Preparing for the Worst: Stafford Dam
Emergency Action Planning and Risk Awareness
2015 FMA Conference
Topics

- Project Overview
- Dam Breach Scenarios
- Downstream Flooding
- Inundation Mapping
- Emergency Action Plan
- Tabletop Exercise
- 3D Animation
Project Overview

- **Client:**
  - North Marin Water District
  - Novato, CA (Marin County)

- **Subconsultant:**
  - Jeffries Public Safety Consulting
  - Dave Jeffries
  - Former City of Novato Police Captain

- **Schedule (2015):**
  - Project Kickoff – March
  - H&H Modeling – April
  - Inundation Mapping – May
  - EAP – May/June
  - Tabletop Exercise – June
  - After Action Report/Revised EAP – July/August
  - 3D Animation – August
Project Overview

- Stafford Dam (Novato Creek Dam)
  - Earthfill embankment
  - 650’ long at crest; 79’ high above original ground surface
  - 4,430 ac-ft Storage Capacity
  - Built in 1951
  - 1985: Embankment enlarged, raised 8’ and spillway reconfigured
  - Dam/Spillway designed for PMF reservoir inflow of 12,305 cfs and PMF spillway outflow of 4,148 cfs

- Stafford Lake provides 20% of the City of Novato’s Water Supply

- Project goal was to identify risk and develop EAP in accordance with Federal and State standards
Dam Breach Scenarios
(Hydrologic Analyses)

- Overtopping failure ruled out because of spillway capacity and freeboard during the Probable Maximum Flood (PMF)
- Piping failure during the PMF using BREACH
- Maximum PMF Discharge is 4,150 cfs
- \( Q_{100} = 2,000 \text{ cfs} \)
Dam Breach Scenarios (Hydrologic Analyses)

- Maximum Breach Outflow ~ 50,000 cfs
Downstream Flooding (Hydraulic Analyses)

- 2-dimensional hydraulic model (FLO-2D)
- 1-dimensional embedded channel
- Reduction factors to account for volume in buildings and reduced conveyance due to buildings
Inundation Mapping
1973 Inundation Map
Emergency Action Plan for
Stafford Dam

North Marin Water District

Dam Owner: North Marin Water District
CA Dam No. 88-000 — NAT DAM ID CA00321

August 2015 — FINAL

With Assistance From:
Emergency Action Plan

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Stafford Dam Emergency Action Plan

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EAP Purpose

- Reduce loss of life/Minimize property damage
- Assist NMWD in communicating emergency levels
  - Provide guide for possible evacuation of at-risk persons
- Provide dam technical info and remediation actions
  - Conducting inspections after earthquake, placing sandbags, riprap materials if spillway has eroded, plugging seepage areas with hay bales, bentonite, etc.
EAP Key Components

- Responsibilities
- 5 Step Action Process
- Evacuation
- Mitigation and Remediation Actions

Step 1: Detection and Evaluation
- Conduct technical evaluation of dam conditions as needed

Step 2: Emergency Level Determination
- Set/Reset Emergency Level Status based on evaluation

Step 3: Notification
- Inform personnel of unusual condition detected and confer on next steps needed

Step 4: Remediation Actions
- Develop Action Plan to save dam and minimize impacts to life, property, and environment

Step 5: Termination and Follow-up
- Notify authorities and other partners that dam condition is stabilized; limit incident ruminations to conditions at the dam
EAP Key Components

- Emergency Notification Flowcharts
- Quick Reaction Checklists

APPENDIX 2: QUICK REACTION CHECKLISTS

This EAP section contains Emergency Quick Reaction Checklists (QRCS) that can be implemented quickly and serve as a “tear away” were they can be removed from the EAP for portability and be marked-up to show complete or still underway. This provides the user of the EAP a more reliable and user-friendly tactical approach. This checklist is primarily designed for Emergency Level 3 however can be used in Emergency Level 2 even if some actions are Non Applicable (N/A). This QRC covers operational tasks, duties, and responsibilities. It also serves to provide memory joggers for those operating within the NMWD Engineering/Operations, Incident Command Center, or other locations to assist/ensure the completion of critical tasks and is not necessarily in sequential order. This QRC does not supplant training, education and experience.

<table>
<thead>
<tr>
<th>TASK/ACTION</th>
<th>AGENCY</th>
<th>STATUS Assigned/Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respond to emergencies at the dam and make initial site visit</td>
<td>Dam Operator</td>
<td>Assigned</td>
</tr>
<tr>
<td>Assist in determining the Emergency Level and consultation with Chief Engineer</td>
<td>Dam Operator/Chief Engineer</td>
<td>Assigned</td>
</tr>
<tr>
<td>Make emergency notifications using INFO Sheet 3</td>
<td>NMWD Incident Command Center</td>
<td>Assigned</td>
</tr>
<tr>
<td>Assist the identified, Incident Commander (IC) in establishing communications</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Info Sheet 3c - Emergency Level 3 Notification Flowchart

Dam failure appears imminent or is in progress

Confidential Information – Destroy Before Discarding

First Call
- General Manager
  - 415-897-4613

Second Call
- County Sheriff, Novato Fire and Marin SO Comm Center
  - 415-472-0911
- Marin County OES
  - 415-473-6584
  - Or Duty Officer
- Novato Police
  - 415-897-1122

Third Call
- Indian Valley Country Club
  - 415-897-1118
- Third Call

After Initial Size-Up
- CalOES Warning Center
  - 916-845-8911 (Go to Sheet 4)
Tabletop Exercise

- Conducted 3.5 hour tabletop exercise on 6/25/15
- Examined awareness, notification, and response to incident using Dam EAP
- Responses to 3 Scenarios:
  1. Unusual, slowly developing event
  2. Potential dam failure that is rapidly developing
  3. Imminent dam failure
Tabletop Exercise

- North Marin Water District
- Marin County
  - Department of Public Works
  - Flood Control & Water Conservation District
  - Sheriff’s Office of Emergency Services
  - Fire Department
- City of Novato
  - Department of Public Works
  - Police Department
  - Fire District
- Novato Unified School District
  - San Marin High School
- California Highway Patrol
- Consultants
  - Jeffries Public Safety Consulting
  - Michael Baker International
Tabletop Exercise - Areas Examined

- How NMWD becomes aware of dam safety event
- How decisions are made/notifications are completed
- Response issues involving multiple organizations
- Community notification and evacuation issues
- Response levels and associated notifications
3D Animation Process

- Create and Run XPSWMM 2D Model
- Refine Surface in 3\textsuperscript{rd} Party Software
- Import Data into Animation Software
- Isolate Scenes “Hotspots”
3D Animation Process

- **Surface 3D Model**
  - Civil3D
  - SketchUp
  - VR-Design Studio
For More Information

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