



Department of Irrigation and Drainage, Malaysia

Malaysia's Water Security and
the UN SDG Goals

Development of a National
Water Balance Management
System: Case Study of the
Muda River Basin



Perak River @ Teluk Intan, Perak

Presentation by: Nor Hisham Ghazali - Dept. of irrigation & Drainage Malaysia

Venue: UNESCO Special Sessions

AOGS

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OUTLINE

- Basic Definitions and Concepts
- Malaysia's Water Security and the SDGs
- NAWABS as a Management Tool For Achieving Selected SDGs
- Case Study: Muda Basin
- Conclusions and Recommendations

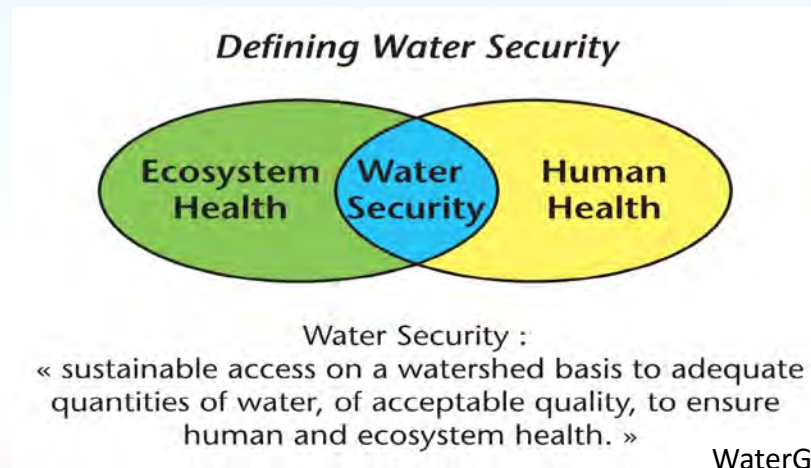


Basic Definitions and Concepts

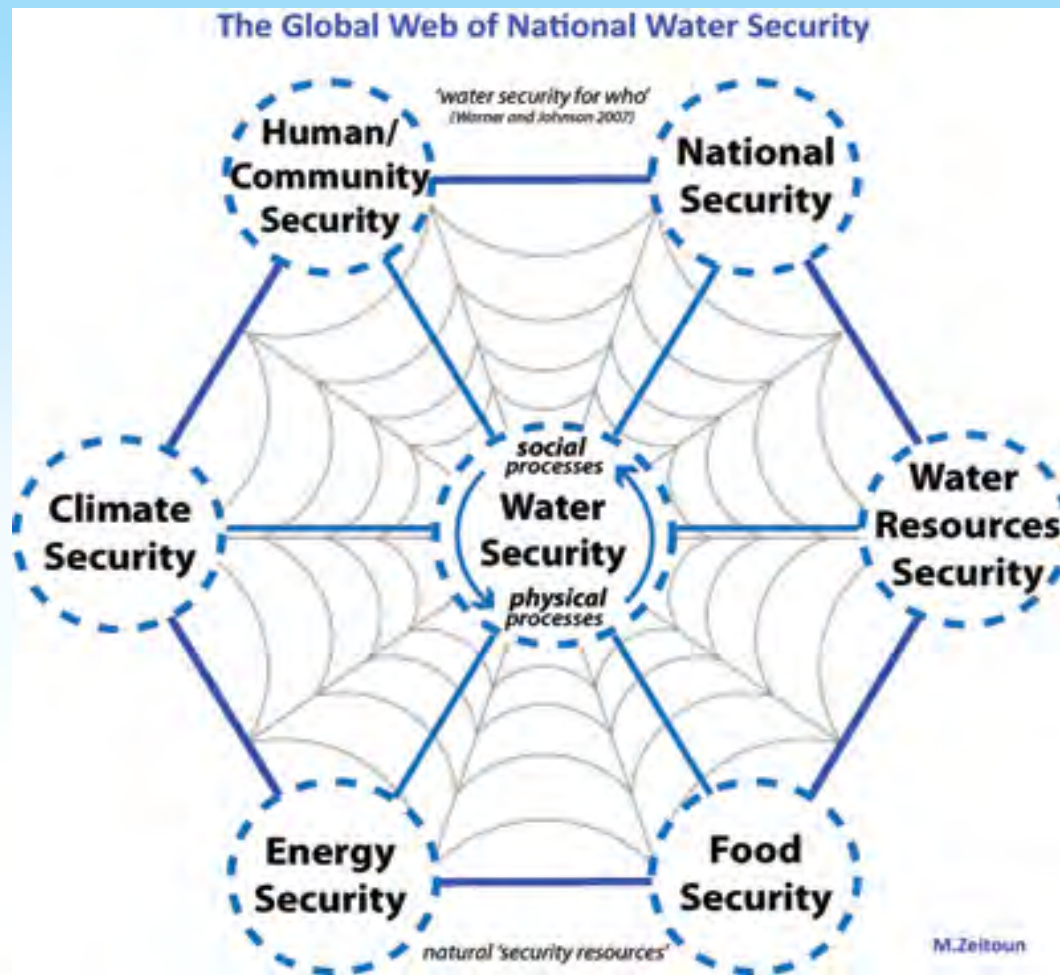
WATER SECURITY is.....

The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability

United Nations, Water (2013)



WATER SECURITY COMPONENTS

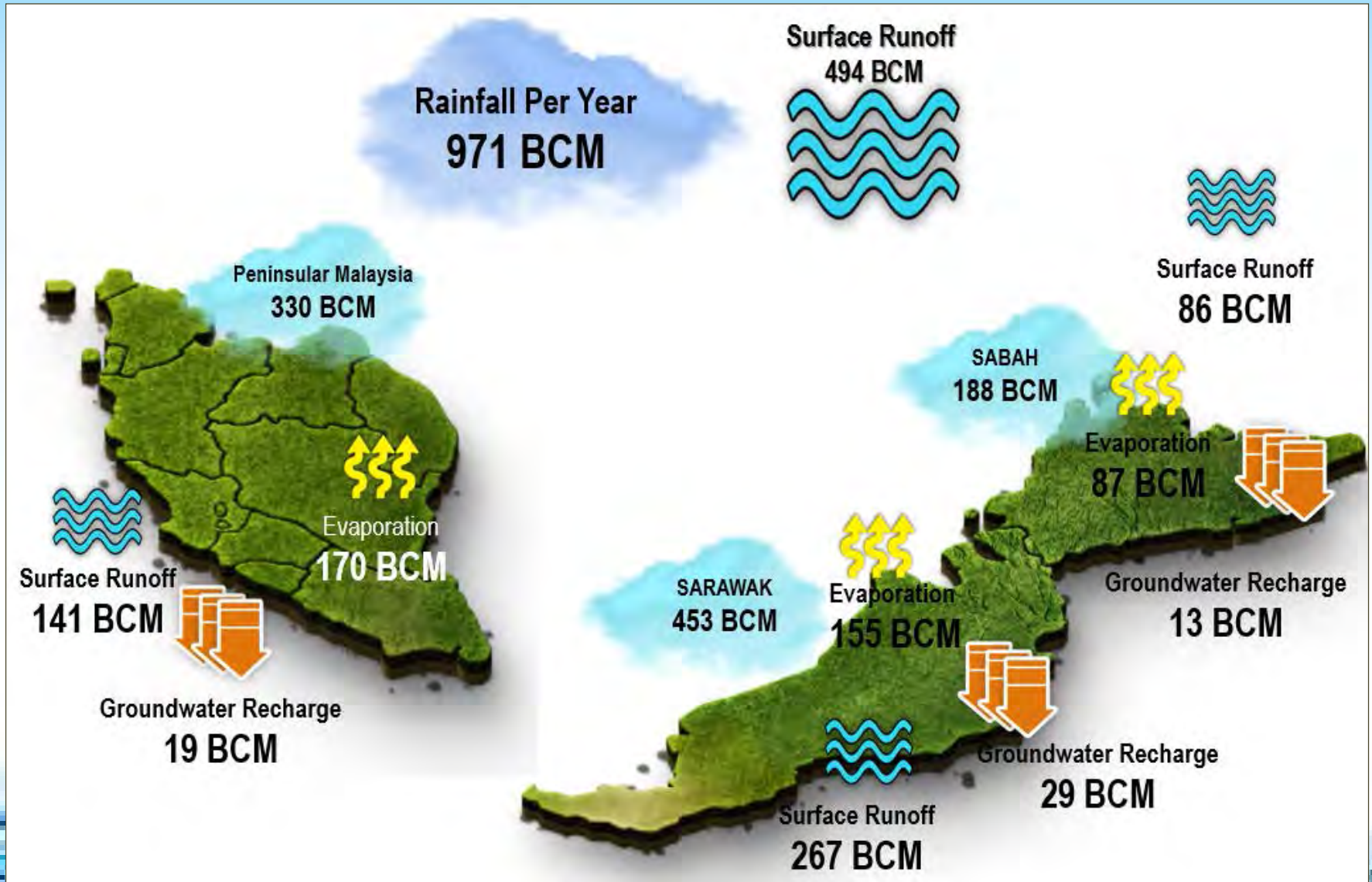




Malaysia's Water Security and the SDGs

MALAYSIA'S WATER SECURITY AND SDGs

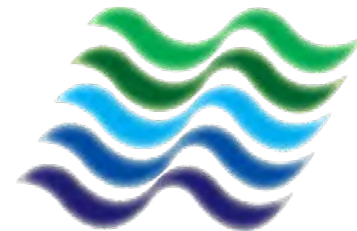
Source: Review of National Water Resources Study (2011)



WATER SECURITY

MALAYSIA WATER VISION

Malaysia will conserve and manage its water resources to ensure adequate and safe water for all by 2050”



MALAYSIA'S WATER SECURITY AND SDGs

Directly
Related
to Water
Security



MALAYSIA'S WATER SECURITY AND SDGs

Directly
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UN SDGs for 2030



SDG 6 (Clean Water & Sanitation) & IWRM

- Security of Water Sources
- Water Supply Management
- Infrastructure Development and Management
- Conjunctive Water Use
- Sustainable Resource Management (surface water and groundwater)
- Pollution Control

SDG 6 TARGETS AND INDICATORS

Target	Indicator
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated 6.3.2 Proportion of bodies of water with good ambient water quality
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0-100) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time
6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
6.b Support and strengthen the participation of local communities in improving water and sanitation management	6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management



NAWABS as a Management Tool For Achieving Selected SDGs

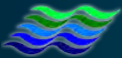
NAWABS (National Water Balance System)



NAWABS
JPS MALAYSIA

The WATER BANK of Malaysia

NAWABS OUTCOME

HOW
 **NAWABS**
WILL HELP
YOU??



Centralised
Decision Making
System for Water
State Manager



Improved
Preparedness



Forecast: 2 months in advance
Warning: 2 weeks in advance

OUTCOME

Forecast : 2 months in advance

Warning 2 weeks in advance

PROPOSED SOLUTIONS

INTER-BASIN WATER TRANSFER

GROUNDWATER EXPLORATION

INCREASE SURFACE WATER STORAGE

RAINFALL HARVESTING

RE-CYCLE WATER

LOW HEAD BARRAGE

DESALINATION

NAWABS OUTPUTS

WATER ACCOUNTING

OPTION AVAILABLE FOR WATER RESOURCES

WATER AVAILABILITY

WATER PRIORITIZATION AND DEMAND MANAGEMENT OPTIONS

WATER ALLOCATION

WATER STORING AND RELEASING DURING HIGH & LOW FLOW

WATER QUALITY (SALINITY, SEDIMENT TRANSPORT AND TURBIDITY)

WATER RESOURCES INDEX (WRI) AND DROUGHT INDEX (DI)

WATER AUDITING

OPERATION MODE

OPTION 1

SURFACE FLOW

OPTION 2

SURFACE FLOW + STORAGE PONDS

OPTION 3

SURFACE FLOW + STORAGE PONDS + GROUNDWATER

OPTION 4

SURFACE FLOW + STORAGE PONDS + INTERBASIN/CHANNELLING + GROUNDWATER

ALTERNATIVE FOR WATER RESOURCES SOLUTION INFRASTRUCTURE

Groundwater Storage

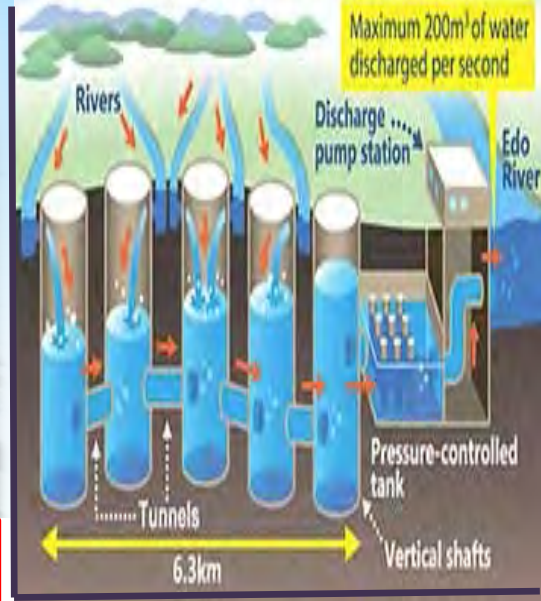


Rainfall Harvesting

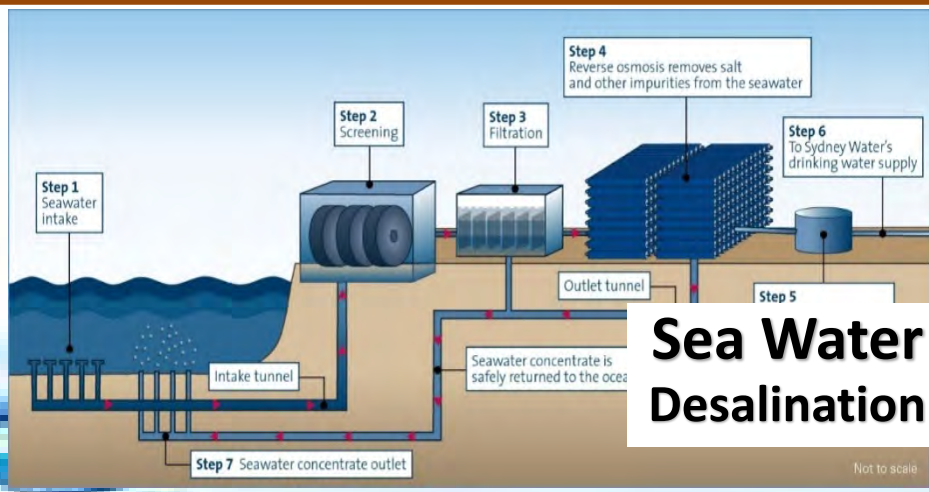


Low Head Barrage

Mechanism of Metropolitan Area Outer Underground Discharge Channel



Re-Cycle Water



Sea Water Desalination

NAWABS AS A MANAGEMENT TOOLS FOR ACHIEVING SELECTED SDGs

- National Water Balance System (NAWABS) born directly from vision of **NWRP** and directly addresses SDG 6 and particularly Target No 5
- Supports the remaining Goal 6 targets as well as many other SDG targets
- NAWABS proposed as comprehensive **Integrated Water Resource Management (IWRM)** instrument implemented at **river basin level**
- Drainage and Irrigation Department is the implementing agency for NAWABS



NAWABS AS A MANAGEMENT TOOLS FOR ACHIEVING SELECTED SDGs

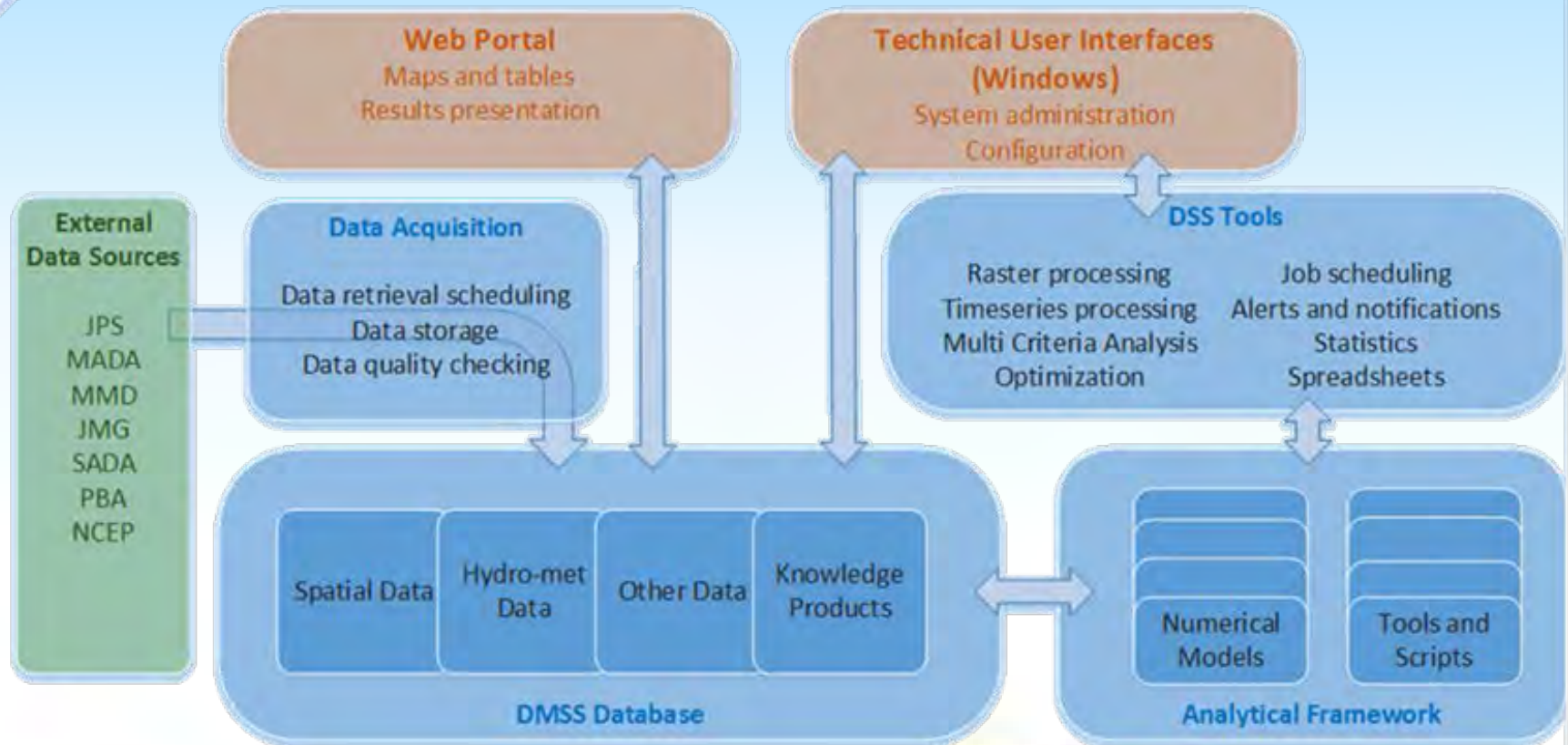
The NAWABS consists of the following key components:

1. Study of basin water balance; environmental flows; demand management options; water resources conservation plan and water-energy-food nexus
2. Numerical model of surface water resources and related infrastructures (dams, barrages, etc.)
3. Numerical model of groundwater resources (including interaction with surface water resources)
4. Database of model results as well as links to external data sources
5. Decision Management Support System and associated DSS Tools
6. Web portal for dissemination of key outputs of NAWABS



NAWABS AS A MANAGEMENT TOOLS FOR ACHIEVING SELECTED SDGs

Integration of NAWABS Components



NAWABS AS A MANAGEMENT TOOLS FOR ACHIEVING SELECTED SDGs

NAWABS has 9 key outputs, which related to SDG Indicators:

1. Water accounting – accounts for all the water entries, exits, and losses within the Sungai Muda basin, and selected sub-basins. It reports in sets of daily, weekly, monthly, seasonal, and annual hindcasts and forecasts. **SDG Indicator 6.1.1, 6.4.1 and 6.5.1.**
2. Water availability – accounts for water availability in terms of volume at selected river stages and demands points. It also accounts for future demands at specific points. **SDG Indicator 6.4.2**
3. Water quality – captures all key water quality parameters including salinity, chloride, suspended sediments, turbidity, pH, temperature as well as flow parameters to determine water quality threshold limits, total maximum daily load, and environmental flow compliance. **SDG Indicator 6.3.2, 6.4.2 and 6.5.1**



NAWABS AS A MANAGEMENT TOOLS FOR ACHIEVING SELECTED SDGs

NAWABS has 9 key outputs, which related to SDG Indicators:

4. Water storages – computes imminent storm event and dry flow periods from analysis using RHN rainfall records, Met Malaysia’s forecasted climate data, and NAHRIM forecasted data. It also provides advisory options to Water Resources Managers on timing and amount of releases from dam and reservoirs, and ground water abstractions. **SDG Indicator 6.4.2 and 6.5.1**
5. Water and drought resources index – forecasts in terms of WRI and DI on a daily, weekly, monthly, quarterly, and yearly basis for the entire basin and selected sub-basins. **SDG Indicator 6.4.2 and 6.5.1**
6. Water audits – performs auditing functions on all aspect of the (movement of) water resources within the Basin and selected sub-basins on a weekly, monthly, quarterly, and yearly basis. **SDG Indicator 6.4.2**



NAWABS AS A MANAGEMENT TOOLS FOR ACHIEVING SELECTED SDGs

NAWABS has 9 key outputs, which related to SDG Indicators:

7. Water allocation - assists the Water Resources Manager on setting appropriate water allocations based on forecasted water availability. **SDG Indicator 6.5.1 and 6.5.2**
8. Alternative demand options - account for all demand from various users (current and future), all water availability, climate changes, and it updates on a monthly basis. **SDG Indicator 6.5.1**
9. Water priorities - recommends decisions on prioritization options based on priorities under ordinary and critical conditions, that will assist the Water Resource Managers in making those decisions only if there is a negative water balance. **SDG Indicator 6.5.1 and 6.B.1**





Case Study : Muda River Basin

Case Study: Sg Muda Basin

- Inter Jurisdictional River
- Catchment Area 4,200 sq. km
- More than 90% of basin is in Kedah

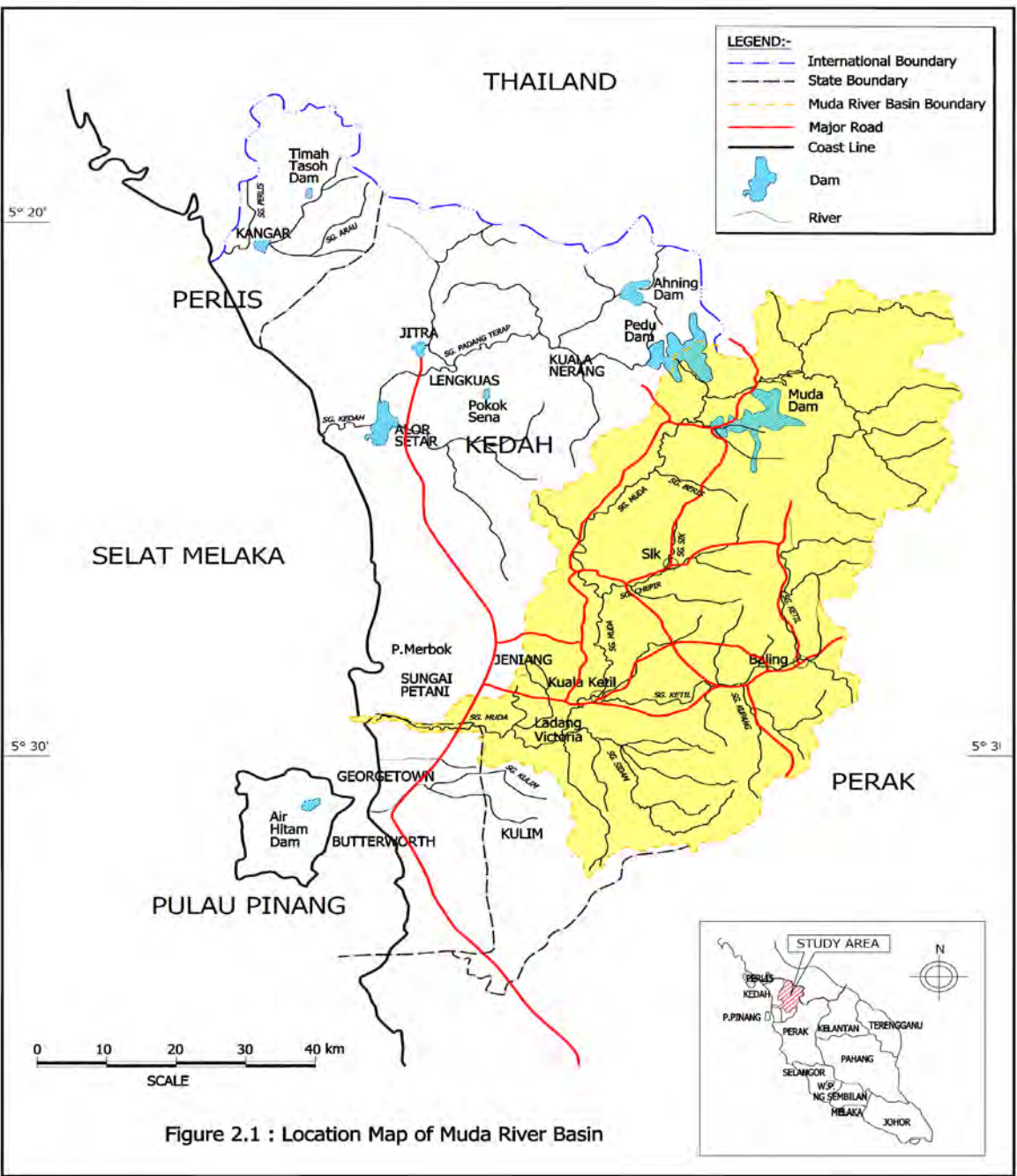


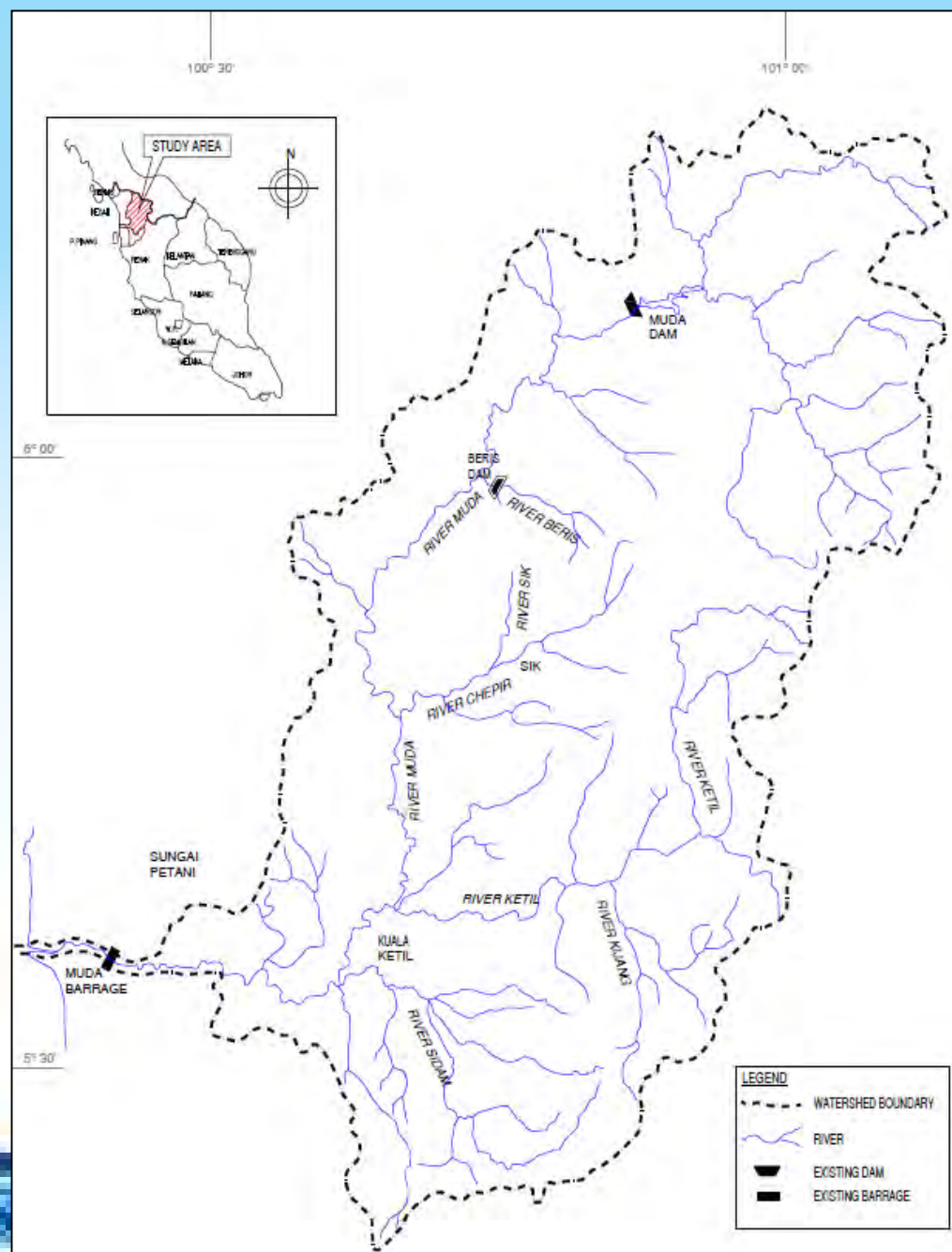
Figure 2.1 : Location Map of Muda River Basin

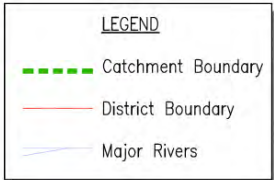
Case Study: Sg Muda Basin

STUDY AREA

River System

- Length 180 km
- Width near river mouth about 300m
- Width at Pinang Tunggal about 150m





STUDY AREA

District and Population

- Baling and Sik districts are totally within the Sg Muda Basin
- Towns – Baling Sik and Kuala Ketil
- Estimated Basin Population 685,260
- Population density of 163 persons/km²

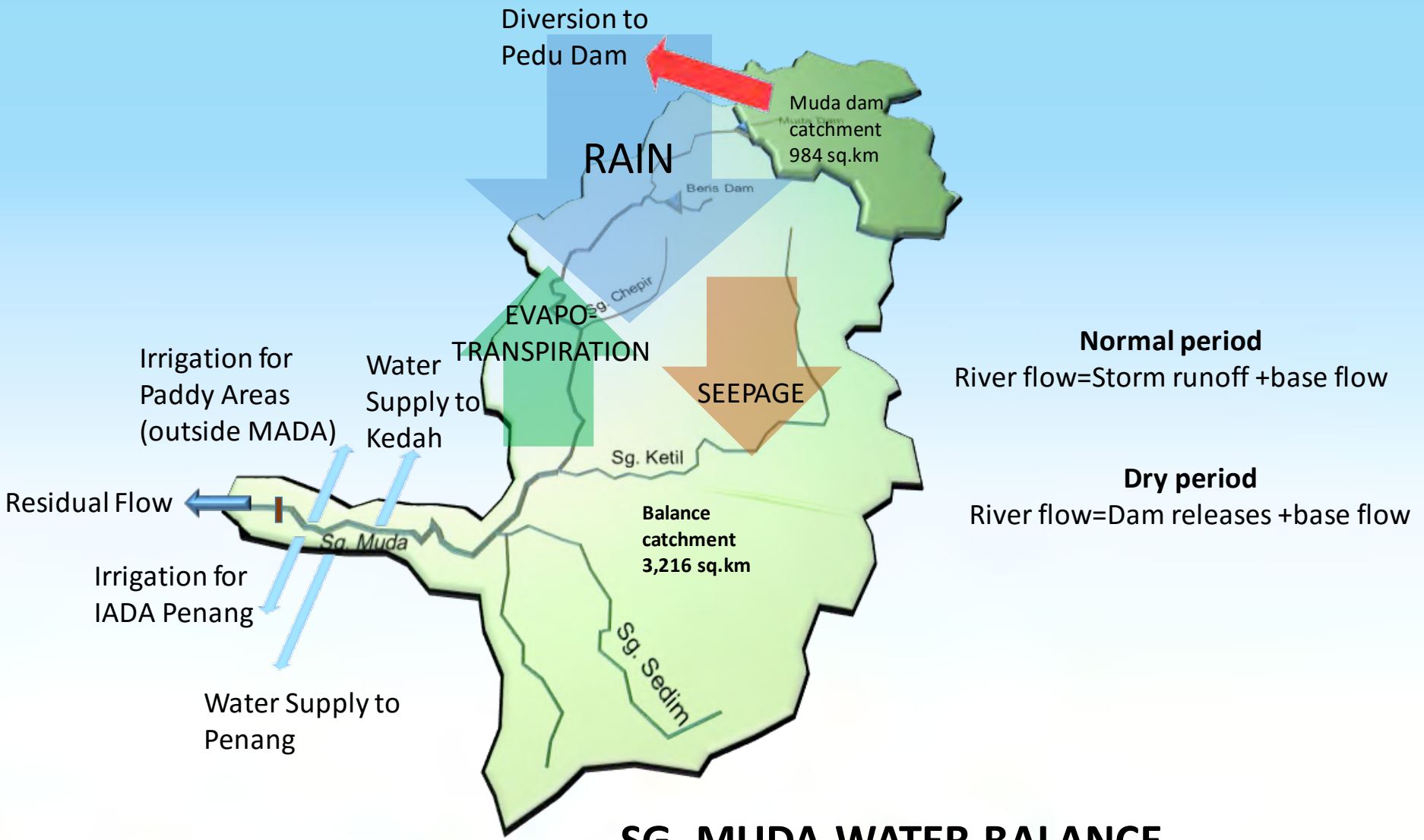
Note: Sg Klang Pop density around 3,000 persons/km²

ISSUES

1. During dry season, releases from Beris Dam is presently not fully optimized leading to occasional partial loss to the sea
2. Increased competition among abstractors will cause conflict if not administered properly based on informed decision
3. PLSM (DID Muda River Basin Office which manages the dam and Muda River Barrage) cannot give proper advice on related developments due to lack of tool for medium and long term operational planning
4. PLSM cannot give detailed technical advice in handling of drought and handling of allocations

NAWABS PROJECT AIMS TO FACILITATE PLSM TO HANDLE THESE ISSUES

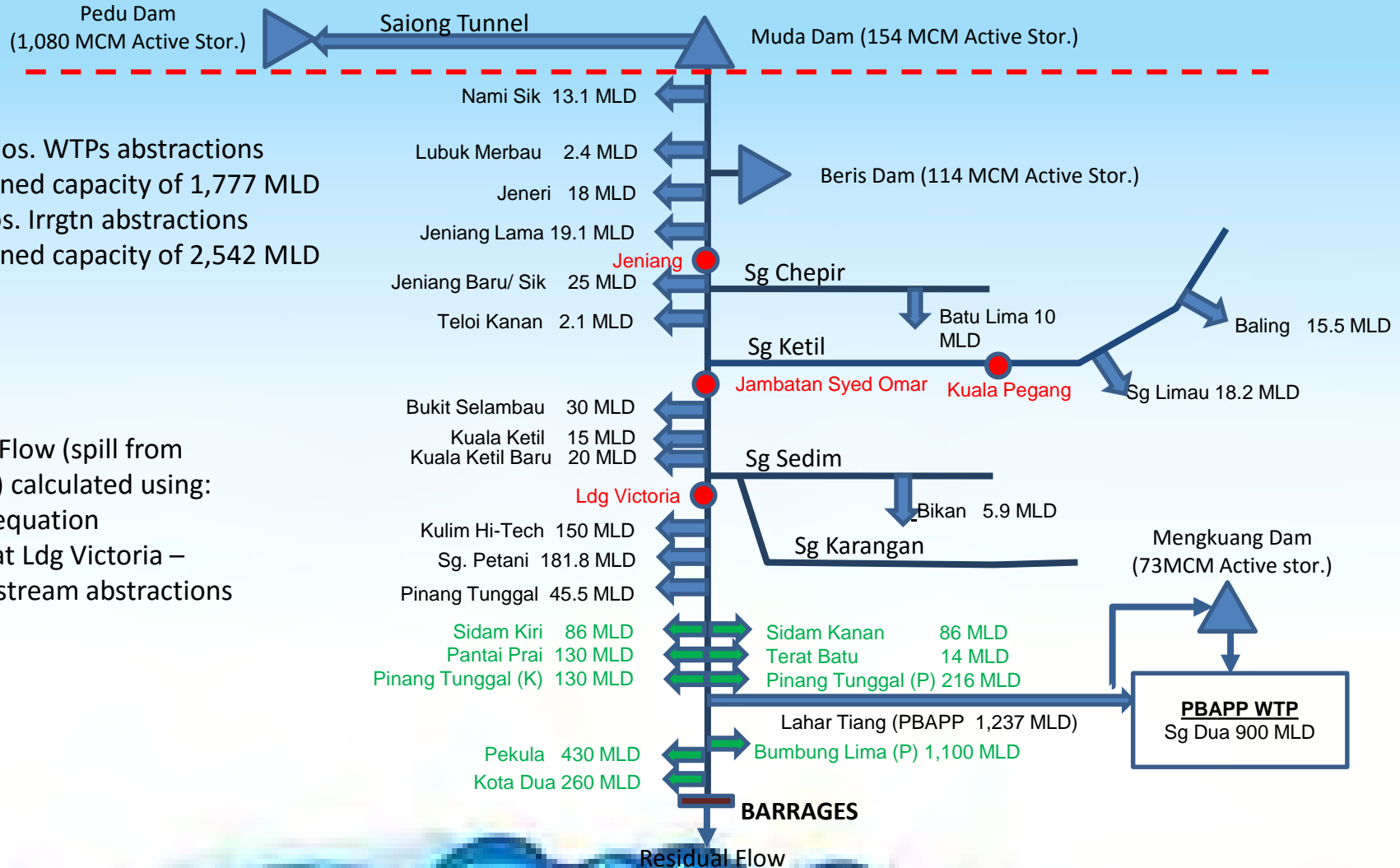




SG. MUDA WATER BALANCE



SG. MUDA SYSTEM DIAGRAM



Total 17 nos. WTPs abstractions

- Combined capacity of 1,777 MLD

Total 9 nos. Irrgtn abstractions

- Combined capacity of 2,542 MLD

Residual Flow (spill from Barrages) calculated using:

- Weir equation
- Flow at Ldg Victoria – downstream abstractions

AVERAGE ANNUAL WATER RESOURCE AVAILABILITY AND UTILIZATION

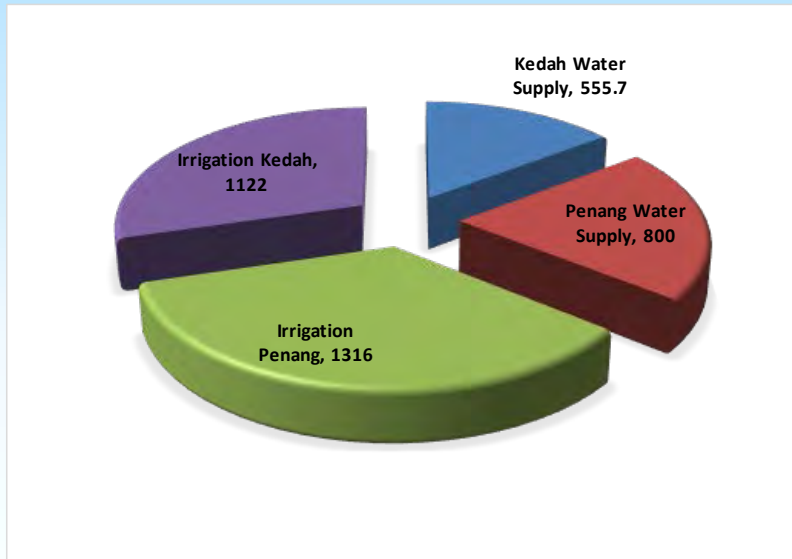
Annual Rainfall	2.35m/yr	
Annual Evapotranspiration	1.60m/yr	
Annual Seepage to Ground	0.15m/yr	
Annual Runoff	0.60m/yr	
Total runoff over 3,226 sq km	1,935.6MCM	per year
Average runoff	5,303.0MLD	
Utilization for Water Supply	1,357.7MLD	25.7%
Utilization for Irrigation	2,438MLD	46.1%
Total Utilization	3,795.7MLD	71.6%
Balance (residual flow)	1,490.9MLD	28.4%

Note: Including the runoff and utilization from Muda Dam catchment, increases utilization to 78%.



WATER DEMAND ESTIMATES

OVERALL DEMAND



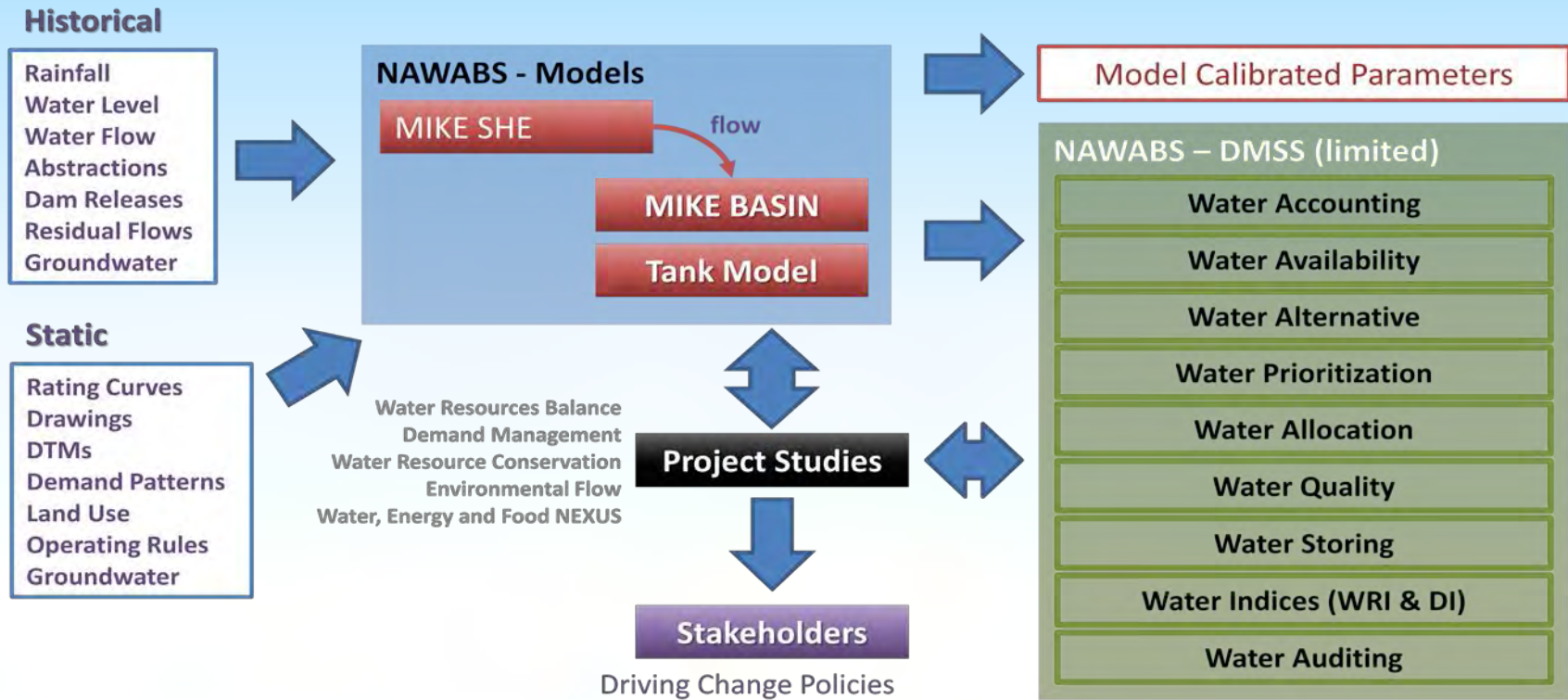
DEMAND WITHIN SG MUDA BASIN



Kedah Water Supply	555.7	MLD
Penang Water Supply	800	MLD
Irrigation Penang	1,316	MLD
Irrigation Kedah	1,122	MLD
TOTAL	3,793.7	MLD

Kedah Water Supply	225 MLD
Penang Water Supply	10 MLD
Irrigation Penang	100 MLD
Irrigation Kedah	300MLD
TOTAL	635 MLD

MUDA BASIN NAWABS STRUCTURE



FUTURE MANAGEMENT SCENARIOS

1. Demand management: adjustment to water tariffs to control per capita water consumption, allocation system to limit water usage for non-drinking purposes during drought conditions
2. More effective water usage: reduction of non-revenue water (NRW), irrigation efficiency improvements
3. Improved operational rules: development of standard operation procedures to optimize releases from Beris Dam and to minimize spills from barrage during dry conditions
4. Increased water storage: off-stream impounding, Tawar-Muda Dam (100 MCM active storage), transfer from Perak (Rui Dam).

Note: Tariff should cover both raw water and treated water





Conclusion

CONCLUSION

1. UN 2030 Sustainable Development Goals (SDG), signed by 193 countries in Sep 2015, has set international agenda for improving how humans interact with environment and each other
2. Water is a central theme to many of the SDGs
3. Water security is directly linked to 9 SDGs and associated targets.
4. Malaysian Water Security requirements are fully consistent with UN SDGs.
5. National Water Balance System (NAWABS) born directly from vision of NWRP and directly addresses SDG 6.
6. NAWABS is a comprehensive Integrated Water Resource Management (IWRM) instrument implemented at river basin level.



CONCLUSION (cont.)

7. NAWABS will facilitate coordinated planning approach to water resources development as well as provide river basin managers with a means to more effectively operate river basin in short to medium term.
8. NAWABS is being developed for the Muda Basin as a pilot
9. Outputs of the NAWABS are related to several SDG 6 targets and indicators.
10. NAWABS will be rolled out for other basins in the future
11. Seen as a key management tool towards achieving Water Security of Malaysia and the SDGs.





Thank You



Klang Mosque, Klang Selangor