

Ross River Dam Emergency Action Plan 2024

Dam ID: 344

Dam Owner: Townsville City Council

Rural no.: Lot 230 Parish of Ross, County of Elphinstone, City of Townsville

Location: Lat: 19.40983° S Lon.146.73744° E

Approved by the delegate of the Chief Executive,
Department of Regional Development, Manufacturing
and Water until 1 October 2025.

Note: The Incident Coordinator (IC) is responsible for the decision to activate the EAP. Should the IC be unavailable, the Dam Duty Officer (DDO) is responsible for the decision.

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Emergency Activation Quick Reference – Dam and Other Hazards

Table 1: Emergency Activation Quick Reference

	Alert	Lean Forward	Stand Up	Stand Down
	<ul style="list-style-type: none"> Locally managed (DDO) 	<ul style="list-style-type: none"> Locally managed (DDO and IC) 	<ul style="list-style-type: none"> Locally managed (DDO and IC) with advice from DSTDM 	<ul style="list-style-type: none"> Locally managed (DDO and IC) with advice from DSTDM
Dam Hazards	Dam Hazard Activation Triggers			
Flood Operations Refer section 5	<ul style="list-style-type: none"> EL 38.45m and rising (0.1m below FSL) 	<ul style="list-style-type: none"> Storage EL 38.65m (gate opening trigger level) 	<ul style="list-style-type: none"> Storage above EL 40.75m 	<ul style="list-style-type: none"> Storage FSL 38.55m and falling
Piping: Embankment, Foundation, or Abutments Refer section 6	<ul style="list-style-type: none"> Increasing leakage through an embankment, the foundations, or abutments 	<ul style="list-style-type: none"> Increasing leakage through an embankment, the foundations, or abutments with cloudy water 	<ul style="list-style-type: none"> Piping condition has been established 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Earthquake Refer section 7	<ul style="list-style-type: none"> Earthquake reported or felt at the dam or in the Townsville area, AND Intensity less than 5 Modified Mercalli (MM) 	<ul style="list-style-type: none"> Earthquake reported or felt at the dam or in the Townsville area, AND Intensity greater than or equal to 5MM, OR Intensity less than 5MM and change detected during surveillance inspection 	<ul style="list-style-type: none"> Earthquake reported or felt in the area, AND A possible failure path has been identified 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Terrorist Threat/ Activity or High Energy Impact Refer section 8	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Possible terrorist activity noticed at dam or threat received Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit) Failure in progress or likely due to impact or explosion Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Gate Function Issues See section 9	<ul style="list-style-type: none"> Move immediately to Stand-Up Activation 	<ul style="list-style-type: none"> Move immediately to Stand-Up Activation 	<ul style="list-style-type: none"> Gate function issue 	<ul style="list-style-type: none"> Risk assessment that risk has reduced Confirmation that all gates are functioning correctly
Overtaking or Sliding of Spillway Refer section 10	<ul style="list-style-type: none"> Indications of movement of spillway noted such as cracking, increased seepage, spilling 	<ul style="list-style-type: none"> Storage at flood of record, EL 40.73m, OR Increase in movement or seepage 	<ul style="list-style-type: none"> Obvious displacement of one or more spillway, OR Evidence of scouring at or near toe of stilling basin area 	<ul style="list-style-type: none"> Risk Assessment has determined that sliding or over turning risk has reduced
Communication Failure Refer section 11	<ul style="list-style-type: none"> Move immediately to Stand-Up Activation 	<ul style="list-style-type: none"> Move immediately to Stand-Up Activation 	<ul style="list-style-type: none"> Communication service faults 	<ul style="list-style-type: none"> Confirmation that all communication services are functioning correctly

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Revision History

Complete version history information is stored within Townsville City Councils electronic document management system Paradigm.

Rev No.	Doc No.	Revision Description	Approved for Issue	Date
1.0	RD0030	Interim 2019-2020 Version		
1.0	RD0031	Initial issue		
1.1	RD0031	Updates following DNRME review		August, 2020
1.2	RD0031	Updates following DDMG review		September, 2020
1.3	RD0031	Annual Review and IC / LEC role combined		September, 2021
1.4	RD0032	Update contacts details. Update section 5 for new SCADA system. Correct errors section 11. New catchment map in appendix B4.		September 2022
1.5	RD0032	Changed flood STAND UP levels to coincide with required downstream warning levels, EA polygons and new AWS messaging. Included AWS compliant messaging. Updated flood classification levels. Update contacts details and position titles. Update PAR numbers.		October 2023
1.6	RD0032	Removed Chemical spill/toxic hazard. Added missing flood maps appendix B. Updated Aplins weir gauge levels. Included fatigue management. Included automatic instrument readers. Change position titles, correct spelling and grammatical errors. Update contact details.		September 2024

1. References, Abbreviations and Definitions

1.1 References/Associated Documents

Ref.	Document title	Reference
A	Townsville City Council Emergency Action Plan	TCC EAP (Current Year)
B	Ross River Dam Detailed Operation and Maintenance Manual for Control Systems	DOMMS-004 Supervisory Control and Data Acquisition System
C	Ross River Dam Standard Operating Procedures	Electronic Document Management System
D	Ross River Dam Operation and Maintenance Manuals	Electronic Document Management System
E	Community Information and Warnings Sub Plan	TCC Website
F	Queensland Disaster Management Guidelines	www.disaster.qld.gov.au
G	Queensland Rainfall and River Conditions (Flood Warning)	www.bom.gov.au/qld/flood/index.shtm
H	TCC Incident and Near Miss Alert Form (Alert Notification)	Inspire (TCC Intranet)
I	Water Supply (Safety and Reliability) Act 2008 (Qld)	Business.qld.gov.au
J	Qld Dam Safety Management Guidelines	Business.qld.gov.au
K	Emergency Action Plan for Referable Dam Guidelines, June 2021	Department of Regional Development, Manufacturing and Water (DRDMW)

1.2 Abbreviations and Acronyms

AHD	Australian Height Datum	PAR	Population at Risk
ANCOLD	Australian National Committee on Large Dams	PMF	Probable Maximum Flood
BGA	Blue Green Algae	PLL	Possible Loss of Life
BOM	Bureau of Meteorology	PMP	Probable Maximum Precipitation
CEO	Chief Executive Officer	QDSMG	Queensland Dam Safety Management Guideline
CRA	Comprehensive Risk Assessment	QFES	Queensland Fire & Emergency Services
D/S	Downstream	QPS	Queensland Police Service
DCF	Dam Crest Flood	RB	Right Bank
DCL	Dam Crest Level	RRD	Ross River Dam
DMG	Disaster Management Group	SDE	Senior Dam Engineer
DDC	District Disaster Coordinator	SFCE	Senior Floodplain and Coastal Engineer
DDMG	District Disaster Management Group	SSE	Senior Stormwater Engineer
DDO	Dam Duty Officer	SDCC	State Disaster Coordination Centre
DDS	Director Dam Safety	SDMG	State Disaster Management Group
DRDMW	Department of Regional Development, Manufacturing and Water (DRDMW)	SDF	Sunny Day Failure
DOMM	Detailed Operation and Maintenance Manual	SES	State Emergency Service
DSR	Dam Safety Regulator	SHD	State Height Datum
DSTDM	Dam Safety Technical Decision Maker	SMS	Short Message Service
DIO	Director Infrastructure & Operations	SOP	Standard Operating Procedure
EA	Emergency Alert	SWL	Storage Water Level
EAP	Emergency Action Plan	TCC	Townsville City Council
EER	Emergency Event Report	TM WRDS	Team Manager Water Resources and Dam Safety
EL	Elevation Level	U/S	Upstream
FIR	Flood Impact Rating	WQ	Water Quality
FODM	Flood Operations Decision Maker		
FSL	Full Supply Level		
GIS	Geographic Information System		
GM WS	General Manager Water Services		
GS	Gauging Station		
HMI	Human Machine Interface		
IC	Incident Coordinator		
LB	Left Bank		
LDMG	Local Disaster Management Group		
Max. OL	Maximum Operating Level		
MM	Modified Mercalli		
O&M	Operation & Maintenance		
OB	Observation Bore		

1.3 Business Terms and Definitions

Term	Definition
Terms set out in section 352A of the <i>Water Supply (Safety and Reliability) Act 2008 (Qld)</i> - Amended	
Dam Hazard	Means a reasonably foreseeable situation or condition that may: <ul style="list-style-type: none"> • cause or contribute to the failure of the dam, if the failure may cause harm to persons or property, OR • require an automatic or controlled release of water from the dam, if the release of the water may cause harm to persons or property.
Dam Hazard Event	Means an event arising from a <i>dam hazard</i> if: <ul style="list-style-type: none"> • persons or property may be harmed because of the event, AND • a coordinated response, involving 2 or more of the following <i>relevant entities</i>, is unlikely to be required; each <i>local group</i> and <i>district group</i> for the EAP, each local government whose area may be affected, the chief executive, another entity the owner of the dam considers appropriate, AND • the event is not an <i>emergency event</i>.
Disaster Management Plan	Of a <i>district group</i> or local government, means the group's or local government's disaster management plan under the Disaster Management Act.
District Group (District Disaster Management Plan)	For an emergency action plan (EAP), means a district group established under the Disaster Management Act, section 22 whose disaster district under that Act could, under the plan, be affected by a <i>dam hazard</i> .
Emergency Event	Means an event arising from a <i>dam hazard</i> if: <ul style="list-style-type: none"> • persons or property may be harmed because of the event, AND • any of the following apply: <ul style="list-style-type: none"> – a coordinated response, involving 2 or more of the following relevant entities, is likely to be required; each local group and district group for the EAP, each local government whose area may be affected, the chief executive, another entity the owner of the dam considers appropriate, OR – the event may arise because of a disaster situation declared under the Disaster Management Act, OR – an entity performing functions under the State disaster management plan may, under that plan, require the owner of the dam to give the entity information about the event.
Local group (Local Disaster Management Group)	For an EAP, means a local group established under the Disaster Management Act, section 29 whose local government area could, under the plan, be affected by a <i>dam hazard</i> .
Notice Response	A dam owner's written response to a notice following an assessment of an EAP by a local government or <i>district group</i> .

Term	Definition
	A dam, or a proposed dam after its construction, will be a referable dam if:
Relevant Entity	<p>Means each of the following under the EAP for the dam:</p> <ul style="list-style-type: none"> the persons who may be affected, or whose property may be affected, if a <i>dam hazard event</i> or <i>emergency event</i> were to happen for the dam, e.g. the owners of parcels of farm land adjacent to the dam or residents of a township each local group and district group for the EAP each local government whose local government area may be affected if a dam hazard event or emergency event were to happen the chief executive another entity the owner of the dam considers appropriate, e.g. the QPS.
	<p>The four levels of EAP activation are:</p> <ul style="list-style-type: none"> Alert: A heightened level of vigilance due to the possibility of an event occurring. No further action may be required; however, the situation should be monitored by someone capable of assessing the potential of the threat. Moving to an Alert level indicates the dam owner is getting ready to activate the Lean Forward level of the EAP if the situation deteriorates. (Note: for Flood Operations, resources are mobilised, personnel are activated, and operational activities commenced at alert level when the dam level is rising). Lean Forward: An operational state characterised by a heightened level of situational awareness of an impending disaster event and a state of operational readiness. Disaster coordination centres are on standby and prepared but not activated. Stand Up: The operational state where resources are mobilised, personnel are activated, and operational activities commenced. Disaster coordination centres are activated. The dam owner needs to provide an Emergency Event Report (EER) in accordance with the provision of the Act. Stand Down: Transition from responding to an event back to normal core business and/or continuance of recovery operations. There is no longer a requirement to respond to the event and the threat is no longer present. <p>The movement through these levels of activation is not necessarily sequential. It should be applied with flexibility and adaptability and be tailored to the location and event. Triggering one of these levels of activation may not necessarily mean a similar activation of LDMGs or DDMGs.</p>

Term	Definition
Bureau of Meteorology Flood Level Classifications	<p>The three levels of flooding are:</p> <ul style="list-style-type: none"> • Minor flooding: This causes inconvenience such as closing of minor roads and the submergence of low-level bridges and makes the removal of pumps located adjacent to the river necessary. • Moderate flooding: This causes the inundation of low-lying areas requiring the removal of stock and/or the evacuation of some houses. Main traffic bridges may be closed by flood waters. • Major flooding: This causes inundation of large areas, isolating towns and cities. Major disruptions occur to road and rail links. Evacuation of many houses and business premises may be required. In rural areas widespread flooding of farmland is likely.
Chemical Spill/Toxic Condition	The contamination of water in the storage of the dam that could create a dam hazard.
Concurrent Flooding	Flood flows downstream of a dam that are not a result of dam outflows, for instance those from adjacent catchments or from the sea, and which occur in the same period as downstream releases or flooding from the dam.
Dam Crest Failure	<p>Dam crest flood is when failure occurs during a flood event with the water level at the crest of the non-overflow section of the dam embankment:</p> <ul style="list-style-type: none"> • for an embankment dam, is the lowest point of the embankment crest • for a concrete dam, is the level of the non-overflow section of the dam, excluding handrails and parapets if they do not store water against them • for a concrete faced rockfill dam, is the lowest point of the crest structure.
Dam Failure	Dam failure is the physical collapse of all or part of a dam or the uncontrolled release of any of its contents.
Downstream Releases	Downstream releases are outflows from the dam made through appurtenant structures such as spillways or outlet works that are in accordance with the design of the dam.
Earthquake	<p>A sudden release of energy in the Earth's crust or upper mantle, usually caused by movement along a fault plane or by volcanic activity, resulting in the generation of seismic waves that can be destructive. The potential consequences of an earthquake include:</p> <ul style="list-style-type: none"> • settlement, sliding, or overturning of spillway in the dam wall • initiation of seepage lines in the foundations or abutments that could lead to piping damage and potential inoperability of appurtenant works.
Flood Release	A flood release from a dam occurs when catchment inflows raise the storage level above the Full Supply Level (FSL) resulting in a discharge from the spillway of the dam.
Piping	Internal scour caused by the water flow and seepage that occurs through earth dams, dam foundations, or dam abutments. The internal scour can lead to the formation of a pipe, which can lead to a failure of the dam.
Plane Strike or Other Impact	The impact of a plane, meteorite, or other high-energy item on or in close vicinity of a dam that could damage the dam structure or create a wave that could overtop the dam.

Term	Definition
Probable maximum flood	Probable maximum flood is the flood resulting from probable maximum precipitation coupled with the worst catchment conditions that can be realistically expected.
Probable Maximum Precipitation	Probable maximum precipitation is the theoretical greatest depth of precipitation physically possible based on generalised methods.
Probable Maximum Precipitation Design Flood	Probable maximum precipitation design flood is the flood resulting from probable maximum precipitation coupled with standard catchment conditions that can be expected.
'Sunny Day' Failure	'Sunny day' dam failure is where the failure occurs at the full supply level and there is no concurrent rain associated flooding.
Terrorist Activity	A deliberate attempt to damage or fail a dam.

2. Introduction

2.1 Context

Under the *Water Supply (Safety and Reliability) Act 2008* (the Act), the owner of a referable dam must have an approved EAP for the dam. Referable dams, by definition, would put lives at risk if they were to fail.

This EAP has been prepared in accordance with Chapter 4 of the Act. The content requirements for EAPs are contained in section 352H of the Act.

Summary of legal requirements – Section 352H

Section 352H(1) of the Act requires that the EAP must identify each dam hazard for the dam; and for each of these dam hazard types (e.g., flood operations, or chemical spill/toxic conditions):

1. identify the area likely to be affected by a dam hazard event or emergency event arising from the dam hazard; and
2. identify each circumstance that indicates a material increase in the likelihood of the dam hazard event or emergency event happening; and
3. state when and how the owner of the dam plans to warn persons who may be harmed, or whose property may be harmed by an event caused by the dam hazard, if one happens, and/or there is a material increase in the likelihood of an occurrence, including the order of priority in which the persons or categories of persons are to be warned; and
4. state when and how the owner plans to notify the relevant entities for the dam, if a dam hazard event or emergency event happens or, there is a material increase in the likelihood of such an occurrence, including the order of priority in which the relevant entities are to be notified; and
5. state the actions the owner of the dam plans to take in response to a dam hazard event or emergency event.

In accordance with section 352H(2) of the Act, the EAP may provide for the dam owner to make arrangements with a relevant entity for warnings to be given by the relevant entity on behalf of the dam owner in appropriate circumstances.

Section 352HA of the Act states that before giving the chief executive an EAP, the owner of the dam must give a copy of the plan to each local government whose area may be affected by a dam hazard identified in the plan; and each district group for the plan.

Section 352HB of the Act states that the local government must assess the EAP for consistency with its disaster management plan. In its assessment, the local government must consult with the local district group for the plan.

Within 30 business days of receiving the EAP, the local government must give the owner of the dam a notice, which states whether it considers the plan is consistent with its disaster management plan; and if not, give reason why it considers the EAP is not consistent. The EAP must include any such notices, provided to the owner of the dam by a local government (or district group); and any responses which the owner gives to these notices. Section 352H(1) further stipulates that an EAP must include any other relevant matter prescribed by regulation.

The local government whose area may be affected by a dam hazard for Ross River Dam has been assessed as **Townsville City Council (TCC)**.

Section 352HC of the Act states that a district group may review the EAP for consistency with its disaster management plan. The district group for Ross River Dam is **Townsville District Disaster Management Group (DDMG)**. TCC has provided the DDMG with a copy of the EAP for review.

2.2 Purpose

The purpose of this EAP is to:

- Manage the risk of harm to persons or property if a dam hazard event or emergency event for the dam happens.
- Identify dam hazards that could occur at Ross River Dam and the area likely to be affected for each hazard.
- Prescribe emergency actions taken and responding to dam hazards and notifying relevant entities.

It is possible for more than one dam hazard to exist at Ross River Dam at the one time. In such a circumstance, it may be necessary to act on the procedures within separate sections simultaneously.

2.3 Scope

The Ross River Dam EAP covers:

- Dam hazards evaluated within TCC Dam Safety Management Program
- Details about the dam that are relevant to a dam hazard
- Identification of circumstances that indicates a material increase in the likelihood of a dam hazard
- Triggers for activation of a tiered response to dam hazards
- Roles and responsibilities in responding to a dam hazard
- Notification, warning, and communication protocols
- Inspection, monitoring, and reporting protocols during emergencies
- Other relevant information that may assist with identifying the area affected by a dam hazard, and the management of such hazards.

2.4 Training

- TCC is committed to ensuring all staff have the necessary knowledge and training to perform their duties safely and competently. Specific pre wet season training is undertaken annually in November and staff with responsibilities under this EAP shall undergo training at various times throughout the year.
- Annual EAP training that is carried out on site shall include DDO, DSTDM, and other appropriate TCC staff as required. This training includes walkthroughs of new changes, scenario (role play) and Q & A to check the knowledge and competency of all those who attended.
- Annual disaster exercises are conducted in the LDCC with the IC, FODM
- New RRD employees shall also be familiarized with the EAP and any responsibilities under the EAP upon commencement with TCC.
- Additional competency requirements and managed in accordance with TWW GP0088 – Training and Competency Procedure.

2.5 Fatigue

- TCC is committed to ensure employees remain safe during EAP activation. All operators will work on a roster a basis as specified by the TLDC in accordance with the Water Services Fatigue Management Procedure WRR-PRO-002.
- Maximum length of shift is 12 hours per day with a maximum of 6 shifts per week followed by a mandatory 48 hour rest break.

2.6 Dam Emergency Organisation

The Ross River Dam emergency management framework utilises the Townsville City Council (TCC) management hierarchy in liaison with the Local Disaster Management Group (LDMG) and other specialized dam safety expert input as illustrated in Figure 1 below.

Decisions / Accountability and Ownership

TCC / WRR Ross River Dam Emergency Response Structure

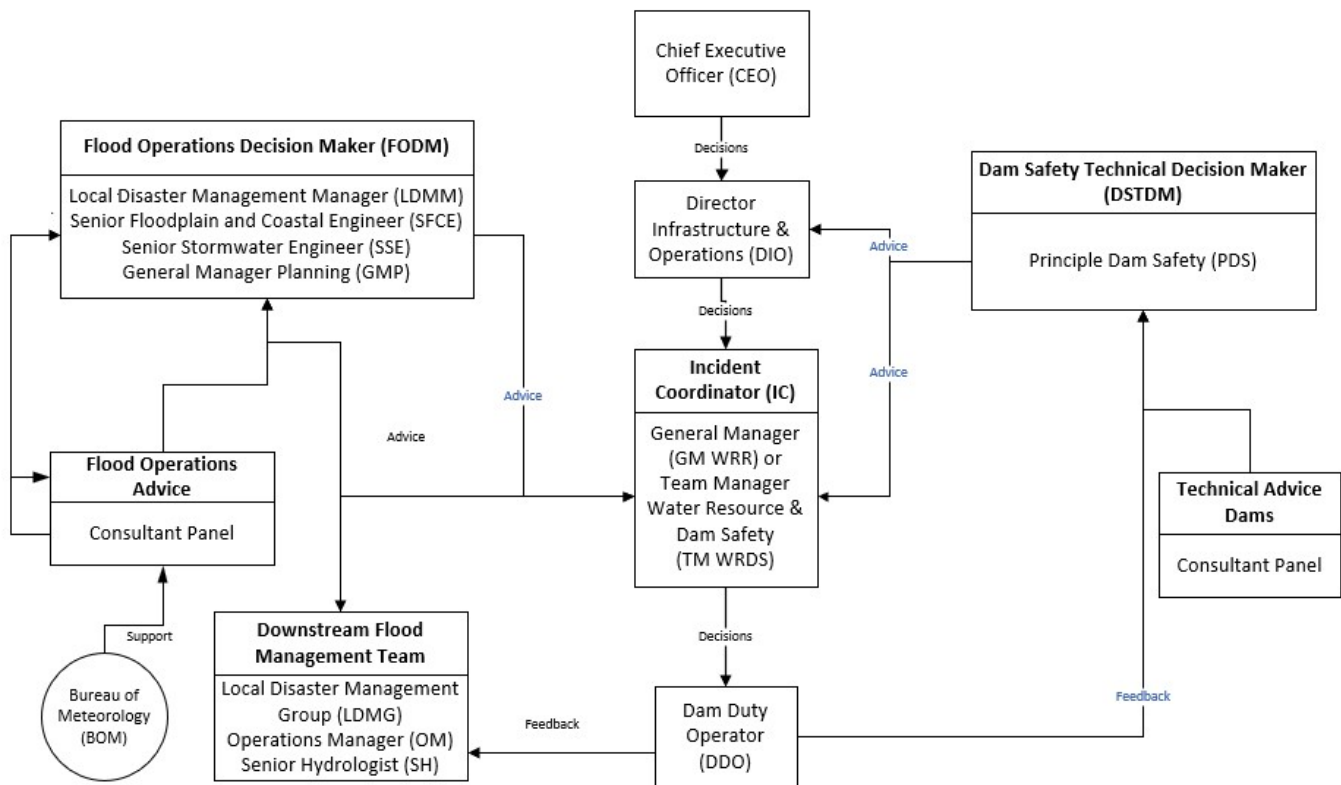


Figure 1 - RRD TCC Emergency Response Organisation

Key aspects of the emergency management framework include:

- Central to the above framework is the role of Incident Coordinator (IC), for any dam hazard at a dam. The IC will maintain overall responsibility for managing the dam hazard.
- The IC is responsible for the decision to activate the EAP. Should the IC be unavailable, the Dam Duty Officer (DDO) is responsible for the decision. If the IC loses all communications during a dam hazard, then as a fail-safe position, the DDO will assume the duties and responsibility of the IC. However, loss of communications could result in some communication processes defined in this EAP not being carried out.
- In-house and external engineering and technical specialists will provide advice to the IC, and DDO on an as needs basis.
- The Flood Operations Decision Maker (FODM) and Dam Safety Technical Decision Maker (DSTDM) will provide flood and dam engineering advice respectively during a dam hazard. Such advice will be provided within an established framework of Standing Operating Procedures (SOPs), models, standards, and manuals. This is an advisory role only and does not diminish the decision responsibility of the IC, or DDO.
- If circumstances develop during a dam hazard that exceeds the established framework, it will be necessary to escalate to either the FODM or DSTDM.
- In some circumstances these decision-making roles may need to direct those in the direct chain of command. These decision-making roles are providing direct engineering supervision to the advisors through the established framework of SOPs, models, standards, and manuals or through direct supervision.

2.7 Community Information

- TCC hosts “Get Ready Townsville” an annual disaster community event in November every year. As part of this event a specific Dam and Flooding stall is run with staff to discuss the role of the EAP and how water releases will impact the downstream residents. An emergency event information sheet is made available to the public showing flood maps for Ross River and location of evacuation centres.
- A copy of the Ross River approved EAP is available to the public on the Townsville City Council website along with answered FAQ and historical dam information.

2.8 Stages of Escalation

This EAP is activated using an escalation model based on the following levels:

Alert	<ul style="list-style-type: none"> • A heightened level of vigilance due to the possibility of an event occurring. It will tend to require increased monitoring with the frequency of monitoring being dependent upon the rate of development of the potential failure condition. • During the ALERT level of EAP activation, the need for, and the frequency of situational reports should be discussed with the relevant Disaster Management Group. • During Flood Operations, resources are mobilised, personnel are activated, and operational activities commenced at alert level when the dam level is rising. • No further action may be required; however, the situation may need to be monitored by someone capable of assessing the potential of the threat.
Lean Forward	<ul style="list-style-type: none"> • An operational state characterised by a heightened level of situational awareness and a state of operational readiness. The disaster management group and dam operational staff are placed in a state of operational readiness to move to the “Stand-Up” level of activation in the event of an emergency event occurring or to mitigate the consequences of such an event. • It will require increased monitoring with the frequency of monitoring being dependent upon the rate of development of the emergency condition. Situational reports to the relevant DMG should continue as previously arranged or otherwise requested. Personnel at the Dam should be on standby, ready to move to the Stand-Up level of activation in the event of an emergency event occurring or to mitigate the consequences of such an event.
Stand Up	<ul style="list-style-type: none"> • An operational state where resources are mobilised, personnel are activated, and operational activities are commenced as part of the EAP activation in response to an emergency event occurring or the need to mitigate the consequences of such an event occurring. • Any works that may become necessary at the dam site to minimise the risk of dam failure or minimise the consequences of failure should be undertaken. • Situational reports should be provided to the relevant DMG and Dam Safety Regulator (DSR) according to agreed timelines. Activation of this level of response will trigger the requirement to develop and Emergency Event Report (EER) in accordance with the provisions of the Act.
Stand Down	<ul style="list-style-type: none"> • Transition from responding to event back to normal core business and/or continuance of emergency recovery operations. • The movement through these levels of activation is not necessarily sequential and should be applied with flexibility and adaptability and be tailored to the location and event. • Triggering of one of these levels of activation may not necessarily mean a similar activation of relevant DMG’s however the provision of information to relevant group members regarding the risks associated with a pending hazard impact should still occur. • There is no longer a requirement to respond to the event and the threat is decreasing.

Movement through these levels of activation is not necessarily sequential and should be applied with flexibility and adaptability and be tailored to the location and event.

3. Dam Details

3.1 General Dam Information

Location: Ross River Dam is located approximately 19km south-southwest of the city of Townsville.

Purpose: Ross River Dam provides water supply to the City of Townsville.

Catchment: 761km² (approx.)

Storage Capacity: The storage capacity at FSL is 233,187ML.

Dam Description: The Dam consists of an 8400m long earth and rock-fill embankment.

Construction: Ross River Dam was constructed by Leighton Holdings by between 1971 and 1974. The Dam was upgraded in 1987 and 2007 when the 3 spillway gates were installed.

Specification: The table below lists general specifications of Ross River dam.

Table 2: Ross River Dam Specifications

Description	Specification
Dam type	Earth core rock-fill
Full Supply Level (FSL)	EL 38.55m AHD
Dam Crest Level (DCL)	EL 48.00m AHD
Dam height (m)	34.4m AHD (from stripped foundation)
Total embankment length (m)	8400m (Crest length)
Historical recorded max storage	43.03m AHD
Crest Width	7.9m Type 1 embankment (Drawing ref. 236551)
Crest Width	6.1m Type 2 embankment (Drawing ref. 236555)
Storage	
Catchment area	761km ²
Full Supply Level (FSL)	EL 38.55m AHD
Storage capacity at FSL	233,187ML
Surface area (at FSL)	5690Ha
Normal Operating range	EL23.7m – 38.55m AHD
Minimum Draw Down Level	EL 23.7m AHD
Spillway	Mass Concrete post tensioned Gravity Structure with 3 hydraulically operated steel radial gates, concrete piers and concrete service bridge
Spillway crest level	EL 34.656m AHD (fixed crest level)
Gate Operating Trigger Level	EL 38.65m AHD
Spillway gates	Width – Gates 1 & 3 x 11.79m, Gate 2 x 13.00m Height (face length) – 5.35m Height (vertical in closed position) – 4.80m <i>Operated by hydraulic rams</i>

Description	Specification
Spillway crest length	36.6m (2x11.8 m, 1x13m, with 2x1.5m piers)
Spillway design capacity (at EL 47.50m – overtopping imminent PMF Inflow Peak)	3,655m ³ /s
PMF Inflow Peak	15,800m ³ /s
PMF Outflow Peak	3,880m ³ /s
Outlet works	
Outlet capacity (max)	2 x cone valves – 13.6m ³ /s
Type of Intake	Dry well in Left Bank Monolith LH5
Control	Electrical hydraulic operation with manual override
Provision for Selective Withdrawal	7x1.5m Dia Butterfly Valves at Selective Levels
Outlet Conduit	1524 mm Dia Cement Lined MS Pipe
Length of Outlet Conduit	47.5m
Outlet Guard Valves	2x1067 mm Dia Butterfly Valves
Regulator Valves	2x840 mm Dia Fixed Cone Dispersion Valves
Valve House	R.C. Structure on Left bank Monolith LH9
Main to Ross Pump Station	1524mm

All levels are to Australian Height Datum (AHD).

Conversion for Dam is AHD = ((State Datum in feet x 0.3048) + 0.303)m

3.2 Population at Risk

Ross River Dam is classified as 'Extreme' for both the 'Sunny Day' and the Incremental Flood Hazard categories (Population at Risk, PAR > 1000) in accordance with Guidelines on the Consequence Categories for Dams (ANCOLD, 2012). It is classified as a Category 2 dam under the QLD Dam Safety Management Guidelines February 2002, with a PAR exceeding 100. (1)

The estimated PAR for flood peak and Sunny Day Failure scenarios is listed in Table 3:

Table 3: Failure Scenarios and anticipated PAR

Scenario	Weighted PAR
48.1 mAHD Flood Overtopping Failure Chainage 500m	134,070
43 mAHD Flood Induced Piping Failure Chainage 500m	117,104
Sunny Day Breach Reservoir Level RL 38.55 Chainage 500m	79,481

3.3 Spillway Adequacy

The spillway is capable of passing routed floods in such a manner that any damage that occurs to the crest, chute or stilling basin will not threaten the safety of the spillway structure. Under extreme floods some damage is acceptable provided it does not threaten the safety of the dam.

Hydraulic studies for the spillway considered flows controlled by the spillway gates and free overflow discharges up to a dam crest flood (DCF) level of 47.5 m. Flow conditions up to a dam crest level of 48.5m were also considered to allow for a potential raising of the dam crest to accommodate inflows up to the PMF. (2)

Notes: 1. Ross River Dam Risk Assessment Review, GHD 122553842-REP-0, 8 February 2023

2. NQ Water, Ross River Dam Upgrade, Stages 2 to 5, Spillway and Stilling Basin Design Report, September 2005.

3.4 General Arrangement

Figure 2 - Ross River Dam - Spillway General Arrangement

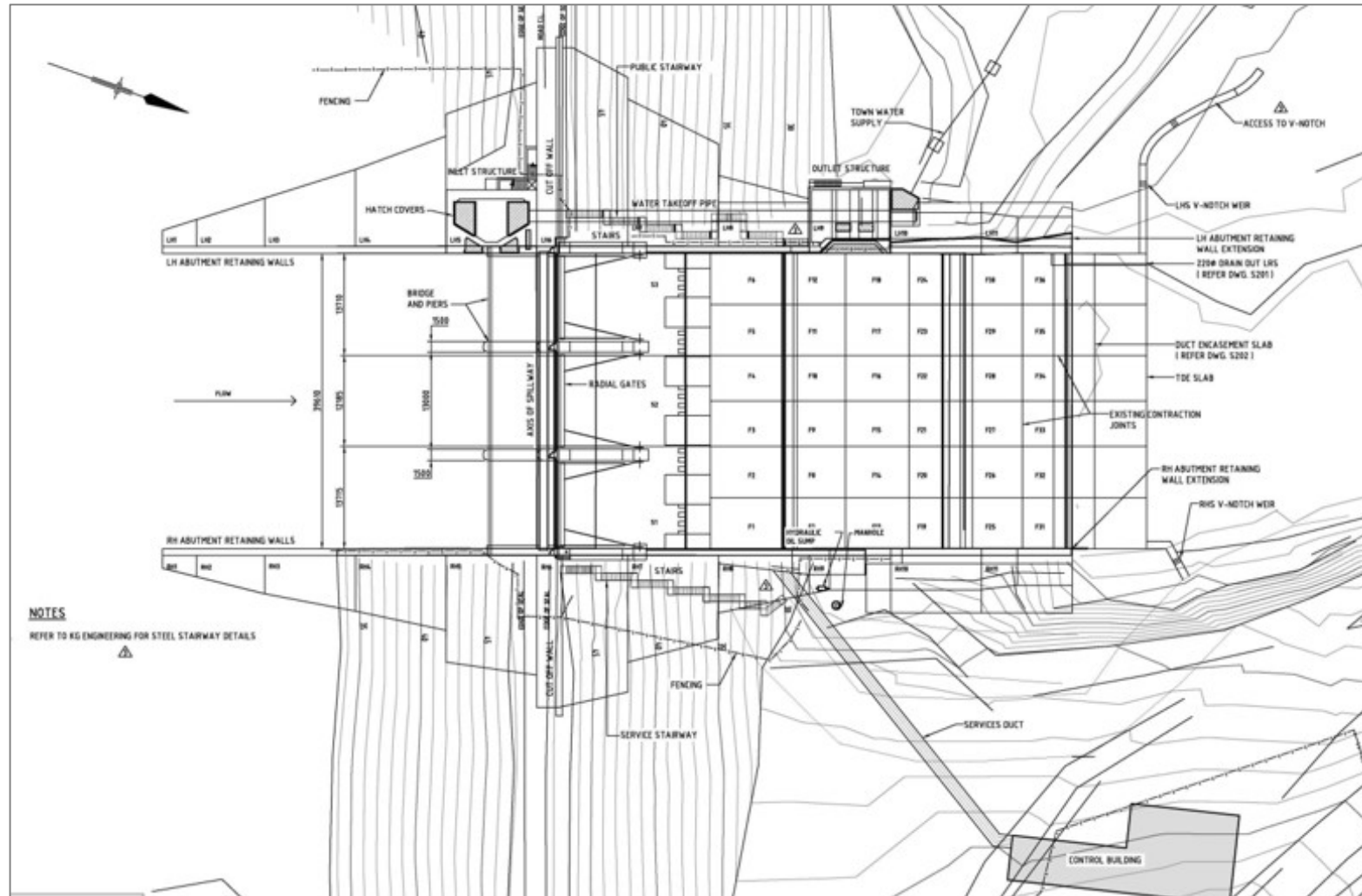
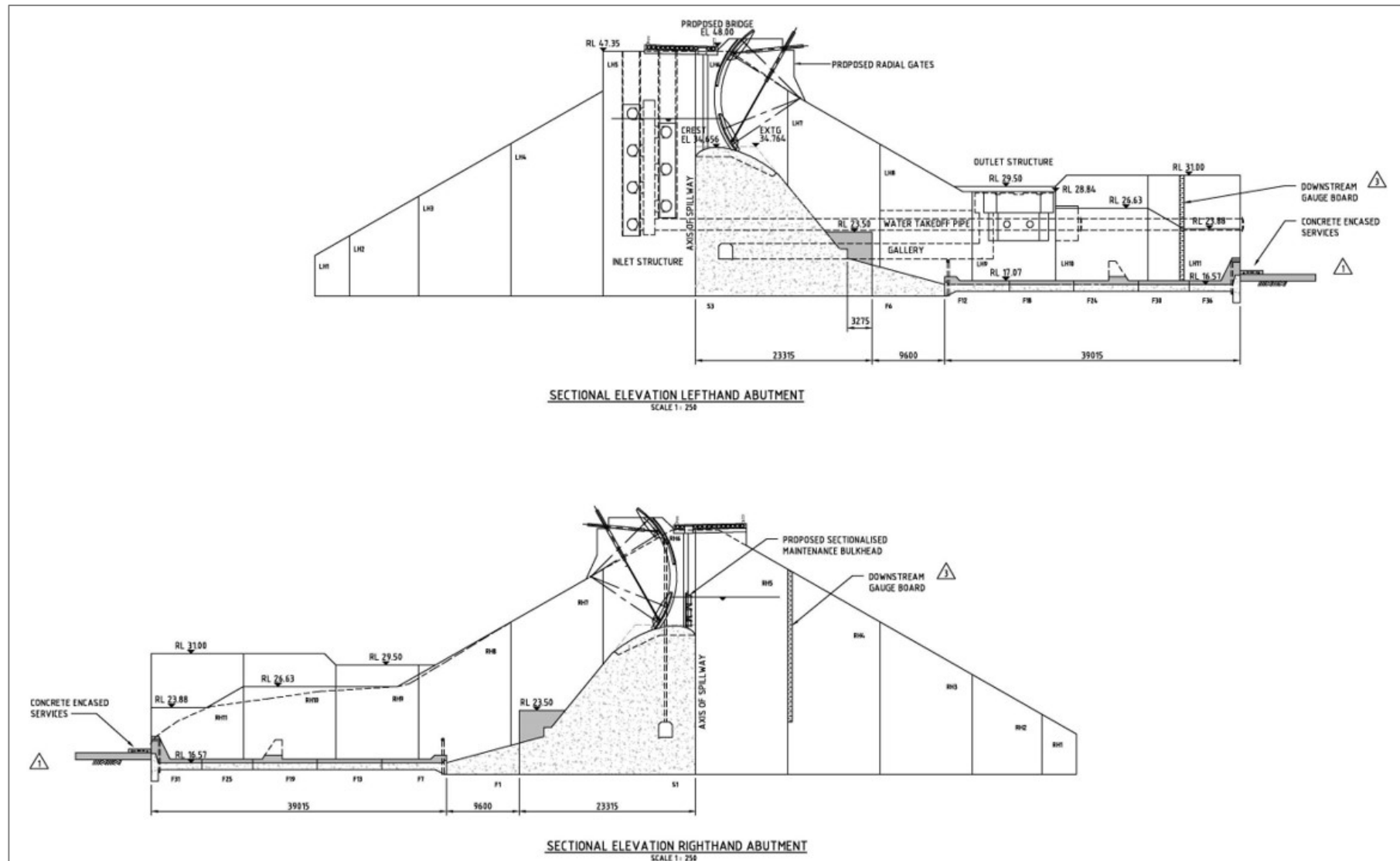


Figure 3 - Ross River Dam - Sectional Elevations, LH & RH Abutments – Spillway General Arrangement



3.5 Emergency Inspections and Monitoring

The Ross River Dam has been designed to conform to modern design standards, so that its failure is highly unlikely. In order to maintain the dam in a safe condition and promptly detect any dam hazards, the following is applicable to Ross River Dam.

3.5.1 Inspections

- **Routine Visual Inspection:** Conducted daily as per the ANCOLD Guidelines or as directed by the DSTDM
- **Detailed Inspection:** Conducted annually
- **Comprehensive Inspection:** Conducted 5-yearly

3.5.2 Instrumentation and monitoring

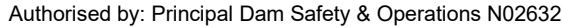
To confirm the structural behaviour and safety of the embankment, the following instrumentation was installed, and is monitored, at Ross River Dam in accordance with SOP-009.

Main Dam	
Settlement/movement Measurement	26 Surface Movement Stations – Manual Measurements
Seepage Measurement	3 x V-Notch Weirs Left D/S Wall – manual measurement Right D/S Wall – manual measurement Gallery – manual measurement 3 x Rectangular-Notch Weirs Main Embankment Seepage, chainage 650m to 8300m – automated bubbler Carpark and Ramp, chainage 610m to 635m – automated bubbler Seepage pipe outlet – manual measurement
Piezometers	40 Hydraulic Piezometers – Manual measurements
Survey Points	4 x Survey Control Stations
Observation Bores x 10	The location of instrumentation and monitoring equipment is illustrated in Figure 4 and Figure 5 on the following pages.

3.5.3 Automatic monitoring

To improve our ability to monitor the performance of the dam, the following automatic monitoring equipment has been installed and maintain By Sixense. All trained operators will have their own log in passwords to the Beyond Monitoring website where data, graphs and trends from the following equipment can be viewed.

Main Dam	
	4 tiltmeters and 10 crack gauges – Continuously Monitored
	Seepage pipe outlet flow meter – Continuously Monitored Seepage pipe turbidity – Continuously Monitored
Piezometers	



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SECTION AT Stn 1+590'

SECTION AT Stn 2+210'

SECTION AT Stn 2+620'

SECTION AT Stn 8+300'

PIEZOMETER SCHEDULE

TIP No.	TYPE	NP No.	TYPE
1	HA	21	HC
2	HA	22	HC
3	HA	23	HC
4	HA	24	HC
5	HA	25	HA
6	HA	26	HA
7	HA	27	HA
8	HA	28	HA
9	HA	29	HA
10	HA	30	HA
11	HC	31	HC
12	HC	32	HC
13	HC	33	HC
14	HA	34	HC
15	HA	35	HA
16	HA	36	HA
17	HA	37	HA
18	HA	38	HA
19	HA	39	HA
20	HA	40	HA

Note: In any M-2-278 Standard Piezometer Type Multipoint Details.

LEGEND:

○ indicates Piezometer Tip

⊕ indicates Benelux Clay Plug

NOTE:

For piezometer readings see Sigsbee 4821/MS.

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Figure 5 - Ross River Instrumentation Layout

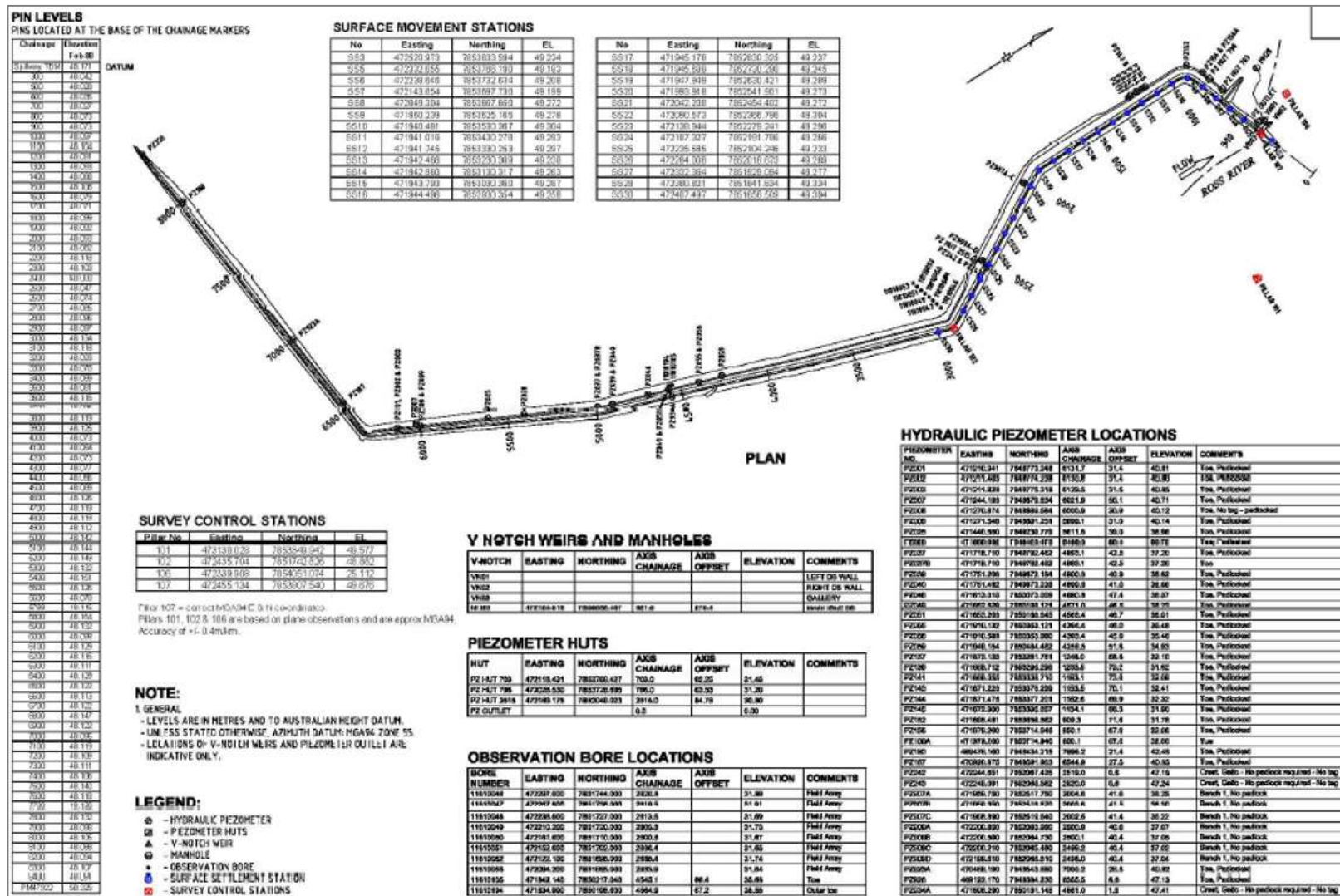
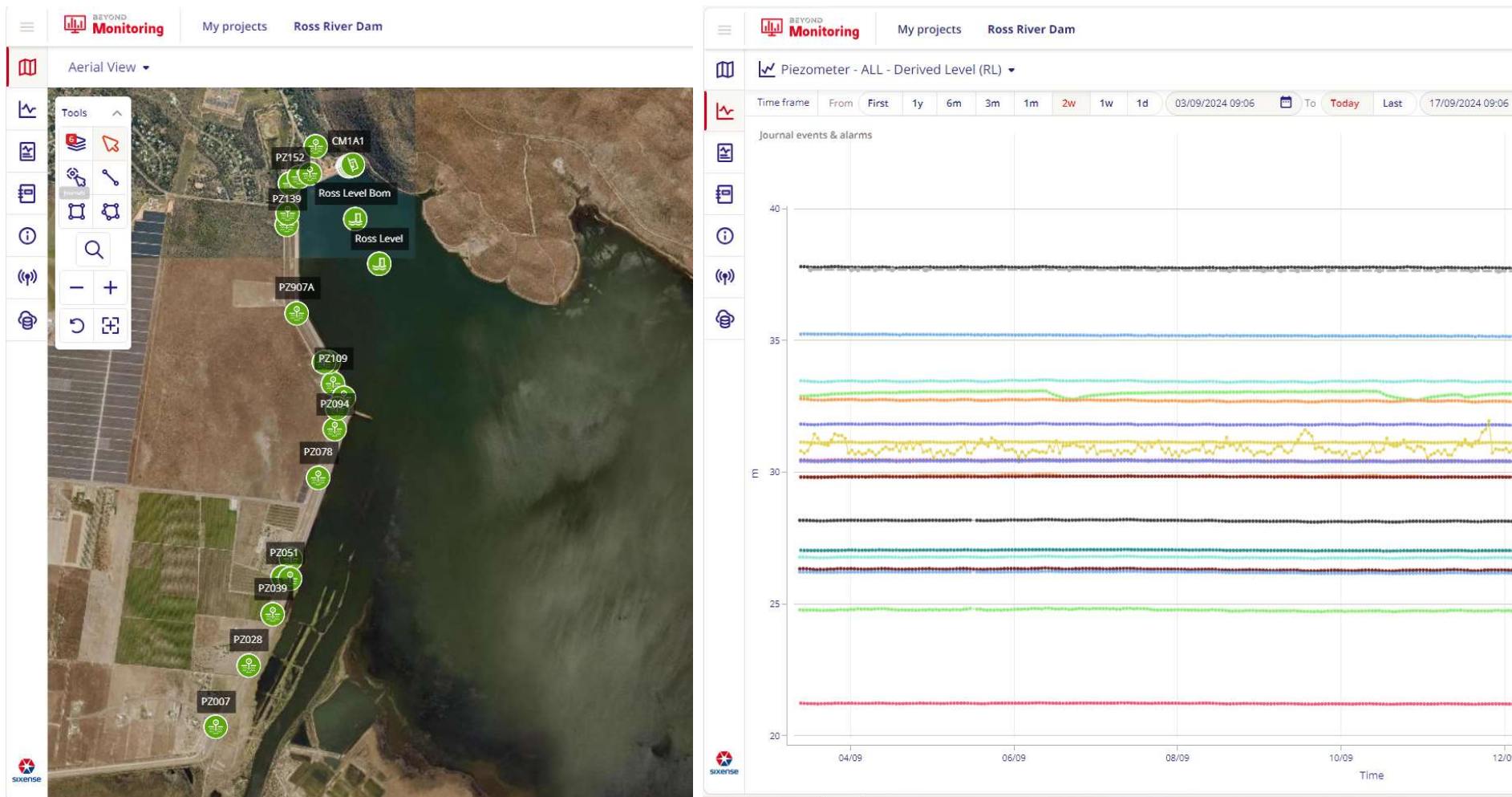


Figure 6 - Ross River Beyond Monitoring Instrumentation Layout & Trend Plots



4. Roles and Responsibilities

Roles and Responsibilities	Position holder ¹
<p>Principle Dam Safety (PDS)</p> <ul style="list-style-type: none"> • Authorise the issuing of EAPs, SOPs and O&M Manuals and amendments. • Facilitate Dam Safety Training Courses for Dam Operators and other staff as appropriate and ensure that all staff required to undertake Dam Safety work are trained and accredited. • Ensure that risks identified in Annual Inspections or other technical reports undertaken in relation to Dam Safety are Included in the EAP. • Ensure visual inspections and instrumentation monitoring frequencies conform to ANCOLD Guidelines. • Ensure all Dam Safety work orders, work instructions and lesson learned outcomes are fully implemented. • Ensure requirements of the Dam Safety Condition Schedule are met. • Ensure the work instructions are correct and the Logbooks, SOPs, Data Books, and EAP is reviewed annually as per the Dam Safety Condition Schedule • Undertake and prepare the 5 yearly Comprehensive Inspection Reports with suitably qualified personnel within the time specified in the Dam Safety Condition Schedule and ensure work orders are created for recommendations and work is undertaken as required. • Undertake Annual Inspections and prepare reports within the time frames specified in the Dam Safety Condition Schedule and ensure work orders are created for recommendations and work is undertaken as required. • Review the Dam Safety Instrumentation Database and evaluate data to verify the structural integrity of the dam on a regular basis and maintain a spread sheet for verification for audit and quality control. • Liaise with the Dam Safety Regulator. • Record communications, notifications and observations as required. 	PDS
<p>Technical Advisor</p> <ul style="list-style-type: none"> • Analyse the situation and provide expert technical advice • Discuss issue with peers and other technical experts and make sound decisions to mitigate risk • Determine response to incidents and emerging issues • Record communications, notifications and observations as required. 	Consultant
<p>Note 1: May be undertaken by one person, or jointly between the following personnel, depending on availability and/or dam hazard</p>	

Roles and Responsibilities	Position holder ¹
Dam Safety Technical Decision Maker (DSTDM) <ul style="list-style-type: none"> Analyse the situation and provide expert technical advice in relation to Dam Safety Discuss Dam Hazard with peers and other technical experts and make sound decisions to mitigate risk. Determine response to incidents and emerging issues. Ensure the EAP is implemented appropriately and carry out the DSTDM role as required. Maintain current RPEQ accreditation. Liaise with Regulator as required. Provide a 24/7 contact. <p>Record communications, notifications and observations as required.</p>	PDS
Flood Operations Decision Maker (FODM) <ul style="list-style-type: none"> Provide hydrological advice in relation to predicted and actual dam outflows. Ensure model outputs are checked and approved. Ensure the EAP is implemented appropriately and carry out the FODM role as required. Record communications, notifications and observations as required. 	Various personnel as per FODM roster
Incident Coordinator (IC) <ul style="list-style-type: none"> Activate the EAP Ensure the EAP is implemented appropriately. Liaise with the LDMG or proxy. Liaise with DSTDM and make any necessary decisions relating to dam operational matters during times when this document is triggered, including during the period in the lead up to events. Provide a 24/7 contact. Record communications, notifications and observations as required. 	GM WS or TMWRDS
Dam Duty Officer (DDO) <ul style="list-style-type: none"> Ensure the EAP is implemented appropriately and carry out the DDO role as required. Take direction from the DSTDM and IC as requested. Arrange immediate site inspection and make informed assessment of the situation. Escalate any issue not covered in the EAP or where actions are not clear. Record communications, notifications and observations as required. 	Various personnel as per DDO roster
Townsville City Council Council has legislated local government functions, as per Section 80 of the Qld Disaster Management Act (2003). These include: <ul style="list-style-type: none"> Ensure it has a disaster response capability. Approve its local disaster management plan. Ensure information about an event or a disaster in its area is promptly given to the district disaster coordinator for the disaster district in which area it is situated. Perform other functions given to the local government under the Act. Must assess (in consultation with its LDMG) the EAP for consistency with the Local Disaster Management Plan. 	TCC

Roles and responsibilities	Position holder ¹
<p>Disaster Management Groups/Personnel - (In addition to requirements outlined in the Qld. Disaster Mgmt. Act 2003). The agreement of the below is sought through the review and approval of this document.</p> <p>LDMG</p> <ul style="list-style-type: none"> Assist to ensure community education around messaging and impacts of EAP related events is undertaken and continually improves. Work with TCC to ensure the EAP is regularly exercised. Identify and coordinate the use of manpower and resources that may be required for an EAP event. Identify and provide advice to DDMG about support services required by the LDMG to manage an EAP event. Provide reports and make recommendations to the relevant DDMG about matters relating to EAP events and any support required. <p>QFES</p> <ul style="list-style-type: none"> Work with LDMG and TCC to ensure Emergency Alerts polygons are prepared, stored and tested. <p>DDMG</p> <ul style="list-style-type: none"> DDMG may review plan with consistency with the District Disaster Management Plan Ensure the communication provided under this EAP is consistent with the District Disaster Management Plan. 	<p>LDMG DDMG QFES</p>
<p>Dam Safety Regulator (DSR)</p> <ul style="list-style-type: none"> Liaise with relevant Minister on necessary actions. Approve this document as required under legislation. Liaise with Chief Executive as required in administering (regulating) the Water Supply (Safety and Reliability) Act 2008. 	<p>DSR</p>

5. Dam Hazard - Flood Operations

5.1 Overview

The emergency action described in this section (dam hazard—flood operations) relates to:

- A dam hazard where natural catchment inflows fill Ross River Dam to FSL 38.55m and the rate of inflow exceeds the capacity of the outlet works. The spillway will then discharge water downstream into the Ross River. These flood flows can create a dam hazard event. Inflows will also cause the storage to temporarily rise to above the full supply level of the storage. Note:
 - The greater the rate of inflow, the higher the storage will rise and the greater dam hazard to residents.
 - The higher the storage level rises, the greater the loads on the dam structure.
 - Although unlikely, the greater the loading, the higher the likelihood of a dam failure.
 - Typically, the level of surveillance is increased during flood operations (refer tables in this section).
 - Spillway discharge from the dam where there have been no indications that a dam failure may be initiating or in progress.

The area likely to be affected by this emergency event is shown in Appendix B2, *Extent of Inundation for Spillway Flow* map for incremental discharges up to 4000m³/s.

Gate System Control during Mobilisation¹

When the DDO is required to mobilise to site, they shall perform the following:

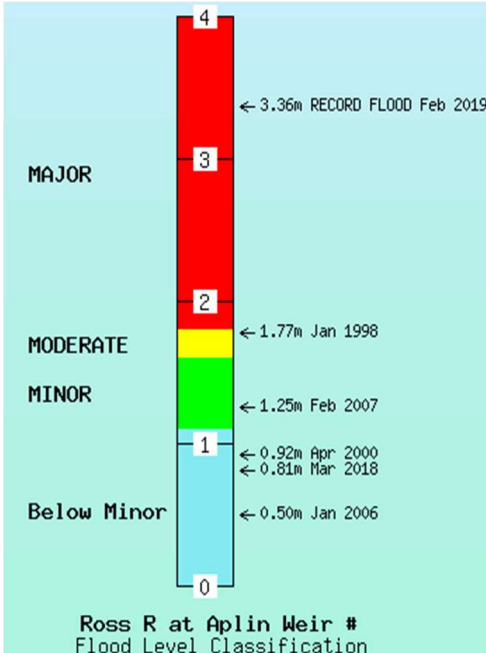
- Log in to SCADA system and confirm HMI communications by switching all gates to AUTO in accordance with SOP001;
- The gates and equipment shall remain in AUTO as per SOP016 and the operator will remain on site until relieved at the end of their 12-hour shift or the Stand Down emergency action is triggered by the IC.

The following steps shall be taken to ensure continuous monitoring of the Ross River Dam during mobilisation and relocation:

- The IC or DSTDM may log into the SCADA system and remotely monitor the dam until the DDO arrives on site.

Note: 1. Dam gate switches must be switched to auto at Dam before the above control can happen.

Table 4: Flood Classification Triggers

	Flood Classification Level	Height at Aplins Weir (m AHD)	Height at Aplins Weir (BOM Gauge Zero)	Estimated corresponding discharge from RRD (m ³ /s)
 <p>ROSS R at Aplins Weir # Flood Level Classification</p>	Major	8.5	2.11	733
	Moderate	7.96	1.57	440
		6.96	0.57	

The following table shows historical floods experienced at Ross River Dam.

Table 5: Historical floods experienced at Ross River Dam (post Gate upgrade)

Flood rank	Date	Peak Height EL (m)
1	03 February 2019	43.03
2	21 March 2012	40.73
3	24 February 2009	40.54
4	12 February 2008	39.84
5	03 February 2011	39.60
6	31 January 2010	39.45
7	4 January 2023	38.96
8	23 March 2010	38.94
9	14 April 2014	38.69

5.2 Emergency Actions

In the table below, each level of activation includes both its own actions and the actions of any lower level, unless those lower-level actions are superseded. Stand Up activation levels have been set to coincide with the required EA alerts for downstream residents. Refer to EA alert maps in Appendix A4

5.2.1 Activation Triggers

Table 6: Flood Emergency Activation Trigger Summary

Alert	EL 38.45m and rising	0.1m below FSL
Lean Forward	Storage EL 38.65m	Gate Opening trigger level Routine water releases minimal impact downstream
Stand Up 1	Storage above EL 40.75m	Minor flooding for BLACK zones
Stand Up 2	Storage EL 41.50m	Minor flooding for PINK zones Moderate flooding for BLACK zones
Stand Up 3	Storage EL 42.25m	All gates fully open at EL 43 Major flooding BLACK & PINK zones
Stand Up 4	Storage EL 45.50m	Dam begins to back flow through Toopan at EL 46.0m Prepare GREEN zones for Evacuation
Stand Up 5	Dam failure extremely likely OR Storage EL 46.50m	Evacuation of GREEN zone required
Stand Down	Storage level FSL 38.55m and falling	

5.2.2 Assessment of circumstances (Indication of increase in the likelihood of flood operations)

The DDO will assess the weather and flood warnings daily in accordance with the relevant SOP. The DDO will escalate to the Incident Coordinator (IC) any warnings that have the potential to generate an inflow event in the catchment in the following 24 hours.

The IC will escalate to the FDOM any local intelligence on catchment conditions that could increase the probability of inflows to the dam.

The DDO will determine whether it is reasonably likely that the dam could reach EL 38.45m within the subsequent 24 hours. If so assessed, the IC will trigger the Alert status for flood operations.

5.2.3 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)
- Flood Operations Decision Maker (FODM)

5.3 Manual Operation and Early Releases

Once the EAP has been activated to the lean forward level it is possible to operate in manual mode, open the gates and conduct an early release of up to 350m³/s of water without exceeding the capacity of the river and inundating properties. However, this early release of water was found to have minimal to no impact on the peak flood levels for a major flood.

The decision to operate in manual mode shall only be made by the IC after considering engineering and flooding advice from the DSTDM and FODM on the potential impacts to the dam and community. If operated in manual mode, only early releases will be permitted and all gate opening levels as required in table C3 shall be followed as the water rises to these set levels. The gates shall not be operated in manual mode with the intention of holding back water to minimise downstream flooding as this compromises Dam safety.

The operation of the gates in manual mode, and the release of water before the Dam has reached FSL level of 38.65 is outside the scope of this EAP and is considered an operational release by TCC for gate testing, environmental releases or other reasons.

Table 7: Flood Operations—DDO Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Up 4	Stand Up 5	Stand Down
Activation Trigger	<ul style="list-style-type: none"> EL 38.45m and rising (0.1m below FSL) 	<ul style="list-style-type: none"> Storage EL 38.65m (gate opening trigger level) 	<ul style="list-style-type: none"> Storage EL 40.75m 	<ul style="list-style-type: none"> Storage EL 41.50m 	<ul style="list-style-type: none"> Storage EL 42.25m 	<ul style="list-style-type: none"> Storage EL 45.50m 	<ul style="list-style-type: none"> Dam failure extremely likely. OR Storage EL 46.50m 	<ul style="list-style-type: none"> Storage FSL 38.55m and falling
Actions	<ul style="list-style-type: none"> Initiate commencement of 24h roster. Ensure emergency power and other backup systems are checked Check gallery sump pumps to prevent build-up of water in gallery Monitor and record water levels and advise FODM as requested Arrange supplies – min 5 days for 2 people Confirm Sat phone charged and functional Mobilise to site Confirm HMI links operational as per SOP-001 Switch gates to auto control as per SOP016 Confirm FODM arrangements Log into Beyond Monitoring to track instrument readings and spillway movements as per SOP-008 	<ul style="list-style-type: none"> As per previous activation level, AND Maintain situational awareness Seek advice from FODM Visually observe gates and spillway flow at hourly intervals or at any gate movements using form QAF0567 Visually check structure for leaks, movement at 4 hourly intervals using form QAF0544 Check and record seepage in gallery at 4 hourly intervals using form QAF0547; includes photos at marked locations When causeway inaccessible, route over top of dam should be used Undertake instrumentation readings as per SOP-008, or as directed by DSTDM Report unusual readings or observations to DSTDM and IC 	<ul style="list-style-type: none"> As per previous activation level, AND Visually monitor reservoir level gauge boards and document hourly If storage level continues to rise at a rate 300mm/d or more, dam should be inspected with full visual surveillance at 4 hourly intervals using form QAF0544 Provide data to FODM as requested Consider adding resource requirements for surveillance 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level, AND Visually monitor reservoir level and gates and notify FODM Inspect embankments & mass concrete in accordance with SOP-009 <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Gates fully open at EL 43.00m</p> </div>	<ul style="list-style-type: none"> As per previous activation level, AND Advise IC/FODM on reaching EL 45.5m & water backflowing to majors creek 	<ul style="list-style-type: none"> As per previous activation level Advise IC/FODM on reaching EL 46.5m & evacuate the vicinity of Dam 	<ul style="list-style-type: none"> Return to routine surveillance activities and frequencies inspect dam for any damage identified Forward EER data to IC
<div style="border: 1px solid black; padding: 10px; text-align: center; color: red; font-weight: bold;"> <p>If loss of Communication with IC and LDMG. DDO to issue warnings in IC communications plan in accordance with Appendix A3, A4 and A5</p> </div>								
<div style="border: 1px solid black; padding: 10px; text-align: right; color: red; font-weight: bold;"> <p>Note: Alert Actions Continued on Next Page</p> </div>								

Table 7 (continued): Flood Operations—DDO Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Up 4	Stand Up 5	Stand Down
Activation Trigger	<ul style="list-style-type: none"> EL 38.45m and rising (0.1m below FSL) 	<ul style="list-style-type: none"> Storage EL 38.65m (gate opening trigger level) 	<ul style="list-style-type: none"> Storage EL 40.75m 	<ul style="list-style-type: none"> Storage EL 41.50m 	<ul style="list-style-type: none"> Storage EL 42.25m 	<ul style="list-style-type: none"> Storage EL 45.50m, 	<ul style="list-style-type: none"> Dam failure extremely likely. OR Storage EL 46.50m 	<ul style="list-style-type: none"> Storage FSL 38.55m and falling
Actions	<ul style="list-style-type: none"> Inspect dam daily (or as instructed by DSTDM) & photograph/video and record using approved forms in appendix D and send to IC and DSTDM Log book entries as per SOP-005 Undertake site preparations if not already completed Record all communication 	<p>Note: DDO must mobilise to site if any doubt, Dam must be manned.</p>	<p>DDO to work with IC to close access ramp, viewing stairs and platform to public. Coordinate with CMO Traffic Controllers and QPS</p>		<p>Note: Gates fully open at EL 43.00m</p>			
Internal Notifications	1.IC 2.DSTDM	1.As previous activation level	1.As previous activation level	1.As previous activation level	1.As previous activation level	1. As previous activation level	1. As per previous activation level	1.DSTDM (at end of event) 2. SMS date and details of event completion
External Notifications	1. Not applicable	1. As previous activation level	1. As previous activation level	1. As previous activation level	1. As previous activation level	1. As previous activation level	1. As previous activation level	1. As previous activation level

Townsville City Council

RD0032 Ross River Dam Emergency Action Plan

Authorised by: Principal Dam Safety & Operations N02632

Effective Date: 30/09/2024

Table 8: Flood Operations—IC Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Up 4	Stand Up 5	Stand Down
Activation Trigger	<ul style="list-style-type: none"> EL 38.45m and rising (0.1m below FSL) 	<ul style="list-style-type: none"> Storage EL 38.65m (gate opening trigger level) 	<ul style="list-style-type: none"> Storage EL 40.75m 	<ul style="list-style-type: none"> Storage EL 41.50m 	<ul style="list-style-type: none"> Storage EL 42.25m 	<ul style="list-style-type: none"> Storage EL 45.50m 	<ul style="list-style-type: none"> Dam failure extremely likely. OR Storage EL 46.50m 	<ul style="list-style-type: none"> Storage FSL 38.55m and falling
Actions	<ul style="list-style-type: none"> Liaise with DSTDM Liaise with LDMG re: situation Obtain catchment conditions from DDO/FODM Advise DDO of anticipated rainfall/inflows Issue incident alert (once only on activation of EAP) Record all communication 	<ul style="list-style-type: none"> As per previous activation level, AND Ensure all abnormal observations or damage have been reported to IC and DSTDM Monitor for storm surge forecast 	<ul style="list-style-type: none"> As per previous activation level <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="color: red; text-align: center;">IC to work with DDO to close access ramp, viewing stairs and platform to public. Coordinate with CMO Traffic Controllers and QPS</p> </div>	<ul style="list-style-type: none"> As per previous activation level, AND 	<ul style="list-style-type: none"> As per previous activation level <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="color: red; text-align: center;">Note: Gates fully open at EL 43.00m</p> </div>	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> Deactivate EAP If required, compile EER and deliver to DSR Complete Situation Report (final) Return to routine activities
Internal Notifications	1.DDO 2.LDMG 3.DSTDM 4.FODM	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level
External Notifications	1.None	1.D/S Residents via LDMG 2.DDMG	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level, AND	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level

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Table 09: Flood Operations—IC Emergency Action

Activation Level	Trigger for communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Alert	• EL 38.45m and rising (preparedness)	1. LDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level		
Lean Forward	• Storage EL 38.65m (gate opening trigger level)	1. LDMG 2. DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level and any known forecasts		
	• Storage EL 38.65m	3. D/S Residents	• TV, Radio, Social Media, Disaster Dashboard, Roadside Signs	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.		
	• Storage EL 40.25m		• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP	Advice EA 8.1	BLACK
	• Storage EL 40.5m		• SMS	https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Watch and Act EA 8.2	BLACK
Stand Up 1	• Storage EL 40.75m	1. LDMG 2. DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? (storage is greater than flood of record) Advise of current storage level and any known forecasts		
		3. D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA 8.3	BLACK

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Table 9: (Continued) Flood Operations—IC Communication Plan

Activation Level	Trigger for communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Stand Up 2	• Storage EL 41.50m	1. LDMG 2. DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level and any known forecasts		
	Storage EL 41.50m	3. D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA 8.3	BLACK
	Storage EL 41.75m				Advice EA 9.1	PINK
	Storage EL 42.00m				Watch and Act EA 9.2	PINK
Stand Up 3	1. Storage EL 42.25m	1. LDMG 2. DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level and any known forecasts		
		3. D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA 9.3	BLACK PINK

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Table 9: (Continued) Flood Operations—IC Communication Plan

Activation Level	Trigger for communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Stand Up 4	<ul style="list-style-type: none"> Storage EL 45.50m 	1. LDMG 2. DDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? What is the status? Advise of current storage level and any known forecasts		
		3. D/S Residents	<ul style="list-style-type: none"> SMS 	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA 9.3	BLACK PINK
Stand Up 5	<ul style="list-style-type: none"> Dam failure extremely likely, OR Storage EL 46.50m 	1. LDMG 2. DDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? What is the status? Advise of current storage level and any known forecasts		
	<ul style="list-style-type: none"> Storage EL 46.50m 	3. D/S Residents	<ul style="list-style-type: none"> SMS 	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Watch and Act EA 10.1	BLACK PINK GREEN
	<ul style="list-style-type: none"> Dam failure extremely likely 				Emergency Warning EA 10.2	BLACK PINK GREEN
Stand Down	<ul style="list-style-type: none"> Storage FSL 38.55m and falling 	1. LDMG 2. DDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? What is the status? Advise of current storage level Advise EAP has been deactivated		
		3. D/S Residents	<ul style="list-style-type: none"> TV, Radio, Social Media, Disaster Dashboard, Roadside Signs 	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.		

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Table 9: Flood Operations - DSTDM Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Up 4	Stand Up 5	Stand Down
Activation Trigger	<ul style="list-style-type: none"> EL 38.45m and rising (0.1m below FSL) 	<ul style="list-style-type: none"> Storage EL 38.65m (gate opening trigger level) 	<ul style="list-style-type: none"> Storage EL 40.75m 	<ul style="list-style-type: none"> Storage EL 41.50m 	<ul style="list-style-type: none"> Storage EL 42.25m 	<ul style="list-style-type: none"> Storage EL 45.50m, 	<ul style="list-style-type: none"> Dam failure extremely likely. OR Storage EL 46.50m 	<ul style="list-style-type: none"> Storage FSL 38.55m and falling
Actions	<ul style="list-style-type: none"> Provide technical advice to DDO and IC on as need's basis Review surveillance reports and determine if any additional responses are required Record all communication 	<ul style="list-style-type: none"> As per previous activation level Liaise with DDO and IC to provide updates. Confirm level activation based on storm surge forecast 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Gates fully open at EL 43.00m</p> </div>	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities
Internal Notifications	1.DDO 2.IC	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level
External Notifications	1.DSR	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level

All communications to IC should be confirmed by email whenever practical

Table 10: Flood Operations - FODM Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Up 4	Stand Up 5	Stand Down
Activation Trigger	<ul style="list-style-type: none"> EL 38.45m and rising (0.1m below FSL) 	<ul style="list-style-type: none"> Storage EL 38.65m (gate opening trigger level) 	<ul style="list-style-type: none"> Storage EL 40.75m 	<ul style="list-style-type: none"> Storage EL 41.50m 	<ul style="list-style-type: none"> Storage EL 42.25m 	<ul style="list-style-type: none"> Storage EL 45.50m, 	<ul style="list-style-type: none"> Dam failure extremely likely. OR Storage EL 46.50m 	<ul style="list-style-type: none"> Storage FSL 38.55m and falling
Actions	<ul style="list-style-type: none"> Monitor situation Extract data from available sources Update flood models Update and issue flood operations report Record all communication 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note: Gates fully open at EL 43.00m</p> </div>	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities
Internal Notifications	1.IC 2.DDO	1.As per previous activation level and 2.DSTDM	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level
External Notifications	1.Not applicable	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level

All communications to IC should be confirmed by email whenever practical

6. Dam Hazard—Piping: Embankment, Foundation, or Abutments

6.1 Overview

The emergency action described in this section relates to a potential dam hazard due to a piping condition through the embankment (Main Dam), foundations, or dam abutment. An early indicator of a piping condition can be an increase in seepage or a new area of seepage. If the seepage water is cloudy or has become cloudy, this may indicate that material is being transported and a pipe is being established.

If a pipe is established and progresses, then a dam failure may result. If a potential pipe is detected early, remedial repairs may be possible in the form of constructing a filter and weighting zone over the pipe exit if safe to do so.

The flood outlines in Appendix B are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by piping. The use of these flood outlines is prescribed below:

- Use the Sunny Day Failure (SDF) outline when a dam failure is in progress or likely due to piping and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Flood (PMF) outline when a dam failure is in progress or likely due to piping and concurrent flooding or downstream releases are occurring or expected to occur.

Note: Definitions for *Concurrent Flooding* and *Downstream Releases* are provided in Section 1.3.

6.1.1 Assessment of circumstances that indicates an increase in the likelihood of piping

An increase in seepage or a new area of seepage is a circumstance that could indicate an increase likelihood of piping. This circumstance is the trigger for the alert status for piping.

Cloudy seepage water is a circumstance that could indicate an increase likelihood of piping. This circumstance is the trigger for the lean forward status for piping.

6.2 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)

Figure 7 - Piping: Embankment, Foundation, or Abutments Flowchart

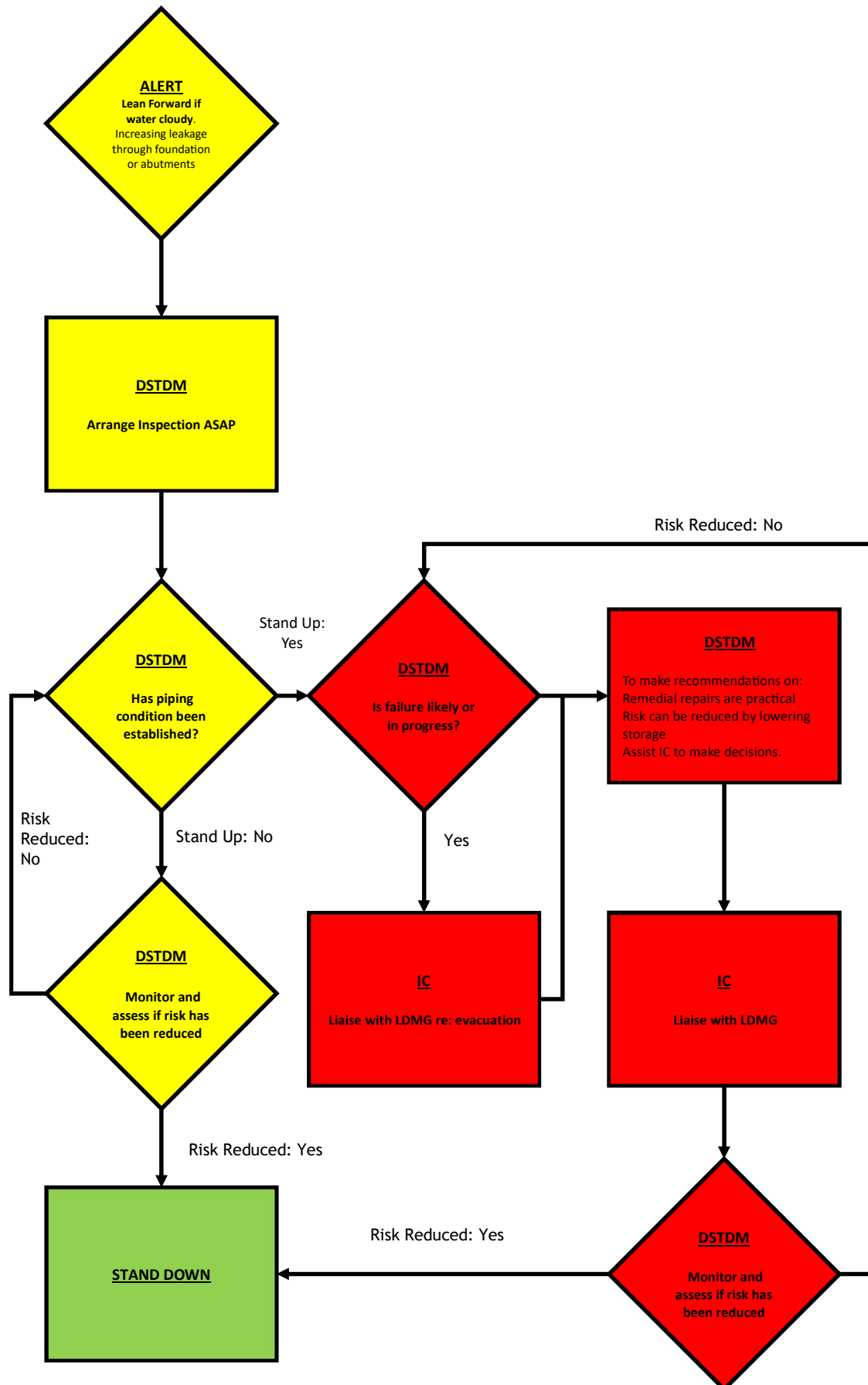


Table 11: Piping: Embankment, Foundation, or Abutments - DDO Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> New leakage through embankment, foundations, or abutments 	<ul style="list-style-type: none"> Increasing leakage through embankment, foundations, or abutments with cloudy water 	<ul style="list-style-type: none"> Piping condition has been established 	<ul style="list-style-type: none"> Failure in progress or likely due to piping, and Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that piping risk has reduced
Actions	<ul style="list-style-type: none"> Monitor flows every 6 hours (or as otherwise instructed by DSTDM) until a decreasing trend is observable, or as directed by the DSTDM Photograph/video piping from a safe point, (if safe to do so) and record using approved forms in Appendix D and send to IC & DSTDM Log Book entry as per SOP-005 Record all communication 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level, and Support/supervise remedial works as required Close any affected roads if not already closed by others Maintain surveillance of area immediately downstream of dam (if safe to do so) and move on any members of the public Liaise with IC on road closures Lower the storage level if directed 	<ul style="list-style-type: none"> As per previous activation level, and Vacate the immediate vicinity of the piping condition Close roads as needed, for public safety 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities Log Book entry as per SOP-005
Internal Notifications	1. IC 2. DSTDM	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level
External Notifications	1. Not applicable	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level

Note: If insufficient time to complete all activities, DELEGATE any necessary actions.

Table 12: Piping: Embankment, Foundation, or Abutments —IC Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> New leakage through embankment, foundations, or abutments 	<ul style="list-style-type: none"> Increasing leakage through embankment, foundations, or abutments with cloudy water 	<ul style="list-style-type: none"> Piping condition has been established 	<ul style="list-style-type: none"> Failure in progress or likely due to piping, and Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that piping risk has reduced
Actions	<ul style="list-style-type: none"> Liaise with DDO, and DSTDM re: situation Complete Situation Report, unless otherwise directed Record all communication 	<ul style="list-style-type: none"> As per previous activation level, and Investigate availability of machinery and materials (if insufficient stockpiles available) Place machinery operators on standby if directed by DSTDM Confirm with LDMG appropriate community information has been disseminated 	<ul style="list-style-type: none"> As per previous activation level, and Mobilise resources to undertake remedial works if directed by DSTDM Liaise with relevant authorities re: road/bridge closures 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> Deactivate EAP If required, compile EER and deliver to the DSR Complete Situation Report (final) Return to routine activities
Internal Notifications	1.DDO 2.DSTDM 3.LDMG	1.As per previous activation level	1.As per previous activation level,	1.As per previous activation level	1. Inform previous notifications of deactivation as required
External Notifications	1.None	1.D/S Residents through the LDMG 2.DDMG	1.As per previous activation level	1.As per previous activation level	1. Inform previous notifications of deactivation as required

Note: If insufficient time to complete all activities, DELEGATE any necessary actions.

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Table 13: Piping: Embankment, Foundation, or Abutments —IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Alert	<ul style="list-style-type: none"> New leakage through an embankment, foundations or abutments 	1.LDMG	<ul style="list-style-type: none"> Phone 	Ross River Dam possible piping issue is not confirmed		
Lean Forward	<ul style="list-style-type: none"> Increase in leakage through an embankment, foundations, or abutments with cloudy water 	1.LDMG 2.DDMG	<ul style="list-style-type: none"> Phone 	<p>Describe current situation with dam—What is the event? (<i>Unconfirmed piping risk</i>)</p> <p>What is the status? (<i>Unconfirmed leakage—Investigation continues</i>)</p> <p>Advise LDMG of current storage level</p> <p>Advise any issues you are aware of LDMG to standby for further advices</p>		
		1.D/S Residents	TV, Radio, Social Media, Disaster Dashboard, Roadside Signs	<p>Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan</p> <p>https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details</p>		
Stand Up 1	<ul style="list-style-type: none"> Piping condition has been established 	1.LDMG 2.DDMG	<ul style="list-style-type: none"> Phone 	<p>Describe current situation with dam—What is the event? (<i>Confirmed piping risk</i>)</p> <p>What is the status? (<i>Confirmed piping/leakage</i>) Advise LDMG of current storage level</p> <p>Advise any issues you are aware of. Discuss any potential road/bridge closures LDMG to prepare for possible evacuations</p>	Watch and Act EA10	BLACK PINK GREEN
		1.D/S Residents	<ul style="list-style-type: none"> SMS 	<p>Emergency Alerts (EA) will be sent to residents through the LDMG</p> <p>Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP</p> <p>https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.</p>		

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Table 18: (Continued) Piping: Embankment, Foundation, or Abutments —IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Stand Up 2	<ul style="list-style-type: none"> Failure likely due to piping, and Sufficient water in storage to create a dam failure Dam failure in progress 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? (Confirmed piping risk) What is the status? (Possible Dam Failure) Advise LDMG of current storage level LDMG to prepare coordinated evacuations		
		3.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA10.1	BLACK PINK GREEN
Stand Down	<ul style="list-style-type: none"> Risk assessment has determined that piping risk has reduced 	1.LDMG 2.DDMG (if from Stand Up)	• Phone	Describe current situation with Dam—What is the event? (Dam Safety Risk—piping) What is the status? (Dam hazard Stood Down) Advise risk assessment has determined that piping risk has reduced and EAP has been deactivated		
		3.D/S Residents	• TV, Radio, Social Media, Disaster Dashboard, Roadside Signs	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.		

Table 14: Piping: Embankment, Foundation, or Abutments - DSTDM Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> New leakage through embankment, foundations, or abutments 	<ul style="list-style-type: none"> Increasing leakage through embankment, foundations or abutments with cloudy water 	<ul style="list-style-type: none"> Piping condition has been established 	<ul style="list-style-type: none"> Failure in progress or likely due to piping, and Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that piping risk has reduced
Action	<ul style="list-style-type: none"> Arrange an inspection of dam to assess its condition as soon as possible, when safe to do so Determine if piping condition has been established Monitor situation and assess risks Record all communication 	<ul style="list-style-type: none"> As per previous activation level Liaise with IC 	<ul style="list-style-type: none"> As per previous activation level, and Assess risk and determine if failure likely or in progress Liaise with the IC Determine if remedial repairs are practical (1) Determine if risks can be reduced by lowering storage (2) Make recommendations regarding (1) and (2) to IC. Supervise* remedial repairs (if applicable) 	<ul style="list-style-type: none"> As per previous activation level, and Liaise with IC and advise on need to recommend evacuations 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities
Internal Notifications	1.DDO 2.IC	1.As per previous activation level	1.As per previous activation level,	1.As per previous activation level	1. Inform previous notifications of deactivation as required
External Notifications	1.DSR	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1. Inform previous notifications of deactivation as required

* Supervision means provide technical oversight to the work. It does not necessarily mean on-site supervision.

All communications to TDM should be confirmed by email whenever practical

7. Dam Hazard - Earthquake

7.1 Overview

The emergency action described in this section relates to a potential dam hazard due to an earthquake causing damage to the dam embankment (Main Dam), foundations, or dam abutment. Damage could take the form of cracking or slumping of the embankment, deformation or land slip, or increased seepage.

If damage does occur, then a dam failure may result. If damage is detected early, remedial repairs may be possible depending on the nature of the damage.

The flood outlines are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by earthquake. The use of these flood outlines is prescribed below:

- Use the Sunny Day Failure (SDF) outline when a dam failure is in progress or likely due to earthquake and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Flood (PMF) outline when a dam failure is in progress or likely due to earthquake and concurrent flooding or downstream releases are occurring or expected to occur.

Note: Definitions for *Concurrent Flooding* and *Downstream Releases* are provided in Section 1.3.

7.2 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)

Figure 8 - Earthquake Flowchart

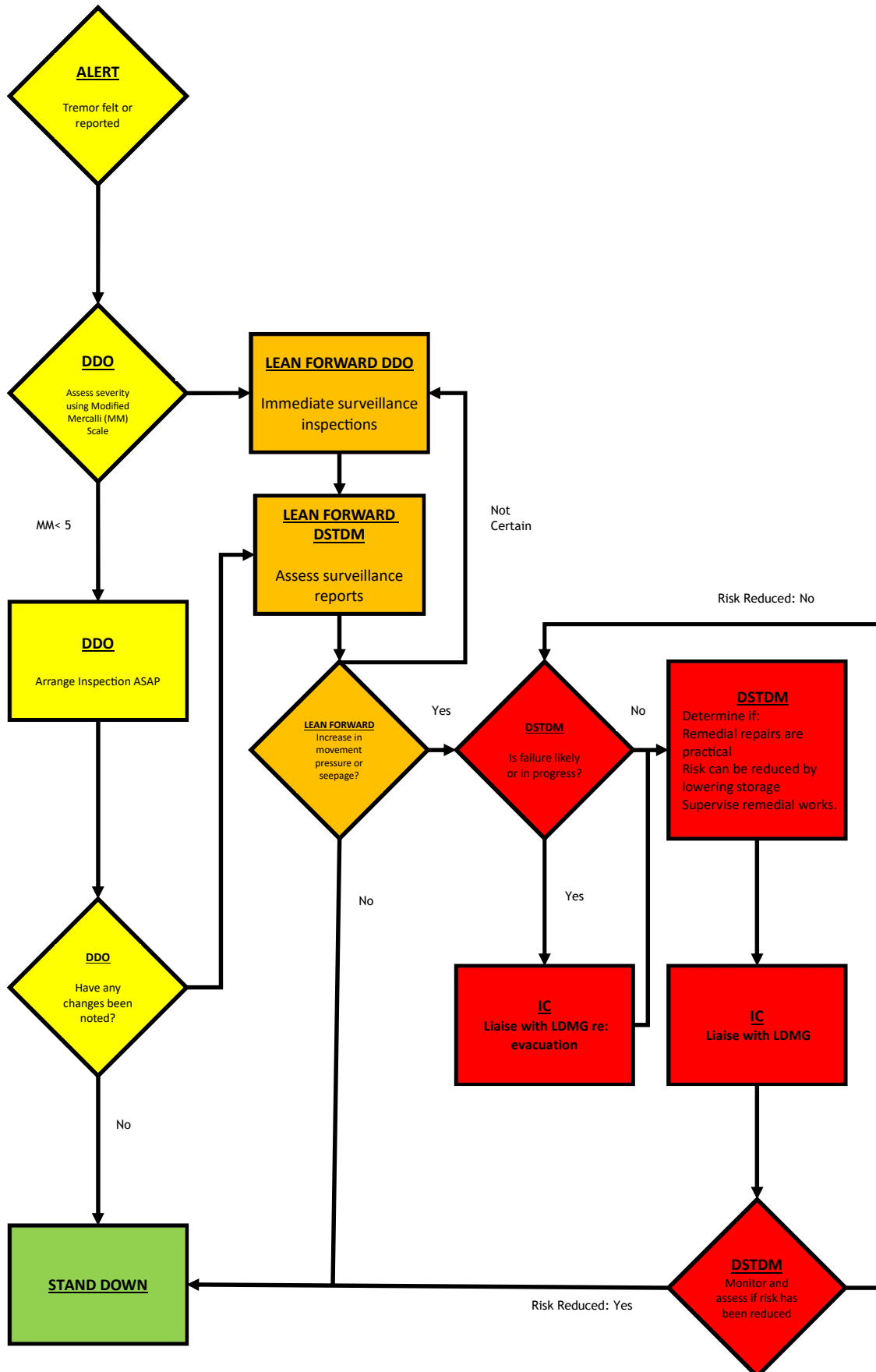


Table 15: Earthquake - DDO Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Earthquake reported or felt in the area and Intensity less than 5MM* 	<ul style="list-style-type: none"> Earthquake reported or felt in the area and Intensity greater than or equal to 5MM*, OR Intensity less than 5MM and change detected during surveillance inspection 	<ul style="list-style-type: none"> Earthquake reported or felt in the area and A possible failurepath has been identified 	<ul style="list-style-type: none"> Failure in progress or likely due to earthquake and Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Actions	<ul style="list-style-type: none"> Immediately inspect embankment, spillway structure, abutments in daylight hours (if safe to do so) and report to DSTDM and IC—photograph/video and record using forms in Appendix D and send to IC and DSTDM Check for leaks, deformation, scour, and concrete damage Record on inspection sheet Repeat inspection as directed Record all communication Read piezometers and other instruments as per SOPs Update Log Book as per SOP-005 	<ul style="list-style-type: none"> As per previous activation level and immediately inspect embankment, spillway structure, abutments (if safe to do so) and report to DSTDM and IC—photograph/video and record using forms in Appendix D and send to IC and DSTDM Repeat the inspection as directed 	<ul style="list-style-type: none"> As per previous activation level and Support/supervise remedial work as required Close any affected roads, if not already closed by others Maintain surveillance of area immediately downstream of dam (if safe to do so) and move on any members of the public Record/photograph the damage from a safe point Vacate the immediate vicinity of the embankment 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> Forward information for EER to IC Update Log Book as per SOP-005 Return to routine activities
Internal Notifications	1.IC 2.DSTDM	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.Inform previous notifications of deactivation as required
External Notifications	1.Not Applicable	1.Not Applicable	1.Not Applicable	1.Not Applicable	1.Not Applicable

* DDO to assess magnitude (MM scale) at dam location.

Table 16: Earthquake—IC Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Earthquake reported or felt in area and Intensity less than 5MM 	<ul style="list-style-type: none"> Earthquake reported or felt in area and Intensity greater than or equal to 5MM, OR Intensity less than 5MM and change detected during surveillance inspection 	<ul style="list-style-type: none"> Earthquake reported or felt in the area and A possible failure path has been identified 	<ul style="list-style-type: none"> Failure in progress or likely due to earthquake and Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Actions	<ul style="list-style-type: none"> Liaise with DDO and DSTDM re: situation Record all communication 	<ul style="list-style-type: none"> As per previous activation level and Investigate availability of machinery and materials (if insufficient stockpiles available) Place machinery operators on standby if directed by DSTDM Complete Situation Report, unless otherwise directed 	<ul style="list-style-type: none"> As per previous activation level and Mobilise resources to undertake remedial works if directed by DSTDM 	<ul style="list-style-type: none"> As per previous activation level and Cease remedial works if directed by DSTDM and plant and personnel to be moved to a safe location 	<ul style="list-style-type: none"> Deactivate EAP If required, compile EER and deliver to DSR Complete Situation Report (final) Return to routine activities
Internal Notifications	1.DDO 2.LDMG 3.DSTDM	1.As per previous activation level	1.As per previous activation level and 2.Discuss with DSTDM need for Emergency alert: LDMG to advise content if required	1.As per previous activation level	1. Inform previous notifications of deactivation as required
External Notifications	1. Not applicable	1. D/S Residents through the LDMG 2. DDMG	1.As per previous activation level	1.As per previous activation level	1. Inform previous notifications of deactivation as required

Table 17: Earthquake—IC Communication Plan

Uncontrolled Copy
Status: Current

Townsville City Council

RD0032 Ross River Dam Emergency Action Plan

Authorised by: Principal Dam Safety & Operations N02632

Effective Date: 30/09/2024

Activation Level	Trigger for Communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Alert	<ul style="list-style-type: none"> Earthquake reported or felt in the area, AND Intensity less than 5MM 	ALERT NOT APPLICABLE				
Lean Forward		1.LDMG 2.DDMG	Phone	Des Describe current situation with dam—What is the event? (Dam Safety Risk—Earthquake damage) What is the status? (Under investigation) Advise of current storage level Stand by for further information		
		3.D/S Residents	TV, Radio, Social Media, Disaster Dashboard, Roadside Signs	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details		

Table 22: (Continued) Earthquake—IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Stand Up 1	<ul style="list-style-type: none"> Earthquake reported or felt in the area, AND A possible failure path has been identified 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? (<i>Dam Safety Risk—Earthquake felt or reported in area</i>) What is the status? (Possible earthquake damage to dam) Advise LDMG of current storage level. Discuss any potential road/bridge closures LDMG to activate emergency response		
		3.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Advice EA11 Watch and Act EA11.1	BLACK PINK GREEN
Stand Up 2	<ul style="list-style-type: none"> Failure in progress or likely due to earthquake, AND Sufficient water in storage to create a dam failure Dam failure in progress 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? (<i>Dam Safety Risk—Earthquake damage</i>) What is the status? (Dam Failure Likely) Advise LDMG of current storage level. Discuss any potential road/bridge closures (if not discussed at Stand Up—1) LDMG to prepare coordinated evacuation		
		3.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA11.2	BLACK PINK GREEN

Table 22: (Continued) Earthquake—IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message text
Stand Down	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced 	1.LDMG 2.DDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? (<i>Dam Safety Risk—Earthquake damage</i>) What is the status? (Dam hazard Stood Down) Advise risk assessment has been determined that failure risk has reduced and that EAP has been deactivated
		3.D/S Residents	<ul style="list-style-type: none"> TV, Radio, Social Media, Disaster Dashboard, Roadside Signs 	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details

Table 18: Earthquake - DSTDM Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Earthquake reported or felt in the area, AND Intensity less than 5MM 	<ul style="list-style-type: none"> Earthquake reported or felt in the area, AND Intensity greater than or equal to 5MM, OR Intensity less than 5MM and change detected during surveillance inspection 	<ul style="list-style-type: none"> Earthquake reported or felt in the area, AND A possible failure path has been identified 	<ul style="list-style-type: none"> Failure in progress or likely due to earthquake, AND Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Action	<ul style="list-style-type: none"> Monitor situation and assess risks Liaise with DDO and IC Record all communication <p>NOTE: 'Reported' is defined as an alert received from Geoscience Australia or other source that advises an Earthquake >4.8ML (Richter Scale) has occurred within a 200km radius of the Dam.</p>	<ul style="list-style-type: none"> As per previous activation level and Review surveillance inspection of dam and assess its condition as soon as possible Determine any possible failure paths from reported damage Liaise with IC on any matters requiring advice 	<ul style="list-style-type: none"> As per previous activation level and Arrange an inspection of dam and assess its condition as soon as possible, when safe to do so Assess risk and determine if failure likely or in progress Liaise with the IC AND Determine if remedial repairs are practical (1) Determine if risks can be reduced by lowering storage (2) Make recommendations regarding (1) and (2) to IC. Supervise* remedial repairs (if applicable) Monitor situation and assess risks 	<ul style="list-style-type: none"> NOTE: If coming to Stand Up—2 from Alert Lean Forward stage, the following actions apply. If coming from Stand Up—1, no additional actions required. Arrange an inspection of the dam and assess its condition as soon as possible, when safe to do so Assess risk and determine if failure likely or in progress Liaise with the IC, AND Determine if remedial repairs are practical (1) Determine if risks can be reduced by lowering storage (2) Make recommendations regarding (1) and (2) to IC. Supervise* remedial repairs (if applicable) Monitor situation and assess risks 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities
Internal Notifications	1.DDO 2.IC	1.As per previous activation level	1.As per previous activation level,	1.As per previous activation level	1.As per previous activation level
External Notifications	1.DSR	2.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level

* Supervision means provide technical oversight to the work. It does not necessarily mean on-site supervision.

All communications to IC should be confirmed by email whenever practical

8. Dam Hazard - Terrorist Threat/Activity or High Energy Impact

8.1 Overview

The emergency action described in this section relates to a potential dam hazard due to a terrorist threat or activity or a high energy impact on the dam such as a plane crash or meteorite.

The vulnerability of Ross River Dam to a terrorist attack is low.

The flood outlines in Appendix B are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by terrorist activity or a high energy impact. The use of these flood outlines is prescribed below:

- Use the Sunny Day Failure (SDF) outline when a dam failure is in progress or likely due to a terrorist activity or a high energy impact and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Flood (PMF) outline when a dam failure is in progress or likely due to a terrorist activity or a high energy impact and concurrent flooding or downstream releases are occurring or expected to occur.

Note: Definitions for *Concurrent Flooding* and *Downstream Releases* are provided in Section 1.3.

8.1.1 Assessment of circumstances indicating an increased likelihood of terrorist activity or high energy impact

Advice from authorities of a specific risk to water infrastructure is a circumstance that could indicate increased likelihood a terrorist threat. If this were specific enough to name a dam, this circumstance would trigger Stand Up 1 activation level.

8.2 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)

Figure 9 - Terrorist Threat/Activity or High Energy Impact Flowchart

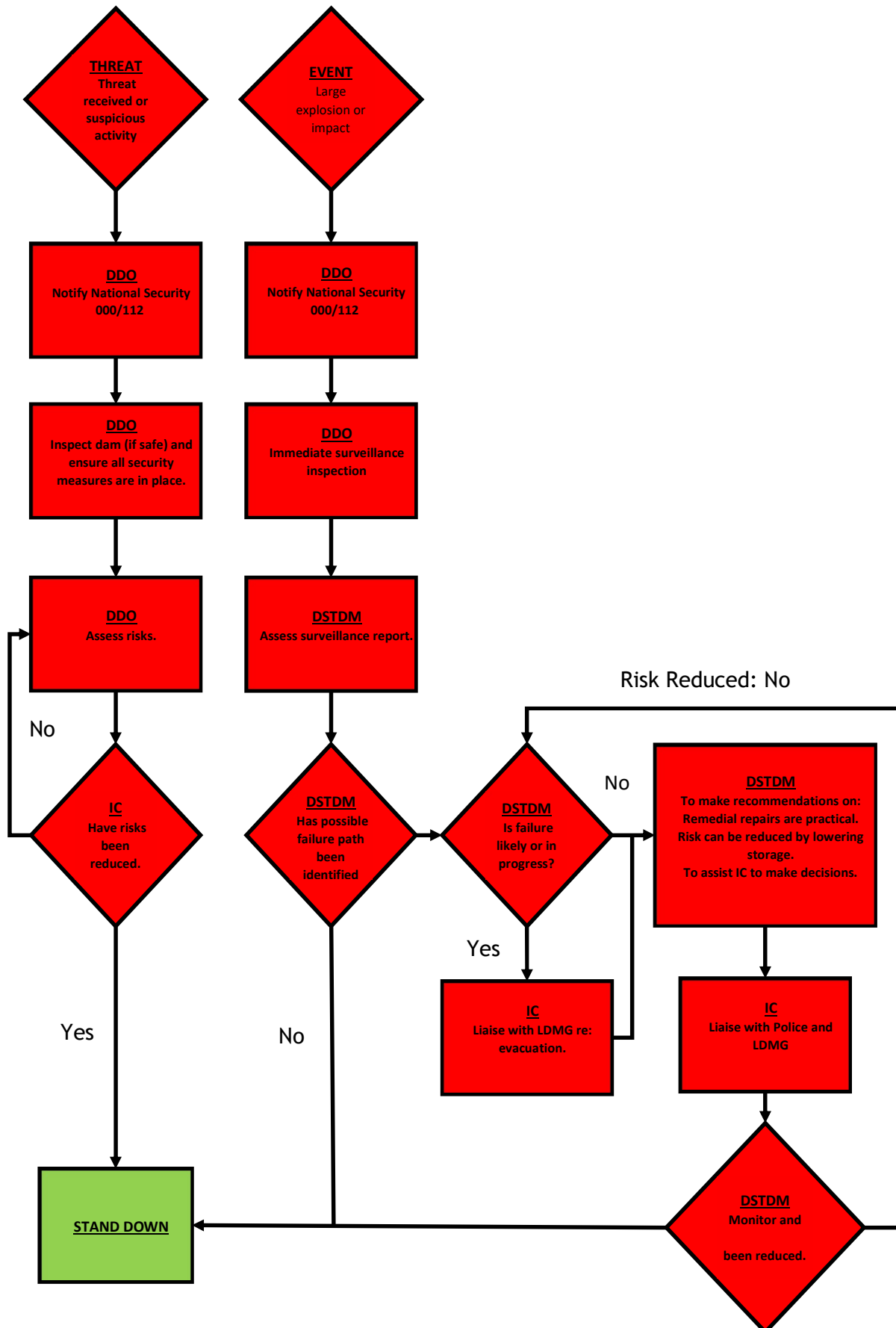


Table 19: Terrorist Threat/Activity or High Energy Impact - DDO Emergency Action

Activation Level	Alert/Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Not applicable 	THREAT <ul style="list-style-type: none"> Possible terrorist activity/suspicious behaviour noticed at the dam Threat received 	EVENT <ul style="list-style-type: none"> Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit) 	RESPONSE <ul style="list-style-type: none"> Failure in progress or likely due to impact or explosion and Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk Assessment has determined that failure risk has reduced.
Actions	1. Not applicable	<ul style="list-style-type: none"> NOTE: If any suspicious behaviour noticed, contact DSTDM for advice. If instructed by DSTDM, or if threat received, complete the following: Notify National Security or 000/112 Inspect dam (if safe) and ensure all security measures are in place (locked gates, etc.) Photograph/video the damage from a safe point, if safe to do so, and record using the approved forms in Appendix D and send to IC and DSTDM Close any affected roads, if not already closed by others Update Log Book as per SOP-005 If Police appoint incident manager, support and follow instructions Record all communication 	<ul style="list-style-type: none"> As per previous activation level and Vacate immediate vicinity of affected area 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> Forward information for EER to IC Update Log Book as per SOP-005 Return to routine activities
Internal Notifications	1. Not applicable	1. DSTDM 2. IC	1. As per previous activation level	1. As per previous activation level	1. Not applicable
External Notifications	1. Not applicable	1. Notify immediately the National Security Line or 000/112	1. As per previous activation level	1. As per previous activation level	1. Not applicable

Table 20: Terrorist Threat/Activity or High Energy Impact - IC Emergency Action

Activation Level	Alert/Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Not applicable 	THREAT <ul style="list-style-type: none"> Possible terrorist activity/suspicious behaviour noticed at dam Threat received 	EVENT <ul style="list-style-type: none"> Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit) 	RESPONSE <ul style="list-style-type: none"> Failure in progress or likely due to impact or explosion, AND Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Actions	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Liaise with DDO, DSTDM and LDMG re: situation If Police appoint incident manager support and follow instructions Monitor situation and assess risks Liaise with DDO regarding possible road/bridge closures Confirm with LDMG appropriate community information has been disseminated Monitor situation and assess risks Record all communication Incident and Near Miss Alert 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level and Liaise with DDO, DSTDM re: potential for evacuations Mobilise resources to undertake remedial works if directed by DSTDM 	<ul style="list-style-type: none"> Deactivate EAP event If required, compile EER and deliver to DSR Complete Situation Report (final) Return to routine activities
Internal Notifications	<ol style="list-style-type: none"> Not applicable 	<ol style="list-style-type: none"> DDO DSTDM LDMG Media Team 	<ol style="list-style-type: none"> As per previous activation level 	<ol style="list-style-type: none"> As per previous activation level 	<ol style="list-style-type: none"> Inform previous notifications of deactivation as required
External Notifications	<ol style="list-style-type: none"> Not applicable 	<ol style="list-style-type: none"> D/S Residents through LDMG DDMG National Security Hotline (if not completed by DDO) 	<ol style="list-style-type: none"> As per previous activation level and SDCC Watch Desk National Security Hotline (if not completed by DDO, or at Stand Up 1) 	<ol style="list-style-type: none"> As per previous activation level 	<ol style="list-style-type: none"> As per previous activation level

Table 21: Terrorist Threat/Activity or High Energy Impact - IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Alert	ALERT NOT APPLICABLE					
Lean Forward	LEAN FORWARD NOT APPLICABLE					
Stand Up 1	THREAT <ul style="list-style-type: none"> Possible terrorist activity /suspicious behaviour notice at dam Threat received 	1.LDMG 2.DDMG 3.National Security Hotline (if not completed by DDO)	• Phone	Describe current situation with dam—What is the event? (Dam Safety Risk—Security threat/ impact/explosion, etc.) What is the status? (Received/noted terrorist threat) Discuss any potential road/bridge closures Activate emergency response	Advice EA11	BLACK PINK GREEN
		4.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.		
Stand Up 2	EVENT <ul style="list-style-type: none"> Large explosion heard /observed at dam (e.g., bomb explosion, aircraft hit) 	1.LDMG 2.DDMG 3.National Security Hotline (if not completed by DDO or at Stand Up—1)	• Phone	Describe current situation with dam—What is the event? (Dam Safety Risk—Security threat/ impact/explosion, etc.) What is the status? (Under Investigation) Discuss any potential road/bridge closures (if not discussed at Stand Up—1) LDMG to prepare coordinated evacuation	Watch and Act EA11.1	BLACK PINK GREEN
		4.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.		

Table 26: (Continued) Terrorist Threat/Activity or High Energy Impact - IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Stand Up 3	RESPONSE <ul style="list-style-type: none"> Failure in progress or likely due to impact or explosion and Sufficient water in storage to create a dam failure 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? (Dam Safety Risk—Security threat/impact/explosion, etc.) What is the status? (Dam Failure Likely/In Progress) LDMG to initiate evacuations		
		3.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA11.2	BLACK PINK GREEN
Stand Down	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? (Dam Safety Risk—Security threat/ impact/explosion, etc.) What is the status? (Dam hazard Stood Down) Advise that failure risk has been reduced and EAP has been deactivated		
		3.D/S Residents	• TV, Radio, Social Media, Disaster Dashboard , Roadside Signs	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details		

Table 22: Terrorist Threat/Activity or High Energy Impact - DSTDM Emergency Action

Activation Level	Alert/Lean Forward	Stand Up 1	Stand Up 2	Stand Up 3	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Not applicable 	THREAT <ul style="list-style-type: none"> Possible terrorist activity/suspicious behaviour noticed at dam Threat received 	EVENT <ul style="list-style-type: none"> Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit) 	RESPONSE <ul style="list-style-type: none"> Failure in progress or likely due to impact or explosion, AND Sufficient water in storage to create a dam failure 	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced
Actions	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Liaise with IC, DDO Record all communication 	<ul style="list-style-type: none"> As per previous activation level, and Arrange an inspection of dam and assess its condition as soon as possible, when safe to do so Assess risk and determine if failure likely or in progress Determine if remedial repairs are practical (1) Determine if risks can be reduced by lowering storage (2) Make recommendations regarding (1) and (2) to IC. IIC to make decision Supervise* remedial repairs (if applicable) Monitor situation and assess risks 	<ul style="list-style-type: none"> As per previous activation level, AND Liaise with the IC and advise on need to recommend evacuations 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities
Internal Notifications	1. Not applicable	1. DDO 2. IC	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level
External Notifications	1. Not applicable	1. DSR	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level

* Supervision means provide technical oversight to the work. It does not necessarily mean on-site supervision.

All communications to IC should be confirmed by email whenever practical

9. Dam Hazard - Gate Function Issues

9.1 Overview

The emergency action described in this section relates to gate function issues and provides advice on actions for any of the six gate function issues identified. It is not an escalation-based section. Any triggers under this section will activate a Stand-Up condition.

It should be noted that gate function issues are unlikely to result in an emergency event unless they occur simultaneously with another hazard.

Note: Definitions for *Concurrent Flooding* and *Downstream Releases* are provided in Section 1.3.

9.1.1 Assessment of circumstances indicating increase in likelihood of gates malfunctioning

A flood event or terrorist threat advice could indicate increased likelihood of gate function issues.

9.2 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)

Table 23: Gate Function Issues—DDO Emergency Action

If above or approaching Fixed Crest Level the following scenarios will activate a STAND UP condition					
Abnormal Gate Operation	Premature Opening or Closing of One or More Gates	Loss of Control of One or All Gates in a Dry Weather Event	Loss of Control of One or All Gates in a Flood Event	Loss of HMI Data Links	Control System Security Breach
Activation trigger <ul style="list-style-type: none"> Unable to confirm HMI control of gates 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely 	Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely
Actions <ul style="list-style-type: none"> Each day, as described in SOP- 001 Communications and SOP- 016 Setting of Normal Operation Criteria, the DDO shall test data links into the RRD Control System HMI and confirm controls are correctly set. 	Actions <ul style="list-style-type: none"> DDO shall immediately attempt to log-on to the RRD Control System (SOP-001) and determine if controls are correctly set (SOP-016). If controls are correctly set, DDO shall attempt to operate gate (or gates) as described in DOMM-001 If controls are not correctly set, DDO shall immediately mobilise to RRD site, and shall operate gate (or gates) as described in DOMM-001 	Actions <ul style="list-style-type: none"> DDO shall immediately attempt to log-on to RRD Control System (SOP-001) and determine if controls are correctly set (SOP-016). If controls are correctly set, DDO shall attempt to operate gate (or gates) as described in DOMM-001 If controls are not correctly set DDO shall immediately mobilise to RRD site, and shall operate gate (or gates) as described in DOMM-001 	Actions <ul style="list-style-type: none"> DDO shall immediately attempt to log-on to the RRD Control System (SOP-001) and determine if controls are correctly set (SOP-016). If controls are correctly set, DDO shall attempt to operate gate (or gates) as described in DOMM-001 If HMI cannot control gates in automatic mode, DDO shall operate gate (or gates) Note: DDO should already be mobilised and on site at RRD before a Spillway Flow Event occurs. 	Actions <ul style="list-style-type: none"> DDO shall mobilise to RRD site and shall operate gates as described in DOMM-001. Although a loss of data links can occur when lake is below FSL, EAP shall still be triggered. In this situation, if gate operation is subsequently required due to increase in level, DDO shall mobilise to the RRD site and shall operate gates as described in DOMM-001 	Actions <ul style="list-style-type: none"> DDO shall mobilise to RRD site, shall immediately switch the spillway gate controls to Manual at the Gate HPU Room <ul style="list-style-type: none"> – Local Control Panel and shall operate gates if required at this location as described in DOMM-001
Internal Notifications <ol style="list-style-type: none"> IC DSTDM 	Internal Notifications <ol style="list-style-type: none"> IC DSTDM 	Internal Notifications <ol style="list-style-type: none"> IC DSTDM 	Internal Notifications <ol style="list-style-type: none"> IC DSTDM 	Internal Notifications <ol style="list-style-type: none"> IC DSTDM 	Internal Notifications <ol style="list-style-type: none"> IC DSTDM
External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required, AND DDMG

Table 24: Gate Function Issues —IC Emergency Action

If above or approaching Fixed Crest Level the following scenarios will activate a STAND UP condition					
Abnormal Gate operation	Premature Opening or Closing of One or More Gates	Loss of Control of One or All Gates in a Dry Weather Event	Loss of Control of One or All Gates in a Flood Event	Loss of HMI Data Links	Control System Security Breach
Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely 	Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely
Actions <ul style="list-style-type: none"> Situation Report is required. 	Actions <ul style="list-style-type: none"> Situation Report is required. 	Actions <ul style="list-style-type: none"> Situation Report is required. 	Actions <ul style="list-style-type: none"> Situation Report is required. 	Actions <ul style="list-style-type: none"> Situation Report is required. 	Actions <ul style="list-style-type: none"> Situation Report is required.
Internal Notifications <ol style="list-style-type: none"> DDO DSTDM 	Internal Notifications <ol style="list-style-type: none"> DDO DSTDM 	Internal Notifications <ol style="list-style-type: none"> DDO DSTDM 	Internal Notifications <ol style="list-style-type: none"> DDO DSTDM 	Internal Notifications <ol style="list-style-type: none"> DDO DSTDM 	Internal Notifications <ol style="list-style-type: none"> DDO DSTDM
External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> As required 	External Notifications <ol style="list-style-type: none"> DDMG

Table 25: Gate Function Issues —IC Communication Plan

Activation Level	Trigger for Communications	Group to contact	Method	Message Text
Alert	ALERT NOT APPLICABLE			
Lean Forward	LEAN FORWARD NOT APPLICABLE			
Stand Up 1	<ul style="list-style-type: none"> Gate function issue 	1.LDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? (<i>Dam Safety Risk—?</i>) What is the status? (Under Investigation)
Stand Down	<ul style="list-style-type: none"> Risk assessment has determined that failure risk has reduced Confirmation that all gates are functioning correctly 	1.LDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? What is the status? (Dam hazard Stood Down) Advise that failure risk has been reduced and EAP has been deactivated

Note: Any release of water will also trigger Flood Operations Section 5

Table 26: Gate Function Issues -DSTDM Emergency Action

If above or approaching Fixed Crest Level the following scenarios will activate a STAND UP condition					
Abnormal Gate Operation	Premature Opening or Closing of One or More Gates	Loss of Control of One or All Gates in a Dry Weather Event	Loss of Control of One or All Gates in a Flood Event	Loss of HMI Data Links	Control System Security Breach
Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Controls are not correctly set or unable to rectify 	Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely 	Activation trigger <ul style="list-style-type: none"> Unable to control gates remotely
Actions <ul style="list-style-type: none"> Liaise with IC to confirm if engineering support is required to mobilise to site Liaise with DSTDM on any matters requiring advice 	Actions <ul style="list-style-type: none"> Liaise with IC to confirm if engineering support is required to mobilise to site Liaise with DSTDM on any matters requiring advice 	Actions <ul style="list-style-type: none"> Liaise with IC to confirm if engineering support is required to mobilise to site Liaise with DSTDM on any matters requiring advice 	Actions <ul style="list-style-type: none"> Liaise with IC to confirm if engineering support is required to mobilise to site Liaise with DSTDM on any matters requiring advice 	Actions <ul style="list-style-type: none"> Liaise with IC to confirm if engineering support required to mobilise to site Liaise with DSTDM on any matters requiring advice 	Actions <ul style="list-style-type: none"> Liaise with IC to confirm if engineering support required to mobilise to site Liaise with DSTDM on any matters requiring advice
Internal Notifications 1.DDO 2.IC	Internal Notifications 1.DDO 2.IC	Internal Notifications 1.DDO 2.IC	Internal Notifications 1.DDO 2.IC	Internal Notifications 1.DDO 2.IC	Internal Notifications 1.DDO 2.IC
External Notifications 1.DSR	External Notifications 1.DSR	External Notifications 1.DSR	External Notifications 1.DSR	External Notifications 1.DSR	External Notifications 1.DSR

All communications to IC should be confirmed by email whenever practical

10. Dam Hazard—Scouring, Overturning and Sliding of Spillway

10.1 Overview

The emergency action described in this section relates to a potential emergency event due to significant scour under and around the concrete spillway abutment walls, which may cause sliding and overturning of the spillway. If scour and movement is detected early, remedial action may be possible depending on the nature of the damage.

The stability of the dam in its current configuration has been evaluated and the findings summarised as follows¹:

- Under usual load conditions there is no tension on the dam faces, and sliding stability is satisfactory.
- Under the Usual Load plus Maximum Design Earthquake (MDE) load case the dam stresses remain in compression and sliding stability is satisfactory. The post-earthquake condition is equivalent to the usual load condition.
- Under the Dam Crest Flood (DCF) load condition the stresses in the dam remain compressive and the sliding FOS is satisfactory.
- Under the Probably Maximum Flood (PMF) load condition satisfactory stability is obtained with the cable's working load being in the range of 60% to 65% of their Maximum Breaking Load (MBL). If spillway block 2 is acting as a single monolith then base cracking can occur but does not extend to the line of the foundation drains.

Overturning or sliding of the spillway should not occur under normal conditions. During a large flood event however, it is possible that significant scour may occur at the toe of the stilling basin and in the natural rock behind spillway outer abutment walls. This scour can cause instabilities in the concrete blade walls supporting the dam gates or spillway ogee and must be assessed by the DSTDM.

If the DSTDM forms the view that significant scouring is occurring which will compromise the integrity of the concrete spillway or abutment walls, then the need for evacuations should be considered by disaster management authorities.

The flood outlines in Appendix B are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by overturning or sliding of the concrete spillway. The use of these flood outlines is prescribed below:

- Use the Sunny Day Failure (SDF) outline when a dam failure is in progress or likely due to overturning or sliding and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Flood (PMF) outline when a dam failure is in progress or likely due to overturning or sliding and concurrent flooding or downstream releases are occurring or expected to occur.

Note: Definitions for *Concurrent Flooding* and *Downstream Releases* are provided in Section 1.3.

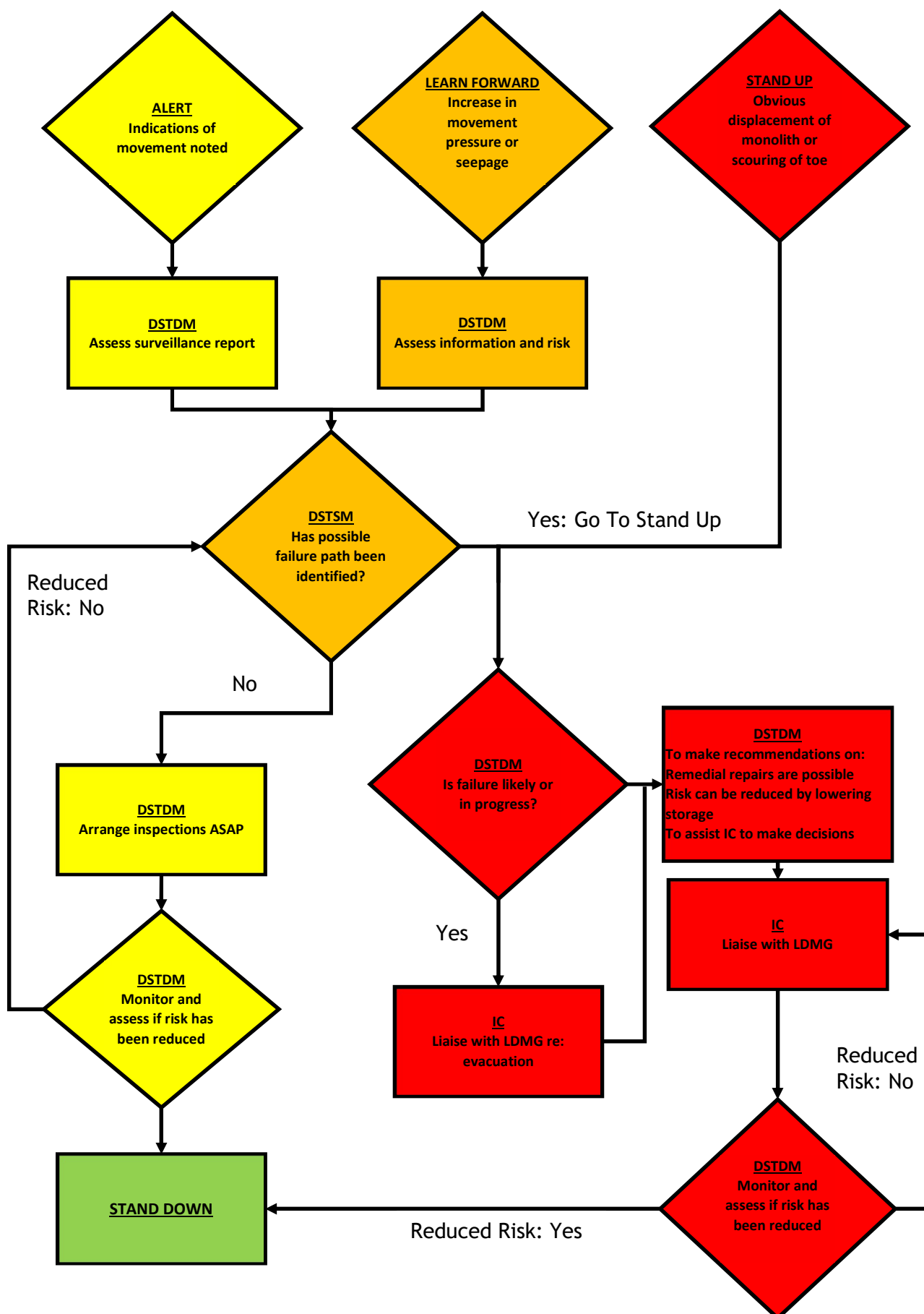
10.2 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)

Note: 1. NQ Water, Ross River Dam Upgrade, Stages 2 to 5, Spillway and Stilling Basin Design Report, September 2005,

Figure 10 - Overturning or Sliding of Spillway Flowchart



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Table 27: Overturning or Sliding of Spillway—DDO Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Indications of excessive movement of spillway recorded in beyond monitoring. Observed cracking, increased seepage, spilling 	<ul style="list-style-type: none"> Storage at, EL 40.73m, or Increase in movement, pressures or seepage 	<ul style="list-style-type: none"> Obvious displacement of spillway or abutment walls, or Evidence of scouring at or near toe of stilling basin area 	<ul style="list-style-type: none"> Failure in progress or likely due to sliding or over turning 	<ul style="list-style-type: none"> Risk Assessment has determined that sliding or over turning risk has reduced
Actions	<ul style="list-style-type: none"> Monitor dam every 6 hours (or as otherwise instructed by DSTDM) until a decreasing trend is observable or as directed by the IC Photograph/video the dam from a safe point and record using the approved forms in Appendix D and send to IC & DSTDM Record details in Log Book entry as per SOP-005 Record all communication 	<ul style="list-style-type: none"> As per previous activation level 	<ul style="list-style-type: none"> As per previous activation level, plus Close road access to dam if not already closed by others Maintain surveillance of area immediately downstream of dam spillway and 'move on' any members of the public 	<ul style="list-style-type: none"> As per previous activation level, plus Vacate the immediate vicinity of the dam spillway 	<ul style="list-style-type: none"> Forward information for EER to IC Log Book entry as per SOP-005 Return to routine activities
Internal Notifications	1. IC 2. DSTDM	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level
External Notifications	1. Not Applicable	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level	1. As per previous activation level

Table 28: Overturning or sliding of Spillway—IC emergency action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Indications of excessive movement of spillway recorded in beyond monitoring. Observed cracking, increased seepage, spilling 	<ul style="list-style-type: none"> Storage Level at, EL 40.73m, or Increase in movement, pressures, or seepage 	<ul style="list-style-type: none"> Obvious displacement of spillway or abutment walls or Evidence of scouring at or near toe of stilling basin area 	<ul style="list-style-type: none"> Failure in progress or likely due to sliding or overturning 	<ul style="list-style-type: none"> Risk assessment has determined that sliding or overturning risk has reduced
Actions	<ul style="list-style-type: none"> Liaise with DDO, LDMG and DSTDM re: situation Complete Situation Report, unless otherwise directed Record all communication 	<ul style="list-style-type: none"> Liaise with LDMG re: situation Confirm with LDMG appropriate community information has been disseminated Place machinery operators on standby if directed by DSTDM 	<ul style="list-style-type: none"> As per previous activation level and Mobilise resources to undertake remedial works if directed by DSTDM Liaise with DDO and relevant authorities regarding potential road/bridge closures 	<ul style="list-style-type: none"> As per previous activation level and Liaise with DDO and DSTDM, re: potential for evacuations 	<ul style="list-style-type: none"> Deactivate EAP If required, compile EER and deliver to the DSR Complete Situation Report (final) Return to routine activities
Internal Notifications	<ol style="list-style-type: none"> DO LDMG DSTDM 	<ol style="list-style-type: none"> As per previous activation level and 	<ol style="list-style-type: none"> As per previous activation level and 	<ol style="list-style-type: none"> As per previous activation level 	<ol style="list-style-type: none"> Inform previous notifications of deactivation as required
External Notifications	<ol style="list-style-type: none"> Not Applicable 	<ol style="list-style-type: none"> D/S Residents through LDMG DDMG 	<ol style="list-style-type: none"> As per previous activation level 	<ol style="list-style-type: none"> As per previous activation level 	<ol style="list-style-type: none"> As per previous activation level

Table 29: Overturning or Sliding of Spillway—IC Communication Plan

Activation level	Trigger for communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Alert	<ul style="list-style-type: none"> Indications of excessive movement of spillway recorded in beyond monitoring. Observed cracking, increased seepage, spilling 	N/A—Internal Communications only				
Lean Forward	<ul style="list-style-type: none"> Increase in movement, pressures, or seepage 	1. LDMG 2. DDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with dam—What is the event? (unconfirmed instability of dam) What is the status? (under investigation) Advise of current storage level Advise of any forecasts you are aware of Confirm EAP has been activated		
		3. D/S Residents	TV, Radio, Social Media, Disaster Dashboard, Roadside Signs	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details		
Stand Up 1	<ul style="list-style-type: none"> Obvious displacement of spillway or abutment walls, OR Evidence of scouring at or near toe of stilling basin area 	1. LDMG 2. DDMG	<ul style="list-style-type: none"> Phone 	Describe current situation with Dam—What is the event? (confirmed instability of dam) What is the status? (prepare for possible evacuations) Advise of current storage level Advise of any forecasts you are aware of Discuss any potential road/ bridge closures Prepare for possible evacuations		
		3. D/S Residents	<ul style="list-style-type: none"> SMS 	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Watch and Act EA10	BLACK PINK GREEN

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Table 34: (Continued) Overturning or Sliding of Spillway—IC Communication Plan

Activation level	Trigger for communications	Group to contact	Method	Message	AWS and EA	Evacuation Zone
Stand Up 2	<ul style="list-style-type: none"> Failure in progress or likely due to sliding or overturning Dam failure in progress 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? (<i>possible dam failure</i>) What is the status? (prepare coordinated evacuation) Advise of current storage level Advise of any forecasts you are aware of		
		3.D/S Residents	• SMS	Emergency Alerts (EA) will be sent to residents through the LDMG, order of priority based on suburbs at risk. Messages will be in accordance with TLDMG Community Information and Warnings Sub Plan or appendix A3, A4, A5 of this EAP https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details.	Emergency Warning EA10.1	BLACK PINK GREEN
Stand Down	<ul style="list-style-type: none"> Risk assessment has determined that sliding or overturning risk has reduced 	1.LDMG 2.DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level Advise EAP has been deactivated		
		3.D/S Residents	TV, Radio, Social Media, Disaster Dashboard, Roadside Signs	Community messaging will be in accordance with TLDMG Community Information and Warnings Sub Plan and the TLDMG Community Education and Marketing Sub Plan https://www.townsville.qld.gov.au/community-support/community-safety/disaster-management for more details		

Table 30: Overturning or Sliding of Spillways - DSTDM Emergency Action

Activation Level	Alert	Lean Forward	Stand Up 1	Stand Up 2	Stand Down
Activation Trigger	<ul style="list-style-type: none"> Indications of excessive movement of spillway recorded in beyond monitoring. Observed cracking, increased seepage, spilling 	<ul style="list-style-type: none"> Storage EL 40.73m, OR Increase in movement, pressures, or seepage 	<ul style="list-style-type: none"> Obvious displacement of one or more spillway, OR Evidence of scouring at or near toe of stilling basin area 	<ul style="list-style-type: none"> Failure in progress or likely due to sliding or over turning 	<ul style="list-style-type: none"> Risk assessment has determined that sliding or overturning
Actions	<ul style="list-style-type: none"> Review surveillance inspection of the dam and assess its condition as soon as possible Determine if there are possible failure paths from reported damage Arrange an inspection of the dam and assess its condition as soon as possible, when safe to do so Monitor situation and assess risks Record all communication 	<ul style="list-style-type: none"> As per previous activation level and Liaise with IC 	<ul style="list-style-type: none"> As per previous activation level and Assess risk and determine if failure likely or in progress Liaise with the IC Determine if remedial repairs are practical (1) Determine if risks can be reduced by lowering storage (2) Make recommendations regarding (1) and (2) to IC. Supervise* remedial repairs (if applicable) 	<ul style="list-style-type: none"> As per previous activation level and Liaise with the IC and advise on need to recommend evacuations 	<ul style="list-style-type: none"> Forward information for EER to IC Return to routine activities
Internal Notifications	1.DDO 2.IC	1.As per previous activation level 2.	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level
External Notifications	1.DSR	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level	1.As per previous activation level

* Supervision means provide technical oversight to the work. It does not necessarily mean on-site supervision.

All communications to IC should be confirmed by email whenever practical

11. Other Emergency Situation - Communications Failure

11.1 Overview

The emergency action described in this section relates to either:

- An emergency situation where all means of communication at the Dam site have been lost
- An emergency situation where all means of communication with the Local area have been lost.

This section specifies actions and provides guidance for the two situations.

11.2 Emergency Actions

Due to the large number of different possible scenarios, the table below only covers the most common or likely conditions.

11.2.1 Activation Triggers

Table 31: Communications Failure Emergency Activation Trigger Summary

Comms Failure – Site	<ul style="list-style-type: none"> • Unable to communicate to or from Dam site (usually affects DDO)
Comms Failure – Local area	<ul style="list-style-type: none"> • Unable to communicate to or from Local Area (likely to affect IC, DSTDM and FODM)

11.2.2 Assessment of circumstances indicating likelihood of communications failure escalating activation level of a current Dam Hazard

The IC will escalate to the FODM any local intelligence on conditions that could increase the probability of a significant communications failure.

The FODM will determine whether it is reasonably likely that there will be a significant communications failure within the subsequent 24 hours and assess the likely effect on current Dam Hazards based on the weather forecast and data. If required, the IC will escalate the activation level of any current Dam Hazards based on the FODM advice.

11.2.3 Emergency Action Roles

The following tables describe the emergency actions and communication plan for the following roles:

- Dam Duty Officer (DDO)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM)
- Flood Operations Decision Maker (FODM)

Table 32: Communications Failure - DDO Emergency Action

Activation Level	Comms Failure Dam Site	Comms Failure Local
Activation Trigger	<ul style="list-style-type: none"> Unable to communicate to Local Area including IC 	<ul style="list-style-type: none"> Unable to communicate with IC, DSTDM or FODM
Actions	<ul style="list-style-type: none"> Continue tasks in accordance with any other current Emergency Action Every hour attempt communications by any and all means noting the following: <ul style="list-style-type: none"> Mobile phone-try texting instead of voice, much higher probability of success Satellite Phone-needs to access open sky unless external antenna fitted Social Media-e.g. Facebook (Internet may be available via landline) Record all communication and attempts via Dam Log Book entries as per SOP-005 	<ul style="list-style-type: none"> Continue tasks in accordance with any other current Emergency Action Every hour attempt communications by any and all means noting the following: <ul style="list-style-type: none"> Mobile phone-try texting instead of voice, much higher probability of success Satellite Phone-needs to access open sky unless external antenna fitted Social Media-e.g. Facebook (Internet may be available via landline) Record all communication and attempts via Dam Log Book entries as per SOP-005
Internal Notifications	1.IC	1.IC
External Notifications	1.As required	1.As required

Table 37: Communications Failure—IC Emergency Action

Activation Level	Comms Failure Dam Site	Comms Failure Local Area
Activation Trigger	<ul style="list-style-type: none"> Unable to communicate to Damsite 	<ul style="list-style-type: none"> Unable to communicate to Local Area i
Actions	<ul style="list-style-type: none"> Issue incident Alert Every hour attempt communications by any and all means noting the following: <ul style="list-style-type: none"> Mobile phone-try texting instead of voice, much higher probability of success Satellite Phone-needs to access open sky unless external antenna fitted Social Media-e.g. Facebook (Internet may be available via landline) Record all communication and attempts Liaise with DSTDM As much as is practicable continue other tasks associated with the role in accordance with any another current Emergency Action 	<ul style="list-style-type: none"> Issue incident Alert Every hour attempt communications by any and all means noting the following: <ul style="list-style-type: none"> Mobile phone-try texting instead of voice, much higher probability of success Satellite Phone-needs to access open sky unless external antenna fitted Social Media-e.g. Facebook (Internet may be available via landline) Record all communication and attempts As much as is practicable continue other tasks associated with the role in accordance with any other current Emergency Action
Internal Notifications	<ol style="list-style-type: none"> DSTDM LDMG 	<ol style="list-style-type: none"> DDO (if available) DSTDM LDMG (if available)
External Notifications	<ol style="list-style-type: none"> DDMG 	<ol style="list-style-type: none"> DDMG (if available)



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Table 33: Communications Failure— IC Communication Plan

Activation Level	Trigger for communications	Group to contact	Method	Message text
Comms Failure Site	<ul style="list-style-type: none">• Unable to communicate to or from Dam site, AND• DDO is at Dam site	1. DSTDM 2. LDMG 3. DDMG	<ul style="list-style-type: none">• Phone	Describe current situation with dam communications. What is the status – estimated time to restore communications?
Comms Failure Local Area	<ul style="list-style-type: none">• Unable to communicate to or from Local Area	1. DDO (if available) 2. DSTDM 3. LDMG (if available) 4. DDMG (if available)	<ul style="list-style-type: none">• Phone	Describe current situation with dam communications. What is the status – estimated time to restore communications?

Table 34: Communications Failure - DSTDM Emergency Action

Activation Level	Comms Failure Site	Comms Failure Local Area
Activation Trigger	<ul style="list-style-type: none"> Unable to communicate to Dam site 	<ul style="list-style-type: none"> Unable to communicate to Local Area including IC
Actions	<ul style="list-style-type: none"> Provide technical advice to IC on as needs basis Record all communication As much as is practicable continue other tasks associated with the role in accordance with any other current Emergency Action 	<ul style="list-style-type: none"> Provide technical advice to IC on as needs basis Record all communication Assume that the DDO is assisting IC As much as is practicable continue other tasks associated with the role in accordance with any other current Emergency Action
Internal Notifications	1.IC 2.GM WS	1.IC 2.DDO (if available) 3.GM WS
External Notifications	1.DSR (if applicable)	1. DSR Regulator (if applicable)

Table 35: Communications Failure - FODM Emergency Action

Activation Level	Comms Failure Site	Comms Failure Local Area
Activation Trigger	<ul style="list-style-type: none"> Unable to communicate to Dam site, 	<ul style="list-style-type: none"> Unable to communicate to Local Area including
Actions	<ul style="list-style-type: none"> Liaise with IC Record all communication As much as is practicable continue other tasks associated with the role in accordance with any other current Emergency Action 	<ul style="list-style-type: none"> Liaise with IC Record all communication Assume that the DDO is assisting IC As much as is practicable continue other tasks associated with the role in accordance with any other current Emergency Action
Internal Notifications	<ol style="list-style-type: none"> IC DSTDM 	<ol style="list-style-type: none"> IC DDO (if available) DSTDM
External Notifications	<ol style="list-style-type: none"> Not applicable 	<ol style="list-style-type: none"> Not applicable