Climate Change Adaptation Planning for Ports and Inland Waterways
EnviCom WG 178 Report

6 September 2022

2nd PIANC Asia Pacific Conference, Melbourne

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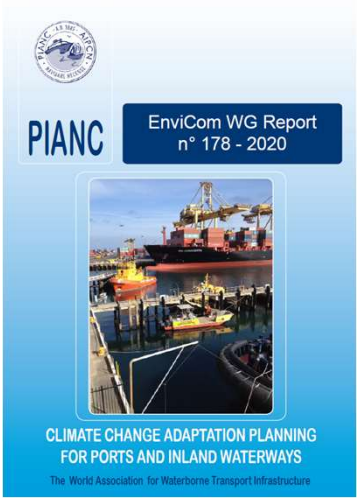

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Background

Maritime freight accounted for **80%** of world **merchandise trade** by volume in 2014

136 port megacities around the world are **vulnerable to coastal flooding**

Spending on infrastructure in developing countries **must double** to reach between US$1.8 and **2.3 trillion per year by 2020**

Source: https://www.euronews.com/green/2022/08/11/in-pictures-europes-mighty-rivers-are-drying-up-in-the-climate-driven-drought

Rhelm

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Background

- International context:
  - Paris Agreement
  - 2030 Agenda for Sustainable Development
  - Sendai Framework for Disaster Risk Reduction
  - SIDS Accelerated Modalities of Action (SAMOA) Pathway

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

13 CLIMATE ACTION

14 LIFE BELOW WATER

TARGET 1.5

BUILD RESILIENCE TO ENVIRONMENTAL, ECONOMIC AND SOCIAL DISASTERS

SUSTAINABLE DEVELOPMENT GOALS

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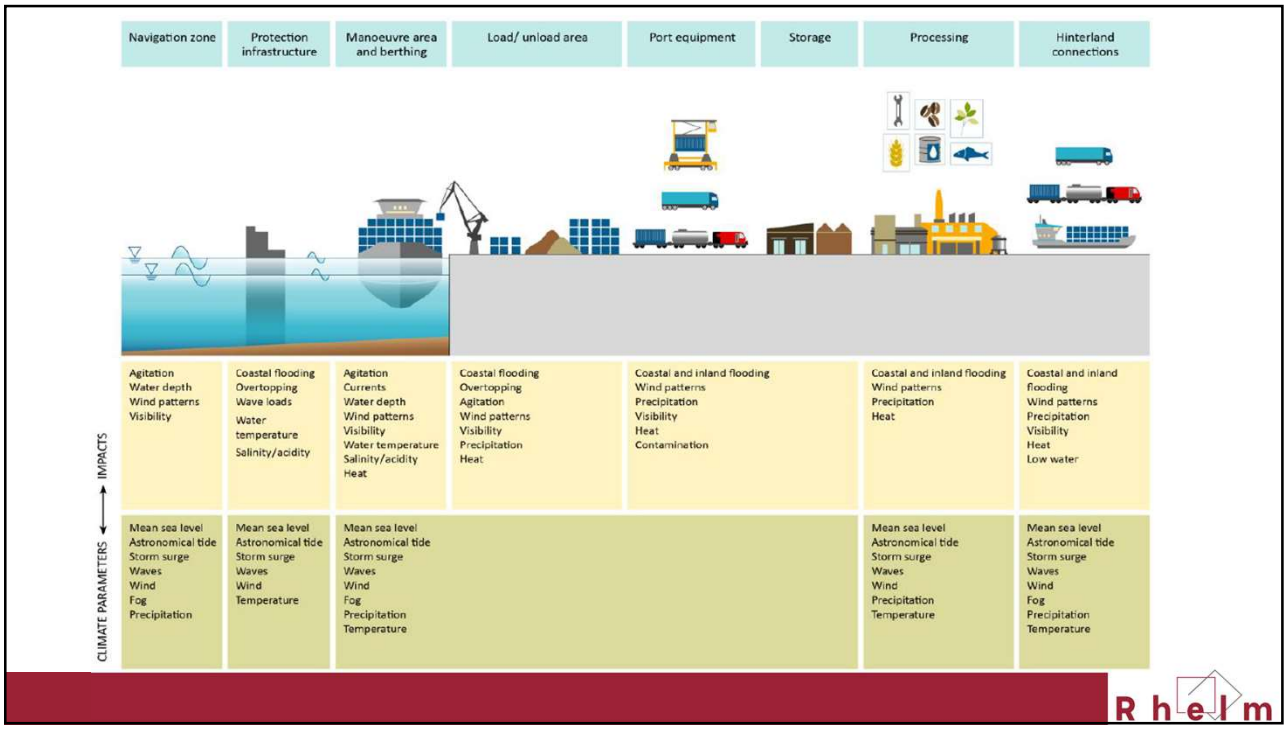

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Working Group 178 Structure

- PIANC EnviCom Mentor – Jan Brooke
- Chair – Charles Haine
- 15 full members and 12 other contributors
- International associations, universities, consultants, government agencies or authorities, such as:
  - UNCTAD
  - International Harbour Masters' Assoc. / International Assoc. Dredging Companies
  - Government of Flanders, Swedish Maritime Administration
- Combination of face-to-face and virtual meetings and workshops, as well as remote working over 2016-2018.

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Overview of the Guideline

- Staged approach to identifying potential climate change adaptation measures
- Detailed methodological framework
- Case studies
- 'Toolbox' of adaptation and resilience measures
- Supporting resources and recommendations to support decision-making

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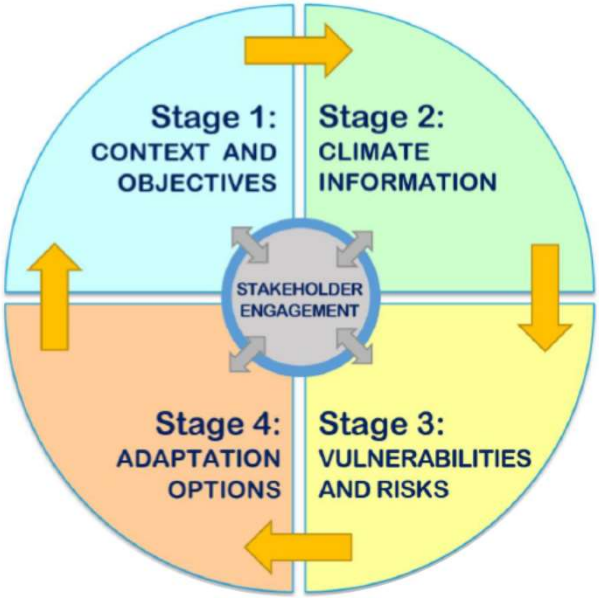
Overview of the Guideline



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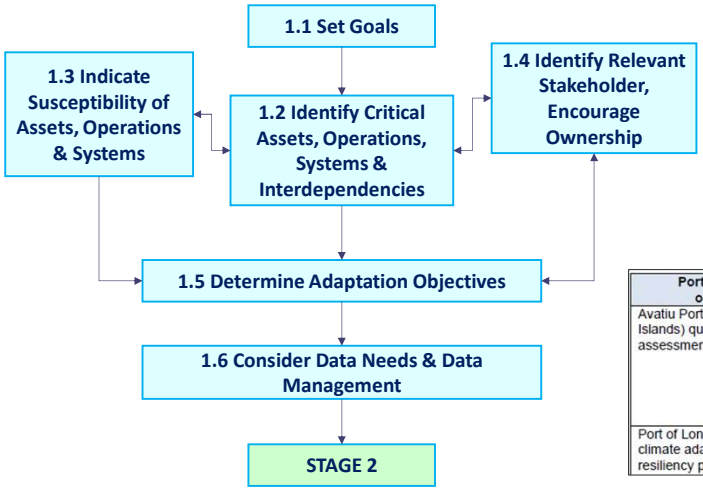
Overview of the Guideline – Stage 1



- Asset inventory – criticality
- Develop objectives for adaptation & resilience for an agreed planning horizon.

Port or navigation organisation	Climate change adaptation objectives
Avatiu Port, Rarotonga (Cook Islands) qualitative climate risk assessment (Case Study 9)	• Understand the risks posed by changes to sea level and wave behaviour on coastal infrastructure and communities in the Avarua area, particularly during extreme events. • Identify needs and develop options for responses to the risks. • Build local capacity to understand the science and manage the risk assessment and planning process.
Port of Long Beach (USA) climate adaptation and coastal resiliency plan (Case Study 2)	• A more resilient Port able to continue operations under changed conditions. • A Port prepared and ready to adapt.

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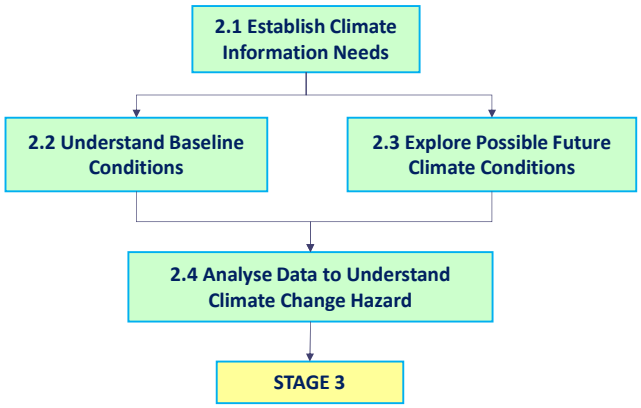
Overview of the Guideline – Stage 2



- Work with stakeholders to identify key climate parameters
- Baseline climate information, incl. trends & extreme events
- Align planning horizons with appropriate scenarios/projections
- Identify key hazards

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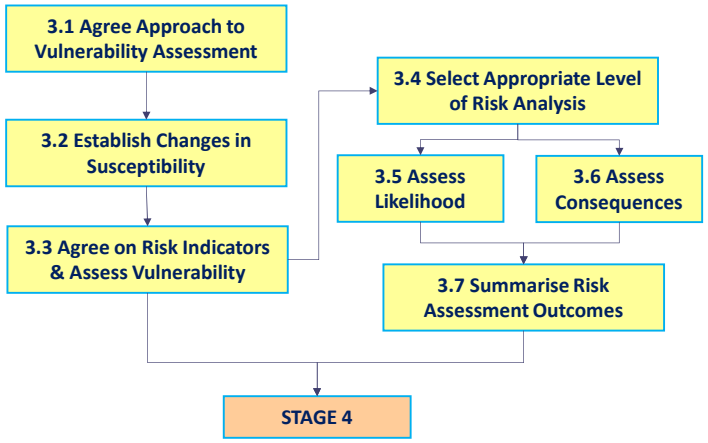
Overview of the Guideline – Stage 3



- Examine how exposure to the climate hazards might change over time
- Exceedence of a threshold or tipping point?
- Adaptive capacity
- Define the risk indicators – **what is an acceptable level of risk?**

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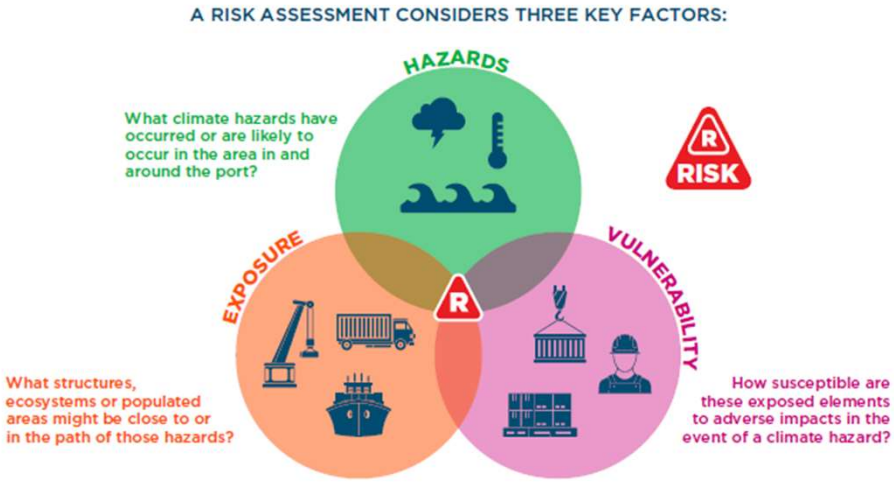
Overview of the Guideline – Stage 3



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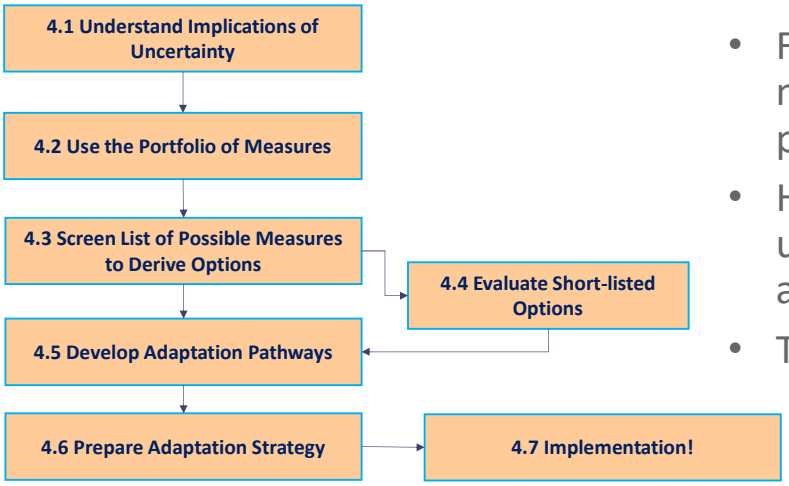
Overview of the Guideline – Stage 4



- Risk of maladaptation
- Flexibility and adaptive management – adaptation pathways approach
- How to manage uncertainty – triggers for action
- Toolbox of measures

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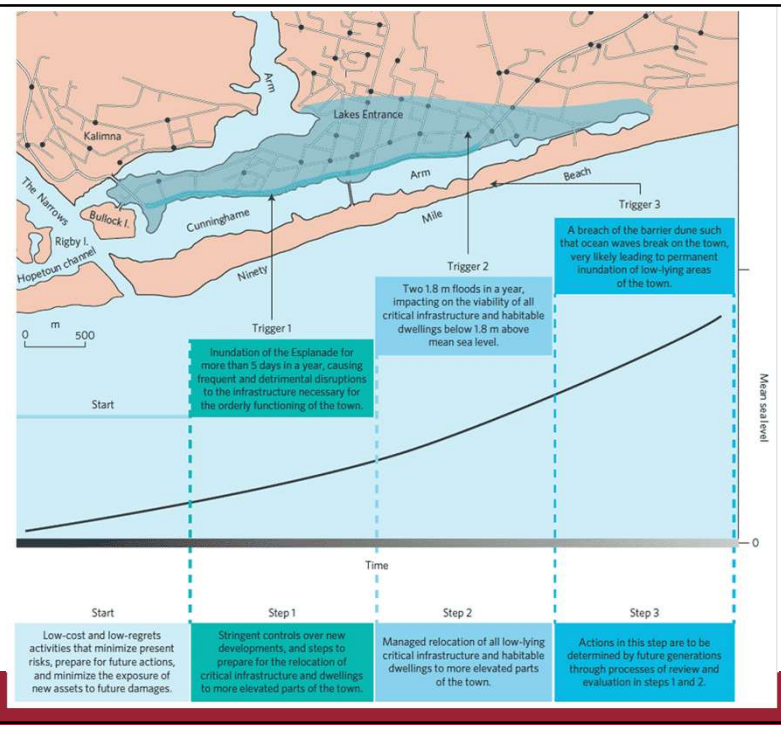
Overview of the Guideline – Stage 4



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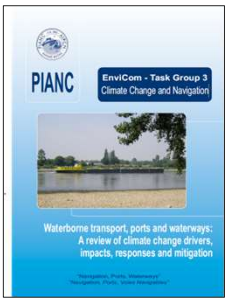
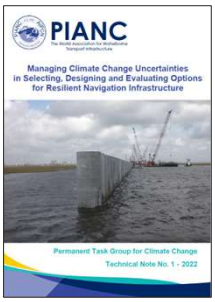
Other Relevant Initiatives

- Permanent Task Group on Climate Change (PTGCC)
- Navigating a Changing Climate www.navclimate.org
- Working with Nature and climate change





R h e l m

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R h e l m

engineering | environmental | economics | engagement

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Physical measures Structures, systems, technologies, services	Social measures People, behaviour, operations, information	Institutional measures Governance, economics, regulation, policy
Prioritise **maintenance** to maximise operational resilience and improve adaptive capacity	Undertake climate change **risk assessment**, prepare **risk maps**	Prepare strategic level climate change **adaptation strategies**
Install **real-time monitoring** infrastructure	**Prepare** and **raise awareness** of contingency, emergency or disaster response **plans**	Review and revise relevant **codes of practice, standards, specifications or guidelines** to accommodate changing conditions
Use **Cloud** (back-up) for data storage to reduce physical risks to systems	Introduce and regularly review **warning systems**	Review **health and safety** requirements and revise if needed
Relocate vulnerable assets and equipment out of high-risk areas	Prioritise **asset inspection**	Introduce **penalties** for non-compliance with standards
Revert to **phased array** for radar	**Educate** workforce, stakeholders, local communities	Require **zoning** of assets, operations or activities based on risk
Invest in **redundancy**, temporary infrastructure or other physical back-up provision for critical assets (including power and water supply)	Liaise and **coordinate with utilities** and other service providers; develop **information-sharing** protocols	Use local regulations (e.g. **byelaws**) to reduce risks, especially in multi-use locations
Reinforce, raise, strengthen or otherwise protect or modify critical assets	Improve (or instigate) **monitoring, record keeping** and **data management**, consider cybersecurity issues	Policies to encourage **relocation** out of high-risk areas
Install or develop new, **responsive** or **demountable infrastructure** or equipment	Undertake trend analysis or **forecasting**	Collaborate with **land-use planning** systems e.g. to introduce **set back** or **buffer areas**
Install **warning equipment**	Develop **revised operational protocols**; modify **working practices** as conditions change	**Limit new infrastructure development** in high-risk areas
Nominate or provide physical **sanctuaries**	Introduce and implement **adaptive management** procedures, base operations or working arrangements on monitoring outputs	Identify, secure and coordinate **alternative transport routes or modes**
Increase **storage capacity**	Allow for **flexibility** and responsiveness in programming (increase operational **hours**, modify staffing **rotas**, vessel **scheduling**, lock operation, etc.)	Promote **reduced insurance premiums** if improved resilience is demonstrated
Install **multi-modal equipment**	Revert to **traditional, low tech,** ways of operating; ensure binoculars, telephone, paper charts, two-way radios are available	Set up **contingency** or disaster response **fund**
Apply **nature-based solutions,** Working with Nature, soft engineering	Ensure availability of **transport** and **accommodation** for personnel during an incident	Introduce and enforce **build-back-better** or build-out-of-harm's-way policy
Install **treatment** or **reception facilities**	**Temporarily** or **permanently restrict** activities in high-risk areas	Facilitate **diversification** in facilities and employment as conditions change
Incorporate **flexibility** in new or replacement infrastructure design to allow for modification as conditions change	Nominate **safe routes** and **areas**, identify **diversions**	Improve **legal protection** for vulnerable habitats with risk reduction role (e.g. absorbing wave energy, providing erosion protection)
Modify **material or equipment selection** to accommodate changing conditions	Identify and exploit **interconnectivity** and **intermodal options** to maintain business continuity during events	Provide **grants or incentives** e.g. for development or maintenance of resilient infrastructure
Invest in **SMART** technology	Provide **training** on new tools, codes of practice, procedures or **protocols**, ensure importance of **redundancy** is understood	**Research** and develop novel tools and methods
	Facilitate **technology transfer**	

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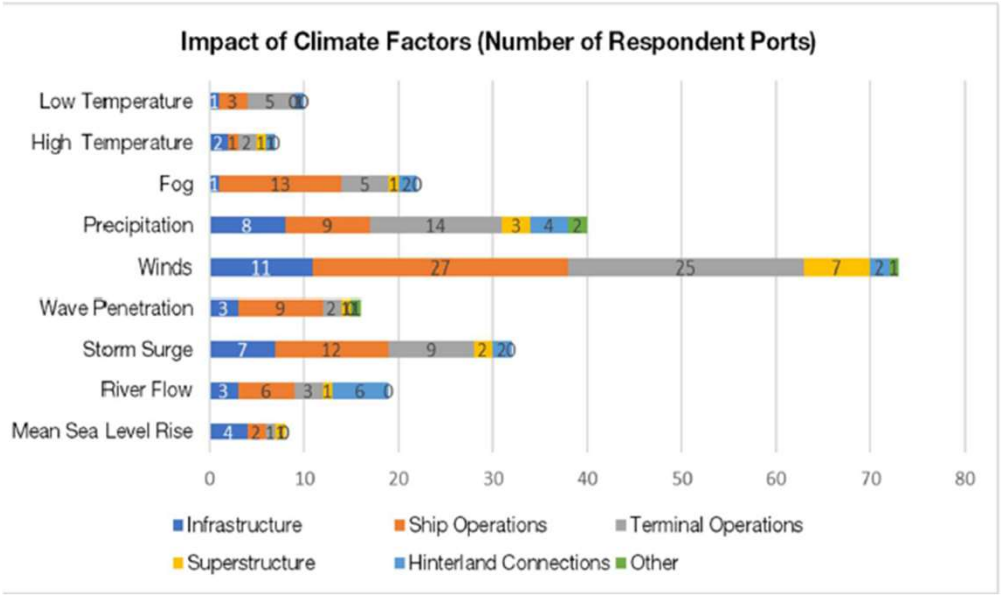

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