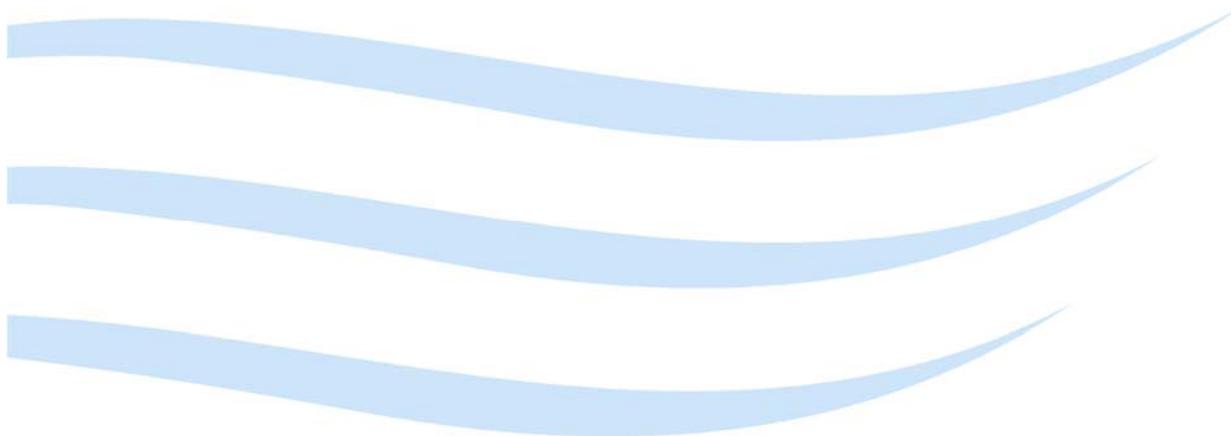


# **GUIDELINES FOR UNDERTAKING DAM INCIDENT INVESTIGATIONS**



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## TABLE OF CONTENTS

<b>1. Introduction</b>	<b>3</b>
<b>2. Guideline Requirements</b>	<b>3</b>
<b>2.1. Reporting</b>	<b>3</b>
<b>2.2. Competence Class</b>	<b>3</b>
<b>2.3. Report Acceptance</b>	<b>4</b>
<b>2.4. Report Review</b>	<b>4</b>
<b>3. Aspects of a Dam Incident Investigation</b>	<b>4</b>
<b>3.1. Consequence Category Assessment</b>	<b>4</b>
<b>3.2. Cause of Dam Incidents or Failures</b>	<b>4</b>
<b>3.3. Investigation requirements</b>	<b>5</b>
<b>3.4. Recommendations</b>	<b>5</b>
<b>3.5. Dam Incident Investigation Report</b>	<b>6</b>
<b>4. Further Information</b>	<b>7</b>
<b>5. ANCOLD Publications</b>	<b>7</b>

## 1. Introduction

These Guidelines (“the Guidelines”) have been developed to assist dam engineers and dam consultants when undertaking dam incident investigations and reporting. The Guidelines should be used as far as practicable to ensure that relevant matters are covered and reported on. It should be noted where necessary and depending on the type of incident, type of dam, consequence category of the dam, the Department may require input from a specialist or expert in their field, which could include a geotechnical engineer, hydrologist, hydraulic engineer, soil mechanics, structural engineer etc.

Dam incident investigations and reporting are required activities under the *Water Management (Safety of Dams) Regulations 2015* (“the Regulations”). The competence class that a person must have is also defined in the Regulations.

A dam incident is defined by the *Water Management Act 1999* (“the Act”) as;

*any incident or event relating to the structural integrity or safety of the dam which causes, or has the potential to cause-*

- *death or injury to a person; or*
- *damage to, or loss of, property or services; or*
- *material environmental harm or serious environmental harm.*

## 2. Guideline Requirements

### 2.1. Reporting

On completion of a dam incident inspection, a dam incident inspection report must be prepared.

The format of the report must cover the aspects of the investigation as per Section 3 of the Guidelines, including an analysis on the cause of the dam incident and comments on the structural integrity of the dam. The test certificates from any soil testing must be provided in the report as an appendix. The report must provide recommendations on any remedial works or options that are needed to make the dam safe.

### 2.2. Competence Class

In undertaking dam incident investigations and reporting, the Regulations specify the competence class required by a person.

Table 1 specifies the minimum required competence class for specific consequence category.

**Table 1 – Competence class required for dam incident investigations and reporting**

Consequence Category						
Very Low	Low	Significant	High C	High B	High A	Extreme
Class 2	Class 2	Class 1 or Class 3	Class 1 or Class 3	Expert team	Expert team	Expert team

### **2.3. Report Acceptance**

These Guidelines provide the minimum standard when undertaking dam incident investigations and reporting. A submitted dam incident investigation report that does not address the basic requirements of the Guidelines will be referred back to the dam owner for revision.

### **2.4. Report Review**

When a dam incident investigation report is reviewed, a fee, in accordance with the Regulations, will be charged for the time spent in reviewing the report. As a minimal, a fee of \$90.60 (FY2015-16) for each half hour assessing the report will be charged.

## **3. Aspects of a Dam Incident Investigation**

### **3.1. Consequence Category Assessment**

It is critical that the consequence category of the dam is assessed as the first step in the preparation of the dam incident investigation report. The assessed Consequence Category will then determine the required level of competency of the person in undertaking the investigation and reporting.

The consequence category assessment must be undertaken in accordance with the *Water Management (Safety of Dams) Regulations 2015* requirements.

When assessing the consequence category, the person undertaking the assessment will need to determine whether there will be potential for loss of life and therefore the need to prepare a Dam Safety Emergency Plan. See [www.dpipwe.tas.gov.au/water/dams/dam-safety](http://www.dpipwe.tas.gov.au/water/dams/dam-safety) for guidelines relating to the preparation of Dam Safety Emergency Plans.

### **3.2. Cause of Dam Incidents or Failures**

Most dam incidents or failures are caused by the following mechanisms (in order of frequency):

- Overtopping of the dam, due to inadequate spillway design, the spillway being blocked (either deliberately or due to lack of maintenance), or settlement of the embankment to such a degree that the spillway becomes redundant;
- Piping failure, where a 'pipe' erodes through the embankment, through the embankment into the foundation, or through the foundation;
- Mass instability, where a translational failure will occur through the embankment and into the foundations;
- Reservoir rim instability, where parts of the reservoir fail into the dam;
- Liquefaction, due to seismic loading including liquefaction of the foundations.

### 3.3. Investigation requirements

**Please note** that an experienced dam engineer will need to determine the level of investigations required for the dam.

In determining the overall structural integrity and condition of the dam, and the impact of the relevant failure mechanism discussed in Section 3.2, it may be necessary to undertake a detailed investigation to establish what caused the incident or the dam to fail and whether there are any other adverse conditions at the dam site or embankment foundations.

Such investigations may include:

- a detailed hydrological study, where the dam has overtopped, or
- a geotechnical investigation, for piping failure, mass instability, reservoir rim failure or liquefaction.

A detailed hydrological investigation will need to assess rainfalls and catchment characteristics, including a flood study for the spillway and an investigation of the integrity of the embankment.

A detailed geotechnical investigation may require test pits, drilling, geophysical investigation including ground penetrating radar, or Cone penetrometer testing (CPTs).

**Note:** *drilling in to an embankment using such methods as reverse circulation (RC) rotary air blast (RAB) or water under high pressure can cause serious and considerable damage to a dam embankment potentially causing the embankment to crack. Such methods as wireline, auger drilling and CPT are consider much safer but should also be used with caution.*

A geotechnical investigation may also include geological mapping and general site appraisal where mass instability is the result, installation of piezometers to measure water levels in a dam or foundations also may be required.

Adverse geotechnical soil conditions may include the identification of highly reactive, highly erosive or dispersive soils and unstable soil conditions, combined with a high phreatic levels.

It should also be noted that where relevant;

- All soils must be classified according to the *Unified Soil Classification System (USCS)*.
- All soil testing must be carried out to AS 1289 Methods of Testing Soils for Engineering Purposes.
- All reporting including test pit or borehole logs must be carried out to AS 1726 *Geotechnical Site Investigations*. Logs sheets and test certificates must be contained within the Appendix of the report.

### 3.4. Recommendations

The person who prepares the report must provide in the dam incident investigation report either:

- a statement that the dam is unsafe and actions need to be taken to make the dam safe. Actions must specify timeframes on when each action is to be completed by; or
- clear recommendations on actions required to bring the dam up to an acceptable safety standard. This could include decommissioning the dam, repairing the dam or rebuilding the dam.

### 3.5. Dam Incident Investigation Report

The following items may be detailed in a dam incident investigation report, the following points are provided as a guide to the report writer in assessing and documenting the investigation.

- Introduction and dam dimensions table.
- A rigorous assessment of the consequence category and outcome of the assessment.
- Description of the regional geology taken from 1 to 250,000 scale Mineral Resources Tasmanian (MRT) geological maps and an assessment of the local geology. In assessing the local geology other adverse features must be identified such as any mapped landslips, potential for sodic or dispersive or reactive soils at or around the dam site.  

A good site appraisal or using satellite imagery can generally pick up areas of adverse soil conditions, the degree of gully erosion or the colour of water in dams.
- A detailed description of the incident, whether it was due to overtopping of the embankment, a piping incident and subsequent failure or mass instability.
- A detailed assessment of the geotechnical conditions encountered at the dam site and their likely impact on the structural integrity of the dam. This may include undertaking subsoil probing such as drilling, backhoe test pits, ground penetrating radar or other methods considered suitable for determining the overall condition of the dam.
- Details on the causes of the dam incident, the structural integrity of the dam and the overall safety of the dam.
- A detailed hydrological assessment and review of the sizing of the spillway.
- A detailed assessment of the condition of the outlet pipe and any other appurtenant works which may impact on the structural integrity of the dam.
- Detailed recommendations, including timeframes, of any work required to bring the dam to an acceptable safety standard and any monitoring equipment that should be installed on the dam including 'V' Notch weirs.
- Provide photos showing all details of the incident, including the interface between different soil types in the embankment, piping voids, cracking and any abnormal findings.
- The report must be certified and dated by the person who undertook the inspection and prepared the report and noting the person's competence class, as defined in the Regulations.
- Appendices:
  - Geotechnical logs and test certificates,
  - ANCOLD Consequence category spreadsheet and description of flood impacted areas.
  - Spillway calculations.
  - Photographic record.

#### **4. Further Information**

Enquiries to:

Dam Safety Coordinator

Water Operations Branch

Department of Primary Industries, Parks, Water and Environment

PO Box 46, Kings Meadows TAS 7249

Visit [www.dpipwe.tas.gov.au/water/dams/dam-safety](http://www.dpipwe.tas.gov.au/water/dams/dam-safety) or

Call 1 300 368 550 for assistance or

Email [Water.Operations@dpipwe.tas.gov.au](mailto:Water.Operations@dpipwe.tas.gov.au).

Links:

- The *Water Management (Safety of Dams) Regulations 2015* and the *Water Management Act 1999* are available at:

<http://www.thelaw.tas.gov.au/>

#### **5. ANCOLD Publications**

ANCOLD publications referred to in the Guideline are available from:

ANCOLD <http://www.ancold.org.au/>