

The impacts of climate change on our stormwater and wastewater systems

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Agenda

- Background
- About the project
- Impacts summary
- Key implications
- Regional analysis
- Some recommendations (what may all this mean, and how should we respond?)



Background

The Rodney & Otamatea Times

WAITEMATA & KAIPARA GAZETTE.

PRICE—10s per annum in advance

WARKWORTH, WEDNESDAY, AUGUST 14, 1912.

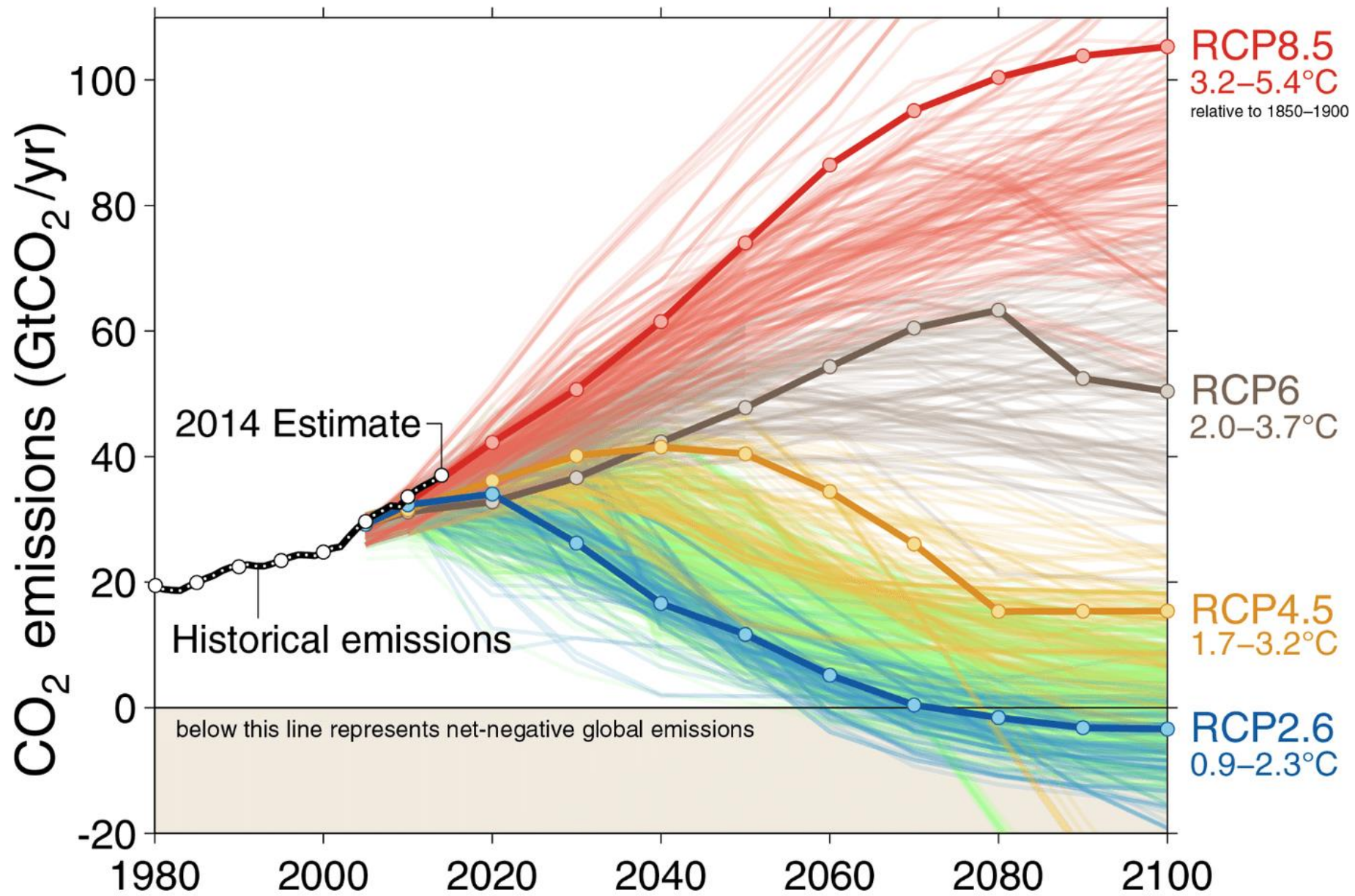
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Science Notes and News.

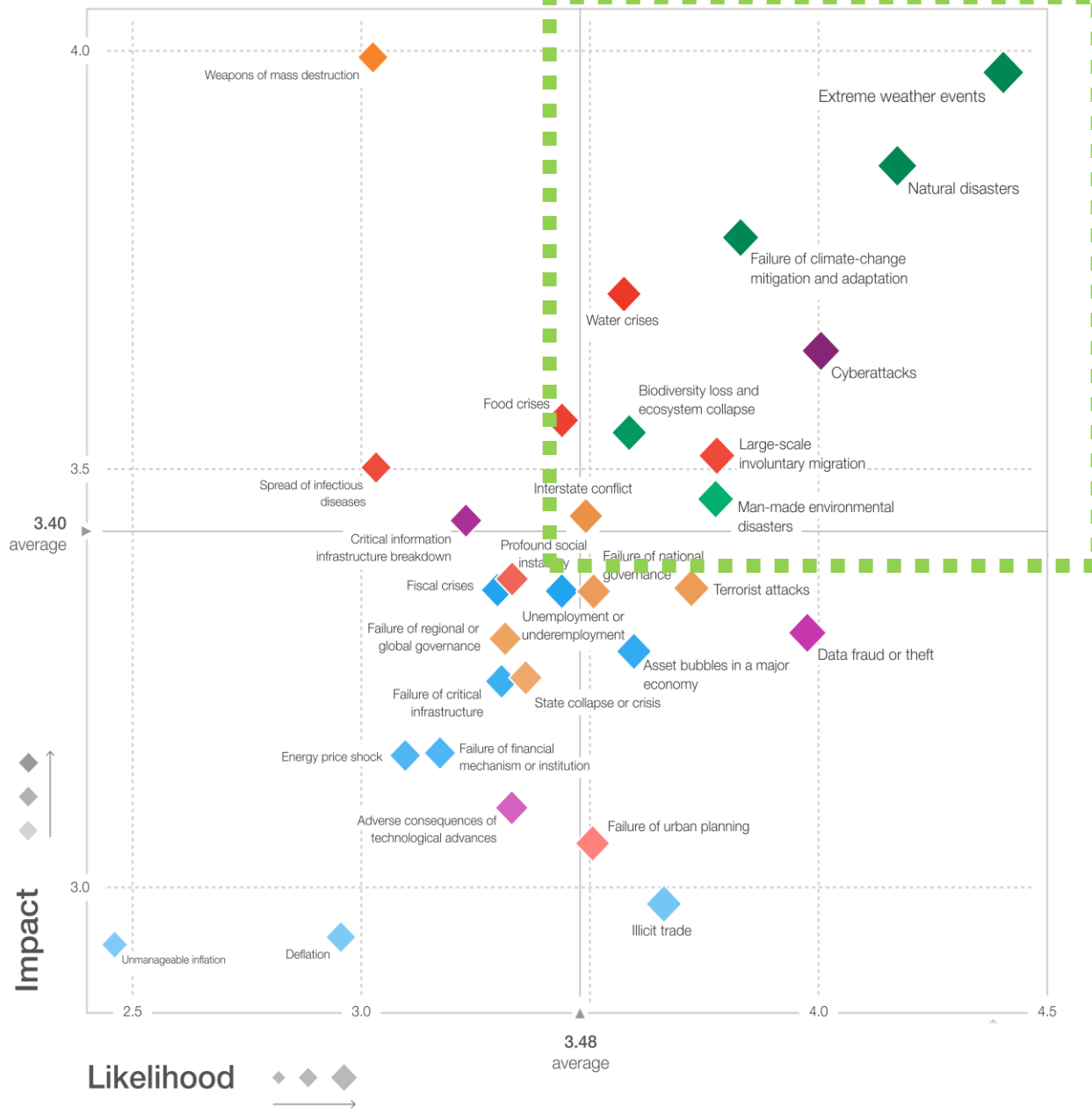
COAL CONSUMPTION AFFECT- ING CLIMATE.

The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries.



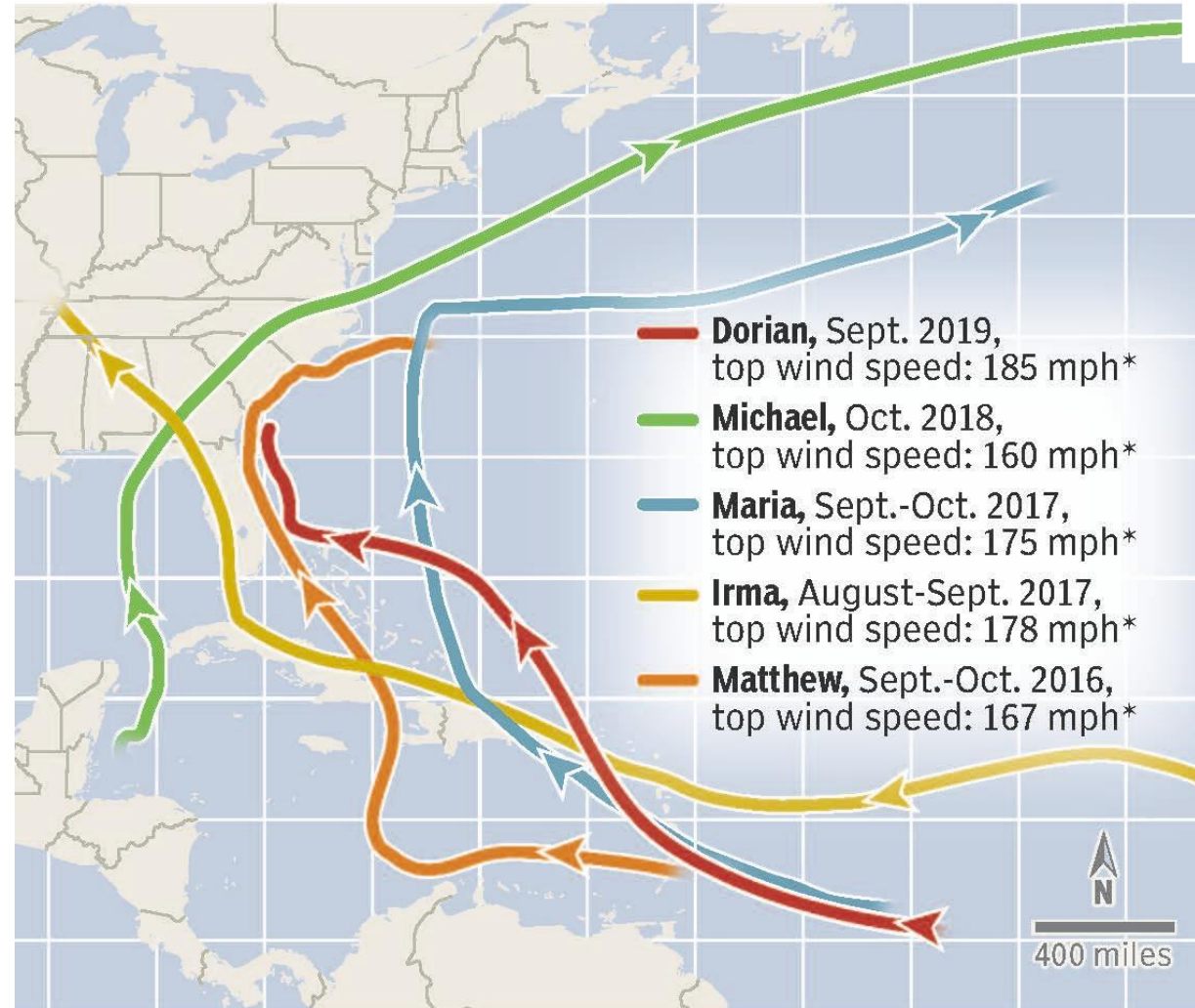


WEF GLOBAL RISK REPORT



Five Cat 5s in four years


The tropical Atlantic has created a rash of Category 5 hurricane since 2016 with five forming, including Hurricane Michael, which made landfall in Florida's Panhandle in 2018.



*These are sustained wind speeds


Source: NOAA; maps4news.com/©HERE

GATEHOUSE MEDIA

An aerial photograph showing the aftermath of a hurricane. The scene is one of widespread destruction. In the foreground, a large, multi-story building has been completely gutted, leaving only its wooden frame. To the left, a beach is visible, with waves crashing against the shore. The middle ground is filled with debris, including twisted metal, broken wood, and scattered household items. Several houses are partially destroyed, with roofs missing or severely damaged. A paved road with yellow double lines runs through the center of the image. In the background, more houses and palm trees are visible, some still standing but many showing signs of damage. The overall atmosphere is one of desolation and the scale of the disaster.


Hurricane Michael's slightly lower pressure than Katrina does not necessarily mean that it will be as dangerous or more so than the storm that flooded New Orleans. Katrina killed more than 1,000 people due to infrastructure failures and [mismanagement](#) of emergency resources, not because of where it sat on the record charts,

Infrastructure impacts

An aerial photograph showing a residential area heavily inundated with floodwater. The water is a muddy, brownish-tan color, covering the streets and yards between houses. The houses have various roof colors, including grey, brown, and red. Some trees are visible, some partially submerged. In the foreground, a wide river flows, with a concrete dam or barrier structure visible. The overall scene depicts significant flooding in a populated area.

364 river control, flood protection, and land drainage schemes


protect some **1.5 million** hectares of land



**Our
Climate
Your Say!**

**Discussion
Document**

Join the conversation...



Environment
Ministry for the Environment



Exposed: Climate change and infrastructure

Guidance for councils

August 2019



**We are.
LGNZ.**
Te Kāhui Kōwhiriwhiri o Aotearoa.

Ministry for the
Environment
Manatū Mo Te Taiao

Arotakenga Huringa Āhuarangi

A FRAMEWORK FOR THE NATIONAL CLIMATE CHANGE
RISK ASSESSMENT FOR AOTEAROA NEW ZEALAND

New Zealand Government



The research project

National **Science** Challenges

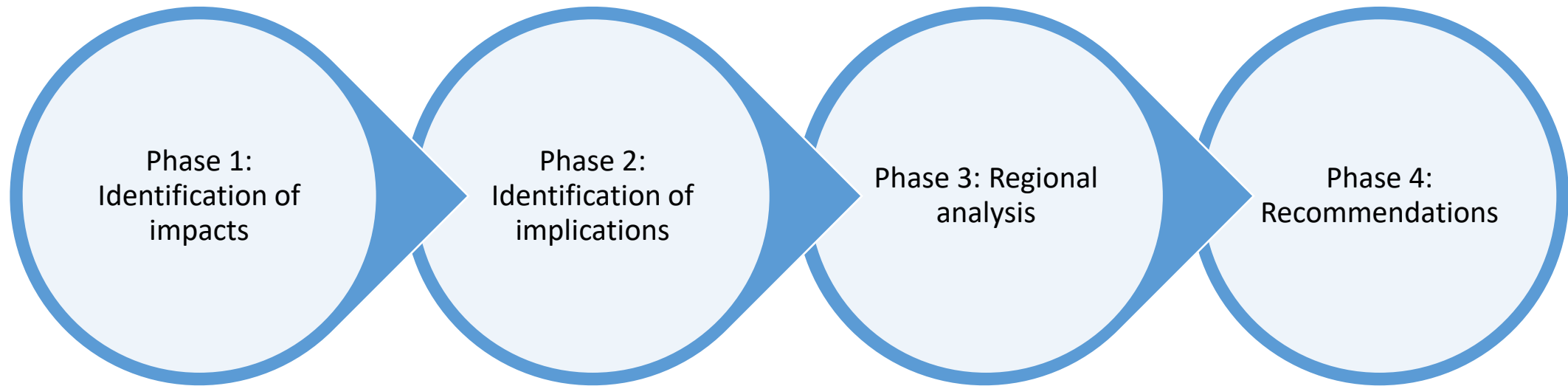
THE DEEP SOUTH

Te Kōmata o
Te Tonga



Wastewater & Stormwater Impacts

Project overview - methodology



Including Case Studies

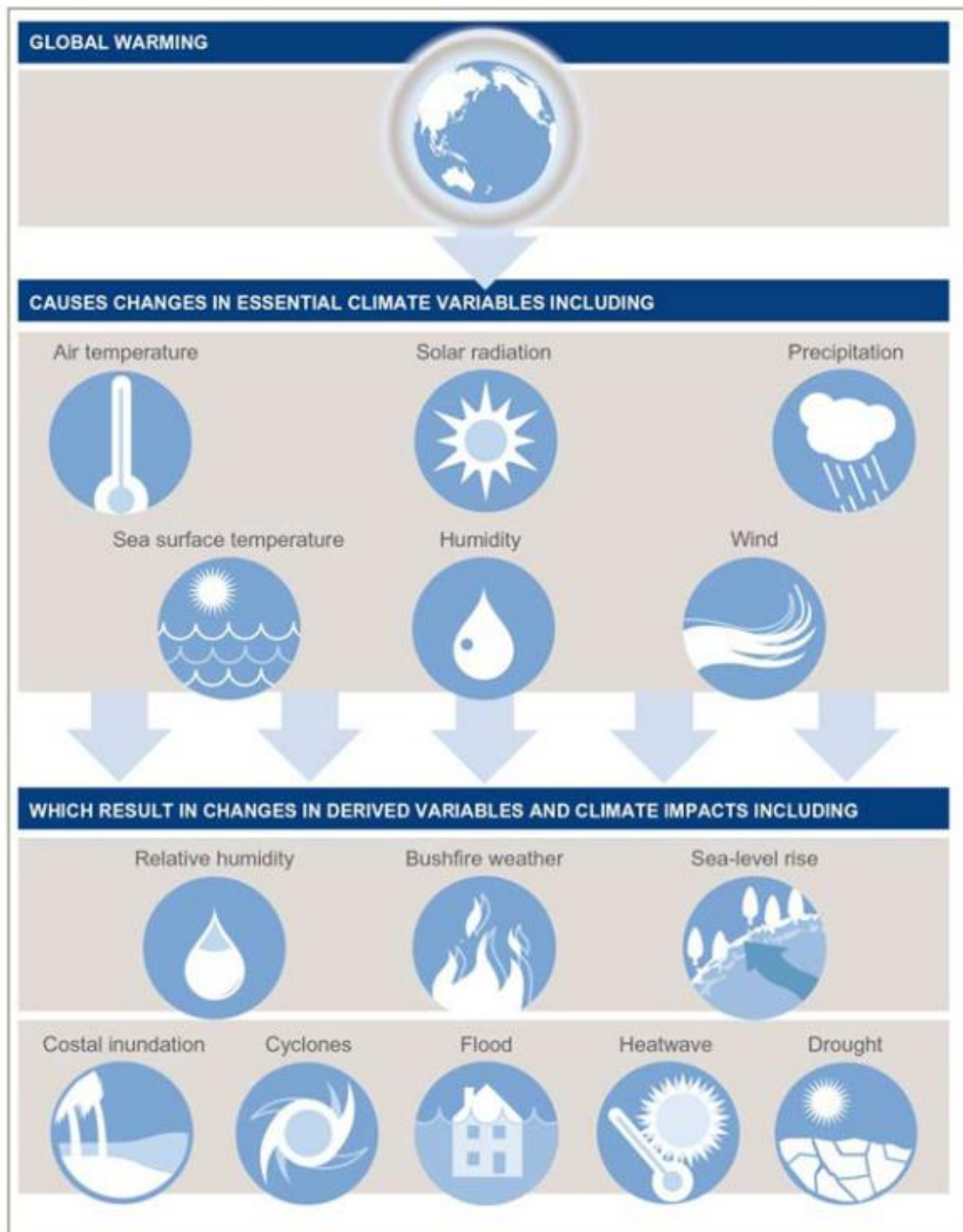


Leadership models in environmental

- PERSONAL**
 - Strong
- BEHAVIORAL**
 - Shared
 - Focus on actions and behaviors
 - Stability
- STRUCTURAL**
 - Shared structures
 - Organizing resources and systems
 - Outcomes focused
- CULTURAL**
 - Doing for

• Shared
• Shared systems
• Combining the best together
• Shared values and beliefs
• Shared not done
• Emergent and adaptable structures
• Process focused
• Duty ethic

Working group



Climate hazards

- Increased rainfall
- Decreased rainfall
- Sea level rise
- Increased temperature
- Increased wind

Stormwater assets considered

Conveyance

- Piped networks
- Overland flow paths
- Stopbanks

Treatment

- Stormwater quality improvement devices

Wastewater assets considered

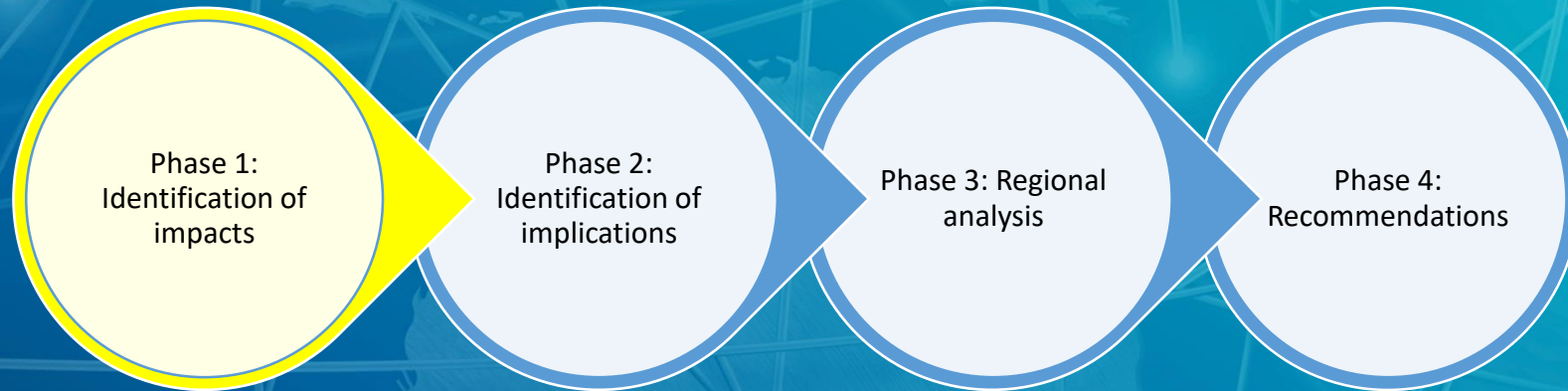
Conveyance

- Separated gravity system
- Combined gravity system
- Pressure system
- Pump stations

Treatment

- Treatment plants and processes
- On site wastewater systems

Impacts on stormwater systems – some key examples



Key stormwater conveyance impacts

Increased Rainfall:

- Increased flooding
- Damage to infrastructure
- Scour and erosion
- Increased contaminant concentrations
- Resuspension of sediments
- Raised groundwater table

Reduced rainfall / increased temp:

- Reduced baseflows
- Warmer water temperatures



Contaminant loading

Increased rainfall:

- Scour and erosion causes TSS increase
- Higher velocities collect more rubbish and debris
- Pollutants of many types
- Higher flows, mean increased flushing

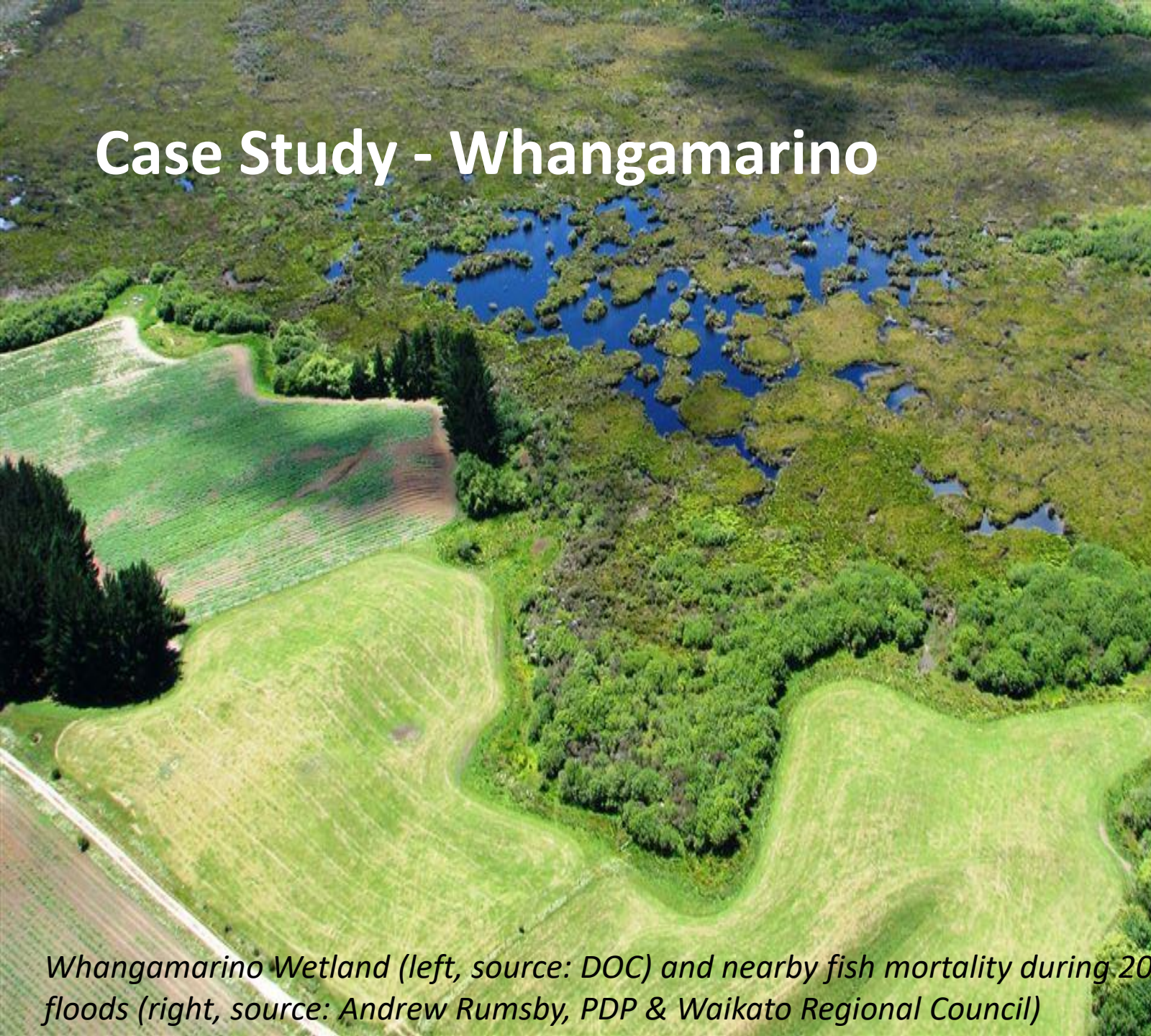


Key stormwater treatment device impacts

- Higher peak flows
 - Increased contaminant loadings
 - Reduced capacities
 - Salinity impacts
 - Rising groundwater
 - Increased evapotranspiration
 - Plant stress – eg in rain gardens
-
- All leading to potential for reduced L.O.S.



Case Study - Whangamarino



Whangamarino Wetland (left, source: DOC) and nearby fish mortality during 2017 floods (right, source: Andrew Rumsby, PDP & Waikato Regional Council)



Impacts on wastewater systems

Wastewater network impacts

Increased rainfall:

- Increased incidences of overflows in wet
- Corrosion risk due to salinity
- Flotation of pipes
- GW ingress
- Infrastructure damage
- Blockages within systems due to low flows in drought

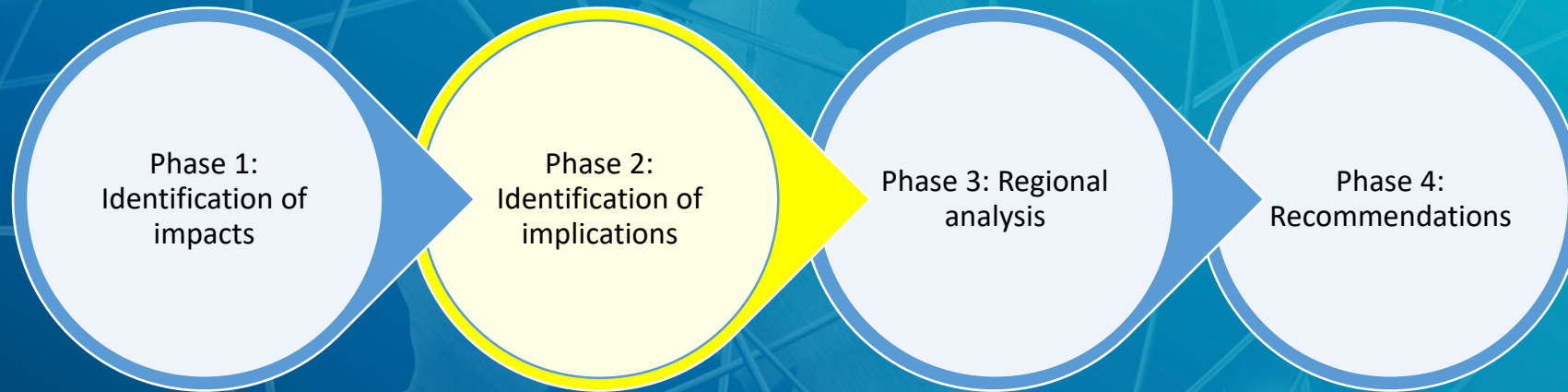


LA Case Study (2015)

**PARDON THE
APPEARANCE OF
OUR LAWNS**

**DUE TO THE DROUGHT AND
CURRENT WATER RESTRICTIONS,
CalPERS HAS STOPPED
WATERING THE GRASS.**

Cascading implications

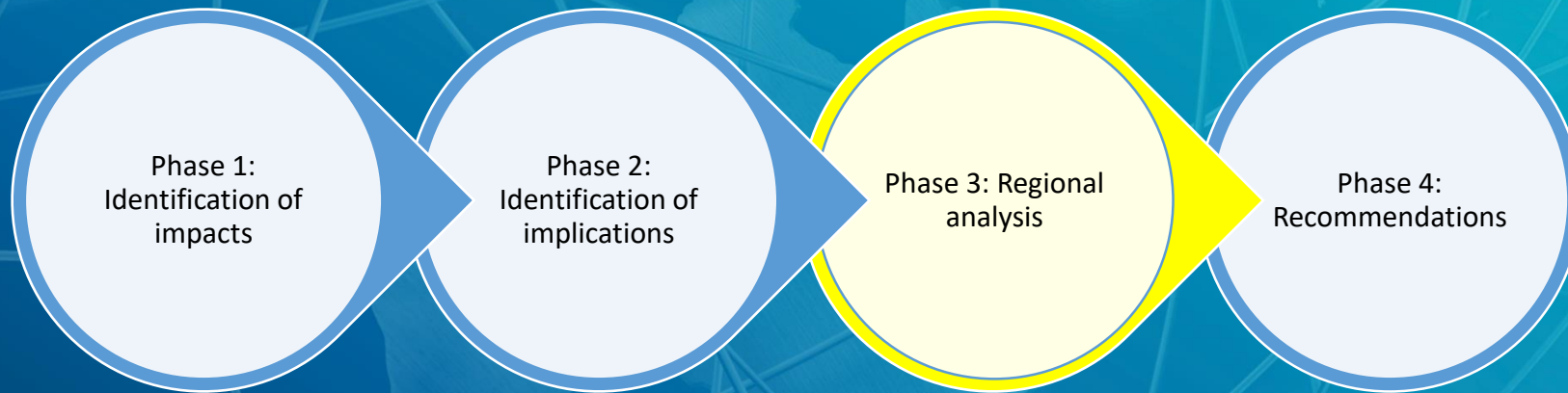


Example: Implications arising from uncontrolled wastewater discharges

- Environmental / habitat degradation
- Significant cultural impacts on water quality, mauri of waterways, mahinga kai, identity and connection to turangawaewae...
- Reduced mental health for community members
- Loss of cultural identity and community cohesion
- Increased incidence of disease
- Reduced amenity of waterways can lead to *solastalgia*, or a loss of sense of place
- Increased preventative maintenance and water quality management costs

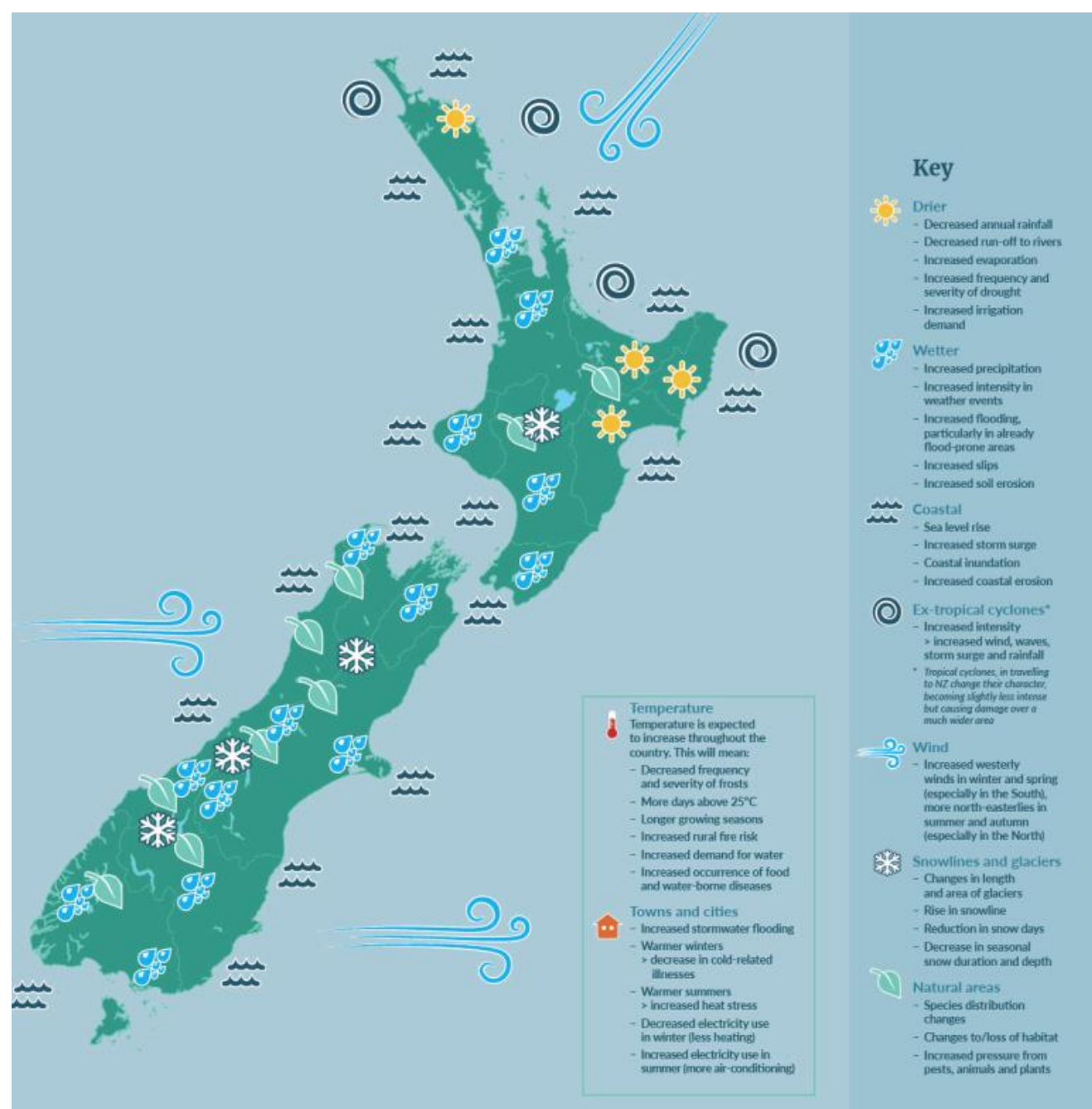


Regional analysis



Regional Analysis

- How might these impacts unfold around NZ?
- Physical factors when combined with climate drivers, may lead to increased risk.

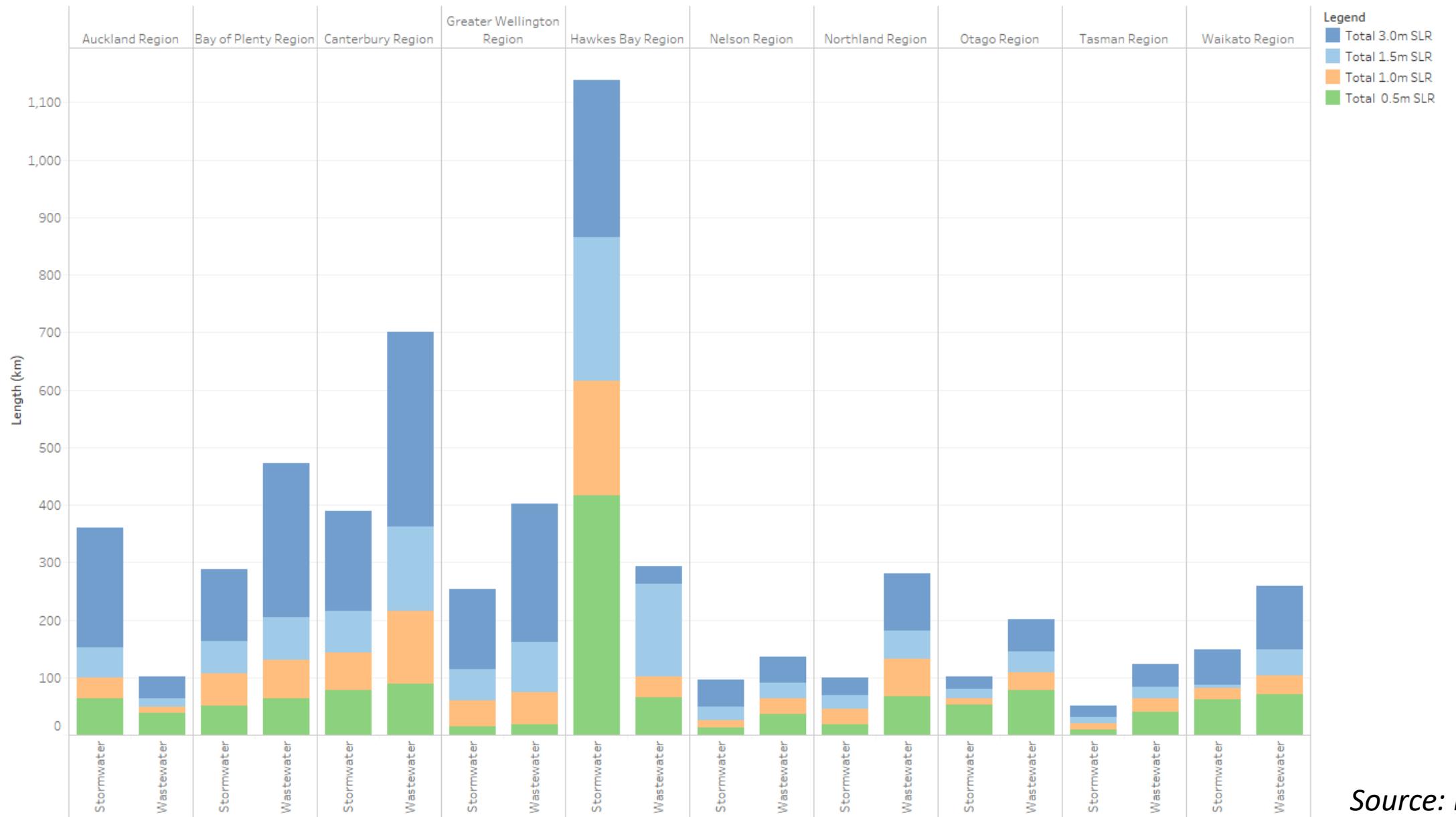


Factors that may increase risk

1. Communities that rely on pumped stormwater systems or are protected by stopbanks
2. Communities with environmentally compromised waterways
3. Communities with low-lying areas prone to flooding or sw systems prone to inundation
4. Communities with low-lying coastal wastewater treatment plants
5. Communities with WWTP which discharge to rivers
6. Other factors that may mean they may have specific vulnerabilities. E.g. socio-economic

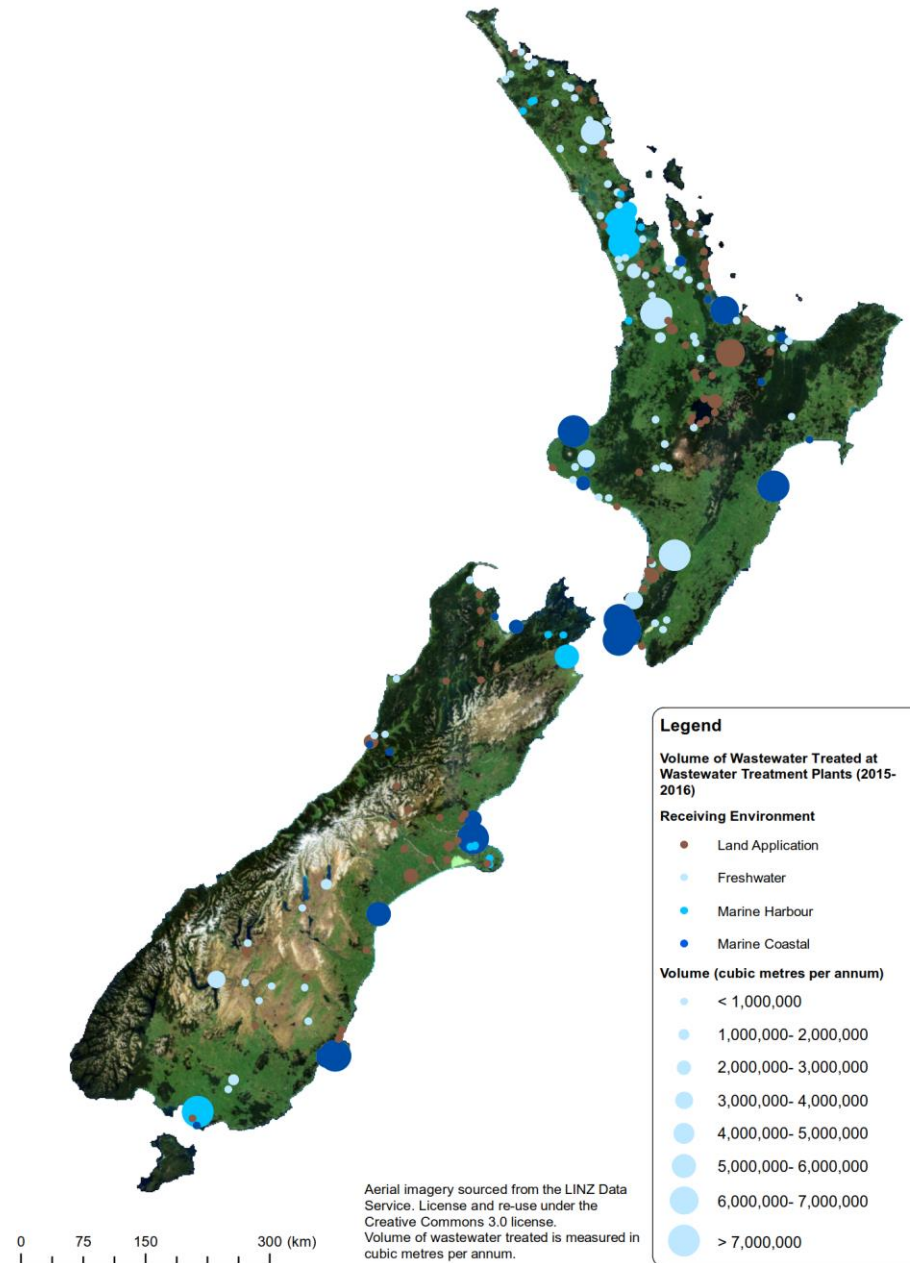


Local Government Sea Level Rise Exposure: Total Length of Pipes (km) per Region by Sea Level Rise Increment (LiDAR)

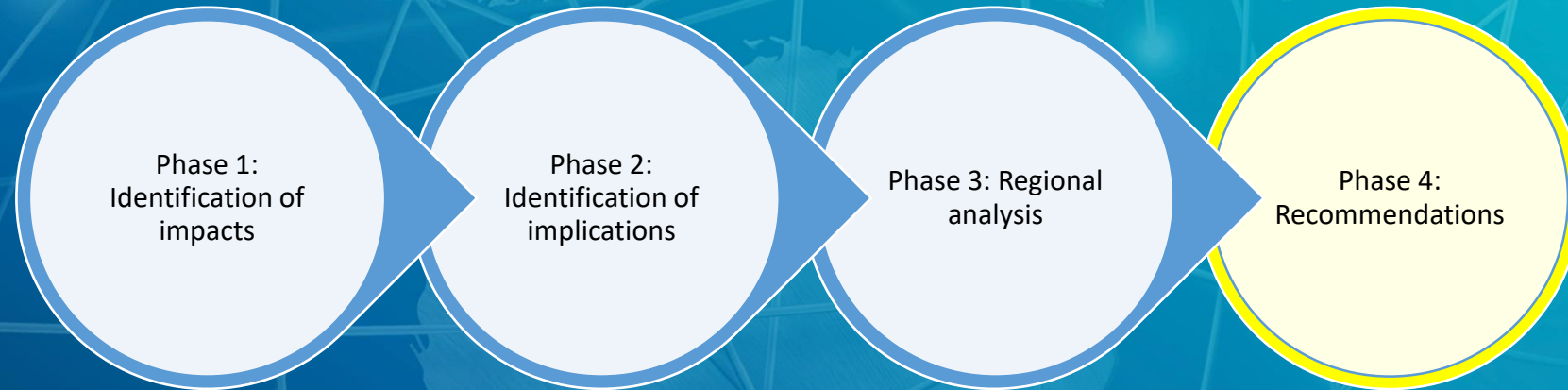


Source: LGNZ

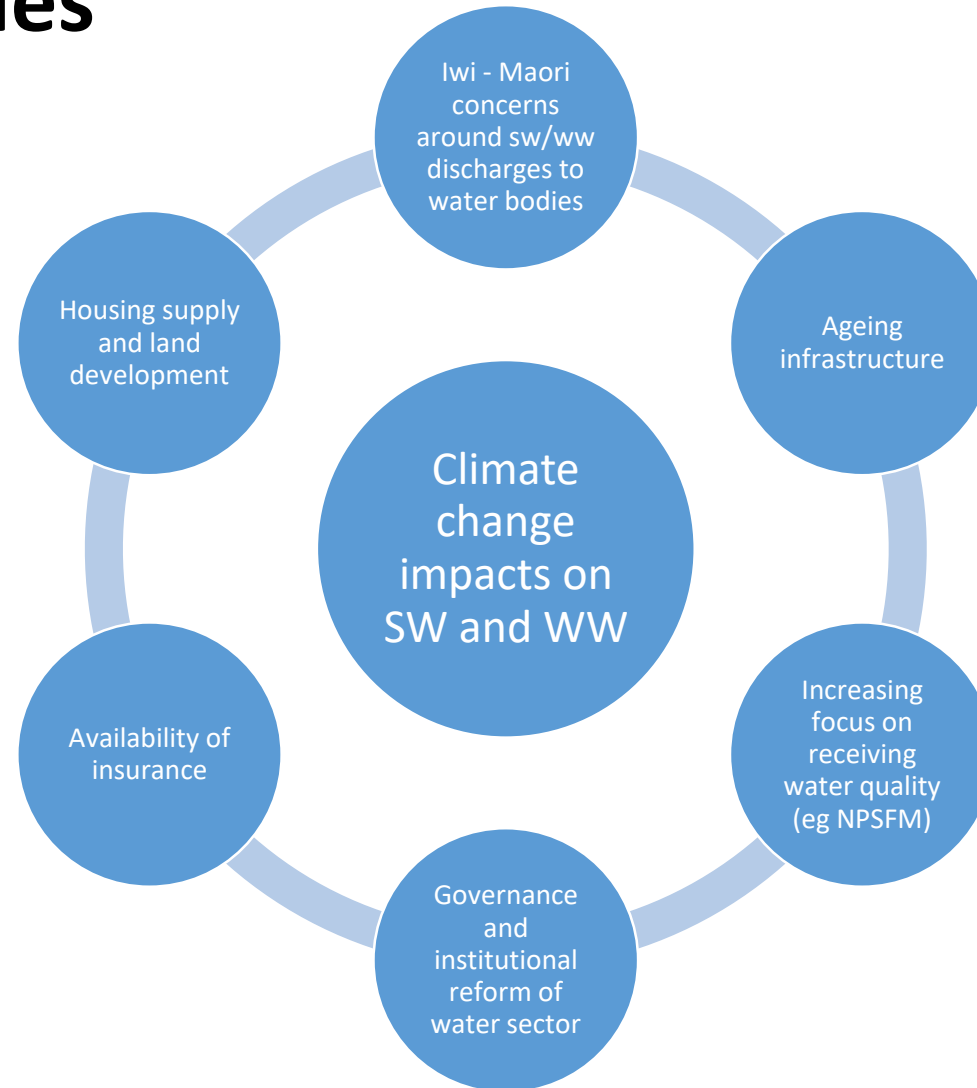
WW treatment plant discharges



Summary and next steps



Confluence of issues



Recommendations

- Improve data management, monitoring and review: to enable good decisions
- Improve approaches to design, asset management and risk management
- Further work required around funding and insurance
- Focus on leadership and governance for climate and infrastructure - embedding climate change into our decision-making.



Greta Thunberg

National **Science** Challenges

THE DEEP SOUTH

Te Kōmata o
Te Tonga



Thankyou

Nelson

Kapiti

Wellington City

Environment
Canterbury

Dunedin

Bay of Plenty

Hawkes Bay

Porirua

Auckland