn, Colusa, Sutter, Lake (Phase II), Yolo, Solano, and San Joaquin.