IRBM AND ECO-HYDROLOGY IN INTEGRATED LAKE BASIN MANAGEMENT

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Chair, ASM Water Committee, 2015 - 2017
Contents

• Lakes and rivers
• IRBM & Eco-hydrology in ILBM
• Moving Forward
LAKES AND RIVERS
Lakes and Rivers

Lakes as part of River Basin

- All water bodies in the watershed are connected to the entire environment
- Lake is only one element, involved in the hydrological cycle of the river basin
- Lake management and monitoring is only a part of river basin management and monitoring

Lakes differ from rivers as ecosystems

- Hydrological circumstances
- Thermal properties
- production/decomposition relations
- Sedimentation rate, sediments & instability of certain phenomena
- Lakes are almost closed systems.
  - Substances once introduced to the lake are permanently incorporated in the circulation
  - Only a part of them are removed, depending on water exchange rate
- Rivers are open system, with constant downstream transport of substances taking place
Lakes and reservoirs

• Contain > 90% of global fresh water

• Lakes and their surrounding basins are a single mutually interacting management unit

• ILBM (Integrated Lake Basin Management) integrates governance, policies, participations, technologies, knowledge and information & finance
IRBM & Eco-hydrology in ILBM
• **Ecology** ..... *the relations of organisms to one another and to their physical surroundings.*

• **Hydrology** ..... *the properties of the earth's water, especially its movement in relation to land.*

• **Eco-hydrology** ..... *interdisciplinary field studying the interactions between water and ecosystems*

• **Ecosystem** ..... *a biological community of interacting organisms and their physical environment.*
Integrated Water Resources Management, (IWRM)

Implementation Unit – IRBM
(Integrated River Basin Management)
Integrated Water Resources Management (IWRM)

• A process which
  – promotes the coordinated development and management of water, land and related resources
    • to maximise the resultant economic and social welfare in an equitable manner
    • without compromising the sustainability of vital ecosystems”
.....builds on river basin management

- from both water quantity and water quality perspective
THE BIG PICTURE for IWRM

- Previous focus – the sciences – enabling environment, institutional roles and management instruments
- IWRM requires a cross-sectoral, multi-level approach

**Components**
- IWRM – Integrated Water Resources Management
- IRBM – Integrated River Basin Management
- IFRM – Integrated Flood Risk Management
- AWM – Agriculture Water Management
- UFWM – Urban Flood Water Management
- DRR – Disaster Risk Reduction
- CCIA – Climate Change Impact Adaptation, Storm water management, Urban water management, etc.
Transforming Our World through SDGs

https://sustainabledevelopment.un.org/?menu=1300

• The 2030 Agenda for Sustainable Development
  – 17 Sustainable Development Goals
    • SDG 6 – Ensure availability and sustainable management of water and sanitation for all
    • SDG 13 – Take urgent Action to combat climate change and its impacts
The River Basin

- Rain
- Deforestation
- Landfill
- Erosion/landslides
- Open defecation
- Water supply
- Sanitation
- Agriculture
- Aquaculture
- Factories
- Housing
- Flood mitigation
- Barrage
- Recreation
- Groundwater
International River Basins of Asia
Major River Basins of Mainland East Asia
189 River Basins Management Units (RBMU) in Malaysia

Malaysia - 330,000 km²
Average Annual Rainfall 1500mm to 4500 mm

Klang River Basin
1280 km²

Kelantan River Basin

SARAWAK - RIVER BASINS
For development planning purposes, the state of Sarawak is divided into 21 major river basins.
River Basins in Labuan

LEGEND:
- Project Boundary
- Sub-Basin Boundary
- SB01-Sg Bt Manikar
- SB02-Sg Lada
- SB03-Sg Belukut
- SB04-Sg Buton
- SB05-Sg Kina Benuwa
- SB06-Sg Keling
- SB07-Kg Rancha Rancha
- SB08-Sg Bt Arang
- SB09-Sg Gersik
- SB10-New Victoria
- SB11-Sg Nagalang
- SB12-Sg Tg Aru
- SB13-Sg Ganggarak
- SB14-Kubong Bluff
- Satellite Islands

Source: IES in Labuan (Draft Report, 2009)
Langat River Basin - Tributaries & Catchments
Putrajaya Catchment, Sg Chuau Catchment, is a tributary of Langat River System

From: Perbadanan Putrajaya
Pahang River Basin

- SAB Dam
- Tasik Chini
- Tasik Bera
The “cascading” Perak river systems
Sg Kurau River Basin
Asian Lake Basins

Lake Dianchi is facing many challenges:

having important implications to others lakes in the world!

M. Nakamura, RCSE Shiga University, Chairman ILEC Scientific Committee
Lake Tonle Sap
Aral Sea - Shrinking

Figure 2: Landsat satellite imagery mosaics showing visible changes of the Aral Sea. Source: USGS/NASA; visualisation by UNEP/GRID-Sioux Falls.

http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=108
River Basins of the Aral Sea

Figure 1: The Aral Sea Basin. Map compiled from: Gaybullaev et al., 2012; Micklin, 2007; Landsat satellite imagery from USGS/NASA; Digital Elevation Model from USGS EROS; visualisation by UNEP/GRID-Sioux Falls.

http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=108
MOVING FORWARD

Replication & upscaling
National Water Resources Policy
Awareness
ASM studies & publication
REPLICATION AND UPSCALING
Replication and upscaling

Putrajaya Lake Basin Management

Any upscaling?
  • Langat and Semenyih reservoirs, upstream?
  • Bukit Merah Reservoir?

DID One state, One river
Started in 2002

Any success stories to share?

Replication

• As we replicate, we upscale
  – How far have we replicated

• What are the major challenges
  – State/federal dichotomy?
  – Governance issues?
  – too pre-occupied elsewhere?
  – Not important enough for national economic development?
  – Financial and human resources?
  – Understanding of the concept?
  – Awareness?
NATIONAL WATER RESOURCES POLICY
The security and sustainability of water resources shall be made a national priority to ensure adequate and safe water for all, through sustainable use, conservation and effective management of water resources enabled by a mechanism of shared partnership involving all stakeholders.
NWRP 2012 - Policy Principles

• Water Resources Security
  Water resources must be secured to ensure their availability to meet the needs and demands of both man and nature, through optimization of their potential and minimization of damaging impacts.

• Water Resources Sustainability
  Water resources are the catalyst for environmental wellbeing and national development, therefore they should be sustained for present and future uses and the Federal and State Governments will look at minimizing wastage of water resources. It also opens up the opportunity to explore the use of alternative sources, and aspects related to demand management.

• Collaborative Governance
  Stakeholder inclusiveness and collaboration is essential towards ensuring the security and sustainability of water resources as well as achievement of common goals towards addressing multiple resources governance concerns and priorities.
## NWRP 2012 – Guiding Tenets

<table>
<thead>
<tr>
<th>Tenet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water for People:</strong></td>
<td>All to have access to adequate and affordable water supply, hygiene and sanitation</td>
</tr>
<tr>
<td><strong>Water for Food and Rural Development:</strong></td>
<td>Provision of sufficient water that will ensure national food security and promote rural development</td>
</tr>
<tr>
<td><strong>Water for Economic Development:</strong></td>
<td>Provision of sufficient water to spur and sustain economic growth within the context of a high income economy</td>
</tr>
<tr>
<td><strong>Water for the Environment:</strong></td>
<td>Protection of the water environment to preserve water resources (both surface water and groundwater) and natural flow regimes, biodiversity and cultural heritage, along with mitigation of water-related hazards</td>
</tr>
</tbody>
</table>
### NWRP Integrated Approaches

#### PENDEKATAN BERSEPADU

DSAN akan meneruskan pendekatan sedia ada yang telah diterima pakai seperti:

- Pengurusan Sumber Air Bersepadu (IWRM)
- Pengurusan Lembangan Sungai Bersepadu (IRBM)
- Pengurusan Tasik Bersepadu (ILM)
- Pengurusan Zon Pantai Bersepadu (ICZM)
- Pelan Pengurusan Persisiran Pantai Bersepadu (ISMP)
- Pengurusan Banjir Bersepadu (IFM)

#### INTEGRATED APPROACHES

The NWRP will continue existing approaches that have been adopted such as:

- Integrated Water Resources Management (IWRM)
- Integrated River Basin Management (IRBM)
- Integrated Lake Management (ILM)
- Integrated Coastal Zone Management (ICZM)
- Integrated Shoreline Management Plan (ISMP)
- Integrated Flood Management (IFM)

Kesemua pendekatan akan membantu menstruktur amalan semasa ke arah tadbir urus sumber air yang lebih baik, dengan mengambil kira keunikan setiap pendekatan dalam menangani bencana. Kaedah yang digunakan dalam menterjemah pendekatan ini dan prinsip-prinsipnya telah diambil kira dan dinyatakan secara kolektif.

These approaches will help structure current practices towards better water resources governance, taking into consideration their unique application ranging from facilitating allocation to addressing hazards. The tools employed in translating the approaches as well as principles that guide them have been taken into account and reflected herein in a collective manner.
<table>
<thead>
<tr>
<th>Core Area 1</th>
<th>Thrust</th>
<th>targets</th>
<th>strategies</th>
<th>Action plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Resources Security</td>
<td>1. Water Intelligence</td>
<td>3, 1 to 3</td>
<td>5, 1 to 5</td>
<td>9, PTS1-PTS9</td>
</tr>
<tr>
<td></td>
<td>2. Water Resources Integrity</td>
<td>3, 4 to 6</td>
<td>5, 6 to 10</td>
<td>15, PTS10 –PTS24</td>
</tr>
<tr>
<td></td>
<td>3. Use of Alternative Water Res and Sources</td>
<td>1, 7</td>
<td>2, 11 &amp; 12</td>
<td>2, PTS25 &amp; PTS26</td>
</tr>
<tr>
<td></td>
<td>4. Water Related Disaster Risk Reduction, Preparedness &amp; Response</td>
<td>1, 8</td>
<td>2,13 &amp; 14</td>
<td>4, PTS27 –PTS30</td>
</tr>
<tr>
<td>Core Area 2</td>
<td>5. Criteria for WR Charactiisation</td>
<td>1, 9</td>
<td>1, 15</td>
<td>2, PTS31 &amp; PTS32</td>
</tr>
<tr>
<td>Sustainability</td>
<td>6. Conservation and Protection of WR &amp; Bodies, both Natural and Artificial</td>
<td>5, 10-14</td>
<td>7, 16 - 22</td>
<td>16, PTS33 - PTS48</td>
</tr>
<tr>
<td>Core Area 3</td>
<td>7. Stakeholder Inclusiveness &amp; Engagement</td>
<td>1, 15</td>
<td>2, 23 &amp; 24</td>
<td>6, PTS49- &amp; PTS54</td>
</tr>
<tr>
<td>Partnerships</td>
<td>8. Shared Water Resources Governance</td>
<td>1. 16</td>
<td>1, 25</td>
<td>7, PTS55 &amp; PTS61</td>
</tr>
<tr>
<td>Core Area 4</td>
<td>9. Capacity Building and Awareness</td>
<td>2, 17-18</td>
<td>3, 26 -28</td>
<td>9, PTS61 &amp; PTS69</td>
</tr>
<tr>
<td>Capacity Building and Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NWRP

• Very comprehensive, include ILM and
  ✓ 8 Ministries
  ✓ 17 policies
  ✓ 4 Core Areas
  ✓ 9 Thrusts
  ✓ 18 Targets
  ✓ 28 Strategies
  ✓ 69 Action Plans

• How do we move forward?
AWARENESS

PRIVATE AND PUBLIC PARTICIPATION
INFORMATION ACCESSIBILITY
Bukit Merah Reservoir Awareness
Tasik Merah Reservoir

believed to have high vegetation growth or sedimentation area
River Basins ..... 

Can we have river basin address?

<table>
<thead>
<tr>
<th>Area</th>
<th>No. Of Basin</th>
<th>Main Basin (&gt;80km²)</th>
<th>Small Basin (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peninsular Malaysia</td>
<td>1,235</td>
<td>74</td>
<td>1,161</td>
</tr>
<tr>
<td>Sabah</td>
<td>1,468</td>
<td>75</td>
<td>1,393</td>
</tr>
<tr>
<td>Sarawak</td>
<td>283</td>
<td>40</td>
<td>243</td>
</tr>
<tr>
<td>Total</td>
<td>2,986</td>
<td>189</td>
<td>2,797</td>
</tr>
<tr>
<td>Total Area</td>
<td>327,897.031</td>
<td>312,863.713</td>
<td>15,033.858</td>
</tr>
<tr>
<td>%Total Area</td>
<td>-</td>
<td>95%</td>
<td>5%</td>
</tr>
</tbody>
</table>

- Basin covers all area in Malaysia except islands (other than Pulau Pinang and Pulau Langkawi)
- Source: Register of River Basins In Malaysia (Phase II) by River Section
- Main River Basin: Basin area is more than 80km²
To understand the climate system - look at the land too - Prof Pavel Kabat, Netherlands

Studied studied climate change for almost 20 years
Started in early 1990s

- Initially climate change, focus on weather, atmosphere and the oceans
- Kabat and team conduct research both on basic aspects of the climate system – how the atmosphere functions and the interaction between land and land use – and on technologies to adapt to climate change
- Land and land use are essential to understanding how the climate system works.
- “...carbon is to a large extent captured on land; tropical forests, for example, play an important role in this.
- ...... carbon emissions are also mostly produced on land.
ASM – ACADEMY OF SCIENCES MALAYSIA
ASM (Akademi Sains Malaysia)

- Statutory Body formed on 1\textsuperscript{st} February 1995 under the Academy of Sciences Malaysia Act 1994
  - The President of ASM is appointed by the King

- Entrusted with the mandate
  - "Thought Leader" in the science, technology and innovation (STI) arena.

- Mission
  - "To Pursue, Encourage and Enhance excellence in the fields of Science, Engineering and Technology, for the development of the Nation and the benefit of Mankind".
Focus of ASM

• Six elements of critical resource namely:
  – Water, Energy, Health, Agriculture, Biodiversity and Emerging Technology (WEHABE), to
    1. deliver its programmes through a wide spectrum of expertise
    2. translates its mission into action
    3. focus on cross-cutting issues and problems

• An ASM Water Committee has been set up since 2008, in which a number of Task Forces have been formed
ASM Water Task Forces – Since 2008

- Lakes
- Groundwater
- Climate Change
- Integrated Water Resources Management
- Integrated River Basin Management
- Water Demand Management
- Water Supply and Sewerage Management
- Water and Agriculture Management
- Urban Water Management
- Research Needs in the Water Sector
- NKPA (National Key Priority Area) in the Water Sector
ASM IWRM Proposed 2016 Publication

• TRANSFORMING THE WATER SECTOR
  National Integrated Water Resources Management (IWRM) Plan: Strategies and Road Map
  – Tracing global and National Development of IWRM
  – Consolidating the works of ASM Water Committee 2008-2016
    • Summary Briefs of ASM Component Plan Studies by ASM Task forces in the various IWRM Sub-themes, such as lakes, groundwater, *etc see slide 6*
  – Complementary Expert Reviews,
    • Guest writers on topics not yet covered by the Task Forces such as
  – Road maps on strategies and action plans, to 2030
TERIMA KASIH