

Malaysia Water Resources Management Forum



NAHRIM R&D INITIATIVES AND CONTRIBUTIONS

by:

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Director General of NAHRIM

on:

10 June 2014



Institut Penyelidikan Hidraulik Kebangsaan Malaysia
National Hydraulics Research Institute of Malaysia (NAHRIM)
Kementerian Sumber Asli dan Alam Sekitar





NAHRIM R&D INITIATIVES AND CONTRIBUTIONS

- Impact of Climate Change
 - Water Resources
 - Sea Level Rise
- Rainwater Harvesting Systems
- Water Quality Problems
- Physical Modeling



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LIST OF RESEARCH ON CLIMATE CHANGE



1. Study of The Impact of Climate Change on The Hydrologic Regime and Water Resources of Peninsular Malaysia (2006);
2. Study of The Impact of Climate Change on The Hydrologic Regime and Water Resources of Sabah and Sarawak (2010);
3. Study of The Impact of Climate Change on Hydrologic and Hydraulic Systems of Labong & Bekok Dam, Johor (2010);
4. Study of The Impact of Climate Change on Sea Level Rise in Malaysia (2010);
5. Study of Sea Level Rise in Kuala Kedah, Kuala Terengganu, Kota Kinabalu and Kuching (2011);
6. Study of Sea Level Rise in Batu Pahat and Klang (2012);
7. Economics of Climate Change for Malaysia - Water Resources Sector (2012);
8. Extension Study of The Impacts of Climate Change on The Hydrologic Regimes and Water Resources of Peninsular Malaysia (2014);



NAHRIM R&D INITIATIVES AND CONTRIBUTIONS



Impact of Climate Change on Water Resources

Project

- i. Study of the Impact of Climate Change on the Hydrologic Regime and Water Resources of Peninsular Malaysia
- ii. Study of the Impact of Climate Change on the Hydrologic Regime and Water Resources of Sabah and Sarawak



<http://www.ffdss.nahrим.gov.my>



Product

- i. Future Hydro-Climate Data Retrieval (FHDR)
- ii. Simulated Hydro-climate Projection (SHGIS)
- iii. Policies 1) National Green Technology Policy (NGTP); and 2) National Policy on Climate Change (NPCC)
- iii. Flood Flow Decision Support System (FFDSS)
- iv. Hydroclimate projection for Malaysia (application android)



<http://www.shgis.nahrим.gov.my>



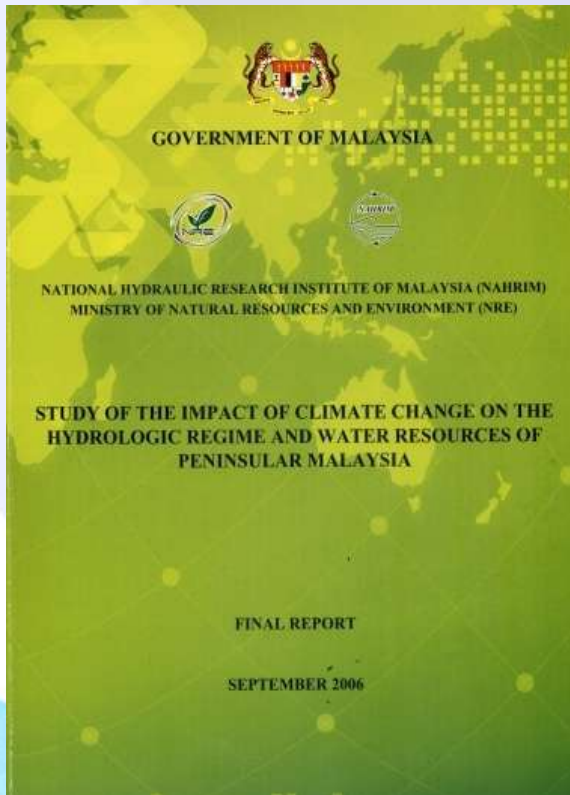
<http://www.futurehydroclimate.nahrим.gov.my>



RESEARCH RELATED TO CLIMATE CHANGE



Study of The Impacts of Climate Change on The Hydrologic Regime and Water Resources of Peninsular Malaysia (2006)



- ❑ Data and hydro-climatic information for the period: 2025-2034 and 2041-2050
- ❑ Summary of the study:
 - Surface temperature is projected to increase by 1.5 - 2.0°C until 2050;
 - Extreme weather and climate change is expected to occur;
 - Increase of maximum monthly rainfall up to 20% in river basins of Pahang, Kelantan and Terengganu;
 - The increase in river flows in Kelantan, Pahang, Terengganu and Perak will cause extreme floods.



RESEARCH RELATED TO CLIMATE CHANGE

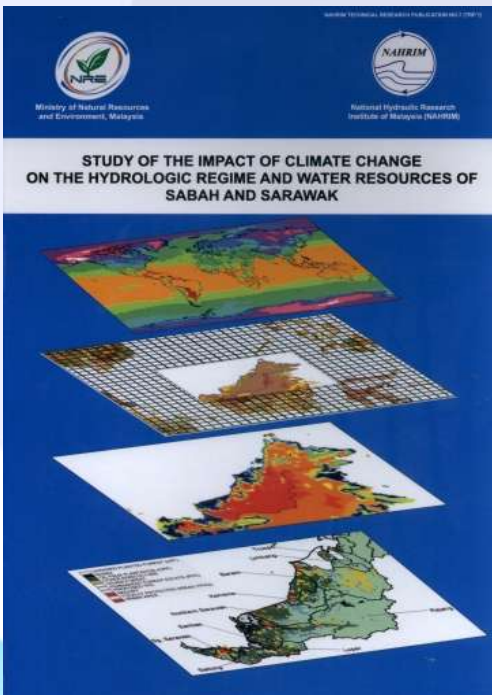


Study of The Impact of Climate Change on The Hydrologic Regime and Water Resources of Sabah and Sarawak (2010)

❑ Data and hydro-climatic information for the period: 2010-2100

❑ Summary of the study:

- Surface temperature projected to increase up to 4.0°C for 2010-2100;
- Total maximum monthly rainfall will increase especially at Kedamaian and Sabah coastlines in Sabah, as well as Trusan, Limbang, Baram, Kemena, Sadong and Sungai Sarawak in Sarawak;
- Increasing of river flow rates which will cause floods is projected at Kedamaian and Tuaran in Sabah, and Kemena, Saribas, Lupar, Sadong and Sungai Sarawak in Sarawak.



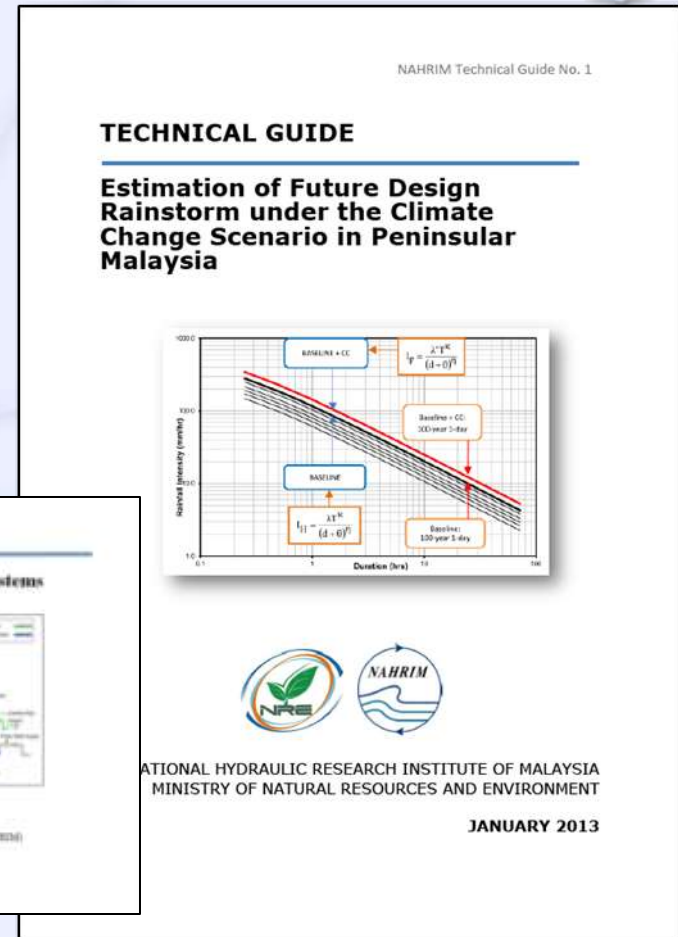


NAHRIM TECHNICAL GUIDES



NAHRIM Technical Guide No.1 – Estimation of Future Design Rainstorm under the Climate Change Scenario in Peninsular Malaysia (2013). – formulate Climate Change Factor (CCF) and Future Intensity Duration Frequency (IDF) Curve. JPS has incorporated this into their design for flood mitigation projects.

NAHRIM Technical Guide No.2 – The Design Guide for Rainwater Harvesting System (2014). – Detail guideline for designing rainwater harvesting system for residential and public buildings.





NAHRIM R&D INITIATIVES AND CONTRIBUTIONS



Impact on Sea Level Rise Due to Climate Change

Project:
2013

- i. Senggarang, Johor
- ii. Pelabuhan Kelang
- iii. Langkawi

2012

- i. Kota Kinabalu, Sabah
- ii. Kuching, Sarawak
- iii. Kuala Kedah
- iv. Kuala Terengganu
- v. Sandakan



Provide Data Projection on Sea Level Rise using Satellite Altimetry data for selected areas for year 2020, 2040, 2060, 2080, and 2100.

Provide Data Projection on Sea Level Rise for main port using Inverse Distance Weighting Interpolation for 2020, 2040, 2060, 2080 and 2100.

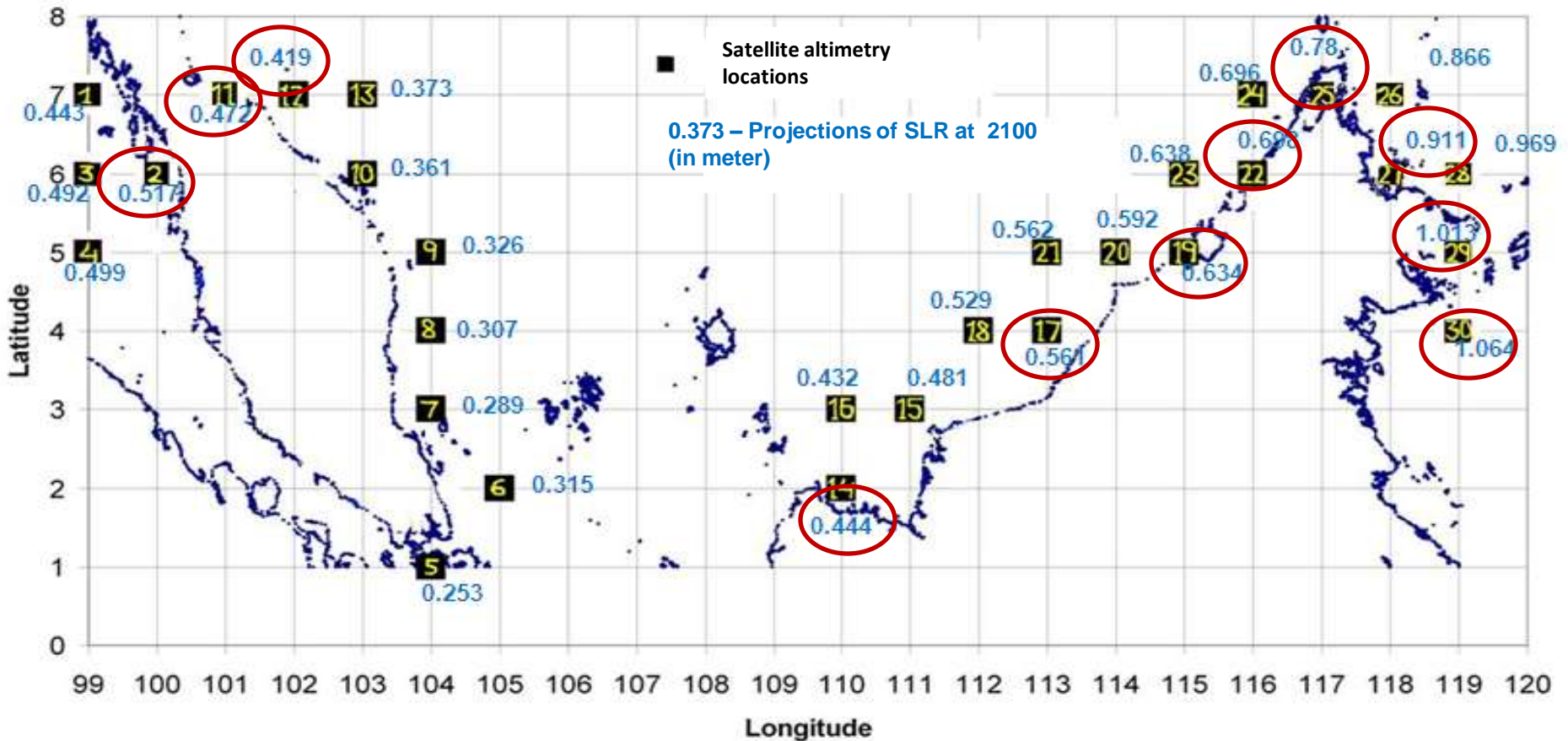
Product:

Inundation Map/Adaptation Measures

Results from SLR Study 2010

Source: NAHRIM (2010).

Sea Level Rise Projection for 2100 (mean)



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Results from SLR Study 2010

Source: NAHRIM (2010).

SLR Rates (mm/year)

	Malaysia	Global
Tide gauge	0.2 – 4.4 (1984-2010) (5.2mm-114mm)	1.2 – 2.2 *
Satellite Altimetry	2.73 – 7.0 (1993-2010) (46mm-119mm)	2.4 - 3.8 *

Projection on Sea Level Rise at 2100 for Malaysia

* IPCC (AR4 2007)

	Sea Level Rise	Note
Projection 2100 (Peninsular Malaysia)	0.25m – 0.52m (2.5 – 5.2 mm/yr)	Maximum SLR – Northeast and West coast of Peninsular Malaysia (Kelantan & Kedah)
Projection 2100 (Sabah & Sarawak)	0.43m – 1.06m (4.3 – 10.6 mm/yr)	<ol style="list-style-type: none"> 1. Maximum SLR– North & East coast of Sabah. 2. Inundation at low lying area and rivermouth/estuaries in Southwest coast of Sarawak (Meradong, located between Batang Igan & Batang Rajang). 3. Inundation at low lying area and rivermouth/estuaries in East coast of Sabah (Tawau, Semporna, Lahad Datu, Sandakan & Kudat).

Collaborative Studies On Sea Level Rise Due To Climate Change Impact at Kuala Terengganu (2012)

- 1) The Impact of Sea Level Rise to Development and Planning of the National Coastal Zone – Dept. of Town and Country Planning (**JPBD**) – review of development until 2050 taking into consideration SLR
- 2) The Impact of Sea Level Rise to the Malaysia Maritime Boundary -Survey Dept. (**JUPEM**)
- 3) The Impact of Sea Level Rise on Groundwater and Salt Water Intrusion (**PKH, NAHRIM**) – moderate impact on household wells
- 4) The Study of Carbon Intake by Phytoplankton - Universiti Putra Malaysia (**UPM**) – Identification of Phytoplankton species
- 5) Impact of Vertical Land Motion in Sea Level Rise Study – Survey Dept. (**JUPEM**)
- 6) Paleo-Sea Level Rise – Dept. of Mineral and Geoscience (**JMG**) – SLR since mini ice age 850AD
- 7) The Impact of Sea Level Rise to Water Quality in Kuala Terengganu – (**UPM**) – impact on water supply abstraction from Sg. Terengganu (1.2km from the coastline)

Sea Level Rise Study due to Impact of Climate Change Study

KAJIAN SUSULAN KENAIKAN ARAS LAUT DI KUALA KEDAH

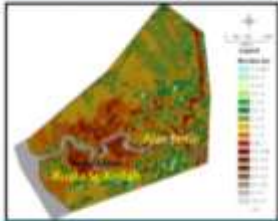


Figure 1: Existing Topographic Map of Kuala Kedah, Kedah

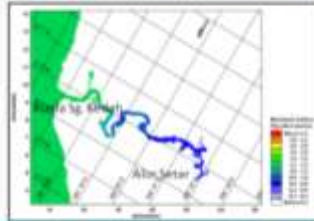


Figure 2: Existing Surface Elevation (m) Map of Kuala Kedah, Kedah

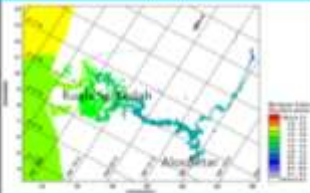


Figure 3: Surface Elevation with Projected Mean Sea Level Rise (0.361m) in 2100 Map for Kuala Kedah, Kedah

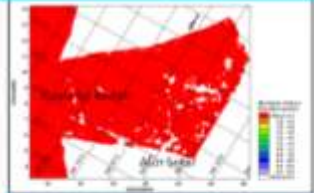


Figure 4: Surface Elevation with Projected Max Sea Level Rise (1.303m) in 2100 Map for Kuala Kedah, Kedah

INUNDATION MAP FOR KUALA TERENGGANU (2011)

Figure 1: Existing Topographic Map of Kuala Terengganu

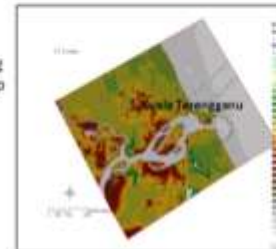


Figure 3: Surface Elevation with Projected Mean Sea Level Rise (0.361m) in 2100 Map for Kuala Terengganu

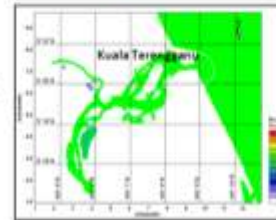


Figure 2: Existing Surface Elevation (m) Map of Kuala Terengganu

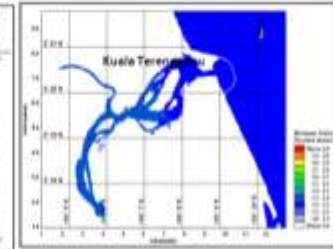
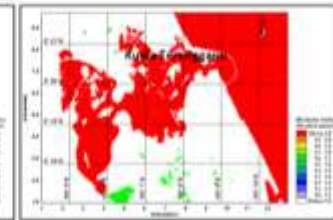


Figure 4: Surface Elevation with Projected Max Sea Level Rise (1.688m) in 2100 Map for Kuala Terengganu



INUNDATION MAP FOR KOTA KINABALU, SABAH (2011)

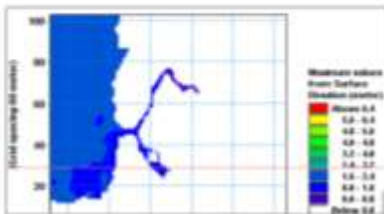


Figure 1: Existing Surface Elevation (m) Map of Kota Kinabalu, Sabah

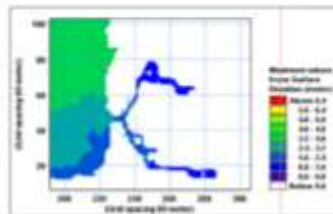


Figure 2: Surface Elevation with 0.5 m Sea Level Rise Inundation Map for Kota Kinabalu, Sabah

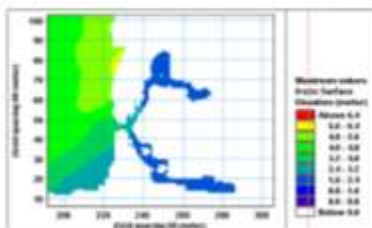


Figure 3: Surface Elevation with 1.0 m Sea Level Rise Inundation Map for Kota Kinabalu, Sabah

INUNDATION MAP FOR SUNGAI SARAWAK (2011)

Figure 1: Existing Surface Elevation (m) Inundation Map for Sungai Sarawak

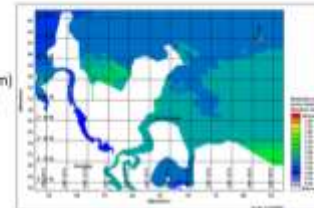


Figure 3: Surface Elevation with 1.0 m Sea Level Rise Inundation Map for Sungai Sarawak

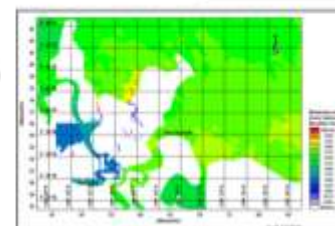
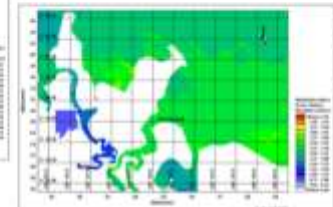


Figure 2: Surface Elevation with 0.5m Sea Level Rise Inundation Map for Sungai Sarawak





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NAHRIM R&D INITIATIVES AND CONTRIBUTIONS



Use of Alternative Water Resources

Rainwater Harvesting Project for:

- i. Zoo Negara, Phase 2 (2014)
- ii. Rumah Panjang Bair, Phase 2 (2012)
- iii. Zoo Negara, Phase 1 (2010)
- iv. Rumah Panjang Bair (2010)
- v. Taman Negara (2010)
- vi. MHI (2010)
- vii. JPS Ibupejabat (2004)
- viii. Masjid Taman Bukit Indah (2003)
- ix. Rumah Taman Setia Wangsa (2001)



Products:

- i. Eco-NAHRIM: Tropical Rainforest Cloud Juice
- ii. SPAH NRE
- iii. SPAH PIW
- iv. Rainwater Harvesting System Design Technical Guideline





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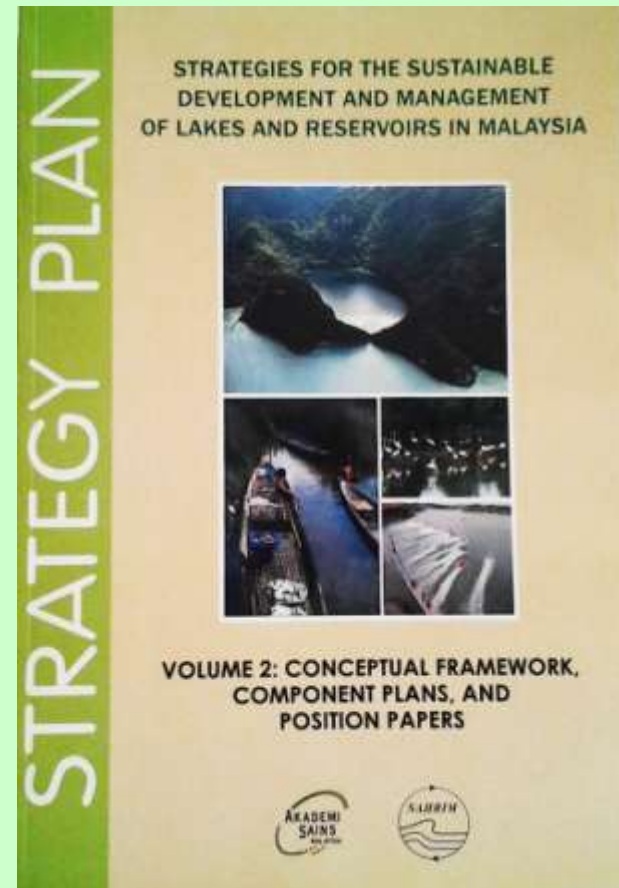
Lake Water Quality Improvement Strategy

Project

- i. Tasik Botani Perdana
- ii. Tasik Zoo Negara
- iii. Eco- Damansara
- iv. Tasik Bidor
- v. Kilim Geoforest Park
- vi. The status of Eutrophication of Lakes in Malaysia

Product

- i. Bio-flocculant**
 - Rawatan Air
 - Peningkatan Kualiti air
- ii. Strategies for the Sustainable Development and Management of Lakes and Reservoirs in Malaysia
- iii. Cleansing biotopes





PEMULIHAN TASIK TUNKU ABDUL RAHMAN ZOO NEGARA

INTRODUCTION:

Tasik Tunku Abdul Rahman Zoo Negara:

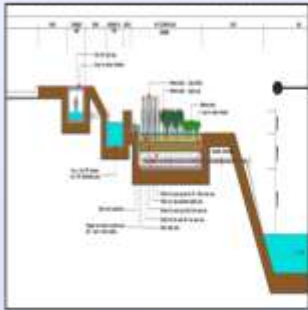
Area = 1.6 hectares (16,000 m²),
 Depth = 0.6 m to 3.3 m
 Volume = 16,000 m³

Undergoing the lake water quality improvement.

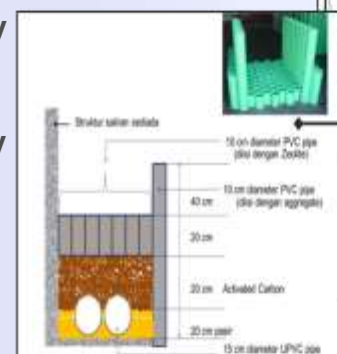
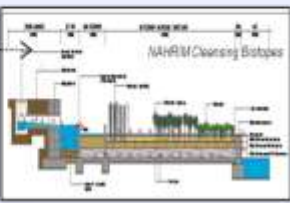
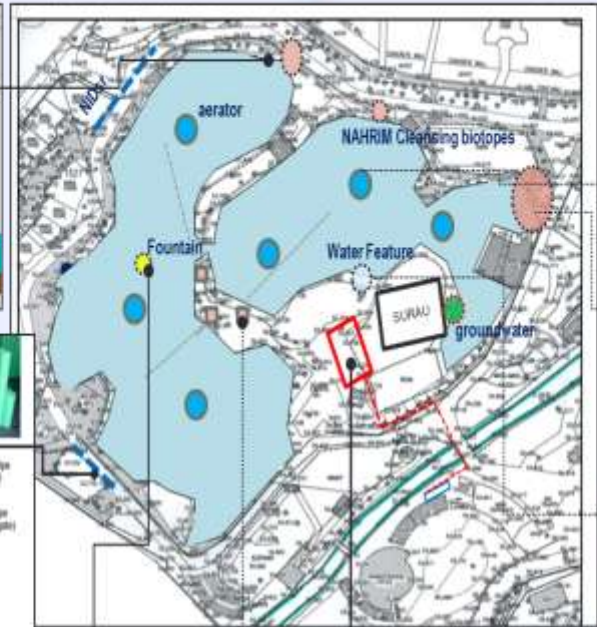
Components of the lake water quality improvement are as listed below:

- Desludging
- Sistem Penapisan Air Hujan (SPA H)
- Air tanah
- NAHRIM Integrated Drainage System (NIDS)
- Aeration System
- Cleansing Biotope
- Water feature
- Water Fountain
- Floatable Wetlands System
- Beneficial Microbes and EKO Klean Solution Treatment Methods
- Sistem Environmental Friendly and Climate Change Biogas System

To reduce pollution due to effluent discharge or surface runoff



To enhance water circulation & inject oxygen



To supplement clean water into the lake

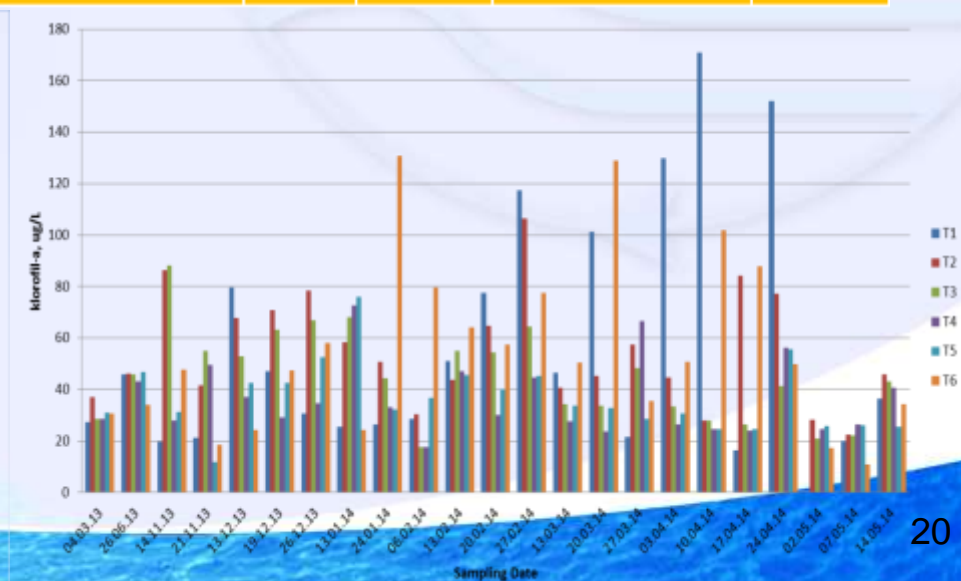
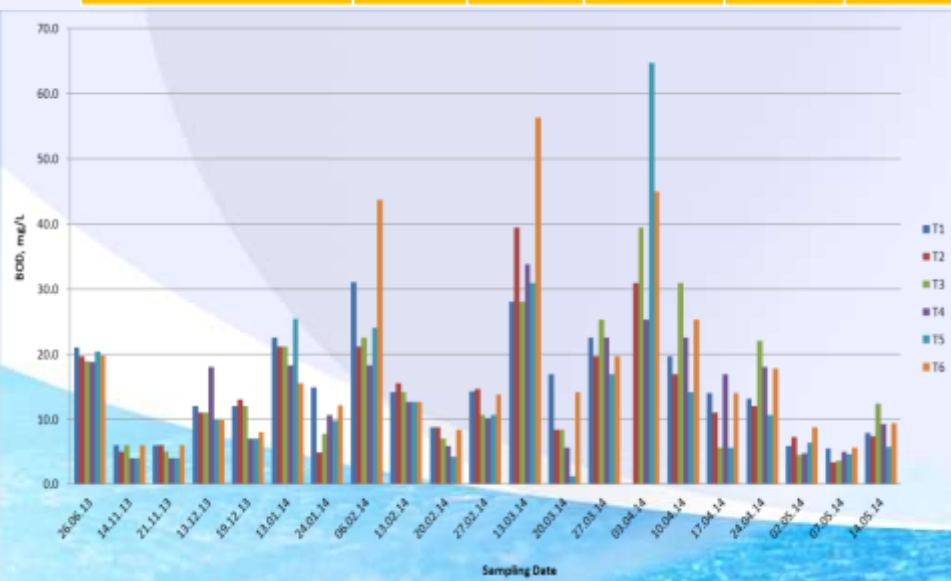




TASIK ZOO NEGARA – WATER QUALITY IMPROVEMENT



Stesyen persampelan	pH	COD	BOD5	DO	AMMONIACAL NITROGEN	TSS	WQI	status	Kelas DOE
			mg/l	mg/l	NH3-N				
T 1	8.79	14.5	5.5	6.25	0.58	8	81	Bersih	II
T 2	8.33	9.6	3.4	5.99	0.44	4	85	Bersih	II
T 3	8.7	9.6	3.6	6.89	0.58	3	86	Bersih	II
T 4	8.53	14.5	5	6.54	0.44	9	83	Bersih	II
T 5	8.62	12.9	4.6	6.6	0.58	8	83	Bersih	II
T 6	8.62	16.1	5.6	5	0.73	7	77	Separa Tercemar	II
Kelas	I	I-II	III	II	III	I			





NAHRIM R&D INITIATIVES AND CONTRIBUTIONS



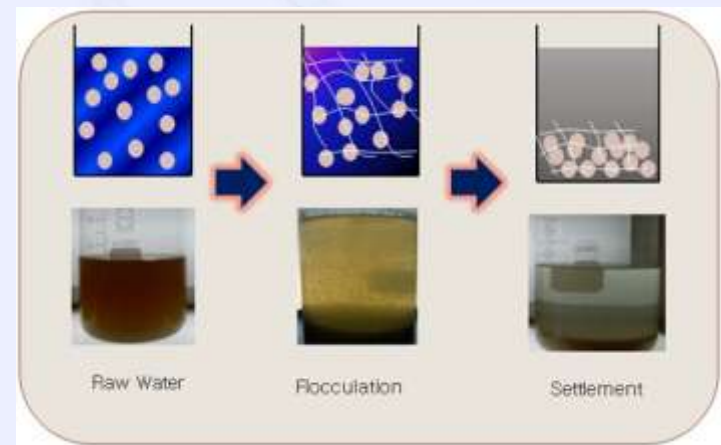
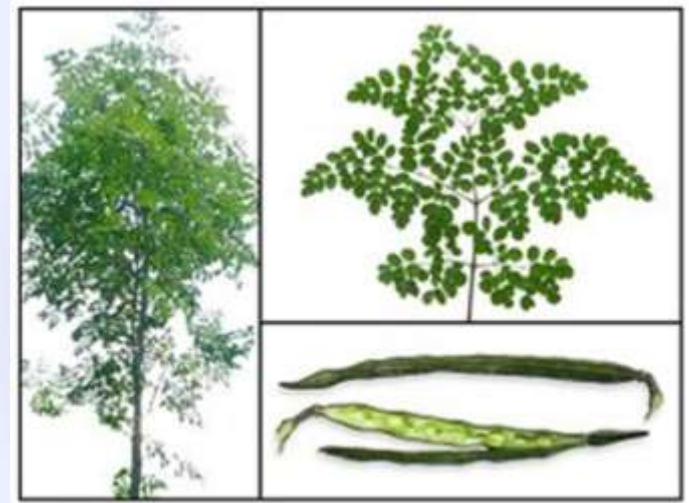
NAHRIM MEMENANGI PINGAT EMAS DI IENA 2013, NUREMBERG, GERMAN

NAHRIM's Bioflocculant (NBIOF) comprise of natural coagulant (*Moringa oleifera Lamarack*) with its flocculation property acts through mechanisms to facilitate the removal of the pollutant inside water by clumping actions transforms it into a scum.

The primary purpose of the flocculation or coagulation process is the removal of suspended matter from the water using bioflocculant with already charged positive by binding with negatively charged negative organic pollutant.

USE OF BIOFLOCCULANT

- ◆As an innovative bioremediation technology model in water treatment which is **affordable, easy to use and does not harm the environment** in order to maintain a sustainable environment.
- ◆A natural bioflocculant that are capable of **providing a clean and sustainably environment and water resources.**



Produk Inovasi Sistem Rawatan bagi Meningkatkan Kualiti Air Kolam Rekreasi

□ Penggunaan gabungan tumbuhan akuatik dan media tanah untuk Bio-engineered



Pemulihan air tasik dengan kaedah Nahrim Cleansing Biotopes



Tasik yang berqualiti di Tasik Hadiqotul Ma', Nahrim

□ Jenis media tanah yang dipilih (berdasarkan keadaan setempat)



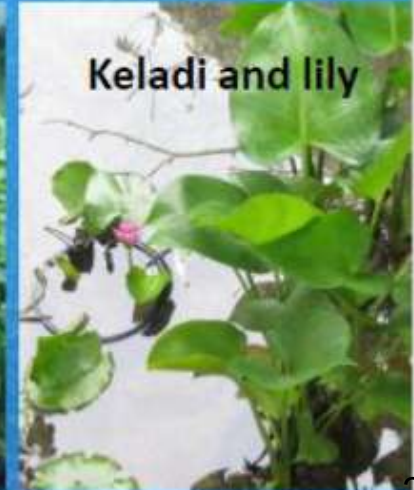
Umbrella Plants



Portulaca



Water Mint and Fern



Keladi and lily

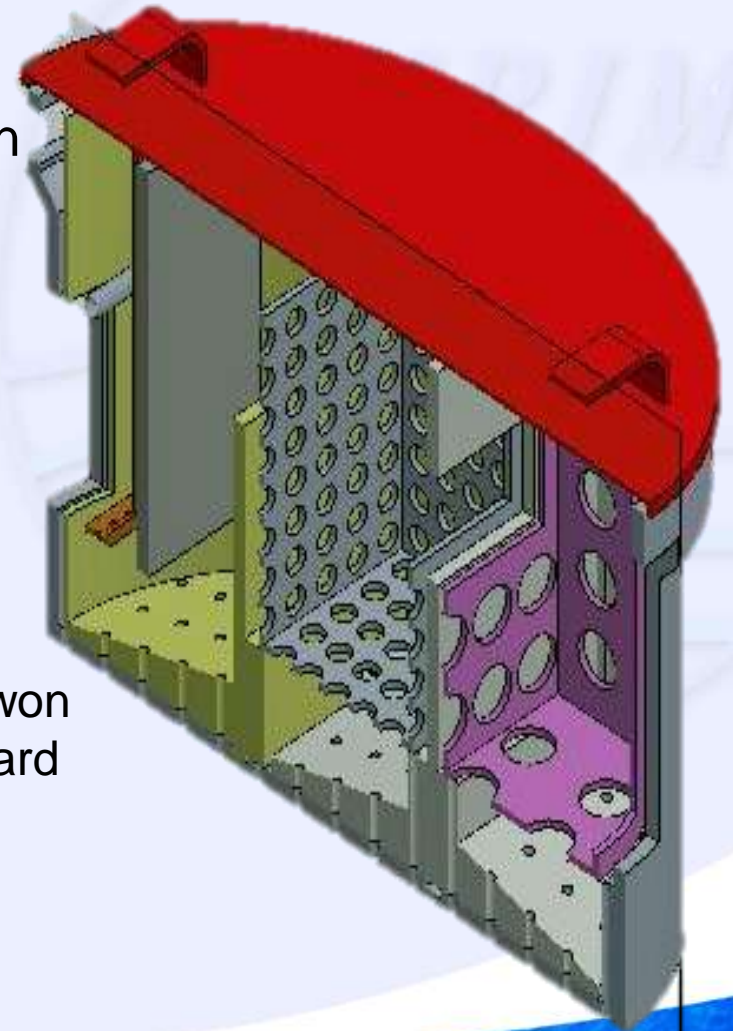


NAHRIM R&D INITIATIVES AND CONTRIBUTIONS



SMADRAT :

Smart Drainage Trap (SMADRAT) installed in a residential area allows pollutants such as floating trash, sediment, including oil and grease are managed at the source before entering the main drain.



Ahli kumpulan dari NAHRIM dan JPS yang diketuai oleh Ketua Pengarah NAHRIM bergambar di ruang pameran produk SMADRAT.

This innovation won Double Gold Award at the British Invention Show 2012.



NAHRIM R&D INITIATIVES AND CONTRIBUTIONS



- **NIDS:** NAHRIM Integrated Drainage System (NIDS) is the latest, most recent drainage technology and the first of its kind in this world. It is designed to replace the existing drainage system which is made from concrete and earth. This innovation won gold medal in IENA 2013.



An environmental friendly drainage system does not only carry runoff but at the same time traps gross pollutant such as trash, sediment and oil contaminants. Also, it treats dissolved pollutants such as agricultural chemicals and heavy metals, and at the same time allows the water that has been treated to seep into the groundwater as a reserve for future extraction.

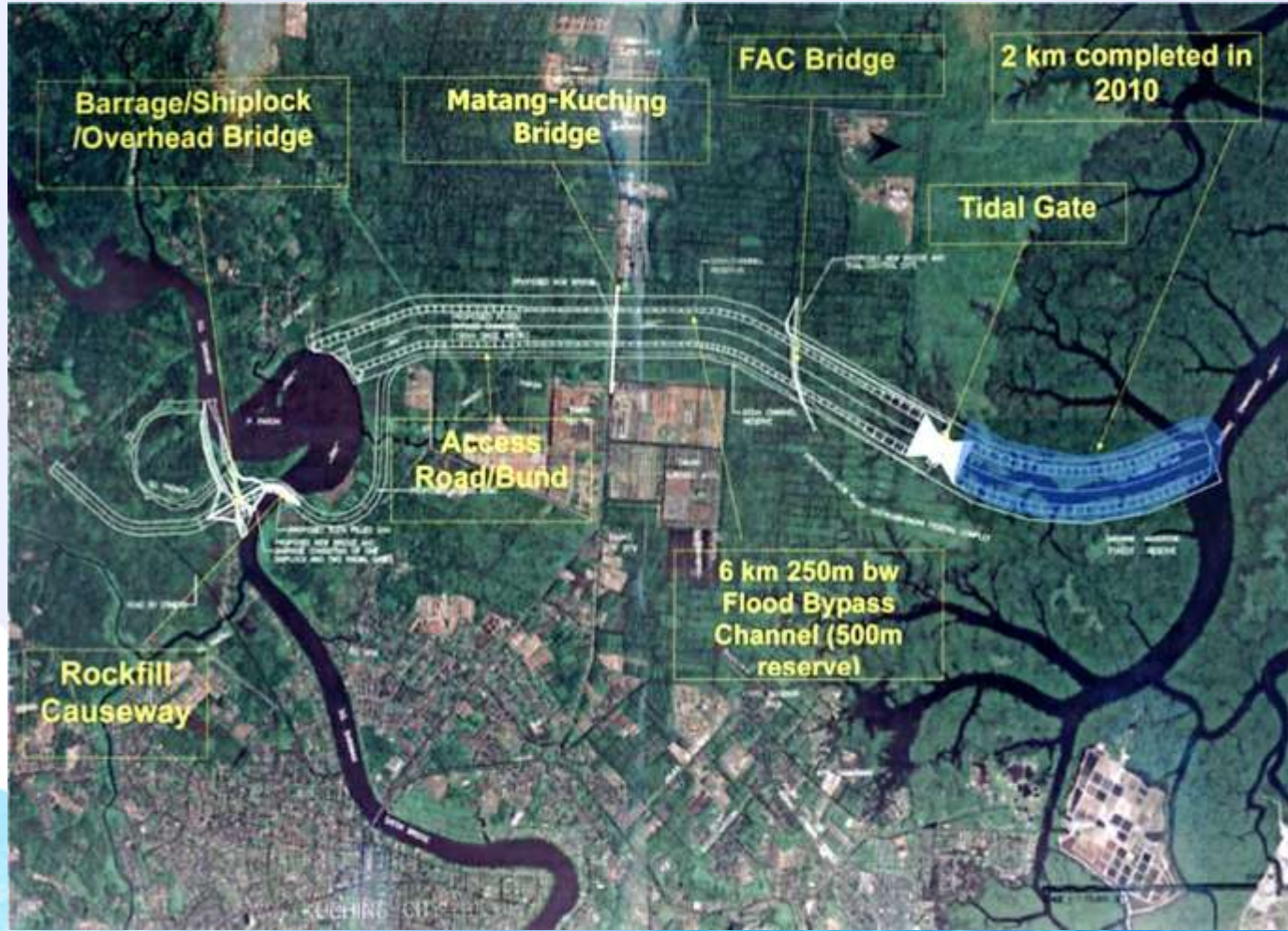


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RTB SG. SARAWAK PROJECT OVERVIEW



Estimated project cost (in million RM):

- i. Bypass: 550 mil
- ii. Barrage : 430 mil
- iii. TCG : 360 mil



RTB SG. SARAWAK PROJECT OVERVIEW



Physical Modelling for Sg. Sarawak Flood Mitigation Scheme for DID Malaysia



FUTURE RESEARCH PROJECTS

Climate Change



Detailed Study On Effects Of Climate Change - Advanced Study Effects Of Climate Change On Water Resources For Malaysia – MSAN-9

1. Study of vulnerability, adaptation and evaluation of water resources and river basin level of the **dam reservoir capacity**;
2. Study of vulnerability, adaptation and economic impact of **urban drainage systems, highways & ecosystems**;
3. Study of vulnerability, adaptation and economy of **water-energy sector**;
4. Further studies projected **sea level rise** due to climate change **on the coast of Malaysia** (Phase 2);
5. Plan strategies and adaptation options for **coastal water sector**; and
6. Development of **design guidelines for engineering practice**.



ENDOCRINE DISRUPTING CHEMICALS (EDC)



Table 1: Comparison of few EDC parameters in Drinking Water Quality Standard (Malaysia, European, New Zealand, Singapore)

No	EDC parameter	Malaysia (mg/l)	EU (mg/l)	NZ (mg/l)	Singapore (mg/l)
1	Bromacil	-	-	0.4	-
2	Dioxane	-	-	0.05	0.05
3	Fenoprop	0.009	-	0.01	0.009
4	Benzene	0.01	0.01	0.01	0.01
5	Benzo (a) pyrene	0.0007	0.00001	0.0007	0.0007
6	1,2-dichloroethane	0.05	0.003	0.03	0.03
7	Bromodichloromethane	0.06	0.06	0.06	0.06
8	tetrachloroethene	0.04	0.01	0.05	0.04



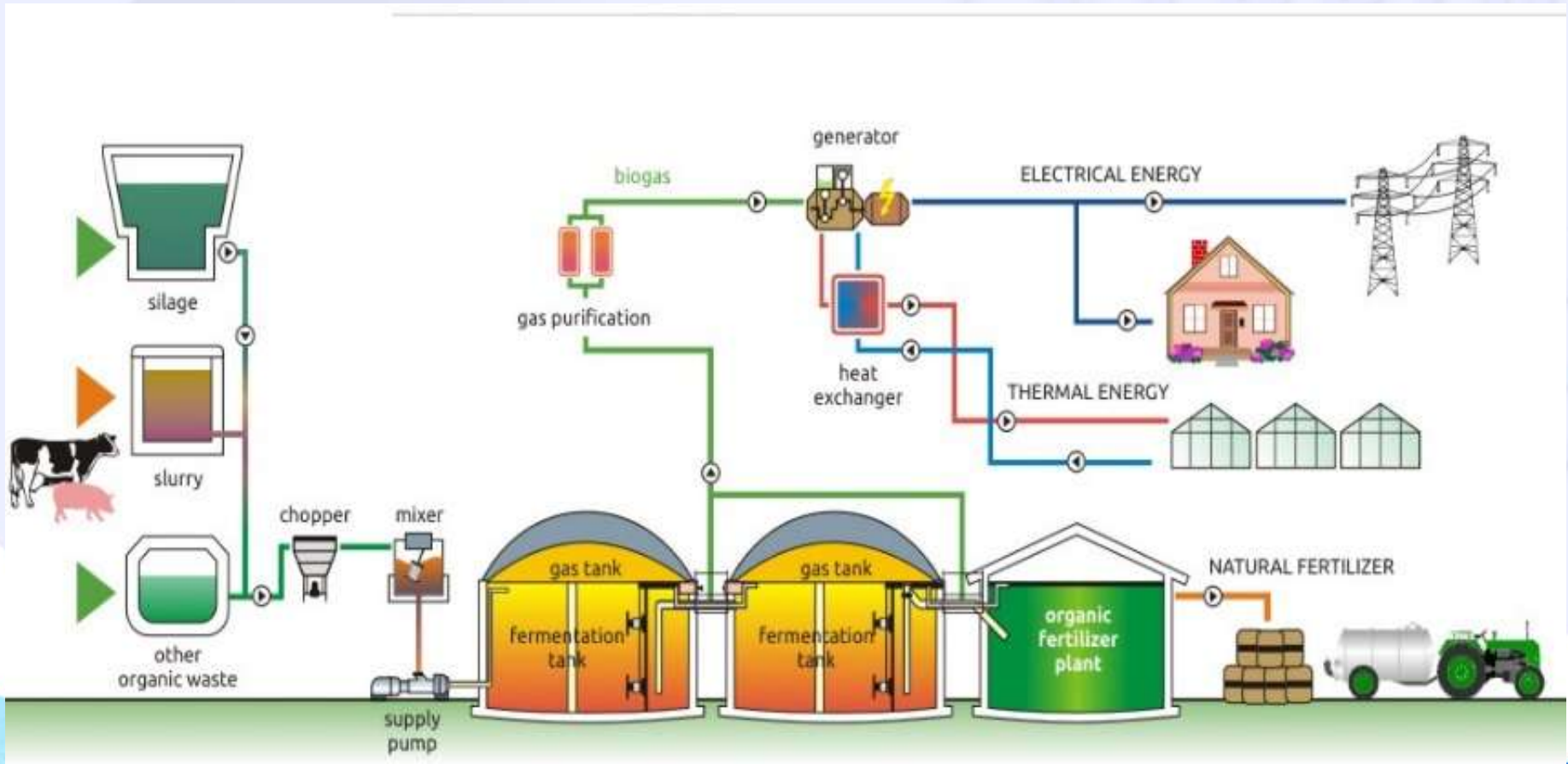
EDC FURTHER RESEARCH

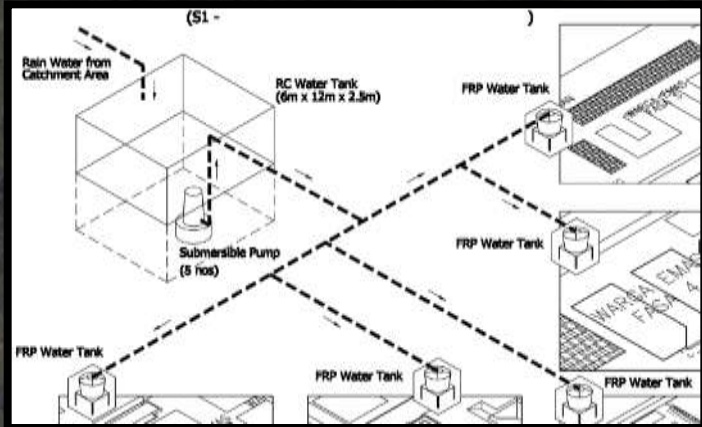


- **Testing:** More comprehensive testing methods are required to identify other possible endocrine disruptors, their sources, and routes of exposure. Emphasize on source control (pre-treatment)
- **Research:** More scientific evidence is needed to identify the effects of mixtures of EDCs on humans and wildlife (mainly from industrial by-products) to which humans and wildlife are increasingly exposed.
- **Reporting:** Many sources of EDCs are not known because of insufficient reporting and information on chemicals in products, materials and goods – emphasizing source control.
- **Collaboration:** More data sharing between scientists and between countries can fill gaps in data, primarily in developing countries and emerging economies. Finding holistic approach to solve the problem.
- **Regulations:** Possibility of new regulations to control the discharge of endocrine disruptors, drinking water quality standard, water treatment plants regulations. Support efforts for more research and government regulation with regards to EDCs.





BIOGAS DIGESTER





Cadangan Kawasan Pelaksanaan SPAH

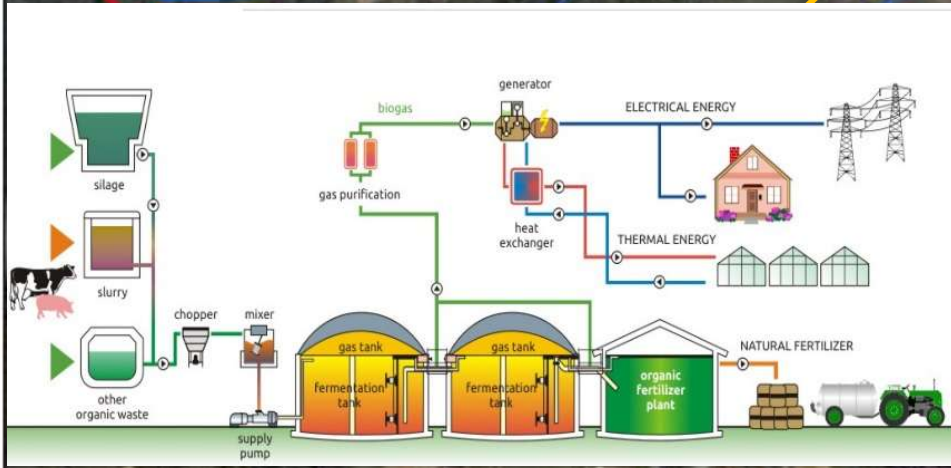
Petunjuk:
 Cadangan NIDS
 Cadangan INTRiGUARD

Cadangan Tapak Pelancaran Projek Perintis NAHRIM

Cadangan tapak Biogas Digester



Cadangan NIDS



Cadangan tapak INTRiGUARD

Tadahan Sg Merah, Ringlet, Cameron Highlands



CONCLUSION



- 1. Water research/products is the scientific basis for solving current water problems which would lead to sustainable national development and healthy water environment.**
- 2. Cooperation with all the stakeholders in R & D & C for water technologies/products (Blue Ocean Strategy).**





Contact Us



For further information, please contact us at:

National Hydraulic Research Institute of Malaysia (NAHRIM)
Ministry of Natural Resources and Environment (NRE)
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