



Designing for resilience: embedding climate risk into asset lifecycle strategies and maintenance

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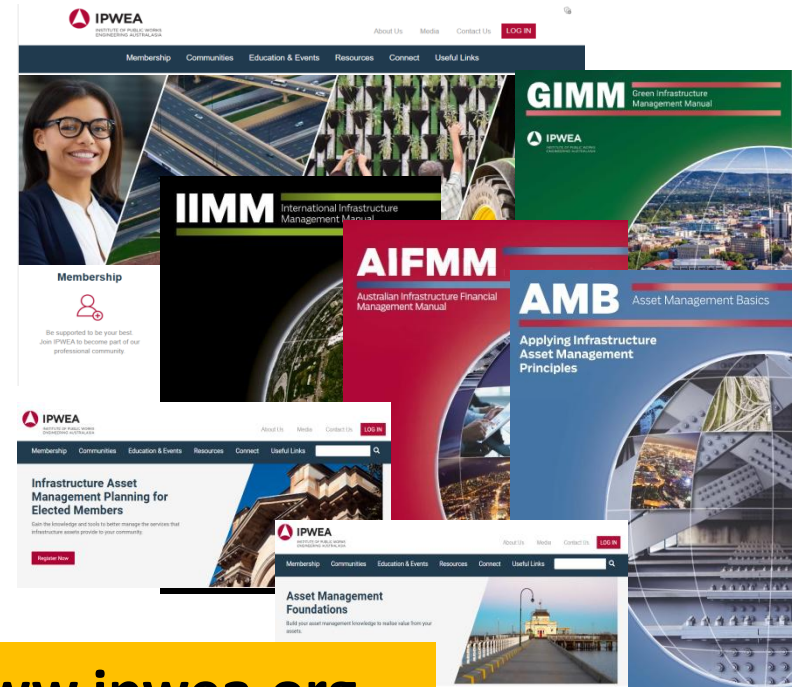
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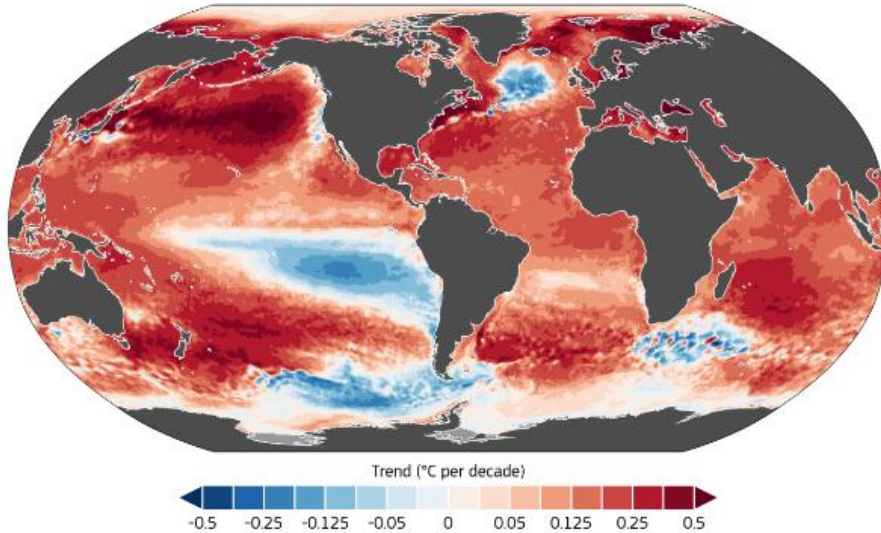


www.ipwea.org

Observed climate changes

Trend in sea surface temperature for 1993–2023

Data: ESA CCI SST v3.0 • Reference period: 1991–2020 • Credit: C3S/ECMWF



Copernicus Climate Change Service
European State of the Climate | 2023

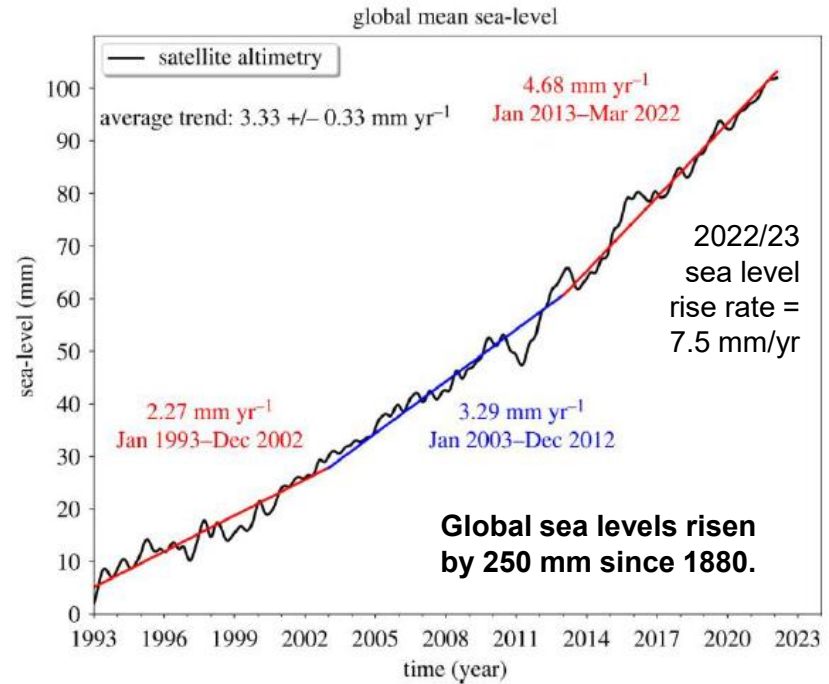


PROGRAMME OF
THE EUROPEAN UNION

Copernicus
European State of the Climate

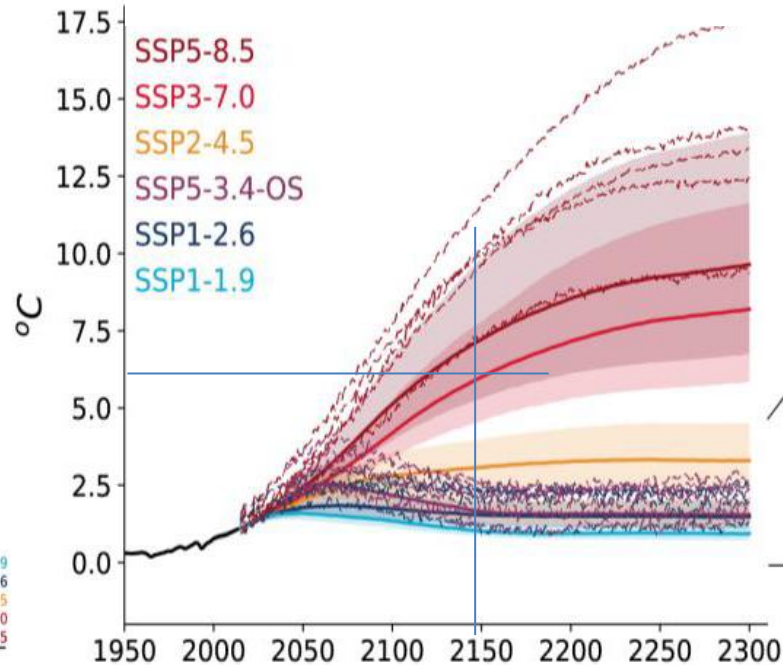
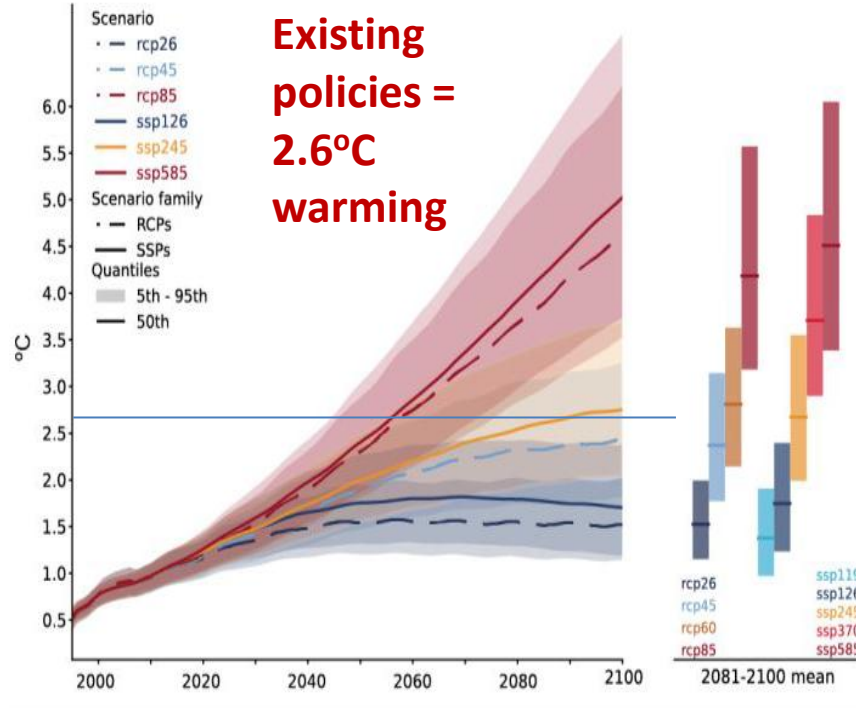
IMPLEMENTED BY
ECMWF

Copernicus 2025



Cazenave and Moreira (2022), NASA (20023)

Future climate changes



Locked into 2 m+ SLR – perhaps by 2100

19-22 m

2-6 m

2-3 m

IPCC AR6, 2023



IPWEA

Climate change impacts - Australia

Climate extremes are increasing / will continue.

Disasters cost the Australian economy \$38 billion each year – forecast to reach at least \$73 billion by 2060.

In 2021-22, ~17.6 million people lived in a disaster declared LGAs – 70% population.

In 2022-23, the Commonwealth provided >\$6.5 billion of disaster funding ... a 57%, increase on the previous year.

For every \$1.00 invested in resilience initiatives, there is an estimated \$9.60 return on investment.



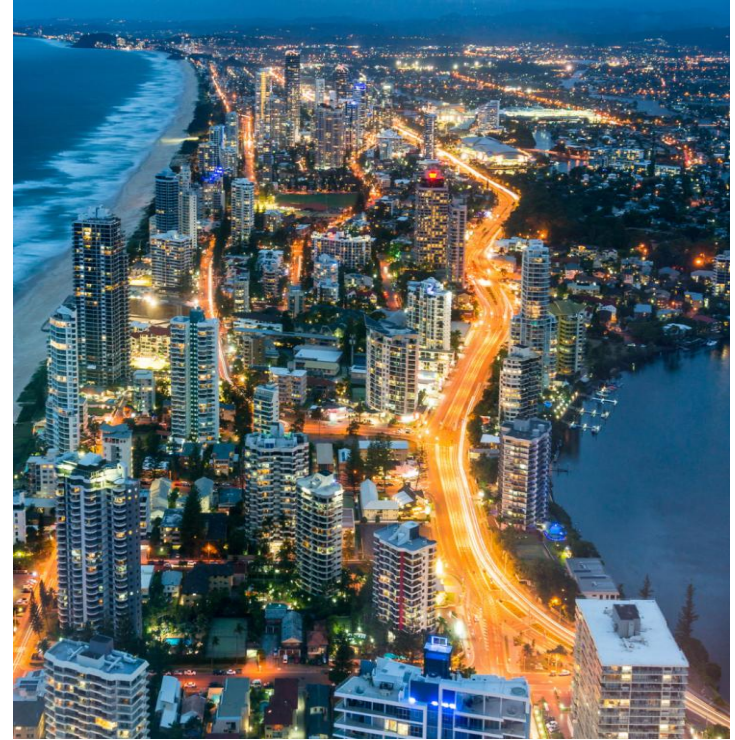
Climate change and infrastructure

Infrastructure assets are long-lived – some more than 100 years.

Settlements will be in place for much longer – some are over 8000 years old!

Need a long-term, asset life-cycle perspective to reduce climate risk and intergenerational inequity.

IPCC recommends planners and infrastructure stewards consider climate scenarios to 2150.



Climate Resilient Infrastructure Guideline

Enables the integration of climate resilience into AMP :

- Provides detailed summary of climate projections for Australia
- Gives guidance on selecting climate scenarios for infrastructure assets and planning timelines
- Details expected damage, deterioration and adaptation for the 9 most commonly used materials and 10 most common infrastructure assets
- Provides guidance on how to integrate climate change vulnerability, risk and adaptation into strategic and asset and financial management plans



Climate, Damage and Deterioration

- Climate projections for: temperature, heatwave, rainfall, drought, flooding, humidity, sea level rise, ocean changes, erosion, storm surges, storms, cyclones, snow, hail and bushfire
- Expected damage and deterioration to the 9 most commonly used materials: bitumen, concrete, FRP, glass, PVC, metals (steel, aluminium, copper) and timber
- Expected impacts for 10 asset classes: bridges, buildings, coastal assets, footpaths, green infrastructure, sealed and unsealed roads, water, stormwater and waste water assets



Climate Adaptation for Infrastructure

Provides detailed materials, design and management adaptation options for all 9 materials and 10 asset classes and includes:

- Details, images, drawings and diagrams of adaptation options
- Risk assessment steps for climate change
- Tools that are available
- Case studies from around the world
- Integration of resilience into asset and financial management planning across the lifecycle and the organisation



Integration into Asset and Financial Management

AM Policy. Principles, Requirements and Responsibilities for AM, linked to Organisational Strategic Objectives.

Strategic AM Plan. AM Objectives, AM System Scope, AM Approach to Delivering Objectives, AM Improvement Plan.

AM Plan. Asset/Service Description, Levels of Service, Demand Forecasts, Managing Risk, Lifecycle Activities, Cashflow forecasts.

Operational Plans. Guide day to day activities of staff and contractors, including operations and capital work programmes.

Objective	Performance Measure Example
The organisation is committed to good asset management practice for its green infrastructure assets	The AM Policy adopted by the elected officials includes references to green infrastructure assets and is reviewed every three years. The AM plans include green infrastructure and is approved by senior management. The AM Plans provide the basis for inputting the costs associated with managing green infrastructure into the long-term financial plan.
Stakeholders are effectively engaged in how green infrastructure is managed	Stakeholder communication is carried out in accordance with the organisation's communication plan. The communications plan is reviewed every three years.
Decision making is based on reliable information	The organisation has a reliable asset register for its green infrastructure assets, with the required condition and performance data to support informed decision making.
Green infrastructure is resilient and risks are mitigated to appropriate levels	A risk register is in place and monitored in accordance with the Risk Policy.
Green infrastructure is managed financially sustainable and prudent manner	The AM Plan describes the long-term expenditure and funding plan.
A continual improvement approach taken	

Case Study: City of Ballarat Yarrowee River and Tributaries River Corridor Masterplan (2020)

This masterplan supports existing City of Ballarat and greater catchment strategic documents to propose the new strategic foundation to improve, develop, manage and maintain the Yarrowee River and tributaries. The plan covers 38 km of the Yarrowee River – from the Gong Gong Reservoir to the City of Ballarat's southern boundary (near Garibaldi) – and over 35 km of tributary creeks that flow into the Yarrowee. The plan provides detailed drawings and recommendations for both the waterways and adjacent reserve land.
<https://www.ballarat.vic.gov.au/about-us/vision-plans-and-strategies/plans-strategies-and-frameworks>

Tool: AUS-SPEC Urban and open spaces

AUS-SPEC is the Australian National Specification System for the design, construction, maintenance and operation of local government assets. AUS-SPEC Urban and Open Spaces guidance covers planning and design, tendering and contract preliminaries, construction, maintenance and operations of urban and open spaces. It also includes the NATSPEC Building Landscape package.
<https://www.aus-spec.com.au/aus-spec-urban-and-open-spaces/>

To learn more about how IPWEA and NATSPEC work together to support end-to-end asset management planning download the joint pamphlet:
<https://www.aus-spec.com.au/wp-content/uploads/2022/07/AUS-SPEC-and-IPWEA-Joint-Brochure.pdf>

Infrastructure life-cycle planning

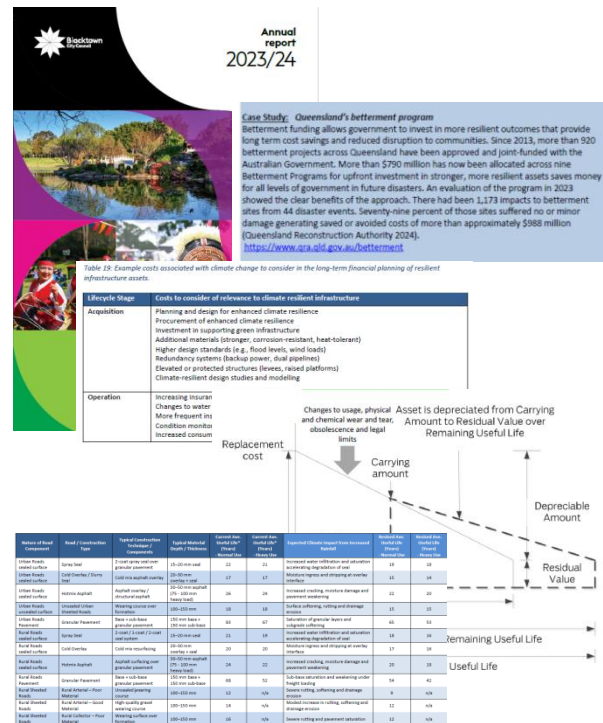
Asset lifecycle management includes acquisition, operation, maintenance, renewal, and disposal or recycling. As part of the process asset managers:

- Forecast demand for services by anticipating future changes such as urban expansion, resource demand and climate change
- Identify climate change damage and deterioration, and changes to levels of service
- Develop asset and long-term financial plans
- Plan for climate scenarios and manage risk

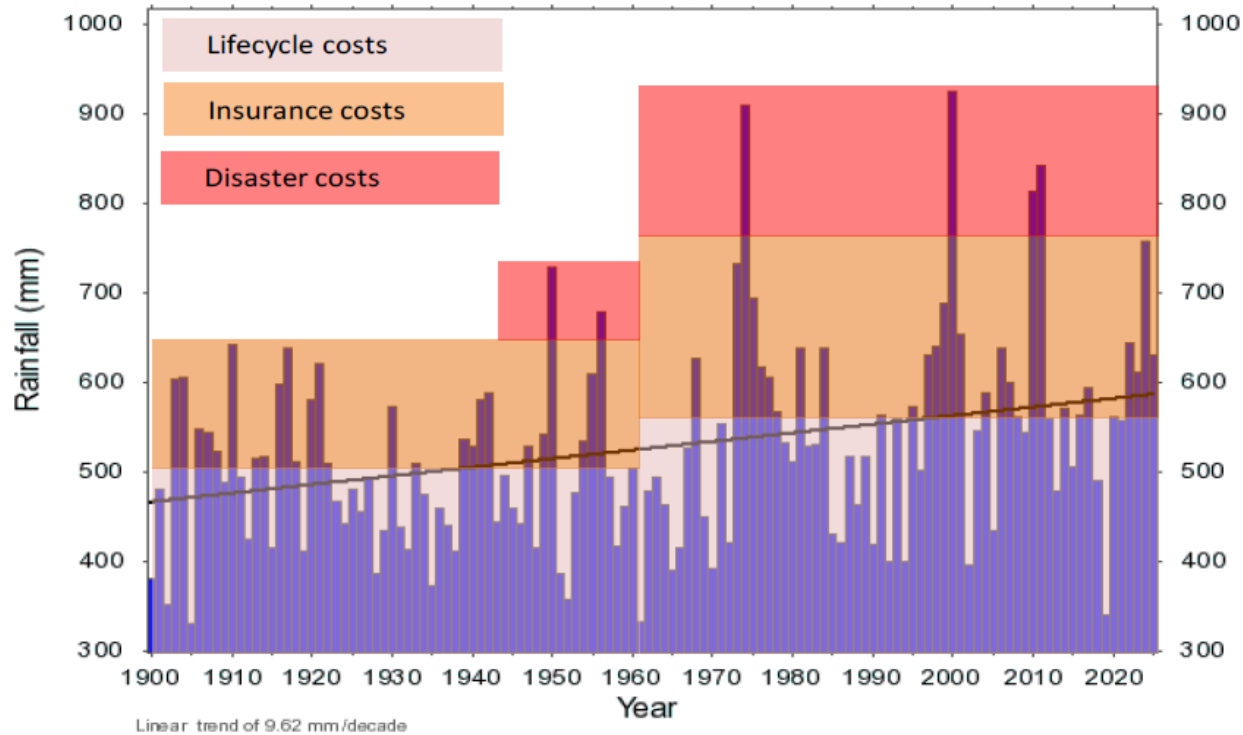


Long term financial planning

- An overview of relevant policies.
- Lifecycle costings including sources for CAPEX and OPEX funding.
- Overview of climate impacts and adaptation feasibility studies, financial analysis and business cases (incl. CBA).
- Incremental climate changes / chronic deterioration – depreciation, Useful Life.
- Acute or extreme climate changes / damage – finance strategies including risk reserves, disaster funding etc.



Climate risk and resilience costs



Climate risk and resilience decision tree

Establish the context

1. Enter which asset / component is to be assessed (including construction material):

2. Enter its location (GPS or address): Enter its elevation (m above AHD): m. What is its criticality level (See: Chapter 9):

3. Tick the box that best aligns with when the remaining useful life of the asset will end: ☒ 2030 ☐ 2050 ☐ 2070 ☐ 2090 ☐ >2100

Identify the risk - exposure and vulnerability

4. Which TWO climate change hazards the asset will be most exposed to in its location over its useful life? (See: Chapter 3. Go to: www.aoc.gov.au/pages/data-explorer)

☐ Higher temperature / heatwave
 ☐ Decreased rainfall / drought
 ☐ Increased rainfall intensity / flooding
 ☒ Sea level rise, saltwater intrusion
 ☐ Increased storm surge
 ☐ Coastal / riverine erosion
 ☐ Increased humidity
 ☐ Increased bushfire weather
 ☐ Increased wind speeds and cyclonic events
 ☐ Increased frost or hail events

5. How vulnerable is the asset to each of the two most exposed hazards? (See: Chapter 4, Chapter 5. Go to: Table A1-2 for rankings)

High High High High High High High High High

Low vulnerability Medium and High vulnerability

6. List existing climate change adaptation responses or actions that are in place to protect the asset from the medium and high vulnerabilities? (See Chapter 7 and Chapter 8).

Hazard 1 Actions:

Hazard 2 Actions:

7. Will the current adaptation responses or actions protect the asset and preserve the existing Level of Service (LOS) to the end of the asset's useful life?

☒ YES ☐ NO or only partially

The asset and LOS are not likely to be materially affected by climate change. No adaptation is currently required. Monitor the asset regularly for changes.

The asset and LOS are at risk from the identified hazard. Assess the residual risks using likelihood and consequences.

Analyse / evaluate residual risk

8. What is the likelihood of the hazard occurring over the asset's expected remaining useful life? Info Unlikely

9. What would be the consequences? Info No risk

10. Risk rating? Info

Treat the risk

11. What additional adaptation actions can be put in place for high and very high risks? (See Chapter 7 and Chapter 8) Monitor asset condition and climate risks every 5 years.

Very High Risk Actions:

High Risk Actions:

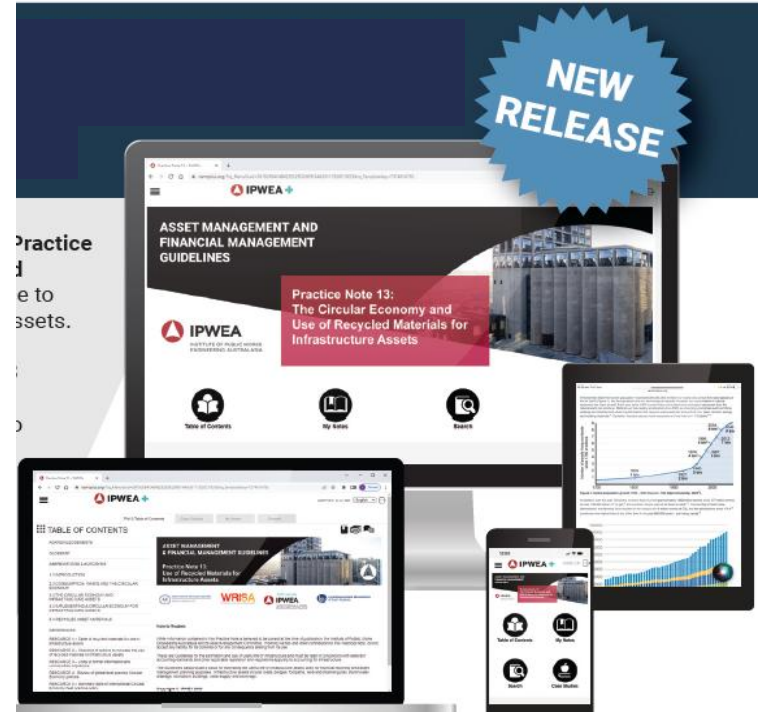
CRIG Supporting Resources

- Summary tables of climate impacts, adaptation / resilience options
- Traffic light tables of climate change vulnerability for over 200 assets
- Advice on how to enable organisational change
- Extensive case studies
- Over 150 references and appendices with active links to further information

[illegible]

Online Training Course

- The CRIG is supported by a stand-alone online training module that includes:
 - Detailed additional information, case studies, links and expert videos
 - Questions and assessment tools
 - A template and guided process to build a business case
- Training modules come with an industry recognised micro-credential.



CRIG Partners

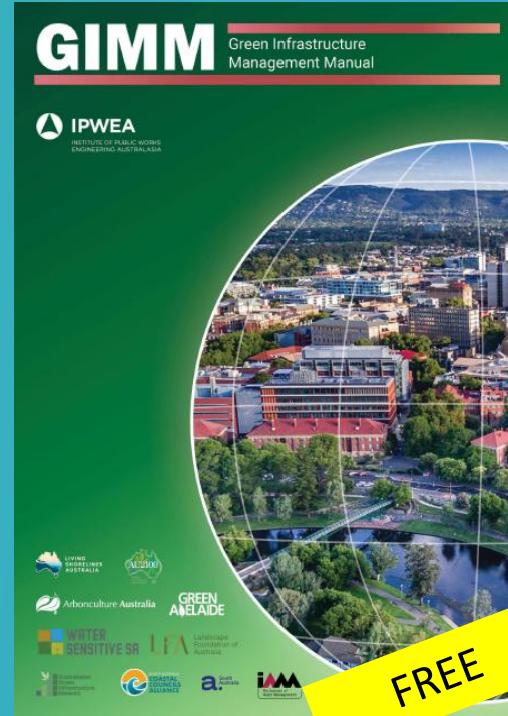
- Alexandrina Council
- ANZBIG
- Brightly Software
- Brimbank City Council
- City of Charles Sturt
- City of Marion
- City of Onkaparinga
- City of Salisbury
- City of Sydney
- City of Unley
- Cook Shire Council
- Coonamble Council
- District Council of Mount Barker
- DPLH WA
- Greenhill Asia-Pacific
- Infrastructure Associates
- Infrastructure Management Solutions
- IPWEA WA
- Manningham Council
- Maroondah City Council
- Melbourne Park
- Modelve
- National Capital Authority
- NATSPEC
- Salisbury City Council
- Shepard Services
- Sustainable business consultants
- Synergy
- Wyndham Council

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<https://www.ipwea.org/resourcesnew/bookshop>



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