

# Canary: Network Resilience in a Changing Climate

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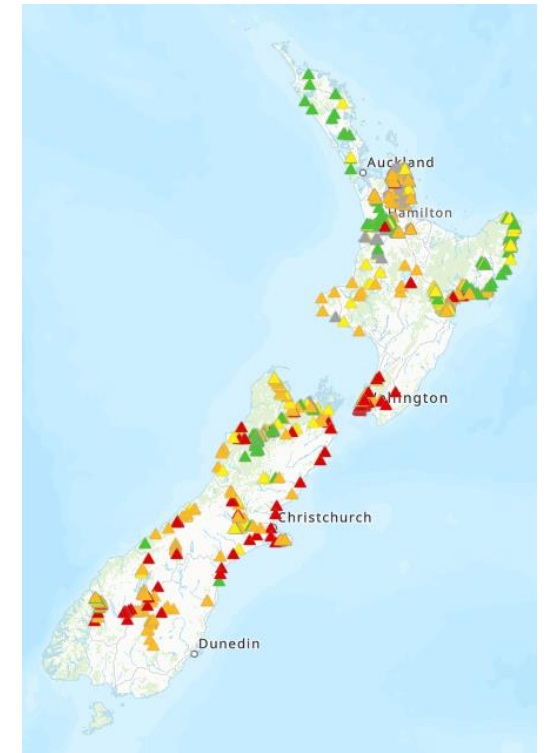
# Agenda

- Strategic Context
- The Problem
- Background of Canary
- Optimising Decisions
- Events and Assets Compatible
- How it Works
- Examples and applications
- Future Development
- Summary



# Strategic Context

- “Resilience is about keeping our roads open so people can get to where they are going despite unplanned events” – NZTA
- \$419M resilience funding made available in 2023 as part of Transport Resilience Fund
  - \$100M for LCLR projects (<\$2M)
  - \$179M for ‘small to medium’ projects (\$2M-\$10M)
  - \$140M for local road upgrades
- Draft GPS has **Increased Maintenance & Resilience** as one of four key strategic priorities
- Often funding gaps – some sites will require management of risk



Draft Government  
Policy Statement  
on land transport  
2024-34

# The Problem



# Background of Canary

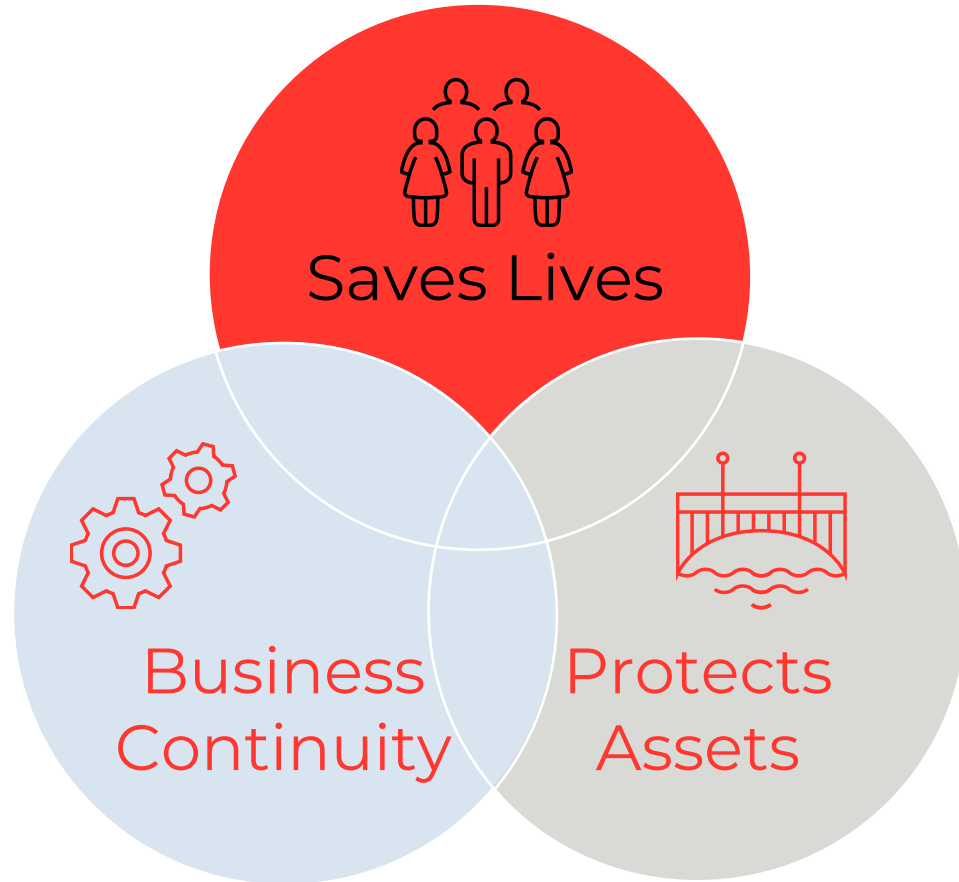


# Trigger Action Response Plans

- TARP Example
- Proactive way to manage risk in lieu of significant investment
- Becoming widely used by NZTA, especially in a bridging, hydrological and geotechnical contexts
- Trigger Action Response Plans for Bridges – NZTA Guidance document produced by WSP for NZTA

Status	Trigger	Action	Response
<b>White Status</b> (Preparedness Phase)	High Rainfall or significant event forecast (i.e., NIWA RED warning level)	<b>SMC</b> to commence monitoring of flow levels. <b>SMC</b> and <b>NOC</b> to make contact. <b>NOC</b> to place Traffic Management on call to be deployed as required.	<b>SMC</b> or <b>NOC</b> to notify all parties of green status if green trigger is reached.
<b>Green Status</b> (Moderate Risk)	River flow rate or debris > <b>Green Threshold Level</b>	Twice-daily day time monitoring by <b>NOC</b> ; report observations to <b>SMC</b> . <b>SMC</b> to review any information or photos from <b>NOC</b> .	<b>SMC</b> to advise any increased monitoring or response required based on performance of structure.
<b>Amber Status</b> (High Risk)	River flow rate or debris > <b>Amber Threshold Level</b>	<b>NOC</b> to close the bridge to traffic during dark hours. Continuous daytime monitoring by <b>NOC</b> ; report observations to <b>SMC</b> . <b>SMC</b> to review any information or photos from <b>NOC</b> .	<b>SMC</b> to advise any increased monitoring or response required based on performance of structure.
<b>Red Status</b> (Critical Risk)	River flow rate or debris > <b>Red Threshold Level</b>	<b>NOC</b> to close structure to all traffic. <b>NOC</b> to immediately call client and <b>SMC</b> . All parties to follow Emergency Protocols and Procedures.	<b>SMC</b> and/or <b>NOC</b> to continuously monitor the bridge throughout closure until flood water levels are subsiding.

# Optimising decisions based on data



# Event and Asset Types

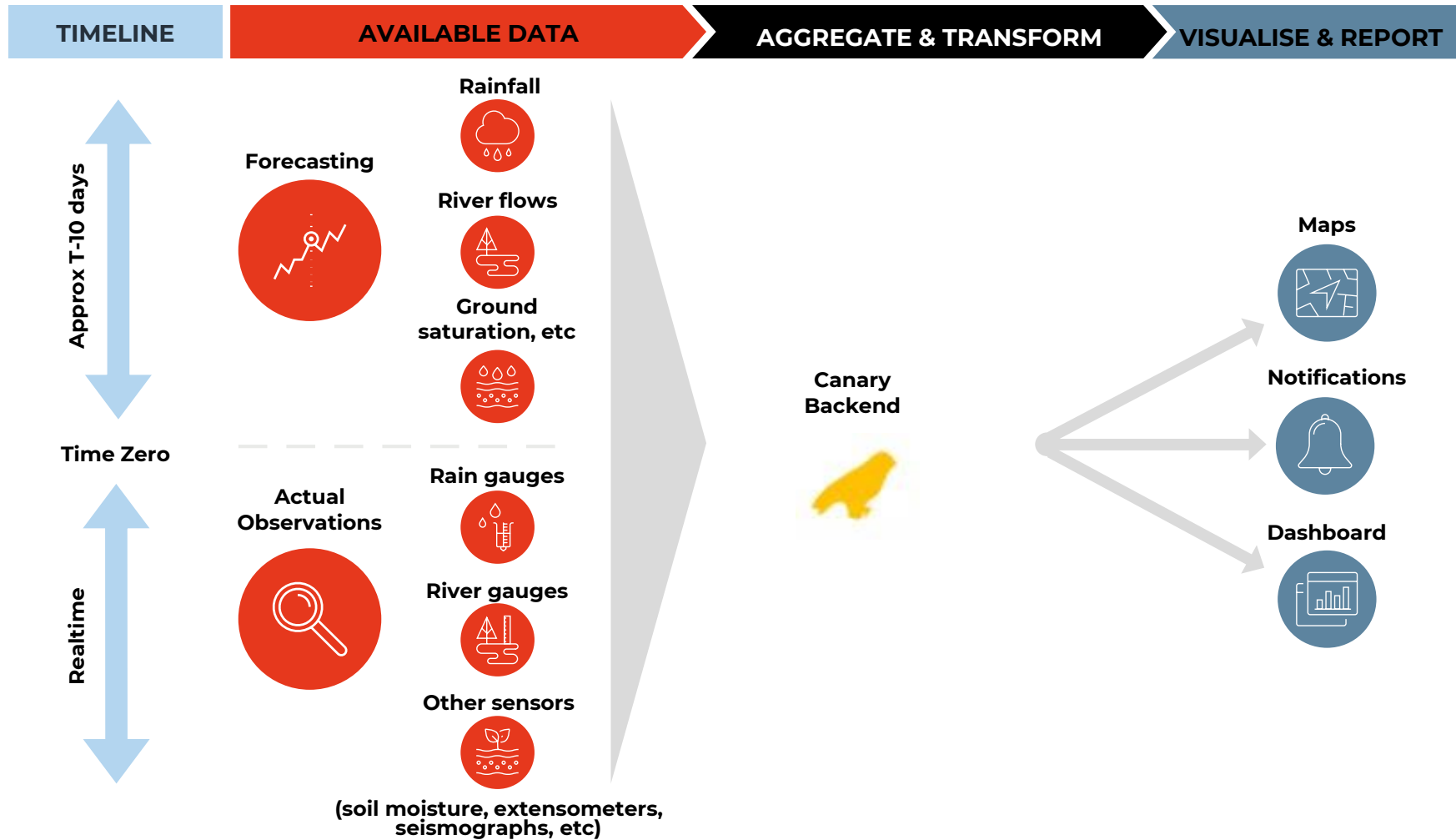


**CANARY**





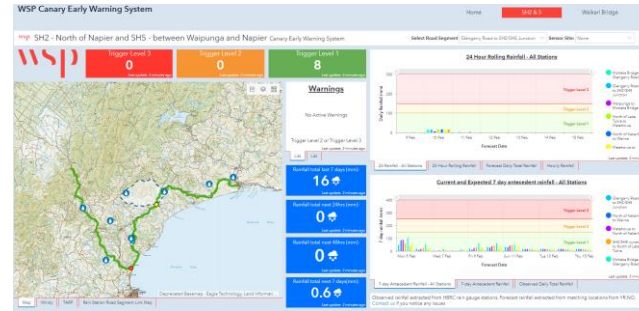
# How it Works



# Event Timeline

## 3-7 days out

- Monitoring dashboard
- Early preparedness



## 3 days out

- Weather Watch alert sent
- Response crews given early warning



## 1 day out

- Weather Warning alert sent
- Response crews stood up
- Comms sent to affected stakeholders

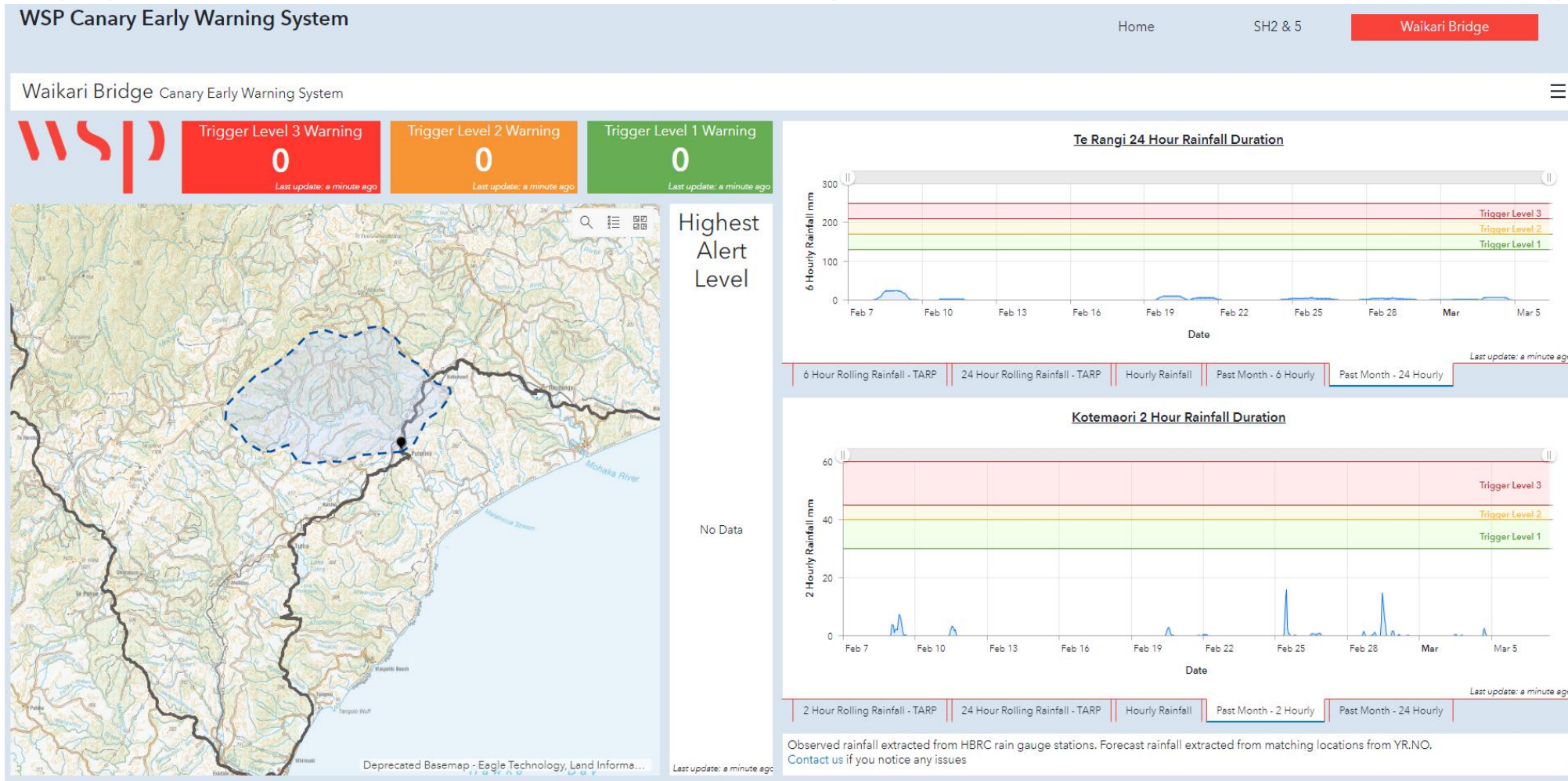


## Realtime

- Monitoring observed weather
- Alerts sent when observed triggers reached



# Applications – Flooding at Vulnerable Bridges



# Applications – Rockfall / slips

WSP SH2 - North of Napier and SH5 - between Waipunga and Napier Canary Early Warning System

Select Road Segment:  Sensor Site:

**Trigger Level 3**  
1  
Last update: 2 minutes ago

**Trigger Level 2**  
2  
Last update: 2 minutes ago

**Trigger Level 1**  
6  
Last update: 2 minutes ago

Map | Windy | TARP | Rain Station Road Segment Link Map

### Sensor TARP

- Morere Hill: blue
- White Pine: blue
- Devils Elbow: red

Last update: 2 minutes ago

List

**Rainfall total last 7 days (mm):**  
1.5 ☁️  
Last update: 2 minutes ago

**Rainfall total next 24hrs (mm):**  
0 ☁️  
Last update: 2 minutes ago

**Rainfall total next 48hrs (mm):**  
1.2 ☁️  
Last update: 2 minutes ago

**Rainfall total next 7 days (mm):**  
3.6 ☁️  
Last update: 2 minutes ago

### 24 Hour Rolling Rainfall - All Stations

Last update: 2 minutes ago

24 Rainfall - All Stations | 24 Hour Rolling Rainfall | Forecast Daily Total Rainfall | Hourly Rainfall

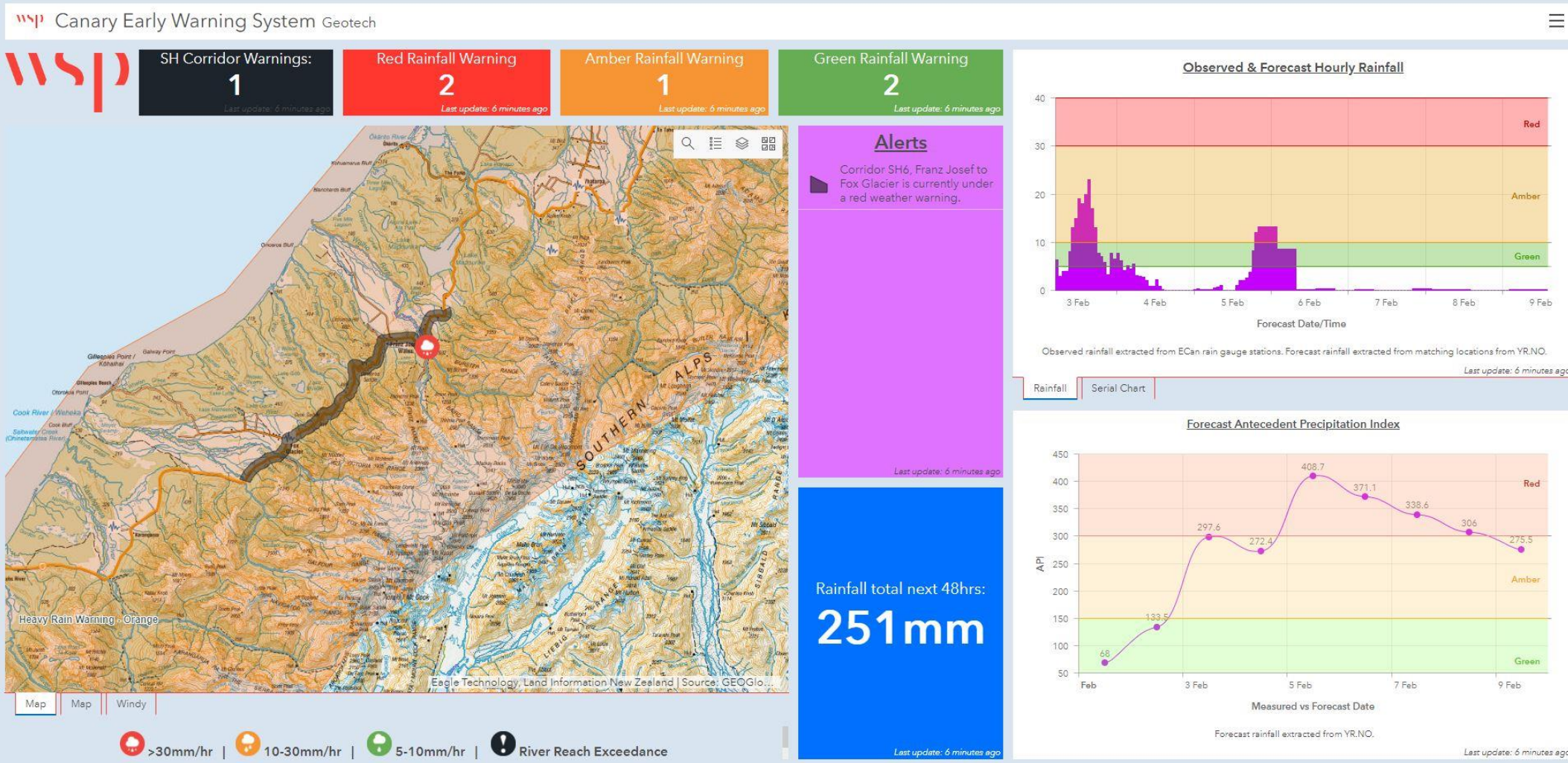
### Current and Expected 7 day antecedent rainfall - All Stations

Last update: 2 minutes ago

7-day Antecedent Rainfall - All Stations | 7-day Antecedent Rainfall | Observed Daily Total Rainfall

Observed rainfall extracted from HBRC rain gauge stations. Forecast rainfall extracted from matching locations from YR.NO. Contact us if you notice any issues

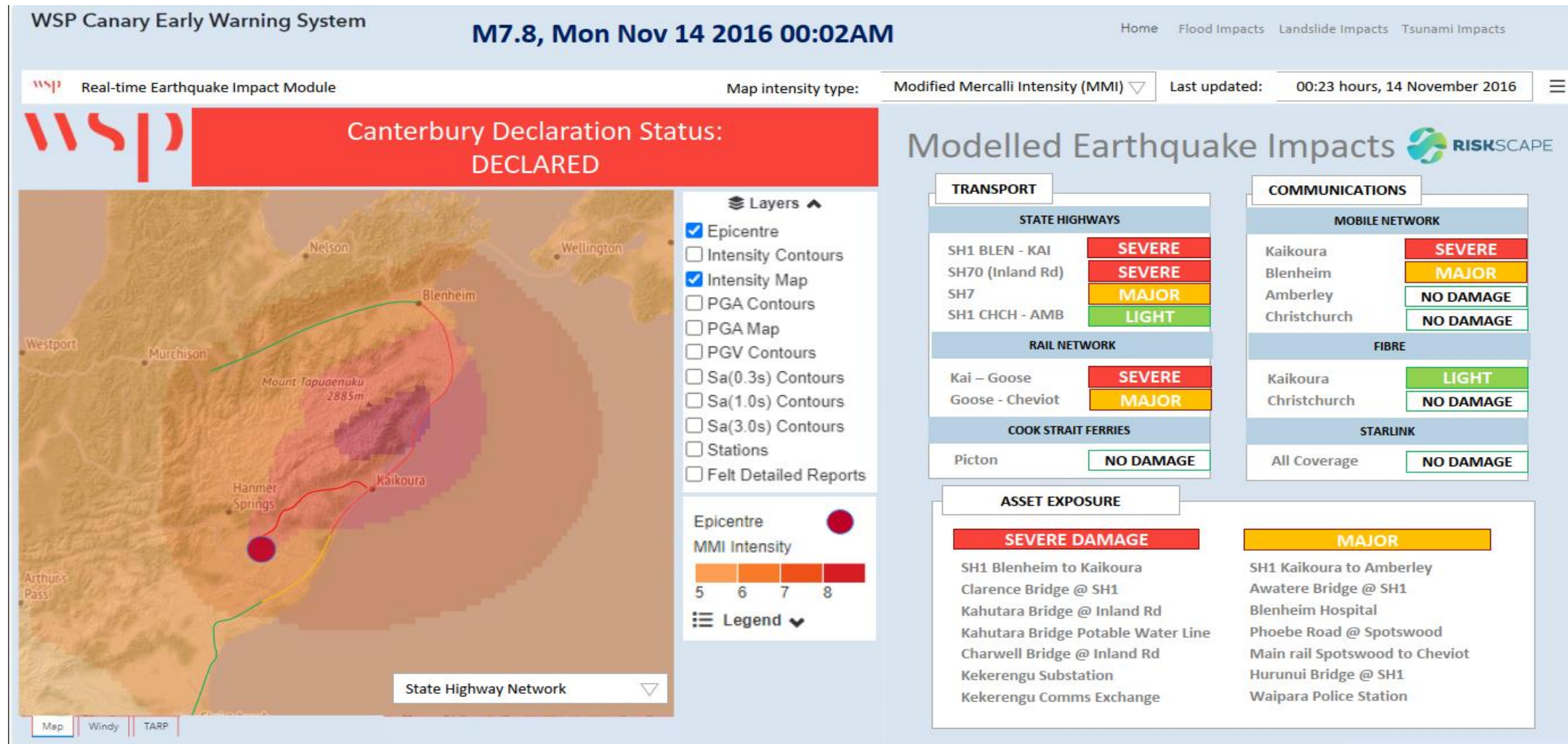
# Example – West Coast debris flow



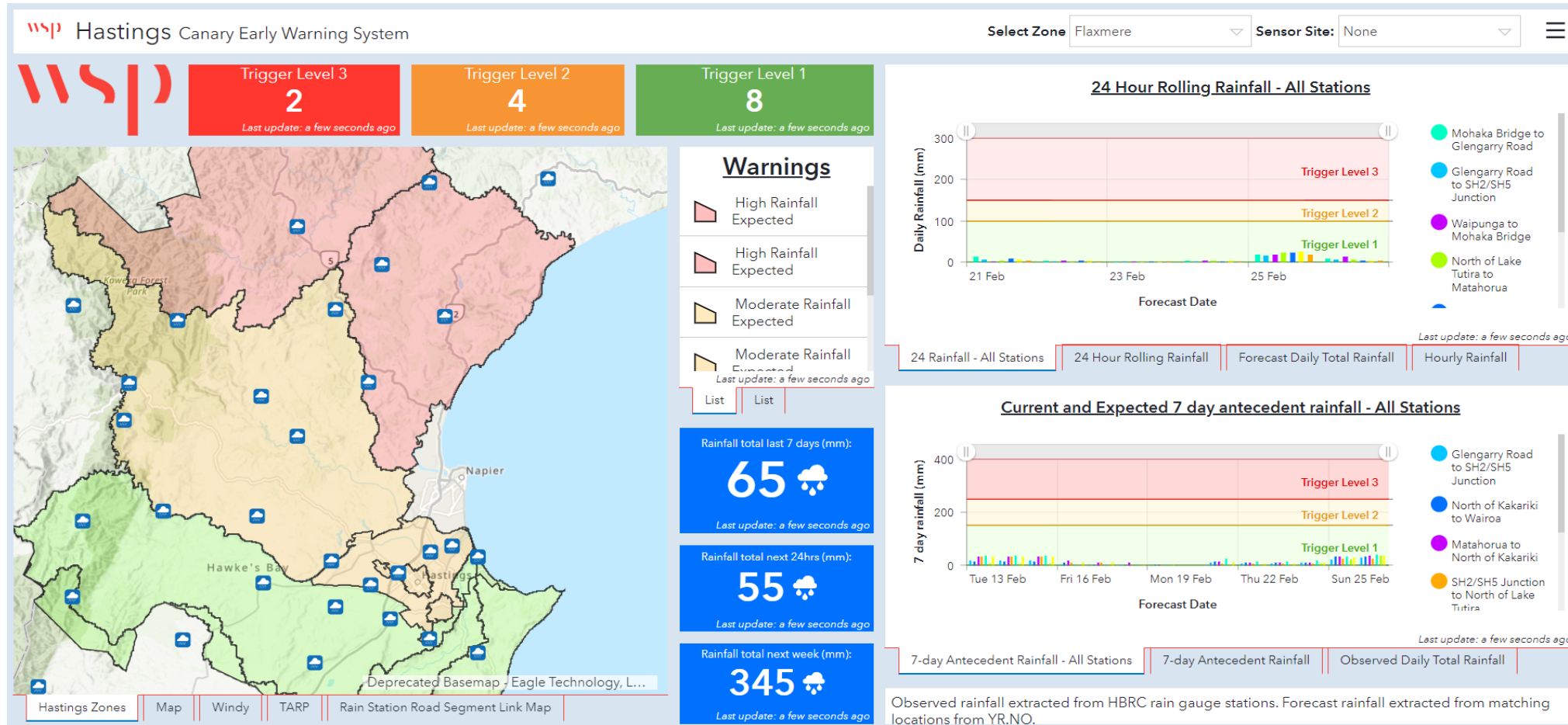
# Example – West Coast debris flow



# Applications – Seismic Response



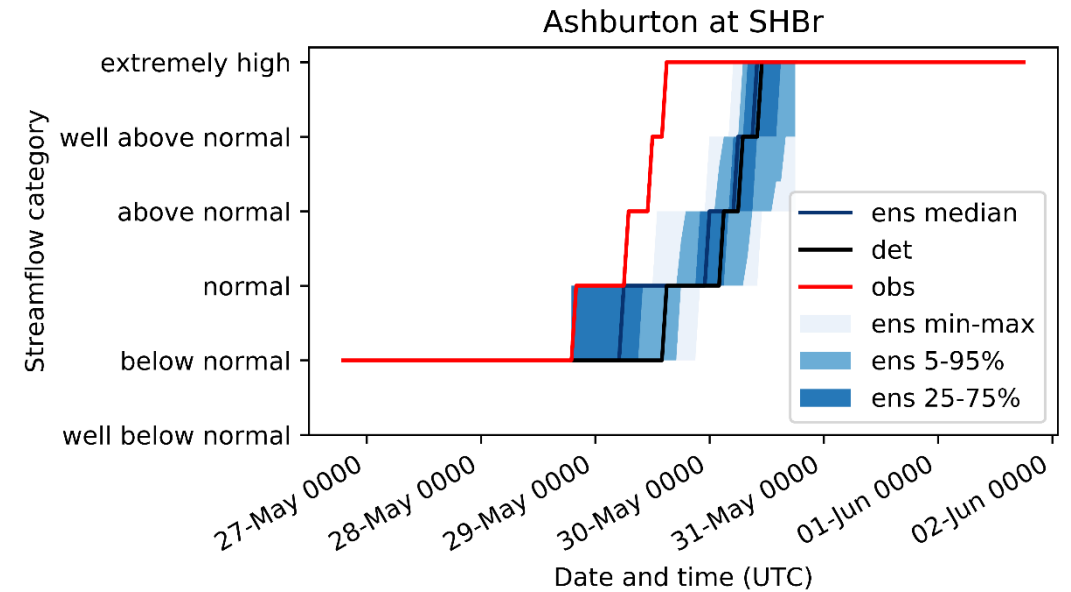
# Applications – Inspection Response





# Future Development

- Working with NIWA for enhanced forecasting, especially river flow forecasting
- Addition of other asset types (e.g. rail, water) and hazards (e.g. ice, snow, heat, wind, storm surge)
- Machine learning analytics to refine automatically trigger levels
- Using GNS landslide forecast modelling



# Summary

- Changing climate exposing more vulnerabilities in assets and respective response plans.
- Government focus on enhanced resilience of roading networks.
- Canary can optimise your preparation and response to events using a data-based approach. This can enable:
  - Cost savings by avoiding unnecessary responses,
  - Being better prepared for events, and
  - Asset owners to sleep better at night.
- Do you think you're doing everything you can to protect your assets, save lives and maintain business continuity?

# Questions & Contact Details



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