EMERGENCY ACTION PLAN
MCKINNON CREEK DETENTION BASIN

Dam ID: 520

Dam Owner: Cairns Regional Council

Document: DM #6578422 v15

Revision: Revision 10 – April 2025

Address: Edmonton, Cairns

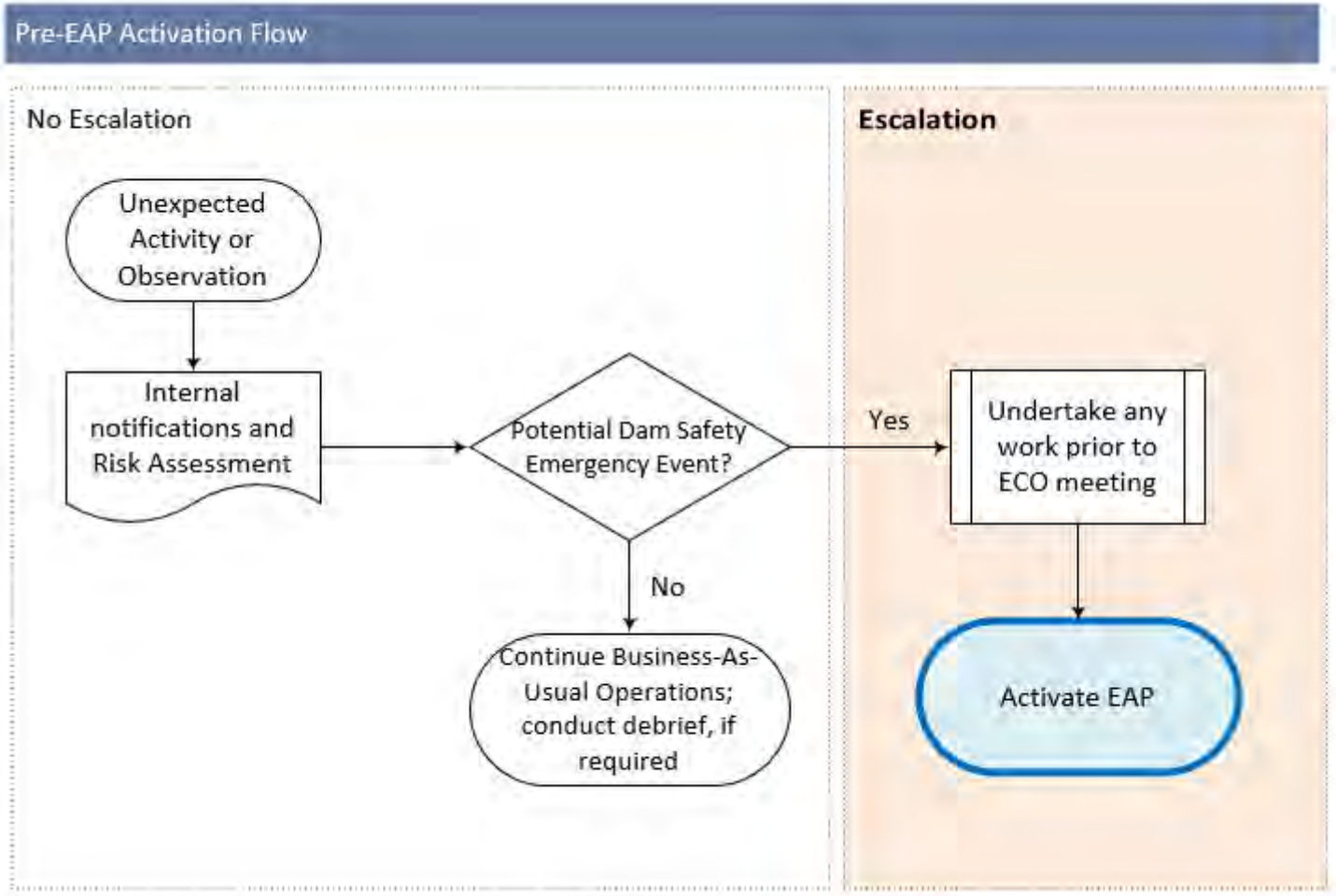
Lat -17.0245687 and Long 145.7237295

Approved Until:

Controlled Copy No.	of 18
Issued To	
Revision	10
Revision Date	2025 Revision
Dam Owner	Cairns Regional Council

Approved by the delegate of the Chief Executive,
Department of Local Government, Water and Volunteers
until 8 March 2030.

Quick Reference Guide



Dam Hazards	Activation Levels for Dam Hazards			
	Alert	Lean Forward	Stand Up	Stand Down
Flooding	Storage at 1.15m below spillway and rising (41.85m AHD or 7.8m Gauge Datum).	Storage reaches spillway crest and rising (43m AHD or 8.95m Gauge Datum).	Storage at DCL - 1m above spillway (44m AHD or 9.95m Gauge Datum).	Storage at 1.15m below spillway and falling, with discharge controlled by pipe conduit.
Embankment Failure	Not Applicable.	Not Applicable.	. Basin impounding water and Observed damage to spillway or embankment toe. Observed increased or new seepage through the embankment.	Risk assessment has determined that failure risk has reduced; OR Embankment failure occurred, no further risk to PAR and recovery efforts are underway.
Terror Threat / Malicious Activity	Not Applicable.	Not Applicable.	Significant threat / verified suspicious activity has compromised dam safety.	Risk assessment has determined that failure risk has reduced.

Other Emergency Situation	Communications Failure – Local Area
Communications Failure	Unable to communicate in Local area – Cairns Region during significant localised weather event. Locally managed by Dam Owner in consultation with ECO and LDMG-CR.

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7.	Executive Manager Business Performance & Compliance	Cairns Regional Council Martyn Street Depot
8.	Construction Engineer/Coordinator	Cairns Regional Council Martyn Street Depot
9.	Coordinator Maintenance South	Cairns Regional Council Gordonvale Depot
10.	Team Leader Works South B	Cairns Regional Council Gordonvale Depot
11.	Coordinator Strategic Asset Management & Planning – Water & Resource Recovery	Cairns Regional Council Spence Street
12.	Senior Technical Officer - Dams	Cairns Regional Council Spence Street
13.	Team Leader Quality & Compliance	Cairns Regional Council Martyn Street Depot
14.	Quality & Dam Safety Systems Officer	Cairns Regional Council Martyn Street Depot
15.	Local Disaster Coordinator	Cairns Regional Council Local Disaster Coordination Centre
16.	Executive Manager Strategic Communications & Engagement	Cairns Regional Council Spence Street
17.	Media Coordinator	Cairns Regional Council Spence Street
18.	Chair Local Disaster Management Group – Cairns Region	Cairns Regional Council Spence Street

Electronic Document Distribution

Position	Email Address	Location
District Disaster Coordinator		Queensland Police Service – Northern Region, Cairns
Counter Terrorism Inspector		Queensland Police Service, Cairns
Emergency Management Coordinator QPS		Queensland Fire & Emergency Services, Cairns
Division 1 Councillor		Cairns Regional Council Spence Street
Division 2 Councillor		Cairns Regional Council Spence Street

Revision History

Revision	Date	Revision Description
1.	2015	DM #4742955 original version.
2.	2016	Modifications following DEWS review and LDMG-CR review.
3.	2018	Annual review and update for DNRME submission.
4.	2019	Review and updates for 2019.
5.	2020	Annual review and updates for 2020.
6.	2021	New DM #6578422 issued. Revision to incorporate changes to *Emergency Action Plan for Referable Dam Guideline (RDMW, 2021).*
7.	2022	Revision to update position descriptions, consistency of triggers, previous Regulator comments.
8.	2023	Revision to incorporate Australian Warning System (AWS) flood warning requirements.
9.	2024	Renewed Emergency Action Plan submitted for assessment and approval by the Chief Executive, Department of Regional Development, Manufacturing and Water (RDMW). Renewal incorporates changes to *Emergency Action Plan for Referable Dam Guideline (RDMW, 2023)*, 2021 Failure Impact Assessment details, dam hazard identification improvements, updated inundation mapping, a revised communications plan, and addresses Schedule of Matters substantive and non-substantive changes. Review 2024 Local Government election changes.
10.	2025	Non-substantive changes as indicated by DLGWV. As per Emergency Action Plan for Referable Dam Guideline, pg. 31, section 4.2 non-substantive changes do not require a Local Government and DDMG notice.

Endorsement

This document has been prepared by the Dam Operator Cairns Regional Council, Cairns Infrastructure & Assets Directorate in consultation with the Dam Owner and key disaster and local government personnel. This revision has been endorsed by the following personnel:

Position	Date Endorsed	Print Name	Signed
Director Cairns Infrastructure & Assets Cairns Regional Council	09/06/2025		
Associate Director Service Delivery Cairns Regional Council	10/06/2025		
Associate Director Engineering Services Cairns Regional Council	11/06/2025		
Executive Manager Works Cairns Regional Council	27/06/2025		
Executive Manager Strategic Asset Management & Planning Cairns Regional Council	07/07/2025		
Executive Manager Business Performance & Compliance Cairns Regional Council	11/06/2025		
Pursuant to section 352HB Water Legislation (Dam Safety) Amendment Act 2017 – the local government has reviewed this Emergency Action Plan and considers it consistent with Cairns Regional Council's Disaster Management Plan.			
Chair Local Disaster Management Group – Cairns Region	15/07/2025		
Chief Executive Officer Cairns Regional Council	08/07/2025		

Abbreviations and Definitions

Abbreviations

Abbreviation	Full Form
AEP	Annual Exceedance Probability
AFC	Acceptable Flood Capacity
AHD	Australian Height Datum
AWS	Australian Warning System
BAU	Business as Usual
BoM	Bureau of Meteorology
BPC	Business Performance & Compliance Branch, Cairns Regional Council
CEO	Chief Executive Officer, Cairns Regional Council
CIA	Cairns Infrastructure & Assets Directorate, Cairns Regional Council
CRC	Cairns Regional Council
DCL	Dam Crest Level
DDMG	District Disaster Management Group
DDMG Cairns	District Disaster Management Group Cairns
DEC	Dam Emergency Controller
DECC	Dam Emergency Compliance Coordinator
DEO	Dam Emergency Observer
DSR	Dam Safety Regulator (see also DLGWV, formerly RDMW)
DTA	Dam Technical Advisor
EA	Emergency Alert
EAP	Emergency Action Plan (This Document)
ECO	Emergency Control Organisation
EER	Emergency Event Report
EL	Elevation Level

Abbreviation	Full Form
FIA	Failure Impact Assessment
FSL	Full Supply Level
IGEM	Inspector-General Emergency Management
LDC	Local Disaster Coordinator
LDCC	Local Disaster Coordination Centre
LDMG-CR	Local Disaster Management Group – Cairns Region
LDMP-CR	Local Disaster Management Plan – Cairns Region
NEAS	National Emergency Alert System
O&M Manual	Operation & Maintenance Manual
PAR	Population at Risk
PMF	Probable Maximum Flood
QDMA	Queensland Disaster Management Arrangements
QFD	Queensland Fire Department [formerly, Queensland Fire and Emergency Services (QFES)]
QPS	Queensland Police Service
DLGWV	Department of Local Government, Water and Volunteers, formerly the RDMW (Department of Regional Development, Manufacturing & Water)
RPEQ	Registered Professional Engineer of Queensland
SCADA	Supervisory Control and Data Acquisition
SDCC	State Disaster Coordination Centre
SDF	Sunny Day Failure
SITREP	Situation Report
SMS	Short Message Service (“text message”)
UHF	Ultra-High Frequency (Radio)

Business Terms

The meaning of terms used in this section are in accordance with the *Water Supply (Safety & Reliability) Act 2008* (the Act), the Queensland Prevention, Preparedness, Response & Recovery Disaster Management Guideline (QPS, 2024), and the Emergency Action Plan for Referable Dam Guideline (RDMW, 2023).

Term	Definition
Activation Levels	This Emergency Action Plan (EAP) is activated using an escalation model based on the following levels. The movement through these levels is not necessarily sequential. The model should be applied with flexibility and adaptability and be tailored to the location and the event. Triggering one of these levels of activation may not necessarily mean a similar activation of the Local Disaster Management Group – Cairns Region (LDMG-CR) or the District Disaster Management Group (DDMG).
	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 that the Dam Owner is preparing to activate the Lean Forward level of the EAP if the situation escalates. The Emergency Control Organisation (ECO) is activated.
	Lean Forward An operational state characterized by a heightened level of situational awareness of an impending disaster event and a state of operational readiness. The Local Disaster Coordination Centre (LDCC) Is on standby and prepared, but not activated.
	Stand Up The operational state where resources are mobilized, personnel are deployed, and operational activities commence. LDCC is activated. The Dam Owner must 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.
Australian Warning System (AWS)	The AWS is a national approach to information and warnings for hazards like bushfire, flood, storm, cyclone, extreme heat, and severe weather. The requirements of the AWS are nationally consistent.
Bureau of Meteorology	The three levels of flooding are:

Term	Definition
(BoM) Flood Level Classifications	• **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 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.*
Dam Failure	The physical collapse of all or part of a dam, or the uncontrolled release of any of its contents.
District Group (DDMG)	District Disaster Management Group – for an EAP, means a district group established under the *Disaster Management Act 2003* section 22 whose disaster district under this 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: o A coordinated response involving two 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

Term	Definition
	o The event may arise because of a disaster situation declared under the *Disaster Management Act 2003*, OR o 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 (LDMG-CR)	Local Disaster Management Group – for an EAP, means a local group established under the *Disaster Management Act 2003* section 29 whose local government area could, under the plan, be affected by a *dam hazard.*
Population at Risk (PAR)	Persons at dwellings or other places where people congregate for extended periods that, as a result of a *dam failure event*, are impacted by flooding or increased flooding.
Probable Maximum Flood (PMF)	The theoretical greatest depth of precipitation for a given duration that is, based on meteorological methods of maximisation, physically possible over a particular catchment area.
Referable Dam	A dam, or a proposed dam after its construction, will be a referable dam if: • A Failure Impact Assessment (FIA) 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 this 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 FIA for the dam, AND • The Chief Executive has not, under section 349 of the Act, accepted a FIA 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; for example, 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 (QPS).

1. Introduction

1.1. Context

Under the *Water Supply (Safety & Reliability) Act 2008* (the Act), the owner of a referable dam must have an approved Emergency Action Plan (EAP) for the dam. A dam is referable if a Failure Impact Assessment (FIA) has been carried out and demonstrates that two or more people would be placed at risk if the dam were to fail.

As such, the McKinnon Creek Detention Basin ("the dam") EAP, this document, has been prepared in accordance with Chapter 4 of the Act, the Queensland Interim State Disaster Management Plan 2024-25 (QDMC, 2024), and the Emergency Action Plan for Referable Dam Guideline (RDMW, 2023). The content requirements for EAPs are contained in section 352H of the Act and summarised below.

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 of the dam 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 providing the Chief Executive with an EAP, the owner of the dam must give a copy of the EAP to each local government whose area may be affected by a dam hazard identified in the EAP; and each district group for the EAP.

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 EAP.

Within 30 business days of receiving an EAP, the local government must give the owner of the dam a notice, which states whether it considers the plan to be consistent with its Disaster Management Plan; and if not, provide reason as to why it considers the EAP not to be 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 this dam, have been determined as **Cairns Regional Council LDMG-CR**. The dam owner has provided the LDMG-CR with a copy of the EAP for assessment against the Local Disaster Management Plan – Cairns Region (LDMP-CR).
Section 352HC of the Act states that a district group may review the EAP for consistency with its District Disaster Management Plan. The district group for this dam is **Cairns DDMG**. The dam owner has provided the DDMG with a copy of the EAP for review.

1.2. Purpose

The purpose of this EAP is:

- To capture and articulate the emergency actions taken by the Dam Operator and the Emergency Control Organisation (ECO) personnel in identifying and responding to dam hazards and notifying relevant entities; and
- To minimise where possible, the risk of harm to persons or property if a dam hazard event or emergency event for McKinnon Creek Detention Basin occurs; and
- To identify dam hazards that could occur at McKinnon Creek Detention Basin and the area likely to be affected for each hazard.

It is possible for more than one dam hazard to exist at McKinnon Creek Detention Basin at the one time. In such a circumstance, it may be necessary to act on the procedures within separate sections simultaneously. Emergency response personnel should always maintain situational awareness and exercise their best judgement in their response. The safety of the public and all emergency response personnel should not be compromised in implementing this EAP.
The focus of this EAP is the management of dam hazards at McKinnon Creek Detention Basin and the communication and notification of dam hazards to the LDMG-CR, DDMG, and the broader Cairns community. However, it should be acknowledged that the EAP sits within the broader emergency response framework and has been developed to be consistent with the LDMP-CR.

1.3. Scope

The scope of this EAP covers:

- Dam hazards;
- 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 event or emergency event;
- Triggers for activation of a tiered response to a dam hazard event or emergency event;
- Roles and responsibilities in responding to a dam hazard event or emergency event;
- Business as usual (BAU) resourcing;
- Notification, warning, and communication protocols;
- Inspection, monitoring, and reporting protocols during and after emergencies; and
- Identification of the areas likely to be affected by a dam hazard.

1.4. Training & Exercises

All personnel with responsibilities under this EAP are to undergo training at various times throughout the year. This is to ensure that EAP activation triggers and roles and responsibilities are known and understood, namely:

- How notification, assessment, and activation will occur;
- What facilities and resources will be used;
- How the team will function and communicate during an event;
- What key decisions each role may need to make; and
- Awareness of the complexities associated with managing a dam hazard event or emergency event.

EAP training exercises are conducted annually and facilitated by the Business Performance & Compliance (BPC) Branch of Cairns Regional Council (CRC) with assistance from the Local Disaster Coordinator (LDC) to engage with the LDMG-CR. The BPC Branch of Cairns Regional Council will also initiate additional training activities to further support the Emergency Control Organisation (ECO) members. These include the Queensland Disaster Management Arrangements (QDMA) training, Dam Safety Surveillance training, and training sessions on the use of the relevant incident management and communications tools used during dam hazard events or emergency events.

When training is provided, attendance records are maintained within individual employee Human Resources files and branch-specific skills and training matrices. Table 1 below outlines the minimum training required to undertake EAP tasks for ECO members and relevant personnel. Where ECO members are appointed prior to completing training, those members will be provided with internal awareness training and scheduled for the next available formal training session.

Table 1 - Dam Safety Training Matrix

Training Requirement	Who
QDMA (every 3 years)	ECO members Personnel providing support during a dam emergency
Dam Safety Surveillance Training (every 5 years)	ECO members Personnel providing support during a dam emergency
Referable Dam Induction (upon commencement of relevant role)	ECO members Personnel providing support during a dam emergency
EAP Exercise Participation (annually)	ECO members Personnel providing support during a dam emergency
Whispir (annually)	ECO members Personnel providing support during a dam emergency
Internal Communications Platform training (at least annually)	ECO members Personnel providing support during a dam emergency
Fatigue Management Awareness Training	ECO members Personnel providing support during a dam emergency

2. Roles and Responsibilities

2.1. Normal Operations – Business as Usual

Roles and Responsibilities	Position Holder
Cairns Regional Council Councils have legislated local government functions, as per section 80 of the *Disaster Management Act 2003.* Functions under this Act include: • Ensure it has a disaster response capability. • Approve its Local Disaster Management Plan (LDMP). • Ensure information about an event or a disaster in its area is promptly given to the DDMG for the relevant disaster district. • Perform other functions given to the local government. • As per section 352HB of the Act, assess the EAP (in consultation with the LDMG-CR) for consistency with the LDMP-CR.	Cairns Regional Council Office of the CEO / Disaster Management Unit
Dam Owner / Dam Operator • Develop and maintain an EAP. • Respond in accordance with the approved EAP in all dam-related emergencies. • Review and seek approval for updated EAPs as required, to ensure it remains current and includes up to date contact details for relevant parties. • Distribute current approved EAP to all parties identified in the controlled distribution list. • Conduct regular onsite monitoring and visual inspections of the conditions at the dam. The dam operator is responsible for conducting a safety evaluation of the dam and to identify any deficiency in the dam's safety. Where deficiencies exist, the dam operator is required to take appropriate steps to minimise the potential risk of dam failure from those deficiencies. • Ensure notification contact lists remain current. • Where applicable, make appropriate dam safety-related decisions based on advice from an experienced and suitably qualified dam engineer. The dam operator is also responsible for authorising immediate expenditure so that urgent repair work will not be delayed. • Report incidents and failures at the dam to the Dam Safety Regulator (DSR) in accordance with the EAP and Dam Safety Conditions Schedule. • Activate the EAP and maintain an incident log when an emergency condition is identified at the dam. • Conduct periodic testing of the EAP. • Prepare an Emergency Event Report (EER) and submit to the DSR within 30 business days after the end of the emergency event. • Ensure a debrief is undertaken to capture any learnings from the emergency event. • During an event, ensure the status of the dam is reported in accordance with the EAP.	Cairns Infrastructure & Assets Directorate, Cairns Regional Council

Roles and Responsibilities	Position Holder
• Ensure adequate resources are allocated to meet dam safety regulations and to respond to a dam emergency. • Actively participate in LDMG-CR meetings and disseminate relevant information regarding dam emergency response as appropriate. • Manage regional water security objectives and activate contingency plans if necessary.	
Disaster Management Groups **LDMG-CR** • As per Inspector-General Emergency Management (IGEM) review recommendation, work together with the dam owner to ensure community education around messaging and impacts of EAP-related events is undertaken and continually improved. • Work with the dam owner to ensure the EAP is regularly exercised. • Identify and coordinate the use of resources and support services that may be required for an EAP event. The dam owner will activate the EAP for safety events unique to the dam. • During a dam hazard event that reaches Stand Up activation level, the LDMG-CR will take the lead role in notifying the broader community. • Identify and provide advice to the relevant DDMG about support services required by the LDMG-CR to manage an EAP event. • Provide reports and make recommendations to the relevant DDMG about EAP event matters. • Participate in ECO training and exercises. • Conduct annual reviews of National Emergency Alert System (NEAS) polygons and Emergency Alert (EA) request forms. • Send NEAS polygons and EA request forms to the State Disaster Coordination Centre (SDCC) Watch Desk to ensure these have been uploaded into the system prior to the annual wet season. • Collaborate with relevant key stakeholders within CRC and the LDMG-CR to ensure NEAS polygons and EA request forms are prepared, stored, and tested by the SDCC Watch Desk. **DDMG** • Review the EAP for consistency with the District Disaster Management Plan (DDMP).	LDMG-CR
Dam Safety Regulator (DSR) • Liaise with relevant Minister on necessary actions; • Assess and approve this EAP as required under legislation; • Liaise with Chief Executive as required in administering (regulating) the Act.	RDMW

Roles and Responsibilities	Position Holder
Dam Technical Advisor (DTA) • Maintain current Registered Professional Engineer of Queensland (RPEQ) accreditation and specialisation in dam safety engineering; • Provide structural and hydrological advice with respect to a dam hazard or emergency event when requested; • Record communications and provide to CRC as required; • The Dam Safety Team at RDMW can be contacted for dam expert advice if required.	Consultant / RDMW

2.2. Dam Operator – Business as Usual

Roles and Responsibilities
Associate Director Service Delivery • Ensure the dam is operated and maintained in line with regulatory requirements and provide executive oversight of the Referable Dam Safety Management Program.
Associate Director Engineering Services • Provide adequate operational resources to respond to a dam emergency. • Deliver capital works projects to maintain the safety of the dam and associated structures.
Executive Manager Works • Provide adequate operational resources to respond to a dam emergency. • Provide resources to support maintenance of dam assets. • Actively participate in Referable Dam Steering Committee meetings and disseminate relevant information regarding dam emergency response as appropriate. • Ensure regular onsite monitoring and visual inspections of the conditions at the dam are undertaken by appropriately trained and experienced personnel. • Maintain a current Operation & Maintenance Manual (O&M Manual).
Executive Manager Business Performance & Compliance • Provide adequate operational resources to respond to a dam emergency. • Coordinate collaboration with local and district disaster management groups and relevant entities regarding EAP reviews and communication with Population at Risk (PAR). • Ensure adequate support and resourcing is provided for all EAP-related training and exercise requirements. • Ensure the EAP, this document, is reviewed in accordance with statutory timelines. • Ensure relevant procedures are available and up to date. • Ensure contact lists are checked and updated at least annually and upon any changes. • Consult with CRC Marketing & Communications and Engagement Units to ensure communication to identified PAR and the broader Cairns community of CRC educational information for McKinnon Creek Detention Basin, its risks, and associated dam emergency arrangements. • Manage regulatory compliance of the Referable Dam Safety Management Program. • Maintain the Internal Communications Platform to be used in a dam emergency.

Roles and Responsibilities
Executive Manager Strategic Asset Management & Planning • Ensure dam safety inspections are undertaken in accordance with Dam Safety Conditions Schedule. • Ensure a formal agreement with the DTA is in place and up to date to request advice at short notice when required. • Maintain a current Dam Data Book.
Executive Manager Asset Services • Ensure adequate maintenance of dam assets is undertaken at the required frequency.
Executive Manager Marketing & Communications • Ensure Australian Warning System (AWS) Media Release templates are current and up to date. • Ensure Referable Dam information is kept current and up to date on Cairns Regional Council's website and the Cairns Disaster Dashboard. • Manage day to day communications with Population at Risk (PAR) outside of an event. • Review and approve messages to PAR via Cairns Alert and Whispir communications platform.

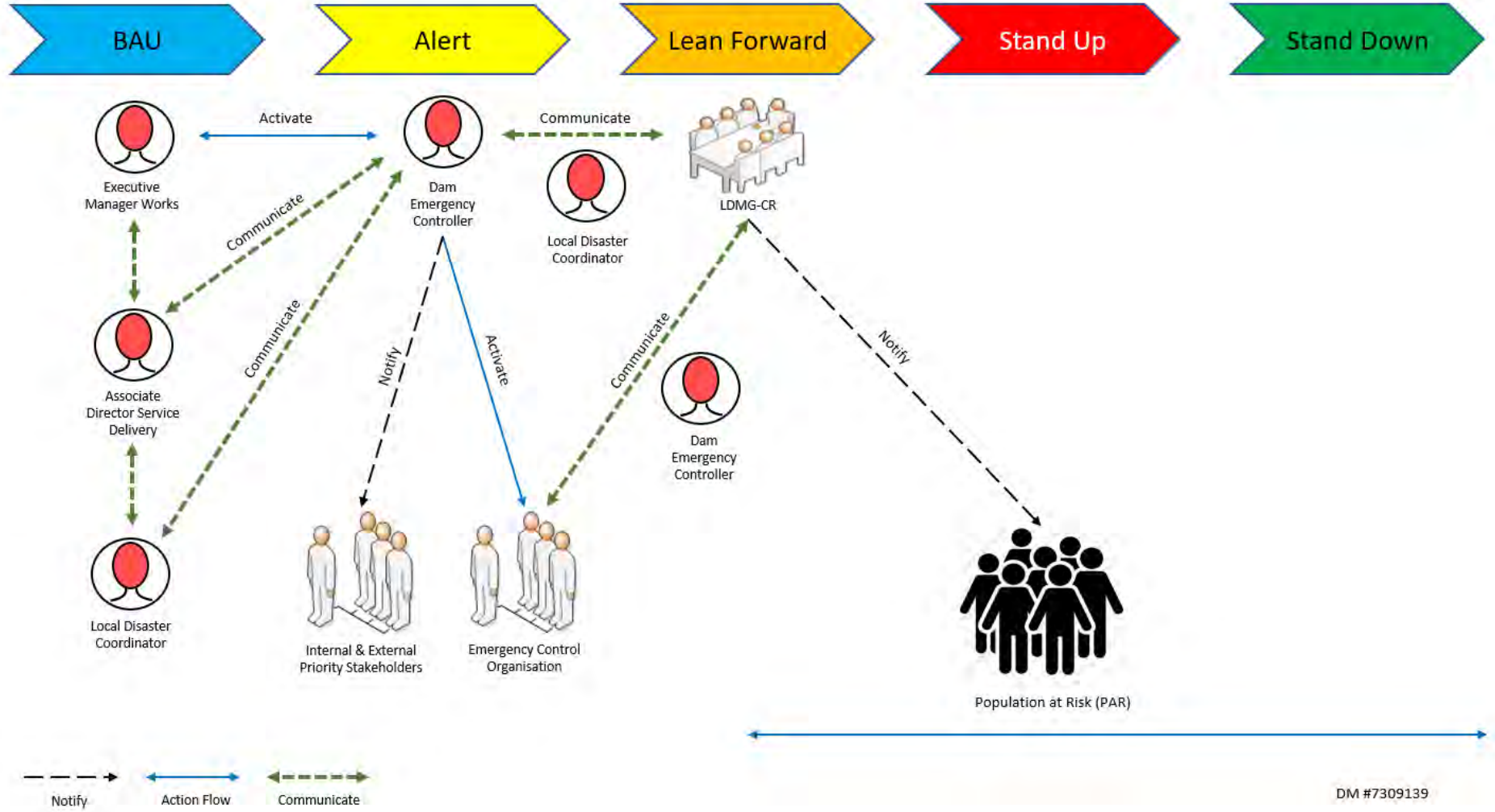
2.3. Dam Emergency Roles

CRC has an emergency response framework implemented for McKinnon Creek Detention Basin. Figure 1 below has been developed to ensure roles and responsibilities are clearly understood, including those of the support agencies available to engage the LDMG-CR resources during a dam emergency. This framework is aligned to disaster management principles and emergency management standards.

2.4. Emergency Control Organisation

An Emergency Control Organisation (ECO) has been established to monitor, assess, and report on the condition of McKinnon Creek Detention Basin during a dam hazard event or emergency event. The ECO consists of three roles; the responsibilities of each which are outlined in Section 3.1 below. ECO primary and alternate role holders are identified, with positions and names correct at the time of approval; however, for the most up-to-date contact details, refer to Appendix L. The identified role holders may, as necessary, delegate assigned tasks to other appropriately trained and experienced personnel. It may be necessary to support the ECO with additional support personnel during a dam hazard event or emergency event. The ECO works closely with the LDMG-CR and CRC management to ensure coordination of response, effective use of resources, and provision of information during an emergency event.

Figure 1 - McKinnon Creek Detention Basin EAP – Emergency Response Framework



3. Emergency Response Framework

3.1. CRC and ECO – Dam Emergency Event

Table 2 - CRC Roles and Responsibilities During a Dam Emergency Event

CRC Roles and Responsibilities
Director Cairns Infrastructure & Assets • Provide event interface between CRC Executive Leadership Team and the ECO. • Ensure all ECO roles are fulfilled to respond to an event.
Associate Director Service Delivery • Provide expert advice and technical support to the LDMG-CR. • Stay abreast of PAR evacuation status from LDMG-CR and advise ECO accordingly. • Provide support to ECO in preparing the EER within regulatory timeframes. • Continuously report the status of the dam and the event in accordance with the EAP.
Associate Director Engineering Services • Ensure all dam safety engineering functions applicable to the emergency event are provided. • Provide expert advice on dam safety engineering aspects of emergency response. • Liaise with Associate Director Service Delivery on emergency operations.
Executive Manager Business Performance & Compliance • Ensure timely and accurate notifications to all parties mentioned in the notification list in the event of a dam emergency. • Provide support to ECO during a dam emergency, taking into consideration CRC's Fatigue Management Policy. • Provide support to ECO in preparing the EER within regulatory timeframes.
Executive Manager Marketing & Communications • Prepare and distribute information to PAR (on request of LDC) using available platforms. • Prepare and distribute information to broader Cairns community (on request of LDC) using available platforms. • Prepare and distribute information to the media and facilitate media requests. • Maintain CRC's digital platforms with the latest dam emergency information.
Executive Manager Strategic Asset Management & Planning • Provide adequate operational resources to respond to a dam emergency event. • Ensure adequate maintenance of McKinnon Creek Detention Basin assets. • Ensure pathway is available to engage external engineering consultants as Dam Technical Advisor (DTA) where required during a dam emergency event.
Senior Engineer Dams • Maintain current Registered Professional Engineer of Queensland (RPEQ) accreditation and are experienced in dam engineering. • Provide structural and hydrological advice with respect to a dam hazard or emergency event when requested.

CRC Roles and Responsibilities
• Undertake site inspections when safe to do so in response to a developing dam hazard event or emergency event. • Liaise with external engineering consultants engaged as DTA as necessary to provide technical support during and after a dam emergency event. • Provide expert advice to the Dam Emergency Controller (DEC) on engineering decisions relating to dam safety during a dam hazard event or emergency event.

Table 3 - ECO Roles and Responsibilities During a Dam Emergency Event

ECO Roles and Responsibilities	Position Holders
Dam Emergency Controller (DEC) • Nominate a DEO to monitor and report on the condition of the dam during a dam emergency event. • Lead the ECO during a dam emergency event. • Dial "000" if dam failure imminent. • Coordinate notification to PAR through LDMG-CR. • Specific tasks as per actions tables in Sections 6 to 11.	Executive Manager Works Construction Engineer / Coordinator Coordinator Maintenance South
Dam Emergency Observer (DEO) • Assist the DEC in the management of the response to a dam emergency event. • Monitor and report on the condition of the dam and manage access to the area during a dam emergency event. • Specific tasks as per actions tables in Sections 6 to 11.	Team Leader Works South B Technical Officer MMS
Dam Emergency Compliance Coordinator (DECC) • Assist the DEC to meet all internal and external compliance obligations. • Provide requested support to the DEC and DEO. • Establish and maintain all communications with the DSR. • Specific tasks as per actions tables in Sections 6 to 11.	Executive Manager Business Performance & Compliance Team Leader Quality & Compliance Quality & Dam Safety Systems Officer

3.2. Other Agencies

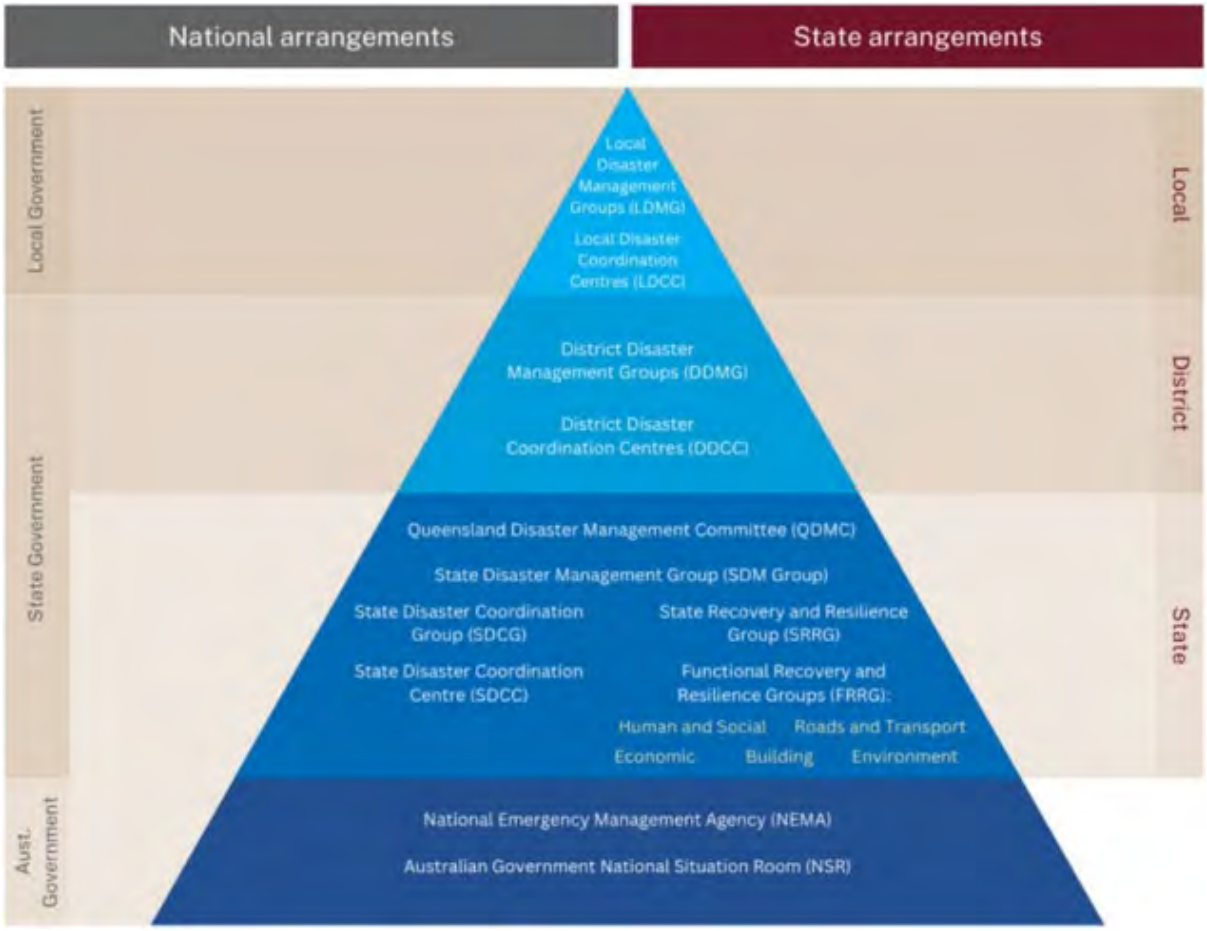
While the Dam Operator and ECO undertake specific dam emergency related actions, CRC acknowledges that a coordinated response to any emergency, whether dam related or not, serves to provide the highest level of structure. CRC therefore follows the QDMA structure as per Figure 2 below.

Roles and Responsibilities	Position Holder
Local Disaster Coordinator **Role:**	Disaster & Community Resilience Manager

Roles and Responsibilities	Position Holder
• Activate the LDMG-CR to act on reports from the ECO during a dam hazard event or dam emergency event. **Responsibilities:** • Initiate an extraordinary meeting of the LDMG-CR Executive when notified that the dam EAP has been activated. • Brief the LDMG-CR Executive on the situation. • Activate the relevant LDMP-CR sub plans. • Activate the Local Disaster Coordination Centre (LDCC). • Once the LDMG-CR has been activated, the responsibilities of the LDC are in accordance with the LDC Operational Checklist and the approved LDMP-CR.	
<u>Local Disaster Management Group – Cairns Region</u> **Role:** • Once the LDMG-CR has been activated, coordinate the response and recovery actions and joint agency responses during a dam emergency event. **Responsibilities:** • Activate LDMG-CR when requested by LDC (if concurrent flooding has not already resulted in the activation of the LDMG-CR). • Communicate with PAR and the broader Cairns community during a dam emergency. • Undertake strategic decision making to assess the requirement to evacuate PAR. • Issue voluntary evacuation advice to PAR. • Request directed evacuation through the Cairns DDMG. • Manage the recovery of PAR (voluntary and directed).	Chairperson LDMG-CR
Role: Upholding the law and providing assistance to the community particularly in times of emergency, disaster and crisis. Responsibilities: • Manage the situation based on local operational procedures and LDMP, including but not limited to: • Provide evacuation support if required directly where LDMG has not stood up yet, • Conduct emergency operations -Provide point of contact (Counter Terrorism Liaison Officer) is possible terrorism situation, • Coordinate and support Dam Owner through LDMG during a declared emergency at the dam, • Liaise with relevant organisations, • Support LDMG to provide evacuation assistance if required, Control of essential traffic, and Providing security support for LDMG as required.	Queensland Police Service – Northern Region

3.3. Queensland Disaster Management Arrangements

Figure 2 - Queensland Disaster Management Arrangements



4. Dam Details

4.1. General Details

Location: McKinnon Creek Detention Basin is situated on Lot 500 RP 887878 & Lot 985 RP 906385 Edmonton, Cairns QLD 4869, approximately 15 kilometres south of Cairns.
Access: Access to McKinnon Creek Detention Basin is via the access driveway between [redacted] or the pathway access between [redacted] Edmonton Cairns QLD 4869.
Construction: McKinnon Creek Detention Basin was constructed in 2000 to provide suitable detention of floodwater to temporarily mitigate floods. McKinnon Creek Detention Basin is a zoned earth and rockfill dam with a clay core embankment and filters with a side channel reinforced grass spillway and uncontrolled flow outlet pipes (conduits).
Specifications: The tables below list general specifications of McKinnon Creek Detention Basin.

4.1.1. McKinnon Creek Detention Basin Specifications

Table 4 - McKinnon Creek Detention Basin Specifications

Description	Specification
Full Supply Level (FSL)	43.0 m AHD
Storage Capacity at FSL	131.7 ML
Dam Crest Level (DCL)	44.0 m AHD
Dam Crest Length	180 m
Crest Width	7 m
Dam Height Above Foundation	8.8 m (approximately) above downstream toe
Catchment Area	1000 hectares (10km^2)
Surface Area	4.3 Ha
Spillway Type	Geotextile reinforced grass spillway
Spillway Crest Height	43 m AHD
Spillway Width	100 m
Spillway Capacity	160 m^3/s (approximately the Probable Maximum Flood discharge)
Outlet Description	Dual 1950mm RRJ reinforced concrete pipes with gabion mattress lined channel
Outlet Capacity	50 m^3/s (@RL 43 m AHD) at FSL
Operational Control	There are no operational controls built into the McKinnon Creek Detention Basin, therefore there cannot be any manual changes applied to control flows through the low-flow pipe or over the spillway. A remote monitoring system including CCTV to monitor rainfall and storage levels is installed, with further details provided in Appendix G. McKinnon Creek Detention Basin is monitored by CRC personnel with routine maintenance inspections undertaken at the required frequency.

Table Notes: All levels are to Australian Height Datum (AHD). Refer to current approved version of the Dam Data Book for further specifications DM #7010769.

4.1.2. Detail and Locality Map

Figure 3 - McKinnon Creek Detention Basin Locality Map

DO NOT SCALE

P.O. Box 359
Cairns QLD 4870
Tel: (07) 4044 3044
Fax:(07) 4044 3022

McKinnon Creek Detention Basin Detail and Locality Map

GDA

Plan: McKinnonCrkDetB

File: G:\Work Requests\ServiceNow\TASK0086578_CRyan_McKinnonCk_DetBasinLocalityMap\McKinnon.WOR

Author: WD

Date: 06/12/2023

Sheet: 1 of 1

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4.2. Population at Risk

A Failure Impact Assessment (FIA) undertaken in 2021 determined that McKinnon Creek Detention Basin met criteria and was rated a Category 1 Referable Dam under the Act with a Consequence Category of High C. This is based on an incremental Population at Risk (PAR) between 2 and 100 and a medium severity of damage and loss under a standards-based assessment. Total PAR figures for McKinnon Creek Detention Basin are calculated for persons at risk when a no-failure flood event accompanies a dam failure event. Incremental PAR figures are calculated for persons who are not at risk from a flood but are placed at risk when the same flood accompanies a dam failure event.

The relevant failure scenarios for McKinnon Creek Detention Basin are related to the main embankment. The largest breach flow, or the Basin's critical event, resulting from these failure modes was found to be the embankment wall piping failure at the location of the outlet conduit upstream invert to the outlet conduit downstream invert, following the alignment of the pipe splay in the 0.05% Annual Exceedance Probability (AEP) event (1 in 2,000-year event). The second largest breach flow resulting from these failure modes was found to be the embankment wall piping failure at the location of the outlet conduit directly across to the parallel overflow channel in the 0.1% AEP event (1 in 1,000-year event). A summary of the PAR estimates reported by the FIA (Water Modelling Solutions, 2021) is provided in Table 5 below. The events with the largest breach flows resulting from these failure modes that have been catered for within this document for McKinnon Creek Detention Basin are:

Scenario 1:

- Embankment wall piping failure from the conduit inlet to the conduit outlet in the 0.05% AEP event.

Scenario 2:

- Embankment wall piping failure from the conduit inlet directly through the embankment in the 0.1% AEP event.

Scenario 3:

- Embankment wall piping failure from the conduit inlet directly through the embankment in the Probable Maximum Flood (PMF) event.

A Sunny Day Failure (SDF) event has not been considered as the McKinnon Creek Detention Basin holds no permanent water storage and as such would be dry in such a scenario.

Table 5 - Summary of Population at Risk (PAR)

Emergency Event	Total PAR	Incremental PAR
Scenario 1: 0.05% AEP Embankment Failure	398	58
Scenario 2: 0.1% AEP Embankment Failure	298	53
Scenario 3: PMF with Embankment Failure	1,593	0

4.3. Community Awareness and Engagement

CRC, in conjunction with the LDMG-CR and Disaster Management Unit, is committed to engaging with the Cairns community to increase public awareness and build community resilience around real and potential local hazards, through ongoing disaster education campaigns and projects. Specific engagement to prepare PAR in the Edmonton area for the unlikely event of a dam-related emergency at McKinnon Creek Detention Basin includes raising awareness of and familiarising the community with community warning systems used in Section 11.5; the primary systems being the National Emergency Alert System (NEAS), the Australian Warning System (AWS) and other secondary platforms being the Cairns Disaster Dashboard and Cairns Alert.

4.4. Flood Adequacy

4.4.1. Acceptable Flood Capacity

The Acceptable Flood Capacity (AFC) is the flood event the dam spillway must have the capacity to pass without causing failure of the dam. AFC is generally expressed as a flood with a specific AEP. The AFC for McKinnon Creek Detention Basin was assessed based on the findings of the FIA (WMS, 2021) and is determined to be the 1 in 57,500 AEP event based on the requirements outlined in the *Guidelines on the Consequence Categories for Dams* (ANCOLD, 2012) and the *Guidelines on Safety Assessments for Referable Dams* (RDMW, 2021).

4.5. Inundation Mapping

4.5.1. Statement of Limitations

Whilst every care has been taken to prepare the inundation maps contained within this document, CRC make no representations or warranties about its accuracy, reliability, completeness, or suitability for any particular purpose and disclaims all responsibility and all liability (including, without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which may be incurred as a result of the product being inaccurate or incomplete in any way and for any reason.

4.5.2. How to Use the Maps

The inundation maps contained within this document provide an indication of potential flood inundation resulting from a failure of the McKinnon Creek Detention Basin. Determining the extent of these flood inundations involves complex modelling techniques that contain considerable uncertainties. These maps have been developed to assist emergency event response and evacuation. The purpose of these maps is to provide a guide that allows emergency response personnel to understand the potential areas that may be impacted by a dam failure scenario.

A dam failure may cause considerable damage to the road network downstream of the McKinnon Creek Detention Basin due to flood levels, high velocities and debris that could potentially be generated by the failure. Therefore, for emergency event planning purposes, it should be assumed that all roads within the inundation extents on the following maps would be rendered unserviceable should a failure of the McKinnon Creek Detention Basin occur.

These maps do not define property flood risks and do not in any way relate to flooding potential associated with natural flood events that do not involve a failure of the McKinnon Creek Detention Basin. Furthermore, these maps do not define the probability of a flood or the probability of a failure of McKinnon Creek Detention Basin. The risk of failure of McKinnon Creek Detention Basin is very low.

In an actual dam failure scenario, the time to peak inundation will be heavily influenced by factors that cannot be predicted with any degree of certainty. Such factors include the specific nature of the failure, the speed at which the failure develops, the size of the dam breach, and concurrent rainfall and associated flooding within the catchment area.

4.5.3. List of Inundation Maps

Click the maps below to navigate.

1. 0.05% AEP Piping Failure Flood Depth Map
2. 0.05% AEP Piping Failure Flood Afflux Map
3. 0.05% AEP Piping Failure Total PAR Location Map
4. 0.1% AEP Piping Failure Flood Depth Map
5. 0.1% AEP Piping Failure Flood Afflux Map
6. 0.1% AEP Piping Failure Total PAR Locations
7. PMF Embankment Failure Flood Depth Map
8. PMF Embankment Failure Flood Afflux Map
9. PMF Embankment Failure Total PAR
10. PMF (Without Dam Failure) Flood Depth Map

4.6. General Arrangement

The following general arrangement drawings for McKinnon Creek Detention Basin are in Appendix D:

- Drawing No. 20461-3: Site Plan
- Drawing No. 20461-4: Detail Plan – Spillway Retaining Wall & Channels
- Drawing No. 20461-10: Typical Dam Wall Make Up Details Pt 1
- Drawing No. 20461-11: Typical Dam Wall Make Up Details Pt 2

4.7. Inspections and Monitoring

The frequency of routine inspections and monitoring of McKinnon Creek Detention Basin have been determined based on the very low probability of failure of the dam. Monitoring requirements are documented in the McKinnon Creek Detention Basin Operation & Maintenance Manual (O&M Manual) #6974230 which contain detailed schedules. The following is applicable to McKinnon Creek Detention Basin to maintain the structure in a safe condition and enable the rapid detection of any potential dam hazards as soon as a hazard begins to develop or becomes apparent.

4.7.1. Inspections

- Routine visual inspection – conducted monthly by the Technical Officer Maintenance Management Systems and informed by the O&M Manual (refer to Appendix H for sample Inspection Schedule).
- Comprehensive inspection – conducted every five (5) years in accordance with the prescribed McKinnon Creek Detention Basin Dam Safety Conditions Schedule No. 8(b) and *Queensland Dam Safety Management Guidelines* (RDMW, 2020).
- Special inspections – conducted as required if a potential deficiency at the dam is identified or the dam has been through abnormal loading conditions. Special inspections of McKinnon Creek Detention Basin will be undertaken in response to a developing dam hazard event or a significant storm event, defined as any flow event that fully submerges the low flow outlet (nominally 1.8 m in depth).

4.7.2. Instrumentation

The following instrumentation and monitoring are applicable to McKinnon Creek Detention Basin to confirm the structural behaviour and safety of the main dam embankment and spillway. The location of instrumentation and monitoring equipment are detailed in the above Section 4.1.2 *Figure 3 – Detail and Locality Map.*

4.7.2.1. Settlement/Movement Measurement

To observe any physical movement occurring in the embankment that would lead to instability, there are three (3) settlement pins installed on the embankment crest. These monitoring points are surveyed every 2 years or more frequently when requested by the Senior Engineer Dams. The survey pickup is completed by a qualified surveyor.

4.7.2.2. Spillway Conditions

Remote visual monitoring of the spillway and embankment can be undertaken through the Closed-Circuit Television (CCTV) camera installed on the embankment crest above the low flow pipes.

4.7.2.3. Reservoir Water Levels

The reservoir water level is primarily monitored through an electronic level transmitter with the data able to be accessed remotely. There are also manual gauge boards installed for visual observation if the level transmitters are unavailable.

4.7.2.4. Automatic and Manual Gauges

Automatic Gauges: One (1) automatic gauge located at the base of the inlet to the low flow pipes, connected to, and continuously monitored by the CRC flood monitoring system.
Manual Gauges: Five (5) gauge boards located on the upstream slope of the embankment visible from the right-side embankment crest and on CRC's CCTV camera.

4.7.2.5. Rainfall

Rainfall levels are monitored and recorded onsite at the McKinnon Creek Detention Basin via an automatic rain gauge located on communications and CCTV tower on the embankment crest.

5. Dam Hazard Identification

The following dam hazard events may impact on the identified PAR and require activation of this EAP:

- Flooding;
- Embankment Failure;
- Terrorist Threat or Malicious Activity;
- Non-Flood Related Events:
  - Earthquake;
  - Cracking or other signs of abnormal behaviour;
  - Blockage of the low flow pipe.

Other Emergency Situation:

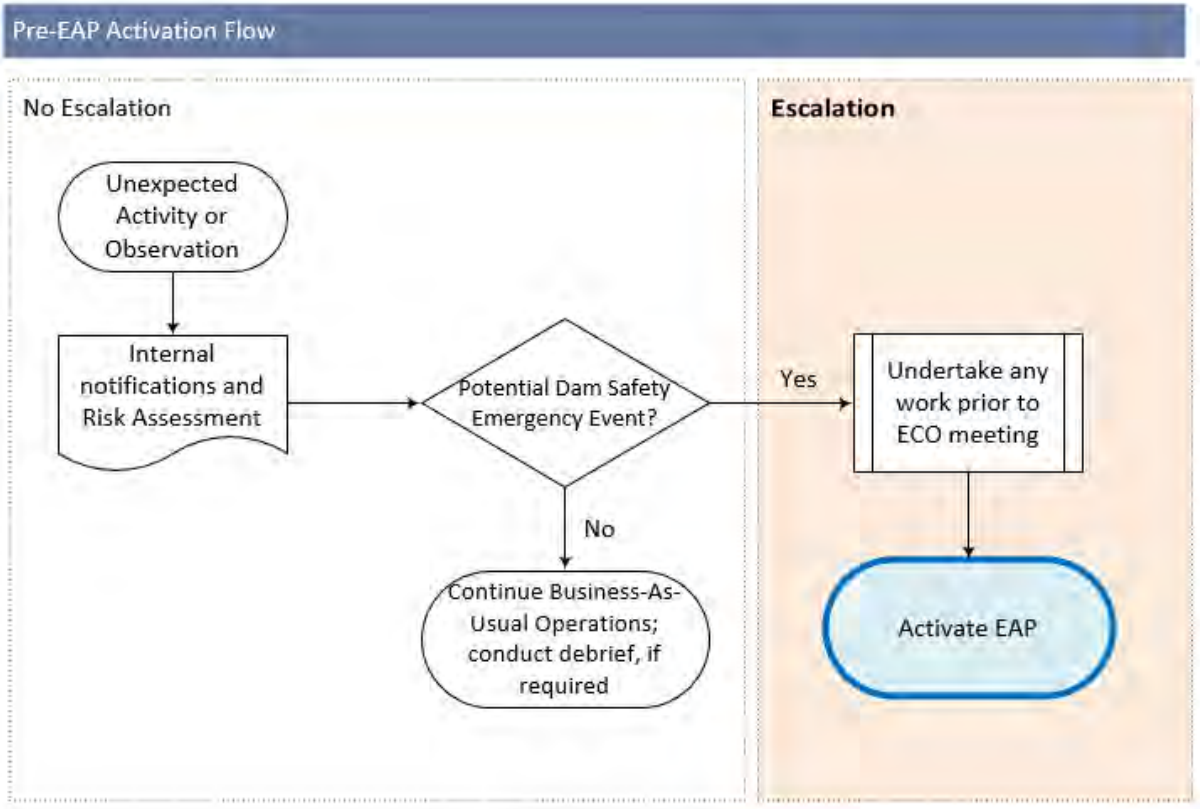
- Communications Failure.

The EAP activation response protocols for each dam hazard are further explained in the following sections along with the associated communication protocols for notifying internal and external key stakeholders, and downstream PAR.

5.1. Escalation of Unusual Activity

In accordance with the *Queensland Dam Safety Management Guidelines* (RDMW, 2020) threats to the safety of McKinnon Creek Detention Basin, whether they are potential or confirmed threats, are escalated via internal notification protocols further described in the O&M Manual #6974230.
Risks should be appropriately assessed in consultation with the Local Disaster Coordinator and escalated in accordance with the EAP activation triggers. Each event is unique in circumstance and the ECO may elect to activate the EAP before triggers are reached if deemed necessary.

Figure 4 - Escalation of Unusual Activity



6. Dam Hazard – Flooding

6.1. Overview

The EAP activation response protocols described in this section relate to rainfall-derived inflows to the McKinnon Creek Detention Basin causing temporary water level rises that could result in the following flood conditions:

- Increased loads on the dam embankment and critical infrastructure resulting in an increased likelihood of failure;
- Continuing storage level rises leading to the overtopping of the embankment, resulting in an increased likelihood of embankment failure;
- Rapidly increasing spillway discharges from the Basin or spillway discharge levels greater than those that cause downstream flooding.

The McKinnon Creek and Collinson Creek catchments are relatively small with short times of travel for flood flows to the McKinnon Creek Detention Basin and the Bruce Highway. Storage releases from the McKinnon Creek Detention Basin can occur via both the low flow conduit and the spillway and are uncontrolled during weather events (as the Basin does not have installed flood gates or valves, there is no existing mechanism to control the release of water).
The properties at risk from flooding as shown in Appendix E are generally along McKinnon and Collinson Creeks bounded by Mount Peter Road, Badilla Street, and Fuller Park to the north, and Shaft Street and Zarr Street to the south. Residents in the downstream area experience flooding in their streets from McKinnon Creek overbank flows and from the Collinson Creek catchment during rainfall events greater than a 1 in 10-year ARI (10% AEP), with the Basin operating below spillway level.

6.2. Assessment of the Hazard

Very heavy rainfall and extensive flooding can occur throughout the Cairns Local Government Area, and whilst the McKinnon Creek Detention Basin spillway does not activate until the 1% AEP event (1 in 100-year) event, when a localised flooding event develops in the Edmonton area that could potentially affect the McKinnon Creek Detention Basin, cooperation between CRC and the LDMG-CR must be maintained. In any such event, it is expected that the LDMG-CR and supporting agencies will already be activated under the LDMP-CR in response to concurrent flooding in the catchment area not related to the Basin's spillway conditions.
In the below scenarios, significant rainfall is occurring in the dam catchment causing storage levels to rise rapidly with abnormally high spillway discharge expected. The activation status of the EAP (this document) will change depending on the amount of rainfall and water levels within the catchment area. The activation of Stand Up requires consideration of potential overtopping: if the rainfall forecast indicates the dam crest level will be reached, then Stand Up will be triggered.

The EAP activation response protocols for a flood event are detailed in the below Table 6 along with the associated communication protocols for notifying internal and external key stakeholders, and downstream PAR.

6.3. Understanding the Dam Hazard – Flooding EAP Activation Triggers

Alert:
When rainfall corresponds to a 1 in 20-year ARI, or 5% AEP event, the Basin is likely to commence filling with the potential for significant discharges to occur through the low flow pipe. Whilst this scenario may present a potential hazard to users of the open space inside the Basin, such a scenario

does not necessarily result in the need for the activation of this EAP. If, however, such rain occurs over a shorter timeframe, the magnitude of the storm and consequent flooding could be greater. In a scenario such as this, surveillance monitoring of the Basin will be conducted via the remote monitoring station (refer to Appendix G for further details) or by onsite personnel who can access the best vantage points for monitoring the earth dam crest via the vacant Canecutter Road lot and along the ridge line against the Canecutter Road property boundaries. Once storage levels reach 1.15m below the spillway (41.85m AHD or 7.8m Gauge Datum), the EAP (this document) will be activated to Alert by the ECO who will then commence the relevant activation response protocols in accordance with Table 6 below.

Lean Forward:

The 1 in 100-year ARI (1% AEP) event generates flows which will cause storage levels within the Basin to rise and result in spillway activation once the Full Supply Level (FSL) has been exceeded. In this scenario, the EAP will be activated to Lean Forward once storage levels reach the spillway crest (43m AHD or 8.95m Gauge Datum). Flows generated by spillway activation during a 1% AEP event are generally contained within the McKinnon Creek from the Basin down towards Mount Peter Road, but will coincide with concurrent flooding conditions in the downstream catchment area; which from Mount Peter Road to the Bruce Highway, may cause over-bank flows, creek breakouts, and property inundation. When spillway flows equate to 300mm above FSL, 700mm of freeboard remains before overtopping of the lower western abutment occurs.

Stand Up:

When storage levels reach the Dam Crest Level at 1m above the spillway (44m AHD or 9.95m Gauge Datum) the EAP will be activated to Stand Up by the ECO. Although unlikely, in this scenario the risk of dam failure increases as continuing water level rises could lead to overtopping of the dam embankment (including spillway). Rising water levels may be attributed to excessive rainfall, or accelerated filling of the Basin if the inlet structure were to become obstructed by debris. Changes to the structural condition of the dam the embankment (including spillway), such as observed damage or embankment toe erosion, during such a scenario may trigger emergency response protocols under Section 7 of this EAP.

Stand Down:

In this scenario, flooding within the catchment area is receding with no significant rainfall occurring since drawdown, and no further significant rainfall is forecast for the catchment area. Storage levels in the Basin have fallen below the spillway, and discharges are being controlled by the outlet pipe conduit; or the Basin may no longer be impounding water. Any contamination has been contained and/or any blockages have been cleared from the low flow conduit.

6.4. Flooding – EAP Activation Response Protocols

Table 6 - Flood Event Response Protocols

Activation Level	Alert	Lean Forward	Stand Up	Stand Down
Activation Trigger	Storage at 1.15m below spillway and rising (41.85m AHD or 7.8m Gauge Datum).	Storage reaches spillway crest and rising (43m AHD or 8.95m Gauge Datum).	Storage at DCL - 1m above spillway (44m AHD or 9.95m Gauge Datum).	Storage at 1.15m below spillway and falling, with discharge controlled by pipe conduit.
Internal Stakeholder Notifications Appendix I	Whispir Template #50	Whispir Template #51	Whispir Template #52	Whispir Template #53
External Stakeholder Notifications Appendix I	Contact Priority 1 external agency stakeholder (Appendix L)	Whispir Template #54 Contact Priority 1 external agency stakeholder (Appendix L)	Whispir Template #55 Contact Priority 1 external agency stakeholder (Appendix L)	Whispir Template #56 Contact Priority 1 external agency stakeholder (Appendix L)
PAR Notifications Appendix J Appendix K	Not Applicable.	Emergency Alert #1 AWS Message #1	Emergency Alert #2 and/or #3 AWS Message #2 and/or #3	AWS Message #4
Response Actions ***Note: Changes to dam structure as a result of flooding may trigger EAP activation response protocols under Sections 7 & 8 of this EAP.***				
DEC	• Send EAP activation notification to priority stakeholders. • Schedule and chair ECO meeting if required. • Assign ECO roles. • Confirm SITREP frequency. • Issue SITREP to LDMG-CR. • Confirm Basin is cleared for operations. • Confirm monitoring expectations and rostering.	• As per previous activation level; AND • Issue EAP escalation notification to internal and external stakeholders via email. • Send request to LDMG-CR to issue PAR notifications.	• As per previous activation level; AND • Liaise with LDMG-CR regarding coordination of PAR notifications and evacuation based on expected inundation (Appendix E). • Liaise with Senior Engineer Dams and DTA as required.	• Issue EAP Stand Down notification to priority stakeholders. • Send request to LDMG-CR to issue PAR notifications. • Review, approve, and issue final SITREP to LDMG-CR. • Coordinate inspection by engaged DTA to check for damage and/or propose a program for the undertaking of remedial works as necessary and to the satisfaction of the Dam Safety Regulator.

	• Advise of communication systems status. • Issue situation-specific actions (road/site closure/dam access). • Monitor weather intelligence and forecast for likelihood of escalation. • Confirm with Senior Engineer Dams requirements for engaging Dam Technical Advisor (DTA). • Commence event log. • **If notified by DEO of observed erosion or seepage flows, or changes to dam structure as a result of flooding, determine need to trigger response protocols under Section 7.**			• Prepare Emergency Event Report per Section 14. • Return to routine activities.
DEO	• Attend ECO meeting if required. • **If safe to do so,** attend site and conduct surveillance inspections and monitor onsite rainfall conditions. • Provide updates from inspections to DEC. • **If safe to do so,** prevent public access to Basin and lock the access gate. • Monitor water levels in the Basin (onsite or via remote monitoring). • **If safe to do so,** check for erosion downstream of the Basin and notify DEC. • **If safe to do so,** check for new or increased seepage flows through the Basin and notify DEC. • Assist DEC with completion of SITREPs.	• As per previous activation level, include matters or information for escalation; AND • Share surveillance inspection report (Appendix H) with DEC	• As per previous activation level, include matters or information for escalation; AND • Check for obstructions; escalate if required to DEC for response.	• Complete and issue final SITREP to DEC. • Assist with preparation of Emergency Event Report per Section 14. • Return to routine activities.

DECC	• Create Operation within Internal Communications Platform. • Attend ECO meeting if required. Record and circulate minutes. • Issue EAP activation notification to key external agencies including Dam Safety Regulator following discussion with DEC. • Provide support to ECO as required.	• As per previous activation level.	• As per previous activation level.	• Issue EAP Stand Down notification to Dam Safety Regulator following discussion with DEC. • Within Internal Communications Platform, finalise Event Log and ensure all documentation and records are accurately recorded within Document Library. • Provide support to ECO as required. • Assist with preparation of Emergency Event Report per Section 14 and submit to Dam Safety Regulator within 30 business days following cessation of event. • Return to routine activities.
ALL	• Record all communication, actions, and event-related documentation within Internal Communications Platform.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.
	ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO. *e.g., taking photographs/video, undertaking dam inspections, taking instrument readings etc.* **ALL PHOTOS MUST BE TIME AND DATE STAMPED.**			

7. Dam Hazard – Embankment Failure

7.1. Overview

The EAP activation response protocols described in this section relate to a potential dam hazard due to a structural failure condition through the McKinnon Creek Detention Basin embankment as a result of piping whilst the Basin is impounding water. Whilst impounding water, an increase in seepage or a new area of seepage is a circumstance that could indicate an increased likelihood of piping through the McKinnon Creek Detention Basin embankment in any of the below scenarios. In a circumstance where a structural condition issue is established and progresses whilst the Basin is impounding water, a dam failure may result. This circumstance shall trigger the EAP activation to Stand Up status for embankment failure. If a structural condition issue is detected whilst the Basin is not impounding water, remedial repairs may be feasible. However, in the event of a serious and developing dam safety issue with significant rainfall forecast for the catchment, it is unlikely that remedial repairs will be possible.

7.2. Assessment of the Hazard

Scenario 1:

In this scenario, embankment failure as a result of piping from the upstream invert of the outlet structure to the downstream invert of the outlet structure, following the general alignment of the outlet structure, is the critical failure event (the event which results in the largest breach flow) for McKinnon Creek Detention Basin during the 0.05% AEP, or 1 in 2,000-year event.

Scenario 2:

In this scenario, embankment failure as a result of piping is likely to occur at the location of the outlet conduit directly across to the parallel overflow channel in the 0.1% AEP or 1 in 1,000-year event.

Scenario 3:

In this scenario, embankment failure as a result of piping is likely to occur at the location of the outlet conduit directly across to the parallel overflow channel in the Probable Maximum Flood (PMF). It is noted that the PMF failure occurs in a different direction to the other events, in a more northerly, overland direction as shown in the afflux mapping (refer to inundation mapping in Appendix E).

Inundation Mapping:

Inundation mapping in Appendix E provides an indicative outline of potentially affected areas in each of the above failure scenarios. In the case of each piping failure scenario, downstream flows are observed to be significantly impacted in the steep areas of the catchment before dissipating once the terrain flattens out and more tributaries converge with McKinnon Creek. Significant impacts are also observed on properties on Canecutter Road and near Mount Peter Road where the creek exceeds its banks. Significant impacts are further observed on important roads including Wiseman Road and Mount Peter Road. In the case of each scenario, the flood wave dissipates quickly once the land flattens out and has an impact less than 200mm by the time it reaches the Bruce Highway.

The inundation maps provided for each scenario are as follows:

- **Scenario 1:** 0.05% AEP event when a dam failure is in progress or likely due to embankment damage as a result of piping from the conduit inlet to the conduit outlet and concurrent flooding or downstream releases are occurring.
    - Flood Depth

- Afflux
- Total PAR

- **Scenario 2:** 0.1% AEP event when a dam failure is in progress or likely due to embankment damage as a result of piping from the inlet conduit directly through the embankment and concurrent flooding or downstream releases are occurring.
  - Flood Depth
  - Afflux
  - Total PAR
- **Scenario 3:** PMF event when a dam failure is in progress or likely due to embankment damage as a result of piping from the inlet conduit directly through the embankment and concurrent flooding or downstream releases are occurring.
  - Flood Depth
  - Afflux
  - Total PAR

7.3. Understanding the Dam Hazard – Embankment Failure EAP Activation Triggers

The EAP activation response protocols for an embankment failure event (refer to above scenarios 1 - 3) are detailed in the below Table 7 along with the associated communication protocols for notifying internal and external key stakeholders, and downstream PAR.

Stand Up:

Signs that the embankment (including spillway) could be damaged and/or the embankment toe is eroding can include:

- Shifting, movement, or erosion of the turf reinforcement mesh forming the dam embankment and spillway;
- Erosion of embankment material on the outside of the spillway sidewalls;
- Erosion of embankment material around the outlet of the low flow pipe;
- Appearance of any new seepage locations or a significantly increased rate of seepage;
- Seepage water appears cloudy/muddy with visible particles; or
- Flows downstream from the structure appear muddy.

The appearance of any of the above during operation of the spillway or whilst the Basin is impounding water indicates that failure of the embankment may be occurring. Immediate action is to be taken to ensure the safety of those monitoring the structure and downstream PAR.

Stand Down:

A risk assessment has determined that the risk of failure has reduced; OR a dam failure has occurred with no further risk to downstream PAR and recovery efforts are underway. Any flooding within the catchment area is receding with no significant rainfall occurring since drawdown, and no further significant rainfall is forecast for the catchment area. Storage levels in the Basin have fallen below the spillway, and discharges are being controlled by the outlet pipe conduit; or the Basin may no longer be impounding water.

7.4. Embankment Failure – EAP Activation Response Protocols

Table 7 - Embankment Failure Event Response Protocols

Activation Level	Alert	Lean Forward	Stand Up	Stand Down
Activation Trigger	Not Applicable.	Not Applicable.	Heavy rain occurring. Basin impounding water. Observed damage to spillway or embankment toe. Observed increased or new seepage through the embankment.	Risk assessment has determined that failure risk has reduced; OR Embankment failure occurred, no further risk to PAR and recovery efforts are underway.
Internal Stakeholder Notifications Appendix I	Not Applicable.	Not Applicable.	Whispir Template #57	Whispir Template #53
External Stakeholder Notifications Appendix I	Not Applicable.	Not Applicable.	Whispir Template #58 Contact Priority 1 external agency stakeholder (Appendix L)	Whispir Template #56 Contact Priority 1 external agency stakeholder (Appendix L)
PAR Notifications Appendix J Appendix K	Not Applicable.	Not Applicable.	Emergency Alert #2 and/or #3 AWS Message #2 and/or #3	AWS Message #4
Response Actions				
DEC	Not Applicable.	Not Applicable.	• Send EAP activation notifications to priority stakeholders. • Send request to LDMG-CR to issue PAR notifications and coordinate evacuation based on expected inundation (Appendix E). • Schedule and chair ECO meeting if required. • Assign ECO roles. • Confirm SITREP frequency. • Issue SITREP to LDMG-CR. • Confirm monitoring expectations and rostering. • Advise of communication systems status.	• Issue EAP Stand Down notification to priority stakeholders. • Send request to LDMG-CR to issue PAR notifications. • Review, approve, and issue final SITREP to LDMG-CR. • Confirm with Senior Engineer Dams requirements for engaging DTA to conduct Special Inspection. • Coordinate inspection by engaged DTA to assess any damage and/or propose a program for the undertaking of any remedial works to the satisfaction of the Dam Safety Regulator.

			• Issue situation-specific actions (road/site closure/dam access). • Monitor weather intelligence and rainfall forecasts. • Commence event log. • If failure pathway identified, issue order for any remaining onsite personnel to evacuate site.	• Prepare Emergency Event Report per Section 14. • Return to routine activities.
DEO	Not Applicable.	Not Applicable.	• Attend ECO meeting if required. • **If safe to do so,** attend site and conduct surveillance inspections and monitor onsite rainfall conditions. • Provide updates from inspections to DEC. • **If safe to do so,** prevent public access to Basin. • Monitor water levels in the Basin (onsite or via remote monitoring). • Assist DEC with completion of SITREPs.	• Complete and issue final SITREP to DEC. • Assist with preparation of Emergency Event Report per Section 14. • Return to routine activities.
DECC	Not Applicable.	Not Applicable.	• Create Operation within Internal Communications Platform. • Attend ECO meeting if required. Record and circulate minutes. • Issue EAP activation notification to Dam Safety Regulator along with phone call, following discussion with DEC and manage ongoing regulatory updates and correspondence. • Provide support to ECO as required.	• Issue EAP Stand Down notification to Dam Safety Regulator following discussion with DEC. • Within Internal Communications Platform, finalise Event Log and ensure all documentation and records are accurately recorded within Document Library. • Provide support to ECO as required. • Assist with preparation of Emergency Event Report per Section 14 and submit to Dam Safety Regulator within 30 business days following cessation of event. • Return to routine activities.
ALL	Not Applicable.	Not Applicable.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.

		ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO. *e.g., taking photographs/video, undertaking dam inspections, taking instrument readings etc.* **ALL PHOTOS MUST BE TIME AND DATE STAMPED.**	

8. Dam Hazard – Terror Threat / Malicious Activity

8.1. Overview

The emergency actions described within this section relate to a potential dam hazard due to a terrorist threat or the occurrence of malicious activity at the dam site. The vulnerability of McKinnon Creek Detention Basin to a terrorist attack is low, however there is critical infrastructure located at the dam site which may be the target of malicious activity; therefore, acts of sabotage or vandalism at the dam site must be responded to accordingly. Such critical infrastructure includes:

- The main embankment and dam crest;
- The spillway and stilling basin;
- The low flow pipe and energy dissipator; and
- The riprap and scour protection upstream or downstream of the embankment.

Due to the nature of the McKinnon Creek Detention Basin, a terrorist threat, or the occurrence of malicious activity at the dam site only represents a risk to the downstream PAR in the event of a significant rainfall and flooding event occurring whilst the dam is in a damaged state. If a dam failure path was identified in such a situation, response protocols per Section 7 above would be enacted accordingly.

Flood mapping in Appendix E provides an indicative outline of potentially affected areas if malicious activity resulted in a catastrophic failure of the dam. The use of flood mapping under this hazard is for the Probable Maximum Flood (PMF) when a dam failure is in progress or likely due to malicious activity and concurrent flooding or downstream releases are occurring or expected to occur.

8.2. Assessment of the Hazard

Advice from authorities of a specific risk to water infrastructure is a circumstance which may indicate increased likelihood of a terrorist threat or the occurrence of malicious activity at the dam site. Advice specifically identifying McKinnon Creek Detention Basin would immediately trigger the EAP to Stand Up activation level.

The following contact notifications would be issued to assist in the response to an act of terrorism which may pose a threat to the safety of the dam and downstream PAR, with further response protocols to be undertaken by the ECO detailed in Table 9 below:

- Priority 1 – Triple zero (if lives are at immediate risk call 000 immediately);
- Priority 2 – Police Link 131 444 or the Local Police Station or Crime Stoppers on 1800 333 000 (if no immediate life threat but you are witnessing suspicious behaviour currently occurring at or around critical infrastructure); or
- Priority 3 – National Security Hotline 1800 123 400 (to report suspicious activity or behaviour).

8.3. Terror Threat / Malicious Activity – EAP Activation Response Protocols

Table 8 - Terror Threat / Malicious Activity Event Response Protocols

Activation Level	Alert	Lean Forward	Stand Up	Stand Down
Activation Trigger	Not Applicable.	Not Applicable.	Significant threat / verified suspicious activity has compromised dam safety.	Risk assessment has determined that failure risk has reduced.
Internal Stakeholder Notifications Appendix I	Not Applicable.	Not Applicable.	Whispir Template #61	Whispir Template #53
External Stakeholder Notifications Appendix I	Not Applicable.	Not Applicable.	Whispir Template #62 Contact Priority 1 external agency stakeholder (Appendix L)	Whispir Template #56 Contact Priority 1 external agency stakeholder (Appendix L)
PAR Notifications Appendix J Appendix K	Not Applicable.	Not Applicable.	Emergency Alert #2 and/or #3 AWS Message #2 and/or #3	AWS Message #5
Response Actions ***Enact dam failure response Sections 7 if change detected during surveillance inspection OR dam failure path identified.***				
DEC	Not Applicable.	Not Applicable.	**Priority 1** – Triple zero (if lives are at immediate risk call 000 immediately); **Priority 2** – Police Link 131 444 or the Local Police Station or Crime Stoppers on 1800 333 000 **Priority 3** – National Security Hotline 1800 123 400. Follow all directions of police/national security personnel. • Follow all directions of police/national security personnel. • Send EAP activation notification to priority stakeholders. • Schedule and chair ECO meeting if required. • Assign ECO roles. • Confirm SITREP frequency. • Issue SITREP to LDMG-CR. • Confirm monitoring expectations and rostering. • Advise of communication systems status.	• Receive notification about reduced threat from LDMG-CR. • Ensure that site is under Council control. • Issue EAP Stand Down notification to priority stakeholders. • Send request to LDMG-CR to issue PAR notifications. • Review, approve, and issue final SITREP to LDMG-CR. • Coordinate inspection by engaged DTA to check for damage and/or propose a program for the undertaking of remedial works as necessary and to the satisfaction of the Dam Safety Regulator. • Prepare Emergency Event Report per Section 14. • Return to routine activities.

			• Issue situation-specific actions (road/site closure/dam access). • Monitor weather intelligence and rainfall forecasts. • Confirm with Senior Engineer Dams requirements for engaging DTA to conduct Special Inspection. • Commence event log. • **If notified by DEO of observed changes or damage to dam structure as a result of sabotage and heavy rainfall is predicted or Basin begins to impound water, determine need to trigger response protocols under Section 7.**	
DEO	Not Applicable.	Not Applicable.	• Attend ECO meeting if required. • **If safe to do so,** attend site and conduct surveillance inspection and monitor onsite conditions. • Provide updates from inspections to DEC. • **If safe to do so,** prevent public access to Basin. • If Basin begins to impound or is impounding water, monitor water levels (onsite or via remote monitoring). • Assist DEC with completion of SITREPs.	• Complete and issue final SITREP to DEC. • Assist with preparation of Emergency Event Report per Section 14. • Return to routine activities.
DECC	Not Applicable.	Not Applicable.	• Create Operation within Internal Communications Platform. • Attend ECO meeting if required. Record and circulate minutes. • Issue EAP activation notification to Dam Safety Regulator along with phone call, following discussion with DEC and manage ongoing regulatory updates and correspondence. • Provide support to ECO as required.	• Issue EAP Stand Down notification to Dam Safety Regulator following discussion with DEC. • Within Internal Communications Platform, finalise Event Log and ensure all documentation and records are accurately recorded within Document Library. • Provide support to ECO as required. • Assist with preparation of Emergency Event Report per Section 14 and submit to Dam Safety Regulator within 30 business days following cessation of event. • Return to routine activities.
ALL	Not Applicable.	Not Applicable.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.	• Record all communication, actions, and event-related documentation within Internal Communications Platform.
	ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO. *e.g., taking photographs/video, undertaking dam inspections, taking instrument readings etc.* **ALL PHOTOS MUST BE TIME AND DATE STAMPED.**			

9. Dam Hazard – Non-Flood Related Events

McKinnon Creek Detention Basin is also susceptible to non-flood related events which do not pose an immediate hazard to the downstream community. There may be no need to activate this EAP if minor defects (for example, cracking, small slips, sinkholes etc) which do not endanger the structural integrity of the dam occur. Any identified defects will be appropriately investigated and monitored, with remedial works undertaken as required to prevent deterioration. If, however, the deficiencies deteriorate into a dam hazard event or emergency event, the EAP will be activated accordingly. Furthermore, any significant rainfall during any of the below events leading to an identified failure pathway will trigger the relevant emergency response protocols detailed in Section 6 or Section 7 above:

- Earthquake;
- Cracking or other signs of abnormal behaviour;
- Blockage of the low flow pipe.

9.1. Earthquake

9.1.1. Overview

Following a seismic event in the vicinity of the McKinnon Creek Detention Basin, signs of distress or abnormalities in the dam embankment like cracking or deformation/sliding, or any other structural damage may occur. Whilst there may be defects present that pose a potential safety hazard to users of the open space inside the McKinnon Creek Detention Basin, these will not necessarily result in a dam hazard event or emergency event. Actions to be undertaken by Council to address any identified defects are to be managed under business-as-usual processes.

A seismic event near the McKinnon Creek Detention Basin could result in the following impacts:

- Piping through embankment – whereby an earthquake causes transverse cracking in the upper section of the embankment. There is potential for these cracks to further propagate and cause piping in the event of a flood occurring prior to the undertaking of remedial works.
- Slope failure – whereby following a seismic event the embankment material could lose strength resulting in strain softening under cyclic loading.
- Liquefaction – whereby an earthquake event could result in liquefaction of the low plasticity clay/silt and river alluvial material.

Potential failure modes of the outlet conduits resulting from a seismic event include:

- Structural failure as a result of damage to the outlet pipes;
- Structural failure as a result of damage to the bandage joint.

Seismic intensity assessments are undertaken by Council in accordance with the Modified Mercalli Intensity scale (MMI scale). The MMI scale is composed of increasing levels of intensity that range from imperceptible shaking to catastrophic destruction and utilises a ranking system based on observed effects, such as the degree of shaking, the manner in which the earthquake is felt by people, and any observable structural damage (see Appendix M).

9.1.2. Assessment of the Dam Hazard

In the event of an earthquake occurrence within a 100km radius of the Basin, an internal tremor intensity assessment and risk analysis using the MMI scale shall be undertaken. The following scenarios and their associated actions are to be considered:

*Earthquake assessed as being **< 5MM:***

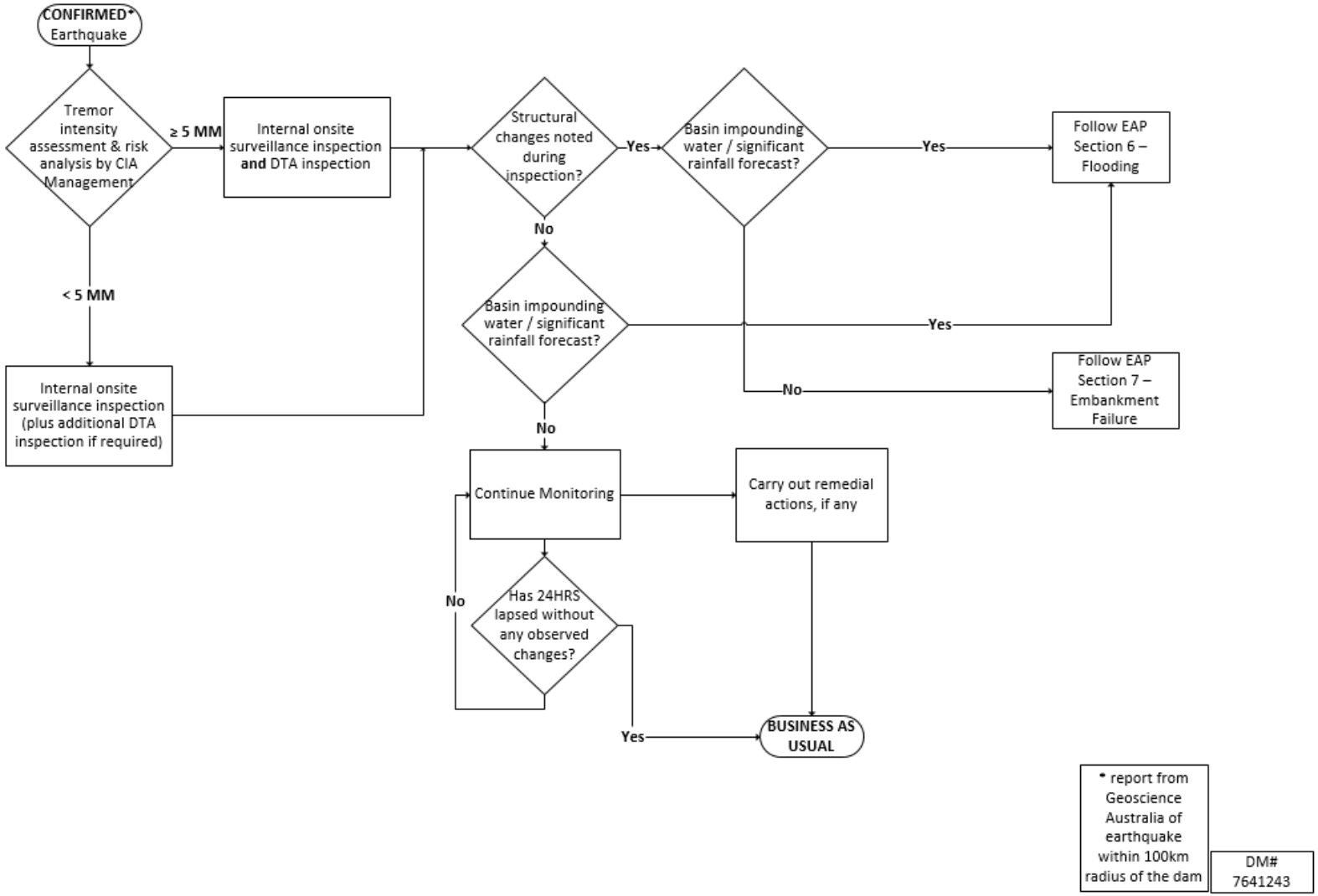
- Enact response protocols per Table 9 (see also Figure 5 - McKinnon Creek EAP – Earthquake Hazard Flowchart)

- No structural changes noted during internal surveillance inspection **and** no significant rainfall forecast –
  - Determine need for external surveillance inspection by DTA – engage as required;
  - Continue monitoring structural condition for 24 hours;
  - If no observed changes have occurred post-monitoring period, no further action under the EAP required.
- No structural changes noted **but** further rainfall forecast –
  - Follow emergency response protocols per **Section 6 – Flooding**.
- Structural changes noted –
  - Follow emergency response protocols per **Section 7 – Embankment Failure**.

*Earthquake assessed as being **≥ 5MM**:*

- Enact response protocols per Table 9 (see also Figure 5 - McKinnon Creek EAP – Earthquake Hazard Flowchart).
  - External surveillance inspection by DTA.
  - No structural changes noted **and** no significant rainfall forecast –
    - Continue monitoring structural condition for 24 hours;
    - If no observed changes have occurred post-monitoring period, no further action under the EAP required.
  - No structural changes noted **but** further rainfall forecast –
    - Follow emergency response protocols per **Section 6 – Flooding**.
  - Structural changes noted –
    - Follow emergency response protocols per **Section 7 – Embankment Failure**.

Figure 5 - McKinnon Creek EAP – Earthquake Hazard Flowchart



9.1.3. Earthquake Event Response Protocols

Table 9 - Earthquake Event Response Protocols

Earthquake Event – Response Actions	
CIA Management	• **If safe to do so**, Coordinate an onsite surveillance inspection to monitor the condition of the structure. • Advise Senior Engineer Dams of current Detention Basin conditions, any additional observations, and response actions undertaken. • Notify the Dam Safety Regulator, if required. • Monitor weather forecasts and Geoscience Australia preliminary earthquake notifications for the region. • Record all communication, actions, and event-related documentation. • If the Detention Basin begins to impound water, follow dam hazard response Section 6 – Flooding. • If dam failure path identified, follow dam hazard response Section 7 – Embankment Failure.
Senior Engineer Dams	• Provide expert advice to CIA Management on engineering decisions relating to dam safety. • Attend dam site and conduct a surveillance inspection of the structure to assess its structural integrity and any remedial works which may be required. • Oversee all communications with the engaged Dam Technical Advisor and coordinate a Special Inspection to assess and propose a program to undertake any remedial works required.
	ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO. *e.g., taking photographs/video, undertaking dam inspections, taking instrument readings etc.* **ALL PHOTOS MUST BE TIME AND DATE STAMPED.**

9.2. Cracking or Other Signs of Abnormal Behaviour

9.2.1. Overview

Routine maintenance inspections as well as pre-and-post annual wet season inspections are in place for McKinnon Creek Detention Basin to review the condition of the dam crest, upstream and downstream embankment slopes, spillway, low level outlet, and miscellaneous equipment (e.g., gauge boards, CCTV equipment, signage etc.) to specifically check for and record details of any signs of cracking or other abnormal behaviour (refer to Appendix H for sample Inspection Schedule).
In addition to cracking, other abnormal behaviour can include, but is not limited to:

- Depressions;
- Deformation of crest or settlement;
- Changes to structural alignment;
- Sinkholes;
- Sliding, slumping, bulging;
- Erosion;
- Damage caused by animal activity (i.e., burrows);
- Cracking or deterioration in the joints or joint sealants.

Cracking or other abnormal activity may result in damage to the following, and require an assessment of the hazard prior to any remedial works being undertaken:

- Main dam embankment and crest;
- Spillway;
- Stilling basin;
- Low flow pipe;
- Energy dissipator;
- Riprap and scour protection upstream or downstream of the dam embankment.

9.2.2. Assessment of the Hazard

Whilst there may be defects present that pose a potential safety hazard to users of the open space inside the McKinnon Creek Detention Basin, these will not necessarily result in a dam hazard event or emergency event unless the Basin begins to impound water during a significant weather event.
Upon receipt of advice that damage to the McKinnon Creek Detention Basin and/or any of its associated structures has occurred, the following response protocols in Table 10 below, are to be followed.

9.2.3. Cracking or Abnormal Behaviour Event Response Protocols

Table 10 - Cracking or Abnormal Behaviour Event Response Protocols

Cracking or Abnormal Behaviour Event – Response Actions	
CIA Management	• **If safe to do so**, coordinate an onsite surveillance inspection to monitor the condition of the structure. • Advise Senior Engineer Dams of current Detention Basin conditions, any additional observations, and response actions undertaken. • Notify the Dam Safety Regulator if required. • Monitor weather forecasts for the region. • Record all communication, actions, and event-related documentation. • If the Detention Basin begins to impound water, follow dam hazard response Section 6 – Flooding. • If dam failure path identified, follow dam hazard response Section 7 – Embankment Failure.
Senior Engineer Dams	• Provide expert advice to DEC on engineering decisions relating to dam safety. • **If safe to do so**, attend dam site and conduct a surveillance inspection of the structure to assess its structural integrity and any remedial works which may be required. • Oversee all communications with the engaged Dam Technical Advisor and coordinate a Special Inspection to assess and propose a program to undertake any remedial works required.
	ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO. *e.g., taking photographs/video, undertaking dam inspections, taking instrument readings etc.* **ALL PHOTOS MUST BE TIME AND DATE STAMPED.**

9.3. Blockage of Low Flow Pipe

9.3.1. Overview

Blockages of the low flow pipe may occur at the public safety fence upstream of the low flow pipe, inside the pipe, or in the lined channel downstream of the structure. These locations are checked for blockages, damage, and cleared of built-up debris or vegetation during routine maintenance inspections and pre-and-post wet season inspections (refer to Appendix H for sample Inspection Schedule).

9.3.2. Assessment of the Hazard

A blockage of the low flow pipe does not compromise the capacity of the McKinnon Creek Detention Basin to safely pass a flood up to and including the PMF. However, a blockage does reduce the flood mitigation capacity of the structure during lesser events such as the 5% AEP (1 in 20-year) and 1% AEP (1 in 100-year) events, resulting in expected increased flooding downstream.
In the 0.05% AEP critical event, a culvert debris blockage causes a storage increase of less than 50 mm in the McKinnon Creek Detention Basin before a breach occurs. A blockage therefore only has a minor effect on the Basin water level as the spillway activates in this critical event.
Whilst conditions which may result in longer term impoundment of water can increase the likelihood of seepage and reduce embankment stability, the McKinnon Creek Detention Basin has been designed to account for longer-term water impoundment resulting from a blockage of the low flow pipe. Should a blockage of the low flow pipe be identified however, the following response protocols in Table 11 below, are to be followed.

9.3.3. Blockage of Low Flow Pipe Event Response Protocols

Table 11 - Blockage of Low Flow Pipe Event Response Protocols

Blockage of Low Flow Pipe – Response Actions	
CIA Management	• **If safe to do so**, coordinate an onsite surveillance inspection to monitor the condition of the structure. • **If safe to do so**, clear the blockage from the pipe. • Advise Senior Engineer Dams of current Detention Basin conditions, any additional observations, and response actions undertaken. • Notify the Dam Safety Regulator if required. • Monitor weather forecasts for the region. • Record all communication, actions, and event-related documentation. • If the Detention Basin begins to impound water, enact dam hazard response Section 6 – Flooding. • If dam failure path identified, enact dam hazard response Section 7 – Embankment Failure.
Senior Engineer Dams	• Provide expert advice to DEC on engineering decisions relating to dam safety. • Attend dam site if required and conduct a surveillance inspection of the low flow pipe to assess its structural integrity and any remedial works which may be required if a blockage has resulted in structural damage. • Oversee all communications with the engaged Dam Technical Advisor and coordinate a Special Inspection to assess and propose a program to undertake any remedial works if required.
	ALL ACTION MUST BE TAKEN WHEN IT IS SAFE TO DO SO. *e.g., taking photographs/video, undertaking dam inspections, taking instrument readings etc.* **ALL PHOTOS MUST BE TIME AND DATE STAMPED.**

10. Other Emergency Situation – Communications Failure

10.1. Overview

The emergency action described within this section relates to an event where all means of communication with the local area have been lost. This section specifies actions and provides guidance for the effective management of the event.

10.2. Activation Trigger

Due to the large number of possible communications failure scenarios, only the most common or likely communication failure conditions are covered in this section.

Communications Failure – Local Area	Unable to communicate to or from Local Area (likely to affect ECO). Managed by dam owner in conjunction with the ECO and LDMG-CR.

10.3. Assessment of the Hazard

Communications failures may occur during normal operations and may affect the SCADA network, instrumentation, monitoring equipment, and/or communications systems like the Internal Communications Platform. Such communication failures may occur across the Cairns region, and whilst a communications failure does not necessarily indicate a dam hazard, not having access to information regarding the dam may lead to the identification of a dam hazard being delayed. CIA Management shall determine if EAP activation is necessary while negotiating such failures.

During a dam hazard event or emergency event, if the ECO loses the functionality of internal communications methods, the ECO will revert to mobile telephone communications (if operational), UHF radio communications, satellite communications, alternative platforms (if available), and the use of paper-based records to record actions and manage an emergency response.

The DEC will determine whether it is reasonably likely that there may be a significant communications failure within the subsequent 24 hours and will assess the likely effect on current dam hazards. If required, the DEC may escalate the activation level of any current dam hazards.

If a communications failure occurs as a result of natural disaster conditions such as a cyclone event, the DEC will cooperate with the LDMG-CR (if already activated to Stand Up level) on communicating with PAR as required. Table 12 below outlines the actions and communications process to be followed in the event that all means of communication within the local area fail.

10.4. Communications Failure Event Response Protocols

Table 12 - Other Emergency Situation - Communications Failure Event Response Protocols

ECO Position	Local Area Communications Failure – Response Actions
DEC	• Follow CIA Business Continuity Plan #6929421. • Establish alternate means of communication and establish a runner system if required. • Activate EAP should a dam emergency occur during a local area communications failure event – refer to specific dam hazard table for response protocols. • Liaise with DEO and DECC regarding status of communications.
DEO	• Every hour attempt communications via: o Landline telephone; o SMS text message (higher probability of successful transmission than calling); o UHF radio; o Social media platform (e.g., Facebook). • Liaise with DEC and DECC regarding status of communications. • As much as is practicable, continue other tasks associated with the ECO position in accordance with any other current emergency action. • Provide support to DEC as required.
DECC	• Set up paper-based Event Log to record all event-related information. • Every hour attempt communications via: o Landline telephone; o SMS text message (higher probability of successful transmission than calling); o UHF radio; o Social media platform (e.g., Facebook). • Liaise with DEC and DEO regarding status of communications. • Attend meetings as requested, providing support to DEC and DEO as required.

11. Notification and Communications Protocols

Communication protocols have been established to ensure effective communication with both internal and external stakeholders during the preparation, response, and recovery stages of a dam emergency event. The various platforms and tools utilised, are listed under clause 11.3, onwards. A communications flowchart is outlined in Figure 6 below.

11.1. Internal Communications

Prior to the activation of the McKinnon Creek Detention Basin EAP, the primary means of communication between CRC officers and the ECO is via mobile telephone. Once the EAP has been activated, the ECO members communicate internally and with non-ECO members via mobile telephone, Ultra-High Frequency (UHF) radio, and through the use of an internal communications platform. This platform is further described in Section 11.4 below. Email may also be used for non-urgent communications and for the issuance of Situation Reports (SITREPs).

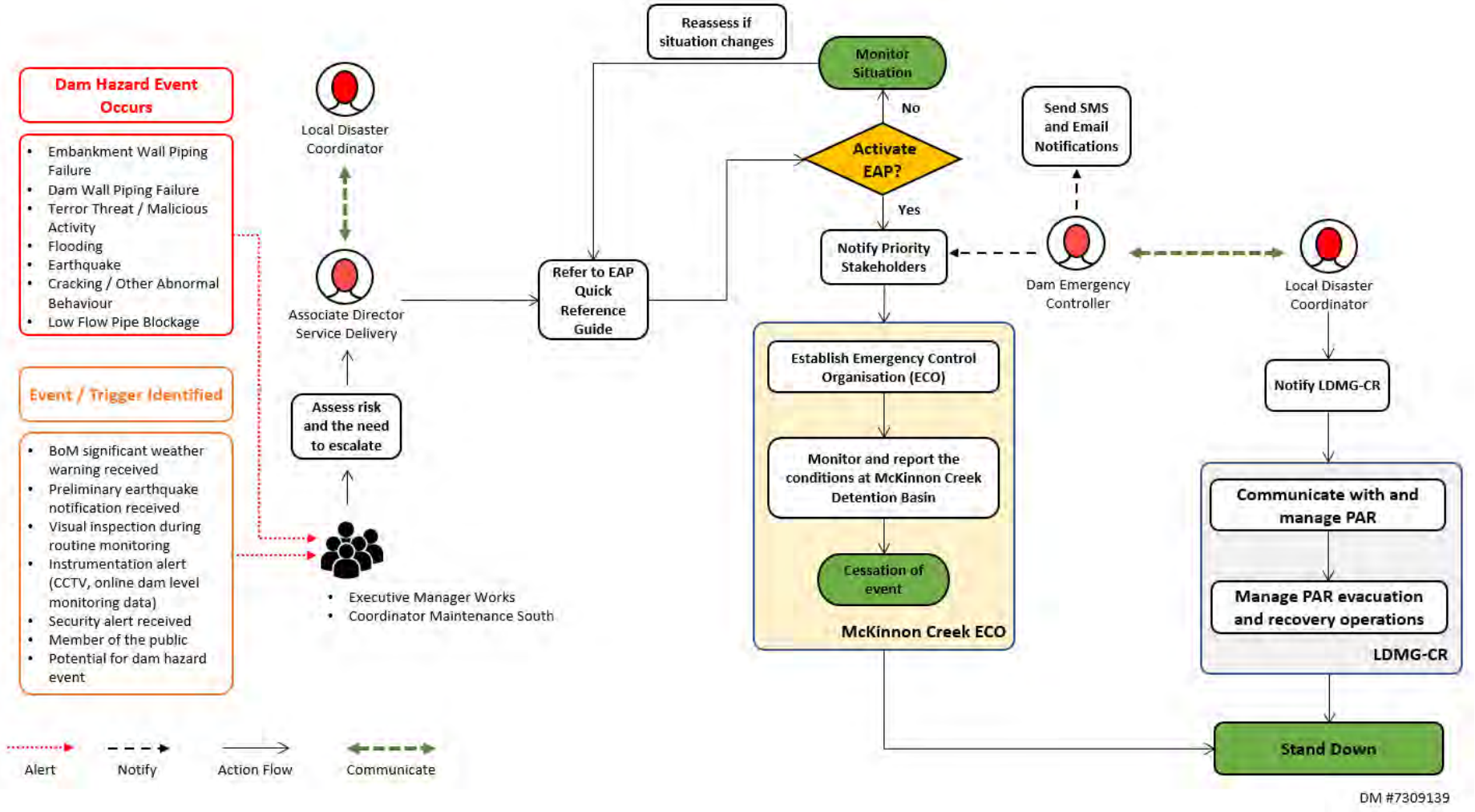
During a dam emergency event the ECO (specifically the Dam Emergency Controller [DEC]) liaises with the Local Disaster Coordinator (LDC) to ensure public communications and all media queries are being managed effectively through the LDMG-CR.

UHF radios to be used in a dam emergency event use the following radio frequencies and are permanently located and available for use at the Martyn Street Depot, Spence Street Council Chambers, and the LDCC.

11.2. External Communications

During emergencies, appropriate notifications are sent to the external key stakeholders as defined by the communication protocol under Annexure L that prioritises contact information of external stakeholders who have a role or responsibility in the actioning of the EAP. The communication templates (AWS, Emergency Alerts and Whispir) in Annexure I are usually utilised for these notifications.

Figure 6 - McKinnon Creek Detention Basin EAP – Communications Flowchart



11.3. Whispir Communications Platform

Whispir is a cloud-based communications platform that CRC uses to issue alerts and warnings via text message (SMS), email, and voice. It ensures messages are timely, useful, and contain relevant content for each situation by using priority communication trees. CRC uses Whispir to issue group communications from the McKinnon Creek Detention Basin ECO to priority internal and external stakeholders listed in Appendix L.

Scenario templates have been created within Whispir with messages specific to dam hazards and dam emergency events. Each message is linked to a distribution list depending on who and when the communication should be sent. Appendix I outlines the communication templates used for Whispir emergency notification messages.

11.4. Internal Communications Platform

The Internal Communications Platform to be used in an event if the Referable Dam Emergency Action Plan Event Microsoft 365 Solution. This is a SharePoint-based internal communications platform that is used to create an auditable Event Log of a dam emergency event. Bulletins can be created and published, allowing for relevant updates to be issued to all individuals with a role in the dam emergency response. Incidents occurring during the dam emergency event can also be created and tracked through to completion within the Solution.

The solution is also used to manage and record all forms of internal and external communication, allowing for accurate recordkeeping. An event-specific documents and records library will contain all relevant documents and records, such as SITREPs, photographs, and email correspondence. CRC personnel appointed to the ECO are to refer to the Microsoft 365 Solution Guidance Document #7207033.

11.5. Community Warnings, Alert Systems, and Dissemination of Information

CRC provides those Cairns community members in high-risk areas with relevant and timely information pertaining to the status of its referable dams and potential dam safety hazards. Communications serve to provide information which supports people in taking suitable actions to prepare for and respond to a potential or real emergency or disaster event. Communication of information can be actioned through a variety of means, including email, web, mobile telephone, and social network platforms like Facebook.

The two primary platforms for public notification during likely or actual emergencies are:

11.5.1. National Emergency Alert System (NEAS)

The National Emergency Alert System (NEAS) is Australia's national telephone warning system. It may be used by emergency services during likely or actual emergencies to send voice messages to landlines and SMS text messages to mobile telephones within a defined area. CRC will use the NEAS to ensure those potentially affected by a dam emergency are notified via voice messages and SMS text messages in the event of flooding causing inundation or flooding causing dam failure. The request to notify the PAR using this method is lodged with the LDMG-CR and managed through its processes.

NEAS notifications are authorised and requested by the LDMG-CR. In Queensland, the NEAS is operated by the State Disaster Coordination Centre (SDCC) Watch Desk. The SDCC Watch Desk approves, tests, and operates Emergency Alerts (EAs) and associated polygons. Should dam failure be imminent, the dam operator may also send NEAS notifications. The McKinnon Creek Detention Basin NEAS polygon and EA request forms are presented within Appendix K of this document.

11.5.2. Australian Warning System (AWS)

The Australian Warning System (AWS) is the national approach to information and warnings for hazards which aims to provide consistent warnings to communities to ensure people know what to do

when they see a warning level. Within the AWS, there are hazard-specific icons supported by call-to-action statements across three warning levels:

Advice: An incident has started. There is no immediate danger. Stay up to date in case the situation changes.

Watch and Act: There is a heightened level of threat. Conditions are changing and you need to start taking action now to protect you and your family.

Emergency Warning: An emergency warning is the highest level of warning. You may be in danger and need to take action immediately. Any delay now puts your life at risk.

Figure 7 - AWS Flood Hazard Icons

The requirements of the AWS are nationally consistent. Accordingly, the flood warnings contained within Appendix J of this document have been developed to satisfy the national AWS framework for all dam hazards and complement all existing warning practices implemented by CRC. These warnings have been designed to inform the community about what impacts are to be expected, and what actions that should take to remain safe in the event of a dam hazard resulting in downstream flooding from the dam. These warning messages have been written using simple, easy to understand language to ensure the information contained within the warnings is as accessible as possible to downstream PAR.

Stand Down for dam safety emergency events is notified through suitable AWS messages (Appendix J) issued by CRC or the Cairns Disaster Group through social media, press & media releases. These messages are also made available on the Natural Disasters page of the CRC website.

Other communication tools utilised to raise PAR awareness are the Cairns Disaster Dashboard and Cairns Alert opt-in message service. These incorporate existing local context and content with information about weather, safe locations, key road closures, and predicted impacts on critical infrastructure and services.

11.5.3. Cairns Disaster Dashboard

The CRC website's Natural Disasters page supports the Cairns Disaster Dashboard https://disaster.cairns.qld.gov.au/. This Dashboard is a real-time information website, integrating public map overlays, live flood and traffic cameras, live road closure information, weather warnings and alerts, and web sourced data feeds (including BoM weather warnings, Ergon power outages etc). The Dashboard allows for emergency services and critical service utilities such as Ergon and Telstra to collate real-time information and show current evacuation routes, shelter locations, and up to date emergency-related mapping.

11.5.4. Cairns Alert

Cairns Alert is a dedicated platform which provides contextualised disaster and emergency information to the Cairns community. Cairns Alert promotes through website, council news media coverage including radio and television and community engagement activities. Cairns Alert is an opt-in messaging service and is freely available for any person (resident or otherwise) to register. Members of the public who opt into the service will receive real-time AWS warning messages issued by DEC via LDMG-CR through the disaster and emergency alerts. These alerts are official communications from the Cairns Disaster Group (LDMG-CR) which manages the response to disasters which may or may not be dam related. The Cairns Alert opt-in service is available at https://www.cairns.qld.gov.au/community-environment/natural-disasters/cairns-alert.

12. Conclusion of the Emergency Event

The deactivation of this Emergency Action Plan and transition from response operations back to business-as-usual (BAU) and/or recovery operations shall occur only once there is no longer a requirement to respond to the event and the threat of an emergency at the McKinnon Creek Detention Basin has passed. The threat of immediate danger is considered to have passed once the following conditions are met and can be verified by visual inspection of the McKinnon Creek Detention Basin:

- The Detention Basin is no longer impounding water;
- No significant rainfall has occurred since drawdown;
- No further significant rainfall is forecast; and
- Any contamination of the Detention Basin has been cleaned or contained.

At such time, the DEC shall determine whether it is appropriate for the ECO to Stand Down. If the above conditions are not met, but an assessment of the structure has deemed that the threat to PAR has sufficiently reduced, it may be appropriate for the ECO to resume operations under an ongoing Alert status until such time that Stand Down status can be achieved.

However, if the Detention Basin has incurred structural damage, the complete deactivation of the EAP can only occur once the structure has been assessed by the engaged DTA and remedial works have been undertaken to the satisfaction of the Dam Safety Regulator (DSR) in accordance with the prescribed Dam Safety Conditions Schedule for McKinnon Creek Detention Basin, and it has been confirmed that it is safe for continued operation.

13. Emergency Event Report

An Emergency Event Report (EER) will be submitted within 30 business days following the cessation of a dam emergency event to the Chief Executive. It is necessary to capture all relevant information

during a dam emergency event in the Internal Communications Platform (see Section 11.4 above) to ensure appropriate details and evidence can be extrapolated and included within the EER.
The Associate Director Service Delivery and Executive Manager Business Performance & Compliance are responsible for convening a post-event debrief with all ECO members, support personnel and the LDMG-CR as necessary to capture opportunities for improvement. The *Emergency Action Plan for Referable Dam Guideline* (RDMW, 2023) provides EER guidance and a report template which will be referred to as required.

14. References

Document Title	Reference / Location
Water Supply (Safety & Reliability) Act 2008 – current as of 20 September 2023	https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2008-034
Queensland Disaster Management Act 2003 – current as of 1 July 2023	https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2003-091
Queensland Prevention, Preparedness, Response and Recovery Disaster Management Guideline (the DM Guideline) (QPS, 2024)	https://www.disaster.qld.gov.au/__data/assets/pdf_file/0032/359465/Interim-QPPRR-Disaster-Management-Guideline-2024-25.pdf
Queensland Warnings Manual *(QPS, 2024)*	https://www.disaster.qld.gov.au/__data/assets/pdf_file/0035/549539/queensland-warnings-manual-v.1-101224.pdf
Guideline for Failure Impact Assessment of Water Dams (RDMW, 2018)	https://www.resources.qld.gov.au/__data/assets/pdf_file/0005/78836/guidelines-failure-impact-assessment.pdf
Guidelines on Safety Assessments for Referable Dams (RDMW, 2023)	https://www.rdmw.qld.gov.au/__data/assets/pdf_file/0011/1589186/guidelines-safety-assessments-referable-dams.pdf
Queensland Dam Safety Management Guideline (RDMW, 2024)	https://www.resources.qld.gov.au/__data/assets/pdf_file/0007/78838/dam-safety-management.pdf
Queensland Interim State Disaster Management Plan (QDMC, 2024)	https://www.disaster.qld.gov.au/__data/assets/pdf_file/0031/528448/Interim-Queensland-State-Disaster-Management-Plan-2024-25.pdf
Emergency Action Plan for Referable Dam Guideline (RDMW, 2023)	https://www.resources.qld.gov.au/__data/assets/pdf_file/0018/84015/eap-guideline.pdf
Queensland S*tate* ***E****arthquake Risk* ***A****ssessment (QFES, 2024)*	https://www.disaster.qld.gov.au/__data/assets/pdf_file/0021/339303/QFES-State-Earthquake-Risk-Assessment.pdf

15. Appendices

Appendix A. Access Options

Appendix B. Storage Capacity Curve

Appendix C. Spillway Rating Curve

Appendix D. General Arrangement Drawings

Appendix E. Inundation Maps

Appendix F. Event Log and SITREP Template

Appendix G. Remote Monitoring Station Details

Appendix H. Detention Basin Inspection Schedule

Appendix I. Communications Plan

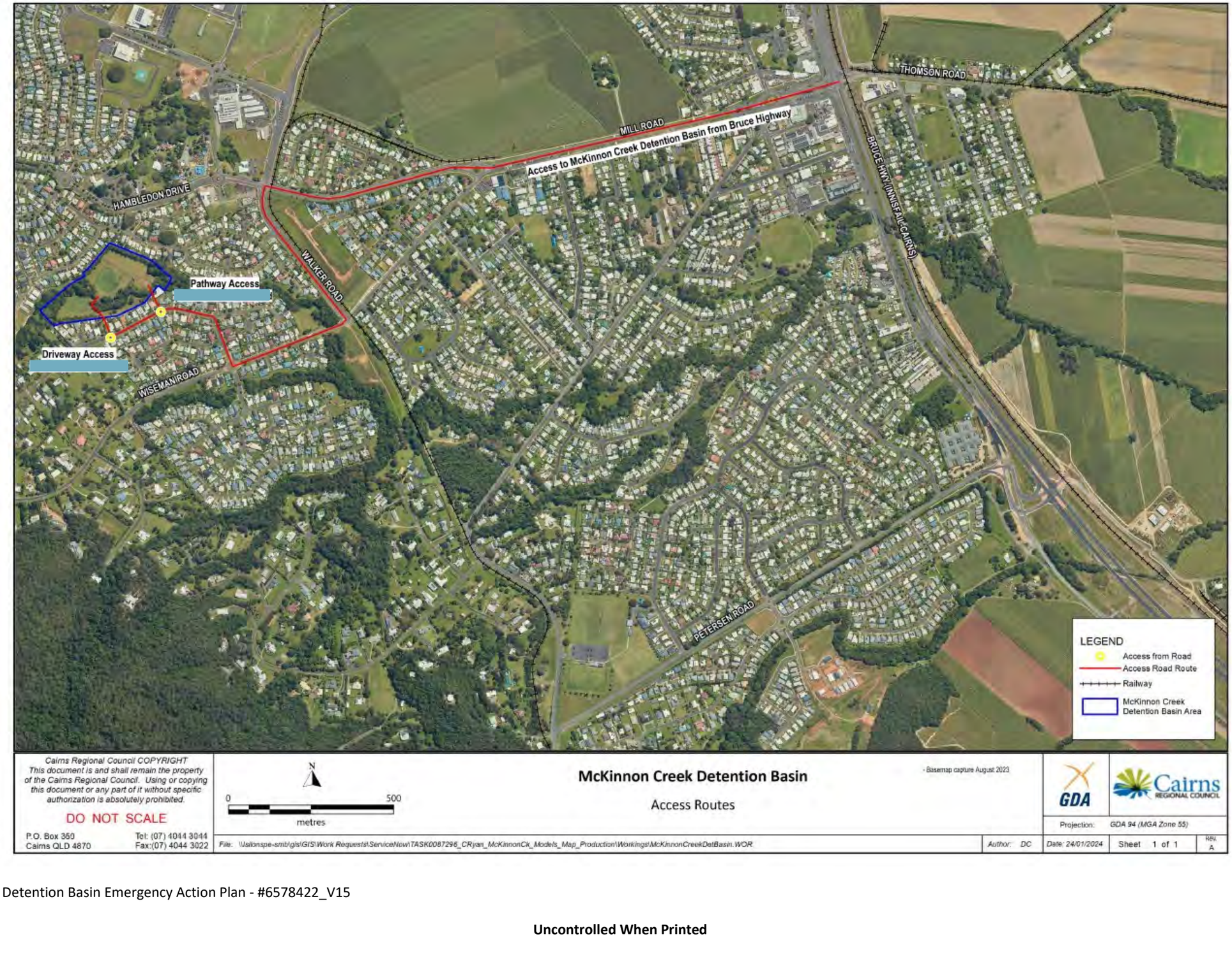
Appendix J. AWS Message Templates

Appendix K. NEAS Polygon and Emergency Alert Request Form Templates

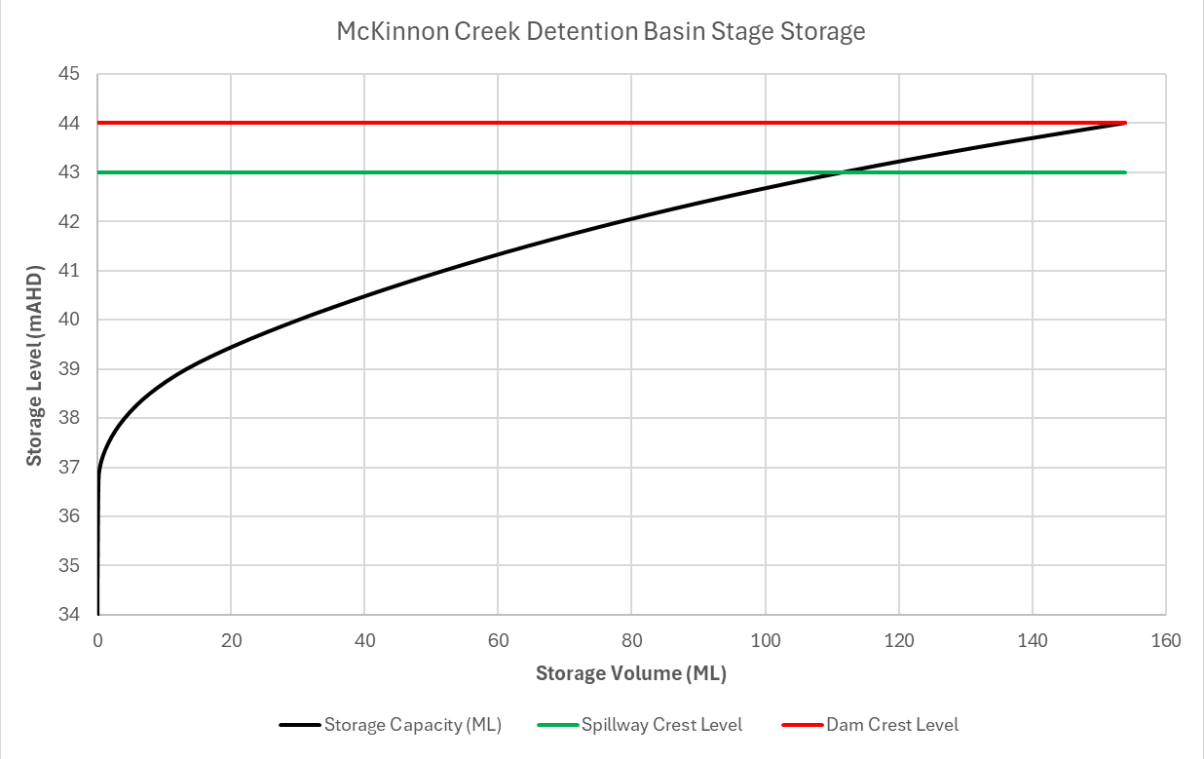
Appendix L. CRC and Key Stakeholder Contacts Lists

Appendix M. Modified Mercalli Scale

A. Access Options

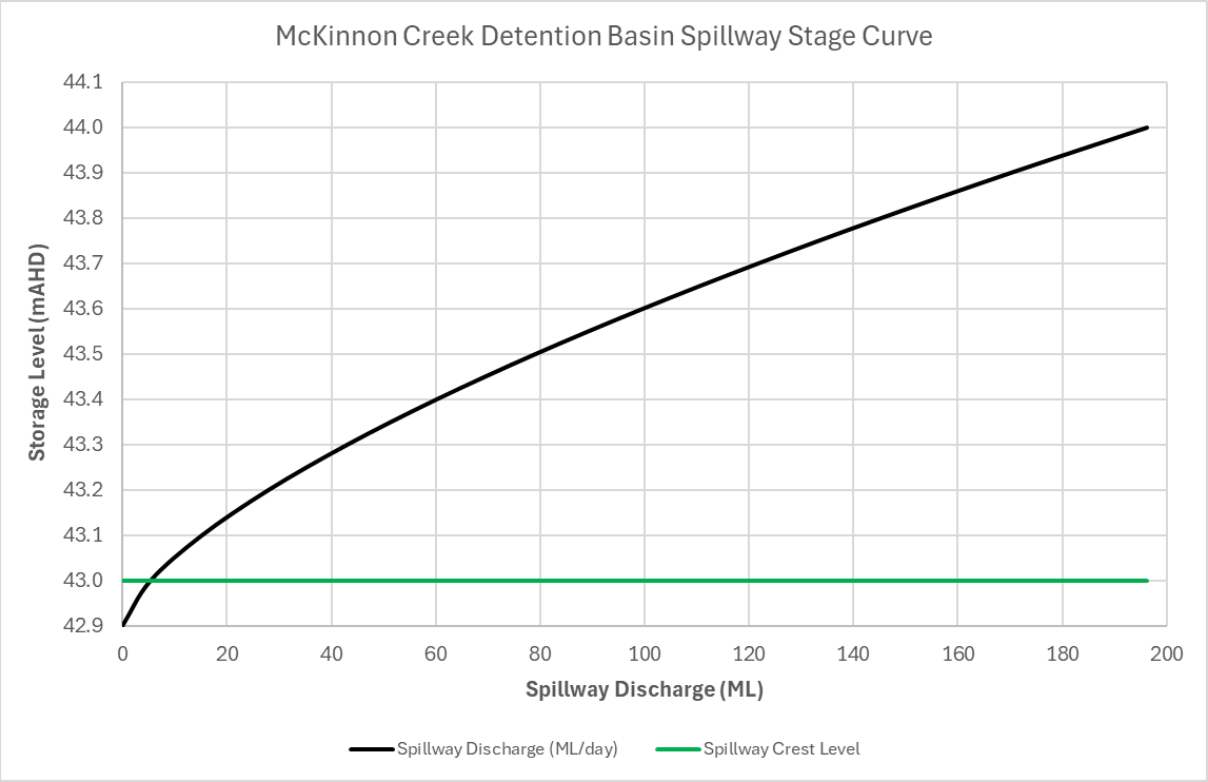


B. Storage Capacity Curve



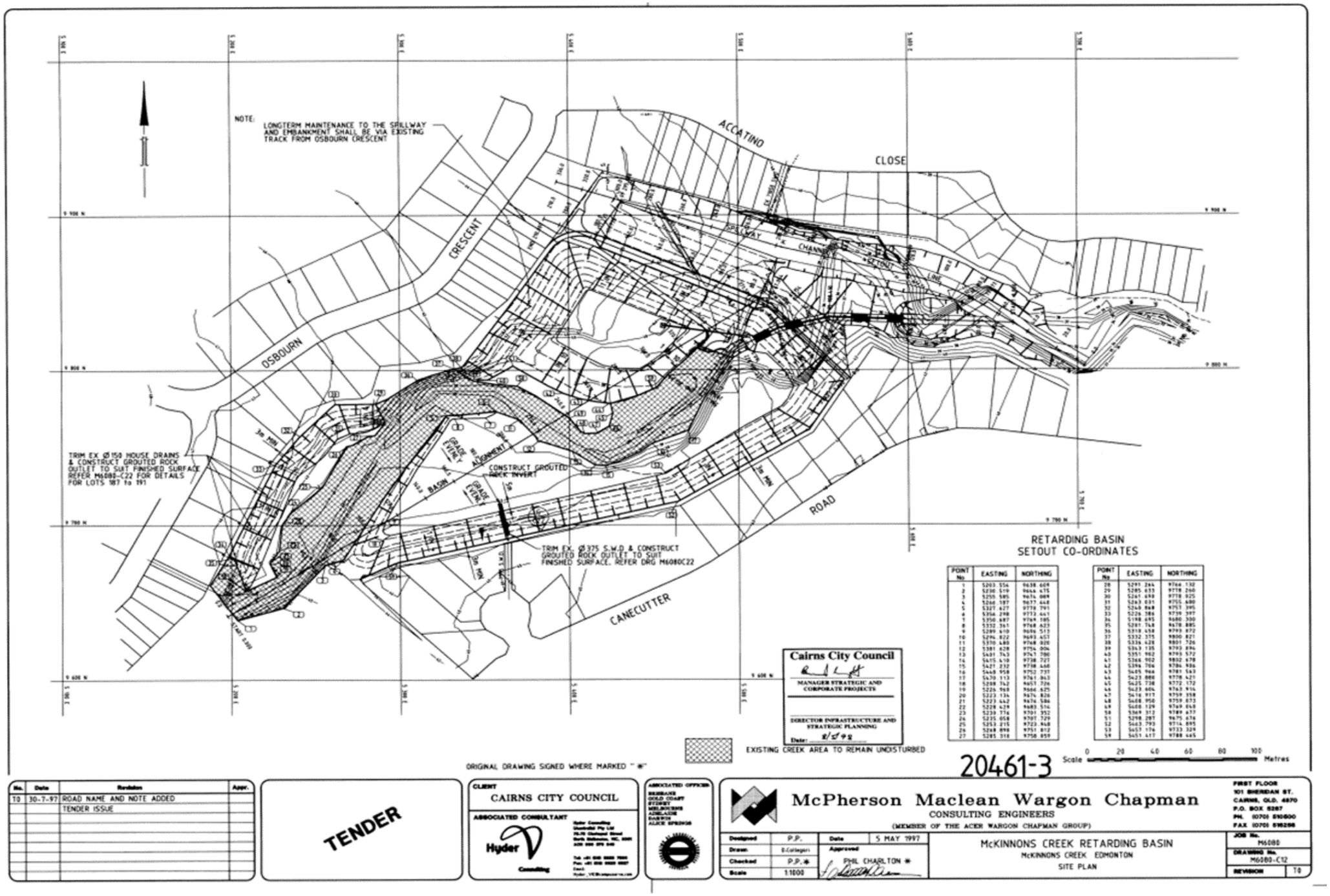
*From McKinnon Creek Detention Basin Failure Impact Assessment (Water Modelling Solutions, 2021) #6639132.

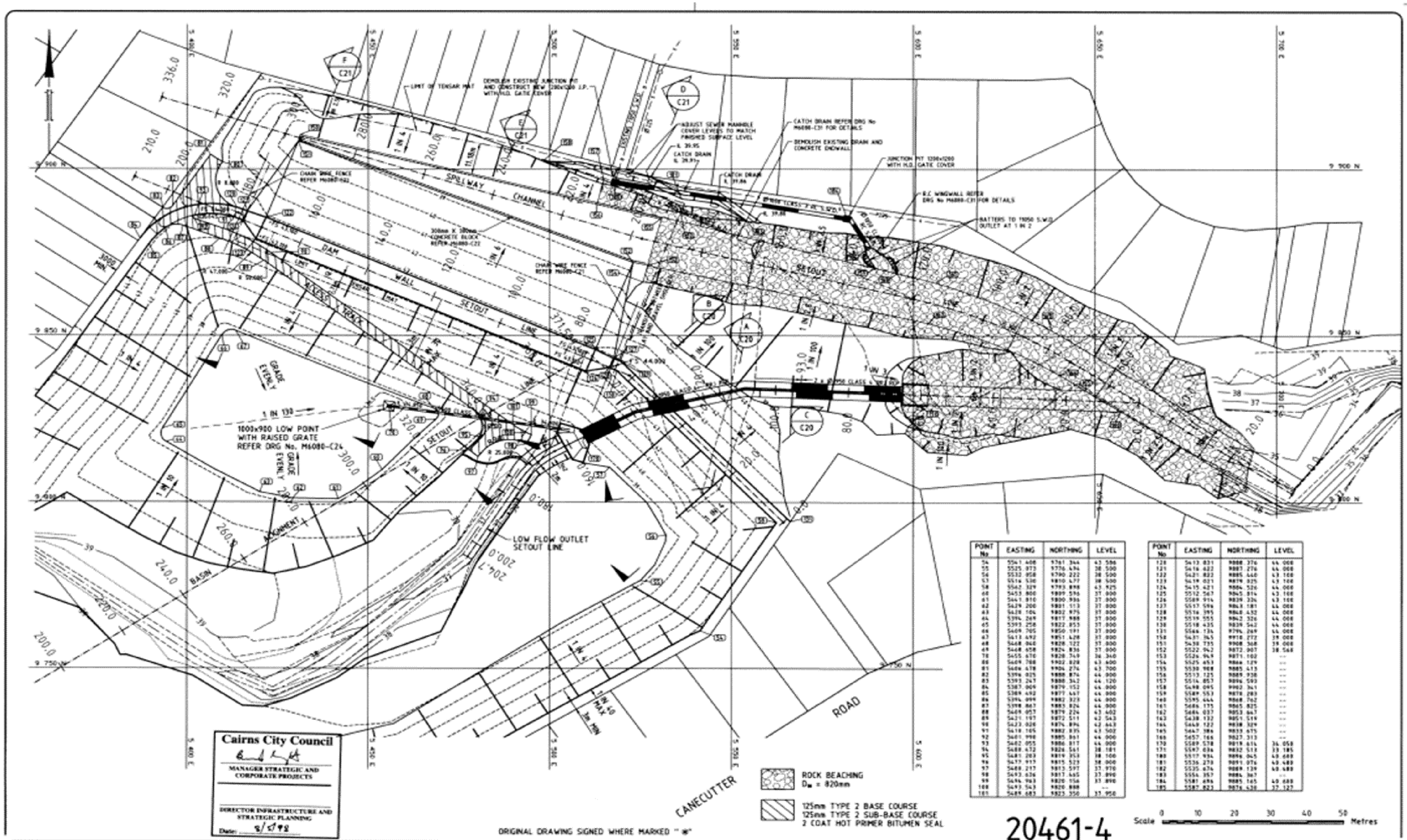
C. Spillway Rating Curve



*From McKinnon Creek Detention Basin Failure Impact Assessment (Water Modelling Solutions, 2021) #6639132.

D. General Arrangement Drawings




SPILLWAY CHANNEL
DAM WALL SETOUT LINE
LIMIT OF TENSAR MAT
DEMOLISH EXISTING JUNCTION PIT AND CONSTRUCT NEW 1200x1200 J.P. WITH H.D. GATIC COVER
ADJUST SEWER MANHOLE COVER LEVELS TO MATCH FINISHED SURFACE LEVEL
CATCH DRAIN REFER DRG No M6080-C31 FOR DETAILS
DEMOLISH EXISTING DRAIN AND CONCRETE ENDWALL
JUNCTION PIT 1200x1200 WITH H.D. GATIC COVER
R.C. WINGWALL REFER DRG No M6080-C31 FOR DETAILS
BATTERS TO 11050 S.W.D. OUTLET AT 1 IN 2
CHAIN WIRE FENCE REFER M6080-C22
300mm X 300mm CONCRETE BLOCK REFER M6080-C22
1000x900 LOW POINT WITH RAISED GRATE REFER DRG No. M6080-C24
GRADE EVENLY
LOW FLOW OUTLET SETOUT LINE
BASIN ALIGNMENT
CANECUTTER ROAD
ROCK BEACHING D_{50} = 820mm
125mm TYPE 2 BASE COURSE
125mm TYPE 2 SUB-BASE COURSE
2 COAT HOT PRIMER BITUMEN SEAL
POINT No | EASTING | NORTHING | LEVEL
Cairns City Council
MANAGER STRATEGIC AND CORPORATE PROJECTS
DIRECTOR INFRASTRUCTURE AND STRATEGIC PLANNING
Date: 8/5/98
20461-4
Scale 0 10 20 30 40 50 Metres
ORIGINAL DRAWING SIGNED WHERE MARKED " * "

No.	Date	Revision	Appr.
T0	30-7-97	PIPE CLASSES ADDED. LEVELS 54 & 58 AMENDED. CHAIN WIRE FENCE ADDED. TENDER ISSUE	
A	17-04-98	ACCESS TRACK PAVEMENT MAKEUP CHANGED 300 X 300 CONC BLOCK SHOWN. MINOR CORRECTIONS TO DWG REF'S & 2 LEVELS	

TENDER

CLIENT

ASSOCIATED CONSULTANT

Hyder Consulting

McPherson Maclean Wargon Chapman
CONSULTING ENGINEERS
(MEMBER OF THE ACER WARGON CHAPMAN GROUP)

FIRST FLOOR
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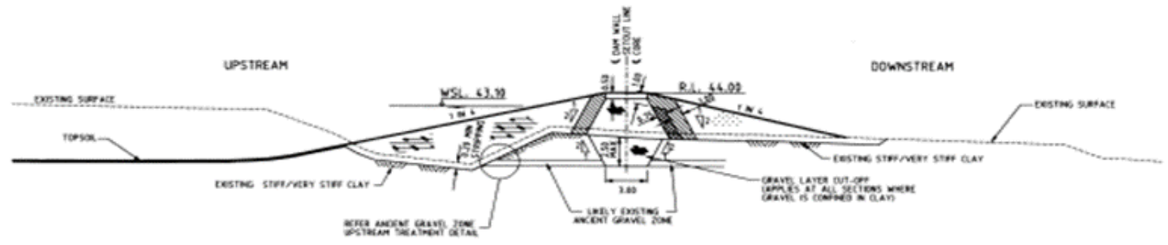
CAIRNS, QLD. 4870
P.O. BOX 5287
PH (070) 510500
FAX (070) 516266

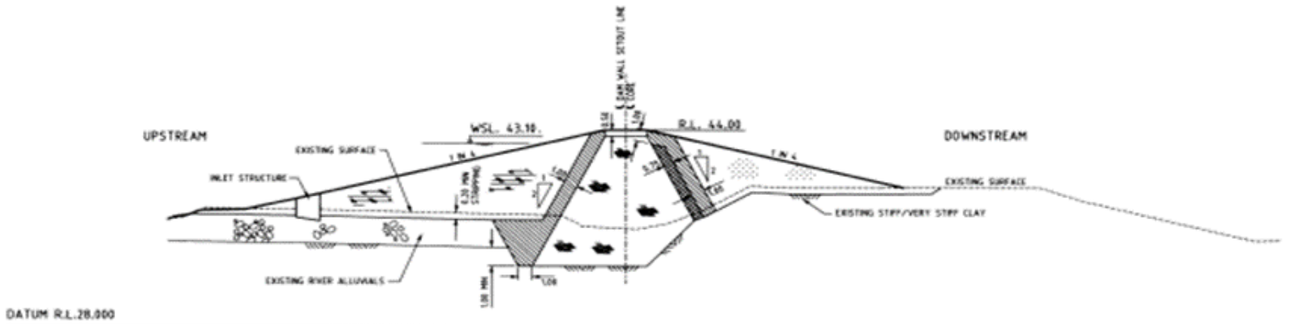
Designed	P.P.	Date	5 MAY 1997
Drawn	D.A.C.	Approved	
Checked	P.P. *	PHIL CHARLTON *	
Scale	1:500		

McKINNONS CREEK RETARDING BASIN
McKINNONS CREEK EDMONTON
DETAIL PLAN - SPILLWAY RETAINING WALL & CHANNELS

Job No. M6080
Drawing No. M6080-C13
Revision A



SECTION C-C



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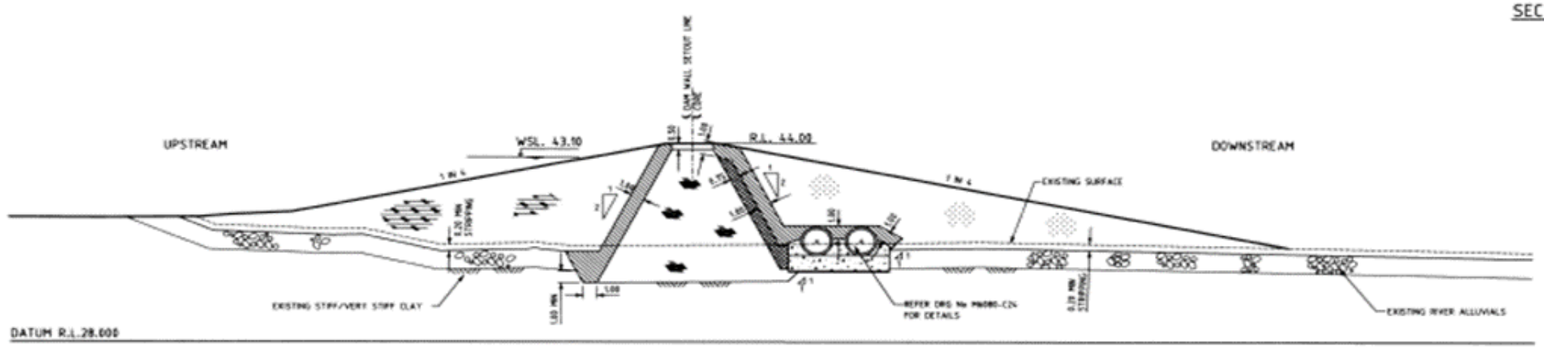


SECTION A-A

LEGEND

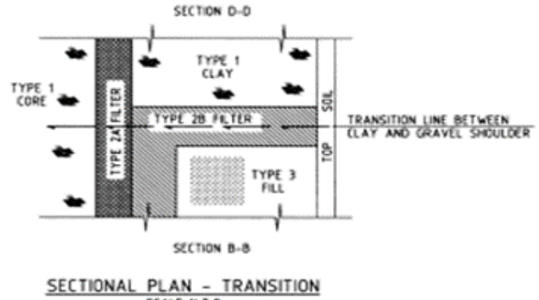
TYPE 4 FILL
CLAY FILL WHICH MAY CONTAIN SMALL QUANTITIES OF ALLUVIAL GRAVELS AND SANDS. PLACED IN CONTINUOUS LOOSE LAYERS NOT EXCEEDING 200mm TO A DRY DENSITY NOT LESS THAN 98% IN ACCORDANCE WITH THE SPECIFICATION

TYPE 3 FILL
SANDS, GRAVEL, COBBLES, AND BOULDERS FREE FROM ORGANIC MATTER, COMPACTED IN 1000mm DEEP LAYERS IN ACCORDANCE WITH THE SPECIFICATION.

TYPE 2B FILTER
EXCAVATED RIVER ALLUVIALS PASSING A 75mm SCREEN, FREE FROM ALL ORGANIC MATTER, CLAYS, AND FINE/MEDIUM SILT, COMPACTED IN 250mm DEEP LAYERS IN ACCORDANCE WITH THE SPECIFICATION.

TYPE 2A FILTER
NON PLASTIC ROCK FRAGMENTS OR SANDS PASSING A 1.8mm SCREEN, AND FREE FROM ORGANIC MATTER, CLAYS AND SILTS, COMPACTED IN 250mm LAYERS IN ACCORDANCE WITH THE SPECIFICATION.

TYPE 1 CORE FILL
STIFF TO VERY STIFF SILTY CLAY OR SANDY CLAYS COMPACTED IN 200mm DEEP LAYERS TO A DRY DENSITY OF NOT LESS THAN 98% IN ACCORDANCE WITH THE SPECIFICATION.



SECTIONAL PLAN - TRANSITION
SCALE N.T.S.

Cairns City Council
MANAGER STRATEGIC AND CORPORATE PROJECTS
DIRECTOR INFRASTRUCTURE AND STRATEGIC PLANNING
Date: 8/7/97

20461-10

No.	Date	Revision	Appr.
TO	30-7-97	TENDER ISSUE	
A	20-6-98	STRIPPING DEPTH AMENDED TO 200mm	
		DETAIL REFERENCE (SECT A-A) CORRECTED	

TENDER

CLIENT
CAIRNS CITY COUNCIL

ASSOCIATED CONSULTANT
Hyder Consulting

ASSOCIATED OFFICES
BRISBANE
GOLD COAST
SYDNEY
MELBOURNE
ADELAIDE
DARWIN
ALICE SPRINGS

McPherson Maclean Wargon Chapman
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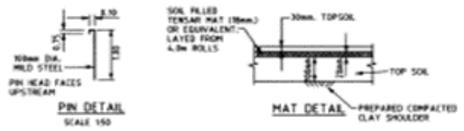
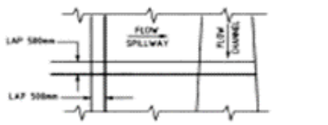
PH. (070) 510500
FAX (070) 518266

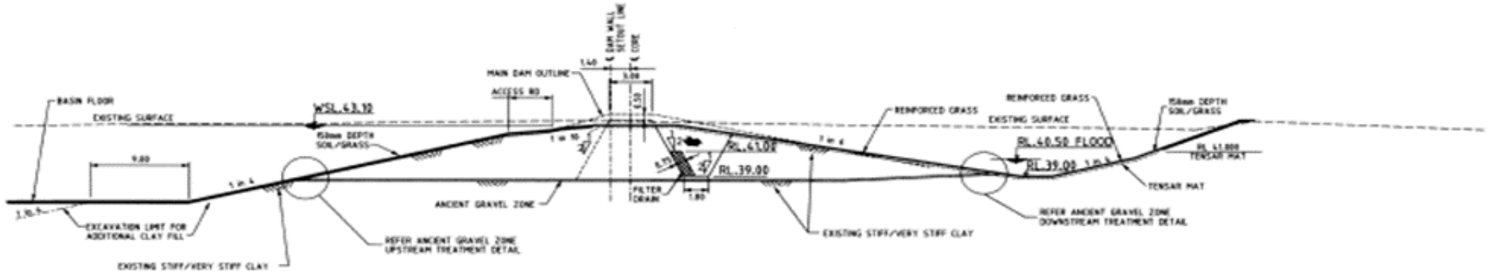
Designed	G.R.	Date	
Drawn	A.B.	Approved	
Checked			
Scale	1:200 SR AS SHOWN		

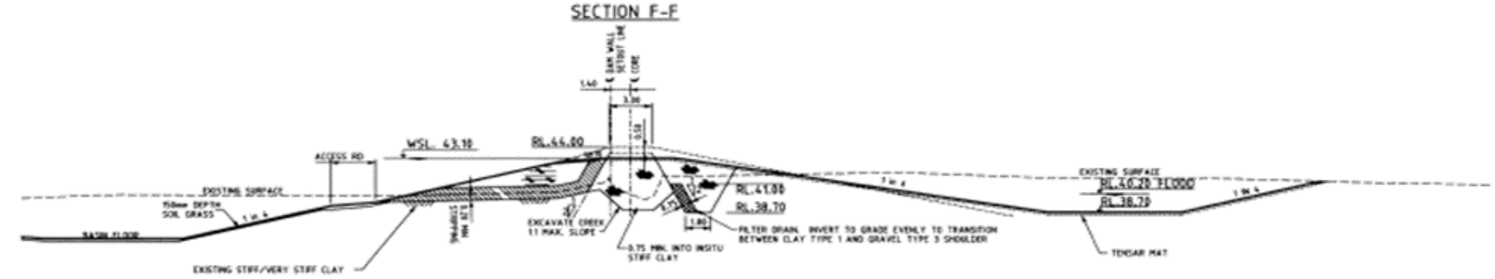
McKINNONS CREEK RETARDING BASIN
McKINNONS CREEK EDMONTON
TYPICAL DAM WALL MAKE UP DETAILS

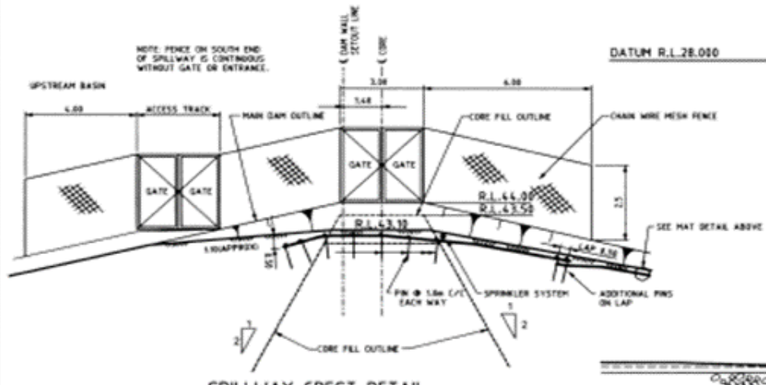
JOB No. M6080
DRAWING No. M6080-C20
REVISION A

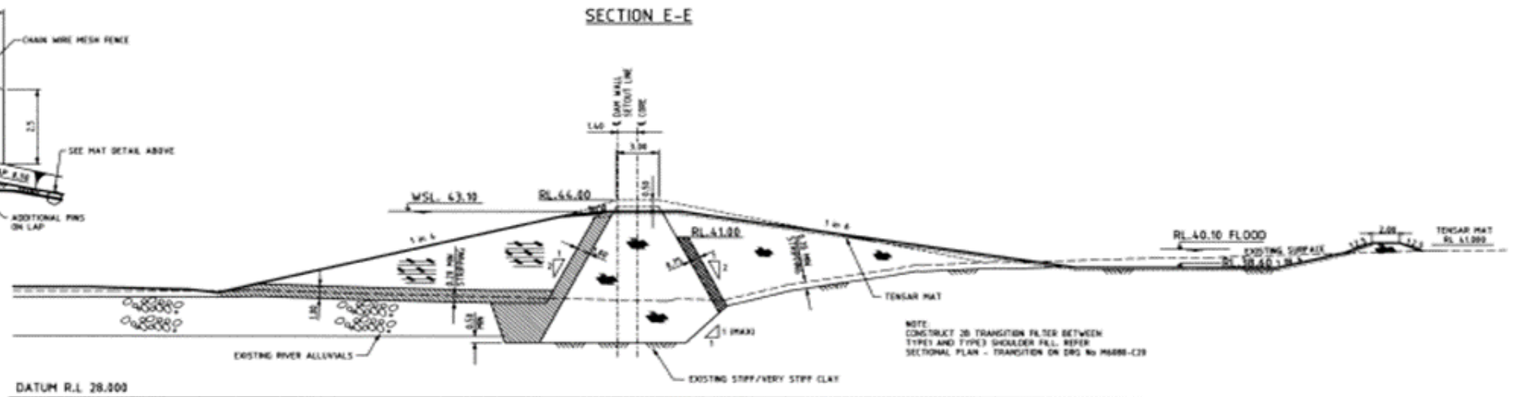












Cairns City Council

MANAGER STRATEGIC AND CORPORATE PROJECTS

DIRECTOR INFRASTRUCTURE AND STRATEGIC PLANNING

Date: 8/5/98

ORIGINAL DRAWING SIGNED WHERE MARKED "✱"

No.	Date	Revision	Appr.
TO	30-7-97	FENCE NOTE ADDED	
		TENDER ISSUE	
A	20-4-98	STRIPPING DEPTH AMENDED TO 200mm	
		MINOR SPELLING CORRECTION.	

TENDER

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CAIRNS CITY COUNCIL

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Hyder Consulting

ASSOCIATED OFFICES
BRISBANE
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SYDNEY
MELBOURNE
ADELAIDE
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McPherson Maclean Wargon Chapman
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P.O. BOX 5267
PH. (070) 510600
FAX (070) 518208

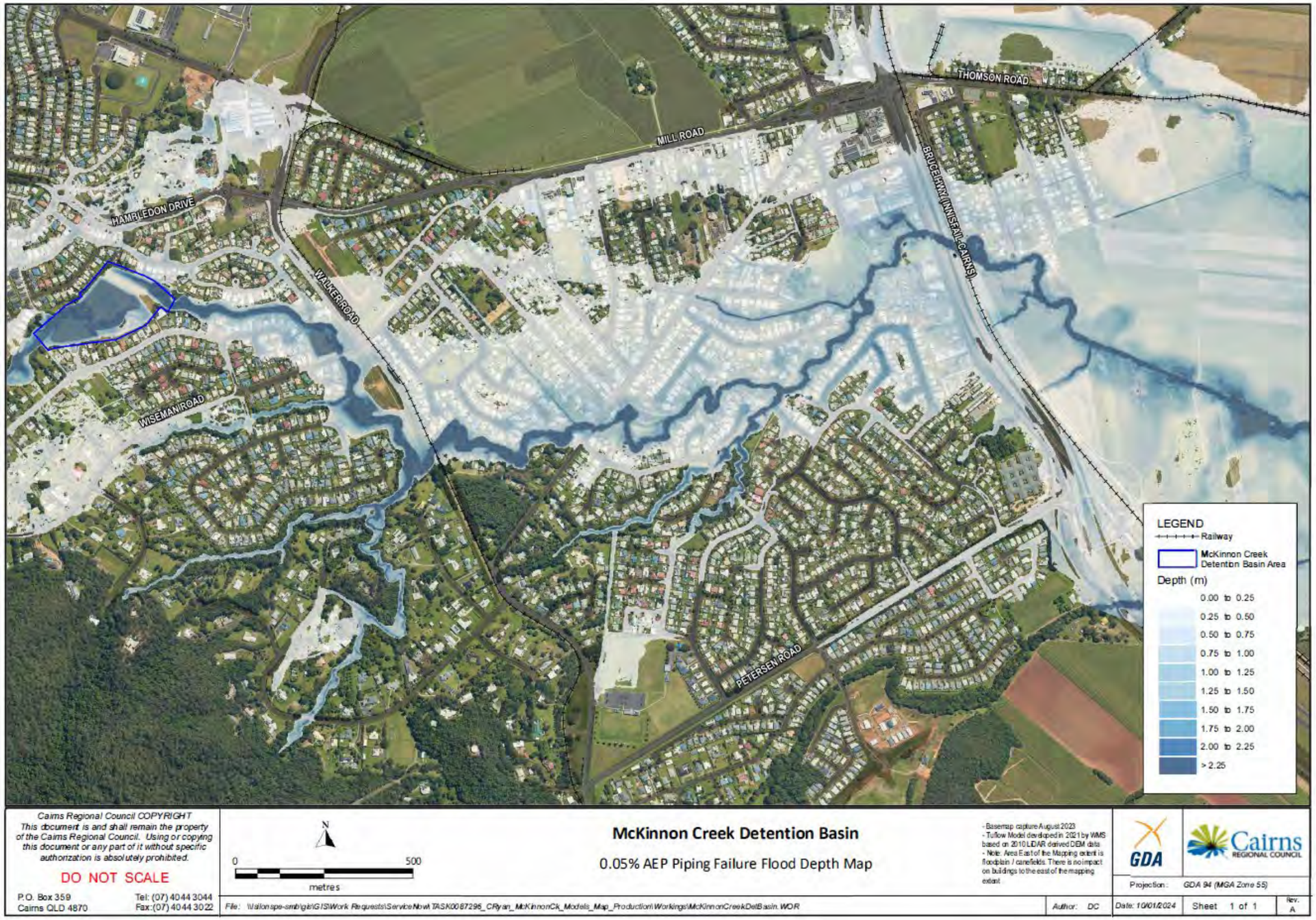
Designed	G.R.	Date	5 MAY 1997
Drawn	A.B.	Approved	PHIL CHARLTON ✱
Checked	P.P. ✱		
Scale	1:200 OR A3 SHEET		

McKINNONS CREEK RETARDING BASIN
McKINNONS CREEK EDMONTON
TYPICAL DAM WALL MAKE UP DETAILS

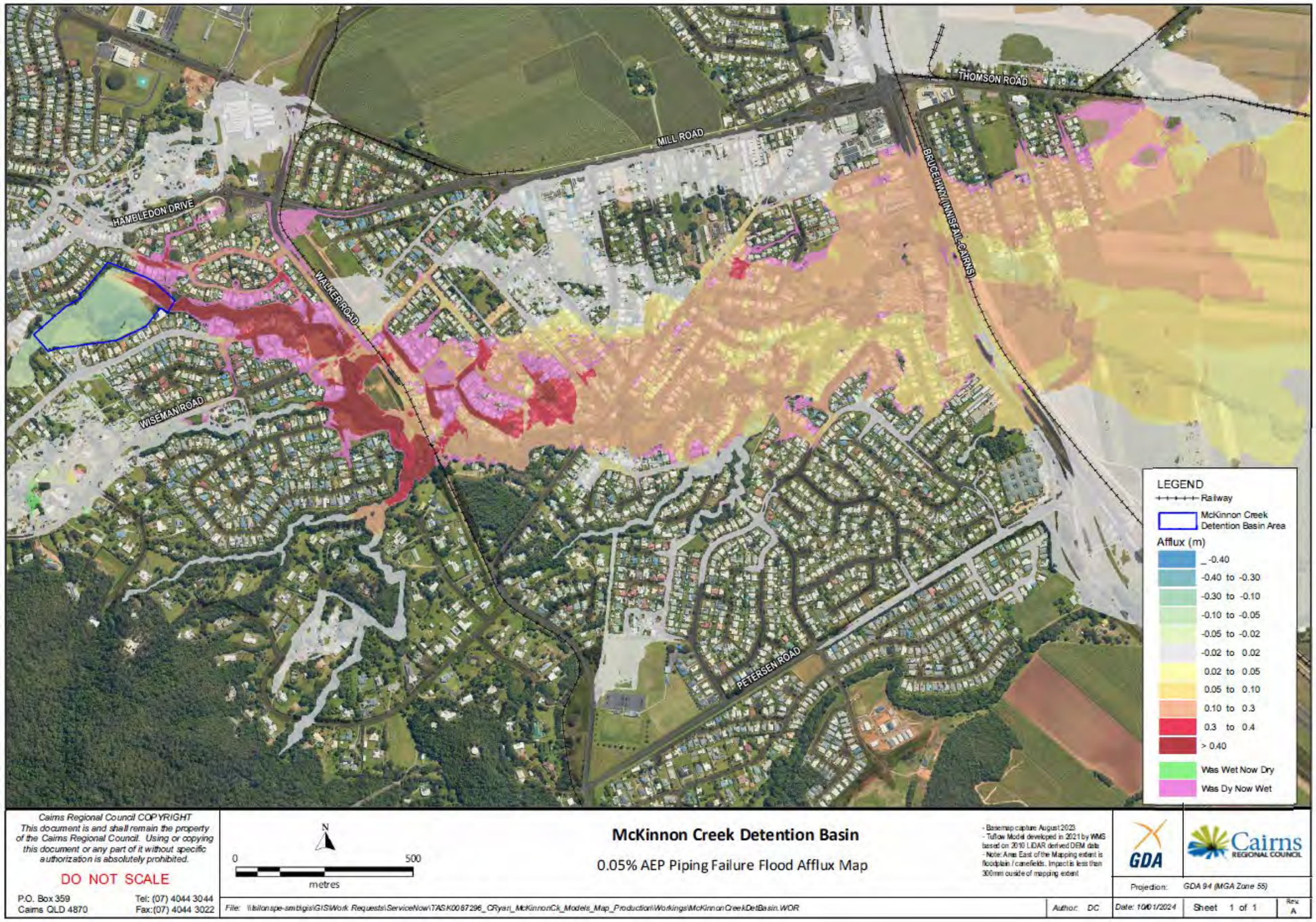
JOB No. M6080
DRAWING No. M6080-C21
REVISION A

20461-11

E. Inundation Maps



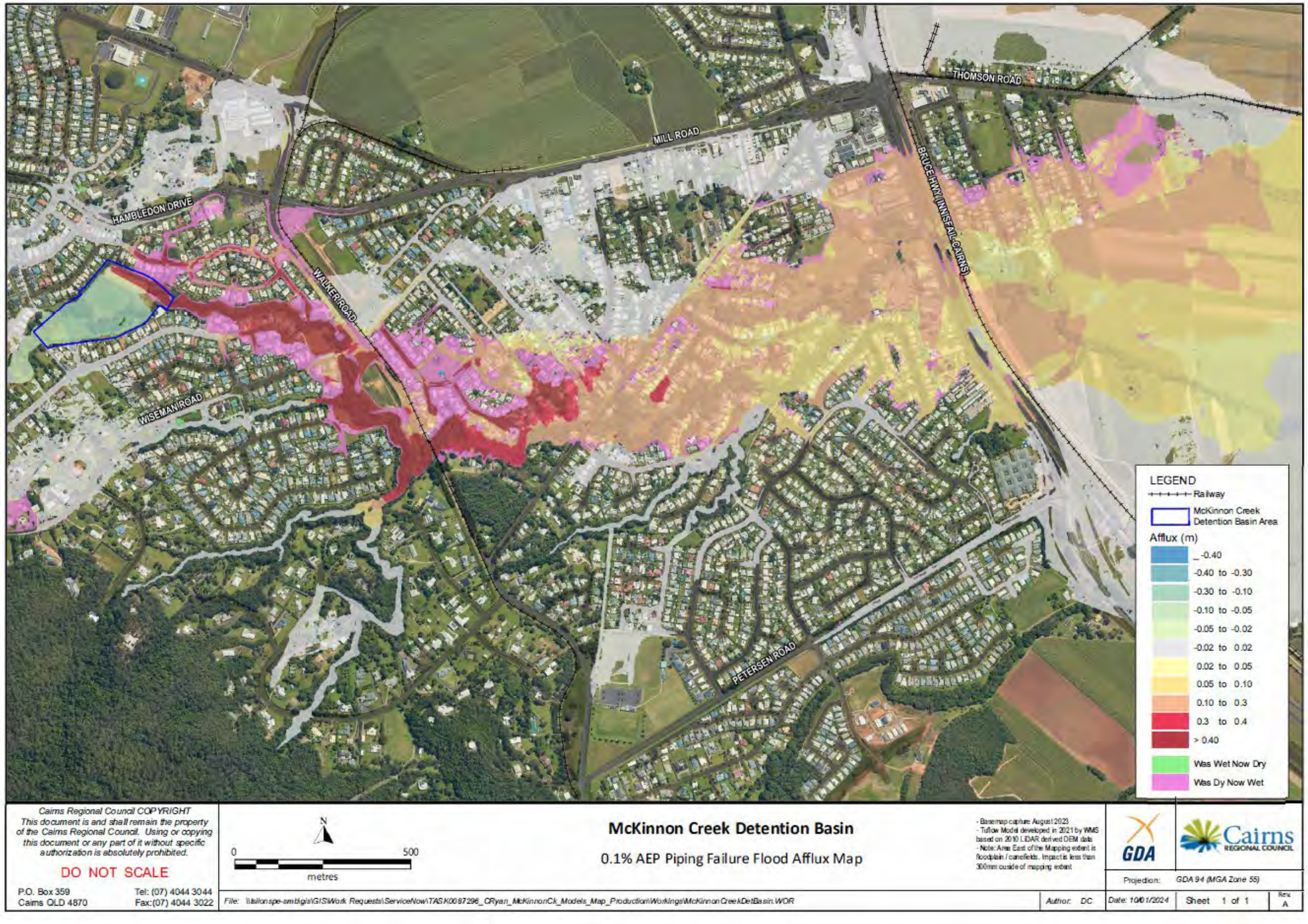
Map 1: 0.05% AEP Piping Failure Flood Depth Map



Map 2: 0.05% AEP Piping Failure Flood Afflux Map

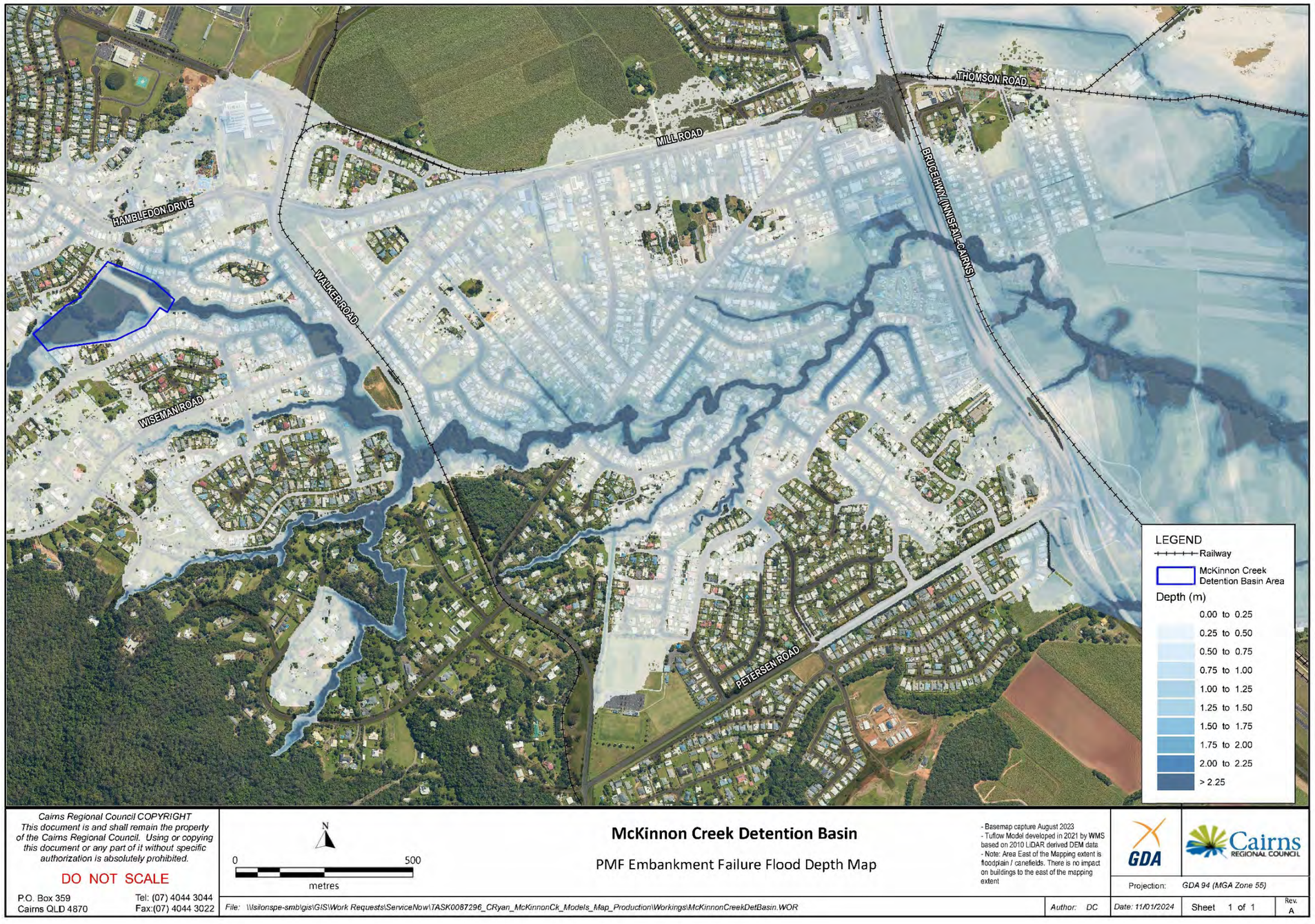
Map 3: 0.05% AEP Piping Failure Total PAR Location Map

Map 4: 0.1% AEP Piping Failure Flood Depth Map

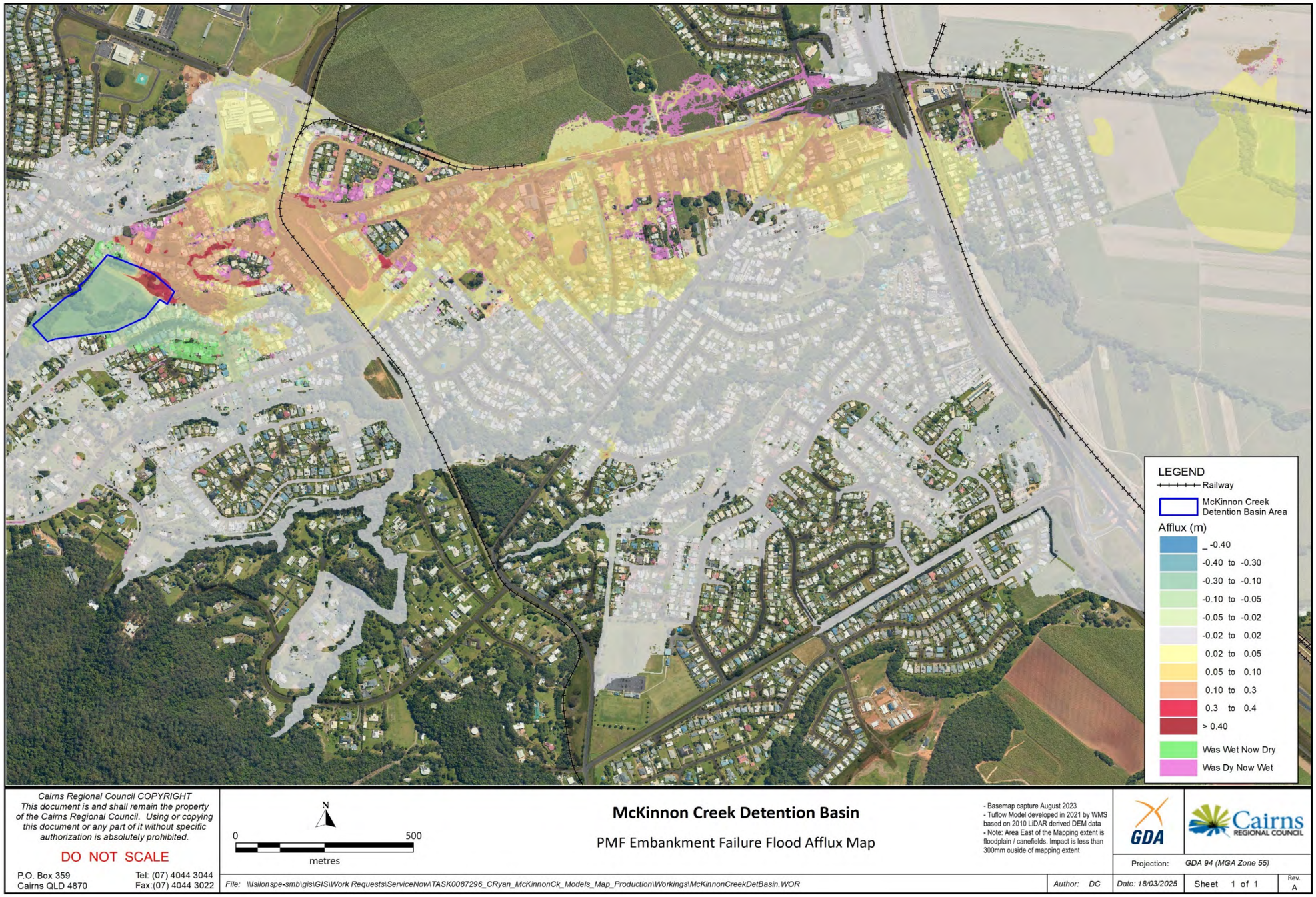


Map 5: 0.1% AEP Piping Failure Flood Afflux Map

Map 6: 0.1% AEP Piping Failure Total PAR Locations

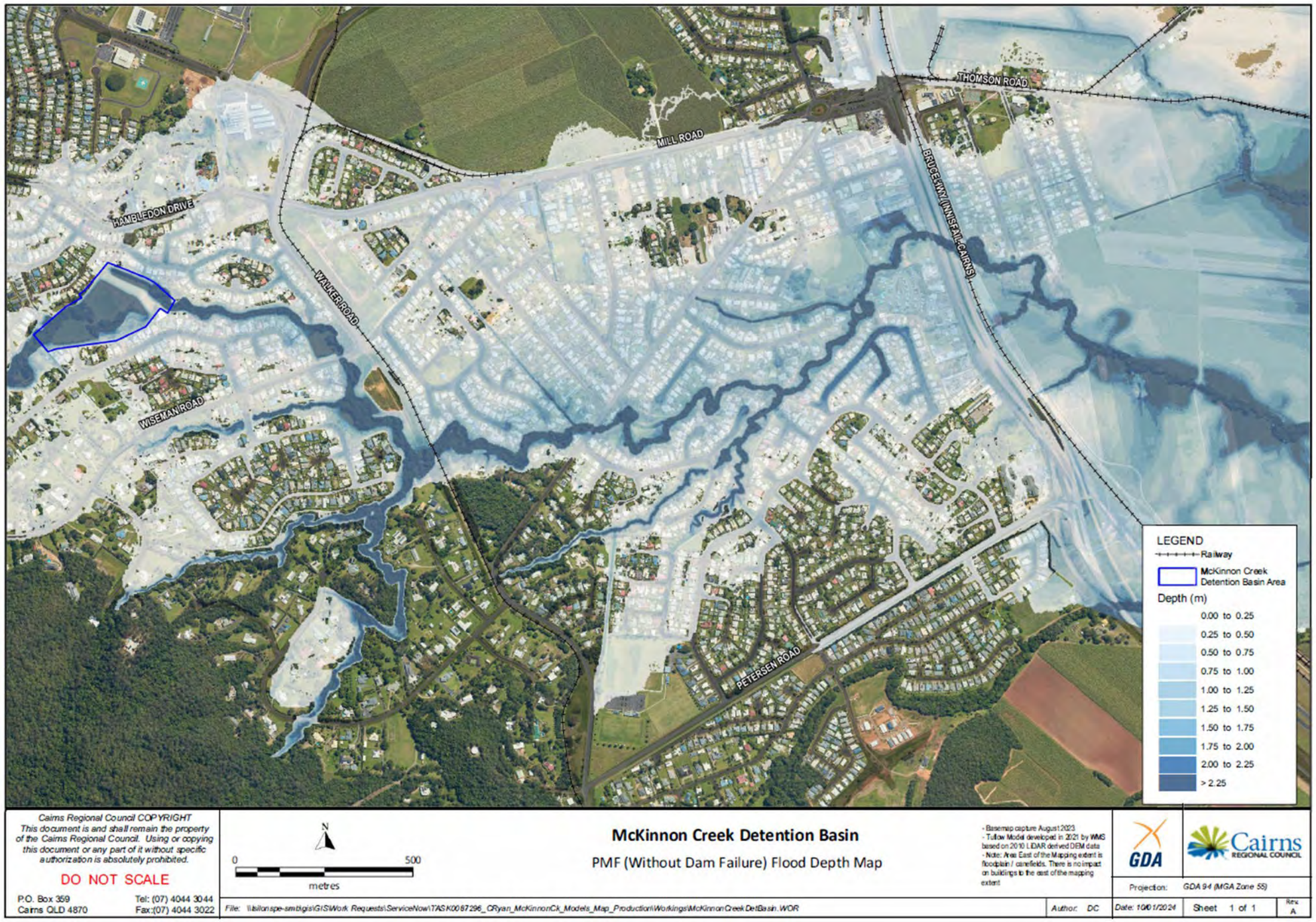


Map 7: PMF Embankment Failure Flood Depth Map



Map 8: PMF Embankment Failure Flood Afflux Map

Map 9: PMF Embankment Failure Total PAR



Map 10: PMF (Without Dam Failure) Flood Depth Map

F. Event Log and SITREP Template

Event Log

EVENT LOG					
DATE:			**ROLE/SHIFT:**		**PAGE:**
Serial	**Time**	**From**	**To**	**Item / Event**	**Comments/Action**

Record all major observations, decisions, actions, messages IN and OUT etc.

SITREP Template

Advice Number:	
Date:	
Time of Issue:	
Sent By:	

Current Water Levels

Location	Level (m AHD)	Rate of Rise Since Last Advice (m per hour)	Time of Observation
McKinnon Creek Detention Basin			

Current Spillway Operation

Location	Spillway Outflow Level (m AHD)	Spillway Outflow (m^3/s)	Time of Observation
McKinnon Creek Detention Basin			

Rainfall

Gauge Location	Rainfall Recorded (mm)	Time of Observation

Element	Report
Current Dam Conditions	*Advise physical changes to dam wall including damage to the embankment, spillway, or outlet.*
Summary	*Describe the major occurrences/events in the reporting period, actions taken, and resources deployed. Cross-reference any other outputs submitted since the last SITREP if appropriate.*
Intentions	*Describe actions planned for the next reporting period including staffing and resources, and mid to longer term intentions.*
Issues	*Highlight any issues that may impact on CRC achieving its desired outcomes; that may attract media attention; or that are likely to have major community consequences.*
Other	*Insert any administrative or other issues that need to be advised to CRC, the LDMG-CR or other stakeholders.*
Assessment	*Include an overall assessment of the situation from CRC's perspective.*

G. Remote Monitoring Station Details

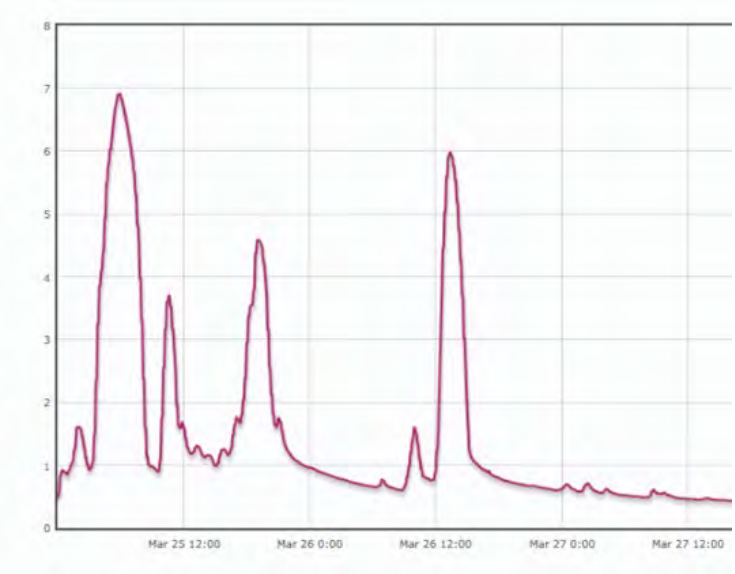
Remote Monitoring Station Login Details

It is recommended that each user set up their own account, however a general CRC login is as follows:

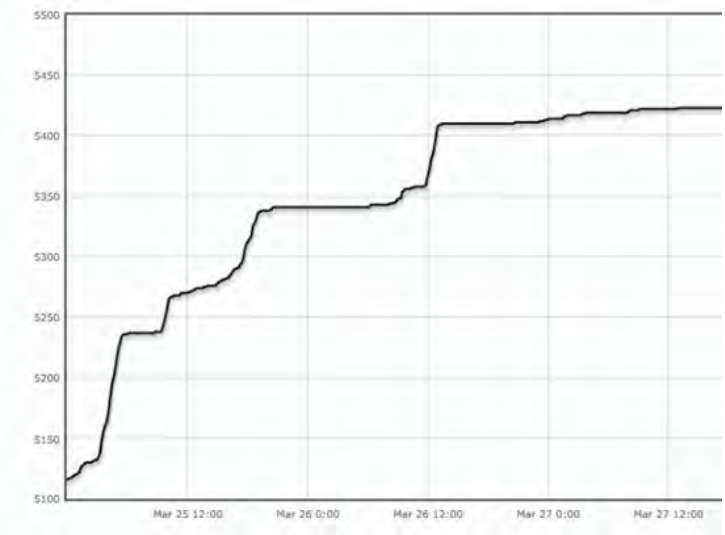
CCTV Access	
Monitoring Data Access	

Example Monitoring Outputs

Water Level



Cumulative Rainfall

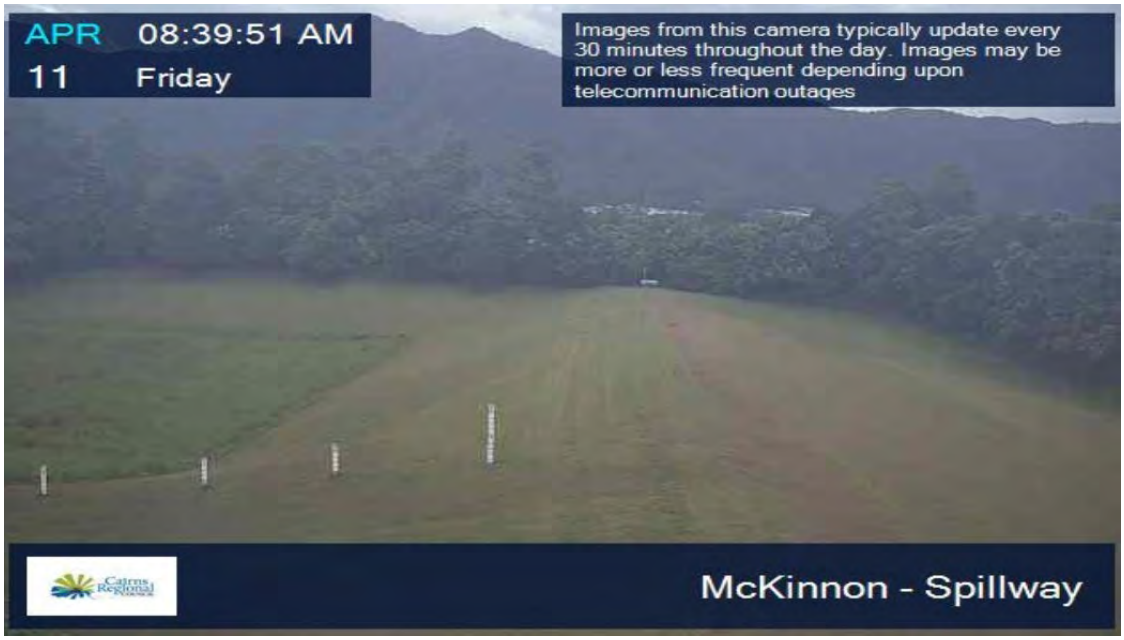


Pre-Set Camera Footage Angles

Click on ellipses to access Live Control of camera.


APR 08:37:41 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
McKinnon - Basin Overview


APR 08:38:30 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
McKinnon - Inlet

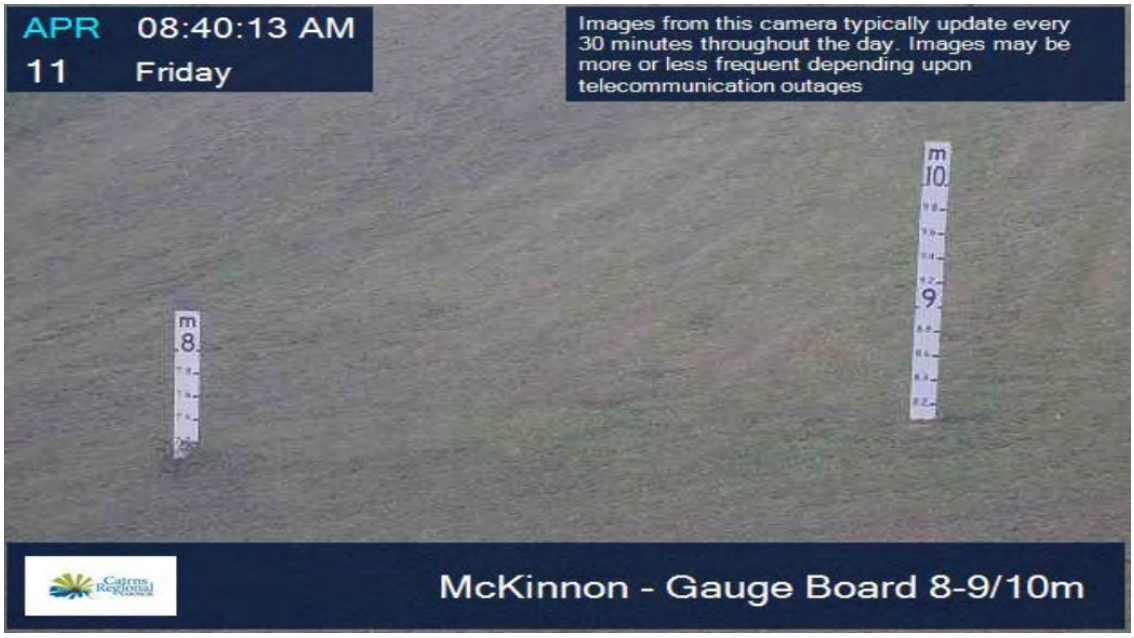

APR 08:39:51 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
McKinnon - Spillway


MAY 01:58:55 PM
15 Thursday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
McKinnon - Basin Overview


APR 08:38:46 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
McKinnon - Dam Crest


APR 08:39:29 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
McKinnon - Spillway Toe


APR 08:38:04 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
m6
m7
McKinnon - Gauge Board 6-7m


APR 08:40:13 AM
11 Friday
Images from this camera typically update every 30 minutes throughout the day. Images may be more or less frequent depending upon telecommunication outages
m8
m9
m10
McKinnon - Gauge Board 8-9/10m

H. Detention Basin Inspection Schedule (SAMPLE ONLY)

Score	0 / 2 (0%)	Flagged items	0	Actions	0
Document No.					
Inspectors Name					
Inspectors Position					
Conducted on					
Site					

SECTION	0 / 2 (0%)
Weather Conditions	
Rainfall past 24 hours (mm)	
Rainfall past 7 days (mm)	
Water level on gauge board (m)	
EMBANKMENT	
Is dam vegetation <300mm high for inspection?	
DAM CREST	
Depressions, cracks / changes?	
Deformation of crest or settlement?	
Alignment unchanged?	
Vegetation maintained (e.g., low grass, no trees, or shrubs)?	
Animal activity (e.g., burrows, termites)?	
Overall condition:	
DOWNSTREAM SLOPES	
Depressions, sinkholes, cracks / changes?	
Deformation, sliding, slumping, or bulging?	

Erosion?	
Vegetation maintained (e.g., low grass, no trees, or shrubs)?	
Wet spots or seepage?	
Animal activity (e.g., burrows, termites)?	
Overall condition:	
UPSTREAM SLOPES	
Depressions, sinkholes, cracks / changes?	
Deformation, sliding, slumping, or bulging?	
Erosion?	
Vegetation maintained (e.g., low grass, no trees, or shrubs)?	
Animal activity (e.g., burrows, termites)?	
Any noticeable water surface conditions (i.e., waves, ripples, or whirlpools?)	
Overall condition:	
SPILLWAY	0 / 1 (0%)
Unobstructed and clear of debris?	
Significant cracking or movement?	
Approach slab change in cracking or movement since previous inspection?	
Ogee crest change in cracking or movement since previous inspection?	
Spillway chute change in cracking or movement since previous inspection?	
Left training wall change in cracking or movement since previous inspection?	
Right training wall change in cracking or movement since previous inspection?	
Stilling basin change in cracking or movement since previous inspection?	
Stilling basin is clear of accumulated material?	

Seepage/ springs observed?	
Any cracking or deformation observed in the joints or joint sealant?	
Overall condition:	
LOW LEVEL OUTLET	0 / 1 (0%)
Head works (culvert) in good condition?	
Trash rack free of debris?	
Dissipator structure outlet unobstructed and clear of vegetation?	
Any concrete damage to dissipator structure?	
Fencing in good condition?	
Outlet free of debris?	
Changes in cracking or seepage observed from joints (if an internal inspection completed)?	
Overall condition:	
MISCELLANEOUS	
Drains are clear of debris?	
Signage is free of damage and graffiti?	
Gauge boards are clearly readable?	
Remote monitoring system is in good condition?	
Camera unobstructed?	
Any public safety issues or vandalism?	
Overall condition:	
FINAL COMMENTS OR ISSUES?	
Any further comments	
Signature	

I. Communication Templates

Activation Level	Alert	Lean Forward	Stand Up	Stand Down
Trigger for Communications: Dam Hazard – Flooding ***CRC Internal Stakeholder Communications***				
Contacted By: Dam Emergency Controller **Contact Group: Appendix I – CRC Internal Stakeholders**				
Whispir 1 – SMS 2 – Email	McKinnon Creek Detention Basin EAP has been activated to ALERT. Dam Hazard – Flooding. Attend ECO meeting and follow directions of the DEC. (Template #50)	McKinnon Creek Detention Basin EAP has been activated to LEAN FORWARD. Dam Hazard – Flooding. Attend ECO meeting and follow directions of the DEC. (Template #51)	McKinnon Creek Detention Basin EAP has been activated to STAND UP. Dam Hazard – Flooding. Attend ECO meeting and follow directions of the DEC. (Template #52)	McKinnon Creek Detention Basin EAP is at STAND DOWN. Attend ECO meeting and follow directions of the DEC. (Template #53)
Trigger for Communications: Dam Hazard – Flooding ***External Stakeholder Communications***				
Contacted By: Dam Emergency Controller and/or Local Disaster Coordinator **Contact Group: Appendix I – Key External Agencies**				
Whispir 1 – SMS 2 – Email	Contact Priority 1 external agency stakeholder (Appendix L)	McKinnon Creek Detention Basin EAP has been activated to LEAN FORWARD. Dam Hazard – Flooding. Follow directions of Local Disaster Coordinator. (Template #54)	McKinnon Creek Detention Basin EAP has been activated to STAND UP. Dam Hazard – Flooding. Follow directions of Local Disaster Coordinator. (Template #55)	McKinnon Creek Detention Basin EAP is at STAND DOWN. Follow directions of Local Disaster Coordinator. (Template #56)
		Contact Priority 1 external agency stakeholder (Appendix L)	Contact Priority 1 external agency stakeholder (Appendix L)	Contact Priority 1 external agency stakeholder (Appendix L)
Trigger for Communications: Dam Hazard – Flooding ***PAR Communications***				
Contacted By: LDMG-CR **Contact Group: Appendix K – NEAS Polygon – PAR**				
1 – Emergency Alert 2 – AWS	Not Applicable.	Emergency Alert #1 AWS Message #1	Emergency Alert #2 and/or #3 AWS Message #2 and/or #3	AWS Message #4
Trigger for Communications: Dam Hazard – Embankment Failure ***CRC Internal Stakeholder Communications***				
Contacted By: Dam Emergency Controller **Contact Group: Appendix I – CRC Internal Stakeholders**				
Whispir 1 – SMS 2 – Email	Not Applicable.	Not Applicable.	McKinnon Creek Detention Basin EAP has been activated to STAND UP. Dam Hazard – Embankment Failure. Attend ECO meeting and follow directions of the DEC. (Template #57)	McKinnon Creek Detention Basin EAP is at STAND DOWN. Attend ECO meeting and follow directions of the DEC. (Template #53)

Activation Level	Alert	Lean Forward	Stand Up	Stand Down
Trigger for Communications: Dam Hazard – Embankment Failure ***External Stakeholder Communications***				
Contacted By: Dam Emergency Controller and/or Local Disaster Coordinator **Contact Group: Appendix I – Key External Agencies**				
Whispir 1 – SMS 2 – Email	Not Applicable.	Not Applicable.	McKinnon Creek Detention Basin EAP has been activated to STAND UP. Dam Hazard – Embankment Failure. Follow directions of Local Disaster Coordinator. (Template #58)	McKinnon Creek Detention Basin EAP is at STAND DOWN. Follow directions of Local Disaster Coordinator. (Template #56)
			Contact Priority 1 external agency stakeholder (Appendix L)	Contact Priority 1 external agency stakeholder (Appendix L)
Trigger for Communications: Dam Hazard – Embankment Failure ***PAR Communications***				
Contacted By: LDMG-CR **Contact Group: Appendix K – NEAS Polygon – PAR**				
1 – Emergency Alert 2 – AWS	Not Applicable.	Not Applicable.	Emergency Alert #2 and/or #3 AWS Message #2 and/or #3	AWS Message #4
Trigger for Communications: Dam Hazard – Terror Threat / Malicious Activity ***CRC Internal Stakeholder Communications***				
Contacted By: Dam Emergency Controller **Contact Group: Appendix I – CRC Internal Stakeholders**				
Whispir 1 – SMS 2 – Email	Not Applicable.	Not Applicable.	McKinnon Creek Detention Basin EAP has been activated to STAND UP. Dam Hazard – Terror Threat/Malicious Activity. Attend ECO meeting and follow directions of the DEC. (Template #61)	McKinnon Creek Detention Basin EAP is at STAND DOWN. Attend ECO meeting and follow directions of the DEC. (Template #53)
Trigger for Communications: Dam Hazard – Terror Threat / Malicious Activity ***External Stakeholder Communications***				
Contacted By: Dam Emergency Controller and/or Local Disaster Coordinator **Contact Group: Appendix I – Key External Agencies**				
Whispir 1 – SMS 2 – Email	Not Applicable.	Not Applicable.	McKinnon Creek Detention Basin EAP has been activated to STAND UP. Dam Hazard – Terror Threat/Malicious Activity. Follow directions of Local Disaster Coordinator. (Template #62)	McKinnon Creek Detention Basin EAP is at STAND DOWN. Follow directions of Local Disaster Coordinator. (Template #56)
			Contact Priority 1 external agency stakeholder (Appendix L)	Contact Priority 1 external agency stakeholder (Appendix L)
Trigger for Communications: Dam Hazard – Terror Threat / Malicious Activity ***PAR Communications***				
Contacted By: LDMG-CR				

Activation Level	Alert	Lean Forward	Stand Up	Stand Down
Contact Group: Appendix K – NEAS Polygon – PAR				
1 – Emergency Alert 2 – AWS	Not Applicable.	Not Applicable.	Emergency Alert #2 and/or #3 AWS Message #2 and/or #3	AWS Message #5

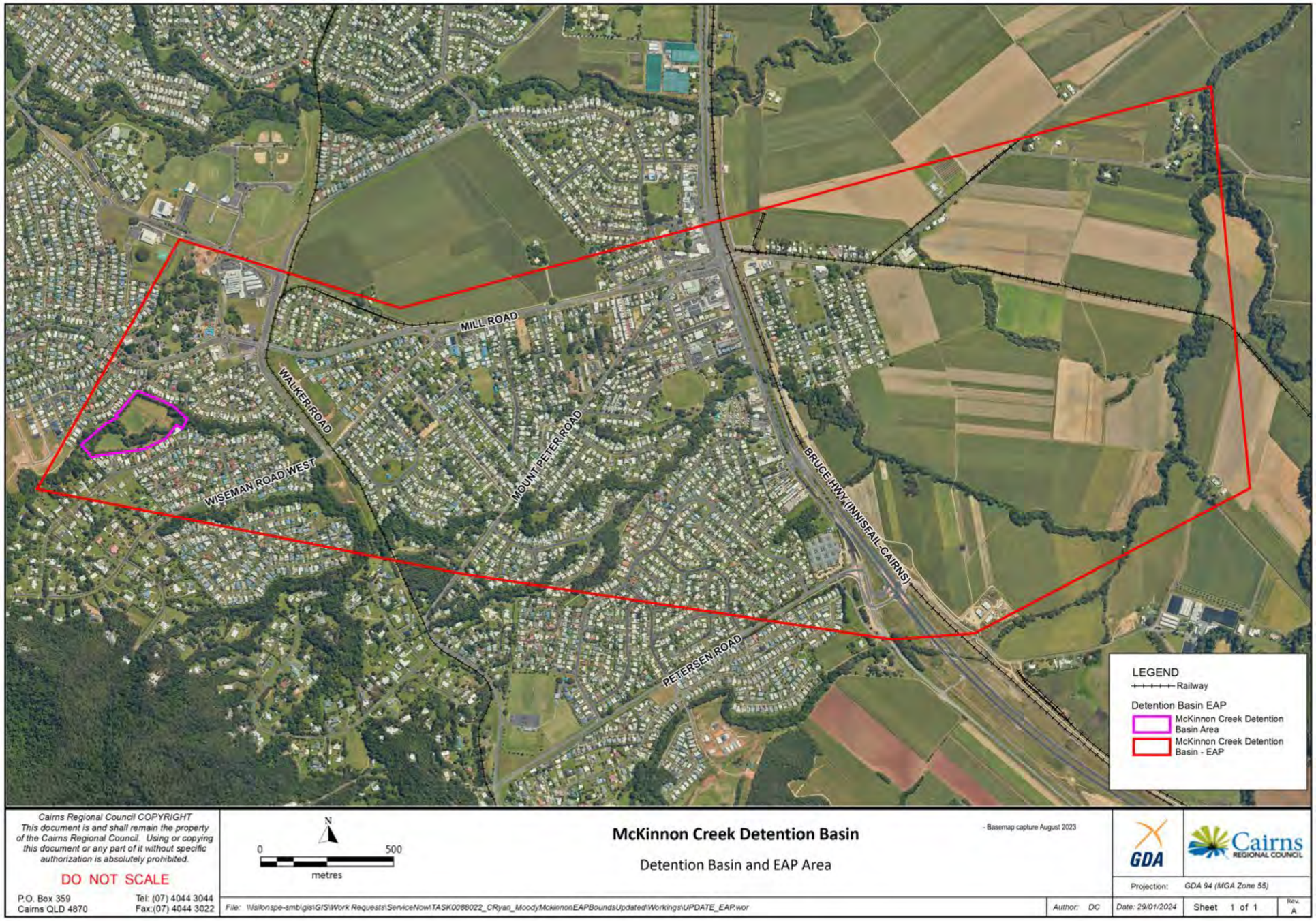
J. AWS Message Templates

AWS	AWS Message #1	AWS Message #2	AWS Message #3	AWS Message #4	AWS Message #5
	WATCH & ACT: PREPARE TO LEAVE/EVACUATE	**EMERGENCY WARNING: LEAVE/EVACUATE IMMEDIATELY**	**WATCH & ACT: AVOID THE AREA**	**ADVICE: RETURN WITH CAUTION**	**ADVICE: RETURN WITH CAUTION**

LONG-FORM TEXT	**PREPARE TO LEAVE/EVACUATE – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].**
	
	Warning Level: WATCH AND ACT
	
	Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek [Edmonton].
	
	Areas in Edmonton near McKinnon Creek Detention Basin may experience rapidly rising water levels and property flooding. Possible danger to residents. Warn your neighbours and **PREPARE TO LEAVE/EVACUATE**.
	
	If your life is in danger, call Triple Zero (000) immediately.
	
	For flood and storm emergency help, call the SES on 132 500 or download the SES Assistance QLD app.
	
	What you should do:
	• Prepare to leave so you can go quickly and safely if the flood gets worse. Get ready now.
	• Stay away from creeks and rivers.
	• If you come to a flooded road, turn around and go another way. If it's flooded, forget it.
	
	If you are camping or caravanning:
	• Pack up your campsite.
	• Move people, pets, your camping gear, and vehicle to higher ground.
	
	Impacts in your area:
	• Flooding above ground floor level [possible] in some places.
	• Flooding above first floor level [possible] in some places.
	
	More information:
	• Click here for all local warnings https://disaster.cairns.qld.gov.au/
	• Tune in to 105.1 for ABC Radio National.
	• Weather warnings go to http://www.bom.gov.au/qld/cairns/
	
	The next update will be sent at [time, day, date] or when the situation changes.
	
	This warning has been issued by Cairns Disaster Group.
		LEAVE/EVACUATE IMMEDIATELY – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].
		
		Warning Level: EMERGENCY WARNING
		
		Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek-[Edmonton].
		
		Water in McKinnon Creek, Collinson Creek, and Stony Creek is rising quickly and there is major flooding in areas of Edmonton. People downstream of McKinnon Creek Detention Basin must **LEAVE/EVACUATE IMMEDIATELY**.
		
		Do not expect emergency services to come to your door.
		
		If your life is in danger, call Triple Zero (000) immediately. For flood and storm emergency help, call the SES on 132 500.
		
		What you should do:
		• Go to a safe place away from the flood now. Stay away from creeks and rivers.
		• If you come to a flooded road, turn around and go another way. If it's flooded, forget it.
		
		Impacts in your area:
		• Flooding above ground floor level [likely] in some places.
		• Flooding above first-floor level [likely] in some places.
		
		More information:
		• Click here for all local warnings https://disaster.cairns.qld.gov.au/
		• Tune in to 105.1 for ABC Radio National.
		• Weather warnings go to http://www.bom.gov.au/qld/cairns/
		
		The next update will be sent at [time, day, date] or when the situation changes.
		
		This warning has been issued by Cairns Disaster Group.
			AVOID THE AREA – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].
			
			Warning Level: WATCH AND ACT
			
			Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek [Edmonton].
			
			Flood water downstream of McKinnon Creek Detention Basin in Edmonton is starting to go down, but it is still too dangerous to start cleaning up and making repairs. **AVOID THE AREA**.
			
			What you should do:
			• If you evacuated, stay where you are until you are told it is safe to go back.
			• If you did not leave, stay in your safe place.
			• Floodwater is dangerous - never drive, walk, or ride through floodwater. If it's flooded, forget it.
			
			More information:
			• Click here for all local warnings https://disaster.cairns.qld.gov.au/
			• Tune in to 105.1 for ABC Radio National.
			• Weather warnings go to http://www.bom.gov.au/qld/cairns/
			• For flood and storm emergency help, call the SES on 132 500.
			• If your life is in danger, call Triple Zero (000) immediately.
			
			The next update will be issued when the situation changes.
			
			This warning has been issued by Cairns Disaster Group.
				RETURN WITH CAUTION – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].
				
				Warning Level: ADVICE
				
				Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek [Edmonton].
				
				Flooding downstream of McKinnon Creek Detention Basin in Edmonton has stopped and the water has gone down. If you left, **RETURN WITH CAUTION**.
				
				Be careful of damage and never drive through floodwaters. If it's flooded, forget it.
				
				What you should do if your home or business has been flooded:
				• Check for building damage before you go inside.
				• Have all electrical and gas equipment professionally tested before use.
				• If water went above power points have the house checked by an electrician before turning the power back on.
				• Clean and dry out the building as soon as you can.
				• Protect your health and safety:
				  • Wear strong boots, gloves and protective clothing when cleaning up.
				  • Wash your hands and clothes often.
				  • Do not eat food that has touched floodwater or mud.
				  • Throw away food that should be kept cold or frozen if you lost power.
				  • Drink only fresh drinking water, like bottled water.
				
				Support and recovery help:
				• For flood and storm emergency help, call the SES on 132 500 or download the SES Assistance Queensland app.
				• Go to https://disaster.cairns.qld.gov.au/ for local updates including road closures and power outages.
				• Tune in to 105.1 for ABC Radio National.
				• Weather warnings go to http://www.bom.gov.au/qld/cairns/
				• For general relief and recovery information go to https://www.getready.qld.gov.au/after-disaster
				
				This warning has been issued by Cairns Disaster Group.
					RETURN WITH CAUTION – McKinnon Creek Detention Basin catchment as at [time, day, date, year].
					
					Warning Level: ADVICE
					
					Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek.
					
					Threat is reduced in the vicinity of McKinnon Creek Detention Basin in Edmonton and you may now **RETURN WITH CAUTION**.
					
					In a life-threatening situation, call Triple Zero (000) immediately.
					
					What are we expecting?
					• The situation at the McKinnon Creek Detention Basin has been resolved. There is no further anticipated threat to the basin.
					
					What you should do:
					• Return to your homes.
					• Stay informed.
					
					For more information:
					• Go to https://disaster.cairns.qld.gov.au/ for local updates including road closures and power outages.
					• Tune in to 105.1 for ABC Radio National.
					• Check road closures at the QLD Traffic website or for phone service call 13 19 40.
					• Follow the Council's news & media releases, here: https://www.cairns.qld.gov.au/council/news-notices/media-releases
					
					This warning has been issued by Cairns Disaster Group.

AWS	AWS Message #1	AWS Message #2	AWS Message #3	AWS Message #4	AWS Message #5
	WATCH & ACT: PREPARE TO LEAVE/EVACUATE	**EMERGENCY WARNING: LEAVE/EVACUATE IMMEDIATELY**	**WATCH & ACT: AVOID THE AREA**	**ADVICE: RETURN WITH CAUTION**	**ADVICE: RETURN WITH CAUTION**
SOCIAL TILE	**PREPARE TO LEAVE/EVACUATE – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].** **Warning Level: WATCH AND ACT** **Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek [Edmonton].** Areas in Edmonton near McKinnon Creek Detention Basin may experience rapidly rising water levels and property flooding. Possible danger to residents. Warn your neighbours and **PREPARE TO LEAVE/EVACUATE**. **If your life is in danger, call Triple Zero (000) immediately.** For flood and storm emergency help, call the SES on 132 500 or download the SES Assistance QLD app. **The next update will be sent at [time, day, date] or when the situation changes.** This warning has been issued by Cairns Disaster Group.	**LEAVE/EVACUATE IMMEDIATELY – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].** **Warning Level: EMERGENCY WARNING** **Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek [Edmonton].** Water in McKinnon Creek, Collinson Creek, and Stony Creek is rising quickly and there is major flooding in areas of Edmonton. People downstream of McKinnon Creek Detention Basin must **LEAVE/EVACUATE IMMEDIATELY**. Do not expect emergency services to come to your door. **If your life is in danger, call Triple Zero (000) immediately. For flood and storm emergency help, call the SES on 132 500.** **The next update will be sent at [time, day, date] or when the situation changes.** This warning has been issued by Cairns Disaster Group.	**AVOID THE AREA – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].** **Warning Level: WATCH AND ACT** **Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek-[Edmonton].** Flood water downstream of McKinnon Creek Detention Basin in Edmonton is starting to go down, but it is still too dangerous to start cleaning up and making repairs. **AVOID THE AREA**. **The next update will be issued when the situation changes.** This warning has been issued by Cairns Disaster Group.	**RETURN WITH CAUTION – McKinnon Creek Detention Basin catchment flood as at [time, day, date, year].** **Warning Level: ADVICE** **Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek, Collinson Creek, and Stony Creek [Edmonton].** Flooding downstream of McKinnon Creek Detention Basin in Edmonton has stopped and the water has gone down. If you left, **RETURN WITH CAUTION**. Be careful of damage and never drive through floodwaters. If it's flooded, forget it. This warning has been issued by Cairns Disaster Group.	**RETURN WITH CAUTION – McKinnon Creek Detention Basin catchment as at [time, day, date, year].** **Warning Level: ADVICE** **Warning Area: Areas downstream of McKinnon Creek Detention Basin and in proximity to McKinnon Creek.** Threat is reduced in the vicinity of McKinnon Creek Detention Basin in Edmonton and you may now **RETURN WITH CAUTION**. **In a life-threatening situation, call Triple Zero (000) immediately.** This warning has been issued by Cairns Disaster Group.

K. NEAS Polygon and Emergency Alert Request Form Templates



Emergency Alert Request Form Templates

Alert 1 – McKinnon Creek Detention Basin Failure – Watch & Act – Prepare to Leave/evacuate

OFFICIAL

Queensland Government	PHONE THE [redacted] – ADVISE EA IS BEING DEVELOPED **EMERGENCY ALERT REQUEST**	
	Location of Alert: McKinnon Creek Detention Basin is situated on Lot 500 RP 887878 & Lot 985 RP 906385 Edmonton, Cairns, QLD 4869. (e.g. Suburb, Town)	**Date:** Click or tap to enter a date.
	LGA/Agency requesting: Cairns Regional Council	**Time:** Click or tap here
Requesting Officer (e.g. Disaster Coordinator/Incident Controller) **Name:** Click or tap here to enter text. **Agency/Position: LDC, Cairns Regional Council**		**Telephone:** Click or tap here to enter text. (SDCC Watch Desk may telephone you)
Email: [redacted]		
Advised	**LDC/LDMG:** ☒ YES **DDC/DDMG:** ☐YES **Neighbouring LDMG/LGA:** ☐YES ☐ N/A	
Send Alert	**Immediately:** ☒YES	**Scheduled:** ☐YES Date & Time Click or tap here to enter text.
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): Click or tap here to enter text.	
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, Chemical Spill, 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): McKinnon Creek Detention Basin Failure Watch and Act Prepare to Leave Evacuate		**Polygon Filename. (Kml, Kmz, Gml, GeoJSON):** [redacted] **Number of polygons 1** (if multiple, attach list in order of priority)
Supplied via: ☒ DM Portal ☐ Email ☐ Verbal ☐ Other (please specify):		**Supplied via:** ☒ DM Portal ☐ Email ☐ Verbal ☐ Other (please specify):
Voice: Type or handwrite, max 4000 characters incls spaces. (Ideally message should be <150 characters)		**Voice type:** Male ☐ Female ☒
FLASH FLOOD WATCH AND ACT message from the Cairns Disaster Group. Areas in Edmonton near McKinnon Creek Detention Basin may experience rapidly rising water levels and property flooding. Possible danger to residents. Warn your neighbours and PREPARE TO LEAVE/EVACUATE. If your life is in danger, Call Triple Zero. Go to www.disaster.cairns.qld.gov.au or listen to ABC radio.		
SMS: Type or handwrite, use capitals to highlight warning level, hazard, location and call to action statement. Max 612 characters incls spaces. (Ideally should be < 160 characters incl. spaces)		
FLASH FLOOD WATCH AND ACT message from Cairns Disaster Group. Areas in Edmonton near McKinnon Creek Detention Basin may experience rapidly rising water levels and property flooding. Possible danger to residents. Warn your neighbours and PREPARE TO LEAVE/EVACUATE. If your life is in danger, Call 000. Go to www.disaster.cairns.qld.gov.au or listen to ABC radio.		
Remove EA from websites:	☒ 12 hrs ☐ 24 hrs ☐ 48 hrs ☐ Specify Date & Time: Click or tap here ☐ Check back in 12 hrs: Contact #:Click or tap here ☐ Replace previous EA message	
Requesting Officer: Click or tap here to enter text. **Signature:** Click or tap here to enter text. **Date:** Click or tap here to enter text.		
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: Click or tap here to enter text. Signature: Click or tap here to enter text. Date: Click or tap here		Emergency Alert No: Click or tap here EMS EA Campaign Report ID: Click or tap here
Authorising Officer Name: Click or tap here to enter text. Signature: Click or tap here to enter text. Date: Click or tap here		
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		

EA Request Form – F.1.177 Last Updated: 20 August 2024 Version: 3.2

OFFICIAL

Alert 2 – McKinnon Creek Detention Basin Failure – Emergency Warning Leave/Evacuate Immediately

OFFICIAL

Queensland Government

PHONE THE [redacted] – ADVISE EA IS BEING DEVELOPED

EMERGENCY ALERT REQUEST

Location of Alert: McKinnon Creek Detention Basin is situated on Lot 500 RP 887878 & Lot 985 RP 906385 Edmonton, Cairns, QLD 4869.
(e.g. Suburb, Town)

Date: Click or tap to enter a date.

LGA/Agency requesting: Cairns Regional Council

Time: Click or tap here

Requesting Officer (e.g. Disaster Coordinator/Incident Controller)
Name: Click or tap here to enter text.
Agency/Position: LDC, Cairns Regional Council

Telephone: Click or tap here to enter text.
(SDCC Watch Desk may telephone you)

Email: [redacted]

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

Send Alert **Immediately:** ☒YES **Scheduled:** ☐YES Date & Time Click or tap here to enter text.

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): Click or tap here to enter text.

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, Chemical Spill, 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):
McKinnon Creek Detention Basin Failure Emergency Warning Leave Evacuate Immediately

Polygon Filename, (Kml, Kmz, Gml, GeoJSON): [redacted]
Number of polygons 1 (if multiple, attach list in order of priority)

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

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

Voice: Type or handwrite, max 40000 characters incls spaces. (Ideally message should be >450 characters)

Voice type: Male ☐ Female ☒

This is a Flash Flood Emergency Warning from the Cairns Disaster Group. Water in McKinnon Creek, Collinson Creek, and Stony Creek is rising quickly and there is major flooding in areas of Edmonton. People downstream of McKinnon Creek Detention Basin must LEAVE/EVACUATE IMMEDIATELY. If your life is in danger, Call Triple Zero.
Go to www.disaster.cairns.qld.gov.au or listen to ABC radio.

SMS: Type or handwrite, use capitals to highlight warning level, hazard, location and call to action statement. Max 512 characters incls spaces. (Ideally should be < 160 characters incl. access)

This is a Flash Flood Emergency Warning from the Cairns Disaster Group. Water in McKinnon Creek, Collinson Creek, and Stony Creek is rising quickly and there is major flooding in areas of Edmonton. People downstream of McKinnon Creek Detention Basin must LEAVE/EVACUATE IMMEDIATELY. If your life is in danger, Call 000. Go to www.disaster.cairns.qld.gov.au or listen to ABC radio.

Remove EA from websites:

☒ 12 hrs	☐ 24 hrs	☐ 48 hrs	☐ Specify Date & Time: Click or tap here	☐ Check back in 12 hrs: Contact #:Click or tap here .

☐ Replace previous EA message.

Requesting Officer: Click or tap here to enter text. **Signature:** Click or tap here to enter text.
Date: Click or tap here to enter text.

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: Click or tap here to enter text.
Signature: Click or tap here to enter text. Date: Click or

Authorising Officer Name: Click or tap here to enter text.
Signature: Click or tap here to enter text. Date: Click or t

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

Emergency Alert No:
Click or tap here
EMS EA Campaign Report ID:
Click or tap here

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

EA Request Form – F.1.177 Last Updated: 20 August 2024 Version: 3.2

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Alert 3 – McKinnon Creek Detention Basin Failure – Watch & Act – Avoid the Area

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Queensland Government

PHONE THE [redacted] – ADVISE EA IS BEING DEVELOPED

EMERGENCY ALERT REQUEST

Location of Alert: McKinnon Creek Detention Basin is situated on Lot 500 RP 887878 & Lot 985 RP 906385 Edmonton, Cairns, QLD 4869.
(e.g. Suburb, Town)

Date: Click or tap to enter a date.

LGA/Agency requesting: Cairns Regional Council

Time: Click or tap here

Requesting Officer (e.g. Disaster Coordinator/Incident Controller)
Name: Click or tap here to enter text.
Agency/Position: LDC, Cairns Regional Council

Telephone: Click or tap here to enter text.
(SDCC Watch Desk may telephone you)

Email: [redacted]

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

Send Alert **Immediately:** ☒YES **Scheduled:** ☐YES Date & Time Click or tap here to enter text.

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): Click or tap here to enter text.

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, Chemical Spill, 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):
McKinnon Creek Detention Basin Watch and Act Avoid the Area

Polygon Filename. (Kml, Kmz, Gml, GeoJSON]:
[redacted]
Number of polygons 1 (if multiple, attach list in order of priority)

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

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

Voice: Type or handwrite, max 4000 characters incls spaces. (Ideally message should be <450 characters) **Voice type:** Male ☐ Female ☒

FLASH FLOOD WATCH AND ACT message from the Cairns Disaster Group. Flood water downstream of McKinnon Creek Detention Basin in Edmonton is starting to go down, but it is still too dangerous to start cleaning up and making repairs. AVOID THE AREA.
Get full warnings and what you should do at www.disaster.cairns.qld.gov.au

SMS: Type or handwrite, use capitals to highlight warning level, hazard, location and call to action statement. Max 612 characters incls spaces. (Ideally should be < 160 characters incl. spaces)

FLASH FLOOD WATCH AND ACT message from the Cairns Disaster Group. Flood water downstream of McKinnon Creek Detention Basin in Edmonton is starting to go down, but it is still too dangerous to start cleaning up and making repairs. AVOID THE AREA.
Get full warnings and what you should do at www.disaster.cairns.qld.gov.au

Remove EA from websites:
☒ 12 hrs ☐ 24 hrs ☐ 48 hrs ☐ Specify Date & Time: Click or tap here ☐ Check back in 12 hrs: Contact #: Click or tap here .
☐ Replace previous EA message.

Requesting Officer: Click or tap here to enter text. **Signature:** Click or tap here to enter text.
Date: Click or tap here to enter text.

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: Click or tap here to enter text.
Signature: Click or tap here to enter text. Date: Click or

Emergency Alert No:
Click or tap here

Authorising Officer Name: Click or tap here to enter text.
Signature: Click or tap here to enter text. Date: Click or t

EMS EA Campaign Report ID:
Click or tap here

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

EA Request Form – F.1.177 Last Updated: 20 August 2024 Version: 3.2

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L. Contact Details for CRC and Key External Agencies

CRC Internal Stakeholders

EAP Role	Name	Contact Details	Contacted By	Contact Priority	Notification Requirement
Dam Emergency Controller (DEC)	Executive Manager Works		Primary Notifier	**1**	**Alert:** Primary role holder or delegate to notify priority internal stakeholders of decision to activate EAP to Alert status. **Lean Forward:** Primary role holder or delegate to notify priority internal stakeholders of decision to escalate EAP to Lean Forward status. **Stand Up:** Primary role holder or delegate to notify priority internal stakeholders of decision to activate EAP to Stand Up status and advise on the severity of the emergency. **Stand Down:** Primary role holder or delegate to notify priority internal stakeholders of decision to transition EAP to Stand Down status.
	Construction Engineer/Coordinator		Dam Emergency Controller		
	Coordinator Maintenance South		Dam Emergency Controller		
Dam Emergency Observer (DEO)	Team Leader Works South B		Dam Emergency Controller	**2**	**Alert:** Advise of decision to activate EAP to Alert status. **Lean Forward:** Advise of decision to escalate EAP to Lean Forward status. **Stand Up:** Advise of decision to activate EAP to Stand Up status and advise on the severity of the emergency. **Stand Down:** Advise of decision to transition EAP to Stand Down status.
	Technical Officer MMS		Dam Emergency Controller		
Dam Emergency Compliance Coordinator (DECC)	Executive Manager Business Performance & Compliance		Dam Emergency Controller	**3**	**Alert:** Advise of decision to activate EAP to Alert status. **Lean Forward:** Advise of decision to escalate EAP to Lean Forward status. **Stand Up:** Advise of decision to activate EAP to Stand Up status and advise on the severity of the emergency. **Stand Down:** Advise of decision to transition EAP to Stand Down status.
	Team Leader Quality & Compliance		Dam Emergency Controller		
	Quality & Dam Safety Systems Officer		Dam Emergency Controller		

EAP Role	Name	Contact Details	Contacted By	Contact Priority	Notification Requirement
Local Disaster Management Group – Cairns Region (LDMG-CR)	Local Disaster Coordinator		Dam Emergency Controller	**4**	**Alert:** Advise of decision to activate EAP to Alert status. **Lean Forward:** Advise of decision to escalate EAP to Lean Forward status. **Stand Up:** Advise of decision to activate EAP to Stand Up status. Advise on the severity of the emergency including likelihood of need for emergency services response assistance. **Stand Down:** Advise of decision to transition EAP to Stand Down status. Request recovery operations assistance if required.
	Chair, LDMG-CR		Dam Emergency Controller		
	Deputy Chair, LDMG – CR		Dam Emergency Controller		
	Out of Hours Disaster Duty Officer		Dam Emergency Controller		
Cairns Infrastructure & Assets Directorate, Cairns Regional Council (CIA Directorate, CRC)	Director Cairns Infrastructure & Assets		Dam Emergency Controller	**5**	**Alert:** Advise of decision to activate EAP to Alert status. **Lean Forward:** Advise of decision to escalate EAP to Lean Forward status. **Stand Up:** Advise of decision to activate EAP to Stand Up status and advise on the severity of the emergency. Advise on the severity of the emergency including likelihood of need for assistance from Dam Technical Advisor. **Stand Down:** Advise of decision to transition EAP to Stand Down status.
	Associate Director Service Delivery		Dam Emergency Controller		
	Associate Director Engineering Services		Dam Emergency Controller		
	Coordinator Strategic Asset Management & Planning WaRR (Senior Engineer Dams)		Dam Emergency Controller		

EAP Role	Name	Contact Details	Contacted By	Contact Priority	Notification Requirement
Cairns Regional Council (CRC)	Chief Executive Officer		Dam Emergency Controller	**6**	**Alert:** Advise of decision to activate EAP to Alert status. **Lean Forward:** Advise of decision to escalate EAP to Lean Forward status. **Stand Up:** Advise of decision to activate EAP to Stand Up status and advise on the severity of the emergency. **Stand Down:** Advise of decision to transition EAP to Stand Down status.
	Mayor		Dam Emergency Controller		
	Division 1 Councillor		Dam Emergency Controller		
	Division 2 Councillor		Dam Emergency Controller		
	Executive Manager Marketing & Communications		Dam Emergency Controller		
	Media Coordinator		Dam Emergency Controller		

Key External Agencies

Agency	Position	Contact Details	Contacted By	Contact Priority	DEC / DECC Notification Requirement
Dam Safety Regulator - Department of Local Government, Water and Volunteers (DLGWV)	RDMW 24/7 Incident Hotline Director Dam Safety	[redacted]	Dam Emergency Compliance Coordinator	**1**	**Alert:** DEC to advise of decision to activate EAP to Alert status via DECC. Advise on the severity of the event and status of the dam. Determine frequency of SITREPs. **Lean Forward:** DEC to advise of decision to escalate EAP to Lean Forward status via DECC. Advise of any changes to the severity of the event and status of the dam. **Stand Up:** DEC to advise of decision to escalate EAP to Stand Up status via DECC. Advise of any changes to the status of the dam during emergency. Notify of any incidents or failures in accordance with the prescribed Dam Safety Conditions Schedule. **Stand Down:** DEC to advise of decision to transition EAP to Stand Down status via DECC.
Queensland Police Service – Disaster Operations	[redacted] Emergency Management Coordinator – Far Northern Region	[redacted]	Local Disaster Coordinator	**2**	**Status Change: Alert** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to activate EAP to Alert status via LDC through internal communications platform. **Status Change: Lean Forward** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to escalate EAP to Lean Forward status via LDC. **Status Change: Stand Up** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to activate EAP to Stand Up status via LDC. Advise on the severity of the emergency including likelihood of need for emergency services response assistance. **Status Change: Stand Down:** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to transition EAP to Stand Down status via LDC. Request recovery operations assistance, if required.

Agency	Position	Contact Details	Contacted By	Contact Priority	DEC / DECC Notification Requirement
Queensland Police Service (QPS)	LDMG-CR QPS Liaison Officer		Local Disaster Coordinator	**3**	**Status Change: Alert** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to activate EAP to Alert status via LDC. **Status Change: Lean Forward** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to escalate EAP to Lean Forward status via LDC. **Status Change: Stand Up** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise LDMG-CR of decision to activate EAP to Stand Up status via LDC. Advise on the severity of the emergency including likelihood of need for emergency services response assistance. **Status Change: Stand Down:** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise of decision to transition EAP to Stand Down status via LDC. Request recovery operations assistance, if required.
	Senior Sergeant SCTN Operations Leader, Far North District				
	Police Duty Phone				
	Executive Officer (XO)				
State Disaster Coordination Centre Watch Desk (SDCC Watch Desk)	Watch Desk Duty Officer		Local Disaster Coordinator	**4**	**Status Change: Lean Forward** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise SDCC of decision to escalate EAP to Lean Forward status via LDC. Request issuance of NEAS Advice/Watch & Act messages to downstream PAR as required. **Status Change: Stand Up** Date: DD/MM/YY Time: HH:MM, Authorised By: DEC DEC to advise SDCC of decision to activate EAP to Stand Up status via LDC. Request issuance of NEAS Emergency Warning messages to downstream PAR.
Dam Technical Advisor (GHD)	Technical Director – Dams		Senior Engineer Dams	**5**	**Alert:** Advise of decision to activate EAP to Alert status. Advise on the severity of the event and status of the dam. Determine frequency of SITREPs. **Lean Forward:** Advise of decision to activate EAP to Lean Forward status. Advise on the severity of the event and status of the dam. **Stand Up:** Advise of decision to activate EAP to Stand Up status. Advise on the severity of the emergency and status of the dam including likelihood of need for Dam Technical Advisor (DTA) assistance. **Stand Down:** Advise of decision to transition EAP to Stand Down status. Engage DTA to assess the dam and propose program for remedial works.
	Technical Director – Surface Water				
	Senior Dams Engineer				

Agency	Position	Contact Details	Contacted By	Contact Priority	DEC / DECC Notification Requirement
Bureau of Meteorology (BoM)	Duty Officer		Local Disaster Coordinator	**6**	**Status Change: Lean Forward** **Date: DD/MM/YY Time: HH:MM, Authorised By: DEC** **DEC to advise BoM of decision to activate EAP to Lean Forward status via LDC. Advise on the severity of the event and status of the dam. Request weather forecast, rainfall, and river conditions intelligence brief.** **Status Change: Stand Up** **Date: DD/MM/YY Time: HH:MM, Authorised By: DEC** **DEC to advise BoM of decision to activate EAP to Stand Up status via LDC. Request updated weather forecast, rainfall, and river conditions intelligence briefs at required frequency.**

M. Modified Mercalli Scale

Scale and description** **sourced from the Queensland Disaster Management Risk assessment for Earthquakes
https://www.disaster.qld.gov.au/__data/assets/pdf_file/0021/339303/QFES-State-Earthquake-Risk-Assessment.pdf

Earthquake magnitude was traditionally measured on the Richter scale, however modern monitoring and alerting centres worldwide are now calculating magnitudes in terms of moment magnitude (Mw), where moment (energy) release is proportional to the fault area multiplied by the average displacement on the fault. This measure is used globally as it is more uniformly applicable than the Richter scale.
The effects of an earthquake are rated using the qualitative Modified Mercalli (MM) intensity scale, which ranges from I (imperceptible) up to X (destruction of most masonry structures). The intensity felt at a location depends on many factors such as distance from the hypocentre, nature of the local strata overlying bedrock, local topography, physical damage and an observer's level of alertness and activity at the time of an earthquake. The descriptions of the MM intensity scale can be seen in Table 1.

Table 1: *The Modified Mercalli Intensity (MMI) scale. Source: Geoscience Australia*

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.