Challenges in the Flood Management in Thailand

Connective Cities international Dialogue Event on “Challenges of organizing flood management”
9-11 February 2015 in Cologne, Germany

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● Challenges in the Flood Management in Thailand
● FED Triangle : A new hope for Water Resources Management in the rural areas in Thailand.
Hydrologic Cycle in Thailand

- **Total Catchment Area**: 514,008 sq.km.
- **Average Rainfall**: 1,581 mm./year
- **Total Volume of Water**: 732,975 MCM./year
- **Evaporation and Infiltration**: 519,672 MCM/year
- **Surface Water**: 213,303 MCM/year
- **Storage**: 76,131 MCM
- **Groundwater Recharge**: 100,000 MCM/year
- **Groundwater Storage**: $1.13 \times 10^{12} \text{ m}^3$
- **Irrigation Area**: 60,480 sq.km.
- **Rain fed Agriculture Project**: 152,000 sq.km.
- **Average Water**: 3,413 cu.m./capita/year
25 River Basins in Thailand

1. Salawin  
2. Kong  
3. Kok  
4. Chi  
5. Mun  
6. Ping  
7. Wang  
8. Yom  
9. Nan  
10. Chaophraya  
11. Sakaekrang  
12. Pasak  
13. Thachin  
14. Maeklong  
15. Prachin  
16. Bangpakong  
17. Tonlesap  
18. Eastern Coast  
19. Petchburi  
20. Western Coast  
21. Eastern South Coast  
22. Tapee  
23. Songkla Lake  
24. Pattani  
25. Western South Coast
27 GW Basins

- Storage 1.13 MMCM
- Annual Recharge 101,000 mcm/year

(Department of Groundwater Resources)
Water Shortage for Domestic & Consumption Purposes

Water Problems

- Upstream Degradation
- Waterway Encroachment
- Insufficient Water For Industry
- Water Quality Degradation
- Wetlands Degradation
- Flood
- Drought
- Wetlands Degradation
Hydrogeological Map or Groundwater Map of Thailand

Flood Plains

Bangkok
People and Nature

“Man to Water”
Growth of Bangkok and vicinity areas


“Water to Man”
Chao Phraya River Basin

Flood Plain Area
35,000 Sq.Km

- Irrigated agricultural land and wetland - 80% - 5 million people
- Urban/commercial/industrial areas - 20% - 13 million people
- Flood can cause a lot of damages.

Source: Strategic Formulation Committee for Water Resources Management (SCWRM)
Causes of 2011 FLOOD

Unusual run off from August to October 2011 to Nakhon Sawan Province which maximum flow of 4,686 cm./s, volume of flow was 36,961 mcm. which was 9,890 mcm. more than volume in 1995 flood.

Water management : water resources development
2.1 capacity and potential of water resources development projects was not enough to cope with unusual run off.

2.2 water management tools eg. Sluice gate, drainage systems, pumps etc. which is a limitation of present situation but relevant to the past 50 years situation.
Time line of Flood Events in 2011

- **Tropical Storm Haima**
  - 24-26 Jun
  - Daily Rainfall: 350 mm/day
  - Flooded in Nakhon Phanom

- **Tropical Storm Nock-Ten**
  - 31 Jul
  - Flooded in 15 Provinces
  - Bhumibol 58% / Sirikit 64% / Pasak 105%

- **Typhoon HAITANG**
  - 27 Sep
  - Flooded in 24 Provinces
  - Bhumibol 63% / Sirikit 79%

- **Tropical Storm Nesat**
  - 1 Oct
  - Flooded in 24 Provinces
  - Bhumibol 93% / Sirikit 99%
  - Outlet of Bhumibol 300 MCM/day

- **Tropical Storm Nalgae**
  - 6-8 Oct
  - Flooded in 24 Provinces
  - Bhumibol 63% / Sirikit 79%
  - Saharatnakorn (5 Oct)

Low Pressure Areas
Rainfall in the North of Thailand

Accumulated Rainfall 2004 to 2011

Higher than Avg: 44.3 %

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg</th>
<th>2004</th>
<th>2006</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (m.m.)</td>
<td>1,220</td>
<td>1,191</td>
<td>1,500</td>
<td>1,184</td>
<td>1,379</td>
<td>1,760</td>
</tr>
<tr>
<td></td>
<td>-29</td>
<td>+280</td>
<td>-36</td>
<td>+159</td>
<td>+540</td>
<td></td>
</tr>
</tbody>
</table>
Rainfall in the Central Part of Thailand

Accumulated Rainfall 2004 to 2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg.</th>
<th>2004</th>
<th>2006</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (m.m.)</td>
<td>1,280</td>
<td>911</td>
<td>1,305</td>
<td>1,495</td>
<td>1,549</td>
<td>1,573</td>
</tr>
</tbody>
</table>

Higher than Avg: 22.9%
Status of 33 major Dams/Reservoirs

29 Nov 2011

Reservoir | Max Capacity (mcm) | Capacity (mcm) | %
---|---|---|---
33 | 70,157 | 64,363 | 92

- Reservior Max Capacity (mcm)
- Capacity (mcm)
- %

Inflow (mcm) | Discharge (mcm)
---|---
67.98 | 100.83

> 80% Capacity : 27
50 - 80% Capacity : 6

หมายเหตุ: เขียนแค่จำนวนเก็บกักน้ำปลายฤดูฝนปี 52
Runoff in Upstream Area of Chao Phraya River Basin

Nakhon Sawan Province

Runoff (cms.)

River capacity 3,500 cms.

2006
2011
Capacity

15 Sep
3 Oct
2011
2006
46 days
29 days
4,686 cms/13 Oct
5,960 cms/18 Oct
31 Oct
10 Sep
17 Oct
24 Oct
Oct
08 Nov
15 Nov
22 Nov
29 Nov
5 Nov

Time

2006
2011
Water Storage in Bhumibol Dam

- Max Water level 260.00 msl, Max. Capacity 13,462 mcm
- Min Water level 213.00 msl, Capacity 3,800 mcm

Upper Rule Curve
Lower Rule Curve

released water through spillway 200-300 MCM/day (October)
Water Storage in Sirikit Dam

Max Water level 162.00 msl, Max. Capacity 9,510 mcm
Min Water level 128.00 msl, Capacity 2,850 mcm

Upper Rule Curve
Lower Rule Curve

released water through spillway 70-150 MCM/day (August)
Tidal Effect
Downstream of Chao-Phraya River

**Peak period**
Major breaches of flood control infrastructure along Chao Phraya River
Damages and Losses

Affected: 66 provinces out of 77 provinces

Deaths: 780
Population affected: 13,595,192

Sector affected:
- **Infrastructures:** flood control, drainage & irrigation, transport, telecommunication, electricity, water supply
- **Productive sector:** agriculture, industry & commerce, tourism, financial and insurance
- **Social sector:** health, education, housing, cultural heritage, Environment

Total damages and losses: USD 45.5 billion

Total Damages
1.4 Trillion Baht
(WB estimate)
URGENT! : ANNOUNCEMENT
Due to this lane was flooded already, those waters who want to flow to the sea Please use the other way Otherwise you can not make it!  

( IAW : I’m Afraid of Water)
Challenges in the Flood Management in Thailand

Announcement of Water Resources as the National Agenda
21 May 2007
Strategies for 3 Basic Problems on Water Resources

1. Watershed protection and rehabilitation
2. Rehabilitation of water sources, waterway and wetlands
3. Development and improvement of water sources, drainage and diversion system
4. Land use management and flood protection in economic area
5. Improvement of agricultural patterns
6. Flood management and rehabilitation

1. Increase water supply
2. Water spreading
3. Increase efficiency of water supply system
4. Management

1. Water Law Legislation
2. Organizations reform on water resources
3. Other related law legislation
4. Capacity building of RBC
5. Establishment of Water Resources Management Organizations for normal and critical situations
6. National Water Resources Information Center
7. Water Resources Fund
8. Projects of Sustainable Water Resources Research
High Risk areas on flash flood and landslide in highland of Thailand

High risk villages

High risk villages with early warning station
Flood Risk Area in Urban Community and Economic Area

32 Cities (15 Groups)

1) Ping
2) Nan-Yom
3) Chiang Rai
4) Chaopaya-Thachin
5) Chanthaburi
6) Bangsapan
7) Mae Kong
8) Mun
9) Surat Thani
10) Chumporn
11) Nakonsitamrat
12) Had Yai
13) Yala
14) Takuapa
15) Trang

Inundated Areas
Proposed

Strategic Plan of Water Resources Management

By

Strategic Formulation Committee for Water Resources Management (SCWRM)
2014
To solve the problem of Water shortage for Industrial

1. Rehabilitation of Upstream Forest and Prevention of Erosion

2. To solve the problem of Water shortage for Domestic Use

3. To solve the problem of Water shortage for Agriculture

4. To solve the problem of Water shortage

5. Flood Prevention and Mitigation

6. Water Quality management

7. Management
1. Rehabilitation of Main Stream and Tributaries

2. Develop Diversion Channels

3. Flood Protection program for Major Cities and Economic areas

4. Improvement of City Planning

5. Preparation of the Retention areas for flood water
Proposed Projects

- Construction of Reservoirs in the Upper Zone
- Retention areas
- Diversion Channels: Chainat-Pasak and Pasak – Gulf of Thailand
- Dredging of Chao Phraya River
- Construction of by pass Diversion Channel, Bangban - Bamgsai
- Short-Cut Channel in Thachin River
- Diversion Channel and 3rd Ring Road
Urgent Diversion Plans

- Increase the Diversion Efficiency in Sukhothai Province
- Study of Flood Mitigation in Prachinburi River Basin
- Study of Flood Mitigation in the Eastern Part of Chao Phraya River basins
- Construction of Flood Protection in Hat yai
Control Gate at Anusartsanan Canal and Chainat Diversio
FED Triangle: A new hope for Water Resources Management in the Rural Areas in Thailand
Drought

Water shortage for Domestic Used
- w/o waterworks system
- Out of order
- With waterworks system

Water shortage for Agriculture

Legend:
- Green: 0 - 140
- Light Green: 140 - 300
- Yellow: 300 - 400
- Orange: 400 - 500
- Red: 500 - 1500
Water Quality

River Basins with critical water degradation

• Thachin
• Bang Pakong
• River mount of Chao Phraya
• Lower Lam Takong
• Songkhla Lake
• Mae Klong
FED Triangle
Linkages and Management of Water Resources

F(Flood)  D(Drought)  E(Environment)

FD Link  FE Link  DE Link

Social & Economic Problems
Water-Food-Energy Nexus

Chaiporn Siripornpibul, 2013
Management of Dual Water Sources

F (Flood)

D (Drought)

E (Environment)

+ Surface Water:
  • Dam, Reservoir, Retention area, etc
  • Rehabilitation

+ Groundwater:
  • Survey & Development
  • Artificial Recharge (AR) in the Wet period
  • Rain harvesting & AR

CUP (Conjunctive Water Use Program)
  + Concept of CUP
  + People participation: data, Capacity building,..

FED Triangle:
Linkages and Management of Water Resources

Chaiporn Siripornpibul, 2013
Conjunctive Use Pilot Project: Buriram province

Groundwater Drilling & Development
Pilot Project

Ban Sab Somboon,

Non Somboon District, Buriram Province
Groundwater Development for Agriculture, Suphanburi Province
Water Quality Control
• Polluted water
• Monitoring system
• Water Treatment
• Reservoirs operation
• …

FED Triangle:
Linkages and Management of Water Resources

Chaiporn Siripornpibul, 2013
F (Flood)  D (Drought)  E (Environment)

- Water Quality Monitoring and Treatment
- Salinity Control: Regulation of discharge rate from reservoirs

FED Triangle:
Linkages and Management of Water Resources

Chaiporn Siripornpibul, 2013
Heavily used of Groundwater In Chainat Province
Diagram of Artificial Recharge using Rain Water
Conclusion: Basic Concepts of Flood Management for Thailand

- Water storage control (reservoir/flood storage)
- Compensation plan for designated flood retention area
- Flood protection and preparedness plan for flood-prone area (community, economic, agriculture zone)
- Flood flow control (Stream network and floodways)
- Flood Mitigation and flood relief plans for flood-affected people
Thank You