

Showcase session 2: Too much water and too little water



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Overview of Session

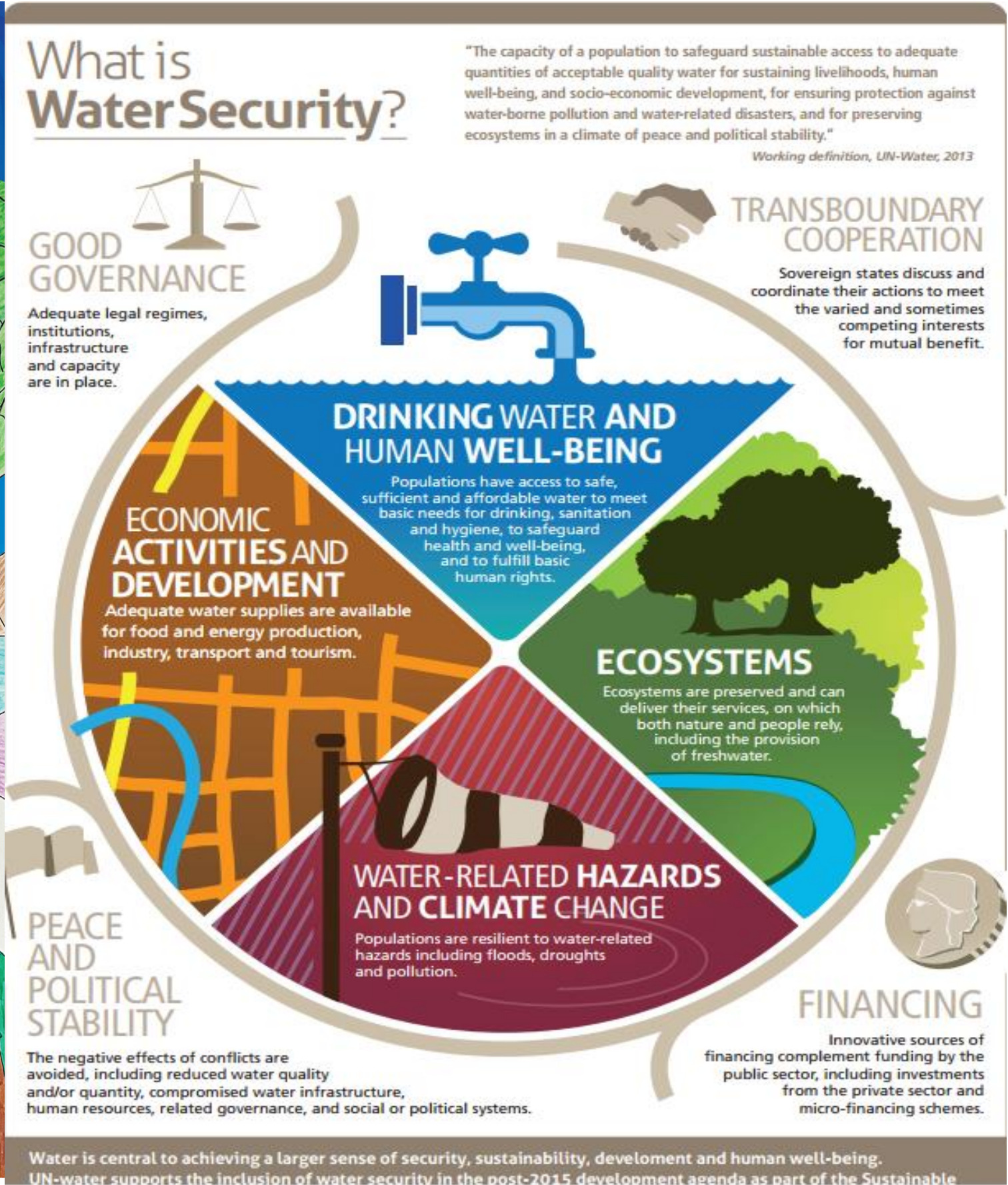
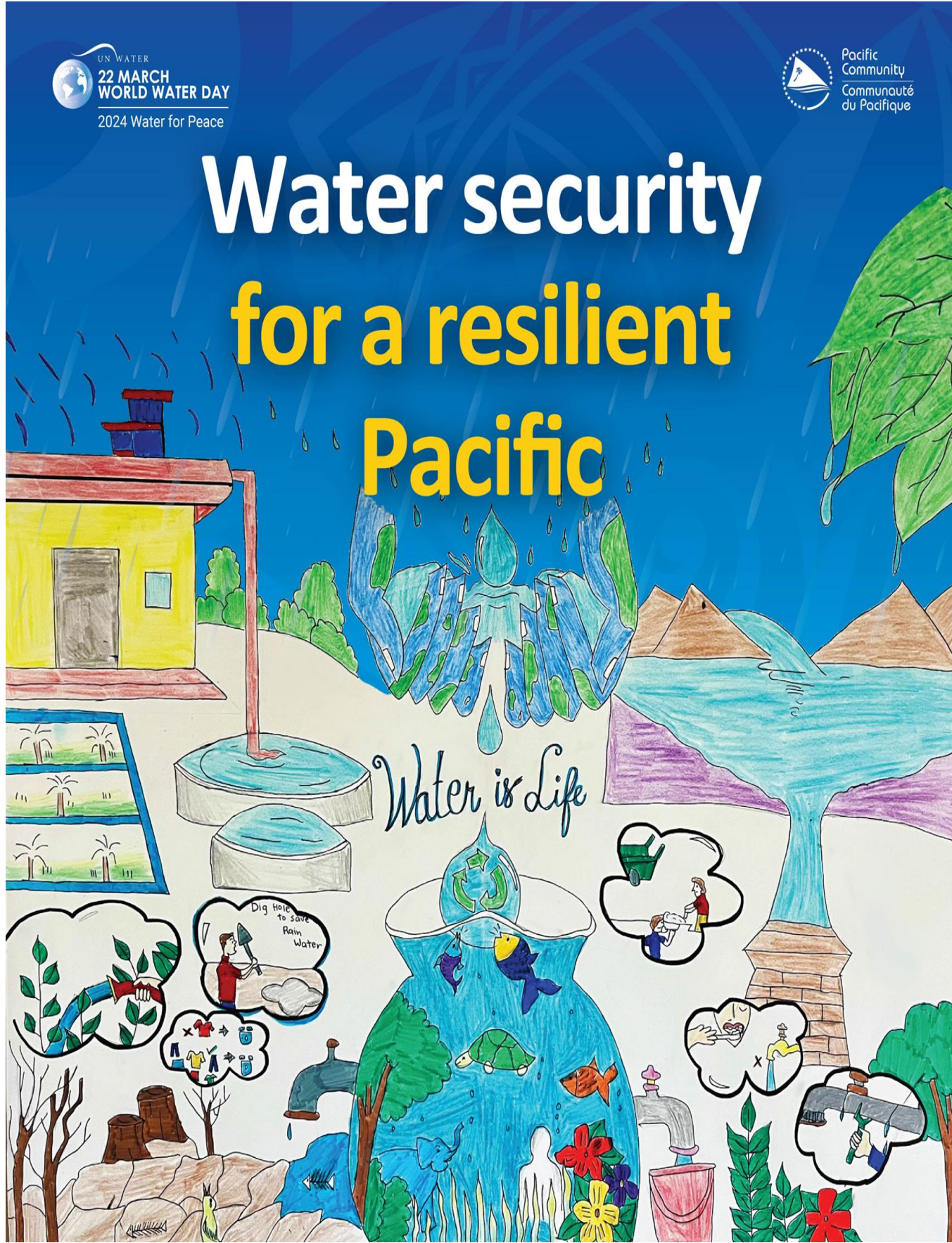
Session Objective

Highlight water security as a critical element of resilience.

Key Focus:

- I. Increasing engagement on Water Security as a key determinant of resilience
- I. Framework for understanding flood early warning systems.
- II. Drought Management Approach

Increasing engagement on Water Security as a key determinant of resilience



Working definition, UN-Water, 2013

The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.”

Is there a more relevant definition for water security?

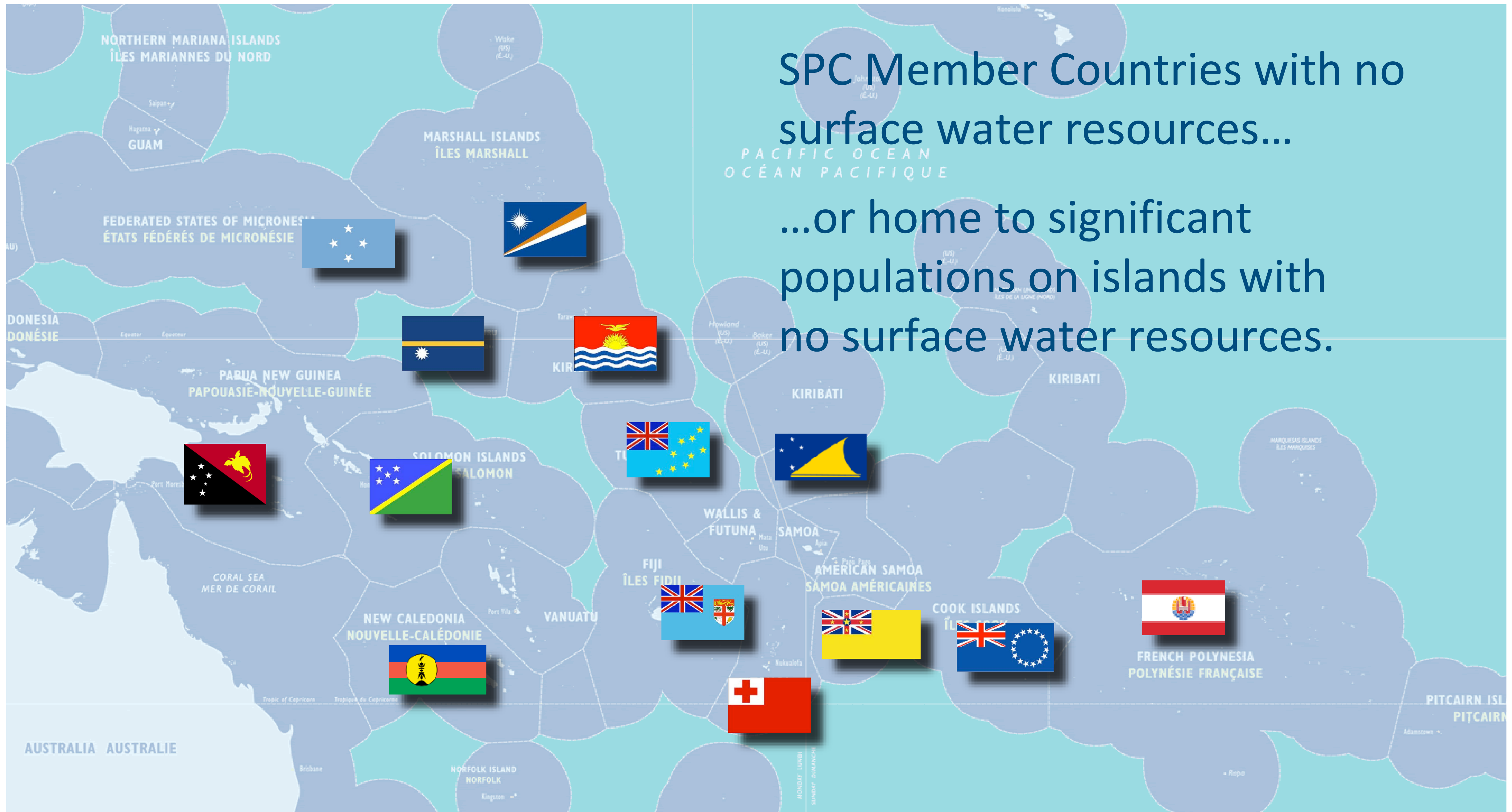


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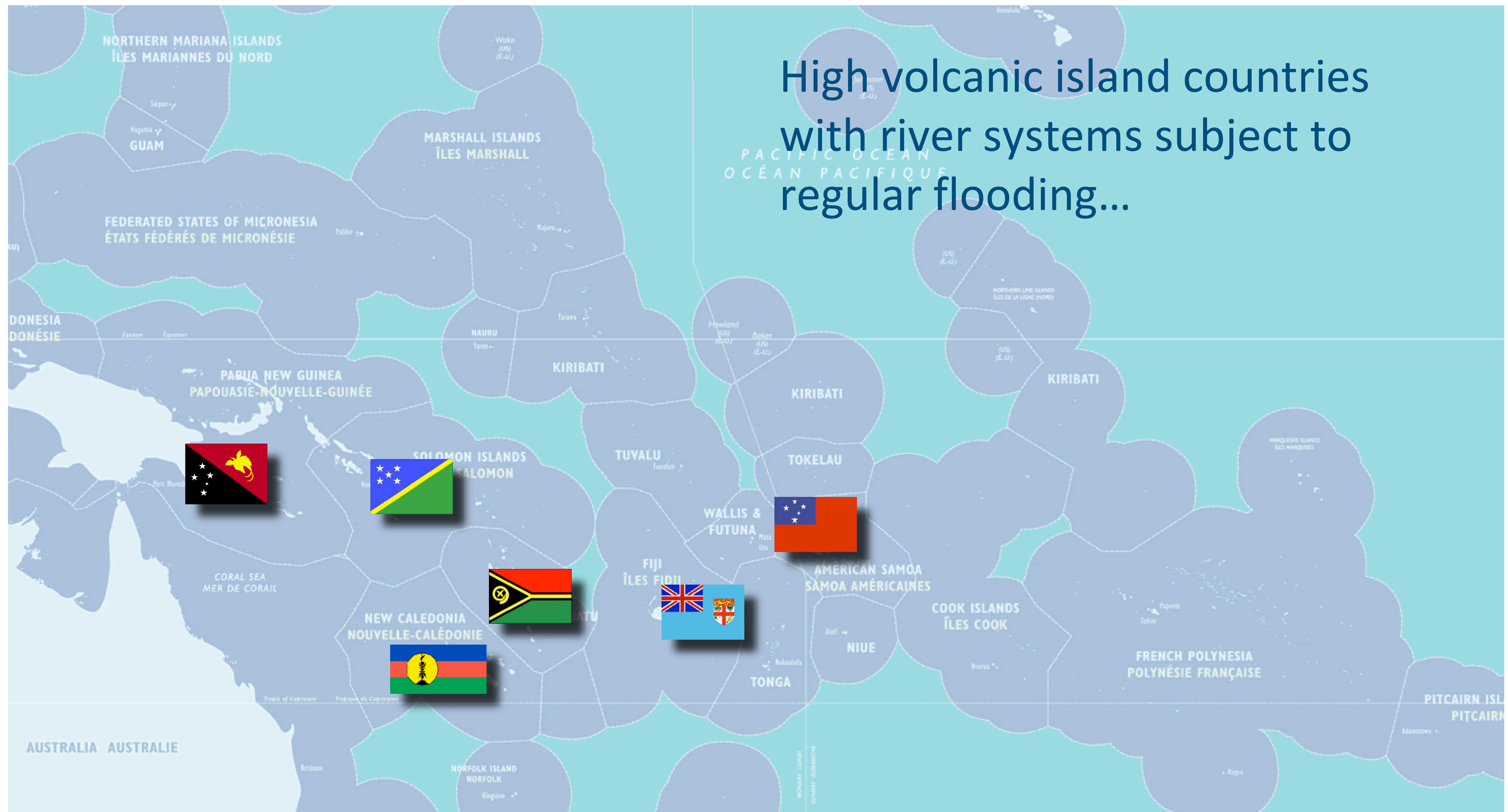


SPC Member Countries with no
surface water resources...

...or home to significant
populations on islands with
no surface water resources.



High volcanic island countries
with river systems subject to
regular flooding...



Increasing Engagement on water security as a key determinant of resilience.

Rationale

- ❖ Persisting Low levels of engagement in water security in regional and national frameworks and decision-making in the Pacific
- ❖ Current frameworks are not fully engaged in water security
- ❖ Nor do they drive effort across multiple sectors or stakeholders.
- ❖ Water as a cause of hazards to individual/community/system resilience
- ❖ Consequences of hazards and climate change on water systems required to support human and ecological systems.
- ❖ Progress not keeping pace with population growth. Millions of Pacific islander's face water insecurities.
- ❖ Impacts of recurring disasters on water infrastructures, resources and services.

Increasing Engagement on water security as a key determinant of resilience.



Establishment of the Pacific Resilience Partnership Water Security Technical Working Group.

- ❖ Meets every two months
- ❖ Multisectoral membership
- ❖ Co-chaired by UNICEF Pacific, Water Aid PNG and the Pacific Islands Alliance of Non-Government Organisations (PIANGO).
- ❖ Drives development of the PRP Water Security Engagement Strategy
- ❖ Secretariate Support – SPC with funding support from MFAT.

Development of the Water Security Engagement Strategy.

Purpose

Identify ways to promote meaningful and increased engagement and coordination on 'water security as an element of resilience-building'

Increasing Engagement on water security as a key determinant of resilience.



Development of the Water Security Engagement Strategy.

- ❖ Desktop study conducted to gauge levels of engagement in water security & build on lessons learned.
- ❖ Multisectoral consultations from November 2023 to Jan 2024. Forty consultations completed.
- ❖ DRR and DRM elements to be reflected
- ❖ Draft strategy is being updated using the Pacific Resilience Standards.
- ❖ An updated draft by end April and a final by mid-May

Findings from the Pacific Resilience Partnership Water Security Engagement Strategy Consultations and Desktop Study Reports.

Regional Frameworks

- ❖ Water Security is captured as an issue.
- ❖ It is not featured as a key determinant of resilience.
- ❖ Not captured as a strategic pathway or with specified activities
 - ❖ Few frameworks have focused sections or pathways for water security
- ❖ The FRDP recognises some dimensions of water security as factors of resilience
- ❖ Inconsistent messaging around the elements of water security.
- ❖ The SAMOA Pathway uses water & sanitation
- ❖ The 2050 Strategy uses the term Water Security.
- ❖ Existing & potential mechanisms – PRP, PIFS, PWWA, SPC, APCDRR

National Frameworks

- ❖ Some dimensions of water security were used.
- ❖ In consistent messaging across the national communication documents
- ❖ Different terms used ‘Water Security’, ‘Water Resource’, ‘Water and Sanitation
- ❖ More recent documents (e.g. Third National Communications use water security’ more often.
- ❖ However, in most it is only used when talking of key issues or risks.
- ❖ Water & Sanitation were listed as key priorities in national infrastructure plans.
- ❖ Differing levels of coordination
- ❖ JNAPs/NAPs provide coordination opportunities and identification of funding opportunities for specified actions

Donors

- ❖ Inconsistent messaging around water security as a resilience issue.
- ❖ A few donors link their water programs with their climate programs
- ❖ Water Programs have a climate lens, water program sits separately.

Elements of the Water Security Engagement Strategy

❖ A set of guiding principles

❖ High Level Strategic Initiatives

❖ An Action Plan

❖ MERL Plan

❖ High level strategic initiatives aligned with the Pacific Resilience Standards:

- Integrate
- Include
- Inform
- Sustain

❖ Adaptable and Flexible to encourage shared ownership and implementation

❖ Encourages alignment with regional and national frameworks

❖ Encourages leveraging existing and mechanisms & Platforms

Tagio Tumas!

HYDROLOGY SUPPORT TO ENHANCE FLOOD EARLY WARNING SYSTEMS IN THE PACIFIC



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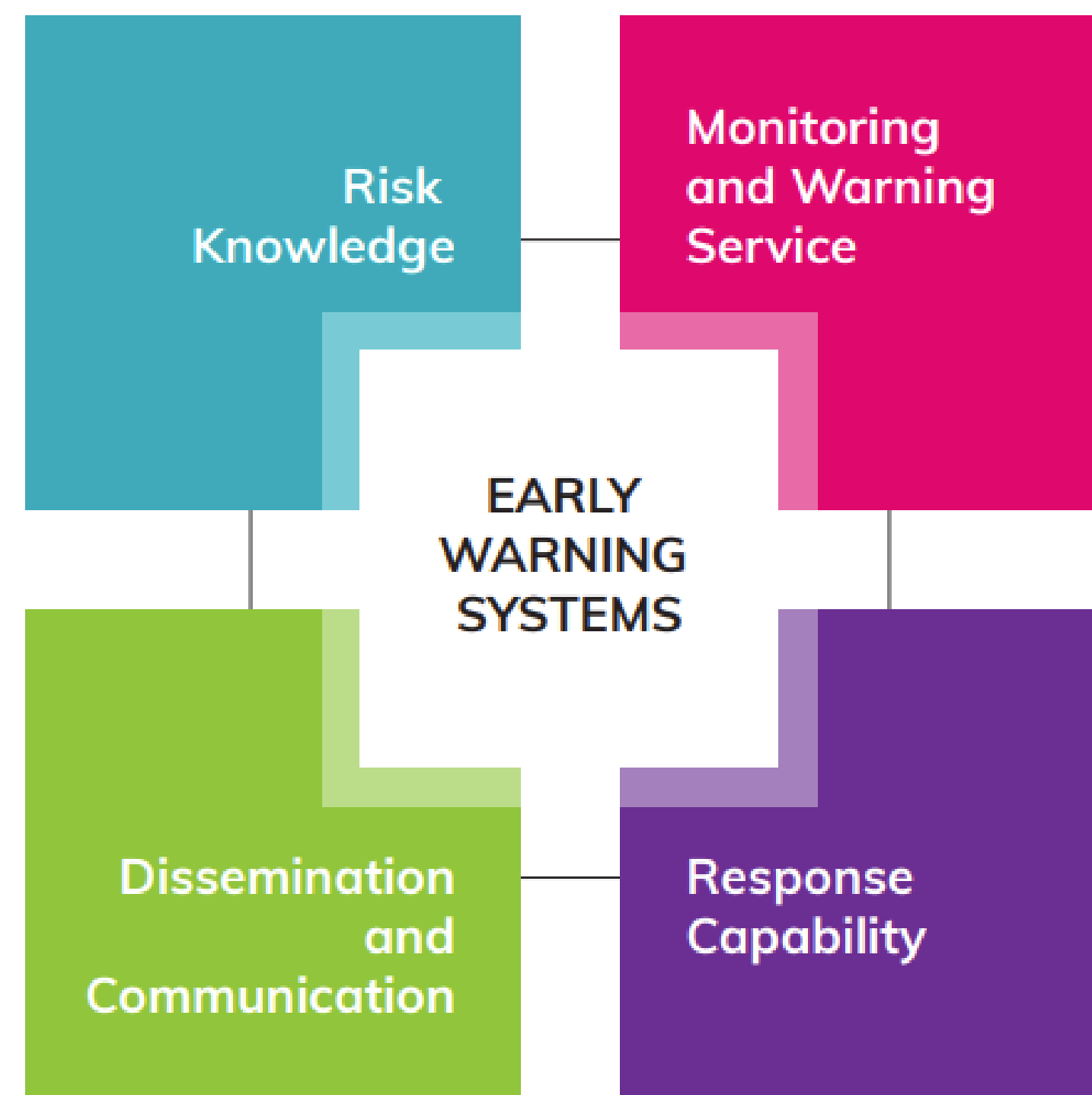
Australian

THE
AUSTRALIAN

Hydrological services support:

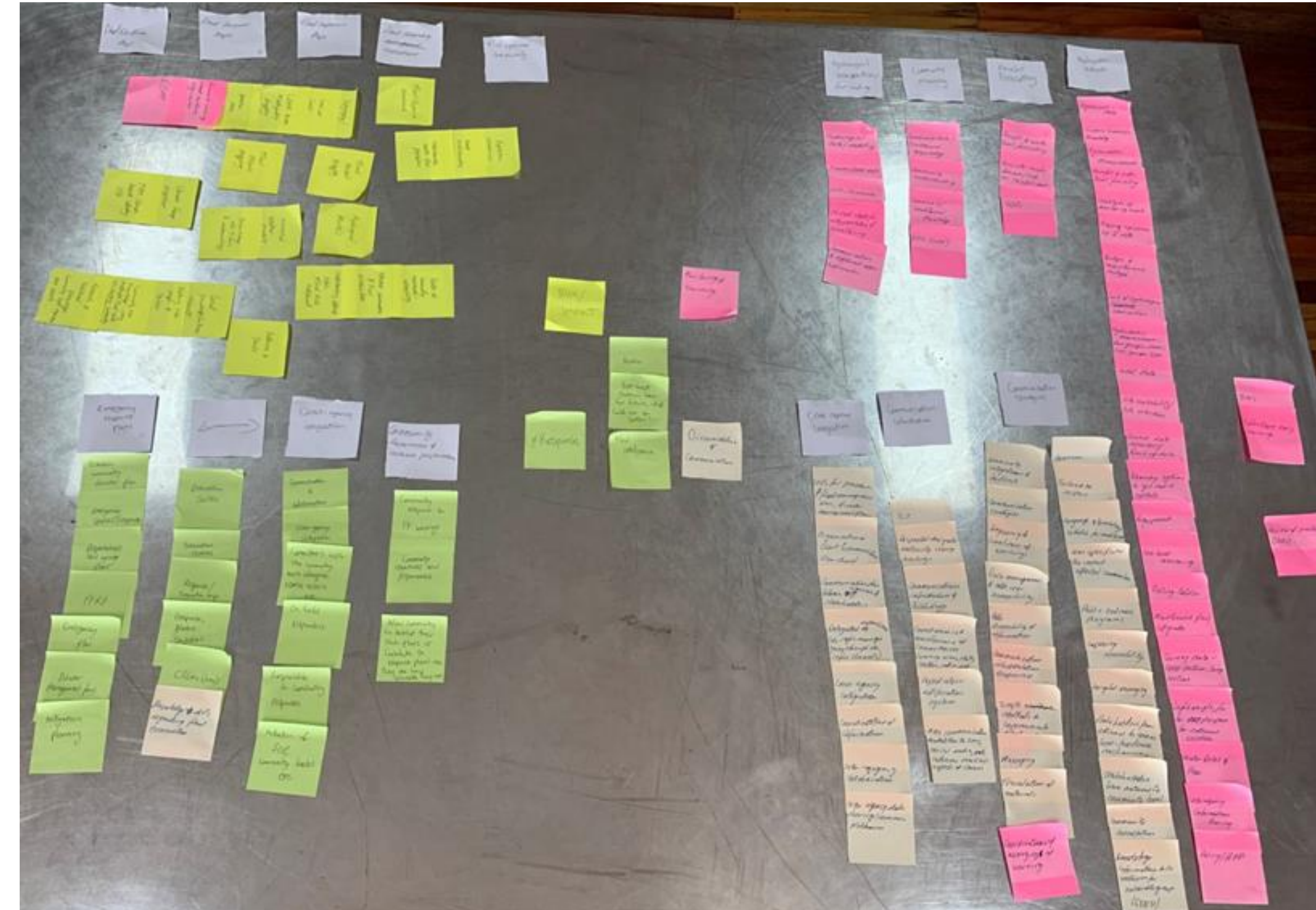
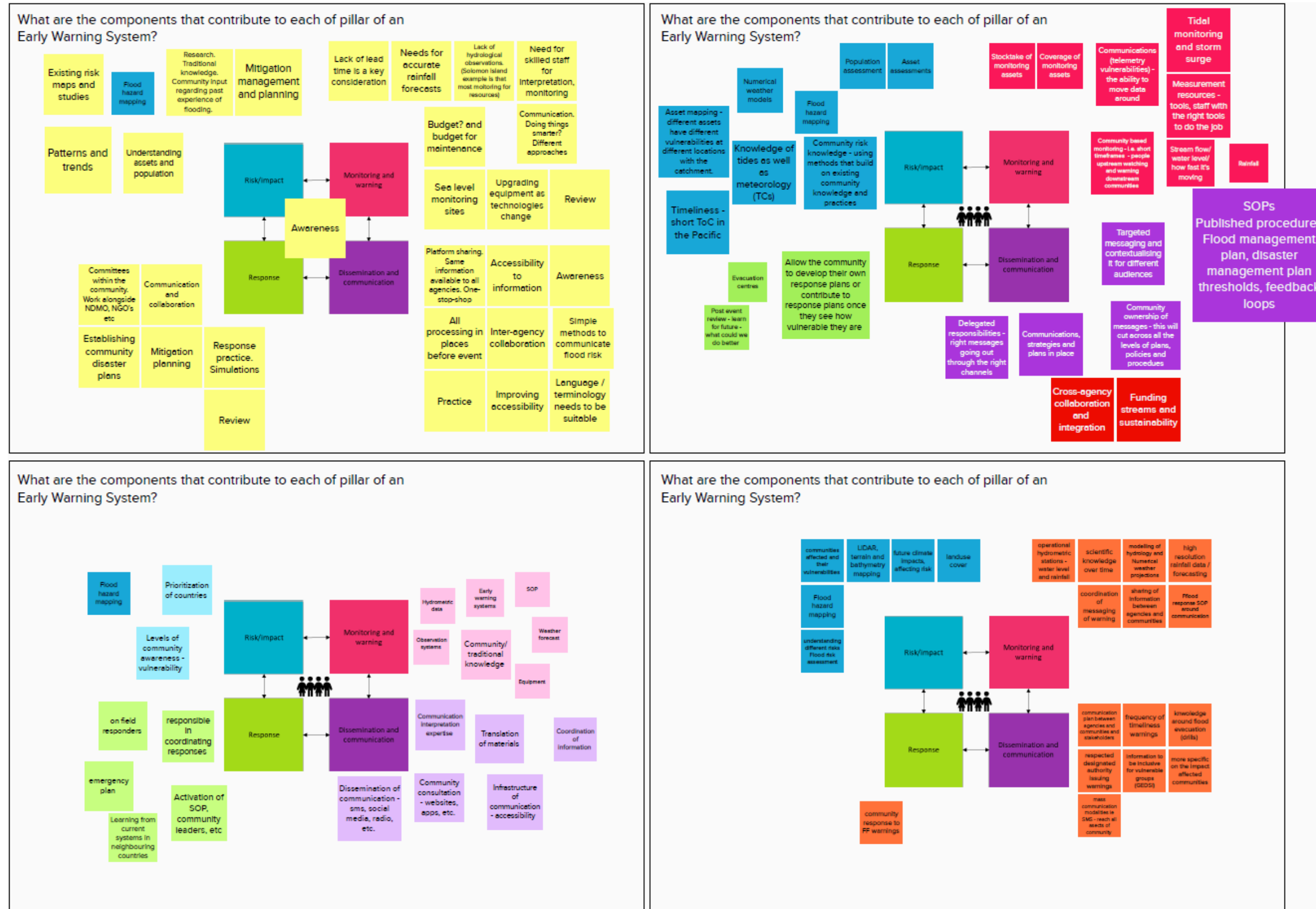
- **Disaster risk reduction**
 - Flood and drought early warning systems
 - Flood protection
- **Climate resilient infrastructure**
 - Bridges that are high enough and strong enough to withstand flooding
 - Buildings that are out of the flood zones
- **Regional water security**
 - Drinking water
 - Water for agriculture
- **Energy security**
 - Hydroelectricity

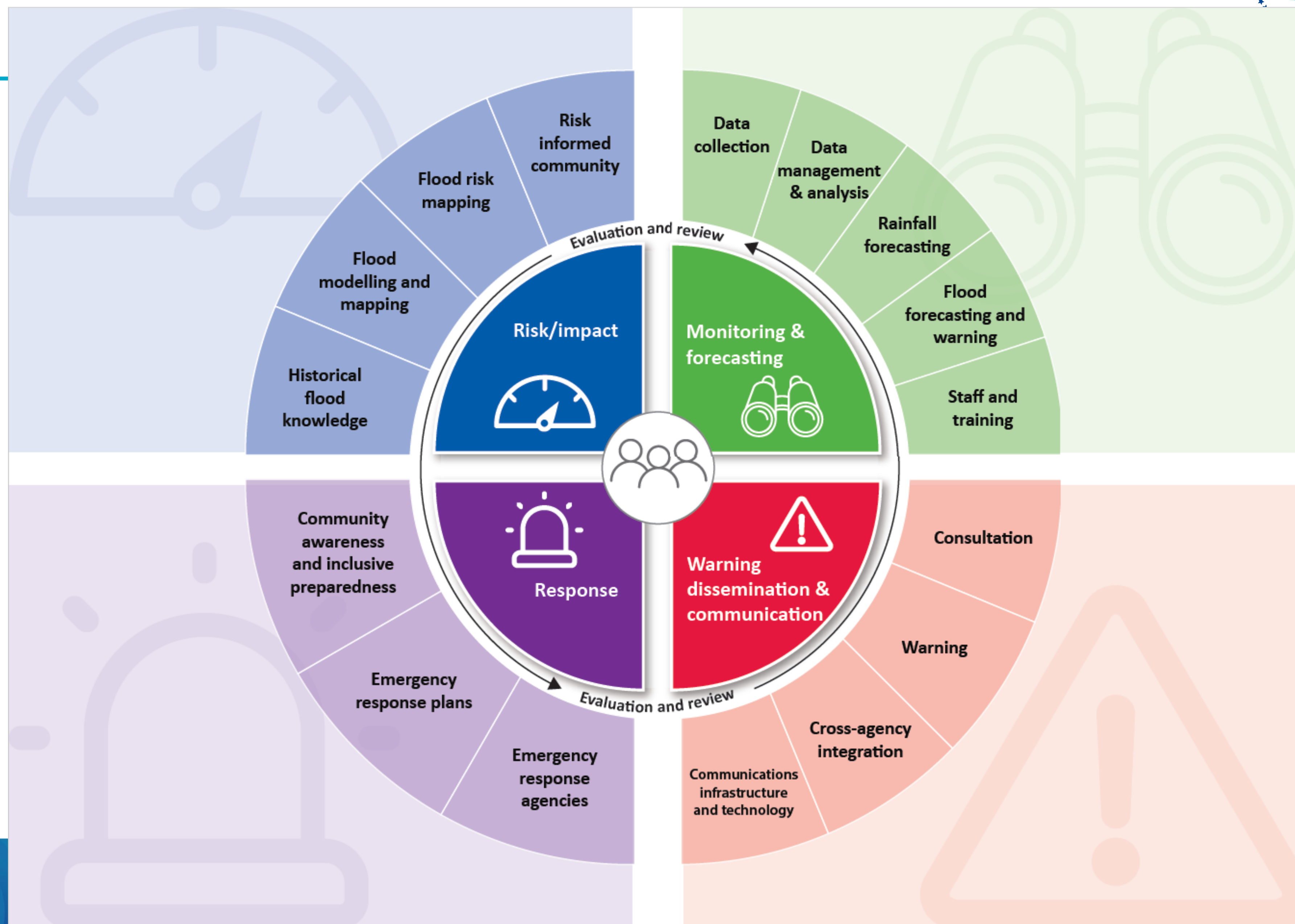




Source: UNDP, 2018, Five approaches to build functional early warning systems







Historical flood knowledge

- ☐ Historical data
- ☐ Community and stakeholder consultation
- ☐ Flood extent mapping
- ☐ Data storage
- ☐ Data accessibility

Flood modelling and mapping

- ☐ Hydraulic models
- ☐ Coverage
- ☐ Elevation data
- ☐ Cross-section data
- ☐ Roughness
- ☐ Boundary conditions
- ☐ Design scenarios
- ☐ Climate change scenarios
- ☐ Validation and/or calibration

Flood risk mapping

- ☐ Exposure: Asset information
- ☐ Exposure: Data accessibility
- ☐ Exposure: Flood exposure assessments
- ☐ Vulnerability: Social
- ☐ Vulnerability: Livelihoods
- ☐ Vulnerability: Safety
- ☐ Vulnerability: Bulding and infrastructure resilience
- ☐ Vulnerability: Data accessibility
- ☐ Vulnerability: Flood vulnerability assessments

Risk informed community

- ☐ Floodplain management plan
- ☐ Community risk awareness
- ☐ GEDSI considerations

Data collection

- ☐ Standard Operating Procedures
- ☐ Site maintenance plans
- ☐ Automatic rainfall monitoring stations

Data management and analysis

- ☐ Standard Operating Procedures
- ☐ Hydrometric data quality
- ☐ Streamflow rating tables
- ☐ Hydrological database

Rainfall forecasting

- ☐ Numerical Weather Prediction models
- ☐ Radar
- ☐ Nowcasting models

Staff and training

- ☐ Resourced staff
- ☐ Flood operations
- ☐ Hydrological data interpretation
- ☐ Hydrometric data collection
- ☐ GEDSI considerations
- ☐ Accountability
- ☐ Information and Communication Technologies (ICT)

Data collection

- ☐ Standard Operating Procedures
- ☐ Site maintenance plans
- ☐ Automatic rainfall monitoring stations
- ☐ Streamflow monitoring stations
- ☐ Telemetry
- ☐ Streamflow measurements
- ☐ Level survey
- ☐ Field validation

Flood forecasting and Warning

- ☐ Flood warning
- ☐ Flood forecasting systems
- ☐ Standard Operating Procedures
- ☐ Post event review
- ☐ Travel time schematics
- ☐ Level/flow thresholds
- ☐ Tidal data
- ☐ Community flood intelligence

Community awareness and inclusive preparedness

- ☐ Community response
- ☐ Community led response plans
- ☐ Response plan awareness

Emergency response agencies

- ☐ Training
- ☐ Resourcing

Emergency response plans

- ☐ Disaster management plans
- ☐ Flood response plans
- ☐ Flood risk mapping
- ☐ Response/ evacuation map
- ☐ Evacuation centres
- ☐ Trigger levels
- ☐ Integration of community response plans
- ☐ Community and stakeholder integration
- ☐ Delegated responsibilities

Consultation

- ☐ Consultation
- ☐ Stakeholder consultation
- ☐ Language
- ☐ Message modality

Warning

- ☐ Impact based forecast
- ☐ Response information
- ☐ Frequency and timeliness of forecasts and warnings
- ☐ Resourced and trained communications staff
- ☐ Community awareness training, and sustainability

Agency integration

- ☐ Responsibilities
- ☐ Operating Procedures

Communications infrastructure and technology

- ☐ Communication modalities
- ☐ Directory of contacts
- ☐ Communication plan



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Historical flood knowledge

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- ☐ Local community knowledge

Data collection

- ☐ Standard Operating Procedures

Data collection

- ☐ Streamflow measurements
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Flood forecasting and Warning

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- ☐ Delegated responsibilities



Consultation

- ☐ Community consultation
- ☐ Agency stakeholder consultation
- ☐ Flood warning language
- ☐ Warning message modality

Cross-agency integration

- ☐ Delegated responsibilities
- ☐ Standard Operating Procedures

Warning

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RISK/ IMPACT



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RISK/ IMPACT



Historical flood knowledge

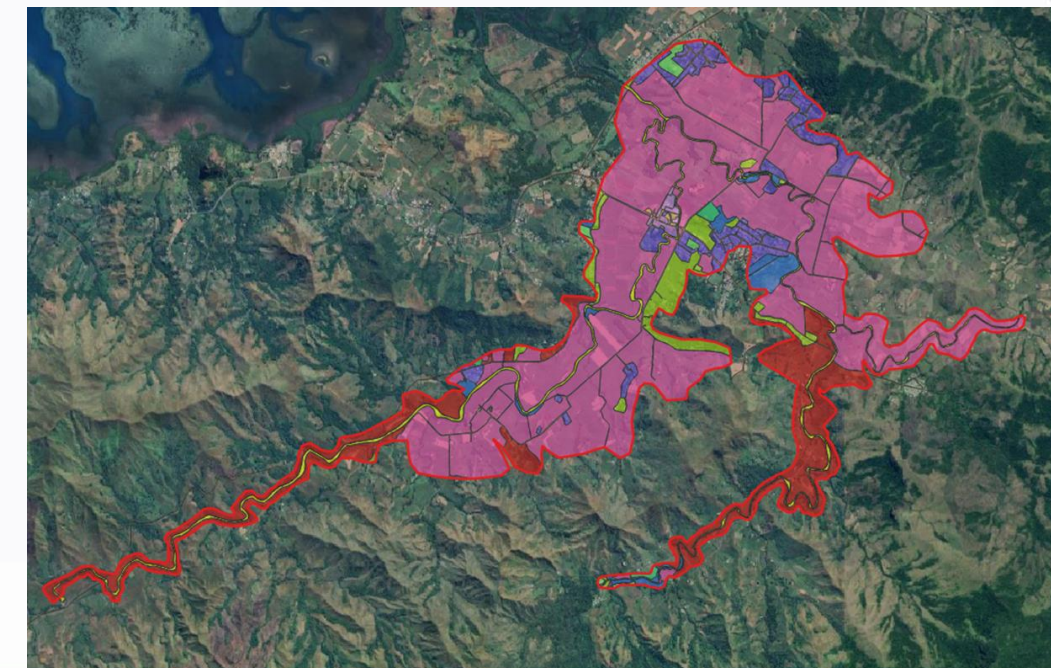
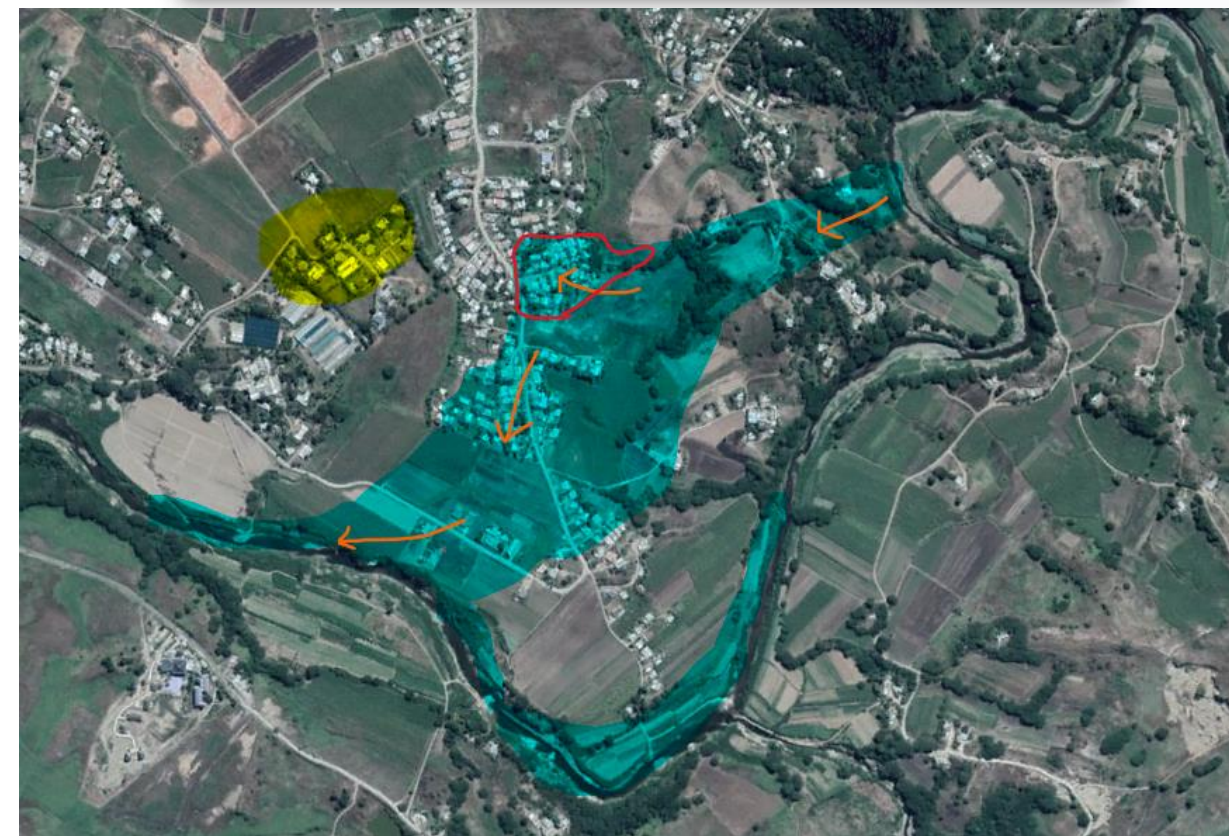
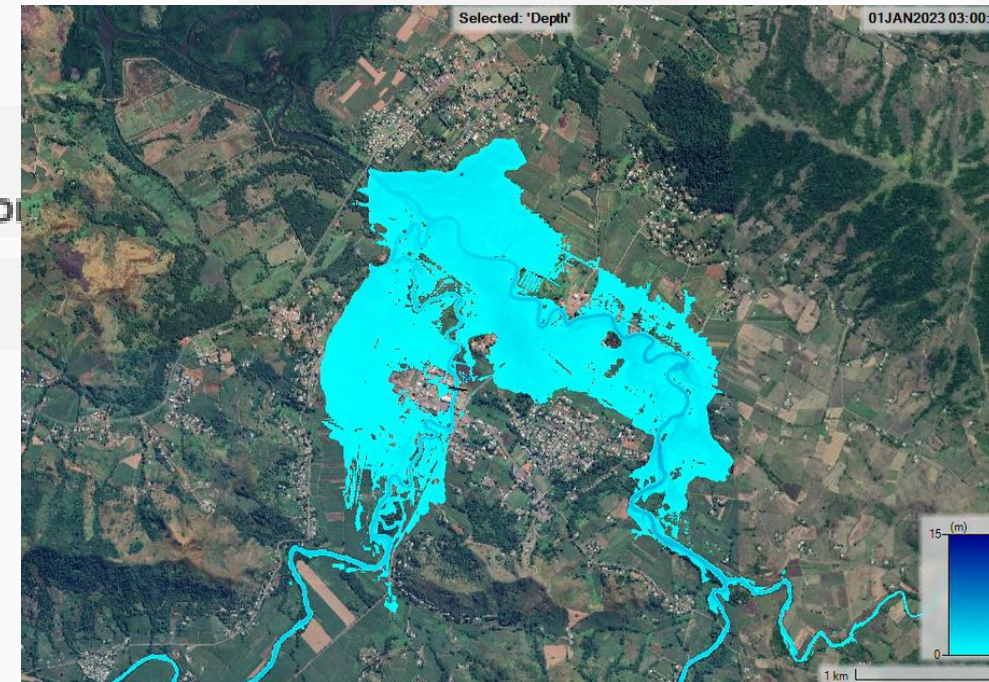
Flood modelling and mapping

Flood risk mapping

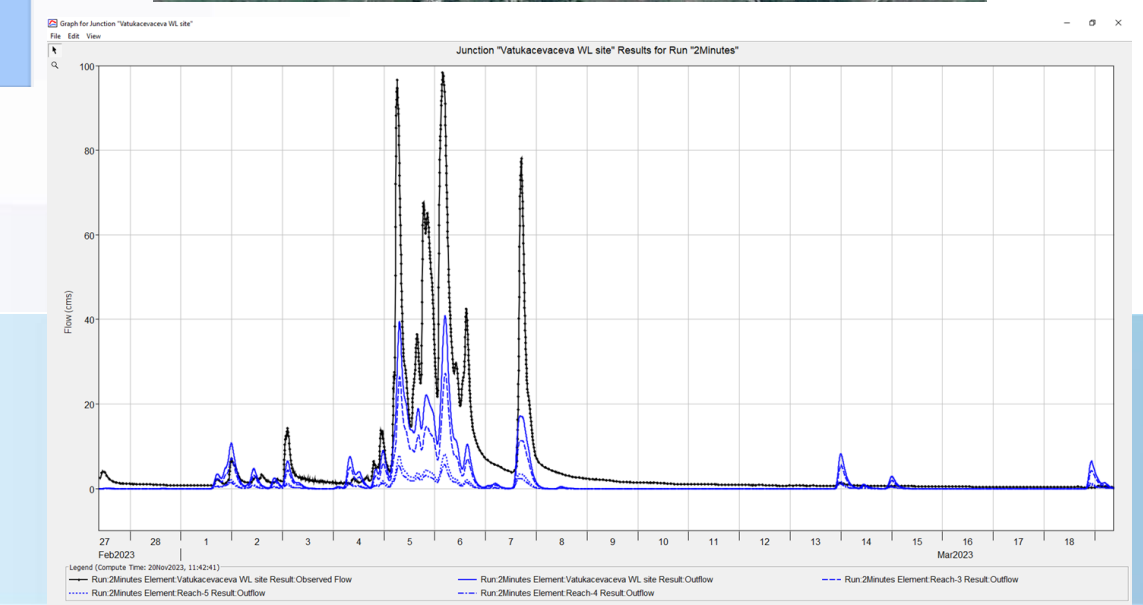
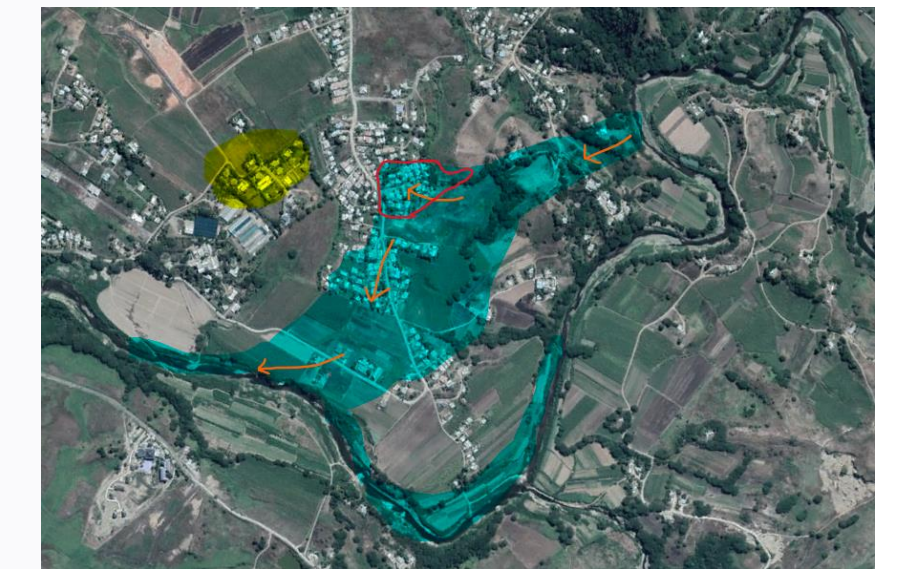
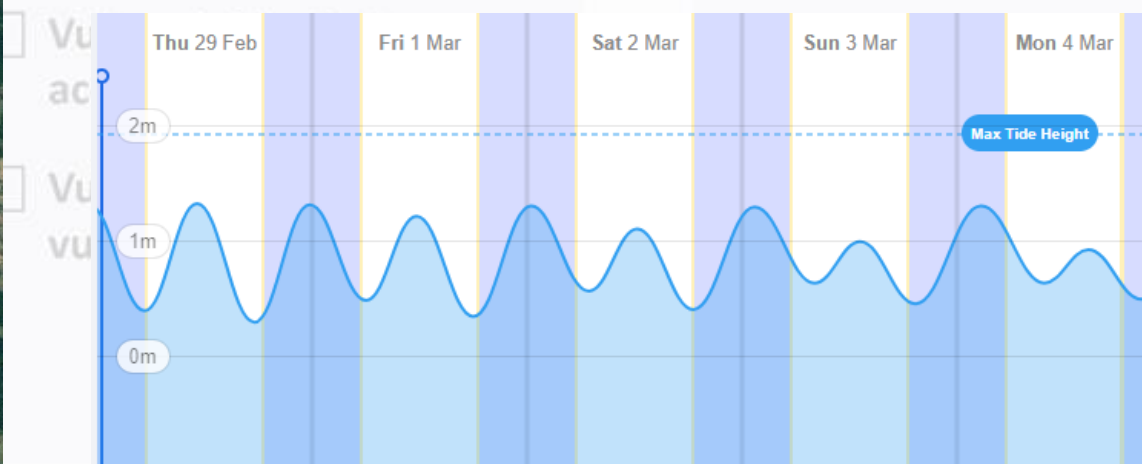
Risk informed community



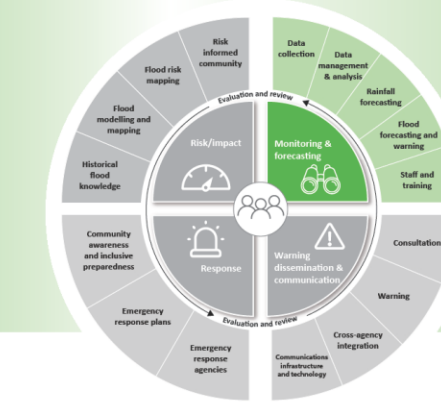
Historical data
Community and
stakeholder consultation
Flood extent mapping
Storage
Accessibility



Vulnerability: Building and infrastructure resilience



MONITORING AND WARNING



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Field assessment

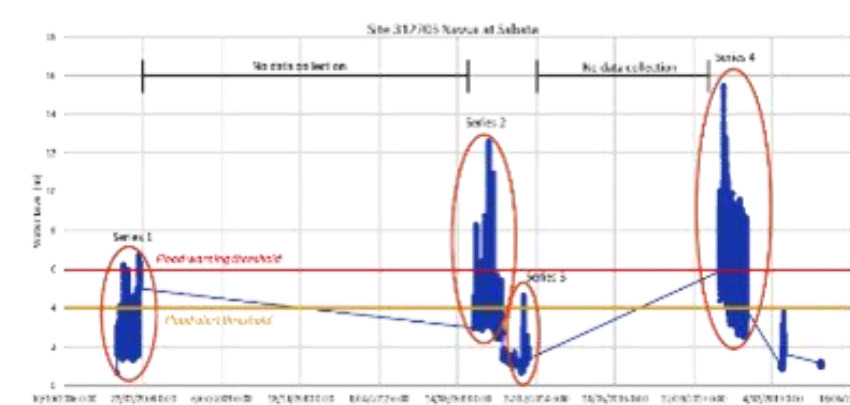


Field maintenance & planning

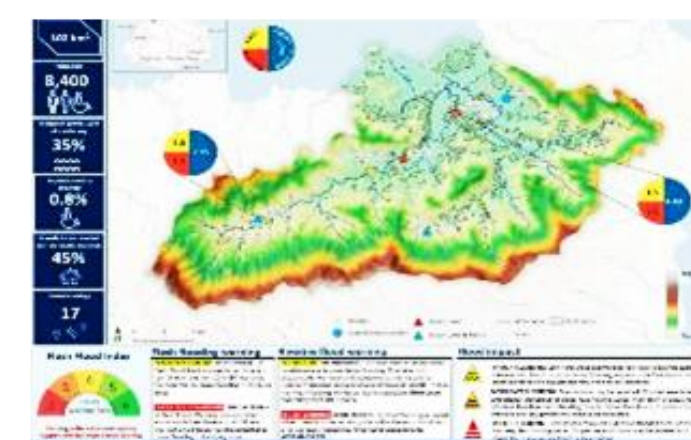
Station	Depth	Temperature	pH	Dissolved Oxygen	Salinity	Turbidity	Chlorophyll a	Chlorophyll b	Chlorophyll c	Chlorophyll total	Secchi depth	Water quality index
1	0.5	28.5	7.2	8.5	35.0	1.2	0.5	0.3	0.2	1.0	1.5	75
2	1.0	28.2	7.1	8.3	35.0	1.5	0.6	0.4	0.3	1.3	1.2	72
3	1.5	28.0	7.0	8.1	35.0	1.8	0.7	0.5	0.4	1.6	1.0	70
4	2.0	27.8	6.9	7.9	35.0	2.0	0.8	0.6	0.5	1.9	0.8	68
5	2.5	27.5	6.8	7.7	35.0	2.2	0.9	0.7	0.6	2.2	0.6	65
6	3.0	27.2	6.7	7.5	35.0	2.5	1.0	0.8	0.7	2.5	0.5	62
7	3.5	27.0	6.6	7.3	35.0	2.8	1.1	0.9	0.8	2.8	0.4	60
8	4.0	26.8	6.5	7.1	35.0	3.0	1.2	1.0	0.9	3.1	0.3	58
9	4.5	26.5	6.4	6.9	35.0	3.2	1.3	1.1	1.0	3.4	0.2	55
10	5.0	26.2	6.3	6.7	35.0	3.5	1.4	1.2	1.1	3.7	0.1	52



Data analysis



Data synthesis



Penang catchment (Rakiraki) – Flood warning

Key statistics

Catchment area

102 km²

Population

8,400



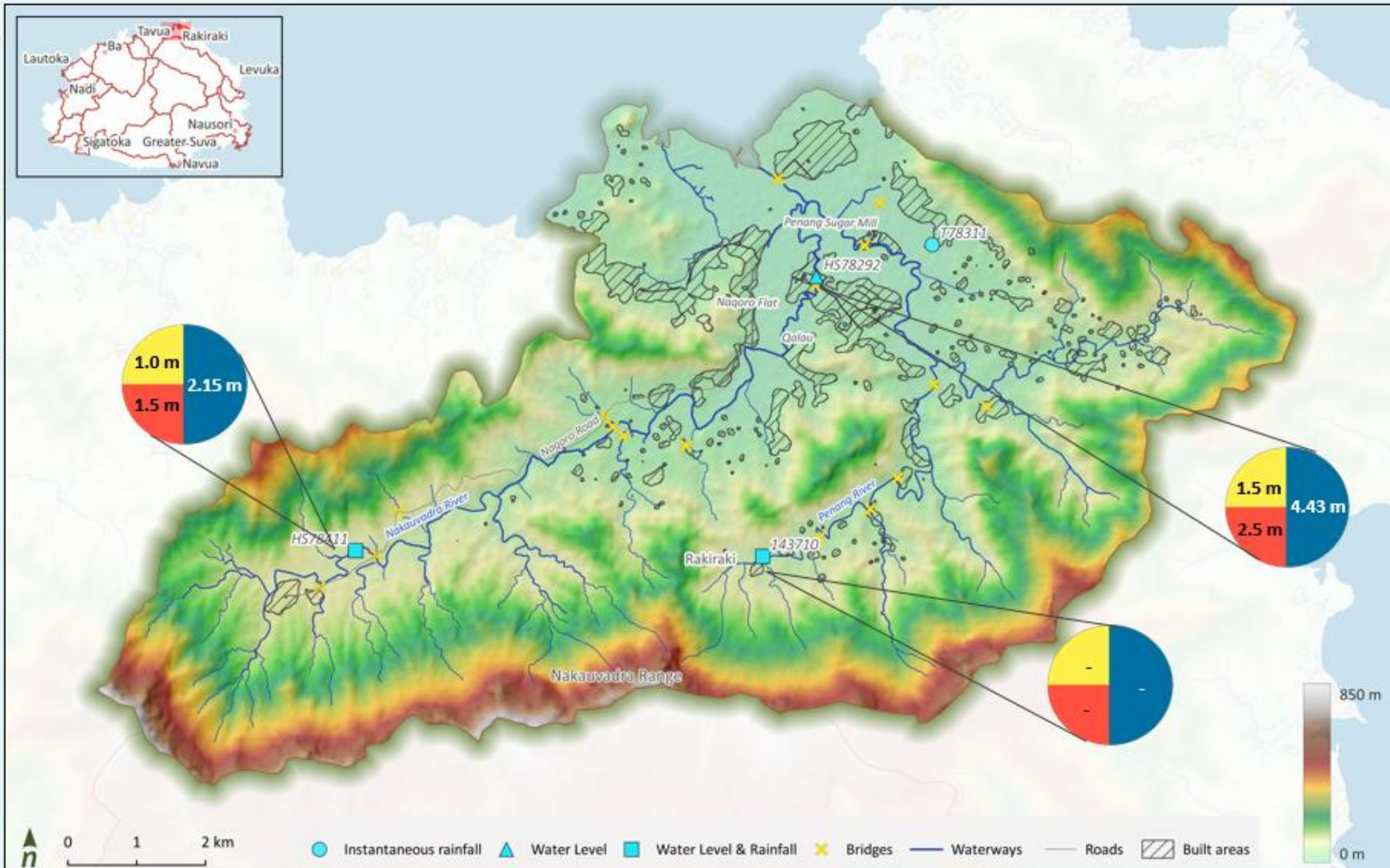
Legend



Alert – The water level when an alert is triggered.

Warning – The water level when a warning is triggered.

Highest recorded level is the peak water level recorded at the specified streamflow monitoring station.



Flash Flood Index



Maximum potential flood warning time is 2 hours.

Flash flooding warning

FLASH FLOOD WARNING: TAKE ACTION - A Flash Flood Warning is issued when actual rainfall and forecast rainfall over the next 1 to 6 hours has the potential to cause flooding in low lying areas.

FLASH FLOOD ALERT: BE PREPARED - A Flash Flood Alert is issued when forecast rainfall over the next 12 to 36 hours has the potential to cause flooding in low lying areas.

Riverine flood warning

FLOOD WARNING: TAKE ACTION - A Flood Warning is issued when there is more certainty that a flood event is imminent or it is already happening. **River Level exceeding its WARNING LEVEL.**

FLOOD ALERT: BE PREPARED - A Flood Alert is issued when conditions are favourable for flooding. This takes into account the river level and trajectory at the site and at upstream stations; and previous and forecast rainfall. It does not mean flooding will occur, but it is possible. **River Level exceeding its ALERT LEVEL.**

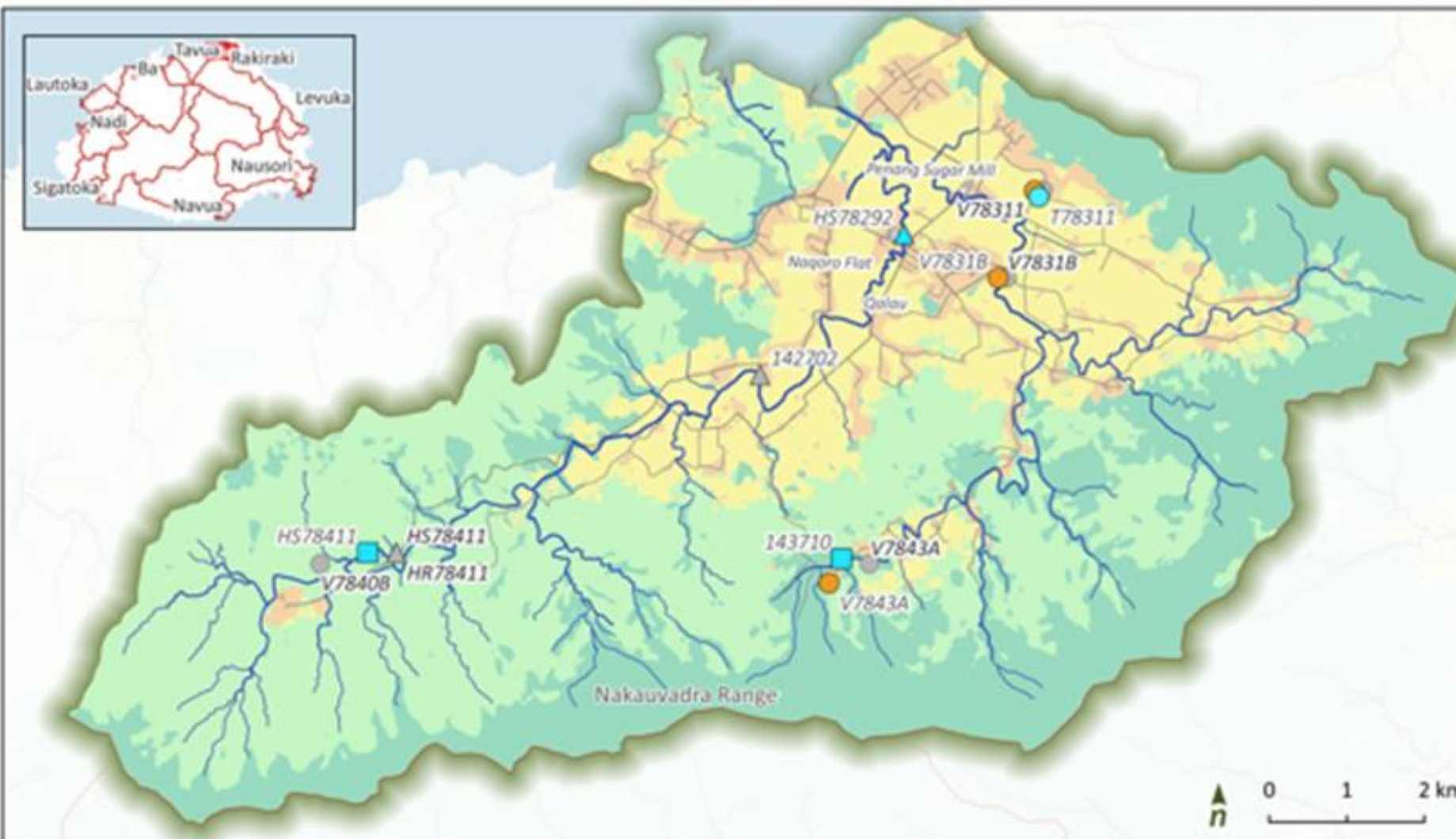
Flood impact

WARNING Very High Risk Take Action
WARNING High Risk Take Action
ALERT Medium Risk / Be Prepared
WATCH Low Risk / Be Aware
Very Low Risk / No Action

Evacuations required - danger to life. Widespread flooding with riverbank overflow and potential landslides causing communities to be inaccessible and damage to properties, infrastructure and loss of livelihood. Major river crossings altered due to higher than usual river flow. Major traffic routes are likely to be affected.

Flooding of roads and settlements (formal and informal) in low lying areas and floodplains. Significant disruption to traffic flow and transport route. Localised disruption to essential services (water, electricity, communications).

Penang catchment (Rakiraki) – Hydrological information



Instantaneous rainfall Water Level Water Level & Rainfall Closed Manual Rainfall Station Closed Water Level & Rainfall
Roads Waterways Built areas Crops Scrub/shrub Trees Other Manual Rainfall Station

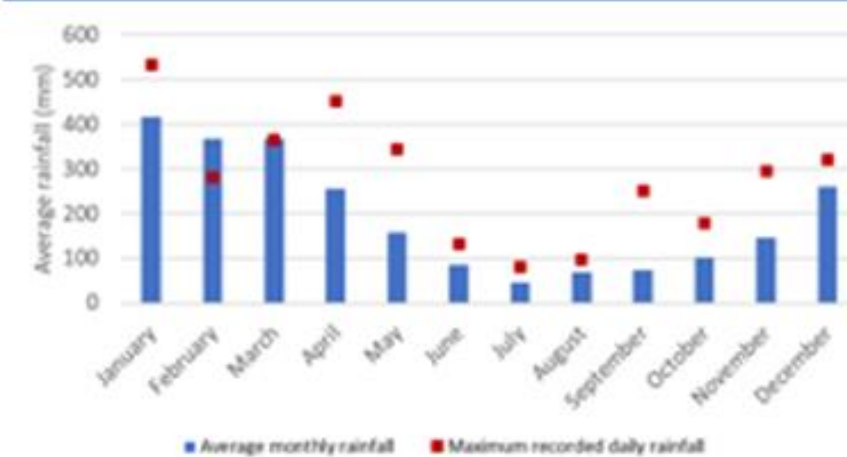
Catchment overview

The Nakauvadra and Penang Rivers drain the steep slopes of the Nakauvadra Range and flow north-east for approximately 19 km and 11 km respectively before joining downstream of Rakiraki town and flowing out to the bay. Elevation ranges from ~850 m at the top of the catchment to ~100 m at Vatukaceveva, to sea level at the outlet. The two rivers dissect the narrow, confined valleys before emerging into a partly confined and extensively cultivated. The catchment is dominated by two major land covers, open grassland and sugarcane agriculture.

Gravel extraction is undertaken throughout both rivers, and dredging occurs in the lower reaches. Unstable reaches, with extensive bank erosion contribute to high sediment loads, particularly in the Penang River, which may impact water quality and contribute to sedimentation in the downstream reaches.

Water Authority Fiji extract water from both the Penang and Nakauvadra Rivers for drinking water supply.

Rainfall Statistics – Penang Mill (Station ID: V78311)



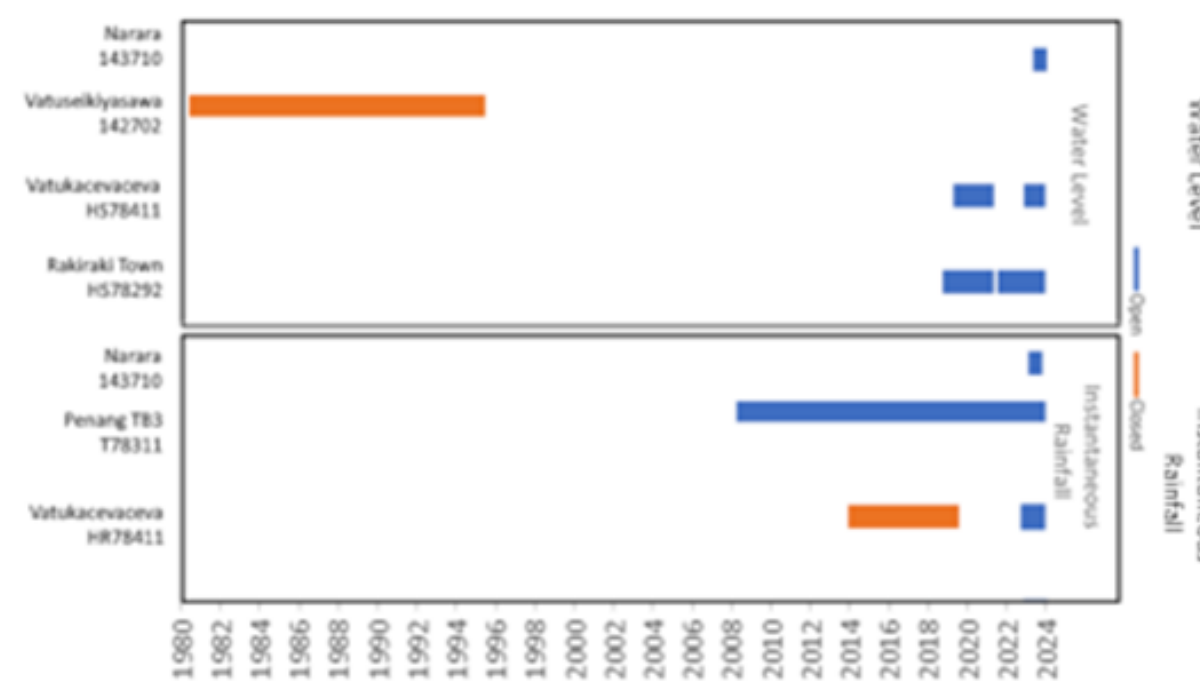
Annual rainfall statistics (1980 to 2022)

	Rainfall (mm)
Maximum	3,957
Minimum	1,274
Mean	2,324
Median	2,243

Historical flood events



Hydrological data record



Fiji Meteorological Service (FMS) Water Level Data

Scan the QR code and click on the site of interest to view the water level and the water level alert and warning thresholds for this station.



Hydrological monitoring

Status	Water level	Rainfall
	Automatic	Automatic (Sub-daily) Manual (daily)
Active	3	3 3
Non-active/ closed	1	1 2

Three telemetered water level monitoring stations operate in the Rakiraki catchment. The Vatukaceveva and Narara stations monitor water levels in the upper reaches of the Nakauvadra and Penang Rivers, while the Rakiraki site is located in the centre of Rakiraki Town.

The Vatukaceveva and Narara water level monitoring sites are co-located with automatic rainfall stations, and a third rainfall monitoring site is located at the former Penang Mill. These stations are used to monitor water level and rainfall intensity and transmit the data in near real-time to FMS so that information can be used for flood early warning.

Rainfall depth is also recorded at four long-term daily read rainfall stations positioned across the catchment. This data is reported to FMS once per month and is used to inform and assess long-term climate variability within the catchment. The longest daily rainfall records in the catchment date back to 1926.

Flood overview

The time between rainfall and water levels rising within the Rakiraki catchment is short, making flooding conditions 'flashy'. This means that flooding can happen quickly following rain, typically between 1 to 3 hours. Flooding is associated both with large scale weather patterns such as Tropical Cyclones and Tropical depressions, and local scale events such as localised thunderstorms.

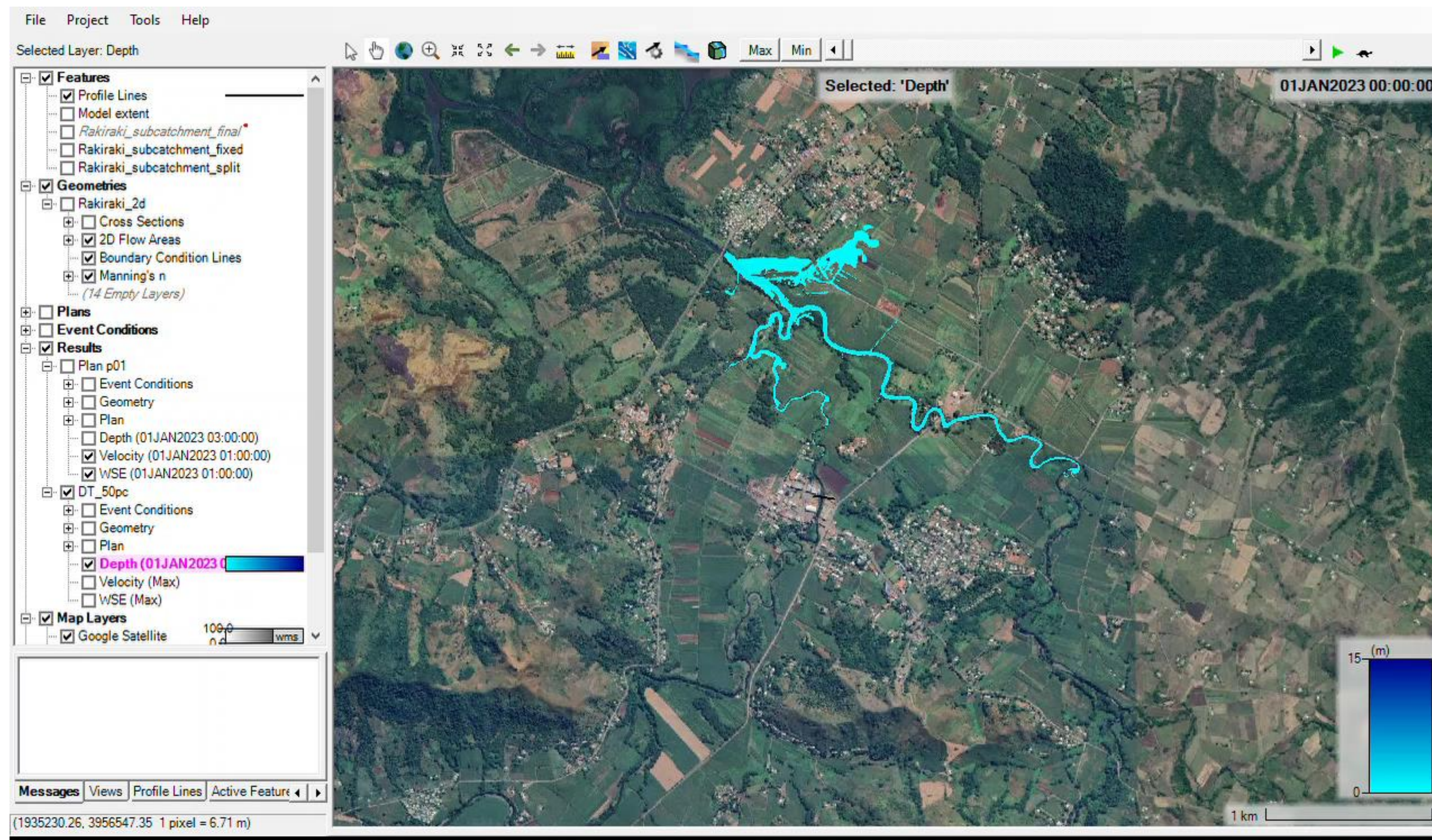
The extent of flooding is increased in the lower catchment during periods of high tide. Flooding in the Rakiraki Town can happen when rain is occurring the upper catchment hillslopes but not in town, giving people no typical warning indications.

Flooding within the catchment has resulted in fatalities and damage to buildings, roads, crops and livestock. The main Rakiraki town is particularly prone to flooding, as is Naqoro Flat, Qalau, FSC Road. Additionally, low level river crossings are frequently submerged during minor flood events, which impact access to villages such as Narara, Rewasa and Vatukaceveva.

Forecasting and warning

Flood forecasters at FMS use a suite of tools to inform flood forecasting including:

- The Flash Flood Guidance System – a tool that compares forecast and actual rainfall to the soil moisture content to calculate the amount of rainfall required to cause flash flooding.
- River threshold level – analysis of water level in rivers compared to predetermined flood thresholds to determine the potential for rivers to breach the bank level and cause flooding.



framework

- About
- Detailed overview

survey

- How to complete this survey
- Registration
- Risk and Impact
- Monitoring and Forecasting
- Warning Dissemination and Communication
- Response
- Project Information

Save survey and continue

results

- Survey Scorecard
- Download survey results



Risk and Impact

What information regarding risk and impact is available?

Historical Flood Knowledge

Historical data (R11)
Is historical data available that defines flood prone areas?

Current Capacity Setting

Available

Agency Responsible

Nothing selected

Additional comments

The current capacity setting is limiting the ability to provide effective flood early warning

Strongly Disagree

Strongly Agree

Community and stakeholder consultation (R12)
Has community and stakeholder consultation been undertaken to identify flood prone areas?

Current Capacity Setting

Broad consultation

Agency Responsible

Nothing selected

Additional comments

The current capacity setting is limiting the ability to provide effective flood early warning

Strongly Disagree

Strongly Agree

Flood extent mapping (R13)
Have flood extent maps been developed for flood prone communities?

Current Capacity Setting

Full development

Agency Responsible

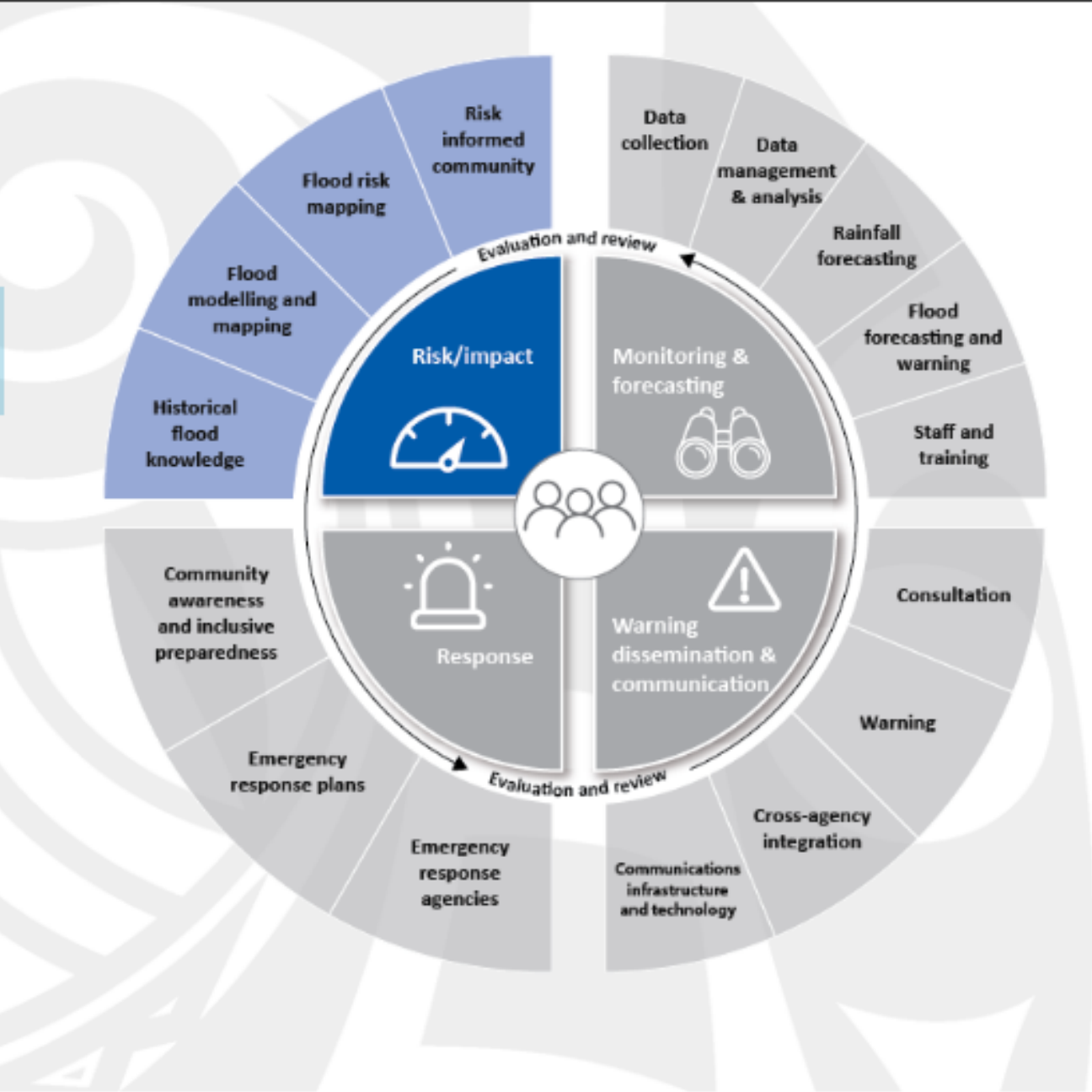
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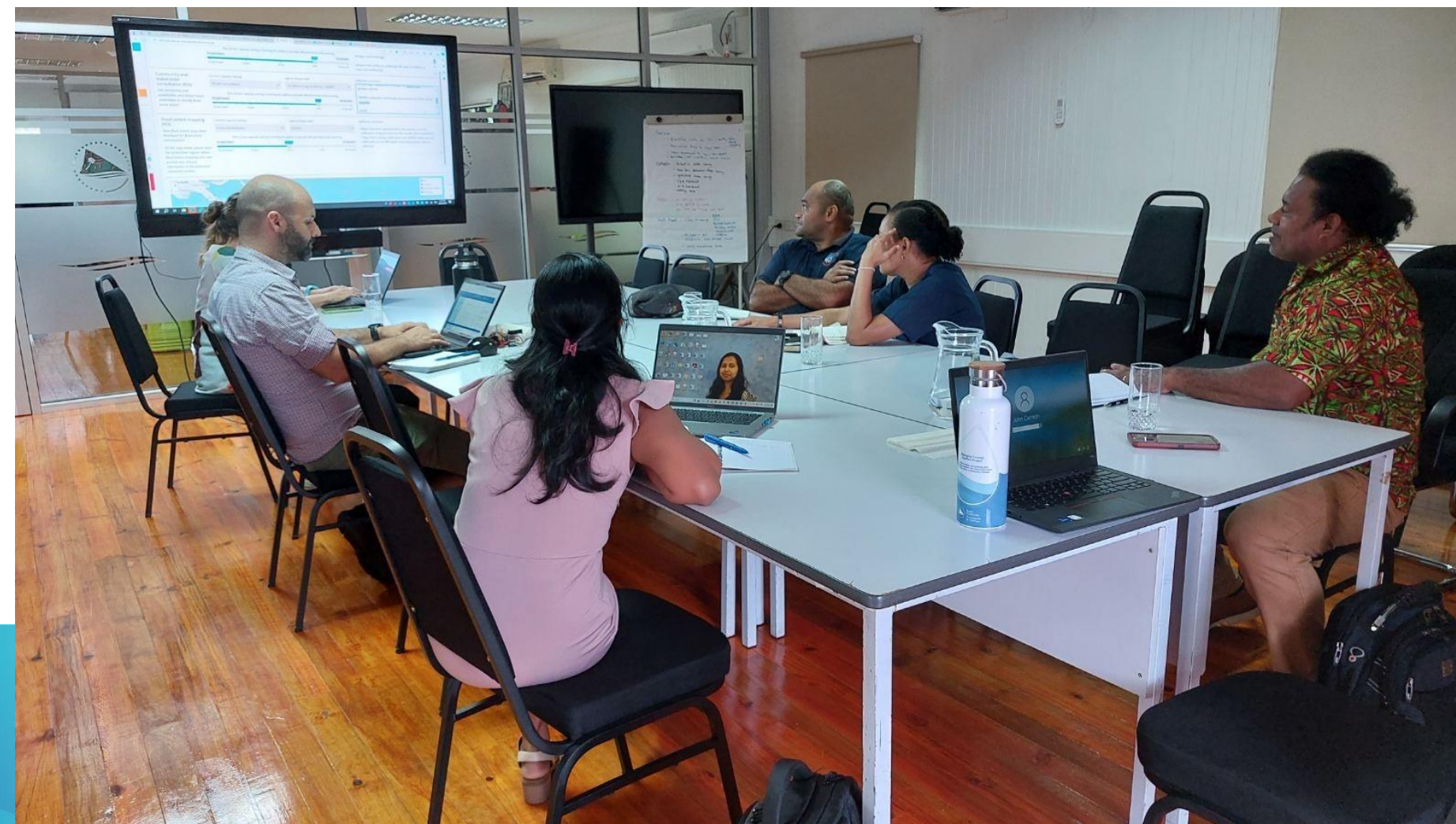
Additional comments

The current capacity setting is limiting the ability to provide effective flood early warning

Strongly Disagree

Strongly Agree





Flood early warning framework results: Example

Australian
Aid

THE
AUSTRALIAN
WATER
PARTNERSHIP



Pacific
Community
Communauté
du Pacifique

cific
mmunity

mmunauté
Pacifique

The Flood Early Warning Framework has been developed to **evaluate the status of end-to-end flood early warning systems**. This framework has been developed as an extension to the four pillars of the UNDRR multi-hazard early warning framework to be specific to flood early warning.

The framework tool has been designed to assess the **current strengths and areas for improvement** in existing systems to help identify and guide where efforts to improve flood early warning may best be directed. Strengths in each pillar is critical to the effectiveness of a flood early warning system.

Responsibility for each pillar of the framework rests with various government agencies across government Ministries. These are typically, but not always, defined in government legislation. Key agencies responsible in Vanuatu are detailed below.



- Responsible Ministry
- 1: Ministry of Lands and Natural Resources
 - 2: Ministry of Climate Change Adaptation, Meteorology, Geohazards, Energy, Environment and Disaster Management
 - 3: Ministry of Internal Affairs

Pillar results

These charts provide a high-level indication of the current data, infrastructure, systems, programs and policies that are in place to support flash flood early warning for each pillar of the framework. The coloured bar represents the status of each pillar when considered against best practice principles for flood early warning to guide where the biggest opportunities to strengthen flood early warning systems exist.



Overview



Flood warning system:
No end-to-end flood warning system is in place in Vanuatu. Generalised heavy rain alerts are issued by the Vanuatu Meteorology and Geohazards Department.



Telemetered hydrometric network
Water level monitoring stations: 3
Automatic rainfall stations: 10
Radar: 0

The hydrometric network does not cover all flood prone catchments.



Flood hazard mapping:
Flood hazard maps have been developed for the two main population centres, Port Vila and Luganville. Priority areas for flood mapping include the Teouma and Mele regions of Efate due to their increased population growth and significant change to land-use in the catchment.



Governance
Responsibilities for the four pillars of the framework are shared across multiple agencies. However, many roles and responsibilities are not clearly defined and improvements and clarity in governance arrangements will allow agencies to be more effective in their roles.

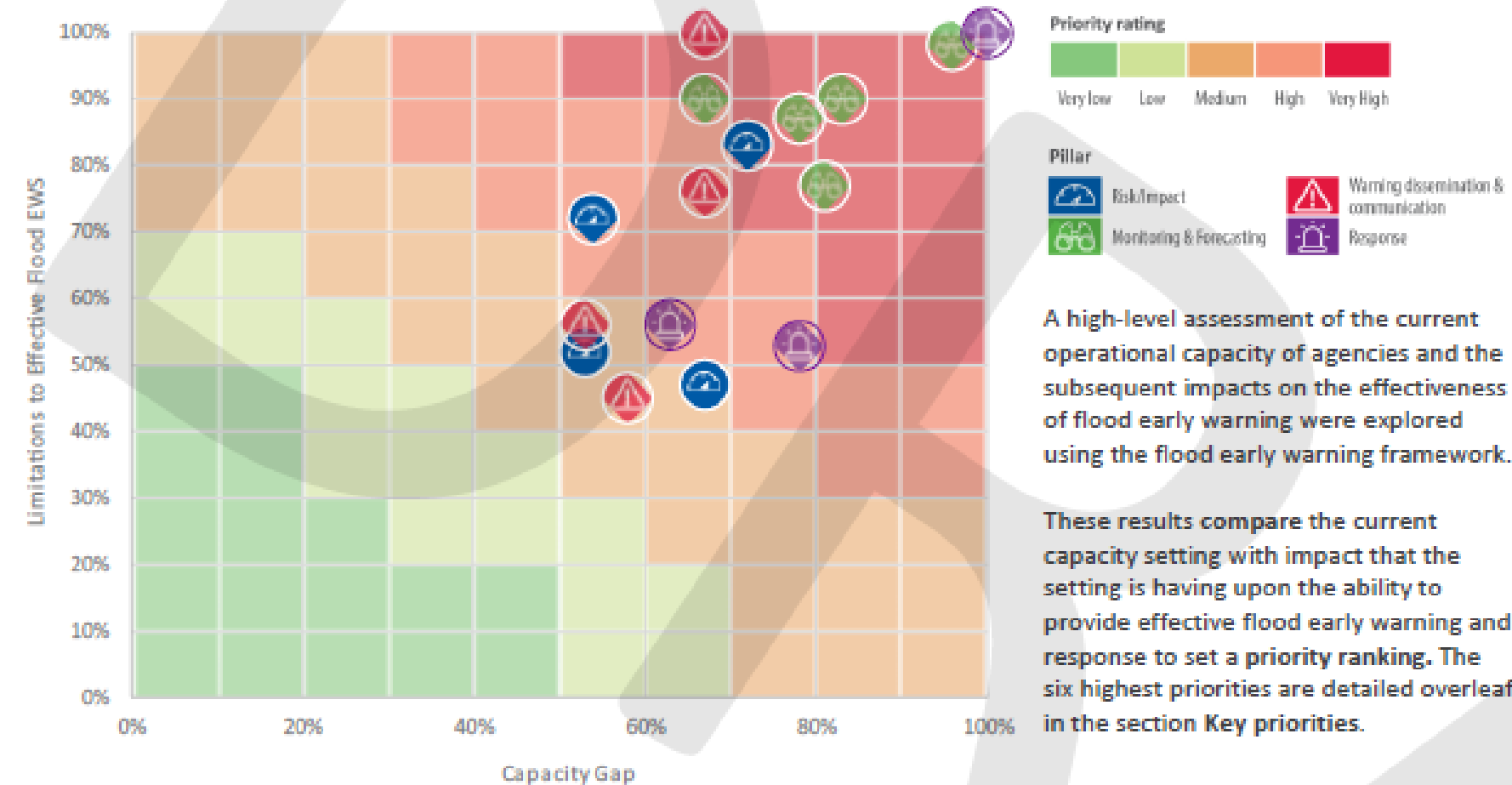
Key priorities

Key priorities listed below have been identified using a prioritisation approach as described in the **Component Results Matrix** overleaf.

- Emergency response agencies**
Increased capacity and development of emergency personnel (staff, training and resources) will improve the ability of flood response.
- Flood forecasting and warning**
Development of a flood forecasting system that incorporates real time data and nowcasting to increase resolution of flood forecasts.
- Data management and analysis**
Develop fit-for-purpose standard operating procedures for field data collection, data management and analysis will improve accuracy of baseline flood information.
- Rainfall forecasting**
Improvements to rainfall forecast resolution, such as the addition of Radar, to increase data confidence enough to be used for accurate and timely flood warnings.
- Staff and training**
Increased training for staff is required to enhance capability and capacity of technical work and leadership.
- Cross-agency integration**
Clearer articulation of roles and responsibilities in flood warning is required to ensure agencies effectively work together to deliver consistent flood messaging.

Flood early warning framework results: Example

Component Results Matrix



Description

The results indicate that the current development level of the Monitoring and Forecasting network is having the biggest impact on providing effective flood early warning in Vanuatu. Investment in the monitoring network to increase data collection and data quality will increase confidence in flood forecasting and the ability to develop improved policy, services, and advice. Improvements to hydrological data will also benefit advancements in flood risk and impact information which was also identified as significantly impacting the effectiveness of flood early warning. Results also indicate that response to flooding is limited by investment and training of staff to be suitably prepared for flood operations.

Framework Survey Information

Survey details
Date – October 2023
Location – Port Vila, Vanuatu

- Participating organisations
- Department of Water Resources (DoWR)
 - Vanuatu Meteorology and Geo-hazards department (VMGD)
 - National Disaster Management Organisation (NDMO)
 - Vanuatu Military Force (VMF)
 - Vanuatu Red Cross Society (VRCS)
 - Radio Vanuatu
 - Eratap Area Council

National legislation and strategy

Various legislative acts cover aspects of flood warning and water resource management.

National legislation:
[Water Resources Management Act 2002](#)
[National Disaster Act 2019](#)
[Meteorology, Geological Hazards, and Climate Change Act 2016](#)

National strategy:
[Vanuatu National Water Strategy 2018-2030](#)

Part 4.17 (e) of the *Meteorology, Geological Hazards and Climate Change Act* stipulates that flood early warning is the responsibility of the Vanuatu Meteorology and Geo-hazards Department with support and advice regarding observed conditions from the Water Resources Division who are the lead agency for hydrological data collection.

Component scorecard results

Risk/ Impact

Risk Informed Community
Historical Flood Knowledge
Flood Risk Mapping
Flood Modelling and Mapping

Monitoring and Forecasting

Staff and Training
Rainfall Forecasting
Flood Forecasting and Warning
Data Management and Analysis
Data Collection

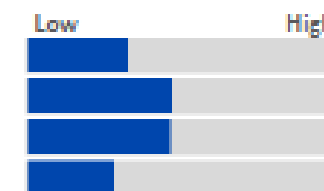
Warning dissemination and communication

Warning
Cross-agency Integration
Consultation
Communications Infrastructure & Technology

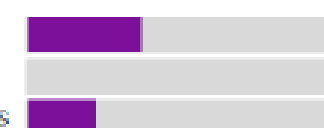
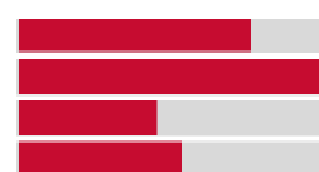
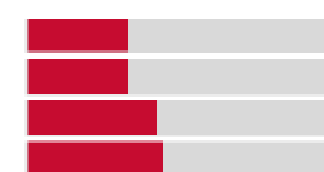
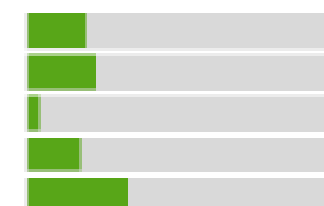
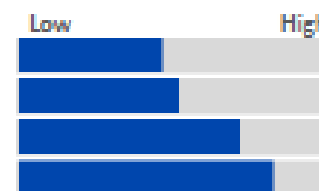
Response

Emergency Response Plan
Emergency Response Agencies
Community Awareness and Inclusive Preparedness

Capacity



Limitation to FEWS

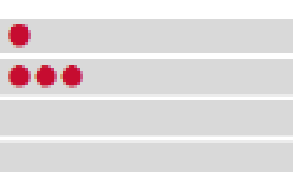
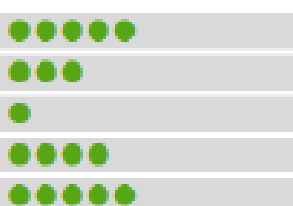
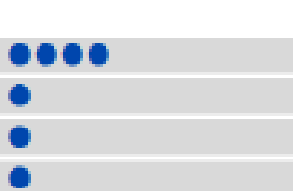


* These results show the current capacity and the corresponding limitations to the ability to provide effective flood early warning and response.

* The Projects to date column shows the number of projects since 1990 that have contributed to improving components of flood early warning, major ones have been described in the adjacent summary

Projects supporting flood early warning

Projects to date



Summary of support to Flood Early Warning

Over the past few decades numerous projects and programmes have addressed various aspects of the Flood Early Warning Framework.

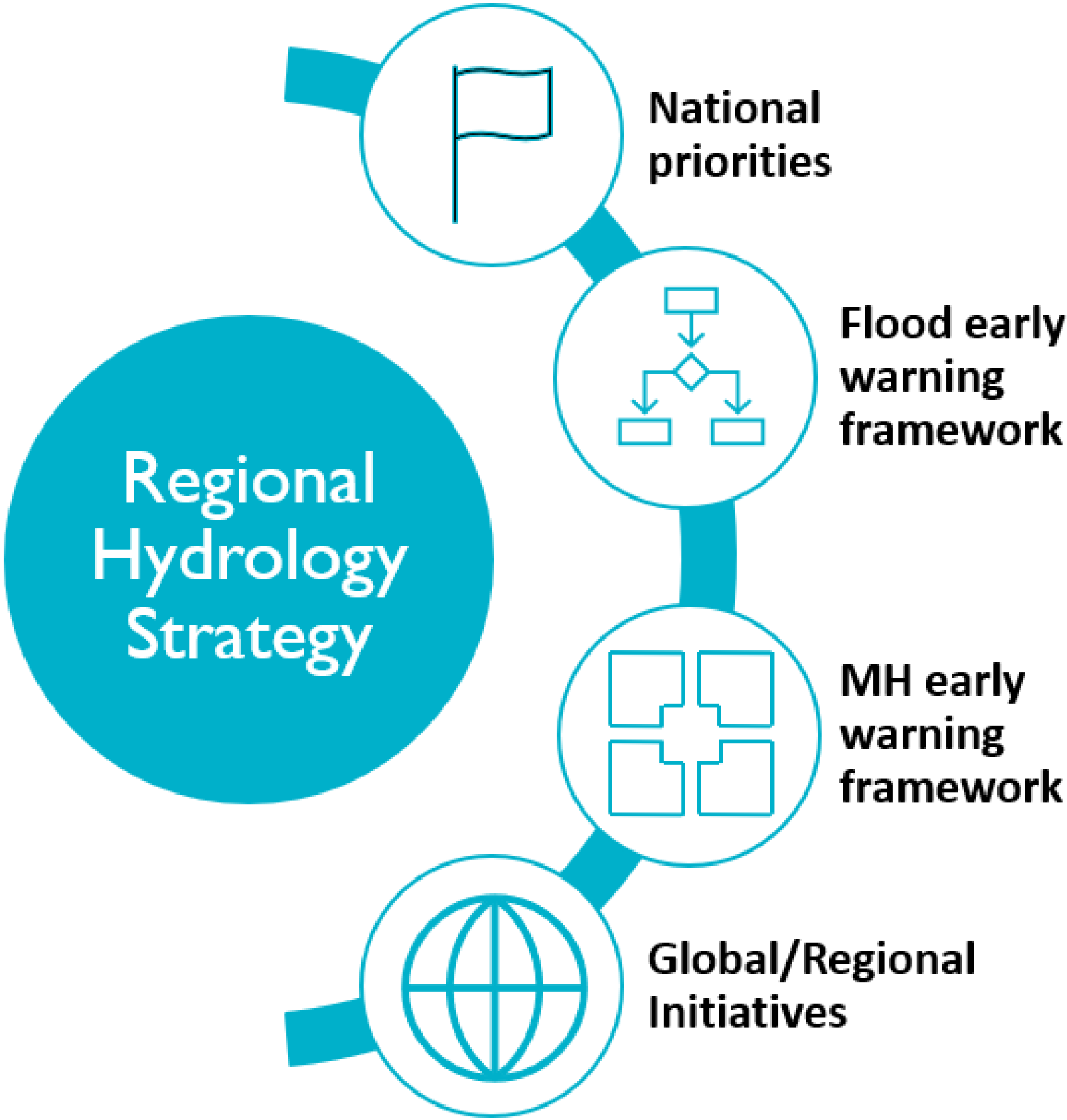
- Contributions to increasing the understanding of flood risk in Vanuatu have been supported through projects such as the *Vanuatu Community Based Climate Project* and flood risk mapping for the major population centres of Port Vila and Luganville through the *VankIRAP* project
- Historic investments in **Monitoring and Forecasting** through the French programs *OSTROM* and *IRD*, and the *Pacific HYCOS*, led to a period of high-quality data collection and skilled staff but a lack of ongoing support and funding for programmes, equipment and training resulted in monitoring system failure that significantly impacted momentum in building upon project achievements. Recent investments through the *AWP*, *VankIRAP*, *VCAP*, and *COSPPac* projects have reinstated hydrometric data collection through the installation of monitoring equipment and the strengthening of field practices, including ongoing training and support by NIWA.
- The *Increasing Resilience to Climate Change and Natural Hazards in Vanuatu* project co-financed the establishment of the national multi-hazard **warning** and emergency operations centre, including refurbishment and equipment for the VMGD forecast division.
- Projects such as *BSRP* and *PIEMA* supported **response** capabilities.

Regional/global initiatives and programs

Development related to Disaster Risk Reduction (DRR) in the Pacific is guided by the Sendai Framework and the Framework for Resilient Development in the Pacific (FRDP). Regional and global initiatives that seek to address the objectives of these Frameworks include:

- The Pacific Community – [Hydrology to support flood early warning in the Pacific](#)
- Pacific Meteorological Council – [Weather Ready Pacific](#)
- World Meteorological Organisation – [HydroHub](#)
- World Meteorological Organisation – [HydroSOS](#)
- World Meteorological Organisation – [Early Warning For All](#)

Next steps:



Too Little Water

Uatea Salesa

Water Security Projects Manager, SPC



Quick Outline

- Showcasing our project work – Kiribati, RMI & Tuvalu
- Drought Management -Emergency Approach
- Drought Modelling – RiskScape

Drought - Emergency Management Approach



- **Mitigation phase**

- Long term planning and strategic action can eliminate or reduce the severity of future droughts and minimise long term effects.

- **Planning phase**

- Enables forward thinking and consideration of potential drought impacts and how best to plan for them.

- **Preparedness phase**

- Focusses on reducing the effects by having plans and capacity in place for the response and recovery stages.

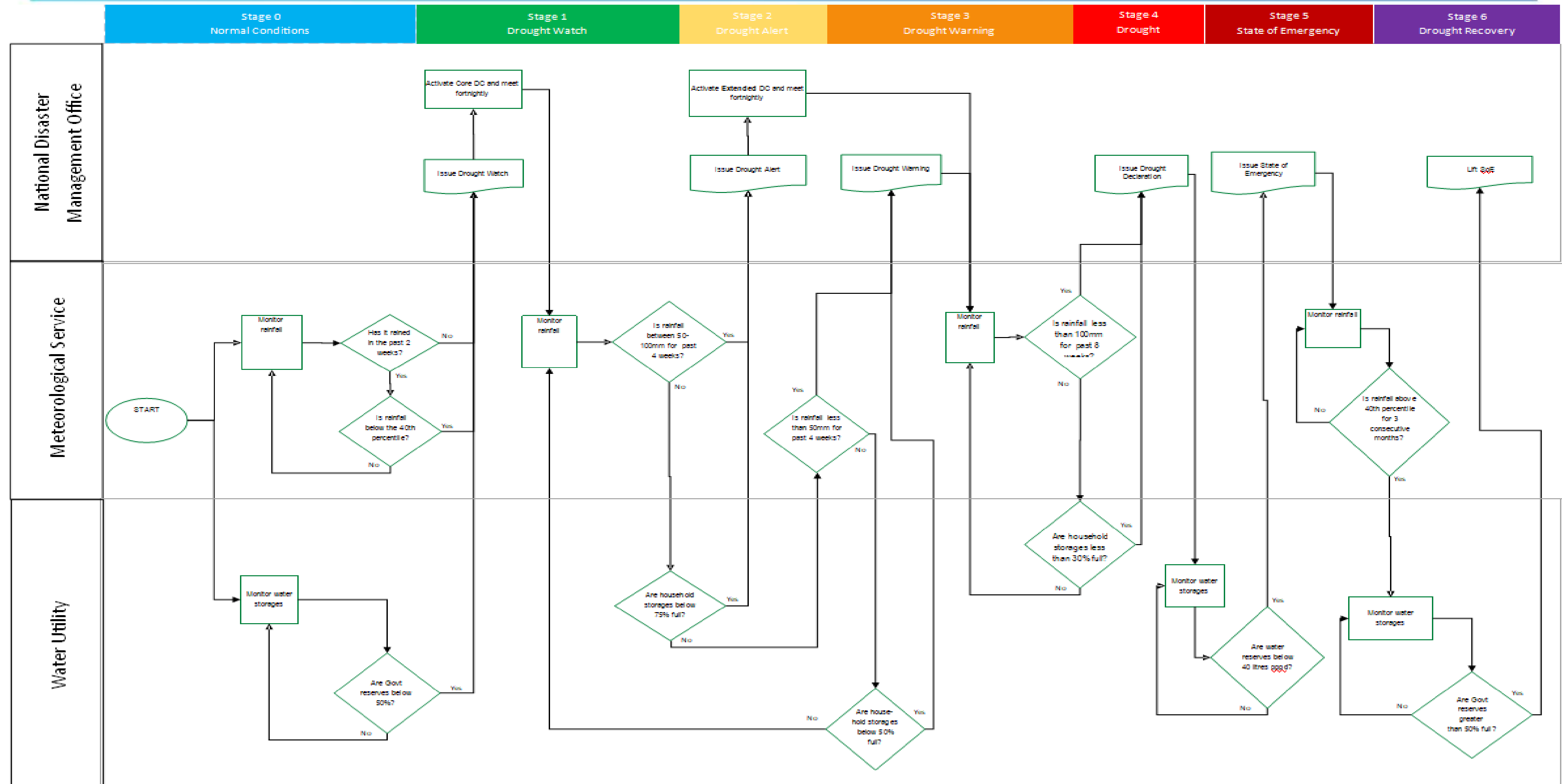
- **Response phase**

- A focus on responding to the drought and implementing relevant plans and actions prepared in previous phases.

- **Recovery phase**

- A focus on returning to day to day activities. Includes a review of the drought response phase to ensure lessons learnt are incorporated into future mitigation, planning and preparedness activities.

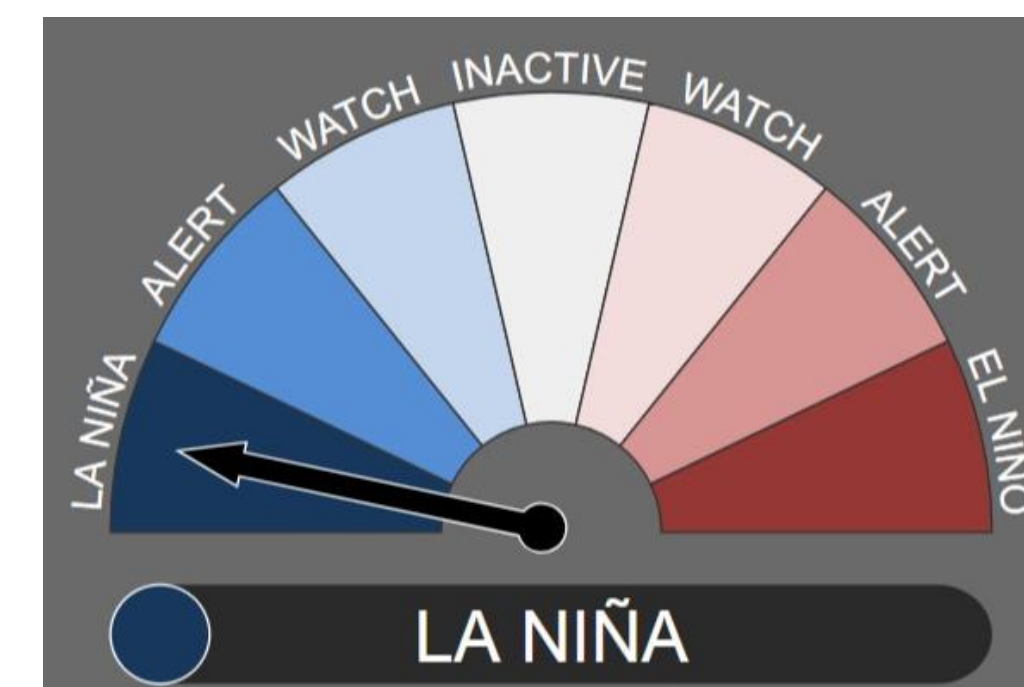
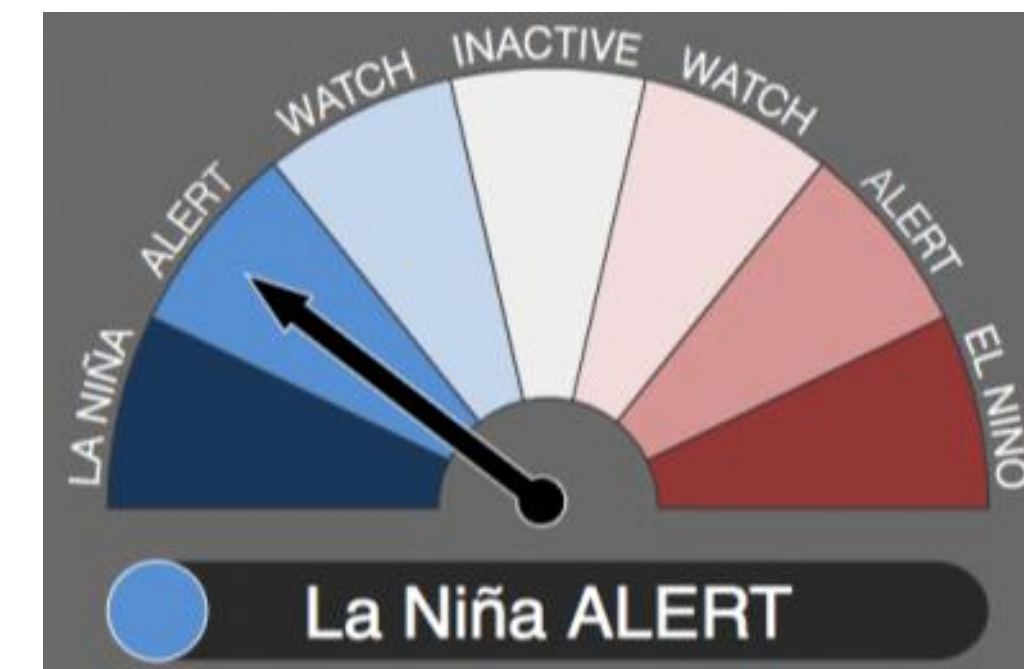
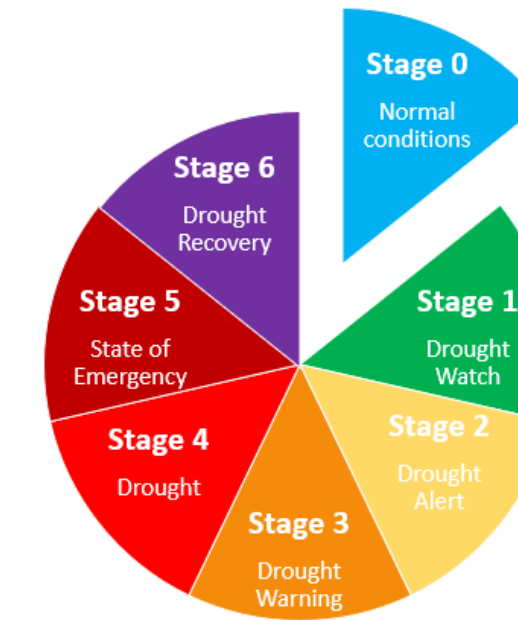
Drought Phases & Stages



Stage 0 – ‘Normal’ conditions

- Key elements

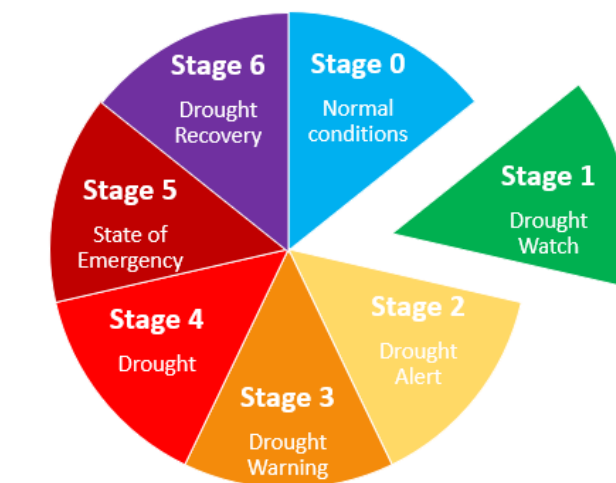
- **Mitigation Phase** - Long term planning and strategic action can eliminate or reduce the severity of future droughts and minimise long term effects.
- Drought Committee (DC) only active when El Nino – Southern Oscillation (ENSO) Outlook is La Nina Alert or La Nina
- Ongoing data collection, analysis and reporting on rainfall and storage/reservoir volumes
- Opportunity to implement actions to reduce future drought risk. (e.g secure funding for construction of additional storages)
- Water Conservation programs - education and awareness raising
- This is where you want to be!



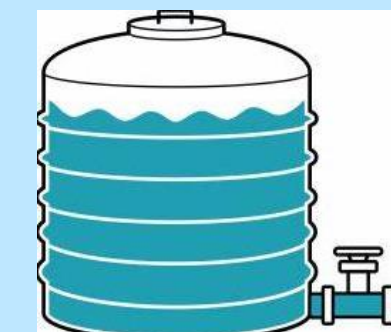
Stage 1 – Drought watch

- Key elements

- **Planning Phase** - Enables forward thinking and consideration of potential drought impacts and how best to plan for them.
- Drought Committee (DC) is active - Core members only, fortnightly meetings
- Ongoing data collection, analysis and reporting on rainfall and storage volumes – bi weekly reporting
- Opportunity to implement immediate actions to reduce drought risk.
- Communicate Drought Watch – increase water conservation programs, education and awareness raising, prepare drought education workshops
- If # of households buying water per day > 60, PWD to start setting up water distribution points and mobilise desalination plants and water trucks to fill tanks



No rainfall past two weeks
OR
Rainfall at or below the 40th
percentile

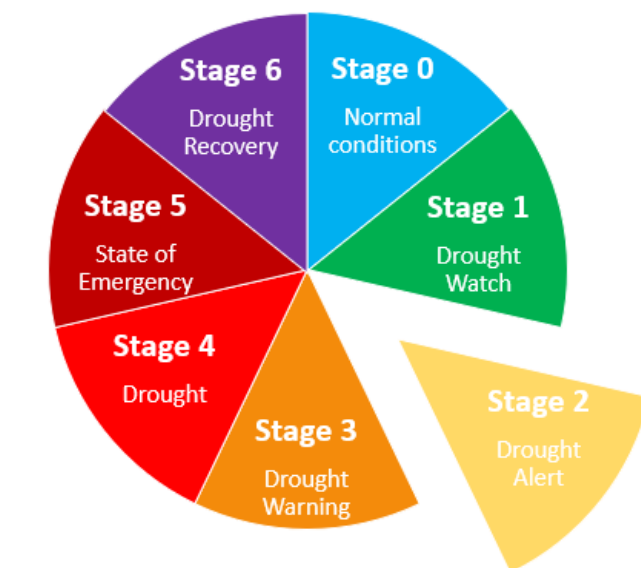


OR
Government/Utility
storages/reservoirs below 50%

Stage 2 – Drought alert

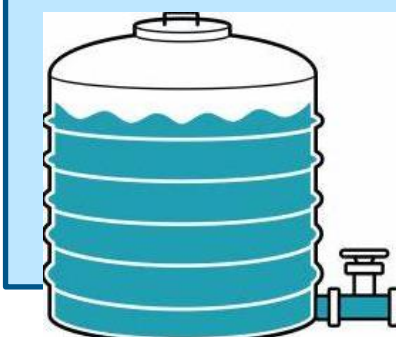
- Key elements

- **Planning Phase** - Enables forward thinking and consideration of potential drought impacts and how best to plan for them.
- Drought Committee (DC) is active - Extended membership, fortnightly meetings
- Ongoing data collection, analysis and reporting on rainfall and storage volumes, weekly reporting
- Opportunity to implement immediate actions to manage drought risk.
- Communicate Drought Alert – increase water conservation programs, education and awareness raising, conduct drought education workshops
- If # of households buying water per day > 60, PWD to set up water distribution points and mobilise desalination plants and water trucks to fill tanks
- Apply drought management non – essential water use restrictions



Between 50 – 100 mm rainfall
past four weeks

OR

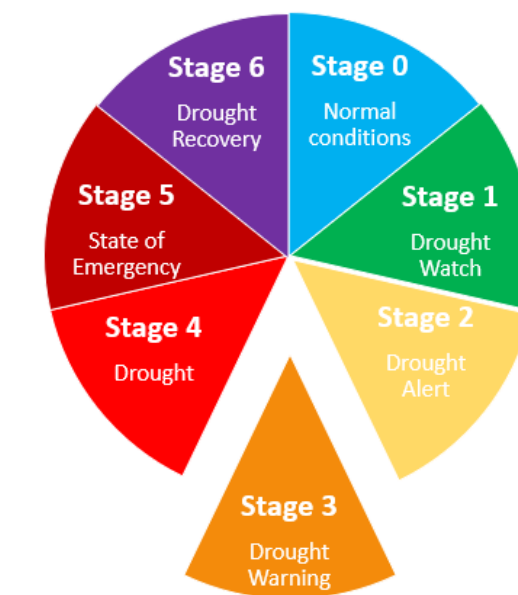


Household storages below 75%

Stage 3 – Drought warning

- Key elements

- **Preparedness Phase** - Focus on reducing the effects by having plans and capacity in place for the response and recovery stages.
- Drought Committee (DC) is active - Extended membership, fortnightly meetings
- Ongoing data collection, analysis and reporting on rainfall and storage volumes, weekly reporting
- Opportunity to implement immediate actions to manage drought risk.
- Communicate Drought Warning – increase water conservation programs, education and awareness raising, conduct drought education workshops
- Apply drought management non – essential water use restrictions, water rationing from Government storages
- Prepare for emergency response for high risk areas, funding preparations



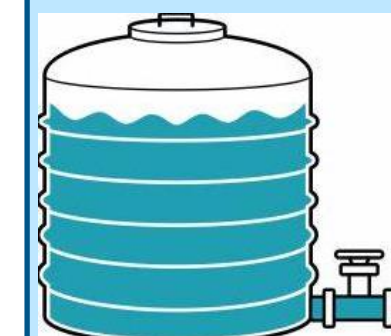
Less than 50mm rainfall for past four weeks

OR

Between 50 – 100mm rainfall for the past six weeks

OR

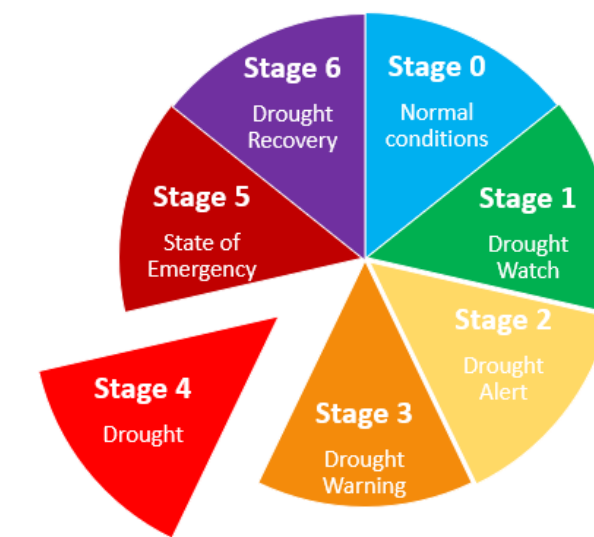
Household storages below 50%



Stage 4 - Drought

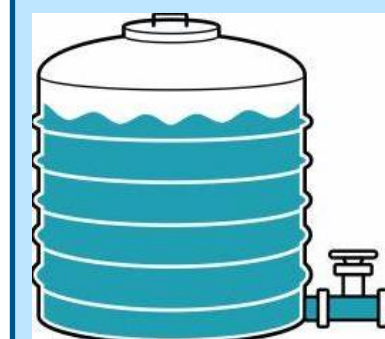
- Key elements

- **Response Phase** - Focus on responding to the drought and implementing relevant plans and actions prepared in previous phases.
- Drought Committee (DC) is active - Extended membership, fortnightly meetings
- Ongoing data collection, analysis and reporting on rainfall and storage volumes, weekly reporting
- Opportunity to implement immediate actions to manage drought risk.
- Communicate Drought Warning – increase water conservation programs, education and awareness raising, weekly press releases
- Apply drought management non – essential water use restrictions, water rationing from Government storages
- Prepare for emergency response for high risk areas , secure necessary funding



Less than 100mm rainfall for
past eight weeks

OR

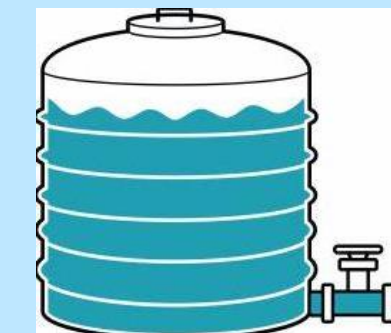
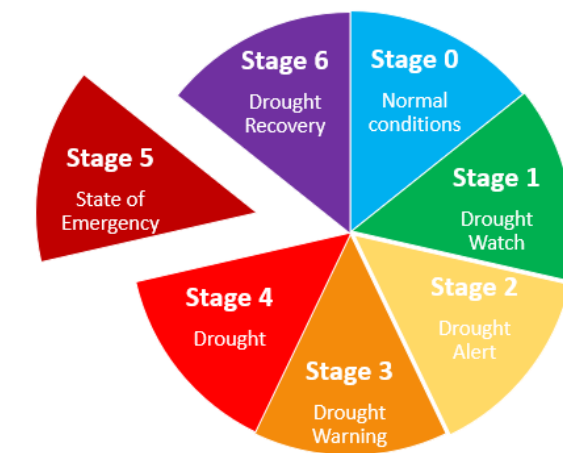


Household storages below 30%

Stage 5 – State of Emergency

- Key elements

- **Response Phase** - Focus on responding to the drought and implementing relevant plans and actions prepared in previous phases.
- Drought Committee (DC) is active - Extended membership, fortnightly meetings
- Ongoing data collection, analysis and reporting on rainfall and storage volumes, weekly reporting
- Opportunity to implement immediate actions to manage drought risk.
- Communicate Drought Warning – increase water conservation programs, education and awareness raising, weekly press releases
- Apply drought management non – essential water use restrictions, water rationing from Government storages
- Prepare for emergency response for high- risk areas , secure necessary funding

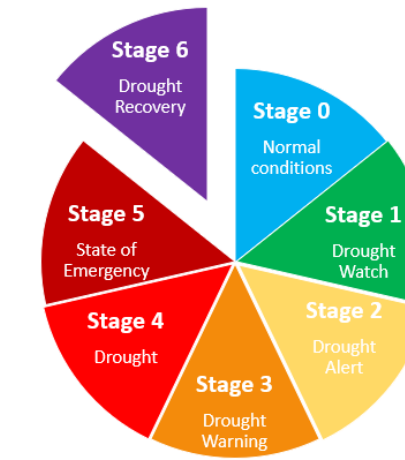


Government, community and household storages combined volume below 40 litres per person per day

Stage 6 – Drought recovery

- Key elements

- **Recovery Phase** – Opportunity to reflect on drought response and to ensure lessons learnt are incorporated into future mitigation, planning and preparedness activities.
- Ongoing data collection, analysis and reporting on rainfall and storage volumes.
- Opportunity to identify improvement initiatives
- Communicate Drought Recovery – scale back water conservation programs, education and awareness raising activities
- Lift drought management water use restrictions and rationing



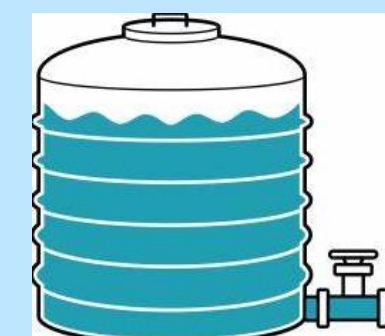
Rainfall above 40th percentile for
at least three consecutive
months

AND

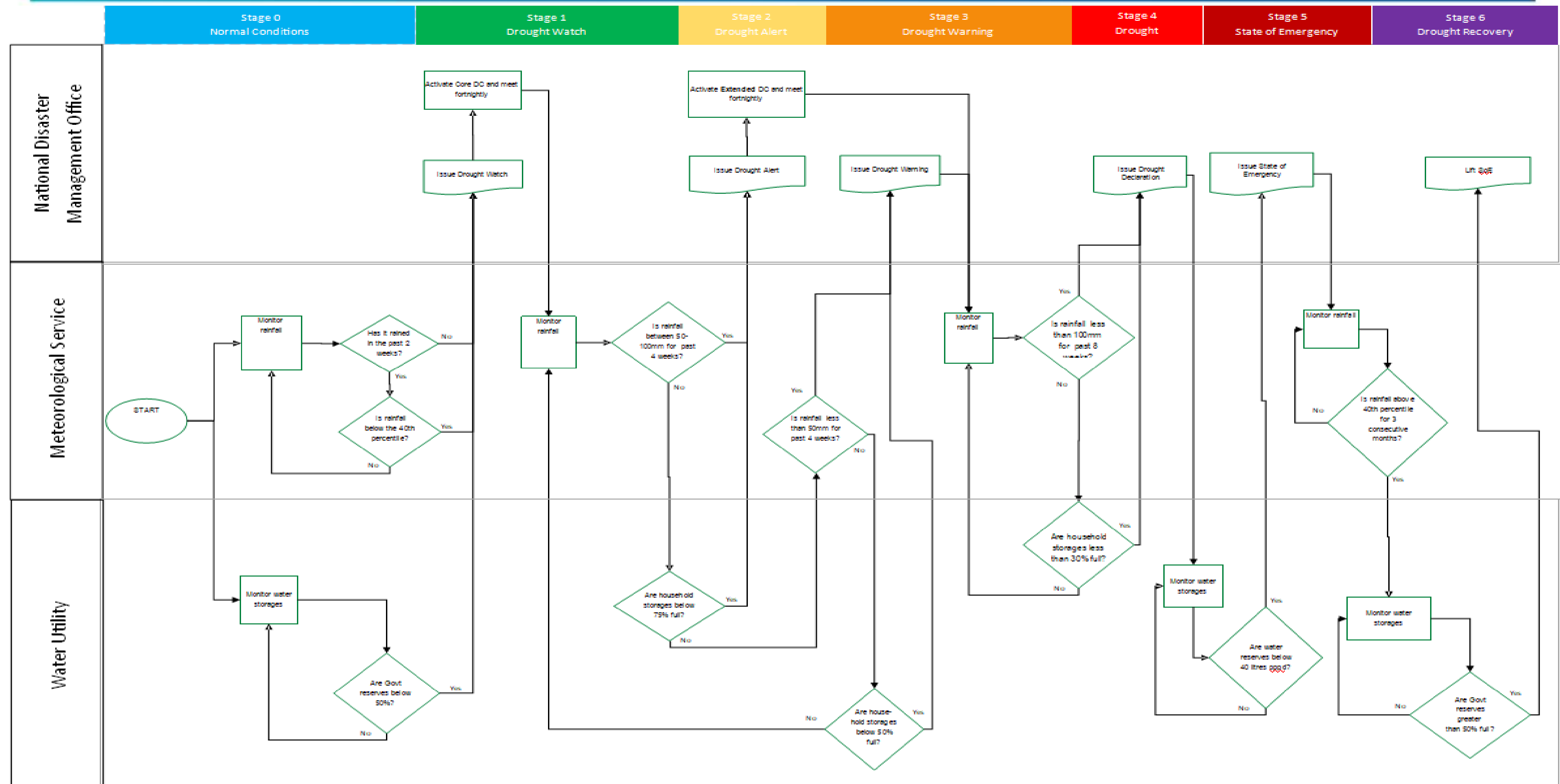
Rainfall above 50th percentile

AND

Government storages above 50%



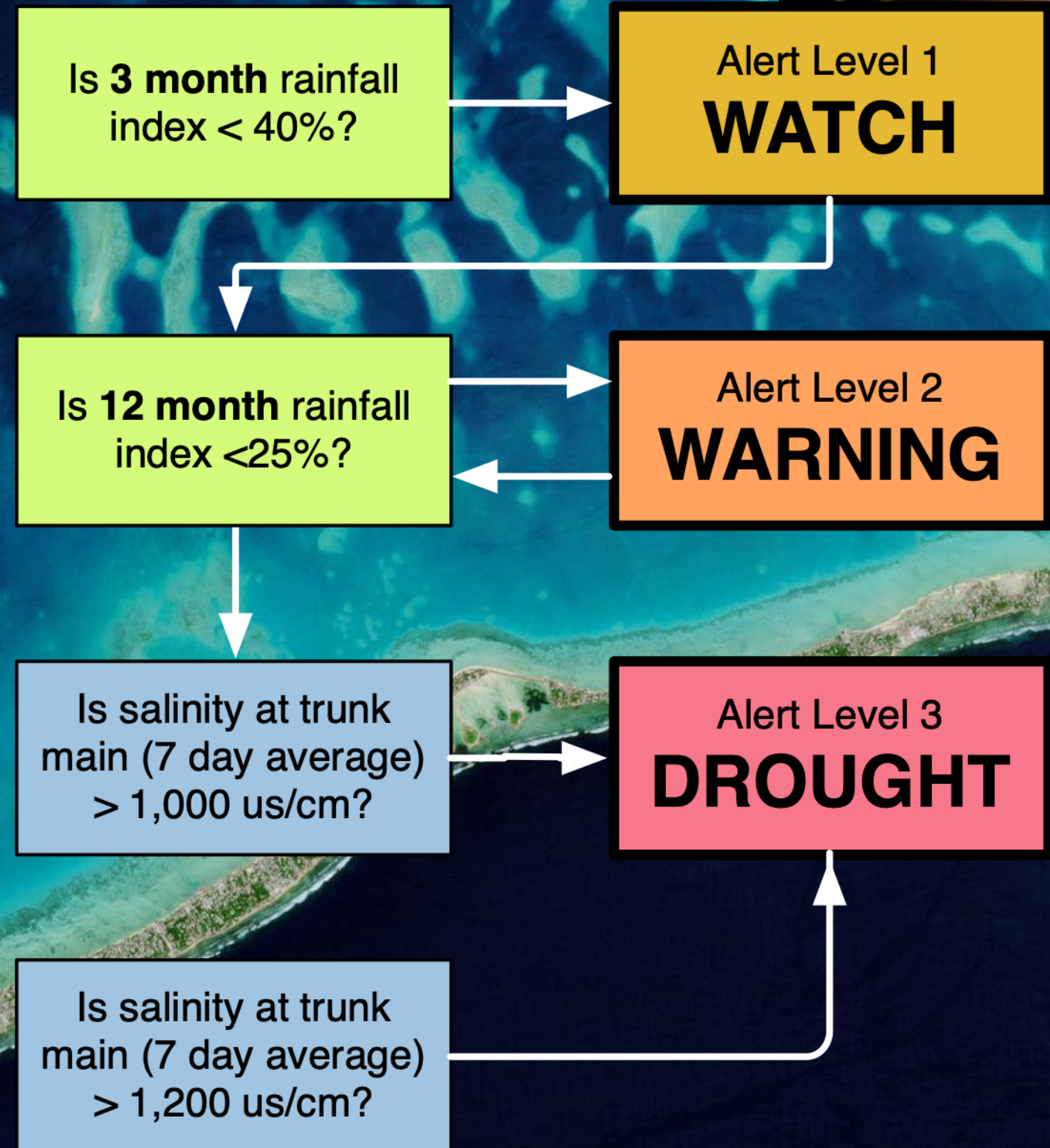
Drought Phases & Stages





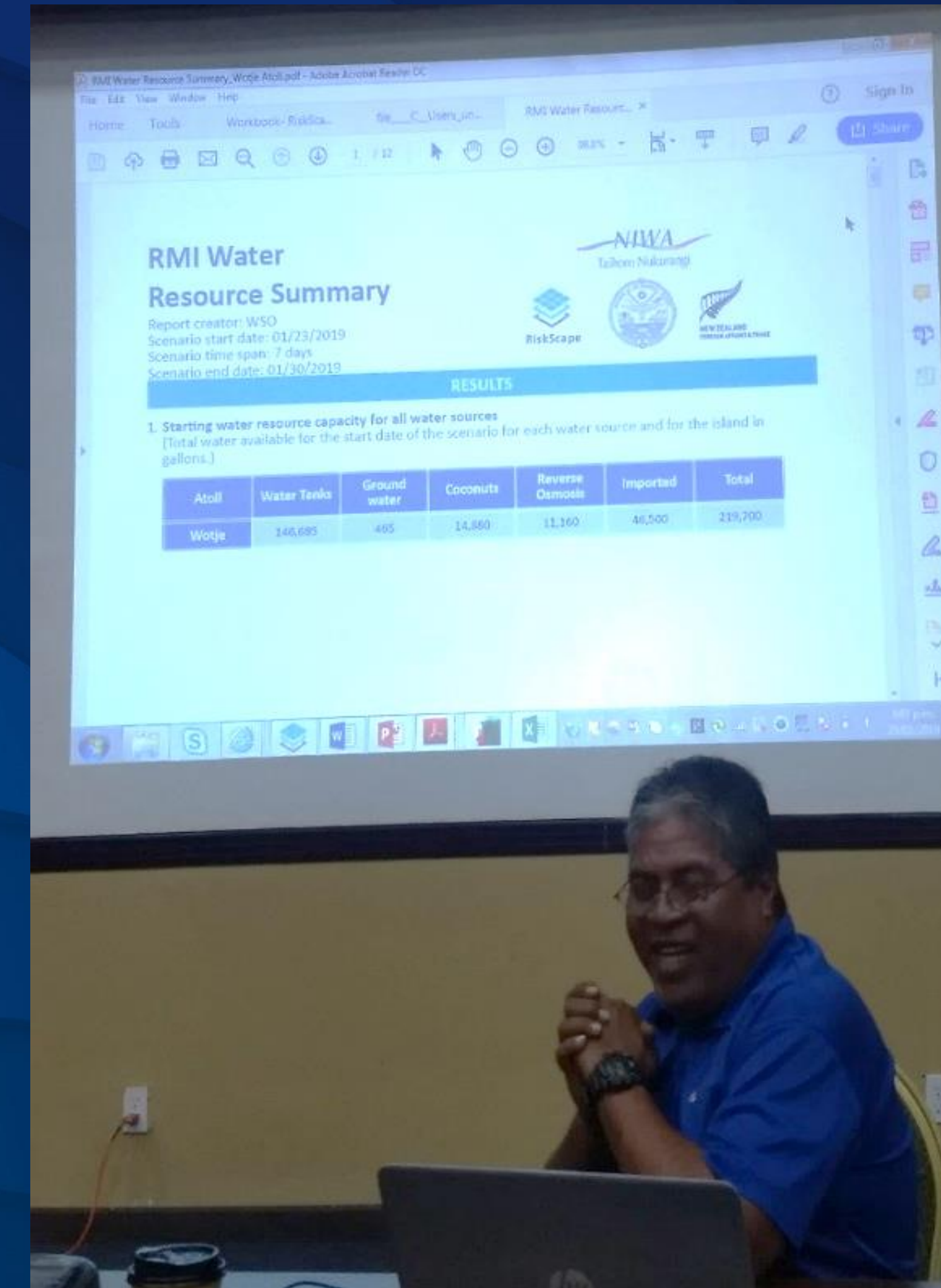
TRIGGERS

ALERT LEVELS



Drought Modelling- RiskScape

- Data inputs that are more flexible for users (RiskScape 2.0)
 - i.e. users can easily change the water resources included
- Rainfall/drought forecasts to be updated in near real-time (hourly or daily)
- Developing interactive maps and dashboards (using the CliDEsc portal)



Rainfall outlook

CliDEsc

RiskScape

CliDEsc

2a. Asset file per household (CSV)

- Location
- # of water tanks
- Size
- # ppl using
- roof area

2b. Water resource info from user input form

- # days of scenario
- # ppl per island
- other water sources
- initial % full of water tanks
- forecasted rainfall per island for the duration of the scenario

3a. Joins input data (2a and 2b)

3b. Consequence function

- Tailored for each island

3c. Results (CSV)
Amount of water remaining at the end of the scenario

- Per household
- Per island

4a. Results CSV for download

4b. Interactive map and Dashboard

- Gov't.
- Community

1a. From global models

1b. From Tuvalu Met Service (CliDE/CliDEsc)

1c. Drought outlook per island

Screenshots of the Demonstration Tuvalu and RMI Drought Model

Tuvalu RiskScape Inputs

What is the name for your scenario?

RMI Tank Level Forecast

What is the start date for the scenario?

2022-10-12

How many days would you like to run the scenario for?

7

What rainfall model do you want to use?

☒ Rainfall model 1

☐ Rainfall model 2

☐ Rainfall model 3

What atolls do you want to look at for this scenario?

☐ Funafuti

☐ Nanumea

☐ Nanumanga

☐ Niulakita

☐ Niutao

☐ Nui

☐ Nukulaelae

☐ Nukufetau

☐ Vaitupu

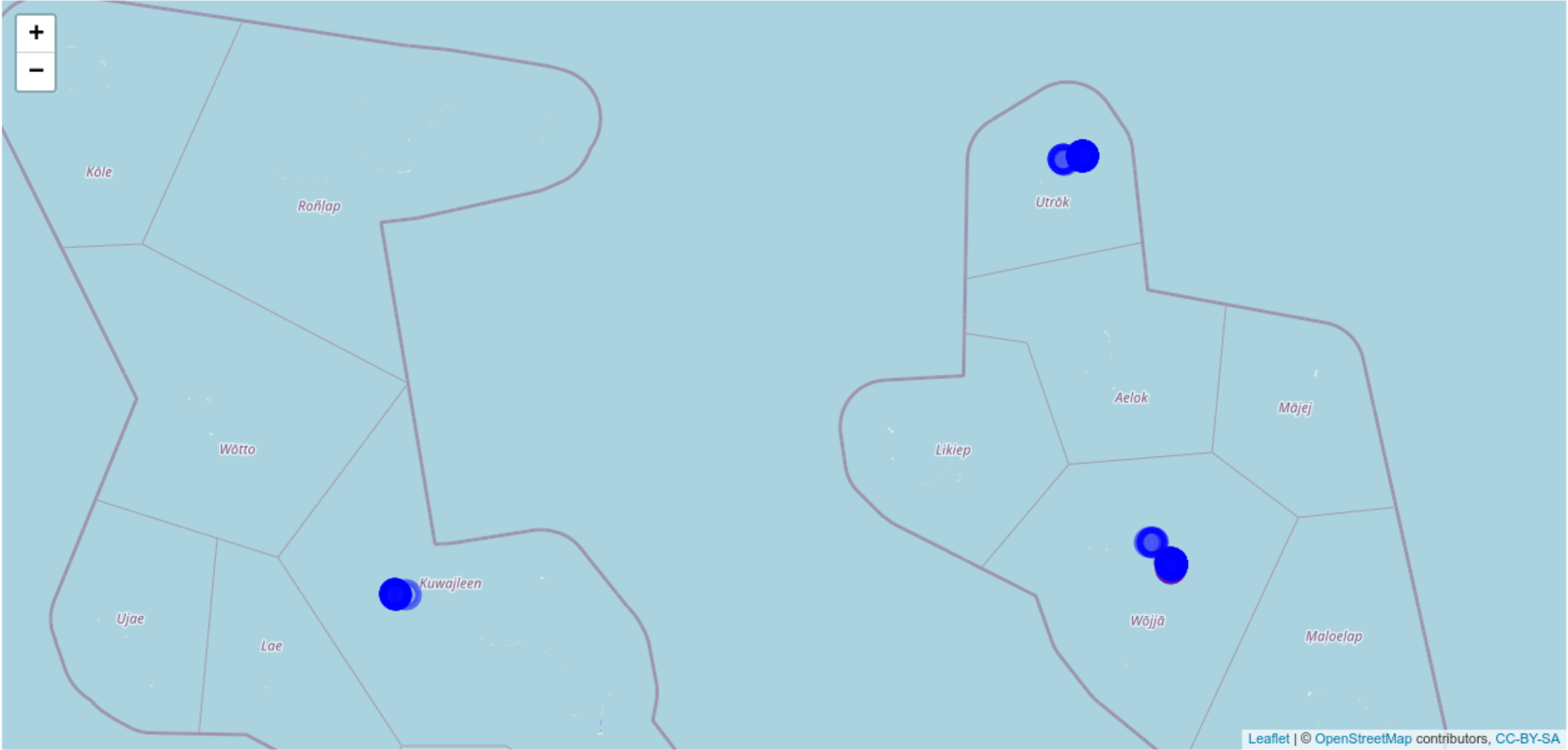
☐ Ebadon

☒ Mejatto

☐ Utrik

☒ Wotje

What is the population of each atoll?



Expected results- viewed in interactive map, dashboard and csv file

1. **Water remaining for all sources** (for drinking/ cooking/ washing/ agriculture purposes)
2. **Consumption days remaining** (at the end of the scenario)
3. **Water remaining in tanks and # of tanks with no water**
4. **Water and rainwater required to refill tanks**
5. **Tank refill trend** (did the water tanks increase, decrease or remain nearly the same)



Vinaka Vakalevu