

STRATEGIC PAPER

The Marine Observation Station

*Monitoring Climate Change on the Coastal &
Marine Environments of Western Pacific*

A Case for Wewak, East Sepik Province, Papua New Guinea

PRESENTED BY

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EAST SEPIK PROVINCIAL
ADMINISTRATION

SOCIAL SERVICES SECTOR
ENVIRONMENT & CLIMATE CHANGE UNIT
UNIT

CONGRESS THEME

Surveyors' Role in Reclaiming the Land

01 – 05 June 2026 · Village Inn Hotel, Wewak



Purpose

- ❑ Highlight Challenges, and
- ❑ Verify importance for coordination.

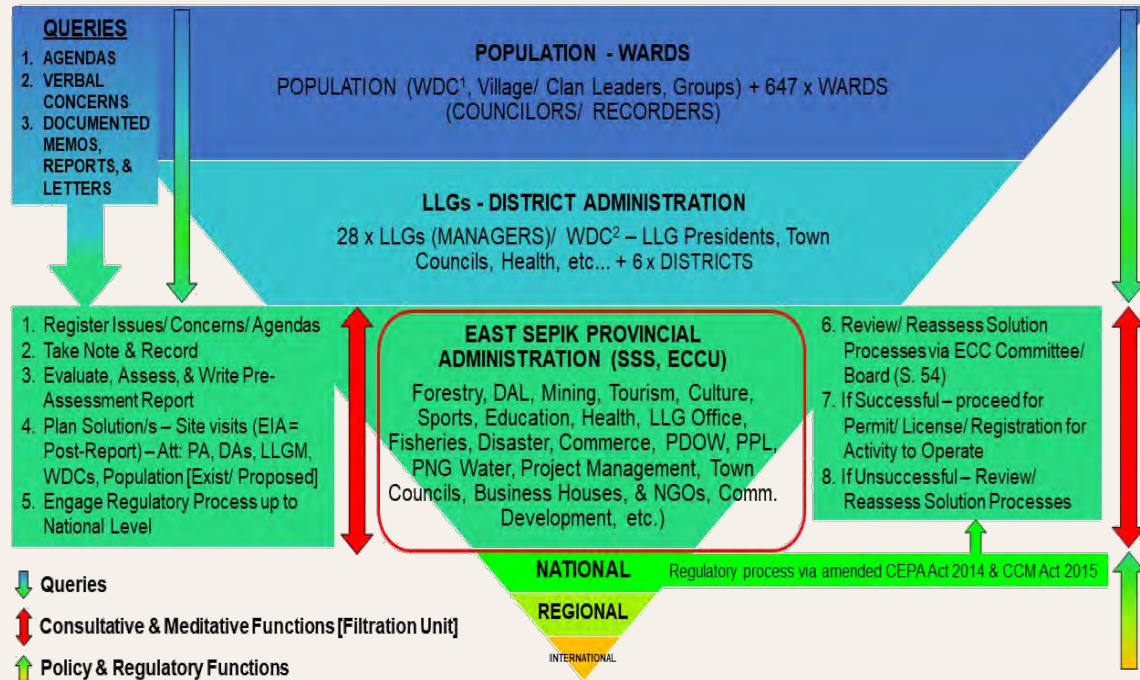
COORDINATION

Institutional Coordination (both horizontally & vertically):

- Community Level
- LLG Level
- District
- Provincial
- National
- International



ESPA ECCU BRIEF CONSULTATIVE & COORDINATION APPROACH



KEYWORDS

Institutional Coordination · Community Level · LLG & District Levels · Provincial · National · National · International



Report on Remote Sensing Monitoring of Marine and Coastal Zones in Papua New Guinea



3 MEMORANDUM OF UNDERSTANDING ON PROMOTING MARINE COOPERATION BETWEEN CLIMATE CHANGE AND DEVELOPMENT AUTHORITY, PAPUA NEW GUINEA AND THE SECOND INSTITUTE OF OCEANOGRAPHY, MINISTRY OF NATURAL RESOURCES, THE PEOPLE'S REPUBLIC OF CHINA

Climate Change and Development Authority (CCDA), Papua New Guinea and the Second Institute of Oceanography (SIO), Ministry of Natural Resources of the People's Republic of China, together referred to "Parties" to this Memorandum of Understanding (MoU).

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Staff Reporter
13/05/2026

About 214 000 hectares of ocean around Western Manus has been designated as a Marine Protected Area as PNG progresses towards achieving the 30 by 30 global initiative to protect and conserve at least 30% of the world's lands, freshwater, and oceans by 2030.

Minister for Fisheries and Marine Resources, Jelta Wong announced this today during a presentation on Marine Protected Areas (MPA). This will be the largest MPA in the Melanesian Region and will in the long run generate income through blue carbon bonds.

Minister for Fisheries and Marine Resources, Jelta Wong who outlined initiatives already in place to protect marine life and announced the allocation of 214 hectares of ocean as Marine Protected Area in Manus Province.

4

Report on Remote Sensing Monitoring of Marine and Coastal Zones in Solomon Islands
(Remote Sensing Services for Onshores and Coastal Zones in Pacific Islands).





News ▾ Life Radio Podcasts Video Sections ≡



Located around 125 kilometres southeast of PNG's Manus Island, the volcano has emitted a large steam plume since earlier this month. Photo: VolcanoDiscovery

A scientist monitoring a submarine volcano that has erupted in Papua New Guinea waters says there's little way of knowing whether it could blow big.

Weekender



OCEAN DEATH MYSTERY

STORY ON PAGE 26



A scientifically justified response to a measurable coastal crisis.

THE PROBLEM

Low-lying coastal regions of East Sepik Province face sea-level rise, coastal erosion, saltwater intrusion, mangrove degradation, and intensified storm surges — yet Papua New Guinea lacks long-term in situ marine observation infrastructure to monitor and respond.

THE EVIDENCE

Sea Level Anomaly along the Sepik coastal estuary has risen from -0.04 m (1998–2002) to $+0.06$ m (2018–2023).

Marine Net Primary Productivity is declining, coastal erosion exceeded coastal expansion nationally during 2000–2020, and coral bleaching warnings persisted up to eight months in 2023.

THE PROPOSAL

Establish a permanent Marine Observation Station (MOS) in Wewak under the CCDA–SIO Memorandum of Understanding, Understanding, integrating tidal monitoring, GIS, hydrographic hydrographic surveying, remote remote sensing, and hybrid aerial–aerial–underwater platforms to deliver continuous surveillance and and disaster early warning.

KEYWORDS

Marine Observation Station · Climate Change · Sea-Level Rise · Coastal Erosion · Remote
· Remote Sensing · East Sepik Province

Section I

CLIMATE IMPACTS ON COASTAL & MARINE
ENVIRONMENTS

Eight environmental indicators.
One consistent signal of change.

COASTAL EROSION · SEA-LEVEL RISE · SALINITY · MANGROVES · SEA SURFACE
TEMPERATURE · MARINE NET PRIMARY PRODUCTION · REEFS · STORM
SURGE

*Synthesised from Cao et al.
(2024) & Failou & Hevoho
(2025)*



What the satellite record now shows.

SEA LEVEL ANOMALY

+3.6

mm/ year

Calculated rise rate along along the Sepik coastal estuary, 1998–2023.

SEA SURFACE TEMPERATURE

29.5

°C mean

Northern equatorial waters — within the Western Pacific Pacific Warm Pool.

COASTAL EROSION

97.6

ha net loss

Vailala estuary, 2010–2023 — against only 40.4 ha of expansion.

CORAL THERMAL STRESS

8

months DHW > L1

Dawson Island bleaching warning threshold exceeded across 2023.

Mangrove cover in the Sepik estuary expanded from **19,978 ha** (2000) to **20,856 ha** (2020), **ha** (2020), yet local-scale degradation continues — underscoring why satellite data alone is data alone is insufficient without permanent field validation.



A quarter-century of rising water at the river's mouth.

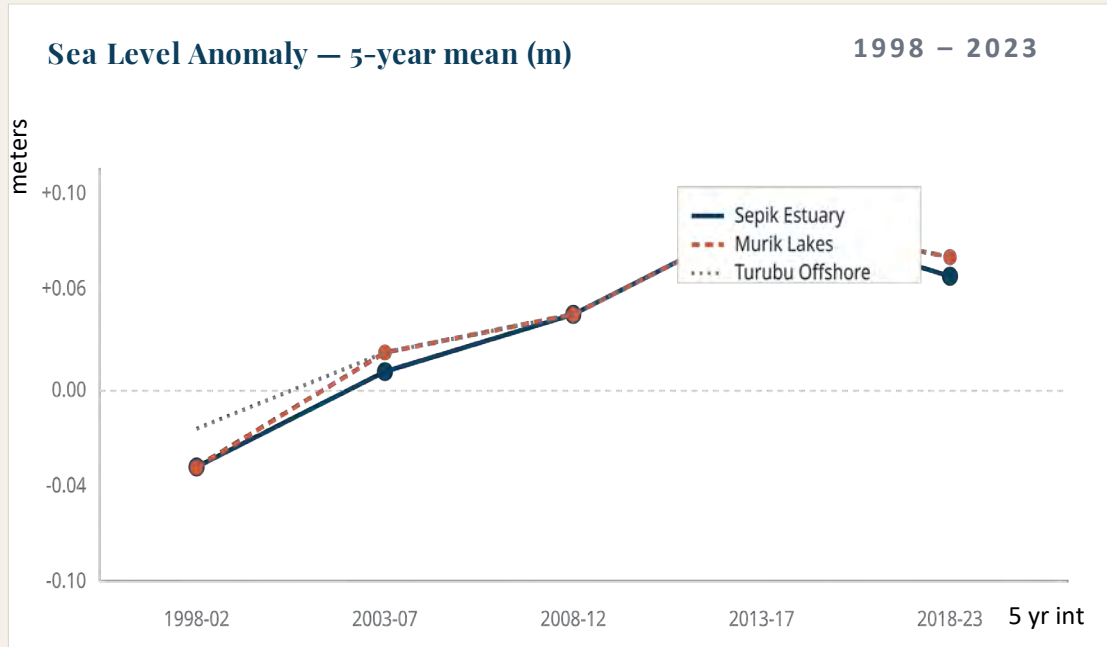


Figure 2. Long-term SLA trend at key estuarine monitoring sites, averaged over 5-year intervals. Source: Failou & Hevoho (2025).

TREND

—0.04 m

to +0.06 m anomaly

A consistent upward trajectory across all three monitoring sites, consistent with global sea-level rise projections.

IMPLICATION

Increased flood and saltwater intrusion risk for the Sepik estuary, Murik Lakes, and Wewak coastal zone.

([Remote Sensing Services for Offshores and Coastal Zones in Pacific Islands](#)).



Estuarine productivity is beginning to fall.

MNPP indexes phytoplankton productivity at the base of the marine food web — a leading indicator of fisheries potential and ecosystem health.

DECLINE DETECTED

Sepik Estuary fell from **1,528** to **1,316.78 mg C m⁻²** between 2013–2017 and 2018–2023. Murik Lakes shows a parallel decline.

LIKELY DRIVERS

Warming surface waters, altered nutrient inputs, and increased turbidity from changing river discharge patterns.

MNPP, 5-year means (mg C m⁻²)

1998 – 2023

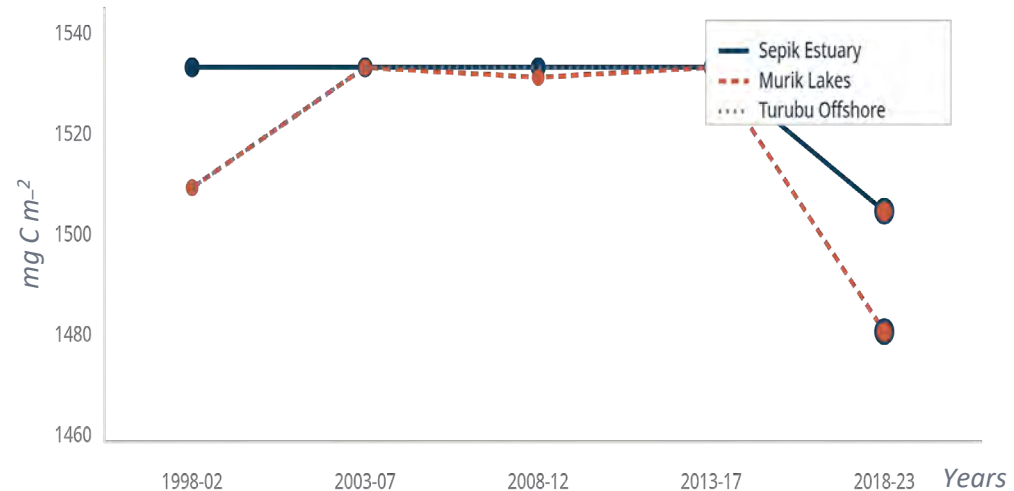
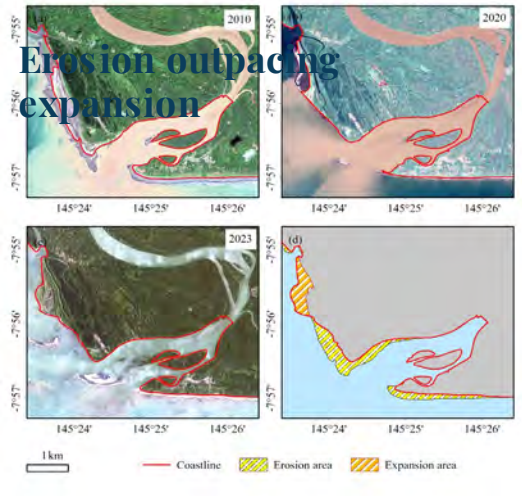


Figure 6. Long-term MNPP trends at key estuarine sites. Source: Source: Failou & Hevoho (2025).

Three pressures converging on the same shoreline.

COASTAL EROSION



MANGROVES & SALINITY



STORM SURGE & DISASTER

Compounding hazards

Global cyclone intensification, rising surge risk, and geological instability converge on East Sepik. After the September 2022 magnitude-7.6 earthquake, SIO satellite monitoring identified eleven landslide areas requiring emergency response.

IPCC (2023); WMO (2022); Cao et al. (2024)

“The absence of adequate coastal hazard monitoring and early warning infrastructure significantly limits the ability of communities and authorities to prepare for and respond to extreme weather events.”

Section
II

CURRENT GAPS IN PNG MARINE & COASTAL MONITORING
MONITORING

We can see the change.

We cannot yet measure it from the ground.

THREE STRUCTURAL GAPS IN PAPUA NEW GUINEA'S ENVIRONMENTAL MONITORING SYSTEM
MONITORING SYSTEM



Satellite observation alone cannot ground-truth a coastline.

Table 1. Summary of current environmental monitoring capabilities and gaps in Papua New Guinea.

MONITORING ELEMENT	CURRENT STATUS	IDENTIFIED GAP
Long-term in situ marine observation	Absent nationally	No permanent MOS on PNG coastline
Sea-level monitoring	Satellite-derived only	No continuous tide gauge network
SST & salinity field monitoring	Satellite-derived only	Limited field validation capability
Coastal erosion mapping	Periodic satellite analysis	No continuous shoreline survey system
Storm surge early warning	Absent	No coastal hazard alert infrastructure
Mangrove ecological monitoring	Satellite mapping only	No integrated field-based assessment

Section
III

THE PROPOSED MARINE OBSERVATION
STATION · WEWAK

A permanent station.
A scientifically grounded response.

INSTITUTIONAL BASIS · SURVEYING TECHNOLOGIES ·
OPERATIONAL FRAMEWORK

*CCDA · ESPA · SIO Memorandum of
Understanding*



An integrated, multi-layered observation system.

The proposed Marine Observation Station integrates satellite remote sensing, ground validation, real-time sensors, drone observations, observations, and community surveillance — anchored by the CCDA–SIO Memorandum of Understanding.

COOPERATION AREAS UNDER THE MOU

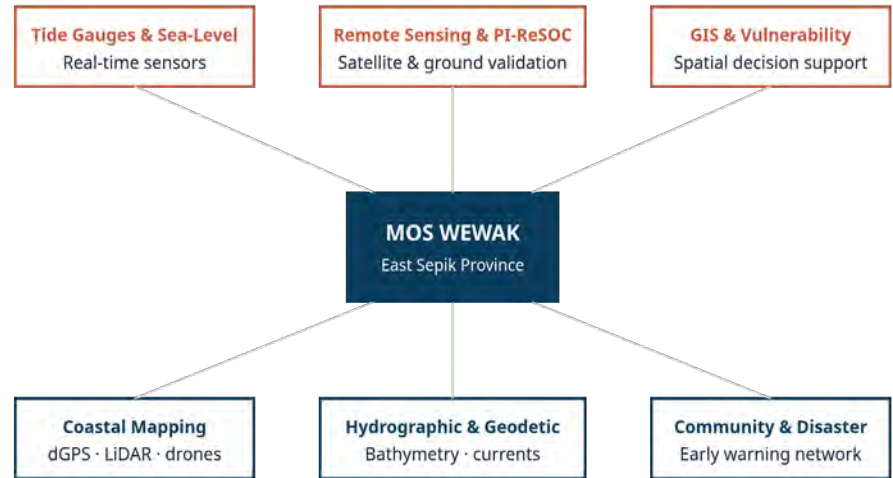
Marine disaster early warning · observation & disaster mitigation · marine environmental evolution (SLA & storm surge) · blue economy development · capacity building · community surveillance and monitoring, coastal surveys.

FORMS OF COOPERATION

Field observation station · joint research and cruise programmes · satellite data centre · joint seminars · exchange of observation data · UN Ocean Decade actions.

FIGURE 8. CONCEPTUAL OPERATIONAL FRAMEWORK

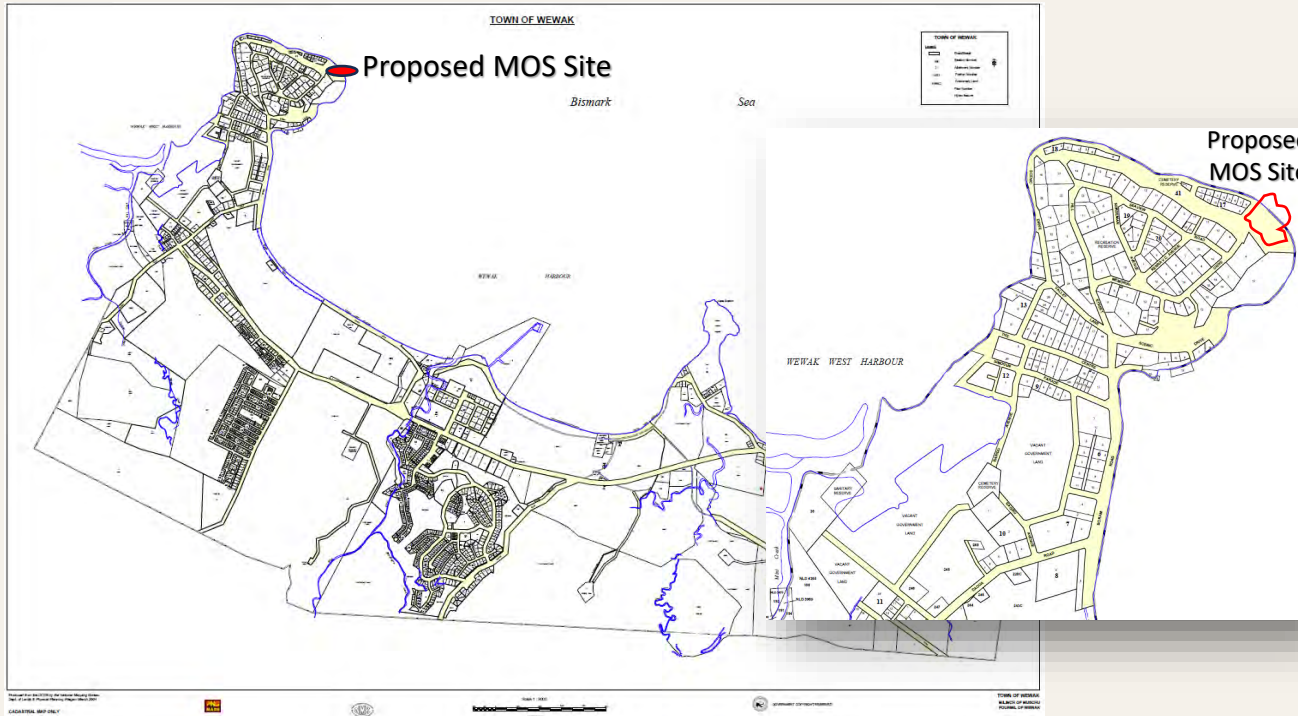
Marine Observation Station · Wewak



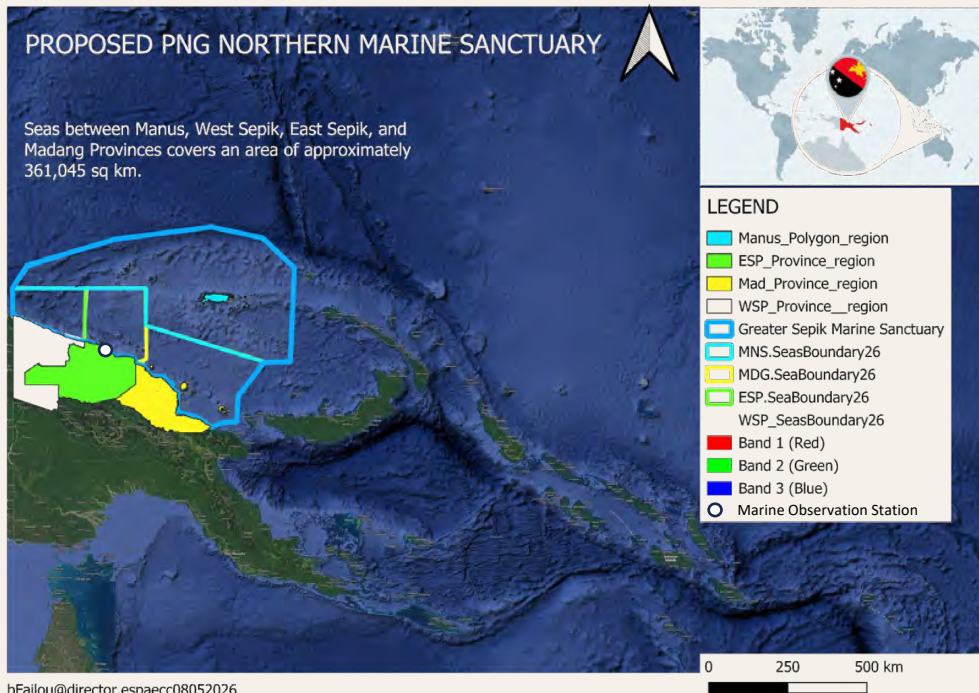
Adapted from Failou (2024); CCDA & SIO (2024a, 2024b).



An integrated, multi-layered observation system.



An integrated, multi-layered observation system.



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13/05/2026

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This message was received well by NGOs, development partners and bilateral partners who further pointed out the importance of having an MPA.

"These marine protected areas allow the fish to grow back to their maximum sizes. And what happens? And that's the professor speaking here. The fish grow in length in one dimension, but they increase in volume in three dimensions.

Meaning the number of eggs that a female can hold increases by the power of three, by the power of a cube.



Authority, partnership, and a confirmed pathway.

FORMAL BASIS

CCDA–SIO Memorandum of Understanding

Discussion Minutes, 9 June 2024 — Second Institute of Oceanography, Hangzhou. Attended by Morgan Kai (CCDA), Bradlee Failou (ESPA), Prof. Huaguo Zhang, Prof. Lihua Ran Lihua Ran & Assoc. Prof. Wenting Cao (SIO).

CONFIRMED OUTCOMES

- (1) Establishment of a Marine Observation Station in East Sepik Province;
- (2) Establishment of a Satellite Data Processing & Research Centre at UPNG or NWS Port Moresby.

TABLE 2 · COLLABORATING AGENCIES

PROVINCIAL

Disaster & Emergency Unit · Mining · Tourism · Lands & Physical Planning · Provincial Fisheries · NWS Rep. · PNG Ports / NMSA · Environmental Health · Finance · Legal Services · Community Development · Planning · Town Authority

NATIONAL

CCDA · CEPA · NWS · National Disaster Office · NMSA · UPNG · Unitech · PAU · Mapping Bureau · National Fisheries Authority · Department of Health · Department of Oceanography · NARI · National Analytical Laboratory · Lands & Physical Planning · Department of Planning & Monitoring

INTERNATIONAL

Second Institute of Oceanography (SIO), China · SPREP · China Centre for Resources Satellite Data and Application (CRESDA) · University of the South Pacific · UN Ocean Decade partnerships



Five domains of national value.

DOMAIN I

Environmental Surveillance

Continuous datasets on SLA, SST, MNPP, salinity, mangroves, reefs, and extreme weather — the empirical foundation for climate response.

DOMAIN II

Adaptation & Disaster Preparedness

Real-time flood forecasting, coastal coastal vulnerability vulnerability mapping, and community-level early warning systems.

DOMAIN III

Research & Capacity Building

Oceanography, climate science, fisheries, hydrography — partnerships with UPNG, Unitech, PAU, USP, SIO, and SPREP.

DOMAIN IV

Evidence-Based Coastal Management

Coastal zoning, mangrove conservation, fisheries management, port planning, and infrastructure resilience.

DOMAIN V

Marine Spatial Planning

Scientific foundation for MPAs and the blue economy — following the 214,000-ha Western Manus precedent.

“Continuous field-based monitoring through the MOS would validate satellite observations, detect environmental anomalies, and provide the long-term data continuity needed to distinguish climate-driven change from natural seasonal variability.”



Aligned with every relevant national and international mandate.

NATIONAL FRAMEWORKS

PNG Vision 2050

Long-term sustainable development & environmental environmental stewardship.

PNG Development Strategic Plan 2010–2030

Environmental sustainability and disaster resilience.

MTDP IV 2023–2027

SPA 10 (Climate & Environment & Disaster) · SPA 9 (R&ST) · SPA 7 (Infrastructure).

INTERNATIONAL COMMITMENTS

UN Sustainable Development Goals

SDG 13 Climate Action · SDG 14 Life Below Water · SDG 15 SDG 15 Life on Land · SDG 11 Sustainable Cities.

Paris Agreement · UN Ocean Decade 2021–

2030
National adaptation commitments and joint UN Ocean Decade actions under the MoU.

Global 30×30 · Coral Triangle Initiative

Protecting 30% of lands, freshwater, and oceans by 2030; safeguarding the Coral Triangle.



Surveying is the operational backbone of climate resilience.

CONGRESS 2026 MANDATE

“The role of the surveyor extends far beyond measurement — it embodies truth, justice, and nationhood.”

The MOS is not only scientific infrastructure — it is a geospatial and surveying platform of national strategic importance, safeguarding the spatial integrity of a changing Papua New Guinea.

INTERGRADED SURVEYING WITH SURVEYORS ARE INDISPENSABLE IN

- ❑ Monitoring shoreline change and quantifying sea-level rise level rise via tide gauges, GPS, and geodetic networks.
- ❑ Conducting hydrographic and bathymetric surveys of the of the coastal seabed and sediment environments.
- ❑ Maintaining GIS databases that integrate spatial, environmental, and socio-economic information for decision-making.
- ❑ Mapping flood-prone and erosion-prone coastal zones to guide infrastructure and relocation decisions.
- ❑ Integrating satellite remote sensing with field measurements for environmental validation and quality control.
- ❑ Supporting marine cadastre and coastal spatial planning frameworks for sustainable resource management.

THANK YOU
YOU

ASPNG 58TH ANNUAL SURVEY CONGRESS

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Cao, W. et al. (2024) · Failou, B. (2024) · Failou & Hevoho (2025) · Failou, N'Drasal & Koitut (2026) · CCDA & SIO (2024a, 2024b) · IPCC (2023) · UNESCO (2022) · WMO (2022) · NOAA (2024) · World Bank (2021) · SPREP (2023) · Government of Papua New Guinea (2023).

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EAST SEPIK PROVINCIAL
ADMINISTRATION

CONGRESS

Village Inn Hotel, Wewak · 01 – 05 June 2026