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Using extended lead time flood forecasts to save lives and property

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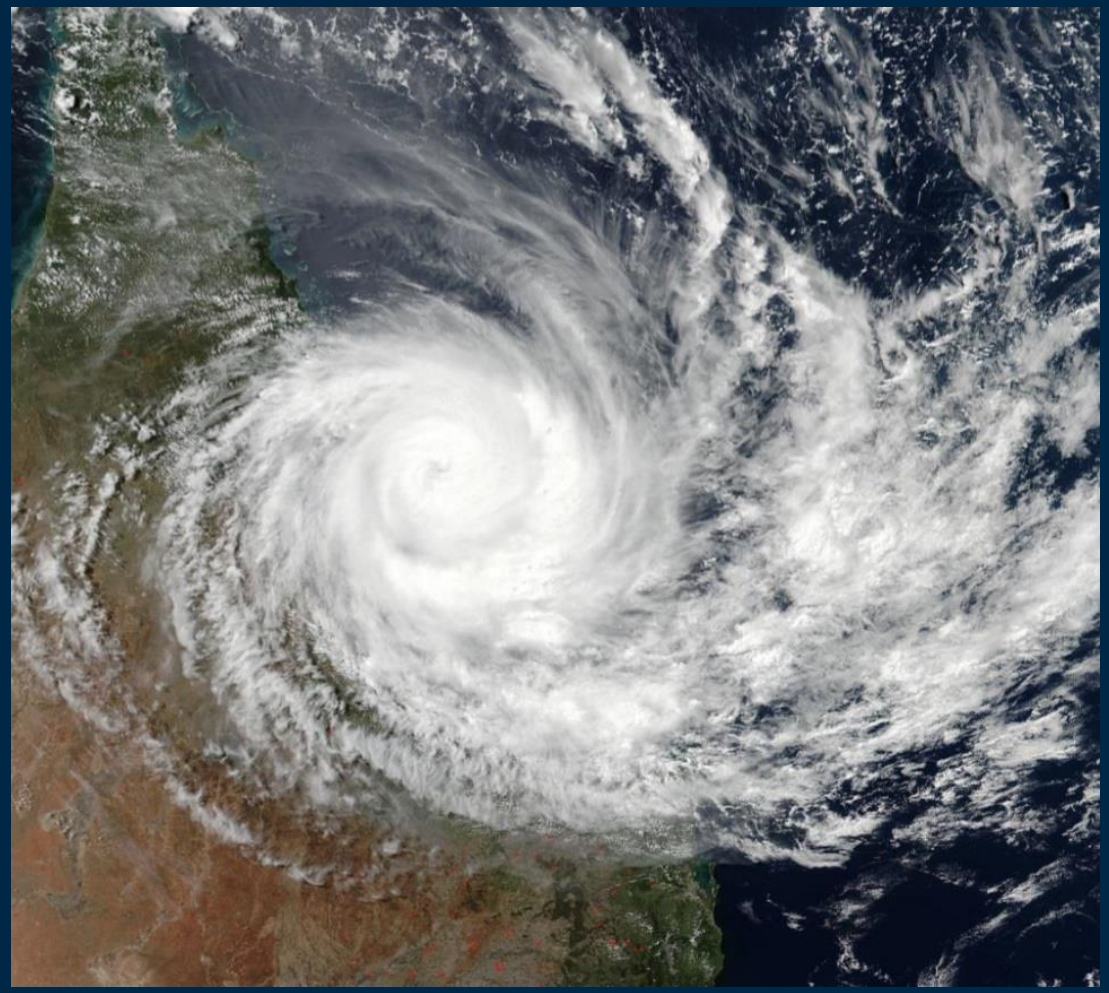
Team Leader National Flood Operations- Sydney
Community Services Group | Environmental Prediction – Water
Australian Bureau of Meteorology

Using extended lead time flood forecasts to save lives and property

- Lessons from recent floods and working with our partners and stakeholders to enhance the Bureau's flood warning services.
- Overview of the enhanced and tailored flood warning services that Bureau is starting to deliver.
- Automated performance analysis of our flood forecasts.



TC Debbie - March 2017
www.bom.gov.au/cyclone/history/debbie17.shtml

2017 Ex-Tropical Cyclone Debbie - NSW Northern Rivers Flooding

- Local communities demonstrated high level of resilience and they helped each other during the flood emergency.
- Local communities are incredibly diverse, and it is not easy to ensure that everyone receives, understands and responds to warnings.
- Warnings and detailed real-time rainfall and river level information is extremely important to local communities, but the volume of data makes it difficult to provide the information via radio.
- The Bureau needs to work with the emergency services and the media to enhance the communication of warning information so people can respond appropriately.

Murwillumbah April 2018 – attended by Jane Golding and Justin Robinson of the Bureau. The Bureau attended community meetings across the Northern Rivers.

High impact warning messages – Example from the Townsville Floods - 2019

Media: Transmitters serving the Ross, Bohle and Black Rivers are REQUESTED TO USE THE STANDARD EMERGENCY WARNING SIGNAL BEFORE BROADCASTING THIS MESSAGE.

TOP PRIORITY: The Bureau and Emergency Services would appreciate this message being broadcast regularly.

RISK TO LIFE AND PROPERTY

Dangerous and high velocity flows will occur in the Ross River Sunday night into Monday. Unprecedented areas of flooding will occur in Townsville. Expect access routes to be cut.

Conditions will change rapidly and continuously. Stay informed, look for updates and follow advice of emergency services.

IMPORTANT INFOMATION FROM TOWNSVILLE CITY COUNCIL:

Residents in many suburbs across Townsville are warned that they may experience flooding from rapid rises of the Ross River. This includes Rosslea, Hermit Park, Railway Estate, Townsville City, Oonoonba, Idalia, Cluden, West End, Rowes Bay, Garbutt, Aitkenvale, Cranbrook, Currajong, Mysterton, Pimlico, Mundingburra, Douglas, Annandale, Kirwan and Thuringowa Central and South Townsville areas.

Everyone in the above suburbs should ensure they move away from riverbanks and get to higher ground before 8.30pm Sunday night. Residents still in their homes in these suburbs should move to the highest ground in their dwelling before 8.30pm Sunday night.

A map of potential inundated properties will released shortly by Townsville City Council.

SEWS

Escalated Priority Information

Head Line Text

RISK TO LIFE AND PROPERTY

Use of high impact words

Dangerous, high velocity, unprecedented

Co-branded warning

Actions for the community

Mapping of impacts

It is not just about the warnings

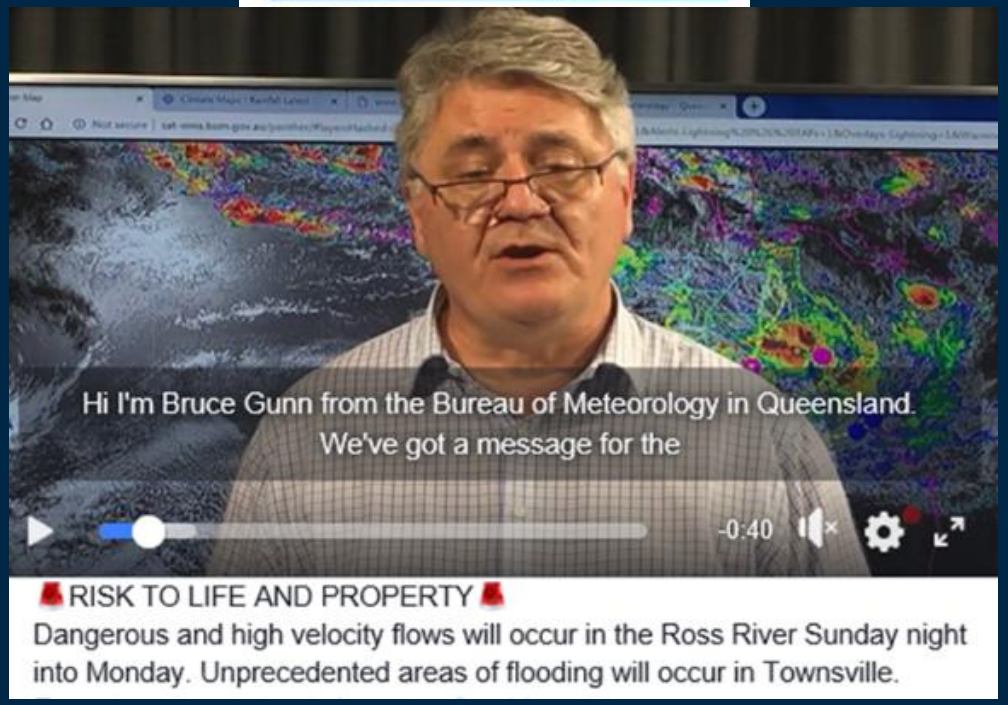
- Need to provide the right warning, to the right people, at the right time with the information they require to effectively protect life and property.

- Fully utilising the communication capability of the Bureau in the provision of warnings.

    - Enhanced Warning Messages.
    - Press Conferences.
    - Social Media.
    - Radio and TV Media.
    - Severe Flood and Weather Videos.

Twitter

Press Conferences



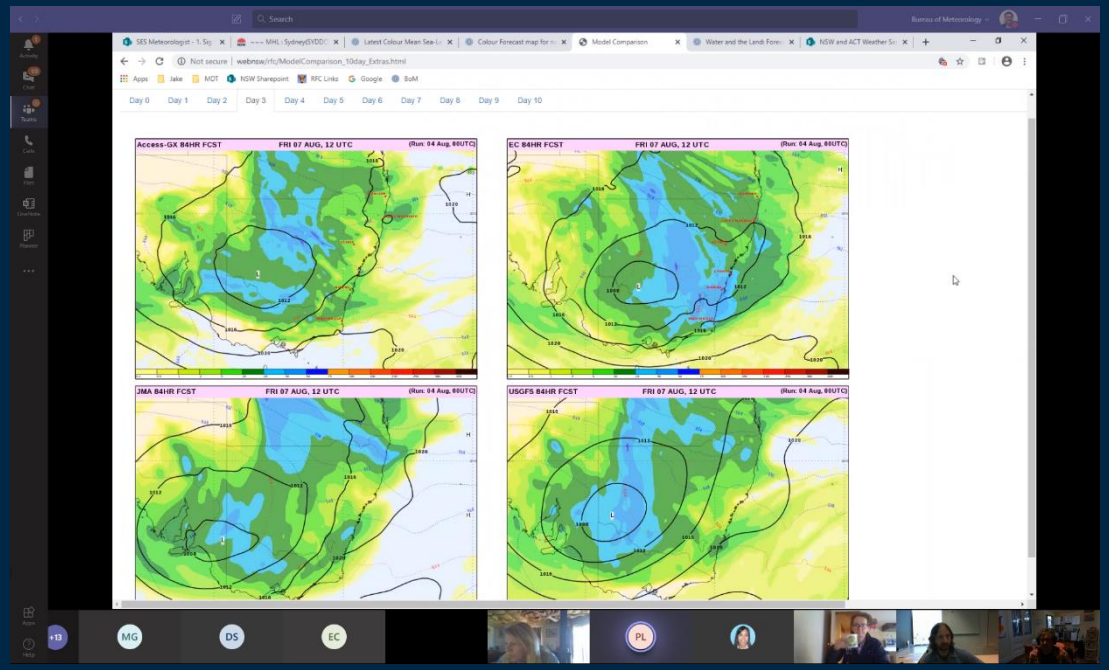
Online Videos

The Decision Makers – Extended Lead Time Flood Forecasting

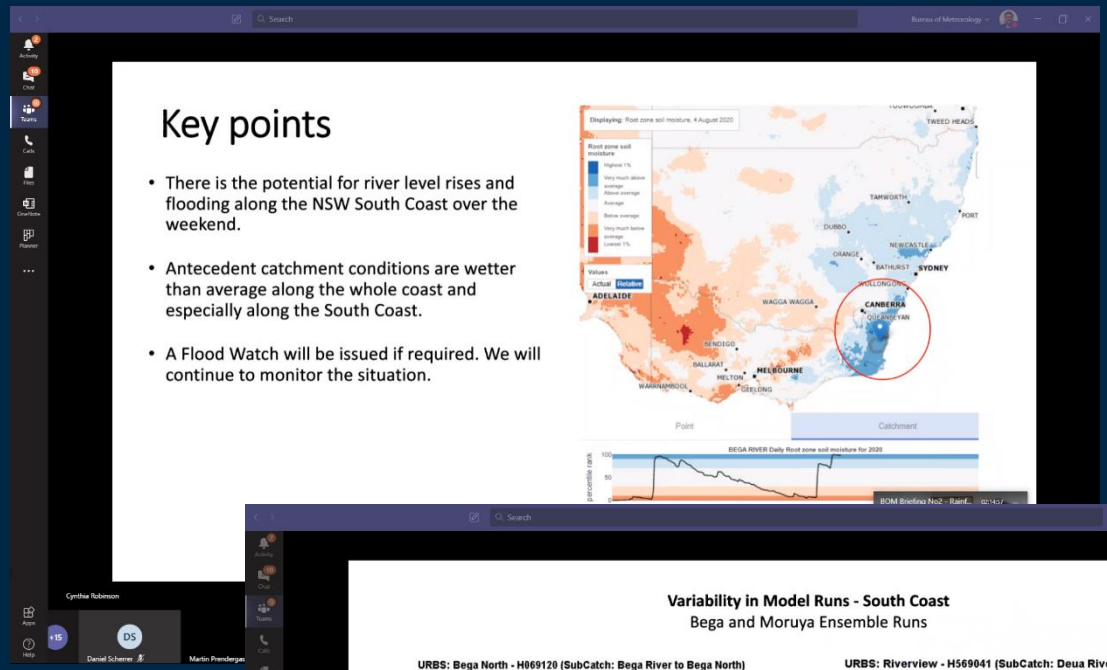
- Key Learning – lots of decisions are made in the days in the lead up to a flood event.

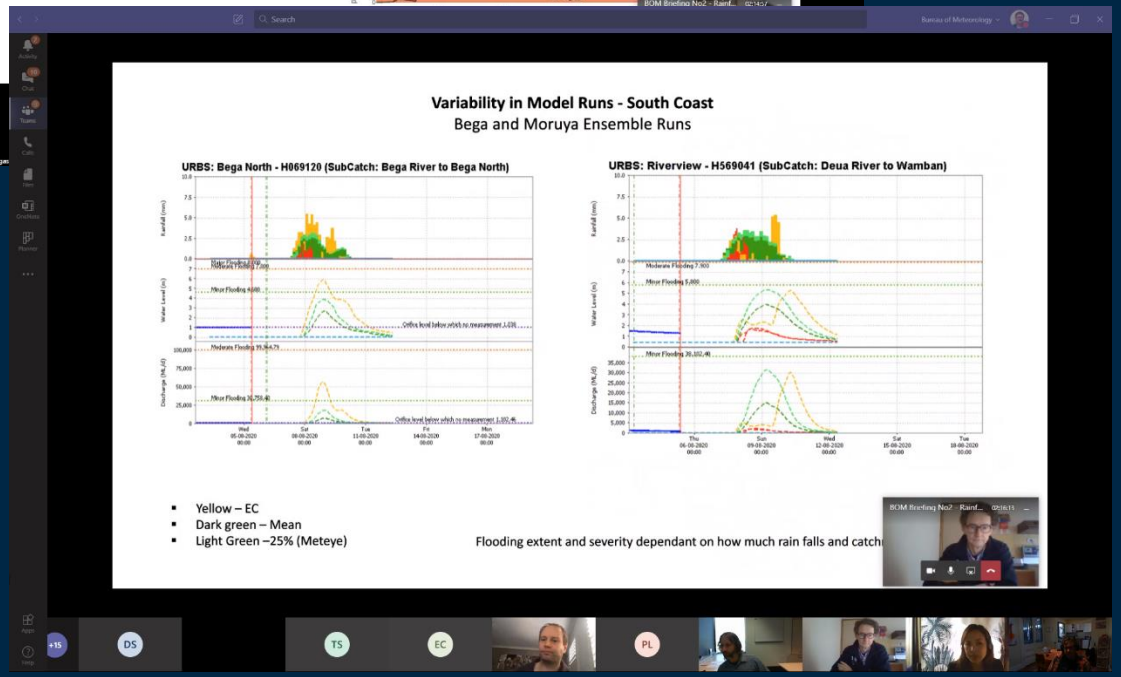
Operational Briefings

The Bureau provides regular briefings to dam operators and emergency services.



Weather





Possible Flood Scenarios

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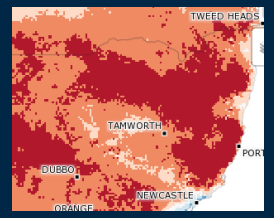
HyFS Flood Forecasting System

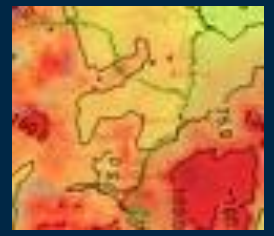
HyFS (Delft-FEWS)

Catchment Wetness

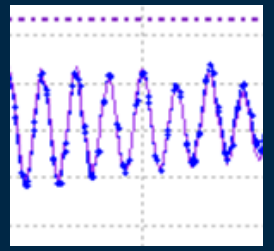


Rainfall and River Observations

Rainfall Forecasts



Tide and Storm Surge Forecasts



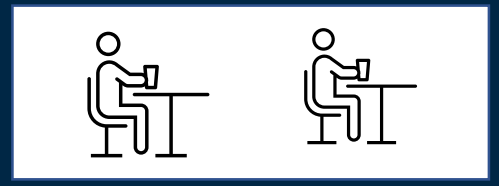
Hydrological Modelling

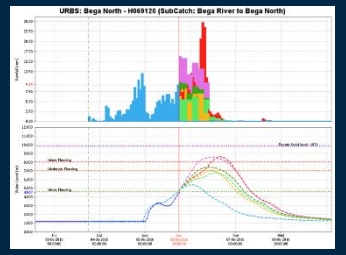
URBS

Reservoir Modelling

RTC-Tools

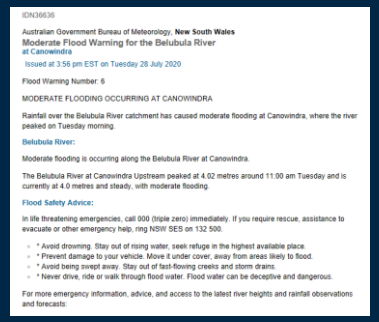
Forecasters



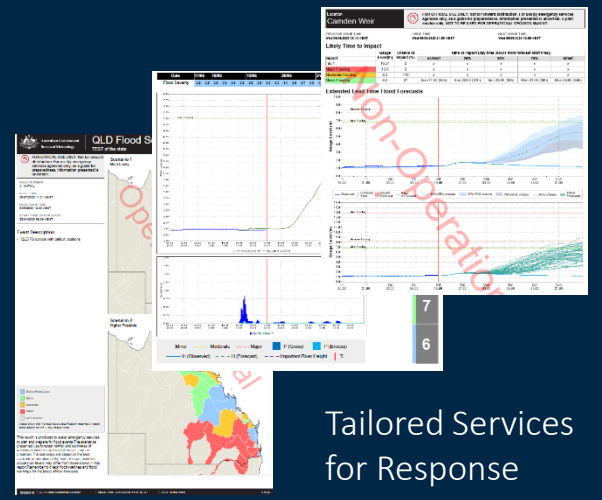


Forecast River Levels, and Flows

Performance Analysis Tool (PAT)



Warnings



Flood Scenarios

Tailored Services for Response Agencies

CAP

CAP and other machine readable formats

Routine Performance Reporting

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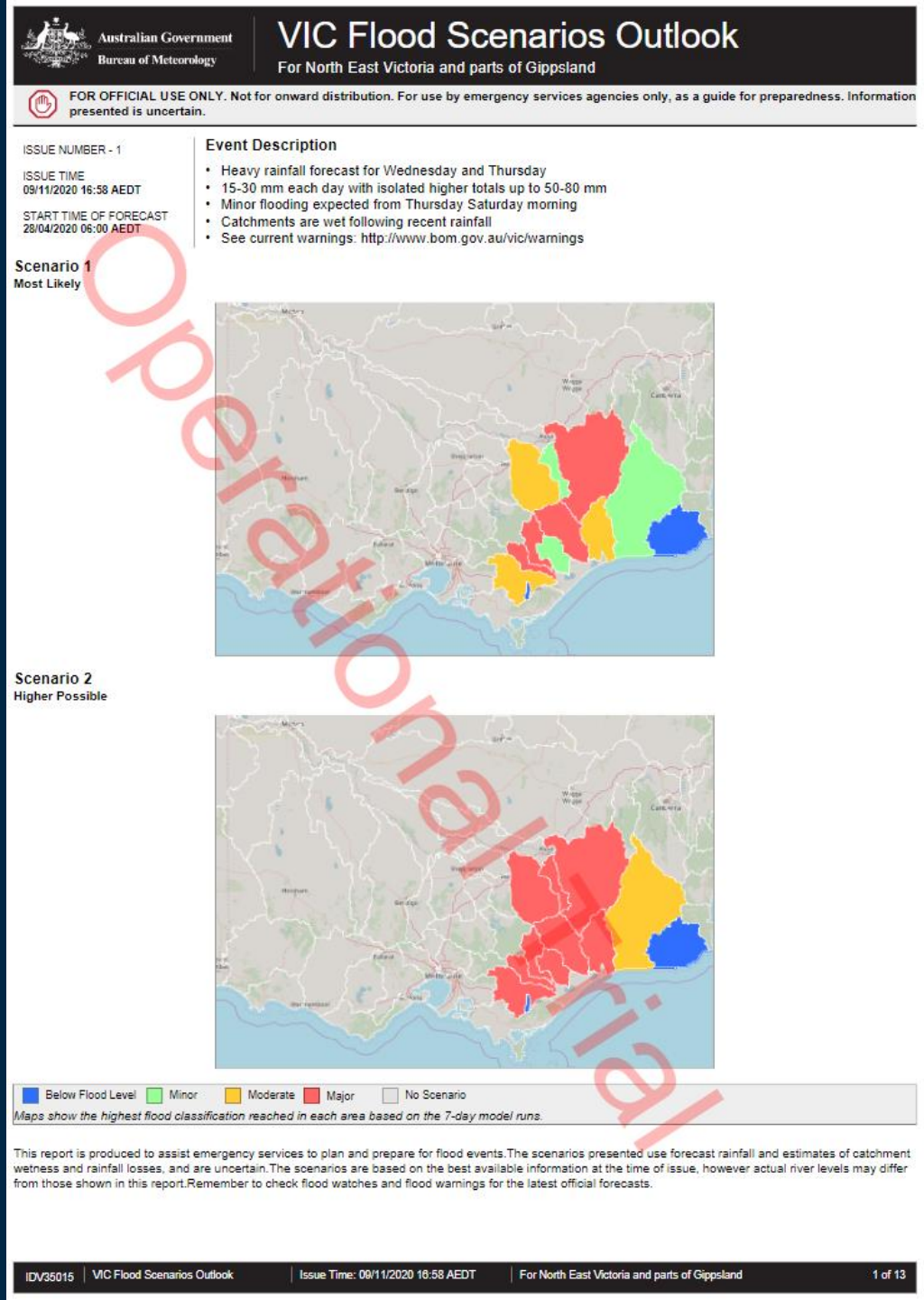
Flood Scenarios Outlook

- Planning service for emergency services.
- PDF report sent to partner agencies via email ahead of flood producing rainfall.
- Visual representation of potential flooding for next 7 days.
- Two different rainfall scenarios.



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VIC Flood Scenarios Outlook

For North East Victoria and parts of Gippsland

FOR OFFICIAL USE ONLY. Not for onward distribution. For use by emergency services agencies only, as a guide for preparedness. Information presented is uncertain.

ISSUE NUMBER - 1

ISSUE TIME
09/11/2020 16:58 AEDT

START TIME OF FORECAST
28/04/2020 06:00 AEDT

Event Description

- Heavy rainfall forecast for Wednesday and Thursday
- 15-30 mm each day with isolated higher totals up to 50-80 mm
- Minor flooding expected from Thursday Saturday morning
- Catchments are wet following recent rainfall
- See current warnings: http://www.bom.gov.au/vic/warnings

Scenario 1
Most Likely

Scenario 2
Higher Possible

Below Flood Level | Minor | Moderate | Major | No Scenario

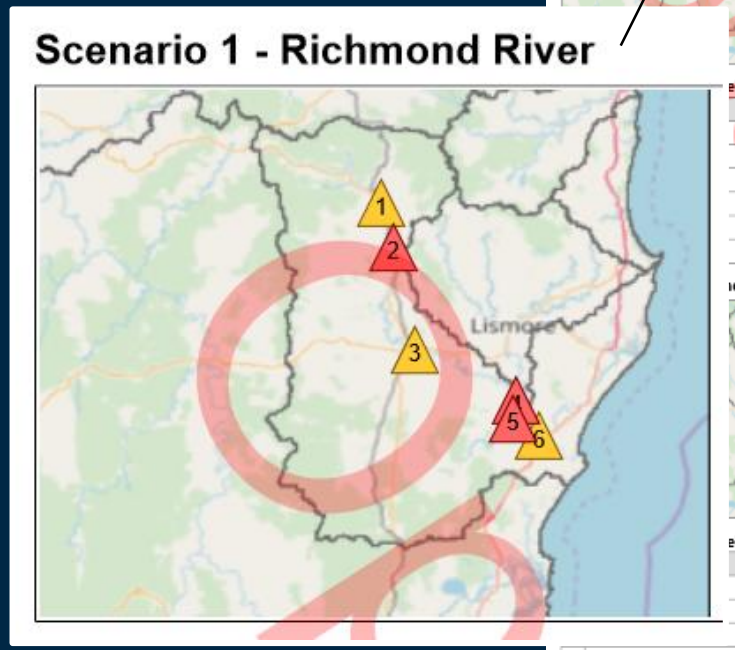
Maps show the highest flood classification reached in each area based on the 7-day model runs.

This report is produced to assist emergency services to plan and prepare for flood events.The scenarios presented use forecast rainfall and estimates of catchment wetness and rainfall losses, and are uncertain.The scenarios are based on the best available information at the time of issue, however actual river levels may differ from those shown in this report.Remember to check flood watches and flood warnings for the latest official forecasts.

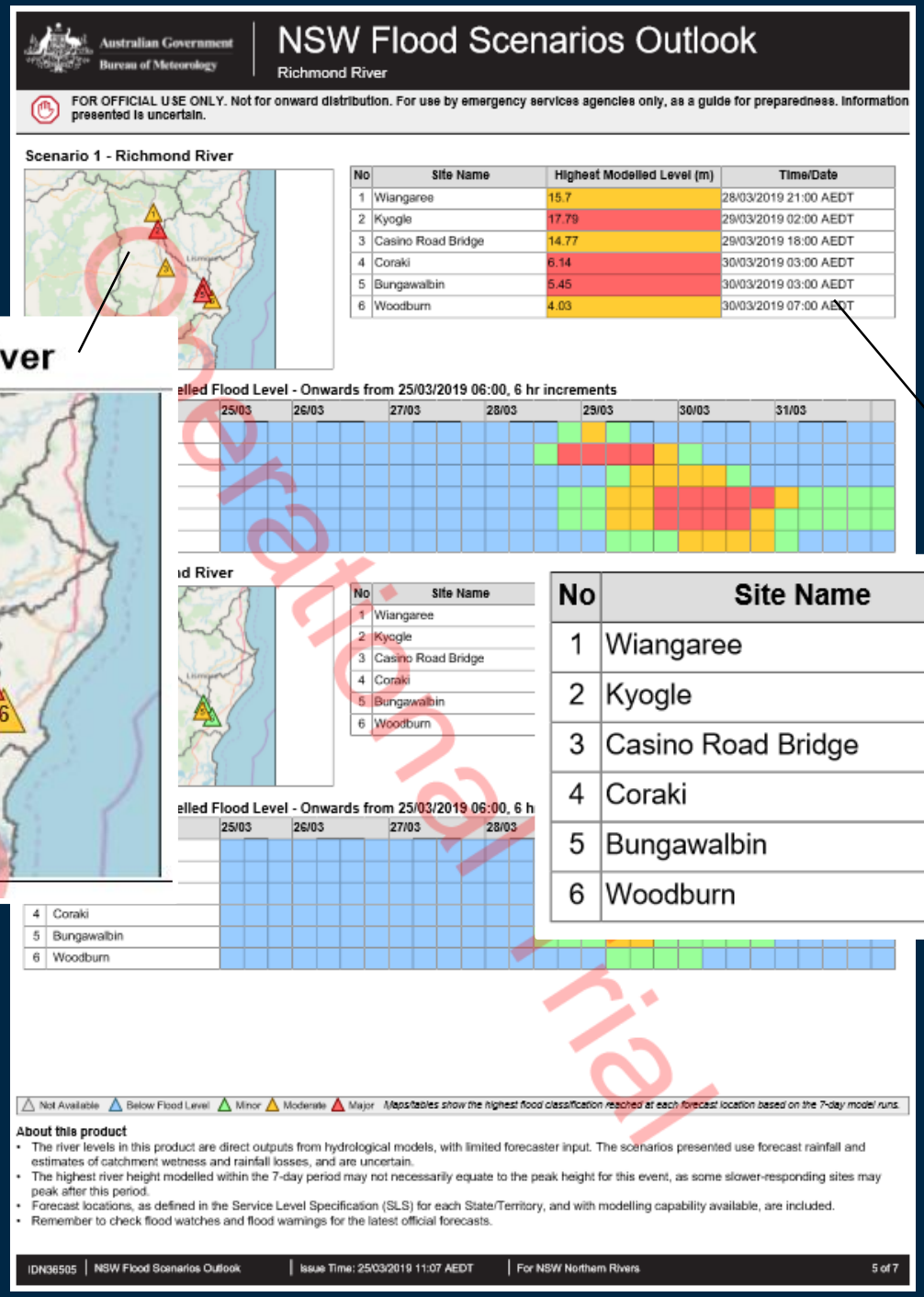
IDV35015 | VIC Flood Scenarios Outlook | Issue Time: 09/11/2020 16:58 AEDT | For North East Victoria and parts of Gippsland | 1 of 13

Page 1:
State Level Summary

Flood Warning Services
Flood Scenarios Outlook



Map



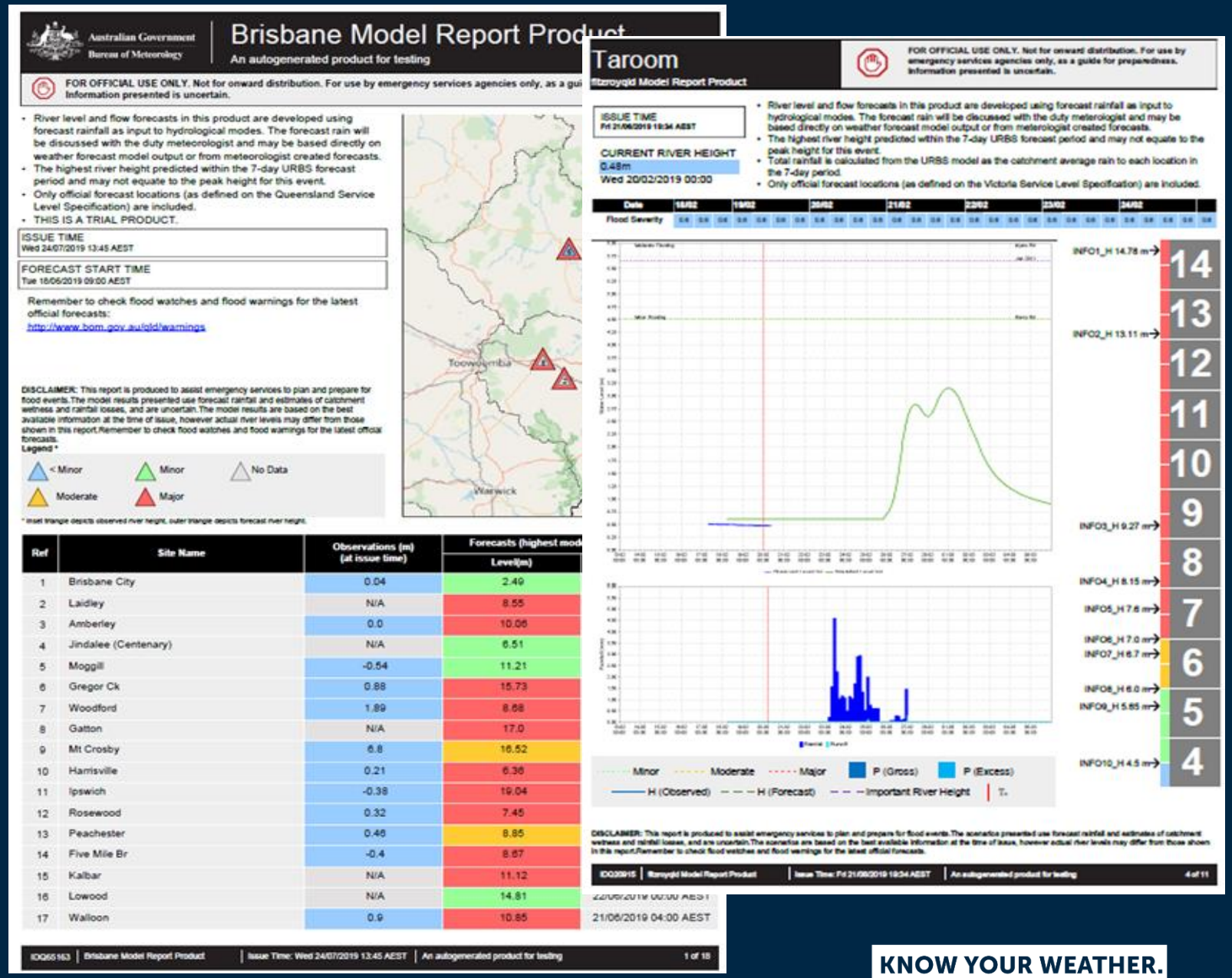
No	Site Name	Highest Modelled Level (m)	Time/Date
1	Wiangaree	15.7	28/03/2019 21:00 AEDT
2	Kyogle	17.79	29/03/2019 02:00 AEDT
3	Casino Road Bridge	14.77	29/03/2019 18:00 AEDT
4	Coraki	6.14	30/03/2019 03:00 AEDT
5	Bungawalbin	5.45	30/03/2019 03:00 AEDT
6	Woodburn	4.03	30/03/2019 07:00 AEDT

Tables with peak modelled heights for each scenario

Separate page for each catchment

Model Results

- Model results for emergency management agencies
- Produces a single deterministic forecast
- Information from HyFS is provided as a PDF as well as machine readable data files.



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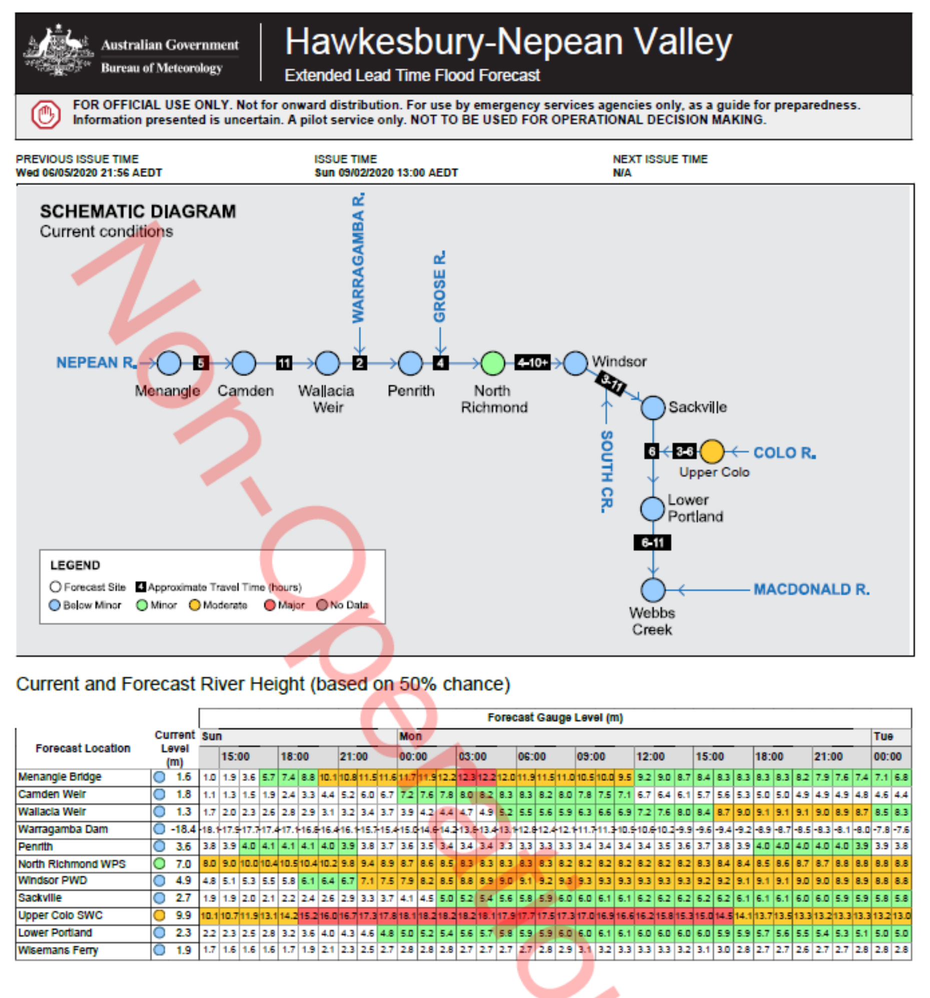
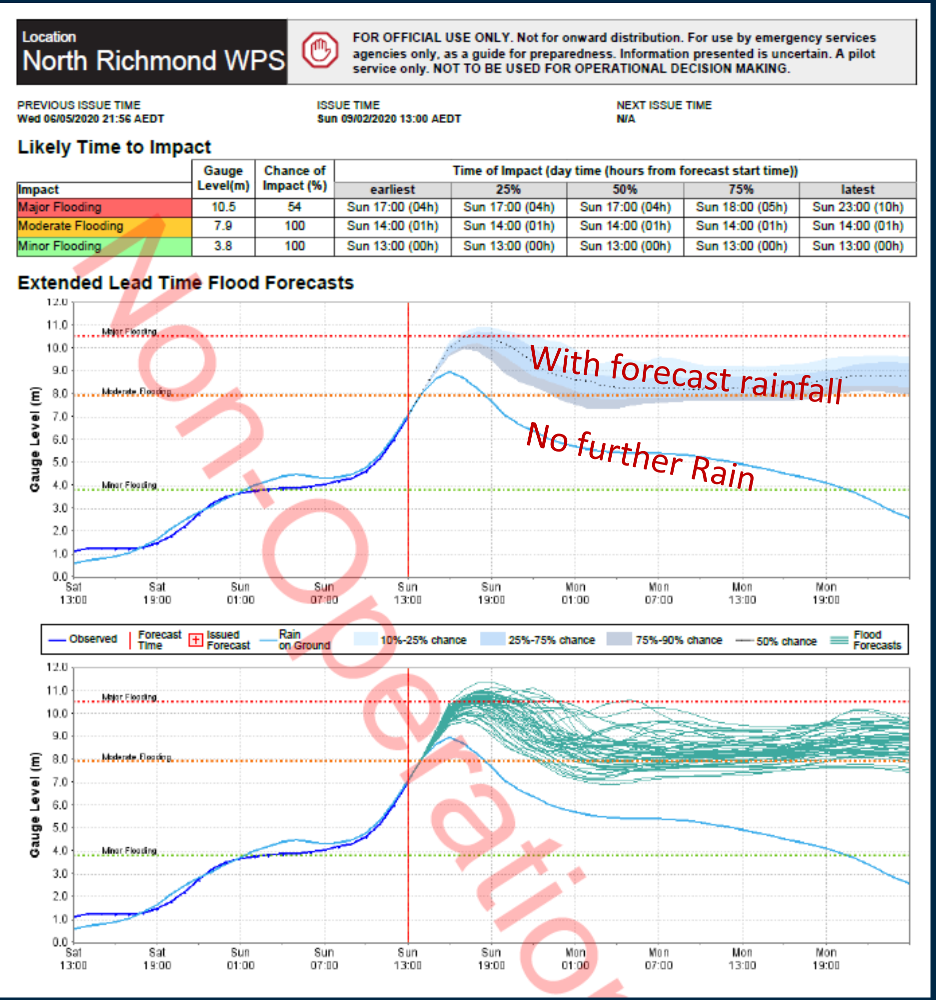
Extended Lead Time Flood Forecasts

- Piloting extended lead time flood forecasts using ensembles
- Co-designed pdf products with machine readable formats
- For extended lead-time flood forecasts decision makers need to understand the level of uncertainty when they are making their decisions.



Summary Cover Page

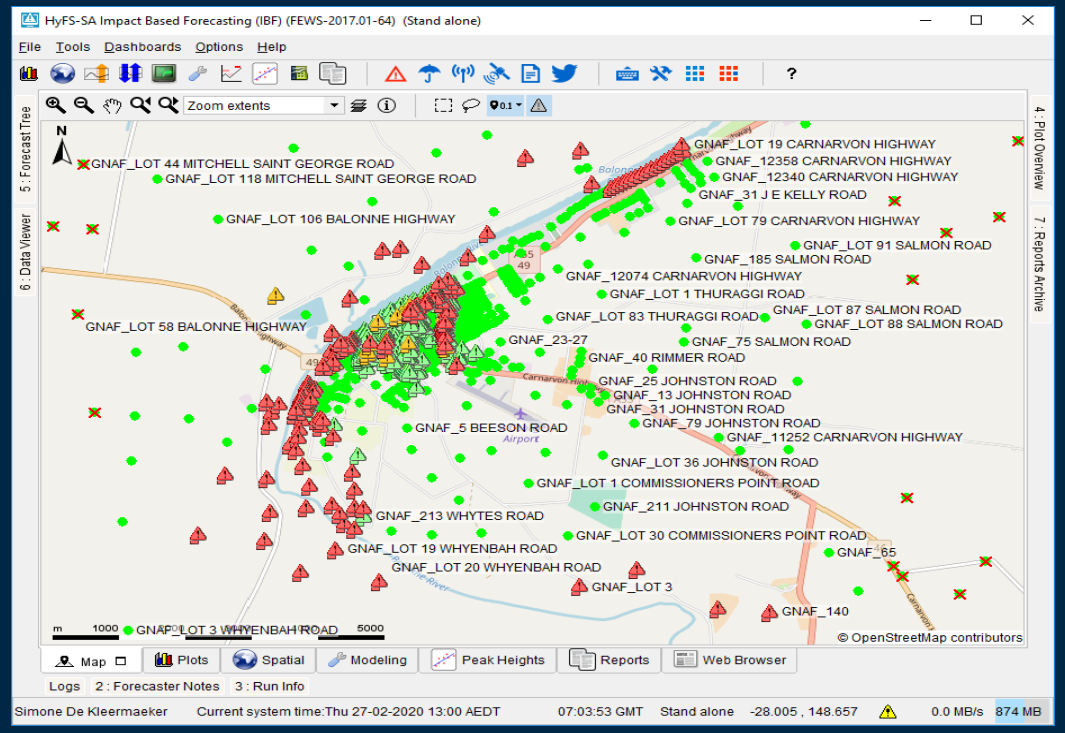


Impact	Gauge Level(m)	Chance of Impact (%)	earliest	25%	50%	75%	latest
Major Flooding	10.5	54	Sun 17:00 (04h)	Sun 17:00 (04h)	Sun 17:00 (04h)	Sun 18:00 (05h)	Sun 23:00 (10h)
Moderate Flooding	7.9	100	Sun 14:00 (01h)	Sun 14:00 (01h)	Sun 14:00 (01h)	Sun 14:00 (01h)	Sun 14:00 (01h)
Minor Flooding	3.8	100	Sun 13:00 (00h)	Sun 13:00 (00h)	Sun 13:00 (00h)	Sun 13:00 (00h)	Sun 13:00 (00h)

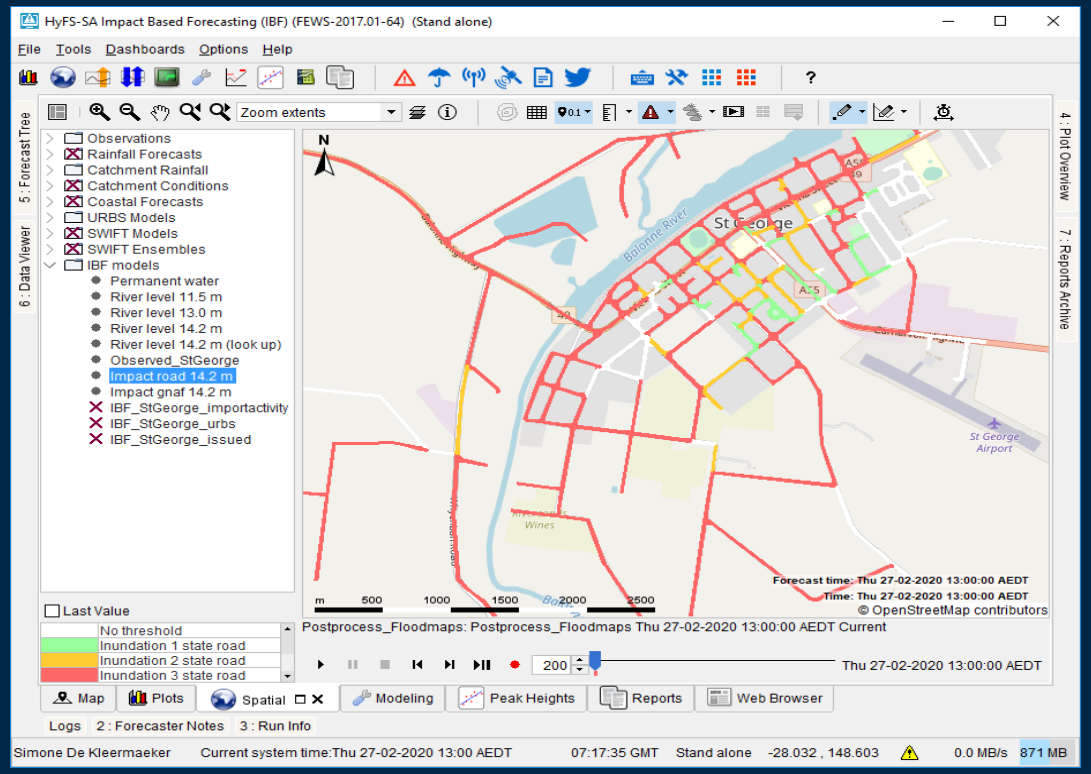
Site Pages

Impact Based Forecasting Services

- Proof of concept for an impact-based flood forecasting service, with Queensland, Fire and Emergency Services, Queensland Department of Transport and Main Roads Geoscience Australia.



People and property impacts



Road impacts

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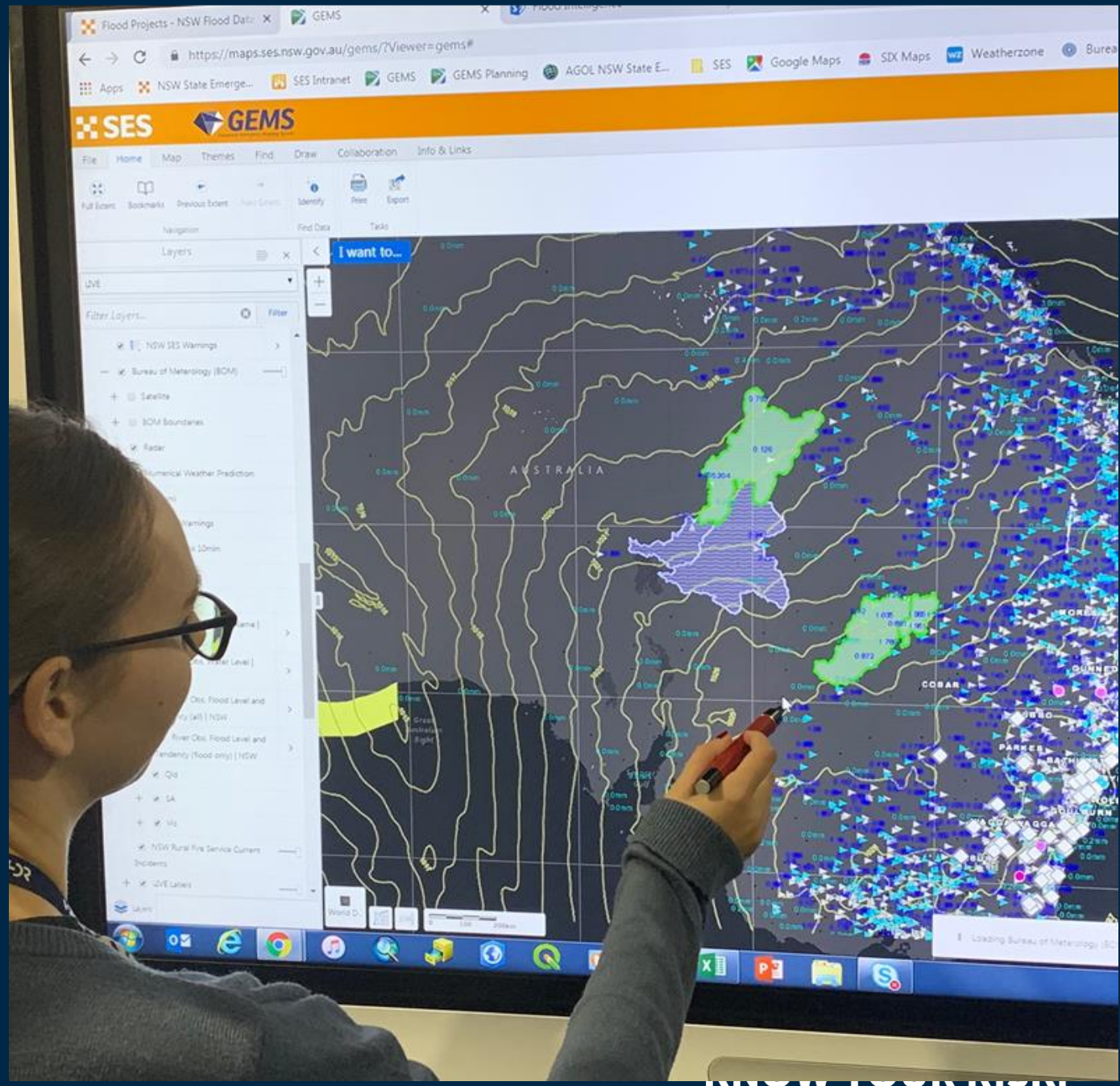
Machine Readable Formats

Flood Watches and Warnings are available in multiple formats:

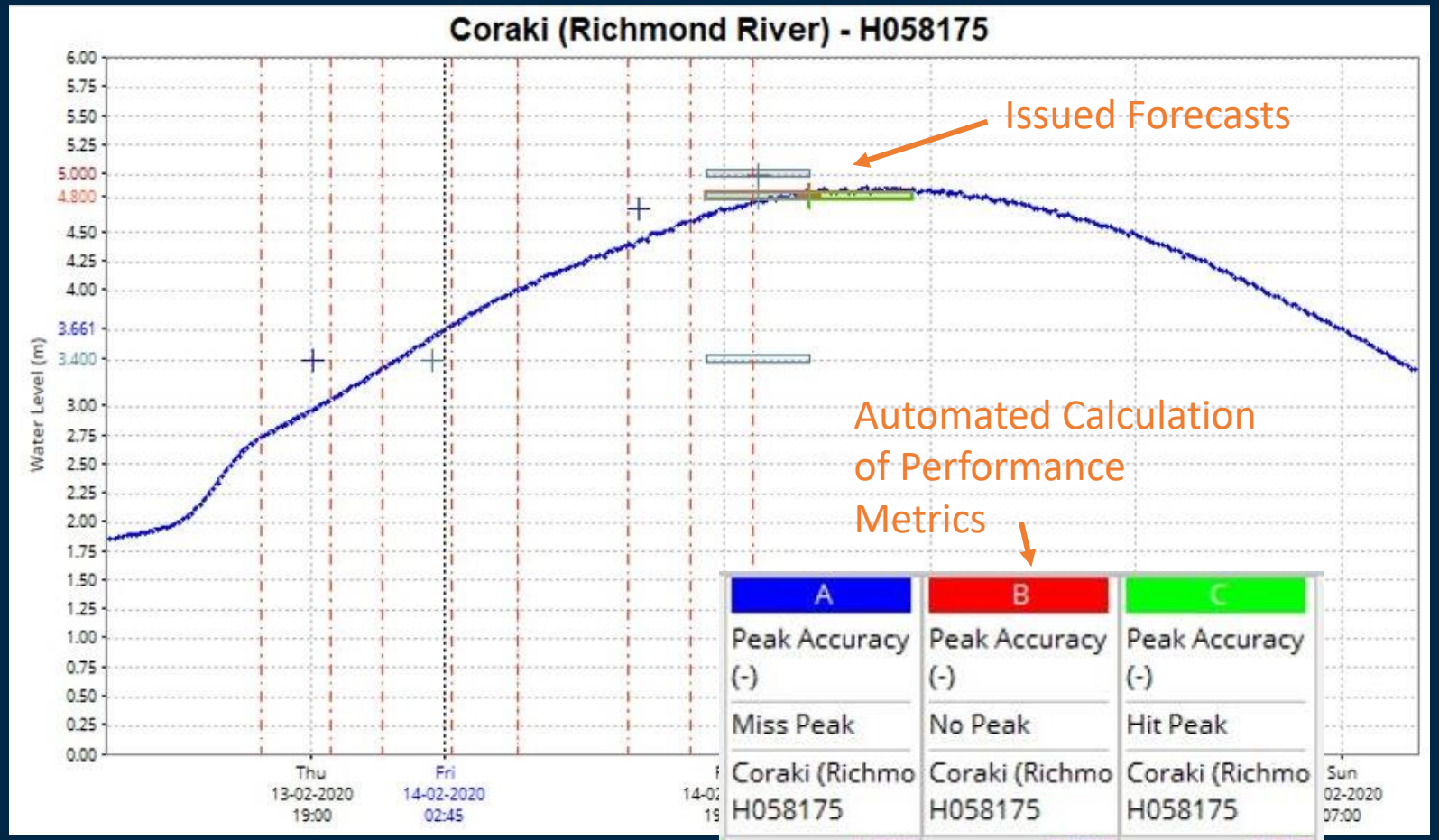
- Human Readable Formats – text (ASCII) and PDF as well as HTML.
- They are also available in Machine Readable formats including CAP (Common Alerting Protocol) and as a Web Mapping Service.

The tailored forecasting products are available as both PDF and machine readable formats



The NSW SES have integrated the Bureau's Web Mapping Products into GEMS (Kirra Waine)

Performance Analysis Tool (in development)



A	B	C
Peak Accuracy (-)	Peak Accuracy (-)	Peak Accuracy (-)
Miss Peak	No Peak	Hit Peak
Coraki (Richmo H058175	Coraki (Richmo H058175	Coraki (Richmo H058175
0.000	0.000	4.000

Performance Measures are aggregate for each state, territory and for Australia

Timeliness

On Time % Watch	On Time % Warning and W
New South Wal NSW	New South Wal NSW
90.909	83.219

Leadtime

Leadtime (-)	Leadtime (-)
Hit %	False Alarm %
New South Wal NSW	New South Wal NSW
60.000	44.444

Accuracy

Peak Accuracy (-)	Peak Accuracy (-)
No Peak %	Hit Peak %
New South Wal NSW	New South Wal NSW
34.351	80.916

Key Points

- Communication of forecasts and warnings is essential if you want communities to take action and make the best decisions.
- The information needs of the public are different to that of response agencies and the Bureau is developing co-designed tailored services to meet their decision making needs.
- Extended lead time flood forecasts – means that we need to communicate both what is the most likely as well as other possible scenarios.
- Currently developing automated verification of our forecasts and warnings for both internal and external stakeholders.

Hawkesbury Nepean Flood Simulation Exercise with NSW SES

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