

# 9 Emergency Action Planning

## 9.1 Introduction

An Emergency Action Plan (EAP) is a formal plan that:

- identifies emergency conditions which could endanger the integrity of the dam and which require immediate action;
- prescribes procedures which should be followed by the dam owner and operating personnel in the event of an emergency;
- provides timely warning to appropriate emergency management agencies for their implementation of protection measures for downstream communities.

The standards used for design, construction, operation, maintenance and inspection of dams are intended to minimise the risk of dam failure. However, as unusual circumstances could result in dam failure, dam owners need to identify conditions which could lead to failure situations and which may require dam safety emergency planning.

Emergency planning takes place at two levels:

- to prescribe activities at the dam - known as the Emergency Action Plan which is prepared and operated by the dam owner, and
- to prescribe activities below or beyond the dam - known as the Counter Disaster Plan, which is prepared and operated by the appropriate local Disaster District Co-ordination Committee (DDCC) with significant input from the dam owner.

An EAP should indicate who is responsible for undertaking particular actions under emergency circumstances and must be tailored to the conditions at each dam.

## 9.2 Dam owner's role

A dam owner should:

- develop and maintain an EAP
- in all emergencies, respond in accordance with the EAP
- determine the area of potential inundation or other impact from dam failure
- establish and maintain a communication system for the timely notification of impending and actual emergencies
- provide the Disaster District Co-ordination Committee (DDCC) with details of emergency response actions at the dam (eg, flood releases) and estimates of their downstream impacts
- develop a test schedule to ensure the EAP is functional and staff are familiar with the EAP.

## 9.3 Process for developing an EAP

When developing an EAP, the following steps should be taken by, or on behalf of, the dam owner:

- determine and identify those conditions that could forewarn of an emergency and specify the actions to be taken and by whom under what circumstances
- in consultation with the District Disaster Coordinator (DDC) for the impacted area (or the Disaster District Manager from the Department of Emergency Services), identify all jurisdictions, agencies and individuals who should be involved in the EAP (for example, local governments, the Queensland Police Service and downstream residents)
- identify response actions to be taken in response to potential emergencies

- identify any necessary resources, special tools, equipment, keys and indicate where they can be located if required in an emergency
- list and prioritise all persons and entities (including contact details) involved in the notification process and the roles and responsibilities assigned to them (eg a flow chart may be used)
- identify primary and secondary communication systems, both internal (between persons at the dam) and external (between dam personnel and outside entities)
- develop a draft of the EAP
- hold meetings with all parties (including emergency management agencies) included in the notification list, to review the draft EAP
- make any revisions, obtain the necessary plan approval and disseminate the EAP to those who have responsibilities under the EAP
- test and revise the EAP at regular intervals.

## 9.4 Issues To Be Considered In Emergency Action Plans

An Emergency Action Plan (EAP) needs to be easily identified. Consequently, it is recommended that the EAP is contained in a hard covered A4 sized folder, colour coded red.

The issues to be included in an EAP should be as follows.

### 1. Distribution control sheet (which is page 1)

It is important that the current EAP is issued to a number of parties including:

- Dam Operator
- Specific dam personnel with roles in the EAP
- Chief executive NR&M
- Local counter disaster groups (eg Disaster District Co-ordination Committee (DDCC) and local Government Counter Disaster Committee (LGCDC))
- Local governments which may be affected by the emergency.

Details of these parties should be listed on the distribution control sheet.

### 2. Title Page/Cover Sheet

### 3. Table of Contents

### 4. Notification listing or flowchart

This listing or flow chart should clearly summarise the following:

- Who is responsible for notifying each dam owner representative(s) and/or emergency management official(s) and others (eg residents located immediately downstream of a dam)?
- What is the prioritised order in which individuals are to be notified?
- Who is to be notified?

The listing or flowchart should include current individual names, position titles, office and home telephone numbers, alternative contacts and means of communication. Where applicable, radio frequencies and call signs should be detailed.

The number of persons to be notified by each responsible individual on the flowchart should be governed by what other responsibilities the person has been assigned. It is usually recommended that any one individual not be responsible for contacting more than three or four other parties.

The following parties should be considered for inclusion in the notification listing or flowchart:

- dam owner
- local emergency management officials (DDCC and LGCDC) and other organisations
- appropriate state emergency management agencies
- residents and property owners located immediately downstream of the dam within the boundary of potential inundation where available warning time is very limited
- local governments which may be affected
- operators of other dams or water-retention facilities which may be affected



- managers and operators of recreation facilities which may be affected
- Bureau of Meteorology.

The decisions as to who needs to be contacted will depend on the scale and timing of the potential impacts.

## 5. Roles and Responsibilities

The responsibilities of the following parties should be specified:

- dam owner
- dam operator
- other dam personnel with a role to play in the EAP (including standby officers where appropriate).

Specific roles, which should be addressed in terms of responsibilities, include:

- notification of local counter disaster agencies (such as DDCC and LGCDC) and dissemination of information to the media and public
- notification of evacuation (eg in the case of a resident located just downstream of the dam the dam owner may need to notify that person directly)
- on-site monitoring of the situation at the dam and keeping parties informed of developing conditions at the dam from time to time
- other actions (eg opening of gates etc where appropriate)
- follow-up evaluation after the emergency (including an Emergency Event Report).

## 6. Area map

This map should show access routes to the storage during fair and adverse weather conditions, identifying travel times and distances.

## 7. Drawing of the Storage Catchment Area

## 8. Emergency Events and action list

Typical emergency or potential problem identification includes but is not limited to:

<b>Problem</b>	<b>General characteristics</b>	<b>When and what to check</b>
Overtopping imminent	Storage full and water level rising - check water levels	During periods of excessive rainfall
Wave erosion	Beaching or notching of the upstream face of embankments by waves generated over long periods of strong wind	During or after periods of strong wind - inspect upstream face of embankment
Toe erosion	Erosion of embankment toe by spillway discharge or diversion flows	During and after large rainfalls - inspect embankment toe

<b>Problem</b>	<b>General characteristics</b>	<b>When and what to check</b>
Gullying	No armouring or vegetation cover on embankment batters or poor drainage	During and after large rainfalls inspect embankment batters for damage to armouring or vegetation cover
Loss of storage contents	Excessive loss from the storage and/or occasionally increased seepage or increased groundwater levels near the storage	During routine monitoring - look for environmental changes such as vegetation damage, salt scalds, etc
Seepage erosion or piping	Progressive internal erosion of the embankment or foundation to form an open conduit or pipe	During routine inspection or after unaccountable increases in seepage flows, look for an emission point
New springs, seeps or boggy areas	Evidence of internal changes in seepage control (could be initial signs of piping failure)	During routine inspection, look for “evergreen” spots, boggy ground or pools of water
Rapid increases or cloudy appearance of seepage	Seepage flow through the storage embankment is cloudy and increasing (piping failure has started)	After detection of cloudy water at seepage monitoring points - look for the source of cloudy water
Increase in gallery seepage	Increase in the normal rate of gallery seepage	After detection - check for differential movement or cracking in concrete components
Foundation failure	Sliding, rotation or settlement of part or entire dam	During routine inspection or immediately after earthquakes - inspect for evidence of foundation movement or displacement immediately adjacent to dam
Slide in downstream slope	Slide in the downstream face	During routine inspection - look for cracks or scarps near the crest and bulges at the toe
Flow slide	Collapse and flow of soil around the storage periphery	During routine inspection and especially with sedimentary/ colluvial soils - look for material displacement around the storage rim



<b>Problem</b>	<b>General characteristics</b>	<b>When and what to check</b>
Landslide	Mass movement of soil or rock from slopes and valley walls around the storage	During routine inspection - look for material displacement
Movement or cracking in structural concrete work	Failure of mechanical components such as pipes, gates etc	During routine inspection or when mechanical problems such as a burst pipe or a jammed gate occur - look for any movement or cracking of the structural concrete work to determine the cause
Failure of appurtenant structures or operating equipment	Loss of ability to supply water or discharge floods safely	After detecting an operational anomaly - identify and investigate the cause
Abnormal instrument readings (if installed)	A sudden change in the values of instrument readings	On detection - check for equipment malfunction and investigate the cause
Algal blooms	Blue green opaque nature of near surface and shallow water	During routine inspections particularly in the summer months - look for rapid colour change of the storage to a blue green opaque nature
Chemical spills	Dead fish and other aquatic life in storage, or a strange odour or colouration	On detection - identify and investigate the cause

In the event of such problems occurring it may be appropriate for more detailed inspections by properly qualified dams engineers. If the problems are likely to cause failure of the dam and loss of storage, the Emergency Action plan should be activated.

### 9. Dam Failure Inundation Map

- Dam failure inundation maps should be developed at a scale sufficient to be used for identifying downstream-inhabited areas within the area subject to possible danger.
- Inundated areas should be clearly identified.
- It may be appropriate to supplement the inundation on the maps with water surface profiles showing the elevation before failure, the peak water surface elevation after failure, and the location of structures at critical locations.
- A narrative description of the areas affected by the dam break can be included to clarify unusual conditions.
- The best available topographic map should be used. The expected inundation following the assumed failure should be delineated on the map.

- The accuracy and limitation of the information supplied on the inundation maps and how best to use the maps should be described.
- Inundation maps should be updated periodically to reflect changes in downstream areas.
- Include any other pertinent information as a result of coordination with the appropriate emergency management authorities.

#### 10. Any other charts, rating tables, considered by the dam owner as necessary

Other charts and rating tables may include charts developed in the hydrological analysis for the dam or during spillway design.

## 9.5 Emergency Event Report

Following an emergency, an Emergency Event Report should be completed which contains:

- a description of the event
- instrumentation readings (where appropriate)
- description of any observed damage
- photographs
- the EAP
- details of communication which took place during the emergency
- comment on the adequacy of the EAP
- any recommendations or suggested changes to the EAP.

Dam owners have the responsibility for implementing the recommendations contained in the Emergency Event Report. Comprehensive inspections and ultimately audits undertaken by the Regulator, will evaluate the dam owners response to Emergency Event Reports.

## 9.6 Counter Disaster Plan

The Department of Emergency Services controls counter disaster coordination and planning in Queensland. If an emergency occurs with a dam which will constitute a disaster, the State Emergency Service will be in charge of the community response including the evacuation of residents. Counter Disaster Plans should be linked to the EAPs prepared for each dam. Dam owners should co-operate with the Disaster District Agencies (DDCC and LGCDC) and the community when preparing Counter Disaster Plans.

For further information on Counter Disaster Plans, refer to Guide 7 of Emergency Management Planning for Floods Affected by Dams published by Emergency Management Australia.

## 9.7 Testing and Reviewing

To ensure EAPs are kept up to date and effective, they need to be maintained by:

- Testing

EAPs should be tested periodically by conducting a drill simulating emergency conditions (exercises). Such tests can be either field or desk top exercises and are used to refresh and train

those likely to be involved if an event occurs.

Operational staff at dams should participate in exercises annually. Larger scale exercises involving coordination between the Counter Disaster Agencies and other authorities should be conducted at least every five years.

- Updating the EAP

A periodic review of the overall plan should be conducted to assess its workability and efficiency (ie timeliness), and to plan for the improvement of weak areas. For example, telephone contact details should be reviewed and updated at least on an annual basis.

The EAP should be reviewed for adequacy at least every five years as part of the comprehensive 5 yearly inspection.

Once the EAP has been revised, the updated version (or the affected pages) should be distributed to all involved parties. The distribution of copies of the EAP and the notification flowchart (if issued separately) must be controlled and documented to ensure simultaneous updating of all copies. Updates should be made promptly. In addition, it is recommended that the entire EAP is reprinted and distributed to all parties at least every 5 years.