

**Emergency Action Plan Template**

**For Florida Dams**

**Instruction Manual**

**February 2021**

**Second Revision**

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**Acknowledgements**

The Emergency Action Plan Template for Florida Dams and companion Instruction Manual were developed by drawing liberally on the work of several agencies. Appreciation is expressed to the following agencies, organizations, and firms that supplied information and input: the Florida Department of Environmental Protection (FDEP); the five Regional Water Management Districts of Florida; the USDA Natural Resources Conservation Service; the Texas Commission on Environmental Quality; the Federal Emergency Management Agency (FEMA); the Federal Energy Regulatory Commission; the National Dam Safety Review Board Emergency Action Plan Workgroup; the National Weather Service; the Association of State Dam Safety Officials; and the United States Army Corps of Engineers.

Thanks are due to the Florida Dam Safety Program and HDR Engineering, Inc. (HDR), especially the following staff for their contributions in the development of the EAP Template for Florida Dams and companion Instruction Manual: Owete S. Owete, PhD, PE, FDEP; Tracy Woods, PG, FDEP; Stanley Inabinet, FDEP; Pamela Gonzales, PE, HDR; Vicki L. Burke, PE, CFM, HDR; David R. Borys, EI, HDR; and Brice S. Shrader II, EI, HDR. Additional thanks to Steve Jamieson, P.E., W. W. Wheeler and Associates, Inc., for his invaluable expertise.

The original versions of the EAP Template and companion Instruction Manual were completed in December 2010 and funded in part by FEMA National Dam Safety Program grant 209-RC-55-0038 (FDEP DAM10). FEMA grant 210-RC-50-0002 (FDEP DAM11) provided partial support for the first revisions in July 2011. These second revisions were partially funded by FEMA grant EMA-2020-GR-00002 (FDEP DAM21).

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**Table of Contents**

[Introduction vi](#_Toc312836290)

[General vi](#_Toc312836292)

[Instruction Manual Information vii](#_Toc312836293)

[Overview of Emergency Action Plan Preparation viii](#_Toc312836294)

[Specific Instructions for Preparing an EAP using the EAP Template x](#_Toc312836295)

[Table of Contents 5](#_Toc312836296)

[EAP Overview 6](#_Toc312836297)

[EAP Flow Chart 6](#_Toc312836298)

[Dam Description and Potential Impact Area Summary 9](#_Toc312836299)

[Purpose 9](#_Toc312836300)

[Directions to Dam 9](#_Toc312836301)

[Potential Impact Area 9](#_Toc312836302)

[Dam Description 10](#_Toc312836303)

[General Roles and Responsibilities 11](#_Toc312836304)

[Section 1.0 Event Detection and Level Determination 15](#_Toc312836305)

[Section 1.1 Event Detection 15](#_Toc312836306)

[Section 1.2 Event Level Determination 15](#_Toc312836307)

[Section 1.3 Examples of Emergency Situations 17](#_Toc312836308)

[Section 1.4 Site-Specific Concerns 19](#_Toc312836309)

[Section 2.0 Notification and Communication 21](#_Toc312836310)

[Section 2.1 Notification Charts 21](#_Toc312836311)

[Section 2.2 Prescript Messages 25](#_Toc312836312)

[Section 2.3 EAP Contacts 27](#_Toc312836313)

[Section 2.4 Dam Owner’s Organization and Roles and Responsibilities 30](#_Toc312836314)

[Section 3.0 Expected Actions 31](#_Toc312836315)

[Section 3.1 Unusual Event Level 31](#_Toc312836316)

[Section 3.2 Watch Event Level 35](#_Toc312836317)

[Section 3.3 Warning Event Level 37](#_Toc312836318)

[Section 3.4 Locally Available Equipment, Labor, and Materials 39](#_Toc312836319)

[Section 4.0 Termination and Follow-Up 41](#_Toc312836320)

[Section 4.1 Termination Responsibilities 41](#_Toc312836321)

[Section 4.2 Follow-up 42](#_Toc312836322)

[Section 5.0 EAP Distribution, Review, Revision, Training and Exercises 43](#_Toc312836323)

[Section 5.1 EAP Distribution 43](#_Toc312836324)

[Section 5.2 EAP Annual Review and Updating 44](#_Toc312836325)

[Section 5.3 Training 45](#_Toc312836326)

[Section 5.4 EAP Exercises 46](#_Toc312836327)

[Appendices – Maps, Forms, Resources, Supporting Data and Glossary 47](#_Toc312836328)

[Appendix A: Maps, Tables, and Details 49](#_Toc312836329)

[Appendix A–1: Project Location Map 53](#_Toc312836330)

[Appendix A–2: Project Watershed Map 55](#_Toc312836331)

[Appendix A–3: Inundation Map and Calculations 57](#_Toc312836332)

[Appendix A–4: Plan View of Dam 74](#_Toc279169335)

[Appendix A–5: Profile of Principal Spillway 75](#_Toc312836333)

[Appendix A–6: Reservoir Elevation-Area-Volume and Spillway Capacity Data 76](#_Toc312836334)

[Appendix A–7: National Inventory of Dams (NID) Data 77](#_Toc312836335)

[Appendix B: Checklist, Logs, & Report 82](#_Toc312836336)

[Appendix B-1: Information for Emergency Management 84](#_Toc279169340)

[Appendix B-2: Action Event Log (Unusual, Watch, and Warning Events) 87](#_Toc279169342)

[Appendix B-3: Dam Event Situation Report 88](#_Toc279169343)

[Appendix C: Resources Available 89](#_Toc312836337)

[Appendix D: Supplementary Information 91](#_Toc312836338)

[Appendix D-1: Record of Holders of Control Copies of this EAP 92](#_Toc279169346)

[Appendix D-2: Concurrences 93](#_Toc279169347)

[Appendix D-3: Record of Revisions Made to EAP 94](#_Toc312836339)

[Appendix D-4: Record of Training 95](#_Toc312836340)

[Appendix D-5: Simulated Event Exercise 96](#_Toc312836341)

[Appendix E Glossary of Terms 97](#_Toc312836342)

Introduction

# General

Dam safety in Florida is a shared responsibility among the Florida Department of Environmental Protection (FDEP), the five regional water management districts, the United States Army Corps of Engineers, local governments, and private dam owners. FDEP is responsible for the Florida Dam Safety Program (FDSP), which is authorized by state legislation. The FDEP Engineering, Hydrology, and Geology Program receives a grant to fund the State of Florida National Dam safety Program in accordance with the Dam Safety and Security Act as most recently revised in 2002. The grant is issued and administered by the Federal Emergency Management Agency (FEMA) specifically to enable the State to take precautions that ensure the safety of dams, such as, the development of regulatory authority for the design, construction, operation and maintenance of dams, undertaking of dam inspections and development of Emergency Action Plans (EAPs) for dams.

Fiscal Years 2009 – 2020 dam safety grants required that more of Florida’s high hazard potential dams have EAPs. EAPs are important documents to have in the event of an unusual situation or emergency involving the potential failure of a dam. The purpose of the EAP is to help save lives and reduce property damage in the event of an actual dam failure or other uncontrollable water release (FEMA 608). It is critical that the information contained in the EAP is accurate and current to effectively warn and evacuate people at risk and other citizens downstream from the dam. An EAP is not a substitute for proper dam maintenance and remedial construction. Rather, it facilitates recognition of dam safety problems as they develop and it establishes nonstructural means to minimize risk of loss of life and reduction in property damage.

A dam breach flood inundation map showing the extent and arrival time of expected flooding from a dam failure is a critical component of the EAP. The inundation map is intended to provide information required for emergency and evacuation planning. The cost of dam break inundation studies is often cited as the primary impediment to EAP development. However, simplified methods can be used to provide useful inundation maps at a reduced cost. Simplified inundation maps (SIMS) are developed by either (1) employing simplified engineering assumptions and methods or (2) identifying potential at-risk residences on photo-based mapping without engineering analysis. SIMS are most applicable for small and intermediate sized dams with a limited number of homes downstream where adequate evacuation procedures can be developed without detailed inundation mapping. Also, SIMS may be used if the downstream flood plain is relatively flat and constant. SIMS may be used to form the permanent basis of emergency and evacuation planning or an interim basis for such plans, until more detailed mapping can be obtained because it provides conservative inundation limits. For large dams situated above populated areas and/or complex downstream flood plains, or dams in a series, a more rigorous modeling approach, such as the use of HEC-RAS with the two-dimensional unsteady state flow option, is recommended.

To facilitate the preparation of EAPs for dams in Florida, the FDSP developed an EAP Template and this companion Instruction Manual. The purpose of the EAP Template is to simplify the preparation of an EAP, reduce cost, provide consistency between individual EAPs, and identify effective lines of communication between Florida dam owners, Florida dam safety personnel, and Florida emergency management community. The EAP Template includes the six basic elements recommended by FEMA (FEMA 64); notification flow chart, emergency detection and classification, responsibilities, preparedness, inundation maps, appendixes (training, exercises, and plan updates).

A simplified engineering analysis was used to develop the SIMS for the “Example Dam” (an earthen dam) shown in the EAP Template. As already noted, the simplified approach may be used if the downstream floodplain is relatively flat and constant. If a floodplain is highly variable, the flood wave depth can vary significantly with changes in channel geometry; for example, the flood depth can be higher than the dam height in narrow channels. In such cases, SIMS may not provide conservative inundation estimates for emergency planning purposes. However, the Example Dam has a floodplain with somewhat varying channel properties. The dam was chosen for the EAP Template Instructions to provide an example of the basic calculation procedures, as well as show how the analysis can be adapted for floodplains that have some variability.

# Instruction Manual Information

This Instruction Manual provides general EAP information and specific instruction for dam owners to prepare an EAP that is tailored to their dam using EAP Template Version February 2021. The EAP Template is a dynamic document that is meant to be improved as feedback is provided to the FDSP. EAP Template preparers and users are encouraged to contact the State Dam Safety Officer with any comments or concerns, to verify the date of the latest version of the EAP Template, or to request a review of their draft EAP prior to final publication. The contact information for the State Dam Safety Officer is as follows:

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<http://www.floridadep.gov/water/engineering-hydrology-geology/content/florida-dam-safety-program>

An owner with several dams in the same area may develop one EAP to cover all of the dams. Each dam will need to be described separately, and there may need to be separate inundation or vicinity maps (or both) and, possibly, notification flowcharts for each dam.

# Overview of Emergency Action Plan Preparation

Coordinated planning with all parties will lay the foundation for a responsible and thorough EAP. The following 10 preparatory steps are recommended for completion of an EAP:

**Step 1.** Obtain the geographic and technical information for the dam and the areas downstream of the dam and perform a field reconnaissance to verify the information. These data will be used for the creation of a project location map, project watershed map, and an inundation map. The procedures for collecting the geographic information needed to create an inundation map are included in Appendix A-3.

**Step 2.** Prepare the inundation maps which clearly depict the estimated flooded areas from a dam break. SIMS may be prepared using photo-based mapping or a simplified engineering analysis.

* Photo-Based Mapping — The following procedures are used to create SIMS for dams with limited downstream development:
* View a hardcopy or electronic copy of an USGS Quad Map and identify the contour elevation of the dam crest height. Assuming a flood Inundation elevation equal to the dam crest height will provide a conservative inundation area estimate.
* Trace the contours equal to the dam height on both downstream sides of the dam until reaching a large open body of water (such as a large regional river, lake or ocean). At this point, the flood waters are assumed to create a negligible impact on the larger water body. Draw a line from the end of one downstream inundation contour to the end of the other downstream inundation contour, following the contour of the larger water body, to define the area of inundation. Shade the enclosed area to highlight the whole inundation area.
* Copy the outline of the inundation area onto an aerial photograph and identify the structures within the estimated inundation area.

The two steps above may be performed simultaneously using an electronic program, such as [FDEP Map Direct](http://ca.dep.state.fl.us/mapdirect/gateway.jsp) (http://ca.dep.state.fl.us/mapdirect/gateway.jsp), in which the topographic contours may be shown on the aerial view and the user can draw in the view and print out a map of the selected view. The public has free access to this program and the FDSP may be contacted for assistance in its use.

* Simplified Engineering Analysis — The following is a brief summary of the detailed instructions provided in Appendix A-3: *Inundation Maps and Calculations:*
* Determine a Dam Breach Peak Discharge (flow rate) at the dam using a reasonable conservative estimate calculated from empirical equations.
* Estimate the peak discharge at locations of interest downstream of the dam by applying the Generalized Flood Attenuation Curves (Washington State Department of Ecology, 2007) to the Dam Breach Peak Discharge.
* Evaluate the peak flood wave depth, peak flood wave stage, and peak flood wave arrival times at the locations of interest downstream of the dam.

Detailed instructions for inundation map labeling and a simplified engineering analysis and the resulting SIMS for the Example Dam are provided in Appendix A-3: *Inundation Maps and Calculations*.

**Step 3.** Identify those situations or triggering events that could result in an event level and require action.

**Step 4.** Identify all jurisdictions, agencies, and individuals who will be involved in the EAP. Contact the local Emergency Management Coordinators and Sheriff for assistance. Coordinate the development of the EAP with these other parties.

* + Determine the roles and responsibilities for each of the principals identified in the EAP:

Identify who will be the Incident Commander during the event. The Incident Commander is responsible for managing and directing persons and organizations during the emergency. Generally, the Sheriff or an Emergency Management Coordinator is the Incident Commander.

* Identify who will be responsible for being the point of contact with the media (generally the Sheriff or an Emergency Management Coordinator).
* Identify who will be the primary contact for the Water Management District, FEMA, and the Florida Dam Safety Program.

**Step 5.** Identify primary and auxiliary communications systems, both internal (between persons at the dam) and external (between dam personnel and outside entities).

**Step 6.** List and prioritize the order of notification for all persons and entities involved in the notification process, and draft the Notification Flowchart.

**Step 7.** Develop a draft of the EAP using the information obtained in Steps 1 through 7 above. It is recommended that the EAP be kept in a three-ring binder that includes a cover and a spine to identify it as an EAP for a specific dam(s), side tabs to subdivide the EAP by individual sections, and top tabs to easily navigate to the most relevant information needed during an event (i.e., event level determination guide, notification flowcharts, contact list, etc.). The EAP should be double-sided and each section should start on a separate page, and the document should be formatted so that a new section page is a front-facing page and not the back of a page. The three-ring binder will allow the quick and easy replacement of revised pages and the removal of obsolete ones. The recommended EAP format is provided in the EAP Template.

**Step 8.** Hold one or more coordination meetings with all local agencies and other parties on the notification list to receive their review comments for the draft EAP.

**Step 9.** Make any necessary revisions, obtain the necessary signatures for plan approval, and distribute the EAP to those who have responsibilities under the plan.

Specific Instructions for Preparing an EAP using the EAP Template

The specific instructions that follow are provided to assist the dam owner in preparing an EAP using EAP Template Version February 2021. The title page, table of contents, EAP overview, sections 1 through 5, and appendices described below follow the format of the EAP Template. The instructions and information provided in the following pages are differentiated as follows to assist in the completion of the EAP Template:

* Examples of charts, figures, and tables are presented to provide the dam owner with an indication of the type of information that needs to be included.
* The notations **“DAM OWNER”** and **“Note to DAM OWNER:”** are included to alert the dam owner and / or preparer to specific information or instructions.
* Excerpts from the EAP Template are provided in red font and are indented from the general instruction text.
* User prompts or instructions to complete blanks in the Template are formatted in all caps, italicized, enclosed in parentheses and highlighted in yellow as shown in this example:

**(USER PROMPT EXAMPLE).**

* All other text is considered to be general instruction.

**EAP TEMPLATE INSTRUCTIONS**

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**Title Page**

The title page should identify the document as an EAP and specify the dam for which it is developed. Include the dam name, the National Inventory of Dams (NID) number (assigned by the Florida Dam Safety Program (FDSP)), the county where the dam is located, the water management district for the dam location, and the specific hazard potential for the dam. The title page should also include a regional or county map and a local map showing the dam location and GPS coordinates. The dam owner or dam owner’s representative should print their name, and sign and date the title page of the master document. The copy number should also be recorded on the title page. The date of the EAP version should be inserted in the footer and the dam name, NID number, and county name should be included in the header.

The following descriptions and links are to assist the DAM OWNER in acquiring the information required for the title page:

* NID Number: The NID number is assigned by the FDSP. The FDSP contact information is located on the title page of this instruction manual. Also include the NID number in the dam information sheet. (Appendix A-7: *National Inventory of Dams (NID) Data*)
* Water Management District (WMD): The water management jurisdiction boundaries are based on watershed boundaries.
  + To access any of the five WMDs, go to <https://floridadep.gov/water-policy/water-policy/content/water-management-districts> and select a WMD on the State map.
  + To identify the WMD for a specific dam location, go to <https://ca.dep.state.fl.us/mapdirect/> and select the “Open Map Direct” icon. Select “ADD MAP LAYERS in the left-hand column and click on the plus sign that appears. Type “Water Management Districts” into the search bar. The search should return the “Water Management Districts (areas)” layer. Select the “Add Layer to Map” icon. Close the add data window and enter the dam address or town into the search window in the upper right-hand corner. Zoom to the dam’s location to see the WMD it’s located in.
* WMD Permit Number: If the dam is a permitted structure (as opposed to a dam constructed pre-rule), enter the permit type and number.
* Hazard Potential for the Dam: The hazard potential classifications are:
* High hazard potential - loss of one human life is likely if the dam fails.
* Significant hazard potential – no probable loss of human life, but likely significant property or environmental destruction.
* Low hazard potential –no loss of life and low economic impact, primarily limited to the owner’s property.

The following document provides the definition of each hazard potential: FEMA Federal Guidelines for Dam Safety, Hazard Potential Classification System for Dams (FEMA Publication 333), January 2004. This document is located at the website: <https://damsafety.org/resourcecenter/national-dam-safety-program-guidelines-flyers-and-other-tools>.

* Month and Date: Enter the month and year that the EAP was created or revised, as is the case.
* Regional or County Map: Utilize Google Maps for the creation of this regional map. Look up the closest intersection or address to the dam and select the zoom that includes the major roads within the county or region. Verify that the map information is correct. Choose the “Map” tab in the upper right hand corner of the Google website screen for this map. Once this has been inserted onto the title page of the EAP Template, label the dam location with the dam name.
* Local Area Map: Utilize Google Maps for the creation of this local map. Look up the closest intersection or address to the dam and select the zoom option that shows the rural roads around the dam. Verify that the map information is correct. Choose the “Satellite” tab in the upper right hand corner of the Google website screen for this map. Once this has been inserted onto the title page of the EAP Template, label the dam location with the dam name and GPS coordinates (in the State Plane coordinate system).
* Dam Owner / Dam Owner’s Representative, Name, Signature, Date, and Copy ( ) of ( ): Provide the printed name and signature of the dam owner or dam owner’s representative responsible for the dam. Include the date on which the document is signed. The copy number should be manually completed prior to distribution, with the master document indicated as number 1 of the total number of EAPs in that distribution.

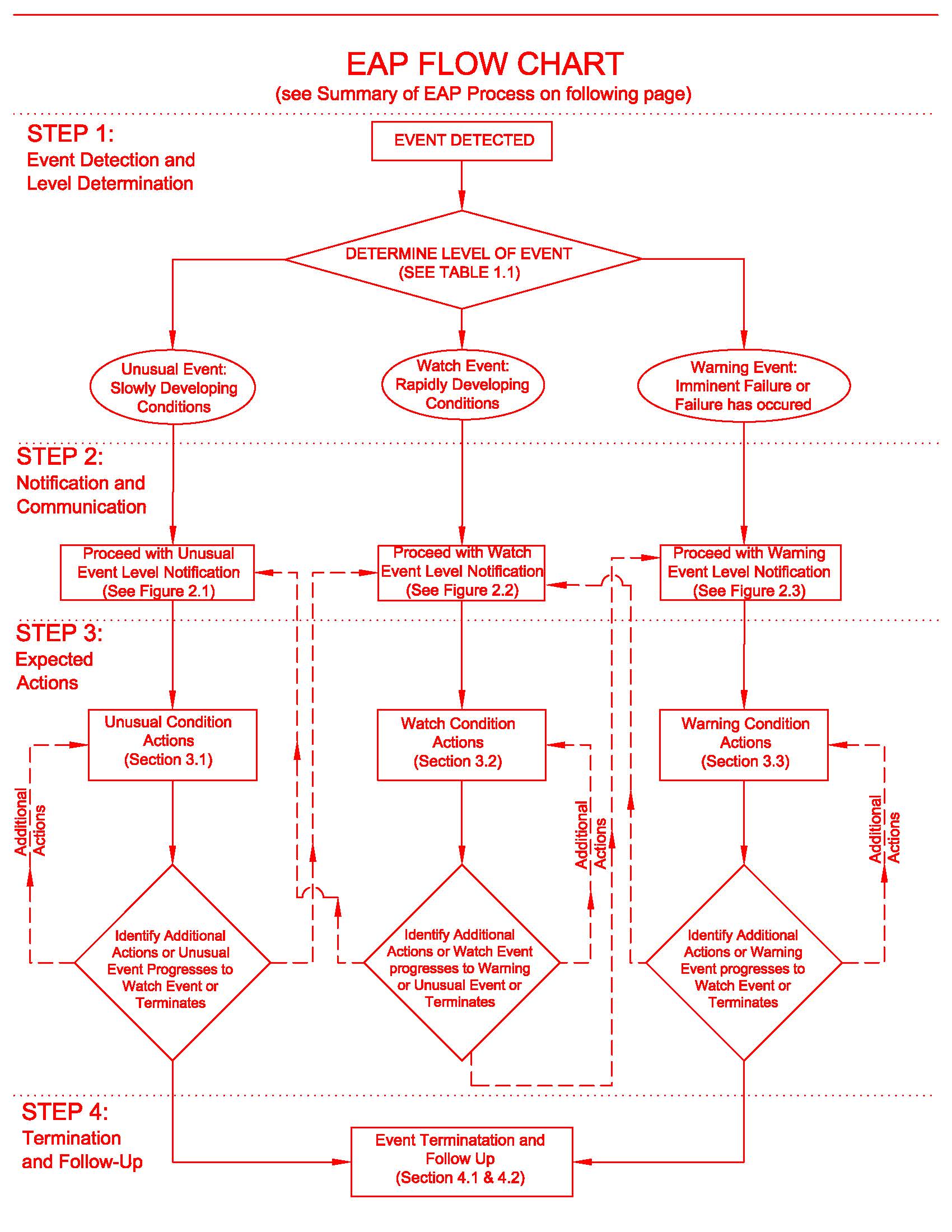
Table of Contents

The table of contents should detail the individual sections and subsections. Side and top tabs should be utilized in the printed document to easily find various sections in the EAP. Side tabs should be used to identify the sections within the document. Top tabs should be used for the most relevant sections, or topics, needed during an event (i.e. EAP Flow Chart, Notification charts, EAP Contact List, etc.).

EAP Overview

# EAP Flow Chart

The EAP Flow Chart, included on the following page, presents the steps to follow from the time the event is first detected and an event level is determined to the termination and follow-up actions of an event. This specific flow chart should be included in your Template to show the procedures the EAP follows. This flow chart serves as a quick reference to the various sections that provide more information regarding the event level determination, notification, actions, and event termination.



**Summary of EAP Process**

Note to **DAM OWNER**: The language provided below is included in the Template. There is no input required in this section of the Template, as these are necessary parts of the EAP*.*

**Summary of EAP Process**

The EAP Process consists of four (4) steps that must be followed anytime an event has been detected.

The 4 steps are as follows:

Step1: Event Detection and Level Determination

Step 2: Notification and Communication

Step 3: Expected Actions

Step 4: Termination and Follow-Up

**Step 1: Event Detection and Level Determination**

When an event is detected at the dam, the level of the event must be determined. Section 1.0*Event Detection and Level Determination* will serve as a guide to determine event level. Each event level has a specific notification and expected actions associated with it. The 3 levels of events are:

* Unusual Event Level-slowly developing, unusual situation
* Watch Event Level-rapidly developing, potential dam failure situation
* Warning Event Level-imminent dam failure or dam failure occurring

**Step 2: Notification and Communication**

Once the level of event has been determined, notifications will be made in accordance with the applicable event level notification flow chart included in Section 2.0*Notification and Communication*.

**Step 3: Expected Actions**

Specific actions will be executed for the level of event. The specific actions for each event level can be found in Section 3.0*Expected Actions*. A continuous process of taking action, notification and assessing the status of the situation may happen during this step. The event may go through multiple event levels as the situation either improves or worsens. After the actions have been performed, evaluation of the actions will occur before proceeding to the next step. If actions have not rectified the event conditions, additional actions may be performed. If event conditions have improved, the event level will be reduced or terminate as the situation dictates.

**Step 4: Termination and Follow-up**

Once the event has ended, termination and follow-up procedures will be followed as explained in Section 4.0 *Termination and Follow-up*. The EAP operations can only be terminated after completing the actions and all issues have been rectified.

# Dam Description and Potential Impact Area Summary

This subsection should include brief descriptions of the purpose of the EAP, the directions to the dam or reservoir, the potential impact area, and the dam or reservoir description.

The purpose of the EAP is to provide a systematic means to:

* Identify emergency conditions threatening a dam.
* Expedite effective responses to prevent a dam failure.
* Prevent or reduce loss of life and property damage should a dam failure occur.

The information presented below provides guidance to the DAM OWNER on the information in the Template that remains unchanged and the information that needs to be inserted into the Template.

## Purpose

The purpose of this EAP is to reduce the risk of human life loss and injury and minimize property damage during a watch or warning event at (Dam Name) (INSERT NAME OF DAM), NID No. (INSERT NID NO.) located in (INSERT COUNTY NAME) County, Florida.

## Directions to Dam

Note to **DAM OWNER**: Verify directions obtained from mapping programs and confirm that the directions provided below are clearly shown on the maps provided in Appendix A to facilitate an emergency response.

Directions to the dam from all four directions are provided below, as applicable. (See Appendix A-1: *Project Location Map* and Appendix A-2: *Project Watershed Map*).

From the North: (INSERT DIRECTIONS TO DAM FROM THE NORTH)

From the East: (INSERT DIRECTIONS TO DAM FROM THE EAST)

From the South: (INSERT DIRECTIONS TO DAM FROM THE SOUTH)

From the West: (INSERT DIRECTIONS TO DAM FROM THE WEST)

## Potential Impact Area

Note to **DAM OWNER**: DAM OWNER will need to prepare the inundation map, referenced below. Instructions are included in Appendix A-3: Inundation Maps and Calculations.

See Appendix A-3: *Inundation Map and Calculations* for the locations of impact and the estimated time for the flood wave to travel from the dam.

## Dam Description

Note to **DAM OWNER**: For any dam description information not readily available, contact the FDSP. If the information is not available, indicate “Unknown” in the Template. At a minimum the dam height should be measured and provided in the Template.

Dam Height: \_\_\_\_\_

Dam Name: \_\_\_\_\_\_

Year Completed: \_\_\_\_\_\_

Former Dam Name: \_\_\_\_\_\_

Legal Description: S\_\_\_\_ T\_\_\_\_R\_\_\_\_

Nearby River or Stream: \_\_\_\_\_\_

Dam Operator: \_\_\_\_\_\_

Nearest Downstream Town: \_\_\_\_\_\_

Latitude: \_\_\_\_\_\_

Longitude: \_\_\_\_\_\_

National Inventory of Dams ID No.: \_\_\_\_\_\_

Normal Storage: \_\_\_\_\_\_

Hazard Potential: \_\_\_\_\_\_

The following information provides a description of each item and how the data can be obtained to aid in completion of this section of the EAP:

* Dam Height: This is the vertical distance between the lowest point on the crest of the dam and the lowest point in the original streambed. The distance can be measured or estimated in the field at the site of the dam.
* Year Completed: This is the year that the original main dam structure was completed.
* Dam Name: This is the official name of the dam. The popular name may be used in the absence of an official name.
* Former Dam Name(s): This is another current name or a former name for the dam.
* Legal Description (S,T,R): The section, township, and range of the dam location is described here. This information may be obtained by locating the dam on the [FDEP Map Direct](https://ca.dep.state.fl.us/mapdirect/) website (https://ca.dep.state.fl.us/mapdirect/) and turning on the “Public Land Survey System” layer. The public has free access to this program and the FDSP may be contacted for assistance in its use.
* Dam Operator: Enter the person(s) or organization/agency responsible for operating the dam.
* Latitude/Longitude: Enter the Latitudinal and Longitudinal coordinates for the centerline of the dam. This information can be obtained by locating the dam on the FDEP Map Direct website and double clicking the “Draw Points” tool on the centerline of the dam and then clicking “Add to Map”. The latitude and longitude of the selected location will be displayed.
* National Inventory of Dams ID No.: This is the official National identification number for the dam, as assigned by the FDSP. The first two characters of the identification number are “FL” to indicate that the dam is located in Florida.
* Normal Storage: This is the volume, usually in acre-feet, of water normally stored in the reservoir, excluding any flood control storage.

Note to **DAM OWNER**: See one of the following three sources of data for the normal storage:

* As-built design plans for the dam/reservoir.
* Reservoir storage records.
* USGS Quad map – measure area behind dam at each contour elevation up to the contour corresponding to the normal storage elevation.
* Hazard Potential: The applicable codes for this entry are H for high, S for significant, L for low, and U for undetermined. *Note to Dam Owner: For the definitions of each hazard potential, see FEMA Federal Guidelines for Dam Safety, Hazard Potential Classification System for Dams (FEMA Publication 333), January 2004. This document is located at the following website:* <https://damsafety.org/resourcecenter/national-dam-safety-program-guidelines-flyers-and-other-tools>
* Nearby River or Stream: Identify the nearby river or stream to a dam. Indicate if the dam is located on a tributary or off-stream to the nearby river or stream, e.g. Manatee River tributary or off-stream of Manatee River.
* Nearest Downstream Town: This is the downstream city, town, or village that would most likely be affected by a dam failure. It can be identified on a map of the area.

# General Roles and Responsibilities

This section of the EAP should identify:

* Who is responsible for operation and maintenance of the dam?
* Who is responsible for observing the dam during extreme flooding events, during holidays, on weekends, and during normal conditions?
* Who is responsible for implementing each of the required various phases of the EAP?
* Who is in charge of emergency response?
* What are the communication and coordination channels?
* Where is the location of the incident command center or emergency operating center?
* What are the lines of succession and assumptions of responsibility necessary to ensure uninterrupted emergency-response actions under any conditions?

The Template provides a list of necessary roles for the EAP implementation. See the following for guidance on filling out the Template.

**Dam Owner/ Dam Owner Representative (Name):** (INSERT DAM OWNER OR DAM OWNER’S REPRESENTATIVE NAME)

*•*As soon as an event is observed or reported, immediately determine the level *(see Table 1.1:*

*Event Level Determination Guidance Table* in Section 1.3: *Examples of Emergency Situations*).

Unusual Event Level 🡪 slowly developing

Watch Event Level 🡪 potential dam failure situation, rapidly developing,

Warning Event Level 🡪 dam failure appears imminent or is in progress.

•Immediately notify the personnel in the order shown on the notification chart for the appropriate level (see Figure 2.1:*Unusual Event Level Notification*, Figure 2.2: *Watch Event Level Notification* & Figure 2.3: *Warning Event Level Notification* in Section 2.1*Notification Charts*).

•Provide updates of the situation to the police/sheriff dispatcher to assist them in making timely and accurate decisions regarding warnings and evacuations.

•Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.

**Dam Operator’s Technical Representatives (Name):** (INSERT DAM OWNER’S ENGINEER AND/OR OTHER TECHNICAL ADVISOR WHO WILL PROVIDE THE DAM OWNER WITH TECHNICAL ASSISTANCE)

•Advise the dam operator of the event level determination, if time permits.

•Advise the dam operator of remedial actions to take if Watch Event occurs, if time permits.

**Incident Commander (i.e. Sheriff, EOC) (Name):** (INSERT NAME OF SHERIFF, POLICE CHIEF, COUNTY EMERGENCY OPERATIONS CENTER COMMANDER, ETC.)Note to **DAM OWNER**: Contact name should be obtained from the County website or be contacting the County Administration office.

•Serve as the primary contact person responsible for coordination of all emergency actions in the dam area and downstream.

•When a Watch Event Level situation occurs:

–Prepare emergency management personnel for possible evacuations that may be needed if a

Warning Event Level situation occurs.

* When a Warning Event Level situation occurs:

–Initiate warnings and order evacuation of people at risk downstream of the dam.

–Notify local emergency management services to carry out the evacuation of people and close

roads within the evacuation area.

•Decide when to terminate the emergency.

•Participate in an annual review and update of the EAP.

**Emergency Management Services (Name):** (INSERT NAME OF CITY OR COUNTY EMERGENCY OPERATIONS CENTER PERSONNEL)

•Maintain communication with media.

•When a Watch Event Level situation occurs:

–Support Incident Commander with preparation of emergency management personnel for possible evacuations that may be needed if a Warning Event Level situation occurs.

–Alert the public as appropriate.

•When a Warning Event Level situation occurs:

–Alert the public.

–Immediately close roads and evacuate people within the evacuation area

(see *Evacuation Map* tab).

•Participate in an annual review and update of the EAP.

**Water Management District (Name):** (INSERT NAME OF WATER MANAGEMENT DISTRICT CONTACT NAME)Note to **DAM OWNER**: See the following web page for contact information for the Water Management Districts to determine the appropriate contact for inclusion in this EAP: <http://www.dep.state.fl.us/secretary/watman>

•Provide technical assistance with relation to flooding extent and repair, as needed.

**Bureau of Emergency Response (Name):** (INSERT FLORIDA DIVISION OF EMERGENCY MANAGEMENT CONTACT NAME) Note to **DAM OWNER**: See the following web page for the contact information for the Florida Division of Emergency Management to determine the appropriate contact for inclusion in the EAP: <http://www.floridadisaster.org/contact/contact.asp>

•Provide technical and on-site assistance to ensure threats to the environment and human safety

are addressed.

**State Dam Safety Officer (Name):** (INSERT FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION DAM SAFETY OFFICER) Note to **DAM OWNER**: See the following web page for the contact information for the Florida Department of Environmental Protection to determine the appropriate contact for inclusion in the EAP: <http://www.dep.state.fl.us/water/mines/damsafe.htm>

•Provide coordination activities, as necessary, for FDEP, Water Management Districts, and local agencies involved in dam safety regulations and inspections.

**Department of Homeland Security (Name):** (INSERT NAME OF FLORIDA DEPARTMENT OF LAW ENFORCEMENT INVESTIGATIONS & FORENSIC SCIENCE PROGRAM OFFICE CONTACT) Note to **DAM OWNER**: See FDLE Regional Contacts at the following: <http://www.fdle.state.fl.us/Content/getdoc/4b2e646d-9037-44f2-9885-4d8d9e5d07b0/Regional-Contacts.aspx>

•Provide assistance in case of event caused by sabotage or terrorist threat.

Section 1.0 Event Detection and Level Determination

# Section 1.1 Event Detection

This subsection consists of a brief description of the event detection process and the steps that must be followed to determine the appropriate event level. This subsection references the subsequent sections that follow for detailed information.

Note to **DAM OWNER**: The standard language provided in the Template in this section does not need revision.

An Unusual, Watch, or Warning Event may be detected by:

•Observations at or near the dam by the dam owner, staff, visitors, or the general public.

•Evaluation of the dam instrumentation data.

•Forewarning of conditions, which may cause an event at the dam, i.e. severe weather forecast.

•Suspicious activity or security threats.

Once an event has been detected and reported, the dam owner must determine what level of event has occurred and start the notification process, Section 1.2 *Event Level Determination* will further describe how to determine the event level.

# Section 1.2 Event Level Determination

The EAP should include definitions of the three event levels and general notification requirements for each level. The three event levels include:

* Unusual Event Level defined by a slowly developing situation that may endanger the structural integrity of the dam.
* Watch Event Level defined as rapidly developing that could quickly lead to dam failure and flash flooding downstream of the dam.
* Warning Event Level defined as imminent dam failure or flash flooding downstream of the dam.

The EAP should include a list of indicators of the onset of problems that might cause failure of the dam. The Template should reference Table 1.1: *Event Level Determination Guidance Table* in this section and provide examples of emergency situations in Section 1.3.

* Slumping, sloughing, or slides on the dam or the abutment
* Cloudy or dirty seepage or seepage with an increase in flow, boils, piping, or bogs
* Seepage around conduits
* Cracks, settlement, misalignment, or sinkholes
* Erosion or riprap displacement
* Animal burrows
* Growth of trees and brush
* Failure of operating equipment
* Abnormal instrument readings
* Leakage of water into the intake tower or drop inlet
* Undermining of spillways
* Overtopping of the dam
* Sabotage

Note to **DAM OWNER**: The standard language provided in the Template in this section does not need revision.

There are three types of events that may occur: Unusual, Watch, and Warning Event.

**Unusual Event Level:**

An Unusual Event Level is defined as a slowly developing situation that may compromise the structural integrity of the dam. This event will be closely monitored and the appropriate notifications will be made according to the notification chart in Section 2.1 *Notification Charts*, Figure 2.1: *Unusual Event Level Notification*. Event preparedness agencies do not need to be notified for an unusual event.

**Watch Event Level:**

A Watch Event Level is defined as a rapidly developing situation that may become a serious emergency, including possible dam failure. Time is usually available to attempt corrective measures to mitigate or prevent the dam’s failure. Emergency preparedness agencies will be notified, so they may prepare to evacuate downstream areas, if necessary, and provided with updates of the situation, and other notifications will be given according to the notifications chart in Section 2.1 *Notification Charts*, Figure 2.2: *Watch Event Level Notification*.

**Warning Event Level:**

A Warning Event Level is defined as an imminent dam failure or dam failure that has already occurred. Time is not available to try corrective measures. Emergency preparedness agencies will be immediately notified so that

immediate evacuations of the impact areas can begin. Specific notifications will be given according to the notifications chart in Section 2.1 *Notification Charts*, Figure 2.3: *Warning Event Level Notification*.

Table 1.1: *Event Level Determination Guidance Table* will serve as an aide providing criteria to help determine the level of event that is occurring. Table 1.1: *Event Level Determination Guidance Table* is provided in Section 1.3 *Examples of Emergency Situations*.

# Section 1.3 Examples of Emergency Situations

The EAP should include a compilation of typical event level scenarios for earthen dams as shown in Table 1.1: *Event Level Determination Guidance Table*. These emergency situations should be correlated to an event level. The **DAM OWNER** should provide this table which includes examples of emergency situations with their respective event levels. Examples of typical emergency situations at dams are provided in Table 1.1 to assist the **DAM OWNER** and should be augmented as necessary.

Note to **DAM OWNER**: The standard language in Section 1.3 provided in the Template does not need revision and Table 1.1 can be included as-is or site-specific situations may be added to the table.

The following, Table 1.1: *Event Level Determination Guidance Table* provides a list of typical emergency situations for earthen dams with the associated Event Level.

#### Table 1.1: Event Level Determination Guidance Table

|  |  |  |
| --- | --- | --- |
| **Event** | **Situation** | **Event Level** |
|  | Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion | Unusual |
|  | Spillway flowing with active gully erosion | Watch |
| Spillway Flow | Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise | Watch |
|  | Spillway flowing with an advancing headcut that is threatening the control section | Warning |
|  | Spillway flow that is flooding people downstream | Warning |
|  | Reservoir water surface greater than elevation XXX and flows in XXX River channel at elevation XXX are greater than XXX cfs | Unusual |
| Flooding | Reservoir water surface greater than elevation XXX | Watch |
|  | Reservoir water surface greater than elevation XXX | Warning |
|  | Intermittent overwash of waves is occurring, but is not eroding the outside embankment slope | Unusual |
| Embankment Overtopping | Reservoir level is 1 foot below the top of the dam | Watch |
|  | Water from the reservoir is flowing over the top of the dam | Warning |
|  | New seepage areas in or near the dam | Unusual |
| Seepage | New seepage areas with cloudy discharge or increasing flow rate | Watch |
|  | Seepage with discharge greater than 10 gallons per minute | Warning |
| Sinkholes | Observation of new sinkhole in reservoir area or on embankment 2 | Watch |
|  | Rapidly enlarging sinkhole | Warning |
| Embankment | New cracks in the embankment greater than ¼-inch wide without seepage | Unusual |
| Cracking | Cracks in the embankment with seepage | Watch |
| Embankment | Visual movement/slippage of the embankment slope | Unusual |
| Movement | Sudden or rapidly proceeding slides of the embankment slopes | Warning |
| Instruments | Instrumentation readings beyond predetermined values | Unusual |
|  | Measurable earthquake felt or reported on or within 50 miles of the dam  Earthquake resulting in uncontrolled release of water from the dam 3 | Unusual |
| Earthquake | Earthquake resulting in visible damage to the dam or appurtenances | Watch |
|  | Earthquake resulting in uncontrolled release of water from the dam | Warning |
| Security Threat | Verified bomb threat that, if carried out, could result in damage to the dam Damage to dam or appurtenances with no impacts to the functioning of the dam 1 | Watch |
|  | Detonated bomb that has resulted in damage to the dam or appurtenances | Warning |
|  | Damage to dam or appurtenance with no impacts to the functioning of the dam | Unusual |
| Sabotage/ Vandalism | Modification to the dam or appurtenances that could adversely impact the functioning of the dam | Unusual |
|  | Damage to dam or appurtenances that has resulted in seepage flow | Watch |
|  | Damage to dam or appurtenances that has resulted in uncontrolled water release | Warning |

# Section 1.4 Site-Specific Concerns

In this section of the Template, the DAM OWNER should specify, in the space provided in the Template, pre-existing conditions around the dam and indicate site-specific factors or scenarios which may potentially trigger the EAP. The items listed could include historic events and past actions. These concerns could also include added risks or hazards that could be involved with a dam failure. These scenarios should include the vulnerability to all appropriate known emergency conditions such as severe thunderstorms with lightning and excessive rains, hurricanes, tornadoes, earthquakes, etc. The following have been provided as examples to assist the DAM OWNER with ideas on how to fill out this section of the Template:

* Excessive rains cause dam overtopping (or excessive erosion)
* The dam contains trees growing out of the embankment which have not been removed.
* Historical events and actions taken

Note to **DAM OWNER**: **DAM OWNER** should provide photographs in this section of the Template of the dam area and/or the other site areas of concern.

The following are site-specific concerns with historical events and actions and photographs, where available;

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Section 2.0 Notification and Communication

# Section 2.1 Notification Charts

The Notification Charts located in this section should contain a top tab to enable the DAM OWNER and other EAP partners to locate these charts easily and quickly during an event. Three event levels are considered; each has a separate flowchart. The event levels are described in Section 1.2 *Event Level Determination*.

The charts should clearly summarize the following information for each of the three levels:

* Who is responsible for notifying each owner representative and public official?
* Who is to be notified?
* The order in which individuals or offices are to be notified
* Individual names, position titles, office and home telephone numbers, alternative contacts, and means of communication

Section 2.3 *EAP Contacts*, (in both the EAP Template and these instructions) contains contact information for people and agencies that can provide assistance with EAP flowchart development and can help identify the appropriate contacts that should be listed. Example Notification Charts are provided in Figures 2.1: *Unusual Event Level Notification*, Figure 2.2: *Watch Event Level Notification*, and Figure 2.3: *Warning Event Level Notification* on the following pages to assist the DAM OWNER in determining how to fill out the charts provided in the Template. Instructions on input for each box within the flowchart are provided. The circled numbers included on each of the following Notification Charts depict the order that the DAM OWNER or DAM OWNER’s representative should call the respective contacts in each of the event levels.

Note to **DAM OWNER**: The state agency information has been filled in on the Watch and Warning Level notification charts in the Template. Contact information has been already been provided for the Florida State Watch Office emergency contact, as well as the Tallahassee contacts for the National Weather Service and the Bureau of Emergency Response. The State Watch Office emergency contact information was also input for the chart. If the **DAM OWNER** is in a location of the state outside of the Tallahassee jurisdiction or if a non-emergency number is needed, use the following web links to find the correct contact information:

* [FL State Watch Office](http://floridadisaster.org/Response/Operations/swp.htm): (http://floridadisaster.org/Response/Operations/swp.htm)
* [National Weather Service](http://www.stormready.noaa.gov/stormmaps/fl-cwa.htm): (http://www.stormready.noaa.gov/stormmaps/fl-cwa.htm)
* [Bureau of Emergency Response](http://www.dep.state.fl.us/law/ber/default.htm): (http://www.dep.state.fl.us/law/ber/default.htm)

#### Figure 2.1: Unusual Event Level Notification

Dam Owner/Dam Owner Representative

Name and Phone Numbers

(INSERT NAME AND PHONE NUMBERS)

Dam Owner’s Technical Representative

**1**

Name and Phones Numbers

(INSERT NAME AND PHONE NUMBERS)

Dam Owner’s Internal Contacts

**2**

Name and Phone Numbers

(INSERT NAME AND PHONE NUMBERS)

Name and Phone Numbers

(INSERT NAME AND PHONE NUMBERS)

Legend

**1**

Call Sequence

#### See Table 2.1: *EAP Contact Table* in Section 2.3: *EAP Contacts* for alternate contact names and phone numbers.

#### Figure 2.2: Watch Event Level Notification

Dam Owner/Dam Owner Representative

Name and Phone Numbers

*(INSERT NAME AND PHONE NUMBERS)*

**3**

**Dam Owner Organization** **Local Agencies** **State Agencies**

**2**

Dam Owner’s County Warning Point FL State Watch Office

**1**

Technical

Representative *(INSERT NAME AND* 800- 320-0519

*PHONE NUMBER)* 850-413-9911

*(INSERT NAME AND*

*PHONE NUMBER)* County Emergency National Weather Service

Management Lead Forecaster

Dam Owner’s Internal *(INSERT NAME AND* 850-942-8833

**4**

Contacts *PHONE NUMBER)*

*(INSERT NAME AND*

*PHONE NUMBER)* County Sheriff

Bureau of Emergency

*(INSERT NAME AND* Response

*PHONE NUMBER)* 850-245-2010

Water Management Bureau of Mining and

District Office Minerals Regulation

(*PHONE NUMBER)* State Dam Safety Officer

850-488-8217

State Highway

Patrol Dispatcher

850-617-2000

Legend

**1**

Call Sequence

-----------------------Technical Consultation

#### See Table 2.1: *EAP Contact Table* in Section 2.3: *EAP Contacts* for a complete list of primary and alternate contact names and phone numbers.

#### Figure 2.3: Warning Event Level Notification

Dam Owner/Dam Owner Representative

Name and Phone Numbers

*(INSERT NAME AND PHONE NUMBERS)*

**Dam Owner Organization** **Local Agencies** **State Agencies**

**2**

**1**

Dam Owner’s County Warning Point State Watch Office

**3**

Technical *(INSERT NAME AND* 800- 320-0519

Representative *PHONE NUMBER)*  850-413-9911

*(INSERT NAME AND*

*PHONE NUMBER)* County Emergency National Weather Service

Management Lead Forecaster

Dam Owner’s Internal *(INSERT NAME AND* 850-942-8833

Contacts *PHONE NUMBER)*

**4**

*(INSERT NAME AND*

*PHONE NUMBER)* County Sheriff Bureau of Emergency

*(INSERT NAME AND* Response

*PHONE NUMBER)* 850-245-2010

Water Management Bureau of Mining and

District Office Minerals Regulation State Dam Safety Officer 850-488-8217

State Highway

Patrol Dispatcher

850-617-2000

Legend

**1**

Call Sequence

-----------------------Technical Consultation

**See Table 2.1: *EAP Contact Table* in Section 2.3: *EAP Contacts* for a complete list of primary and alternate contact names and phone numbers.**

# Section 2.2 Prescript Messages

The **DAM OWNER** should prepare prescripted messages for the Watch and Warning Event Levels. These messages should include the event level, the status of the event, the indication that the EAP has been initiated, your contact information, and the requested action you wish the message’s recipient to take. Please see the three example messages provided in the Template below, with prompts to assist the **DAM OWNER** in filling out the prescript messages in the Template. **DAM OWNER** shall edit the messages to indicate the water bodies and locations of residents/businesses and highways that are between the dam and the downstream extent of inundation. See Appendix A: *Inundation Mapping and Calculations* in these instructions for more information to evaluate the extent of inundation.

**Watch Event Level Message**

This is an emergency message. (INSERT NAME OF DAM OWNER ORGANIZATION) has declared a Watch Event and possible dam failure for Dam (INSERT DAM NAME), NID No. (INSERT DAM NID NO.). Attempts to save the dam are under way, but their success cannot be determined as yet. Emergency water releases to lower lake (are/are not) being made. W**e** request that you initiate appropriate emergency management procedures and prepare for evacuation of the threatened areas. If (INSERT DAM NAME) Dam does fail, flooding will occur along the (INSERT STREAM/RIVER/CREEK NAME), the (INSERT STREAM/RIVER/CREEK NAME) and the (INSERT STREAM/RIVER/CREEK NAME). For verification, call the phone numbers listed on the Notification Flowchart of the Emergency Action Plan for the (INSERT DAM NAME) Dam. The Emergency Management Coordinators for (INSERT CITY/COUNTY NAME, FLORIDA) have been notified of this condition and may be contacted for information on emergency procedures. (INSERT NAME OF DAM OWNER ORGANIZATION) will supply additional information regarding the status of the dam as it becomes available.

**Warning Event Level – Imminent Dam Failure Message**

**Urgent!** This is an emergency message. (INSERT NAME OF DAM OWNER ORGANIZATION) has declared a Warning Event. (INSERT DAM NAME), NID No. (INSERT DAM NID NO.) is in imminent danger of failing. Attempts to save the dam will continue, but their success is unlikely. We request that you IMMEDIATELY initiate evacuations in the flood areas shown on the inundation map. It is probable that the dam will fail in (INSERT AMOUNT OF TIME). If Dam (INSERT DAM NAME) fails, a flood wave will move down the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME), up the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME), and upstream and downstream on the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME). For verification, call the phone numbers listed on the Notification Flowchart of the Emergency Action Plan for Dam (INSERT DAM NAME). The Emergency Management Coordinators for (INSERT CITY/COUNTY NAME, FLORIDA) have been notified of this condition and may be contacted for information on emergency procedures.

**Warning Event Level – Dam Failure Message**

**Emergency!** This is an emergency message. (INSERT NAME OF DAM OWNER ORGANIZATION) has declared a Warning Event. (Name) (INSERT DAM NAME), NID No. (INSERT DAM NID NO.) has failed. A flood wave is moving down the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME), up the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME), and upstream and downstream on the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME) toward (INSERT DOWNSTREAM CITY NAME) and (INSERT DOWNSTREAM CITY NAME). The flood waters have already reached (INSERT DOWNSTREAM ROAD NAME), (INSERT DOWNSTREAM ROAD NAME), on (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME). The City of (INSERT DOWNSTREAM CITY NAME) will begin flooding at (INSERT AMOUNT OF TIME AFTER BREACH – THIS SHOULD MATCH THE INUNDATION MAP). (INSERT DOWNSTREAM ROAD NAME) on the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME) will begin flooding at (INSERT AMOUNT OF TIME AFTER BREACH – THIS SHOULD MATCH THE INUNDATION MAP). The flood wave will go up the (INSERT DOWNSTREAM STREAM/RIVER/CREEK NAME) and flood areas along the river. (INSERT DOWNSTREAM ROAD NAME) in (INSERT CITY/COUNTY NAME, FLORIDA) will begin flooding at (INSERT AMOUNT OF TIME AFTER BREACH – THIS SHOULD MATCH THE INUNDATION MAP). (INSERT DOWNSTREAM ROAD NAME) at (INSERT DOWNSTREAM LANDMARK) will begin flooding at (INSERT AMOUNT OF TIME AFTER BREACH – THIS SHOULD MATCH INUNDATION MAP). Evacuate threatened areas immediately. For verification, call the phone numbers listed on the Notification Flowchart of the Emergency Action Plan for Dam (INSERT DAM NAME). The Emergency Management Coordinators for (INSERT CITY/COUNTY NAME, FLORIDA) have been notified of this condition. This condition mandates an IMMEDIATE evacuation of all potential inundation area residents as listed in Appendix A-3: Inundation Maps and Calculations of the Emergency Action Plan for (INSERT DAM NAME) Dam.

# Section 2.3 EAP Contacts

The **DAM OWNER** should prepare a contact list, using the form included in the Template, to summarize the people or agencies included in the EAP notification process with their contact information. Names, agencies, contact numbers, and numbers where these individuals can be reached after hours should be recorded in this table. Table 2.1 *EAP Contact Table* is provided on the next page with prompts for the **DAM OWNER** on how to fill out the table in the Template.

The following parties may be contacted to assist in determining the appropriate contacts and phone numbers for key agencies to be notified in an emergency:

Florida Dam Safety Program

Owete S. Owete, PhD, PE

850-488-8217

National Weather Service – Tallahassee, Florida

Jeffry Evans

850-942-8833

The National Weather Service can assist with the development of alert messages if they are contacted as the EAP is developed.

#### Table 2.1: EAP Contact Table

Primary Contact Alternate Contact

|  |  |  |
| --- | --- | --- |
| **Dam Owner:** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Dam Operator’s Technical Representative** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Alternate: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Incident Commander** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Alternate: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Emergency Management Services** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Dam Safety Officer** | FDEP-Bureau of Mining & Minerals Regulation | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact: | Dr. Owete S. Owete | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | 850-488-8217 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Water Management District** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Bureau of Emergency Response** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | 850-245-2010 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Homeland Security** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | 202-282-8000 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **County Warning Point** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **County Sheriff** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **State Highway Patrol Dispatcher** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | 850-617-2000 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **State Watch Office** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | 800-320-0519 | 850-320-0519 |
|  |  |  |
| **National Weather Service** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | Lead Forecaster | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | 850-942-8833 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Internal Contact** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  |
| **Internal Contact** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Contact Person: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Phone Number: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
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# Section 2.4 Dam Owner’s Organization and Roles and Responsibilities

Note to **DAM OWNER**: Identify the internal organization structure and dam safety personnel, roles and responsibilities in this section.

The following is the internal organizational structure, with roles and responsibilities defined for personnel involved in the implementation of the EAP:

Section 3.0 Expected Actions

This section should discuss actions at the dam to remedy an observed situation or prevent or delay failure after an event is first discovered. These actions should only be undertaken under the direction of the **DAM OWNER’S** engineer or technical representative. Because of uncertainties about their effectiveness, preventative actions are usually carried out at the same time as notification of an impending failure.

The EAP should identify ways of preparing for an emergency, increasing response readiness in a uniform and coordinated manner, and helping to reduce the effects of a dam failure. The goal is maximum readiness to respond in minimum time.

The EAP should categorize potential emergencies into conditions and identify specific actions to reduce the possibility of either under reacting or overreacting. A list of anticipated situations and appropriate responses is provided in Table 3.1: *Typical Remedial Actions*, in Section 3.1 *Unusual Event Level*.

# Section 3.1 Unusual Event Level

Under this condition, the emergency situation is slowly developing. This event level is described in Section 1.2 *Event Level Determination*. An example of a situation and general response is included below.

* *Situation*: A problem has been detected at the dam which requires monitoring or action to repair or correct.
* *Response*: At this time, the distress condition is manageable by dam personnel. An Unusual Event Level will continue until the problem is corrected, or it progresses rapidly to a possible dam failure situation (corresponding to a Watch Event Level, as described in Section 1.2 *Event Level Determination*).

The following Template paragraphs provide guidance for the **DAM OWNER** in filling out the blanks in this section of the Template.

In this condition, the situation is slowly developing. The following actions should be taken:

1. If (INSERT DAM OWNER OR DAM OWNER’S REPRESENTATIVE) becomes aware of a situation at the dam and they determine that the event level is an Unusual Event, call according to the Event Level Notification chart (Figure 2.1: Unusual Event Level Notification).
2. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions. Refer to Table 3.1: Typical Remedial Actions for a list of conditions and specific actions.
3. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) and (INSERT NAME OF DAM OWNER’S ENGINEER); refer to Table 1.1: Event Level Determination Guidance Table, Section 1.3 in determining the appropriate event level for the new condition and recommended actions.
4. Record all calls, information, observations, and actions taken on Appendix B-2:Action Event Log. Following the termination of the event, complete Appendix B-3:Dam Event Situation Report**.** Note the time of changing conditions. Document the situation with photographs and video, if possible.

Note to DAM OWNER: Table 3.1 Typical Remedial Actions should be included in its entirety and augmented with site specific categories and actions, as appropriate.

|  |  |
| --- | --- |
| **Condition** | **Recommended Actions** |
| **Embankment Overtopping** | 1. Place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway. 2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection. |
| **Flooding** | 1. Monitor flood conditions and report any reservoir water surface changes of 0.5 foot within 12 hours. 2. Consider opening the gates as much as reservoir and downstream change conditions allow. Notify downstream residents. 3. Inspect the dam; including the full length of the upstream slope, crest, downstream toe, and downstream slope. Look for piping, increased seepage, erosion, cracking or settlement and report any of these finds immediately. |
| **Seepage and Sinkholes** | 1. Open the principal spillway gate or low-level outlet works to lower the reservoir level as rapidly as possible to a level that stops or decreases seepage to a non-erosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required. Continue lowering the water level until seepage stops. Continue operating at a reduced level until repairs are made. 2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting. 3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage. 4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss of life and dam failure from the collapse of an underground void. |

**Table 3.1: Typical Remedial Actions**

|  |  |
| --- | --- |
| **Embankment Movement** | 1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required. Continue operation at a reduced level until repairs are made. 2. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard. 3. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide. |
| **Auxiliary Spillway Erosion** | 1. Provide temporary protection at the point of erosion by putting in place sandbags, riprap materials, or plastic sheets weighted with sandbags. 2. Consider pumps and siphons to help reduce the water level in the reservoir. 3. When inflow subsides, lower the water in the reservoir to a safe level. Continue operation at a lower water level in order to minimize spillway flow. |
| **Failure at an Appurtenant Structure Such as an Inlet or Outlet Spillway** | 1. Implement temporary measures to protect the damaged structure, such as closing the inlet or putting in place temporary protection for a damaged spillway. 2. Employ experienced, professional divers, if necessary, to assess the problem and possibly implement repair. 3. Lower the water level in the reservoir to a safe elevation. If the inlet is inoperable, pumping or siphoning may be required. |

# Section 3.2 Watch Event Level

Under this condition, the event situation is rapidly developing and a potential failure situation is occurring. The Watch Event Level is described in Section 1.2 *Event Level Determination*. An example of a situation and general response is included below.

* **Situation**: A problem has been detected that is progressively getting worse.
* **Response**: Efforts to correct the situation will be taken but a possibility exists that the dam could fail if these efforts are unsuccessful. There is no immediate danger; however, if conditions continue to deteriorate, the dam could fail.

The following paragraph provides guidance for the **DAM OWNER** in filling out this section of the Template.

In this condition, the emergency type is a potential dam failure event that is rapidly developing. The following actions should be taken:

1. If (INSERT DAM OWNER OR DAM OWNER’S REPRESENTATIVE) becomes aware of a situation at the dam and they determine that the event level is a Watch Event, call according to the Event Level Notification chart (Figure 2.2: Watch Event Level Notification). Be prepared to provide the information listed in Appendix B-1: Information for Emergency Management to emergency management personnel.
2. If time permits, (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also, check the reservoir area, abutments, and downstream channel for signs of changing conditions.
3. If time permits, emergency remedial actions should be taken as appropriate. Typical remedial actions are listed in Table 3.1: Typical Remedial Actions in Section 3.1. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. The dam must be closely monitored to confirm the success of the actions taken.
4. Record all calls, information, observations, and actions taken on Appendix B-2: Action Event Log. Following the termination of the event, complete Appendix B-3: Dam Event Situation Report. Note the time of changing conditions. Document the situation with photographs and video, if possible. Attach as supplementary information to the Action Event Log.
5. If increased piping, seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) and (INSERT NAME OF DAM OWNER’S ENGINEER); refer to Table 1.1: Event Level Determination Guidance Table in determining the appropriate event level for the new condition and recommended actions.
6. Provide updates to (INSERT NAME OF CITY, FLORIDA POLICE CHIEF OR COUNTY, FLORIDA SHERIFF) and emergency management personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.

# Section 3.3 Warning Event Level

Under this condition, the event situation is that of an appearance of imminent dam failure or that the dam failure is in progress. The Warning Event Level is described in Section 1.2 *Event Level Determination*. An example of an anticipated failure and general response is included below.

* **Failure**: The owner or operator has determined that conditions will progress to failure of the dam and an uncontrollable release of the reservoir. If the failure has already occurred, the flood wave is now moving downstream. Flooding will start immediately and will continue to move downstream until water levels at the reservoir are stabilized.
* **Response**: Evacuation of downstream areas should continue in accordance with local plans. It is normally the responsibility of local governments, upon receiving such notification, to warn the public, make recommendations about evacuation, carry out the evacuations, and offer shelter to area residents. Sometimes, however, it is more appropriate for the DAM OWNER to warn certain individuals instead of, or in addition to, relying on local government officials, particularly with small dams that may only affect a few people.

The following paragraph provides guidance for the **DAM OWNER** in filling out this section of the Template.

In this condition, dam failure is imminent or is occurring. The following actions should be taken:

1. If (INSERT DAM OWNER OR DAM OWNER’S REPRESENTATIVE) becomes aware of a situation at the dam and they determine that the event level is a Warning Event, call according to the Event Level Notification chart (Figure 2.3: Warning Event Level Notification). Be prepared to provide the information listed in Appendix B-1: Communications Checklist to emergency management personnel.
2. INSERT NAME OF CITY, FLORIDA POLICE CHIEF OR COUNTY, FLORIDA SHERIFF) shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam, see Appendix A-3**:** Inundation Map and Calculations.
3. Emergency management services personnel shall alert the public and immediately evacuate at-risk people and close roads as necessary.
4. (INSERT NAME OF DAM OWNER) will advise the people monitoring the dam and the event to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.
5. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will maintain continuous communication and provide (INSERT NAME OF CITY, FLORIDA POLICE CHIEF OR COUNTY, FLORIDA SHERIFF) with updates of the situation to assist him/her in making timely decisions concerning warnings and evacuations.
6. Record all calls, information, observations, and actions taken on Appendix B-2:Action Event Log. Following the termination of the event, complete Appendix B-3:Dam Event Situation Report. Document the situation with photographs and video, if possible. Attach photographs or video to the Action Event Log.

# Section 3.4 Locally Available Equipment, Labor, and Materials

The EAP should identify equipment, labor and materials that could potentially be needed for the event levels mentioned above. An example of a record of the resources available is provided in Appendix C: *Resources Available*. For each applicable item, include specific contacts and their business and any other contact information. The **DAM OWNER** should use example record in Appendix C: *Resources Available* and the following examples of items that may be needed to assist in filling out the EAP Template:

* Support capabilities, such as personnel or organizations that can render assistance and the procedures for contacting them;
* The existence and location of supplies and equipment available for use in remedial actions, preferably as close as possible to the dam;
* Procedures for emergency purchase or procurement of supplies and equipment needed for remedial actions; and
* Remedial construction and other activities to prevent a failure of the dam and who will carry them out.

Equipment, supplies, and other resources may be needed such as sandbags, riprap, fill materials, and heavy equipment. A list of available resources, labor, and equipment is provided in the table in Appendix C: *Resources Available*.

Resources that may be helpful include:

* Earth-moving equipment
* Riprap
* Sand and gravel
* Sandbags
* Pumps
* Pipe
* Laborers
* Lighting equipment
* Divers

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Section 4.0 Termination and Follow-Up

When a situation is over that required the activation of the EAP, the declaration of an event level and subsequent required actions, the EAP operations must be terminated and follow-up procedures completed. The EAP should define these procedures. The DAM OWNER should read the following sections for information on the development of these procedures and the guidance on how to fill out the Template.

Note to **DAM OWNER**: The standard language provided in the Template in this section does not need revision.

# Section 4.1 Termination Responsibilities

The EAP should identify the person responsible for terminating EAP operations and for relaying this decision to the person identified at the top of the Notification Chart. (Note to **DAM OWNER**: This is typically the Incident Commander.) This chart should again be utilized for the notification of the remaining contacts regarding the termination of the EAP.

Prior to termination of a Warning Event Level that has not yet resulted in dam failure, the EAP should specify the entity responsible for a dam inspection to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. (Note to **DAM OWNER**: This is typically either the **DAM OWNER’S ENGINEER** or the technical representative.) The **DAM OWNER** shall utilize the following paragraphs to assist in completing this section of the EAP Template.

This section explains how (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) and State and local officials will coordinate to terminate an event. The applicable State or local emergency management officials are responsible for termination of the disaster response activities. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will designate at least one person for on-site monitoring of the situation at the dam and keep local authorities informed of developing conditions at the dam from the time that an event starts until the event has been terminated. Provisions for security measures at the dam during the event should be specified.

The Incident Commander is responsible for terminating EAP operations and relaying this decision to all parties involved in the emergency. It is then the responsibility of each person to notify the same group of contacts that were notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Event Level that has not resulted in dam failure, Dam Owner’s Technical Representative will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined that conditions do not pose a threat to people or property, the Incident Commander will be advised to terminate EAP operations as described above.

# Section 4.2 Follow-up

The EAP should define the person/entity responsible for assuring that the event has been properly documented and that all required forms are completed. (Note to **DAM OWNER**: This is typically the **DAM OWNER OR THE DAM OWNER’S REPRESENTATIVE**). The DAM OWNER should keep the original event records. A copy of this documentation should be distributed to the DAM OWNER’s Engineer or technical representative. The DAM OWNER should use the following paragraphs to assist in completing this section of the EAP Template.

A follow-up evaluation after an event by all participants should be specified. The results of the evaluation should be documented in a written report.

(INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will assure that the Appendix B-3: Dam Event Situation Reportform is completed to document the event and all actions that were taken. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will keep the original completed event records, Appendix B-1, B-2, and B-3 forms, and available photographs and videos in the master document. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will make available copies of the completed report to (INSERT NAME OF DAM OWNER’S ENGINEER) and the FDEP Dam Safety Officer.

Section 5.0 EAP Distribution, Review, Revision, Training and Exercises

The following sections provide instructions for distribution, annual review and update, training, and exercises for the EAP.

# Section 5.1 EAP Distribution

At a minimum, the EAP should be assigned to the persons/entities identified in the Notification Charts. The assignment of each copy of the EAP should be recorded in Appendix D-1: *Record of Holders of Control Copies of this EAP***.** This form should be filled out with the name of the agency, contact person, and contact information for all holders of a copy of the EAP.

A copy of the complete up-to-date EAP should be available to the dam operator, local emergency management personnel, and other local officials. Include a form on which the dam owner and local emergency responder sign a statement that they have reviewed the EAP and concur with the notification procedures (Appendix D-2: *Concurrences)*. Include this signed concurrency form in Appendix D: *Supplementary Information* of the EAP. The DAM OWNER shall keep the form with the original signatures and provide copies to all EAP holders.

Note to **DAM OWNER**: The text in this section may remain unchanged.

See Appendix D-1: *Record of Holders of Control Copies of this EAP* for EAP distribution documentation and Appendix D-2: *Concurrences* for Signatures of key EAP participants assigned roles and responsibilities.

# Section 5.2 EAP Annual Review and Updating

Update the EAP promptly after each change in personnel involved or their telephone numbers. Likewise, conduct a comprehensive review of the adequacy of the EAP with local emergency management officials annually or when there is a significant change in operation, downstream development, or other conditions which affect the plan. The **DAM OWNER** should keep a record of the EAP revisions in Appendix D-3: *Record of Revisions Made to EAP*. The completed form (Appendix D-3) should be included in the EAP revision pages.

Furnish copies of any revisions that result from updating or from periodic testing of the EAP to all who received the original EAP. Establish an internal procedure to ensure that all copies of the EAP are sent to the original EAP holders. The **DAM OWNER** shall use the following paragraphs to assist in completing this portion of the EAP Template.

This plan will be reviewed and updated annually by (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) and personnel from local emergency management agencies in conjunction with (INSERT NAME OF DAM OWNER OR DAM OWNER REPRESENTATIVE)’s annual maintenance inspection of the dam(s). All signatories to this plan are encouraged to attend, to ensure that all names

and contact information are current. If all signatories do not attend, (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will follow up with those entities individually to verify that phone numbers, addresses, and persons identified in the specified positions are current. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) is responsible for updating the EAP document. The EAP document held by (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) is the master document. When revisions occur, (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will provide the revised pages and a revised revision summary page, (Appendix D-3: Record of Revisions Made to EAP) to all the EAP document holders. The document holders are responsible for replacing their outdated pages of the EAP document whenever revisions are received. Outdated pages shall be immediately destroyed to avoid any confusion with the revisions and control access to information.

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# Section 5.3 Training

Training of the persons involved in the EAP should ensure that they are thoroughly familiar with all elements of the plan, the availability of equipment, and their responsibilities and duties under it. The level of detail involved in training is dependent upon the size and complexity of the dam.

Training for employees associated with the dam should be scheduled to familiarize them with the EAP by addressing:

* How to use the EAP
* How to identify problems and their severity
* How to use the notification procedures and the communications equipment
* What resources are available
* The importance of employees’ roles during events
* The importance of updating downstream information

Enough people should be trained to ensure adequate coverage at all times. Keep a record of training completed by key personnel. The training form (Appendix D-4: *Record of Training)* is attached in Appendix D: *Supplementary Information*. All training should be recorded on this form and included in Appendix D: *Supplementary Information* of the master document of the EAP. The **DAM OWNER** shall use the following paragraph to assist in completing this portion of the EAP Template.

(INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will ensure that persons involved in the EAP will be trained so that they are thoroughly familiar with its elements, the availability of equipment, and their responsibilities and duties under the plan. Personnel will be trained in problem detection, evaluation, and appropriate corrective measures. This training is essential for proper evaluation of developing situations at all levels of responsibility. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will keep records of the training provided to those individuals involved in the EAP on form Appendix D-4: Record of Training. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) should keep the training records in Appendix D of the master document and

may provide these records as a revision.

# Section 5.4 EAP Exercises

Exercises simulating dam failures are excellent training mechanisms for ensuring readiness. Cross-training in more than one responsible position for each individual is advisable. Coordinate with state and local officials before any EAP exercises are conducted.

The **DAM OWNER** should conduct a tabletop exercise at least once every five years in the form of a meeting with state and local emergency management officials in a conference room. The exercise should begin with a description of a simulated event and proceed to discussions among the participants to evaluate the EAP and response procedures, and to resolve concerns about coordination and responsibilities. Written documentation of the exercise shall be conducted and any required revisions to the EAP shall be conducted at this time.

The Event Exercise form (Appendix D-5: *Simulated Event Exercise)* is attached in Appendix D: *Supplementary Information*. All exercises should be recorded on this form and included in Appendix D: *Supplementary Information* of the master document of the EAP. The DAM OWNER shall use the following paragraph to assist in completing this portion of the EAP Template.

A tabletop exercise will be conducted at least once every five years. The tabletop exercise involves a meeting between the dam owner or dam owner’s representative and state and local emergency management personnel in a conference room. The exercise begins with a description of a simulated event and proceeds with discussions by the participants to evaluate the EAP and response procedures, and to resolve concerns regarding coordination and responsibilities. (INSERT NAME OF DAM OWNER OR DAM OWNER’S REPRESENTATIVE) will serve as facilitator during the discussion. Appendix D-5: Simulated Event Exercise should be completed to record the exercise and maintained in the master document. Any problems identified during an exercise may prompt revisions to the EAP.

Appendices – Maps, Forms, Resources, Supporting Data and Glossary

**DAM OWNER** shall provide Appendix -A, -B, -C, -D, and -E side tabs for each appendix located in this section. Each appendix description below includes instructions for completing the forms, maps, and other supporting information to include in the Template.

* A – Maps, Tables, and Details
* B – Checklist, Logs, and Report
* C – Resources Available
* D – Supplementary Information
* E – Glossary of Terms

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Appendix A: Maps, Tables, and Details

The following appendices contain the following maps, calculations, and supplementary information:

* Appendix A-1: Project Location Map Example
* Appendix A-2: Project Watershed Map Example
* Appendix A-3: Inundation Maps and Calculations
* Appendix A-4: Plan View of Dam (Limited Distribution)
* Appendix A-5: Profile of Principal Spillway (Limited Distribution)
* Appendix A-6: Reservoir Elevation-Area-Volume and Spillway Capacity Data (Limited Distribution)
* Appendix A-7: National Inventory of Dams (NID) Data (Limited Distribution)

The **DAM OWNER** shall create the maps, perform the inundation calculations, provide the supplementary information, and include this information as part of the EAP behind the Appendix A side tab. Distribution to *Appendices A-4 through A-7* should be limited to the **DAM OWNER’s** master document, and others who need this information, such as the **DAM OWNER’s** engineer, and the State Dam Safety Officer. These forms should not be included in all other copies of the EAP.

**General Mapping Guidelines**

The creation of multiple maps is required to complete the EAP guidelines. There are a number of items that should be included in the various maps as outlined below. The maps presented here in Appendix A are examples of what the various maps could look like and the information they should include. A number of items on each of the following example maps have been circled and numbered to identify different components that should be included on the map and a general description of that data. The actual maps created should not include these circles and numbers. There are shared map components that will be needed on all of the maps and there are also other specific items that are unique to the map on which they appear. A brief summary of the various items is presented here:

Maps to include in **Appendix A** of the EAP:

1. **Project Location Map:** This map shows the general location of the dam and reservoir, typically on a regional scale.
2. **Project Watershed Map:** This map shows the watershed or basin boundaries of the dam and reservoir. This map is typically zoomed in closer to the area of the study than with the Project Location Map.
3. **Inundation Map:** This is the dam breach flood map that shows an area of inundation that has been estimated based on a photo-based analysis or engineering analysis. A SIMS engineering analysis is described in detail in Appendix A-3 below.

**Shared Map Components to Include:**

The numbers and descriptions outlined here are identified with the same numbers on each of the maps.

1. Quick Reference Map Title: This is an abbreviated map title with larger text to quickly identify the map.
2. North Arrow and Scale: A north arrow or direction marker should be used to identify the map and project orientation. The scale bar is another required item that shows the correlation between the map and the actual distance portrayed.
3. Map Legend / Key: This critical piece of information explains the meaning of the various lines, shapes, and symbols that are used in the map.
4. Potential Flood Inundation Area: While this information is required in the Inundation Map, it can be optionally included in the Project Location Map and Project Watershed Map as helpful supplementary information. Details for estimating the inundation area are provided in Appendix A-3.
5. Dam Reservoir: This is the boundary of the reservoir or water body impounded by the dam. The outline may already be present on USGS Quadrangle maps but this may need to be verified as some delineations will change over time due to various circumstances. This boundary should be well defined and should be a relatively accurate representation of the water surface acreage that is to be calculated in Appendix A-3. Though it should be well defined on the map, take caution to not thicken or distort the boundary line too much as it will skew the representation.
6. Roads and Highways: It is important to show the location of major and local roads and have them labeled. It is recommended to label all the roads on the map that are used to provide directions (Directions to the Dam) in the Dam Description and Potential Impact Area Summary subsection of the EAP Overview.
7. Title Block: This shall contain at a minimum the name of the dam, NID No., county, source of the map data shown with date (i.e.-USGS Feb 2010), and the figure number and formal name of the map.
8. Base Map: This is simply the basic underlying layer of the map and may vary. Common examples include: USGS Quad maps, aerial photographs and satellite imagery, some of which may be obtained free from online services.

**Unique Map Components to Include:**

These numbered circles may appear on each example map but identify unique items specific to the map types as outlined here:

**Project Location Map (Appendix A-1)**

1. Vicinity Map: (Also included in the Project Watershed Map) This is a smaller view frame inserted into the main project location map. This second viewport is typically zoomed out much farther than the main map to show on a broader scale, the location of the project. The vicinity map within the location map example shown in this document shows most of the state of Florida and the area of the state in which it is located.
2. County Lines and Labels: At certain scaled views or for projects near county borders, it is recommended to include the county line delineations to help identify nearby areas that may also be affected by a dam breach and may need to be involved in the EAP process.

**Project Watershed Map (Appendix A-2)**

1. Vicinity Map: (Also included in the Project Location Map) This is a smaller view frame inserted into the main project watershed map. This second viewport is typically zoomed out much farther than the main map to show on a broader scale, the location of the project. The vicinity map within the watershed map example shown in this document shows the county of the dam location and portions of surrounding counties.
2. Watershed / Basin Boundaries: This is the watershed or basin boundary of or surrounding the dam and reservoir. This map is typically zoomed in closer to the area of the study than with the Project Location Map. Labels and boundary lines should be used to identify the different watersheds or basins that are present in the surrounding area. These boundaries may help identify areas that could be affected by a dam breach.

**Inundation Map (Appendix A-3)**

These maps may consist of different kinds of base maps to show different information. There are two examples provided in this document that show the potential flood inundation area; the first uses an aerial photograph and the second uses a USGS Quad map. The data included in each of the two maps are the same.

9) Flood Inundation Location: The area that is estimated to be inundated in the event of a dam breach should be shaded in on the map. Callouts that contain information about the projected inundation conditions at specific locations should be included on the map. The callouts should include the distance downstream from the dam, the peak flood wave depth, the peak flood wave stage (elevation), and the peak flood wave arrival time that could be expected. The estimation methods and calculation forms are contained in Appendix A-3.

10) Reservoir/Lake Data: While the boundary of the water body should already be included (Shared Map Item Number 5), on the flood inundation map, additional information regarding the water body should also be shown. The water body should be clearly labeled as well as include the elevation for which the flood breach surface acreage was calculated.

11) Points of Interest: Typically it is beneficial to label locations such as roadways, bridges, homes, neighborhoods, nearby cities or towns, or any other significant location within the inundation area. Structures or other features within the vicinity of the dam that may serve as directional landmarks to emergency responders should also be labeled on the map.

# Appendix A–1: Project Location Map

Note to **DAM OWNER**: The Project Location Map needs to be provided by the **DAM OWNER**. An example has been included below as guidance to the **DAM OWNER**. **DAM OWNER** should obtain the USGS Quad Map in one of the following ways:

1. [Download a copy of the USGS map](http://store.usgs.gov/b2c_usgs/usgs/maplocator/(xcm=r3standardpitrex_prd&layout=6_1_61_48&uiarea=2&ctype=areaDetails&carea=%24ROOT)/.do) needed from the following website: http://store.usgs.gov/b2c\_usgs/usgs/maplocator/(xcm=r3standardpitrex\_prd&layout=6\_1\_61\_48&uiarea=2&ctype=areaDetails&carea=%24ROOT)/.do (Note: Follow on-screen instructions for downloading a copy of the USGS map in your area).
2. [Purchase a copy of the USGS map](http://store.usgs.gov/b2c_usgs/usgs/z_usgspartnerlistmap/(xcm=r3standardpitrex_prd&layout=6_1_61_75&uiarea=2&ctype=areaDetails&carea=%24ROOT)/.do) from one of the dealers indicated on the following website: http://store.usgs.gov/b2c\_usgs/usgs/z\_usgspartnerlistmap/(xcm=r3standardpitrex\_prd&layout=6\_1\_61\_75&uiarea=2&ctype=areaDetails&carea=%24ROOT)/.do
3. [Contact your closest USGS office](http://www.usgs.gov/contact_us/?state=FL) for the ability to view their USGS map products by appointment at the following website: (http://www.usgs.gov/contact\_us/?state=FL)

**Appendix A–1: Project Location Map**

# Lake Grady Dam is located in central Hillsborough County, Florida. This map includes circles highlighting the shared and unique map components, numbers 1 through 10, discussed previously.

# Appendix A–2: Project Watershed Map

The Project Watershed Map needs to be provided by the **DAM OWNER**. An example has been included below as guidance to the **DAM OWNER**. **DAM OWNER** should obtain a copy of the USGS Quadrangle map in one of the methods identified in **Appendix A-1 Project Location Map.** Obtain the latest watershed areas and boundaries from your local Water Management District. To access any of the five WMDs, go to <http://www.dep.state.fl.us/secretary/watman> and select a WMD on the State map that is shown on this website.

**Appendix A–2: Project Watershed Map**

# The immediate and surrounding watersheds for Lake Grady Dam are shown on this aerial map. This map includes circles highlighting the shared and unique map components, numbers 1 through 10, discussed previously.Appendix A–3: Inundation Map and Calculations

The Inundation Map needs to be provided by the **DAM OWNER**. This appendix contains step by step instructions for collecting the geographic and dam parameter data, calculating an area of inundation, and preparing Simplified Inundation Maps (SIMS). The SIMS engineering analysis presented below is based on empirical estimates of peak discharge at the time of dam failure. An example of completed calculations and the resulting SIMS for an “Example Dam” (an earthen dam) are included to provide guidance to the **DAM OWNER**.

Note to **DAM OWNER**: The completed calculations should be included in *Appendix A-3* of the EAP Template to support the prepared inundation map(s). Alternatively, if a hydraulic and hydrologic modeling evaluation is performed, the model input and output data should be included in *Appendix A-3*.

The instructions that follow are the recommended procedure for developing an inundation map, but variations may be acceptable.

**Geographic and Dam Parameter Data Collection**

**Topographic and Aerial Maps:**

Obtain a copy of the latest USGS Quad Map by using one of the methods identified in the instructions for Appendix A-l *Project Location Map.* The best available aerial photographs of the potential inundation area should also be obtained to identify homes and structures that may be affected by a flood. Obtain a digital copy of the aerial image at the following website: <http://www.usgs.gov/pubprod/>

Follow the on-screen instructions for the download of the aerial images.

**Site Inspection:**

A visual inspection of the dam and its vicinity, including the downstream channel and potential impact areas, should be performed before creating a dam breach inundation map to field-verify the accuracy of the base maps and to evaluate the dam height and values for the channel morphology parameters to use in the inundation calculations. Values for the following features will be necessary at each location of interest to complete the SIMS engineering analysis presented below:

* Hydraulic cross-sectional area
* Hydraulic radius
* Average channel (bottom) slope
* Mannings roughness coefficient

**Approximate Distance to Downstream River/Ocean:**

This parameter identifies the distance to the closest water body capable of absorbing or dissipating the flood wave resulting from a full dam breach. This distance is the distance the flood wave will travel before dissipating and terminating; at this point the flood wave will no longer be a threat to downstream features. The distance is estimated in feet and/or miles. Flow termination occurs when this peak flow reaches a water body with the capacity to handle this incoming flow. A water body’s capacity to handle a flow generally means there will be a negligible rise in water surface elevation and/or adverse impacts such as erosion, scour, and risk to homes or structures.

**Simplified Inundation Map Preparation**

In preparing the Simplified Inundation map needed for the EAP, identify the dam data and the downstream channel properties in the blanks and table provided below. This information will be used in the Simplified Engineering Analysis below to calculate parameters needed to create the inundation map for the dam.

The following calculations are to be performed by (INSERT NAME OF INDIVIDUAL PERFORMING CALCULATIONS) so the inundation map can be created. The following calculations are based on information provided in the Federal Energy Regulatory Commission’s (FERC) Engineering Guidelines for the Evaluation of Hydropower Projects Chapter 2 - Selecting and Accommodating Inflow Design Floods for Dams – Appendix II-A. Please note that this document will not calculate any values itself, the calculations should be done using a calculator or computer software and the results should be input in these forms.

Enter the dam data in the Dam Key Data Table below using the same information entered in the *Dam Description Table in the EAP Overview Section* of the EAP Template.

Dam Name:

Location: City: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ County: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approx. Distance to Downstream River/Ocean:

       Feet ÷ 5,280 (feet per mile) =       miles

Reservoir Surface Elevation:        Feet

*Note: Helpful Hints and references to EAP Instruction Manual shown in [ ] symbols.*

**Dam Key Data Table:**

Height of dam = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_feet

Normal storage = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_acre-feet

Maximum storage = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_acre-feet

Reservoir surface area = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_acres

Manning’s roughness coefficient = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Enter the channel properties downstream of the dam location below.

**Downstream Channel Properties Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location i  (Reach) | Distance xi Downstream of Dam  miles | Average Channel Bottom Slope (S)  ft/ft | Average Channel  Side Slope (z) (H:1V)  ft/ft | Channel Bottom  Elevation (b)  Feet NGVD |
| 1 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| 2 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| 3 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| 4 | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |

**Simplified Engineering Analysis Steps**

Step 1 – Determine the peak discharge (flow rate) at the dam, referred to as the Dam Breach Peak Discharge (Qp), using the empirical estimates available in the literature:

Empirical equations for predicting the Dam Breach Peak Discharge from a breached embankment dam have been developed by different investigators. The equations relate the peak discharge to the height and/or the volume of water behind the dam. Five empirical equations for calculating a Dam Breach Peak Discharge are considered in the SIMS engineering analysis provided below for the Example Dam; the United States Bureau of Reclamation (USBR (1988)), Evans (1986), Froehlich (1995), Pierce (2008) and the National Weather Service Simplified Dam Break Model (NWS SMPDK (1984)). A reasonably conservative value for the Dam Breach Peak Discharge should be selected from the resulting range of estimates. The five empirical equations considered are as follows:

Procedure Empirical Equation Units for Qp, H and Vr

USBR (1988): *Qp = 75H1.85* ft3/s and ft

Evans (1986): *Qp*= 0.72*Vr*0.53 m3/s and m3  Froehlich (1995): *Qp* = 40.1*Vr*0.295*H*1.24 t3/s, acre-feet and ft

Pierce (2008) *Qp* = 0.038*Vr0.475H1.09* m3/s, m3 and m

NWS SDBM (1984): ft3/s and ft

where: Qp = Dam Breach Peak Discharge.

Vr = Reservoir volume.

H = Height of water in reservoir.

W = Base width of breach (feet).

τ = Breach formation time (hours).

C = 23.4As/W

As = Surface area of reservoir at H (acres).

Note 1: Degree of uncertainty in the estimated Dam Breach Peak Discharge (Qp)

The USBR and Evans empirical equations use only one variable parameter, water height and reservoir volume, respectively, to predict the Peak Discharge from a breached embankment dam. Thus, the equations may overestimate or underestimate the Peak Discharge. The estimated Peak Discharges could have a high degree of uncertainty and should not be relied upon without comparison with estimates from multivariable empirical equations. The Pierce, the Froehlich and the NWS SMPDK empirical equations are based on multivariable relationships, using both water height and reservoir volume of water behind the dam to predict the Peak Discharge. The Pierce empirical equation is based on a multiple regression analysis of a composite database of eighty-seven (87) cases studies. According to Pierce, et al. (2010), the Pierce predictor equation is suited for practical applications where a best estimate of the Peak Discharge is desired. It yields less conservative values of Peak Discharge, compared to other regression relationships, such as the Froehlich and the NWS SMPDK predictors. For these reasons it is recommended to use several empirical equations and compare the results before selecting a Peak Discharge.

Note 2: Estimation of breach formation time (τ)

The breach formation time (τ) is usually estimated from rules of thumb:

τ = *H*/10, where H is the depth (feet) of water at time of breaching and time is in minutes. This approach is based on relations in the NWS SMPDK model. The values of τ for the dams used in the model ranged from 0.1 to 2.0 hours.

τ = 0.02*H* + 0.25, where τ is in minutes and H in meters, based on Von Thun and Gillette equations for erosion resistant dams.

; where Vr is in meter3 and H is in meters. This approach is based on Froehlich equations.

The breach formation time should be selected based on the range of values estimated from the methods, as well as personal knowledge of the conditions of the dam embankment. Verbal communication with other investigators indicates that it could take a minimum of 15 minutes for a breach to fully develop in most embankment dams.

Step 2 - Determine the peak discharge (Qi) at locations i of interest downstream of the dam:

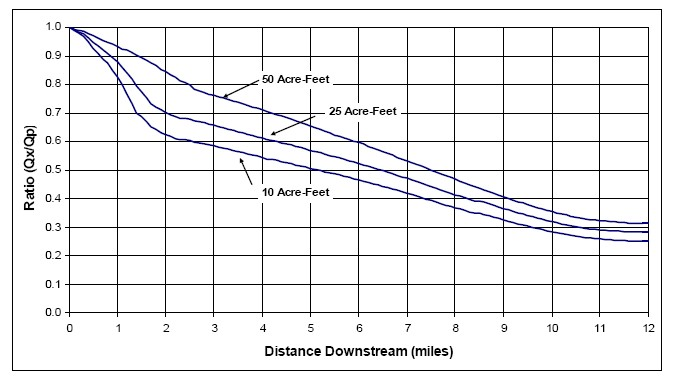
Attenuate the Dam Breach Peak Discharge (Qp), obtained from Step 1, using the Generalized Flood Attenuation Curves shown below (Washington State Department of Ecology, 2007). Assuming the location i is at a distance xi (miles) downstream of the dam, determine the peak discharge (Qi) using the attenuation curve corresponding to the reservoir volume (acre-feet) to obtain the attenuation ratio (*Ratio (Qi/Qp)*). Then, calculate Qi using the following equation:

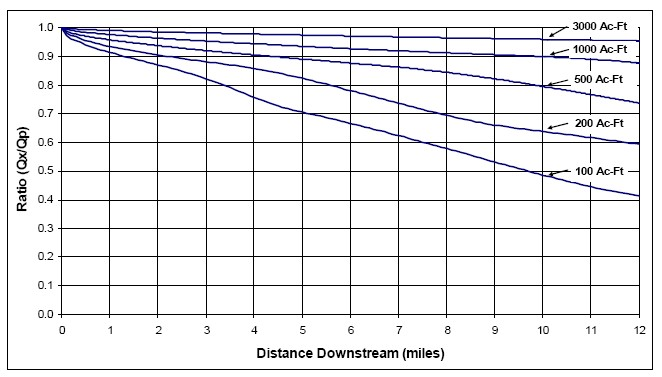
*Qi*= *Qp*x *Ratio* (*Qi/Qp*)

where: *Qi* = Peak discharge (cfs) at a distance xi downstream of dam

Ratio (Qi/Qp) = Reduction (ratio) of flood peak discharge at distance xi downstream of the dam

Note: *Ratio* (*Qi/Qp*) is equal to the *Ratio* (*Qx/Qp*) in the Generalized Flood Attenuation Curves shown below.





GENERALIZED FLOOD ATTENUATION CURVES

Washington State Department of Ecology (2007)

Enter the results of the calculations from Step 2 in the Table below.

Qi calculated at the four locations in table above using selected Qp

|  |  |  |
| --- | --- | --- |
| Location | Calculated Qi | Ratio Qi/Qp |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

Step 3 - Determine peak flood wave depth (yi) and peak flood wave arrival time (Tai) at the locations i downstream of the dam:

A key step in obtaining these parameters is solving Manning’s equation for the peak flood wave depth (yi) and cross-sectional area (A), using the peak discharge (Qi) obtained from Step 2 and the flow channel cross-sectional geometry. Assume steady state flow at peak discharge.

Manning’s Equation:

*Qx*= (1.49*AR*2/3*S*1/2)/*n* OR n*Q*i/1.49 (*S*1/2) = *A*(*R*2/3)

where: Qi = Peak discharge at a distance xi downstream of the dam (cfs)

A = Flow area (hydraulic cross-sectional area) at the location i downstream of the dam (ft2)

R = Hydraulic radius (ft)

S = Average channel (bottom) slope (ft/ft)

n = Manning’s roughness coefficient

Channel Cross-sectional Geometry:

The cross-section of a typical channel is trapezoidal in shape, as shown below. The equations for determining the cross-sectional area, the hydraulic radius and the top width are as follows:

d

1

z

y

y

b

*A* = *by* + *zy*2

*R* = *A/* [*b* + 2*y* (1+*z*2)0.5]

*d = b +* 2*zy*

where: d = Top width, ft

b = Bottom width, ft

z = Average side slope (Horizontal : Vertical), ft/ft

y = Water depth, ft

A = Cross-sectional area, ft2

R = Hydraulic radius, ft

The bottom and side slopes of the channel may be uniform or may vary significantly with distance downstream of the dam. For this reason, average channel properties may be estimated for the entire channel or for reaches between i locations. For example, an average channel bottom slope and an average side slope could be calculated for an entire channel if the channel is fairly uniform. However, different slopes could be calculated for the reaches between i locations where the channel slope varies.

Step 3(a) – Determine peak flood wave depth (yi):

For each location i, solve the Manning’s equation by a trial and error process. First, compute the value of the expression {*nQi*/1.49 (*S*1/2)} using the peak discharge (Qi), the Manning’s roughness coefficient (n) of the channel and the channel bottom slope (S). Next, assume a value of the peak flood wave depth (yi), calculate the corresponding cross-sectional area (A) and the hydraulic radius (R) of the channel. Then calculate the expression {*A*(*R*2/3)}. Compare the results of the expressions {*nQi*/1.49(*S*1/2)} and {*A*(*R*2/3)}. If the values are not equal, assume other values of yi and repeat the processuntil there is a close match between the values of the expressions {*nQi*/1.49 (*S*1/2)} and {*A*(*R*2/3)}. The value of yi that results in a close match is the peak flood wave depth.

Note: The peak flood wave stage at each location i may be determined using the peak flood wave depth (yi) as follows (this is the elevation where the peak flood wave will laterally intersect the land surface):

*Peak Flood Wave Stage at Location i*

*= Peak Flood Wave Depth* (yi)

*+ Channel Bottom Elevation at Location i*

Step 3(b) - Determine the peak flood wave travel time (Ti) and the peak flood wave arrival time (Tai):

Suppose there are m locations of interest at distances x downstream of the dam. Each location i (i = 1, 2, 3,…, m) is at xi distance downstream of the dam. The flood wavevelocity (Vi) at location i can be calculated using the peak discharge (Qi) and the channel cross-sectional area (Ai) corresponding to the peak flood wave depth (yi) as follows:

*Vi = Qi / Ai* (i = 1, 2, 3,…, m)

The time (Ti) it takes the flood wave to travel the distance xi is calculated as follows:

where: Ti = Flood wave travel time (s).

xi = distance downstream from the dam (ft)

xo = zero (0) feet, which is the location of the dam.

Vi = Flood velocity (ft/s) at location i downstream of the dam.

The peak flood wave arrival time (Tai) at location i can be determined by summing up the peak flood wave travel time and the breach formation time (τ):

*T ai = Ti* + *τ*  (i = 1, 2, 3,…, m)

**Summary of Results**

The detailed formulas provided above in Steps 1, 2 and 3 should be used to calculate the Peak Flood Wave Depth, Peak Flood Wave Stage, Peak Flood Wave Travel Time and Peak Flood Wave Arrival time for all locations identified above in the *Downstream Channel Properties Table*. These calculations will be used for the Simplified Inundation Map. *(Note: an example of the calculations is provided in the Instruction Manual)*. Use the table below to enter the results of the simplified inundation mapping calculations for the four locations.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Location i | Distance xi  Downstream  of Dam miles | Peak Flood Wave Depth yi (feet) | Peak Flood Wave Stage  (feet NGVD) | Peak Flood Wave Travel Ti Time (min) | Peak Flood Wave Arrival Time Tai (min) | | 1 |  |  |  |  |  | | 2 |  |  |  |  |  | | 3 |  |  |  |  |  | | 4 |  |  |  |  |  | |

Note: It is customary to add an additional two feet to the final peak flood wave depths and stages (calculated using the original peak flood wave depth) on the SIMS inundation map estimate. The addition of two feet should be footnoted. Also, the peak flood wave arrival times may be rounded down to the nearest minute.

**SIMS Calculation Example**

Below is an example dam with identified downstream channel properties and the calculations for the parameters needed to create the Simplified Inundation Map. A summary table of the results of the calculations is included at the end of the example. The example maps following the calculations display the results of the example below.

**Example Dam Key Data Table:**

Height of dam = 25 feet

Normal storage = 1,360 acre-feet

Maximum storage = 1,870 acre-feet

Reservoir surface area = 164 acres

Manning’s roughness coefficient = 0.09

**Downstream Channel Properties Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location i  (Reach) | Distance xi Downstream of Dam miles | Average Channel Bottom Slope (S)  ft/ft | Average Channel  Side Slope (z) (H:1V) ft/ft | Channel Bottom  Elevation (b)  Feet NGVD |
| 1 | 0.40 | 0.0024 | 28 | 20 |
| 2 | 0.60 | 0.0023 | 46 | 17.5 |
| 3 | 0.80 | 0.0027 | 29 | 15 |
| 4 | 1.15 | 0.0032 | 10 | 10 |

**Simplified Inundation Map Calculations for the Example Dam**

Step 1 – Estimate the Dam Breach Peak Discharge (Qp)using the Key Data (see table above) and the empirical equations:

|  |
| --- |
| 1. USBR (1988)   =28,920 cfs |
| 1. Evans (1986)   =1700 m3/s =59,930 cfs |
| 1. Froehlich(1995)   =20,030 cfs |
| 1. Pierce (2008)   =3650 m3/s =12,890 cfs |
| 1. NWS SMPDK   Model (1984)  Estimate *W* for earthen dam: (W = 75 feet for the Example Dam).  Calculate C: C = 23.4As/W = 23.4 (164/75) = 51.168  Estimate breach formation time (τ) using the following rules of thumb:  = 2.5 minutes; H is depth (feet) of water at time of breaching and time is in minutes. This approach is based on relations in the NWS SMPDK model  0.1 hours = 6 minutes (based on the lower range of the values used in the NWS SMPDK model: 0.1 to 2.0 hours).  = 0.4 minutes (τ is in minutes and H in meters), based on Von Thun and Gillette equations for erosion resistant dams.  = 58 minutes; Vr is in meter3 and H is in meters. This approach is based on Froehlich equations.  The breach formation times estimated above are 0.4, 2.5, 6, and 58 minutes, respectively.  Based on the site-specific conditions of the dam, a breach formation time of 15 minutes (0.25 hours) was selected. The Dam Breach Peak Discharge Qp was then calculated using the NWS SMPDK empirical equation as follows:  = 27,030 cfs |

Based on the range of values calculated (Pierce: 12,890; Froehlich: 20,030; NWS SMPDK: 27,030; USBR: 28,920; and Evans: 59,930 cfs), a conservative Dam Breach Peak Discharge, Qp equal to 28,000 cfs was selected for use in the next step.

Step 2 – **Determine peak discharge (Qi) at four locations using the “*Generalized Flood Attenuation Curves.*”**:

Four downstream locations of interest, Locations 1 through 4, were established for the Example Dam. The channel properties in each reach are provided in the *Downstream Channel Properties* table above. The Dam Breach Peak Discharge (Qp = 28,000 cfs) was obtained from Step 1 above. Based on the reservoir maximum storage of 1,870 acre-feet (see *Key Data* table), approximate flood attenuation ratios (*Ratio (Qi/Qp)*) of 0.99 and 0.98 were obtained from the *Generalized Flood Attenuation Curves*, at downstream distances of up to 0.60 mile and 1.15 miles from the dam, respectively.

The peak discharges at Locations 1 and 2, Q1 and Q2, respectively, were calculated as and , which are approximately 27,700 cfs. The peak discharges at Locations 3 and 4, Q3 and Q4, respectively, were calculated as and which are approximately 27,400 cfs.

Step 3(a) – **Determine peak flood wave depth (yi)**:

At x = 0.40 mile (2,112 feet), calculate using the Example Dam Channel Properties (see table):

Assume y = 16.0 ft: START HERE

Try y =17.0 ft:

Try y = 16.7 ft:

;

Peak Flood Wave Depth at Location 1 (y1) = 16.7 ft.

Peak Flood Wave Stage at Location 1 = 36.7 ft NGVD

Step 3(b) – **Determine the peak flood wave arrival time (Tai):**

Peak Flood Wave Arrival Time at Location 1 (Ta1) = 25.4 min

**Summary of Results**

The detailed calculations provided above for Location 1 of the downstream channel illustrate the simplified inundation mapping calculations (Steps 1, 2 and 3). The Step 3 calculations were also performed for the other three downstream locations (reaches) of the channel using the data presented in the *Downstream Channel Properties Table* and the peak discharges determined from Step 2. The table below is a summary of the results of the simplified inundation mapping calculations for the four locations.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Location i | Distance xi  Downstream  of Dam (miles) | Peak Flood Wave Depth yi (feet) | Peak Flood Wave  Stage  (feet NGVD) | Peak Flood Wave Travel Ti Time (min) | Peak Flood Wave Arrival Time Tai (min) | | 1 | 0.40 | 16.7 | 36.7 | 10.4 | 25.4 | | 2 | 0.60 | 14.1 | 31.6 | 16.4 | 31.4 | | 3 | 0.80 | 16.1 | 31.1 | 21.4 | 36.4 | | 4 | 1.15 | 27.7 | 37.7 | 30.7 | 45.7 | |

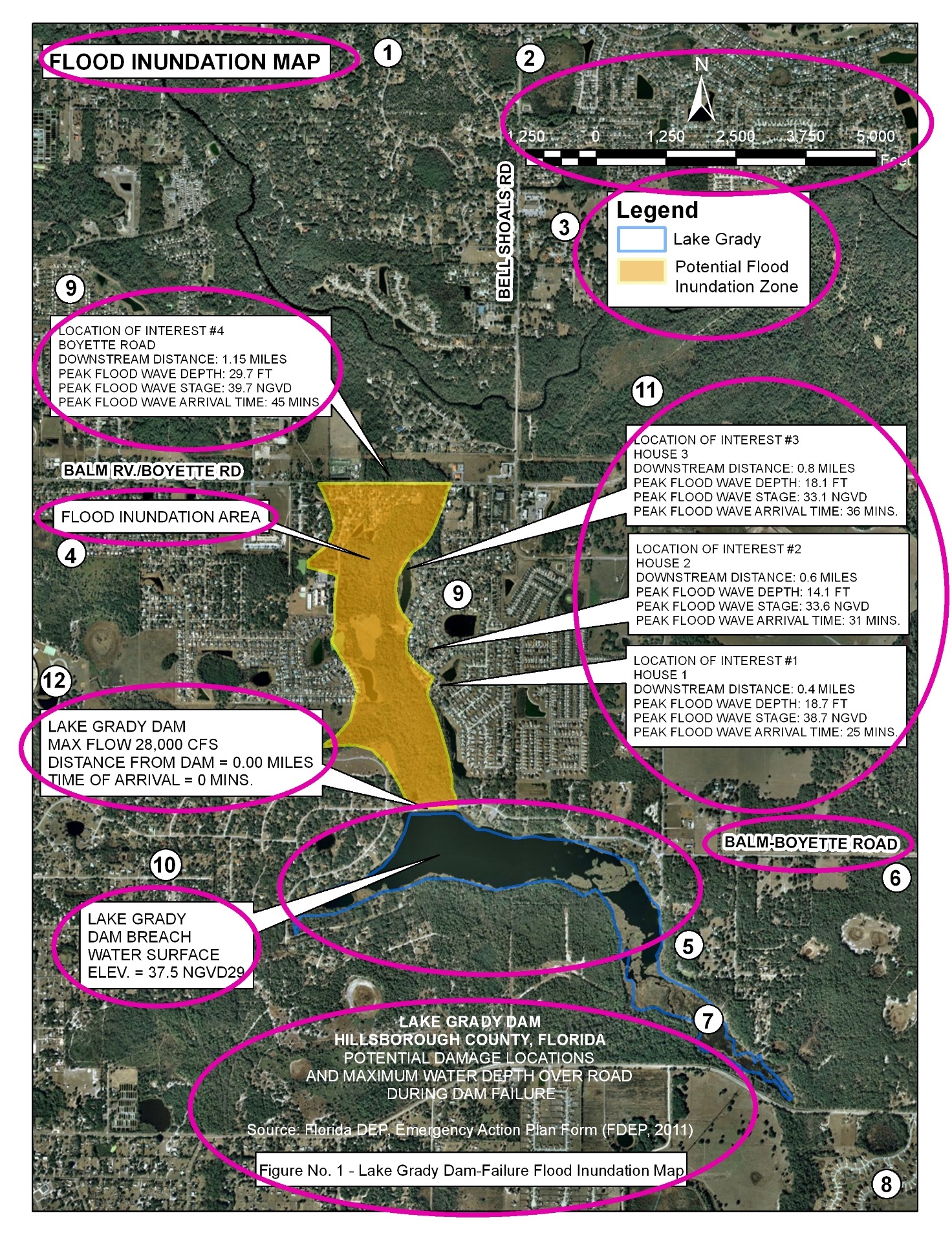
The actual results of the SIMS calculations are presented above. It is customary to add an additional two feet to the peak flood wave depths and stages shown on the SIMS to provide a protective estimate. Also, the peak flood wave arrival times may be rounded down to the nearest minute.

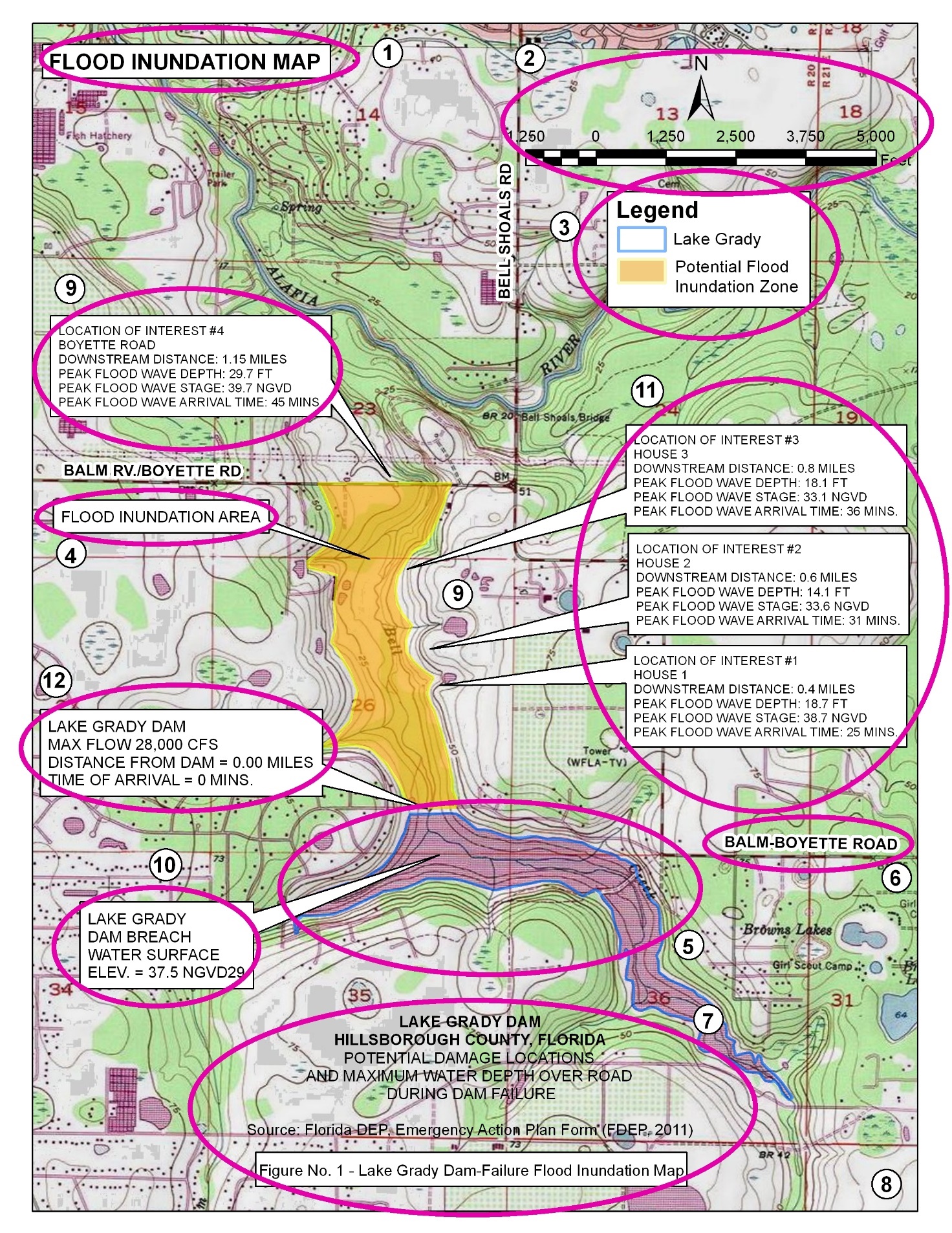
**Simplified Inundation Maps**

Create an inundation map or maps using either a topographic map or aerial map or both showing the shared and unique SIMS components described in the introduction of Appendix A. The shared map components consist of a quick reference map, a north arrow and scale, a map legend / key, an inundation area, the dam reservoir, roads and highways, title block, and base map. The features that are unique to the SIMS are the callouts containing the peak flood wave depth and stage and peak flood wave arrival time for each location of interest within the inundation area, the dam breach elevation, and points of interest, such as structures within the inundation area and area landmarks.

Note to **DAM OWNER**: It is recommended that a disclaimer, such as the one that follows, be included on each inundation map: “…the methods, procedures and assumptions used to develop the flooded areas, the limits of flooding shown and flood wave travel times are approximate and should only be used as a guideline for establishing evacuation zones. Actual areas inundated will depend on actual failure of flood conditions and may differ from areas shown on the maps…” (FERC 2007).

Appendix A–3: Inundation Map with Aerial

Appendix A–3: Inundation Map with Quad Map

A**ppendix A–4: Plan View of Dam**

The Plan View of the Dam needs to be provided by the **DAM OWNER**. An As-Built Plan View is acceptable to meet this requirement. Distribution of this appendix should be limited to the **DAM OWNER’s** master document, and others who need this information, such as the DAM OWNER’s engineer, and the State Dam Safety Officer. A plan view of the dam should not be included in all other copies of the EAP.

# Appendix A–5: Profile of Principal Spillway

The Profile of the Principal Spillway of the Dam needs to be provided by the **DAM OWNER**. An As-Built Profile View of the Spillway is acceptable to meet this requirement. Distribution of this appendix should be limited to the **DAM OWNER’s** master document, and others who need this information, such as the DAM OWNER’s engineer, and the State Dam Safety Officer. A profile of the principle spillway should not be included in all other copies of the EAP.

# Appendix A–6: Reservoir Elevation-Area-Volume and Spillway Capacity Data

Note to **DAM OWNER**: This information should be available in the dam design documentation or calculations. **DAM OWNER** should fill out the information requested below and distribution of this appendix should be limited to the **DAM OWNER’s** master document, and others who need this information, such as the DAM OWNER’s engineer, and the State Dam Safety Officer. **The reservoir elevation-area-volume and spillway capacity data should not be included in all other copies of the EAP.**

(Limited Distribution)

**DAM NAME:** (INSERT DAM NAME)

**NID No.:** (INSERT NID ID No.)

|  |  |  |  |
| --- | --- | --- | --- |
| **Elevation** | **Reservoir Surface Area (acres)** | **Reservoir Storage Volume (acre-feet)** | **Spillway Discharge**  **(ft3/s)** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Principal Spillway Crest | | | |
| **Elevation** | **Reservoir Surface Area (acres)** | **Reservoir Storage Volume (acre-feet)** | **Spillway Discharge**  **(ft3/s)** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Auxiliary Spillway Crest | | | |
| **Elevation** | **Reservoir Surface Area (acres)** | **Reservoir Storage Volume (acre-feet)** | **Spillway Discharge**  **(ft3/s)** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# Appendix A–7: National Inventory of Dams (NID) Data

Note to **DAM OWNER**: Use the following definitions to help complete the form that follows. Distribution of this appendix should be limited to the **DAM OWNER’s** master document, and others who need this information, such as the DAM OWNER’s engineer, and the State Dam Safety Officer. This form should not be included in all other copies of the EAP.

* Dam Name = Official name of the dam. Abbreviations should not be used unless part of the official dam name. For dams that do not have an official name, use the popular name.
* State = Enter the name of the State in which the dam is located.
* NID ID = Enter the official NID identification number for the dam, known formerly as the National ID. The first two characters of the identity are the state two-letter abbreviation. Typically, the last five characters of the identity are a unique number, although the use of alphanumeric combinations is also allowed.
* Longitude = Enter the longitude at the dam centerline as a single value in decimal degrees, NAD83. Longitude coordinates should be negative values.
* Latitude = Enter the latitude at dam centerline as a single value in decimal degrees, NAD 83.
* Geodetic Location = Location of the dam centerline in State Plane (x,y) coordinates.
* County = Enter the name of the County in which the dam is located.
* Stream = Enter the stream designation in accordance to its official name. If the stream does not have a name, identify it as a tributary to a named stream.
* Nearest Town = Enter the name of the nearest downstream city, town or village that is most likely to be affected by floods resulting from the failure of the dam.
* Distance to nearest town = Enter the distance from the dam to the nearest affected downstream city, town or village to the nearest mile (or tenth of a mile, if appropriate).
* Operator = Enter the name of the dam operator.
* Year Constructed = Enter the four digit year when the original dam structure was completed.
* Max. Discharge = Enter the maximum discharge, in cubic feet per second (cfs), which the spillway is capable of discharging when the reservoir is at its maximum designed water surface elevation.
* Max. Storage = Enter the maximum storage, in acre-feet, which is defined as the total storage space in a reservoir below the maximum attainable water surface elevation, including any surcharge storage.
* Normal Storage = Enter the normal storage, in acre-feet, which is defined as the total storage space in a reservoir below the normal retention level. This should include any dead and inactive storage and exclude any flood control or surcharge storage. For normally dry flood control dams, a zero value is acceptable. If value is unknown, please leave value blank and not zero.
* Surface Area = Enter the surface area of the impoundment, in acres, at its normal retention level.
* Drainage Area = Enter the drainage area of the dam, in square miles, which is defined as the area that drains to the dam on a stream.
* Inspection Frequency = Enter the scheduled frequency interval for periodic inspections, in years.
* State Regulated? = Enter “Yes” if the dam meets the state regulatory organization’s definition of a state regulated dam.
* State Reg. Agency = Enter the State regulatory agency, if applicable.
* Federal Funding = Enter the code identifying the federal agency involved in the funding of the dam. If there is more than one, separate by a semi colon. If there are none, leave blank.

USDA NRCS: United States Department of Agriculture, Natural Resources Conservation Service (formerly the Soil Conservation Services (SCS))

USDA FS: United States Department of Agriculture, Forest Service

CE: US Army Corps of Engineers

DOD USA: Department of Defense, US Army

DOD USN: Department of Defense, US Navy

DOD USAF: Department of Defense, US Air Force

DOI BR: Department of Interior, Bureau of Reclamation

DOI BIA: Department of Interior, Bureau of Indian Affairs

DOI BLM: Department of Interior, Bureau of Land Management

DOI FWS: Department of Interior, Fish and Wildlife Service

DOI GS: Department of Interior, Geological Survey

DOI NPS: Department of Interior, National Park Service

DOL MSHA: Department of Labor, Mine Safety and Health Administration

DOE: Department of Energy

* Federal Design = Enter the code identifying which federal agency was involved in the design of the dam. If there is more than one, separate by a semi colon. If there are none, leave blank.
* Federal Constructed = Enter the code identifying which federal agency was involved in the construction of the dam. If there is more than one, separate by a semi colon. If there are none, leave blank.
* Program Authority = Enter the name of the Agency that has authority over the operation of the dam. If there is more than one, separate by a semi colon. If there are none, leave blank.
* Watershed No. = Enter the Watershed ID number for the watershed in which the dam is located. If this number is unknown, leave blank.
* Watershed Name = Enter the name of the Watershed in which the dam is located. If the watershed is unknown, leave blank.
* Service Life = Enter the service life, in years, the dam was originally designed for. If this is unknown, leave blank.
* O&M Insp. Resp. = Enter the entity responsible for the operation and maintenance of the dam.
* O&M Insp. Current? = Enter whether the operation and maintenance inspections are current.
* Population at Risk = Enter the population at risk resulting from a dam failure or misoperation.
* Dam Height = Enter the height of the dam in feet, to the nearest foot. The height is defined as the vertical distance between the lowest point on the crest of the dam and the lowest point in the original streambed.
* Dam Length = Enter the length of the dam, in feet. The length is defined as the length atop the top of the dam. This length should include locks, spillways, etc if attached to the dam.
* Dam Volume = Enter the total number of cubic yards occupied by the materials used in the dam structure. Portions of powerhouse, locks, and spillways are only included if they are an integral part of the dam and required for structural stability.
* Design Hazard Potential = Enter the code to indicate the potential hazard during design to the downstream area resulting from failure or misoperation of the dam or facilities:

L = Low (Failure or misoperation results in no probable loss of human life and low economic and/or environmental losses, limited to the owner’s property).

S = Significant (Failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns).

H = High (Failure or misoperation results in probable loss of human life.

U = Undetermined (Hazard potential has either not been designated or is not provided).

* Current Hazard Potential = Enter the code to indicated the current potential hazard to the downstream area resulting from failure or misoperation of the dam or facilities.
* Hazard Potential Class. Year = Enter the four digit year that the hazard potential was provided for the dam.
* Sediment Storage = Enter the storage area, in acre feet, set aside for sediment deposition.
* Flood Storage = Enter the total storage area, in acre feet, accommodating flood storage above the normal retention level.
* Surcharge Storage = Enter the storage area, in acre feet, between the normal retention level and the maximum attainable water surface elevation.
* Other Storage = Enter the storage area, in acre feet, for any other expected event or use. If there are none, leave blank.
* Principal Spillway Type = Enter the code that describes the type of spillway

C: Controlled

U: Uncontrolled

N: None

* Principal Spillway Conduit Diameter = Enter the spillway conduit diameter, in inches.
* Auxiliary Spillway Type = Enter the code that describes the type of spillway.
* Auxiliary Spillway Width = Enter the width of the spillway in feet, to the nearest foot, available for discharge when the reservoir is at its maximum designed water surface elevation.

**Appendix A–7: National Inventory of Dams (NID) Data**

|  |  |
| --- | --- |
| Federal constructed: | **\_\_\_\_\_\_\_** |
| Program authority: | **\_\_\_\_\_\_\_** |
| Watershed number: | **\_\_\_\_\_\_\_** |
| Watershed name: | **\_\_\_\_\_\_\_** |
| Service life: | **\_\_\_\_\_\_\_years** |
| O&M inspection responsibility: | **\_\_\_\_\_\_\_** |
| O&M inspection current?: | **\_\_\_\_\_\_\_** |
| Population at risk: | **\_\_\_\_\_\_\_** |
| Dam height: | **\_\_\_\_\_\_\_feet** |
| Dam length: | **\_\_\_\_\_\_\_feet** |
| Dam volume: | **\_\_\_\_\_\_\_yd3** |
| Design hazard potential: | **\_\_\_\_\_\_\_** |
| Current hazard potential: | **\_\_\_\_\_\_\_** |
| Hazard potential classification year: | **\_\_\_\_\_\_\_** |
| Sediment storage: | **\_\_\_\_\_\_\_acre-feet** |
| Flood storage: | **\_\_\_\_\_\_\_acre-feet** |
| Surcharge storage: | **\_\_\_\_\_\_\_acre-feet** |
| Other storage: | **\_\_\_\_\_\_\_acre-feet** |
| Principal spillway type: | **\_\_\_\_\_\_\_** |
| Principal spillway conduit diameter: | **\_\_\_\_\_\_\_inches** |
| Auxiliary spillway type: | **\_\_\_\_\_\_\_** |
| Auxiliary spillway width: | **\_\_\_\_\_\_\_feet** |

|  |  |
| --- | --- |
| Dam name: | **\_\_\_\_\_\_\_\_\_\_** |
| State: | **\_\_\_\_\_\_\_\_\_\_** |
| NID ID: | **\_\_\_\_\_\_\_\_\_\_** |
| Longitude: | **\_\_\_\_\_\_\_\_\_\_** |
| Latitude: | **\_\_\_\_\_\_\_\_\_\_** |
| Geodetic location: | **\_\_\_\_\_\_\_\_\_\_** |
| County: | **\_\_\_\_\_\_\_\_\_\_** |
| Stream: | **\_\_\_\_\_\_\_\_\_\_** |
| Nearest town: | **\_\_\_\_\_\_\_\_\_\_** |
| Distance to nearest town: | **\_\_\_\_\_\_\_\_\_\_miles** |
| Operator: | **\_\_\_\_\_\_\_\_\_\_** |
| Year constructed: | **\_\_\_\_\_\_\_\_\_\_** |
| Maximum discharge: | **\_\_\_\_\_\_\_\_\_\_ft3/s** |
| Maximum storage: | **\_\_\_\_\_\_\_\_\_\_acre-feet** |
| Normal storage: | **\_\_\_\_\_\_\_\_\_\_acre-feet** |
| Surface area: | **\_\_\_\_\_\_\_\_\_\_acre** |
| Drainage area: | **\_\_\_\_\_\_\_\_\_\_mi2** |
| Inspection frequency: | **\_\_\_\_\_\_\_\_\_\_years** |
| State regulated?: | **\_\_\_\_\_\_\_\_\_\_** |
| State regulatory agency: | **\_\_\_\_\_\_\_\_\_\_** |
| Federal funding: | **\_\_\_\_\_\_\_\_\_\_** |
| Federal design: | **\_\_\_\_\_\_\_\_\_\_** |
|  | |

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Appendix B: Checklist, Logs, & Report

The following forms are located within this appendix:

* Appendix B-1: Information for Emergency Management
* Appendix B-2: Action Event Log
* Appendix B-3: Dam Event Situation Report

Note to **DAM OWNER**: Provide the blank forms shown below in the EAP document. Each of these forms will need to be copied and filled out during an event, as described in Section 3.0, Expected Actions. After each form is filled out with the event information, retain the completed forms in the master document of the EAP and provide a copy to each holder of the EAP document. Copies of completed forms should be available, if requested.

#### 

#### Appendix B-1: Information for Emergency Management

The following information provides a description of each item and how the data can be obtained to aid in completion of this section of the EAP:

* Time of Call: This is the time the Dam Owner or Dam Owner’s representative completes the call to the Emergency Management office to notify them of an event.
* Caller name/call back phone number/caller represents: This is the name of the Dam Owner or the Dam Owner’s representative who contacted the Emergency Management Office, a phone number where the caller can be reached by the Emergency Management office and who the caller represents.
* Time/Date of incident: This is the time and date that the event occurred for the dam.
* Location of incident (dam name, street address, city, county): This is where the event occurred. Enter the dam name, street address, city and county where the event occurred.
* Has dam breakage occurred: (Yes/No): This is to identify if a dam break has occurred as part of the event.
* If no break, is it anticipated and time: This is to identify if a dam break is anticipated as part of the event. If a dam break is anticipated enter the approximate time and date that the break may occur.
* Any threat to population: This is where any threat to population would be identified. Describe the threat and approximate location.
* Evacuation (yes/no), (where & how many): This is to identify is any evacuations are necessary. Describe the location of evacuations and approximately how many evacuations are anticipated.
* Injuries (# and severity): This is to identify any injuries that have already occurred with the event. Identify the number of injuries and describe the severity of the injuries.
* Fatalities #: This is to identify any fatalities that have occurred as a result of the event. Identify the number of fatalities that have occurred.
* What agencies are on the scene: This is to identify if any agencies have reported to the scene as a result of the event. Identify all agencies on the scene.
* Any assistance requested: This is to identify any assistance needed from Emergency Management or assistance from other agencies already requested. Identify any assistance needed from Emergency Management as a result of the event.
* Who has been notified: This is to identify all parties/agencies that have already been notified of the event.
* Water capacity of the dam: This is to identify the water capacity of the dam. Identify the amount of water capacity of the dam involved in the event.
* Staging location: This is to identify the location where any agencies and/or parties are meeting and staging to assist with the event. Identify the area that has been designated as the staging location for all parties/agencies.
* Estimated time for repairs: This is to identify the amount of time needed to make the repairs to the dam that will allow the dam to function normally. Identify the amount of time that is estimated to do the necessary repairs.

#### Appendix B-1: Information for Emergency Management

(Typical information requested by emergency management personnel)

1. Time of Call: \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Caller name/call back phone number/caller represents: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Time/Date of incident: \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Location of incident (dam name, street address, city, county): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Has dam breakage occurred: Yes/No
2. If no break, is it anticipated, and time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Any threat to population: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Evacuations (yes/no), (where & how many): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Injuries (# and severity): \_\_\_\_\_\_\_\_\_\_\_\_\_
6. Fatalities #: \_\_\_\_\_\_\_\_\_\_\_\_\_
7. What agencies are on scene: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Any assistance requested: \_\_\_\_\_\_\_\_\_\_\_\_\_
9. Who has been notified: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. Water capacity of dam: \_\_\_\_\_\_\_\_\_\_\_\_\_
11. Staging location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. Estimated time for repairs: \_\_\_\_\_\_\_\_\_\_\_\_\_

#### 

#### 

#### Appendix B-2: Action Event Log

(To be completed during Unusual, Watch, or Warning Events)

Dam name:         County:

When and how was the event detected? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Weather conditions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

General description of the event situation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Event level determination: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Made by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Calls, Information, Actions and Event Progression**

(Include caller’s name, organization, and contact information)

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Time** | **Action / Event Progression** | **Taken by** |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

Report prepared by:       Date:       

#### Appendix B-3: Dam Event Situation Report

(To be completed following the termination of the event)

Dam name:

National Inventory of Dams (NID) No.:

Dam location:       

*(City) (County) (Stream/River)*

Date:       Time:

Weather conditions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

General description of emergency situation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Area(s) of dam affected: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Extent of dam damage: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Possible cause(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Effect on dam’s operation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Initial reservoir elevation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Maximum reservoir elevation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Final reservoir elevation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description of area flooded downstream/damages/injuries/loss of life: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Other data and comments: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Observer’s name and telephone number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Report prepared by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Appendix C: Resources Available

Note to **DAM OWNER**: This form is referenced in *Section 3.4, Locally Available Equipment, Labor, and Materials*. Use this form to document the available resources and include it as Appendix C in the EAP. Update the form as necessary and include the updated form in the revisions of the EAP.

Locally available equipment, labor, and materials: (COMPANY/ENTITY NAME) has/have the following resources that can be utilized in the event of an emergency:

Count: (NO.)Item: (ITEM DESCRIPTION) Count: (NO.) Item: (ITEM DESCRIPTION)

Count: (NO.) Item: (ITEM DESCRIPTION) Count: (NO.) Item: (ITEM DESCRIPTION)

Count: (NO.) Item: (ITEM DESCRIPTION) Count: (NO.) Item: (ITEM DESCRIPTION)

Contact the (CITY, COUNTY, NAME) Road Department — See Emergency Management Services (Table 2.1: *EAP Contact Table*, in Section 2.3 *EAP Contacts*)

Other locally available resources include:

|  |  |  |
| --- | --- | --- |
| **Heavy Equipment Service and Rental**  **(Name/Address/**  **Phone/Website/Email)** | **Sand and**  **Gravel Supply**  **(Name/Address/Phone/**  **Website/Email)** | **Ready-Mix**  **Concrete Supply**  **(Name/Address/Phone/**  **Website/Email)** |
| (ENTER CONTACT INFORMATION) | (ENTER CONTACT INFORMATION) | (ENTER CONTACT INFORMATION) |
|  | | |
| (ENTER CONTACT INFORMATION) | (ENTER CONTACT INFORMATION) | (ENTER CONTACT INFORMATION) |
|  | | |
| **Pumps**  **(Name/Address/Phone/**  **Website/Email)** | **Diving Contractor**  **(Name/Address/Phone/**  **Website/Email)** | **Sand Bags**  **(Name/Address/Phone/**  **Website/Email)** |
| (ENTER CONTACT INFORMATION) | (ENTER CONTACT INFORMATION) | (ENTER CONTACT INFORMATION) |

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Appendix D: Supplementary Information

The following appendix contains the following supplementary information and forms:

* Appendix D-1: Record of Holders of Control Copies of this EAP
* Appendix D-2: Concurrences
* Appendix D-3: Record of Revisions Made to EAP
* Appendix D-4: Record of Training
* Appendix D-5: Simulated Event Exercises

**Appendix D-1: Record of Holders of Control Copies of this EAP**

Note to **DAM OWNER**: This form is referred to in *Section 5.1, EAP Distribution*. Use this table to document the organizations and contacts that have a copy of this EAP document. Include an updated form in each revision of the EAP.

|  |  |  |
| --- | --- | --- |
| **Copy Number** | **Organization Name, Address, Phone Number, and Email Address** | **Person Receiving Copy** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |

#### Appendix D-2: Concurrences

Note to **DAM OWNER**: This form is referred to in *Section 5.1, EAP Distribution*. Use this signature page to obtain concurrence by key EAP participants with assigned roles and responsibilities.

1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

1. Printed Dam Owner name and title:

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

2. Printed Emergency Responder name and title:

3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

3. Printed name and title:

4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

4. Printed name and title:

5.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

5. Printed name and title:

6.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

6. Printed name and title:

7.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

7. Printed name and title:

8.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Organization Date

8. Printed name and title:

# Appendix D-3: Record of Revisions Made to EAP

Note to **DAM OWNER**: This form is referenced in *Section 5.2 EAP Annual Review and Updating*. Use this table to document revisions to the EAP. Include the revisions summary in EAP revisions.

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision Number** | **Date**  (MM/DD/YYYY) | **Description of Revisions Made** | **By Whom** |
| 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20 | / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / /    / / |  |  |

# Appendix D-4: Record of Training

Note to **DAM OWNER**: Use this table to document training, as instructed in *Section 5.3, Training*. File completed original signature pages in the Master document. Copies may be provided in EAP revisions. A thorough review of each section in the EAP should be performed during training. Appropriate employees and EAP team members should attend a training session annually.

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
| Training Location: | | | |
| Date: | Time: | Instructor: | |
| Class Sign-In: | | | |
|  | | |  |
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# Appendix D-5: Simulated Event Exercise

Note to **DAM OWNER**: A simulated event exercise should be conducted once every five years, per *Section 5.4, EAP Exercises*. Use this table to document the attendees and type of simulated event exercise.

|  |  |
| --- | --- |
| Date of Exercise: | |
| Participant Sign In: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| Type of Simulation Conducted: | Event Type (Please Circle):  Unusual Event Level  Watch Event Level  Warning Event Level: Imminent dam failure  Warning Event Level: Dam failure |
| Comments, Results of Exercise: |  |
| Revisions Needed to EAP Based on Results of Exercise? | Yes No  If yes, list revisions required: |

Appendix E Glossary of Terms

*Note to DAM OWNER: Include the Glossary as-is, in the EAP or add additional terms.*

**Abutment** That part of the valleyside against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.

**Acre-foot** A unit of volumetric measure that would cover 1 acre to a depth of 1 foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.

**Appurtenant Structure** A structure necessary for the operation of a dam such as outlets, trashracks, valves, spillways, powerplants, tunnels, etc.

**Berm** A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.

**Boil** A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

**Breach** An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.

**Conduit** A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

**Control section** A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

**Cross section** A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. It is also a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream. Cross section can also refer to a slice across a stream or channel from one bank to the other; showing changes in elevation vertically, and horizontally showing width and/or shape of the stream or channel at that section.

**Dam** An artificial barrier generally constructed across a watercourse for the purpose of impounding or diverting water.

**Dam failure** The uncontrolled release of a dam’s impounded water.

**Dam Operator** The person(s) or unit(s) of government with responsibility for the operation and maintenance of dam.

**Drain, toe or foundation,** A water collection system of sand and gravel and typically pipes along

**or blanket** the downstream portion of the dam to collect seepage and convey it to a safe outlet.

**Drainage area (watershed)** The geographic area on which rainfall flows into the dam.

**Drawdown** The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.

**Embankment** Any dam constructed of excavated natural materials, such as both earthfill and rockfill dams, or of industrial waste materials, such as a tailings dam.

**Emergency Action Plan** A formal document identifying potential emergency conditions that may

**(EAP)** occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts.

**Evacuation map** A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.

**Event** A situation or a condition which develops that is of a serious nature that may endanger the dam, or endanger persons or property, and demands immediate attention.

**Filter** The layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.

**Freeboard** Vertical distance between a stated water level in the reservoir and the top of dam.

**Gate, slide or sluice,** An operable, watertight valve to manage the discharge of water from

**or regulating** the dam.

**Groin** The area along the intersection of the face of a dam and the abutment.

**Hazard classification** A system that categorizes dams (high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or misoperation of a dam.

**Height, dam** The vertical distance between the lowest point along the top of the dam and the lowest point at the downstream toe, which usually occurs in the bed of the outlet channel.

**Hydrograph, inflow or** A graphical representation of either the flow rate or flow depth at a

**outflow, or breach** specific point above or below the dam over time for a specific flood occurrence.

**Incident Commander** The highest predetermined official available at the scene of an emergency situation.

**Instrumentation** An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.

**Inundation area** The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.

**Inundation Map** A map showing areas that would be affected by flooding from releases from a dam’s reservoir. The flooding may be from either controlled or uncontrolled releases or as a result of a dam failure. A series of maps for a dam could show the incremental areas flooded by larger flood releases.

**Notification** To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.

**Outlet works** An appurtenant structure that provides for controlled passage of normal

**(principal spillway)** water flows through the dam.

**Piping** The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.

**Probable Maximum** The theoretically greatest precipitation or resulting flood that is

**Precipitation (PMP) or** meteorologically feasible for a given duration over a specific drainage a

**Flood (PMF)** area at a particular geographical location.

**Reservoir** The body of water impounded or potentially impounded by the dam.

**Riprap** A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.

**Risk** A measure of the likelihood and severity of an adverse consequence.

**Seepage** The natural movement of water through the embankment, foundation, or abutments of the dam.

**Slide** The movement of a mass of earth down a slope on the embankment or abutment of the dam.

**Spillway (auxiliary** The appurtenant structure that provides the controlled conveyance of

**or emergency)** excess water through, over, or around the dam.

**Spillway capacity** The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.

**Spillway crest** The lowest level at which reservoir water can flow into the spillway.

**Tailwater** The body of water immediately downstream of the embankment at a specific point in time.

**Toe of dam** The junction of the upstream or downstream face of an embankment with the ground surface.

**Top of dam (crest of dam)** The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.

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