Appendix N

# **CONSULTATION REPORT**

# Appendix N

# **Consultation Report**

# Introduction

### **PURPOSE**

This report documents how key stakeholders were consulted during the Performance Review of the Flood Warning Gauge Network (FWGN). This project was commissioned by the Queensland Department of Natural Resources and Mines (DNRM) and executed by Kellogg, Brown & Root Pty Ltd (KBR) with subcontractor Pentair/Greenspan.

#### **OVERVIEW**

As part of the Queensland Government's commitment to improving the flood warning system in Queensland, a performance review of the FWGN was undertaken. The review focused on the monitoring of rainfall and stream level gauges by various local, state, private and Commonwealth entities, and the ongoing maintenance of these gauges for flood warning purposes. The project identified opportunities to rationalise and/or augment the network to reduce flood risk to the people of Queensland and its assets. As part of the review, consultation was undertaken with key stakeholders throughout the state.

## **Objectives**

The review had multiple objectives:

- assemble an inventory of FWGN instrumentation that is:
  - currently used by the Bureau of Meteorology (BoM) and other entities for flood warning purposes
  - may be used to augment the FWGN in the future.
- assess the adequacy of the Flood Warning Network's spatial configuration
- assess the condition of instrumentation (using a sample of gauges)
- assess the reliability of data gathered from the instruments
- consider the data needs of stakeholders
- prepare technical standards and guidelines for instrumentation
- identify priorities for future improvements.

### Study area

The review considered rainfall and stream level gauges across Queensland that are currently used by or could in the future be used by the Bureau of Meteorology and other entities for flood warning purposes.

# Consultation approach

The project team recognised that stakeholders across Queensland held valuable information for the Review. Collecting this information was important to:

- answer critical questions that could not be addressed through other sources
- cross-check information gathered through desk-top research
- validate spatial modelling that was undertaken.

The consultation that was undertaken acknowledged:

- flood warning and management is integral to supporting and protecting local communities against flooding, particularly for local governments
- much valuable work has already been carried out by stakeholders in this area.

The consultation strategy was developed in liaison with DNRM, consistent with the Inspector-General Emergency Management Stakeholder Engagement Framework 2014-2018 and designed to ensure that the views and interests of stakeholders were consistently and meaningfully considered.

## **CONSULTATION OBJECTIVES**

The objectives of the consultation were to:

- provide stakeholders with balanced and objective information to help them understand the purpose, process and intended outcomes of the Review
- obtain stakeholder input (perceptions, opinions and technical information) to enable a thorough Review of the FWGN throughout Queensland.

### **CONSULTATION RISKS AND OPPORTUNITIES**

The main consultation risks (Table 1) and opportunities (Table 2) associated with the Review are outlined below.

Table 1 Potential consultation risks with proposed mitigation

Potential risk	Proposed mitigation
Questionnaires and requests for information may not reach the individuals that hold the appropriate knowledge to complete a response.	Initial contact was made with organisations to identify appropriate participants.
Local councils may not be in a position to provide adequate responses in a timely manner.	Requests for participation were accompanied by offers of assistance to complete the questionnaire and/or prepare responses.
Low response rates due to review timing and/or timeframes	To encourage participation a sensible time period of three weeks was set for initial responses and this was extended by an additional two weeks where organisations indicated that they could not meet the deadline for various reasons. A reminder email and follow up phone calls were also implemented.
Internet access may vary across key stakeholders' organisations.	Requests for participation were emailed and sent in hard-copy via Australia Post.
	To remove barriers to participation, respondents were able to provide information verbally, in hard-copy, via an online survey tool and email.

Potential risk	Proposed mitigation
Asset owners will be reluctant to provide responses fearing that funding cuts or reduced access to data may result.	Clear articulation of the Review objectives and reiteration that the overall aim was to help to inform governments and gauge owners to improve flood warning and reduce flood risk for Queensland communities.
	Existing disaster management networks were used to encourage participation in the review.
Definition of 'flood' and 'settlements susceptible to flooding' may be subjective.	Terms were clearly defined in communication materials.

## Table 2 Potential consultation opportunities with proposed enhancement

Potential opportunity	Proposed enhancement
May generate greater awareness of and willingness to coordinate efforts and share assets and data.	The objectives of the Review were clearly articulated and it was reiterated many times that the overall aim of the review was to help to inform governments and gauge owners to improve flood warning and reduce flood risk for Queensland communities.
May contribute to local communities taking greater ownership and responsibility for the Flood Warning Network they rely on.	As part of the consultation process, the roles of DNRM and BoM in relation to the Flood Warning Network were articulated to aid other organisations to better understand their potential role and the contribution they do/could make.

## **TARGETED STAKEHOLDERS**

The consultation targeted stakeholders identified in liaison with the project team (KBR, DNRM and Pentair/Greenspan) (Table 3).

## Table 3 Targeted stakeholders identified for the Review

	Sta	кe	ho	ld	lers	
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### Commonwealth Government

- BoM
- Department of Science, Information Technology and Innovation (DSITI)

## State Government

- DNRM
- Queensland Rail
- Department of Transport and Main Roads (DTMR)
- Department of Energy and Water Supply (DEWS)
- Department of Infrastructure, Local Government and Planning (DILGP)
- Department of Premier and Cabinet (DPC)

## Local government

- 77 local councils throughout Queensland
- Local Government Association of Queensland (LGAQ)

## Disaster management groups and committees

- Queensland Reconstruction Authority (QRA)
- Inspector-General of Emergency Management (IGEM)
- Public Safety Business Agency (PSBA)
- Queensland Fire and Emergency Services (QFES)

#### Stakeholders

Queensland Police Service (QPS)

### Government-owned corporations

- Energex
- Ergon Energy
- PowerLink
- Gladstone Area Water Board
- Segwater
- Sunwater Limited

### Private sector businesses

- Aurizon
- Stanbroke Pty Ltd
- Origin Energy
- Glencore Coal Assets Australia
- BHP Billiton Mitsubishi Alliance
- QCG
- Santos

# Consultation methodology

Consultation occurred from 9 June and 9 September 2015. The timing of consultation activities was aligned to the project schedule to ensure gathered information could be incorporated into the Review.

The main consultation activities undertaken were:

- 1. meeting with the Key Stakeholder Group (KSG)
- 2. introducing the Review to other stakeholders and confirming appropriate contacts
- 3. collecting and collating information from stakeholders through:
  - a. questionnaire (local councils only)
  - b. in-depth interviews and site inspections (selected local councils)
  - c. meetings and r equests for information (RFI) via email and formal letters (commonwealth and s tate government agencies, government-owned corporations and private sector businesses)
- 4. providing feedback to participants on findings of the review.

Each activity is described in detail in the following sections.

## **ESTABLISHING AND MEETING WITH KEY STAKEHOLDER GROUP**

Chaired by the QRA, the KSG was comprised of senior officers from:

- QRA (Chair)
- DSITI

DNRM

LGAQ

BoM

PSBA

DEWS

QFES

DILGP

QPS.

DPC
 IGEM (Observer)

The KSG was established by DNRM prior to the Review starting. The group's role was to guide the Review and to encourage participation from members of their networks as appropriate. The KSG endorsed the consultation strategy before it was implemented.

The KSG was convened as three workshops throughout the Review and was occasionally required to provide out of session input. Table 4 outlines the date and purpose of each workshop.

Table 4 Key Stakeholder Group workshops

Workshop	Date	Purpose
Hold Point 1 Workshop	9 June 2015	Endorse the risk based methodology and consultation plan
Hold Point 2 Workshop	10 August 2015	Review preliminary findings and discuss key issues before draft report is finalised
Hold Point 3 Workshop	9 September 2015	KBR's presentation of draft report for comments from KSG over the following week

#### INTRODUCING THE REVIEW TO TARGETED STAKEHOLDERS

On 20 May 2015, DNRM distributed letters of introduction to targeted stakeholders that:

- provided a brief overview of the review and its objectives
- indicated that KBR would be consulting with their organisation
- offered assistance with preparing a response
- called for nomination of an appropriate contact for the consultation
- provided the contact details for the project team.

An example of this letter is included in Section 5.

Follow up emails and calls were made to confirm appropriate contacts where organisations were not prompt in nominating a person.

## **COLLECTING INFORMATION**

In total, information was collected from 56 local councils (Figure 3-1) and eight other organisations from across the state via:

- questionnaire
- in-depth interviews
- site inspections
- meetings and requests for information (RFIs).

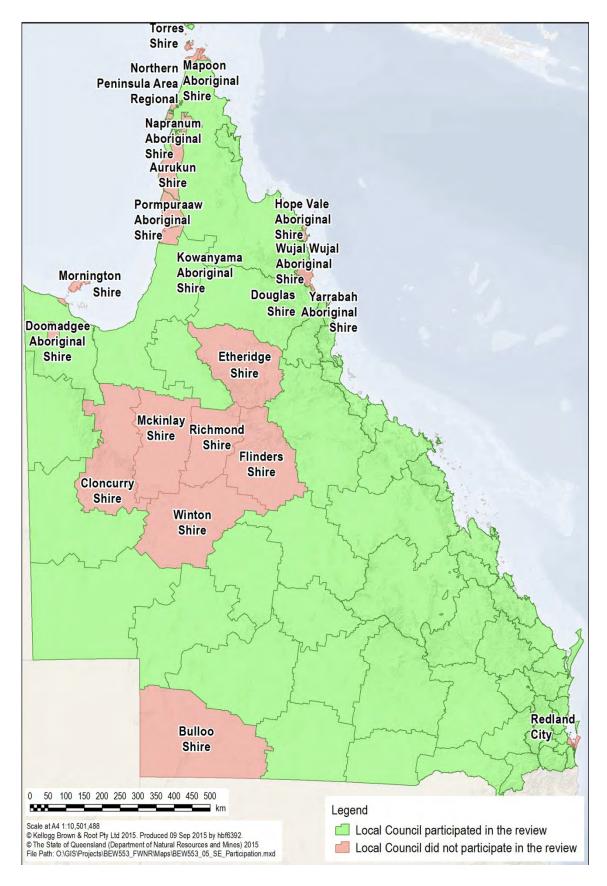


Figure 1
LOCAL COUNCILS THAT RESPONDED TO THE PROJECT TEAM'S INVITATION AND PARTICIPATED IN THE REVIEW.

## Questionnaire for local councils

A questionnaire was prepared and distributed to the 77 local councils throughout Queensland. The questionnaire was designed to collect information on five topic areas:

- settlements and critical infrastructure impacted by flooding
- rainfall and stream level gauge locations
- use of data from gauges
- · rainfall and stream level gauge reliability
- asset management.

A copy of the questionnaire is included in Section 5.

The questionnaire was distributed via email and in hard-copy in the post. The package of materials that accompanied the questionnaire included:

- Cover letter that requested the participation of the local councils in the Review.
- Project overview factsheet that briefly explained the objectives and methodology for the Review.
- Questionnaire factsheet that explained the questionnaire's purpose, and how to complete and return it within the required timeframe.
- Basin/s Map (showing sub-basin boundaries, local government areas, the location of known rainfall and stream level gauges accepted by BoM, and settlements known to flood).
- Gauge Meta-data Spreadsheet (if there were rainfall and stream level gauges within the local government area in question that are accepted by BoM).
- Template (spreadsheet) for providing additional meta-data on gauges that was not currently listed on the above spreadsheet but may be of interest in the future for flood warning purposes.

Copies of the factsheets are included in Section 5.

Key dates for the implementation of the questionnaire are outlined in Table 5.

Table 5 Key dates for implementation of the questionnaire

Date	Activity	
23 June 2015	Questionnaire pack emailed and posted to nominated contacts within each local council	
30 June 2015	Reminder email to encourage local councils to participate	
2 July 2015	Letter emailed to QRA, QFES, IGEM and LGAQ formally asking for their support and for them to encourage, via their own networks, local council participation	
10 July 2015	Initial deadline for questionnaire submissions	
20 July 2015	Follow up calls to encourage local councils who had not responded, to complete the questionnaire and to offer assistance if required	
31 July 2015	Extended deadline for questionnaire submissions (to account for council staff not being available or able to meet the earlier deadline due to school holidays, end of financial year obligations or other commitments)	

The questionnaire could be completed:

- online (via the Wufoo survey platform)
- electronically using the form provided and emailing it with any appropriate attachments to the project team (floodstudies@kbr.com)

• in hard copy and mailing it to the project team (Flood Studies at KBR, Reply Paid 633, Brisbane Qld 4001)

The responses received to each question are summarised in Section 4.1.

### In-depth interviews with local councils

In-depth interviews were carried out with 27 selected local councils from across Queensland between 6 July and 24 July 2015. Local councils were selected to ensure a representative cross-section based on:

- type of council (super council, regional hub council, rural council or indigenous council)
- location (inland or coastal)
- recent government investment in gauge installation (<\$50,000, \$50,000 to \$100,000, or no funding)</li>
- number of high risk settlements already known to the project team
- logistical accessibility during the timeframes of the review.

In-depth interviews were used to gain a more detailed understanding of the council's:

- approaches to flood warning
- needs and capacity for establishing and maintaining the FWGN
- · suggestions for improvements to the FWGN
- concerns in relation to the FWGN.

As well as further exploring some of the local council's responses to the questionnaire, and their knowledge and preparedness with regard to flooding and flood warning.

A copy of the interview guide (PowerPoint presentation) is included in Section 5.

The interviews were attended by up to four members of the project team including representatives from DNRM, KBR, and Pentair/Greenspan. They were also attended by a representative of the BoM Hydrology team. This crossorganisational mix of people with a multidisciplinary skill and knowledge base positioned the project team well to understand the diversity of political and physical operating environments of the local councils.

Face-to-face in-depth interviews were conducted with 25 local councils:

Balonne Shire Council	<ul> <li>Goondiwindi Regional Council</li> </ul>	Murweh Shire Council
Banana Shire Council	Gympie Regional Council	Paroo Shire Council
Barcaldine Regional Council	Hinchinbrook Shire Council	Rockhampton Regional Council
Brisbane City Council	Ipswich City Council	• Sunshine Coast Regional Council
Burdekin Shire Council	Lockyer Valley Regional Council	Tablelands Regional Council
• Cassowary Coast Regional Council	Longreach Regional Council	Toowoomba Regional Council
• Central Highlands Regional Council	Mackay Regional Council	Whitsunday Regional Council
• Cherbourg Aboriginal Shire Council	Mareeba Shire Council	Woorabinda Aboriginal Shire Council

· City of Gold Coast

In-depth interviews via telephone were held with and additional two councils where logistics prevented the project team from travelling to the location:

Bundaberg Regional Council

• Mount Isa City Council.

An in-depth interview was also offered to Carpentaria Shire Council but required council personnel were not available during the Review period.

The results of the in-depth interviews are documented in Section 4.2.

#### Site inspections

Site inspections of 81 selected gauge sites were coordinated with travel for the in-depth interviews with local councils (between 6 July and 24 July 2015). The site selection was:

- based on geographic accessibility within logistical constraints of the project
- · with the aim of visiting a range of gauge types
- with the aim of visiting gauges owned and/or operated by a range of stakeholders (BoM, DNRM and councils).

Generally, council representatives attended the site visits and provided additional insights into the rationale for the gauges and how the gauge information was used.

The site inspections were used to:

- validate the scope of the FWGN
- validate stations are fit-for-purpose or can support the flood warning service
- inspect instrument condition
- evaluate site risks (e.g. flooding, bushfire)
- identify risks to the communication network.

A copy of the site inspection check-list is included in Section 5.

Notes taken during the site inspections were incorporated directly into the project report.

### Meetings and requests for information

Table 6 outlines the organisations to which RFIs were made and where appropriate face-to-face or teleconference meetings were held. It also identifies the organisations that responded with information.

Table 6 Organisations contacted for information

Organisation	FRI letter emailed	Meeting held	Response received
Aurizon	✓		
BoM		<b>√</b>	✓
BHP Billiton Mitsubishi Alliance	<b>√</b>		✓
DNRM	✓	✓	✓
DTMR	✓		
Ergon Energy	✓		
Gladstone Area Water Board	✓		✓
Glencore Coal Assets Australia	✓		
Origin	✓		
PowerLink	✓		

Organisation	FRI letter emailed	Meeting held	Response received
QGC	✓		
QRA	<b>√</b>		
Queensland Rail	✓	✓	
Santos	<b>√</b>		
Seqwater	✓	✓	✓
Stanbroke Pty Ltd	✓		✓
Sunwater Limited	✓	✓	✓

Key dates for the meetings and requests for information are outlined in Table 7.

Table 7 Key dates for the requests for information

Date	Activity
18 June - 7 August 2015	Meetings held
2 July 2015	Formal letter requesting information distributed via email
17 July 2015	Deadline for information submissions
20 July 2015	Follow up calls to encourage organisations who hadn't responded to provide information
31 July 2015	Extended deadline for information submissions

The questions posed in the RFIs and at the meetings were tailored for each organisation to reflect their current and/or potential future role in relation to the FWGN.

The information requested typically included:

- copies of organisational policies, procedures and technical standards relating to the installation, operation and maintenance of rainfall and stream level gauges that are currently used for, or may be used in the future for, flood warning
- review of any data provided by BoM on gauges currently maintained by the organisation
- any gauges that the organisation operate and maintain that are not currently accepted by BoM but may be considered to possibly augment the existing Flood Warning Network in the future
- gauges operated and/or maintained by their organisation that are considered particularly important to the Flood Warning Network used by BoM
- from field observations, any recent changes to the floodplain (e.g. levees, bridges, road works, developments, etc.) that might have impacted a gauging station site used by BoM for the Flood Warning Network
- the datum (if any) that gauges are survey to (e.g. Australian Height Datum)
- suggestions for any changes to rainfall or stream water level gauges that would improve flood warning time (e.g. addition or relocation of gauges)
- documents that helped to describe the changes outlined (see above)
- suggestions for any new directions for technological advancement in gauge i nstrumentation including communication systems
- · copies of existing rainfall and stream level asset register

- fields within their existing asset register believed to be essential
- additional fields believed to be useful
- Which fields within existing asset registers are superfluous
- copies of documented operation and maintenance plans, with specific questions relating to:
  - what maintenance regimes are in place for the rainfall and stream water level gauges that DNRM operate and maintain? For example: reactive maintenance following flood or reported damage; proactive maintenance - once per year, twice per year, three times per year or another regime?
  - Do DNRM personnel carry out maintenance on the rainfall and stream water level gauges that DNRM operate and maintain, or are contractors used?
  - At what frequency are gauges calibrated?
- reliability issues with gauges

Notes taken during the meetings and other data collected from the RFIs are in Section 4.3.

# Consultation results

### QUESTIONNAIRE RESPONSES

The questionnaire achieved a 68% response rate, with 53 of the 77 local councils throughout Queensland providing a response. Of the 53, 28 councils emailed their response to the project team using the electronic form or a scanned hardcopy and 25 councils used the online survey. The local councils that responded included:

_	Balonne	Chira	Caupail
•	Dalullle	SIIIIE	Council

- Fraser Coast Regional Council 

  Murweh Shire Council

- Barcaldine Regional Council
- Gladstone Regional Council
- North Burnett Regional Council

- Barcoo Shire Council
- Goondiwindi Regional Council Gympie Regional Council
- Quilpie Shire Council Rockhampton Regional Council

- Blackall-Tambo Regional Council **Boulia Shire Council** 
  - Hinchinbrook Shire Council
- Scenic Rim Regional Council

- Brisbane City Council
- **Ipswich City Council**
- Somerset Regional Council

- **Bundaberg Regional Council**
- Isaac Regional Council
- South Burnett Regional Council

- Burdekin Shire Council
- Livingstone Shire Council
- Southern Downs Regional Council

- Burke Shire Council
- Lockhart River Aboriginal Shire Council
  - Sunshine Coast Regional Council

- Cairns Regional Council
- Lockyer Valley Regional Council
  - **Tablelands Regional Council**

- Carpentaria Shire Council
- Logan City Council
- Toowoomba Regional Council

- Cassowary Coast Regional Council
- Longreach Regional Council
- Torres Strait Island Regional

- Central Highlands Regional Council
- Noosa Council
- Townsville City Council

- City of Gold Coast
- Mackay Regional Council
- Western Downs Regional Council

- Charters Towers Regional Council •
- Maranoa Regional Council
- Whitsunday Regional Council

- Cook Shire Council
- Mareeba Shire Council
- Weipa Town Authority

- Croydon Shire Council
- Moreton Bay Regional Council
- Woorabinda Aboriginal Shire Council

- Diamantina Shire Council
- Mount Isa City Council

The individuals that completed the questionnaire on behalf of each local council were diverse in their roles and responsibilities. The titles of the individuals that provided responses to the questionnaire were:

- · Acting Director of Engineering Services
- · Arts and Cultural Officer
- Assistant Engineer
- · Chief Executive Officer (two individuals)
- Consulting Engineer
- · Coordinator Asset Planning
- Coordinator Disaster and Emergency Management
- Coordinator Disaster Management (two individuals)
- · Coordinator Disaster Planning
- Coordinator Local Disaster (three individuals)
- Coordinator Emergency Management
- Coordinator Natural Hazards
- Coordinator Flooding and Stormwater Management
- Deputy Chief Executive Officer
- Design Office Manager
- Director Corporate Services/Local Disaster Coordinator
- Director Infrastructure Services
- Director of Engineering Services
- Disaster Management Officer (two individuals)
- Disaster Management Senior Officer
- Engineer Floodplain Management (two individuals)
- Engineer Infrastructure
- Engineer Roads

- Engineer Stormwater
- Environmental Engineer/Flood Modeller
- Executive Assistant to Chief Executive Officer and Executive Officer
- Flood Mitigation Project Manager
- Floodplain Project Officer/Hydrologist
- General Manager Engineering and Environmental Services
- Governance Officer/Disaster Management Officer
- Manager Asset Emergency
- Manager Design & Technical Services
- Manager Disaster Management
- Manager Engineering Services
- Manager Procurement and Community Security
- Manager Technical Services
- Project Officer
- Safety Advisor
- Senior Advisor Disaster Management
- Senior Engineer (two individuals)
- Senior Engineer Waterways and Drainage Planning
- Specialist Emergency Management
- Strategic Mapping/ Disaster Management Officer
- Technical Officer (three individuals)
- Technical Officer Emergency Management
- · Workshop and Fleet Manager

The following section summarises local councils' response to each question. Any interpretation of this information has been incorporated into the main body of the Performance Review Report.

# 1. Referring to the Basin Map provided, are there any additional settlements or critical infrastructure known to flood due to <u>riverine flooding</u> that are not shown on the map?

Response	Number of respondents	Percentage of respondents
No	23	44%
Yes	29	56%
TOTAL	52	

Respondents identified the following additional settlements or critical infrastructure known to flood due to riverine flooding that are not shown on the map.

Local government area	Additional settlements or critical infrastructure
Barcoo Shire Council	Jundah Township (specific infrastructure affected is the water treatment plant and associated infrastructure and caravan park)
Brisbane City Council	Large areas of Brisbane are subject to riverine flooding. For more detail please see Brisbane City Council's Flood Awareness Maps, "River" tab under the "Flood Sources" drop down menu.  (http://www.brisbane.qld.gov.au/community/community-safety/disasters-emergencies/types-disasters/flooding/understand-your-flood-risk)
Bundaberg Regional Council	North Bundaberg
	South Bundaberg
	East Bundaberg
	Givelda
	Morganville
	Tirroan
	Winfield
	Bucca
	Drinan
	Invicta
	Woodgate
	Branyan
	Sharon
	Millbank Water Treatment Plant (plus numerous sewer pumps)
	East Bundaberg Depot (Council's primary depot)
	Qld Fire and Emergency Services HQ in Bundaberg CBD
	Qld Ambulance Service primary station
	Childers Water Treatment Plant
	Gin Gin Water Treatment Plant
	Bundaberg Base Hospital
Burdekin Shire Council	Ayr township
Cairns Regional Council	Machans Beach
	Holloways Beach
	Yorkeys Knob
	Barron
	Stratford
	Kamerunga
	Freshwater
	Lake Placid
	Caravonica
Carpentaria Shire Council	Normanton
Cassowary Coast Regional Council	Midgenoo
	Japson

Local government area	Additional settlements or critical infrastructure
Central Highlands Regional Council	Emerald Irrigation Area on lower Nogoa Floodplain, i.e. lower Nogoa downstream of Emerald to its junction with Comet, and lower Retreat Creek to it junction with Theresa Creek.
	A couple of major coal mines on the floodplain — Ensham near confluence of Comet and Nogoa, and Curragh downstream of Bedford Weir on the Mackenzie River.
	Emerald should also include a number of residences that lie between the Fairbairn Dam spillway and the Emerald Township.
City of Gold Coast	Almost all "settlements" and "critical infrastructure" within City of Gold Coast can be affected by flood so the list below of affected flood areas is indicative only. These areas have higher likelihood to be affected by regional flooding:
	All major creeks and rivers
	Budds Beach Reserve (Surfers Paradise)
	Coombabah Lake
	Woongoolba
	Jacobs Well
	Steiglitz
	Merrimac
	Carrara
	Mudgeeraba Show Ground (Worongary)
	Firth Park (Mudgeeraba)
	Coplick Sports Park (Tallebudgera)
	Boundary Street (Currumbin Waters)
	Tugun
	Coolangatta
Fraser Coast Regional Council	Pacific Haven - settlement situated between Burrum and Cherwell
	Rivers eastwards of Howard
	Maaroom - coastal settlement southwards of Maryborough and approx. 10 km north of Boonooroo
	Little Tinana - rural settlement on Teddington Road off Cooloola Coast Road
	Mungar - rural settlement situated on Mungar Road northwest of Tiaro
Goondiwindi Regional Council	Inglewood
	Goondiwindi
Hinchinbrook Shire Council	Macknade (between Bemerside and Halifax)
	Note: Mount Gardiner is shown on the map in the incorrect location. Mount Gardener is just north of Bemerside at the base of the Cardwell Range.
Ipswich City Council	Amberley Air Base
	Multiple bridges on Bremer/Brisbane River
	North Booval
	Barellan Point
	Bundamba
	Tivoli
	North Ipswich
	Leichardt One Mile
Lockyer Valley Regional Council	Lockyer Waters
	Glenore Grove
Logan City Council	Logan Reserve

Local government area	Additional settlements or critical infrastructure	
Longreach Regional Council	Isisford	
	Note: Ilfracombe and Yaraka are not subject to riverine or flash flooding.	
Mackay Regional Council	Cremorne	
	Mackay Central Business District	
	East Mackay	
	West Mackay	
	South Mackay	
	North Mackay	
	Glenella	
Mareeba Shire Council	Mt Mulgrave Road - Mitchell Road Crossing	
	Strathaleven Road - Mitchell Road Crossing (Gamboola)	
	Drumduff Link Road - Mitchell Road Crossing (Hughes Crossing)	
	Burke Developmental Road - Lynd River, Walsh River (Trimbles), Walsh River (Ferguson's)	
	Leadinghand Creek Road - Walsh River	
	Wolfram Road - Walsh River	
Moreton Bay Regional Council	Beachmere	
	Lawnton	
	Petrie	
	Donnybrook	
	Whiteside	
	Flood prone buildings within the Moreton Bay Regional Council area are distributed over the various creek and river catchments. Within a single suburb there are typically flood prone properties impacted by different creeks and rivers and the flood impacts for these separate clusters of properties are related to different gauges. For example, within "Caboolture" Male Road properties are impacted by King Johns Creek, Appaloosa Close properties are impacted by Lagoon Creek, Mary Street properties are impacted by Caboolture River. A single water level gauge does not provide information relevant to all the properties within the one suburb and it is difficult to represent these various locations by a single point on the map. In addition there are many flood prone properties scattered throughout the region with only one or two within a suburb.	
Murweh Shire Council	Augathella	
	Charleville	
Quilpie Shire Council	Adavale	
	Eromanga.	
Rockhampton Regional Council	Kabra	
Scenic Rim Regional Council	Water and sewerage treatment plants	
Southern Downs Regional Council	Note: Pratten is not known to flood due to riverine flooding	
Sunshine Coast Council	Marcoola	
	Bli-Bli	
	Currimundi	
	Yandina-Coolum Road	
	Yandina-Bli Bli Road	
	Nambour-Bli Bli Road	
	David Low Way	
	Crosby Hill Road	

Local government area	Additional settlements or critical infrastructure
Toowoomba Regional Council	Yarraman
	Nobby
	Hodgson Vale
	Meringandan
	Quinalow
	Glenvale
	Clifton
Townsville City Council	Areas of the urban footprint are subject to riverine flooding
Weipa Town Authority	PDR crossings at Moreton Telegraph Station (Wenlock River) and Archer River which are significantly affected by seasonally riverine/flash flooding. These impact on Weipa, as it is the only road access north and south.
Woorabinda Aboriginal Shire Council	Pearl Creek
	Double Gully
	Anna Branch

# 2. Referring to the Basin Map provided, are there any additional settlements or critical infrastructure known to flood due to <u>flash flooding</u> that are not shown on the map?

Response	Number of respondents	Percentage of respondents
No	29	56%
Yes	23	44%
TOTAL	52	

Respondents identified the following additional settlements or critical infrastructure known to flood due to flash flooding that are not shown on the map.

Local government area	Additional settlements or critical infrastructure
Boulia Shire Council	Boulia to Mt Isa Road is subject to flash flooding at Upper Limestone Creek
	Sulieman Creek
	Number of creek crossings between Mt Isa and Dajarra
Brisbane City Council	Brisbane is subject to flash flooding from its 38 major creek catchments as well as its many large overland flow paths. For more detail please see BCC Flood Awareness Maps, "Creek" and "Overland Flow" tabs under the "Flood Sources" drop down menu. (http://www.brisbane.qld.gov.au/community/community-safety/disasters-emergencies/types-disasters/flooding/understand-your-flood-risk)

Local government area	Additional settlements or critical infrastructure
Bundaberg Regional Council	The rain event associated with Tropical Cyclone Oswald in January 2013 resulted in rapid escalation of riverine flooding (in particular, 500 mm rain overnight across the lower Burnett River catchment on the 28 January), with effects akin to flash flooding but in conjunction with riverine flooding, at these locations:
	North Bundaberg
	South Bundaberg
	East Bundaberg
	Givelda
	Morganville
	Tirroan
	Winfield
	Bucca
	Drinan
	Invicta
	Woodgate
Cairns Regional Council	Suburbs recently impacted by flash flooding (2009 to present):
	Aeroglen
	Manunda
	Manoora
	Mooroobool
	Babinda
	Brinsmead
	Brampston Beach
	Caravonica
	Cairns North
	Cairns City
	Portsmith
	Bungalow
	Parramatta Park
	Edmonton
	Lake Placid
	Mount Sheridan
	Machans Beach
	Holloways Beach
	Yorkeys Knob
	Palm Cove
	Clifton Beach
	Trinity Beach
	Redlynch
	Smithfield
	Earlville
	Stratford
1	Freshwater

Local government area	Additional settlements or critical infrastructure	
	Westcourt	
	Whitfield	
	Woree	
Cassowary Coast Regional Council	Refer to Master Drainage Studies for Cassowary Coast Regional Council if required	
Central Highlands Regional	Rubyvale township	
Council	Carnarvon Gorge National Park and its associated camp and picnic grounds	
City of Gold Coast	Almost all "settlements" and "critical infrastructure" within City of Gold Coast can be affected. Therefore, the list of affected flood areas is indicative and it does not represent all possible affected areas. The following areas have a higher likelihood to be affected by flash flooding:	
	Major overland flow path areas	
	All stormwater and drainage reserves	
Goondiwindi Regional Council	Inglewood is believed to have 6-8 hour notice of flood events from dam walls. Issues. It would have 20-36 hour notice of a rain event likely to cause flooding	
Ipswich City Council	Many areas are affected by flash flooding, the main ones are:	
	Grandchester	
	Calvert	
	Bellbird Park	
	Booval	
	Bundamba	
Livingstone Shire Council	Yeppoon Central Business District	
Logan City Council	Marsden	
	Slacks Creek	
	Logan Reserve	
Mackay Regional Council	Mackay Central Business District	
	East Mackay	
	West Mackay	
	South Mackay	
	Glenella	
Mareeba Shire Council	Bilwon Road and surrounding farms - Barron River	
	Herberton Street, Mareeba - Barron River	
	Mulligan Highway, Mareeba - Granite Creek	
	Leadingham Creek Road - Bridge	
	Leadingham Creek	
	Pinnacle Creek Causeway	
	Three Mile Creek Causeway	
	Ootarn Road - Sandy Tare Road	
	Mossman - Mt Molloy Road - Busay Creek	
	Mulligan Highway - Mitchell River	
	Mulligan Highway - Mitchell River	

Local government area	Additional settlements or critical infrastructure	
Moreton Bay Regional Council	Deception Bay	
	Mango Hill	
	Everton Hills	
	Bruce Highway	
	North Coast Railway	
	Dayboro	
	Moodlu	
	Burpengary East	
	Upper Caboolture	
	Bray Park	
	Kallangur	
	Morayfield	
	Petrie	
Noosa Council	Tewantin - Daintree Estate (Currently a major flood mitigation project is underway that will greatly reduce flooding of properties for events that are greater than a 1:100 event).	
	Pomona - Rifle Street (a project to address this is underway but delayed due to land acquisitions issues).	
	Noosaville - Lake Entrance Boulevard	
	Lake Macdonald - There are a number of areas surrounding Lake Macdonald dam that are affected by flash flooding from this local catchment and Dam overflow areas.	
Rockhampton Regional Council	Marmor	
	Kabra	
Scenic Rim Regional Council	Water and sewerage treatment plants (refer to Queensland Urban Utilities)	
Somerset Regional Council	Gallinani Creek crossing across the Brisbane Valley Highway is often cut with little or no warning. This major highway being closed has isolated the township of Toogoolawah requiring establishment of evacuation centres	
Southern Downs Regional Council	Note: Karara, Maryvale and Thulimbah are only known to flash flood not riverine flood as the mapping suggests.	
Sunshine Coast Council	Mooloolah	
	Alexandra Headland	
	Warana	
	Wurtulla	
	Lansborough	
	Golden Beach	
	Tanawha	
	Bruce Hwy at Coonowrin Crossings, Mooloolah River Interchange, Eudlo Creek	
	Nicklin Way, Sunshine Motorway (East of Kawana Way interchange)	
	Eumundi - Noosa Road	
	Eumundi - Kenilworth Road	
	Nambour Connection Road	
	Steve Irwin Way	
	Kilcoy - Beerwah Road	
	Maleny - Kenilworth Road at Elaman Ck and along Mary River	

Local government area	Additional settlements or critical infrastructure
Toowoomba Regional Council	Kulpi
	Highfields
	Pittsworth
	Southbrook
	Goombungee
	Crows Nest
Townsville City Council	Areas of the urban footprint are subject to flash flooding
Weipa Town Authority	PDR crossings at Moreton Telegraph Station (Wenlock River) and Archer River which are significantly affected by seasonally riverine/flash flooding. These impact on Weipa, as it is the only road access north and south.
Whitsunday Regional Council	Jubilee Pocket

# 3. Are there any settlements or critical infrastructure that are isolated or significantly inconvenienced by flooding?

Response	Number of respondents	Percentage of respondents
No	7	13%
Yes	45	87%
TOTAL	52	

Respondents identified the following additional settlements or critical infrastructure that are isolated or significantly inconvenienced by flooding.

Local government area	Additional settlements or critical infrastructure
Balonne Shire Council	St George
	Dirranbandi
	Bollon
	Thallon
	Hebel
	Mungindi
	Nindigully
Barcaldine Regional Council	Muttaburra
	Aramac
	Barcaldine
	Jericho
	Alpha
Barcoo Shire Council	Windorah Township
	Jundah Township
	Jundah Water Treatment Plant
	Jundah Health Clinic
Blackall-Tambo Regional Council	Tambo
	Blackall
	Barcoo River Bridge (between towns can get inundated and road cut)
	Areas of the Landsborough Highway either side of Blackall and Tambo where the roads are closed due to water.

Additional settlements or critical infrastructure
Urandangie
Moggill/Bellbowrie
Mt Crosby/Karana Downs
Pinkenba
Moreton Island
Bundaberg (discrete locations within Bundaberg as well as more generally when the Bruce highway cuts).
North Bundaberg (although this has been ameliorated up to a 2013 flood event following the raising of Gin Gin Road to act as an evacuation route).
Gin Gin (on Bruce Highway)
Childers (on Bruce Highway)
Givelda
Morganville
Tirroan
Winfield
Bucca
Drinan
Invicta
Woodgate
Buxton
Bargara South
Innes Park North
Tallon Bridge
Burnett River traffic bridge at Bundaberg
Millbank Water Treatment Plant (plus numerous sewer pumps)
East Bundaberg Depot (Council's primary depot)
Queensland Fire and Emergency Services Head Quarters in Bundaberg Central Business District
Queensland Ambulance Service primary station
Childers Water Treatment Plant
Gin Gin Water Treatment Plant
Bundaberg Base Hospital
Ayr
Home Hill
Brandon
Giru can become isolated with roads cut in all directions.
Burketown
Burketown Airport
Burketown Water

Cairns Regional Council Flooding of Peets Bridge isolates Goldsborough Valley community. Flooding of Clydes Road bridge isolates East Trinity community. Flooding of Barron River Bridge and Western Arterial Road will effectively separate the city fron its northern beach-side suburbs.  Wastewater treatment plants located at Babinda, Gordonvale, Edmonton, Southern (Portsmith) Martin Coast (Smithfield) and Northern (adjacent to Cairns Airport) for the Cairns area. There a in excess of 100 wastewater pumping stations throughout the Cairns area, most in the low-lying areas. Cairns Regional Council operates a remote monitoring and operational system (SCADA) that enables instantaneous feedback on all water and sewerage infrastructure. Backup power supplies are located at each WWTP and at major pump station facilities.  Carpentaria Shire Council  Cassowary Coast Regional Council  Innisfail Tully  Majority of other settlements (Refer to Cassowary Coast Regional Council Flood Study)  Central Highlands Regional Council  A group of properties on Apis Creek Road between Mackenzie River and Marlborough get isloated by Mackenzie River.  At the Gemfields area: Graves Hill and Reward (Jurassic Park area).  When the Basalt and the Clarke rivers flood access is cut to Greenvale therefore cutting off access to water and sewerage infrastructure.  City of Gold Coast  Floods are random events and almost all "settlements" and "critical infrastructure" within City of Gold Coast can be affected. Therefore, the list below of affected flood areas is indicative and it does not represent all possible affected areas. The following areas have higher likelihood to be isolated by flood waters:  Woongoolba  Wongawallan  Guanaba  Clagiraba  Beechmont  Carrara  Merrimac  Worongary  Mudgeeraba
Flooding of Barron River Bridge and Western Arterial Road will effectively separate the city fron its northern beach-side suburbs.  Wastewater treatment plants located at Babinda, Gordonvale, Edmonton, Southern (Portsmith) Marlin Coast (Smithfield) and Northern (adjacent to Cairns Airport) for the Cairns area. There as in excess of 100 wastewater pumping stations throughout the Cairns area, most in the low-lying areas. Cairns Regional Council operates a remote monitoring and operational system (SCADA) that enables instantaneous feedback on all water and sewerage infrastructure. Backup power supplies are located at each WWTP and at major pump station facilities.  Carpentaria Shire Council  Cassowary Coast Regional Council  Innisfail  Tully  Majority of other settlements (Refer to Cassowary Coast Regional Council Flood Study)  Central Highlands Regional Council  A group of properties on Apis Creek Road between Mackenzie River and Marlborough get isloated by Mackenzie River.  At the Germfields area: Graves Hill and Reward (Jurassic Park area).  Charters Towers Regional Council  When the Basalt and the Clarke rivers flood access is cut to Greenvale therefore cutting off access to water and sewerage infrastructure.  City of Gold Coast  Floods are random events and almost all "settlements" and "critical infrastructure" within City of Gold Coast can be affected. Therefore, the list below of affected flood areas is indicative and it does not represent all possible affected areas. The following areas have higher likelihood to be isolated by flood waters:  Woongoolba  Wongawallan  Guanaba  Clagiraba  Beechmont  Carrara  Merrimac  Worongary  Mudgeeraba
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Guanaba Clagiraba Beechmont Carrara Merrimac Worongary Mudgeeraba
Clagiraba Beechmont Carrara Merrimac Worongary Mudgeeraba
Beechmont Carrara Merrimac Worongary Mudgeeraba
Carrara  Merrimac  Worongary  Mudgeeraba
Merrimac Worongary Mudgeeraba
Worongary Mudgeeraba
Mudgeeraba
Bonogin
Tallebudgera Valley
Currumbin Valley
Cook Shire Council Pormpuraaw
Palmer River Mining Area
Maytown
Croydon Shire Council Richmond Road
Claraville Road
Prospect Momba Road
Guilford Road
Coralie Road

Local government area	Additional settlements or critical infrastructure
Fraser Coast Regional Council	Pacific Haven
	Maaroom
	Boonooroo
	Little Tinana
	Mungar
	Tinnanbah
	Glenwood
	Gundiah
	Bauple
	Tiaro
	Maryborough
	Ararama
	Broweena
	Aldershot
	Torbanlea
	Howard
	Burrum Heads
	Toogoom
	Hervey Bay
	Lenthalls Dam
Gladstone Regional Council	Agnes Water
	Seventeen Seventy
	Baffle Creek
	Deepwater
	Rules Beach
	Mount Maria
	Berajondo
	Lowmead
	Rosedale
	Pikes Crossing
	Many Peaks
	Ubobo
	Nagoorin
	Boyne Island
	Tannum Sands
	Benaraby
	Wurdong Heights
	Essendean Bridge (TMR asset on Bundaberg-Miriam Vale Road)
	Hills Road Bridge (one lane bridge access to Baffle Creek settlement areas)
	Road networks in the various catchments

Local government area	Additional settlements or critical infrastructure
Goondiwindi Regional Council	Nungunya
	Toobeah
	Talwood
	Goondiwindi
	Yelarbon
	Inglewood
Gympie Regional Council	lmbil
	Widgee
	Kilkivan
	Kandanga
	Southside
Hinchinbrook Shire Council	Lucinda
	Forrest Beach
Ipswich City Council	Karalee
	One Mile/Leichhardt
Livingstone Shire Council	Stanage
	Byfield
Lockhart River Aboriginal Shire Council	Lockhart River and Portland Road are isolated by flooding for approximately four months of the year for light 4WD vehicles. Heavy over land freight is normally confined to six months per year only. During large monsoonal events, Portland Road is isolated from the Lockhart River Airport.
Lockyer Valley Regional Council	All areas of Lockyer valley will be isolated in a large flood.
Logan City Council	Logan Reserve
Mackay Regional Council	Habana (Reliance Creek)
	Seaforth (Constant Creek)
	Cape Hillsborough
	Haliday Bay and Ball Bay (Seaforth Creek)
	Sarina Beach
	Campwin Beach
	Grasstree
	Hay Point (Bells Creek)
	Alligator Creek (Bruce Hwy south of Mackay)
	Antonio's Crossing (North Eton Road)
	Currans Crossing (Mirani-Eton Road)
	Golflinks Road (Beaconsfield)
	Keeleys Road (Slade Point)
	Vines Creek (North Mackay)
	Sandy Creek (Homebush)
	Sandy Creek (Eton)
	Sandy Creek (North Eton)
	Blackrock Creek (Calen - Yalbaroo Road)
	Finch Hatton Gouge
	Middle Creek (West Plane Creek Road)
	Prospect Creek (Sarina Marlborough Road)

Local government area	Additional settlements or critical infrastructure
	Northpoint Retail Complex - Heaths Road Glenella (Gooseponds Creek)
	Fourways Shopping Complex - cnr Nebo/Bridge Rd West Mackay
Maranoa Regional Council	Hodgson just north-west of Roma
Mareeba Shire Council	Settlements north side of Walsh River - Dimbulah
	All cattle stations north of Chillagoe who access the Burke Developmental Road
	Mary Farms District on Mulligan Hwy (Mt Carbine Area)
	Bilwon/Biboohra District
	Granite Creek sputs Mareeba town
Moreton Bay Regional Council	Bribie Island
	D'Aguilair Highway
	Morayfield Road
	Bribie Island Road
	Beachmere Road
Murweh Shire Council	Charleville
	Augathella
	Morven
Noosa Council	Pomona Township is regularly cut in two by the low lying roads from the subway for the railway.
North Burnett Regional Council	Monto
	Eidsvold
	Mundubbera
	Gayndah
	Biggenden
Quilpie Shire Council	Adavale
	Quilpie
	Toompine
	Eromanga
	Cheepie
Rockhampton Regional Council	Alton Downs
	Ridgelands
	Mt Morgan
	Stanwell
	Bajool
Somerset Regional Council	Brisbane River (Burtons Bridge/Banks Creek areas)
	Linville/Mt Stanley areas
	Jimna
	Villeneuve
	Kilcoy township
Southern Downs Regional Council	Note: Pratten does not flood as the mapping suggests but is inconvenienced by isolation.
	I

Local government area	Additional settlements or critical infrastructure
Sunshine Coast Council	Kenilworth
	Conondale
	Cambroon
	Gheerulla
	Kidaman Creek
	Belli Park
	Nambour
	Marcoola
	Mudjimba
	Pacific Paradise
	Bli Bli
	Diddilibah
	Currimundi
	Eudlo
	Kawana Forest
	Rainforest Sanctuary (Tanawha)
Tablelands Regional Council	Malanda
	OzCare residential home just outside of 1:100 year event
	Princes Crossing Bridge on Malanda-Atherton Road
	Duncan Brown Bridge on Mary Street
	Sewer pump stations - three secondary and one major
	Ravenshoe
	Sewer pump station on Wormboo Street
	Sewer treatment plant on Cemetery Road
	Millstream water pump stations x2
	Tumoulin Road
	Grigg Street
	Kennedy Highway
	Tully Falls Road (access to Koombooloomba Dam)
	Mt Garnet and Innot Hot Springs
	isolated due to flooding of Kennedy Highway
	Crooks and Wyndham Dams inaccessible during flooding
	BP Service Station in Mt Garnet would be partially inundated
	Herberton
	Herberton-Moomin Road (access to Wild River Dam)
	Community would be isolated.
	Atherton-Herberton Road
	Longlands Gap-Herberton Road
	Wondecla
	Community would be inconvenienced due to flooding but not isolated
	Longlands Gap-Herberton Rd inundated
	Atherton
	Water pump station by the Barron River on Picnic Crossing Road North – road also

Local government area	Additional settlements or critical infrastructure
	floods
	Sewer pump station - Danzer Drive, Mazlin Creek
Toowoomba Regional Council	Cecil Plain
	Jondaryan
	Oakey
	Quinalow
	Maclagan
	Cooyar
	Yarraman
	Pampas
	Yandilla
	Tummaville
	Clifton
	Millmerran
	Crows Nest
Townsville City Council	Much of the road network about Townsville is subject to closure from riverine or flash flooding.
Weipa Town Authority	Although the locations do not appear on the map, it is important to consider the PDR crossings at Moreton Telegraph Station (Wenlock River) and Archer River which are significantly affected by seasonally riverine/flash flooding. These impact on Weipa, as it is the only road access north and south.
Whitsunday Regional Council	Proserpine
	Airlie Beach and all surrounds become isolated
	Strathdickie
	Conway Beach & Wilson Beach
	Dingo Beach & Hydeaway Bay
	Heronvale
	Merinda
	Bowen
	Collinsville
Woorabinda Aboriginal Shire Council	Blackboy Creek and Central Creek when flooded cuts access to the three Woorabinda bores that supply portable water to the township. Also cutting access to two outstations which are Bore 4 and Blackboy camp.

# 4. Are there any settlements or critical infrastructure you believe do not have sufficient flood warning time?

Response	Number of respondents	Percentage of respondents
No	24	45%
Yes	29	55%
TOTAL	53	

Respondents identified the following additional settlements or critical infrastructure that do not have sufficient flood warning time.

Local government area	Additional settlements or critical infrastructure
Balonne Shire Council	Ballon - worst case scenario is about five hours to prepare for flood water and close the openings in the levee which takes more than 24 hours to complete.
Blackall-Tambo Regional Council	There have in the past been instances where the Blackall community have considered there has not been sufficient flood warning time. In response to this Council installed ALERT river height recording stations at Duniera (535126) and Gillespie (535148).
	It is considered that a further river/rain automated recording station could be located at Swan Hill ( GPS -24.596913 145.938234). This would enable improved early warning of flooding of the Barcco River Bridge on the Landsborough Highway.
Boulia Shire Council	Mt Isa Road particularly at night when storms are in the district.
Brisbane City Council	Typically Brisbane's creeks and overland flow paths have short times to flood peak. However, Council's FloodWise® Information System, allows it to respond to creek flash flooding and provide emergency management teams with accurate information in a timely manner. The system monitors real-time telemetry gauges (rainfall and stream height) across Brisbane and provides the current readings on a web portal. Automatic alerting is received via SMS or email by on-call duty officers across the organisation. Brisbane City Council offers the Creek Flooding Alert Service to identified properties that may be affected by creek flooding in the suburbs of: Albion, Archerfield, Boondall, Brookfield, Coorparoo, Corinda, Deagon, East Brisbane, Greenslopes, Hemmant, Herston, Kenmore, Moorooka, Northgate, Nundah, Oxley, Rocklea, Salisbury, Windsor, Woolloongabba, Wynnum and Wynnum West.  Other areas (e.g. overland flow) may subscribe to Brisbane Early Warning Alert Service based on BoM weather warnings.
Bundaberg Regional Council	Bundaberg Regional Council flood modelling has benchmarked flood time frames based on Paradise Dam (i.e. a level at Paradise Dam equates to a level downstream at Walla in about 12–18hours and a level at Bundaberg in about 24hours). While BoM's hydrological models provide earlier warning they do not quantify the extent of flooding typically (i.e. BoM warning will be primarily qualitative: "Minor; Moderate; Major". Based on this, there are a number of locations that receive less than 12hours notice of flood peaks, including: Goodnight Scrub, Morganville, Wallaville, Pine Creek and Bungadoo (roughly the Wallaville area)
Burke Shire Council	During the wet season/flood times, Burketown has limited knowledge of the state of the Nicholson River as there are no automatic stations. A manual gauge is at Doomadgee and Escott Station but a person is required to read them. The Nicholson catchment is monitored on BoM site but the information displayed is of the Gregory River and does not reflect the state of the Nicholson River. If the Nicholson, Gregory and Leichardt Rivers are all in major flood together, Burketown could have major inundation but would have sufficient warning if the information of the Nicholson at Doomadgee and Escott is readily available. The Escott gauge (29159) is said to be set up to be automatic but has not been followed through.
Cassowary Coast Regional	Innisfail
Council	Tully
	others
Central Highlands Regional	Rubyvale - small catchment, rapid rise
Council	Sapphire, Reward and Graves Hill areas - mainly because of the foreign tourists that may be camped and located anywhere across the fossicking areas including on the flats and in close proximity to Retreat and May Creeks.

Local government area	Additional settlements or critical infrastructure	
City of Gold Coast	Almost all "settlements" and "critical infrastructure" within City of Gold Coast can be affected.	
	The Local Disaster Management Group is only activated if a disaster is declared although proactive steps and constant monitoring of the situation are undertaken.	
	As noted, floods are random events and generally unpredictable in determining exactly where rainfall will fall and in what volume; potential impacts to 'settlements' and 'critical infrastructure' is generally not known until the event begins to unfold. Therefore, it is difficult to give exact information, noting that the areas mentioned in question 1, 2 & 3 (being the most likely to flood) are probably the areas that may not receive sufficient flood warning time.	
	The list below of affected flood areas is indicative and it does not represent all possible affected areas:	
	Wongawallan	
	Guanaba	
	Clagiraba	
	Beechmont	
	• Carrara	
	Merrimac	
	Worongary	
	Mudgeeraba	
	Bonogin	
	Tallebudgera Valley	
	Currumbin Valley	
Croydon Shire Council	Belmore Creek on Guilford Road	
	Esmeralda Creek on Richmond Road	
	Clara River on Richmond Road	
	Norman River on Richmond Road	
Gladstone Regional Council	Calliope River Camping Grounds, a popular recreation spot with campers and caravaners.  There are not enough gauges upstream to provide intelligence on the likelihood of water rises in terms of both depth and speed of onset.	
Goondiwindi Regional Council	Inglewood town has very little notice in some events	
Ipswich City Council	Generally all flash flood catchments provide little warning time. Upper areas of major rivers (riverine flooding) also have limited warning time.	
Livingstone Shire Council	Yeppoon—there are no stream gauges to warn of flash flooding.	
Lockhart River Aboriginal Shire	Portland Road would benefit from understanding the river conditions in Chillie Creek.	
Council	Lockhart River would benefit from river height data being available on crossings at the Wenloch River (upper) and the Claudie River.	
Lockyer Valley Regional Council	Muphys Creek—limited time to all areas	
Logan City Council	Marsden	
	Kingston	
Longreach Regional Council	Longreach—needs an automated gauge at Camoola, however, the warning time with current gauges are satisfactory	

Local government area	Additional settlements or critical infrastructure
Mackay Regional Council	Finch Hatton (base of Clarke Range feed by two separate tributaries of Cattle Creek) —very fast inflow, rapid rises and limited rainfall gauges in area (west of township). Evacuation to caravans in FH Showgrounds required March 2012.
	Glenella (Jane Creek)—rapid rises in Gooseponds Creek. Currently one rain gauge in Rowallan Park but not accessible during wet weather if failure occurs. Previous failures have occurred with several days to over a week of outage. Need additional rain gauge and river height near West Mackay-Glenella Road.
	East Mackay (Shellgrit Creek)—subject to flash flooding beside Mackay Airport.
	Antonios Crossing—subject to flash flooding and spilling of Kinchant Dam and dam releases required to maintain dam levels in accordance with EAP.
	Habana (Reliance Creek)—subject to rapid rises from localised flooding.
	Middle Creek—subject to overflows from Middle Creek dam.
	Walkerston (Bakers Creek) —subject to flash flooding west of township. Gauge in township.
Maranoa Regional Council	There are major settlements or critical infrastructure that does not have sufficient flood warning time Roma. Bungil Creek has three river monitoring station one at Tabers which has a lead time of 12hours to Roma, the second Tindarra with a lead time of 2hours, the third is in Roma at Bungil Street (Manual Read). Bungil Creek has a major feed from the Mooga Hills Catchment which has a major impact on the town of Roma. This catchment feeds the Bungil Creek by way of Mooga Creek, it feeds the Bingil Creek 2hours above the Tindarra station, and as in 2011/2012 Roma did not get sufficient warning to prepare the communities.
	In 2012 the Mooga catchment flood water pushed a 1.2 m wall of water over the top of the Bungil Creek flood water and this flood water caused the fatality off a Roma lady, crossing the long drain in town. The second problem with Tindarra Station is a reliability one. This station only gives Roma a 2hour lead time. A lot more data is needed on a more frequent basis and BoM need to request the information at 30 minute intervals this causes the River station to drop off line. This happened in 2010 and 2012 and Maranoa Regional Council did not have sufficient warning of the pending flood water.
Mareeba Shire Council	Bilwon - Barron R
	Mareeba - Grawite
	The needed information may be available but communication lines for alerts are not clear.
Moreton Bay Regional Council	Caboolture
	Deception Bay
	Mango Hill
	Samford
	Burpengary
	Dayboro
	These settlements do not have sufficient warning time because of the natural short response time of some of the catchments. Improved forecast data is required to improve flood warning time.
Noosa Council	All of the flash flooding affected areas listed in question 3 including:
	Tewantin - Daintree Estate
	Pomona - Rifle Street and the Subway
	Noosaville - Lake Entrance Boulevard
	Lake Macdonald - surrounds
Rockhampton Regional Council	Rockhampton (flash flooding)
	Stanwell
	Mt Morgan (Dee River)
	Bouldercombe (Dee River)
	Bajool
	Gonango

Local government area	Additional settlements or critical infrastructure
Somerset Regional Council	Esk—flash flooding during 2011 highlighted that there isn't sufficient warning time for Esk.
	Toogoolawah - Rosentretters gauge—relatively close to the township and cannot provide adequate warning time.
	Minden—forecast data not available .
	Jimna—not monitored/forecasted.
	Linville/Mt Stanley areas—large number of crossings with limited data available.
South Burnett Regional Council	Burnett Highway/Barambah Creek crossing has no stream level/rainfall station to the east advising if an event is going to impact on the highway. Tropical Cyclone Marcia traversed through the region in early March inundating the eastern catchment but not anywhere else in the region. An advisable site would be at the bridge adjacent to the Kilcoy-Murgon Rd/Pei Road intersection.
	Kearneys Road/Stuart River is an advisable site in advance of the Bunya Highway, just to the south west of Kingaroy. This site would provide lead time with a coordinated response towards managing one of the major highways in the region.
	Chinchilla Wondai Road/Stuart River is an advisable site due to its geographic location in respect to other stream level/rainfall stations and the acreage developments that exist around this location.
	Barkers Creek near Barker Creek Road/Nanango Brooklands Road Intersection is an advisable site in advance of the D'Aguilar Highway, just to the west of Nanango. This site would provide lead time with a coordinated response towards managing the busiest highway in the region.
Sunshine Coast Council	Kenilworth
	Conondale
	Cambroon
	Kidaman Creek
	Belli Park
	Nambour
	Marcoola
	Mudjimba
	Pacific Paradise
	Eudlo
	Rainforest Sanctuary (Tanawha)
	Glasshouse Mountains
	Beerwah
	All listed flash flood locations
Tablelands Regional Council	Malanda—gauges are downstream of township. During the February 2015 event the Glen Allyn ALERT, downstream of Malanda received 90 mm of rain in an hour. This event reached 500 mm below the record flood of 1967. An initial MINOR flood warning for the Johnstone River was issued at 09:38 on Sunday 8 February 2015. By this time, the bridge at Malanda Falls was already inundated. Several roads and bridges were already flooded in the Malanda community including homes and businesses.
Toowoomba Regional Council	Quinalow—Total inundation of town in events greater than 100year. No water level gauging upstream and very limited pluviograph network in the region.
	Cooyar—Inundation of town possible and has occurred in the 1980s. No water level gauging upstream and very limited pluviograph network in the region.
	Oakey—System is in place but would likely to have a better pluviograph network in the catchment.
	Jondaryan—Significant inundation and no water level gauging upstream and very limited pluviograph network in the region.

Local government area	Additional settlements or critical infrastructure
Weipa Town Authority	PDR crossings at Moreton Telegraph Station (Wenlock River) and Archer River which are significantly affected by seasonally riverine/flash flooding. These impact on Weipa, as it is the only road access north and south.
Whitsunday Regional Council	Proserpine River has no ALERT river height or rainfall gauges.
	Airlie Beach and surrounds has no rainfall gauges.
	Conway Beach and Wilson Beach have no rainfall gauges.
	Dingo Beach and Hydeaway Bay has no rainfall gauges.

# 5. Are all of the rainfall and stream water level gauges your council operate and maintain shown on the map and is the information about each gauge in the spreadsheet accurate and complete?

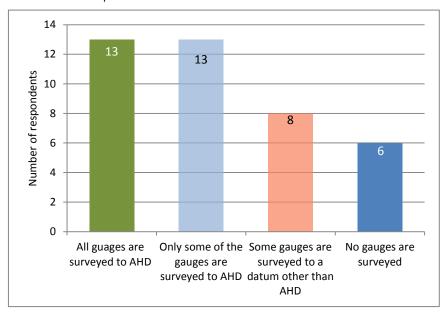
Response	Number of respondents	Percentage of respondents
No	18	41%
Yes	26	59%
TOTAL	44	

In addition to the above, one council noted they also maintain gauges in an adjacent local government area as well as their own local government area. Another council noted that they operate and maintain no gauges.

Seven of the 18 respondents that indicated the spreadsheet was incomplete or inaccurate provided additional information to address these shortcomings. The additional information has been integrated into asset inventory that was prepared as part of this Performance Review.

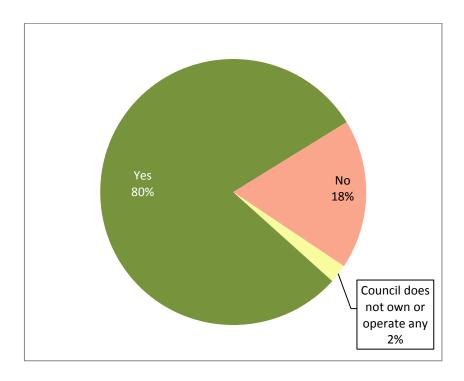
# 6. Are the stream water level gauges your council operate and maintain surveyed to the Australia Height Datum (AHD)?

Total number of respondents: 36



# 7. Are all of the rainfall and stream water levels gauges that your council operate or maintain on your Council Asset Register?

Total number of respondents: 44



Respondents identified the following gauges that were not on their Council Asset Register:

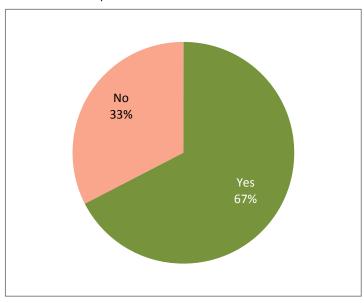
Local government area	Identified gauges not currently on Council Asset Register
Whitsunday Regional Council	All nine (9) river and rainfall gauges installed in 1989 have not been added to the Asset Register. Council does, however, pay for part replacement when necessary from general maintenance fund.
Southern Downs Regional	541091 Ballandean Hill ALERT
Council	541092 Bony Mountain ALERT
	541136 Durikai ALERT
	541135 Cons Plain ALERT
	541136 Gambubal Road ALERT
	541138 Killarney (Spring Creek) ALERT
	541139 Queen Mary Falls ALERT
	541140 Spicers Peak ALERT
	541143 Strathyre Road ALERT
	541144 The Head ALERT
Mackay Regional Council	Four new gauges built in 2013 are fully on asset management system.
	Ex PRIT (Pioneer River Improvement Trust) gauges are on system to record maintenance but asset value was deemed to small when transfer from PRIT to Council in 2014. All PRIT gauges electronics, canisters ex where replaced when moved from Futuretech to ELPRO
Noosa Council	There has never been a documented handover of these assets and so they are yet to be written on to the asset register. They are on the maintenance activities register though.
Barcaldine Regional Council	Sedgeford ALERT
	Betanga ALERT
	Jericho ALERT
	Glencoe ALERT

Respondents also stated the following reasons for gauges not being on the Council Asset Register:

- projects to extend their gauge network were underway but final commissioning had not been completed
- a spreadsheet (separate to the asset register) is used to record gauge ownership
- new asset register software was being introduced across the council and spreadsheet records had not yet been loaded into it
- discussions were needed to clarify who the asset owner is (e.g. council, DNRM, BoM or other parties), especially where equipment is co-owned or jointly housed in the same shed or tower.

# 8. Are there any rainfall or stream water level gauge changes you believe would improve flood warning time (e.g. addition or relocation of gauges)?

Total number of respondents: 46



The potential changes suggested by respondents who answered 'yes' to this question included:

Local government area	Suggested changes
Barcaldine Regional Council	Additional rainfall gauge higher up in Jordan Creek and Alpha Creek will provide 48hour warning.
	Register flood gauges recently installed at Burgoyne (Jordan Creek) 5 km south of Jericho.
	Additional ALERT stations in and up stream of Muttaburra (Thomson River) for early flood warning.
Barcoo Shire Council	New gauge on Westerton Road at Vergemont Creek in the Cooper Creek catchment upstream of Stonehenge for flood impacts on road access between communities.
	New gauge on Yaraka-Retreat Road at Powells Creek in the Cooper Creek catchment.
	New gauge on Connemara Road at Farrars Creek in the Diamantina River catchment.
	Possible additional gauge on adjoining watercourse channel to the existing Farrars Creek TM gauge.

Local government area	Suggested changes	
Blackall-Tambo Regional Council	Addition of ALERT automated recording gauges south and south west of Tambo. Replacing manual stations (sites: 35073, 44168, 35190, 35142, 35129) would provide improved data during flood events benefiting Murweh Shire.	
	Consider replacing manual sites (sites: 63134, 36081, 36040) north west of Blackall with automated systems.	
	There are other sites that would potentially provide beneficial information that have not currently been surveyed or have a manual reading station.	
	New rain stations would be beneficial at:	
	• -24.722632 146.352727 (Windeyer Creek)	
	<ul> <li>-24.065763 145.911997 (Dismal Creek) (a second rain gauge may be needed as a repeater for this site).</li> </ul>	
Boulia Shire Council	Need to utilise data from remote automated devices.	
Brisbane City Council	Council has recently added four river gauges to the network as well as two gauges to monitor backflow prevention devices. River velocity gauges are currently also being considered.	
Bundaberg Regional Council	Addition of gauges at coastal catchments and sub-catchments associated with:	
	Bargara	
	Burnett Heads	
	Elliott Heads	
	Woodgate	
	Moore Park Beach	
	Coral Cove	
	Innes Park	
	Without detailed knowledge of the upper Burnett catchment exact locations cannot be specified but there would be benefit in providing additional gauges in this catchment. The North Burnett Council have been undertaking great work in this area and would be in a better position to provide recommendations.	
Cairns Regional Council	As a result of the Freshwater Creek Flood Study, Council is to install a rainfall and river height ALERT monitoring station at Goomboora Park, Brinsmead (edge of confluence of tidal influence in the Barron River). The study also recommended additional rainfall and river height monitoring stations further upstream within the catchment due to the geographic dependent influence of the topography and related rainfall intensity.	
	A second site for installation of a rainfall and river height ALERT monitoring station would be in Babinda. Council recently benefited from a QFMP Level 2 Flood study in this area and a recommendation was for the installation of an ALERT station on Babinda Creek near Dickson Road.	
Carpentaria Shire Council	Difficult to predict until reliability of readings from new gauges can be determined.	

Local government area	Suggested changes
Central Highlands Regional Council	Old BoM manual gauge site Gainsborough at Dawson River crossing Capricorn Highway.
	Upper Retreat Rain Gauge to improve warning for Sapphire, Reward and Graves Hill area. Site selected with BoM but need to finalise approvals with landholder. Equipment has been purchased and installation likely before 2015/16 wet season.
	Emerald ALERT needs to be relocated to higher ground probably on eastern side of Nogoa River because of the flood modelling analysis work now completed.
	Tartrus needs an ALERT gauge installed and perhaps an additional repeater rain gauge in between to ensure signal can reach the distance to Blackdown ALERT repeater.
	Having the gauges on the ALERT system ensures Council receives triggers real-time via its EnviroMon software and can make decisions or send alerts on to the public.
	An additional rain ALERT gauge in upper Comet on eastern side of catchment and a repeater rain gauge to enable data to transmit back to Rhoddas lookout or via Banana's network back to Blackdown Tableland.
	Rewan could then be upgraded to include the Sat over IP communications plus an ALERT canister as a backup on the DNRM gauge.
City of Gold Coast	More sensors outside of Gold Coast catchments that Gold Coast can retrieve recordings from.
Croydon Shire Council	Additional gauges at:
	Belmore Creek on Guilford Road
	Esmeralda Creek on Richmond Road
	Clara River on Richmond Road
	Norman River on Richmond Road.
Fraser Coast Regional Council	The installation of a number of rainfall gauges namely at Mary River and anabranches, and Tinana Creek have been discussed with BoM. Any installation will depend on funding. No specific plans are in place but research has been undertaken.
Gladstone Regional Council	Additional gauges in the Calliope River catchment. Actual locations will depend on the finalisation of the Calliope River Flood Study and consultation with BoM and others.
Goondiwindi Regional Council	Additional gauges on the northern part of Inglewood, specifically the Canning Creek Catchment. The best organisation to comment would be BoM who rely on data to prepare flood warnings.
Hinchinbrook Shire Council	Additional rainfall station in the upper Stone River catchment to pick up rainfall in the upper catchment. The main rain gauge is at Michael Creek which is in a different watershed.
Ipswich City Council	It would be beneficial to convert to AHD survey.
	Obviously more gauges the better, however, generally Ipswich City Council has good representation of major rivers and creeks.
Isaac Regional Council	Unknown at this stage.
Lockhart River Aboriginal Shire	Additional guages at:
Council	Upper Wenlock
	Claudie River (Lockhart)
	Chillie Creek (Portland Roads).
Lockyer Valley Regional Council	Sandy Creek Forest Hill.
Logan City Council	Addition of a stream water level gauges around Kingston and Marsden
Mackay Regional Council	Mirani ALERT does not have a backup and is critical to flood warning for Mackay (less than 4hours travel time). An additional gauge at Mirani Township (current gauge is on Sunwater property at Mirani Weir thereby limiting access.
	Hospital Bridge ALERT requires relocation due to change in surrounding conditions and trees etc. to be accurate.

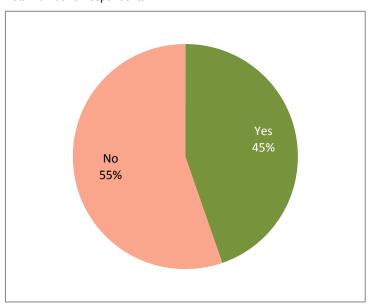
Local government area	Suggested changes	
Maranoa Regional Council	Additional rainfall or stream water level gauges at:	
	Mooga Hills Catchment (Mooga Creek)	
	Bungil Creek Junction at:	
	<ul> <li>Blyth Creek and Bungil Creek (Back up water and flow times/Height back into and Roma)</li> </ul>	
	<ul> <li>Bungeworgorai Creek and Bungil Creek (Back up water and flow times/Height back into and Roma).</li> </ul>	
	Bungeworgorai Creek North-West of Roma (Flow times and height)	
	Maranoa River Catchment (Junction)	
	Maranoa River (West Branch)/Maranoa River(Eastern Branch)	
	Merivale River / Sandy Creek.	
North Burnett Regional Council	Council has used/piggy-backed off existing Sunwater sites where possible. The location of these sites was originally chosen for irrigation scheme purposes and are not necessarily ideal for flood warning purposes. However, to keep project costs down this was the best compromise. Additional work would be required to identify the optimum sites.	
Somerset Regional Council	Consider installing gauges to give better warning to:	
	• Esk	
	Toogoolawah	
	Minden	
	Jimna	
	Linville/Mount Stanley areas	
	Some investigations/flood studies may have to occur to assist with this process.	
South Burnett Regional Council	Additional gauges at:	
Council	26d41'48.2" 152d13'01.3" Elevation 351m	
	26d41'42.5" 151d41'55.3" Elevation 458m	
	26d22'20.3" 151d38'55.6" Elevation 371m	
	26d42'36.6" 151d51'36.2" Elevation 367m	
	In addition to the above, we would recommend that the manual stations should be converted to ALERT/telemetry systems (e.g. RN40138), as the reliance on them for regional areas to assess response is pivotal. Catchment boundary BoM stations should be linked to both catchments for ease of assessment, rather than exiting one catchment's portal to obtain data on the boundary conditions e.g. Mt Mowbullan (Condamine/Balonne), as it also impacts on the Barambah/Stuart catchments from a rainfall perspective.	
Southern Downs Regional Council	Rainfall ALERT gauges in the catchment of Leslie Dam.	
	Stream water level gauge down stream of Leslie Dam.	
Sunshine Coast Council	Additional gauge in Mooloolah Valley to improve rainfall understanding of the upper Mooloolah catchment.	
	Gauges also required for the future Caloundra South community. Sites negotiated as part of the Council Infrastructure Agreement with Stockland.	
Tablelands Regional Council	Possible relocation of gauges in the Malanda area. These gauges are not owned or maintained by Tablelands Regional Council.	
Toowoomba Regional Council	Earlier this year, Toowoomba Regional Council commissioned ENGENY to undertake a review of the existing hydrometric gauge network. The report includes several recommendations for new gauge locations. Council intends to implement these recommendations as funding becomes available.	
	In addition, all gauge data available in real-time through BoM's EnviroMon software would be useful.	

Local government area	Suggested changes
Weipa Town Authority	Additional stream water level gauges could be installed at Moreton (Wenlock River) and Archer River.
Whitsunday Regional Council	Additional gauges at:
	<ul> <li>Proserpine River two new ALERT river/rainfall gauges.</li> </ul>
	<ul> <li>Proserpine Catchment four new rainfall gauges: Jubilee Pocket, Cannonvale, Dingo Beach and Conway areas.</li> </ul>

Respondents provided no additional documentation to further describe potential changes.

## 9. Does your council have any plans to increase the number of gauges and/or upgrade gauges in your local government area?

Total number of respondents: 47



The planned improvements of respondents who answered 'yes' to this question included:

Local government area	Suggested changes
Boulia Shire Council	Install gauges in the Upper Lime Stone Creek catchment.
Bundaberg Regional Council	Identified growth-areas are coastal with several small catchments/sub-catchments that can respond rapidly to heavy or prolonged rainfall. ABS data evidences the growth and demographic characteristics.
Cairns Regional Council	As described in question 8.
	Freshwater Creek this financial year.
	Babinda in the 2016-17 capital works budget.
Carpentaria Shire Council	Potential to increase the number of gauges or more locations where gauges are inundated if necessary.

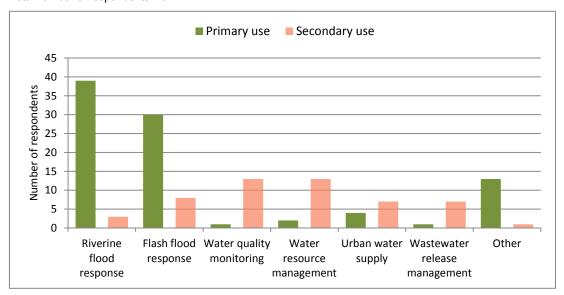
Local government area	Suggested changes
Central Highlands Regional Council	Council is installing upper retreat rain ALERT gauge and a complete standalone backup ALERT gauge with data logger at Craigmore before December 2015.
	Council does not have capital works funds to do other flood warning installs work this coming financial year.
	Council would like to convert Penjobe, Mantuan Downs, Springsure and Bogantungan across to ALERT gauges. BoM would similarly like to see this happen.
	Currently they are aging TM gauges on Telstra carrier. Council has already held discussions with BoM and wants to introduce data redundancy systems into all of its key river height gauges. This requires adding a data logger to each ALERT canister and BoM has not yet provided their direction on the best most reliable and low maintenance way to do this on our existing network. Council currently relies on nitrogen gas bottle setup, which comes with some WH&S issues, but being pragmatic, it has stood the test of time in terms of reliability and low maintenance costs.
City of Gold Coast	Assets custodians for the gauges plan for new gauges according to requests by others e.g. flood modellers and disaster managers.
Goondiwindi Regional Council	Some sites need to be improved to reduce OH&S issues associated with maintenance
	2. A new site in the upper reaches of Wyara Creek could provide more timely information on potential flooding of the national Gore Highway. Diversions need to be established at least 90 km north to this crossing so as much time as possible would be necessary. This crossing floods regularly and strands many motorists.
Isaac Regional Council	As previously advised the flood warning indicator network will be refurbished/repaired this financial year and integrated into the regional information and alert system.
Lockyer Valley Regional Council	Further gauges across Warrego Highway.
Logan City Council	We have undertaken major enhancements to our network of gauges over the past few years, but there are still some areas that would benefit from additional gauges or safety measures such as smart flood warning signs.
Mackay Regional Council	Emergency Management team is currently preparing a Five Year Strategic Plan for Emergency Management and State Emergency Service for Council's consideration and endorsement. The draft plan contains funding for additional rainfall and river gauges to increase situational awareness. Council will also be looking at what joint funding opportunities exist to improve the network.
Maranoa Regional Council	The sites currently available to Maranoa Regional Council to aid in early warning during flood events are limited. Additional sites are required to fill some of the gaps in the system to provide a more robust monitoring network with early warnings moving forward.
	Council is currently reviewing Disaster Management
	Weather Data Network system. (Review): Discuss the network and look at how we may be able to improve the system moving forward (set an action plan)
	Weather Data Network system: Investigate a data sharing agreement between Santos/ Origin/ Maranoa regional Council, DNRM and BoM/Council
	Develop at Weather Data System (River height, road closure and forecasting).
	Council is working on its website and public information display systems and options with the councils IT department. This Dataonline system has the ability to push data into the Council database. Overlays/maps/other information that can be derived from this data and presented through council's existing website. There are a number of options with this and it really depends on the scope/final outcome Council would like.
	One of the main objectives is the ability to have alarming level parameters. Given some historic information, existing systems on Dataonline can be configured to send emails/SMS to Council staff to aid in early warning of pending flood events. These triggers and types of alarms are all completely customisable by Council staff/managers.

Local government area	Suggested changes
Moreton Bay Regional Council	Preliminary planning subject to budget allocation for additional gauges as follows:
	Additional ALERT rainfall gauge for Bribie Island
	Additional ALERT rain/river gauge for Lagoon Creek in the vicinity of Lagoon Street
	<ul> <li>Additional ALERT rain/river gauge on South Pine river upstream of Mt Samson Road.</li> </ul>
Rockhampton Regional Council	Manual peak water height gauges in creek (Rockhampton).
	Rainfall gauges on all reservoirs in region.
	Re-instate Stanwell gauge (Neekol Creek).
	Investigate options at Bajool.
Scenic Rim Regional Council	Construction of additional site is nearing completion, with site to be fully operational and commissioned by 30 September 2015.
Southern Downs Regional	Rainfall ALERT gauges in the catchment of Leslie Dam.
Council	Stream water level gauge down stream of Leslie Dam
	Upgrading of the stream water level gauges to include a gas pressure sensor for the following locations: Killarney ALERT, Warwick ALERT, Connolly Dam ALERT, Murrays Bridge ALERT, Storm King Dam H/W ALERT and Granite Street ALERT.
	The above is only a concept plan and there has been no funding allocated to new or upgrading gauges at present and is unlikely for the foreseeable future.
Sunshine Coast Council	Additional gauge in Mooloolah Valley to improve rainfall understanding of the upper Mooloolah catchment.
	Gauges also required for the future Caloundra South community. Sites negotiated as part of the Council Infrastructure Agreement with Stockland.
	In addition, the Golden Beach gauge has problems with instrument drift and has been damaged by boating activity in the past. A DSITI (Radar) gauge is planned for the same location to inform Coastal Management at a higher resolution. Recommend using signal from new gauge and connecting to ALERT canister, decommission the pressure sensor of the ALERT gauge. Also considering a complimentary network of cheaper instruments to inform of road flooding so that this can be reported on Council's community portal (DisasterHub).
Toowoomba Regional Council	Earlier this year, Toowoomba Regional Council commissioned ENGENY to undertake a review of the existing hydrometric gauge network. The report includes several recommendations for new gauge locations. Council intends to implement these recommendations as funding becomes available.
Townsville City Council	A capital budget is allocated for the 2019/2020 financial year for additional rainfall and river level gauges. The budget is reviewed yearly and this program will be evaluated against competing priorities for the allocation of funds.
Western Downs Regional Council	Currently completing 'Round 2'. No further plans beyond that at this time.
Whitsunday Regional Council	Whitsunday Regional Council will be seeking funding for additional gauges at:
	Proserpine River two new ALERT river/rainfall gauges.
	<ul> <li>Proserpine Catchment four new rainfall gauges: Jubilee Pocket, Cannonvale, Dingo Beach and Conway areas.</li> </ul>

Two respondents (Blackall-Tambo Regional Council and Brisbane City Council) noted that they had no plans to make improvements now but didn't rule out improvements in the future. Specifically, Blackall-Tambo Regional Council state that if funding became available they would work with BoM to identify upgrades to the system. Brisbane City Council stated that the completion and implementation of new Catchment Flood Management Plans in coming years may identify the need for additional gauges. Expansion of the gauge network may also be required in response to population growth, urbanisation, climate change, legislation change and community needs.

#### 10. How do you use the data from rainfall and stream water level gauges?

Total number of respondents: 48

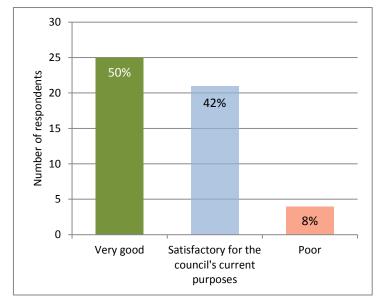


Other primary data uses identified by respondents included:

Primary use	Number of respondents that identified this use
Traffic management (issue of warnings and diversion planning)	4
Flood modelling	3
Support for road remediation	1
Town planning and infrastructure design (historical data)	1

The other secondary use identified by a respondent was calibration of Council Flood Models during the course of flood study reviews.

#### 11. How would you rate the overall <u>accuracy</u> of the data from the rainfall and stream water level gauges that your council uses data from?



Comments made by respondents that rated the overall accuracy as very good for their council's current purposes included:

- The process is automated and calibrated. However, there are typically some gauges that malfunction during
  events (not the same gauges each time). Despite weekly checks of data and routine maintenance, sometimes
  issues only become apparent when there is significant rainfall and water levels are rising. Constant diligence is
  required to make sure the gauge data is good.
- It provides constant, reliable and continuous data for the BoM hydrology unit who then provide us with good solid flood data.
- Very good f rom the automatic stations installed. A recent Central Highlands Regional Council Floodplain
  Management Study has, however, identified some issues with upper end of ratings tables on some gauges.
  Hence, a further synthetic rating tables project is being undertaken. Council does not undertake any instream
  flow calibration checks such as those done by hydrologists periodically during flood events on some of their
  gauges.
- Orifice blockage has occurred in the past which can lead to instrument drift. Regular purging required at some locations (Retrofit of timers is occurring). Gauge boards are recommended at locations of ALERT water level stations so that peak levels can be retrospectively verified.
- Bundaberg Regional Council has worked closely with BoM to install nearly two-dozen river/rain gauges since the
  record flooding at Bundaberg in 2013. This being the case, the gauges installed were completely aligned with
  BoM requirements. Additionally, batteries and solar panels were included in the install of these locations to
  ensure greater robustness in the face of significant weather events.
- Hydrology modelling carried out by BoM based on rainfall station records and stream gauge heights has
  produced very accurate predictions of peak river heights in recent events.
- Council's Hydrometric Network provides the delivery of real-time telemetry data from rainfall and stream height gauges; 24 hours a day, 7 days a week. A maintenance program is carried out each year to ensure this level of service
- All gauges had electronics and canisters replaced in 2010/2011 when changeover from Futuretech to ELPRO.
   Reliability has improved significantly since this changeover and now have spare parts/canisters to undertake immediate changeovers if required.
- In major rainfall events and storm events our organisation relies heavily on the accuracy of the data received to
  model potential flooding areas. Where automated gauges have been installed near manual systems, the manual
  systems are still being read. Data is comparable.

Comments made by respondents that rated the overall accuracy as satisfactory for their council's current purposes included:

- The most recent gauges to be installed have yet to be rigorously tested due to below average rainfall. Other
  existing gauges are very good. Unable to refer to AHD in most cases, which creates issues when determining
  outcome of heights.
- Satisfactory for the Weipa BoM gauges. Poor for the Moreton/Archer River as information on river heights is
  provided informally back to Weipa Town Authority and Wiepa Local Disaster Management Group by local
  residents.
- Council's consultant liaises directly with BoM and DNRM to obtain rainfall data from relevant rain gauges.
- Hydrographic patterns for the various catchments that have already been developed by the BoM would be handy.
- Newly commissioned system and Council is still ironing out some bugs.

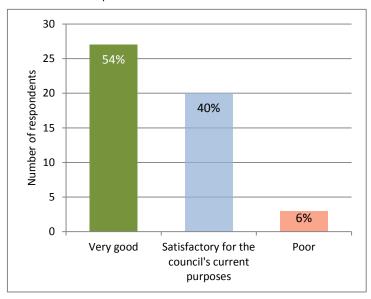
• Issues include but are not limited to: error with recording, malfunction during flood event, datum error, scale error, inability to communicate between neighbouring Councils or PCs.

Comments made by respondents that rated the overall accuracy as **poor** for their council's current purposes included:

- The information is accurate but the gauges are in the wrong location, e.g. downstream of the Malanda township.
- The recently completed Don River Flood Risk Study, 2015, identified issues with the BoM rating curve for the river. This differs significantly to that used by DNRM and leads to inaccurate flood warnings.
- Camoola High risk due to manual readings and property owners not being available.
- No gauges in use

#### 12. How would you rate the overall timeliness of the data from the rainfall and stream water level gauges that your council uses data from?

Total number of respondents: 50



Comments made by respondents that rated the overall timeliness as very good for their council's current purposes included:

- Only now because the system is updated every 30 minutes.
- Accessibility is not as efficient as Council would like as tedious to access through BoM website.
- Timeliness is heavily dependent on cloud cover.
- · Generally real-time.
- The provision of EnviroMon program allows for constant monitoring on a 24 hour per day basis.
- Access to data from BoM website is timely.
- ALERT system is almost real-time and the EnviroMon software transmits this to Disaster Management staff
  mobile phones no matter where they are. Only issue is data redundancy. Without loggers, if for any reason data
  transmission from station fails for a period, the team cannot go back to station post-event and download data for
  flood analysis work.
- Through this survey I have been made aware of some gauges being operated by Sunwater that I was unaware of and that we have no data feed from.

- ALERT technology means that BoM and Council have access to data in virtual real-time.
- Have EnviroMon in the Coordination Centre to give live data.
- Obviously a major component is the understanding of the relationship between ALERT stations and the resultant establishment of trigger points when certain levels are reached/or predicted to reach particular heights. For example in the Barron, the Myola station reading at a level of 7 m or more constitutes a flood; minor below 8.5 m whereas levels above 10 m are considered major. The relationship between this station and Kamerunga is integral as the Kamerunga and Lake Placid stations provide more direct information in the delta. For the Kamerunga gauge, a minor flood is a reading at 6 m, moderate at 8 m and major at 9 m. BoM have good interpretive information on their website showing the comparative relationship between Myola and Kamerunga stations in major flooding events.
- Council operates an EnviroMon Alert system with BoM.
- Local reports from the community have been very positive regarding the data being available on the website very rapidly following rain events.

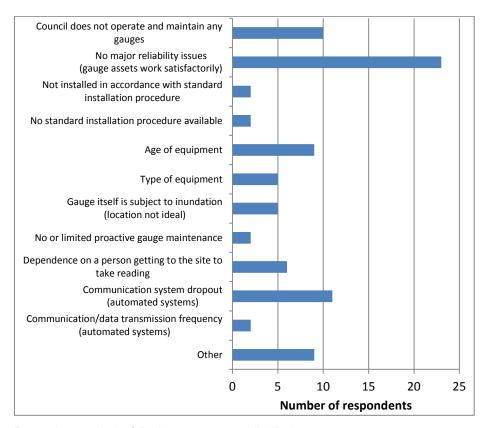
Comments made by respondents that rated the overall timeliness as satisfactory for their council's current purposes included:

- Delay due to the use of satellite communications and going through a third party before being received by BoM.
- During rain events, the Fall Creek data takes a while to be uploaded to BoM.
- Some flash flooding events are very quick and stream rises can be rapid cutting off access before communities
  have much warning. This is largely a function of extreme rainfall intensity and relatively small catchments.

Comments made by respondents that rated the overall timeliness as poor for their council's current purposes included:

- The information is untimely because the gauges are in the wrong location, e.g. downstream of the Malanda township.
- Availability of historic data is extremely difficult to obtain for modelling purpose.
- No gauges in use.

#### 13. Where your council operate and maintain rainfall and stream water level gauges, what are the reliability issues with these gauges?



Respondents made the following comments on reliability issues:

- There are typically some gauges which malfunction during events (not the same gauge each time). Despite
  weekly checks of data and routine maintenance, sometimes issues only become apparent when there is
  significant rainfall and water levels are rising. Requires constant diligence to make sure the gauge data is good.
- Occasional data drop outs, may need to be resolved with the construction of an additional repeater station.
- Council currently has recently contracted reactive maintenance however generally is under resourced in the operation of the flood gauges.
- Every endeavour is made to adhere to the requirements of BoM. However, the monitors could be deemed to be antiquated with the use of the nitrogen gas bottles when compressor type equipment could be used.
- Gauge 29157 Burketown Airstrip is difficult to access in flood time, Burke Shire Council installed a river camera to help with this.
- There is a mix of new sites and retro fitting to existing Sunwater sites, as well as a mix of old and new hardware.
- · Gauges are all relatively new.
- A successful maintenance program with BoM and Council working together is in place.
- Levels at Ferny Gully and O'Reillys Weir can be impacted if water levels are below doppler height. As such, it
  may not be evident when issues arise outside of the maintenance program.
- Tindarra Station has a low reliability. It only gives Roma a 2 hour lead time. A lot more and frequent data is
  required. BoM need to request the information at 30 minute intervals and this causes the river station to drop
  offline due to power usage. This happened in 2010 and 2012 and M aranoa Regional Council did not have
  sufficient warning of the pending flood water.

- Orifice blockages at some locations. Council recommends: purge timers, moisture shorts, five yearly battery replacement, 15 year canister replacement.
- Occasional failure due to storm damage, inadvertent public damage or vandalism.
- Stream water level gauges can be damaged due to flood debris striking the tubes and damaging them. The gas cylinder can also run out of gas. We presently have no way of knowing if the cylinder runs out of gas in between servicing visits. Warwick's main gauge did not record a reading in the last flood on 2 May for this reason.
- The extraordinary flood event of January 2013 saw some equipment in the Baffle Creek catchment inundated, however, with the topography of the terrain little can be done to alleviate this possibility.
- Since 2013, installation of new gauges had been done us ing appropriate technology prescribed by BoM.
  However, the ALERT gauge installed at the Mt Lawless site may be vulnerable as the Mt Lawless location (a hut)
  was inundated in 2013. Council has installed the ALERT gauge technology above the 2013 flood height in an
  attempt to mitigate inundation.
- Prior to 2013, there were few if any ALERT gauges in the region; the majority of gauges were telemetry gauges
  only or even manual gauges. There were numerous instances where telemetry gauges were unable to provide
  data due to damage or no power to telephone towers. Additionally, the gauge at Bundaberg township was a
  manual gauge and was itself damaged in 2013. However, these issues have been addressed by the installation
  of ALERT river/rain gauges at existing sites and new ALERT rain gauges more broadly across the region.
- The data from the gauges is delivered to Bundaberg Regional Council's EnviroMon system via two repeaters:
   Watalgan and Mt Goonaneman. This data is also delivered to BoM. If the EnviroMon system was to fail the data can still be delivered to BoM in Brisbane via Gympie from the Mt Goonaneman repeater.
- It would be ideal to have proper rating curves for gauges for improved calibration of flood models.
- Council has very limited skills and resources.
- Council's major issue and talking point with BoM relates primarily to advances in technology; particularly how the use of emerging technology can be integrated into the existing BoM networks and warning systems. Council experiences some frustration with the lack of consistency coming out of BoM redesign and equipment configuration specifications for new ALERT installations that don't necessarily have the traditional Elpro canister set-up. After reviewing current 'whole package' systems on the market and discussing with other Councils who have installed, Council certainly considers this technology moving forward in the expansion of our ALERT network. However, if BoM will not provide the data on EnviroMon, we are in a bind. With consideration to programming: as the equipment (aside from the compressor) and sensors are the same as the normal stations, the units have certified calibration and are installed in the same manner to spec. Council doesn't see a reason why BoM would not support the increase in available ALERT network data (on EnviroMon) irrespective of the manufacturer. It is Council's understanding that these systems meet all relevant certification.
- Debris or silt giving false readings.
- Council has no issues with equipment age affecting reliability as all electrical gear is under six years old and only
  in service for five years. This is supported by:
  - A proactive battery changeover policy
  - Constant monitoring by Emergency Management staff and Field Officer in active (daily) and non-active (weekly) season
  - Increased monitoring by Emergency Management staff in storm season and periods of high forecast rain.
- For manual gauges floods can cut access to the gauge.

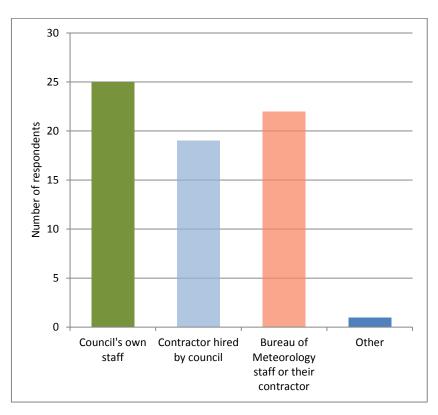
- For automated gauges the system is partly reliant on internet access that can fail during a flood.
- While the gauges generally work well, errors/faults can occur as a result of servicing the gauges. Also, a lack of
  understanding about how the gauge network works can result in accidental incorrect operation of the gauges e.g.
  not ensuring sensors are reinstalled to their calibrated level after removal.

#### 14. How is the maintenance funded for rainfall and stream water level gauges operated and maintained by your council?

Local government area	Funding mechanism
Barcaldine Regional Council	Local government budget.
	State government funding if available.
Barcoo Shire Council	From existing Council revenue sources. Council would prefer that additional external funding be provided for the operation and maintenance of these gauges.
Blackall-Tambo Regional	Ongoing maintenance expenses are accounted for in Council's budget.
Council	Council staff have been trained by BoM to undertake routine maintenance.
	BoM staff are engaged to undertake major maintenance. This has been supported by funding (funding to install stage 2 covered the maintenance of the existing sites which was undertaken when BoM was here to install new sites).
Boulia Shire Council	As per DTMR budget for main roads maintenance.
Brisbane City Council	Approved Hydrometric Asset Management Plan, and fully funded budget to ensure desired level of service is maintained.
Bundaberg Regional Council	An allocation is made by Council's Disaster Management area through the annual Council budget process. The budgeted amount is derived from previous years' costs and advice from BoM or external supplier (i.e. Prospect Environmental, who have installed two gauges in this area since 2013). In the short to medium term there will be a maintenance expense of up to \$15,000 as BoM technician is engaged to undertake proactive annual maintenance on a cost recovery basis. The medium term plan is for a Bundaberg Regional Council technician to undertake proactive as well as reactive maintenance.
Burdekin Shire Council	Council budget allocation.
Burke Shire Council	When required through Council's maintenance programs.
Cairns Regional Council	Council maintain the regions Flood Alert gauges with BoM monitoring and calibrating annually. An Electrical Services and Facilities Maintenance officer accompanies BoM on their annual visits.
Carpentaria Shire Council	Through Council budget.
Cassowary Coast Regional Council	Through the operational budget. Levels are reasonable at present but as gauges and installations age, more funding will be required.
Central Highlands Regional Council	Council operational budget, plus a very sound working relationship with technical officers in BoM.
City of Gold Coast	Funds are provided in the annual City budget.
Fraser Coast Regional Council	Through Council budget.
Gladstone Regional Council	Funding is included in operational budget allocations for Disaster and Emergency Management.
Goondiwindi Regional Council	BoM do six monthly proactive maintenance runs with council providing materials and consumables. Council does minor reactive maintenance
Hinchinbrook Shire Council	Funding for Maintenance and Operations is included in the Engineering Departments' Operating Budget.
Ipswich City Council	Recently it has been through operational budgets allocated yearly (previously no budget)
Isaac Regional Council	Through Council's operational budget
Lockyer Valley Regional Council	Through Council's budget

Local government area	Funding mechanism
Logan City Council	Through Council's budget
Mackay Regional Council	Through Council's budget
Maranoa Regional Council	Council's operational budget
Moreton Bay Regional Council	Adhoc maintenance is undertaken internally by Council at Council Cost (staff and equipment costs Council Funded).
	For gauges installed before December 2012, annual gauge maintenance is undertaken by BoM with assistance from Council (BoM fund BoM staff costs, Council fund Council staff costs and equipment costs).
	For gauges installed after December 2012, annual gauge maintenance is undertaken by BoM with assistance from Council (Council fund BoM costs (BoM cost recovery), Council staff costs and equipment costs).
	Six monthly maintenance checks are undertaken internally by Council at Council Costs (staff and equipment).
Noosa Council	An allocation for maintenance is provided however there is no scope to undertake any renewal works as it is yet to determine that these assets should be on Council's asset register.
North Burnett Regional Council	Through Council's operational budget.
Rockhampton Regional Council	Through Council's budget.
Scenic Rim Regional Council	Through Council's annual operational budget.
Somerset Regional Council	Original installation was paid for by NDRP funding. Ongoing maintenance paid by Council's operational budget.
Southern Downs Regional Council	Funding is allocated Council's budget (Disaster Management) and is determined by Councillors.
	The current budget has seen a major reduction of funding to the Disaster Management Cost Centre and resulted in prioritisation against other disaster management activities and events.
Sunshine Coast Council	Through Councils internal operational budget.
Toowoomba Regional Council	Through Councils internal operational budget (Transport & Drainage Planning Department).
Townsville City Council	Through Councils operational budget.
Western Downs Regional Council	Through Councils internal budget.
Whitsunday Regional Council	BoM do the annual maintenance assisted by Council Staff. Council pay for replacement equipment and items as required.

#### 15. Who carries out the maintenance on rainfall and stream water level gauges your council operate and maintain?

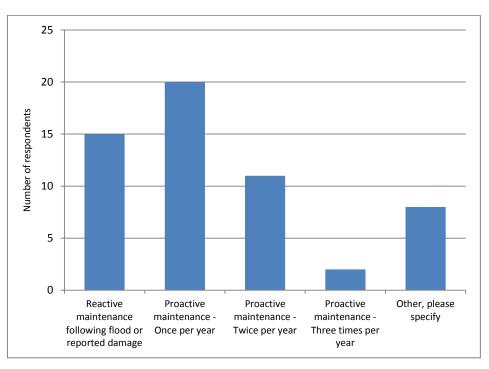


Where one respondent recorded that an 'other' party carried out the maintenance on rainfall and stream water level gauges their council operated and maintained they did not specify who this other party was.

Contractors that Council's identified they were hiring were:

- Prospect Group, Nundah
- · Pentair/Greenspan,

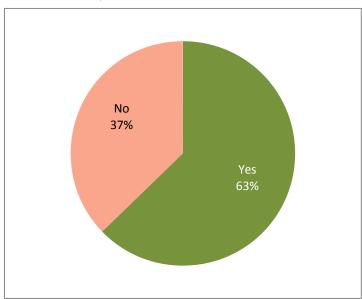
#### 16. What maintenance regimes are in place for the rainfall and stream water level gauges your council operates and maintains?



Other maintenance regimes that respondents specified included:

- · Adhoc maintenance as issues arise
- Pre- and post- storm season servicing
- Quarterly checks
- No maintenance (for new gauages as regime is yet to be agreed with BoM)
- · Reactive maintenance following EnviroMon review
- Proactive fire mitigation maintenance on key gauges considered at risk of excessive fuel load build-up.

#### 17. Do you have any suggestions for improving the efficiency and coordination of maintaining rainfall and stream water level gauges, and/or sharing of data collected from gauges?



The suggestions of respondents who answered 'yes' to this question were:

Local government area	Funding mechanism
Barcaldine Regional Council	Is flood data along the Thomson River being used and shared efficiently between all local governments within the catchment? For example, Barcaldine Regional Council data is useful to Longreach Regional Council. Investigate if automated stations along the Thomson will improve coordination.
Barcoo Shire Council	Maintenance in this remote region by one entity to achieve uniformity and cost efficiencies. Shifting from satellite data transmission to other alternative means when/if other communication services become available to avoid data delay and third party data handling.
Blackall-Tambo Regional Council	BoM online map could be larger or have the zoom capacity so we can zoom in on our region better.
Brisbane City Council	The maintenance of rainfall and water level gauges is a specialised field and not readily available to all authorities. Fostering and assistance with resources in this area should be considered.
Bundaberg Regional Council	Neighbouring local government authorities have installed ALERT BoM-appropriate gauges. These gauges are being made visible on Bundaberg Regional Council's EnviroMon system (the software provided and utilised by BoM).
	Sunwater has requested access to Council's EnviroMon server; there are some issues with external agencies accessing Council systems that need to be resolved before this is finalised.
Burke Shire Council	Installation of automatic gauges at Doodadgee (currently gauge 29158) and Escott Station (currently 29159) on the Nicholson will provide necessary information to accurately monitor flood levels of all of the Nicholson River catchment area.
Cairns Regional Council	Consideration should be given to the integration of new technologies that require less maintenance. There are new systems designed as a camera system with automated sign control and the ability to report on the ALERT network. Unfortunately, if the system does not use the BoM standard Elpro canisters/equipment e.g. Campbell's, it is not considered to meet their specifications. There are a number of Campbell- based sites online and transferring through BoM's system. Some of these have been operating for years so it would be nice to see some consistency and also currency in offering the best information possible to local government and the wider disaster management community decision makers.
Carpentaria Shire Council	Adjusting the numbering of some gauges to better reflect basin information.
Cassowary Coast Regional Council	This review is needed to sort out ownership issues and maintenance responsibilities as records are often unavailable.
	Land access issue would be better managed through a consistent approach possibly lead by the State as each Council will be doing their own thing when freehold land changes hand there may be issues regarding access. BoM guys are great and very helpful.
Central Highlands Regional Council	Queensland is one of the few states where BoM has technical support staff that do work in the field with Local Government officers both in maintenance advice and support, and with siting of flood warning equipment. They are perhaps under-resourced now with the number of additional gauges installed since 2010/11 floods. While there is scope to have private contractors maintain equipment, what fails in that process is the network relationships that become absolutely critical for good sensible dialogue during a disaster event between the Emergency leaders and Councils LDMG (these are too late to be built during an event). Also the direct learnings and connections made by Council staff and BoM staff working in the field pre-season are invaluable in discussing catchment behaviour. The interpretation and warnings system is currently relying on some experienced staff in both DNRM and BoM and as these retire, without a planned and strategic staff development program - knowledge will drop away.
	While Council can develop its own modelling expertise and improved capability to develop better in-house predictions, this must never come at the expense of supporting and enhancing the capability of the central agency, BoM, who is chartered with this responsibility and will always have far greater skills base and longitudinal capacity to deliver this role.
	Joint regional flood warning discussions and workshops between asset managers and key disaster management staff might be useful in a tight financial market as we are now. DNRM, BoM, Sunwater and local government to discuss flood warning networks and improve the collective way in which all the agencies collaborate and decide on regional priorities and direct capital funds to see the necessary and high priority changes occur. Currently funding

Local government area	Funding mechanism
	is either a direct result of a catastrophe or piecemeal shire by shire. Catchment boundaries do not follow shire boundaries; early warning for one shire is often early warning for the next.
City of Gold Coast	A central database for storing all recordings which all Councils have access to and regular meetings with different stakeholders.
Diamantina Shire Council	Possible upgrade in future required for automated systems.
Fraser Coast Regional Council	There are over 100 agencies across Australia that operate rainfall and flood monitors. It is high time that all monitors are placed under the control of a single agency be that State or Federal level. They could also be provisioned with specific funding for maintenance from either government level.
Gladstone Regional Council	It would be beneficial to be able to access rainfall data from neighbouring local government areas for situational awareness and for input to modelling as appropriate. (Link through EnviroMon?)
	Also, the ability to access historical data from other agencies and organisations to inform flood studies and provide background awareness would be beneficial.
Goondiwindi Regional Council	Gauges should be under ownership and control of one national body as our flood water for most settlements is created by rain events in northern NSW. This would limit duplication that exists at some locations and provide for greater utilisation of the available data. Users of the data like councils, Sunwater and state agencies could subscribe to the controlling body for access to the information.
Ipswich City Council	Apply standard procedures/policy/guidelines adopted nationally/state wide
	Allocate dedicated staff to operate and maintain flood gauges as a critical asset
	Adopt AHD nationwide
	Data and services for disaster management purposes should generally be made free of charge. For example: Should not charge for subscriptions for improving disaster management/flood forecasting, such as rainfall grids etc., as it possibly disadvantages smaller Councils that cannot afford these services.
Lockhart River Aboriginal Shire Council	Expand network and fast track upload of data to BoM.
Lockyer Valley Regional Council	A better method of coordination, e.g. all gauges by one owner and the capability to send data to appropriate agencies.
Longreach Regional Council	Refer previous comments about the need for automated river height gauges.
Mackay Regional Council	If online access to DNRM gauges was available this would assist in forecasting and monitoring weather events and provide greater situational awareness. Also if more opportunities to have more joint sheds with DNRM with own equipment installed to enable alerting would be a cost advantage. Need to take advantage of better data sharing, maintenance and cost sharing if applicable.
Mareeba Shire Council	Data from all gauges should be readily available to local government.
Moreton Bay Regional Council	It probably needs to be recognised that with the large increase in number of gauges that BoM resources to maintain the gauges are stretched and a collective pressure may be required to ensure the appropriate resources are provide to meet this need (2014/2015 annual maintenance is certainly much behind schedule).
Noosa Council	These are expensive equipment and whilst Council is very appreciated of the technical support of BoM to undertake an annual inspection and maintenance there is very limited funding for renewing or replacing these assets.
Rockhampton Regional Council	Convert to automatic systems and make publically available details of the gauges (age, type, error range).
	More consultation with Councils on location of gauges and maintenance.
	More details on costs and greater cost sharing.
South Burnett Regional Council	Private gauge results should also be made available to the Local Government Area that they are sited in, to assist with further responsive action. For example, South Burnett has North Burnett gauges and Western Downs gauges located with its boundaries yet have no access to that information unless it is sought as a reactive measure.

Local government area	Funding mechanism
Sunshine Coast Council	AWRIS was meant to be the facility for sharing of data collected under the Water Act. This is still required.
	Council has a desire to have near real time access to ALERT rain gauges from other LGA's, so that rainfall totals can be readily observed on internal systems (TARDIS, DisasterHub) as an event approaches. This data should be readily accessible via FTP from BoM.
Tablelands Regional Council	Better cross boundary cooperation across local governments when installing rainfall and river height gauges to ensure that the benefits are wider than a single council area.
	All agencies to agree access to their gauges with BoM which in turn enables public/agency access. Aware that many different agencies have gauges but not all are accessible.
Toowoomba Regional Council	Make STREAMS data (Main Roads) available to Councils in real time through EnvironMon
	Make Queensland Rail data available to Councils in real time through EnviroMon
	Provide assistance to Councils to upgrade old pluvios to BoM standard (205mm) pluvios.
Townsville City Council	The TARDIS software developed by Council is a web-based interface which complements the EnviroMon software. TARDIS gets processed data from EnviroMon. The entire archive of data within TARDIS can be searched and then displayed as IFD charts and various reports. Set up appropriately, TARDIS can be used for flood-forecasting using Thiessen polygons. TARDIS also has an option for integrating BoM Meteye rainfall predictions for flood-forecasting. In addition, there are a number of asset management features in TARDIS such as communication outage alerts.
Weipa Town Authority	More regular updates of gauge readings on BoM website. Water levels can change very frequently through the season; it would be useful if the information would be updated more regularly.
Whitsunday Regional Council	Share information with Queensland Rail who also has gauges.
Woorabinda Aboriginal Shire Council	DNRM to come to the community and run a workshop with community, Council and other interested parties on this project and its objectives.

#### **IN-DEPTH INTERVIEWS SUMMARY**

Interview summary sheets follow.

#### Consultation communication materials

This section provides copies of:

- Letter of introduction
- Local government questionnaire
- Overview factsheet

LGA QLD Rail
Date 15/07/2015
Method Face to face

Tucc to fucc	
Name	Organisation
Haydn Betts	KBR
Wai Tong Wong	DNRM
Phil	QR
Spiro	QR

ID	Flood susceptibility	Net	work	Operation		Maintenance	Maintenance		
	riood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope	
1		120 rain and water level gauges (WL reference is to top of rail).  Where possible, stations connect to ENVIROMON  Also records air teperature and rail	28 new stations planned for 2016, but none beyond	Sensors to QR to ENVIROMON		Batteries are cycled out at 2 years			
2		Analogue radio and repeater stations	Looking for better monitoring for flash floods with cameras and sensors	Batteries can last 14 days		Maintained every 6 - 12 months, recoded as KM point			
3		3G will be used in newer areas, reliability fair, with occasional 5 minute drops outs that reset automatically.  These are need for rail operations	Would like to improve communication	Has asset registers		No lightning strikes			
4		Network provides coverage at critical locations and is assessed on threat to rail network (risk based)		Do not use data supplied by others		QR does own maintenance			
5		Have drawings for installations, basics are the same, calibrated in same manner.  QR does not follow BoM standards, but sufficient to augment data to BoM		When something happens, train controllers will use BoM data straight from BoM website		Has maintenance registers			
6		New sites are surveyed to AHD		Have an emergency control room, 'Watch Desk'		Calibration by telcom technical staff,			
7		Gauges have been installed over 10-15 years, and locations are linked back to Google Earth		Look to BoM for indicators of upstream flooding					
8		Have cameras - really good for debris checks on bridges		Regional and SEQId are "different worlds" Use Metroweather (commercial) and weather radar as early indicators					
9		In SEQId, rails are generally above 100 year ARI		Don't have access to ENVIROMON					
10		Only a few gauges are mounted high, permanent steps on pole mounts, use ladders for rain gauges		No provisions for replacements at this stage					
11		Use different sensors on old bridges		Gear reports every 30 minutes, health checks every 24 hours, only poll to see if alive, SCADA looks for deviations					
12		Bridge vibration monitoring		System is off-shelf SCADA					
13		Inclinometers - slope protection inn cuttings		Data archiving through SCADA					
14									
5					I				

LGA Rockhampton
Date 20/07/2015
Method Face to face

race to lace	
Name	Organisation
Haydn Betts	KBR
Greg Scroope	DNRM
Ashley Harrigan	Greenspan
Chris MacGeorge	BoM
Sam Williams	RRC
Jim	RRC
Martin	RRC
Bob	RRC

ID	Flood susceptibility		Network	Operation			Maintenance	Out of scope
יין	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	- Out of scope
	Kabra - riverine and flash flooding	Have rainfall recorders at reservoirs in North Rockhampton	About to install 30 peak height cups	Don't have access to ENVIROMON	RRC only maintains South Yaamba gauge - done by electricians		RRC would like assistance: supply, install and maintain	Council resourcing is limited
2	•	All linked by SCADA (not to ENVIROMON)	Have known issues with inaccurate surveys	Historic data for modelling is with our consultants				Can get black coloured water from one local catchment (timber/swamp/ decayed vegetation
3	Rockhampton city: both regional and flash	For modelling only have	Nearkol Creek gauge has been	Have talked with SunWater and use BoM site				V 2 (1/11/V)
	flooding	rainfall at airports	decommissioned by worth getting back to service	continually				
4	North Rockhampton. 3 hours time of concentration, 6 creeks systems	Riverslea gauge stopped reading in 2010/11		During TC Oswald, no external communications, cable broke and without comms for 36 hours  DMG had contact through Ch 34, ham network				
5	Habitable areas affected in 2013	DTMR has one cmaera		Since 2013, QFES has two back of vehcile communication systems incl satellite dish				
6	Short notice flood risk for Stanmore, Bajoolm Stanwall	Flashing lights - crews get out quickly		Cyclone lost QAS mast at Mt Archer				
7	Coincident flooding with Fitzroy R flooding			Have lots of black spots				
	Three types of flooding,: catchments affecting Bajool adding to Fitzroy R; flash flooding; Fitzrov R							
9	Levee at airport only has 2% AEP immunity.							
10	Mount Morgan is isolated, a few house affected but has two dams and no gauges							
11	Kjim's rule of thumb for predicting town gauge: Riverslea /3 = town gauges +100/200 mm							
12	Local town gauge - 1.48 = AHD						1	
13								

LGA Central Highlands
Date 21/07/2015
Method Face to face

Face to face	
Name	Organisation
Haydn Betts	KBR
Greg Scroope	DNRM
Ashley Harrigan	Greenspan
Chris MacGeorge	ВоМ
Bill Wilkinson	CHRC
Glenn Bell	CHRC
Keith Jarrett	CHRC
Peter McGuire (Mayor)- short visit	CHRC

ID	Flood susceptibility		Network	Operation	1	Maintenance	e	Out of scope
טון	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	- Out or scope
1		Quite a good network and expanding	Installing water level gauges at major tributaries to provide increased visibility of inflows, and improve warning time	CHRC has asset, parts and maintenance registers - supplied Asset management system		Full maintenance is done with BoM		KJ recommended the Qld FWGN information/database be installed on a platform similar to that used bby the Stock Route asset management system
2		38 additional stations installed after 2008 flood and before the 2010 flood.	Relocating other gauges to imrove access and provide more meaning	CHRC needs to have a conversation with BoM		If 5 Watt collapses, CHRC can interchange and self change settings and upgrade to a higher wattage		Challenge for councils is rapid turnover of staff - 30% Have to run 24 hour shifts but only have 24 hour capability, can't fill all positions
3	Emerald drain LN1	Key gauges are: Billaboo, Green Valley, Bogantugan in west	Need a gauge in upper Retreat Creek	1	CHRC is progressively educating sub-groups	Current stock: 40 batteries, solar panels, 5W to 10W use 2 aerials a year, have 8 canisters, 2 x 25W repeaters,		Would think about 15 hour day shift and 11 hour night shift
4	to evacuate 7000 people	Use ELPRO equipment All current technology Have spare solar panels, and canisters	Reinstating Canarvan Gorge, Lake Brown, Mt Olga, Mt Panorama	CHRC observed: CHRC netowrk performed better than those of other councils which they have attributed to the service/hydrologist relationship with BoM				Takes 6-8 weeks to understand a location flood problem and determine where to put a gauge plus following conversations with BoM, its signal path testing, and then sourcing funds
5	preferably 48 hours warning to evacuate those numbers	Most important gauges are for Emerald: Fairbairn Dam, Craigmore, Van Dyke, Raymond, Petrona		Asset, parts and maintenance registers to be attached to LDMP				Gauges to east of CHRC are near the Dawson R catchment and service Woorabinda and Banana Shires
6	but also need Raymond and VanDYke to	Flash flooding: Sapphire, Rubyvale, Rolletson, Bluff, Canarvan Gorge						
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LGAWoorabindaDate22/07/2015MethodFace to face

Face to тасе	
Name	Organisation
Haydn Betts	KBR
Greg Scroope	DNRM
Ashely Harrigan	Greenspan
Chris MacGeorge	ВоМ
Dooley	WSC
Lawrie	WSC
Ron Smith (CEO)	WSC

[	Flood consensibility	Network		C	peration	M	aintenance	Out of some
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
	Woorabinda Shire has three areas: two pastoral and cropping areas adjacent to Mackenzie R and Woorabinda township. Folyvale is a concern if Mackenzie River backs up. WSC does not have visibility of this - 17,500 ha of crops impacted 20,000 ha of pastoral	Have a manual rain gauge Stream staff gauge						WSC seeking 50 KVA generator in Council and 70KVA for shop
	Township itself is reasonably immune except for southern part of town near school (1 house in 1990). Peach Creek Mimosa Creek Anabranch off Dawson However town is isolated for days by streams							Police and QAS have radios
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LGABananaDate23/07/2015MethodFace to face

Name	Organisation
Haydn Betts	KBR
Greg Scroope	DNRM
Ashely Harrigan	Greenspan
Chris MacGeorge	BoM
Frank Nastasi (Director Infrastructure)	BSC

	Flood sussentibility	Network		Operation	Operation		Maintenance		
"	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope	
1	10 towns,	FWGN is in early days		Rely on BoM		BSC gauges installed by private company and		BSC currently working through	
	badly affected by Callide Creek discharges in	Good coverage along the Dawson River but				are maintained by another		IGEm recommendations	
	TC Marcia, also Kariboe Creek, Grevillia Ck etc	not for the eastern creeks				20 ALERT sites, of 13 rain and 7 stream/rain			
2	Warning times from Kroombit Tops is a	54 Stations in BSC area but no ALERT stations		Rainfall gauges are relied upon		BSC has asset register, maintenace register,		Main focus is Callide area	
	concern	in Don R system		Have good community network		spare register			
				(telephone each other re flood situation)					
3	Thangool Airport has 5-10year ARI immunity			Have no visibility of DNRM gauges					
4				Use ENVIROMON					
5				Have 1 week Taroom to Baralaba					
				48 hours Taroom to Theodore					
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LGA Bundaberg
Date 8/07/2015
Method Phone

Method Present

Phone	
Name	Organisation
Chris Gimber	KBR
Greg Ross	KBR
Wai-Tong Wong	DNRM
Jason R	Bundaberg RC
Ross O	Bundaberg RC
Matt B	Bundaberg RC

ID Flood susceptibility	Network		Operation		Maintenance		0.1.1
riood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
Bundaberg vulnerable to flash flood and	Spatial network of river gauges is adequate,	Money should be spent on upgrading	Share information with other entities - there is		Spend 15K to inspect gauges each year		
riverine flood	future investment should be on more rain	equipment rather than installing new	a community of practice that meet quarterly.				
	gauges - better value	locations	This includes: North Burnett RC; Sunwater;				
			Gladstone RC, Fraser Coast RC, Gypmie RC				
	Lower Burnett catchment - river gauges are		Enviromon system is used for maintenance		Risk is that is no flooding for a long period,		
	adequate		surveillance - identifies if there are holes in the data		budget will be cut		
3	Upper Burnett catchment - there are still		Enviromon generates alarms for flash flooding		BOM has implemented cost recovery with		
	some gaps in the river gauge network		(based on predefined triggers)		council		
4	3 key gauge locations - everything		Heuristic response to flash flooding (i.e. based		Council perform reactive maintenance		
	downstream of Paradise Dam (12-24 hrs to		on past experiences)				
	Bundaberg from the dam)						
5	Rain gauges critical for flash flooding		Flash flooding - council will phone normal		Routine maintenance is undertaken by BOM,		
			customers impacted to provide warning		but council attend so they can learn		
5	Manual gauges are used as a backup				Prosect and Greenspan provide fall back		
					maintenance options if BOM are not available		
					and council do not have the skill		
,	Some cameras have been installed, they are						
	most useful for flash flooding (e.g. check if						
	bridges are cut)						
3	Cameras are more susceptible to vandalism						
	(particularly in remote areas)						
)	Redundancy has been incorporated into new						
	installations - e.g. bigger batteries and panels;						
	still have telemetry parallel to ALERT systems;						
	maintain manual gauges						
.0	If one repeater goes down, there are others						
	that will pick up the signal						
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LGA Cherberg
Date 10/07/2015

Method Face to face meeting

Name	Organisation
Chris Gimber	KBR
Greg Scroope	DNRM
Tim Foster	Greenspan
Warren Collins	Cherbourg
Chatur Zala	Cherbourg

ID		Network Current Improvement		Operation		Maintena	Out of soons	
שון	Flood susceptibility			Current	Improvement	Current	Improvement	Out of scope
1	Cherbourg has population of 2000 and can be	River gauge installed (Greenspan) 2 years ago,		They receive text messages from Sunwater		No maintenance on their gauge has occurred	They plan to outsource maintenance	
	isolated for up to 4 days	but not added to BOM network		about North Barambah Creek, but they don't		since installation.		
				know where the gauge is or how to interpret				
				level				
2		Unreliable internet connection (Telstra) can be		Sunwater have provided EAP to council, but		The gauge is on council's asset management		
		cut off for 4 days		have not spoken with council since or		register		
				attended any LDMG meetings				
3		Do not have radio redundancy		There is limited flood information and data for				
				Cherbourg, although they have good				
				knowledge based on 2011 and 2013 flood				
				events				
4				Use BOM website to view Sipples Weir - which				
				provides 4-8 hours warning				
5				Do not have any prediction of height				
6				Estimate flood levels based on experience (but				
				this is not documented)				
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LGA Toowoomba
Date 13/07/2015

Method Face to face meeting

race to race meeting	
Name	Organisation
Chris Gimber	KBR
Greg Scroope	DNRM
Sue Oates	вом
Peter Johnson	Greenspan
Blake Bouton	Toowoomba RC
Scott Moffett	Toowoomba RC
Kasi Bashar	Toowoomba RC
Kerry Nargwarn	Toowoomba RC
Mario	Toowoomba RC
Daniel	Toowoomba RC
Mike Flanigan	Toowoomba RC

<u></u>	Flood	Flood suscentibility Network		Operation		Maintenance		Out of some
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	35 towns in the LGA with 30 affected by flash			Council has built a flood forecast model		Maintenance conducted by third party		
	flooding (<6hr response time)	gauges for flash flood warning	avoid duplication of TMR and Council	(URBS) and uses PMD and AMFD to predict				
				flood level				
2	Oaky severely affected 2011, has 6-9 hr	Sparse pluvial network across LGA	Increased density of pluvio network across	Flood intelligence cards, hard copy maps,				
	warning		LGA	flood wardens, manual gauge boards - all for				
				redundancy				
3	Yarraman and Qinalow present a flood risk	Engeny have completed a gauge optimisation		Council download the rainfall forecast product				
		report. Recommended 20 locations for pluvial		from BOM to run their model				
		and 4 stream gauges						
4	Flood risk ranking being prepared by	Use radio links and backup 3G		In future will expand model prediction to				
	MWH/WBM assessment for every settlement			Cooyar, Yarraman, Quinalow				
	in LGA							
5		Communication systems between		Looking at add-ons to ENVIROMON: EG,				
		organisations are not capatible. ENVIROMON,		TARDIS, Hydro				
		Streams (DTMR), SCADA (Greenspan)						
6				Flood classifications for forecast locations				
				have not been done yet - requires further				
				analysis				
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LGA Goodoowindi Date 14/07/2015

Method Face to face meeting

Tuce to face meeting	
Name	Organisation
Chris Gimber	KBR
Greg Scroope	DNRM
Sue Oates	вом
Peter Johnson	Greenspan
Jason Quinell	Goondoowindi RC
Rick Kearney	Goondoowindi RC

<u></u>	Flood	Nets	work	Operation		М	aintenance	Out of source	
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope	
	Inglewood is the highest risk settlement in LGA - Engeny have recently completed a risk assessment for the town. 6-8 hrs between dam and the town		AWS at airport would be useful. Currently read every 3 hours	Poor communications between Sunwater and council (LDMG)				Council questioned the need for them to be the lead agency for disaster management. They do not enough resources or expertise	
2	Texas is not a flood risk	41506 and 41507 are critical gauges for Goodoowindi	OHS issues need to be rectified	Can be difficult to maintain contact with BOM during events (i.e. BOM may have competing demands if widespread flooding)					
3	Above Texas there is a flash flood risk	All existing gauges are useful as they allow council to track the peaks		Volume data is useful for council's own predictions					
4		Kibronae gauge is important for traffic management		Council also collect information from landowners (e.g. road closures etc) to verify BOM information					
5		Flash flooding above Texas is managed by an irrigators group (informal communication network)		Council resources are inadequate					
6		OHS issues exist with access to gauges on bridges		Council do not have a standard approach towards compiling data during an event - it is developed on the fly					
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**LGA** Balonne **Date** 15/07/2015

Method Face to face meeting

Name	Organisation
Chris Gimber	KBR
Greg Scroope	DNRM
Sue Oates	вом
Peter Johnson	Greenspan
Ben Gardiner	Balonne RC

ID	Flood susceptibility	Net	work	Operation		Maintenance		Out of scope
וטו	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1 Bo	ollon has flash flood risk (5-6 hr) and the	Maranoa (43100) is a critical gauge. There is a	Need gauge downstream of Hoola (ideally	Good communication and information sharing		Council does not own any gauges, rely on		
le	vee may be difficult to close in an	big gap further upstream	ALERT)	with Maranoa R.C.		BOM gauges		
er	mergency							
2 He	ebel is not a flood risk (situated on a rise)	Flash flood managed through informal network (word of mouth communication) from upstream landowners	_ ·	Semi-formal data sharing agreement with TMR (Roma)				
3			, ,	Flood categories are too low (i.e. no impact in a minor flood), but there is a reluctance to raise categories since community are familiar with the existing levels.				
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**LGA** Paroo **Date** 16/07/2015

Method Face to face meeting

Name	Organisation
Chris Gimber	KBR
Greg Scroope	DNRM
Sue Oates	вом
Peter Johnson	Greenspan
Trevor Jones	Paroo RC

ID	Flood susceptibility	Network		Operation		Maintenance		Out of scope	
ושו	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope	
1		Gauges have recently been installed by South			Better understanding and correlation between	South West NRM Ltd maintains the gauges on			
		West NRM Ltd (50:50 split funding with			gauge height and flood impact is required	behalf of council (council pays for			
		council). Council takes ownership				maintenance)			
2		South West NRM gauges are not accepted on							
		the BOM FWN.							
3		There are a number of manually read gauges							
		on the Paroo River, but the risk is people leave							
		and then no replacement							
4		South West NRM gauges are interpreted							
		relative to the road level							
5		Gauge network is adequate							
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**LGA** Murweh **Date** 17/07/2015

Method Face to face meeting

Name	Organisation
Chris Gimber	KBR
Greg Scroope	DNRM
Sue Oates	вом
Peter Johnson	Greenspan
Allan Pemberton	Murweh RC

IE	Flood susceptibility	Netv	work	Operation		Maintenance		- Out of scope
"	Fidou susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1		South West NRM	Upgrade South West NRM gauges to ALERT, so that they can be fully integrated into the BOM FWN	SWMM model run when BOM weather alert is issued (prior to events). The model is rerun		South West NRM Ltd maintenance approx \$30K/year for 1 council		South West NRM Ltd gauges are approx \$7K intsalled versus approx \$30K for a BOM standard gauge
2		although all gauges provide value	Move South West NRM gauge to Cooladdi (so businesses can check water level) and provide ALERT above Charleville					
3			Manually read gauge at 27 Mile Gardens as a backup					
4		No gauges are considered superfluous						
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Organisation

BOM

Date Method Present 4/08/2015 Face to face meeting

Name	Organisation
Chris Gimber	KBR
Greg Scroope	KBR
Wai-Tong Wong	DNRM
Chris MacGeorge	вом
Rob Webb	вом
Bruce Gunn	вом

<u></u>	Florid consensativities	Ne	etwork	Operation	Maintenar	ice	Out of some	
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	BOM believe local council is best placed to interpret and respond to flash flooding since they know the local area and landuse (and recent changes).	Gauge data that is not formally accepted by BOM still provides a useful function - e.g. overview information, general awareness, movement of peaks etc	Push towards national standardisation of equipment. Facilitated through the national infrastructure working group (in early stages)	SLS relies on non-BOM gauges. If gauges are removed this will affect the service available		4 people maintain approx 1200 sites		
2		South West NRM Ltd), but it is not directly adopted for input to models	suppliers) may occur in the future. This has been successfully applied to aviation equipment	BOM provides substantial support to local councils. This includes network design (hydrologists) and design details (technical staff)		Typical maintenance cost is \$600-\$1,000/a per site. Lower end if rain gauge only, higher end if rain/river		
3		FWN performance is reviewed regularly in the form of an event debrief. This includes assessment of where gaps exist and where upgrades would be beneficial	Move towards performance specification, rather than product (technology) specification. This will open up the field to more suppliers and innovation	Risk is high staff turnover in council and loss of intellectual knowledge on flooding		BOM \$150K operational cost (excluding FTEs) including repeater maintenance		
4		There is only one supplier of ALERT (Alpro Technology), which should be addressed to increase commercial competition	should be developed and funded	BOM's role in flash flood is to provide information on heavy rainfall and understanding the type of rain that may lead to flash flooding. Interpretation and response is best performed by council.		Asset replacement typically \$50- 100K/a (excluding manual only sites) and uniformly distributed year on year		
5		Key weaknesses in the current FWN are: 1) lack of standards; 2) lack of governance		Council need to match flash flood risk to resourcing. i.e. a risk based approach		Maintenance cost should be 10% of capital cost if performed properly		
6		KPIs for network performance are under development (not yet available)		The FWN is very resilient. BOM can still provide a flood warning service even if components break down (although the accuracy of the service may diminish)		Typical replacement life of: Battery - 2y, Canister - 10y, Infrastructure - 20y		
7		KPIs are required around all components of the system. For example, a 3rd party system could be operating but there may be a breakdown in the connection between a 3rd party and BOM.		Data accuracy during an event is checked by spatial visualisation, filters etc. During an event a technician is assigned to review data, compare flows and identify unusual data		Maintenance report given to council after inspection - includes recommendations		
8		Benefit of ALERT is that it avoids reliance on 3rd parties, meaning there are fewer points of failure		BOM resources are prioritised by the lead forecaster. Duty officers are assigned to specific catchments for the duration of the event. Allocation of resources depends on the size of the event, complexity etc				
9		BOM feel the main source of failure is third party communications providers		Forecasters have degree qualifications in environmental science or engineering and complete in-house training				
10		BOM guidance if for gauge station housings to be situated above historical flood peak levels						

**LGA** Hinchinbrook Shire Council

**Date** 15/07/2015

Method Face to face meeting

race to race meeting	
Name	Organisation
Kyra Stemm	KBR
Graeme Milligan	DNRM
Chris Mcgeorge	вом
Tristan Richter	Greenspan
James Stewart	Hinchinbrook SC
Jenna	Hinchinbrook SC

ID Flood ourseastibility	Network		Oper	ration	Maintenance		Out of soons
ID Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1 Hallifax identified as a key risk	HSC have 14 gauges listed in their asset register		Remote enviromon access	Some vulnerability when a gauge site goes down. This is generally not equipment related and more to do with the environment (ie. Bank letting go)	Maintenance is through an allocated budget (Engineering operations budget).	always an opportunity for more funding	
Carwell identified as at risk from flows from the mountain	Gauges are on the BOM network		Flood information provided to the public and broadcast throughout the town during an event.		Engineering operations budget is based on previous years spending - the engineering operations budget has specific allocation to the flood warning network		
3	There are some gauges located outside their LGA		There is a good public understanding of flood impacts in Ingham based on indicators at Gairlock Gauge. In the process of transferring this to Ingham Pump Station gauge which is considered more reliable and provides better warning.		Gauges are financially recorded on the asset management register		
4	Gauges in the network are sufficiently placed		in the process of installing depth indicators throughout the town including event markers to have physical information available to the public on the ground.		Annual maintenance round with BOM		
5			To provide public with information and help with the transition from Gairlock to Ingham Pump Station, magnet style tables/information is provided to the public for both locations to translate to the new site.				
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LGA Tablelands Regional Council

**Date** 16/07/2015

Method Face to face meeting

Present N

race to face meeting	
Name	Organisation
Kyra Stemm	KBR
Graeme Milligan	DNRM
Chris Mcgeorge	вом
Tristan Richter	Greenspan
Sarah Dean	Tablelands RC
Rosa Lee Long	Tablelands RC
Geoff Stocker	Tablelands RC
Dean Davidson	Tablelands RC
Patrick Clifton	Tablelands RC
Rob Copland	Tablelands RC

ın	Flood sussentibility	Net	work		Operation	Maintenance		Out of some
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	Susceptible to flash flooding as they are located in the upper catchment	BOM is heavily relied upon for flood warning	identified a potential site at the junction of Williams Creek and Johnston River which may provide some improved warning time (in the order of minutes not hours)	no gauges to operate	would require resources (money and personnel i.e. Technicians)	No gauges to maintain		Some people do not want to be classified as being in a flood area
2	given they are in the upper catchment there is not sufficient warning time	all gauges in the LGA have been installed by other LGAs/organisations	rain gauges upstream are more beneficial to correlate rainfall (mm) to flooding (ie. Understanding Xmm of rainfall in XXhrs may impact on these settlements)	do not use enviromon	Modelling is more expensive but it is likely that rainfall gauges and modelling would be of use upstream to provide warning	Council has a limited budget with little capacity for installing/operating gauges		
3	localised flash flooding during high intensity rainfall in the Upper Barron	existing gauges are positioned as recommended by DNRM (used by DNRM)	gauges need to be positioned to benefit town warning		river gauges would translate what is on the ground and what the impact is from the rainfall			
4	in the past local knowledge has been used to correlate rainfall with flood impacts and approximate warning times however this knowledge is slowly being lost		need gauging on the Herbert River					
5	Flash flooding in Malanda may be a significant impact while the event may be classified as minor downstream		identified a potential rainfall gauge site in the catchment above Malanda (water supply offtake station)					
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LGA Mareeba Regional Council

**Date** 16/07/2015

Method Face to face meeting

Name	Organisation	
Kyra Stemm	KBR	
Graeme Milligan	DNRM	
Chris Mcgeorge	вом	
Tristan Richter	Greenspan	
Val Shannon	Mareeba RC	
Lyal Buhmann	Mareeba RC	
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ID	Flood susceptibility	Netv	work	Operation		Maintenance		Out of scope	
ויין	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope	
1	Mareeba is impacted once the (Tinaroo) dam ills	No flood warning gauges	More communication with BOM/DNRM	no gauges to operate				Sunwater is not involved in the LDMG for dam operation at Mareeba	
		At present Council does not have access to the flood warning network (through enviromon)	A better understanding of what tools are available (ie. Enviromon)	do not use enviromon					
3	ink Road can go under for weeks	BOM is heavily relied upon for flood warning							
4		Mareeba have approximately 7 rain gauges which they are aware of which have recently been installed/currently undergoing installation which are not part of the flood warning network (for water supply and							
5		Some Cairns flood warning gauges are located in Mareeba LGA							
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LGA Cassowary Coast Regional Council

Date 17/07/2015

Method Face to face meeting

Face to face meeting	
Name	Organisation
Kyra Stemm	KBR
Graeme Milligan	DNRM
Chris Mcgeorge	BOM
Tristan Richter	Greenspan
Jason Hemmingway	Cassowary Coast RC
David Sharp	Cassowary Coast RC
Rod	Cassowary Coast RC
Hayley	Cassowary Coast RC

ID	Flood susceptibility		Network	Operation		Maintenance		Maintenance		Out of scope
טו		Current	Improvement	Current	Improvement	Current	Improvement	Out of scope		
	A number of communities get cut off from flooding	Rely on BOM to issue warnings	Access to QR and TMR gauges and integrate with the flood network (avoid duplication of infrastructure)	Flood studies/modelling have been undertaken for emergency management	There are some challenges in getting the community to believe/understand the PMF flood levels as they generally only understand the 1967 event (which modelling suggests is a 1:30 year event)	management). Unsure of expenditure due to aging gauge equipment.	Having a dedicated resource (Technician) for the flood gauges. Currently there is not a huge amount of experience as maintaining the gauges is only one of the priorities	Access issues identified included access t private property - it takes time for farmers to grant access to the gauges. Issues due to Panama outbreak on Banana farms.		
	and Tully gets cut-off	by Council which are located	Integrate with gauge information on the SKADA network (ie. Try to do more with one gauge)	3 modelling) for 2 to 500	Would like to do more on identifying "Minor",  "Moderate" and "Major" indicators as they  don't reflect the current modelling.	Currently CCRC are trying to put a good management plan together including a condition assessment to identify what is Council's and setup a maintenance strategy	Regular clearing program as part of the maintenance.	Planning scheme identifies a required floor level and freeboard for new structures, however it is unsure what the final level is as there is no final floor survey. Would help in understanding flood impacts.		
3		There are some gauges installed by "Rivertrust" which still exist. At present it has not been formalised that Council own the gauges that were originally installed by Rivertrust	upstream of the confluence and perhaps downstream of the confluence would be	Enviromon is in the main office (Innisfail) and visualised on the server	Better understanding of flood impacts by understanding the flood height related to overfloor flooding. Properties would require floor survey.		Access for maintenance/repairs especially in events) is a key issue for CCRC. Some gauges are located in adjacent LGAs where there have been some issues with access being locked. A masterlock system would be beneficial for shared gauges.			
	, ,	WBM have assessed the distribution of gauges	More communication with DNRM and BOM (some DNRM gauges are not on ALERT)	Enviromon receiver in Tully			National Parks lock gates before an event (to prevent campers etc. from entering) however it cuts off access to gauges and clearing immediately after an event.  Master key or other access provisions would be beneficial.			
5		Gauges in the network are sufficiently placed	Access to DNRM sites (eg. Silkwood)	Can access enviromon information from any office		Maintenance of gauges relies heavily on recommendations from the BOM maintenance				
6			ALERT gauge/s for Cardwell			Battery replacement is usually 3 yearly with ADHOC maintenance for batteries etc based on Environon				
7			More rain gauges to provide more information on temporal distribution and correlate gauge heights with rainfall			Solar panel replacement on an as- needed basis				
9						Some available spares Technicians with computers are brought in from Tully if canisters require reprogramming				

Present

LGA Lockyer Valley
Date 6/07/2015
Method Visit

Name
Organisation
Haydn Betts
KBR
Andrew Chapman
Wai-Tong Wong
DNRM
Greg Scroope
DNRM
David Mazzaferri
Lockyer Valley RC
Tristan Richter
Pentair

#### Sites inspected

UPPER LOCKYER ALERT (540566 - Council)

SPRING BLUFF ALERT (540527 - Council); SPRING BLUFF TM (540507 - DNRM)

WOODLANDS ROAD ALERT (540680 - Council)

MULGOWIE ALERT (540528 - Council)

	Flood output like	Network	Network Operation Maintenance				Out of some	
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	Almost all townships vulnerable to rapid onset flooding (flash)	All LVRC council gauges are shared with BOM and transmit via UHF	Some valleys not properly gauged	Direct enviromon access	·	LVRC carry some equipment spares (canisters, batteries, solar panels)	·	
2			Flows breaking out of channel in agricultural areas not easily monitored – creeks are mobile and flooding mechanisms change	Proper equipment and construction used for installations.		Shared maintenance with BOM. LVRC undertake 6 month inspection (clean, test battery, cylinders, etc) and team up with BOM for annual service		
3		changing conditions across roads or channel breakouts in perched systems	sent to public when set triggers are reached			Maintaining the O&M funds is challenging.		
4		Need a lot of repeater stations due to the terrain		Manual gauge readings provided by members of public.				
5 7	Mostly flash flooding and some	All gauges are in partnership with BOM		Weekly network status check via online system (enviromon) Share information with other entities -		Spend 15K to inspect gauges each year		Erosion changes flow directions, Junction
	riverine		Mount Sylvia	with SEQWater, Somerset RC and Ipswich		-processor and processor and p		View
8	High with major flooding and loss of life: Gatton, Murphys Creek, Laidley, Forest Hill etc	Rain gauges critical for flash flooding		Enviromon system is used for maintenance surveillance - identifies if there are holes in the data		Risk is that is no flooding for a long period, budget will be cut		Risk: Tourists to Glenrock
9	Bridge and road losses	Some cameras have been installed, they are most useful for flash flooding (e.g. check if bridges are cut)		Enviromon generates alarms for flash flooding (based on predefined triggers)		BOM has implemented cost recovery with council		DTMR: local not keen on council supplied website onto DTMR system
10		Cameras highly valued if pan, tilt zoom Cameras report through 4G, LVRC is revamping its website using Somerset RC website as a model		Heuristic response to flash flooding (i.e. based on past experiences)		Council perform reactive maintenance		
11		Spatial network of river gauges could be improved, future investment should be on more rain rain gauges - better value	Better ability to log onto websites	Flash flooding - council will phone normal customers impacted to provide warning		Routine maintenance is undertaken by BOM, but council attend so they can learn		Guage Lats and Long should be to 6 digits after decimal point
12		Have own ENVIROMON server all in VHF and repreaters BOM has a backup LVRC has a firewall There are no gauges that are not in the BOM system BOM/LVRC maintain together	More gauges at breakout points			Prosect and Greenspan provide fallback maintenance options if BOM are not available and council do not have the skill		
13		LVRC buys equipment and spares Standardised on ELPRO	Holes in valleys susceptable to thunderstorm flooding					
14			Capabilty to improve warning by text/sms service					
15		Battery checks every 6 months	Would never have too many gauges					
16		Annual network maintenance						
17		Not resourced enough so pay BOM to maintain and operate						

Present

LGA Lockyer Valley
Date 6/07/2015
Method Visit

Name Organisation
Haydn Betts KBR
Andrew Chapman KBR
Wai-Tong Wong DNRM
Greg Scroope DNRM

David Mazzaferri Lockyer Valley RC

Tristan Richter Pentair

Sites inspected

UPPER LOCKYER ALERT (540566 - Council)

SPRING BLUFF ALERT (540527 - Council); SPRING BLUFF TM (540507 - DNRM)

WOODLANDS ROAD ALERT (540680 - Council)

MULGOWIE ALERT (540528 - Council)

ID	Flood susceptibility	d suscentibility Network		Operation		Maintenance		Out of scope
10	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
18		Trigger levels based on Minor, Moderate and Major						
		flood levels.						
19		Repeaters Mulgowrie, Mt Garigal Road						
22		Cameras are more susceptible to vandalism						
		(particularly in remote areas)						
23		Redundancy has been incorporated into new						
		installations - e.g. bigger batteries and panels; still						
		have telemetry parallel to ALERT systems; maintain						
		manual gauges						

LGA Sunshine Coast
Date 8/07/2015
Method Visit

Method Y

Name	Organisation
Andrew Chapman	KBR
Greg Scroope	DNRM
Tim Forster	Pentair
Crispin Smythe	Sunshine Coast RC
Geoff Ganges	Sunshine Coast RC
Jeff Morrin	Sunshine Coast RC

### Sites inspected

Warana Bridge AL (540088 - Council) ; Warana Bridge TM (540266 - DNRM)

Bli Bli AL (540506 - Council)

Dunethin Roack AL (540095 - Council)

Nambour Alert (540137 - Council) ERRTS canister SN# 94778024 - Field Station Freq 1515, RG 1.0 mm Rimco bucket

[[	Flood susceptibility	Network		Operatio	on	Mainte	enance	Out of scope
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	Many locations at risk of flash flooding.		warning.	Real time gauge data is imported to TARDIS every 5 minutes from Enviromon. Inside TARDIS Council can see all data and custom meteorological analysis outputs.	Council want non-alert gauges visible in enviromon for SMS alert capability.	Sometimes Council has surplus O&M budget that is spent on additional replacement stock or upgrading gas bottles in stream gauges to new compressor units.		They would like to be represented at the key stakeholder group (KSG).
2	Some settlements at risk of riverine flooding may not have 6 hours warning (Marcoola, Bli-Bli, Currimundi)	Good coverage of majority of 'at risk' areas.	0 0 00 ,	Little reliance on BOM riverine warnings.	Want to see gauges north of Noosa for advanced tracking of low pressure systems	Shared maintenance with BOM. Council undertake 6 month inspection (clean, test battery, cylinders, etc) and team up with BOM for annual service		
3		There is redundancy in the repeaters and receivers (Nambour and Caloundra)	Augmenting the environmental monitoring sites at the Caloundra South development site. Sites negotiated as part of the infrastructure agreement with Stockland.					
4			The DNRM gauge at Peachester (Stanley River) could be added to ALERT system to service the community of Peachester.					
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LGA Gympie
Date 9/07/2015
Method Visit

Method Present

Name Organisation

Andrew Chapman KBR

Greg Scroope DNRM

Tim Forster Peter Mann Gympie RC

Grayden Curry Gympie RC

Sites inspected Location of station

Woolooga (40365 - BOM) -26.050372, 152.391893 (river gauge location - rain gauge located at back of hotel)

Dagun Pocket AL (540569 - S -26.322367, 152.702404 Gympie Weir TM (540215 - S Couldn't locate gauge Gympie Alert (40993 - BOM) -26.191266, 152.656525

ID	Flood susceptibility		Network	Op	Operation Maintenance		Maintenance	
Lib	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1		BoM is the single point of truth and rely heavily on what they predict	Predictions of rise and fall, not just the peak forecast. This is most important for reopening major roads, for which Council is the local contact.		Woolooga Pub owner needs to telephone line connection to operate his ROT terminal for the rain gauge.	No gauges to maintain.	Council believe maintenance could be improved. Although they do not own or operate any gauges they have been impacted by non-functioning gauges in the past.	
2		Obtain data from TMR network regarding road closures.		Gympie do not use Enviromon. No Council resources with hydrology skills to interpret data or make predictions.				
3	Council doesn't actively warn or manage flood events for the community – survive with community knowledge and resilience	Council look to the gauge operated by SCRC near Kenilworth for advance warning of Gympie flood regarding rate of rise and duration.	There could be improvements with TMR with sharing camera vision with Council.					
4			Gympie are happy with the current arrangements but would like to see more gauges installed (non specific).					
5			Biggest concern for Council is who to contact regarding gauges owned/operated by numerous agencies.					
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LGA Barcaldine
Date 21/07/2015

Method Present Visit

V1510	
Name	Organisation
Andrew Chapman	KBR
Graeme Milligan	DNRM
Marc Schmidt	Pentair
Paul Birch	вом
Alan Luyt	Barcaldine RC (Engineer)
Des Howard	Barcaldine RC (CEO)

Sites inspectedLocation of stationJericho AL (35285 - BOM)-23.603905, 146.130304Glencoe AL (535104 - Council)-23.712757, 146.169787Alpha (35229 - BOM)-23.648918, 146.646845Bargoyne (local resident)-23.6562, 146.1496

ID	Flood susceptibility		Network		Operation		enance	Out of scope
ا"ا	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
	Main flood risk is Jericho and Alpha which can flood at the same time from a signel storm event.	Few Council gauges.	Issue with "declining interest in manual read" with less people on properties and more caretakers		old manual gauge downstream of the town weir - for big flows there will be some	Yet to work out maintenance and operation arrangements for new Council gauges.	Need to establish asset and maintenance registers.	
	Barcaldine, Aramac and Muttaburra are slow regional events.	New ALERTS installed by Council recently.	Additional rain gauges upstream of Jericho and Alpha would provide greater warning.	There is good local knowledge in CEO	No written procedures or documentation of potential impacts given certain gauge levels			
3		(not official gauge sites) for	Jericho. This should be converted into a gauge.	Just getting started with Enviromon. Computer at Alpha office processes data and has UPS power backup, but mail server is cloud based and could have issues in blackout. Council is happy to work with CHRC (Emerald) for redundancy (Alert data sent to Alpha and Emerald).				
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LGA Longreach
Date 22/07/2015

Mark Watt

Method Present Visit

Name
Organisation

Andrew Chapman
Graeme Milligan
Marc Schmidt
Paul Birch
John Roworth

Organisation

KBR
DNRM
Pentair
Pentair
BOM
Director Infrastructure Services

CEO

Sites inspected

Longreach TM (36161 - DNRM)
Darr TM (536005 - DNRM)
Camoola Park (36013 - BOM)

Location of station -23.409909, 144.228686 -23.215995, 144.080567 -23.039231, 144.517777

ľ	Flood susceptibility	Ne	twork	Operation			Maintenance	Out of scope
liD	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	- Out of scope
1	Regional flooding with lots of warning.		The manual gauge at Camoola Park should be augmented to an ALERT gauge as this is a key monitoring and warning point for Longreach and downstream settlements. There is already strong communication signal at the property.				The manual gauge at Camoola Park is in disrepair and needs replacement. BOM haven't had funding to maintain gauges (generally) since 2010.	
2	No formal coordination of community around flood events.	because of the capital and operating costs	A lot of rainfall stations in the upper Thomson catchment are manual. Many property owners are leaving and caretakers are not interested in reporting to BOM. Many of these need to be upgraded to automatic gauges.					
3			A need is to automate the stations at Coolagh (for Isisford) and Muttaburra					
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LGA Whitsunday SC Date 7/07/2015

Method Face to face meeting

race to race meeting	
Name	Organisation
Haydn Betts	KBR
Graeme Milligan	DNRM
Andy Barnes	вом
Tristan Richter	Greenspan
Hennie van der Schyff	Whitsunday SC
Jessica Cristaudo	Whitsunday SC

ID	Flood susceptibility	Net	Network			Maintena	nce	Out of scope	
וייו	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	- Out of scope	
1	Flooding issues	Unable to provide answers as recent	Agree need for TPZ camera			WSC do not do maintenance		No confidence in current Minor,	
	Isolation Bruce Highway: loss of access,	resignation and new person on leave at the						Moderate Major flood classifications	
	resupply	time						·	
2	Vulnerable communities	Flash flood - go and close roads	Rain gauges: Euri Ck catchment at say Thurso	Don't have ALERT warnings for road				Had recent study by AECOM but unable to	
	Merinda		Road	operations				interpret the results	
	Saltwater Creek		Prosperpine basin						
	Inlets to north of Bowne Township								
	Boolooloo Rd/Woodstoick Rd								
	Coastal surge								
	Merilin Ck - response time								
	Don R								
	Bogie River								
	Cassawary National Park (Foxdale, Hamilton								
	Plains, Crystall Brook)								
	Silver Creek								
	Googanda Ck								
	Gumlu								
	Elliott River								
	Guthalungra								
3	All beach communities cut off in a 2 year	Manual gauges are isolated	Rain gauges in local catchments for flash flood					Flooding not viewed by Council as a high	
	event		warnings					priority	
	Bowen 12,000 people	Scott applied for 9 gauges - only got one							
	Sandy Gully goes over quite quickly					-			
	Houses are not flooded (unsure of validity of								
	this statement - need to check AECOM report)								
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12									

LGA	Burdekin SC
Date	8/07/2015

Method Face to face meeting
Present Name

Name	Organisation
Haydn Betts	KBR
Graeme Milligan	DNRM
Andy Barnes	BOM
Tristan Richter	Greenspan
Matthew Ingle	Burdekin SC
Dean ?	Burdekin SC

	1	l No	twork		Operation	Maintenance		
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	Regional Flooding:	Have ENVIROMON	Millaroo ALERT to be moved upstream to	Current	improvement	Dean does maintenance work with BOM each	improvement	
1	Giru	Have asset registers	capture the Bogie River			year and as problems occur. Ian come up		
	Jerona	Thave asset registers	captare the bogic river			each year for two weeks. BSC have two staff		
	Alua					and there is a 9 year relationship		
	Brandon					und there is as year relationship		
	Ayre							
	Riti Island							
	Home Hill							
	Clare							
	Millaroo							
2	Haughton R and Yellow Gin Creek cut access	No private stations	Have grants fro new stations at			Ian Roh looks after ENVIROMON		
	north and south		Yellow Gin Creek					
			Brandan					
			Landers					
			Upper /East Barattas					
-			Landers Ck at Expidition					
3	Have 'lots of notice' about floods	No camera, flashing lights	Cameron Hill repeater sometimes has cloud			BSC has spares		
<u> </u>		A COLOR OF THE COLOR	covers - so battery levels drop			6 1 1 1 212 21 1 1		
4	Haughton floods every year - Giru	Matthew is happy with the network at	Equipment is up to date but battery and solar			Dean has backup within council but they don't		
		present,	are dated			have time to do 6 monthly panel cleans		
		new stations need to focus on raod access				Maintenance is treated as day to day business		
		Does not think BSC has too many gauges						
5	Sewer pump stations may be vulnerable to		Afe of units - most about 1991, cylliners					
	local flooding - only in towns Ayr, Home Hill,		about 2006/07					
	Brandon							
6			main vulnerability cloud cover					
	Manually checked every three hours		· ·					
7	Warnings issued by ABC radio and local radio							
	stations							
8	Matthew Ingle wanted to know if BOM used							
	temporal patterns							
9	BSC generally satisfied with Minor, Moderate							
<u> </u>	Major flood classifications					1		
10								
11						<del> </del>		
12								

LGA Mackay Regional Council

**Date** 9/07/2015

Method Face to face meeting

Name	Organisation	
Haydn Betts	KBR	
Graeme Milligan	DNRM	
Andy Barnes	вом	
Tristan Richter	Greenspan	
Bruce Chester-Martin	Mackay RC	
Robin ? (SW Engineer)	Mackay RC	
Luke ? (Planner)	Mackay RC	
Patrick (Rick) O'Riely (civil ops)	Mackay RC	

ID	Flood susceptibility	Network			Operation	Maintenance		Out of scope
וטי	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1 Pio	neer River - only get 10 hours notice with Mirani providing 4	All gauges moved from the Pioneer River	Plane Creek above Sarina		Add TARDUS system for others to see data	Rick does with BOM		
hou		Improvement Trust to MRC			from ENVIROMON	Does casual maintenance		
2 Hea	avily dependent on ALERT system	In 2009 change from Futuretec to ELPRO	Middle Creek Dam above Sarina		Council has a quality management system but			
					not sure whether it is in plac e for FWN.	rates fund \$600kpa, of which 80% to capital		
					DO daily checks to see if system is working	Thinking about another fund for risk		
					Not set up as SOP - a to do job	management		
3 Hav	ve ENVIROMON server and pager	Clark Range has two stand alones about 2m				KPI - all working within 2 days of going out		
Jilav	ve Envincent server and pager	apart - needed for lightning strike				an working within 2 days of going out		
4 Rac	dio linked with triple redundancy - Mackay, Paget and BOM	apart needed for lightning strike	Obtain access to DNRM gauges at Mirini,			Keep maintenance records		
	, , , , , , , , , , , , , , , , , , ,		Marion, Gorgette(?), Finch Hatton,					
			Dumbleton (on opposite side), Whiteford					
5 Vul	nerabilities: Finch Hatton, population to the mnorth - main		Gargett on old roadf could be better			100% of batteries less than 5 years, prefer 2		
	ad is out, Dumbleton.		positioned			years		
6 Hav	ve list of stations and warning implications		Flash flood cameras/flashing lights on TMR			Stations - expect 98% to be working -3 day		
			Peak Downs Hgy and causeway at Sandy			outage		
			Creek					
	Tiger Dam was not successful - too difficult to set up and		Need PTZ camera for Mitani Weir, Middle Ck					
	nerable I to review Minor, Moderate and Major flood classifications		Dam					
			Sarina Depot does not have backup power					
	sh flood areas - urban are of Mackay		Batteries now 5 years onl and need replacing					
Sari	m failure - impact on the southern side of Sarina		Mirani needs a back up as a time critical					
10 Dai	m railure - impact on the southern side of Sarina		•					
			catchment. At present have to run through					
11 BOI	M website updates 23 mins part the hour		No gauges in Sarina area - need Plane Ck and					
	Website apaates 25 mins part the noar		Middle Ck, east side of Sarina - Bells Creek					
			which is a major access road					
12 Crit	tical infrastructure:		MRC would like access to more DNRM sites -			1		
We	therston Shopping Centre, Airport, CBD _ Telstra, Police,		dial in ?					
Rur	ral; View - McCready Street - access to the new cyclone							
	eter is an issue							
13 No	gauge superfluous - running very lean		Radar gets cut for 1.5 hours twice a day while					
			BOM recalibrates???					
	ess lost:							
	gator Creek to south							
	ne Ck							
	ak Donws Hgy							
	ndy Ck at eaton							
Nor	rth at Jane Ck, Kolizo and Black Rock floodway							

LGA SunWater
Date 14/07/2015

Method Face to face meeting

Name	Organisation
Haydn Betts	KBR
Graeme Milligan	DNRM
James (Jimmy) Stuart	SunWater
Jason Venables	SunWater
Ben	SunWater

ID	Flood susceptibility		Network	Ope	ration	Ma	aintenance	Out of scope
ם	riood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	
1	Callide - refer IGEM report	Ross R dam: access data through Townsville City Council	Sunwater has installed a new gauge in Callide system	Doing internal training	Sunwater will provide access to its gauges for the ALERT network			
	Mackay City - is set up, large number of people in the floodplains - about 5000-6000 people in the Emergency Apert Polygons - effectively a flood warning system	Others - feed off ENVIROMON data - FTP available within an hour	Need gauges at Paradise and other high risk dams	have SOP, O&M Plans, internal training register, part of A&M process				
	Callide - we have highlighted issues with temporal patterns used to design dams - for small catchments (less than 500km2) under dispute		For new dam sites, a hydrologic network exists in the Connors River - rain gauges are in the bush probably owned by nobody - need to check with John Ruffini at DSITI	Gauges are examined - quartlery as a minimum				
4	Townsville and Mareeba - all DNRM		Priority is dam safety: all high risk dams have at least one gauge	Annual calibration on river stations				
	Cairns - ALERT system is all for Cairns, nothing for Mareeba		Large gaps in the flood warning network - need ALERT for Mareeba and Pioneer Valley	check WUIN and then gauge level				
	Tinaroo - all DNRM - upper catchment Paradise and other high risk dams	Tinaroo - need upper catchment pluvios	Rating curse are from BOM and synthetic  Looking at own system - Water Infrastructure Network	Do rely on DNRM gauges - a legacy issue				
	St George has a manual gauge - different to ALERT		Data mgt HYDSTRA					
9	Clair has 3 gauges - staff, DNRM and BOM ALERT - which is being reported?		Flash flooding is a major risk to Sunwater - dam safety eg North Pine and Callide					
10	All state datum now converted to AHD		Current gauges are to be configures to ALERT eg Mareeba and an additional pluvio					
11	Have tail water gauges		TVIAITCE SA ATTA ATT AGAITMENT STAVIO					
12	Sunwater want toavoid confusion and insist on AHD for water levels behind a dam - primary purpose is water management, secondary is emergency management							
	Sunwater has SCADA system and currently investigating how to ingest that into Sunwater system							
	Technical standards - use AS 3778, uSGS and Dept Interior BOM 2013 standard ofr instruments is expensive							
	Key vulnerabilities: mobile networks Redundancy - back up needed timeliness of data support ot councils Sunwater is only on 3G with 6 on land line flood debris - rippling out capiliary lines							

LGA Brisbane
Date 12/07/2015

Method Face to face meeting

Name	Organisation
Haydn Betts	KBR
Graeme Milligan	DNRM
Brany lezzi	BCC
Evan Caswell	ВСС
Rachel Lindsay	всс

ID	Flood susceptibility	Network		Ope	Mainter	Out of scope		
טו	riood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
	BCC need forecasts at creek scale, we have published maps and people are aware of flooding, but not the source of flooding.	Have 4 new river gauges, reinstated the Port Office gauges,, no requirement for BOM forecasts,	BCC looking for more opportunities for gauge - funding is an internal business cases	Have an asset management plan for hydrometric network, have a big asset, have to justify a budget to maintain.  The asset mgt system identifies the assets, -	Intending to set up fora with other councils	Maintained 24/7		
2	Moggill and Jindalee - where have redundancy	Have a new gauge at Milton where installed a backflow prevention device - for operational reasons - used in TC Marcia	ALERT2 - ELPRO	Have risk mangement plans	Thinking about 3 hour warnings	Included software in Floodwise		
	Vulnerabilities are subject to contingency plans and hydrometric officers, with electrical backup		Another gauge or two	KPI - repair immediately	Issues WHS, Sunlisht access	More work being done on documentations Have a manual		
	All gauges updated to ALERT/ELPRO and will upgrade to ALERT2 when it comes			TMR has access to our gauge info through BOM - we don't provide direct access to otehrs	Stage Policy Improvements: Consistent standards for maintenance, WHS, ladders, locked in place at base Sharing of info but want info before sharing, so policy is for OA of data	Rehab 5 years ago: Con has spreadsheets		
5	Power outages - have workarounds offline through BOM			Data sharing through BOM network	Sharing of data - its costs, so who pays?			
6	Flash flooding Oxley and Bulimba			Consult with other councils	Have to provide to BOM under Water Act, but have processes and firewalls, BOM water accounting			
	Dams and storages: Forest Lake - have a guages, Dams are owned by others				transfers by WTDEF files			
8	SEQWater Dams: - all to AHD Gold Creek Lake Manchester Enoggera Lake Harrison							

**LGA** Ipswich City Council

**Date** 14/07/2015

Method Face to face meeting

Name	Organisation
Haydn Betts	KBR
Wai Tong Wong	DNRM
Adam Berry	ICC
Hoy Song Yau	ICC

ID	Flood susceptibility	Networ	k	Operation		Maintena	nce	Out of scope	
טו	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope	
1	Flash flood forecasting is a concern but under resourced	11 new gauges	Think pretty well covered, good coverage on the Bremer	ICC has gone through a massive upgrade program using 3m and 4m poles - this poses significant WHS issues	Seeking a real time flash flood forecasting tool but non in Aus yet	Prospect dues annual maintenance		Trailing rain on grid modelling , 2m grid using RAFTS temporal patterns	
2	How is flash flood managed? Scared, no resources, ICC relate well with SES teams 3 hour duration storms	18 upgradeds including some complete replacements have tried the tilting poles - but BOM won't maintain	Have stream gauge gap on a dam	Height of poles is a trade off between WHS and the required immunity of gauges (no good for flood warning if they are flooded)		BOM does a pre-season run		Don't have a disaster management officer	
3		Configuration of the platform - swinging gates considered	ICC WANTS A STANDARD			Prospect fixes faults: to be fixed within two days unless urgent		Council is aware of the need but not the need for resources	
4	Don't pay much attention to Warrill Creek - flood risk is low		Amberly needs a rain gauge for its warning			Don't have people in councils that can maintain - we can do but don't have the resources		Having a meeting with other councils and SEQWater for mutual support	
5	BOM forecast points: currently reviewing with BOM, for Rosewood and Amberly. BOM have three forecast locations - ICC say need 9 BOM is overloaded					Gauges now treated as an asset		Need to refine waterRIDE for 3 hour events	
6	Flash flooding: bundamba, Woogaroo					Have Service Level Agtreement for existing stations		Thinkning about an alternate platfor ofr ENVIROMON - Aquareious, Hydronet, TARDIS, not thought about mobile apps, IT is outsourced	
7						11 new stations - ICC to maintain		Struggling with rating curves	
8						Not resourced enough - can't employ a full time equivalent		BOM Minor, Moderate and Major classifications: outdated, source of confusions, tend to underestimate, need to be reviewed - base on rural classifications: Risk is that if there is a change in meaning, the public will not understand - ICC needs an extreme classification	
9								Policy: worried about liability particularly for flash flooding, run risk of engineers doing work for which not trained	
10								Want FPMgt Guidelines that have uniformity	
11 12 13								No State policy on floodplain management  Need BOM to review temporal patterns  Succession planning is a risk	

LGA Gold Coast City Council

**Date** 12/07/2015

Method Face to face meeting

Name	Organisation
Haydn Betts	KBR
Wai Tong Wong	DNRM
Elton Chong (Natural hazards)	GCCC
Brian Parkes (has resp for gauges)	BCC
Bree Cornier (Dist Mgt)	BCC

ID	Flood susceptibility	Netw	ork	Оре	ration	Maintenance		Out of scope
וטין	Flood Susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	las three referable dams	Datum of gauges - survey to AHD	Tallebudgera TM is not as good,		Looking at automated road closures	Have asset register (800MB) incl 250		
		but spillways are different:	transmission is unreliable,		base don rainfall, SMS and manaual	high res photos		
		Tallebudgera 0 at spillway			means			
		Loders Ck - 0 AHD						
		Biggera 0 AHD						
		BOM and DNRM maybe different						
2	Each PC receivs different data - BOM trying to			KPIs for gauge network - no failure	Trailling automated flashing lights	Have compelted an audit of everything		
	replicate same info across the 3 servers			during a flood, use people to check	Training duconfaced flashing lights	battery levels, age of batteries, size of		
	epileate same imo del oss the 3 servers			manual gauges		nanels		
3	ogan R Catchment - can't see what is in Logan			Sensor data to BOM & ENVIRMON	Interrogate transmitter from gauge -	Maintenance regime:		
	City - having a conversation with BOM				Bonogin, Tallebudgera and 3others	last maintinaed is recorded but not		
	,					updated		
						All service by BOM and availability in		
						BOM report as are batterios, condition,		
						calibrations, rain gauges are calibrated		
4	T and tM restrictions, having conversatiosn at			Have 3 servers - Southport, Tech	Flash flooding improvements - need	Adequately resourced to maintain and		
-	officer level			Services,	better planning	operate		
	Flash floods - monitored but rely on			Use ENVIROMON to do own forecasts		Aiming to have a workable plan to fix,		
	modelling,			(running council's URBS models		replace decommission		
6	Bonogan,. Tallebudgera, Coombabah			Operations mainly through DMU for		Have Quality management system for		
				regional flooding		whole of council; - maybe will set on		
$\sqcup$						up for gauges		
7								
8								
9		ļ	]					

LGA Mt Isa City Council
Date 15/07/2015
Method Telecon

Name	Organisation
Haydn Betts	KBR
-	DNRM
Ric Marino A/Dri Eng Serv	Mt Isa
Chevy Palmer (Town Planner)	Mt Isa
Ellie Johnson (Tech Serv)	Mt Isa

ın	Flood sussentihility	Network		Operation	Mainte	nance	Out of score	
ID	Flood susceptibility	Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1	2010 event was higher than normal	Don't have any rain gauges	Be good to monitor Leighart R to Mt Julia	Use DNRM and Sunwater gauges		Don't maintain any rain		Flood warnings and evacuation are
			Road			gauges		done by LDMG
2	Lady Annie is isolated in a flood	Have in area:	Rain gauge at Inca Creek on Barkley Highway -	Only mark high flood water levels after an				In TC Yasi - issued flyers and radio
		2 Sunwater gauges	road to Camooweal	event for model calibration				warnings
		3 DNRM						
		12 BOM						
3	Gunpowder - no concerns							Don't have ENVIRMON
4	Local flooding (flash) is only flooding issue -							Have warnign lights Mt Isa CBD, on the
	had one house where depth over floor 0.5m							raod to Lake Moodara and in school
								area
5	1-2 hours and event all over							
6	Isolation is biggest problem:							
7	DTMR responsible for closing highways							
	Lose access to Lake Julius							
8								
9								
10								
11								

LGA SEQWater
Date 15/07/2015
Method Face to face

race to lace	
Name	Organisation
Haydn Betts	KBR
Wai Tong Wong	DNRM
Michel Raymond	SEQWater
John Tibaldi	SEQWater
Carolyn Ellis-Mallard	SEQWater
Stewart Neilsen (hydrographer	SEQWater
Mark Mackenzie (hydrogrpahe	SEQWater

ID	Flood susceptibility	Network		Operation		Maintenance		Out of scope
		Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1		Majority of gauges have been upgraded	Looking for improvements to the EPLRO canisters with 4-20 mA signal	TM sites visit quarterly	ALERT 2 is 16 bit compared to 8 bit for ALERT	ALERT visit twice		SEQWater operate 1/3 of gauges in the SE
2		Have replaced sensor	Would like to get rid of gas bottles		For Doppler gauging during floods off bridges, so have to meet TMR requirements for TMR's insurance - PL, indemnities, consequential losses - so want coordination between state agencies			ELPRO have not technologically improved in last 10 years
3		No issues with compressor installations yet, but may get some failures with drying system on solenoids		Check signals every 3 hours - used to be 12 hours		Reactive work above that		The most critical gauges are in SEQWater's preparedness report
4		180 rain and river	CVCIIIS	SEQwater believes its "reasonable best practice" but seeking continuous improvement				Bremer R - can look downstream of Amberly/Walloon to Ipswich
5		300 sensors		Rain gauges are not calibrated by do check occasionally at 100mm/hr. Expect a 2% accuracy threshold - if not sent back to RIMCO				Moggill is the proxy for Brisbane
6		Emphasis is on key gauges - frequent inspections and daily checks of data		Have spares on site				Location of gauges is opportunitistic
7		Have DRUCK & HS40 on streams		Check gauge boards against electronic reports				Offical position is that BOM does forecasts
8		Some sites are vulnerable to flash floods - gauge resilience		ALERTS report of ENVIROMON TM reports to WISKI				SEQWater treats the whole system as a networ rather than individual gauges
9		Think some tail water gauges are superfluous but needed for statutory reporting, have already rationalised		WISKI exports to the Water Information System				Chech equipment - disparate quality and duplication
10		an coor retionalises		SEQWater thinks it is as resilient as it can be				Need legislative back ing to flood manauals
11				To state the state of the state				SEQWater has a core of expertise and canprovide opportunities for other organisatsion to feed off
12 13								Cameras OK on bridges

OrganisationDNRMDate18/06/2015MethodFace to face

Face to face	
Name	Organisation
Chris Gimber	KBR
Haydn Betts	KBR
Wai-Tong Wong	DNRM
Greg Scroope	DNRM
Graeme Milligan	DNRM
Tanya Bartlett	DNRM
Nigel Kelly	DNRM
Michael Mawn	DNRM
Ray Alford	DNRM

ID	Flood susceptibility	Network		Operation		Maintenance		Out of scope
اتا		Current	Improvement	Current	Improvement	Current	Improvement	Out of scope
1		523 stations (including 45 standalone pluvials)	Technology / communications	Have operations registers		10 yr asset management plan		Multiple rating cures each site
2		35 co-located BoM and DNRM sites		ISO accreditation				Concern local government capability/capacity
3		Asset mgt/life cycle - 5, 10, 50 years old						Instrumentation standards needed
4		Some sites shared with Councils/DSITI						Need BoM modernisation standards
5								DNRM will supply systems maps
6								
7								
8								
9								
10								
11								
12								



20 May 2015

Department of Natural Resources and Mines

Mr Bernie McCarthy Chief Executive Officer Aurukun Shire Council 39 Kang Kang Road AURUKUN Queensland 4892

Dear Mr McCarthy

### Performance Review of Flood Warning Gauge Network in Queensland

The Queensland Government is committed to improving the flood warning system in Queensland and has commenced a performance review of the Flood Warning Gauge Network dealing with the monitoring of rainfall and stream flow information by various local, state, private and Commonwealth entities, and its on-going maintenance for flood warning purposes, used primarily by the Bureau of Meteorology.

The study has multiple objectives including assessing:

- The adequacy of the spatial distribution of the hydrometric network used for flood warning
- The standards of instrumentation, making an inventory of instrumentation, assessing asset condition and developing agreed technical standards
- The asset management arrangements, asset owner capacities and identifying options for alternative arrangements
- Flow rating curves, survey datum for river height gauges, geo-location and gauge metadata.

The project is being managed and assisted by this department, and overseen by a Key Stakeholder Group chaired by the Queensland Reconstruction Authority. The Local Government Association of Queensland is a member of the group.

The review is being undertaken by KBR (with subcontractor Pentair/Greenspan). Both KBR and Pentair have extensive experience in flood warning systems.

KBR will be consulting with your organisation, with a questionnaire dealing with the flood warning network of your area. The Department may assist you in responding, if required. From the data returned, KBR will identify and approach a sample set of organisations requesting a meeting to gain a more detailed understanding. The meeting will also discuss potential improvements in the spatial extent and management of flood warning networks.

To assist the review process, I would appreciate your *nominating an officer* in your organisation that will be available for technical discussions of flood warning gauging matters. Please provide contact details for the nominee by 27 May 2015 to Greg.Scroope@dnrm.qld.gov.au.

Thank you for your assistance in these matters.

Should you have any further enquiries, please contact Mr Graeme Milligan, Project Director of the department on telephone (07) 3199 8706.

Yours sincerely

Lloyd Taylor
Executive Director
Operations Support

# Performance Review of Flood Warning Gauge Network in Queensland: Local Government Questionnaire

### Before starting the questionnaire

Please ensure you have reviewed the information provided to you with your invitation to participate. In particular, you will need to have reviewed:

- Basin/s Map (showing sub-basin boundaries, local government areas, location of known rainfall and stream water level gauges that are accepted by the Bureau of Meteorology (BOM), and settlements known to flood).
- Gauge Meta-data Spreadsheet (rainfall and stream water level gauges that are accepted by the BoM).
- Template for providing additional gauge meta-data. You will be asked to refer to these documents as you complete the questionnaire so please have them at hand.

#### **SECTION 1: YOUR CONTACT DETAILS**

Name

Role

Organisation

Your involvement with rainfall and stream water level gauges

Phone

E-mail

Postal address

#### SECTION 2: SETTLEMENTS AND CRITICAL INFRASTRUCTURE IMPACTED BY FLOODING

In the context of this review, a 'settlement known to flood' has been defined as one that has in the past been damaged by flood waters (on-property or over-floor flooding) in residential, commercial or public space areas within the recognised settlement boundaries. This definition of flood includes both flash flooding and riverine flooding, where:

- flash flooding is any flooding of short duration with a relatively high discharge in which the time interval between the observable causative event and the flood is less than six hours
- riverine flooding is any flooding where the rain-to-flood delay time is relatively high and typically more than six hours but excludes flooding caused by: elevated sea levels, storm surge, flash floods or the failure of any man-made infrastructure (e.g. dams or levees).

Settlements are considered to be isolated or significantly inconvenienced by flooding when the settlement itself is not inundated but major transport routes (road and/or rail) or other critical infrastructure (e.g. water, electricity supply, power stations, airports, mines, etc.) is disrupted by flooding.

1. Referring to the *Basin/s Map* provided, are there any additional settlements or critical infrastructure known to flood due to <u>riverine flooding that are not shown on the map</u>?

No

Yes, please list names of these settlements or critical infrastructure:

2. Referring to the *Basin/s Map* provided, are there any additional settlements or critical infrastructure known to flood due to <u>flash flooding that are not shown on the map</u>?

No

Yes, please list the names of these settlements or critical infrastructure:

3. Are there any settlements of	critical infrastructure that are isolated or significantly inconvenienced by flooding?
No	
Yes, please list names of these settlements or critical infrastructure:	
4. Are there any settlements or Yes, please list names of these settlements or critical infrastructure:	critical infrastructure you believe do not have sufficient flood warning time?
SECTION 3: RAINFALL AND STRE	AM WATER LEVEL GAUGE LOCATIONS
· · · · · · · · · · · · · · · · · · ·	efer to the Gauge Meta-data Spreadsheet and Basin/s Map provided. If your ain any gauges in your local government area please go to question 10.
	am water level gauges that you operate and maintain shown on the map and is the ne spreadsheet accurate and complete?
No	
Yes	
If No, please provide the details of	any additional gauges or corrections to the provided data by:
i. Attaching your own asset registe the gauges	er or other spreadsheets, reports or documentation that provide meta-data about
ii. Making corrections/additions to cells of the spreadsheet yellow wh	and then attaching the provided Gauge Meta-data Spreadsheet (please colour the lere you make changes)
iii. Completing and attaching the 7	emplate for providing additional gauge meta-data.

(/ (110) :	
All of the gauges are surveyed to AHD	
Only some of the gauges <u>are</u> <u>surveyed to AHD</u>	
Please identify the gauges that are surveyed to AHD:	
Some of the gauges are surveyed to a datum other than AHD	
Please identify the gauges and which datum they have been surveyed to:	
None of the gauges are surveyed	
Comments:	
7. Are all of the rainfall and streat Asset Register?	am water levels gauges that your council operate or maintain on your Council
No	
Yes	
If no, please identify the gauges not on your Council Asset Register:	
Comments	

Are the stream water level gauges that Council operates and maintains surveyed to the Australia Height Datum

8. Are there any rainfall or stream addition or relocation of gauges)?	water level gauge changes you believe would improve flood warning time (e.g.
No	
Yes	
Please describe the change/s and the sub-basin/s in which they would occur:	
Please attach any documents that he provided <i>Basin/s Map</i>	elp to describe the change/s you have outlined (optional), e.g. mark-ups on the
9. Does your council have any pla government area?	ns to increase the number of gauges and/or upgrade gauges in your local
No	
Yes	
Please describe the changes that you have planned:	
SECTION 4: USE OF DATA FROM G.	AUGES
	rainfall and stream water level gauges? (please indicate the <b>primary use/s</b> for number '1' in the relevant box and any <b>secondary use/s</b> by typing a number '2'
Riverine flood response	
Flash flood response	
Water quality monitoring	
Water resource management	
Urban water supply	
Wastewater release management	
Other, please specify	

#### SECTION 5: RAINFALL AND STREAM WATER LEVEL GAUGE RELIABILITY

In the context of this review, a reliable gauge is considered to be one from which the data collected is accurate and timely (available when needed).

11 How would you rate the overall timeliness of the data from the rainfall and stream water level gauges that your council uses data from? (please tick the one box that best applies)

Very good

Satisfactory for the purposes your council currently uses the data

Poor

Comment

12. ow would you rate the overall accuracy of the data from the rainfall and stream water level gauges that your council uses data from? (please tick the one box that best applies)

Very good

Satisfactory for the purposes your council currently uses the data

Poor

Comment

13. Where your council operate and maintain rainfall and stream water level gauges, what are the reliability issues with these gauges? (please tick all the boxes that apply)

No major reliability issues (gauge assets work satisfactorily)

Installation (not properly installed in accordance with standard installation procedure)

Installation (no standard installation procedure available)

Age of equipment

Type of equipment

Gauge itself is subject to inundation (location not ideal)

No or limited proactive gauge maintenance

Dependence on availability/ability of a person to get to the site to take reading

Communication system dropout (for automated systems)

Communication/data transmission frequency (for automated systems

Other, please specify

Comment

#### SECTION 6: ASSET MANAGEMENT

14 How is the maintenance funded for rainfall and stream water level gauges operated and maintained by council?Please describe:

15. Who carries out the maintenance on rainfall and stream water level gauges that you operate and maintain? (please tick all of the boxes that apply)

16. What maintenance regimes are in place for the rainfall and stream water level gauges your council operates and maintains?

17. Do you have any suggestions for improving the efficiency and coordination of maintaining rainfall and stream flow gauges, and/or sharing of data collected from gauges)

Council's own staff

Contractor hired by Council, please provide their name and address

Bureau of Meteorology staff or their contractor

Other, please specify

Reactive maintenance following flood or reported damage

Proactive maintenance - Once per year

Proactive maintenance - Twice per year

Proactive maintenance-Three times per year

Other, please specify

No, current arrangements are effective.

Yes, please describe

Thank you for your contribution to this important project.
The Department of Natural Resources and Mines
will keep you informed as this project progresses.

Please return your completed survey and the relevant attachments to the project team via:

- email: floodstudies@kbr.com
- post: Flood Studies at KBR

Reply Paid 633, BRISBANE QLD 4101:

### **PROJECT OVERVIEW**

### What is the purpose of the review?

The Queensland Government is committed to improving the flood warning system in Queensland and has commenced a performance review of the Flood Warning Gauge Network. The project focuses on rainfall and stream water level gauges that are monitored by various local, state, Commonwealth and private entities, and the ongoing maintenance of these gauges for flood warning purposes.

The objectives of the review are to:

- Assemble an asset inventory of the flood gauge warning instrumentation in Queensland that is currently used by the Bureau of Meteorology (BoM) and other entities for flood warning purposes, or may be used to augment the Flood Warning Gauge Network in the future
- Assess the adequacy of the spatial configuration of the flood gauge warning network
- Assess the condition of instrumentation (using a sample of gauges)
- Assess the reliability of data gathered from the instruments
- Consider the data needs of stakeholders
- Review asset management arrangements
- Prepare technical standards and guidelines for instrumentation.

#### What is the desired outcome?

The aim of the project is to identify priorities for improving the flood warning gauge network in Queensland. This will help efforts to make more timely and accurate flood warnings and forecasts.

#### Who is involved in the review?

Several parties are involved in the review:

- Department of Natural Resources and Mines (DNRM) is managing and assisting the review.
- A Key Stakeholder Group is guiding the review. This group is comprised of senior officers from agencies involved in flood warning, disaster management and floodplain management including BoM, Queensland Reconstruction Authority (chair of group), Local Government Association of Queensland (LGAQ), etc.
- Kellogg, Brown and Root Pty Ltd (KBR) are conducting the review.
- Other stakeholders are being consulted throughout the review including local government representatives and gauge owners and operators.

### How is the review being conducted?

The review applies a risk-based methodology to analyse the flood warning network using spatial analysis, review of historical data, site inspections and stakeholder input.

Stakeholder consultation is being carried out in four steps:

- Inviting local governments to complete a questionnaire
- 2. Conducting more in-depth interviews with a selection of local governments
- 3. Meeting with other gauge owners and operators (including state government departments)
- Providing feedback to all participants of the outcomes of the review once the project is completed.



### **LOCAL GOVERNMENT QUESTIONNAIRE**

### Why complete the questionnaire?

It is recognised that local governments across Queensland hold valuable information for the review. We know local governments regard flood warning and management as integral to supporting and protecting local communities against flooding. We also recognise that much valuable work has already been carried out by local governments in this area.

Your information will be used as part of a review of the Flood Warning Gauge Network in Queensland, so more efficient and coordinated approaches can be established for maintaining rainfall and stream water level gauges, and sharing collected data.

Ultimately, the outcomes of the review will help to inform governments and gauge owners to improve flood warning and reduce flood risk for Queensland communities.

### Before starting the questionnaire

Please ensure you have reviewed the information provided with your invitation to participate. In particular, you will be asked to refer to the following documents to complete the questionnaire:

- Basin/s Map (showing sub-basin boundaries, local government areas, the location of known rainfall and stream water level gauges accepted by BoM, and settlements known to flood)
  - Gauge Meta-data Spreadsheet (if there are rainfall and stream water level gauges within your local government area that are accepted by BoM)
  - Template for providing additional gauge meta-data.

### How long will it take?

To complete the six short sections of the questionnaire, we anticipate between 30 minutes and one hour will be required.

### How to complete the questionnaire

The questionnaire can be completed:

- Online
   (https://engagement1.wufoo.com/forms/per formance-review-of-flood-warning-gauge-network/)
- Electronically using the form provided and emailing it with any appropriate attachments to the project team (<u>floodstudies@kbr.com</u>)
- In hard copy and mailing it to the project team (Flood Studies at KBR, Reply Paid 633, Brisbane Qld 4001)

#### Completing the online questionnaire

The online questionnaire must be completed in one session and cannot be stopped part-way through and returned to later. However, each section of data you enter will be saved when you click next so if there is a disruption, the work you have completed will not be lost.

To respond to some questions you have the option of uploading your existing asset management registers or other documents. Please have these available. The maximum data quota that can be uploaded during the questionnaire is 20MB, however not more than 10MB can be uploaded in any one field. Documents can also be emailed to the project team if this is more convenient.

### Deadline for completed questionnaire

Please ensure your completed questionnaire is submitted by Friday 10 July 2015.

### Need help completing the questionnaire?

For assistance responding to specific questions please contact Greg Scroope (DNRM) on (07) 3199 7815.

If your online entry is disrupted for any reason, or for other queries about returning your completed questionnaire please contact Cindy Hammill (KBR) on (07) 3144 9230.

