Otorita Ibu Kota
NUSANTARA

Session 3:

Smart City: Earthquake Risk Reduction & Preparedness Case Study in Nusantara

Nusantara Capital Authority

International Training Workshop on Smart Cities in Asia and the Pacific
"Building safe, resilient, inclusive, livable, and sustainable cities and communities"

14th May 2025

Potential Natural Disasters in Nusantara

Earthquakes and Ground Movements

IKN area falls into the Low Earthquakes KRB category with PGA (Peak Ground Acceleration) reaching 0.1 in its bedrock.

Landslide

The potential for land movement is predominantly in the very low to low vulnerability category.

Tsunami

Potential based on subduction and fault earthquake sources indicates the possibility of one-meter-high sea waves.

Flood

Moderate potential is dominant, but some areas are recurrent flood zones.

Forest and Land Fires

Moderate – High fire category.

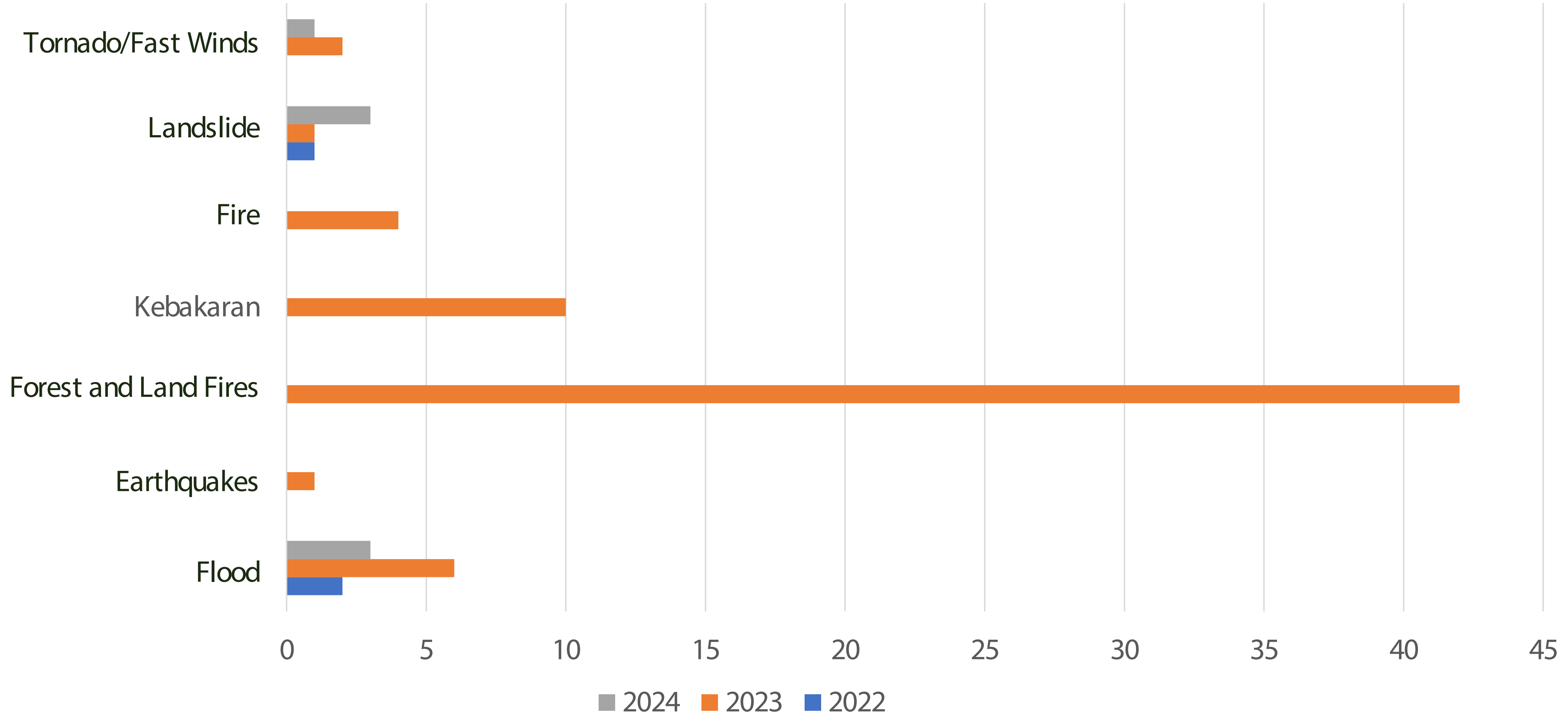
Drought

A prolonged dry days at Sepinggan Station was recorded for 83 days.

Source: Presentation Material of Deputy for Environment and Natural Resources (NCA) on Disaster Management to Realise Safe & Affordable Nusantara

Number of Disaster Event in Nusantarafrom 2022 to 2024

NUSANTARA



Nusantara **Urban** City Concept in Natural Disaster Management

Forest City

Managing the sustainable forest city concept as a nature – based solution. Forest makes cities more resilient and restraint to disasters, thereby reducing disaster – related costs.

Sponge City

Capable of restoring and maintaining the altered natural water cycle. The sponge city concept will support water harvesting, flood risk reduction, water purification, ecological preservation, and more.

Smart City

Smart emergency management includes an Early Warning System (EWS), disaster preparedness's, and response, and will also be supported by flood and stormwater management.

Source: Deputi Bidang Lingkungan Hidup dan Sumber Daya Alam – Penanggulangan Bencana Mewujudkan IKN Aman & Terjangkau

Policy and Spatial Planning Strategies as a Disaster Mitigation Effort for Nusantara

Reducing the Risks of Climate Change and Disasters

1. Regulating activities and the utilization of watershed areas (DAS), as well as managing water resources to preserve the function and sustainability of protected areas.
2. Monitoring and controlling development within watershed regions.
3. Rehabilitating mangrove areas.

Implementation of a Multi – Hazard Early Warning System

1. Development of a control center and integrated system.
2. Installation of monitoring equipment and supporting facilities.

Flood Risk Reduction for Disaster Resilience

1. Development of flood control infrastructure.
2. Protection of riverbank buffer zones.
3. Mapping of flood – prone areas and installation of flood gauges.
4. Implementation of building standards based on flood risk.

Strategies to Minimize Risk

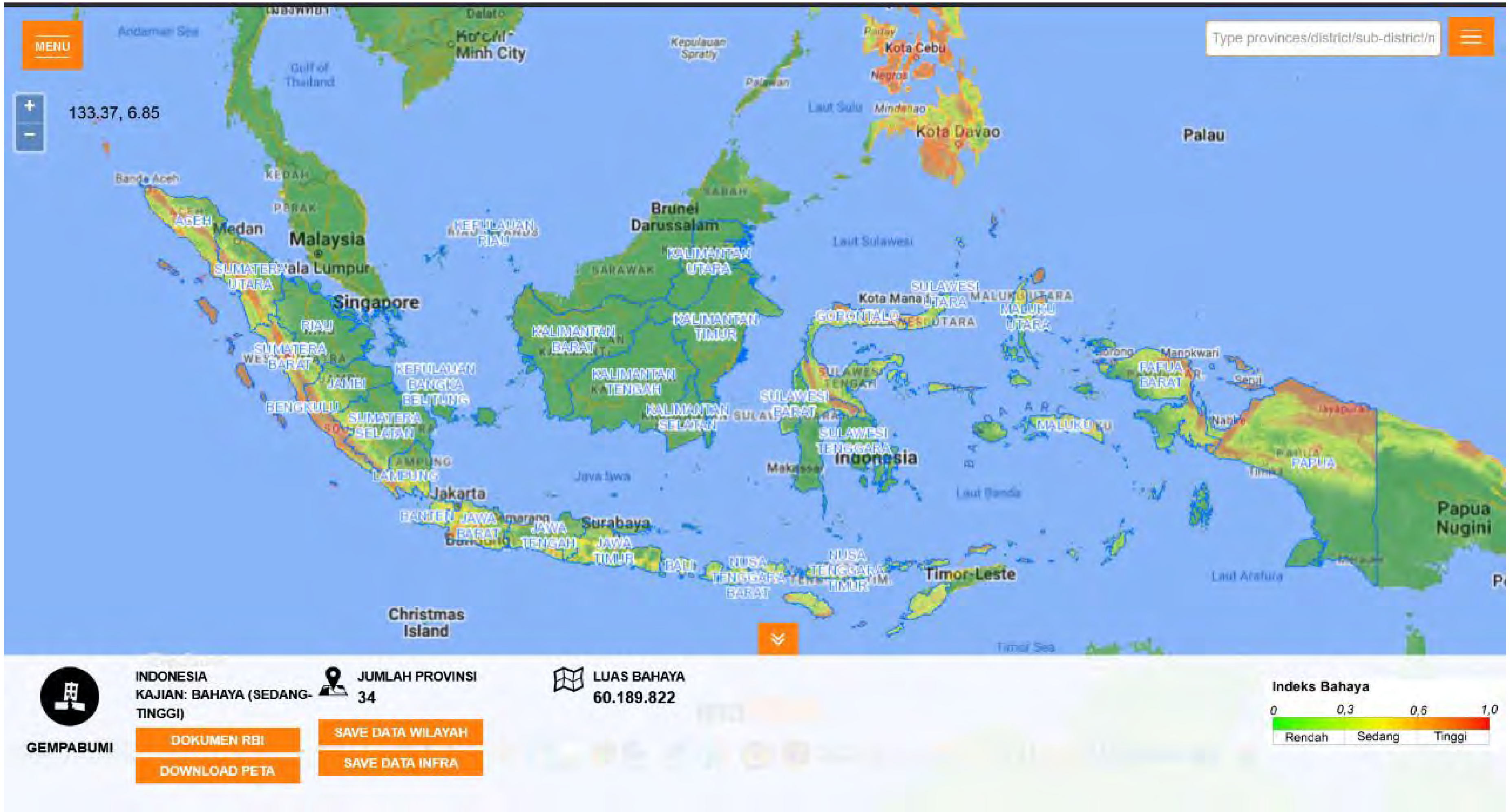
1. Strengthening policies and institutions.
2. Risk assessment and integrated watershed – based planning.
3. Enhancing the effectiveness of disaster prevention and mitigation.
4. Strengthening government and community preparedness.

NCA collaborates with other Ministers/Agencies

Building a Command Center System for Natural Disaster Early Warning

Source: Deputi Bidang Lingkungan Hidup dan Sumber Daya Alam – Penanggulangan Bencana Mewujudkan IKN Aman & Terjangkau

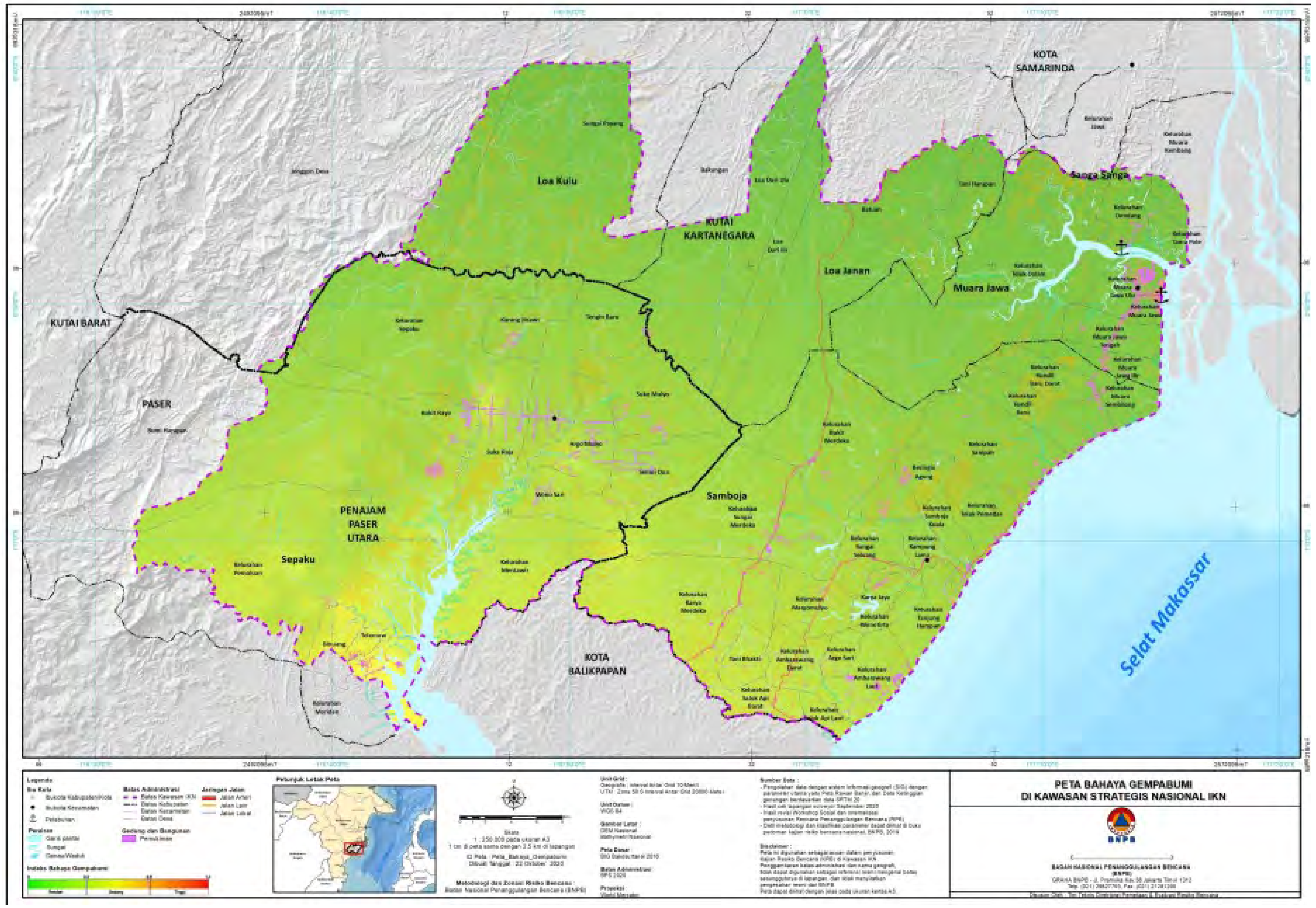
Earthquake Hazard Map in Indonesia

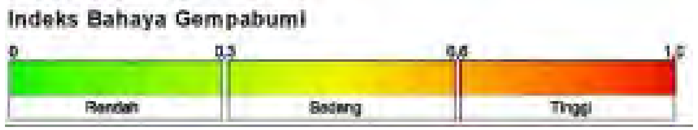


The earthquake hazard map is shown using the hazard index indicator. Meanwhile, it is shown that the distribution of the hazard index is relatively low in East Kalimantan (shown by the green indicator)

inarisk.bnpb.go.id

Earthquake Hazard Map in Nusantara



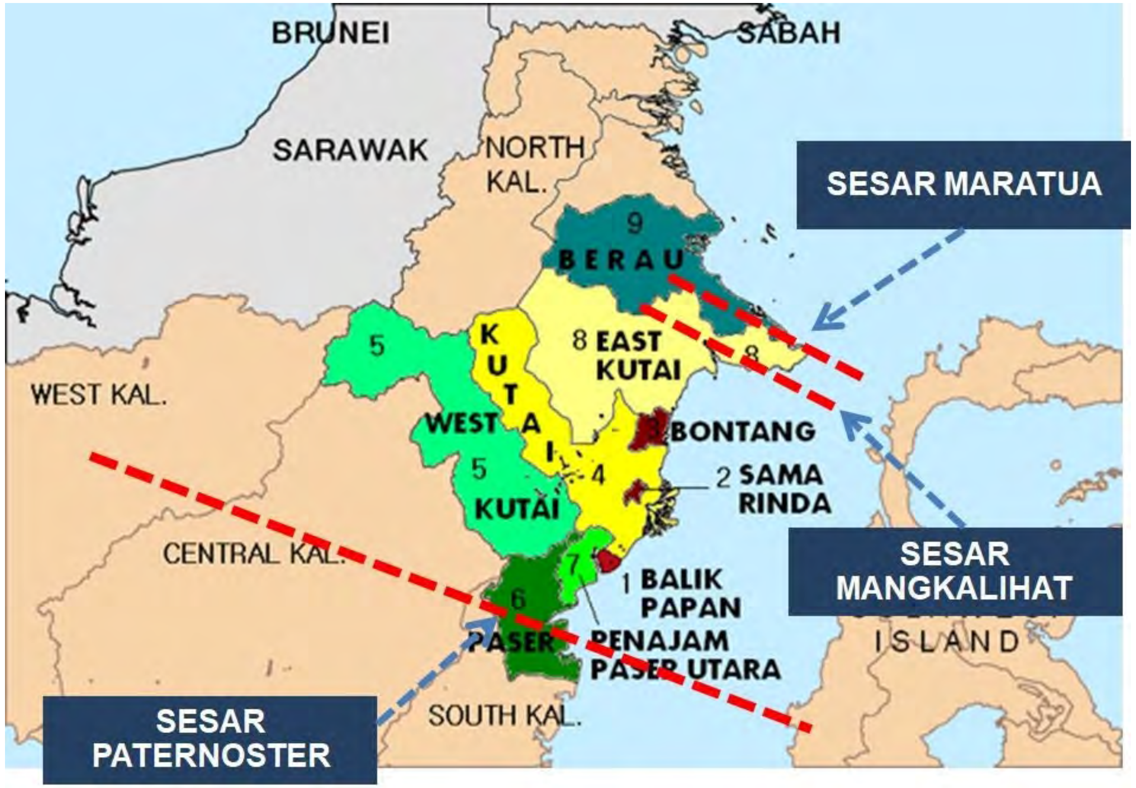


Based on the results of a disaster risk study conducted by National Agency for Disaster Countermeasure (BNPB) in 2020, it appears that IKN area has a predominantly low risk of earthquake hazards.

Source: Disaster Risk Study by the National Agency for Disaster Countermeasure, 2020

Distribution of Major/Regional Faults around East Kalimantan

- In general, Kalimantan Island is far from the earthquake source route.
- Because in the Neogene Era (23–0.05 million years ago) Kalimantan Island was locked by the South China Sea, and the subduction route moved to the south of Java Island (Hamilton, 1979)



Map of Geological Disaster-Prone Areas (PVMG, 2014) as well as major faults in Kalimantan

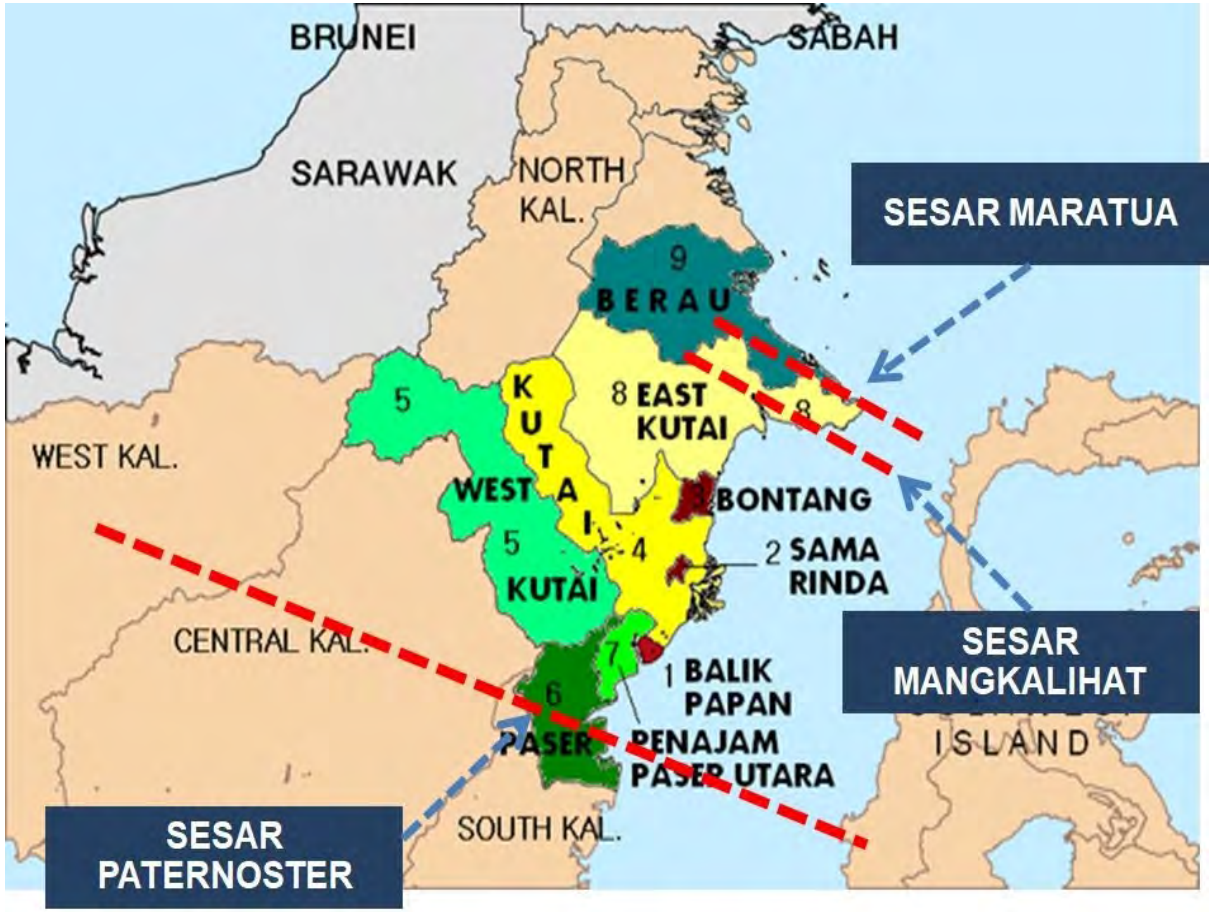
There are 3 Major Faults or Regional Faults that have quite an impact around Kalimantan Island, namely:

1. Sangkulirang Fault (Maratua and Mangkabayar), about 200-300 km away from KIKN.
2. Adang/Pasternoter fault, about 50 - 100 km from KIKN
3. Palu Koro Fault in P. Sulawesi.

- From those 3 major faults, only the Palu Koro Fault on Sulawesi Island has been proven to be active until now
- The capital of the Nusantara, is included in the Low Earthquake Disaster Zone
- Active faults are located northwest of KIPP and have the potential to cause earthquakes
- However, it is estimated that the resulting earthquake potential is relatively small, because the active fault is classified as a minor fault

Source: Results of seismotectonic studies by the Geological Agency (2020)

History of Earthquakes in the East Kalimantan Region



Map of Geological Disaster-Prone Areas (PVMG, 2014) as well as major faults in Kalimantan

It was recorded that from 1921 – now there was an earthquake in East Kalimantan which claimed quite a number of victims, including:

- The 1921 Sangkulirang earthquake (about 200-300 km away from KIKN), the intensity of the VII MMI earthquake and caused a tsunami in Sekuran.
- The 1923 Tarakan earthquake, intensity VIII MMI (about 600 km away from KIKN), caused several buildings to collapse and the ground to crack.
- The 1925 Tarakan earthquake, intensity VIII MMI (about 600 km away from KIKN), caused quite strong shaking in Tarakan and Luikas.
- The 1936 Tarakan earthquake (about 600 km away from KIKN), the magnitude reached 6.5 on the Richter scale.
- The 1957 Balikpapan earthquake (about 10-20 km from KIKN), intensity VI MMI earthquake, resulted in a tsunami on Balikpapan Beach.
- Earthquake in Tarakan, earthquake intensity IV – V MMI (about 600 km away from KIKN).

From those several large earthquakes, none have affected the Nusantara Capital Region. Generally, the source of earthquakes comes from the Palu Koro Fault and tectonic activity around Sulawesi.

Potential Tsunami around North Kalimantan-East Kalimantan (1)

The following is a record of earthquakes in East Kalimantan related to the Maratua Fault and Sangkulirang Fault:

- Sangkulirang Earthquake and Tsunami on May 14, 1921. The earthquake had an intensity scale of VII-VIII MMI and was followed by a tsunami.
- The Tanjung MangkaSee earthquake measuring M=5.7 on November 16, 1964.
- East Kutai earthquake measuring M=5.1 on June 4, 1982.
- Muarabulan earthquake, East Kutai, measuring M=5.1 on July 31, 1983
- The Mangkabayar earthquake measuring M=5.4 on June 16, 2000.
- The Tanjungredep earthquake measuring M=5.4 on January 31, 2006.
- Muaralasan earthquake, Berau, measuring M=5.3 on February 24, 2007.

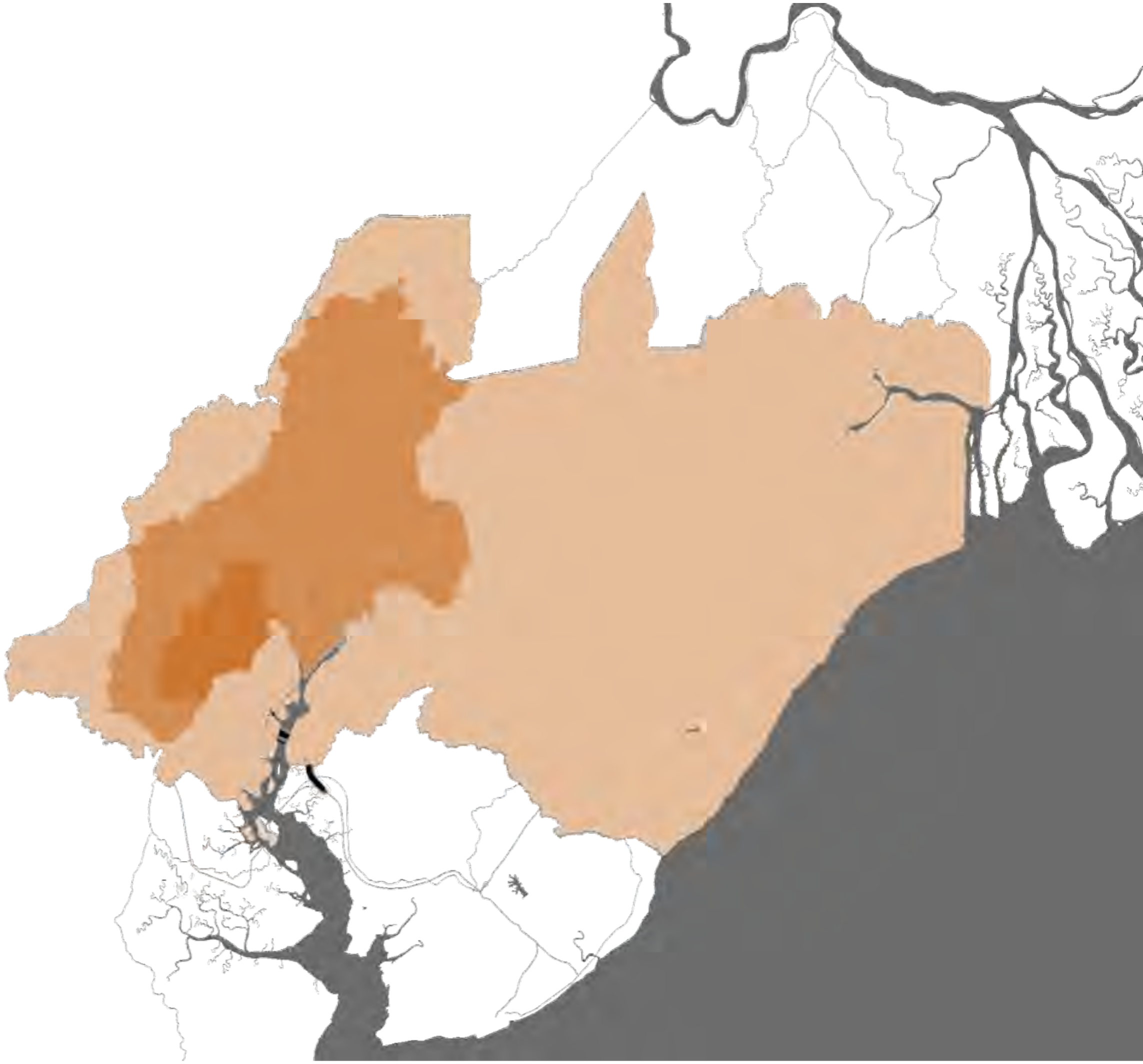
Source: the National Earthquake Study Center (PUSGEN), 2017

Tsunamis were recorded at:

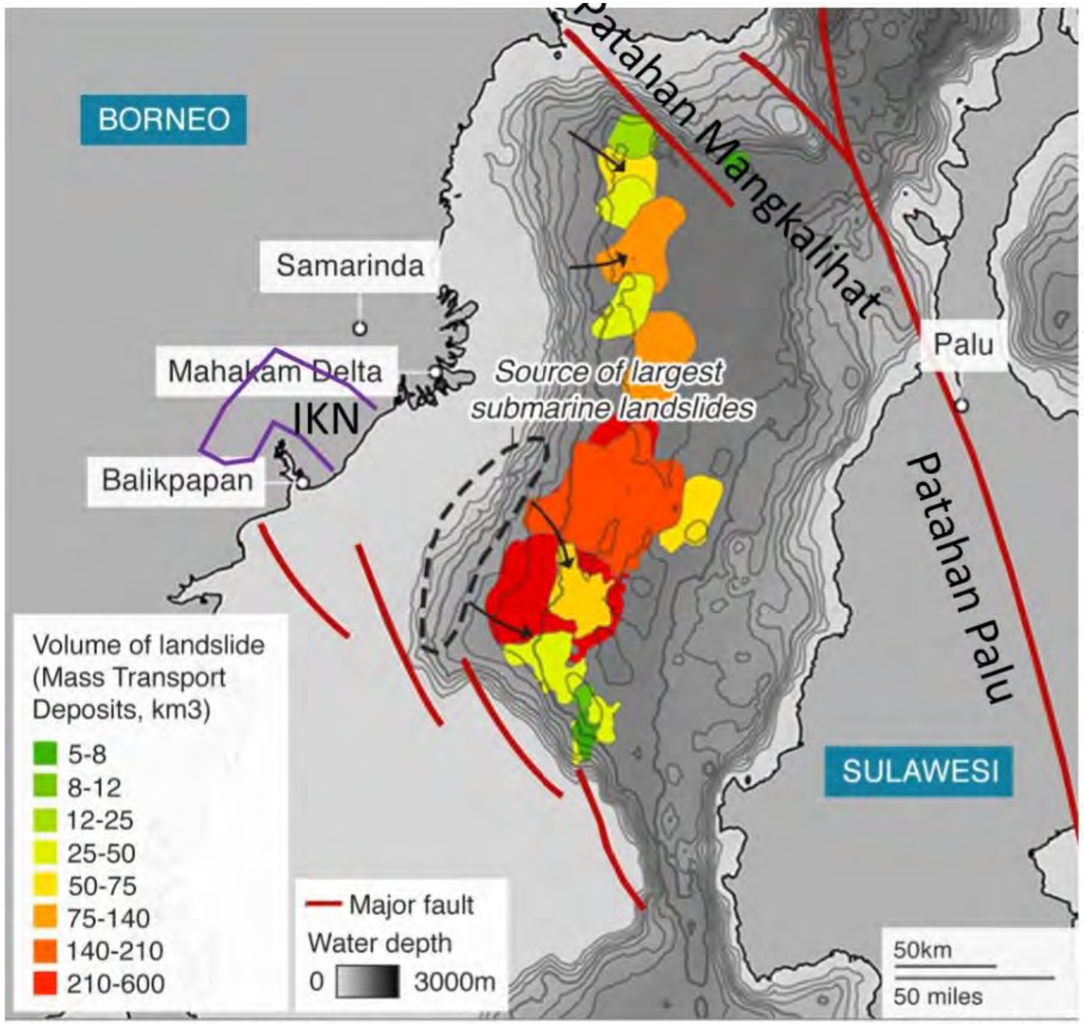
- The 1921 Sangkulirang earthquake, an intensity of the MMI VII earthquake and caused a tsunami in Sekuran.
- The 1957 Balikpapan earthquake, an intensity VI MMI earthquake, resulted in a tsunami on Balikpapan Beach

East Kalimantan's coastline faces Tsunami Risk from the North Sulawesi Megathrust. BMKG modeling using TOAST indicates that an M8.5 earthquake in this zone could trigger a tsunami over 3 meters high along the East Kalimantan coast, classified as a "watch" level threat.

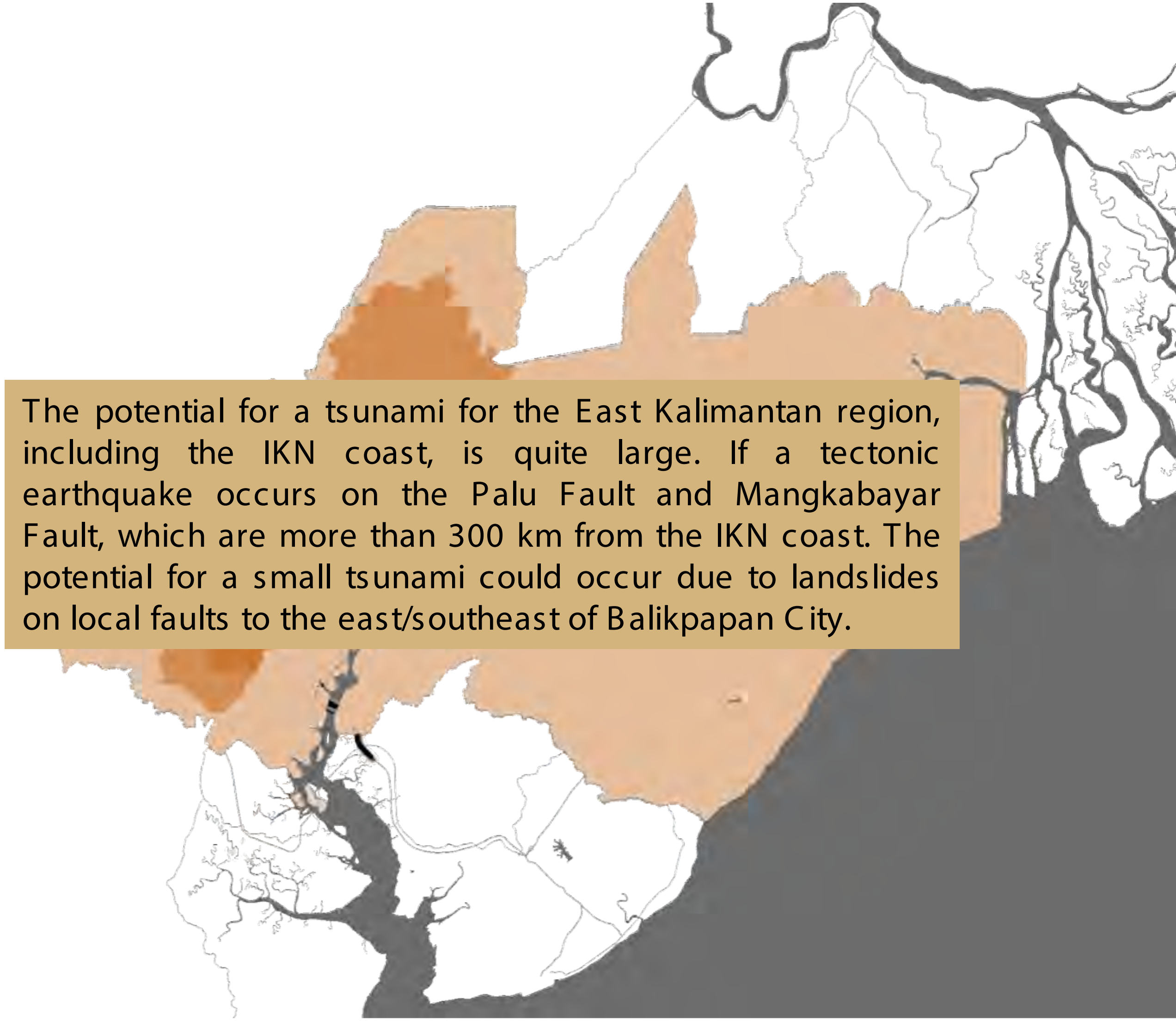
Source: Daryono, Detik, August 2019.



Potential Tsunami around North Kalimantan-East Kalimantan (2)



Source: RE Brackenridge et al



The potential for a tsunami for the East Kalimantan region, including the IKN coast, is quite large. If a tectonic earthquake occurs on the Palu Fault and Mangkabayar Fault, which are more than 300 km from the IKN coast. The potential for a small tsunami could occur due to landslides on local faults to the east/southeast of Balikpapan City.

Seismic Monitoring Sensor

- Utilizes advanced LoRaWAN® wireless communication technology,
- Enabling real-time transmission of seismic data with extremely low power consumption,
- Ideal for continuous monitoring applications

Advantage:

- integrates a high-precision three-axis accelerometer that can detect ground vibrations across all spatial dimensions,
- providing valuable real-time information on seismic activity,
- designed to operate reliably in harsh environmental conditions,
- ensuring uninterrupted performance regardless of weather factors,
- features: Near Field Communication (NFC) capabilities, facilitating easy setup, configuration, and maintenance via mobile devices.

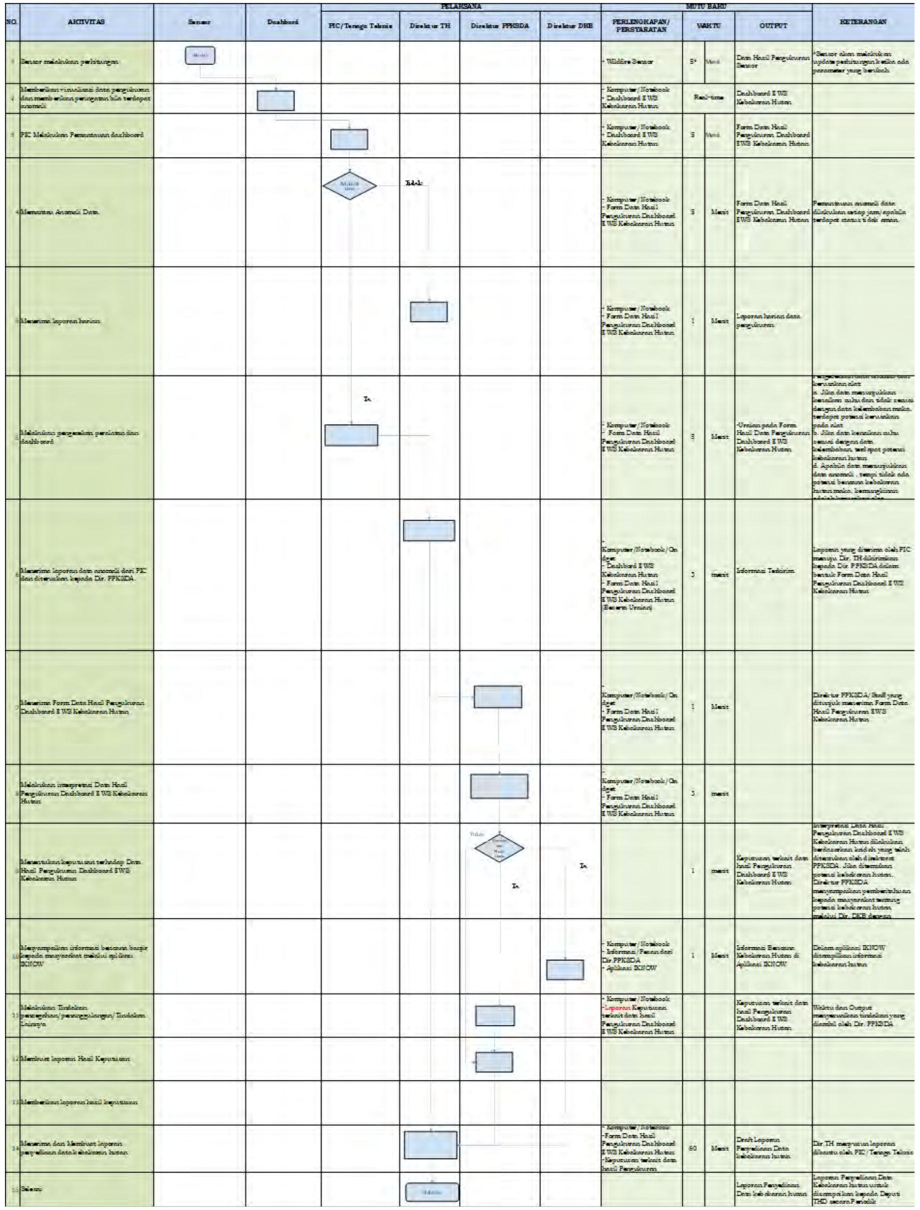
- Integrated with the Building Management System → enhancing the Early Warning System to improve disaster preparedness and ultimately strengthen Nusantara overall resilience.

The Disaster Information Management

The Nusantara Capital Authority (OIKN) has formulated a comprehensive Standard Operating Procedure (SOP) for the management of information collected from flood sensors, wildfire sensors, and air quality monitoring devices. This SOP clearly delineates the responsibilities of all relevant parties and establishes detailed procedures for data monitoring, verification, and reporting.

Through this structured framework, OIKN strengthens accountability and enhances the efficiency of disaster information management.

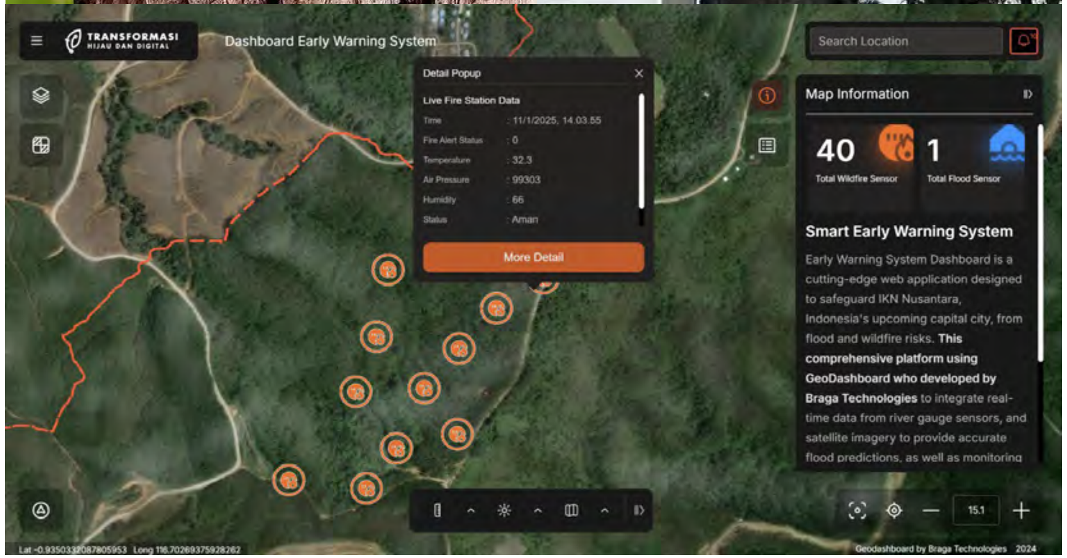
This approach underscores OIKN's unwavering commitment to developing a well-coordinated and responsive disaster early warning system for Nusantara Capital City.



Smart Forest Fire Monitoring Sensor

Wildfire sensors are designed to detect environmental parameters in real time, including temperature, humidity, air pressure, as well as concentrations of carbon monoxide (CO) and carbon dioxide (CO_2). Their installation forms part of broader efforts to mitigate the risk of forest fires and to enable continuous monitoring of ecosystem conditions within Nusantara Capital City.

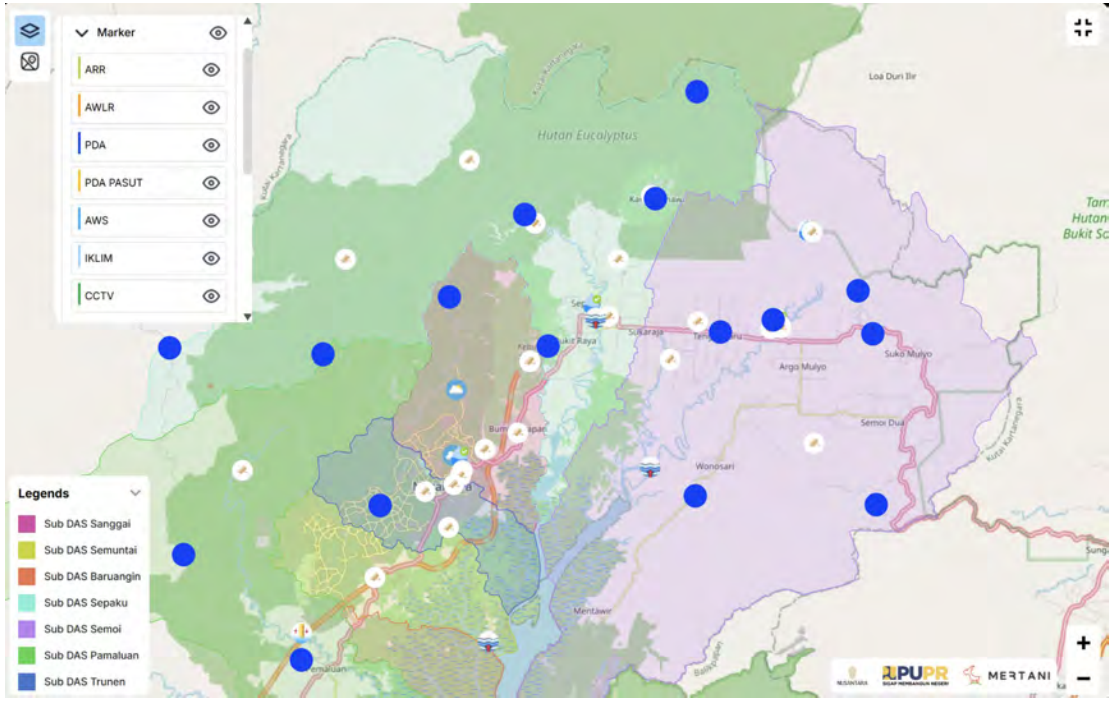
These monitoring system is fully integrated with IKN Integrated Control and Command Center (IKN ICCC).

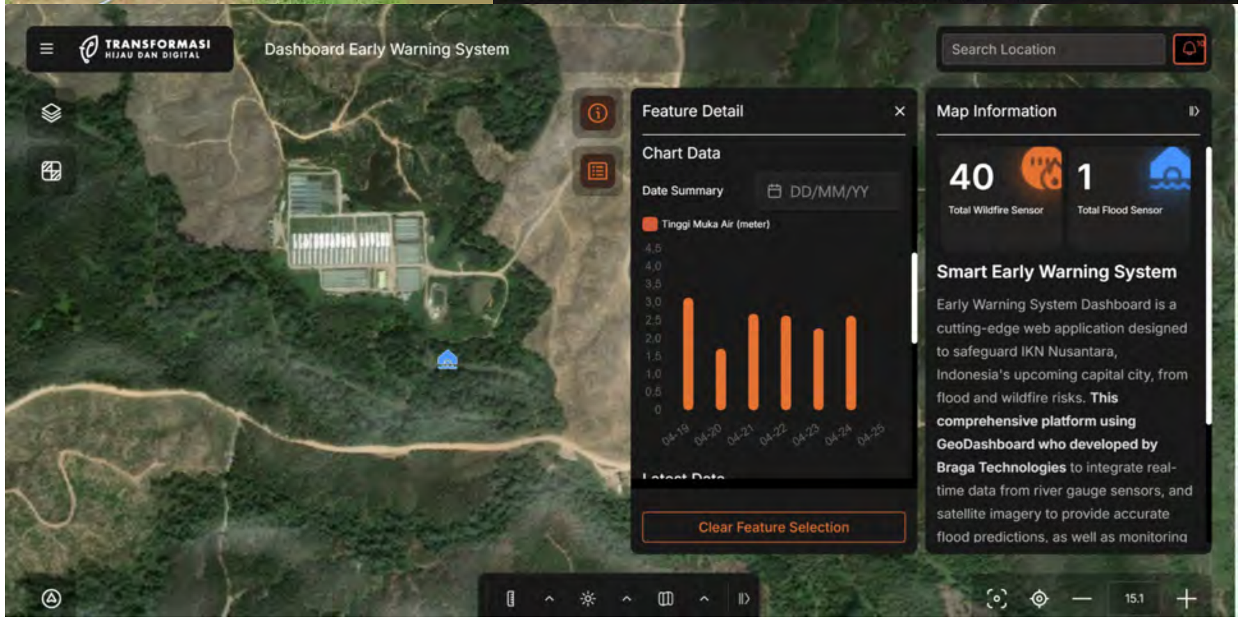


Flood Monitoring System

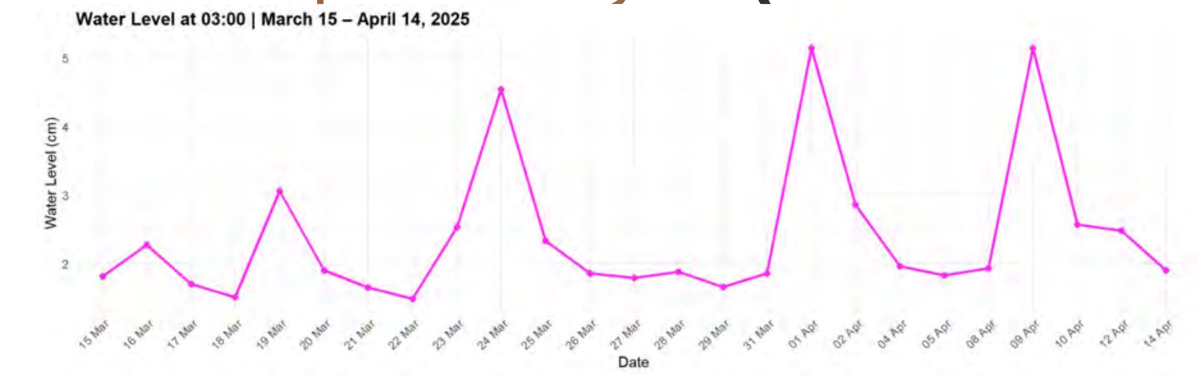
A total of 18 rainfall sensors and 16 Automatic Water Level Recorders (AWLR) have been installed in Nusantara Capital City (OIKN). Sensors are collecting data every 5 minutes and designed to measure rainfall and river water levels. To enhance monitoring, 18 CCTV also installed along the rivers.

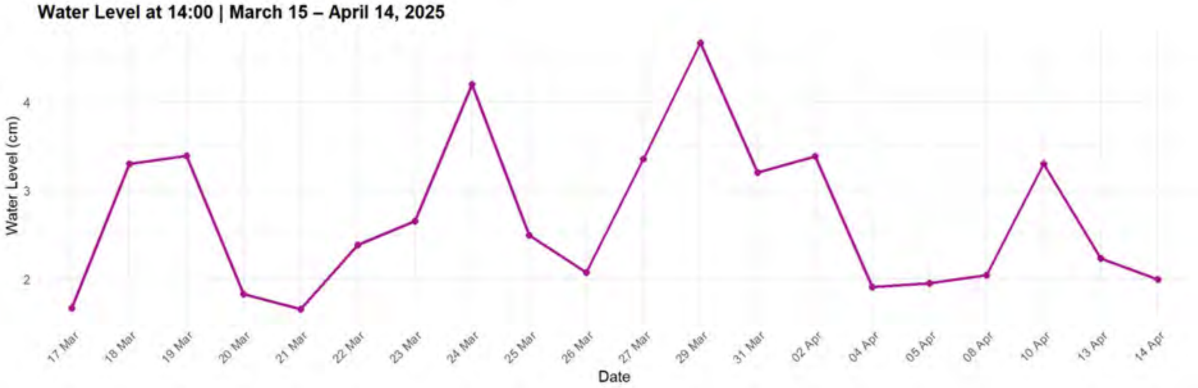
These monitoring system is fully integrated with IKN ICCC.

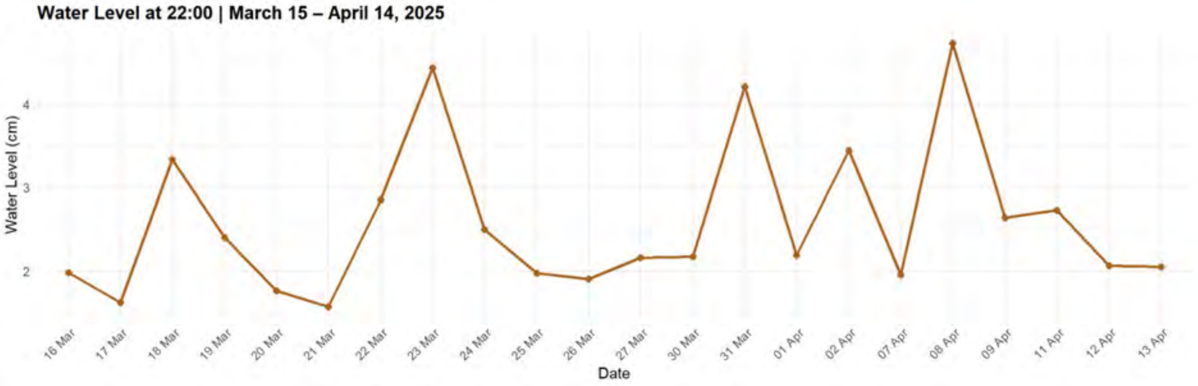




Flood Graphic Analysis **(15 March - 14 April 2025)**







Sepaku River water level, measurements of March 15 - April 14, 2025, recorded at
- 03:00 → critical time/ very low respond
- 14:00 → full readiness
- 22:00 → less respond

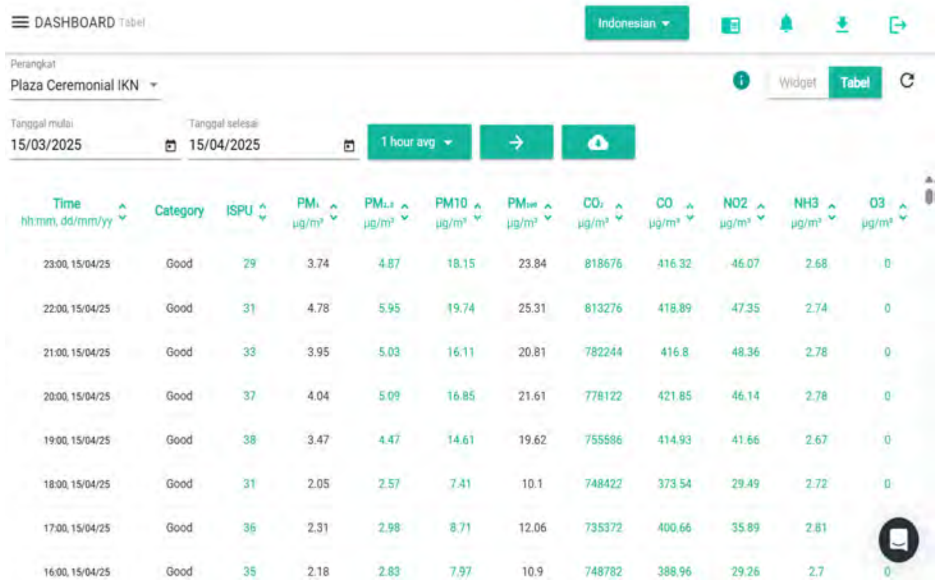
Each collected at five-minute intervals. The analysis reveals that flooding events could occur at any of these times, demonstrating no consistent pattern or specific time of day that reliably predicts flooding.

A flood-warning threshold has been set at 2 meters, above which the risk of flooding significantly increases. Once water levels reach 3 meters, flooding becomes almost inevitable, necessitating continuous (24/7) alertness from both community members and flood-monitoring personnel.

Air Quality Monitoring Sensor

Realtime monitoring, with key parameters monitored include:

- Airborne particulates (PM_1, $PM_{2.5}$, PM_{10}, PM_{100})
- Pollutant gases such as CO_2, CO, NO_2, NH_3, and O_3
- Temperature, humidity, air pressure, wind direction and speed
- Light intensity, noise levels, UV radiation, and hydrocarbons



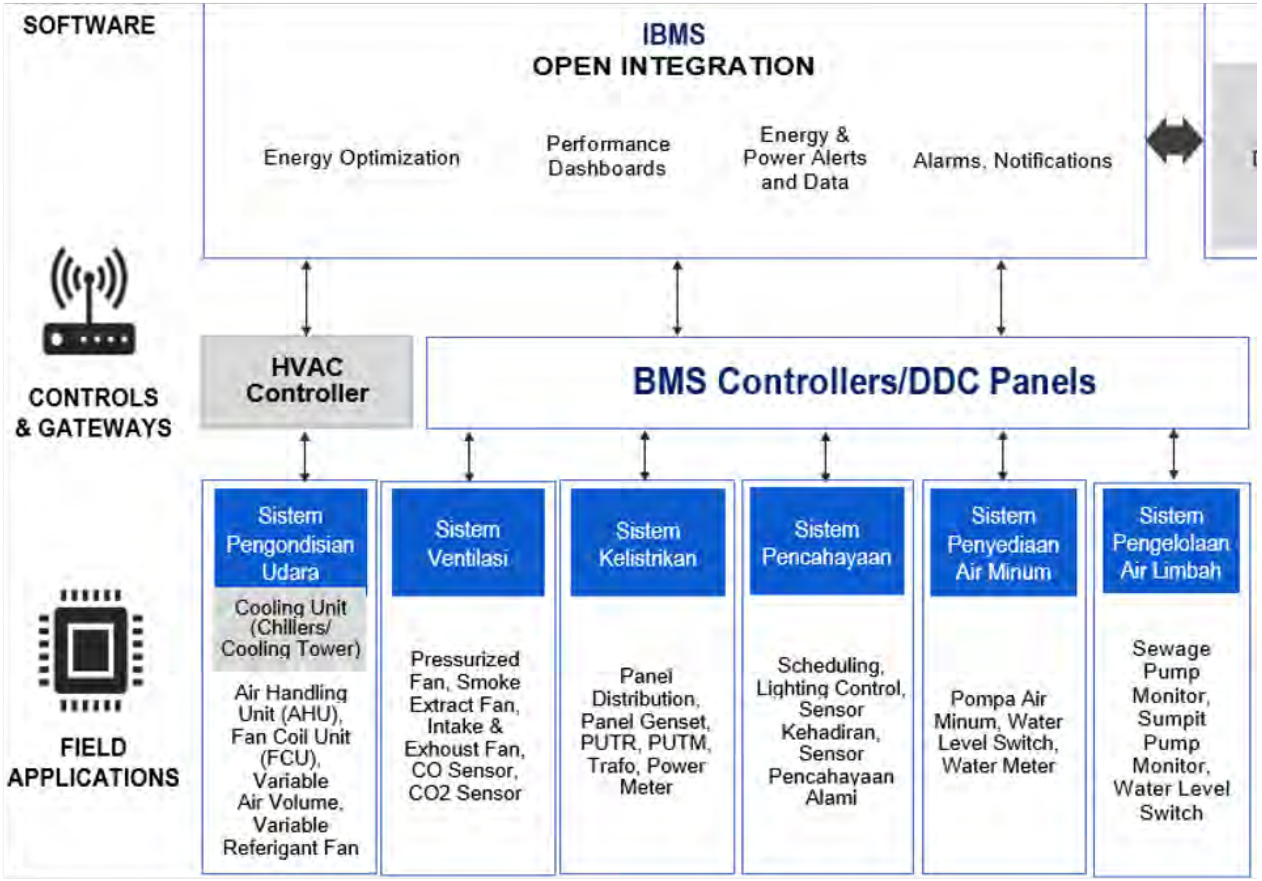
DASHBOARD Tabel

Perangkat: Plaza Ceremonial IKN

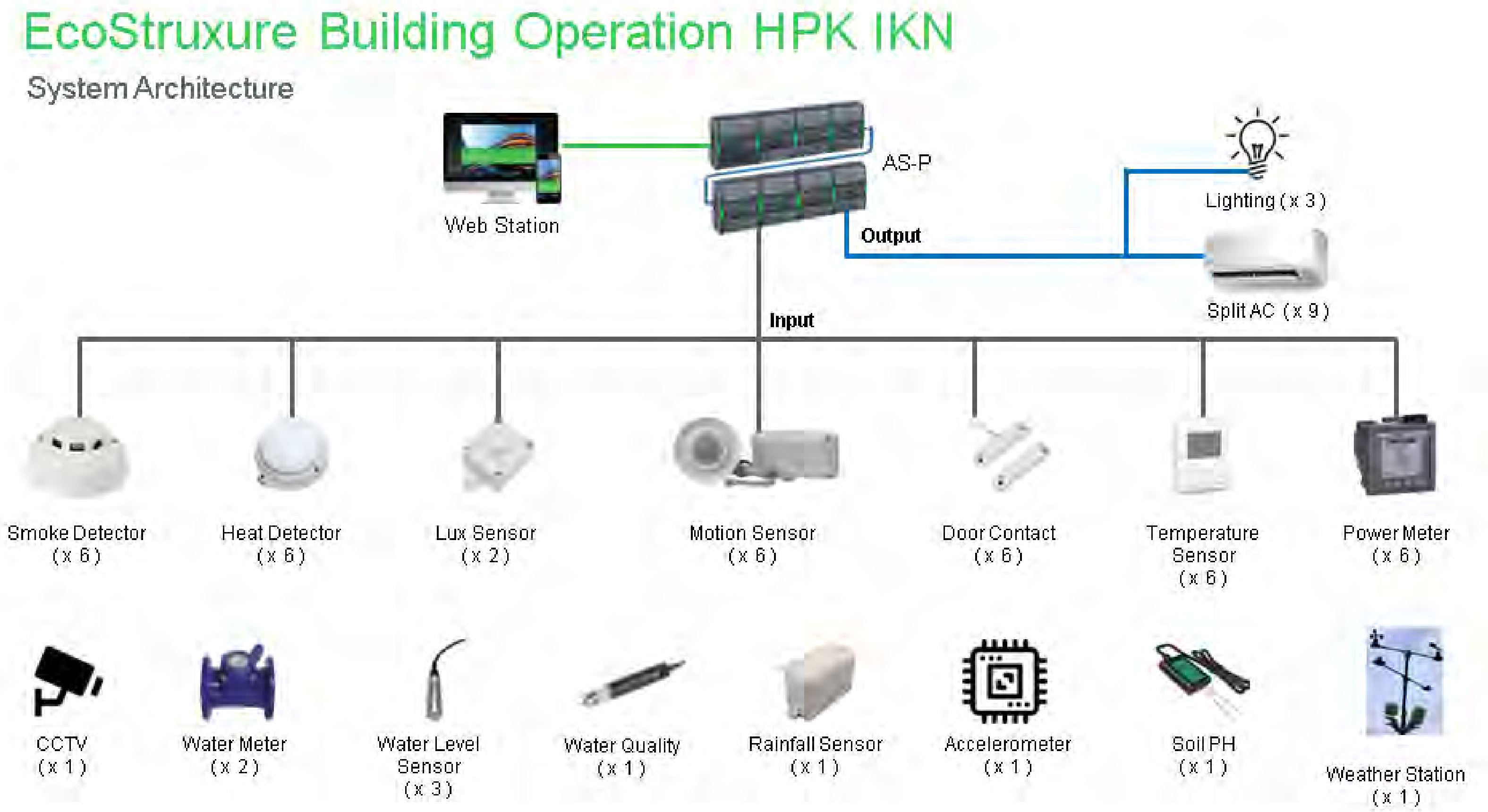
Tanggal mulai: 15/03/2025 — Tanggal selesai: 15/04/2025 — 1 hour avg

Time hh:mm, dd/mm/yy	Category	ISPU	PM_1 µg/m³	$PM_{2.5}$ µg/m³	PM10 µg/m³	PM_{100} µg/m³	CO_2 µg/m³	CO µg/m³	NO2 µg/m³	NH3 µg/m³	O3 µg/m³
23:00, 15/04/25	Good	29	3.74	4.87	18.15	23.84	818676	416.32	46.07	2.68	0
22:00, 15/04/25	Good	31	4.78	5.95	19.74	25.31	813276	418.89	47.35	2.74	0
21:00, 15/04/25	Good	33	3.95	5.03	16.11	20.81	782244	416.8	48.36	2.78	0
20:00, 15/04/25	Good	37	4.04	5.09	16.85	21.61	778122	421.85	46.14	2.78	0
19:00, 15/04/25	Good	38	3.47	4.47	14.61	19.62	755586	414.93	41.66	2.67	0
18:00, 15/04/25	Good	31	2.05	2.57	7.41	10.1	748422	373.54	29.49	2.72	0
17:00, 15/04/25	Good	36	2.31	2.98	8.71	12.06	735372	400.66	35.89	2.81	
16:00, 15/04/25	Good	35	2.18	2.83	7.97	10.9	748782	388.96	29.26	2.7	0

Nusantara Capital Authority's Office Building Management System



Housing of Construction Workers' Building Management System



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