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Policy and Technocratic Intervention for Water-Sensitive and Climate-Resilient Cities in Indonesia

Sumber: Warga melintasi banjir di Pela Mampang, Jakarta Selatan, Minggu (7/11/2021). ANTARA

Sumber: Banjir Kota Sorong, Bappenas

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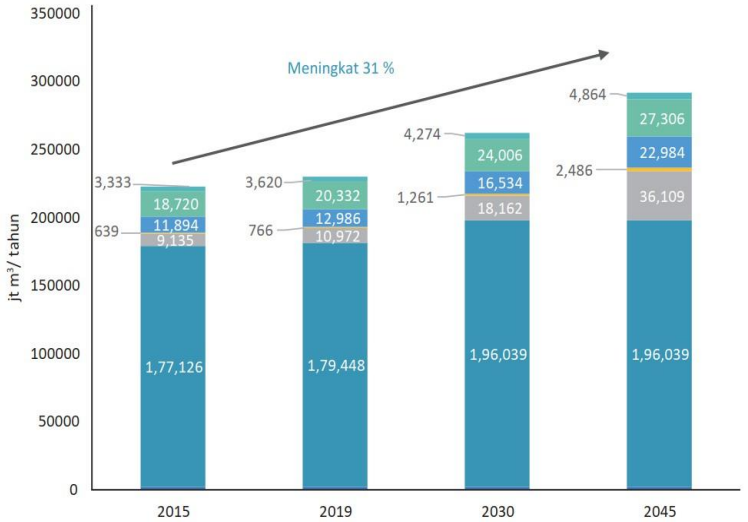
Increasing Water Demand & Land Subsidence

Proyeksi kebutuhan air tahunan berdasarkan sektor, 2015–2045



Source: World Bank & Bappenas, 2019

Water demand is projected to increase by 31% due to demographic and economic changes.

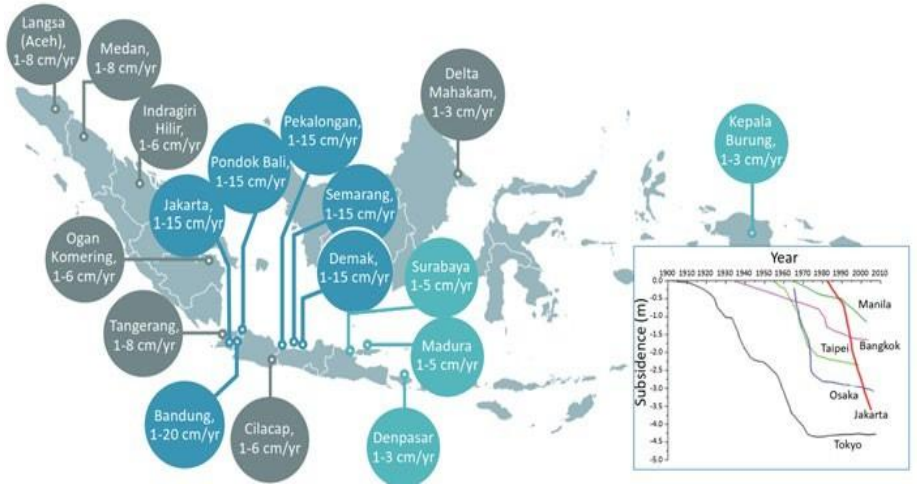
- **Agricultural water use** will face **increasing** competition from other sectors.
- **Industrial water needs** are expected to **quadruple**.
- On the supply side, raw water capacity is only expanding by an average of 2 m³ per year, while **the development of water supply systems (SPAM) remains highly dependent on local governments.**

Only **22% of Indonesia's population has access to piped drinking water**, while the majority still depend on potentially contaminated sources like rivers and wells. Despite being a safer option, piped water remains largely confined to urban areas – Ministry of Public Works, 2025[1]

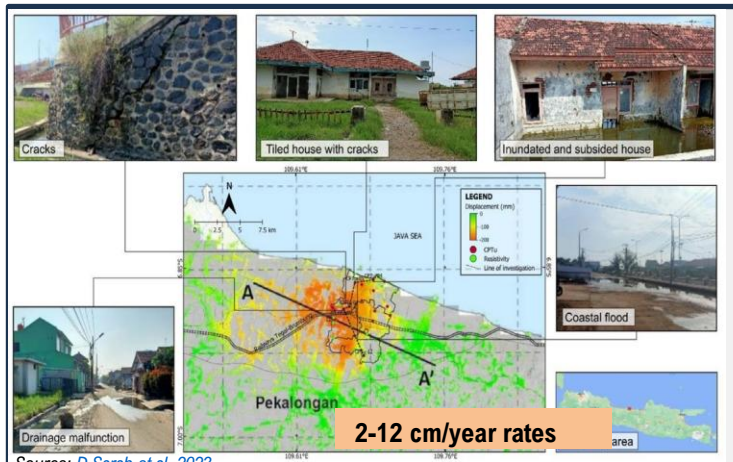
Source: Tempo, 2025

Land Subsidence – A Consequence of Water Insecurity

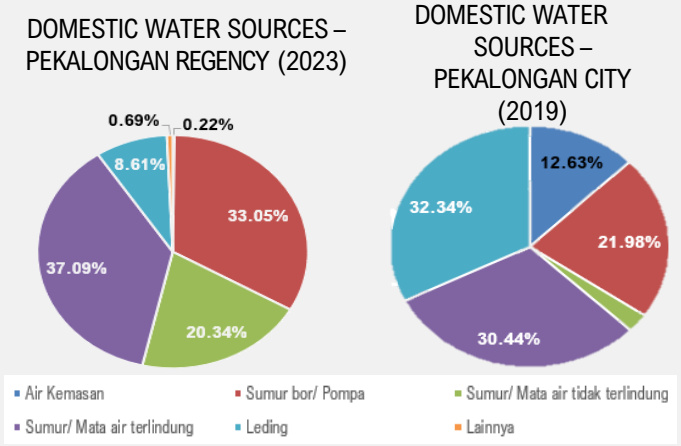
Rising water demand and low piped water access drive groundwater use, intensifying land subsidence—especially in Java's densely populated northern coast (Pantura)



Study Case: Pekalongan Area



Source: D Sarah et al, 2023



In Pekalongan, reliance on groundwater has triggered land subsidence and chronic tidal flooding, costing Rp 1.7T, with projected losses of Rp 31.2T by 2035 and Rp 6.7T needed for further response.

Threat of Flood Disasters and Extreme Wave and Abrasion Disasters

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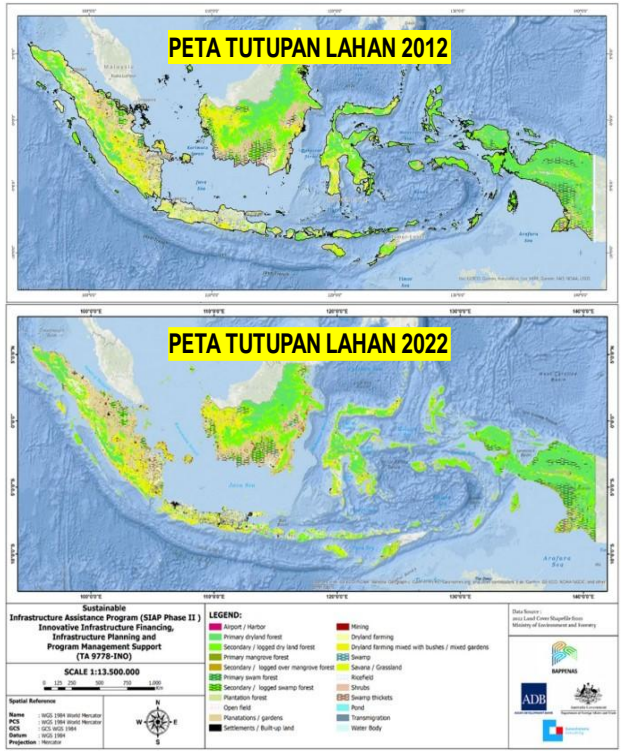
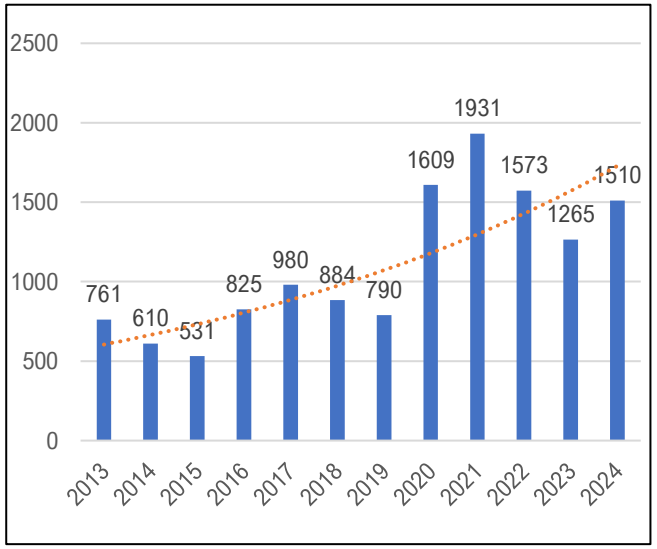
Land Use Change

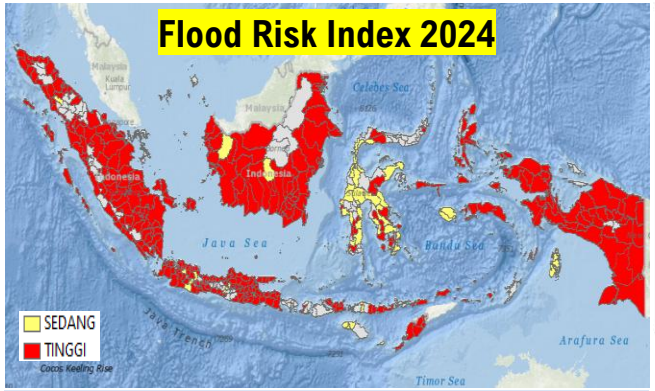


Types of land use with high water retention capacity (**runoff coefficient ≤ 0.1**) **decreased by 6.54% between 2012 and 2022, thereby increasing flood vulnerability across all regions**

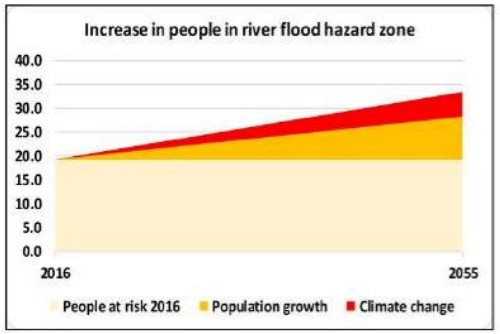
Flood Events in Indonesia



- In the last 11 years, flood events have shown **an increasing trend**.
- A total of **13 thousand floods occurred** with a total of **800 thousand houses submerged** and total people affected is **24 thousand people**.
- Flood disasters cause the largest impact of financial losses reaching per year (ADB, 2019) **11.29 trillion Rupiah**



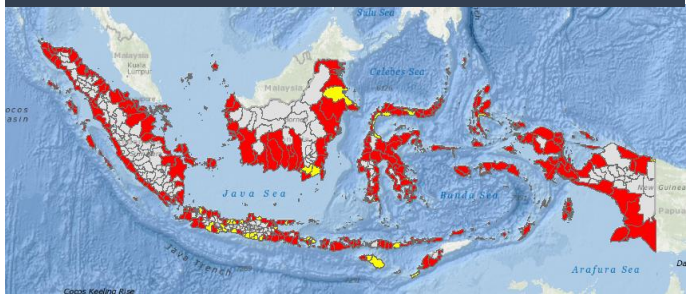
100 Million People (38% of the population) are exposed to Flood Risk, and 338 Cities/Regencies are at high risk.



It is predicted that there will be an increase in flood-affected areas in 2055 by up to **32%**, which **without adequate intervention** will have an impact on losses of up to **-1.65% of GDP in 2030**.

Population Density Map In Coastal Areas And Coastline Changes, 2013–2023

Extreme Wave and Abrasion Index 2024



- 42 million people live at elevations less than 10 m above sea level, making them highly vulnerable to the threat of **sea level rise**;
- **50 cm sea level rise** could result in **permanent inundation** of densely populated coastal areas in Bekasi and Jakarta, affecting around 270,000 people.
- A total of **282 cities/regencies** are exposed to the risk of extreme wave disasters and high abrasion.

Challenges & Gaps in Managing Flood Risks

Operational Institutionalization of Flood Risk Management Stakeholders

Development of strategies/legal products to promote collaboration in flood management, which can engage the commitment of central ministries/agencies and local governments in managing flood risks from upstream to downstream.

Data Integration

Strengthening data, information, and knowledge management in flood risk management: integration of data platforms, knowledge management, multidimensional aspects (watersheds, stakeholders, administration, plans, sectors, temporal).

Improving Local and Community Capacities

Development of strategies/roadmaps for enhancing the capacity of local governments and communities in managing flood risk systems

Integration of Nature-based Solutions

Preparation of planning guidelines, implementation, and integration of nature-based solutions in flood risk management.

Budgeting/Funding Sources

Identification of financing strategies for flood management through creative financing: funding integration, new funding sources (LVC, CSR, PES, communities, PPP).

Land Acquisition

Strengthening risk mitigation related to the land procurement process: for example, special units, strengthening stakeholder collaboration in land procurement, addressing social impacts.

Enhancing Operational and Maintenance Capacity

Strengthening operational and maintenance capacities to ensure sustainable benefits from already constructed infrastructure.

Monitoring and Control

Strengthening control (monitoring and enforcement) in utilizing flood-risk-based spatial areas: zoning, licensing, building codes.

Optimization Strategies for Improving Cross-Sector Coordination:
Flood Management Strategic Coordination Working Group

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Supervision and Control
- Supervision and Control of community activities that have the potential to aggravate flood disasters
- Supervision of the implementation of the Flood Management Program

(Agencies: Ministry of Environment and Forestry, Ministry of Public Works, OIKN, Regional Government, Community)

Socio-Economic Strengthening
- Countering the socio-economic impact of national flood management
- Improving the economy in order to increase flood resilience
- Reducing flood risk through gender mainstreaming

(Agencies: Ministry of Social Affairs, Ministry of Villages, OIKN, Regional Government, Bappenas)

Hydrological Information System and Preparedness
- Development of Hydrological Information Systems and EWS
- Increasing community preparedness in flood management

(Agencies: BMKG, Ministry of Public Works, BNPB, OIKN, Regional Government, Community)

Disaster Resilience Infrastructure
- Planning of river and drainage management masterplan
- Development of flood resilience infrastructure

(Agencies: PU, OIKN, Regional Government, BNPB)

Spatial Planning and Risk Mapping
- Flood risk area requirement
- RTRW and RDTR Planning
- Solution of river boundary problems
- Implementation of building codes that implement flood resilience in flood-prone areas

(Agencies: ATR/BPN, OIKN, Regional Government, BIG, Bappenas)

Forest and Land Rehabilitation
- Restoration of critical land areas
- Implementation of environmentally sound farming practices
- Development of erosion control infrastructure

(Agencies: MoEF, OIKN, Regional Government, Perhutani, NGOs, Community)

Multi-sectoral integrated development through the Mix-used Development approach

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Raw Water Supply
- Drinking Water Supply System ★ ◆
- Dam ★ ◆
- Offshore Reservoir ★ ◆

Strengthening Connectivity
- Highway ★ ◆
- Bridge ◆

Water Damage Control
- River-Coast Embankment ▲
- Sea Embankment ◆
- Retention Pond ▲
- Polder System ▲
- Drainage System ▲
- Normalization ▲
- Break Water ▲
- *Groins/jetties* ▲
- Mangrove ▲

Land Development
- Reclamation ★
- Commercial Housing ★
- Settlements ◆
- Industrial Estate ★
- Business Area ★
- Riverside development ★ ◆
- Green Area ★ ◆

Environmental Planning
- **Conservation:** Forest and land rehabilitation; terracing; gully plug ▲
- **Wastewater Treatment** ▲
- **Waste Management:** TPST, TPS3R ▲

Database
- Knowledge System ▲
- Flood Early Warning System ▲
- Land Subsidence Monitoring ▲
- Abrasion Monitoring ▲

Industrial
- Logistics and Port Industry ★ ◆
- Agriculture and Food Industry ◆ ▲
- Tourism Industry ★ ◆
- Maritime and Fisheries Industry ◆
- Petrochemical and Energy Industry ★ ◆
- Cement and Building Materials Industry ★ ◆

★ Commercial –Private Sector

◆ Public Services– KPBU/BUMN

▲ *Backbone* – Government

Global Examples of Water Sensitive Cities Implementation

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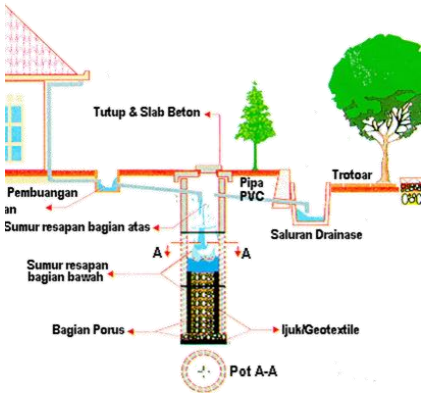
A Water Sensitive City is

Liveable + Resilient + Sustainable + Productive

Water Sensitive Cities | *Sponge Cities* | *Nature-based Solutions*

Australia



Infiltration Well

Rainwater falling on the roof is channeled through pipes into a well, with the excess discharged into the drainage system.

Bioretention

Water flowing through the channel can infiltrate into the ground.

Tiongkok

Permeable Pavement Sidewalk

It facilitates the percolation of water into the subsurface soil layers.

Netherlands

Retention Pond

A retention pond is used to temporarily store excess surface runoff and rainfall during heavy precipitation events.

Renaturation

River renaturation refers to the process of restoring a river to its natural form or condition.

WATER SENSITIVITY IN ACTION: IKN as a Model

REGIONAL SCALE	TYPE OF INTERVENSTION	CHALLENGES
River Basin	River Renaturation, Natural Depth Wetlands, Mangrove Forest	Requires Sufficient Land Procurement
City	Retention Ponds and Detention Ponds, Green Open Spaces, Permeable Sidewalks, Green Corridors, Bioretention Areas, Urban Forests, Infiltration Wells.	
Local Community/RT/RW		Operation and Maintainance

Source: World Bank Group processed again oleh Dit. SDA (2023)

Water Sensitive Urban Development in IKN

Applying the Sponge City concept, and the implementation of Low Impact Development as well as the Zero Delta Q policy.

Concept *Urban Design Development*

Drainage Masterplan and Flood Control in Sanggai River Basin

Integrated Master Plan

Water Sensitive Urban Design

Adapt to the soil, climate, and environment. The concept is that all runoff will be: **Collected, Managed, Controlled, Used, and Rechanneled.**

Blue and Green Space

LID, ΔQ=0, *Sponge City*

Smart City

Area Development Plan

Implementation of Development

Source: BWS Kalimantan IV (2023)

Case Examples of Water Sensitive Cities Implementation in Indonesia

REVITALISING INFORMAL SETTLEMENTS AND THEIR ENVIRONMENTS
In Makassar

The Challenges

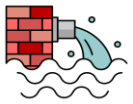
- 1 Billion people live in urban settlements
- 580.000 children under 5 die of diarrhea each year

The Goals

RISE Program has implemented in 24 settlements across Makassar. It aims to improve environmental health and public wellbeing through decentralized, nature-based water infrastructure.

RISE Design – A Holistic Approach

Flood Protection



Sanitation- Improving Public Health

Water Quality - Improving environmental quality

Water Resources – Rainwater harvesting & wastewater recycling

Productive Landscapes – Serviced through alternative water supplies

Source: Adaptation and Implementation of Water Sensitive Cities in Indonesia, Monash University, 2025

IMPLEMENTATION OF WATER SENSITIVE URBAN DESIGN (WSUD)
In Sentul, Bogor

Water sensitive urban design (WSUD) is an approach to planning and designing urban areas to make use of this valuable resource and reduce the harm it causes to our rivers and creeks.

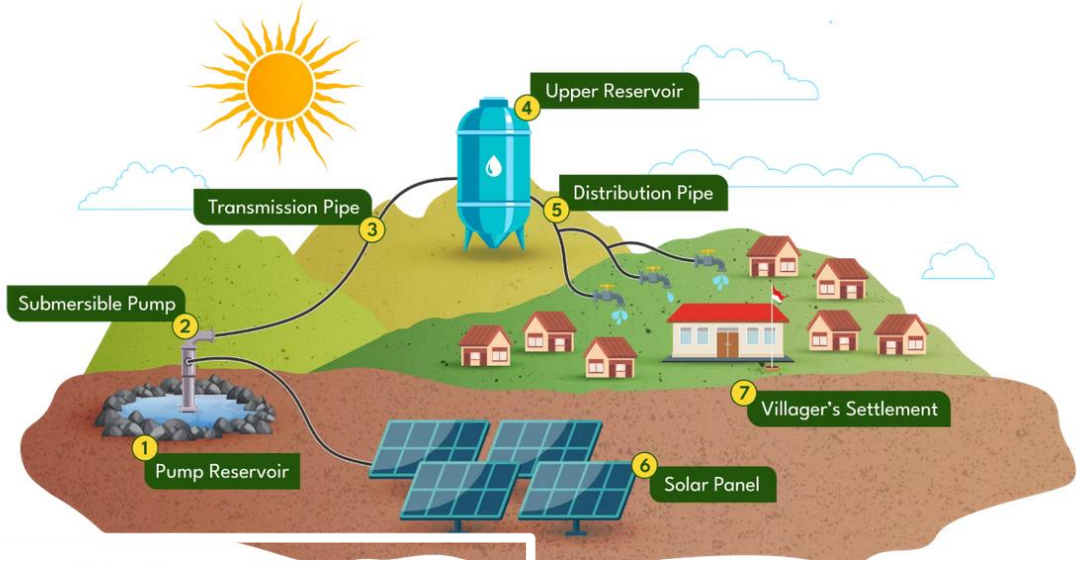
Recommendation for Urban Design in Sentul, Bogor

1. Integrate Green Infrastructure into the water management system
2. Adapt the WSUD framework to local guidelines and regulations for developers and residents to include WSUD in their current and future plans. Also, alternatives for retrofitting existing urban spaces to provide better water management.
3. Include rainwater-harvesting systems in residential and commercial areas.

Source: Sentul City – Lesson Learned Monash University, 2019

Innovative Water Solutions for Climate-Resilient

Solar-Powered Water Pump for Clean Water in East Nusa Tenggara



Source: Solar Chapter (NGO)

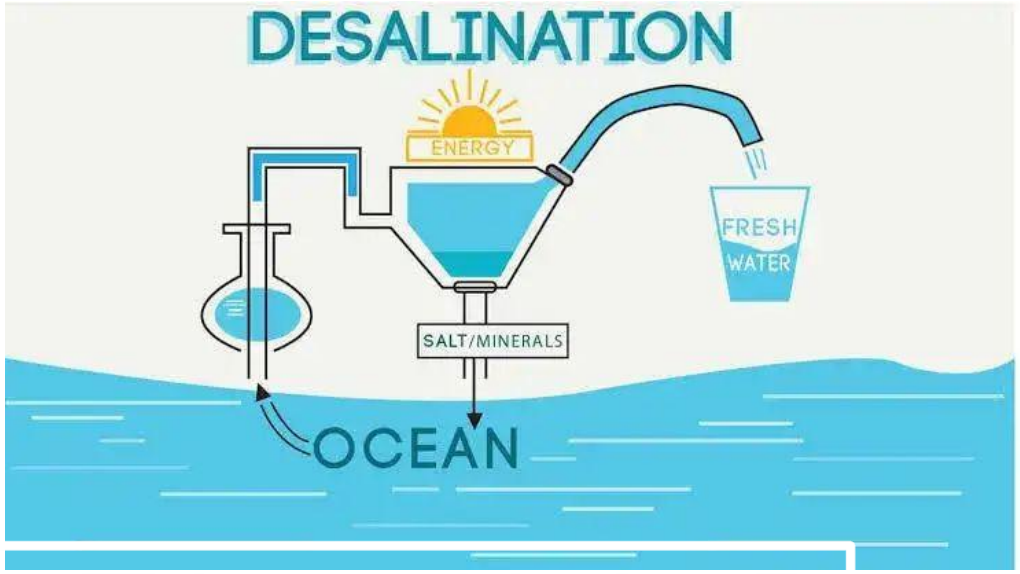
The Challenges

- Uneffective Water Infrastracture
- Unreliable Water Data
- Weak Stakeholder Coordination

The Goals

To provide clean water by using solar panels that convert sunlight into electricity for water pumps, while reducing pollution and supporting environmental sustainability.

Seawater Desalination Technology to Address the Clean Water Crisis in Demak & Jepara



Source: UNDIP collaborated with Australian National University, 2024

The Challenges

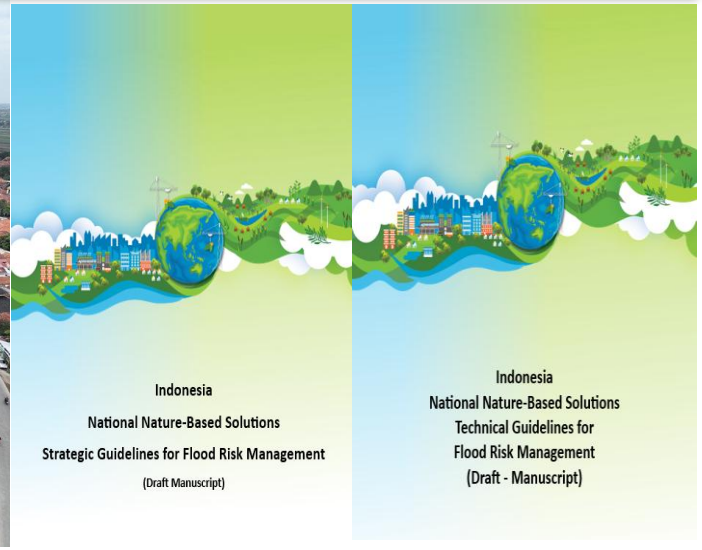
- Climate Change Issue
- Saltwater Intrusion

The Goals

To provide clean water through desalination technology that converts brackish and seawater into drinking water, and to create economic value and ensure environmental sustainability

Strengthening and Implementation of Nature-based Solutions

Technical Assistance on Mainstreaming Nature Based-Solutions - ADB



Technical Assistance on Mainstreaming Nature Based-Solutions

Partnership: the Government of Indonesia, Asian Development Bank (ADB), and Netherland Enterprise Agency (RVO).

Objectives:

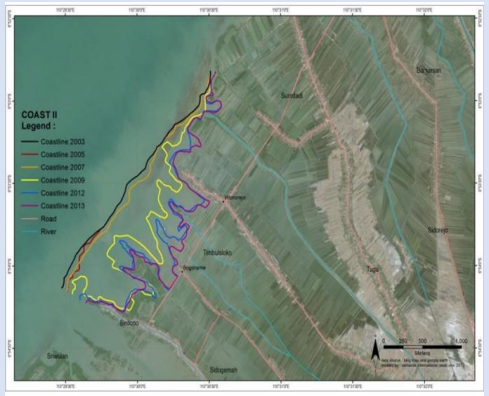
- To Develop **strategic and technical guidelines** on Nature-Based Solutions for flood risk management;
- Support is provided to align with the **RPJMN 2025–2029** targets, with a **priority location target in 2025**.
- **As a pilot** to support the FMNJP projects.
- **Start-End : September 2024 – September 2025 (Phase I)**

Hybrid approaches in NBS *(grey-green-blue infrastructures)*

Bali Beach Sand Nourishment Coastal Conservation Project

The implementation of Nature-Based Solutions (NBS) is carried out to restore the beach conditions to their natural sandy state, supported by the construction of groins (grey infrastructure) to limit sediment transport.

Study case implementation of NBS in Demak, Central Java



The construction of permeable dam structures as sediment traps and a foundation for mangrove rehabilitation. Within 1.5 years, 45 cm of sediment was successfully trapped. Capacity building and socio-economic improvements to support Nature-Based Solutions (NBS) were also carried out.

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Thank You