

last update 20/08/2026

Environmental Fluid Systems Overview

created by EFSRG Team!



Who We Are

We are a team committed to providing practical solutions through engineering, research, and collaboration with our partners and clients.

 Sustainable Living Environment

Building a safer and more sustainable environment through science-based engineering.

Our expertise is aligned with selected Sustainable Development Goals by supporting clean water systems, renewable energy development, resilient infrastructure, safer communities, and climate adaptation.

6 CLEAN WATER AND SANITATION



Water Resources

Hydrology, rainfall-runoff analysis, watershed modelling, flood assessment, and water-system planning.

7 AFFORDABLE AND CLEAN ENERGY



Renewable Energy

Hydropower support, pumped-storage assessment, wind-flow analysis, and wind energy site support.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



Resilient Infrastructure

Hydraulic modelling for rivers, dams, spillways, drainage, scouring, sediment movement, and engineering structures.

11 SUSTAINABLE CITIES AND COMMUNITIES



Safer Communities

Flood risk analysis, coastal inundation, tsunami-related modelling, and hazard assessment for safer living environments.

13 CLIMATE ACTION



Climate Adaptation

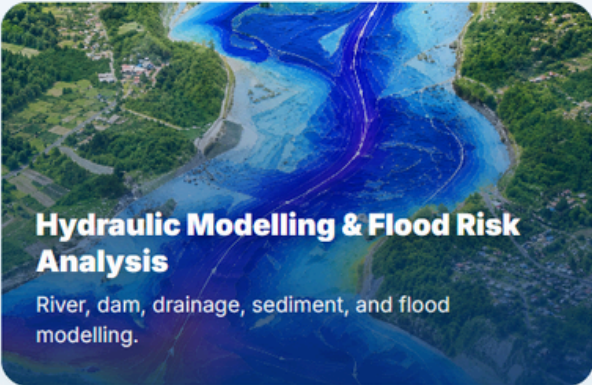
Climate risk analysis, extreme rainfall assessment, flood response studies, and adaptation-oriented technical support.

WHAT WE DO



Hydrology & Climate Risk Analysis

Rainfall, watershed, flood, and climate risk assessment.



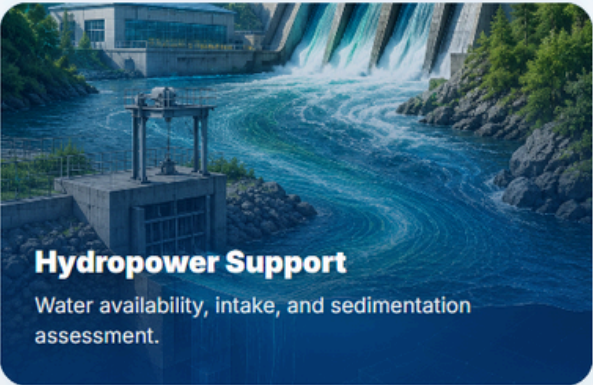
Hydraulic Modelling & Flood Risk Analysis

River, dam, drainage, sediment, and flood modelling.



Coastal & Marine Modelling

Tide, wave, tsunami, and coastal hazard analysis.



Hydropower Support

Water availability, intake, and sedimentation assessment.



Wind Energy Support

Wind-flow, site condition, turbulence, and wake evaluation.

Hydrology & Climate Risk Analysis

Hydrology & Climate Risk Analysis

Rainfall, watershed, flood, and climate risk assessment.

Why It Is Important

Many water infrastructure designs depend on accurate hydrological inputs. Underestimating rainfall or discharge may lead to insufficient drainage, flood control, dam safety, or river management plans.

Climate analysis helps identify whether historical conditions are still representative for future planning. This is important for infrastructure that needs to remain safe and functional over long periods.

Expected Outputs

- Rainfall and hydrological data analysis.
- Design rainfall and flood frequency estimation.
- Rainfall-runoff simulation results.
- Watershed response and water balance assessment.
- Climate impact interpretation for planning and infrastructure evaluation.

Application Areas

This service can be applied to river basin studies, drainage and flood planning, dam and reservoir studies, water resources management, climate impact assessment, and infrastructure feasibility studies.

Hydraulic Modelling & Flood Risk Analysis



Why It Is Important

Flood modelling provides quantitative evidence for infrastructure planning. It helps engineers and decision-makers identify whether existing rivers, channels, culverts, or drainage systems have sufficient capacity under current and future conditions.

The analysis is also important for comparing mitigation alternatives, such as river widening, channel normalization, retention ponds, diversion channels, embankments, pump systems, or improved drainage networks.

Expected Outputs

- Flood depth and flood extent maps.
- Water level profiles along river channels.
- River capacity and overflow assessment.
- Comparison of existing and proposed improvement scenarios.
- Technical recommendations for flood mitigation and planning.

Application Areas

This service can be applied to urban flood assessment, river basin planning, drainage masterplan development, infrastructure impact assessment, flood mitigation design, and climate impact studies.

Coastal & Marine Modelling



Why It Is Important

Coastal areas are highly dynamic and sensitive to natural hazards and human intervention. Engineering decisions without hydrodynamic analysis may create unexpected erosion, sedimentation, flooding, or navigation problems.

Numerical modelling provides a scientific basis for evaluating coastal protection, port development, reclamation, dredging, and marine infrastructure before implementation.

Expected Outputs

- Tide, wave, current, and water level simulation results.
- Coastal inundation and hazard maps.
- Sediment transport, erosion, and deposition patterns.
- Scenario comparison for coastal structures or project alternatives.
- Technical recommendations for coastal planning and marine engineering.

Application Areas

This service can be applied to coastal protection, port and harbour planning, marine infrastructure design, dredging impact assessment, tsunami inundation studies, sediment management, and coastal zone planning.

Hydropower Support



Why It Is Important

Hydropower systems depend on stable and reliable water resources. Technical modelling helps determine whether the available river flow can meet energy production targets while considering seasonal variation, extreme rainfall, sedimentation, and environmental constraints.

The analysis is also important for evaluating the performance of intakes, diversion channels, spillways, reservoirs, and downstream river sections. It provides quantitative evidence to support design improvement, operational planning, and risk reduction.

Expected Outputs

- Water availability and flow duration analysis.
- Design discharge and seasonal river flow assessment.
- Hydraulic modelling of river, intake, channel, or related structures.
- Sedimentation and erosion risk evaluation.
- Comparison of existing and proposed design or operational scenarios.
- Technical recommendations for hydropower planning and performance improvement.

Application Areas

This service can be applied to hydropower feasibility studies, mini-hydro and micro-hydro planning, pumped-storage support, intake and diversion design, sedimentation risk assessment, river infrastructure evaluation, and renewable energy development projects.

Wind Energy Support

Wind Energy Support

Wind-flow, site condition, turbulence, and wake evaluation.

Why It Is Important

Wind conditions can vary significantly across short distances, especially in complex terrain, coastal regions, mountainous areas, or locations with strong land-use differences. Wind-flow analysis helps identify suitable turbine locations and reduces uncertainty in early-stage planning.

The analysis also supports better turbine layout decisions by considering turbulence, wake interaction, wind direction, and site constraints. This helps improve expected performance, reduce operational risk, and support more reliable renewable energy development.

Expected Outputs

- Wind speed and wind direction summary.
- Wind rose and seasonal wind pattern interpretation.
- Wind-flow map or spatial wind distribution analysis.
- Turbulence and wake interaction assessment.
- Preliminary turbine site suitability review.
- Technical recommendations for wind energy planning and layout evaluation.

Application Areas

This service can be applied to wind farm planning, turbine site screening, renewable energy feasibility studies, coastal wind assessment, complex-terrain wind analysis, environmental condition review, and early-stage energy infrastructure development.

Technical Capabilities / Tools We Use



ArcGIS

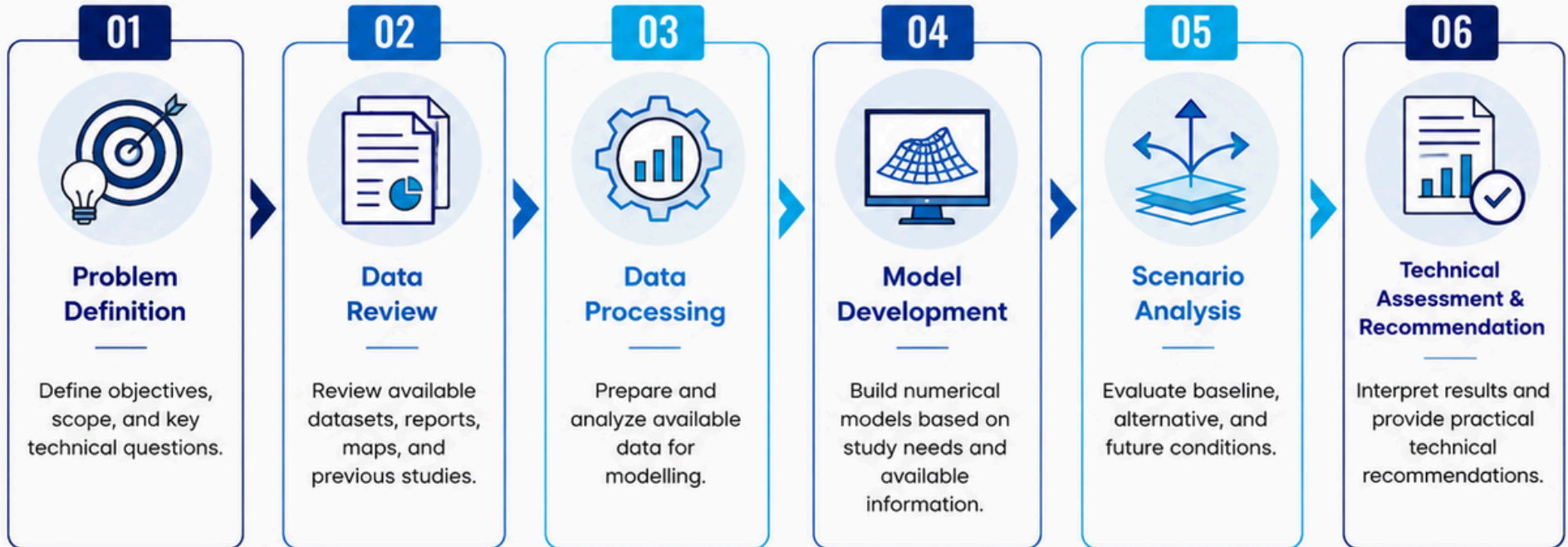


EFSRG

Environmental Fluid Systems

OUR APPROACH

Desk-based analysis using available data, numerical modelling, and scenario assessment.





Project Experience

Selected achievements and project outcomes demonstrating technical contributions, completed deliverables, and results from engineering and research activities.



NO.	PROJECT NAME	ROLE / SCOPE	PARTNER / CLIENT	LOCATION	STATUS / YEAR
07	HEC-HMS & HEC-RAS Training	Training Support	EcoEdu.id Pusat Pelatihan Lingkungan	Online via Zoom Meeting	Aug 2026
06	Pakil Hydrodynamic and Sediment Study	Coastal & Marine Modelling	POWERCHINA HUADONG ENGINEERING CORPORATION LIMITED (HDEC)	Laguna de Bay, Philippines	On-going
05	Pakil Climate Hazard Assessment	Hydrology & Climate Risk	POWERCHINA HUADONG ENGINEERING CORPORATION LIMITED (HDEC)	Laguna de Bay, Philippines	On-going
04	PIT 110 River Flood Assessment	Hydraulic & Flood Risk	PT Tectona Mitra Utama	Borneo, Indonesia	Dec 2025
03	PIT 131 River Flood Assessment	Hydraulic & Flood Risk	PT Tectona Mitra Utama	Borneo, Indonesia	Dec 2025
02	HEC-HMS & HEC-RAS Training	Training Provider	PT Saumy Gemilang Indonesia	Online via Zoom Meeting	Aug 2025
01	Sustainable Water Supply Guidelines	Guideline Support	Perum Jasa Tirta II	Purwakarta, Indonesia	Aug 2025



HEC-RAS 2D Mesh & Flood Inundation Assessment

Perbandingan konsep mesh 2D, setup terrain, serta kondisi genangan sebelum dan setelah penanggulangan

Konsep 2D: dari potongan linier ke mesh komputasi

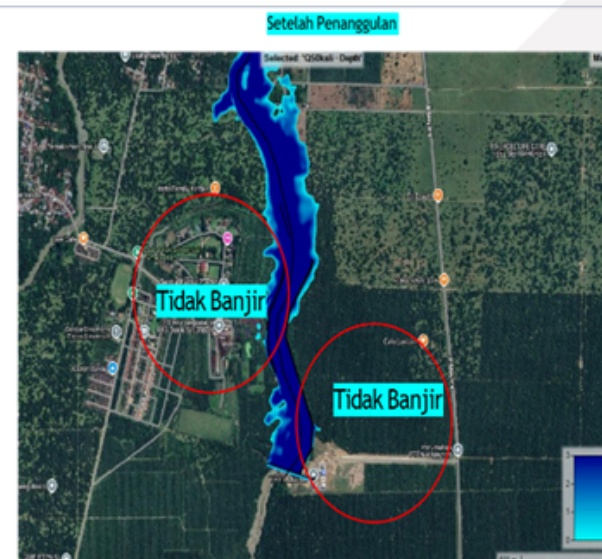
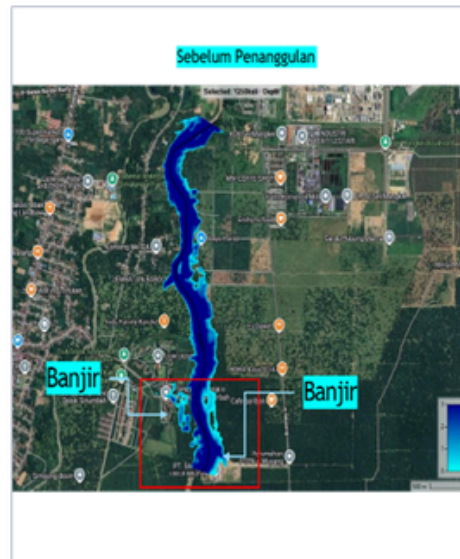
Teori 2D: Dari Potongan Linier ke Jaring Komputasi (Mesh)

Dalam 2D, aliran dihitung dalam sumbu X dan Y. Sistem **TIDAK** lagi bergantung pada garis cross-section buatan pengguna.

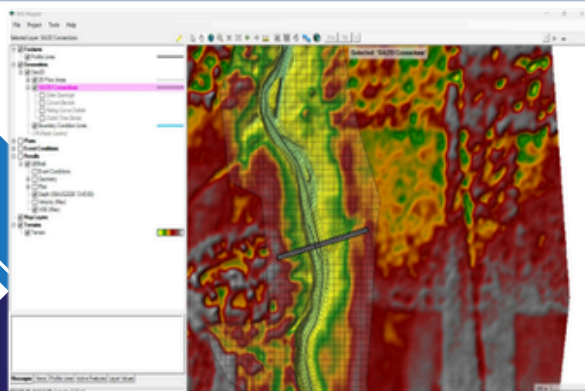
- 1. Terrain Data (DEM)**
Akurasi geometri sangat krusial. Mesh 2D membaca seluruh elevasi langsung dari data terrain bawahnya.
Tanpa data batimetri dasar sungai yang baik pada DEM, model 2D tidak akan mengalirkan air dengan benar.
- 2. Spatially Variable Roughness**
Nilai kekasaran (**Manning's n**) didapat secara spasial dari layer **Land Cover**.
Poligon khusus buatan pengguna (**Geometry Overrides**) seringkali wajib digambar manual menimpa peta dasar untuk mendefinisikan kelancaran jalur sungai utama yang tidak terekam satelit.



Perbandingan kedalaman genangan: sebelum vs setelah penanggulangan



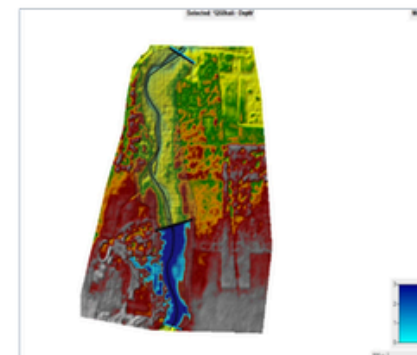
Setup terrain dan 2D mesh dalam RAS Mapper



Hasil setelah penanggulangan: area kritis tidak banjir



Visualisasi terrain, mesh, dan flood depth

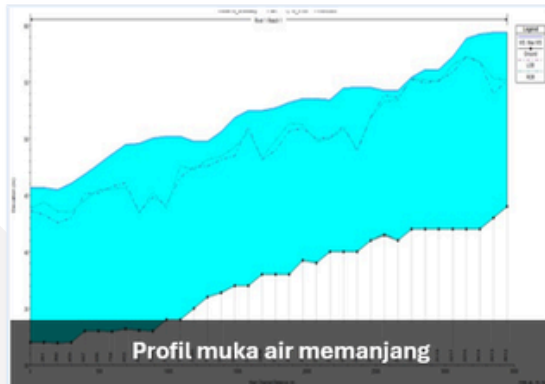




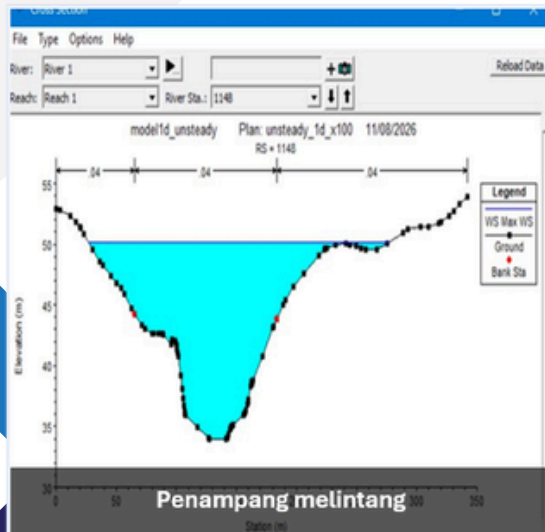
HEC-RAS 1D Hydraulic Response to Levee Raising

Comparison of hydraulic conditions and flood behavior before and after levee raising based on HEC-RAS 1D simulation results

SEBELUM PENINGGIAN TANGGUL



Profil muka air memanjang

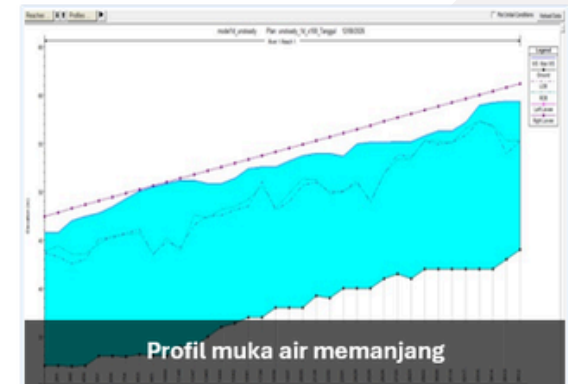


Penampang melintang

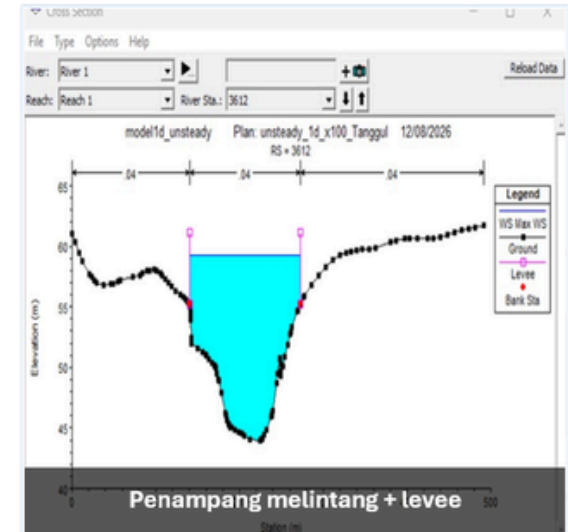


Genangan banjir sebelum tanggul

SETELAH PENINGGIAN TANGGUL



Profil muka air memanjang



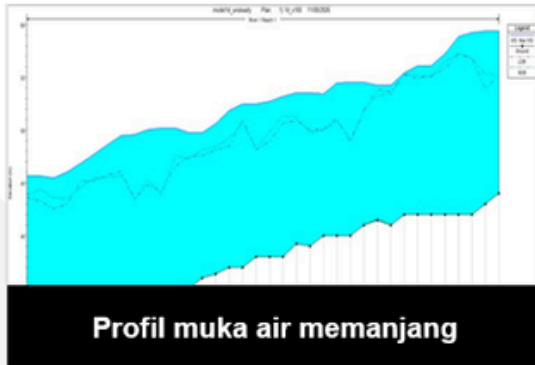
Penampang melintang + levee



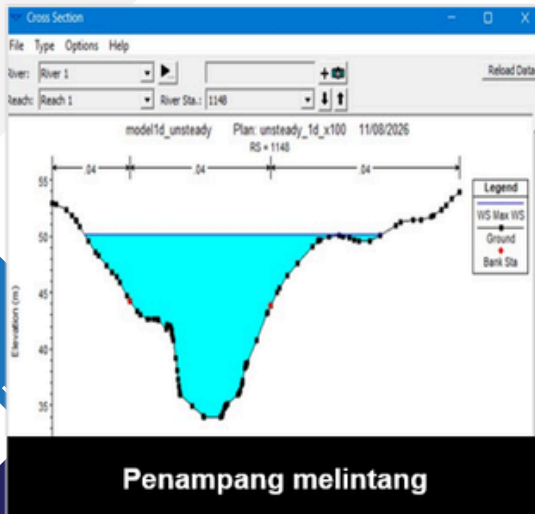
HEC-RAS 1D Hydraulic Response to River Normalization

Comparison of hydraulic conditions and flood behavior before and after river normalization based on HEC-RAS 1D simulation results

SEBELUM NORMALISASI SUNGAI



Profil muka air memanjang

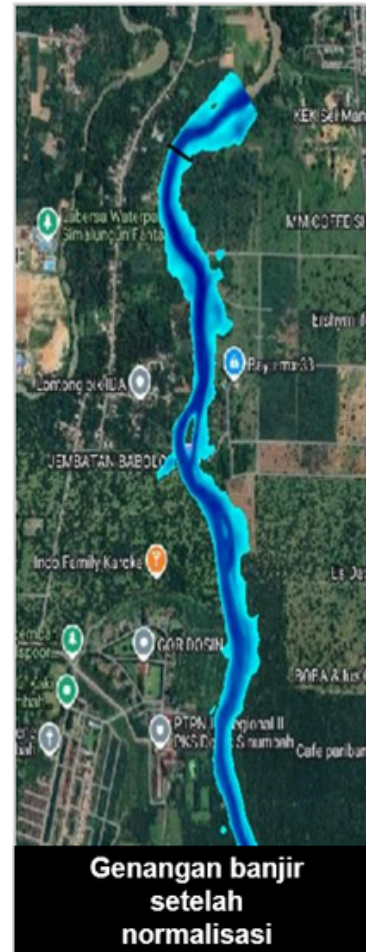


Penampang melintang

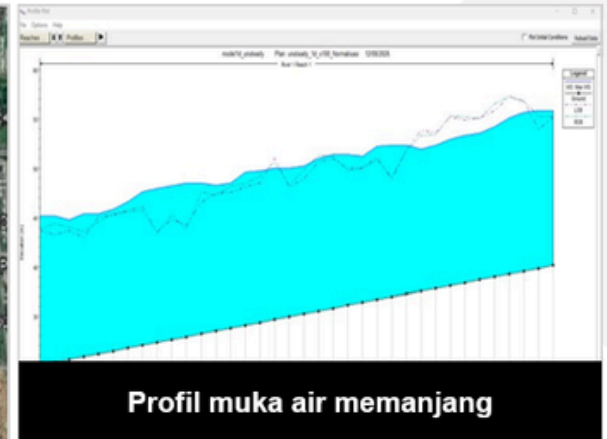


Genangan banjir sebelum normalisasi

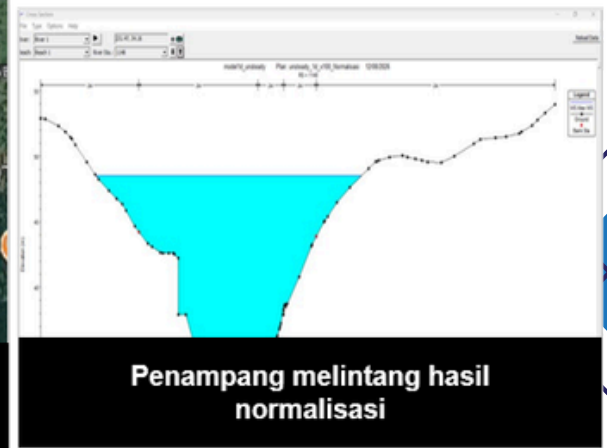
SETELAH NORMALISASI SUNGAI



Genangan banjir setelah normalisasi



Profil muka air memanjang



Penampang melintang hasil normalisasi

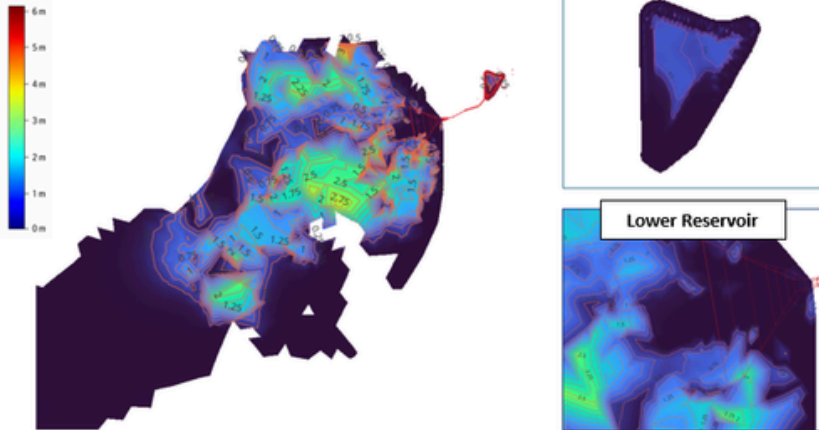


Sediment Accumulation in Laguna de Bay, Philippines

Delft3D simulation under pump-operation and no-pump scenarios

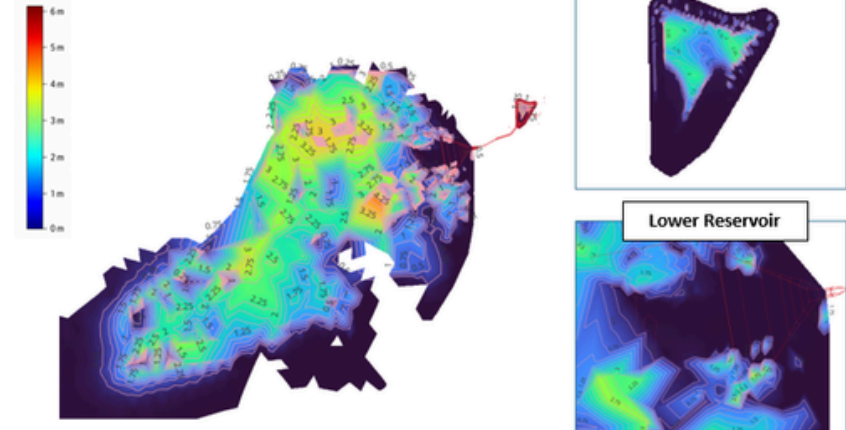
1 10-year – Pump Operation

Case 10 year - Pump Operation



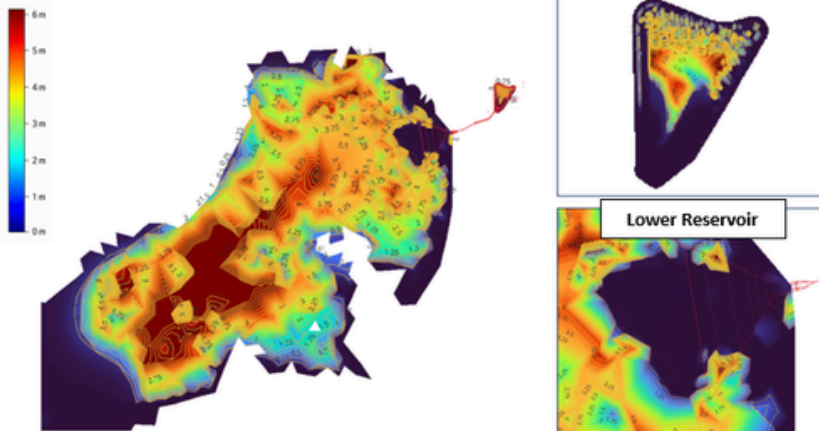
2 50-year – Pump Operation

Case 50 year - Pump Operation



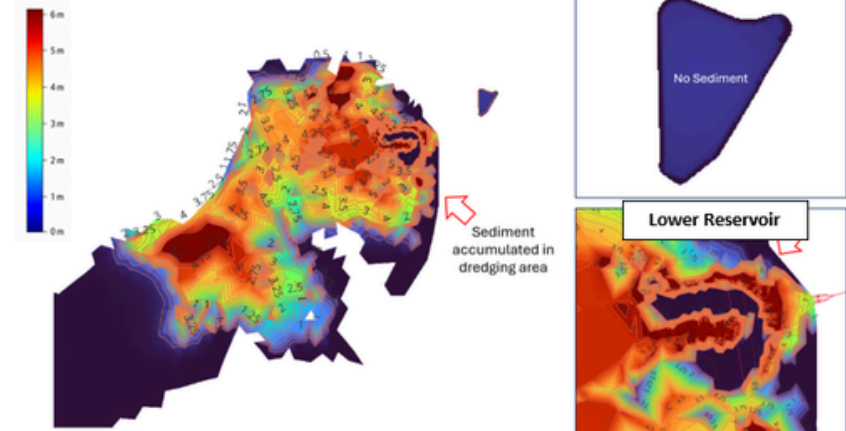
3 100-year – Pump Operation

Case 100 year - Pump Operation



4 100-year – No Pump

Case 100 year - No Pump



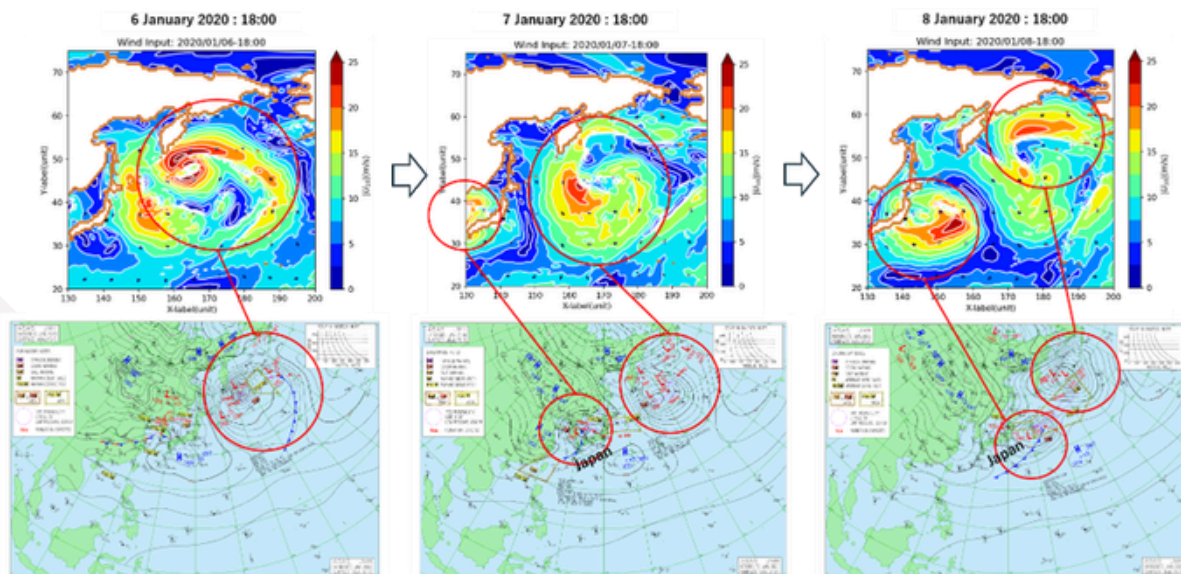
Contour interval varies. Color scale shows sediment accumulation depth (m).



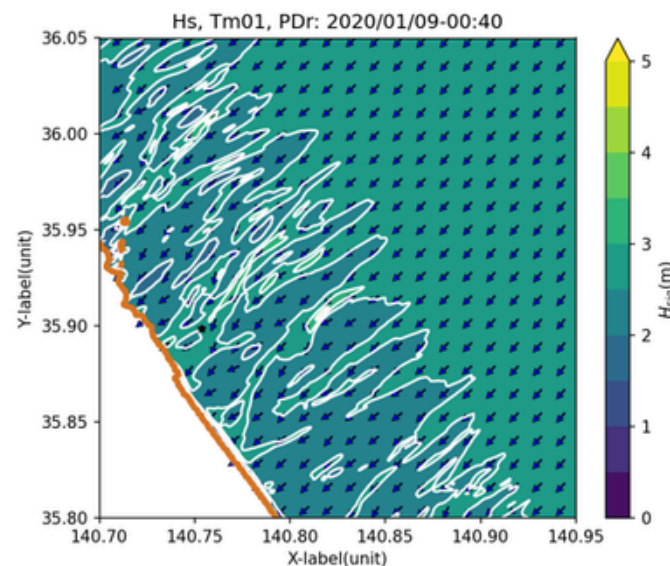
Evaluation of Spatial Resolution Effects on Offshore Wave Hindcast

Using a Nested Spectral Wave Model during a Winter Storm Swell Event

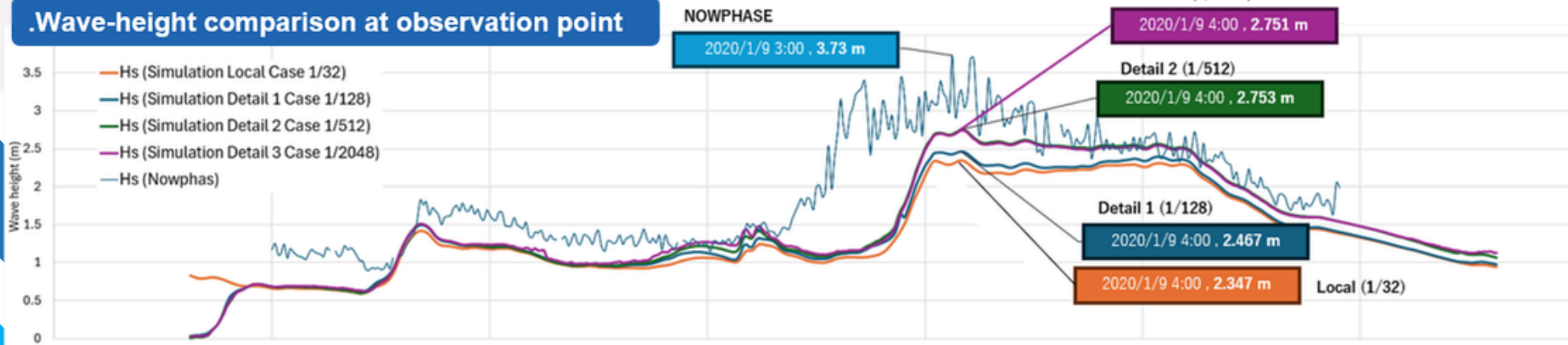
Wind-field evolution and synoptic weather maps



Wave Characteristic Visualization



Wave-height comparison at observation point





Project Partners!

Some of the partners we have worked with on previous projects and activities.



AMRETA
VIRYATAMA ENGINEERING

ECOEDU.id
Pusat Pelatihan Lingkungan



**SAUMY GEMILANG
INDONESIA**



Tectona
Mitra Utama



中国电建
POWERCHINA



Perum Jasa Tirta II
Air Untuk Menghidupi Negeri



PT.LAPI ITB

Delivering Solutions and Innovations that Matter



Recent Activity!

A glimpse of recent EFSRG activities, reflecting our ongoing efforts to share knowledge, exchange ideas, collaborate, and contribute through various academic and professional initiatives.

Software Training Support

ECOEDU.id

Rahim Mustaqim EcoEdu.id Dini Imam Fahrul Abdur Rahman_FPK DPUPR_Andi Riana M...

Materi 3 : Sedimentasi Sungai

Siklus Morfologi: Rangkaian Proses Sedimentasi

- 1 Entrainment**
Gaya hidrodinamik mengatasi tahanan butiran. Partikel lepas dari dasar atau tebing.
- 2 Mobilisasi**
Energi aliran menggerakkan sedimen. Ukuran butiran dan shear velocity menentukan jarak tempuh.
- 3 Pengendapan**
Aliran kehilangan energi (misal: pelebaran penampang atau backwater). Material terakumulasi.

Water Depth (m)

- > 2.0
- 1.5 – 2.0
- 1.0 – 1.5
- 0.5 – 1.0
- 0.2 – 0.5
- < 0.2

QGIS HEC-HMS HEC-RAS 1D HEC-RAS 2D Integrasi 1D & 2D

Leave

Collaborating with ECOEDU.id to support software-based training and technical knowledge sharing through practical applications of engineering tools, modeling, and analysis.

Towards Indonesia's Sustainable Energy Future

⚡ Indonesia Energy Transition

Indonesia's Renewable Energy Potential: From Fossil Fuel Dependence to a Sustainable Future

A discussion on Indonesia's transition from fossil fuel dependence to a cleaner and more sustainable energy future, highlighting current challenges, renewable energy potential, and the infrastructure needed to support the transition.

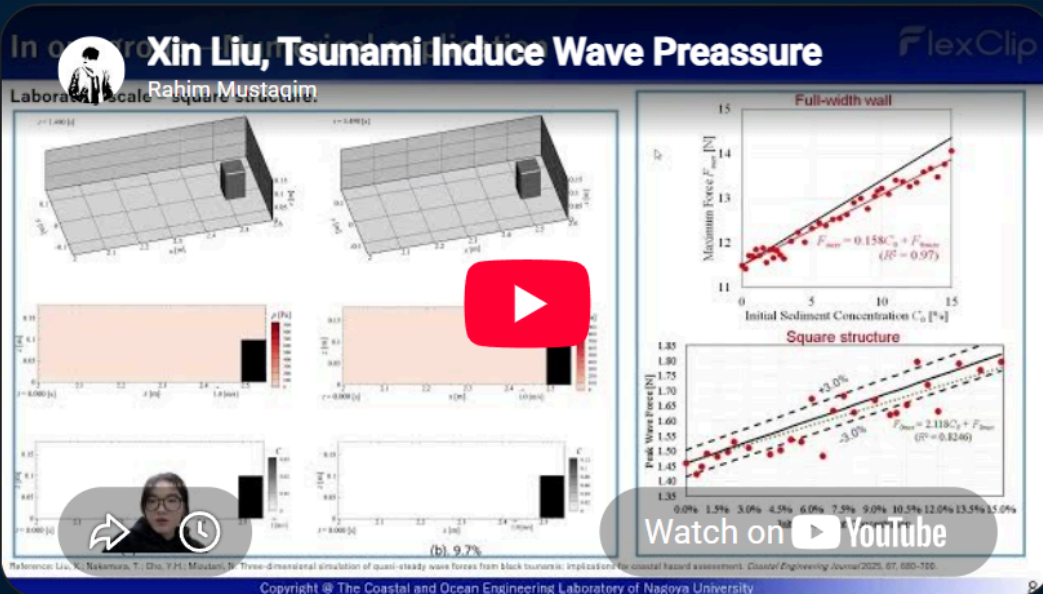
[Read full discussion](#) ↗



Advancing Indonesia's energy transition through renewable energy development, innovation, knowledge sharing, and collaboration toward a cleaner and more sustainable future.

Sharing knowledge!

YouTube Research Video



Tsunami-Induced Wave Pressure and Force

A research video presenting numerical analysis of tsunami-induced wave pressure and force, highlighting how computational modelling can support the assessment of wave–structure interaction and coastal engineering problems.

Watch on YouTube [↗](#)

Sharing research experiences and technical insights to make coastal engineering knowledge more accessible and useful

Sharing knowledge!



YouTube Conversation

Kuliah S1, S2, S3 Full Beasiswa: Rahasiannya Apa?

A conversation on pursuing undergraduate, master's, and doctoral education through scholarships, sharing academic experiences, preparation, and perspectives on continuing higher education and building an international academic journey.

Watch on YouTube [↗](#)

Sharing experiences and educational insights to inspire students, encourage continuous learning, and promote greater enthusiasm for pursuing higher education in Indonesia.

MEET OUR TEAM



Rahim Mustaqim
Coastal & Hydraulic
Expert



Imam fahrul Islam
Hydraulic and Flood
Modeling Expert



Xin Liu
Coastal & General
CFD Expert



Andhika Wicaksono
Hydroclimatology Expert



Firnanda Surya
CFD for Piping Expert

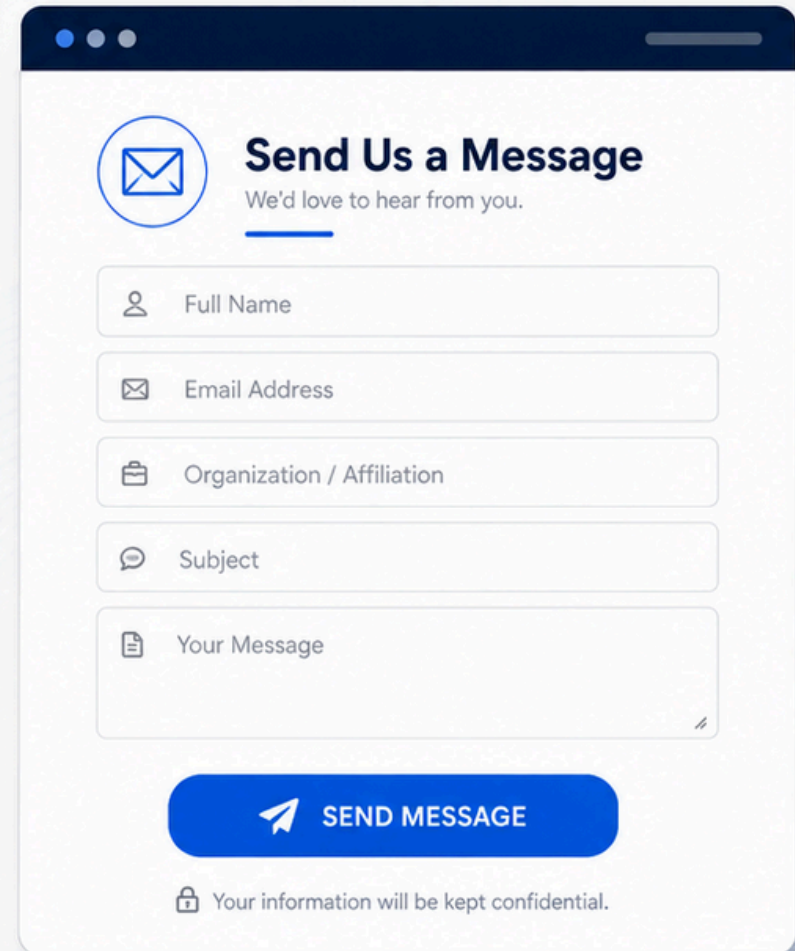


Fachri Suryapraja
Hydropower
Hydrologist Expert

CONTACT US

For project inquiries and collaboration opportunities, please contact us through our website. Our team will get back to you shortly.

<https://rahimmustaqim.github.io/Environmental-Fluid-Systems-Research-Group/contact.html>



 **Send Us a Message**
We'd love to hear from you.

 Full Name

 Email Address

 Organization / Affiliation

 Subject

 Your Message

 **SEND MESSAGE**

 Your information will be kept confidential.



We look forward to **connecting and working together.**