KOLAN RIVER, GIN GIN CREEK & GIN GIN TOWNSHIP

Flood Information Session

Dwayne Honor, Manager Design, BRC
Dan Copelin, Civil Engineer, GHD

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Overview

- Background on Studies;
- State Government Funding;
- GHD Presentation on findings;
- Flood Warning System upgrades;
- Question & Answers

Background

- *New Regional Planning Scheme*
- *Qld Flood Commission of Inquiry (QFCI)*

Recommendation 8.1

- Councils should, resources allowing, maintain flood maps and overland flow path maps for use in development assessment. For urban areas these maps should be based on hydraulic modelling; the model should be designed to allow it to be easily updated as new information (such as information about further development) becomes available.

Government Funding

- Flood Study
  $73,000 contribution
  $155,000 Total Cost

Queensland Government

- Floodplain Risk Management Study
  $52,000 contribution
  $130,000 Total Cost

Kolan River and Gin Gin Creek

Flood Study &
Floodplain Risk Management Study

Dan Copelin (Civil Engineer)

BRC and GHD Pty Ltd

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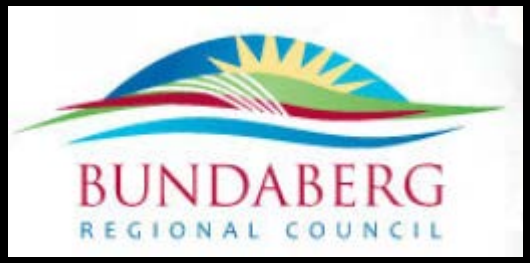
Presentation (45 minutes):

- 2013 Event Flood Behaviour
- Overview of GHD Studies
- Flood Modelling & Mapping
- Flood Risk Assessment
- Evacuation Route Mapping
- Other Recommendations
- Flood Warning System Upgrade (BRC)

Questions & Answers
Information Discussion – Close 8:30pm

1. January 2013 Flood Event



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January 2013 Flood Event

- Near record flood (very similar to 1875)
- **Largest flood in nearly 140 years**
- 300 – 900 mm of rain over 3 days caused by ex-TC Oswald
- Heaviest rainfall fell on inland ranges
- 6.85 m of water over Fred Haigh Dam spillway
- 8 m of water over Bucca Weir
- Main parts of Gin Gin and Avondale mostly spared
- Extensive damage to isolated properties, roads and infrastructure

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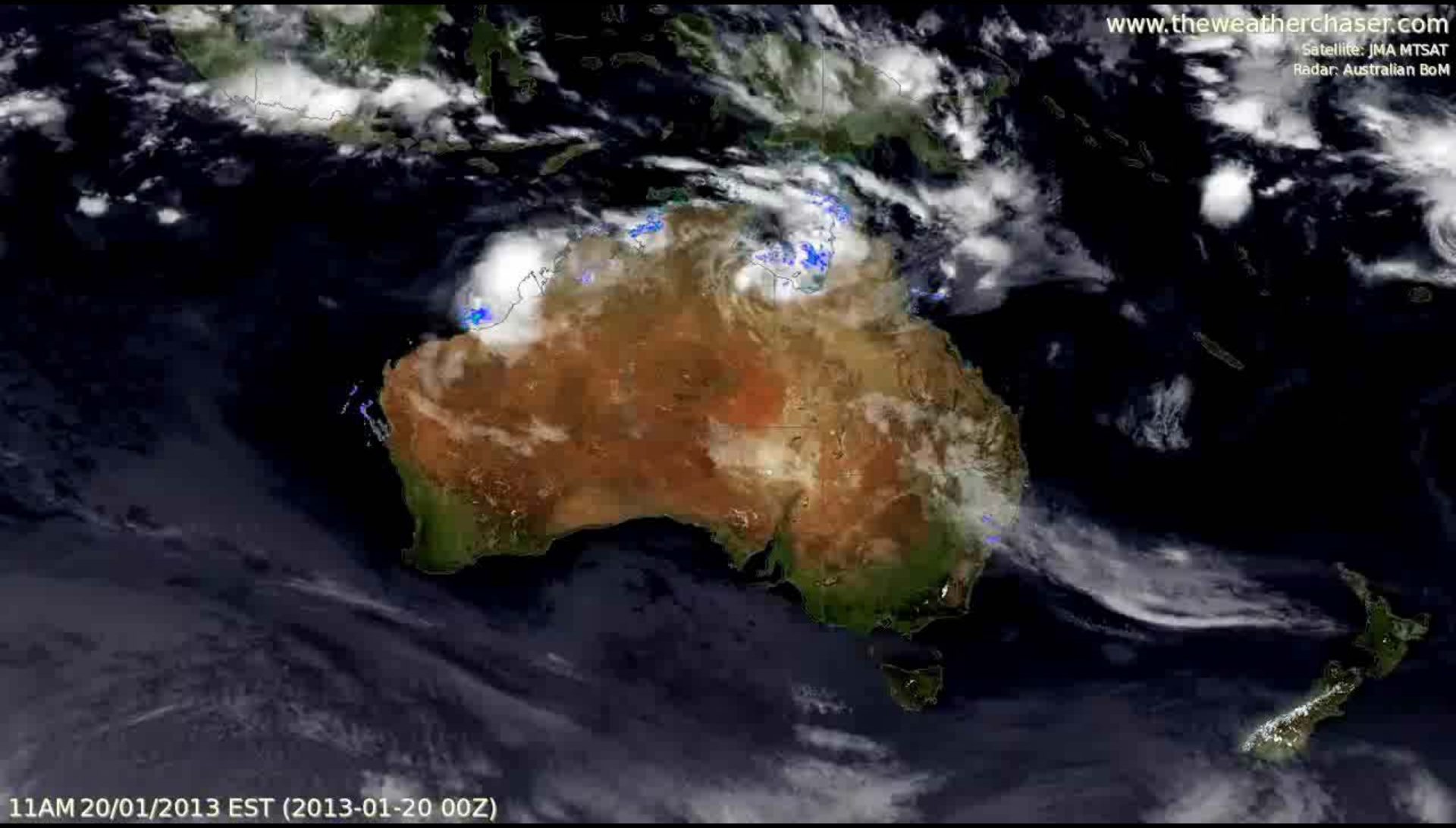
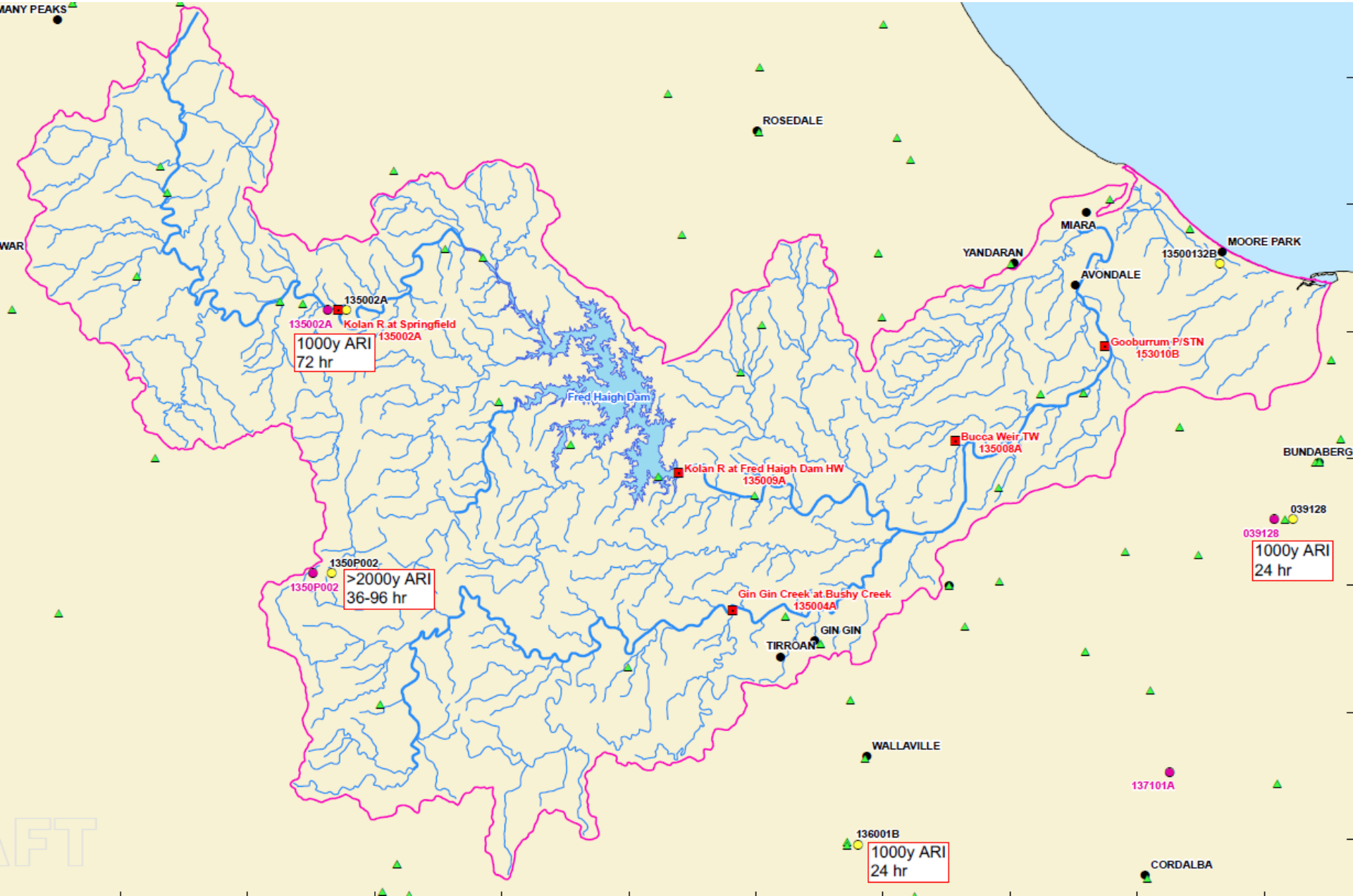
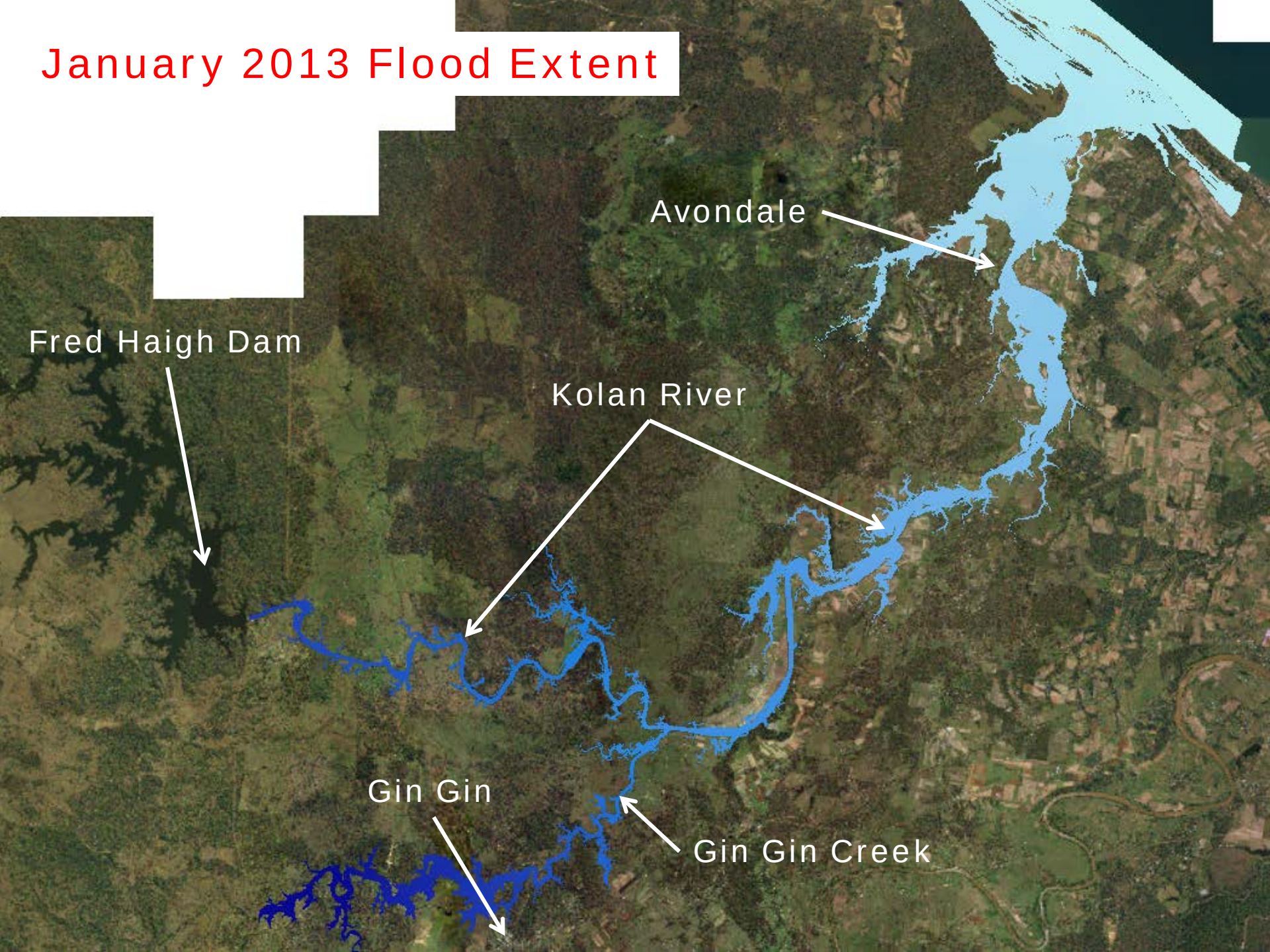
2013 Flood Animations

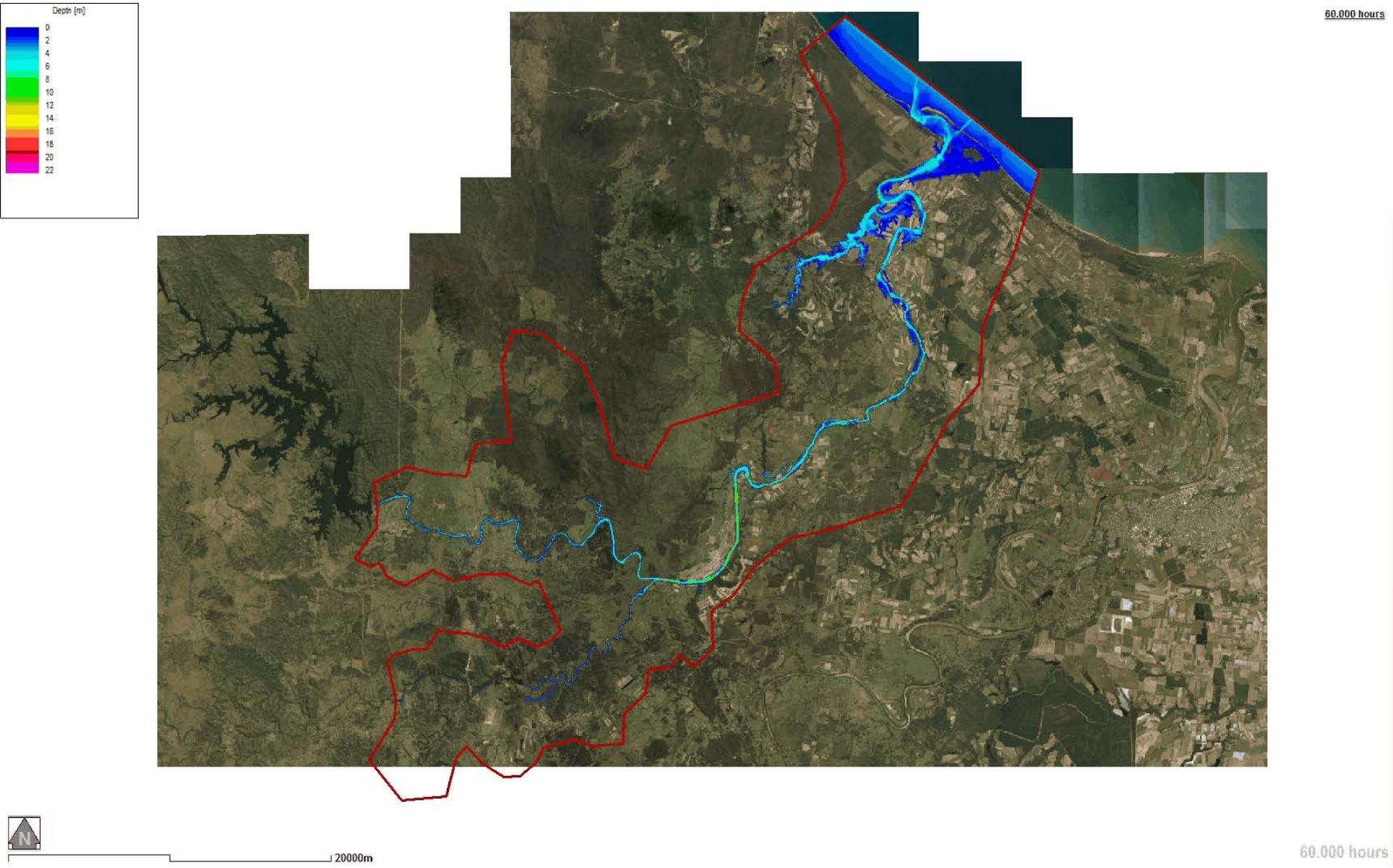
Cyclone Oswald January 2013
Satellite: JMA MTSAT
Radar: Australian BOM



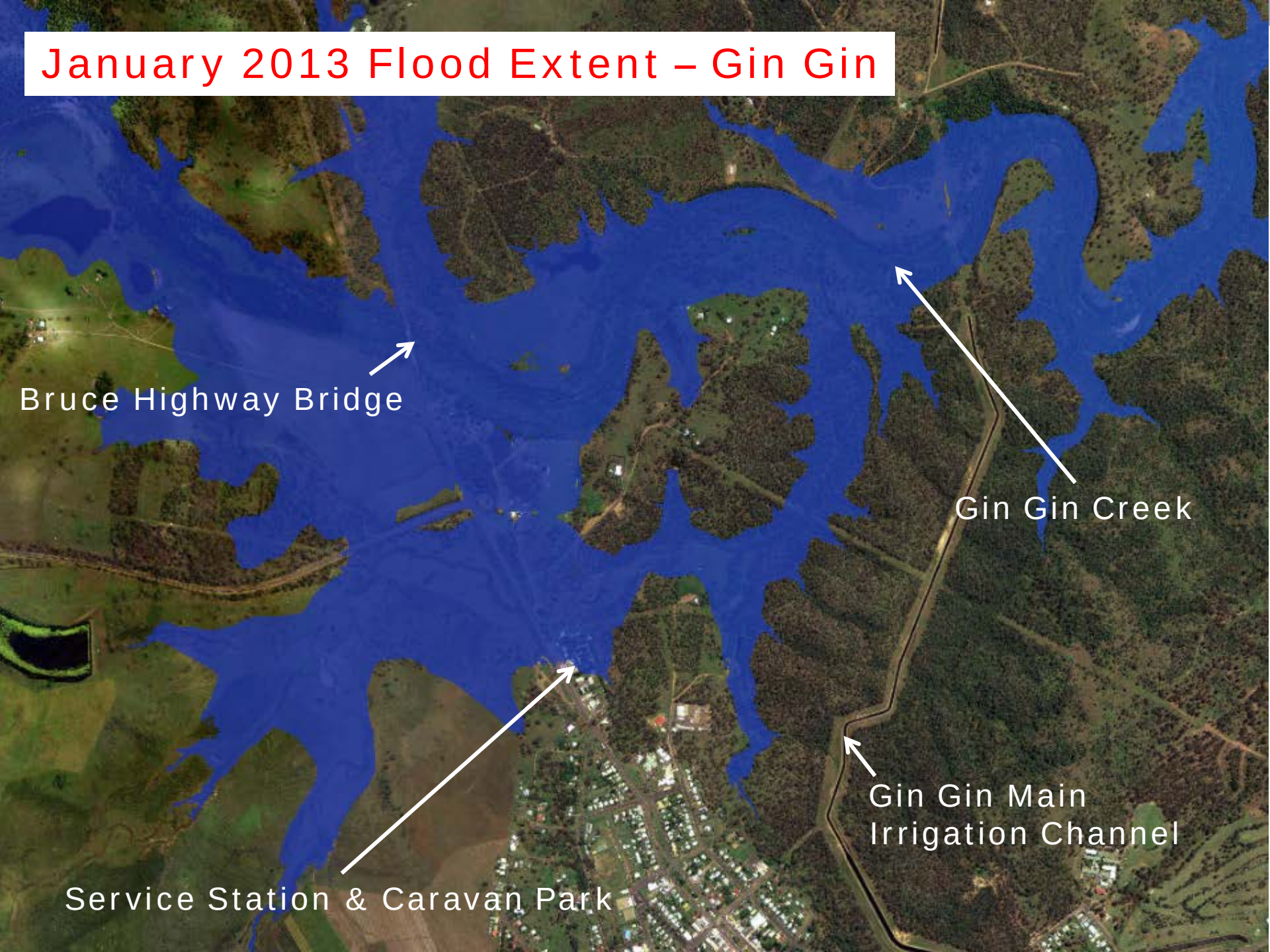
January 2013 Rainfall Depths

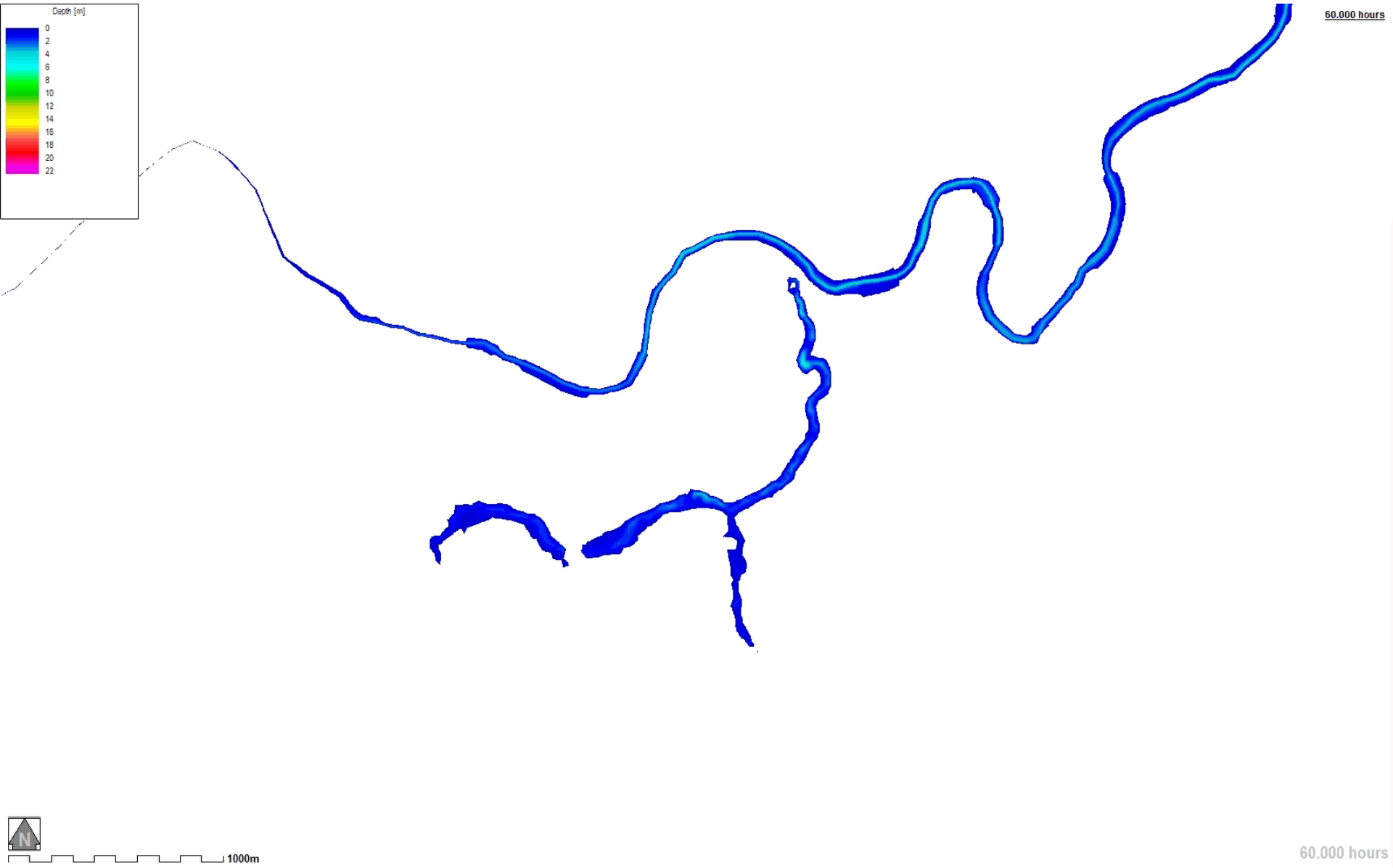



January 2013 Flood Extent
Avondale
Fred Haigh Dam
Kolan River
Gin Gin
Gin Gin Creek



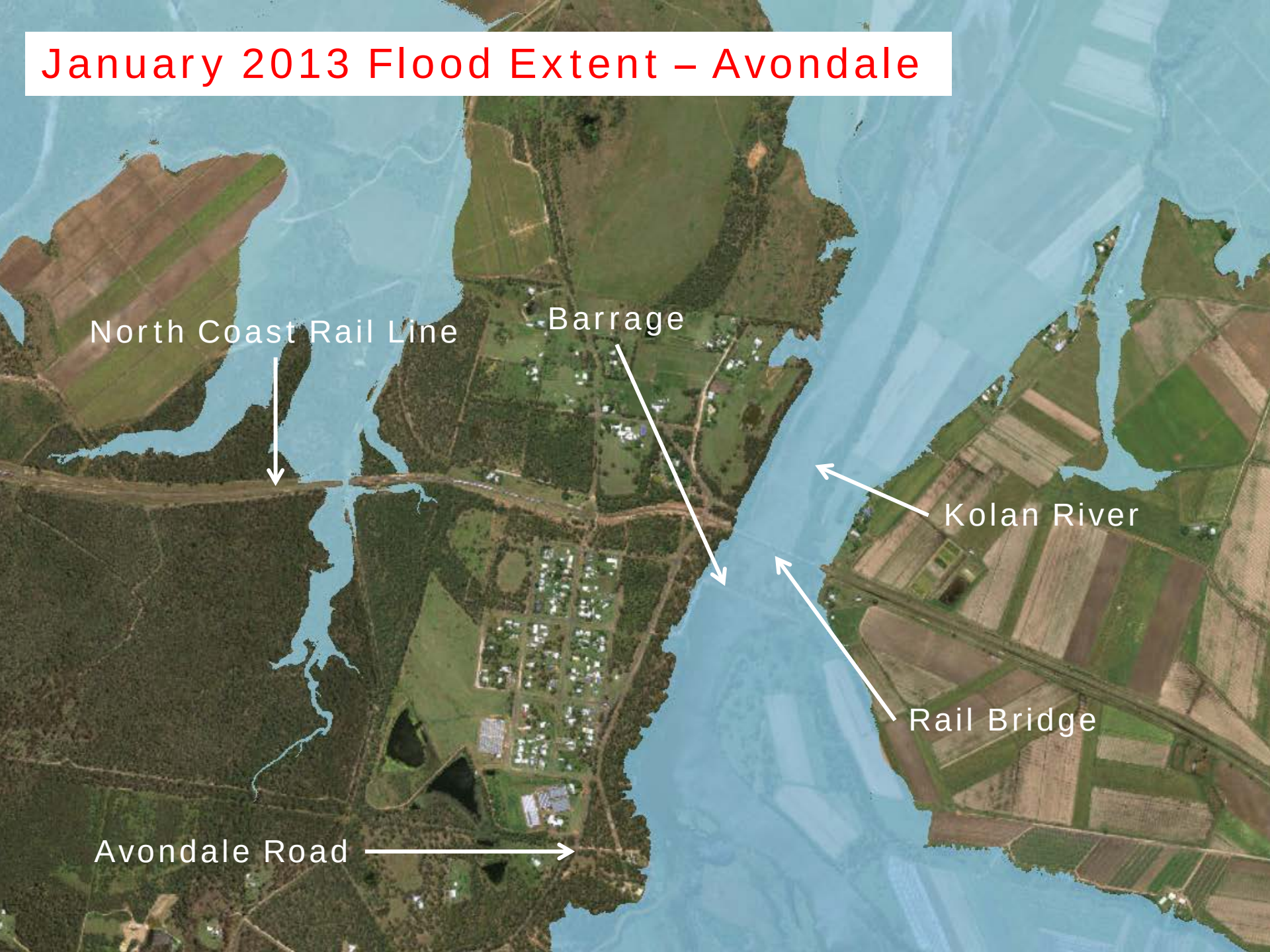
January 2013 Flood Depth - Animation


January 2013 Flood Extent – Gin Gin
Bruce Highway Bridge
Gin Gin Creek
Gin Gin Main
Irrigation Channel
Service Station & Caravan Park



January 2013 Flood Depth – Gin Gin Creek

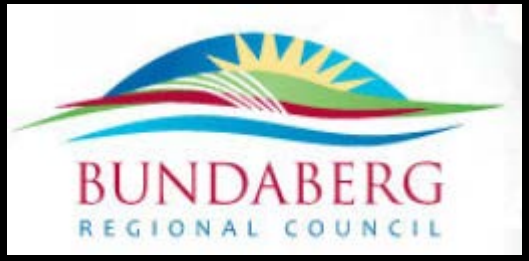
January 2013 Flood Extent – Avondale



2. GHD Studies

Flood Study

Floodplain Risk Management Study



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GHD Studies

- Began in October 2012, completed July 2014
- 2 major reports:
  - **Kolan River & Gin Gin Creek Flood Study**
    - Generates flood data and mapping
  - **Kolan River & Gin Gin Creek Floodplain Risk Management Study**
    - Risk analysis and recommendations for management

Stage 1. Flood Modelling & Mapping

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How did GHD model the Kolan River and Gin Gin Creek catchments?

2 different types of numerical models were developed:

- A **hydrologic** model: used to estimate how rainfall turns into flows in a waterway. Outputs: flow rate hydrographs.

- A **hydraulic** model: used to simulate how the water travels down the waterways and across the floodplain. Outputs: Flood extents, levels, depths and velocities.

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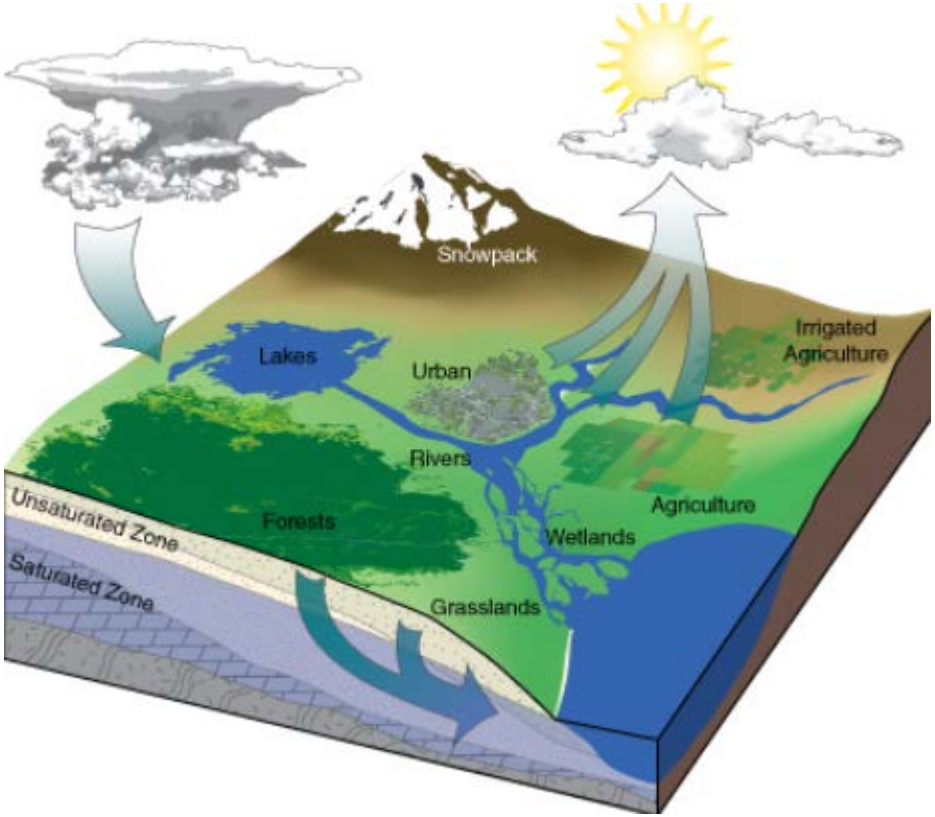
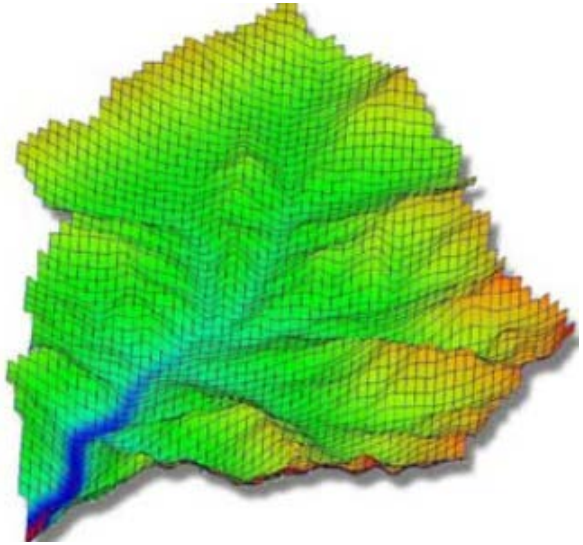


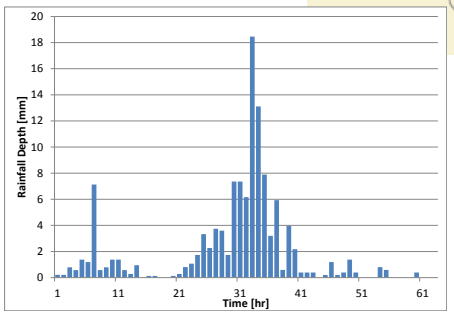
Hydrologic Model



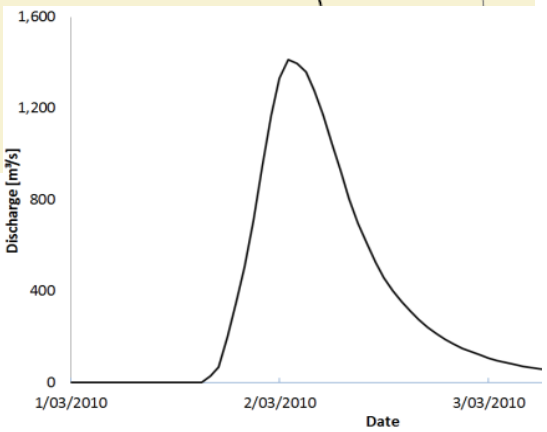
Hydraulic Model

Hydrological Model

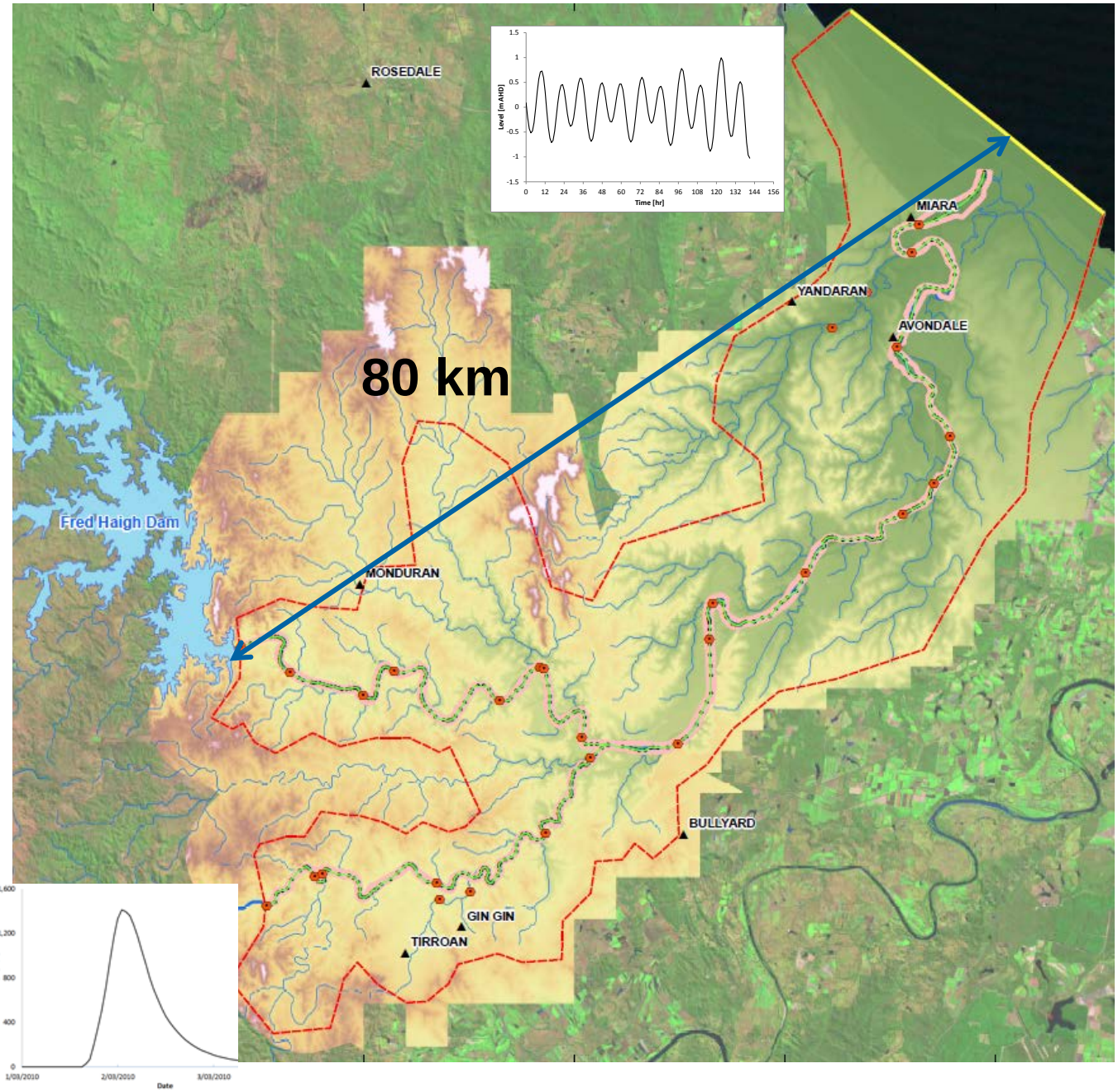
- 107 sub-catchments
- Each sub-catchment defined by:
- Area, slope, roughness, soil conditions



Hydrologic Model

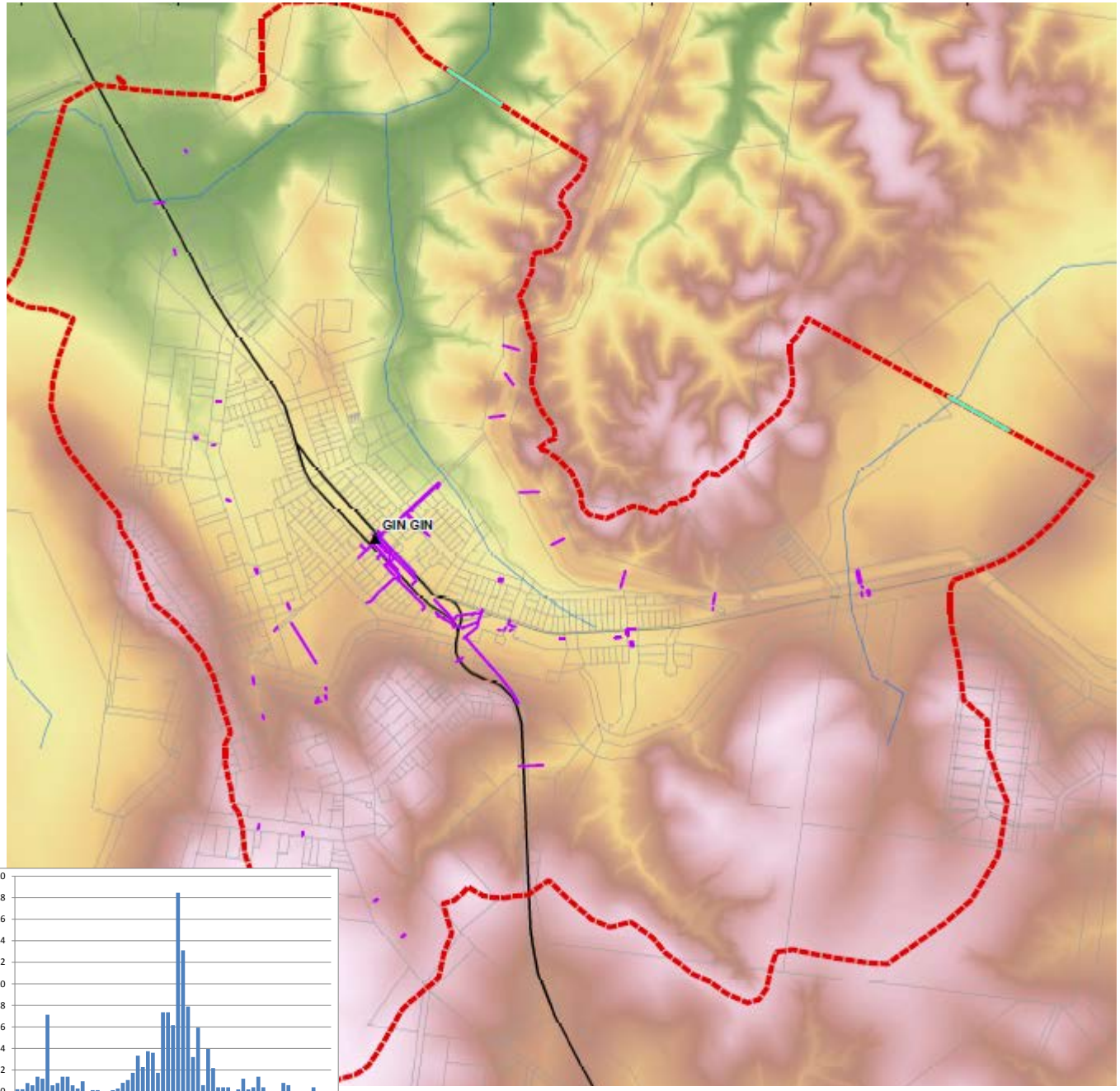


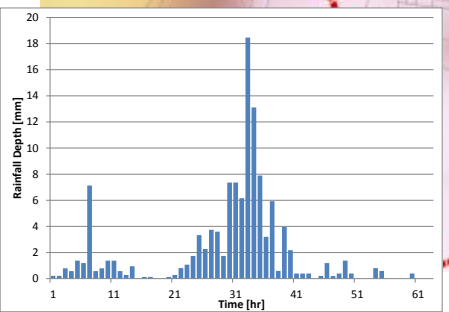
Regional Hydraulic Model



- 2 dimensional dynamic hydraulic model
- 3D DEM represented by a 30 m grid cell & 1D cross-sections
- Bridges, weirs, rail
- Boundary conditions – flood flows & tide
- Produces flood characteristic such as flood level, velocity & hazard

Local Gin Gin Hydraulic Model

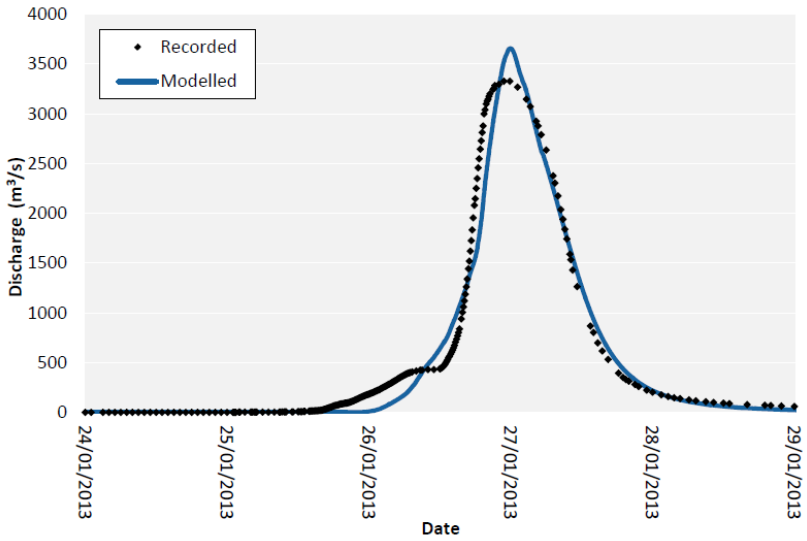




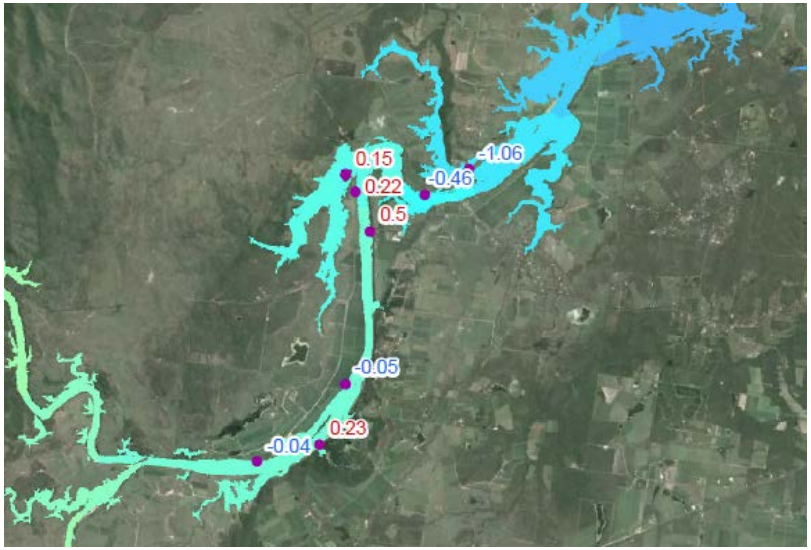
- 2 dimensional dynamic hydraulic model
- 3D DEM represented by a 3 m grid cell – higher level of detail
- Boundary conditions – direct rainfall
- Pipes, culverts
- Produces flood characteristic such as flood level, velocity & hazard

Calibration

Hydrologic calibration: focus on flow rate



Hydraulic calibration: focus on water level



- 3 historical events used: 2010, 2012, 2013;
- A good level of calibration achieved to each event;
- Confidence in results.

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Definitions:

AEP: Annual Exceedance Probability
e.g. 1% AEP

ARI: Average Recurrence Interval
e.g. 100 year ARI

1% AEP = 1 in 100 chance in any given year

100 year ARI = average interval between events is 100 years

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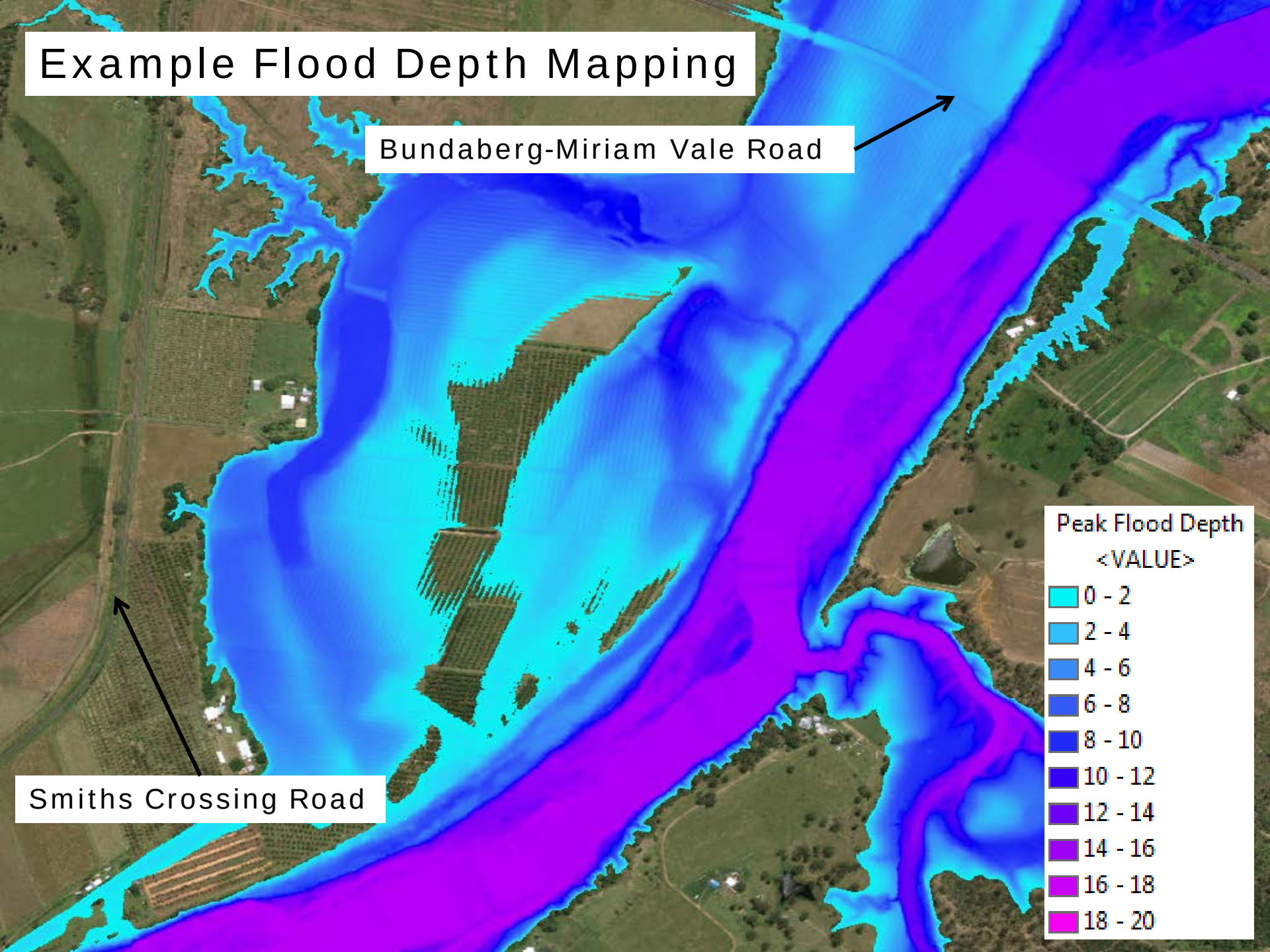
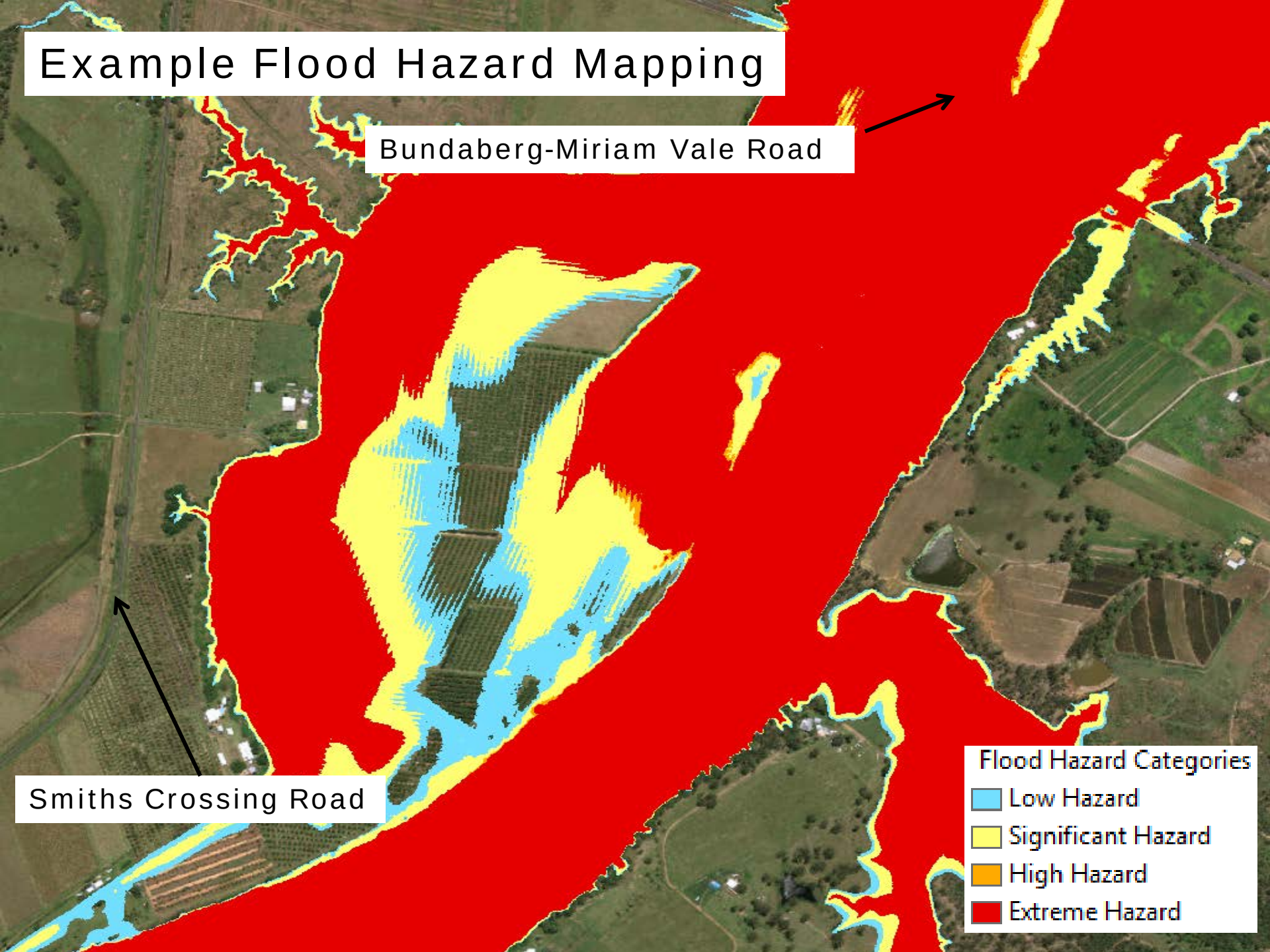
Design Flood Events

- Modelled the following flood events:
  - 5% AEP – 20-year ARI
  - 2% AEP – 50-year ARI
  - 1% AEP – 100-year ARI
  - 0.5% AEP – 200-year ARI
  - 0.2% AEP – 500-year ARI
  - Plus 20% AEP (5-year ARI) & 10% AEP (10-year ARI) – Gin Gin Only

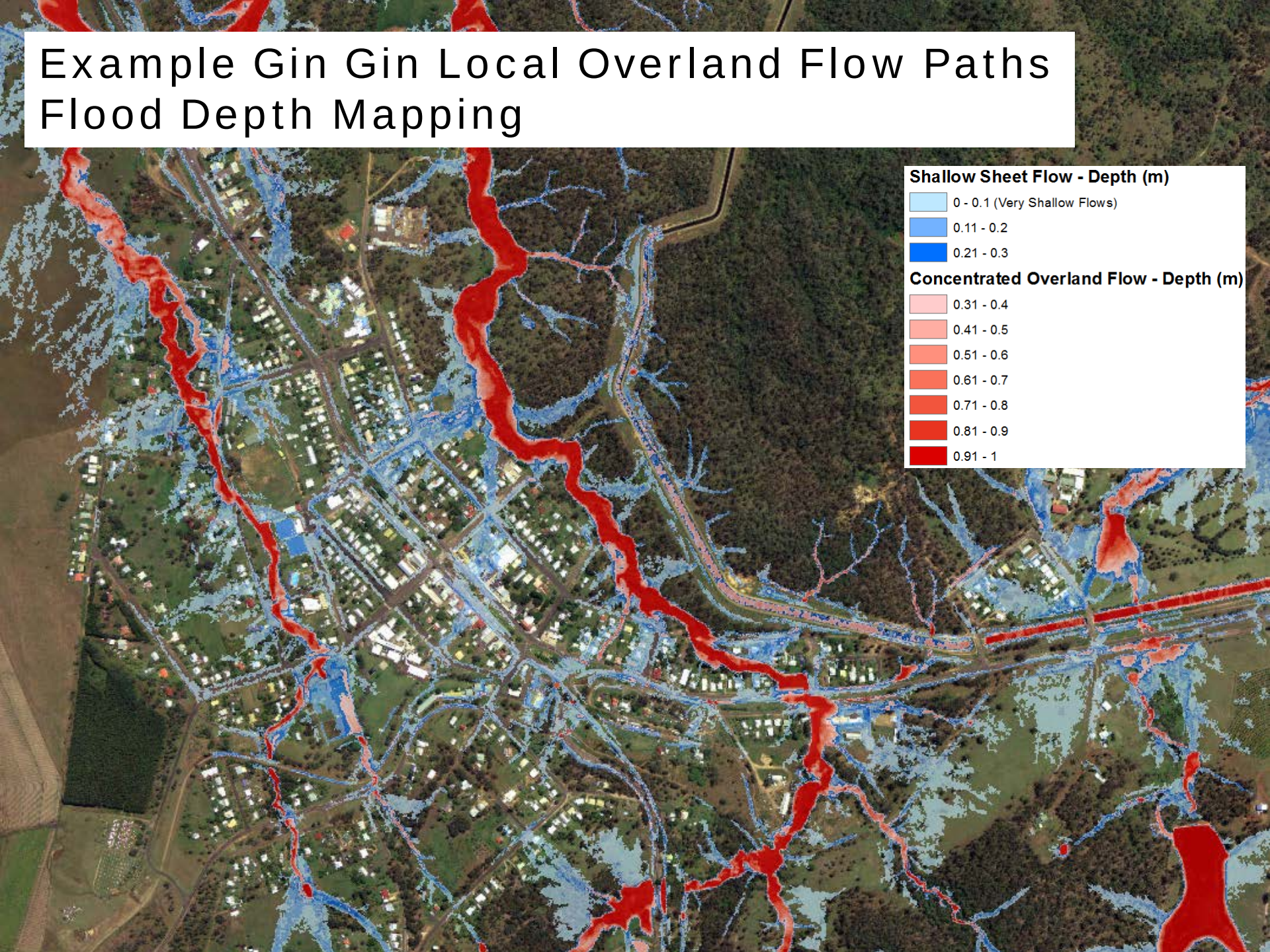
December 2010 & March 2012 – Smaller than 5% AEP (20-year ARI)

January 2013 – Larger than 0.2% AEP (500-year ARI)

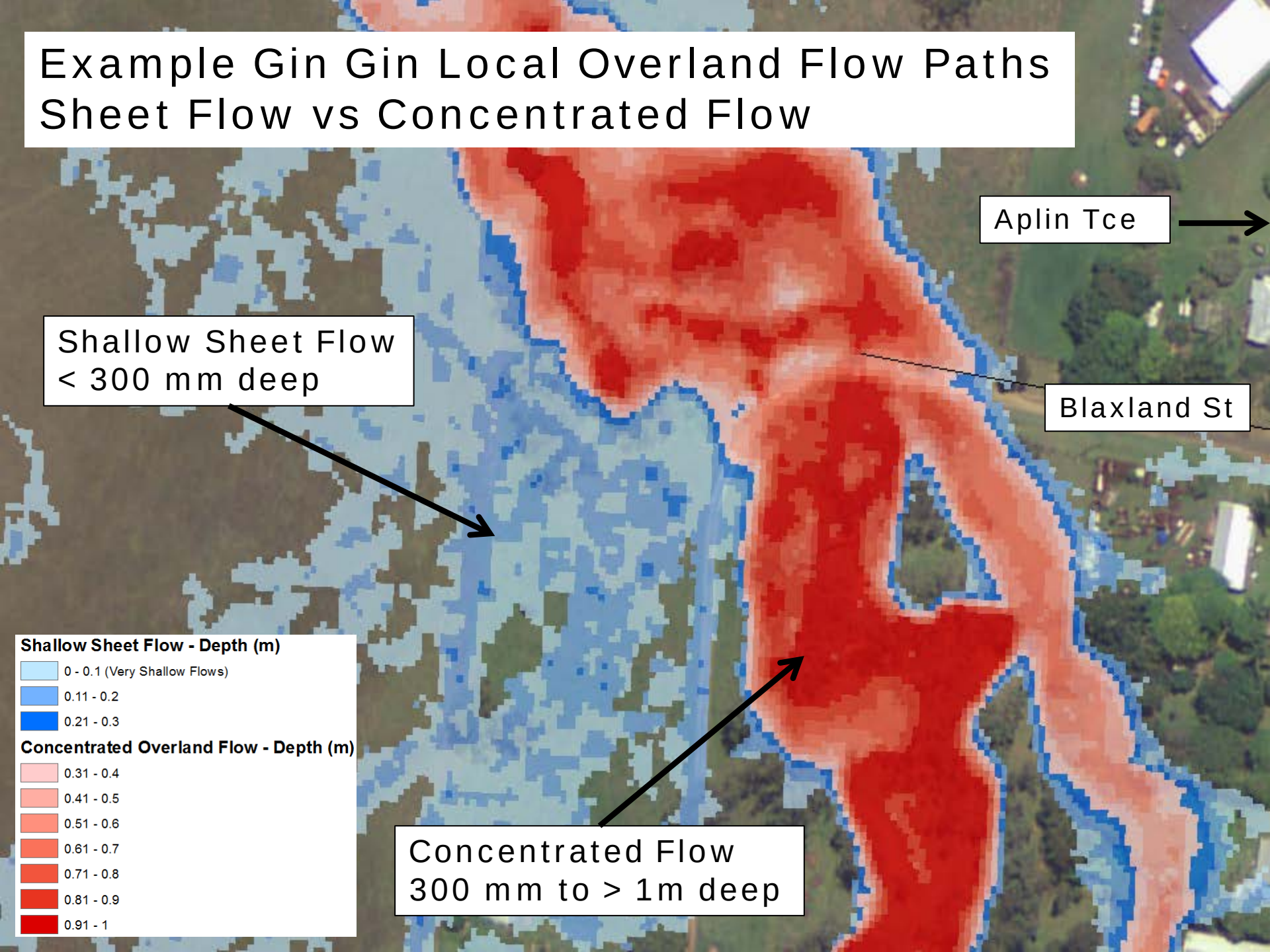

Example Flood Depth Mapping
Bundaberg-Miriam Vale Road
Smiths Crossing Road
Peak Flood Depth
<VALUE>
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
16 - 18
18 - 20

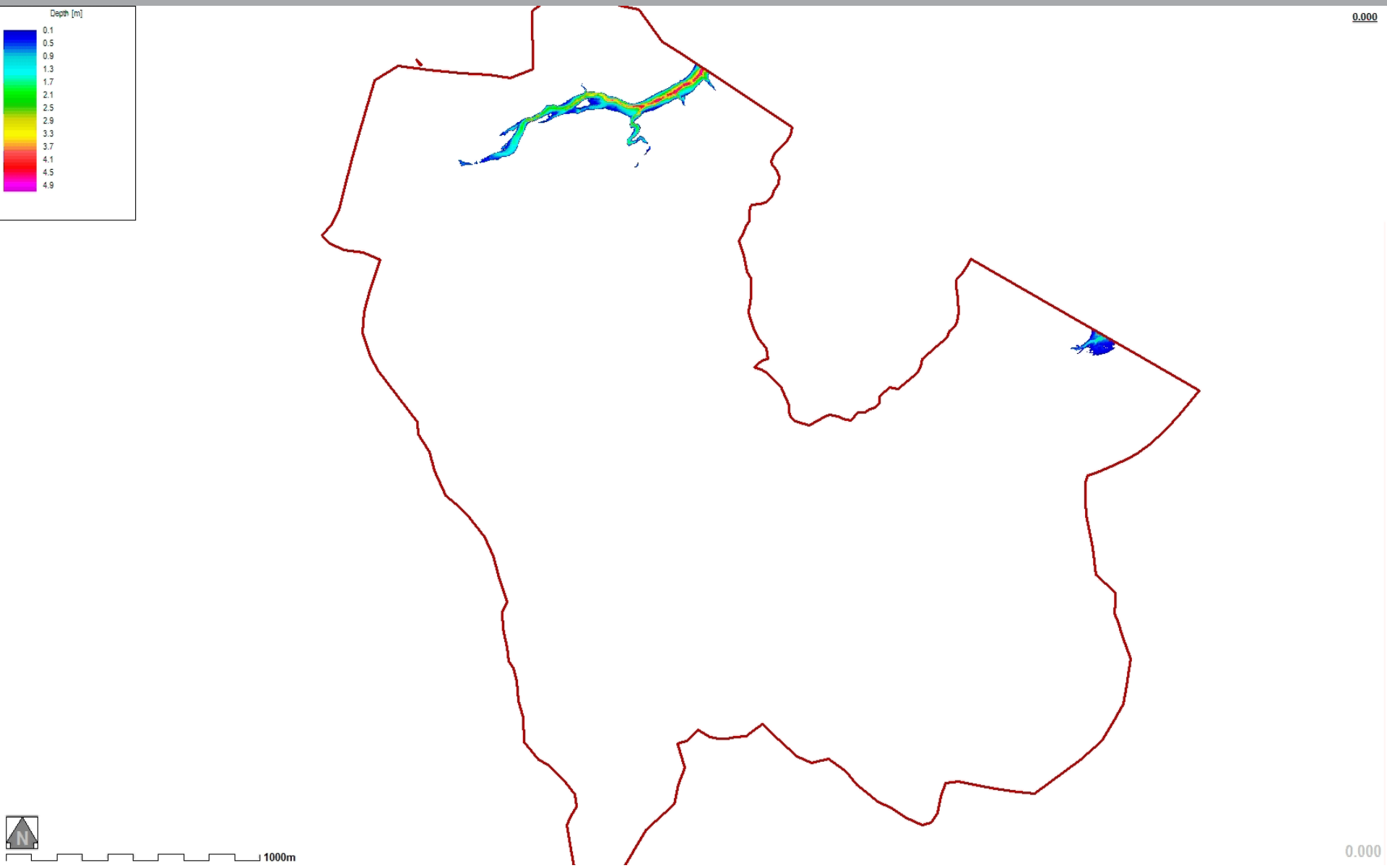

Example Flood Hazard Mapping
Bundaberg-Miriam Vale Road
Smiths Crossing Road
Flood Hazard Categories
Low Hazard
Significant Hazard
High Hazard
Extreme Hazard

Example Gin Gin Local Overland Flow Paths Flood Depth Mapping



Example Gin Gin Local Overland Flow Paths
Sheet Flow vs Concentrated Flow




Depth [m]
0.1
0.5
0.9
1.3
1.7
2.1
2.5
2.9
3.3
3.7
4.1
4.5
4.9
0.000
N
1000m
0.000

Stage 2 – Flood Risk Assessment

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Flood Risk Assessment

- Helping Council and the community understand the impact of flooding
- Assessment focused on these issues:
    - Inundation of properties and land
    - Impacts on key infrastructure
    - Travel times
    - Durations of inundation
    - Flood function mapping
    - Evacuation

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Residential Property Inundation

- **Relatively few properties are subject to above-floor inundation (~30 in the 1% AEP flood event).**
- **Numbers of properties in entire study area subject to some inundation:**

Flood event (AEP)	12 hour Rainfall (mm)	18 hour Rainfall (mm)	24 hour Rainfall (mm)	72 hour Rainfall (mm)	No. of flood affected residential properties
5%	160 - 200	200 - 240	230 - 270	300 - 370	**188**
2%	200 - 240	240 - 290	280 - 330	370 - 450	**192**
1%	220 - 270	270 - 320	310 - 370	430 - 520	**229**
0.5%	250 - 300	300 - 360	350 - 420	500 - 600	**231**
0.2%	290 - 340	350 - 420	400 - 480	600 - 720	**507**

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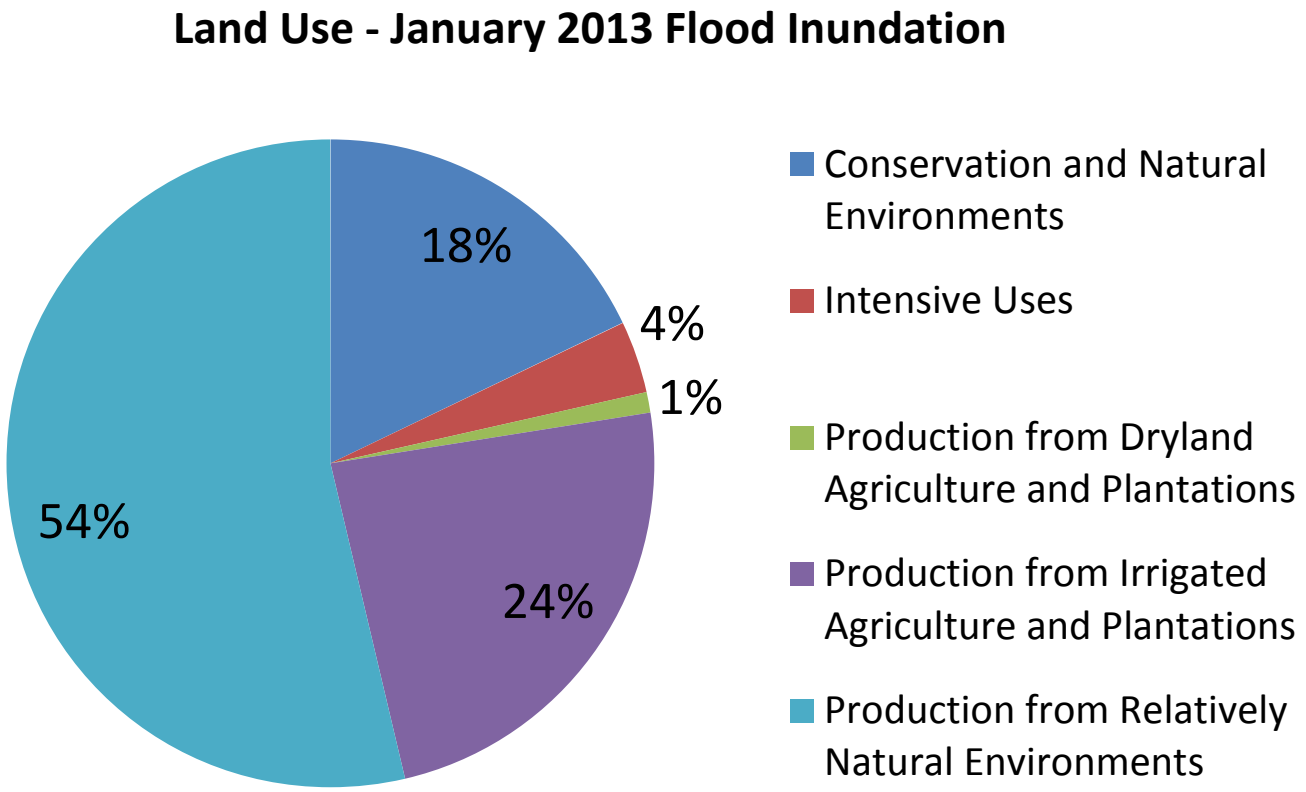
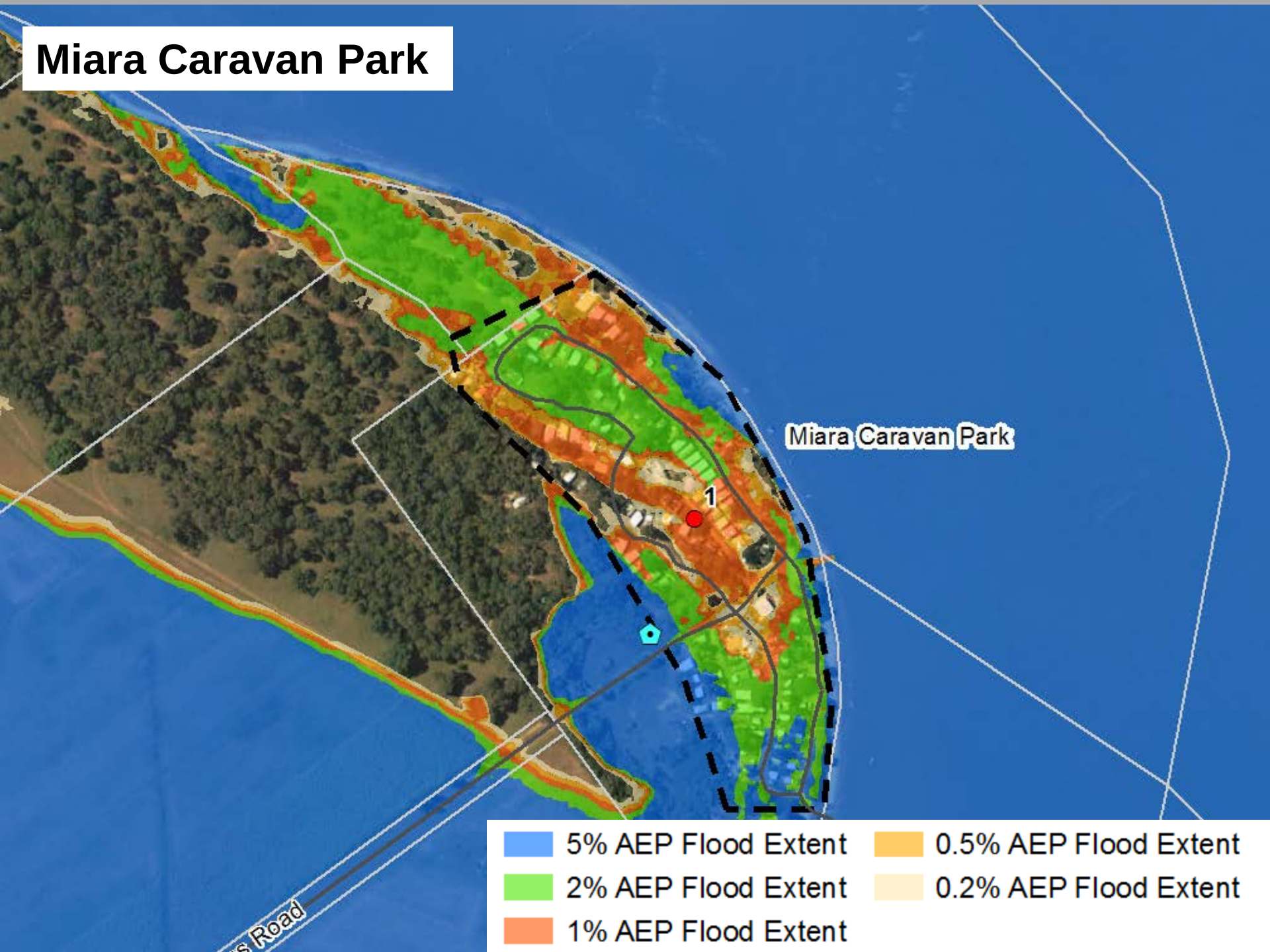
Land Inundation

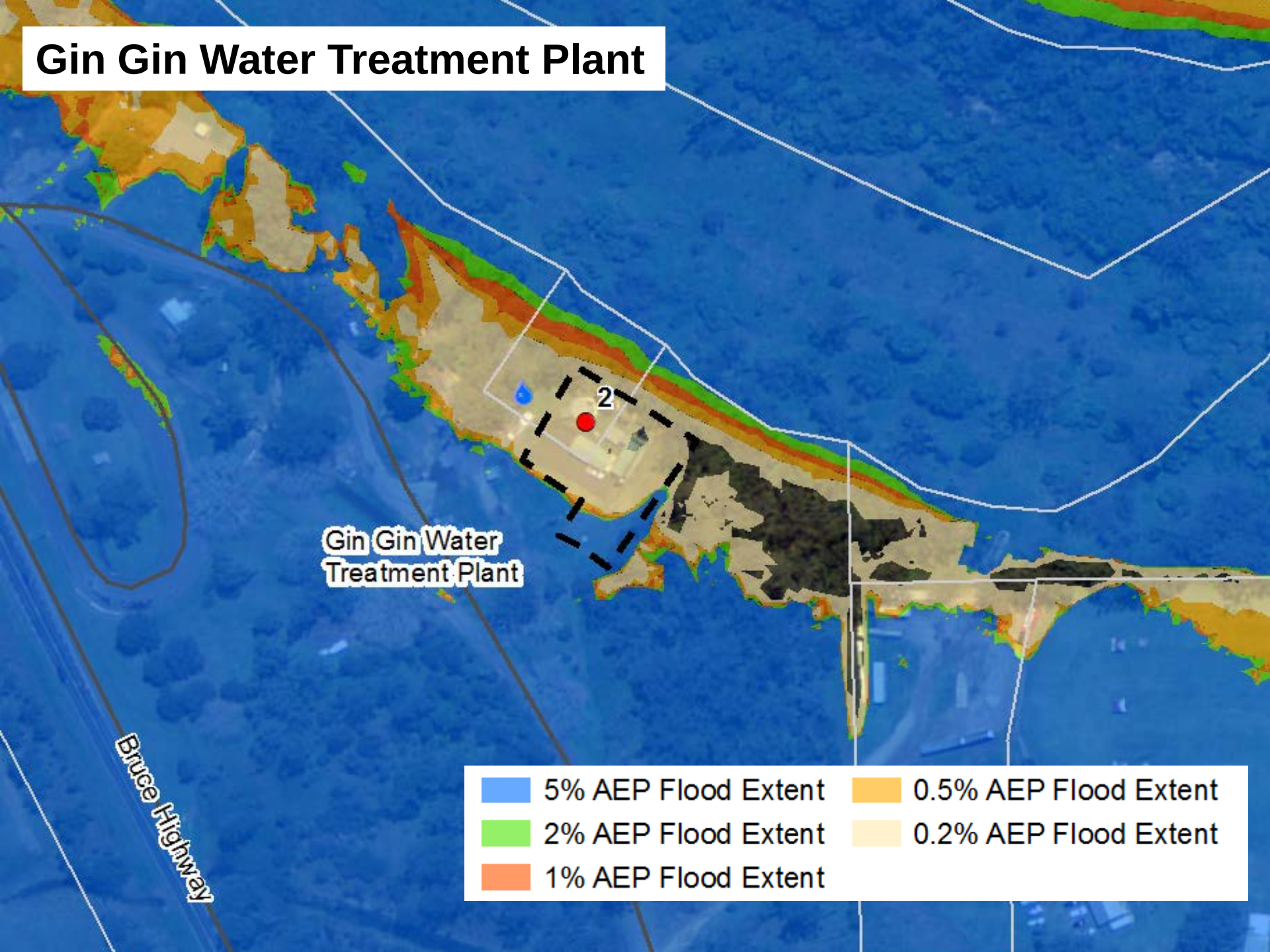
- ~80% (~7000 ha) of land inundated is used for cropping and grazing
- Only ~4% (~320 ha) of land inundated is for intensive uses – i.e. residential development



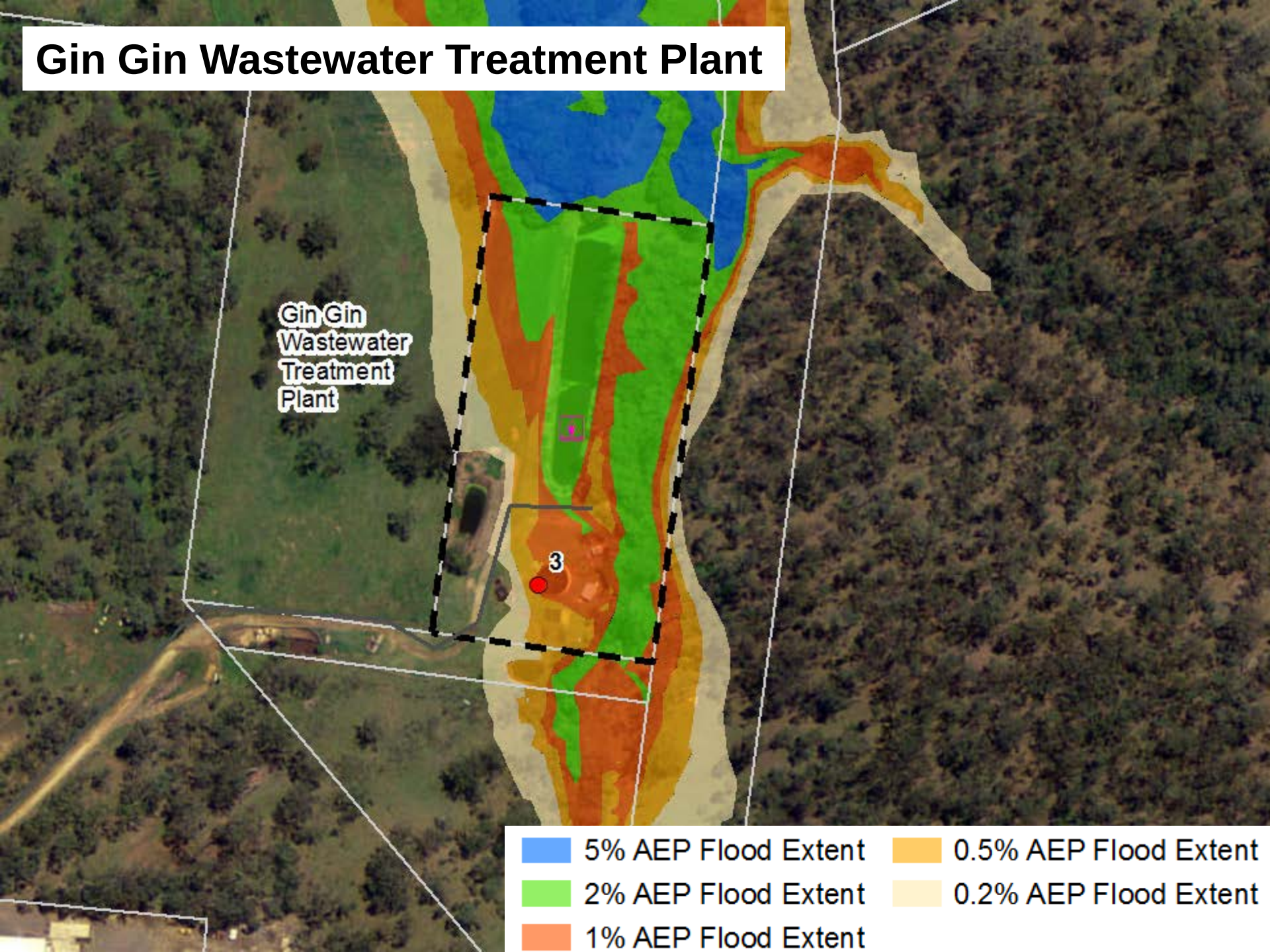
Miara Caravan Park



Gin Gin Water Treatment Plant



Gin Gin Wastewater Treatment Plant



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Flood Travel Times

- **Relatively small and steep catchment compared to the Burnett River.**
- **Very fast response times – FLOOD WATERS RISE QUICKLY**
- **Very fast travel times – FLOODS TRAVEL DOWNSTREAM QUICKLY**
- **Approximately 12 – 14 hours of travel time between Fred Haigh Dam & the mouth**

Event	Fred Haigh Dam to Kolan River / Gin Gin Creek Junction	Brushy Creek Gauge to Kolan River / Gin Gin Creek Junction	Kolan River / Gin Gin Creek Junction to Bucca Weir	Bucca Weir to Avondale Barrage	Avondale Barrage to River Mouth
2013 Event	2.5	9	1	4	4
1% AEP	2.5	5	1	5	4
2% AEP	2.5	5	1	5	5
5% AEP	2.5	4	1	5	6

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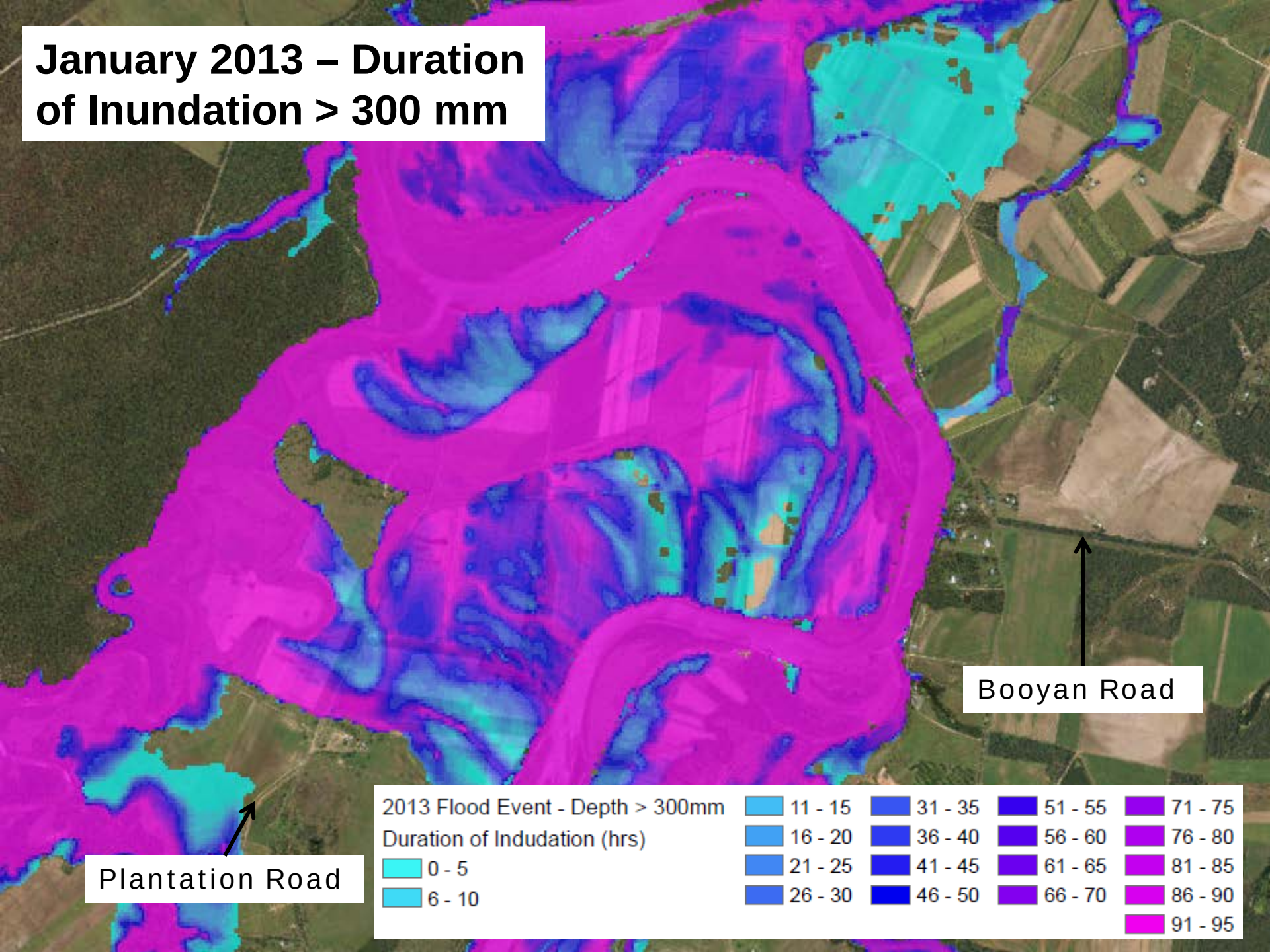
Duration of Inundation

- Important for:
  - Flood preparedness – can you be self-sufficient if isolated?
  - Emergency response and recovery – when will flooded areas be accessible?
- Will vary from one flood to the next – depends on rainfall patterns
- Can vary between:
  - Several hours at the edge of the floodplain
  - **4 – 5 days in low lying areas, particularly closer to the mouth**

January 2013 – Duration of Inundation > 300 mm



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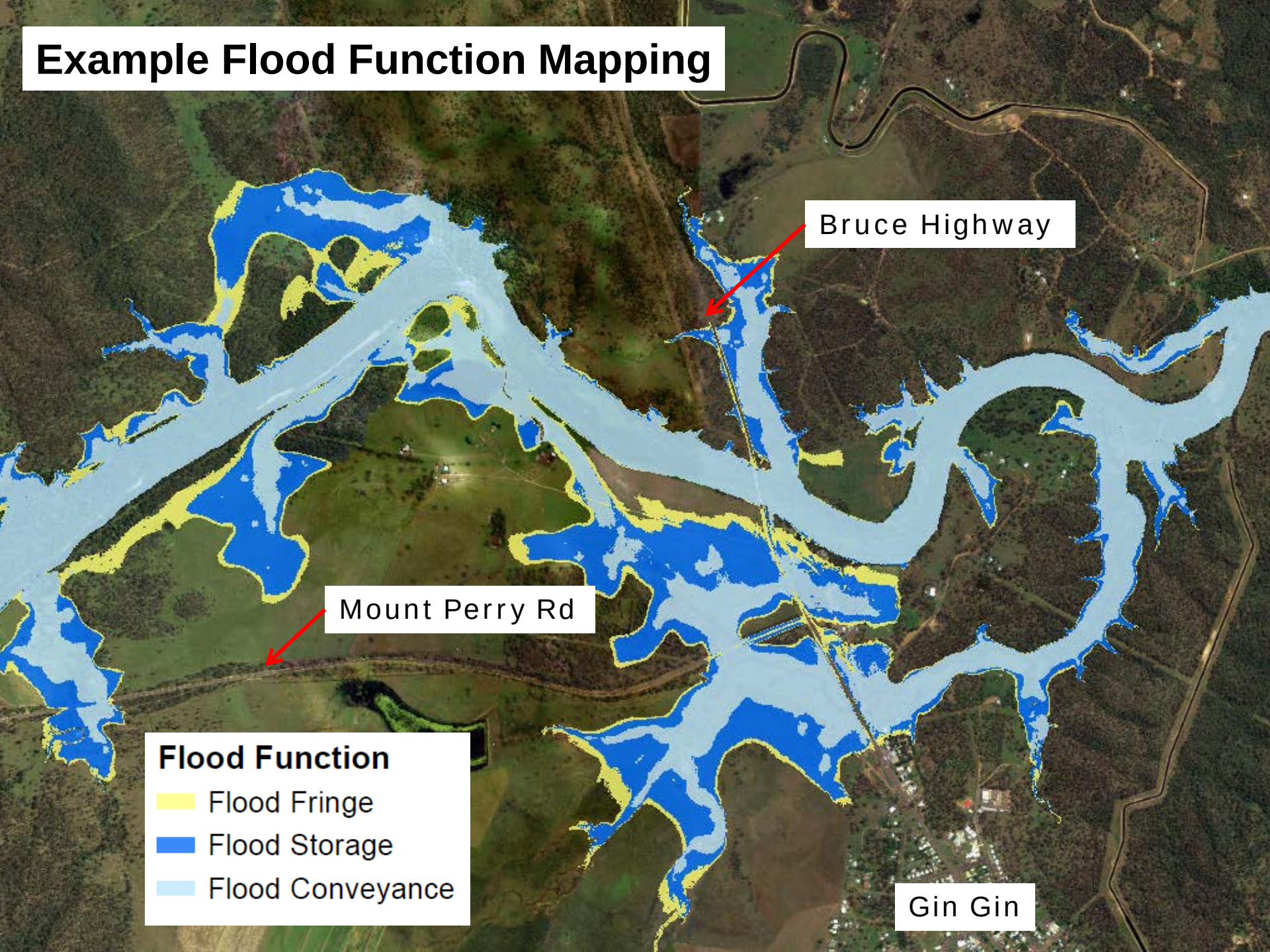
Flood Function Mapping

- Divides the floodplain into functional areas:
  - **Flood Conveyance** – High velocity flow paths
  - **Flood Storage** – Deep but low velocity flood waters
  - **Flood Fringe** – Shallow water at the very edge of the floodplain
- Important for:
  - Land Use Planning – Is development consistent with the function of the floodplain?
  - Maintaining flood function – Making sure that flooding is not worsened by blocking active conveyance areas or excessively filling flood storage areas.

Example Flood Function Mapping



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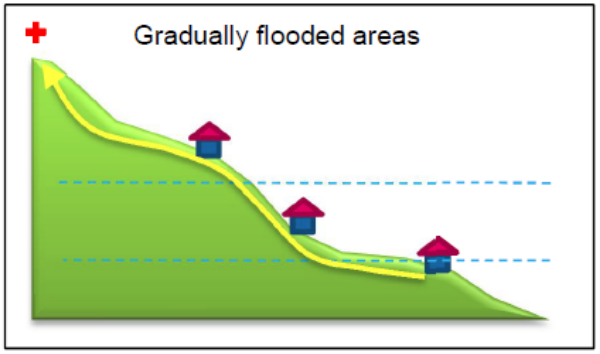
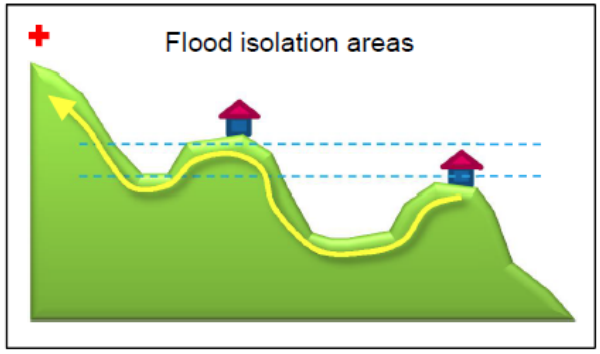
Flood Evacuation Routes

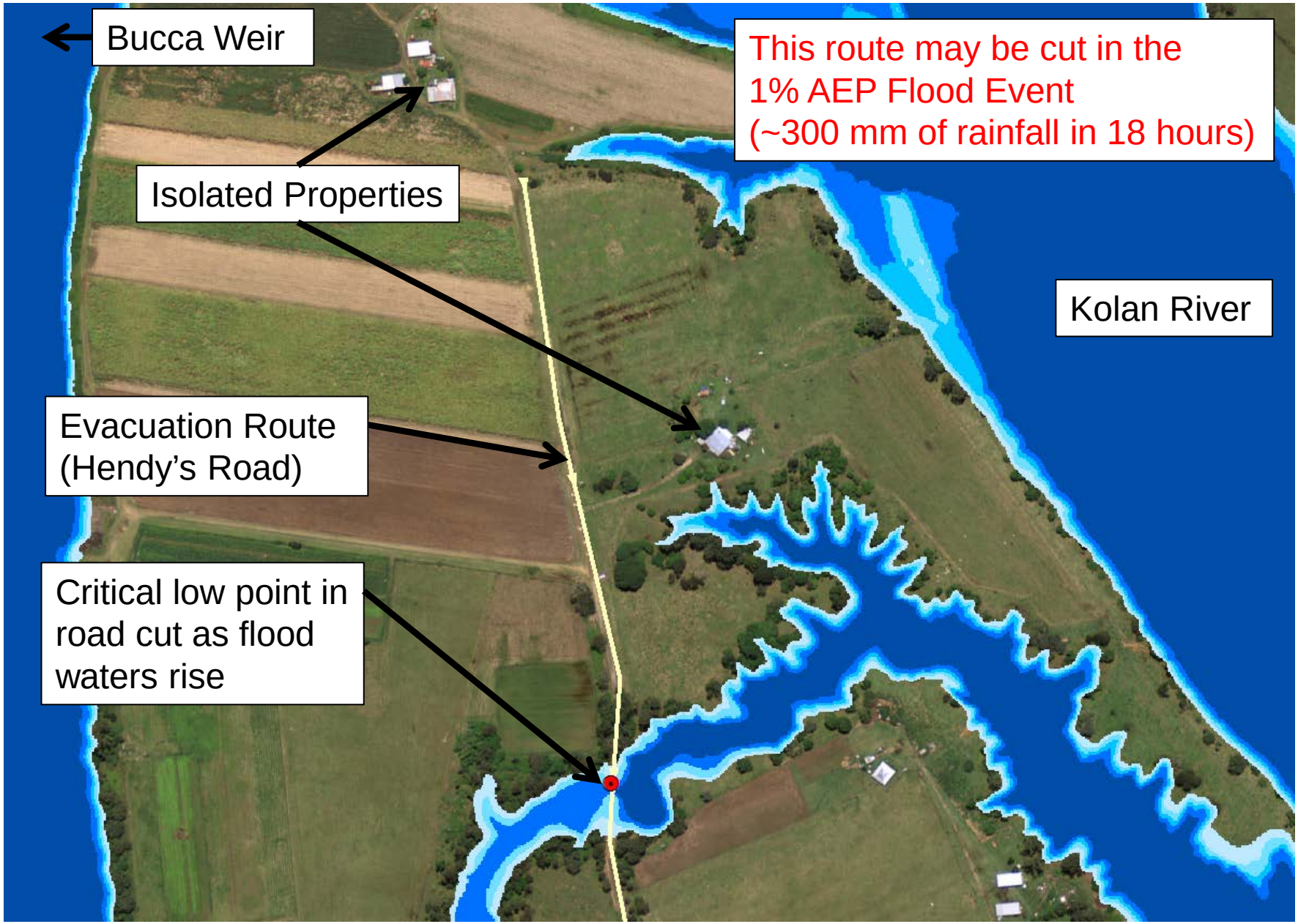
- *Identified areas affected or isolated by flooding, and the key access roads to those areas*
- *Identified the critical point in the road that is first cut by flooding*
- *Identified the amount of rainfall across the catchment that may close the route*
- Difference between gradually flooded (rising roads) and isolated areas:



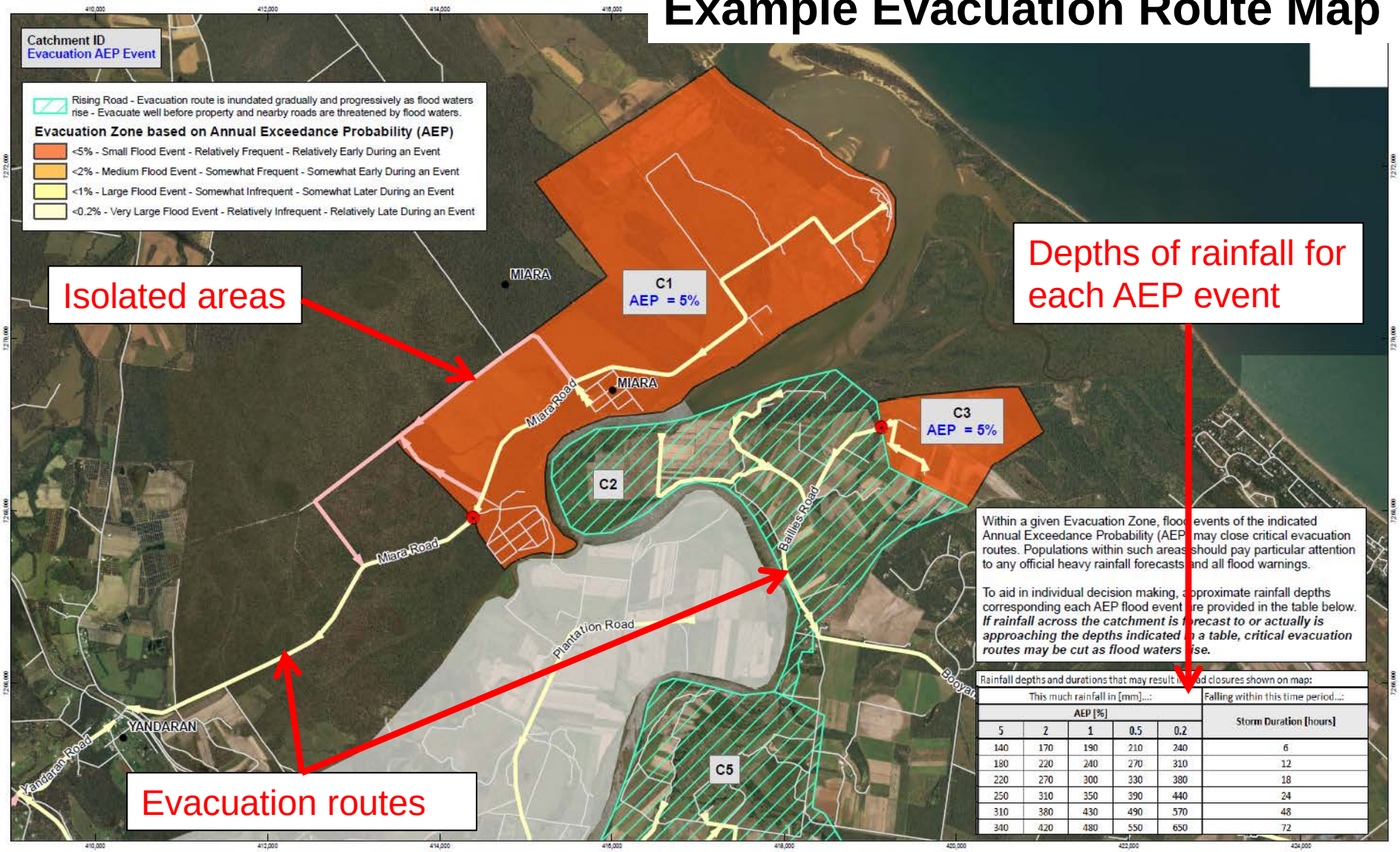


- Important for:
  - Emergency management and making informed individual decisions

Example Flood Isolation and Evacuation Route Scenario



Example Evacuation Route Map



Within a given Evacuation Zone, floo events of the indicated Annual Exceedance Probability (AEP may close critical evacuation routes. Populations within such areas should pay particular attention to any official heavy rainfall forecasts and all flood warnings.

To aid in individual decision making, approximate rainfall depths corresponding each AEP flood event are provided in the table below. ***If rainfall across the catchment is forecast to or actually is approaching the depths indicated in a table, critical evacuation routes may be cut as flood waters rise.***

Rainfall depths and durations that may result in flood closures shown on map:

This much rainfall in [mm]...:					Falling within this time period...:
AEP [%]					Storm Duration [hours]
5	2	1	0.5	0.2	
140	170	190	210	240	6
180	220	240	270	310	12
220	270	300	330	380	18
250	310	350	390	440	24
310	380	430	490	570	48
340	420	480	550	650	72

1:40,000 @A3
0 1,000 2,000
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: MGA56

LEGEND
Critical Road Closure Location
Primary Evacuation Route
Secondary Evacuation Route
Refer to another map in the series

Bundaberg Regional Council
Kolan River and Gin Gin Creek
Floodplain Risk Management Study

Job Number 41-27710
Revision A
Date 11 Jul 2014

Page 1 of 6
Flood Evacuation Routes

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Stage 3. Gin Gin Areas of Interest

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Gin Gin Drainage Areas of Interest

- Each area will be **considered by Council** as part of future capital works program and will be **subject to a merit based assessment and prioritisation process**.
- Must be weighed against other drainage projects for the region.
- Flagged potential upgrades for 4 drainage areas based on hydraulic modelling:

    1. **Campbell Street**
    2. **Dear Street**
    3. **Elliot Street**
    4. **King Street / Aplin Terrance**

- Flagged 3 areas for further detailed investigation:

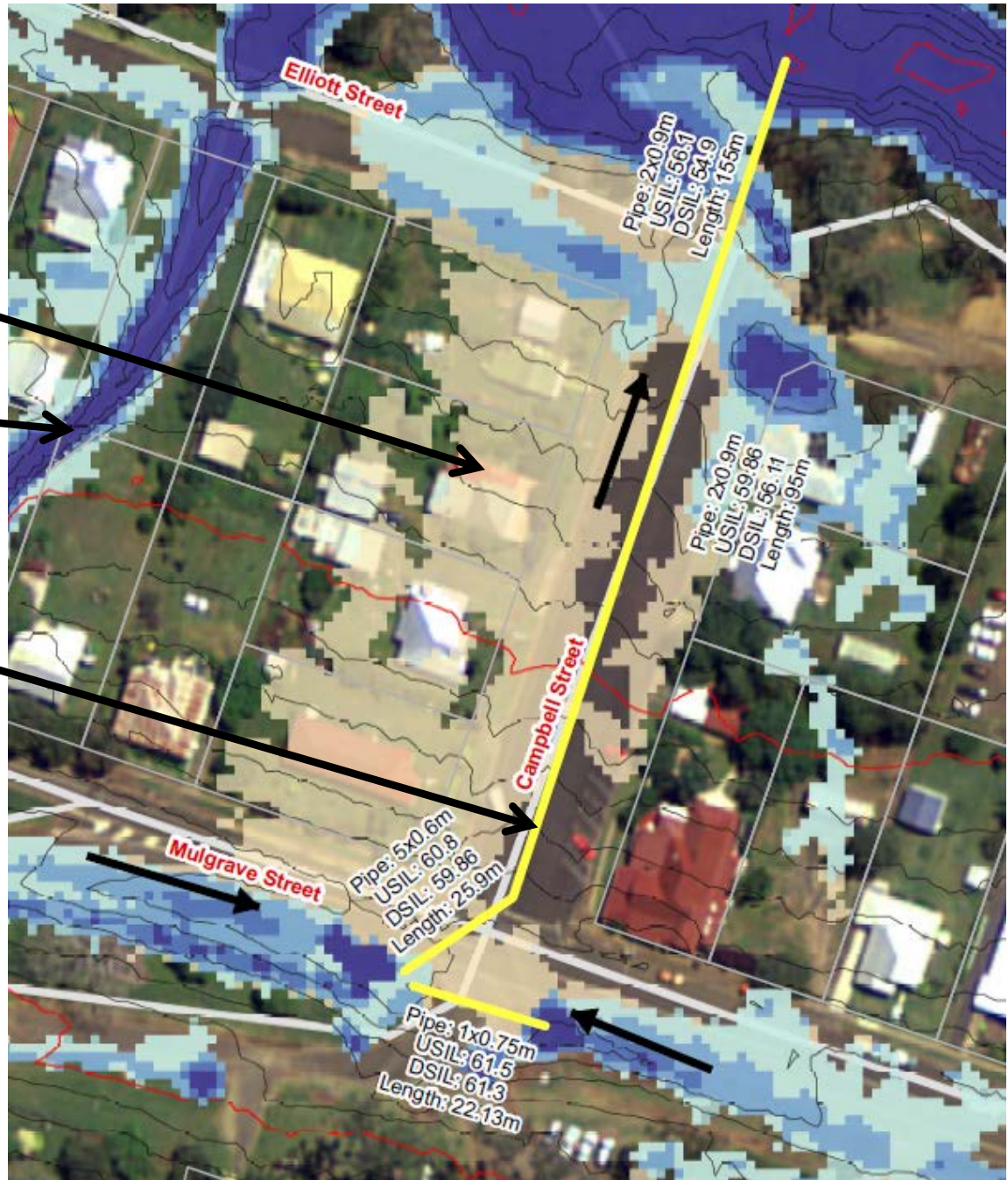
    5. **Mulgrave Street – Streetscape Works**
    6. **Salloom Street Industrial Area**
    7. **High School Road**

1. Campbell Street Potential Drainage Upgrade

Existing flood extent (cream)

Proposed flood extent (blue)

New Stormwater Drainage

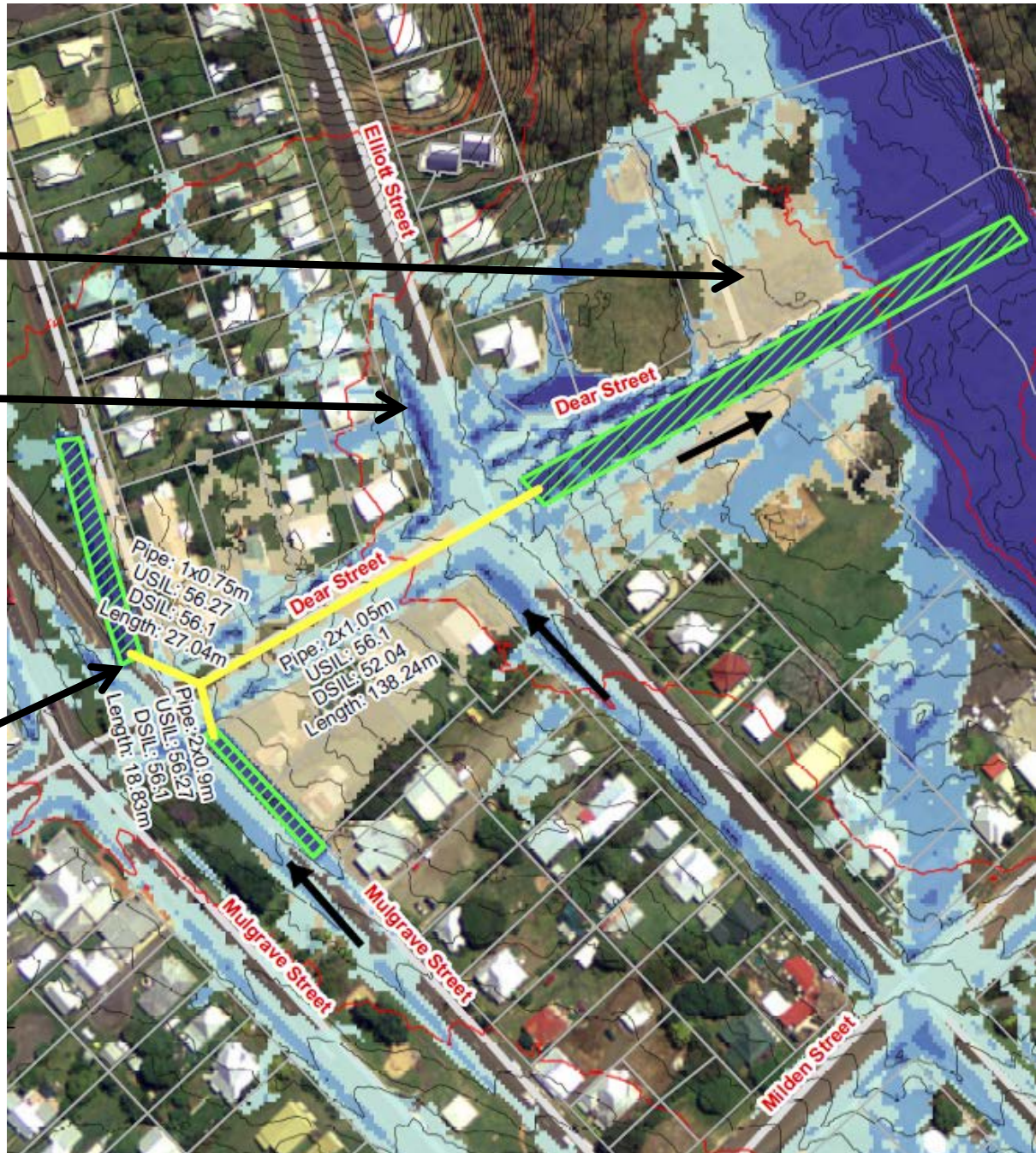


2. Dear Street Potential Drainage Upgrade

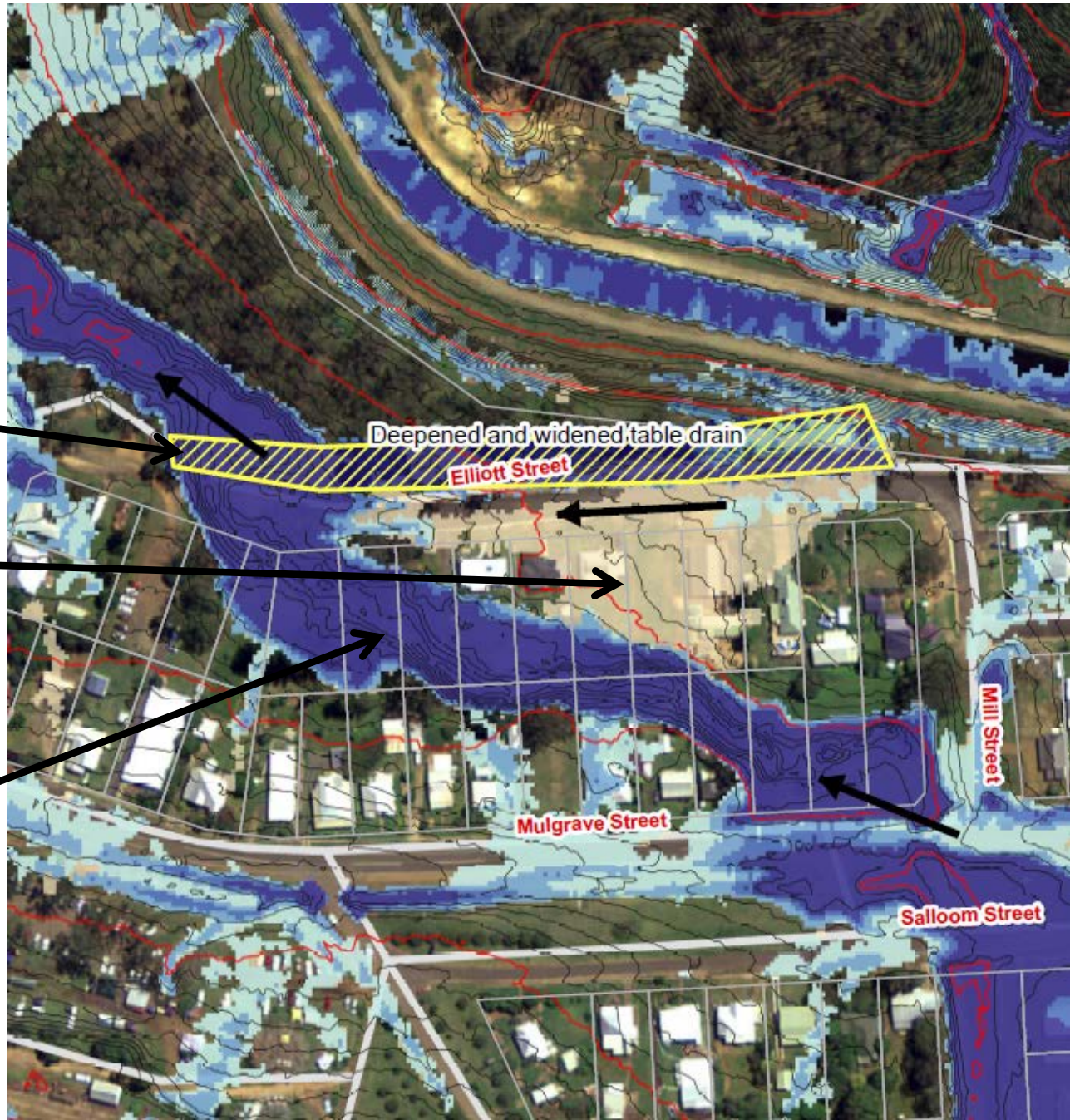
Existing flood extent (cream)

Proposed flood extent (blue)

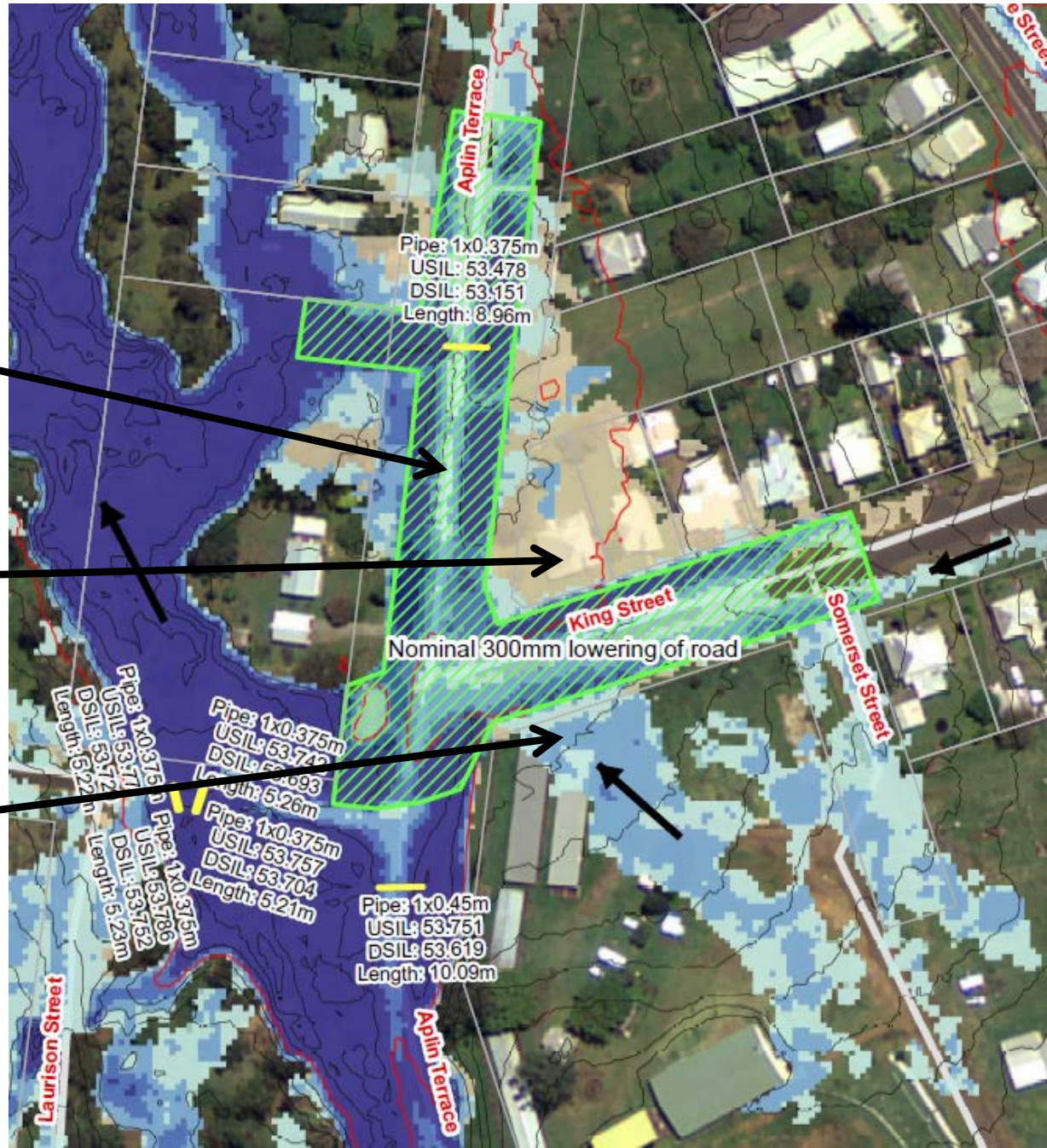
New Stormwater Drainage



3. Elliott Street Potential Drainage Upgrade



4. King Street / Aplin Terrace Potential Drainage Upgrade



Road lowered in this section

Existing flood extent (cream)

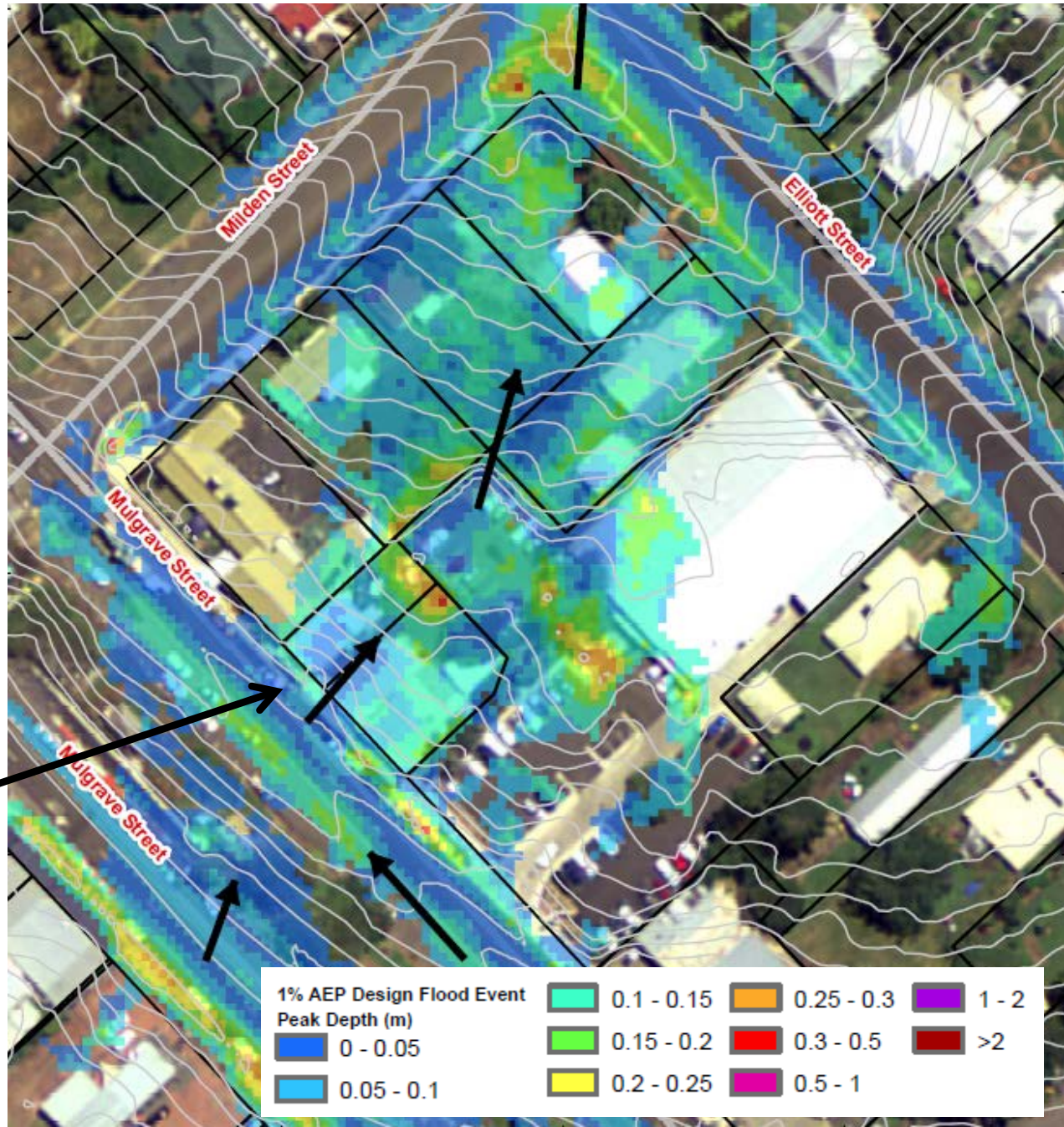
Proposed flood extent (blue)

5. Mulgrave Street Further Investigation Area

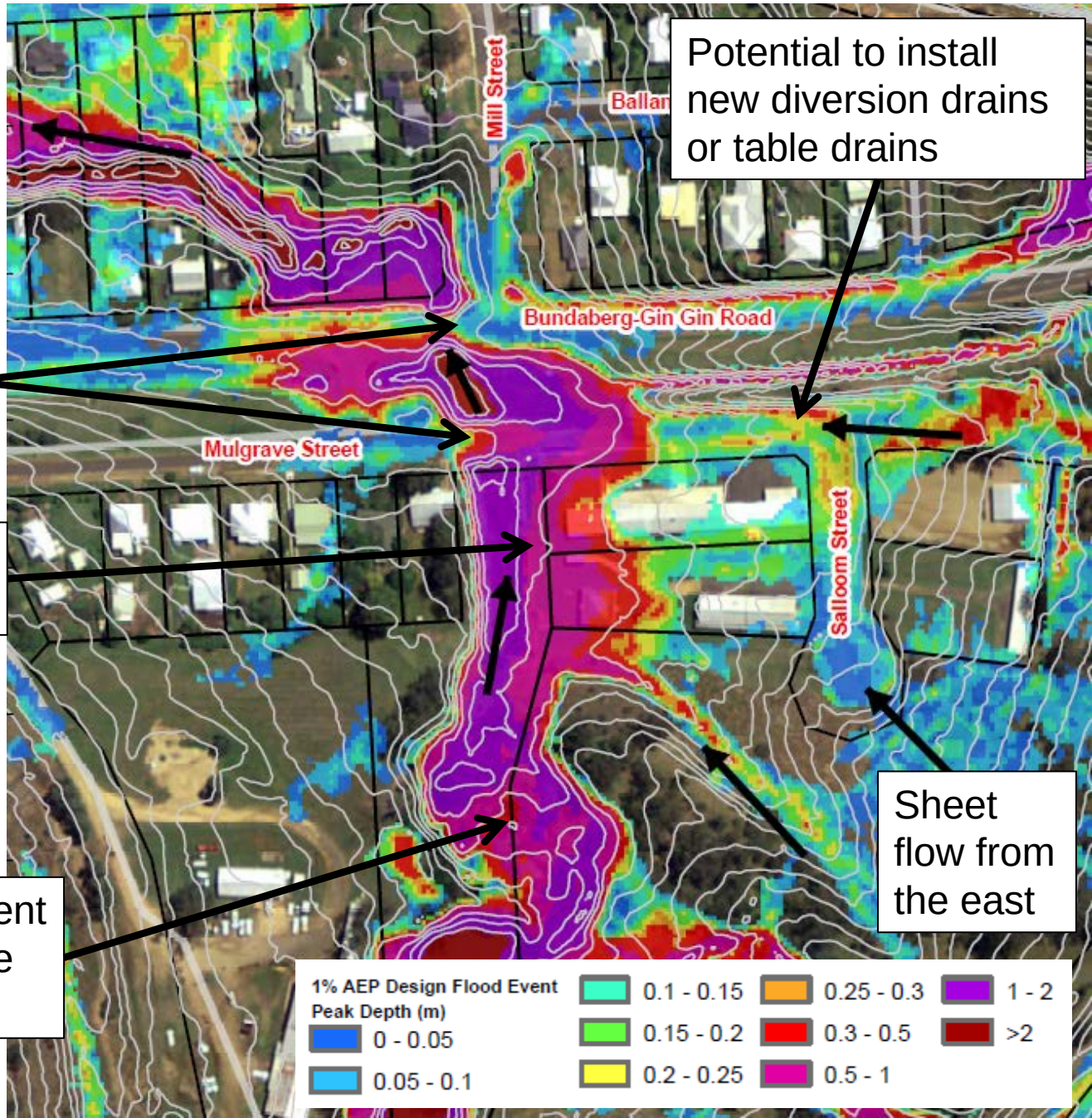
Recent drainage and streetscape works have greatly reduced the frequency and severity of flooding in this area.

However, some residual overland flow may still occur following very intense rainfall.

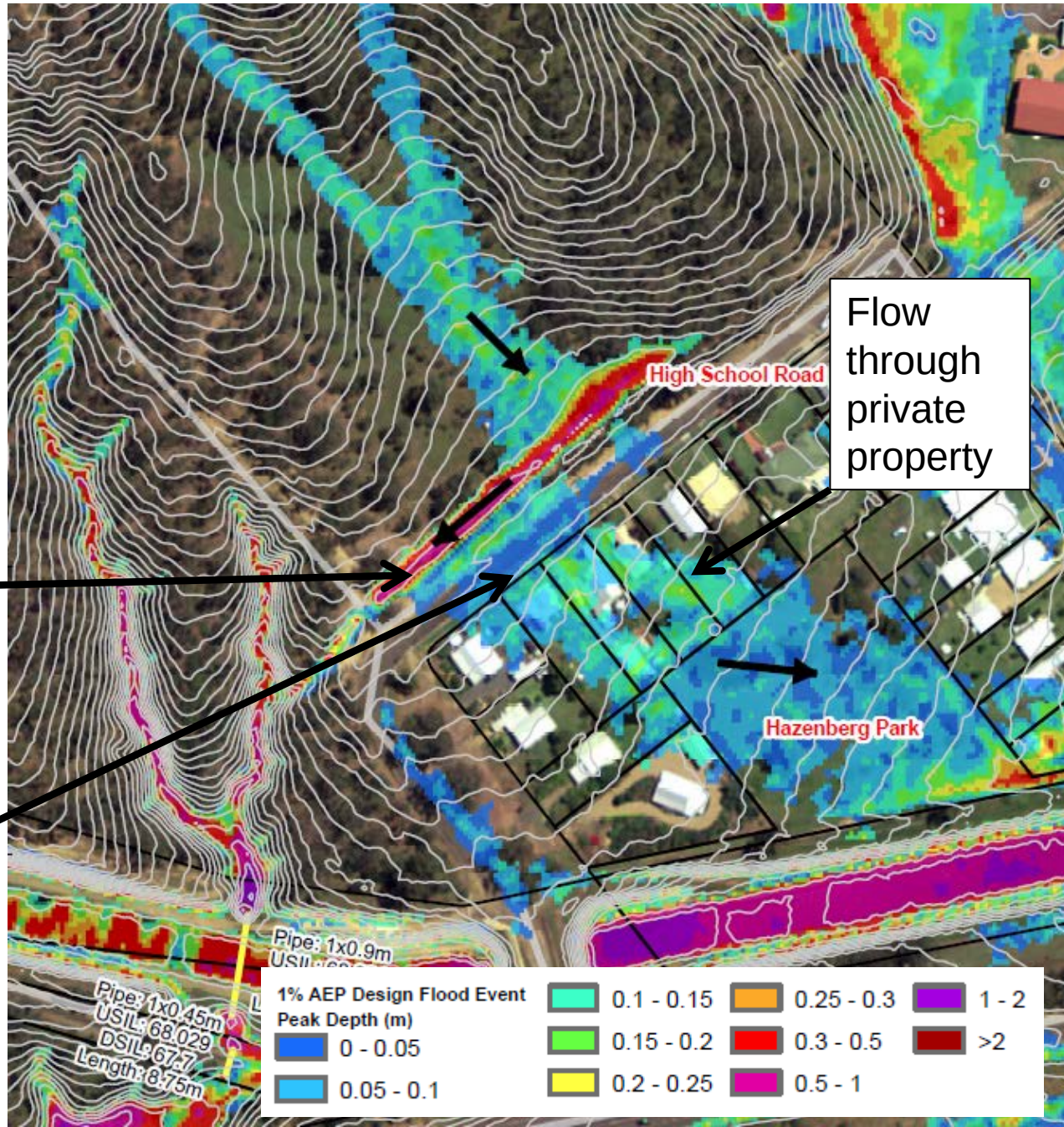
Flows may overtop Mulgrave Street kerb and channel following very intense rainfall



6. Salloom Street Industrial Park Further Investigation Area



7. High School Road Further Investigation Area



Stage 4. Other Recommendations

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Other Recommendations

- Improvements to flood warnings:
  - **Installation of additional rainfall stations**
  - Revised minor / moderate / major flood classifications

- Improvements to evacuation procedures:
  - Development of a **local flood evacuation plan** based on results of these studies
  - Improved dissemination of flood warnings
  - Incorporation of **evacuation route mapping into formal planning**
  - Installation of **evacuation route signage**
  - Marking and monitoring of road closure points
  - Review of evacuation centre capacities

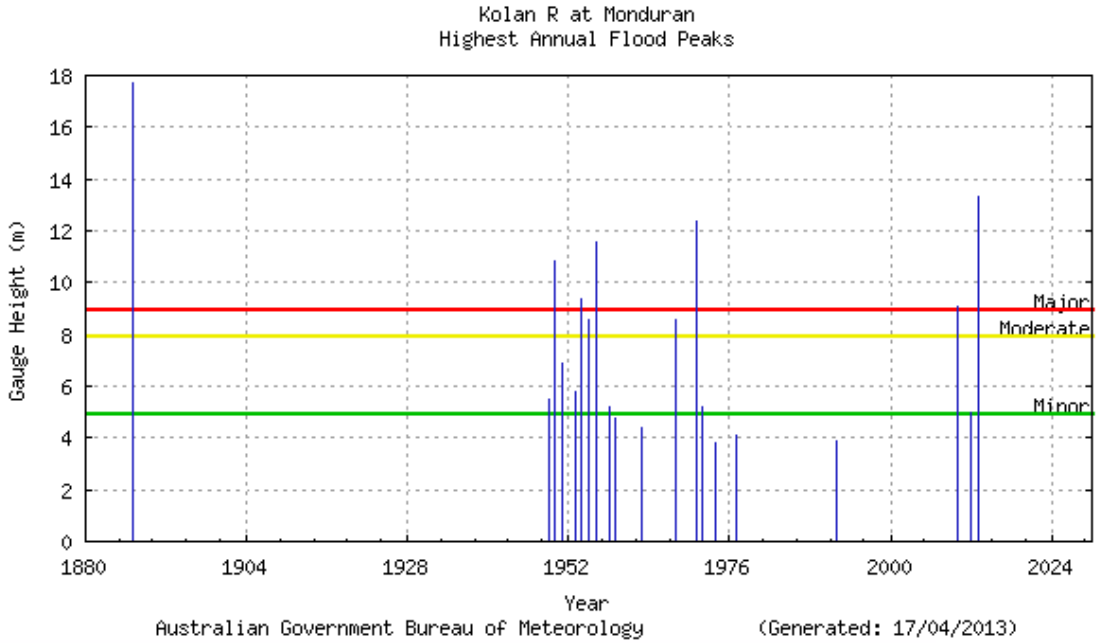
- Improvements to community awareness:
  - Development of online portals and property flood searches

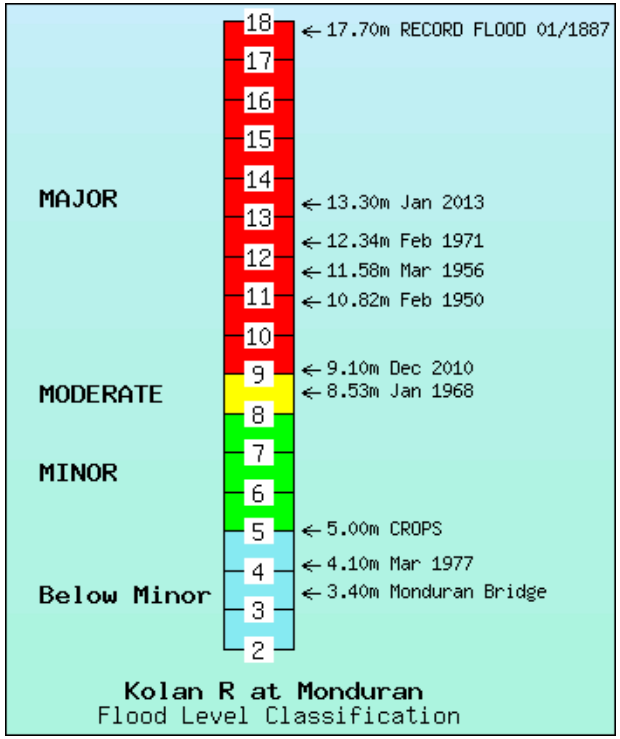
Feedback

- Council is seeking feedback on Gin Gin urban drainage areas. Form at information desk.
- Final reports are currently being reviewed for Council adoption and release to the public
- Available on Councils website August

Flood Warning System

- Flood warning system operated by Bureau of Meteorology
- *Council $86,000 Upgrade*





Australian Government
Bureau of Meteorology

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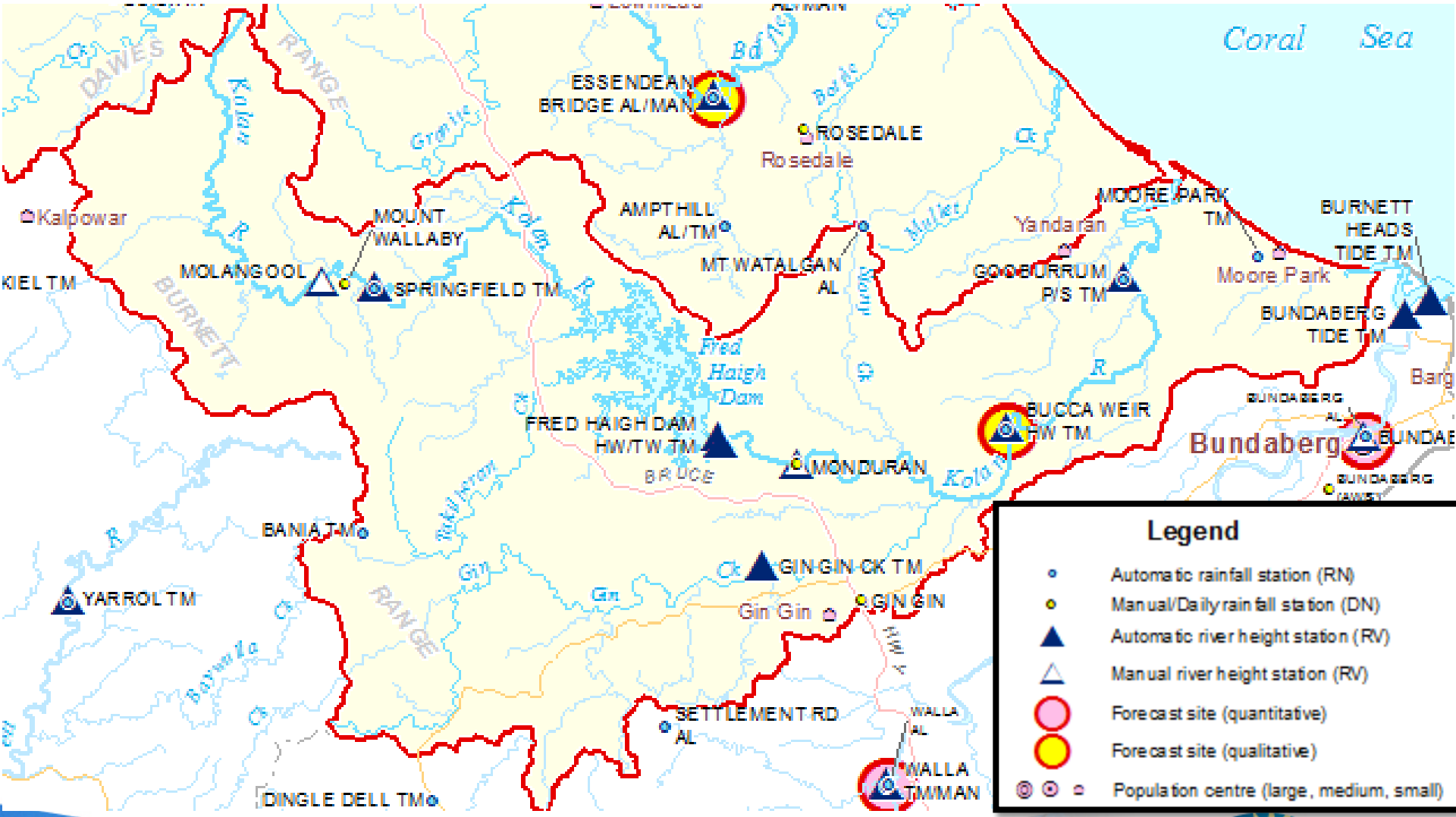
Existing Flood Warning System



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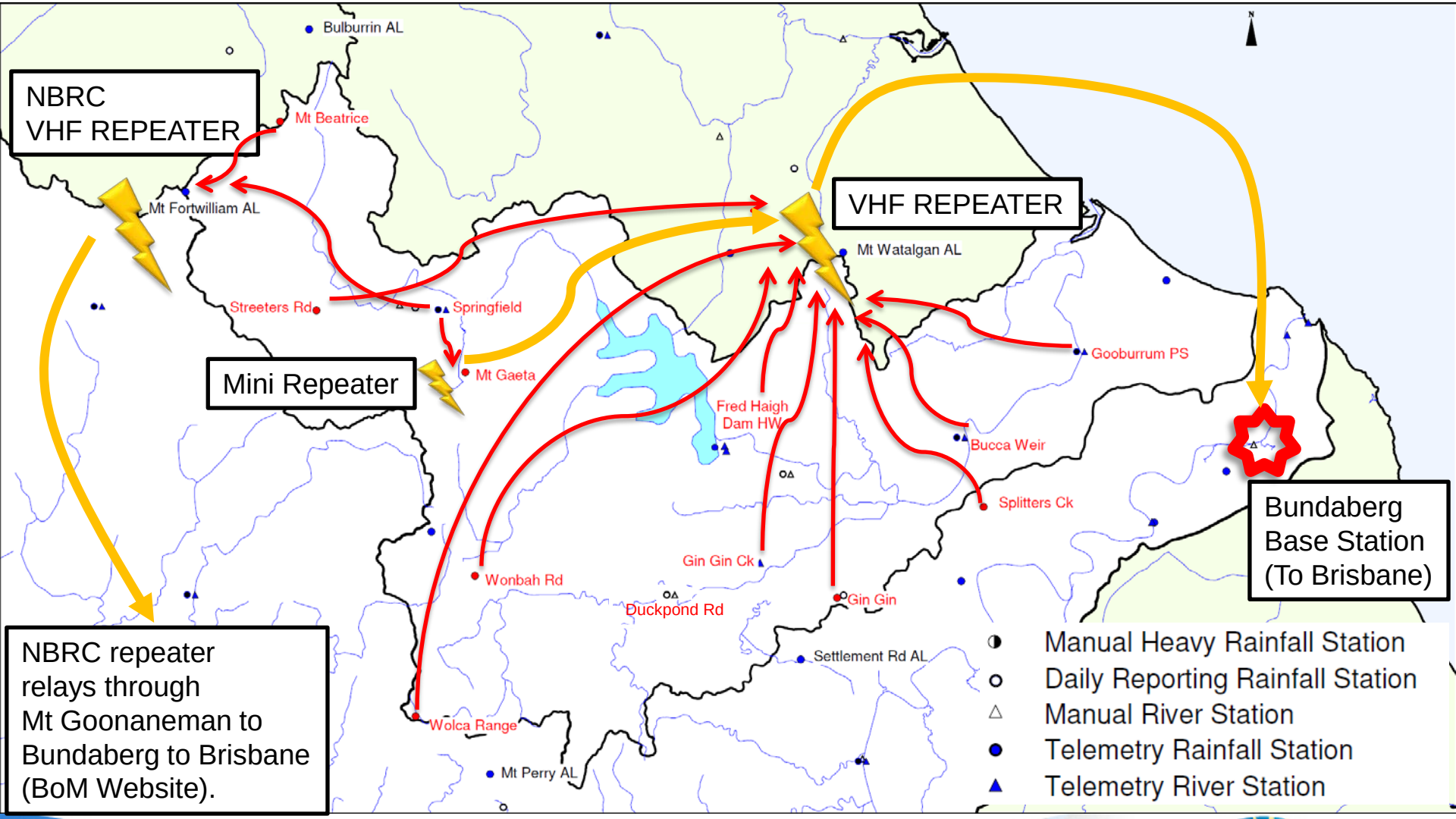
Upgraded Flood Warning System



Flood Warning System

- New *"Rain Trees" on road reserves* and River Level Stations Upgraded to BoM "ALERT" VHF technology

Questions?

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