Introduction

• Discussion of Dam Breach Technical Analysis for a Large and Small Dam
• Dam Safety – Emergency Action Plans
• Considerations for Floodplain Administrators
Dam Breach Introduction

- Dam Break Introduction
- Large Versus Small Dams
- Lessons Learned

Teton Dam Failure - Courtesy geol.ucsb.edu/
Dam Breach Parameters

• Breach parameter determination fundamental to breach analysis
• Dam breach parameters define the development of a dam breach, and include:
  – Breach height, $h_b$
  – Breach width, $B$
  – Breach side slopes, $m$
  – Time to full breach formation, $t_f$
Dam Breach Parameters – Breach Height

Downstream Face

Dam in Profile View

$h_b$
Dam Breach Parameters – Breach Width

Downstream Face

Dam in Profile View
Dam Breach Parameters – Time to Failure

- Directly related to peak flow
- Related to volume of water stored and depth of water stored
Mode of Failure

- Overtopping – uncontrolled flow over the dam
- Piping – seepage through the dam erodes soil, creating a flow path through the embankment
West Point Dam (Large) versus John Creighton Boulevard Dam (Small)

Introduction

Large Versus Small Dams

Lessons Learned
Project Introduction

• West Point Dam, Georgia
  – Map dam breach inundation
  – Inform USACE Emergency Action Plan

• John Creighton Boulevard (JCB), Omaha, NE
  – Map dam breach inundation
  – Inform City’s Emergency Action Plan

Courtesy wikimedia.org
High Hazard

West Point Dam, Georgia

JCB, NE

Dam Breach
Large and Small
West Point

- Power Generation
- Recreation
- Flood Control
- Fish and Wildlife
- Area Redevelopment
- Navigation

Courtesy fws.gov
Purpose
JCB

ADAMS PARK
GREEN SOLUTION DESIGN

SEEPAGE PROTECTION FILTER DETAIL
West Point Dam Size

- At summer normal pool elevation:
  - Area of 25,900 acres
  - Storage of 604,527 acre-feet
- West Point Dam located on the Chattahoochee River
JCB Dam Size

- Maximum Capacity:
  - Area of 14 acres
  - Storage of 90 acre-feet (top of dam)
Input Data - Topographic

West Point

Omaha

Dam Breach
Large and Small
Input Data – Operational
West Point Dam
Input Data – Operational

JCB
## Breach Parameters

**Prediction of Embankment Dam Breach Parameters**

### West Point

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to breach (hours)</td>
<td>3.8</td>
</tr>
<tr>
<td>Final breach width (ft), $B$</td>
<td>380</td>
</tr>
<tr>
<td>Final breach height (ft), $h_b$</td>
<td>96</td>
</tr>
</tbody>
</table>

### JCB

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to breach (hours)</td>
<td>0.71</td>
</tr>
<tr>
<td>Final breach width (ft), $B$</td>
<td>40</td>
</tr>
<tr>
<td>Final breach height (ft), $h_b$</td>
<td>8</td>
</tr>
</tbody>
</table>

![Dam Breach Diagram](image)
Modeling Approach

West Point

- Unsteady HEC-RAS
  - Sunny Day Analysis versus Spillway Design Storm
  - Piping Failure
  - Downstream limit: 2-foot difference in water surface elevations (Dam breach versus 100-year)

JCB

- Unsteady HEC-RAS
  - Overtopping Failure
Modeling Approach – FEMA FIS Data
West Point
Modeling Approach - Incremental Hazard Analysis

JCB

• Request by Nebraska DNR

• Dam volume small compared to possible hydrologic events
Downstream Characterization
West Point

Small Towns
Rural
Downstream Modeled Extent
Downstream Characterization

JCB
Lessons Learned

Dam Break Introduction

Large Versus Small Dams

Lessons Learned

Teton Dam Failure - Courtesy geol.ucsb.edu/
Lessons Learned

• Dam Breach analyses help describe total flood risk in a community
  – Potential for dams to increase hazard
• EAPs may be helpful in developing local floodplain ordinances
• Dam breach hazards not intuitive or straightforward
Dam Safety Information

http://www.damsafety.org/map/
Questions?

What did the fish say when he swam into the wall? DAM

Credit: https://susannesartandlife.wordpress.com/tag/shark/