EMERGENCY ACTION PLAN — WURUMA DAM (ID 378)

ISSUE: 8.2 — September 2024 **Expiry Date:** 1 July 2026

Prepared by **Sunwater Limited**

Controlled Copy No.

Gated: No	Staffed: Yes

Type: Mass gravity concrete with upper and lower galleries

Project: Wuruma Dam EAP **File no.:** 08-000384/001

Address: 2834 Wuruma Dam Road

Location: Lat. –17.183548° (–17°11'00.77"S)
Lon. 145.571359° (145°34'16.89"E)

Approved by the delegate of the Chief Executive, Department of Regional Development, Manufacturing and Water until 1 July 2026.

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Emergency activation quick reference

The Emergency Action Plan (EAP) for Wuruma Dam covers five dam hazards evaluated within Sunwater's Dam Safety Management Program.
Use the following table to select the relevant section of the EAP that deals with the dam hazard. **Note: The Incident Coordinator (IC) is responsible for the decision to activate the EAP. Should the IC be unavailable, the Local Event Coordinator (LEC) or Dam Duty Officer (DDO) is responsible for the decision.**

Table 1: Emergency activation quick reference

Dam Hazards and section numbers	Activation Levels			
	Alert	Lean Forward	Stand Up	Stand Down
	Activation triggers for dam hazards			
Flood operations See section 5	• EL 228.19m and rising (0.1m below FSL)	• Storage above FSL 228.29m	• Storage above EL 229.29m	• Storage EL 228.39m and falling with no forecast increase in EL
Piping: embankment, foundation, or abutments See section 6	• Increasing leakage through an embankment, the foundations, or abutments	• Increasing leakage through an embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Risk assessment has determined that failure risk has reduced
Earthquake See section 7	• Earthquake reported or felt in the area, AND • Intensity less than 5 Modified Mercalli (MM)	• 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	• Earthquake reported or felt in the area, AND • A possible failure path has been identified	• Risk assessment has determined that failure risk has reduced
Overturning/sliding monoliths. See section 8	• Indications of movement of monoliths noted such as cracking, increased seepage, spilling	• Storage level at flood of record, EL 232.03m, OR • Increase in movement, pressures, or seepage	• Obvious displacement of one or more monoliths, OR • Evidence of scouring at or near toe of dam, OR • Storage Level at stability factor of safety =1.3, EL 238.78m	• Risk Assessment has determined that sliding or overturning risk has reduced
Terrorist threat/activity or high energy impact See section 9	• Not applicable	• Not applicable	• Possible terrorist activity noticed at the 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 hazard	• Risk assessment has determined that failure risk has reduced

CONTINUED NEXT PAGE: EMERGENCY ACTIVATION QUICK REFERENCE

Emergency activation quick reference – Other Emergency Situations

The EAP for Wuruma Dam covers one other emergency situation evaluated within Sunwater's Dam Safety Management Program. Use the following table to select the relevant section of the EAP that deals with the other emergency situation. **Note: The Incident Coordinator (IC) is responsible for the decision to activate the EAP. Should the IC be unavailable, the Local Event Coordinator (LEC) or Dam Duty Officer (DDO) is responsible for the decision.**

Table 1: Emergency activation quick reference (continued)

Other Emergency Situations and section numbers	Activation levels		
	Communications Failure – Dam Site (DDO)	Communications Failure – Local Area (LEC/SM)	Communications Failure – Brisbane (IC/DSTDM)
	• Site managed (DDO - becomes LEC)	• Brisbane managed by Incident Coordinator (IC)	• Locally managed by Local Event Coordinator (LEC)
	Activation triggers for other emergency situations		
Comms Failure See section 10	• Unable to communicate to or from dam site	• Unable to communicate to or from local area	• Unable to communicate to or from Sunwater Brisbane

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Document control

Authorisation of document

This document has been reviewed and accepted by the following:

Name	Position/role	Signature	Date
	EAP Program Lead — Prepared for submission		20/09/2024

Document revision history

Version	Date	Prepared by	Reason for change	Ref no.
2	May 2008		Significant changes of Wuruma Dam Emergency Action Plan to reflect Sunwater Management structure and other minor changes.	HB # 734175
3	October 2011		Significant changes to Wuruma Dam Emergency Action Plan to reflect Sunwater Management structure and other changes.	HB # 1135644
3C	September 2013		Amendments due to new legislative requirements	HB # 1060355
4	August 2016		New Emergency Action Plan developed at expiry of 3E approval. Issued for consultation with Relevant Disaster Management Groups. Addition of Emergency condition — Overturning.	HB # 1869581
5	October 2017		New Emergency Action Plan developed with contact list updates.	HB # 2086664
6	July 2018		Revised and reviewed Emergency Action Plan developed at expiry of approval. Also includes updates that reflect the Water Legislation (Dam Safety) Amendment Act 2017, implementation of changes to Sunwater management structure, new event management roles and addition of new Emergency Activation section (Other Emergency Situations).	HB # 2254307
7	September 2018		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes.	HB # 2367491
7.1	September 2019		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes.	HB # 2468736
7.2	September 2020		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes.	HB # 2572880
7.3	September 2021		Amended contacts and associated sections, e.g., Organisation chart & Controlled Copy Holders list. Minor error corrections and other non-substantive changes such as removing Comprehensive Risk Assessments description (2.9) and simplifying FODM role in Activation triggers (5.2.1) including removing para 5.2.2.	HB # 2653143
7.4	September 2022		Amended contacts and associated sections. Minor error corrections and other non-substantive changes. The Chemical Hazard section has been removed as it is not a Dam Safety Hazard and is dealt with in other more relevant documents.	HB # 2726210

Version	Date	Prepared by	Reason for change	Ref no.
8.0	March 2023		Amendments to section 3, including PAR and dam specifications. Appendix B Inundation maps updated. Amendments to emergency activation triggers in section 5. Revision of sections 8.1 and 8.2, including emergency activation triggers. Minor error corrections and other non-substantive changes to improve readability and useability. Incorporated AWS messaging changes.	HB # 2743857
8.1	September 2023		Non-substantive updates as part of Annual Safety Statement. Minor error corrections and readability improvements.	# 2809878
8.2	September 2024		Wet Season Preparedness – Contact Updates	# 2865474

Controlled document distribution list

Copy no.	Position	Location
1.	Operator Maintainer—Wuruma Dam	Sunwater, Wuruma Dam
2.	General Manager	Sunwater, Bundaberg
3.	Emergency Action Plan Program Lead	Sunwater, Brisbane
4.	Local Disaster Coordinator—Local Disaster Management Group (LDMG 1)	North Burnett Regional Council, Gayndah
5.	Local Disaster Coordinator—Local Disaster Management Group (LDMG 2)	Bundaberg Regional Council
Note: Communication information for each 'Controlled Copy Holder' is attached in Appendix A		

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Position	Location
Executive Officer— Bundaberg District Disaster Management Group (DDMG)	Police, Bundaberg
Senior Flood Forecaster	Bureau of Meteorology, Brisbane
Emergency Management Coordinator	Queensland Police Service
Note: Communication information for each 'Electronic Copy Holder' is in Appendix A	

1. References, abbreviations, and definitions

1.1 References/associated documents

Ref.	Document title	Reference/location
A	Sunwater (internal) Strategic Event Procedure	Strategic Event Procedure
B	Sunwater (internal) Wuruma Dam Operation and Maintenance Manual	Wuruma Dam O&M Manual
C	Sunwater (internal) Wuruma Dam Safety Condition Schedule (Internal)	HB # 2720254
D	Queensland State Disaster Management Plan 2023 (Queensland's Disaster Management Committee)	Interim-2023-QSDMP-V1.2.pdf (disaster.qld.gov.au)f
E	Queensland Rainfall and River Conditions (Flood Warning)	http://www.bom.gov.au/qld/flood/index.shtml?ref=hdr
F	Queensland Emergency Alert Manual – M.1.174 (November 2022)	M.1.174 Queensland Emergency Alert Manual (disaster.qld.gov.au)
G	Emergency Alert Protocol (Internal)	HB # 2156253
H	Sunwater (internal) Wuruma Dam Comprehensive Risk Assessment (2022)	HB # 2719942
I	Sunwater (internal) Fatigue Management Procedure	Fatigue Management Procedure
J	Sunwater (internal) Standing Operating Procedure (SOP) 12 – Dam Logbooks	Policies, Procedures and Guidelines - SOP12 Dam Log Books - All Documents - Default (Function and Activity) (sharepoint.com)

1.2 Abbreviations and acronyms

ABC	Australian Broadcasting Corporation
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AMTD	Adopted Mean Thread Distance
ANCOLD	Australian National Committee on Large Dams
AWS	Australian Warning System
BOM	Bureau of Meteorology
CED	Chief Engineer Dams
CEO	Chief Executive Officer
CRA	Comprehensive Risk Assessment
CTG	Counter Terrorism Group
D/S	Downstream
DCF	Dam Crest Flood
DCL	Dam Crest Level
DDC	District Disaster Coordinator
DDMG	District Disaster Management Group
DDMP	District Disaster Management Plan
DDO	Dam Duty Officer
DDS	Director Dam Safety
DSR	Dam Safety Regulator
DSSC	Dam Safety Surveillance Coordinator
DSTDM	Dam Safety Technical Decision Maker
EAP	Emergency Action Plan
EA	Emergency Alert
EER	Emergency Event Report
EGMO	Executive General Manager Operations
EGME&WR	Executive General Manager Engineering & Water Resources
EL	Elevation Level
FCL	Fixed Crest Level
FODM	Flood Operations Decision Maker
FSL	Full Supply Level
GM	General Manager
IC	Incident Coordinator
IFHC	Incremental Flood Hazard Category
IGEM	Inspector-General Emergency Management
LB	Left Bank
LDC	Local Disaster Coordinator
LDMG	Local Disaster Management Group
LDMP	Local Disaster Management Plan
LEC	Local Event Coordinator
MAP	Manager Asset Planning
Max. OL	Maximum Operating Level
ME	Manager Environment
MM	Modified Mercalli
O&M	Operation & Maintenance
OB	Observation Bore
OC	Operations Centre
OCDO	Operations Centre Duty Officer
OCO	Operations Coordinator
OM	Operator Maintainer
OMGR	Operations Manager
OS	Operations Supervisor
ORR	Owner's Regional Representative
PAR	Population at Risk
PDSE	Principal Dam Safety Engineer
PFRM	Predictive Flood Routing Model
PLL	Probable Loss of Life
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PMPF	Probable Maximum Precipitation Flood
PWRE	Principal Water Resources Engineer
QDMC	Queensland Disaster Management Committee
QFD	Queensland Fire Department
QPS	Queensland Police Service
RB	Right Bank
RC	Regional Council
RCC	Roller Compacted Concrete
RDMW	Department of Regional Development, Manufacturing and Water
ROC	Regional Operations Centre
RPEQ	Registered Professional Engineer of Queensland
RSL	Reduced Supply Level
SCED	Senior Civil Engineer Dams
SCTN	Security and Counter Terrorism Network
SDCC	State Disaster Coordination Centre
SDF	Sunny Day Failure
SDTE	Senior Dam Technical Engineer
SES	State Emergency Service
SMS	Short Message Service
SMT	Sunwater Media Team
SO	Standby Operator
SOP	Standing Operating Procedure
SRT	Strategic Response Team
SS	Storage Supervisor
SWL	Storage Water Level
SWRE	Senior Water Resources Engineer
U/S	Upstream
WHS	Workplace Health & Safety
WQ	Water Quality

1.3 Business terms and definitions

The meaning of terms used in this section are set out in accordance with relevant legislation or as defined by operator requirements.

Term	Definition
Terms set out in section 352A of the *Water Supply (Safety and Reliability) Act 2008 (Qld) - Amended*	
Dam hazard	Means a reasonably foreseeable situation or condition that may: • 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 *dam hazard* if: • persons or property may be harmed because of the event, AND • a coordinated response, involving two or more of the following relevant entities, is unlikely 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, AND • the event is not an emergency event.
Disaster management plan	Of a *district group* or local government, means the groups or local government's disaster management plan under the Disaster Management Act.
District group (District Disaster Management Group)	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 *dam hazard*.

Emergency event	Means an event arising from a *dam hazard* if:
	• persons or property may be harmed because of the event, AND
	• any of the following apply:
	  ○ 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 *dam hazard*.
Notice response	A dam owner's written response to a notice following an assessment of an EAP by a local government or *district group*.

Term	Definition
Referable dam	A dam, or a proposed dam after its construction, will be a referable dam if: • a failure impact assessment of the dam, or the proposed dam, is carried out under the Act, AND • the assessment states the dam has, or the proposed dam after its construction will have, a category 1 or category 2 failure impact rating, AND • the chief executive has, under section 349 of the Act, accepted the assessment. Also, a dam is a referable dam if: • under section 342B of the Act, the owner of a dam is given a referable dam notice and, before the effective day for the notice, does not give the chief executive a failure impact assessment for the dam, AND • the chief executive has not, under section 349 of the Act, accepted a failure impact assessment of the dam.
Relevant entity	Means each of the following under the EAP for the dam: • the persons who may be affected, or whose property may be affected, if a dam hazard event or emergency event were to happen for the dam, e.g., the owners of parcels of farmland 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 Queensland Police Service.
Terms consistent with Queensland disaster management arrangements:	
Activation levels	The four levels of EAP activation are: • **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. • **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. 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.

Term	Definition
Bureau of Meteorology flood level classifications	The three levels of flooding are: • **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.
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	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: • 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	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: • settlement, sliding, or overturning of monoliths 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.
Probable maximum flood	The flood resulting from probable maximum precipitation coupled with the worst catchment conditions that can be realistically expected.
Probable maximum precipitation	The theoretical greatest depth of precipitation physically possible based on generalised methods.

Term	Definition
Probable maximum precipitation flood	The flood resulting from probable maximum precipitation coupled with standard catchment conditions that can be expected.
Stability, main embankment	High foundation pore pressure peaks may reduce the Factor of Safety against slip circle failure to an unacceptable level.
'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.

Note: Sunwater has attempted to write the EAP to cope with all reasonably foreseeable emergency situations. However, there is considerable uncertainty about how any emergency situation might develop and progress. Factors such as the weather, the location, the mechanics, and the rate and size of any actual failure can considerably affect any resulting flood discharges. Therefore, a significant number of assumptions have had to be made in compiling sections of the EAP. Some variation in outcome should be expected where the event differs from the assumed behaviour.

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):

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 governments whose areas may be affected by a dam hazard for Wuruma Dam have been assessed as **North Burnett Regional Council (NBRC)** and **Bundaberg Regional Council (BRC).** Sunwater has provided the NBRC and BRC with copies of the draft EAP for assessment.

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 Wuruma Dam is **Bundaberg District Disaster Management Group (DDMG)**. Sunwater has provided the DDMG with a copy of the draft EAP for review.

2.2 Purpose

The purpose of this EAP is:

- to minimise the risk of harm to persons or property if a dam hazard event or emergency event for the dam happens
- to identify dam hazards that could occur at Wuruma Dam and the area likely to be affected for each hazard.
- to prescribe emergency actions taken by the dam owners and operating personnel in identifying and responding to dam hazards and notifying relevant entities.

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

The focus of this EAP is the management of emergency conditions at Wuruma Dam by the owner of the dam (Sunwater) and the communication and notification of dam hazards to the LDMGs, DDMGs and broader community. However, the EAP sits within the broader emergency response framework. This EAP has been developed to be consistent with and support the objectives of the North Burnett Regional Council Local Disaster Management Plan. Bundaberg Regional Council have been given the opportunity to comment as Paradise Dam may be affected should a Dam Safety incident occur at Wuruma Dam.

2.3 Scope

The Wuruma Dam EAP covers:

- dam hazards evaluated within Sunwater's 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 and/or emergency event happening.
- triggers for activation of a tiered response to dam hazards and/or emergency event happening.
- roles and responsibilities in responding to an emergency event.
- notification 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/or an emergency event, and the management of emergency events at Wuruma Dam.

2.4 Sunwater provides training.

Training of the use and implementation of this EAP document is carried out at various times throughout the year, but specific pre - wet season training is undertaken in the months leading up to the wet season at each dam site.

During this time Sunwater staff have work instructions for site preparations, and during July to September carry out checks on stores, supplies of fuel, and review the current EAP for contact details for individuals and dam information.

The EAP training that is carried out on site include walkthroughs of new changes, scenario (role play) and Q & A to check the knowledge and competency of all those who attended. DSTDM information sessions are carried out once a year with the same walkthrough of new changes and Q & A, but this is not specific to any one dam. New employees to these various roles would also have a walkthrough of the EAP to understand after they start at Sunwater.

Sunwater is also working towards carrying out a full test once annually involving each local Council. Where there is more than one referable dam in a local area, the exercise could involve more than one dam, or the location will be rotated. This full test would involve the SDCC and include the (non-live) testing of Emergency Alerts.

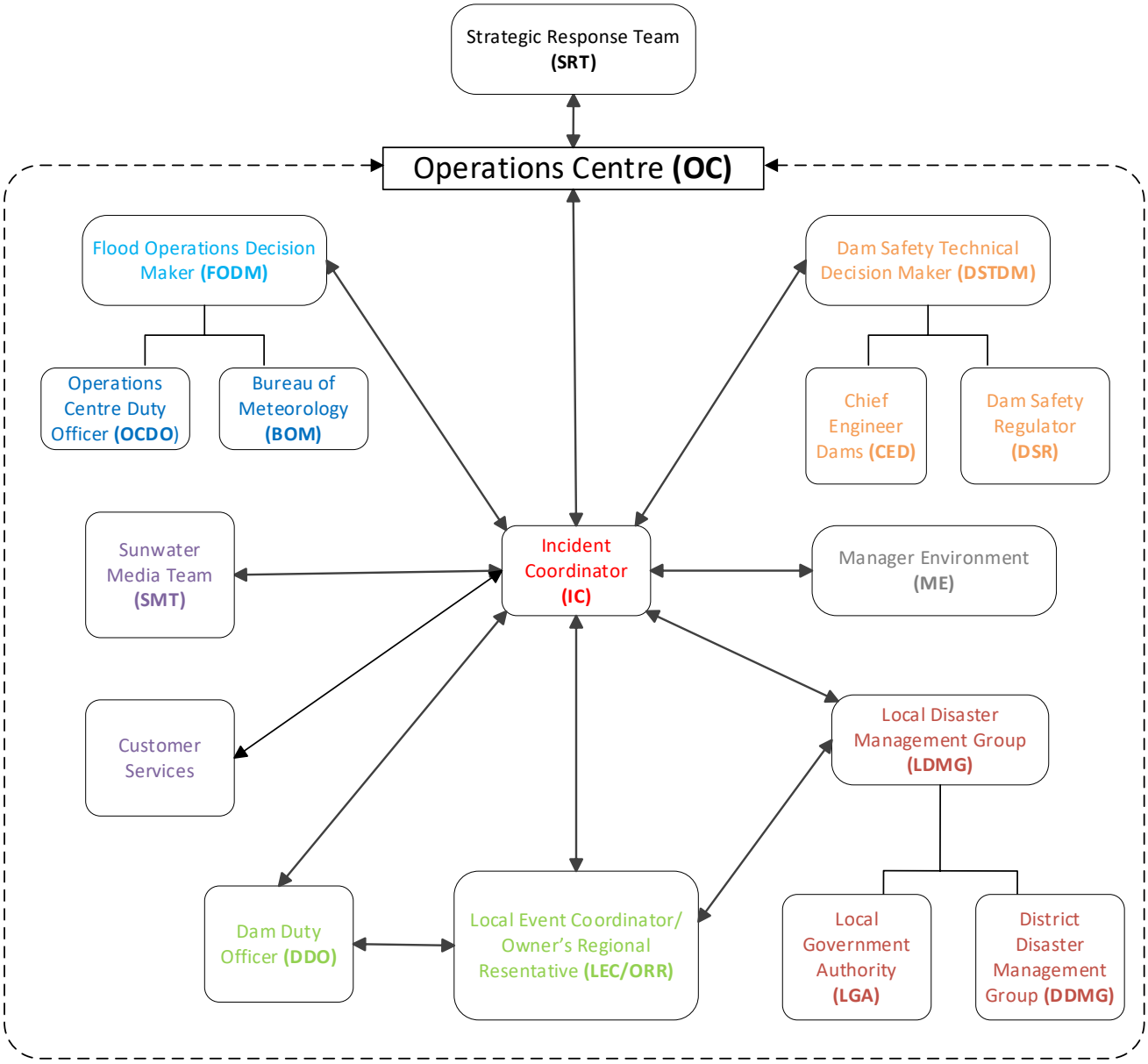
2.5 Fatigue Management Plan

Sunwater has a Fatigue Management Procedure. This document recognises fatigue as an important workplace hazard and has identified and outlined control processes to mitigate the risk of fatigue impaired HSE incidents. A copy of Sunwater's Fatigue Management Procedure can be provided upon request.

2.5.1 Dam emergency organisation within Sunwater

The Sunwater emergency management framework generally utilises the organisation's hierarchy and in-house experts as illustrated in Figure 1 below.

Figure 1: Sunwater emergency response organisation



Key aspects of the emergency management framework are:

- Central to the framework is the role of Incident Coordinator (IC) for any dam hazard at a dam. The IC will maintain overall responsibility for coordination of the EAP when activated.
- The DSTDM is primarily responsible for analysing dam safety and providing expert technical advice in this regard. They will be expected to discuss dam hazards with peers and other technical experts and make sound decisions to mitigate risks and to determine a response to incidents and emerging issues. The DSTDM is the key communication contact with the Dam Safety Regulator.
- The FODM has responsibility for all matters involving flood modelling and forecasting and determining the associated impact to Sunwater storages/infrastructure and EAP actions. The FODM may pre-emptively advise the IC to activate the EAP in accordance with available hydrology forecast information. For example, if an EAP trigger level is predicted to be exceeded based on forecast dam inflows derived from observed rainfall and streamflow conditions upstream of the dam, the EAP may be activated to the predicted level. Regarding the operation of the OC, the FODM must liaise with the IC as necessary to inform of decisions made.

- The IC is responsible for the decision to activate the EAP. The IC is the lead coordinator in the implementation of any EAP in events for Sunwater. Should the IC be unavailable, the Local Event Coordinator (LEC) followed by the Dam Duty Officer (DDO) is responsible for the implementation of the EAP. If the IC loses all communications during a dam hazard, then as a fail-safe position, the LEC followed by 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.
- The FODM and DSTDM roles are filled by Registered Professional Engineers of Queensland (RPEQ) and are suitably qualified professionals who are able to make engineering decisions and provide engineering decisions as defined in the *Professional Engineers Act of Queensland*.

2.6 Community information

Sunwater with the assistance of North Burnett and Bundaberg Regional Councils will ensure community education around messaging and impacts of the EAP and its related events is undertaken and continually improved by incorporating actions from Lesson Learnt (section 2.7).

Sunwater currently provides information externally to customers, downstream residents, and the community in a range of ways or channels in relation to dam hazards and emergency situations. Individuals can access information through Facebook, Twitter, the Sunwater web page, the Sunwater App and at several regional show/field days across regional Queensland where Sunwater may have stalls and information available.

Immediate D/S residents of Wuruma Dam are also provided information in text message/phone calls in the event of an activation of this EAP.

In the event of a dam failure or when required, Sunwater also have the use of the National Emergency Alert System to send a voice message or SMS. This service is provided by the State Disaster Coordination Centre and the process Sunwater follows is documented in Appendix A8.

A copy of all Sunwater approved EAPs are available to the public on the Sunwater website: https://www.sunwater.com.au/community/preparing-for-emergencies/emergency-management/

These copies are redacted to protect people's personal details.

2.7 Lessons learnt

Sunwater carries out Lessons Learnt workshops as part of its post event management. These Lessons Learnt can result in changes to the EAP. These are captured and if applicable to this document are implemented at the earliest opportunity and are made available in the next EAP update to the Regulator as part of Sunwater's continual improvement of its EAPs. The lessons learnt actions if relevant are provided to stakeholders, such as the LDMGs, DDMGs, other dam owners and RDMW as appropriate.

In addition, Sunwater requests any post event learnings be communicated regarding operational effectiveness and areas for improvement.

2.8 Downstream notifications list

Sunwater has compiled the notification lists through an iterative process. At least every five years Sunwater writes to all lot on plan landholders that are impacted in the downstream zones. In addition to individual letters, advertisements are placed yearly in local papers to capture any new residents in the areas. All year, applicable individuals can register to receive notifications for this EAP and are able to register either through the Sunwater website or by calling Sunwater Customer Enquiries on 13 15 89.

3. Dam details

3.1 General dam information

Location: Wuruma Dam is located on the Nogo River at AMTD 23.0 km. The Nogo River is a tributary of the Burnett River in the north-west part of the basin. The dam is situated approximately 22.5 km north-west of Eidsvold.

Purpose: Wuruma dam is used for irrigation and town water supply of surrounding areas.

Construction: Wuruma Dam was constructed to its full height in 1968 and is a mass-concrete, gravity dam.

Specification: The table below lists general specifications of Wuruma.

Table 2: Wuruma Dam specifications

Description	Specification
Dam type	**Mass gravity concrete with upper and lower galleries**
Full Supply Level (FSL)	EL 228.29 m
Historical recorded max storage — Jan 2013	EL 232.03 m
Storage capacity at FSL	165,400 ML
Storage area at FSL	1,639 ha
Catchment area	2349 km^2
Dam Crest Level (DCL)	EL 235.46 m (top of kerb EL 235.66 m)
Maximum height above foundation	44 m
Length across crest (including spillway)	343 m
Dam Crest Level Flood (DCF)	1 in 2,800 AEP (2022 CRA)
Spillway type	**Uncontrolled concrete ogee crest with Horizontal Flip at end**
Spillway crest level	EL 228.29 m
Spillway design capacity	3,819 m^3/s (329,962 ML/d)
Spillway crest length	91.44 m
Maximum spillway depth at DCF	7.17 m
Saddle Dam	**Earth and rock-fill embankment**
Saddle Dam embankment crest level	EL 239.27 m
Saddle Dam length	182.88m
Saddle Dam maximum height	12.3 m
Outlet works	**Located in monolith 14**
River outlet works	2/914 mm concrete-lined mild steel pipe, with 2/914 mm butterfly valves, and 2/762 mm cone dispersion valves
River outlet capacity	11.4 m^3/sec

Note: 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

The 2022 Comprehensive Risk Assessment (ref H) estimated the weighted total population at risk (PAR) for Wuruma Dam is 2,474 for the 1 in 100,000 AEP failure scenario, and 8 for the Sunny Day Failure (SDF) scenario.

3.3 General Arrangement

The general arrangement drawings are in Appendix B.

3.4 Emergency inspections and monitoring

The Wuruma Dam has been designed to conform to modern design standards, so that its failure is highly unlikely. To maintain the dam in a safe condition and detect any dam hazards, as soon as it begins to develop, or becomes apparent, the following is applicable to Wuruma Dam.

3.4.1 Inspections

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

3.4.2 Instrumentation and monitoring

To confirm the structural behaviour and safety of the embankment, the following instrumentation was installed, and is monitored, at Wuruma Dam.

- **Settlement/movement measurement**
  - 23 surface settlement points—6 located along the crest of the right abutment, 7 located along the crest of the left abutment and 10 located along the spillway.
  - 5 control stations, located around the main dam wall.
- **Seepage measurement**
  - Main Dam—4 gallery leakage monitoring points (v-notch weirs) within the galleries
  - Saddle Dam—1 v-notch weir downstream of the Saddle Dam and 5 observation bores located on the crest of the Saddle Dam

The instrumentation layout drawing (206771) is in Appendix B.

4. Roles and responsibilities

EAP roles and responsibilities	Position holder
Owner • Liaise with the Board and Minister • Activate Sunwater Strategic Response and Business Continuity Plans if required. • Ensure necessary resources are available to manage any event • Record communications, notifications and observations as required	CEO EGMO EGM E&WR
Owner's Head Office Representative • Authorise the issuing of EAPs, SOPs and O&M manuals and amendments. • Facilitate Dam Safety training courses for Service Managers, Operations Supervisor, 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 CRAs, 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 Condition Schedule are met. • Ensure the work instructions are correct and the logbooks, SOPs, Data Books, and EAPs are reviewed annually as per the Condition Schedule • Undertake and prepare the five yearly Comprehensive Inspection Reports with suitably qualified personnel within the time specified in the Condition Schedule and that 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 Condition Schedule and that 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 dams on a regular basis and maintain a spreadsheet for verification for audit and quality control. • Record communications, notifications and observations as required	GM Asset Integrity GM Asset Management
Owner's Regional Representative (ORR) • Liaise with the Storage Supervisor/Operator Maintainer • Arrange dam specific training and accreditation for relevant staff. • Ensure competent, trained, and accredited personnel operate the storages. • Undertake the role of LEC as required. • Record communications, notifications and observations as required. • Ensure all work orders, work instructions and lesson learned outcomes are fully implemented.	GM Burnett & Lower Mary OCO OS
Technical Advisor • Analyse the situation and provide expert technical advice. • Discuss issue with peers and other technical experts and make sound decisions to mitigate the risk. • Determine response to incidents and emerging issues. • Record communications, notifications and observations as required.	GM Environment

EAP roles and responsibilities	Position holder
Dam Safety Technical Decision Maker (DSTDM) • 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 the risk. • Determine response to incidents and emerging issues. • Issue warning on dam failure and advise on protective measures. • Ensure the EAP is implemented appropriately and carry out the DSTDM role as required. • Maintain current RPEQ accreditation. • Liaise with Regulator as required. • Record communications, notifications and observations as required	Various personnel as per DSTDM roster
Flood Operations Decision Maker (FODM) • Maintain current RPEQ accreditation. • Provide hydrological advice in relation to predicted and actual dam outflows including assessment of weather and flood warnings and other related matters as identified in the OC SOP • Interpret and apply rainfall data in accordance with the OC SOP, including, as required under the OC SOP, liaising with BOM. • 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
Operations Centre Duty Officer (OCDO) • Decide if a flood is imminent and record modes of operation. • Extract data relative to the event from available sources • Utilise this data in predictive flood models and determine results from these models for approval by FODM. • Liaise with the FODM or IC to update current flood situation and routing data. • Record communications, notifications and observations as required	Various personnel as per OCDO roster
Sunwater Media Team (SMT) • Analyse sensitive issues, discuss with the Owner and issue media releases. • Handle public and customer comments (including social media) and advise the Owner if necessary. • Liaise with the IC and update SDMG of flood events. • Record communications, notifications and observations as required	Various personnel as per Media Team roster
Incident Coordinator (IC) • Notify council of intent to use the Emergency Alert • Activate the EAP • Ensure the EAP is implemented appropriately and carry out the IC role as required. • Arrange situation reports and determine frequency as required. • Record communications, notifications and observations as required	Various personnel as per IC roster
Local Event Coordinator (LEC) • Liaise with the Local Disaster Coordinator or proxy. • Activate the EAP when necessary. • Ensure the EAP is implemented appropriately and carry out the LEC role as required. • Record communications, notifications and observations as required	Various personnel as per LEC roster

EAP roles and responsibilities	Position holder
Dam Duty Officer (DDO) • Complete accreditation to operate and maintain relevant storage. • 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	SOM SS OM
Councils (North Burnett Regional Council and Bundaberg Regional Council) Council has legislated local government functions, as per Section 80 of the Qld Disaster Management Act (2003). These include: • 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. And as per Section 352HB of the Water Legislation (Dam Safety) Amendment Act (2017): • Assess (in consultation with its LDMG) the EAP for consistency with the Local Disaster Management Plan	
Disaster Management Groups/Personnel - (In addition to requirements outlined in the Qld Disaster Management Act (2003) LDMG • Assist Sunwater, the North Burnett Regional Council and Bundaberg Regional Council to ensure community education around messaging and impacts of EAP related events is undertaken and continually improves. • Work with North Burnett Regional Council, Bundaberg Regional Council and Sunwater 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. QFD • Work with dam owner and LDMG to ensure Emergency Alerts polygons are prepared, stored, and tested at the State Watch Desk DDMG • DDMG may review plan with consistency with the District Disaster Management Plan	LDMG DDMG QFD
Dam Safety Regulator (DSR) • 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*	DDS

5. Dam Hazard—flood operations

5.1 Overview

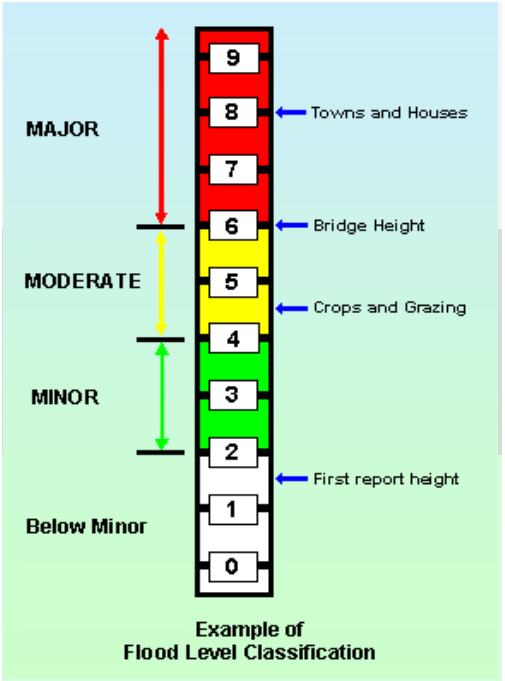
The emergency action described in this section (Dam Hazard—flood operations) relates to:

- Where natural catchment inflows fill Wuruma Dam to FSL (228.29m) and the rate of inflow exceeds the capacity of the outlet works, and outflows occur via the spillway downstream into the Nogo River. These outflows can create a downstream hazard during flood events. Inflows will also cause the storage to temporarily rise to above the FSL of the storage. Note:
  - The greater the rate of inflow, the higher the storage will rise.
  - 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).

Table 3 provides the Bureau of Meteorology flood classification triggers for Wuruma Dam, described as:

- If the water level reaches the minor flood level, it causes inconvenience. Low-lying areas next to water courses are inundated. Minor roads may be closed, and low-level bridges submerged. In urban areas, flooding may affect some backyards and buildings below floor level as well as bicycle and pedestrian paths. In rural areas, removal of livestock and equipment may be required. If the water level reaches the moderate flood level, the area of inundation is larger. Traffic routes may be affected, such as low-level crossings. Some buildings may be affected above floor level. Evacuation may be required. In rural areas, livestock, and infrastructure in the river such as pump sites will be affected.
- When the storage height exceeds major flood level (1.5m over the spillway) EL 229.79m, extensive rural areas and/or urban areas are inundated. Many buildings may be affected above the floor level. Properties and towns are likely to be isolated and major rail and traffic routes closed. Evacuation of flood affected areas may be required. Utility services may be impacted.

Table 3: Flood classification triggers

	Flood Classification Level	Depth over Spillway (m)	Storage Elevation (m AHD)
	Major	1.5	229.79
	Moderate	1.0	229.29
	Minor	0.50	228.79

Source: Bureau of Meteorology

The following table shows historical floods experienced at Wuruma Dam.

Table 4: Historical floods experienced at Wuruma Dam

Flood Rank	Date	Peak Height EL	Peak Height (m over crest)
1	Jan 2013	232.03m	3.74
2	Dec 2010	231.67m	3.38
3	Mar 2013	231.11m	2.82
4	Feb 2015	229.75m	1.46
5	Feb 1971	228.88m	0.59

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.

5.2.1 Activation triggers

Table 5: Flood emergency activation trigger summary

Alert	• EL 228.19m and rising. (0.1m below FSL)
Lean Forward	• Storage above FSL 228.29m
Stand Up 1—moderate flood level	• Storage above EL 229.29m (Moderate flood classification level)
Stand Up 2—greater than flood of record	• Storage above EL 232.03m (Flood of record—January 2013)
Stand Up 3— saddle dam overtopping	• Storage above EL 239.27m (Saddle Dam embankment crest level; allowing for wave action) OR; • As advised by the DSTDM
Stand Down	• Storage level EL 228.39m and falling with no forecast increase in EL

While this EAP is not triggered until Wuruma Dam reaches a level of 228.19m, Sunwater and the North Burnett and Bundaberg Regional Councils' LDMGs will work cooperatively and will endeavour to share intelligence of any rainfall event as and when either organisation becomes aware of a situation that could result in the activation of the EAP, in particular when high outflows are expected.

The activation of Stand Up – 3 requires consideration of wave action. For example, if the gauge reading was forecast to reach 1m below the dam crest level and the DDO reported 1m high waves, Stand Up – 3 will be triggered. Furthermore, the DSTDM may also trigger this activation if there are any dam safety concerns as the storage approaches dam crest level.

5.2.2 Emergency action roles

Table 6 to Table 11 specify EAP actions for the following roles:

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

Table 6: Flood operations—DDO emergency action

Activation level	Alert	Lean Forward	Stand Up 1 — moderate flood level	Stand Up 2 — greater than flood of record	Stand Up 3 — saddle dam overtopping	Stand Down
Activation trigger	• EL 228.19m and rising (0.1m below FSL)	• Storage above FSL 228.29m	• Storage above EL 229.29m	• Storage above EL 232.03m	• Storage above EL 239.27m (allowing for wave action) OR; • As advised by the DSTDM	• Storage level EL 228.39m and falling with no forecast increase in EL
Actions	• Inspect the dam wall and Saddle Dam daily (or as instructed by the DSTDM) and photograph/video and record using approved forms and send to DSTDM and IC • Undertake site preparations (if not already completed) including but not limited to: – check fuel and operation of backup generator. – check communication systems (including backup, landline, satellite phone, fax, and internet) • Monitor catchment conditions. • Notify the SO (who will be available for duty and onsite for the duration of a flood or emergency event) • Record the Storage Level daily (or as instructed by the Owner's Rep/DSTDM) using the gauge boards and confirm accuracy of gauging station. • Read dam instrumentation (or as instructed by the DSTDM) as per section 3.4.2 • Record rainfall—daily • Record all communication. • Update Dam Logbook as per SOP 12	• As per previous activation level, AND • Inspect the dam wall and Saddle Dam daily (or as instructed by the DSTDM) and photograph/video and record using approved forms and send to DSTDM and IC. Attention will be given to: – visual inspection of flow patterns over spillway and dissipater for evidence of scouring – obvious signs of seepage – inspect embankment for leaks, deformation, and erosion. • Report any unusual readings or observations to the DSTDM and IC as soon as practical. • Record the Storage Level twice daily (or as instructed by the Owner's Rep/DSTDM) using the gauge boards and confirm accuracy of gauging station. Report any irregularities to the FODM	• As per previous activation level, AND • Inspect the dam wall and Saddle Dam twice daily (or as instructed by the DSTDM) and photograph/video and record using approved forms and send to DSTDM and IC **NOTE:** At approx. EL 229.62m Saddle Dam inspections may need to be undertaken by walking through gallery as bridge/vehicle access may not be possible.	• As per previous activation level, AND • Inspect the dam wall and Saddle Dam 6-hourly (or as instructed by the DSTDM) and photograph/video and record using approved forms and send to DSTDM and IC	• As per previous activation level	• Return to routine surveillance activities and frequencies—inspect the dam for any damage identified. • Forward information for EER to IC and OC emails • Update Dam Logbook as per SOP 12
Internal notifications	• IC • SO	• As previous activation level	• As previous activation level	• As previous activation level	• As previous activation level	• As previous activation level
External notifications	• As required	• As previous activation level	• As previous activation level	• As previous activation level	• As previous activation level	• As previous activation level

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 7: Flood operations—LEC emergency action

Activation level	Alert	Lean Forward	Stand Up 1 — moderate flood level	Stand Up 2 — greater than flood of record	Stand Up 3 — saddle dam overtopping	Stand Down
Activation trigger	• EL 228.19m and rising (0.1m below FSL)	• Storage above FSL 228.29m	• Storage above EL 229.29m	• Storage above EL 232.03m	• Storage above EL 239.27m (allowing for wave action) OR; • As advised by the DSTDM	• Storage level EL 228.39m and falling with no forecast increase in EL
Actions	• Liaise with LDMG re: situation. • Record all communication. • Develop/implement staff roster	• As per previous activation level, AND • Liaise with relevant Council(s) regarding potential road/bridge closures	• As per previous activation level (no incident alert required)	• As per previous activation level	• As per previous activation level	• Forward information for EER to IC email • Return to routine activities
Internal notifications	• IC • DDO	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• LDMG 1	• As per previous activation level	• As per previous activation level	• As per previous activation level, AND • LDMG 2	• As per previous activation level	• As per previous activation level

Table 8: Flood operations—IC emergency action

Activation level	Alert	Lean Forward	Stand Up 1 — moderate flood level	Stand Up 2 — greater than flood of record	Stand Up 3 — saddle dam overtopping	Stand Down
Activation trigger	• EL 228.19m and rising (0.1m below FSL)	• Storage above FSL 228.29m	• Storage above EL 229.29m	• Storage above EL 232.03m	• Storage above EL 239.27m (allowing for wave action) OR; • As advised by the DSTDM	• Storage level EL 228.39m and falling with no forecast increase in EL
Actions	• Liaise with Sunwater Customer Support to send SMS to D/S residents and phone those without mobiles. • Liaise with the DSTDM • Create Sunwater Incident Report • Update Sunwater intranet with dam status **NOTE**: IC to carry out LEC actions unless LDMG 1 is *Stood Up*	• As per previous activation level, AND • Ensure all abnormal observations or damage has been reported to DSTDM	• As per previous activation level	• As per previous activation level, AND • Refer Section 9 (Overturning or Sliding). That section activates at this level if not already activated	• As per previous activation level, AND • IC to check with FODM on inflow assessment and potential Paradise Dam EAP activation due to flows over secondary spillway	• Complete all internal and external notifications. • Forward all communications including relevant emails for EER to IC email address. • Close Sunwater Incident Report • Update Sunwater intranet with dam status • Return to routine activities
Internal notifications	• DDO • DSTDM • FODM • LEC/ORR • SMT • SRT	• As per previous activation level •	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• D/S Residents • DDMG	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level, AND • SDCC Watch Desk • ABC Radio	• Inform all previously notified contacts of stand down

Table 9: Flood operations—LEC & IC external communication plan

Activation level	Trigger for communications	Group to contact	Method	Message text
Alert	• When EL 228.19m and rising (preparedness)	• **LDMG 1**	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
Lean Forward	• Storage above FSL 228.29m	• **LDMG 1** • DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level and whether any flood releases are due to commence. Discuss any potential road/bridge closures
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
Stand Up 1 — moderate flood	• Storage above EL 229.29m	• **LDMG 1** • DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? (Storage is greater than moderate flood level) Advise of current storage level Advise of any forecasts you are aware of
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS

Table 9 (Continued): Flood operations—LEC & IC external communication plan.

Activation level	Trigger for communications	Group to contact	Method	Message text
Stand Up 2 — greater than flood of record	• Storage above EL 232.03m	• **LDMG 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 LDMG of current storage level. Advise of any forecasts you are aware of
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
Stand Up 3 — saddle dam overtopping	• Storage above EL 239.27m (allowing for wave action) OR; • As advised by the DSTDM	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? What is the status? Advise LDMG of current storage level. Advise of any forecasts you are aware of
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS**
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
		• ABC Radio	• Phone	To be determined.
Stand Down	• Storage level EL 228.39m and falling with no forecast increase in EL	• **LDMG 1** • **LDMG 2** (if from Stand Up -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
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS

Table 10: Flood operations—DSTDM emergency action

Activation level	Alert	Lean Forward	Stand Up 1 — moderate flood level	Stand Up 2 — greater than flood of record	Stand Up 3 — saddle dam overtopping	Stand Down
Activation trigger	• EL 228.19m and rising. (0.1m below FSL)	• Storage above FSL 228.29m	• Storage above EL 229.29m	• Storage above EL 232.03m	• Storage above EL 239.27m (allowing for wave action) OR; • As advised by the DSTDM	• Storage level EL 228.39m and falling with no forecast increase in EL
Action	• Provide technical advice to DDO and IC on an as-needed basis. • Review surveillance reports and determine if any additional responses are required. • Record all communication. • Notify DSR	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level • Make assessment on likely impacts to Paradise Dam	• Forward information for EER to IC email • Return to routine activities. • Notify DSR • Activate dam inspection if required
Internal notifications	• DDO • IC	• As per previous activation level	• As per previous activation level	• As per previous activation level, AND • CEO—if time permits	• As per previous activation level	• As per previous activation level
External notifications	• DSR	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level

Table 11: Flood operations—FODM emergency action

Activation level	Alert	Lean Forward	Stand Up 1 — moderate flood level	Stand Up 2 — greater than flood of record	Stand Up 3 — saddle dam overtopping	Stand Down
Activation trigger	• EL 228.19m and rising. (0.1m below FSL)	• Storage above FSL 228.29m	• Storage above EL 229.29m	• Storage above EL 232.03m	• Storage above EL 239.27m (allowing for wave action) OR; • As advised by the DSTDM	• Storage level EL 228.39m and falling with no forecast increase in EL
Action	• Provide technical advice to DDO, DSTDM and IC on a need basis. • Inform IC of any EAP decisions made. • Review SDCC reports and determine if any additional responses are required. • Undertake inflow assessment as per the OC SOP and update as necessary. • Update and issue Status Updates if required. • Record all communication and decisions made	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Forward EER information to IC email • Return to routine activities
Internal notifications	• IC • DDO • DSTDM	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• BoM	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level

6. Dam Hazard—piping: embankment, foundation, or abutments

6.1 Overview

The emergency action described in this section relates to a potential dam failure hazard due to a piping condition through the embankment (Main Dam or Saddle Dams), 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 Precipitation Design Flood (PMPDF) 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.

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

6.1.1 Assessment of circumstances that indicate an increase in the likelihood of piping.

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

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

6.2 Emergency action roles

Table 12 to Table 16 specify emergency actions for the following roles:

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 2: Piping: embankment, foundation, or abutments flowchart

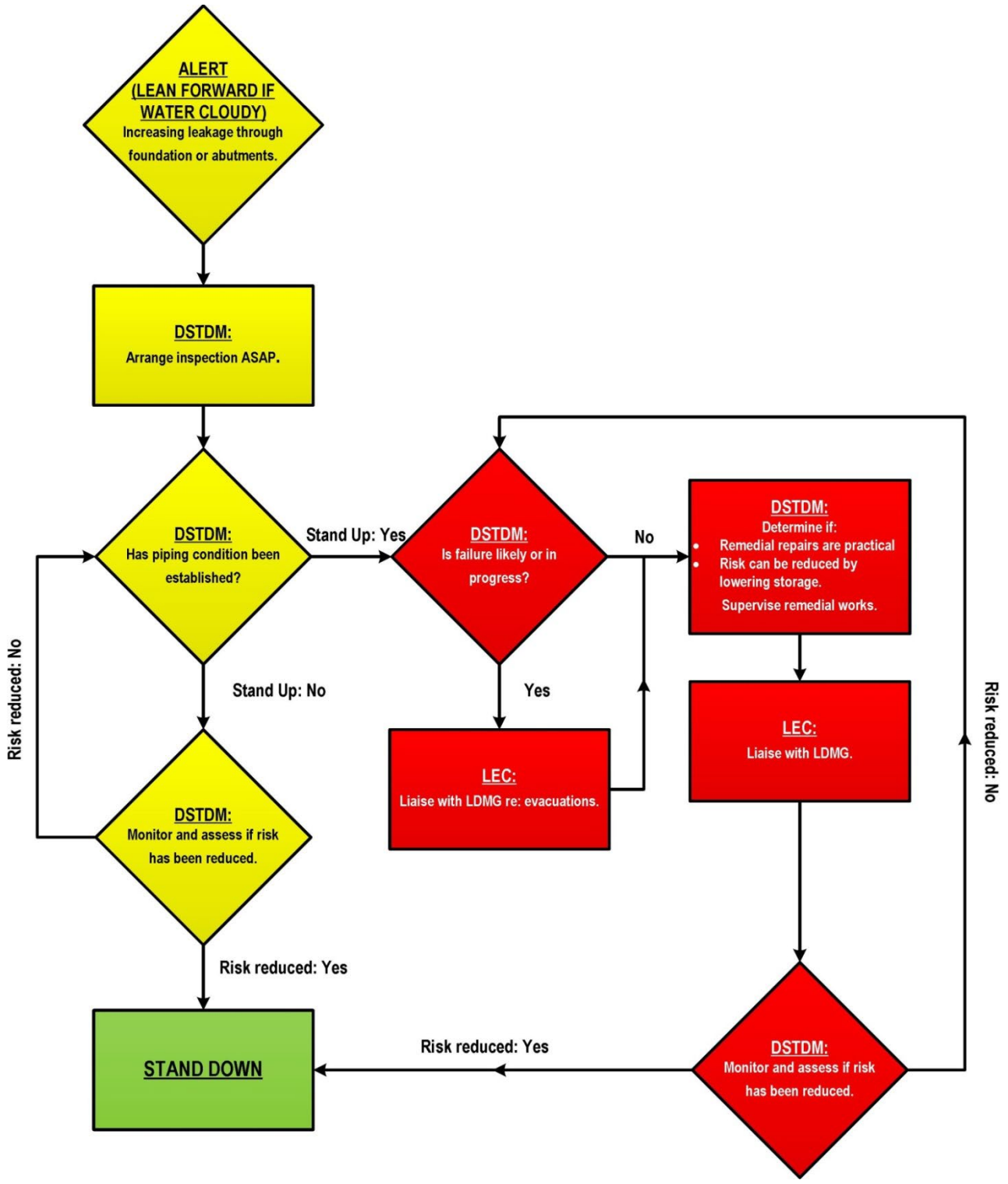


Table 12: Piping: embankment, foundation, or abutments—DDO emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Increasing leakage through the embankment, the foundations, or abutments	• Increasing leakage through the embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that piping risk has reduced
Actions	• Monitor flows every 6 hours (or as otherwise instructed by the DSTDM) until a decreasing trend is observable, or as directed by the IC. • Photograph/video the piping from a safe point and record using approved forms and send to DSTDM and IC • Notify SO • Update Dam Logbook as per SOP 12 • Record all communication	• As per previous activation level	• 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 or Saddle Dam (if safe to do so) and move on any members of the public	• As per previous activation level, AND • Vacate the immediate vicinity of the piping condition • Ensure remedial works cease and plant and personnel have been moved to a safe location • Record/photograph the piping damage and/or dam failure from a safe point	• Inspect the dam for any damage and photograph any damage identified during the event. • Forward information for EER to IC email • Update Dam Logbook as per SOP 12 • Return to routine activities.
Internal notifications	• DSTDM • SO • IC	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• As required	• As required	• As required	• As required	• As per previous activation level

Table 13: Piping: embankment, foundation, or abutments—LEC emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Increasing leakage through the embankment, the foundations, or abutments	• Increasing leakage through the embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that piping risk has reduced
Actions	• Liaise with IC & DDO re: situation. • Record all communication	• As per previous activation level, AND • Liaise with LDMG 1 re: situation	• As per previous activation level, AND • Liaise with relevant council(s) regarding potential road/bridge closures	• As per previous activation level	• Forward information for EER to IC email • Return to routine activities
Internal notifications	• IC • DDO	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• As required	• LDMG 1	• As per previous activation level, AND • LDMG 2	• As per previous activation level	• As per previous activation level

Table 14: Piping: embankment, foundation, or abutments—IC emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Increasing leakage through the embankment, the foundations, or abutments	• Increasing leakage through the embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that piping risk has reduced
Actions	• Liaise with DSTDM, DDO and LEC re: situation. • Create Sunwater Incident Report • Update Sunwater intranet with EAP status **NOTE**: IC to carry out LEC actions unless LDMG 1 is *Stood Up*	• 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. • Consider the need to appoint a recovery coordinator. The recovery coordinator is then responsible for the follow through on actions to close out all matters and works outstanding after the initial emergency is over.	• As per previous activation level, AND • Liaise with Sunwater Customer Support to send SMS to D/S residents and phone those without mobiles. • Inform FODM and request inflow assessment for Paradise Dam • Mobilise resources to undertake remedial works if directed by DSTDM	• As per previous activation level, AND • Liaise with the DSTDM to confirm that dam failure is in progress • Confirm that remedial works have ceased if directed by the DSTDM and plant and personnel have been moved to a safe location • Liaise with DDO and DSTDM re: potential for evacuations • IC to activate Paradise Dam EAP based on FODM inflow assessment	• Complete all Internal and External notifications. • Forward all communications including relevant emails for EER to [redacted] • Close Sunwater Incident Report • Update Sunwater intranet with dam status • Return to routine activities
Internal notifications	• DSTDM • DDO • LEC/ORR • SMT • SRT	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• As required	• As per previous activation level, AND • DDMG	• As per previous activation level, AND • D/S residents • SDCC Watch Desk • ABC Radio	• As per previous activation level •	• Inform all previously notified contacts of stand down

Table 15: Piping: embankment, foundation, or abutments—LEC & IC external communication plan

Activation level	Trigger for communications	Group to contact	Method	Message text
Alert	Increasing leakage through the embankment, the foundations, or abutments			N/A – Internal communications only
Lean Forward	• Increase in leakage through an embankment, the foundations, or abutments with cloudy water	• **LDMG 1** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Unconfirmed piping risk)* What is the status? (Unconfirmed leakage—Investigation continues) Advise of current storage level Advise any issues you are aware of Standby for further advice
Stand Up—1	• Piping condition has been established	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Confirmed piping risk)* What is the status? (Confirmed piping/leakage) Advise of current storage level Advise any issues you are aware of. Discuss any potential road/bridge closures. Prepare for possible evacuations
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** *Develop messages in consultation with DSTDM*
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
		• ABC Radio	• Phone	To be determined.

Table 15 (Continued): Piping: embankment, foundation, or abutments—LEC & IC external communication plan.

Activation level	Trigger for communications	Group to contact	Method	Message text
Stand Up—2	• Failure likely due to piping, AND • Enough water in storage to create a dam hazard	• **LDMG 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 of current storage level Prepare coordinated evacuations
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** *Develop messages in consultation with DSTDM*
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
		• ABC Radio	• Phone	To be determined.
	• Dam failure in progress	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Confirmed piping risk)* What is the status? (Dam Failure in Progress) Advise of current storage level Coordinate evacuations of affected Downstream Residents and move people to higher ground
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS**
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
		• ABC Radio	• Phone	To be determined.
Stand Down	• Risk assessment has determined that piping risk has reduced	• **LDMG 1** (if from Lean Forward) • **LDMG 2** (if from Stand Up) • DDMG (if from Lean Forward)	• 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
		• D/S residents (if from Stand Up)	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS

Table 16: Piping: embankment, foundation, or abutments—DSTDM emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Increasing leakage through the embankment, the foundations, or abutments	• Increasing leakage through the embankment, the foundations, or abutments with cloudy water	• Piping condition has been established	• Failure in progress or likely due to piping, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that piping risk has reduced
Action	• Arrange an inspection of the 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. • Advise DSR on EAP activation	• As per previous activation level	• 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. • Determine if risks can be reduced by lowering storage. • Supervise* remedial repairs (if applicable) • Monitor situation and assess risks	• As per previous activation level, AND • Liaise with the IC and advise on need to recommend evacuations. • Make assessment on impacts to Paradise Dam	• Forward information for EER to IC email • Return to routine activities
Internal notifications	• DDO • IC	• As per previous activation level	• As per previous activation level	• As per previous activation level, AND • CEO—if time permits	• As per previous activation level
External notifications	• DSR	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level

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

7. Dam Hazard—earthquake

7.1 Overview

The emergency action described in this section relates to a potential dam failure hazard due to an earthquake causing damage to the dam embankment (Main Dam or Saddle Dams), 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 in Appendix B are there to provide indicative outlines of the maximum potentially affected area of a dam hazard caused by earthquake damage. 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 damage and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Precipitation Design Flood (PMPDF) outline when a dam failure is in progress or likely due to earthquake damage 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

Table 17 to Table 21 specify emergency actions for the following roles:

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 3: Earthquake flowchart

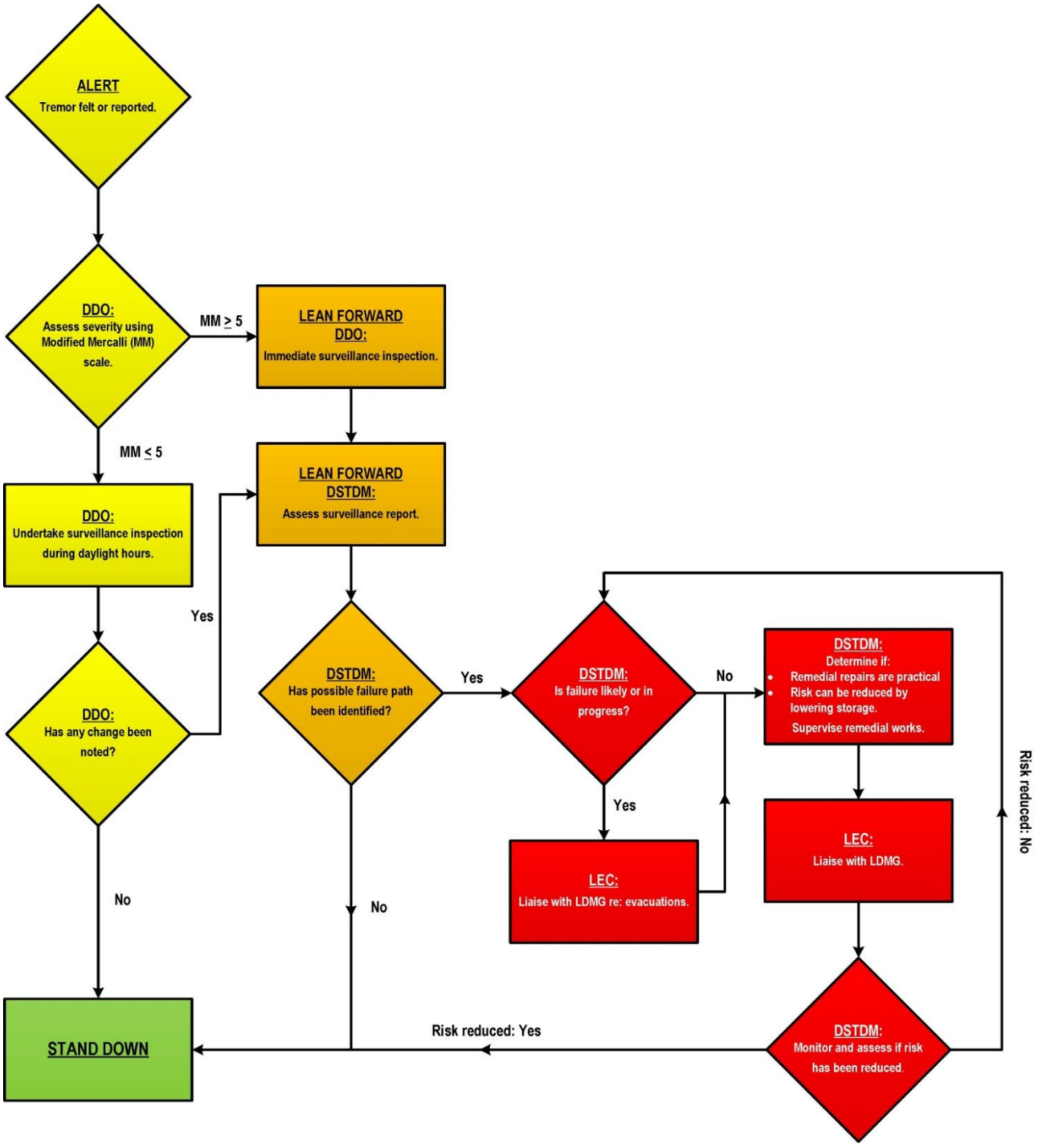


Table 17: Earthquake—DDO emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Earthquake confirmed* (by DSTDM) or felt in the area, AND • Intensity less than 5MM~	• Earthquake confirmed* (by DSTDM) or felt in the area, AND • Intensity greater than or equal to 5MM~, OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed* (by DSTDM) or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Actions	• Inspect the dam wall, spillway structure, abutments, and Saddle Dam in daylight hours (if safe to do so) and report to the DSTDM and IC—photograph/video and record using approved forms and send to DSTDM and IC • Check for leaks, deformation, erosion, and concrete damage. • Notify SO • Update Dam Logbook as per SOP 12 • Record all communication	• As per previous activation level, AND • Inspect the dam wall, spillway structure, abutments, and Saddle Dam (if safe to do so) and report to the DSTDM and IC (unless inspection completed in Alert Stage) — photograph/video and record using approved forms and send to DSTDM and IC • Repeat the inspection as directed	• As per previous activation level, AND • Support/supervise remedial work as required. • Lower the storage if directed. • Close any affected roads, if not already closed by others • Maintain surveillance of area immediately downstream of dam or Saddle Dam (if safe to do so) and move on any members of the public. • Vacate the immediate vicinity of the embankment	• As per previous activation level, AND • Ensure remedial works cease and plant and personnel have been moved to a safe location • Record/photograph the earthquake damage and/or dam failure from a safe point	• Inspect the dam for any damage and photograph any damage identified during the event • Forward information for EER to IC email • Update Dam Logbook as per SOP 12 • Return to routine activities
Internal notifications	• DSTDM • IC • SO	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• As required	• As required	• As required	• As required	• As per previous activation level

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

*'Confirmed is defined as an alert from Geoscience or other source that advises an Earthquake >4.9 ML (Richter Scale) has occurred within a 200km radius of the Dam

Table 18: Earthquake—LEC emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Earthquake confirmed* (by DSTDM) or felt in the area, AND • Intensity less than 5MM~	• Earthquake confirmed* (by DSTDM) or felt in the area, AND • Intensity greater than or equal to 5MM~, OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed* (by DSTDM) or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Actions	• Liaise with DDO and IC re: situation. • Record all communication	• As per previous activation level, AND • Liaise with LDMG 1 re: situation	• As per previous activation levels, AND • Liaise with DDO & relevant Council(s) regarding potential road/bridge closures	• As per previous activation level •	• Forward all communication including relevant emails for EER to • Return to routine activities
Internal notifications	• IC • DDO	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• As required	• LDMG 1	• As per previous activation level	• As per previous activation level, AND • LDMG 2	• Inform all previously notified contacts of stand down

˜ DDO to assess magnitude (MM scale) at dam location

* Confirmed' is defined as an alert received from Geoscience Australia or other source that advises an Earthquake >4.9 ML (Richter Scale) has occurred within a 200km radius of the Dam

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

Table 19: Earthquake—IC emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Earthquake confirmed* or felt in the area, AND • Intensity less than 5MM~	• Earthquake confirmed* or felt in the area, AND • Intensity greater than or equal to 5MM~, OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed* or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Actions	• Liaise with DDO, DSTDM and LEC re: situation. • Create Sunwater Incident Report • Update Sunwater intranet with dam status **NOTE**: IC to carry out LEC actions unless LDMG 1 is *Stood Up*	• 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	• As per previous activation level, AND • Liaise with Sunwater Customer Support to send SMS to D/S residents and phone those without mobiles • Mobilise resources to undertake remedial works if directed by DSTDM. • Liaise with relevant council(s) regarding potential road/ bridge closures.	• As per previous activation level, AND • IC to activate Paradise Dam EAP based on FODM inflow assessment. • Liaise with the DSTDM to confirm that dam failure is in progress • Confirm that remedial works have ceased if directed by the DSTDM and plant and personnel have been moved to a safe location • Liaise with DDO and DSTDM re: potential for evacuations • Cease remedial works if directed by the DSTDM and plant and personnel to be moved to a safe location.	• Complete all internal and external notifications. • Forward all communications including relevant emails for EER to [redacted] • Close Sunwater Incident Report • Update Sunwater intranet with dam status • Return to routine activities
Internal notifications	• DDO • DSTDM • LEC/ORR • SMT • SRT	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• As required	• As per previous activation level, AND • DDMG	• As per previous activation level, AND • D/S Residents • SDCC Watch Desk • ABC Radio	• As per previous activation level •	• Inform all previously notified contacts of stand down

˜ DDO to assess magnitude (MM scale) at dam location

* 'Confirmed' is defined as an alert received from Geoscience Australia or other source that advises an Earthquake >4.9 ML (Richter Scale) has occurred within a 200km radius of the Dam

Table 20: Earthquake—LEC & IC external communication plan

Activation level	Trigger for communications	Group to contact	Method	Message text
Alert	• Earthquake confirmed* or felt in the area, AND • Intensity less than 5MM~			N/A—Internal communications only
Lean Forward	• Earthquake confirmed* or felt in the area, AND • Intensity greater than or equal to 5MM~, OR • Intensity less than 5MM~ and change detected during surveillance inspection	• **LDMG 1** • DDMG	• Phone	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
Stand Up—1	• Earthquake confirmed* or felt in the area, AND • A possible failure path has been identified	• **LDMG 1** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Dam Safety Risk—earthquake felt or reported in area)* What is the status? (Possible earthquake damage to dam) Advise of current storage level. Discuss any potential road/ bridge closures. Activate emergency response
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** *Develop messages in consultation with DSTDM*
		• D/S Residents	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**
		• ABC Radio	• Phone	To be determined.

Table 20 (Continued): Earthquake—LEC & IC external communication plan.

Activation level	Trigger for communications	Group to contact	Method	Message text
Stand Up—2	• Failure likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Dam Safety Risk—earthquake damage)* What is the status? (Dam Failure Likely) Advise of current storage level. Discuss any potential road/bridge closures (if not discussed at Stand Up—1) Prepare coordinated evacuation
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** *Develop messages in consultation with DSTDM*
		• D/S Residents	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**
		• ABC Radio	• Phone	To be determined.
	• Dam failure in progress	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Dam Safety Risk—earthquake damage)* What is the status? (Dam Failure in Progress) Advise of current storage level Coordinate evacuation of Downstream Residents and move people to higher ground
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS**
		• D/S Residents	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**
		• ABC Radio	• Phone	To be determined.
Stand Down	• Risk assessment has determined that failure risk has reduced	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—what is the event? *(Dam Safety Risk—earthquake damage)* 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
		• D/S Residents (if from Stand Up)	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS

Table 21: Earthquake—DSTDM emergency action

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Earthquake confirmed* or felt in the area, AND • Intensity less than 5MM~	• Earthquake confirmed* or felt in the area, AND • Intensity greater than or equal to 5MM~, OR • Intensity less than 5MM~ and change detected during surveillance inspection	• Earthquake confirmed* or felt in the area, AND • A possible failure path has been identified	• Failure in progress or likely due to earthquake, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has been determined that failure risk has reduced
Action	• Monitor situation and assess risks. • Liaise with DDO & IC • Record all communication. • Review surveillance inspection of the dam and assess its condition as soon as possible • Review instrumentation data and determine if any additional responses are required • Advise DSR of EAP activation	• As per previous activation level, AND • Review surveillance inspection of the dam and assess its condition as soon as possible. • Determine if there are any possible failure paths from reported damage	• As per previous activation level, AND • 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 • Determine if remedial repairs are practical. • Determine if risks can be reduced by lowering storage. • Supervise* remedial repairs (if applicable) • Monitor situation and assess risks	• As per previous activation level, AND • Contact FODM to make assessment on likely impacts to Paradise Dam	• Forward all communications including relevant emails for EER to [redacted] • Return to routine activities
Internal notifications	• DDO • IC	• As per previous activation level	• As per previous activation level, AND • CEO—if time permits	• As per previous activation level, AND • CEO—if time permits (if not from Stand Up—1)	• Inform all previously notified contacts of stand down
External notifications	• DSR	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down

-DDO to assess magnitude (MM scale) at dam location

· 'Confirmed' is defined as an alert received from Geoscience Australia or other source that advises an Earthquake >4.9 ML (Richter Scale) has occurred within a 200km radius of the Dam

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

ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO
e.g., taking photographs/video, dam inspections, instrument readings

8. Dam Hazard—Overturning or sliding of monoliths.

8.1 Overview

The emergency action described in this section relates to a potential dam failure hazard due to overturning or sliding of one or more of the concrete monoliths.

If one or more monoliths become unstable, a dam failure may result. If movement is detected early, remedial actions may be possible depending on the nature of the damage.

The non-overtopping monoliths are overtopped by the DCF flood of EL 235.45 m (1:2800 AEP). Scouring of the toe of the non-overflow monoliths may impact the stability of the monolith at approximately EL 239.5 m (1:80,000 AEP). The saddle dam (crest EL 239.27 m) is overtopped at floods greater than 1:50,000 AEP (EL 238.89 m).

Stability analysis from the 2022 Dam safety review (#2693294) indicates both overtopping and non-overtopping monoliths can withstand a flood of 1:20,000 AEP (EL 237.96 m, 50% PMP-DF). Monoliths 12, 9 and 7B were indicated to be critical with FOS reaching 1.4. As the water level elevates to EL 238.8 m, monolith 15 becomes critical as it reaches a FOS of 1.0.

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 monoliths. 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 of monoliths and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Precipitation Design Flood (PMPDF) outline when a dam failure is in progress or likely due to overturning or sliding of monoliths and concurrent flooding or downstream releases are occurring or expected to occur.

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

8.2 Emergency action roles

Table 22 to Table 26 specify emergency actions for the following roles:

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 4: Overturning or sliding of monoliths flowchart.

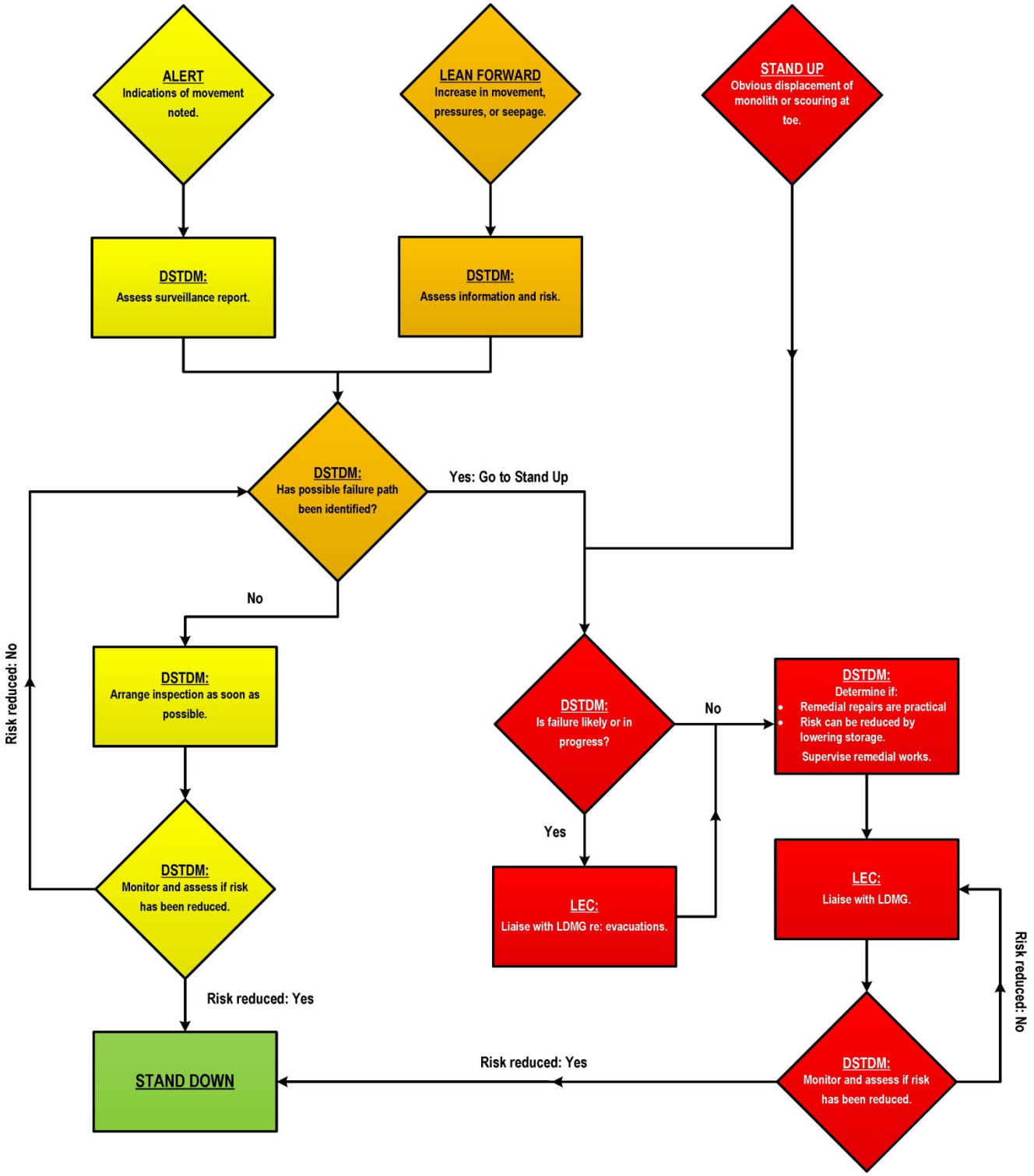


Table 22: Overturning or sliding of monoliths—DDO emergency action.

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, spilling	• Storage at flood of record, EL 232.03m, OR • Increase in movement or seepage. •	• Obvious displacement of one or more monoliths, OR • Evidence of scouring at or near toe of dam, OR • Storage level at stability factor of safety =1.4, EL 237.96 m	• Failure in progress or likely due to sliding or overturning, OR • Storage level at stability factor of safety =1.0, EL 238.8 m	• Risk assessment has determined that sliding or overturning risk has reduced
Actions	• Monitor dam every 6 hours (or as otherwise instructed by the DSTDM) until a decreasing trend is observable or as directed by the IC. • Maintain photographic record. • Notify SO • Update Dam Logbook as per SOP 12	• As per previous activation level	• 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 and 'move on' any members of the public	• As per previous activation level, plus • Vacate the immediate vicinity of the dam	• Forward information for event report to IC • Update Dam Logbook as per SOP 12 • Return to routine activities
Internal notifications	• DSTDM • SO • IC	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• As required	• As required	• As required	• As required	• As per previous activation level

Table 23: Overturning or sliding of monoliths—LEC emergency action.

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, or spilling	• Storage Level at flood of record, EL 232.03m, OR • Increase in movement, pressures, or seepage	• Obvious displacement of one or more monoliths, OR • Evidence of scouring at or near toe of dam, OR • Storage level at stability factor of safety =1.4, EL 237.96 m	• Failure in progress or likely due to sliding or overturning, OR • Storage level at stability factor of safety =1.0, EL 238.8 m	• Risk assessment has determined that sliding or overturning risk has reduced
Actions	• Liaise with DDO and IC re: situation. • Record all communication	• As per previous activation level, AND • Liaise with LDMG re: situation	• As per previous activation level, AND • Liaise with relevant council(s) regarding potential road/bridge closures	• As per previous activation level, AND	• Forward information for EER to IC email • Return to routine activities
Internal notifications	• DDO • IC	• As per previous activation level	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• As required	• LDMG 1	• As per previous activation level, AND • LDMG 2	• As per previous activation level	• As per previous activation level

Table 24: Overturning or sliding of monoliths—IC emergency action.

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, or spilling	• Storage Level at flood of record, EL 232.03m, OR • Increase in movement, pressures, or seepage	• Obvious displacement of one or more monoliths, OR • Evidence of scouring at or near toe of dam, OR • Storage level at stability factor of safety =1.4, EL 237.96 m	• Failure in progress or likely due to sliding or overturning, OR • Storage level at stability factor of safety =1.0, EL 238.8 m	• Risk assessment has determined that sliding or overturning risk has reduced
Actions	• Liaise with DDO, DSTDM and LEC re: situation. • Create Sunwater Incident Report • Update Sunwater intranet with dam status • Record all communication **NOTE**: IC to carry out LEC actions unless LDMG 1 is *Stood Up*	• As per previous activation level, AND • Place machinery operators on standby if directed by DSTDM	• As per previous activation level, AND • Liaise with Sunwater Customer Support to send SMS to D/S residents and phone those without mobiles. • Mobilise resources to undertake remedial works if directed by DSTDM. •	• As per previous activation level, AND • Liaise with DDO, DSTDM, and LDMG re: potential for evacuations. • IC to activate Paradise Dam EAP based on FODM inflow assessment	• Complete all internal and external notifications. • Forward all communications including relevant emails for EER to [redacted] • Close Sunwater Incident Report • Update Sunwater intranet with dam status • Return to routine activities
Internal notifications	• DDO • DSTDM • LEC/ORR • SMT • SRT	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• As required	• DDMG	• As per previous activation level, AND • D/S Residents/Irrigators • SDCC Watch Desk • ABC Radio	• As per previous activation level	• Inform all previously notified contacts of stand down

Table 25: Overturning or sliding of monoliths—LEC & IC external communication plan.

Activation level	Trigger for communications	Group to contact	Method	Message Text
Alert	• Indications of movement of monoliths noted such as cracking, increased seepage, or spilling			N/A—internal communications only
Lean Forward	• Storage level at flood of record, EL 232.03m, OR • Increase in movement, pressures, or seepage	• **LDMG 1** • DDMG	• 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
Stand Up—1	• Obvious displacement of one or more monoliths, OR • Evidence of scouring at or near toe of dam, OR • Storage level at stability factor of safety =1.4, EL 237.96 m	• **LDMG 1** • **LDMG 2** • DDMG	• 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
		• SDCC Watch desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** Develop messages in consultation with DSTDM
		• D/S Residents	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**
		• ABC Radio	• Phone	To be determined.

Table 25 (Continued): Overturning or sliding of monoliths—LEC & IC external communication plan.

Activation level	Trigger for communications	Group to contact	Method	Message text
Stand Up—2	• Failure in progress or likely due to sliding or overturning, OR • Storage level at stability factor of safety =1.0, EL 238.8 m	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Possible dam failure)* What is the status? (Prepare coordinated evacuation) Advise of current storage level Advise of any forecasts you are aware of
		• SDCC Watch Desk	• Phone & Email	Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS Develop messages in consultation with DSTDM
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
		• ABC Radio	• Phone	To be determined.
	• Dam failure in progress	• **LDMG 1** • **LDMG 2** • DDMG	• Phone	Describe current situation with dam—What is the event? *(Dam failure)* What is the status? (Dam failure in progress move to higher ground—LDMG coordinate evacuation of affected downstream residents) Advise of current storage level Advise of any forecasts you are aware of
		• SDCC Watch Desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS**
		• D/S Residents/Irrigators	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**
		• ABC Radio	• Phone	To be determined.
Stand Down	• Risk assessment has determined that sliding or overturning risk has reduced	• **LDMG 1** • DDMG (if from Stand Up)	• Phone	Describe current situation with dam—What is the event? What is the status? Advise of current storage level Advise EAP has been deactivated
		• D/S Residents (if from Stand Up)	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**

Table 26: Overturning or sliding of monoliths—DSTDM emergency action.

Activation level	Alert	Lean Forward	Stand Up—1	Stand Up—2	Stand Down
Activation trigger	• Indications of movement of monoliths noted such as cracking, increased seepage, or spilling	• Storage at flood of record, EL 232.03m, OR • Increase in movement, pressures, or seepage	• Obvious displacement of one or more monoliths, OR • Evidence of scouring at or near toe of dam, OR • Storage level at stability factor of safety =1.4, EL 237.96 m	• Failure in progress or likely due to sliding or overturning, OR • Storage level at stability factor of safety =1.0, EL 238.8 m	• Risk assessment has determined that sliding or overturning risk has reduced
Action	• 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. • Notify DSR	• As per previous activation level	• 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. • Determine if risks can be reduced by lowering storage. • Supervise* remedial repairs (if applicable)	• As per previous activation level, AND • Liaise with the IC and advise on need to recommend evacuations. •	• Forward all communications including relevant emails for EER to [redacted] • Return to routine activities
Internal notifications	• DDO • IC	• As per previous activation level	• As per previous activation level	• As per previous activation level, AND • CEO—if time permits	• Inform all previously notified contacts of stand down
External notifications	• DSR	• As per previous activation level	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down

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

9. Dam Hazard—terrorist threat/activity or high energy impact

9.1 Overview

The emergency action described in this section relates to a potential dam failure 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 Wuruma 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 a terrorist attack 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 attack or a high energy impact and no concurrent flooding or downstream releases are occurring or expected to occur, or
- Use the Probable Maximum Precipitation Design Flood (PMPDF) outline when a dam failure is in progress or likely due to a terrorist attack or a high energy impact and concurrent flooding or downstream releases are occurring or expected to occur.

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

9.1.1 Assessment of circumstances that potentially indicates an increase in the 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 of a terrorist threat. If this were specific enough to name a dam, this circumstance would trigger Stand Up—1 activation level.

9.2 Emergency action roles

Table 27 to Table 31 specify emergency actions for the following roles:

- Dam Duty Officer (DDO)
- Local Event Coordinator (LEC)
- Incident Coordinator (IC)
- Dam Safety Technical Decision Maker (DSTDM).

Figure 5: Terrorist threat/activity or high energy impact flowchart

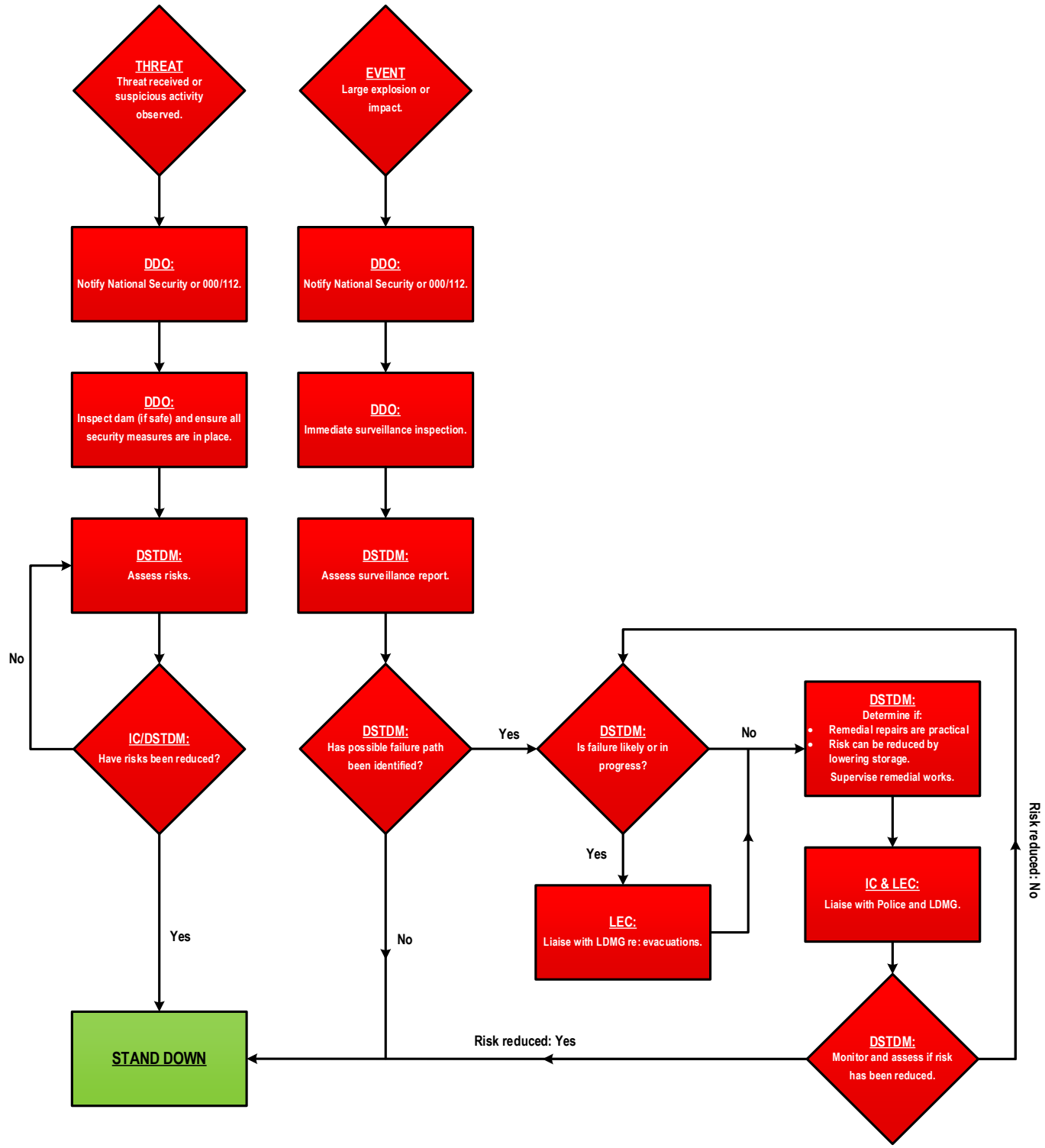


Table 27: Terrorist threat/activity or high energy impact—DDO emergency action

Activation level	Alert/Lean Forward	Stand Up—1	Stand Up—2	Stand Up—3	Stand Down
Activation trigger	• Not applicable	THREAT • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	EVENT • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	RESPONSE • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Not applicable	• In an emergency call 000. • Record all communication. • If any suspicious behaviour noticed, contact DSTDM for advice. If instructed by DSTDM, of if threat received, complete the following: • Inspect dam (if safe) and ensure all security measures in place (locked gates, etc.) • Photograph/video suspicious items from a safe point and record using the approved forms and send to IC & DSTDM • If Police appoint Incident Manager, support, and follow instructions. • Close any affected roads as directed. • Notify SO • Update Dam Logbook as per SOP 12	• As per previous activation level, AND • Undertake surveillance inspect dam (if safe) • Vacate the immediate vicinity of the affected area	• As per previous activation level	• Forward information for EER to IC email • Update Dam Logbook as per SOP 12 • Return to routine activities
Internal notifications	• Not applicable	• DSTDM • IC • LEC/ORR • SO	• As per previous activation level	• As per previous activation level	• As per previous activation level
External notifications	• Not applicable	• #000 Emergency	• As per previous activation level	• As per previous activation level	• As per previous activation level

Table 28: Terrorist threat/activity or high energy impact—LEC emergency action

Activation level	Alert/Lean Forward	Stand Up—1	Stand Up—2	Stand Up—3	Stand Down
Activation trigger	• Not applicable	THREAT • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	EVENT • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	RESPONSE • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Not applicable	• Liaise with DDO, IC, and LDMG re: situation. • If Police appoint Incident Manager, support, and follow instructions. • Liaise with relevant council(s) regarding possible road/bridge closures	• As per previous activation level	• As per previous activation level, AND • Liaise with DDO, IC, and LDMG re: potential for evacuations	• Forward all communication and inspection sheets for EER to: • Return to routine activities
Internal notifications	• Not applicable	• DDO • IC	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• Not applicable	• LDMG 1 • LDMG 2	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down

Table 29: 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	• Not applicable	THREAT • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received **NOTE**: IC to carry out LEC actions unless LDMG 1 is *Stood Up*	EVENT • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	RESPONSE • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Actions	• Not applicable	• Record all communication. • Liaise with DDO, DSTDM and LEC • Contact National Security • If Police appoint Incident Manager, support, and follow instructions. • Create Incident Report Record • Update Sunwater intranet with dam status **NOTE**: IC to carry out LEC actions unless LDMG1 is *Stood Up*	• As per previous activation level	• As per previous activation level, AND • Liaise with DDO, DSTDM, and LEC re: potential for evacuations. • Mobilise resources to undertake remedial works if directed by DSTDM. • IC to activate Paradise Dam EAP based on FODM inflow assessment	• Deactivate EAP event. • Compile EER and organise delivery to the DSR if required. • Close Incident Report Record • Update Sunwater intranet with dam status • Return to routine activities
Internal notifications	• Not applicable	• DDO • DSTDM • LEC/ORR • SMT • SRT	• As per previous activation level	• As per previous activation level	• Inform previous notifications of deactivation as required
External notifications	• Not applicable	• CTG • DDMG	• As per previous activation level, AND • D/S Residents • SDCC Watch Desk • ABC Radio	• As per previous activation level	• As per previous activation level

Table 30: Terrorist threat/activity or high energy impact—LEC & IC external 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	THREAT • Possible terrorist activity/suspicious behaviour notice at the dam, OR • Threat received	• **LDMG 1** • **LDMG 2** • DDMG • CTG	• 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
Stand Up—2	EVENT • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	• **LDMG 1** • **LDMG 2** • DDMG • CTG	• 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) Prepare coordinated evacuation
		• SDCC Watch desk	• Phone & Email	**Complete Emergency Alert Request form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** *Develop messages in consultation with DSTDM*
		• D/S Residents	• SMS • Phone (for those without mobiles)	**Liaise with Sunwater customer support and communications to send appropriate messaging via SMS**
		• ABC Radio	• Phone	To be determined.

Table 30 (Continued): Terrorist threat/activity or high energy impact—LEC & IC external communication plan.

Activation level	Trigger for communications	Group to contact	Method	Message text
Stand Up—3	RESPONSE • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• **LDMG 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) Initiate evacuations
		• SDCC Watch desk	• Phone & Email	**Complete Emergency Alert Request Form as per instructions (copies in Appendix A8) and email to SDCC Watch Desk to send SMS** .
		• D/S Residents	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS
		• ABC Radio	• Phone	To be determined.
Stand Down	• Risk assessment has determined that failure risk has reduced	• **LDMG 1** • 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
		• D/S Residents)	• SMS • Phone (for those without mobiles)	Liaise with Sunwater customer support and communications to send appropriate messaging via SMS

Table 31: 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	• Not applicable	THREAT • Possible terrorist activity/suspicious behaviour noticed at the dam, OR • Threat received	EVENT • Large explosion heard/observed at dam (e.g., bomb explosion, aircraft hit)	RESPONSE • Failure in progress or likely due to impact or explosion, AND • Sufficient water in storage to create a dam hazard	• Risk assessment has determined that failure risk has reduced
Action	• Not applicable	• Record all communication. • Liaise with IC and DDO • Assess risks. • Liaise with SRT • Notify DSR	• 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 IC • Determine if remedial repairs are practical. • Determine if risks can be reduced by lowering storage. • Supervise* remedial repairs (if applicable) • Monitor situation and assess risks	• Liaise with the IC and advise on need to recommend evacuations. • Determine if remedial repairs are practical. • Determine if risks can be reduced by lowering storage. • Supervise* remedial repairs (if applicable) • Monitor situation and assess risks. • Contact FODM to make assessment on likely impacts to Paradise Dam	• Forward all communications including relevant emails for EER to [redacted] • Return to routine activities
Internal notifications	• Not applicable	• IC • DDO • SRT	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down
External notifications	• Not applicable	• DSR	• As per previous activation level	• As per previous activation level	• Inform all previously notified contacts of stand down

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

10. Other emergency situation—communications failure

10.1 Overview

The emergency action described in this section (Other emergency situation—communications failure) 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.
- An emergency situation where all means of communication with Brisbane site have been lost.

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

10.2 Emergency actions

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

10.2.1 Activation triggers

Table 32: Communications failure emergency activation trigger summary

Comms Failure – Site	• Unable to communicate to or from dam site (usually affects DDO)
Comms Failure – Local area	• Unable to communicate to or from local area (likely to affect LEC or SM)
Comms Failure – Brisbane	• Unable to communicate to or from Sunwater Brisbane (could affect DSTDM or FODM & will affect IC)

10.2.2 Assessment of circumstances that indicates the likelihood of communications failure escalating the activation level of a current dam hazard.

The Operations Centre Duty Officer (OCDO) will assess the weather and flood warnings daily in accordance with the Operations Centre (OC) SOP. The OCDO will escalate to the Flood Operations Decision Maker (FODM) any warnings that have the potential to cause a significant communications failure.

The on-call 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. If required, the FODM will instruct the IC to escalate the activation level of any current dam hazards.

10.2.3 Emergency action roles

Table 33 to Table 38 specify emergency actions for the following roles:

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

Table 33: Communications failure—DDO emergency action

Activation level	Comms Failure – Local Area	Comms Failure – Brisbane
Activation trigger	• Unable to communicate to local area including LEC or SM	• Unable to communicate to Sunwater Brisbane including IC or DSTDM or FODM
Actions	• As much as practicable, assume the role of LEC. • Continue tasks in accordance with any other current emergency action. • Every hour, attempt communications by all means noting the following: – Mobile phone - try texting instead of voice, much higher probability of success. – Satellite phone - needs to access open sky unless external antenna fitted. – Fax - generally uses fixed landline and is therefore less likely to have failed. – Social media - e.g., Facebook (Internet may be available via landline) • Record all communication and attempts via dam logbook entries as per SOP 12 and communications log if EAP event is current	• Determine if LEC is in communication and if not, assume the LEC role as much as is practicable. • Continue tasks in accordance with any other current emergency action. • Every hour, attempt communications by all means noting the following: – Mobile phone - try texting instead of voice, much higher probability of success. – Satellite phone - needs to access open sky unless external antenna fitted. – Fax - generally uses fixed landline and is therefore less likely to have failed. – Social media - e.g., Facebook (Internet may be available via landline) • Record all communication and attempts via dam logbook entries as per SOP 12 and communications log if EAP event is current
Internal notifications	• IC • SO (if available)	• LEC • SO (if available)
External notifications	• As required	• As required

Table 34: Communications failure—LEC emergency action

Activation level	Comms Failure – Dam Site	Comms Failure – Brisbane
Activation trigger	• Unable to communicate to Dam site	• Unable to communicate to Sunwater Brisbane including IC or DSTDM or FODM
Actions	• Every hour, attempt communications by all means noting the following: – Mobile phone -try texting instead of voice, much higher probability of success. – Satellite phone - needs to access open sky unless external antenna fitted. – Fax - generally uses fixed landline and is therefore less likely to have failed. – Social media -e.g., Facebook (Internet may be available via landline) • Record all communication and attempts. • Assume that the DDO is carrying out LEC role at site as much as practicable. • Liaise with IC • Liaise with DSTDM • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Issue Sunwater Incident Alert • Every hour, attempt communications by all means, noting the following: – Mobile phone - try texting instead of voice, much higher probability of success. – Satellite phone - needs to access open sky unless external antenna fitted. – Fax - generally uses fixed landline and is therefore less likely to have failed. – Social media – e.g., Facebook (Internet may be available via landline) • Record all communication and attempts. • Liaise with the DDO and assume IC role. • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal notifications	• IC • DSTDM • SO (if available)	• DDO • DSTDM (if available) • SO
External notifications	• LDMG	• LDMG • DDMG

Table 35: Communications failure—IC emergency action

Activation level	Comms Failure – Dam Site	Comms Failure – Local Area
Activation trigger	• Unable to communicate to dam site	• Unable to communicate to local area including LEC and SM
Actions	• Issue Sunwater Incident Alert • Every hour, attempt communications by all means, noting the following: – Mobile phone - try texting instead of voice, much higher probability of success. – Satellite phone - needs to access open sky unless external antenna fitted. – Fax - generally uses fixed landline and is therefore less likely to have failed. – Social media - e.g., Facebook (Internet may be available via landline) • Record all communication and attempts. • Liaise with LEC • Liaise with DSTDM • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Issue Sunwater Incident Alert • Every hour, attempt communications by all means, noting the following: – Mobile phone - try texting instead of voice, much higher probability of success. – Satellite phone - needs to access open sky unless external antenna fitted. – Fax - generally uses fixed landline and is therefore less likely to have failed. – Social media - e.g., Facebook (Internet may be available via landline) • Record all communication and attempts. • Liaise with the DDO and carry out functions of the LEC as much as practicable. • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal Notifications	• LEC • DSTDM • SO (if available)	• DDO (if available) • DSTDM • SO (if available) • FDOM
External Notifications	• DDMG	• LDMG (if available) • DDMG (if available)

Table 36: Communications failure—LEC and IC communication plan

Activation level	Trigger for communications	Group to contact	Method	Message text
Comms Failure – Site	• Unable to communicate to or from dam site, AND • DDO is at dam site. •	• IC/LEC • DSTDM • SO (if available) • LDMG • DDMG	• Phone	• Describe current situation with dam communications. • What is the status – estimated time to restore communications?
Comms Failure – Local Area	• Unable to communicate to or from local area including LEC and SM	• DDO (if available) • DSTDM • SO (if available) • **LDMG** (if available) • DDMG (if available)	• Phone	• Describe current situation with dam communications. • What is the status – estimated time to restore communications?
Comms Failure – Brisbane	• Unable to communicate to or from Sunwater Brisbane	• DSTDM (if available) • LDMG • DDMG	• Phone	• Describe current situation with dam communications. • What is the status – estimated time to restore communications?

Table 37: Communications failure—DSTDM emergency action

Activation level	Comms Failure – Dam Site	Comms Failure – Local Area
Activation trigger	• Unable to communicate to dam site	• Unable to communicate to local area including LEC and SM
Actions	• Provide technical advice to IC/LEC on a need basis. • Record all communication. • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action	• Provide technical advice to IC on a need basis. • Record all communication. • Assume that the DDO is assisting IC with LEC role. • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal notifications	• IC • LEC • And CEO (if time permits)	• IC • DDO (if available) • And CEO (if time permits)
External notifications	• DSR (if applicable)	• DSR (if applicable)

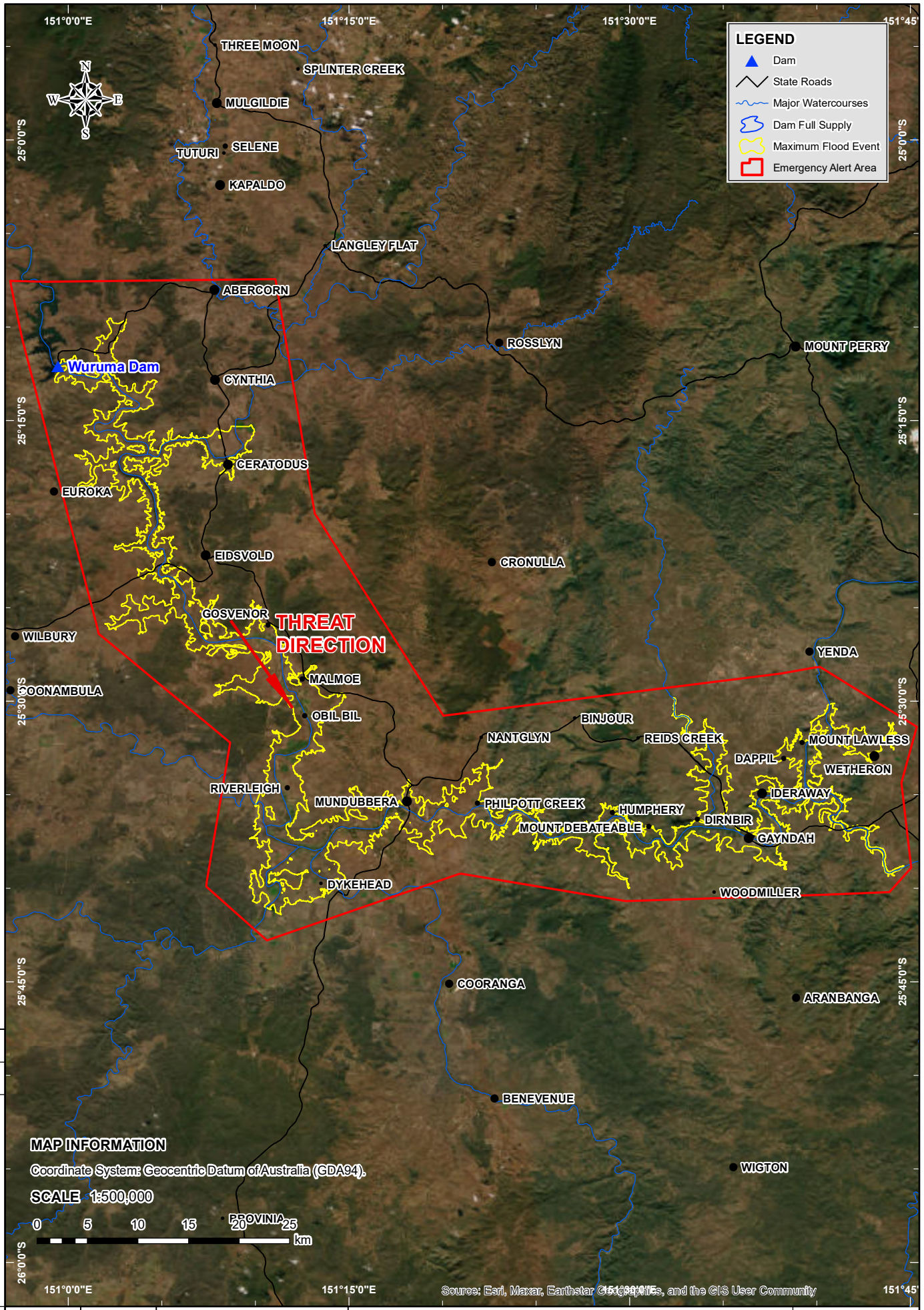
Table 38: Communications failure—FODM emergency action

Activation level	Comms Failure – Site	Comms Failure – Local Area
Activation trigger	• Unable to communicate to dam site	• Unable to communicate to local area including LEC and SM
Actions	• 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	• Liaise with IC • Record all communication. • Assume that the DDO is assisting IC with LEC role. • As much as is practicable, continue other tasks associated with the role in accordance with any other current emergency action
Internal notifications	• IC • LEC • DSTDM	• IC • DDO (if available) • DSTDM
External notifications	• Not applicable	• Not applicable

Appendix A Notification and communication lists

A1 Sunwater regional notification list
A2 Sunwater Brisbane notification list
A3 External notification list
A4 D/S residents' notification list
A5 Other D/S residents' notification list (outside area—requested messaging)
A6 Other reference contacts
A7 Emergency alert polygon
A8 Dam failure emergency alert request

Appendix A1 to Appendix A6 have been redacted



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REVISION	DATE	REMARKS		
B	15/06/23	EMERGENCY ALERT AREA UPDATED	CC	CC
A	23/01/18	ISSUED FOR USE	MB	CKD
			MH	PSD

DRAWN FMT	DESIGNED	sunwater	WURUMA DAM EMERGENCY ACTION PLAN EMERGENCY ALERT AREA
CHECKED CC	CHECKED		
APPROVED C. CHRYSTAL 15/6/2023		©SUNWATER LIMITED ACN 131 034 985	CONTRACT NUMBER DRAWING NUMBER 249589 REV. B SHEET 1 OF 1 DATE JUNE 2023

Appendix A7: Dam failure emergency alert request

Queensland emergency alert request guidelines

An Emergency Alert Request form should be completed, if required (see Sections 5 to 10 for actions) and sent to the SDCC Watch Desk to activate the Wuruma Dam Emergency Polygon.

Instructions

- This form is not to be used for flood UNLESS a flood has triggered an emergency event.
- Print off the following Queensland Emergency Alert Request form.
- Telephone the SDCC Watch Desk on [redacted] and tell them your intention to use the Emergency Alert for an emergency event for Wuruma Dam.
- A KML Polygon for this dam is stored in the Sunwater area of the Disaster Management Portal in the Emergency Alert area. Ask the SDCC operative to locate the polygon. It will be a KML file called [redacted]
- Give them your phone number, confirm their name, and end the call after advising the form will be sent shortly.
- IC and DSTDM will work together to craft a message relevant to the hazard and discuss with the LDMG if there is time.
- Fill in the form and send to SDCC watch desk email: [redacted] This form must come from the IC, DSTDM, or member of the Executive.
- Phone back to check the message has been sent and ask for an email to confirm.
- Send an internal Incident Alert to advise of completion.
- This form MUST be sent from a Sunwater email address. If Sunwater email is not functional, they can confirm identification through the RDMW (Regulator) if required.
- Use the following text to complete the emergency alert request:

Filename:	Voice Message:	SMS:
[redacted]	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Woo roo mah Dam including Eids vold must LEAVE IMMEDIATELY. Woo roo mah Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. Monto and Proston are safe. Get full warnings and what you should do at North Burnett Regional Council emergency dot north burnett dot que el dee dot guv dot ay you	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Wuruma Dam including Eidsvold must LEAVE IMMEDIATELY. Wuruma Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. Monto and Proston are safe. Get full warnings and what you should do at North Burnett Regional Council http://emergency.northburnett.qld.gov.au/

The next two pages contain a pre-filled version of the Wuruma Dam Emergency Alert request form.

Queensland Government

PHONE THE SDCC WATCH DESK [redacted] – ADVISE EA IS BEING DEVELOPED

EMERGENCY ALERT REQUEST

Location of Alert: Wuruma Dam
(e.g. Suburb, Town)

Date:

LGA/Agency requesting:

Time:

Requesting Officer (e.g. Disaster Coordinator/Incident Controller)
Name:
Agency/Position:

Telephone:
(SDCC Watch Desk may telephone you)

Email:

Advised **LDC/LDMG**: ☐ YES **DDC/DDMG**: ☐ YES **Neighbouring LDMG/LGA**: ☐ YES ☐ N/A

Send Alert **Immediately**: ☐ YES **Scheduled**: ☐ YES Date & Time / / : hrs

Event Type
☐ Cyclone ☐ Storm Tide ☐ Flash Flood ☐ Flood
☐ Bushfire ☐ Fire Incident ☐ Smoke / Toxic Plume ☐ Chemical Spill
☐ Tsunami (Sent as Location Based Text Message ONLY)
☒ Other (please specify): Catastrophic Dam Failure

Distributed by: (Channel)
☒ Voice (Landline only) ☒ SMS – Location Based (Location of phone at time of distribution) ☐ SMS – Service Address Based (Registered billing address)

Message Severity
☒ Emergency Warning (Activates SEWS) ☐ Watch & Act ☐ Advice

Threat Direction Required? (e.g. Fire, Dam Spill) ☐ YES ☐ N/A

Threat location indicated on map? Only For Emergency Warning Voice & Service Address SMS ☐ YES ☐ N/A

EA Messaging Filename (Doc, Pdf):

Polygon Filename, (Kml, Kmz, Gml, GeoJSON):

Number of polygons _____ (if multiple, attach list in order of priority)

Supplied via: ☐ DM Portal ☐ Email ☐ Verbal ☐ Other
Other (please specify):

Supplied via: ☐ DM Portal ☐ Email ☐ Verbal ☐ Other
Other (please specify):

Voice: Type or handwrite, max 4000 characters incls spaces. (Ideally message should be < 450 characters)

FLOOD EMERGENCY WARNING from Sun Water. People downstream of Wuruma Dam including Eidsvold must LEAVE IMMEDIATELY. Wuruma Dam possible failure/is failing. Major flooding is happening now. Water in the Proserpine River is rising fast. Your life is at risk. Go now to a safe place away from the flood. Monto and Proston are safe. Get full warnings and what you should do at North Burnett Regional Council at emergency dot north burnett dot q l d dot gov dot ay you or call Triple 0 if your life is in danger.

SMS: Type or handwrite, use capitals for clarity, max 612 characters incls spaces. (Ideally should be < 160 characters incl. spaces)

FLOOD EMERGENCY WARNING from Sunwater: People downstream of Wuruma Dam including Eidsvold must LEAVE IMMEDIATELY. Wuruma Dam possible failure/is failing. Major flooding is happening now. Water in the Proserpine River is rising fast. Your life is at risk. Go now to a safe place away from the flood. Monto and Proston are safe. Get full warnings and what you should do at North Burnett Regional Council http://emergency.northburnett.qld.gov.au. Call 000 if your life is in danger.

Remove EA from websites:
☐ 12 hrs ☐ 24 hrs ☐ 48 hrs ☐ Specify Date & Time: ☐ Check back in 12 hrs:
☐ Replace previous EA message / / : hrs Contact #:_____

Requesting Officer: **Signature:** **Date:** / /

Send to [redacted] to confirm receipt

FOR USE BY SDCC

EA Request Form completed by: SDCC Watch Desk ☐ Requesting Officer ☐

Notification of any delays provided to Requestor: ☐ YES ☐ NO

EA User Name:
Signature: Date: / /

Emergency Alert No:

Authorising Officer Name:
Signature: Date: / /

EMS EA Campaign Report ID:

Report provided to Requestor on EA outcomes: ☐ YES ☐ NO

The EA Manual, EA Quick Reference Guide, EA Request Form Template are available at: www.disaster.qld.gov.au

DO NOT SEND THIS PAGE

(Sunwater internal use only)

Emergency Alert (EA) Request instructions

Complete ALL initial fields, especially contact details, and check applicable boxes.

STEP 1.	EA Polygon Area (e.g., detailed description and location reference to allow positive identification of message area, including street names with cross street, areas of interest such as parks, rivers, dams, coastal areas) it is preferable to attach a map identifying the message area. If a Threat Direction has been requested, please clearly indicate it on the map. Check applicable box.
STEP 2.	Enter the Polygon file name/s.
STEP 3.	*Sunwater Polygons are all in *.kml format.* Check applicable box.
STEP 4.	*Sunwater Messaging/spatial data is always supplied via DMportal.* Check applicable box. Enter the file name.

Voice Message: Either type or handwrite the required message in CAPITALS. As the message will be translated by a text-to-speech process it is important that words are not unintelligible when translated e.g., "qld" used in a web site address must be entered as "Q L D", similarly the word "DOT" must be entered into a web address instead of a full stop.
An Emergency Warning message must start with "EMERGENCY EMERGENCY" Do not use special characters.

SMS: Either type the message or handwrite the characters into the boxes.
Capitals only required as per normal grammar rules, but an Emergency Warning message must start with "EMERGENCY EMERGENCY" (in capitals). Do not use special characters.

Voice example:

EMERGENCY. EMERGENCY. SUN WATER ADVISE IMMINENT FAILURE OF CANIA DAM. RESIDENTS DOWNSTREAM OF THE DAM NEED TO ACT TO PROTECT LIFE AND LEAVE IMMEDIATELY. FAILURE OF THE DAM WILL RESULT IN EXTREMELY DANGEROUS FLOODING DOWNSTREAM INCLUDING: MOONFORD AND MONTO. DO NOT DELAY. LEAVE NOW. CENTRAL MONTO AND BILOELA ARE SAFE LOCATIONS.

SMS example:

EMERGENCY. EMERGENCY. Sunwater advise imminent failure of Cania Dam. Take action to protect life and leave now. Moonford and Monto are at risk. Info on ABC Radio. Central Monto & Biloela are safe.

If using template EA messages, please provide the appropriate variables that are in the template message guides. Refer to the Queensland EA Manual for copies of the template message guides.

Appendix B Drawings, inundation maps and emergency control measures

B1 Drawings

B2 Flood impacts–downstream

B3 Inundation maps

B4 Locality plan

B5 Catchment plan

NOTE: Actual levels may differ from those shown in flood inundation maps due to variations in assumptions made in the models to actual flood events.

FILE REFERENCE
2-01146

RIGHT BANK

LEFT BANK

NOGO RIVER

DIVERSION CONTROL STRUCTURE

CONTROL POINT 'A'

TRASHRACK STRUCTURE

DAM AXIS 349°22'23"

VALVE HOUSE

7210950N 7211000N 7211050N 7211100N 7211150N 7211200N 7211250N

297350E 297400E 297450E 297300E

1 2 3 4 5 6 7A 7B 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

PLAN
SCALE A

RIGHT ABUTMENT 97530 | SPILLWAY 91440 | LEFT ABUTMENT 164592

NS

15240 TYP

CREST EL 228.29
EL. 224.64
EL 220.37
3962
UPPER GALLERY
LOWER GALLERY
TRAINING WALL
AXIS OF DAM
UPSTREAM
DOWNSTREAM
EL 203.45

ELEVATION LOOKING UPSTREAM
SCALE A

SECTION A
SCALE B

4572
KERB EL 235.66
EL 235.46
NOM DECK LEVEL
EL 230.20
0.67
1.0

SECTION B
SCALE B

NOTES:

1. LEVELS DATUM : AHD
   AHD = STATE DATUM (feet) x 0.3048 + 0.303
2. AZIMUTH DATUM : AMG
3. CONTROL POINT 'A' = 297347.905E, 7211121.412N (AMG)
   = 10316.890E, 9951.350N feet
   (ORIGINAL LOCAL GRID)

REVISION	DATE	REMARKS	CKD	PSD

REFERENCE DRAWINGS: A3-214417 SITE PLAN

SCALES
0 10 20 30 40 50 METRES 1:1000
0 5 10 15 20 25 METRES 1:500

DRAFTING IMP
DRAFTING CHK KPC
DESIGN
DESIGN CHK
RECOMMENDED
APPROVED KCL
CHIEF ENGINEER CIVIL DESIGN

Engineering Services
NATURAL RESOURCES

WURUMA DAM
MAIN DAM ARRANGEMENT

CONTRACT NUMBER
DRAWING NUMBER A3-214278
DATE FEB 2000

214278 (TIF)

Q:\Dam Safety Review 2-01146\WURUMA\214278.dwg
10 Mar 2000 5:04 PM

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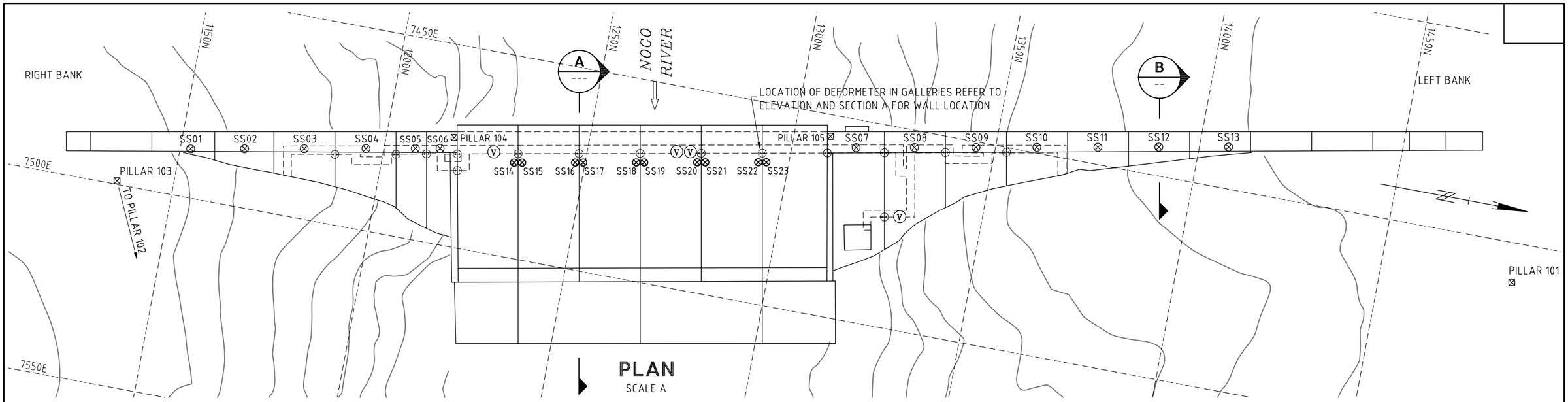
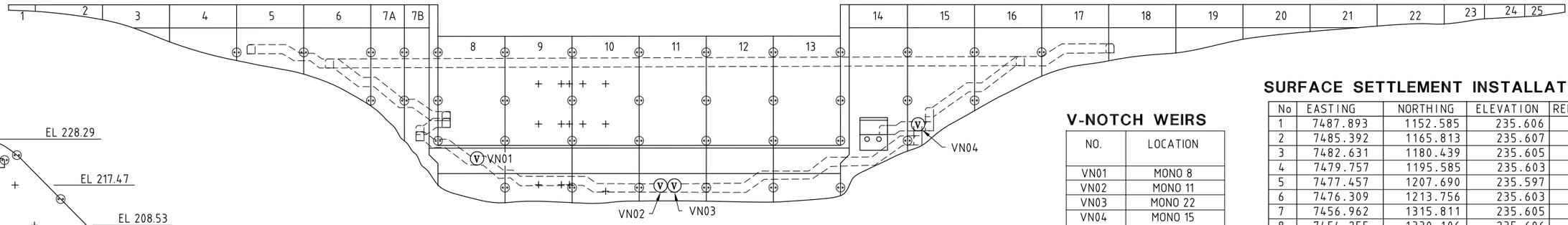
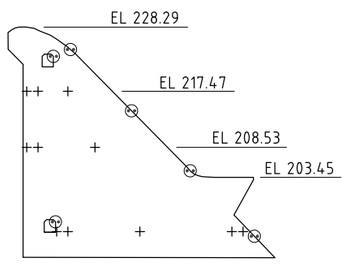




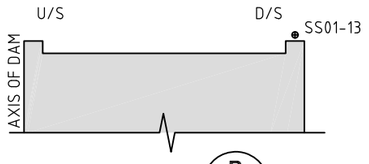
ELEVATION LOOKING UPSTREAM

SCALE A



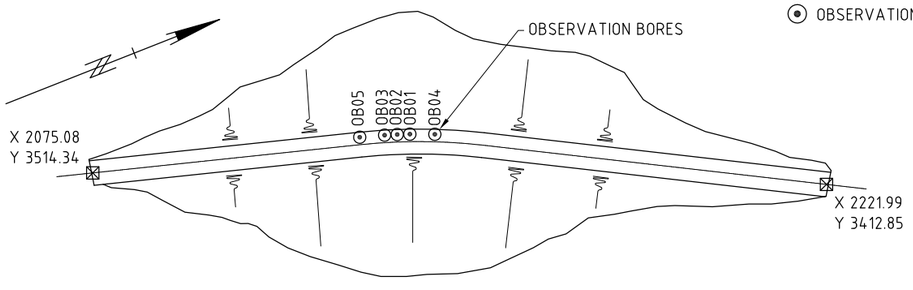
SECTION A

SCALE A



SECTION B

NTS



SADDLE DAM

SCALE B

LEGEND

- ⊗ SURFACE SETTLEMENT POINT
- ⊠ CONTROL STATION
- (V) V-NOTCH WEIR
- + THERMOMETER (INSTALLED, NO LONGER IN USE)
- ⊙⊙ DEFORMETER INSTALLATION
- ⊙ OBSERVATION BORE (INSTALLED, NO LONGER IN USE)

V-NOTCH WEIRS

NO.	LOCATION
VN01	MONO 8
VN02	MONO 11
VN03	MONO 22
VN04	MONO 15

SURVEY CONTROL STATIONS

No	EASTING	NORTHING	ELEVATION	REMARKS
101	7459.843	1482.885	238.376	PILLAR
102	7603.420	1184.272	241.916	PILLAR
103	7499.093	1135.986	236.640	PILLAR
104	7472.713	1218.002	236.825	PILLAR
105	7455.421	1308.794	236.827	PILLAR

NOTES:

1. LEVELS DATUM : AHD BASED ON PM89210 AT EL 235.414.
2. AZIMUTH DATUM : GDA94 ZONE 56.
3. SADDLE DAM COORDS: LOCAL WORKING GRID
4. COORDINATES : PLANE TRUNCATED FROM PM89210 E7433.133 N1429.713.
   EASTING: ADD 290 000 TO EQUATE TO PLANE MGA94 ZONE 56
   NORTHING: ADD 7 210 000 TO EQUATE TO PLANE MGA94 ZONE 56
5. TOP OF PILLAR AND SETTLEMENT MARKS ARE 0.055m LOWER THAN LEVELS SHOWN IN TABLES.
6. THERE ARE 66 DEFORMETER BAR INSTALLATIONS ALONG CONSTRUCTION JOINTS AT LOCATIONS SHOWN IN SECTION A.

SURFACE SETTLEMENT INSTALLATIONS

No	EASTING	NORTHING	ELEVATION	REMARKS
1	7487.893	1152.585	235.606	
2	7485.392	1165.813	235.607	
3	7482.631	1180.439	235.605	
4	7479.757	1195.585	235.603	
5	7477.457	1207.690	235.597	
6	7476.309	1213.756	235.603	
7	7456.962	1315.811	235.605	
8	7454.255	1330.106	235.606	
9	7451.405	1345.208	235.610	
10	7448.567	1360.129	235.605	
11	7445.731	1375.110	235.600	
12	7442.892	1390.055	235.605	
13	7439.664	1407.168	235.613	
14	7475.635	1234.411	224.583	BOLT
15	7475.579	1234.660	224.586	BOLT
16	7472.775	1249.397	224.586	BOLT
17	7472.722	1249.647	224.591	BOLT
18	7469.937	1264.366	224.589	BOLT
19	7469.896	1264.621	224.589	BOLT
20	7467.095	1279.358	224.578	BOLT
21	7467.059	1279.609	224.577	BOLT
22	7464.234	1294.310	224.598	BOLT
23	7464.199	1294.561	224.598	BOLT

OBSERVATIONS BORES - SADDLES DAM

NO.	X	Y	TOP OF CASTING EL	DEPTH	REMARKS
OB01	2144.33	3479.23	239.30	23.30	
OB02	2141.70	3480.87	239.30	25.50	
OB03	2139.04	3482.44	239.30	25.40	
OB04	2149.40	3475.84	239.30	21.80	
OB05	2133.69	3485.38	239.30	19.50	

EASTINGS AND NORTHINGS ARE APPROX ONLY AND ARE BASED ON A LOCAL WORKING GRID

REVISION				
12.06.13	C	POINTS 14–23, 104, 105 ADDED	WRH	AMB
20.11.08	B	PILLARS AND SETTLEMENT POINTS	RET	BH
6.7.00	A	CHECKED AND SIGNED		
DATE		REMARKS	CKD	PSD

REFERENCE DRAWINGS	
L23062	LOCATION OF DEFORMETER
L23410	LAYOUT OF WIRING TO THERMOMETERS
S29077	SADDLE DAM LEAKAGE TEST
L22475	SUMP & DRAINAGE OUTLETS
L21185C	GALLERIES DRAINAGE & GROUT. GA.

SCALES (A3 SIZE)

A 0 10 20 30 40 50 METRES 1:1000

B 0 25 50 75 METRES 1:1500

DRAWN IMP	DESIGNED
CHECKED MS	CHECKED
APPROVED	
CHIEF ENGINEER CIVIL DESIGN	

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ACN 131 034 985

DAM SAFETY INVESTIGATION

WURUMA DAM

INSTRUMENTATION LAYOUT

CONTRACT NUMBER

DRAWING NUMBER A3-206771

DATE MAY 2000

A B C

DRAWING PRODUCED BY:
SUNWATER
LEVEL 9, 179 TURBOT ST
BRISBANE QLD 4000
TEL: (07) 3120 0000

T:\Asset Solutions\SW-Upper Burnett WSS\N-WBBU-04-01-01-BN_Wuruma Dam Survey Points\Drawings\AutoCAD\206771-C.dwg
12 Jun 2013 3:02 PM

CREST LEVEL INFORMATION

CHAINAGE (m)	ELEVATION (m)	DESCRIPTION
0.0	236.21	U/S KERB
1.5	236.21	U/S KERB
1.6	236.11	U/S KERB
3.9	235.80	U/S KERB
4.2	235.76	U/S KERB
4.4	235.78	U/S KERB
11.9	235.76	U/S KERB
19.5	235.76	U/S KERB
27.1	235.75	U/S KERB
34.8	235.75	U/S KERB
42.3	235.75	U/S KERB
50.0	235.75	U/S KERB
57.7	235.74	U/S KERB
65.2	235.75	U/S KERB
72.7	235.74	U/S KERB
80.5	235.74	U/S KERB
88.1	235.75	U/S KERB
94.9	235.74	U/S KERB
96.3	235.76	U/S KERB
SPILLWAY EL 228.37m		
188.3	235.75	U/S KERB
189.7	235.76	U/S KERB
204.0	235.76	U/S KERB
219.2	235.76	U/S KERB
234.4	235.75	U/S KERB
249.7	235.75	U/S KERB
265.0	235.76	U/S KERB
280.2	235.76	U/S KERB
295.4	235.76	U/S KERB
310.7	235.75	U/S KERB
325.9	235.75	U/S KERB
335.0	235.76	U/S KERB
339.6	235.76	U/S KERB
343.9	235.76	U/S KERB

BENCH MARKS (COORDINATES MGA94)

BM NO.	EASTING (m)	NORTHING (m)	ELEVATION (m)	DESCRIPTION
PM89210	297433.127	7211429.687	235.548	BRASS PLAQUE
PM89211	297480.224	7211181.183	235.529	BRASS PLAQUE

NOTES:

- CHAINAGE IS IN METRES UNLESS NOTED OTHERWISE.
- LEVELS DATUM: AUSTRALIAN HEIGHT DATUM, ORIGIN PM89210.
- USING THE UPDATED AHD LEVEL (JULY 2011) ON PM89210 OF EL 235.548m THE FOLLOWING IS NOTED:
  - LEFT HAND SPILLWAY CREST LEVEL = 228.374m (JUNE 2016)
  - RIGHT HAND SPILLWAY CREST LEVEL = 228.384m (JUNE 2016)
- SURVEY IN MGA94 PLANE COORDINATES BASED ON PM89210.
- DATE OF SURVEY: 4TH JULY 2016.
- SURVEYED LEVELS ARE OF UPSTREAM KERB. ALL LEVELS ARE ABOVE DESIGN LEVEL EL 235.74m.
- KERB HEIGHT IS 0.2m INDICATING ALL CREST LEVELS ARE ABOVE ORIGINAL DESIGN CREST LEVEL (DCL) EL 235.54m.

S:\BW Asset Delivery\SW-Upper Burnett WSSVR-WBBU-02-01-01 Wuruma Dam Deformation Survey 2016\Drawings\AutoCAD\247001-A.dwg
15 Nov 2016 9:25 AM

DRAWING PRODUCED BY:
ASSET DELIVERY
TEL: (07) 3120 0000

REVISION					REFERENCE DRAWINGS	
					247002	SADDLE DAM, CREST LEVEL SURVEY, JUNE 2016
22/07/16	A	ISSUED FOR USE	AN	M. COSTA	21181	CROSS SECTIONS DAM
DATE		REMARKS	CKD	PASSED	21180	GENERAL ARRANGEMENT OF DAM PLAN & ELEVATIONS

SCALES (A3 SIZE)

0 10 20 30 40 50 60 METRES

1:1250

DRAWN TH	DESIGNED MR
CHECKED AN	CHECKED
APPROVED M. COSTA	
15/11/16	RPEQ 15963

SunWater

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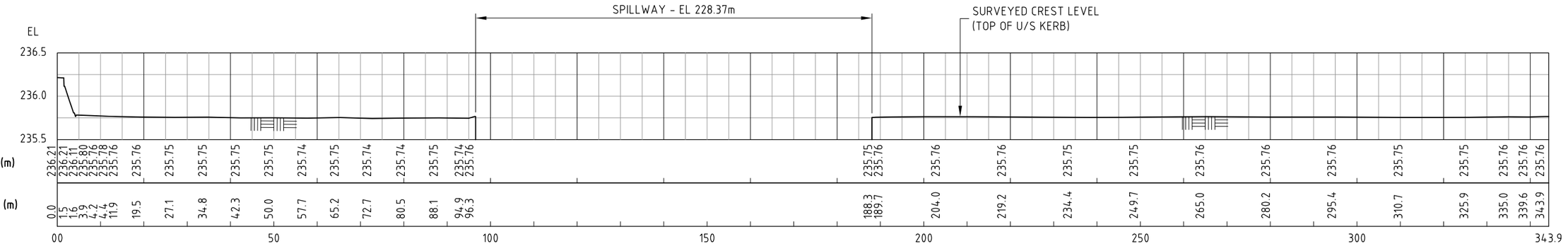
ACN 131 034 985

WURUMA DAM - NOGO RIVER 23.0km MAIN WALL

CREST LEVEL SURVEY

JULY 2016

CONTRACT NUMBER	
DRAWING NUMBER	REV.
247001	A
SHEET 1 OF 2	
DATE JULY 2016	



LONGITUDINAL SECTION

SCALE: 1:1000 HORIZONTAL AND 1:50 VERTICAL

NOTES:

- FOR DETAILED NOTES REFER SHEET 1.

S:\BW Asset Delivery\SW-Upper Burnett WSS\R-WBBU-02-01-01 Wuruma Dam Deformation Survey 2016\Drawings\AutoCAD\247001-A.dwg
15 Nov 2016 9:26 AM

DRAWING PRODUCED BY:
ASSET DELIVERY
TEL: (07) 3120 0000

REVISION				
22/07/16	A	ISSUED FOR USE	AN	M. COSTA
DATE		REMARKS	CKD	PASSED

REFERENCE DRAWINGS	
247002	SADDLE DAM, CREST LEVEL SURVEY, JUNE 2016
21181	CROSS SECTIONS DAM
21180	GENERAL ARRANGEMENT OF DAM PLAN & ELEVATIONS

SCALES (A3 SIZE)

0 0.5 1.0 1.5 2.0 2.5 METRES 1:50

0 10 20 30 40 50 METRES 1:1000

DRAWN TH	DESIGNED MR
CHECKED AN	CHECKED
APPROVED M. COSTA	
15/11/16	RPEQ 15963

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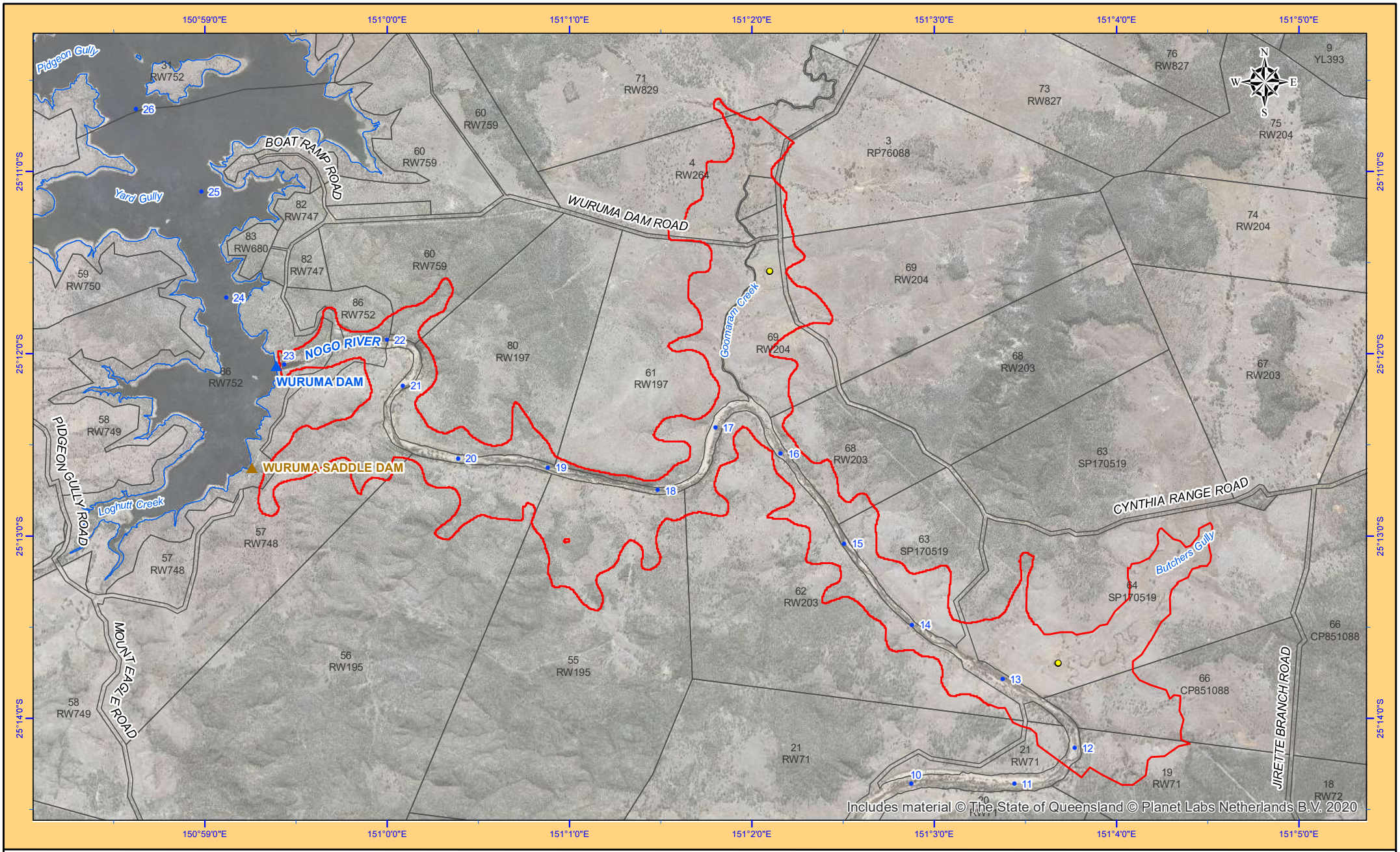
WURUMA DAM - NOGO RIVER 23.0km
MAIN WALL
CREST LEVEL SURVEY
JULY 2016

CONTRACT NUMBER	
DRAWING NUMBER 247001	REV. A
SHEET 2 OF 2	
DATE JULY 2016	



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While every care is taken to ensure the accuracy of this product, Sunwater makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose.

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA2020).

SCALE (A4 SIZE)
0 500 1,000 1,500 2,000 2,500 m 1:50,000

LEGEND
- AMTD (Markers)
- PAR - No Dam Failure
- Wuruma Dam FSL
- Limit of Downstream Notification Area

WURUMA DAM
DOWNSTREAM NOTIFICATION AREA

NOTES
Areas further downstream will become progressively more impacted by other rainfall and inflows that occur downstream of the dam (not shown here).

sunwater

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DRAWING No. 250724 C

Document: S:\BW_WaterResources\GIS_Data\SW_Upper Burnett WSS\WurumaDam_CRA2022\Drawings\ArcMap\250724-C.mxd
Printed: 21/06/2023

Appendix B3 : Inundation maps

Drawings:

- Key map
- SDF
- PMF

Disclaimer: Every effort has been made to ensure the currency of the flood inundation maps reproduced in this EAP. However, as the maps have been extracted from external sources, their accuracy cannot be guaranteed. Refer to the North Burnett Regional Council Emergency Management Dashboard for more specific inundation maps.

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Document: S:\BW_WaterResources\GIS_Data\SW_Upper Burnett WSS\WurumaDam_CRA2022\Drawings\ArcMap\256777-A.mxd
Printed: Monday, 19/12/2022 02:17:34 PM

MAP PRODUCED BY:
SUNWATER LTD
TEL: (07) 3120 0000

300000 320000 340000 360000 380000

7220000 7200000 7180000 7160000

WURUMA DAM ROAD
Three Moon Creek
Sprinter Creek
Burnett River
Moggo River
Eastern Creek
ROSSLYN
MOUNT PERRY
MONTO - MOUNT PERRY ROAD
BUNDABERG REGIONAL COUNCIL
WURUMA DAM
CYNTHIA
John Goleby Weir
CERATODUS
EUROKA
Kirar Weir
EIDSVOLD
CRONULLA
Reid Creek
PARADISE DAM
GAYNDAH - MOUNT PERRY ROAD
NORTH BURNETT REGIONAL COUNCIL
YENDA
LIMIT OF MODEL
GOOROOLBA - BIGGENDEN ROAD
WILBURY
EIDSVOLD - THEODORE ROAD
MOOROONGIE
COONAMBULA
St John Creek
WETHERON
IDERAWAY
MUNDUBBERA
Jones Weir
Claude Wharton Weir
GAYNDAH
COALSTOUN LAKES
Barambah Creek
ISIS HIGHWAY
BURNETT HIGHWAY
Boyne River
Auburn River
MUNDUBBERA - DURONG ROAD

SHEET 1 OF 11
SHEET 2 OF 11
SHEET 3 OF 11
SHEET 4 OF 11
SHEET 5 OF 11
SHEET 6 OF 11
SHEET 7 OF 11
SHEET 8 OF 11
SHEET 9 OF 11
SHEET 10 OF 11
SHEET 11 OF 11

N W E S

LEGEND
- State Road (DTMR)
- Major Watercourse
- Built Up Area
- Qld Local Government Area
- Maximum Flood Event

Sunwater Storages
- Dam
- Weir
- Dam Reservoir

REVISION					
19/12/22	A	ISSUED FOR USE	LH	MGH	
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Projected Coordinate System: Mapping Grid of Australia (MGA2020), Zone 56.

DRAWING REFERENCE
256778 - Sunny Day Failure
256779 - Probable Maximum Flood

SCALES (A3 SIZE)
0 3 6 9 12 15 km 1:300,000

DRAWN	DESIGNED
IDH	
CHECKED	CHECKED
	LH

APPROVED
M.G. HUGHES
19/12/2022
RPEQ: 18351

sunwater
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ACN 131 034 985

WURUMA DAM
DAM BREAK ANALYSIS 2022
INUNDATION PLANS
KEYMAP

CONTRACT NUMBER

DRAWING NUMBER	REV.
256777	A

SHEET 1 OF 1
DATE NOVEMBER 2022

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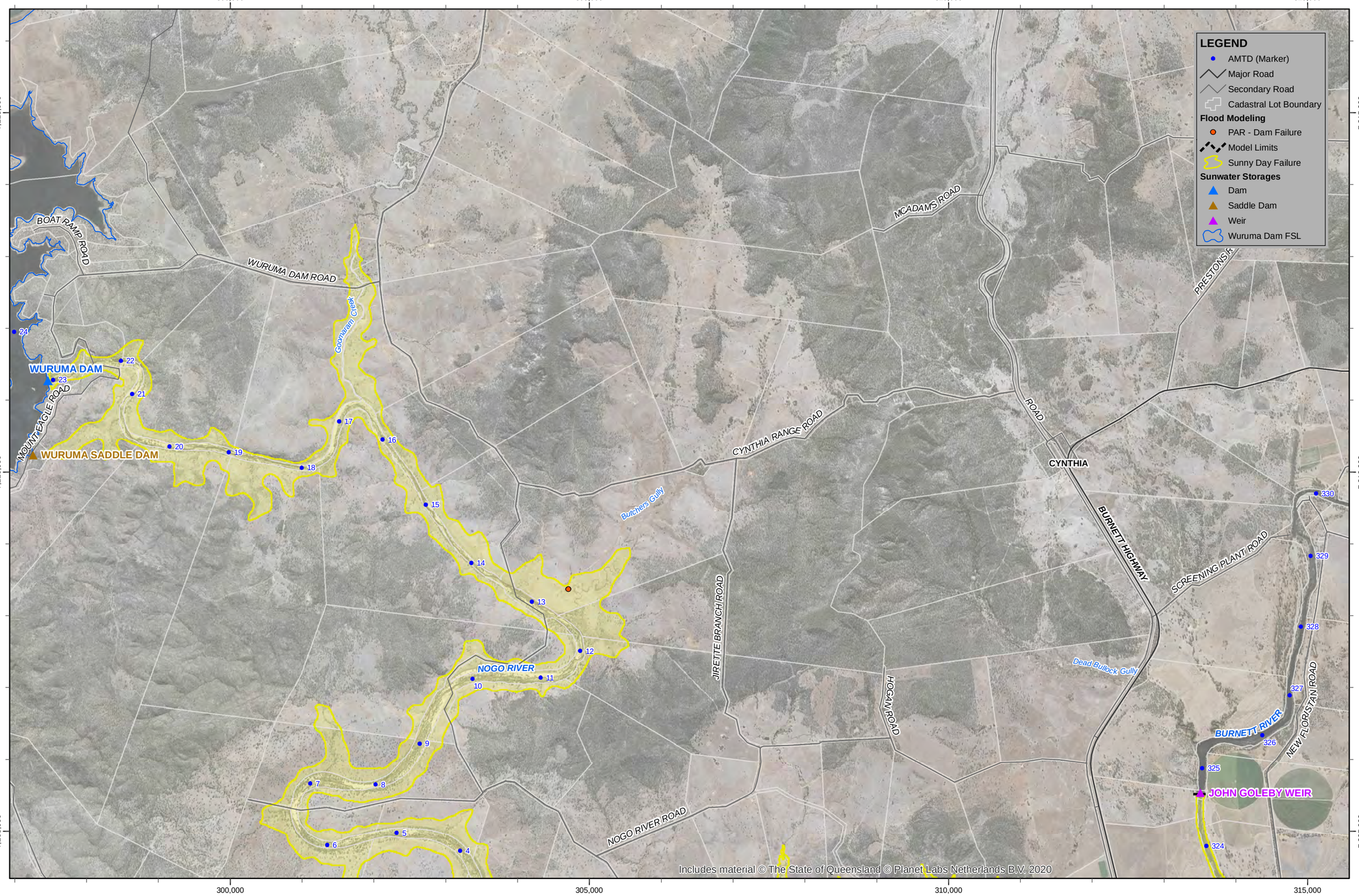
Document: S:\BW_WaterResources\GIS_Data\SW_Upper Burnett WSS\WurumaDam_CRA2022\Drawings\ArcMap\256778-A.mxd
Printed: Monday, 19/12/2022 02:21:09 PM

Map Produced By:
Water Resources and Dam Safety
Tel: (07) 3120 0000



REVISION					
19/12/22	A	ISSUED FOR USE	LH	MGH	
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Projected Coordinate System: Mapping Grid of Australia (MGA2020) Zone 56.

REFERENCE DRAWINGS
256770 - Keymap

SCALES (A3 SIZE)
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1:50,000

DRAWN	DESIGNED
IDH	
CHECKED	CHECKED
	LH
APPROVED	
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WURUMA DAM
DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

CONTRACT NUMBER	
DRAWING NUMBER	REV.
256778	A
SHEET 1 OF 11	
DATE OCTOBER 2022	

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Map Produced By:
Water Resources and Dam Safety
Tel: (07) 3120 0000

300,000 305,000 310,000 315,000

7,200,000

7,195,000

NOGO RIVER
BURNETT RIVER
ROAD
NEW FLORISTAN ROAD
The Springs
Jackass Creek
NETZ ACCESS
CERATODUS
KERWEE ROAD
NOGO JUNCTION ROAD
Yellow Creek
Five Mile Creek
Euroka
Smalls Creek
MOUNT EAGLE ROAD
TOLO ROAD
BURNETT HIGHWAY
Harkness Boundary Creek
OLD RAWBELLE ROAD
Long Gully
LONG GULLY LANE
KIRAR WEIR
MOONLIGHT ROAD
KIRAR WEIR ROAD
AIRSTRIP ACCESS
Sawmill Creek
OLD PERRY COACH ROAD
HOLLYWELL ROAD
Boggy Gully
Middle Creek
Spring Creek
SPRING GULLY ROAD
EIDSVOLD
Lambing Gully

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323

LEGEND

- AMTD (Marker)
- Major Road
- Secondary Road
- Cadastral Lot Boundary

Flood Modeling

- PAR - Dam Failure
- Model Limits
- Sunny Day Failure

Sunwater Storages

- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

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WURUMA DAM
DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER 256778 | REV. A

SHEET 2 OF 11

DATE OCTOBER 2022

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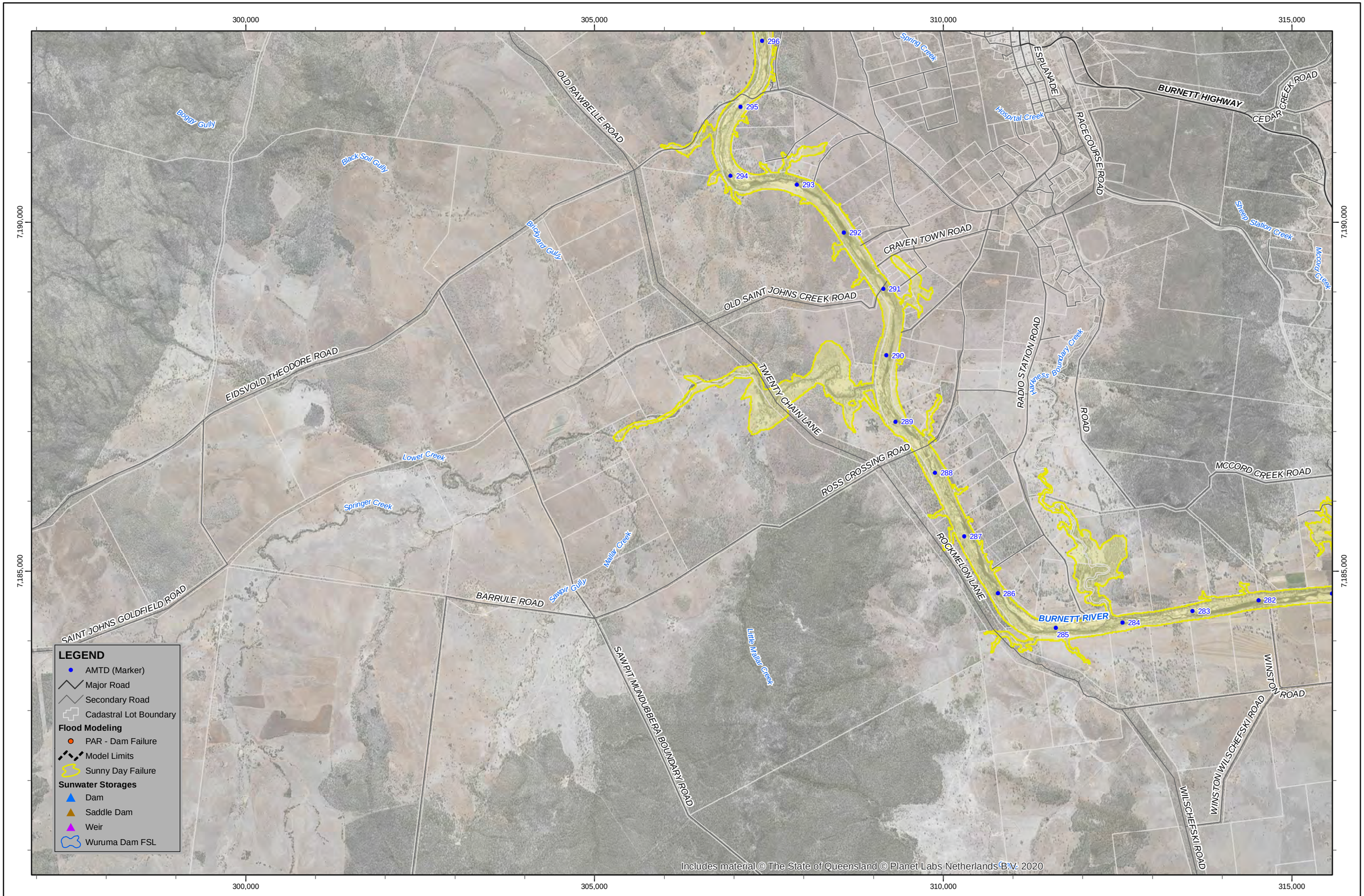

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WURUMA DAM
DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

CONTRACT NUMBER	
DRAWING NUMBER	REV.
256778	A
SHEET 3 OF 11	
DATE OCTOBER 2022	

MAP PRODUCED BY:
WATER RESOURCES AND DAM SAFETY
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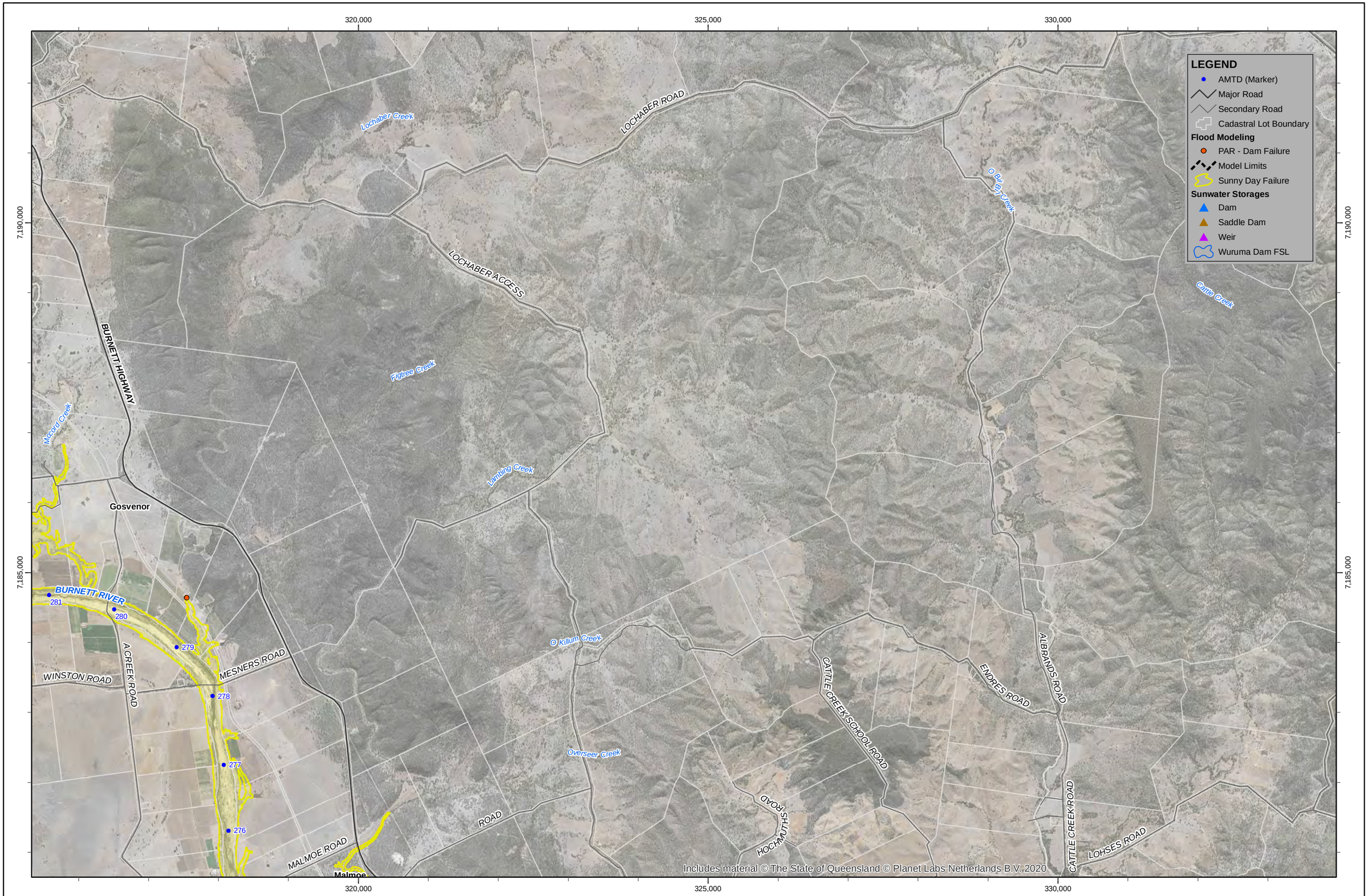

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DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

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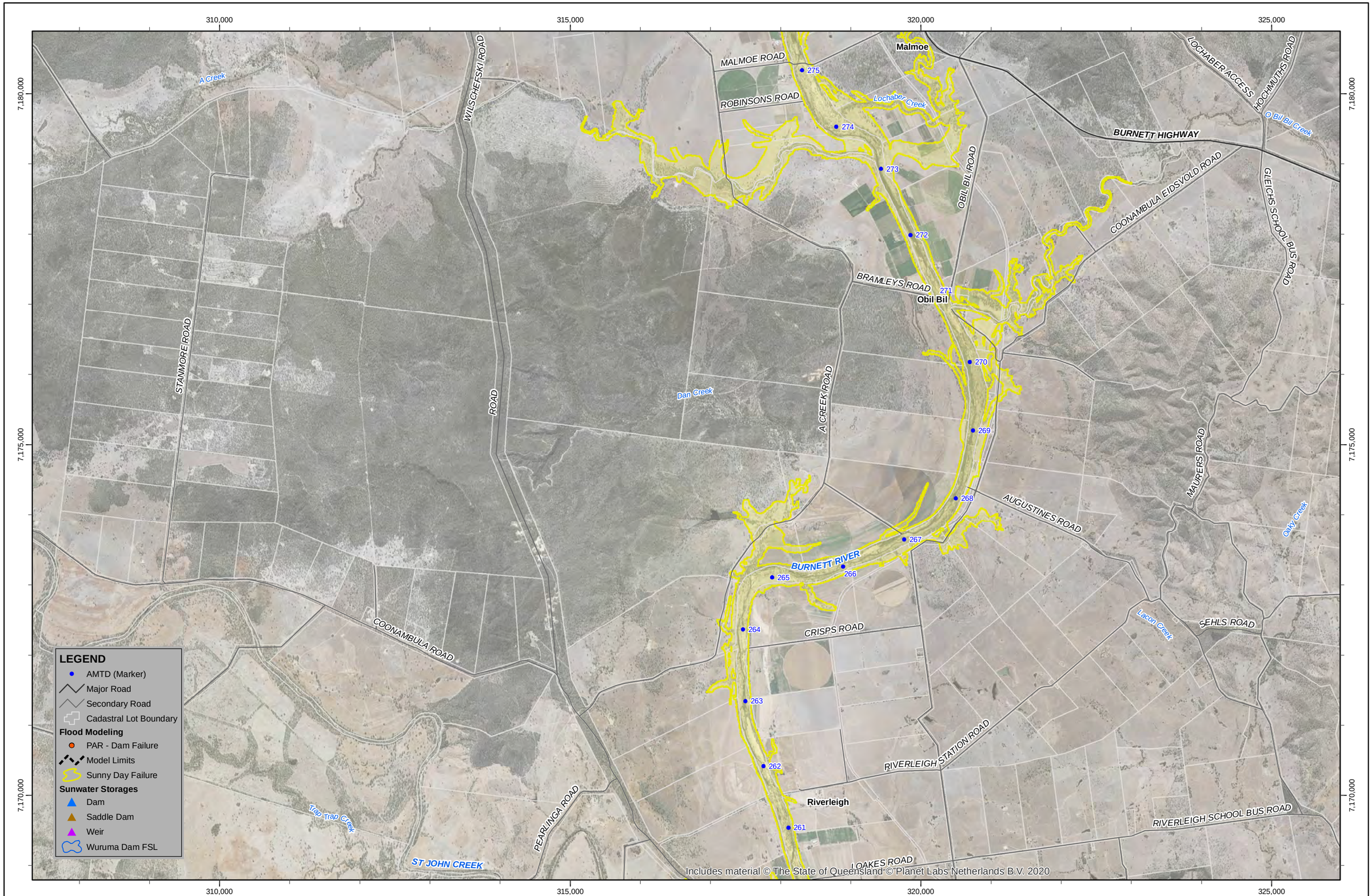

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DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

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DRAWING NUMBER 256778
REV. A
SHEET 5 OF 11
DATE OCTOBER 2022

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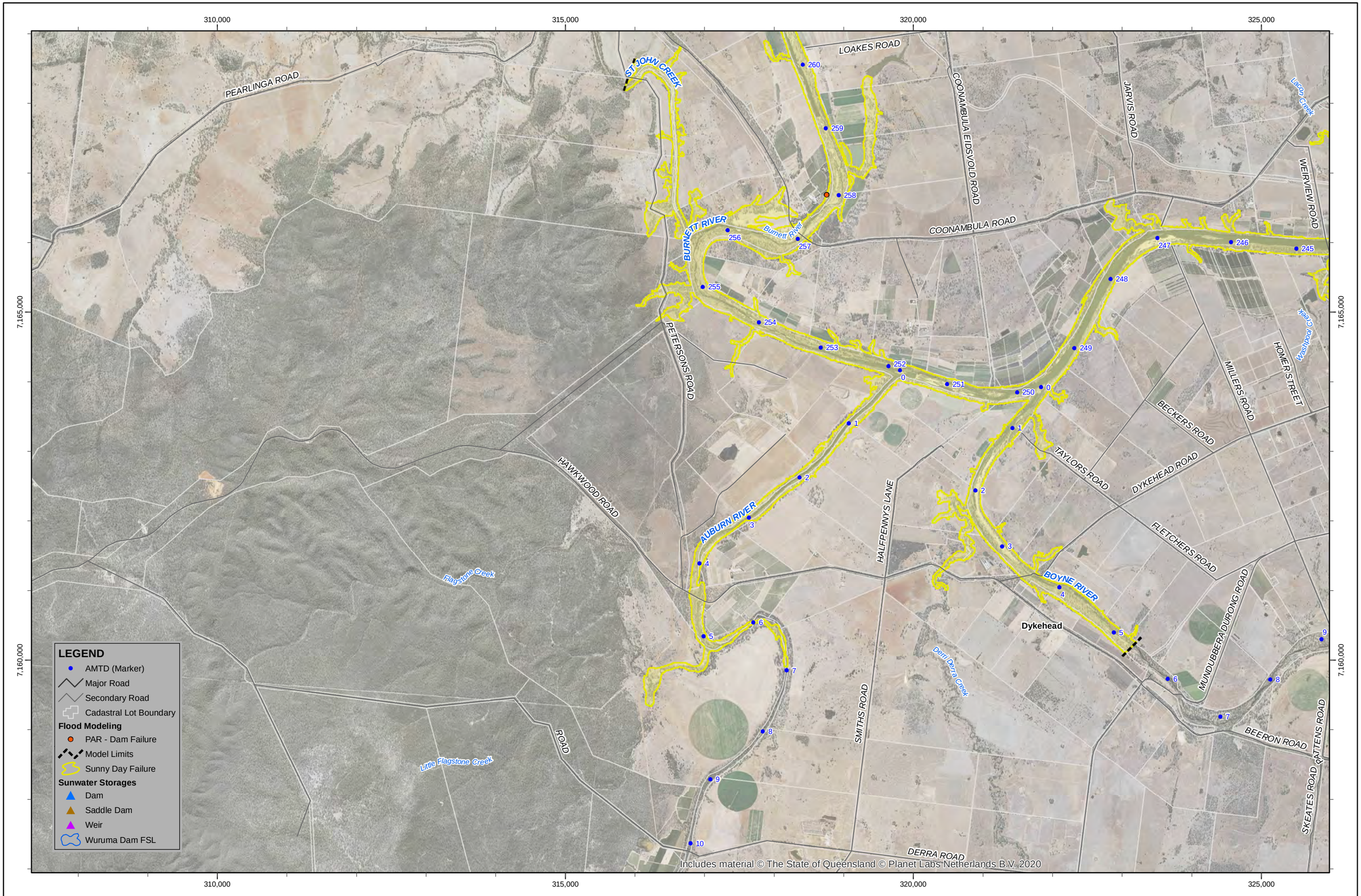

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MAP PRODUCED BY:
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TEL: (07) 3120 0000

330,000 335,000 340,000

7,170,000

7,165,000

BALD HILLS NORRIS CORNER ROAD
SEHLS ROAD
MUNDOWRAN ROAD
BLEES ROAD
Pumpkin Hill Creek
Philpott Creek
CHERRYS LANE
First Branch Creek
PHILPOTT ROAD
BURNETT HIGHWAY
Killaja Creek
SHALLCROSS ROAD
ROAD
BROWNINGS LANE
BUNCE STREET
EZZY ROAD
BENHAMS ROAD
COONAMBULA ROAD
MUNDUBBERA
Philpott Creek
MCINDOES ROAD
KERLES LANE
Lacon Creek
JONES WEIR
241
240
242
239
236
235
BURNETT RIVER
233
234
232
231
227
226
SANDERSONS LANE
238
237
MIDDLETONS LANE
HARDINGS LANE
230
228
225
243
229
224
GAYNDAH MUNDUBBERA ROAD
BOONDOOMA ROAD
Burner Creek
Castor Oil Creek
244
BOOMERANG ROAD
Neil Creek
223
221
222
WEIRVIEW ROAD
MUNDUBBERA DURONG ROAD
GUYMERS ROAD
MIDDLE BOYNE ROAD
BACK GLENRAE ROAD
Murdering Hut Creek
GLENRAE DIP ROAD
DYKEHEAD ROAD
Washpool Creek
SPRYS ROAD
BRITISH EMPIRE ROAD

LEGEND
- AMTD (Marker)
- Major Road
- Secondary Road
- Cadastral Lot Boundary

Flood Modeling
- PAR - Dam Failure
- Model Limits
- Sunny Day Failure

Sunwater Storages
- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

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DATE		REMARKS	CKD	PSD	

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REFERENCE DRAWINGS
256770 - Keymap

SCALES (A3 SIZE)
0 500 1,000 1,500 2,000 2,500 m
1:50,000

DRAWN	DESIGNED
IDH	
CHECKED	CHECKED
	LH

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19/12/2022
RPEQ: 18351

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WURUMA DAM
DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
256778	A

SHEET 7 OF 11

DATE OCTOBER 2022

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MAP PRODUCED BY:
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345,000 350,000 355,000 360,000

7,165,000 7,160,000

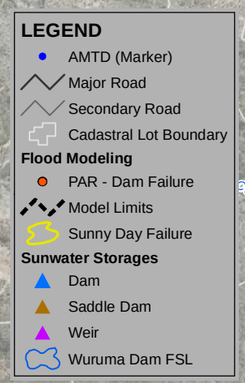
Newton Creek
Oaky Gully
Farley Gully
Breakneck Creek
Aranbanga Creek
Crooked Creek
Wallaby Gully
Five Mile Creek
Oaky Creek
Ripecliff Creek

Humphery
Mount Debateable
Dirnbir
Woodmiller
GAYNDAH

BOOMERANG ROAD
HUMPHERY BINJOUR ROAD
BEINKE ROAD
MOUNT DEBATABLE ROAD
BROWNS ROAD
DIRNBIR ROAD
ABBOTTS ROAD
BURNETT HIGHWAY
RIFLE RANGE ROAD
BERONNE ROAD
RICHARDS ROAD
OXFORD STREET
BOYD ROAD
MESON STREET
ARTHUR STREET
QUEEN STREET
CAPPER STREET
FIELDING STREET
PORTER STREET
E GORDON STREET
TABLELAND ROAD
OLD NANANGO ROAD
BARLYNE ROAD
LITTLE WOODMILLAR ROAD
WEST WOODMILLAR ROAD
MCCALLUMS ROAD
CROOKED CREEK ROAD
GAYNDAH MUNDUBBERA ROAD
GILBERTS ROAD
BACK WOODMILLAR ROAD
HUTHS ROAD
ROAD
LANGS ROAD
EAST WOODMILLAR ROAD
CARINYA ROAD
WIGTON ROAD

REID CREEK
BURNETT RIVER
CLAUDE WHARTON WEIR

194 195 196 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220



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256770 - Keymap

SCALES (A3 SIZE)
0 500 1,000 1,500 2,000 2,500 m
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DRAWN	DESIGNED
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	LH

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19/12/2022
RPEQ: 18351

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WURUMA DAM
DAM BREAK ANALYSIS 2022
SUNNY DAY FAILURE (SPILLWAY FAILURE) INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
256778	A

SHEET 8 OF 11

DATE OCTOBER 2022

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Tel: (07) 3120 0000

345,000 350,000 355,000 360,000

7,180,000 7,175,000 7,170,000

LEGEND

- AMTD (Marker)
- Major Road
- Secondary Road
- Cadastral Lot Boundary

Flood Modeling

- PAR - Dam Failure
- Model Limits
- Sunny Day Failure

Sunwater Storages

- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

Blue Gum Gully
GUYATTS ROAD
PRESSLANDS ROAD
REIDS CREEK ROAD
FAULKS ROAD
Tarrara Creek
SANDOWS ROAD
HEBBARDS ROAD
CARLAWS ROAD
DALGANGAL ROAD
GREGGERYS ROAD
Binjour
SWANS ROAD
BURNETT HIGHWAY
REID CREEK
LARA ROAD
Reids Creek
HALEYS ROAD
ZAHLS ROAD
Lambing Gully
DENTS ROAD
REDVALE ROAD
DARLINGTONS ROAD
LINSKETTS ROAD
SCANLANS ROAD
YENDA ROAD
HUMPHERY BINJOUR ROAD
Camp Gully
SLAB CREEK ROAD
EMMERTONS ROAD
IDERAWAY ROAD
SMITHS ROAD
Newton Creek
MOUNT DEBATABLE ROAD
Oaky Gully
MOUNT DEBATABLE ROAD
DIRNBIR ROAD
IDERAWAY
BURNETT RIVER
192
193
ABBOTTS ROAD
Outlet Creek

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Sunwater Storages
- Dam
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BURNETT RIVER
BERONNE ROAD
BON ACCORD WETHERON ROAD
WHARTONS ROAD
BERNIE TAYLORS ROAD
BURNETT HIGHWAY
LILYVALE ROAD
WASHPOOL ROAD
Oaky Creek
Oaky South Branch Creek
Four Mile Creek
BRIAN PASTURES ROAD
TABLELAND ROAD
LANE CREEK ROAD
Lane Creek
BARAMBAH CREEK
ROAD
Woodmillar Creek
BARLYNE ROAD
THE LIMITS ROAD
Pipeclay Creek
Campbell Creek
CAMPBELL CREEK ROAD
Horseshoe Creek
PROEFKE ROAD
BAN BAN ROAD
THE RIDGES ROAD
Back Creek
One Mile Creek

190 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 197 198

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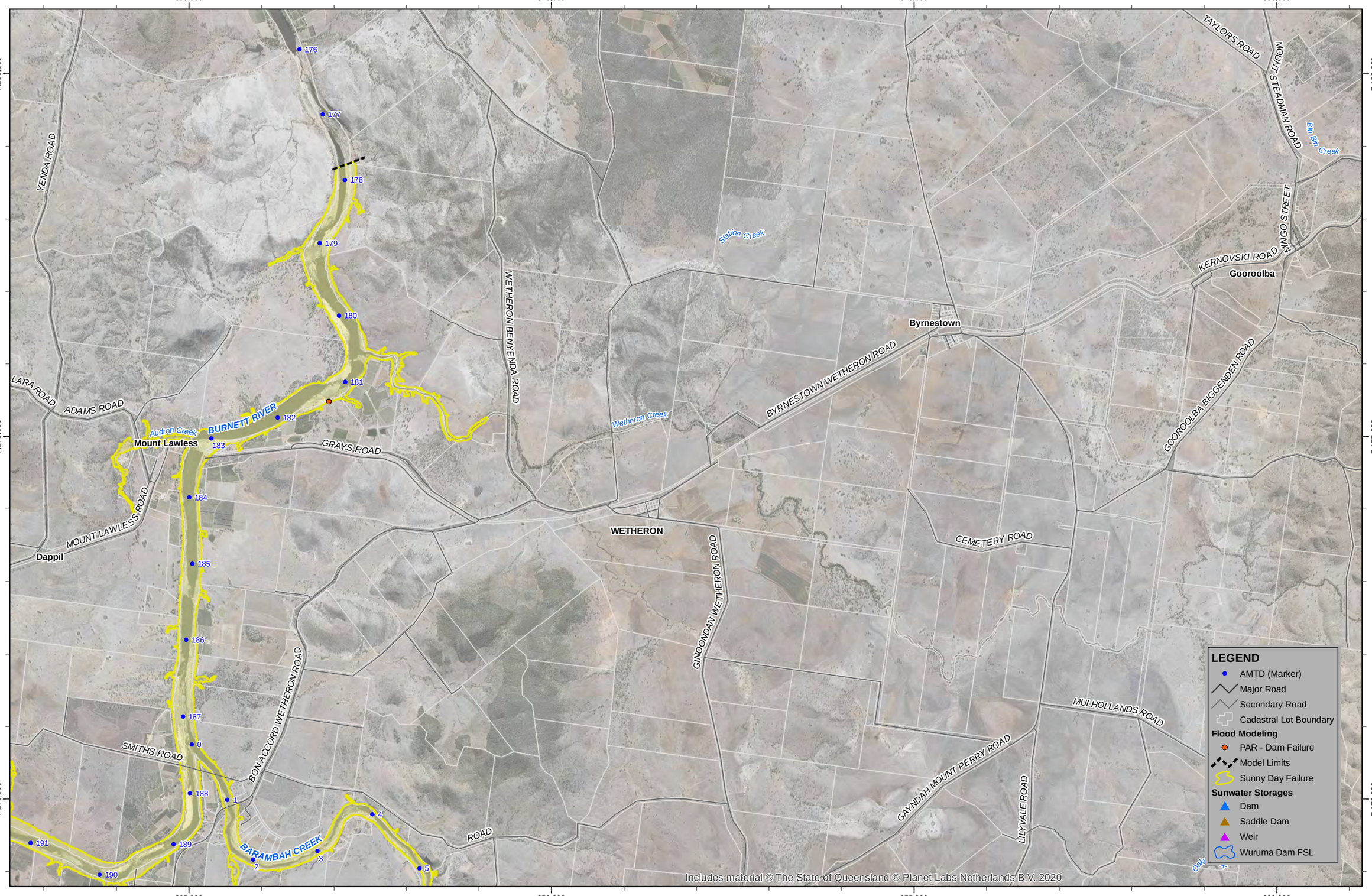
7,180,000 7,175,000 7,170,000

176 177 178 179 180 181 182 183 184 185 186 187 0 188 1 191 189 190 2 3 4 5

YENDA ROAD
LARA ROAD
ADAMS ROAD
MOUNT LAWLESS ROAD
SMITHS ROAD
BON ACCORD WETHERON ROAD
WETHERON BENYENDA ROAD
GRAYS ROAD
ROAD
BARAMBAH CREEK
BURNETT RIVER
Audron Creek
Station Creek
Wetheron Creek
BYRNESTOWN WETHERON ROAD
GINOONDAN WETHERON ROAD
CEMETERY ROAD
MULHOLLANDS ROAD
GAYNDAH MOUNT PERRY ROAD
LILYVALE ROAD
GOOROOLBA BIGGENDEN ROAD
KERNOVSKI ROAD
MOUNT STEADMAN ROAD
TAYLORS ROAD
WONGO STREET
Bin Bin Creek

Mount Lawless
Dappil
WETHERON
Byrnestown
Gooroolba



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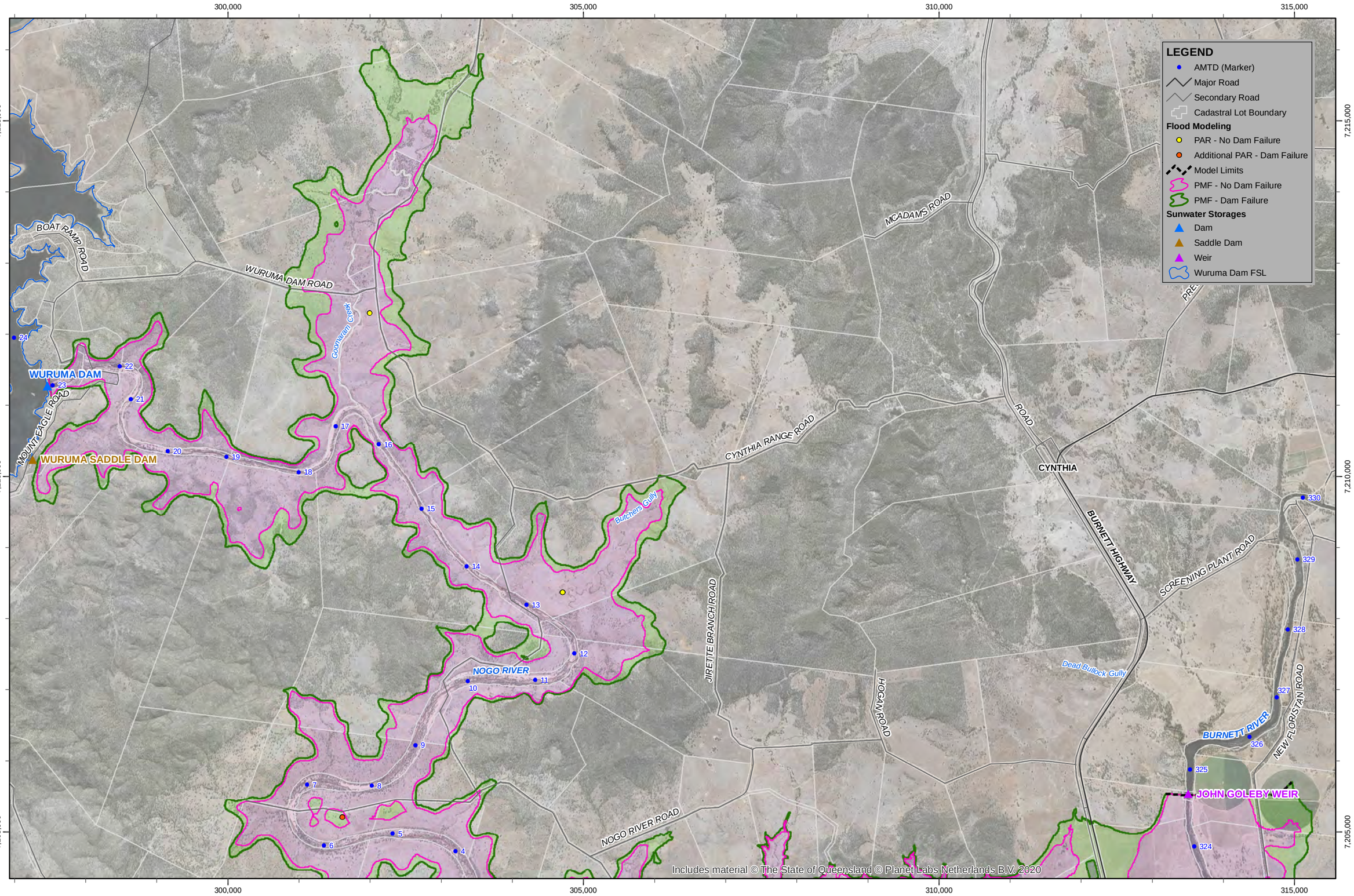

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MAP INFORMATION
Projected Coordinate System: Mapping Grid of Australia (MGA2020) Zone 56.

REFERENCE DRAWINGS
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SCALES (A3 SIZE)
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IDH	
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	LH
APPROVED	
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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD SPILLWAY FAILURE INUNDATION PLAN

CONTRACT NUMBER

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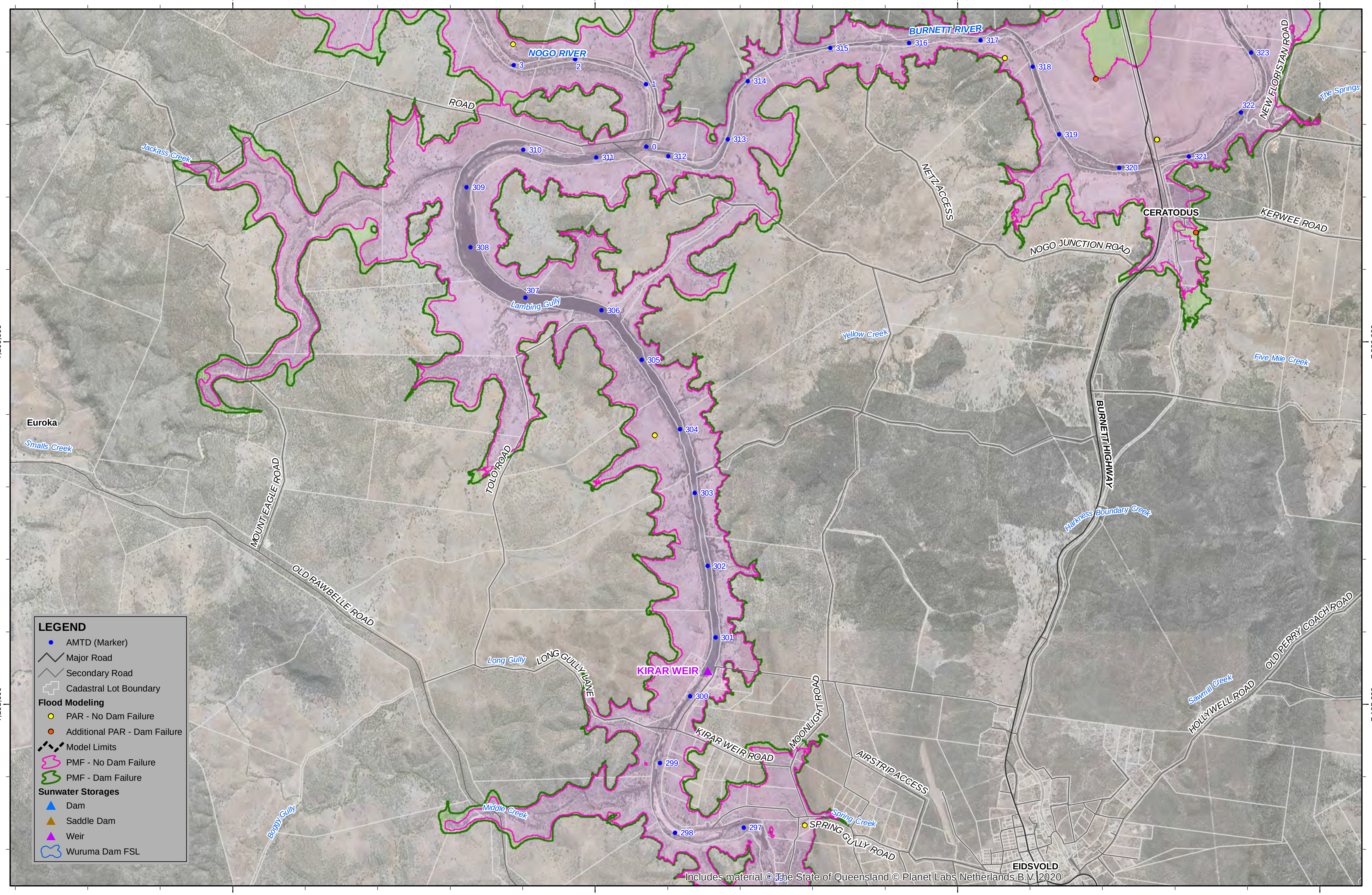

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WATER RESOURCES AND DAM SAFETY
TEL: (07) 3120 0000

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
SPILLWAY FAILURE
INUNDATION PLAN

CONTRACT NUMBER
DRAWING NUMBER 256779
REV. A
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Tel: (07) 3120 0000

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7,190,000 7,185,000

OLD RAWBELLE ROAD
EIDSVOLD THEODORE ROAD
CRAVEN TOWN ROAD
OLD SAINT JOHNS CREEK ROAD
TWENTY CHAIN LANE
ROSS CROSSING ROAD
BARRULE ROAD
SAWPIT MUNDUBBERA BOUNDARY ROAD
ESPLANADE
BURNETT HIGHWAY
CEDAR CREEK ROAD
RACECOURSE ROAD
RADIO STATION ROAD
MCCORD CREEK ROAD
ROCKMELON LANE
BURNETT RIVER
WINSTON ROAD
WINSTON WILSCHEFSKI ROAD
WILSCHEFSKI ROAD

Boggy Gully
Black Soil Gully
Bulgaroo Gully
Lower Creek
Springer Creek
Mallar Creek
Sawpit Gully
Little Mallar Creek
Spring Creek
Hospital Creek
Sheep Station Creek
Mccord Creek
Kalpowar Boundary Creek

296 295 294 293 292 291 290 289 288 287 286 285 284 283 282

LEGEND

- AMTD (Marker)
- Major Road
- Secondary Road
- Cadastral Lot Boundary

Flood Modeling

- PAR - No Dam Failure
- Additional PAR - Dam Failure
- Model Limits
- PMF - No Dam Failure
- PMF - Dam Failure

Sunwater Storages

- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
SPILLWAY FAILURE
INUNDATION PLAN

CONTRACT NUMBER

DRAWING NUMBER	REV.
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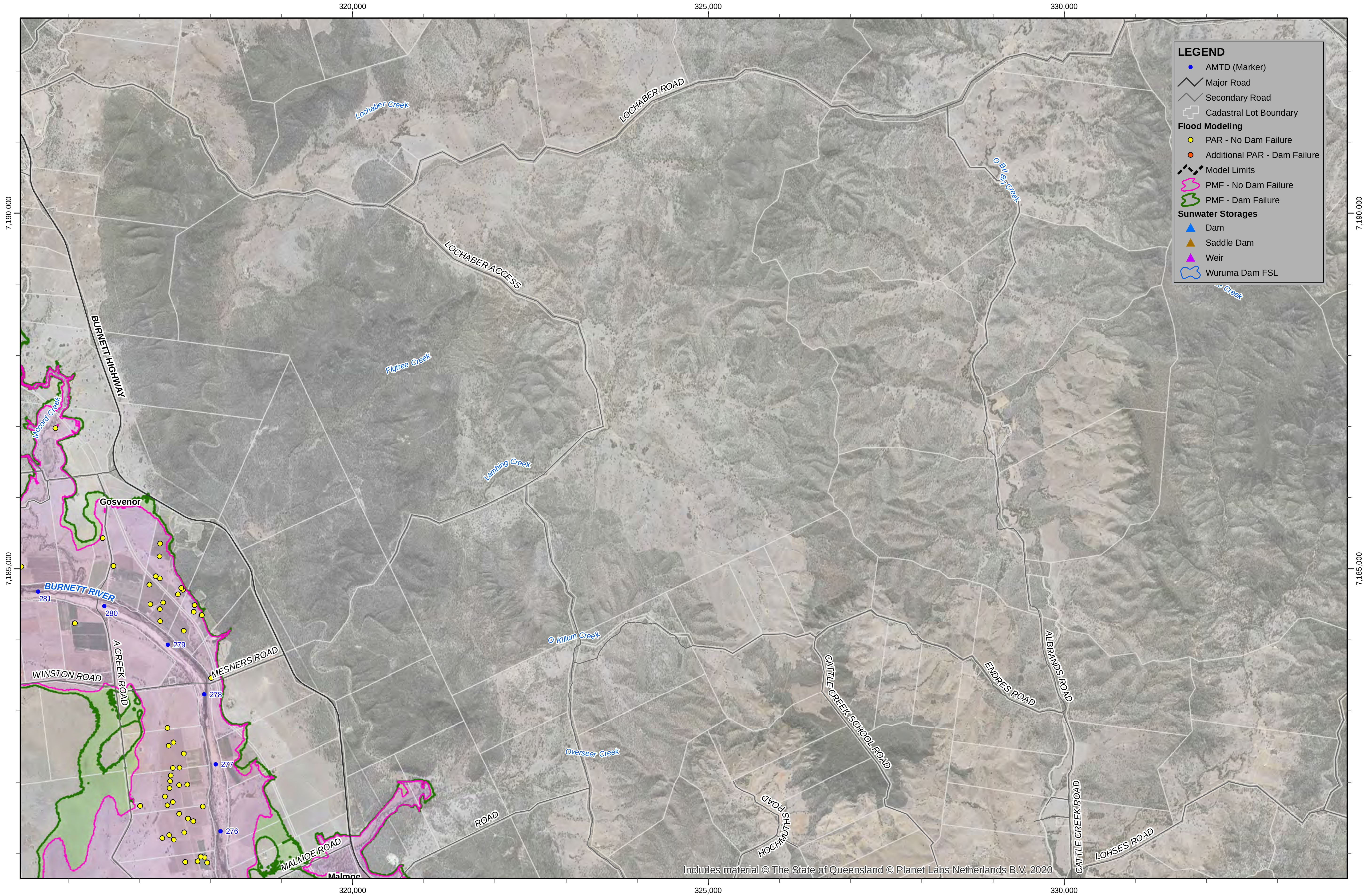

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD SPILLWAY FAILURE INUNDATION PLAN

CONTRACT NUMBER:
DRAWING NUMBER: 256779
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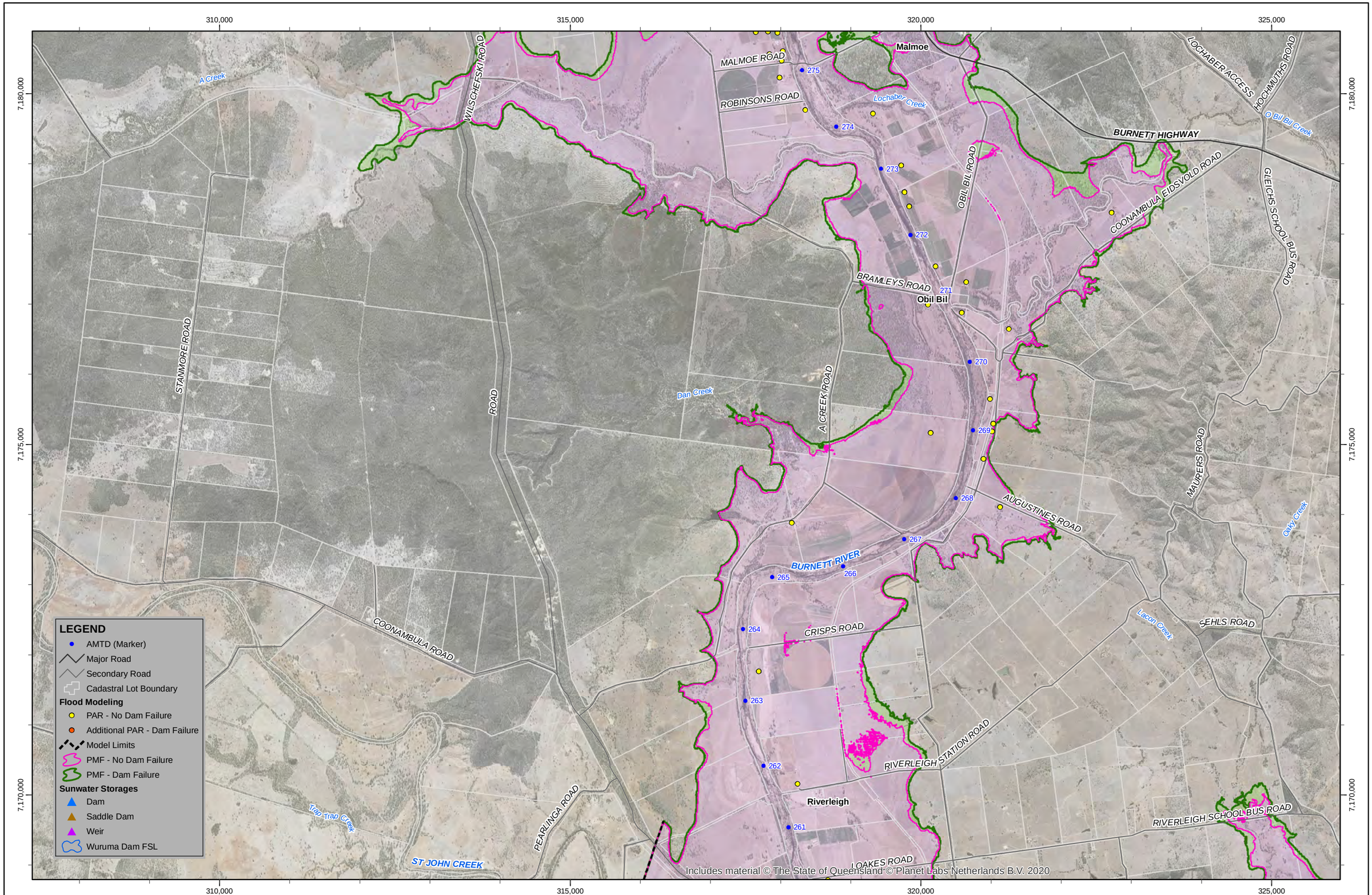

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
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INUNDATION PLAN

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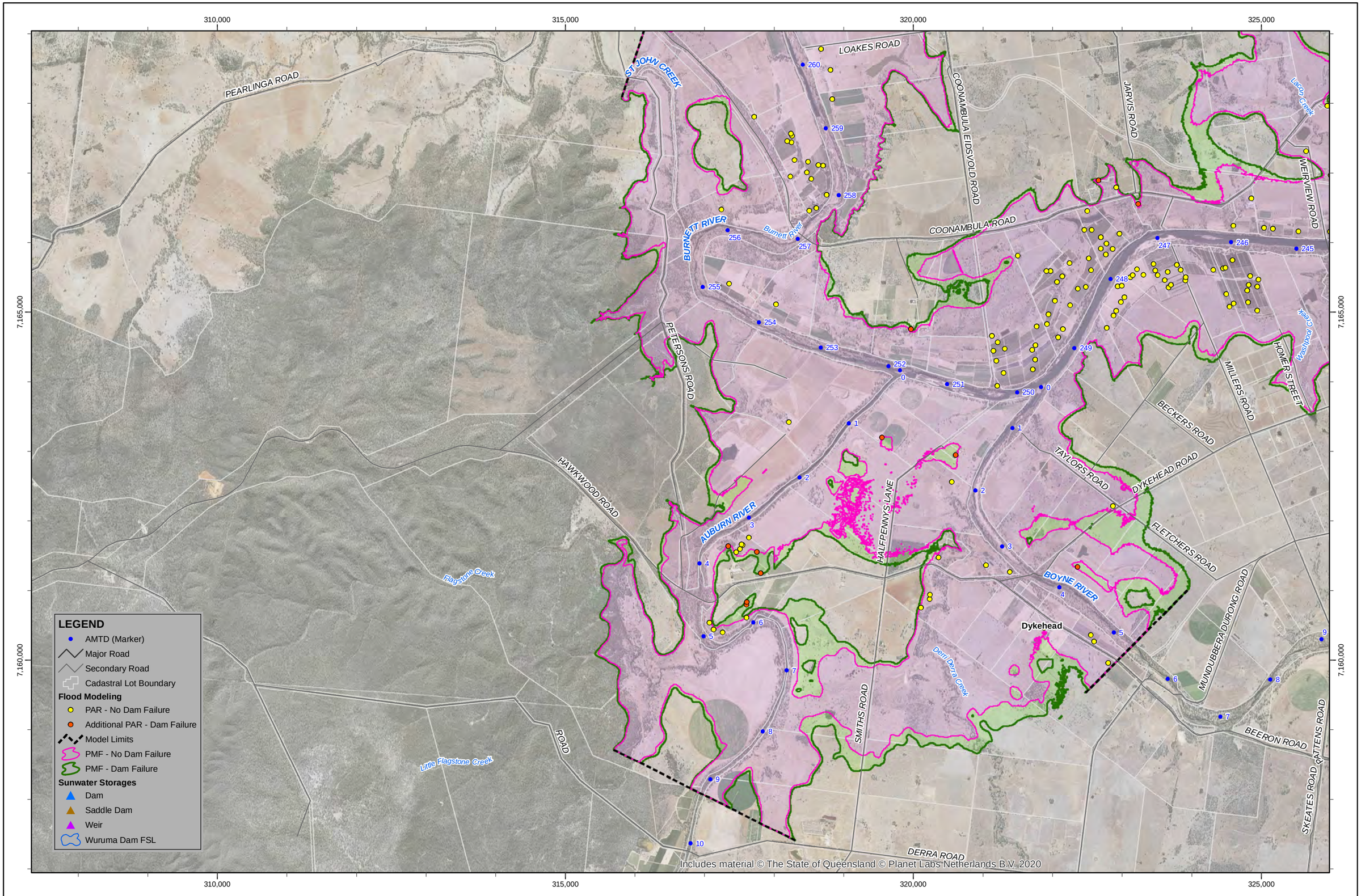

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
SPILLWAY FAILURE
INUNDATION PLAN

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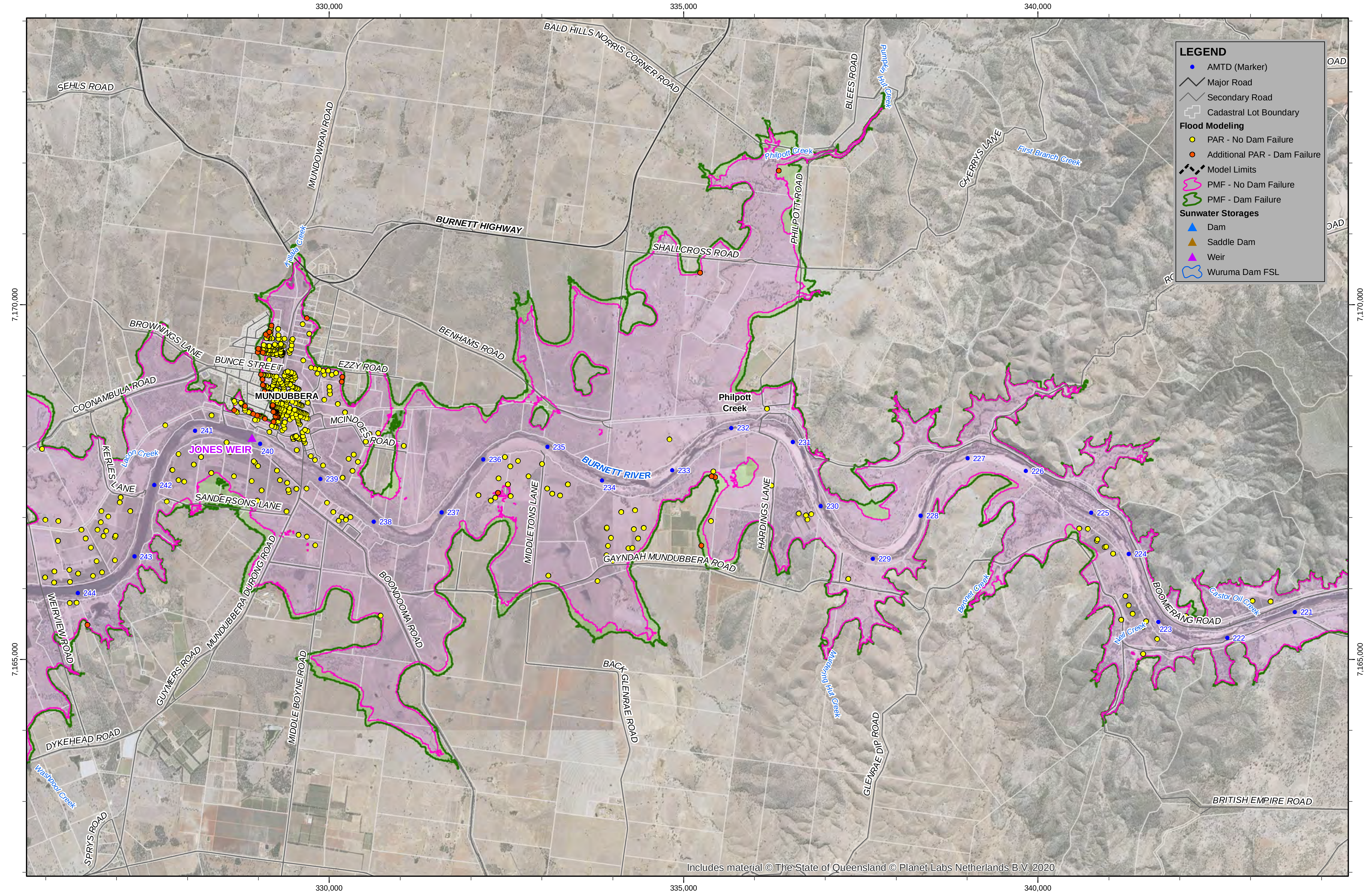

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
SPILLWAY FAILURE
INUNDATION PLAN

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345,000 350,000 355,000 360,000

7,165,000 7,160,000

Newton Creek
Oaky Gully
Farley Gully
Breakneck Creek
Humphery
Mount Debateable
Dirnbir
Woodmiller
Gayndah
Wallaby Gully
Five Mile Creek
Aranbanga Creek
Crooked Creek
Oaky Creek
Plyecday Creek

BOOMERANG ROAD
HUMPHERY BINJOUR ROAD
BEINKE ROAD
MOUNT DEBATEABLE ROAD
MCCALLUMS ROAD
CROOKED CREEK ROAD
GAYNDAH MUNDUBBERA ROAD
GILBERTS ROAD
BACK WOODMILLAR ROAD
HUTHS ROAD
ROAD
BROWNS ROAD
DIRNBIR ROAD
REID CREEK
BURNETT HIGHWAY
BURNETT RIVER
CLAUDE WHARTON WEIR
ABBOTTS ROAD
RIFLE RANGE ROAD
BERONNE ROAD
RICHARDS ROAD
LORD STREET
MESON STREET
QUEEN STREET
ARTHUR STREET
FIELDING STREET
PORTER STREET
CAPPER STREET
GORDON STREET
BOYD ROAD
TABLELAND ROAD
OLD NANANGO ROAD
BARLYNE ROAD
WEST WOODMILLAR ROAD
LITTLE WOODMILLAR ROAD
LANGS ROAD
CARINYA ROAD
EAST WOODMILLAR ROAD
WIGTON ROAD

216 215 217 214 218 219 220 213 212 211 210 209 208 207 206 205 204 203 202 201 200 199 196 195 194

LEGEND

- AMTD (Marker)
- Major Road
- Secondary Road
- Cadastral Lot Boundary

Flood Modeling

- PAR - No Dam Failure
- Additional PAR - Dam Failure
- Model Limits
- PMF - No Dam Failure
- PMF - Dam Failure

Sunwater Storages

- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

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SCALES (A3 SIZE)
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	LH

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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
SPILLWAY FAILURE
INUNDATION PLAN

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7,180,000 7,175,000 7,170,000

LEGEND

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Sunwater Storages

- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

Binjour
Reids Creek
IDERAWAY
Blue Gum Gully
Tarrara Creek
Lambing Gully
Camp Gully
Oaky Gully
Newton Creek
Cutler Creek
BURNETT RIVER
REID CREEK
GUYATTS ROAD
PRESSLANDS ROAD
FAULKS ROAD
REIDS CREEK ROAD
CARLAWS ROAD
DALGANGAL ROAD
GREGGERYS ROAD
SANDOWS ROAD
HEBBARDS ROAD
SWANS ROAD
BURNETT HIGHWAY
LARA ROAD
HALEYS ROAD
ZAHLS ROAD
DENTS ROAD
REDVALE ROAD
DARLINGTONS ROAD
LINSKETTS ROAD
SCANLANS ROAD
YENDA ROAD
HUMPHERY BINJOUR ROAD
SLAB CREEK ROAD
EMMERTONS ROAD
IDERAWAY ROAD
SMITHS ROAD
MOUNT DEBATABLE ROAD
DIRRIBIR ROAD
ABBOTTS ROAD
192
193

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N W E S

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1:50,000

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CHECKED	CHECKED LH
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WURUMA DAM
DAM BREAK ANALYSIS 2022
PROBALE MAXIMUM FLOOD
SPILLWAY FAILURE
INUNDATION PLAN

CONTRACT NUMBER

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365,000 370,000 375,000 380,000

7,165,000 7,160,000

LEGEND
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- Cadastral Lot Boundary

Flood Modeling
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- Model Limits
- PMF - No Dam Failure
- PMF - Dam Failure

Sunwater Storages
- Dam
- Saddle Dam
- Weir
- Wuruma Dam FSL

BON ACCORD WETHERON ROAD
WHARTONS ROAD
BERNIE TAYLORS ROAD
BURNETT HIGHWAY
WASHPOOL ROAD
LILYVALE ROAD
BERONNE ROAD
BURNETT RIVER
BRIAN PASTURES ROAD
TABLELAND ROAD
LANE CREEK ROAD
PROEFKE ROAD
BAN BAN ROAD
THE RIDGES ROAD
BARLYNE ROAD
THE LIMITS ROAD
CAMPBELL CREEK ROAD
ROAD

Four Mile Creek
Oaky Creek
Oaky South Branch
Lane Creek
BARAMBAH CREEK
Woodmillar Creek
Campbell Creek
Pipeclay Creek
Horseshoe Creek
Back Creek
One Mile Creek

190 197 198 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

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7,180,000 7,175,000 7,170,000

176 177 178 179 180 181 182 183 184 185 186 187 0 188 1 191 189 190 2 3 4 5

YENDA ROAD
LARA ROAD
ADAMS ROAD
MOUNT LAWLESS ROAD
Dappil
Mount Lawless
Audron Creek
BURNETT RIVER
GRAYS ROAD
SMITHS ROAD
BON ACCORD WETHERON ROAD
BARAMBAH CREEK
ROAD
WETHERON BENYENDA ROAD
Station Creek
Wetheron Creek
WETHERON
GINOONDAN WETHERON ROAD
BYRNESTOWN WETHERON ROAD
Byrnestown
CEMETERY ROAD
MULHOLLANDS ROAD
GAYNDAH MOUNT PERRY ROAD
LILYVALE ROAD
GOOROOLBA BIGGENDEN ROAD
TAYLORS ROAD
MOUNT STEADMAN ROAD
Bin Bin Creek
KERNOVSKI ROAD
WONGO STREET
Gooroolba

LEGEND
- AMTD (Marker)
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Flood Modeling
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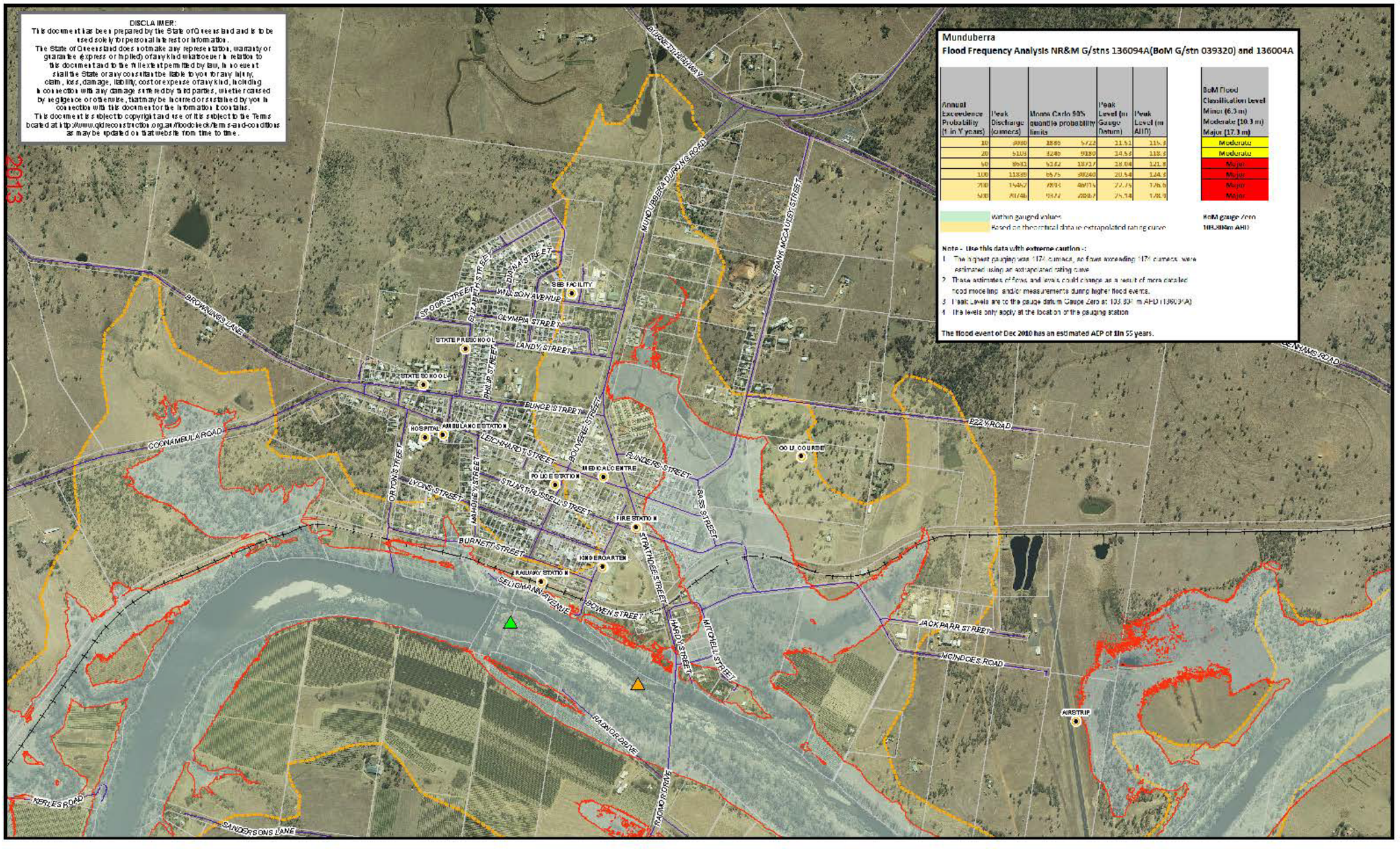
DATE OCTOBER 2022

Appendix B3: Inundation maps (continued)



Queensland Reconstruction Authority 1800 110 841 www.qldreconstruction.org.au	Points of interest Roads Rail	Interpolated flood line BOM gauging station NRM gauging station	Cadastre Interim Floodplain Assessment Overlay	Local Authority: North Burnett Regional Council Locality: Munduberra Datum: Horizontal- Geocentric Datum of Australia 1994 (GDA94) Projection: Horizontal- Geocentric Datum of Australia 1994 (GDA94)	0 100 200 300 400 500 Metres Scale at A3 - 1:15,000	**Flood Investigation Level 2** **Map 1 Mundubbera** **Draft Indicative Extent of Flood Event (December 2010)** ***[18.303m at BOM Gauge # 039320]***	277 11/10/2012 1

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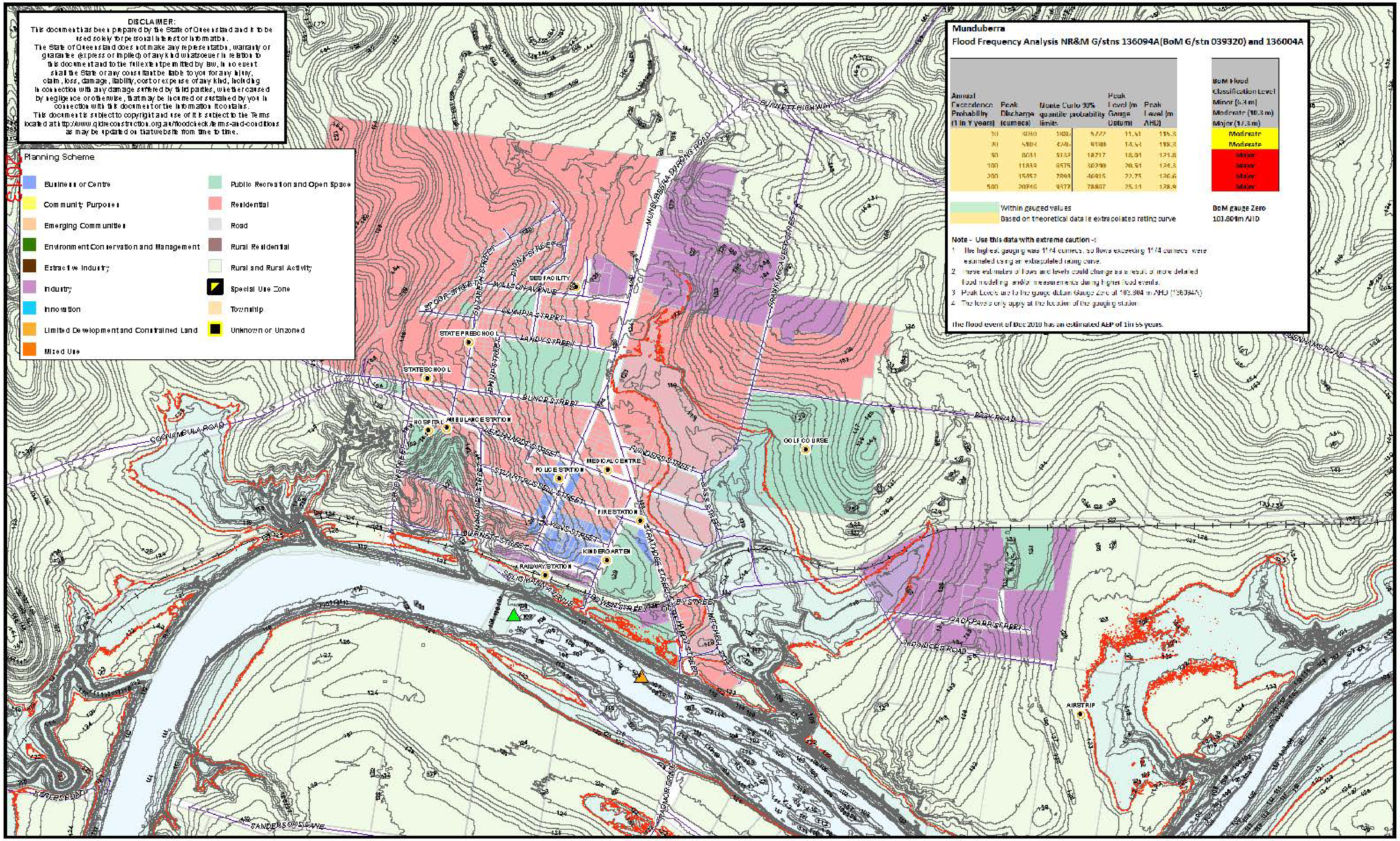

Mundubberra

Flood Frequency Analysis NR&M G/stns 136094A(BoM G/stn 039320) and 136004A

Annual Exceedence Probability (1 in Y years)	Peak Discharge (cumecs)	Monte Carlo 90% quantile probability limits		Peak Level (m Gauge Datum)	Peak Level (m AHD)	BoM Flood Classification Level Minor (6.3 m) Moderate (10.3 m) Major (17.3 m)
10	3030	1886	5722	11.51	115.3	Moderate
20	5103	4746	9180	14.54	118.3	Moderate
50	8031	5132	18717	18.01	121.8	Major
100	11339	6575	30240	20.51	124.3	Major
200	15452	7894	46415	22.75	126.6	Major
500	20746	9377	78867	25.14	128.9	Major

Within gauged values

Based on theoretical data ie extrapolated rating curve

BoM gauge Zero 103.804m AHD

Note - Use this data with extreme caution -:

1. The highest gauging was 1174 cumecs, so flows exceeding 1174 cumecs were estimated using an extrapolated rating curve.
2. These estimates of flows and levels could change as a result of more detailed flood modelling and/or measurements during higher flood events.
3. Peak Levels are to the gauge datum Gauge Zero of 103.804 m AHD (136094A)
4. The levels only apply at the location of the gauging station.

The flood event of Dec 2010 has an estimated AEP of 1in 55 years.

Queensland Reconstruction Authority

1800 110 841

www.qldreconstruction.org.au

Points of Interest — BOM gauging station — Contour (1m interval)

Roads — NRM gauging station — Cadastre

Rail — Interpolated flood line

Local Authority: North Burnett Regional Council

Locality: Mundubbera

Datum: Horizontal - Geocentric Datum of Australia 1994 (GDA94)

Projection: Horizontal - Geocentric Datum of Australia 1994 (GDA94)

0 100 200 300 400 500 Metres

Scale at A3 - 1:15,000

Flood Investigation Level 2
Map 2 Mundubbera
Planning Scheme and Draft Indicative Extent of Flood Event (December 2010)
[18.303m at BOM Gauge # 039320]

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15/10/2012

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2013

Munduberra

Flood Frequency Analysis NR&M G/stns 136094A(BoM G/stn 039320) and 136004A

Annual Exceedence Probability (1 in Y years)	Peak Discharge (cumecs)	Monte Carlo 90% quantile probability limits		Peak Level (m Gauge Datum)	Peak Level (m AHD)
10	3030	1886	5722	11.51	115.3
20	5103	3246	9180	14.53	118.3
50	8631	5132	18717	18.04	121.8
100	11839	6575	30240	20.54	124.3
200	15452	7893	46915	22.75	126.6
500	20746	9377	78867	25.14	128.9

BoM Flood Classification Level
Minor (6.3 m)
Moderate (10.3 m)
Major (17.3 m)
Moderate
Moderate
Major
Major
Major
Major

Within gauged values
Based on theoretical data ie extrapolated rating curve

BoM gauge Zero 103.804m AHD

Note - Use this data with extreme caution -:
1 The highest gauging was 1174 cumecs, so flows exceeding 1174 cumecs were estimated using an extrapolated rating curve.
2 These estimates of flows and levels could change as a result of more detailed flood modelling and/or measurements during higher flood events.
3 Peak Levels are to the gauge datum Gauge Zero at 103.804 m AHD (136094A)
4 The levels only apply at the location of the gauging station

The flood event of Dec 2010 has an estimated AEP of 1in 55 years.

BURNETT HIGHWAY
MUNDUBBERA DURONG ROAD
FRANKMACAULEY STREET
BENHAMS ROAD
EZZY ROAD
BROWNINGS LANE
COONAMBULA ROAD
KERLES ROAD
SANDERSONS LANE
RADNOR DRIVE
JACK PARR STREET
McINDOES ROAD
AIRSTRIP
GOLF COURSE
SES FACILITY
WILLSON AVENUE
OLYMPIA STREET
LANDY STREET
STATE PRESCHOOL
STATE SCHOOL
BUNCE STREET
HOSPITAL
AMBULANCE STATION
LEICHHARDT STREET
MEDICAL CENTRE
POLICE STATION
FIRE STATION
KINDERGARTEN
RAILWAY STATION
SELWYMANN AVENUE
BOWEN STREET
BURNETT STREET
STUART RUSSELL STREET
LYONS STREET
ORTON STREET
MAHONEY STREET
PHILIP STREET
ELIZABETH STREET
DONA STREET
SPOOR STREET
FLINDERS STREET
BOWER STREET
BASS STREET
STRATHDEE STREET
HARDY STREET
MITCHELL STREET

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www.qldreconstruction.org.au

Points of interest
Roads
Rail
BoM gauging station
NRM gauging station
Cadastre

Depth (m)
0 - 0.5
0.5 - 0.8
0.8 - 1
1-2
>2

Local Authority: North Burnett Regional Council
Locality: Munduberra
Datum: Horizontal- Geocentric Datum of Australia 1994 (GDA94)
Projection: Horizontal- Geocentric Datum of Australia 1994 (GDA94)

0 200 400 600 800
Metres
Scale at A3 - 1:15,000

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This map is based on or contains data provided by the State of Queensland (Department of Natural Resources and Mines) 2012.

Flood Investigation Level 2
Map 3 Mundubbera
Draft Indicative Extent and Depth of Flood Event (December 2010)
[18.30m at BoM Gauge # 039320]

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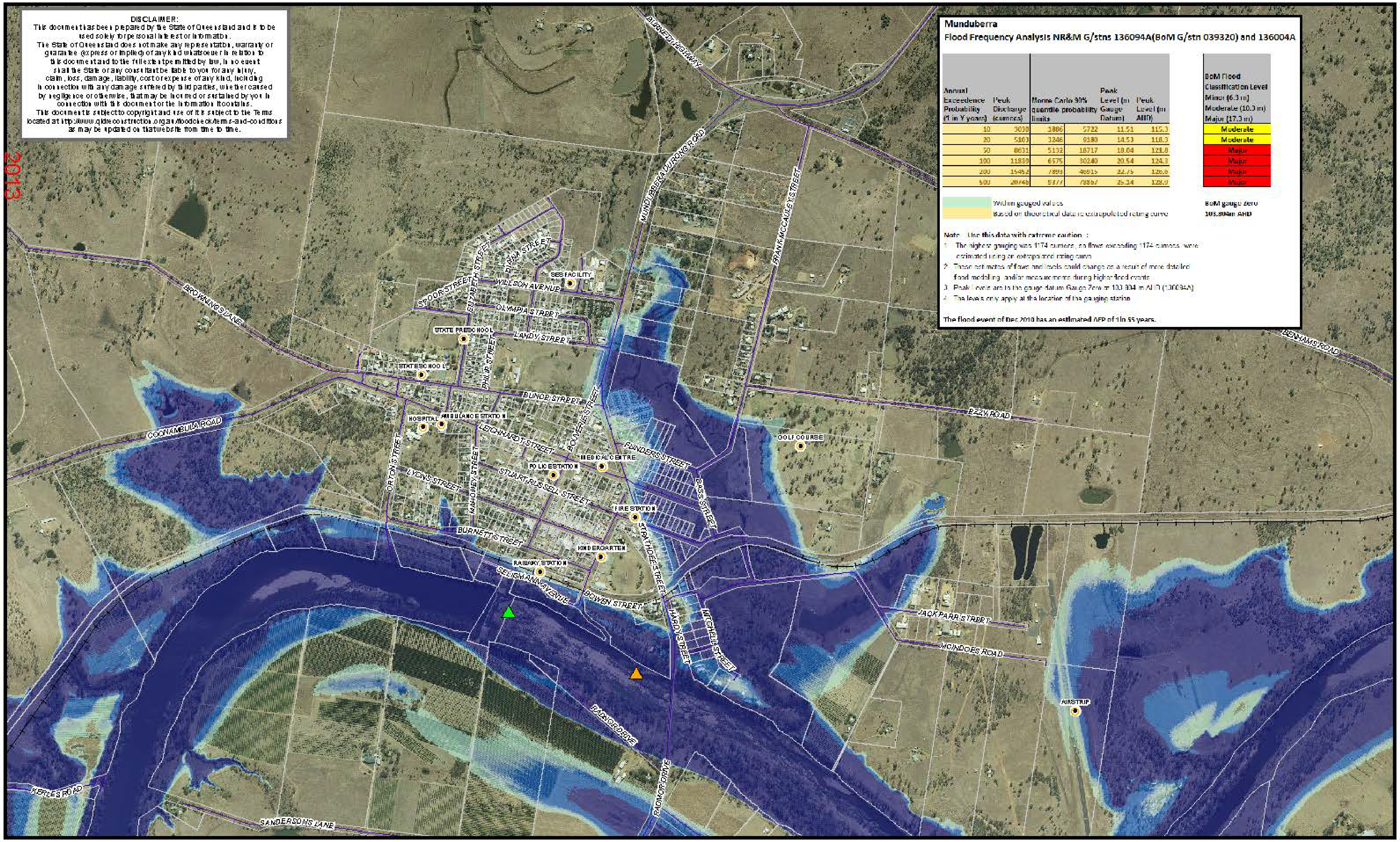
sunwater



Munduberra
Flood Frequency Analysis NR&M G/stns 136094A(BoM G/stn 039320) and 136004A

Annual Exceedence Probability (1 in Y years)	Peak Discharge (cumecs)	Monte Carlo 90% quantile probability limits		Peak Level (m Gauge Datum)	Peak Level (m AHD)	BoM Flood Classification Level Minor (6.3 m) Moderate (10.3 m) Major (17.3 m)
10	3030	1886	5722	11.51	115.3	Moderate
20	5103	3246	9180	14.53	118.3	Moderate
50	8631	5132	18717	18.04	121.8	Major
100	11839	6575	30240	20.54	124.3	Major
200	15452	7893	46915	22.75	126.6	Major
500	20746	9377	78867	25.34	128.9	Major

Within gauged values
Based on theoretical data ie extrapolated rating curve

BoM gauge zero 103.804m AHD

Note: Use this data with extreme caution:
1. The highest gauging was 1174 cumecs, so flows exceeding 1174 cumecs were estimated using an extrapolated rating curve
2. These estimates of flows and levels could change as a result of more detailed flood modelling and/or measurements during higher flood events
3. Peak Levels are to the gauge datum Gauge Zero at 103.804 m AHD (136094A)
4. The levels only apply at the location of the gauging station

The flood event of Dec 2010 has an estimated AEP of 1 in 55 years.

Queensland Reconstruction Authority
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www.qldreconstruction.org.au

Points of interest
Roads
Rail
BOM gauging station
NRM gauging station
Cadastre
Depth (m)
0 - 0.5
0.5 - 0.8
0.8 - 1
1-2
>2

Local Authority: North Burnett Regional Council
Locality: Mundubbera
Datum: Horizontal - Geocentric Datum of Australia 1994 (GDA94)
Projection: Horizontal - Geocentric Datum of Australia 1994 (GDA94)

0 100 200 300 400 500
Metres
Scale at A3 - 1:15,000

Flood Investigation Level 2
Map 7 Mundubbera
Draft Indicative Extent and Depth of Estimated Flood AEP 1 in 100 yrs
[20.54m at BOM Gauge # 039320]

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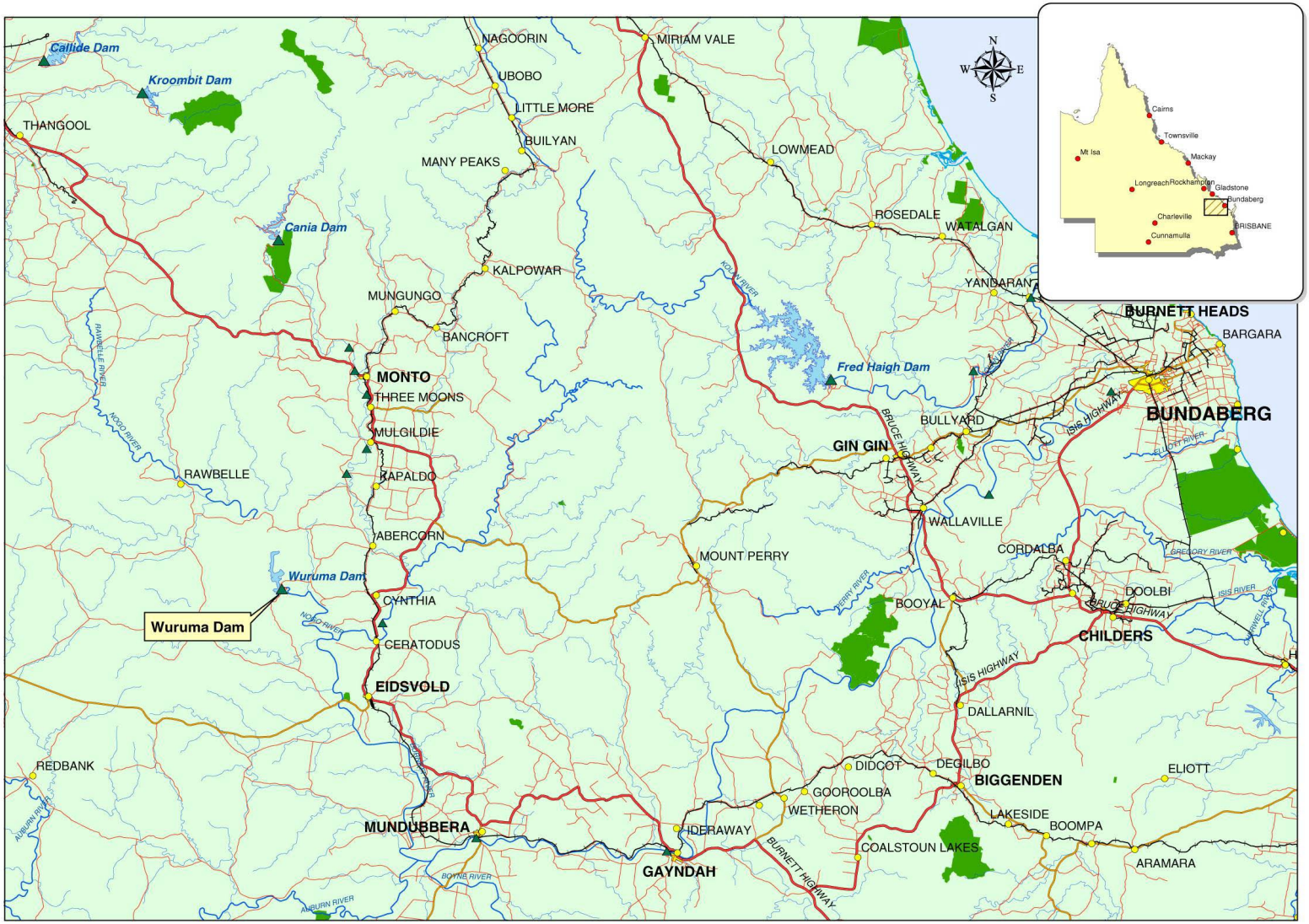
Appendix B4 : Locality plan

Figure B3: Wuruma Dam locality plan



MAP PRODUCED BY:
SUNWATER LTD
TEL. (07)3120 0000

Document: S:\BW Asset Delivery\GIS_Data\Enterprise_GIS\Water_Supply_Schemes\Upper Burnett\Drawings\ArcMap\253512-A.mxd
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150°30'0"E 150°40'0"E 150°50'0"E 151°0'0"E

24°40'0"S 24°50'0"S 25°0'0"S 25°10'0"S 25°20'0"S

N W E S

BURNETT HIGHWAY (MONTO - BILOELA)
RAWBELLE RIVER
CANIA DAM ROAD
COOMINGLAH
MOONFORD
CANIAVIEW AL
UPPER CASTLE AL
COOMINGLAH TBR
RAWBELLE
COLODAN
NOGO RIVER AT RAWBELLE
RAWBELLE
NOGO RIVER
GLENCOE
RAWBELLE SOUTH TBR
WURUMA DAM ROAD
WURUMA HW AL
WURUMA DAM TW TM
WURUMA DAM HW TM
WURUMA DAM
WURUMA SADDLE DAM
TIREEN
GLENCOE RD AL
BURNETT RIVER
EUROKA
EIDSVOLD - THEODORE ROAD
CLONCOSE

LEGEND

- Town
- Rainfall Station
- Rainfall & River Station
- River Station
- Towns
- River
- Creek
- Minor Watercourse
- State Roads (DTMR)

Sunwater Storage Infrastructure

- Dam
- Saddle Dam

sunwater

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WURUMA DAM
BURNETT RIVER CATCHMENT
CATCHMENT MAP

MAP INFORMATION
Coordinate System: Geocentric Datum of Australia (GDA94).

SCALES (A3 SIZE)
0 2.5 5 7.5 10 12.5 km
1:250,000

Source: US National Park Service, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

DRAWING No. 253512 A

Appendix C Equipment and technical information

C1 List of equipment available during an emergency

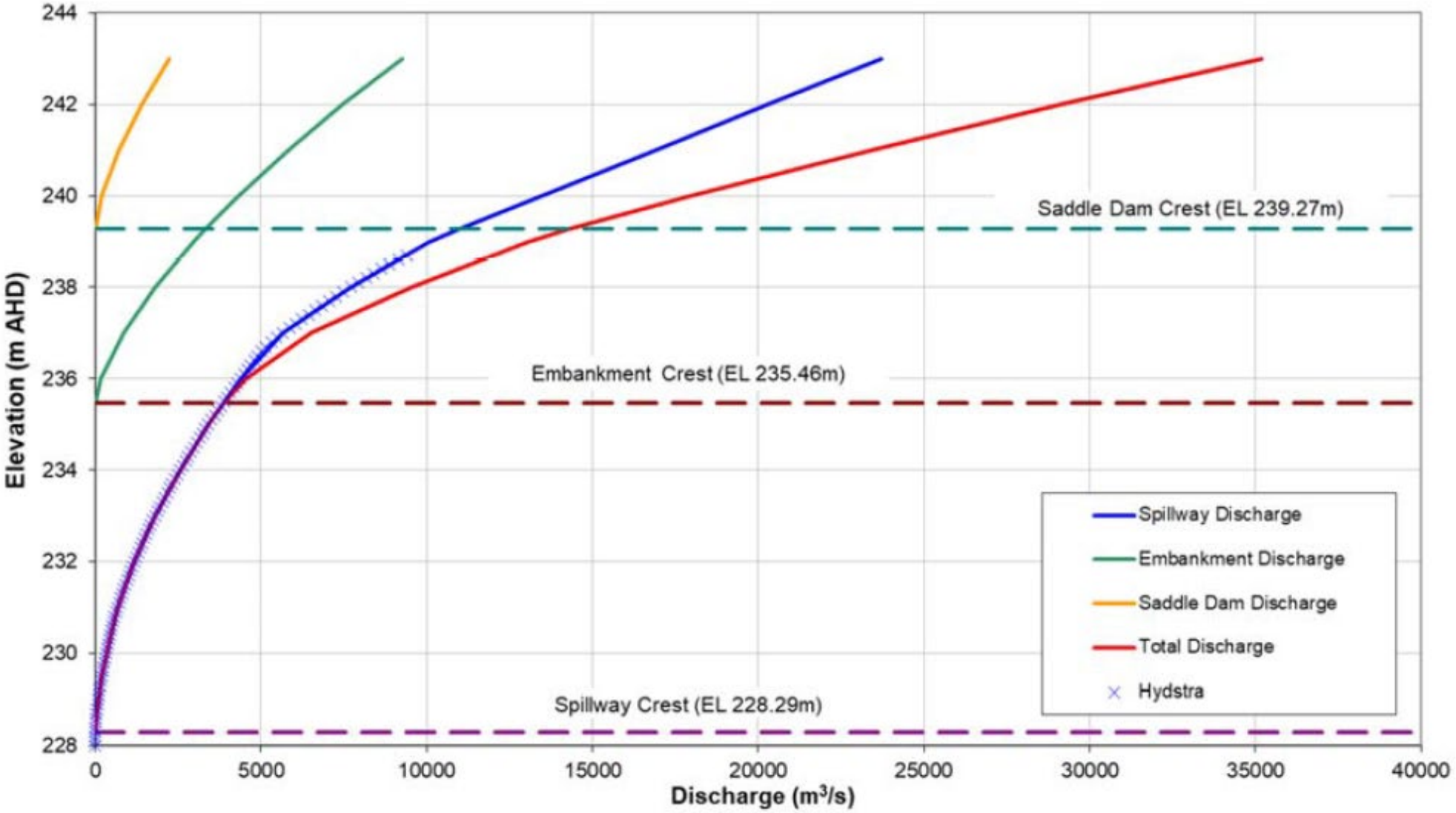
C2 Wuruma Dam spillway discharge

C3 Wuruma Dam storage curve

Appendix C1 has been redacted

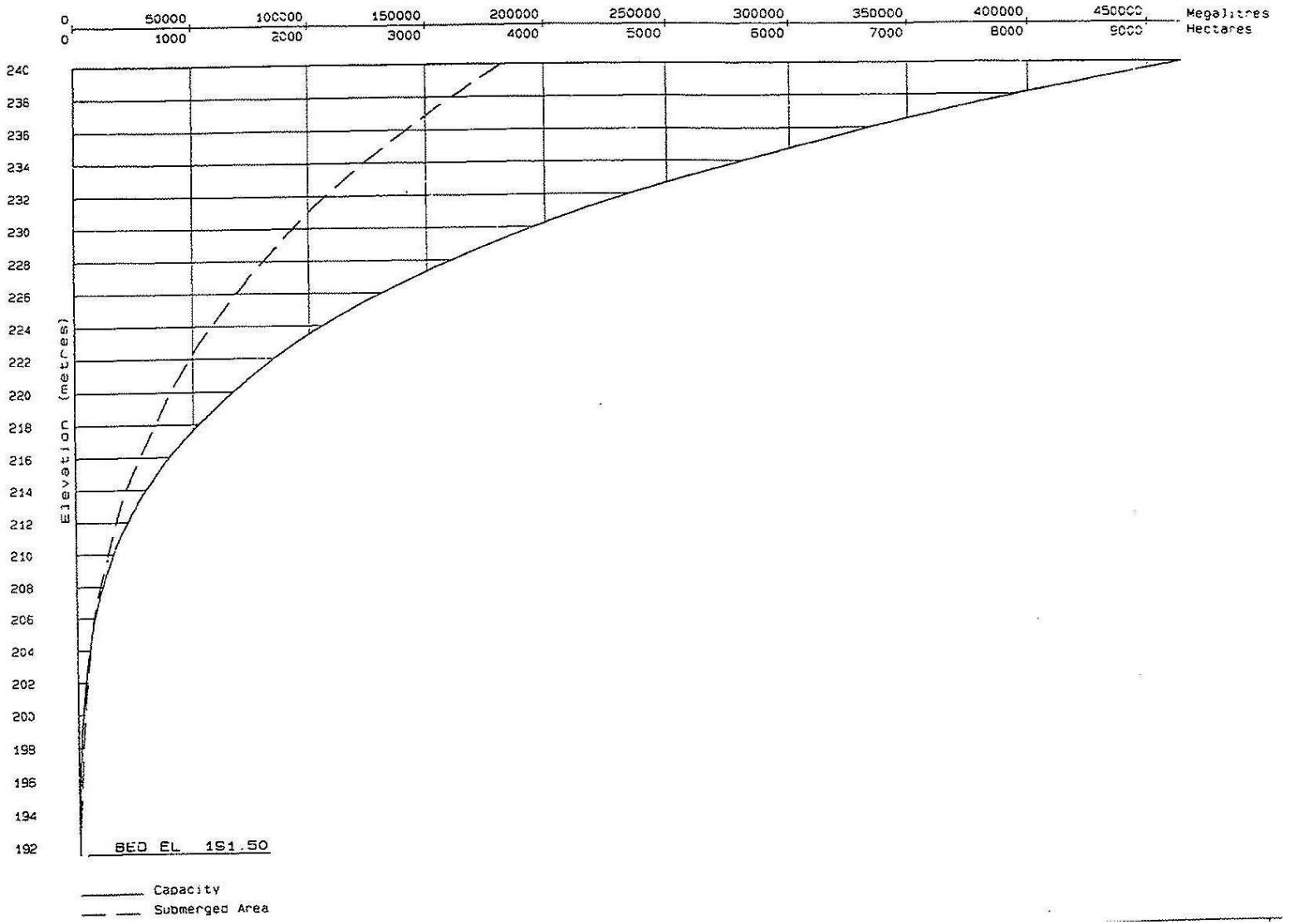
Appendix C2 : Wuruma Dam spillway discharge

Figure C1: Wuruma Dam spillway discharge



Appendix C3 : Wuruma Dam storage curve

Figure C2: Wuruma Dam storage curve



Appendix D Interaction with Local Government and District Groups

To be populated when EAP next completes a substantive review

Annexe — Wuruma Dam SMS Messages

	Advice Stay informed	**Watch and Act** Prepare to leave	**Emergency** Leave immediately To be issued in consultation with council
SMS	ADVICE from Sunwater. Wuruma Dam is spilling excess water into Nogo River. People downstream of Wuruma Dam should STAY INFORMED. Water flows from Wuruma Dam expected to remain within beds and banks of river / may contribute to widespread/ localised/ overland flooding. Expect increased river flows in 6-12 hours / later today/ overnight/ tomorrow. There is no danger yet. Call Triple Zero (000) if your life is in danger. Call the SES on 132 500 for flood help. Get full warnings and what you should do at https://bit.ly/RecandSafety	FLOOD WATCH AND ACT from Sunwater. Excess water spilling from Wuruma Dam into Nogo River has increased significantly. Water flows from Wuruma Dam may contribute to dangerous/widespread flooding downstream. Expect increased river flows in 6-12 hours / later today/ overnight/ tomorrow. People downstream of Wuruma Dam must PREPARE TO LEAVE in case the flood gets worse. Tell others. Call Triple Zero (000) if your life is in danger. Call the SES on 132500 for flood help. Get full warnings and what you should do at https://bit.ly/RecandSafety	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Wuruma Dam including Eidsvold must LEAVE IMMEDIATELY. Wuruma Dam possible failure/is failing. Major flooding is happening now. Water in the Proserpine River is rising fast. Your life is at risk. Go now to a safe place away from the flood. Monto and Proston are safe. Get full warnings and what you should do at North Burnett Regional Council http://emergency.northburnett.qld.gov.au

Annexe — Wuruma AWS warning levels mapping

EAP flood activation trigger	EAP trigger summary	Current EAP message (SMS)	AWS-aligned message	AWS level
ALERT Align with council Only relevant to 10 km	EL 228.19m and rising (0.1m below FSL)	SUNWATER NOTIFICATION. Wuruma Dam; spillway discharge likely due to rain in the catchment. Review your emergency plan. Refer www.sunwater.com.au for more details	ADVICE from Sunwater. Wuruma Dam is spilling excess water into Nogo River. People downstream of Wuruma Dam should STAY INFORMED and MONITOR CONDITIONS. Water flows from Wuruma Dam expected to remain within beds and banks of river / may contribute to widespread/ localised/ overland flooding. Expect increased river flows in 6-12 hours / later today/ overnight/ tomorrow. There is no immediate danger. More information here: bit.ly/RecandSafety	ADVICE
LEAN FORWARD	Storage above FSL 228.29m	SUNWATER NOTIFICATION. Wuruma Dam; now discharging water over spillway due to rain in the catchment. Avoid potential safety hazards downstream. Refer www.sunwater.com.au for more details		
STAND UP 1 – Moderate flood level Align with council Only relevant to 10km	Storage above EL 229.29m (moderate flood classification level)	SUNWATER NOTIFICATION. Wuruma Dam continues to discharge water over spillway due to continuing rain in the catchment. Review your emergency plan and stay alert for further advice. Refer www.sunwater.com.au for more details.	FLOOD WATCH AND ACT from Sunwater. Excess water spilling from Wuruma Dam into Nogo River has increased significantly. Water flows from Wuruma Dam may contribute to dangerous/widespread flooding downstream. Expect increased river flows in 6-12 hours / later today/ overnight/ tomorrow. People downstream of Wuruma Dam must PREPARE TO LEAVE in case the flood gets worse. Call Triple Zero (000) if your life is in danger. Call the SES on 132500 for flood help. More information here: bit.ly/RecandSafety	WATCH AND ACT
STAND UP 2 – Greater than flood of record	Storage above EL 232.03m (flood of record—January 2013)	Sunwater Emergency notification DAM: Wuruma EVENT: Flood STATUS: Flood of record ACTION: Monitor weather and local conditions	FLOOD EMERGENCY WARNING from Sunwater: People downstream of Wuruma Dam including Eidsvold must LEAVE IMMEDIATELY. Wuruma Dam possible failure/is failing. Major flooding is happening now. Your life is at risk. Go now to a safe place away from the flood. Monto and Proston are safe. More information here: North Burnett Regional Council emergency.northburnett.qld.gov.au/	EMERGENCY
STAND UP 3	Storage above EL 239.27m (Saddle Dam embankment crest level)	IMMINENT FAILURE OF WURUMA DAM TAKE ACTION TO PROTECT LIFE AND LEAVE NOW. EIDSVOLD IS AT RISK. INFO ON ABC RADIO. MONTO & PROSTON ARE SAFE.		
STAND DOWN	Storage level EL 228.39m and falling	Sunwater Emergency notification DAM: Wuruma EVENT: Flood STATUS: Dam hazard stood down ACTION: None	n/a	