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Dam Rehabilitation & Improvement Project

Central Water Commission

DAM SAFETY MANAGEMENT IN MALAYSIA: RESILIENCE DAM FOR SAFE COMMUNITIES

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MALAYSIAN NATIONAL COMMITTEE ON LARGE DAMS
MY COLD

KEMENTERIAN ALAM SEKITAR DAN AIR
Ministry of Environment and Water

AGENSI PENGURUSAN BENCANA NEGARA
NADMA MALAYSIA

UNIVERSITI TENAGA NASIONAL
The Energy University

JABATAN PENGAIRAN DAN SALIRAN MALAYSIA

TNB GENCO
A subsidiary of Tenaga Nasional

10-12 October 2022 at Jaipur, Rajasthan (India)

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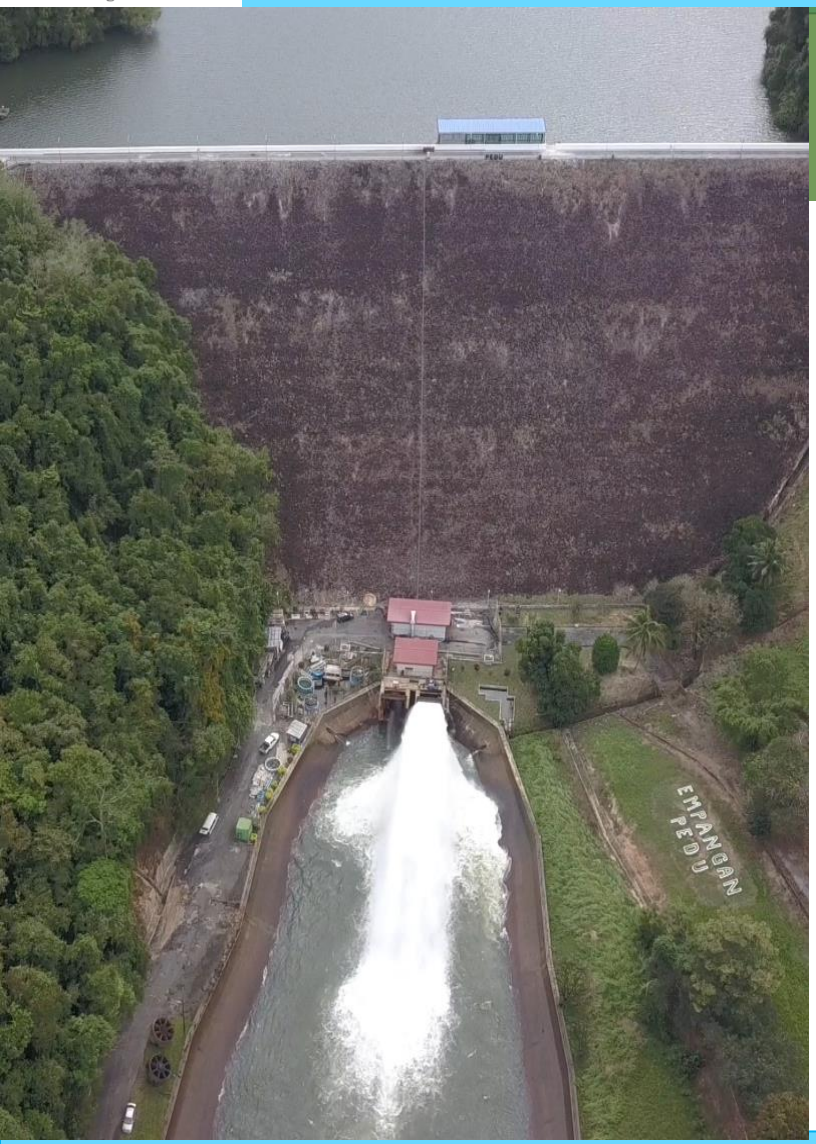

PRESENTATION OUTLINE

- Dams in Malaysia
- Issue and Challenges
- Malaysia Government Initiatives
- Way Forward
- Conclusions

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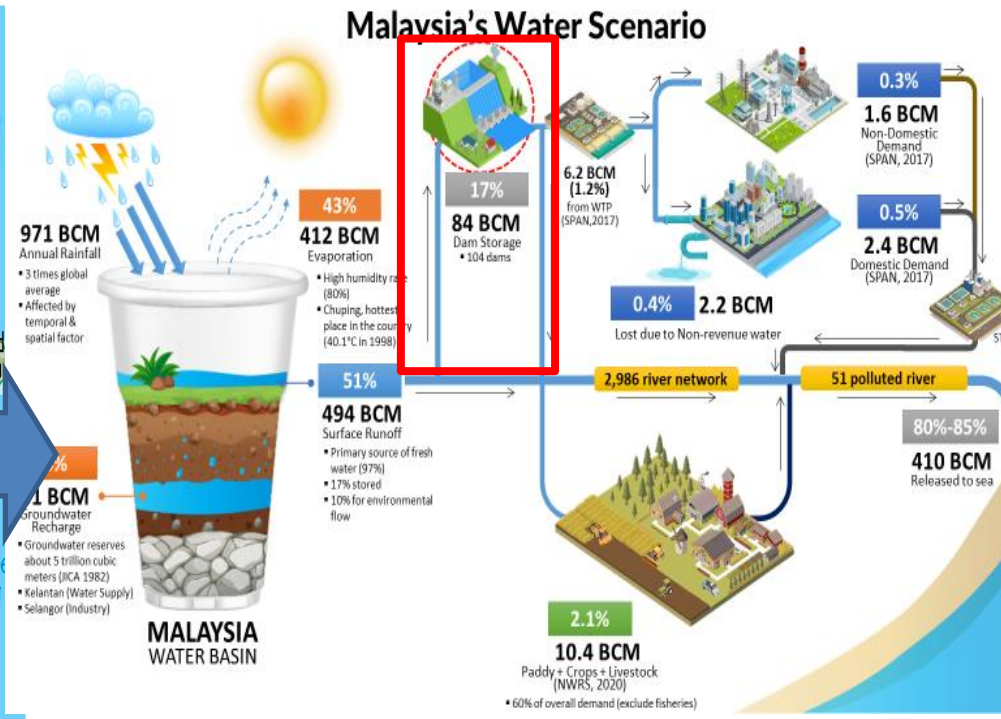

Average rainfall 2,500 – 3,000mm per year

Source: DID, 2019

32.7 million POPULATION

Source : DOSM

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NATIONAL WATER MANAGEMENT

Water-Food-Energy Nexus is the key enabler for water security to allow integrative management and planning of the future resources

State Government is responsible for **water**, **rivers**, land, and forest including gazetting the water catchment areas and control of development in the states

State Government **control** and **regulate** on the ground pertaining to Water & Land, while **Federal Government** promoting legislations uniformity, providing financial support, technical advice and capacity building with **IWRM** approach

State Water Authority handling human intervention by enforcement and IWRM adaptation

DID conduct IRBM studies by basin to major river basins in the country

12 studies ready,
25 studies to be completed by 2020

National Water Resources Policy, guidelines to Federal & State Government

Water Resources Act, a holistic water law to implement IWRM & IRBM approaches

NAWABS a decision making supporting tools in water resources management

NAFFWS assist in high water disaster management and warning dissemination

Source: DID, 2021

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DAM FACTS IN MALAYSIA

MAIN FUNCTION

63 WATER SUPPLY

16 HYDROELECTRIC

14 IRRIGATION

4 SEDIMENTATION

5 FLOOD MITIGATION

2 RECREATION

104 DAMS IN TOTAL

TYPE OF DAMS

70 EARTHFILL

18 CONCRETE

14 ROCK FILL

4 OTHERS

DAMS OWNER

Dam Owner / Operators in Malaysia	
BBA, KASA	62
DID, KASA	16
Energy Company	16
MAFI	7
Private/Local Authority/Recreation	3

- ✓ Average age of Dams have exceeded 50 years
- ✓ Bukit Merah oldest large dam (113 years)
- ✓ Total storage is 84,000 MCM

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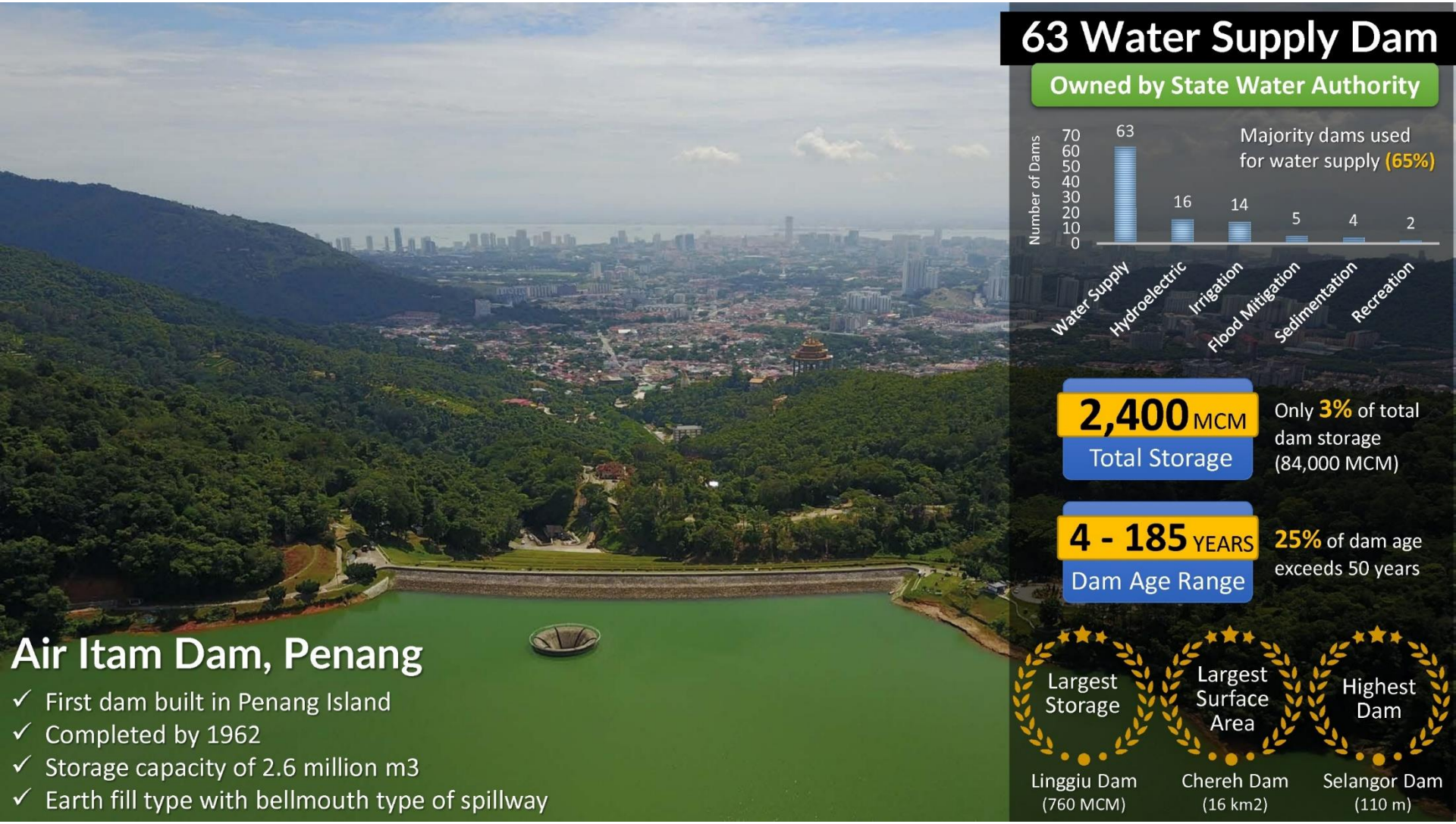

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Source: DID, 2019

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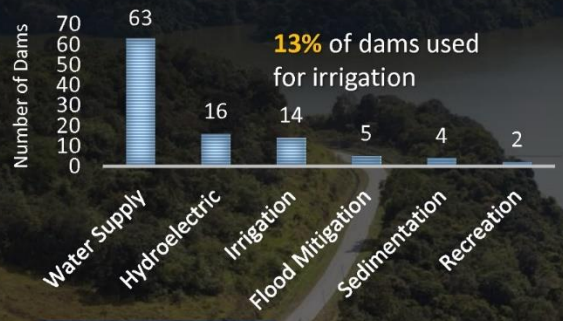
14 Irrigation Dam

Owned by DID & MOA



13% of dams used for irrigation

2,000 MCM
Total Storage

Only **2.4%** of total dam storage (84,000 MCM)

4 - 113 YEARS
Dam Age Range

50% of dam age exceeds 50 years

Largest Storage	Largest Surface Area	Highest Dam
Pedu Dam (1,073 MCM)	Paya Peda Dam (77 km2)	Ahning Dam (74 m)

Muda Dam, Kedah

- ✓ Built in 1969 under the Muda Irrigation Scheme
- ✓ Aimed to provide irrigation to enable double cropping of paddy (96,000ha)
- ✓ Storage capacity is 154 MCM
- ✓ Reinforced concrete buttress (ambursen) type with overflow spillway.

Source: DID, 2019

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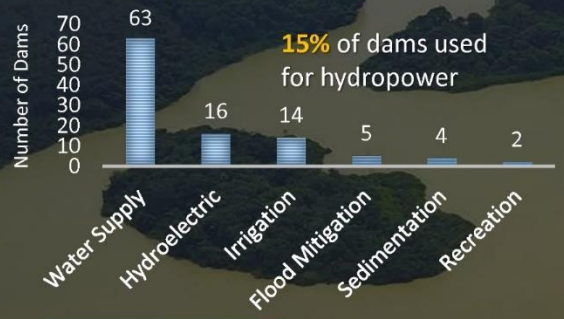
16 Hydropower Dam

Owned by Energy Company



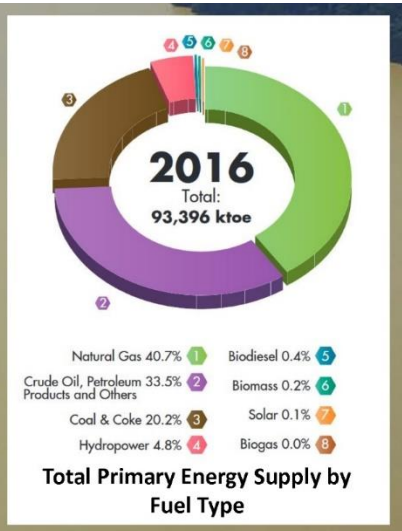
15% of dams used for hydropower

80,000 MCM
Total Storage

95% of total dam storage (84,000 MCM)

4 - 89 YEARS
Dam Age Range

25% of dam age exceeds 50 years



Total Primary Energy Supply by Fuel Type

Chenderoh Dam, Perak

- ✓ The oldest hydropower dam in Malaysia
- ✓ Completed in 1930 to meet the electricity demand for tin mining industry in Perak
- ✓ Concrete hollow buttress Ambursen type dam
- ✓ Total storage of 95.4 MCM

Source: DID, 2019

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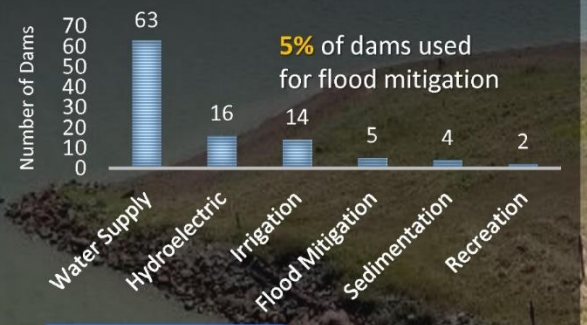
5 Flood Mitigation Dam

Owned by DID



5% of dams used for flood mitigation

137 MCM
Total Storage

0.16% of total dam storage (84,000 MCM)

27 - 37 YEARS
Dam Age Range

Dam age below 50 years

Largest Storage	Largest Surface Area	Highest Dam
Timah Tasoh Dam (33 MCM)	Timah Tasoh Dam (13 km2)	Batu Dam (44 m)

Sembrong Dam, Johor

- ✓ Completed in 1984
- ✓ Primarily cater for flood mitigation, later tapped for water supply.
- ✓ Total storage capacity up to 18 MCM during Normal Pool Level.

Source: DID, 2019

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DAM FAILURE CASES IN MALAYSIA

Location of TNB Power Stations

- The collapse of the cofferdam due to overtopping by flood during construction at Paya Peda Dam, in 2012.

- Earth fill dam failed by a classic slip on the upstream slopes following an extremely wet and prolonged dry period in 1970

- October 2013
- 4 deaths
- Excess water released from the dam during monsoon.

- 1981
- Dam failed by a classic slip on the upstream slopes during a prolonged wet spell

- The collapse of the spillway at Anak Endau Dam in 1986 during its first overspilling

Bukit Panchor Dam, Penang

Paya Peda Dam, Terengganu

Stesen Janaelektrik Sultan Mahmud, Kenyir

Sultan Abu Bakar Dam, Pahang

Batu Arang Dam, Selangor

Anak Endau Dam, Pahang

Dam Safety is Our Top Priority

Stesen Janaelektrik Sultan Mahmud, Kenyir had been badly affected due to major landslides incident on 27 February 2022

10-12 October 2022 at Jaipur, Rajasthan (India)

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KUALA KUBU DAM FAILURE 1883

Built in 1780s with earth & logs for tin mining activities

1.6km length
91.4m width

In 29 October 1883 (103 years), a heavy downpour caused the dam to burst open and flood the town.

Tin mining activities affected

38 houses washed away

33 people killed
Incl. Cecil Ranking, Revenue Officer & First English Magistrate at Kuala Kubu

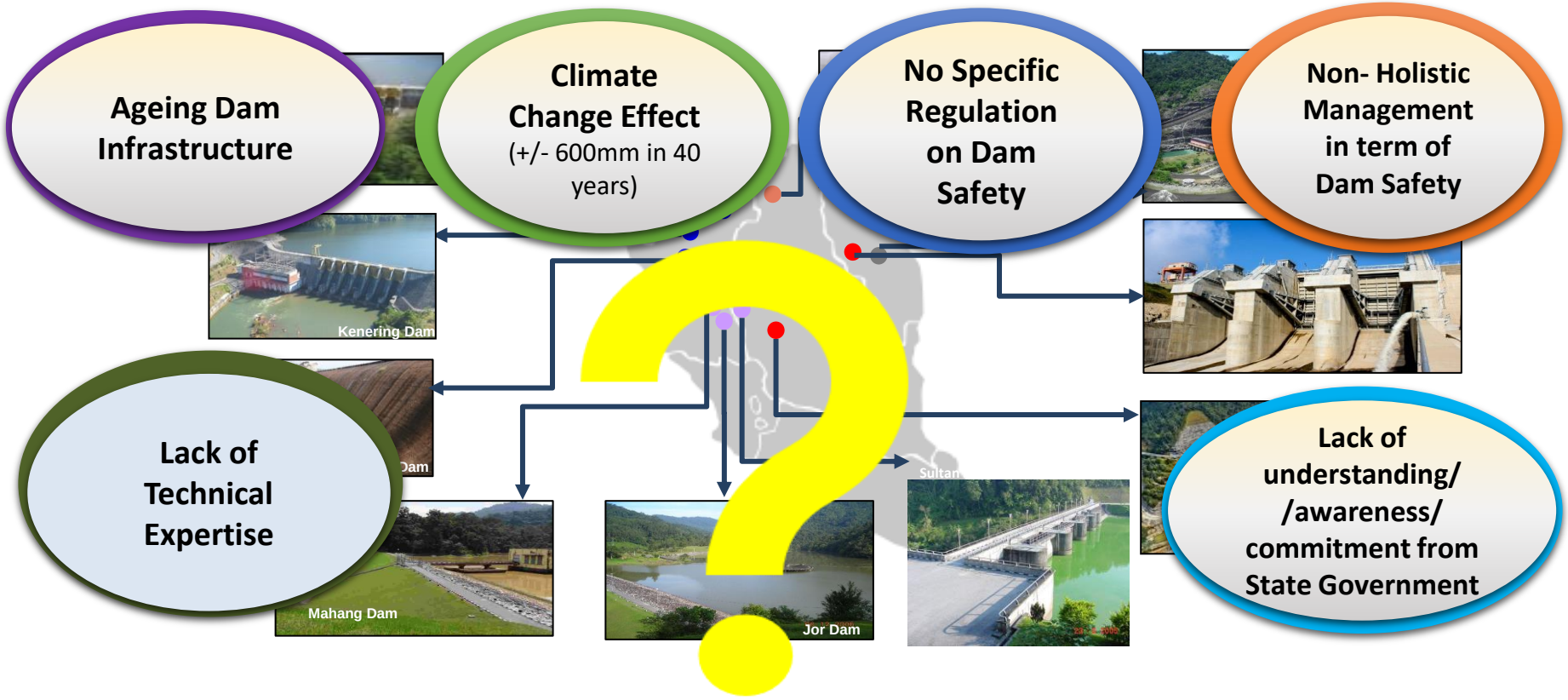
Pada tarikh 29 haribulan Oktober tahun 1883, Ampangan Kuala Kubu telah pecah dan roboh akibat dari berlakunya bencana banjir besar melanda Sungai Selangor. Ampangan yang terletak dekat Kampung Asam Lenggong sekarang dikenali sebagai Kampung Ampang Pecah kira-kira 2.4 km dari pekan Kuala Kubu itu telah dibina oleh pelombong-pelombong Melayu dan Orang Asli dalam tahun 1780an untuk melampan bijih timah.

Ampangan itu yang penjangnya hampir 1.6 kilometer dan lebarnya lebih 91.4 meter itu dibina dari tanah dan batang-batang kayu melintangi Sungai Kubu iaitu anak Sungai Selangor. Apabila Ampangan ini pecah dan roboh, pekan Kuala Kubu dan kawasan sekitarnya telah tenggelam. Pembukaan Kuala Kubu pada kurun kelapan belas adalah disebabkan perlombongan bijih timah yang terawal di kawasan itu oleh orang-orang Melayu. Lombong ini juga menarik minat penduduk-penduduk dari berbagai kaum terutamanya orang-orang China.

Kuala Kubu juga menjadi Kubu pertahanan Raja Mahadi dan Syed Mashor menentang angkatan perang Tengku Kudin dalam perang saudara di Selangor pada tahun 1868 hingga tahun 1873. Banjir besar yang mengakibatkan ampangan itu pecah dan roboh telah menghanyutkan 38 buah rumah, mengorbankan 33 jiwa termasuk Cecil Ranking iaitu Pegawai Pemungut Hasil dan Majistret pertama Inggeris di Kuala Kubu. Banjir ini juga turut memusnahkan harapan dan mata pencarian terutamanya orang-orang Melayu untuk meneruskan kerja-kerja melombong bijih dengan cara melampan.

Source: DID, 2019

Dam Safety concerns are growing…….



WHERE ARE THE GREATEST RISKS?

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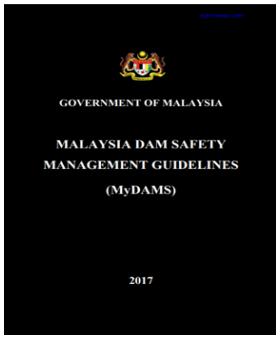
Government Initiatives

1. ESTABLISH A SPECIAL COMMITTEE ON DAM SAFETY AT THE FEDERAL LEVEL (KASA)



2. CONDUCT IMMEDIATE PROPER MAINTENANCE WORK FOR 41 HIGH HAZARD DAM

3. ESTABLISH DAM TECHNICAL CENTRE (DTC)

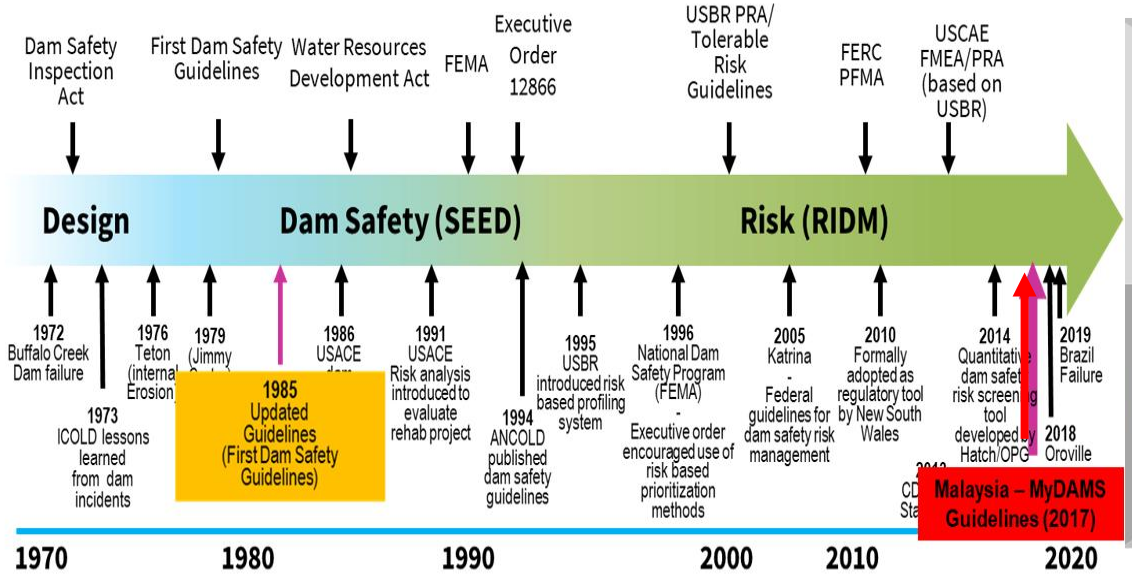
4. PREPARE AN EMERGENCY RESPONSE PLAN (ERP/EAP)

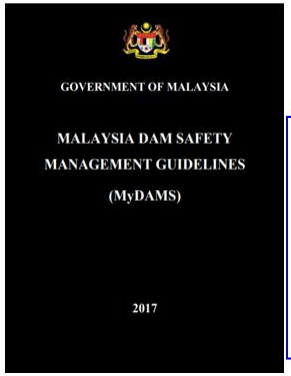
5. STRENGHTHENING THE CAPACITY OF TECHNICAL TEAM AND DAM OPERATO

Sustainable Development Goals 2015 - 2030

- **SDG Target 06** – Clean Water and Sanitation - Ensure availability and
- **SDG Target 07** – Affordable and Clean Energy -

MALAYSIA DAM SAFETY MANAGEMENT GUIDELINES (MYDAMS)





MyDams

Provides a framework for the management of dam safety, and guidelines for development and implementation of dam safety practices throughout Malaysia

Applicable to dam:

(i)Height : ≥ 10m & storage capacity : ≥ 20,000 m³

(ii)Height : ≥ 5m & storage capacity : ≥ 50,000 m³

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MyDAMS 2.0 (REVISION)

- Scheduled to be revised in 2023.
- Full revision/ improvement of MyDAMS based on experience and feedback by all dam operator / stakeholder.
- Feedback form/ questionnaire.
- Technical workshop

Objectives:

- To improve current MyDAMS with latest data, technology andl International practices.
- To **ensure uniform dam safety management practices** according to acceptable International standard.

MyDAMS WORKSHOP




10-12 October 2022 at Jaipur, Rajasthan (India)

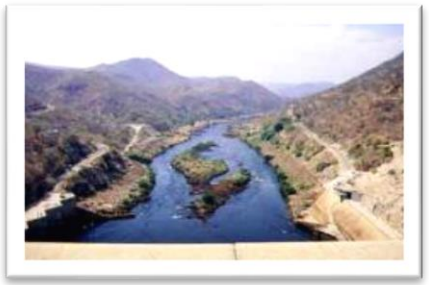
PROTECTION OF DAM CATCHMENTS

✓ Secure from encroachment or trespassing

✓ Gazette the area as a dam reserve to prevent encroachment and for maintenance purposes.

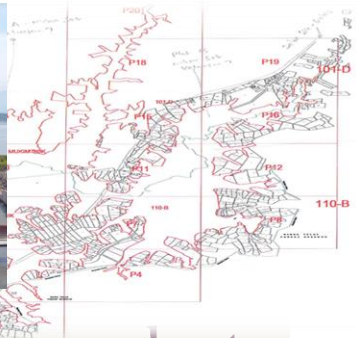
✓ Control pollution and disturbances of catchment area

✓ Inadequate enforcement presence



✓ State jurisdiction

PROTECTED AREAS AND PROTECTED PLACES ACT 1959 (KLTL)



Gazette the operating area and water water body of the dam.

•The Ministry will continue to ensure the security of the dam by ensuring that the management of the dam complies with the law of Protected Areas and Protected Places Act 1959

The Ministry will continue to work with the state government to ensure that the dam can be gazetted for the public interest in terms of security and water resources.

COMMITMENT FROM STATE GOVERNMENT

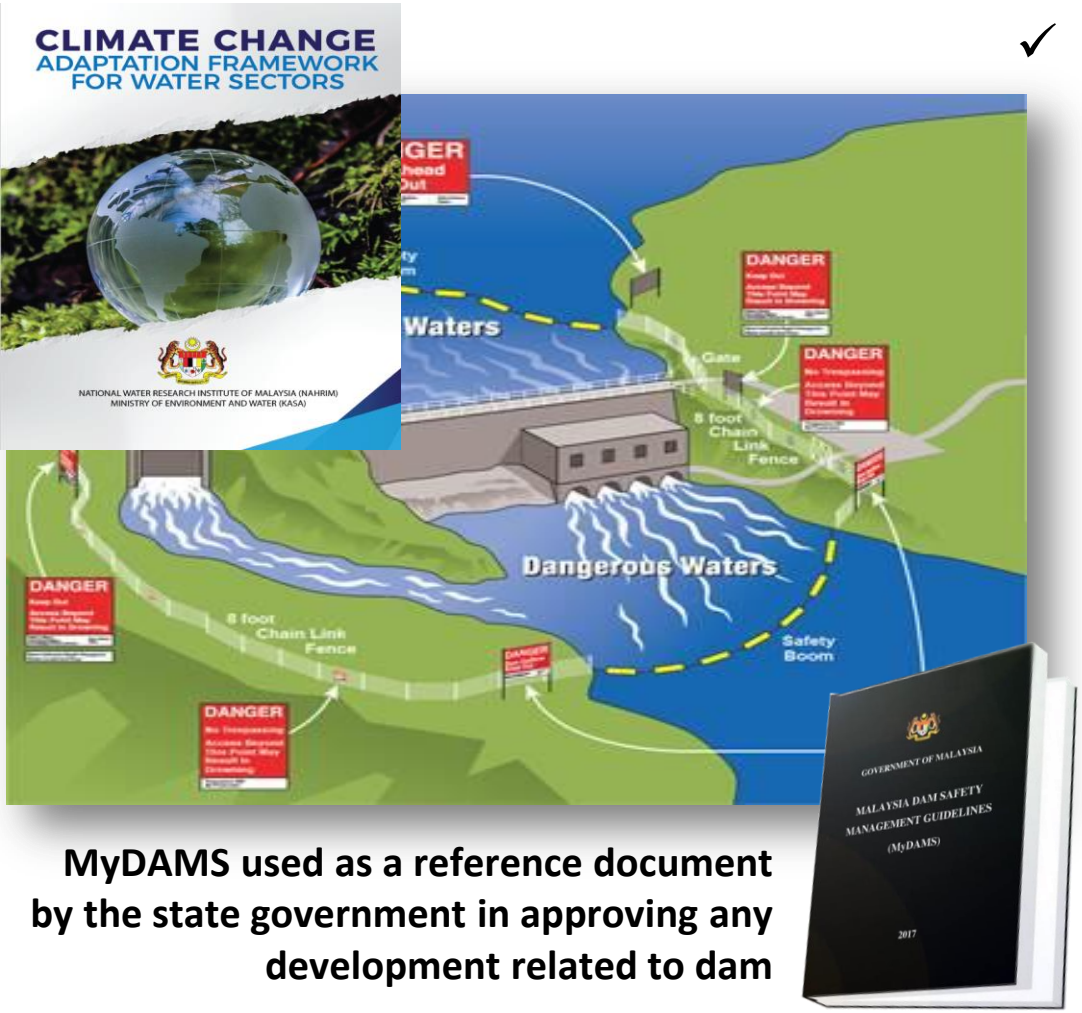
a) Technical:

- Upkeep instrumentation
- Enhance basic data collection
  - Upkeep staffing
  - Mastery on basic and regular inspection

b) Administration:

- Increasing fund for O&M
- Enforcement of law that protect catchment areas

DAM SAFETY REGULATION



MyDAMS used as a reference document by the state government in approving any development related to dam

- ✓ **Revising and strengthening the structure of existing procedures**
  - ❖ **Revisit the Dam Safety Act under Federal Law**
  - ❖ **Linking Planning and Strategies to POLICY**
  - ❖ Involving planning, design, development and maintenance of dams, emergency preparedness , decommissioning etc.

Strengthening the role and function of the dam safety 'flying squad'

- ❖ through engagement with **National Audit Department**

DAM PERFORMANCE MONITORING & MAINTENANCE WORK FOR 41 DAM (HIGH HAZARD DAM)

- Documentation of procedures and practices is needed to ensure the safe operation of the dam under various conditions.
- The potential impacts of operations on the public, the environment, and other stakeholders should be documented.

ENHANCING DAM SURVEILLANCE DATABASE

- ✓ Provision made for continuity of dam records and database for future reference
- ✓ Improving surveillance assessment
- ✓ Enhance the decision making process related to dam safety and operation using AI
- ✓ Digitalisation and Digitisation of dam records and documents
- ✓ Smart Dam Database and Management System
- ✓ Revise the screening tool for dam hazard classification

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INTEGRATED DAM SAFETY MANAGEMENT APPROACH

Dam

Problems

- Ageing dam infrastructures
- O&M issues
- Cracks due to seismic
- Lack of adequate early warning
- system
- Reliability of mechanical parts
- Funding for Dam Safety Management Program
- Competent Dam operators

Solutions

- Ensure integrity of the structure
- Real time instrumentation data collection
- Using Satellite & UAV
- Effective O&M

RIDM

Before

Inflow& Sediment Forecasting

Uncontrolled Land Clearance

After

Satellite monitoring

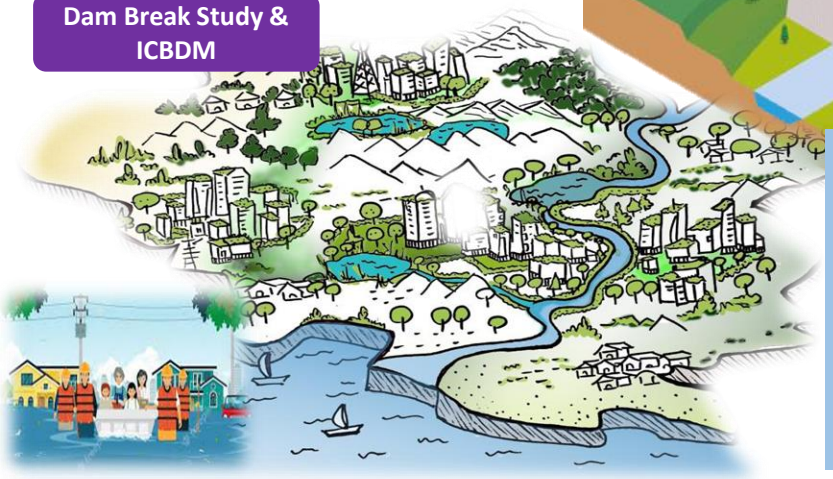
Problems

- Urbanisation at downstream of the river
- Sufficient water passage route
- Adequate early warning System

Solutions

- Sufficient Water Passage
- Preparedness for emergency

Dam Break Study & ICBDM



Reservoir

Problems

- Siltation decrease reservoir capacity to hold water and cause additional pressure on dam upstream scenarios
- Water quality
- Illegal dumping of garbage affect flow at intake and spillway
- Climate Change effect

Solutions

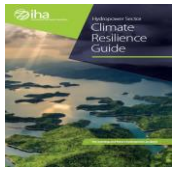
- Ensure safe quality and quantity of water sourc
- Operational Reservoir Safety

Problems

- Slope clearing affect velocity of water
- High activity increase siltation at dam
- Encroachment to u/s catchment
- Climate change effect

Solutions

- Prevent activity that affects the availability of water
- Automation and Remote Sensing, Satellite monitoring



DOWNSTREAM RIVER | RESERVOIR & DAM | CATCHMENT AREA

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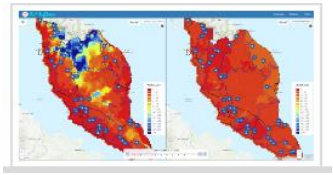
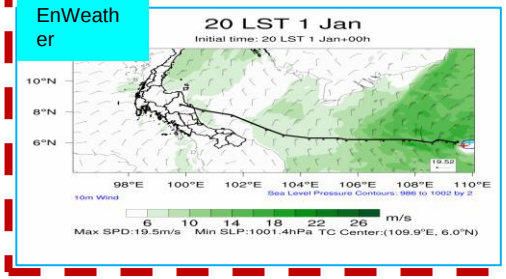
PREPARATION FOR CLIMATE CHANGE IMPACT - MONSOON SEASON

1. WEATHER FORECASTING

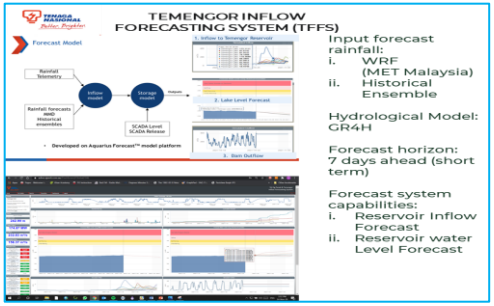


Source of Data:
- NAHRIM (N-HyDaa)
- JPS – NAWABS
- Global Weather Prediction

EnWeather



2. RESERVOIR INFLOW FORECASTING

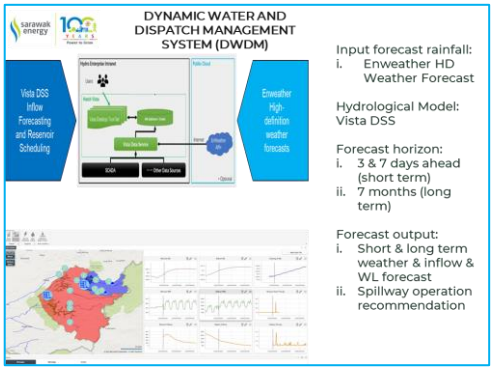


Input forecast rainfall:
i. WRF (MET Malaysia)
ii. Historical Ensemble

Hydrological Model: GR4H

Forecast horizon: 7 days ahead (short term)

Forecast system capabilities:
i. Reservoir Inflow Forecast
ii. Reservoir water Level Forecast



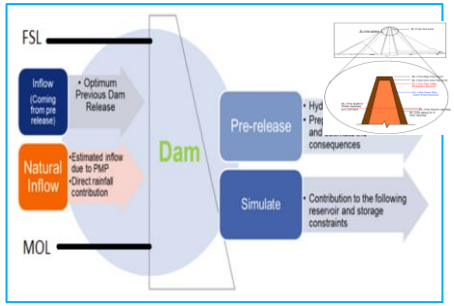
Input forecast rainfall:
i. Enweather HD Weather Forecast

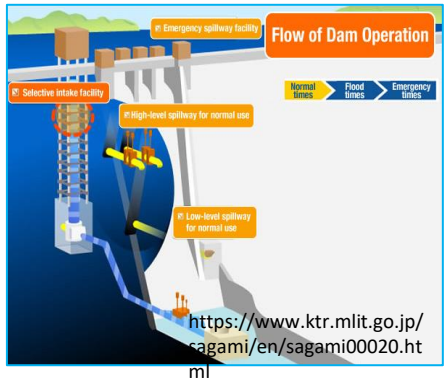
Hydrological Model: Vista DSS

Forecast horizon:
i. 3 & 7 days ahead (short term)
ii. 7 months (long term)

Forecast output:
i. Short & long term weather & inflow & WL forecast
ii. Spillway operation recommendation

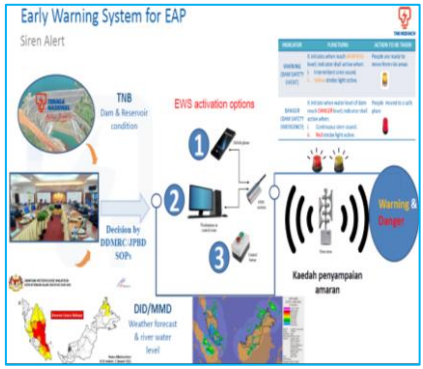
3. DAM PRE-RELEASE STRATEGY





https://www.ktr.mlit.go.jp/sagami/en/sagami00020.html

4. EMERGENCY ACTION PLAN & EMERGENCY PREPAREDNESS



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OUR STRATEGY IS TO INTEGRATE DAM SAFETY MANAGEMENT WITH GOVERNMENT NAWABS & NAFFWS PROGRAM

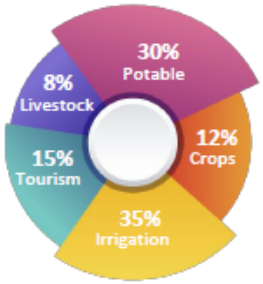
Water Accounting

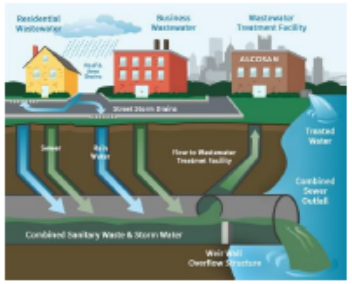
All water entry and exit/loss within the river basin

Availability
Volume and river stage (m) at all key demand points

Demand
All demands from various users

POTABLE · LIVESTOCK · FISHERIES · IRRIGATION · TOURISM · NON-PADDY

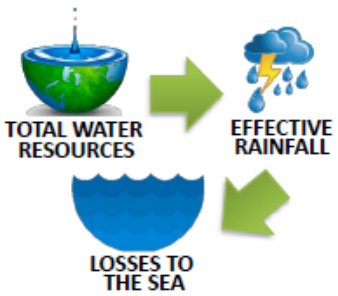


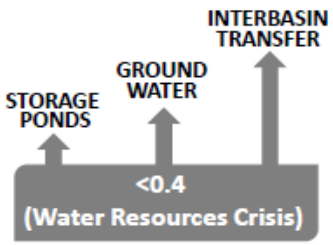


Water Prioritization
Decision on who gets the water first base on demand & availabilities

Water Allocation
Decision on how water is allocated base on demand & priorities

Water Quality
Determine water quality threshold limits, TMDL and environmental flow compliance





Water Auditing
Perform audit on all water resources inflow, effective rainfall and losses to the sea

WR & Drought Index
Calculate Water Resource Index (WRI) & Drought Index (DI)

Dam Release & Storage
Forecast dam inflows and decide timing and amount of water to release

OFFICE
Of Water Prediction

"Integration from concept planning to frontline"

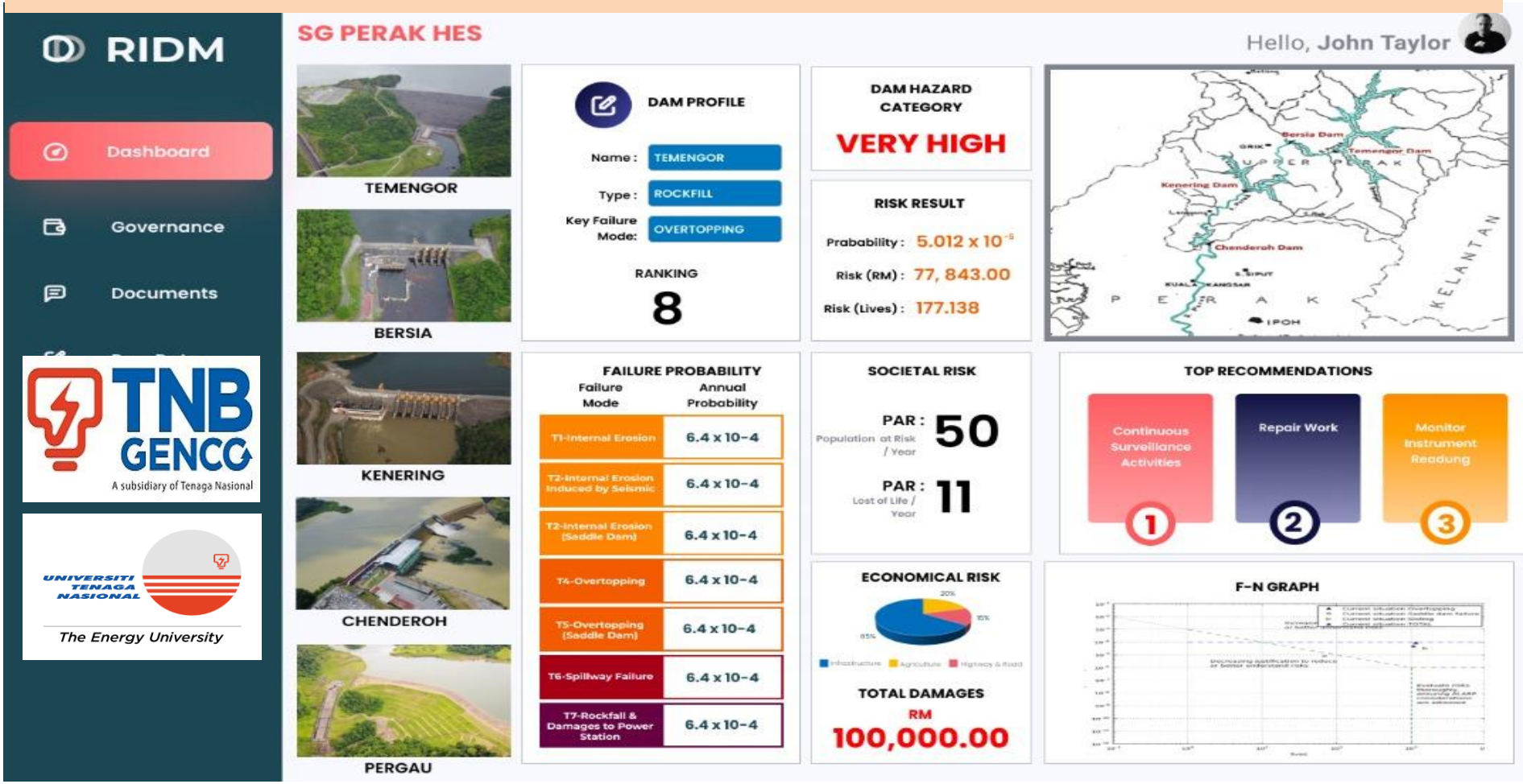
INCOLD
Indian National Committee on Large Dams

INTERNATIONAL DAM SAFETY CONFERENCE

DRIP
Dam Rehabilitation & Improvement Project

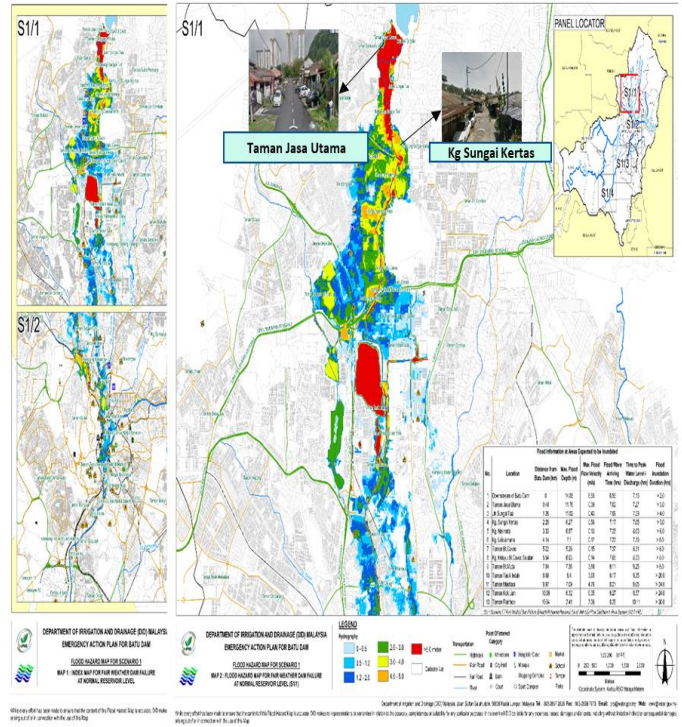
Central Water Commission

PARADIGM SHIFT FROM DETERMINISTIC APPROACH TO RISK-INFORMED DECISION MAKING IN DAM SAFETY MANAGEMENT

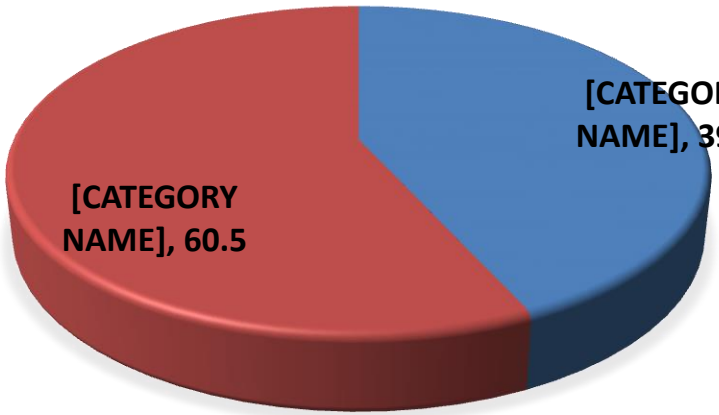


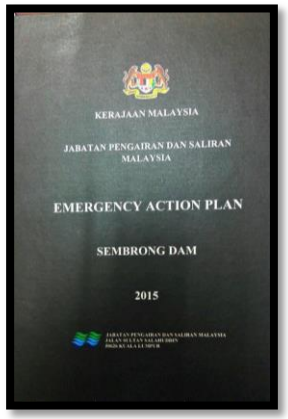
10-12 October 2022 at Jaipur, Rajasthan (India)

PREPARE AN EMERGENCY ACTION/RESPONSE PLAN (EAP/ERP)



ERP STATUS





In 2021, **39.5%** of Malaysian Dams **do not have** a **ERP.**

Latest info:

JPS 100% (16/16) MOA 57% (4/7)

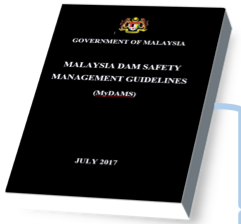
BBA 40% (25/62) Recreation/Private 66% (2/3)

TNB/SEB/SABAH 100% (16/16)

IMPLEMENTATION OF EMERGENCY ACTION/RESPONSE

Exercise the EAP (MyDAMS 10.5.2)

Malaysia Dams Safety Management Guidelines (MyDAMS)



ORIENTATION/ SEMNAR/ WORKSHOP

(Dam personnel and agencies)
Aim to refresh the participants to the plans and procedures in ERP. The seminar could be conducted through lectures, panel discussions or media presentations.

DRILL EXERCISE (Annually)

(Dam personnel)
Aim to train staff in house and test procedures

TABLETOP EXERCISE (Every 4 years)

(Dam personnel and agencies)
Aim to ensure that lines of communication and responsibilities between organisations work .

FUNCTIONAL EXERCISE

(Dam personnel & agencies)
Testing of communication & notifications procedure between dam personnel & agencies to simulate incident or emergency. These test is conducted at individual's agencies' place.

FULL SCALE EXERCISE

(Dam personnel, agencies and community)
These test actual on ground drills together with agencies and community

DENAI KEBANGSAAN

8

STRENGHTEN THE CAPACITY OF TECHNICAL TEAM & DAM OPERATOR

Capacity Building

- Technical advise /short course for Dam Operator/Dam Owner
- Involvement of representatives from “Flying Squad”.
- Technical Collaboration with International Bodies (ICOLD, JWA, USACE, INACOLD, INCOLD, SPANCOLD, CDA)
- **Technical Cooperation with MYCOLD**
  - **Certified Dam Safety Inspector (CDSI)**
  - **Certified Specialised Risk Assessment**

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CAPACITY BUILDING OF DAM INDUSTRY SECTORS

1. CERTIFIED DAM SAFETY INSPECTOR TRAINING COURSE

Collaboration with

The Energy University; JABATAN PENGAIRAN DAN SALIRAN MALAYSIA; TNB GENCO A subsidiary of Tenaga Nasional; MY COLD; entura

Objective CDSI

- To produce dam safety inspectors who are qualified in carrying out safety inspection duties

Current	Coming Soon
CDSI (1st Batch) November 2020 30 participants	MYCOLD targets to hold 2 batches intake annually **Program will be certified by MYCOLD/CIDB**

Flying Squad




2. CERTIFIED DAM RISK ASSESSMENT TRAINING COURSE

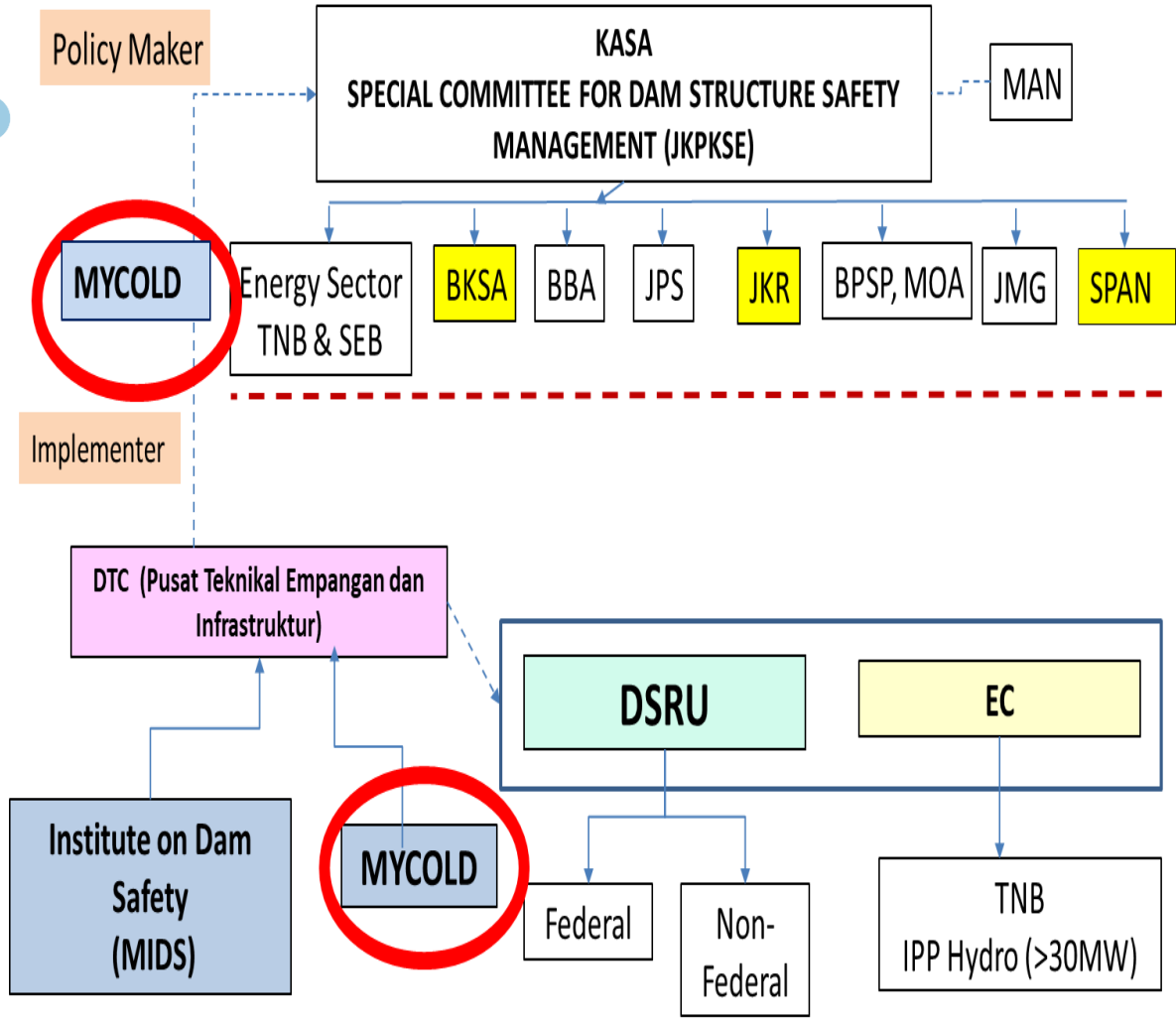
By 2025

300

Certified Dam Safety Inspector

DAM SAFETY FRAMEWORK

- To regulate the management of dams
- To ensure compliance to dam management standards



STRATEGIC PARTNERSHIP WITH MYCOLD

06 Develop a National certification program for dam sector.

05 Promoting, educating and engagement with communities
Emergency Action Plans are intended to support decision making and enhanced community resilience

04 Provide input in Guidelines regularly reviewed and updated for the betterment and industry applications

03 Research & Development (R&D) related to dam safety management – automatically supporting and enhancing MyDams.

02 Increasing and providing Capacity Building – Training and certified training in Malaysia

01 Communicate with worldwide dam experts in providing specialized training platforms.

07 Improve & develop necessary competencies necessary for dam operator dam's related & personnel

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ICDSME2023
INTERNATIONAL CONFERENCE ON DAM SAFETY MANAGEMENT AND ENGINEERING 2023

CALL FOR PAPERS

IMPORTANT DATES

Abstract Submission Dateline	31st October 2022
Abstract Acceptance Notification	15th November 2022
Full Paper Submission Deadline	6th January 2023

RESILIENT DAMS FOR SAFE COMMUNITIES

16 & 17 MARCH 2023

KUALA LUMPUR - MALAYSIA

CO - ORGANISERS

www.mycold.com.my

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Conference Secretary : secretariat@mycold.com
/mycoldmalaysia

TRACK TOPICS

01 Operation, Maintenance and Emergency Management

02 Major Rehabilitation and Other Risk Reduction Investments

03 Dam Monitoring, Data Acquisition and Processing

04 International Best Practices in Dam Safety Management & Governance

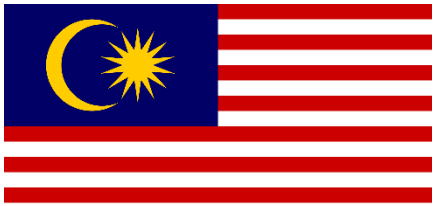
05 Safety Reviews and Risk Assessment

06 Sustainable Dam and Reservoir Management.

Jaipur, Rajasthan (India)

CONCLUSIONS

- **Safety is a CORE VALUE of our Dams Profession (Protect People, Property & Environment)**
- **Institutionalizing Dam Safety is about regulating how we address risks posed by ageing dams**
- **MyDAMS is the first step – a federal initiative – but responsibilities remain with dam owners**
- **Addressed the technical aspect, but need to address the legal framework to ensure behavioral change**
- **TRADITIONAL Approach (Deterministic – good practices) to EMERGING Approach (RIDM, PFMA and Life Cycle Risk Assessment)**
- **State & federal government cooperation crucial in establishing an effective management framework for dam safety**



THANK YOU

Supported By

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Ministry of Environment and Water

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