

The background image shows a sunset over a flooded urban area. A bridge is visible in the middle ground, and several people are in small boats on the water. The sun is low on the horizon, creating a golden glow and reflecting on the water. The sky is a mix of orange and yellow.

Long Term Strategy for Flood Prevention and Mitigation in the Chao-Phraya River Basin

**Basic Concept for Chaophraya River Basin Flood Control Master Plan and Preparation
for next rainy season**

**Sub-Committee for Long Term Planning and Sustainable Solutions
Strategic Formulation Committee for Water Resources Management
(SCWRM)**

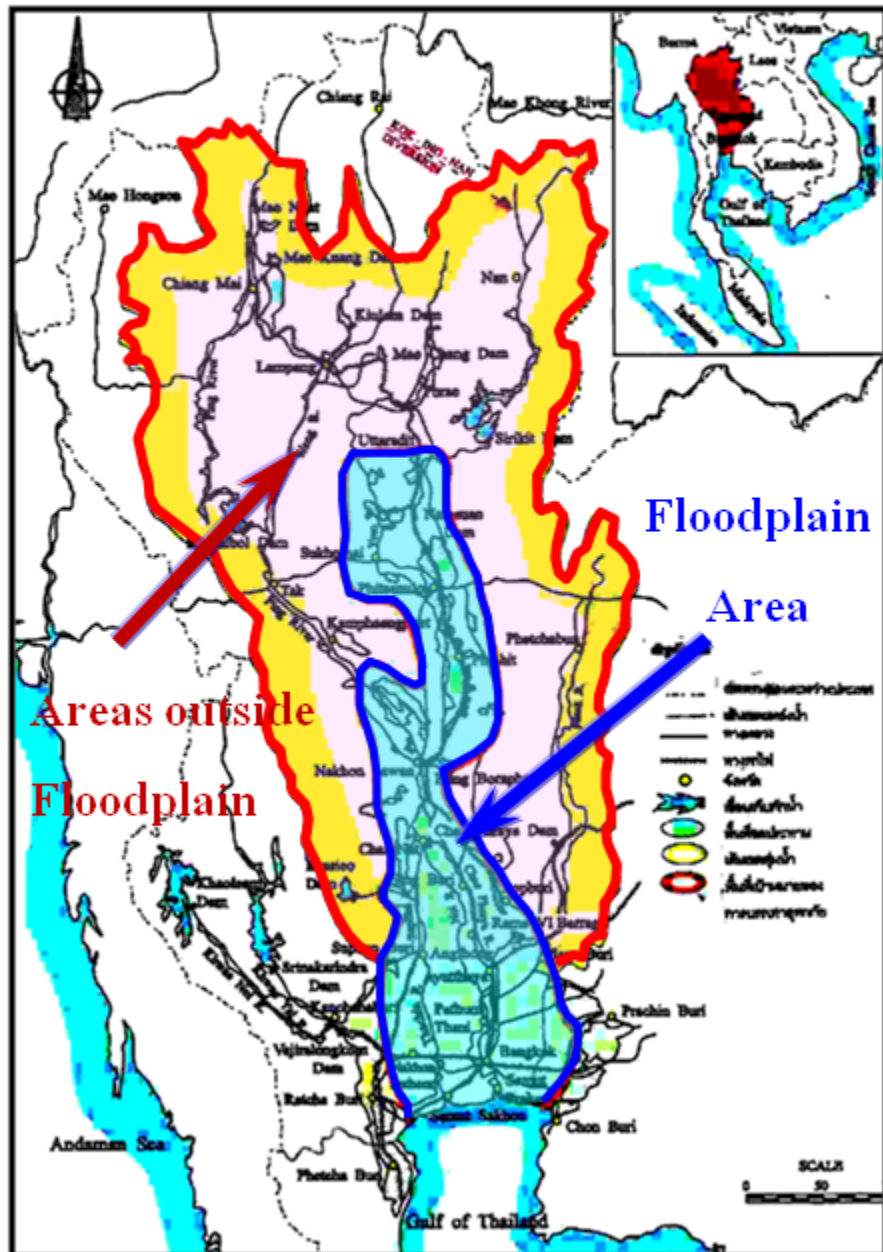
14 January 2012

Background

In the aftermath of the massive flood in 2011, the Sub-Committee for Long Term Planning and Sustainable Solutions, under the Strategic Committee for Water Resources Management (SCWRM), has prepared

- ❖ **Strategies, measures and plan of actions for flood prevention and mitigation in various river basins**
- ❖ **An investment Plan to implement such plan of actions**
- ❖ **Strategy to increase income and improve social security for people in agricultural, commercial and industrial sectors and to promote overall economic growth**
- ❖ **Strategy for sustainable water, land and forest resources management**

General Condition of Chao-Phraya River Basin: 158,000 km²

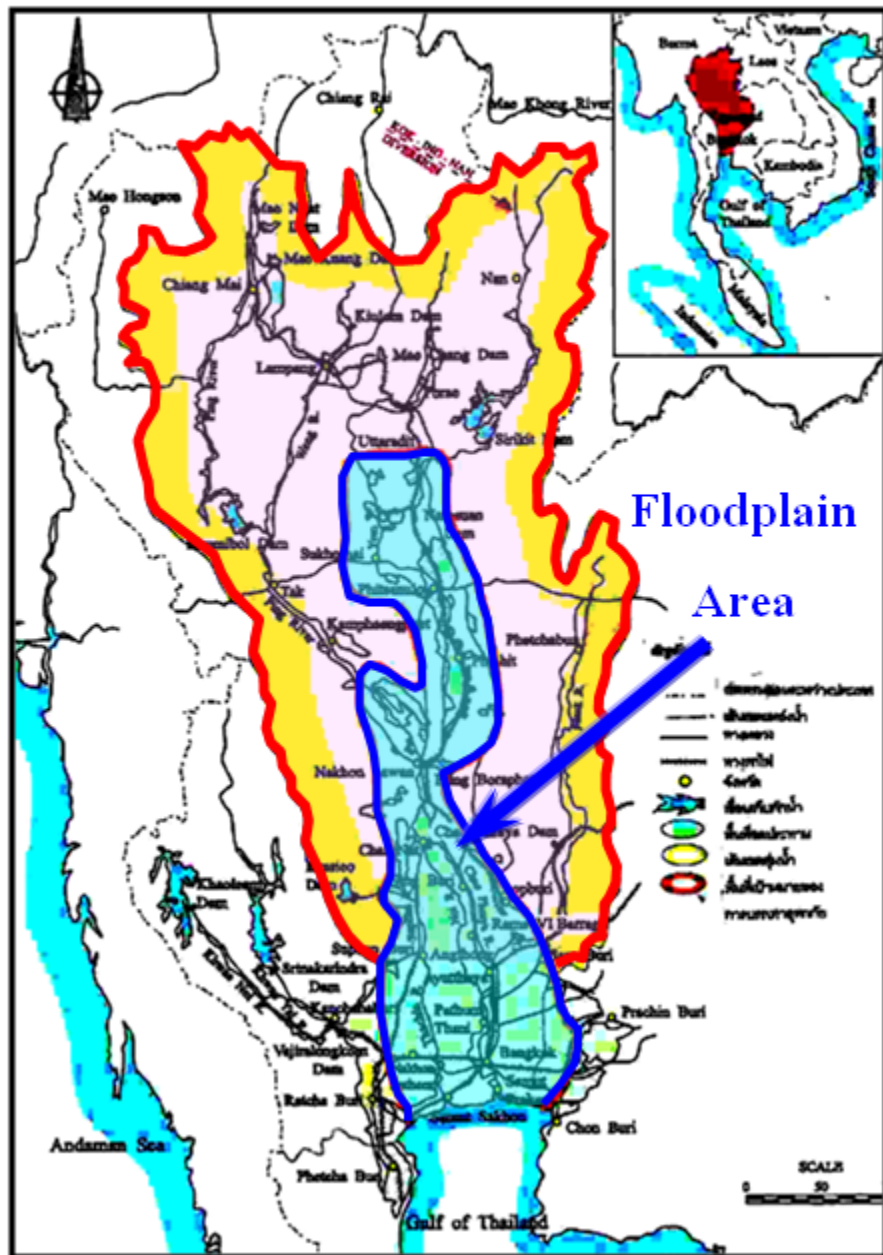


➤ Floodplain 35,000 km²

➤ Areas outside Floodplain
123,000 km²

➤ Population 25 million

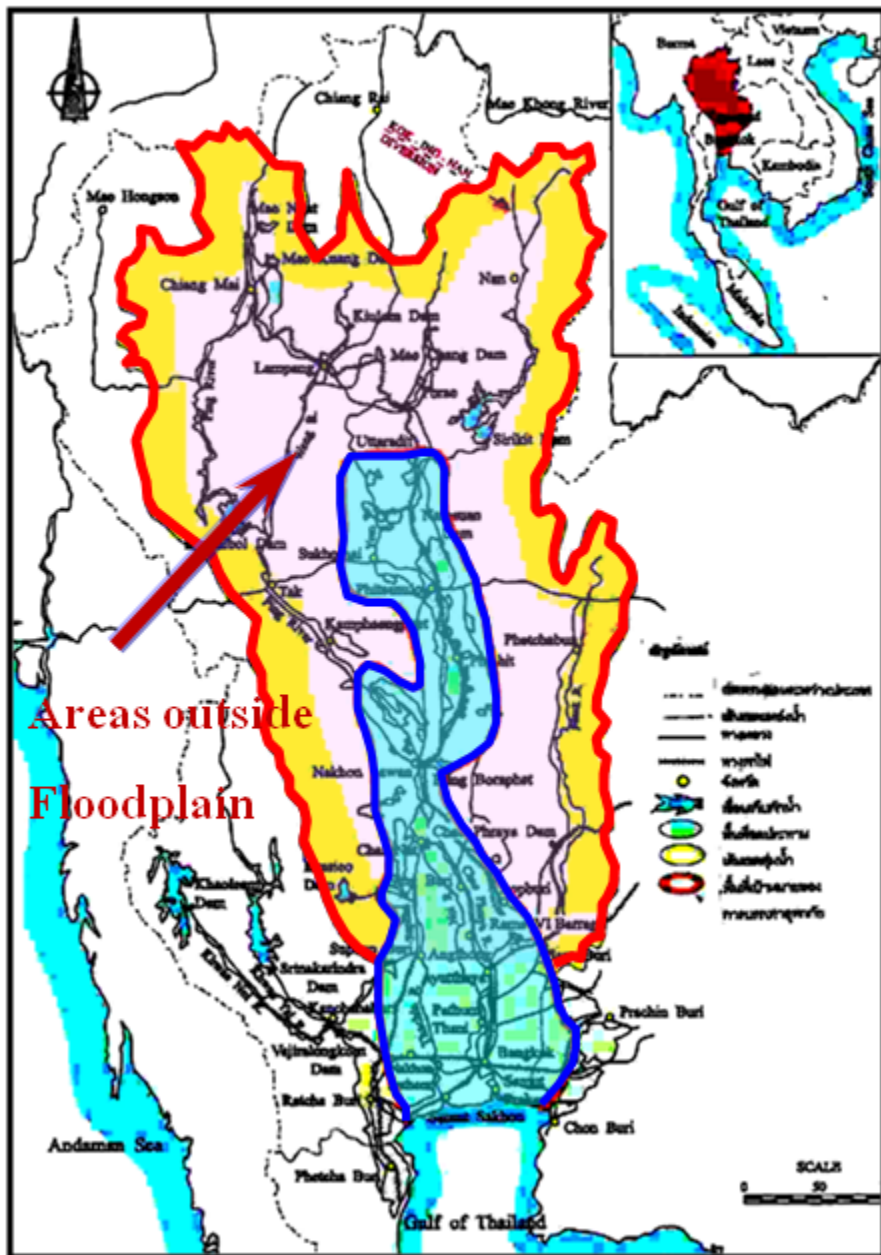
Floodplain 35,000 km²



Intensively utilized

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

Areas outside Floodplain 123,000 km²



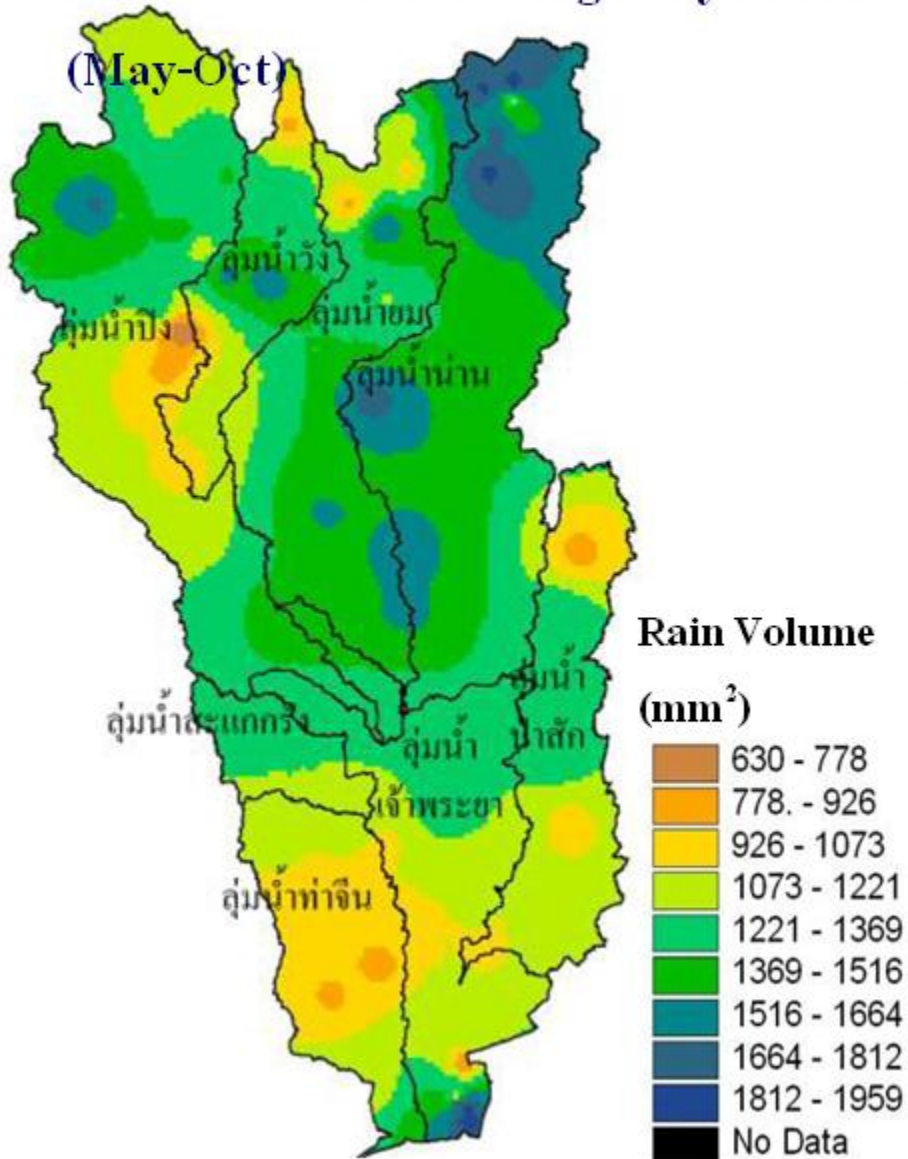
Less intensive utilization

- Mostly, forest and non-irrigated agricultural land
- Reservoirs
- Some urban/commercial /industrial areas
- 7 million people
- Less damages when flooded

Rain Volume in 2011

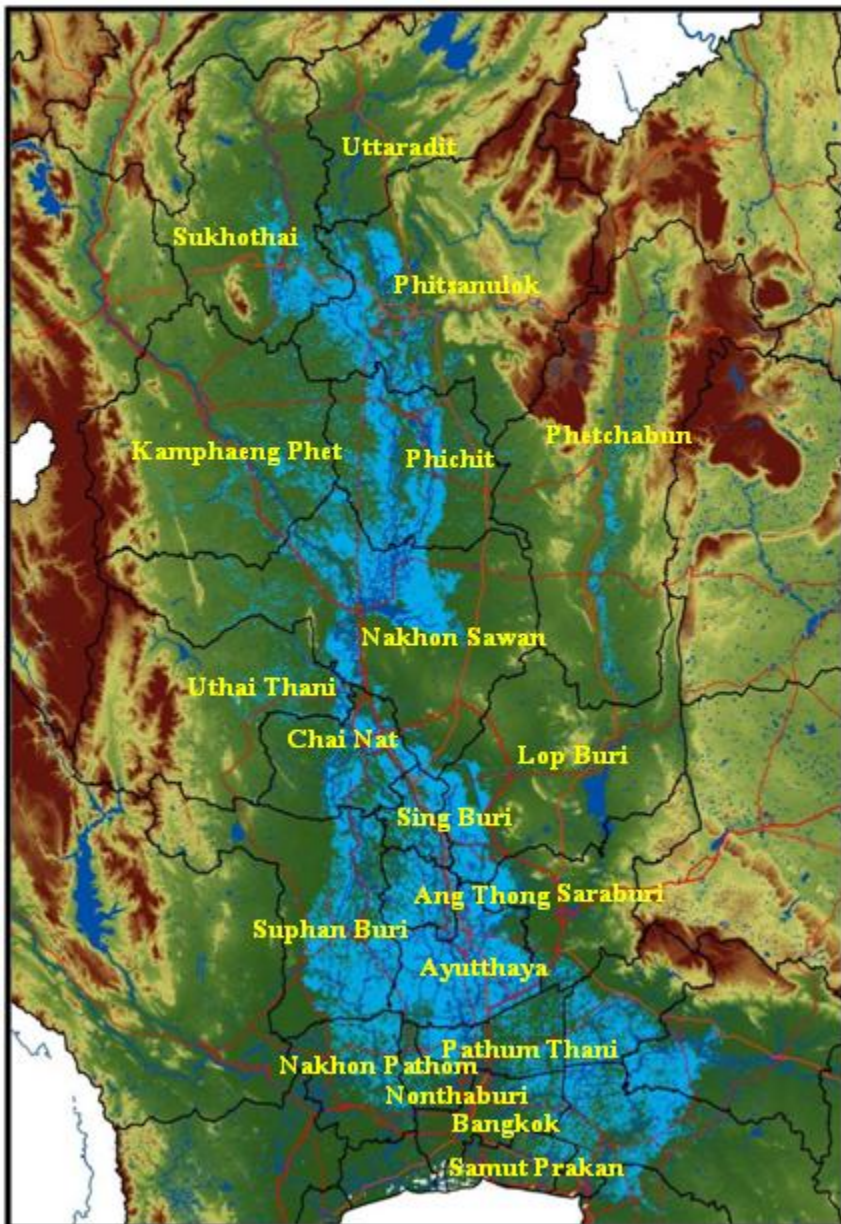
Accumulated rain during rainy season

(May-Oct)

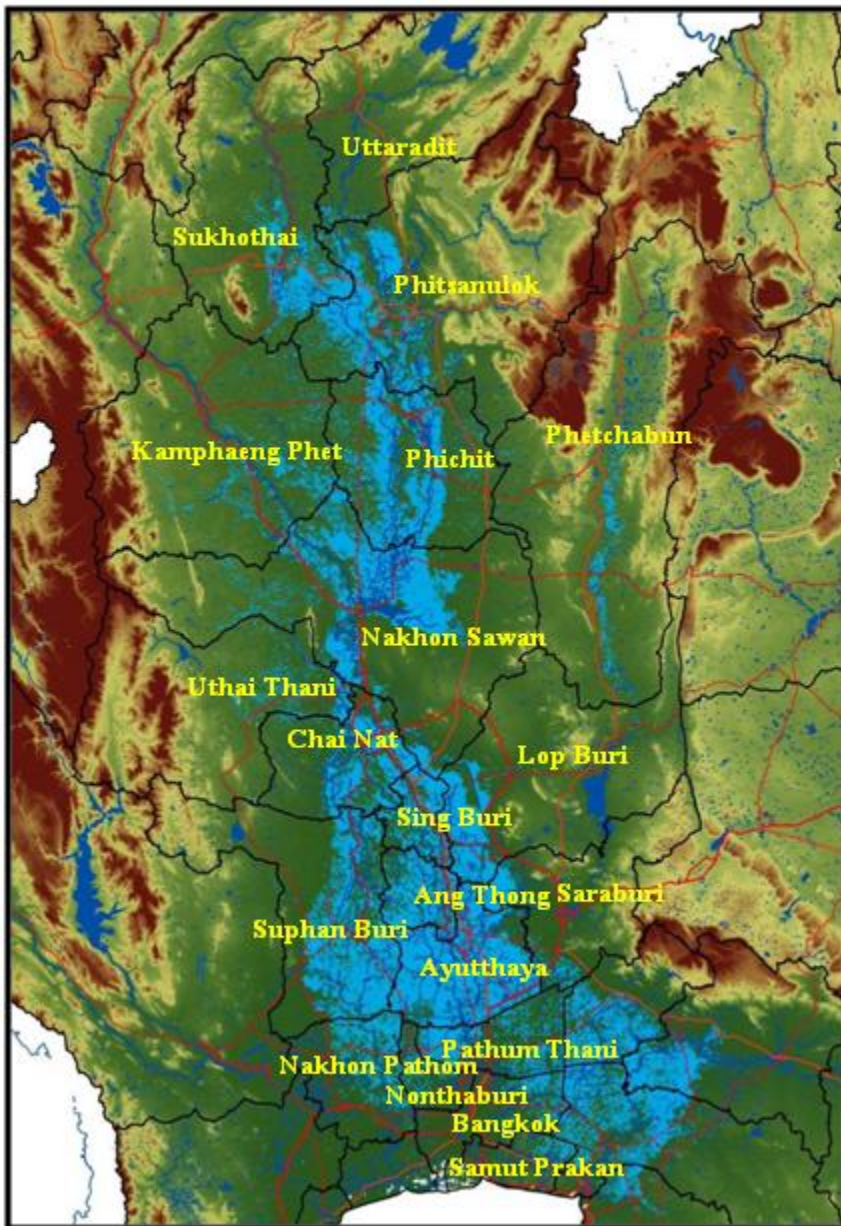


Month	Rainfall Dept in 2011 (mm.)		30 Year Average (mm.)	
	North	Central	North	Central
May	259	197	173	178
Jun	222	205	154	127
Jul	252	193	180	134
Aug	297	242	221	171
Sep	322	271	220	279
Oct	140	232	116	205
Total	1,492	1,340	1,064	1,094

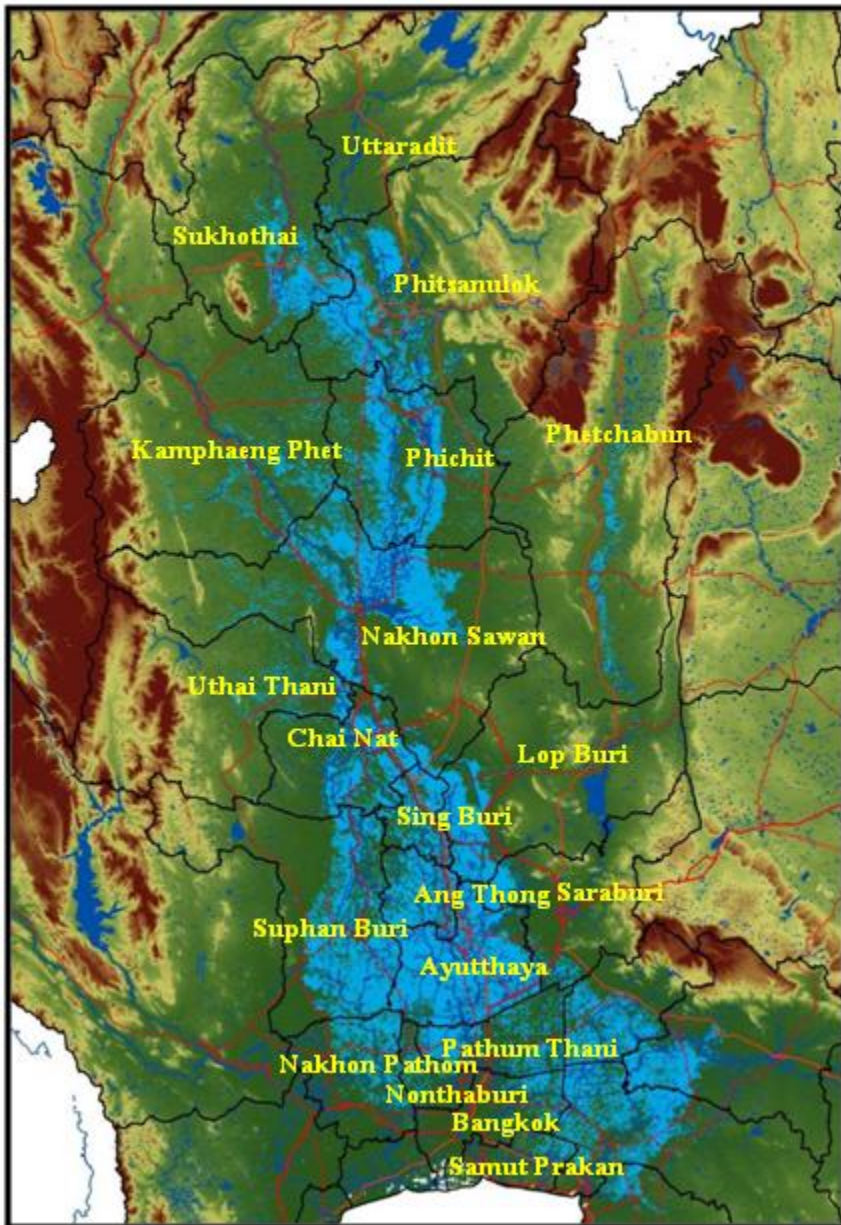
Flood in 2011: Rural/Agricultural Areas



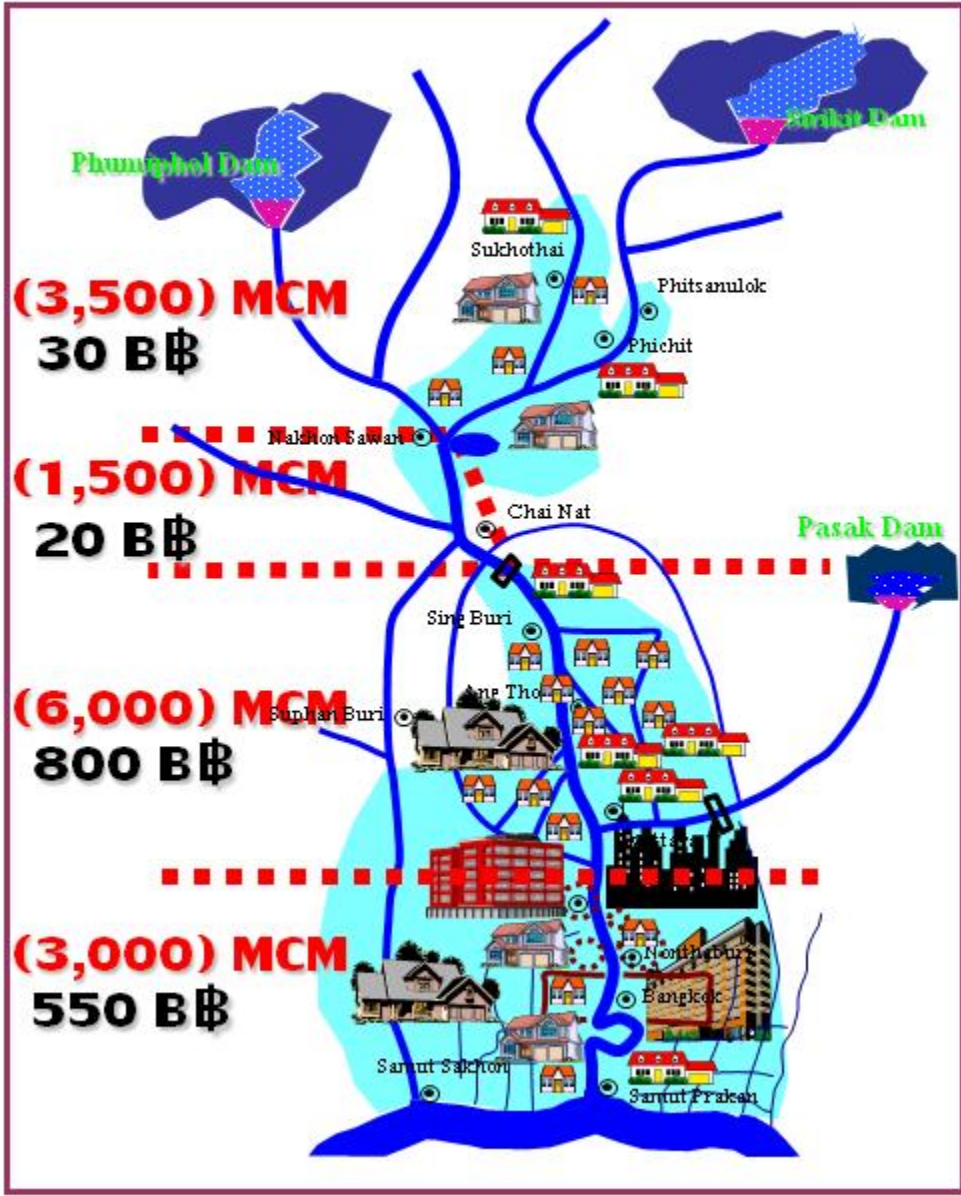
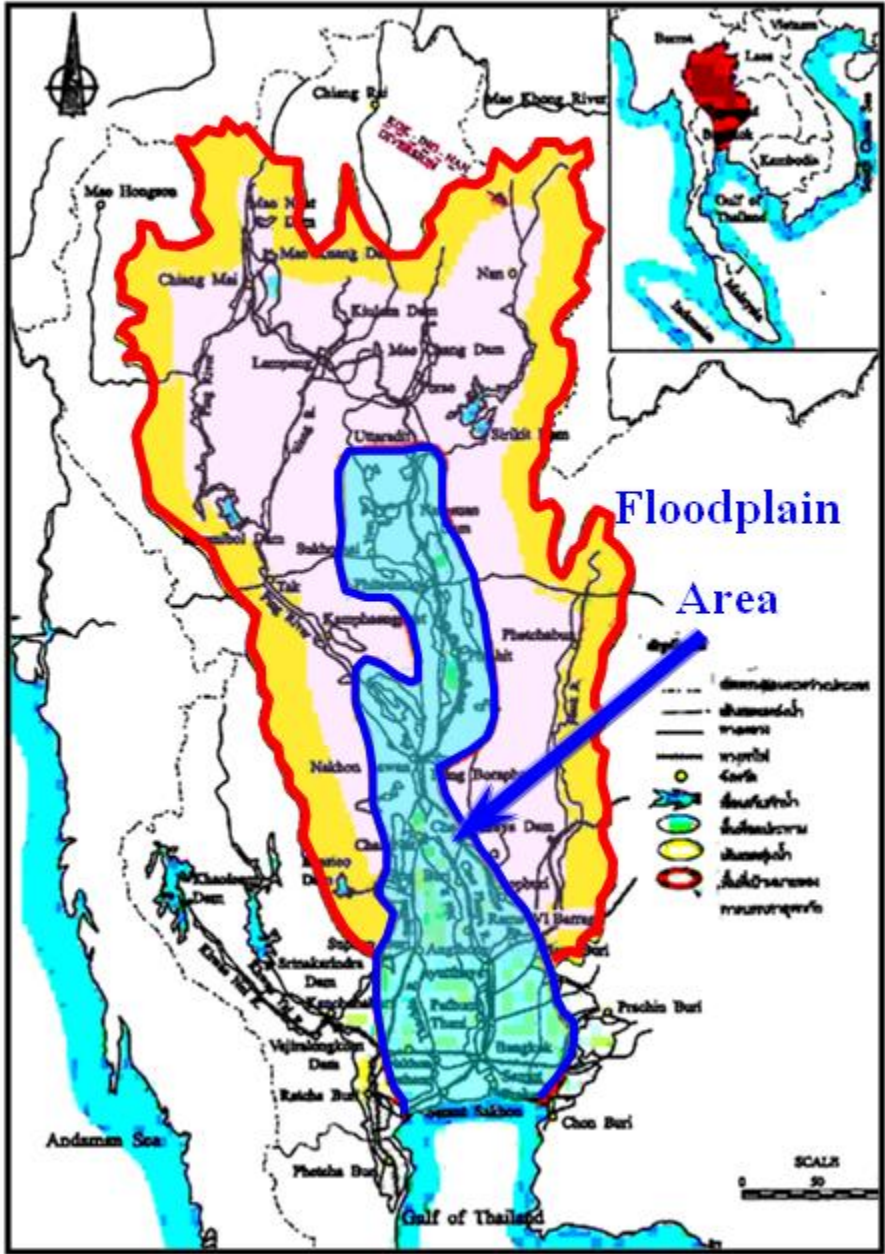
Flood in 2011: Urban Areas



Flood in 2011: Industrial Areas and Major Infrastructure



Flood 2011: Damages in Floodplain



Total Damages 1,400 billion Baht

Long Term Strategy for Flood Prevention and Mitigation in the Chao-Phraya River Basin

Principles, Objectives and Rationales

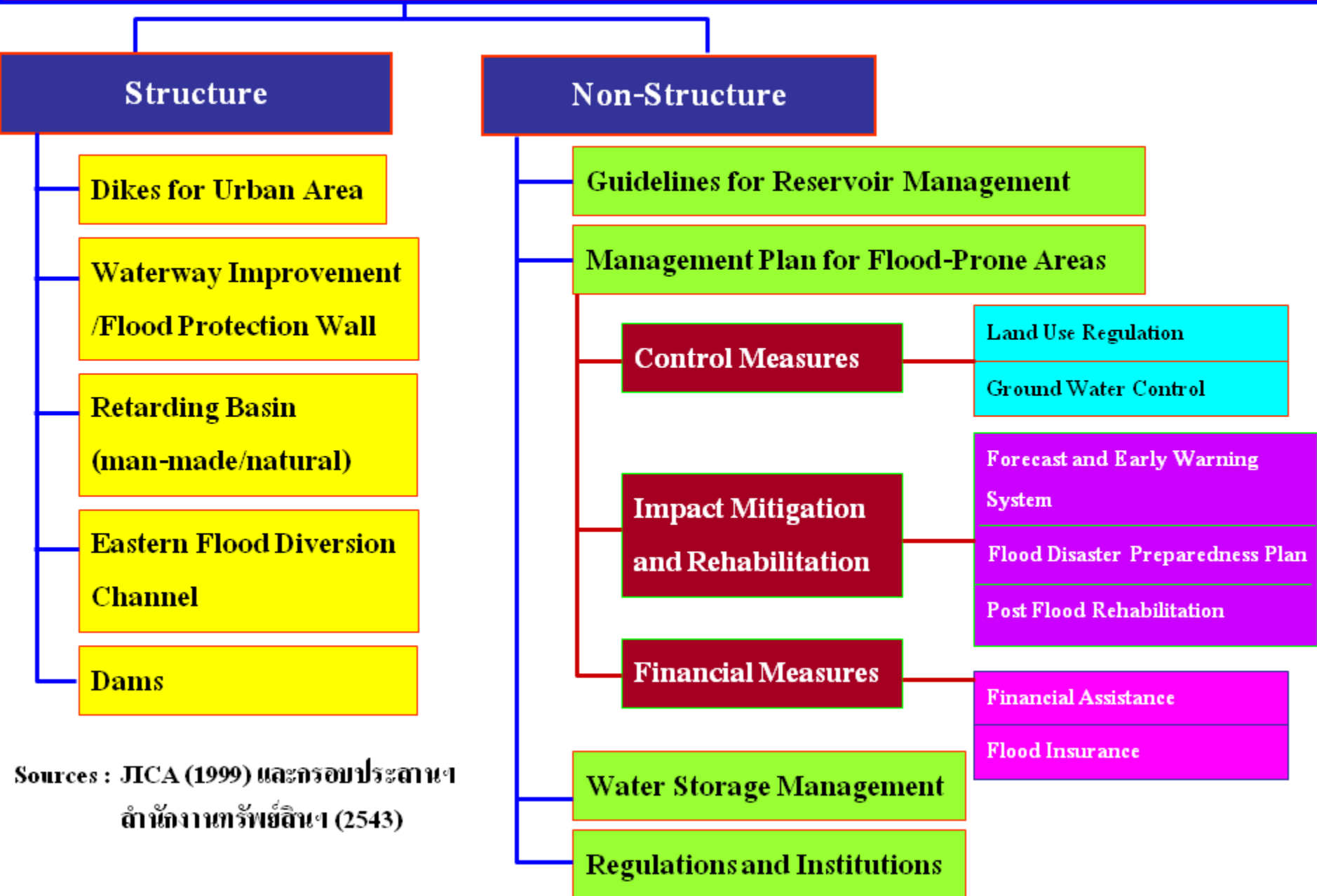
- Flood is a natural phenomenon with benefits, such as to maintain the proper balance among water, land and human resources and to ensure sufficient supply of water for household and business consumption and ecological conservation
- Flood management means ensuring proper flow (through rivers and floodways) and providing sufficient storage (further develop “Kam Ling”)
- There is a need to regulate land use to ensure its consistency with the water management plan. – When flood occurs, the goal is to mitigate the impacts and damages. –This could also serve as an opportunity to increase income and improve social security for grassroots.

Long Term Strategy for Flood Prevention and Mitigation in the Chao-Phraya River Basin

Principles, Objectives and Rationales

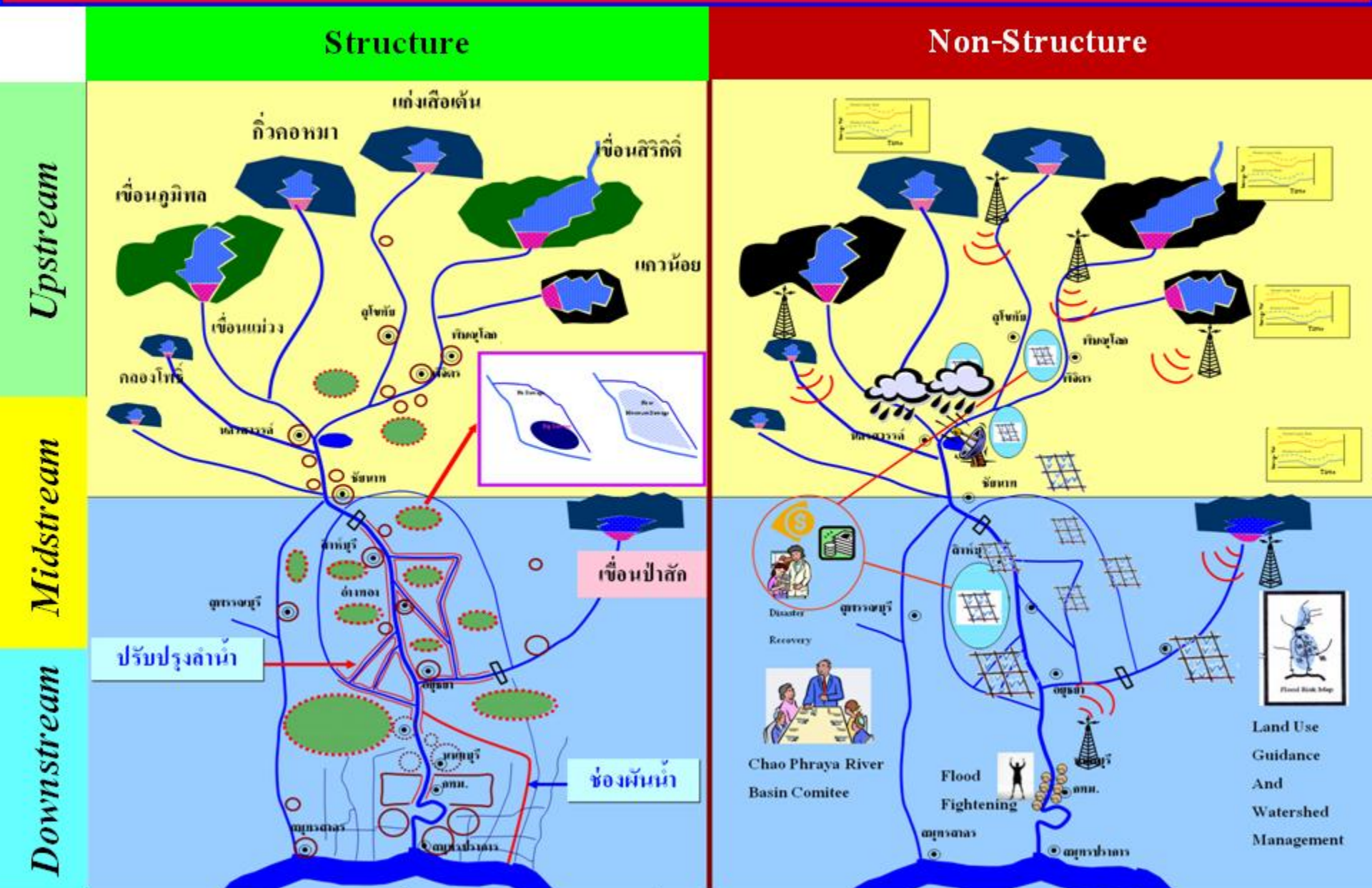
- Drought prevention and ecological conservation are integral parts of flood strategy.
- The strategy is based on the principles of “sufficiency economy” and “neo-agriculture”.
- There is a need to establish a “Single Command Authority” to ensure coherent and timely decision based on the central database and common interests.
- It is important to promote public awareness of people (both in the floodplain and other areas) to ensure their support and cooperation for flood management strategy.

Long Term Measures for Flood Prevention in Chao-Phraya River Basin



Sources : JICA (1999) และกรอบประเทศไทย
สำนักงานทรัพยากรน้ำ (2543)

Long Term Measures for Flood Prevention in Chao-Phraya River Basin



Sources: JICA (1999) และกรอบประสานฯ สำนักงานทรัพยากรน้ำ (2543)

Major Components (1)

Upstream

- Forest and Land Rehabilitation/Conservation
- More Reservoirs
- Land Use/Development Regulation

Midstream

- Protection for Provincial Urban Areas
- Absorbing Flood Peak and Increasing Income in Irrigated Floodplain
- Land Use/Development Regulation

Downstream

- Protection for Important Economic Zone
- Floodways through/around the Areas
- Land use/Development Regulation

Major Components (2)

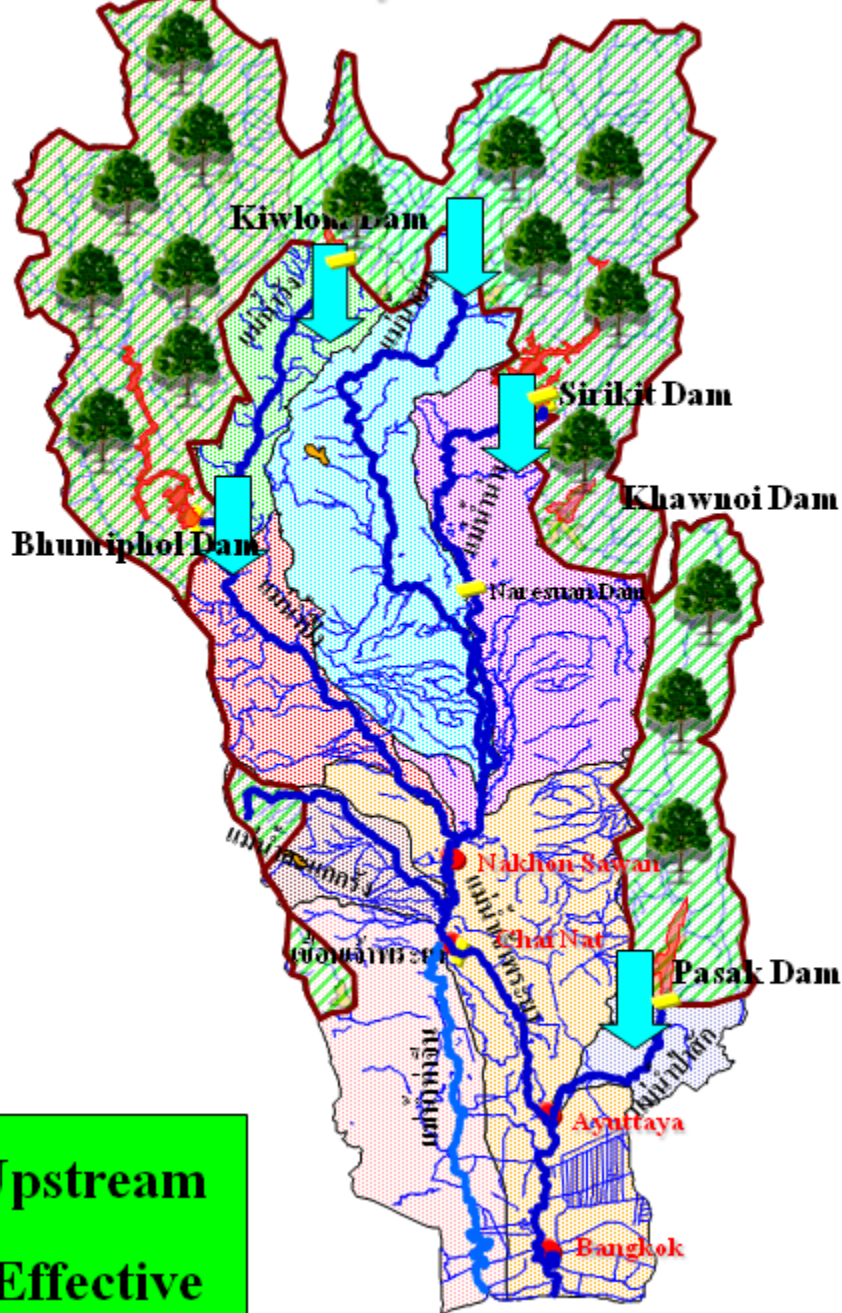
➤ **Develop Database and Prediction and Early Warning Systems**

➤ **Develop Effective and Realistic Regulation and Compensation Regime**

➤ **Establish a “Single Command Authority”**

➤ **Promote public awareness, participation and support**

Chao-Phraya River Basin



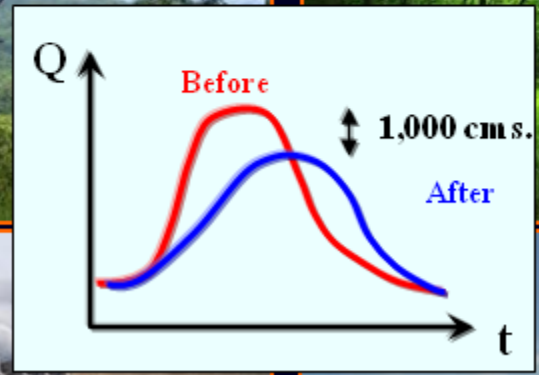
**Upstream
/Effective**

Measures

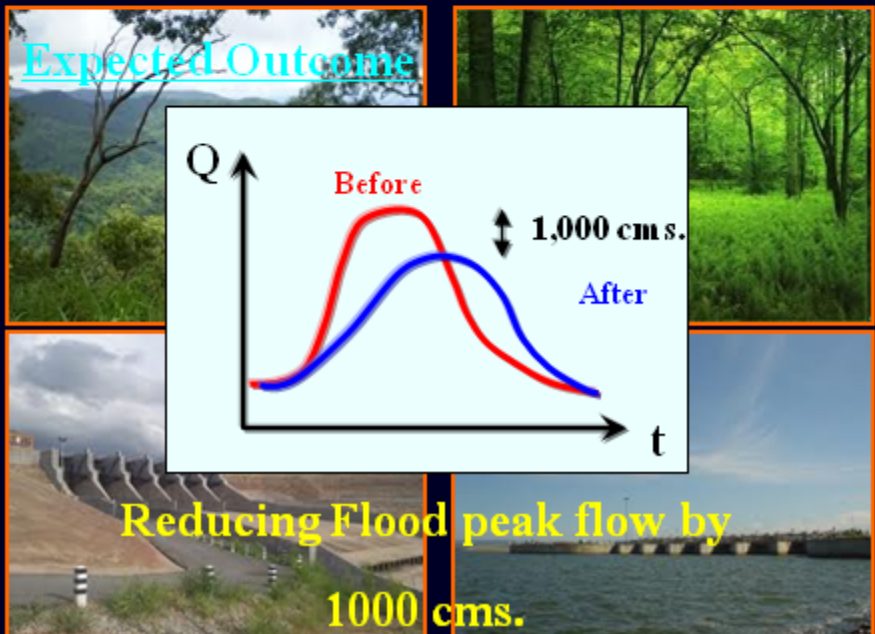
Costs (MB)

▶ Forest and Land Rehabilitation	10,000
▶ Reservoir Construction	50,000
▶ Land Use/Development Regulation	5,000
▶ Others (waterway improvement, early warning system)	3,000
Total	68,000

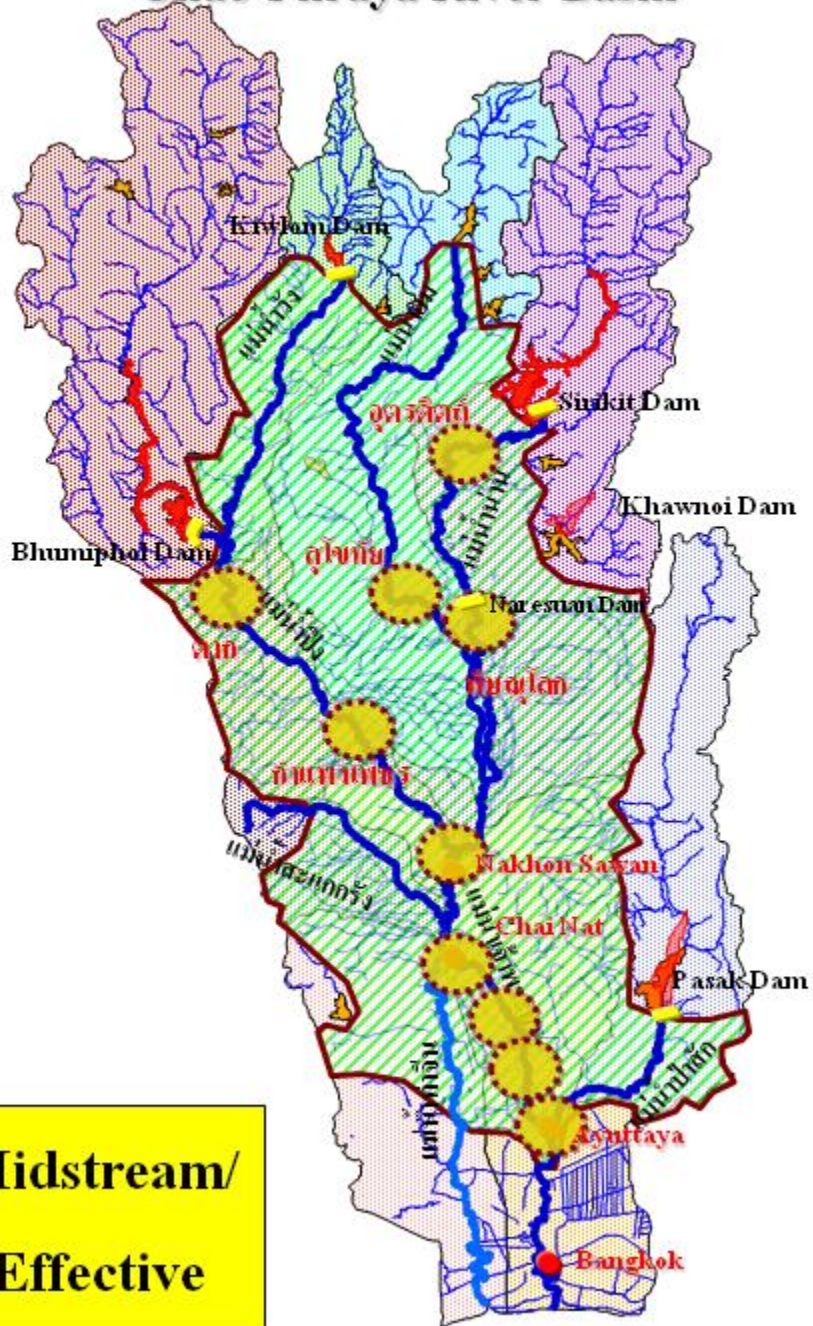
Expected Outcome



**Reducing Flood peak flow by
1000 cms.**



Chao-Phraya River Basin



**Midstream/
Effective**

Measures

Costs (MB)

➤ Protection for provincial urban areas 10,000

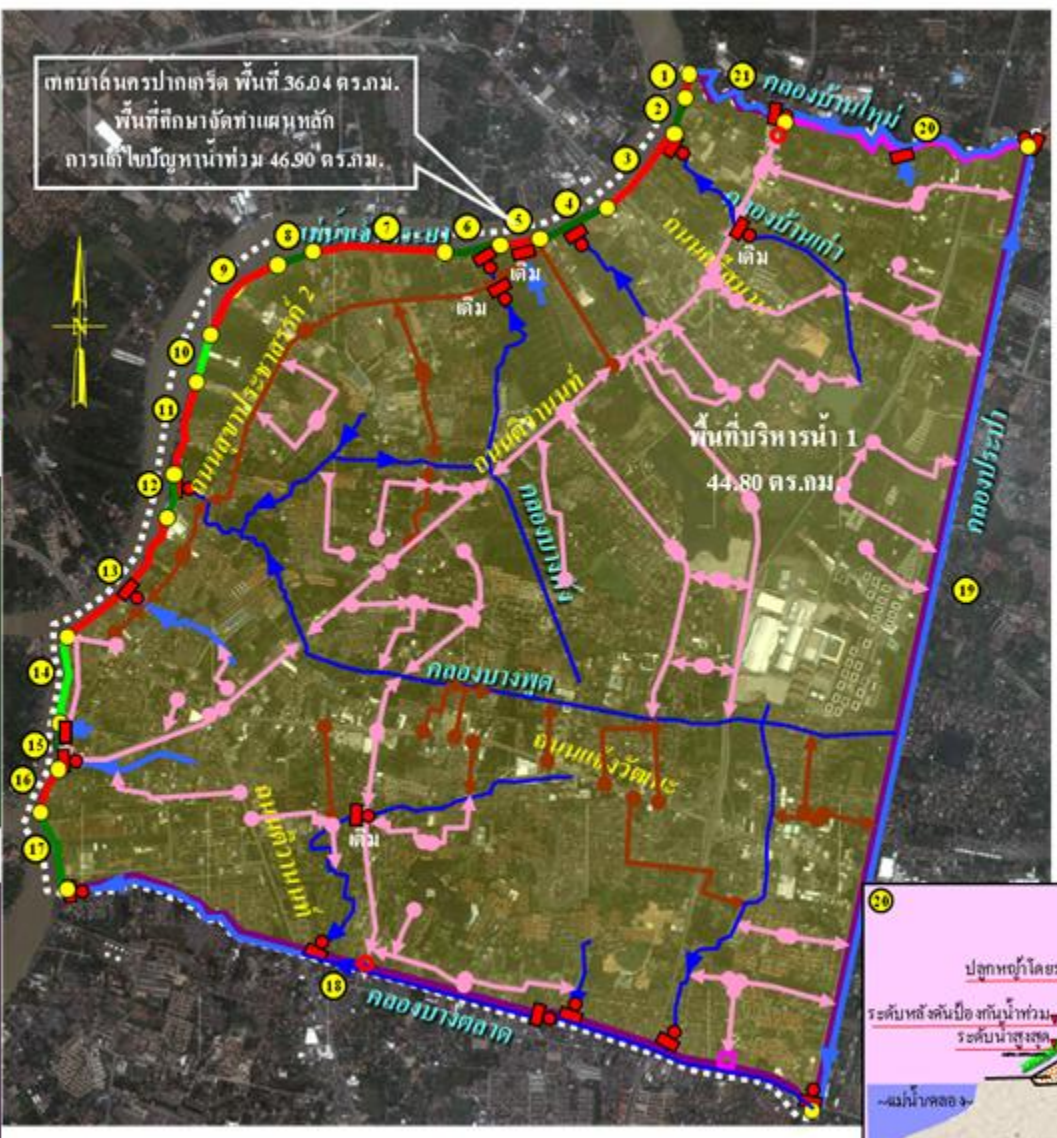


Example : Polder of Pakkret municipal (Nonthaburi Province)

**ก่อสร้างสวนสาธารณะระบายน้ำ
ทางเดินริมเขื่อน**

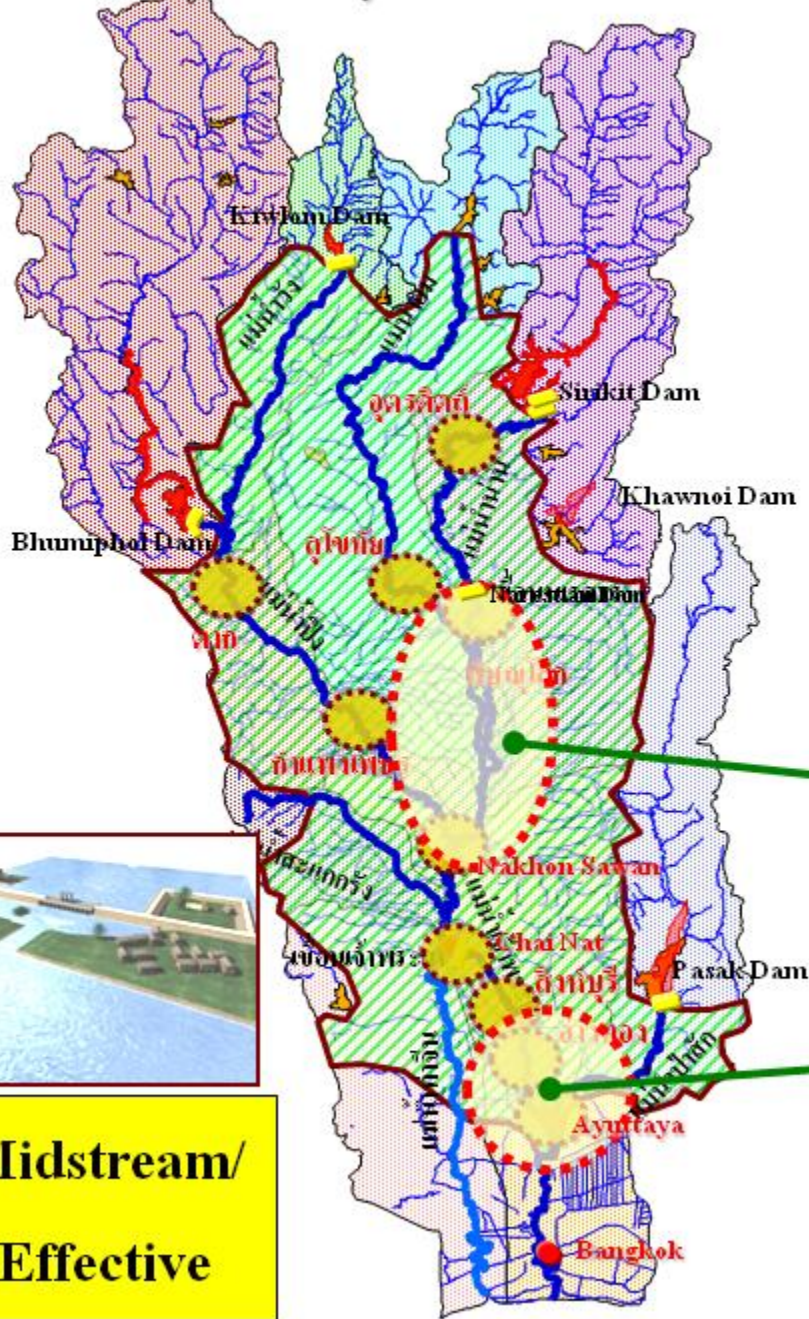
ปรับปรุงเสริมเขื่อนเดิมด้วยเสาเข็มยึดเหล็ก

**ก่อสร้างเขื่อนคอนกรีตแบบเสาเข็มยึด
และเสาเข็มตมอัดด้านใน**



ปรับปรุงยกระดับกันดินริมแม่น้ำ/คลอง

Chao-Phraya River Basin



**Midstream/
Effective**

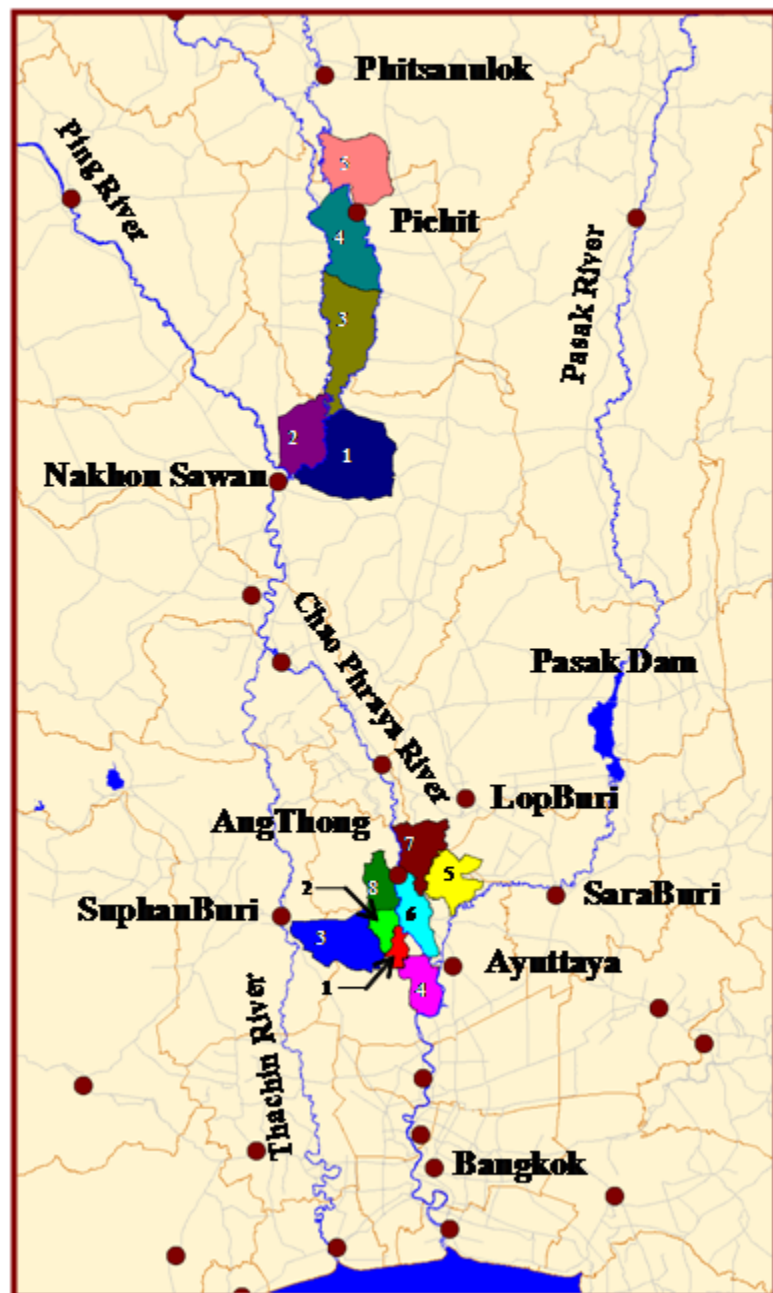
Measure

Cost (MB)

- Protection for provincial urban areas 10,000
- Flood peak absorption 60,000



Irrigated land and wetland to be used as floodplain



Upper Chao-Praya Basin

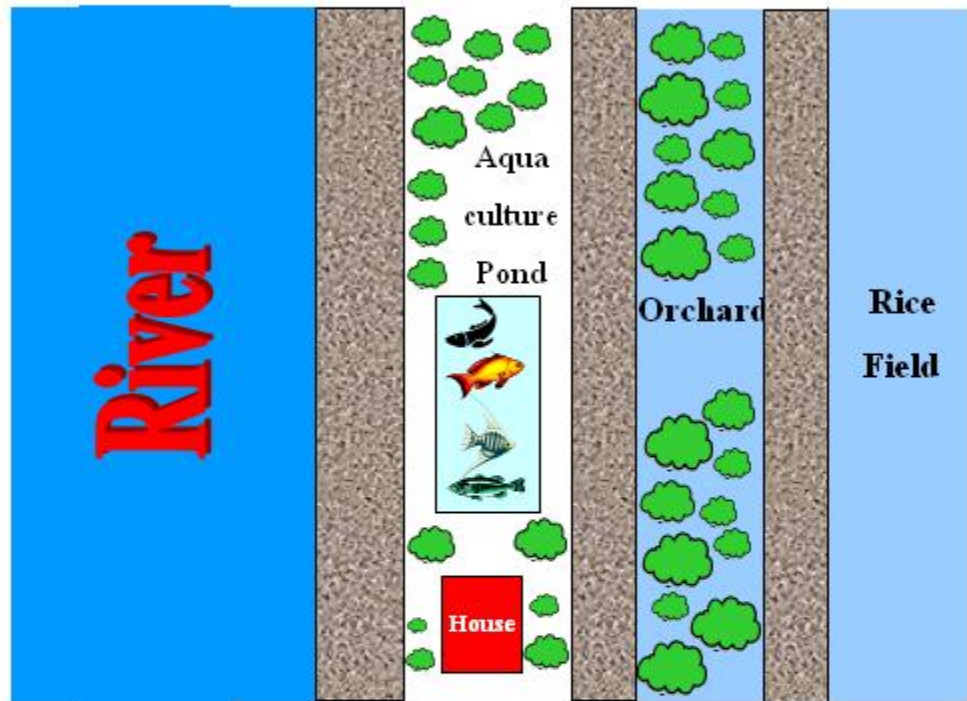
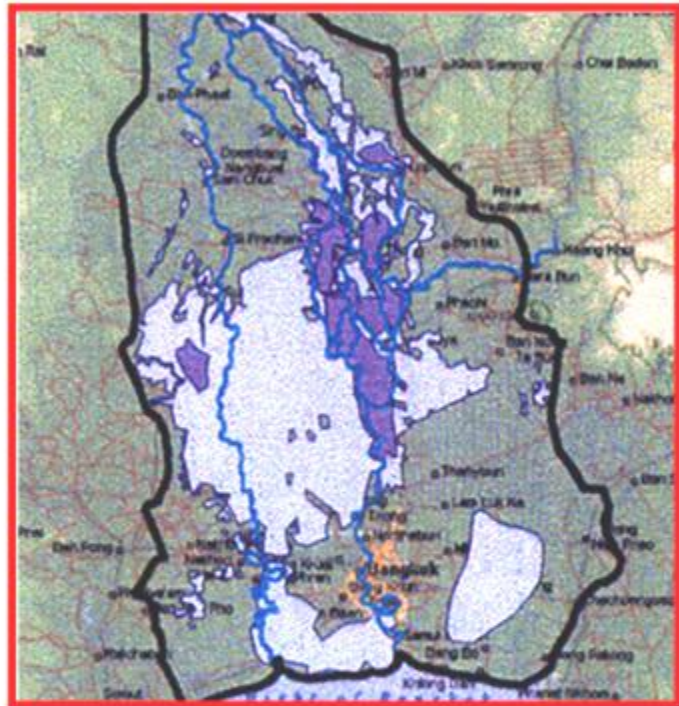
No.	Area	Size (km ²)
1	Boraped Lake – Chum Saeng	500
2	Chum Saeng – Gao Liaw – Amphur Muang Nakornsawan	200
3	Tapandun – Bang Mulnak – Po Talae	400
4	Amphur Muang Pijit – Po Pratabchange	350
5	Bang Kratum	350
Total		1,800

Lower Chao-Praya Basin

No.	Area	Size (km ²)
1	Bang Bal 1	500
2	Pa Mok – Pak Hai	69
3	Pak Hai – Bang Yi Hon	350
4	Bang Bal 2	160
5	Don Pud - Maharach	200
6	Phukaothong – Bang Pa-in	160
7	Chaiyo – Ban Prak	200
8	West of Ang Thong	100
Total		1,329

Management of Agricultural Land in Floodplain

In Case of Medium and Large Flood + To Increase Income



Floodplain Management in Wet Season

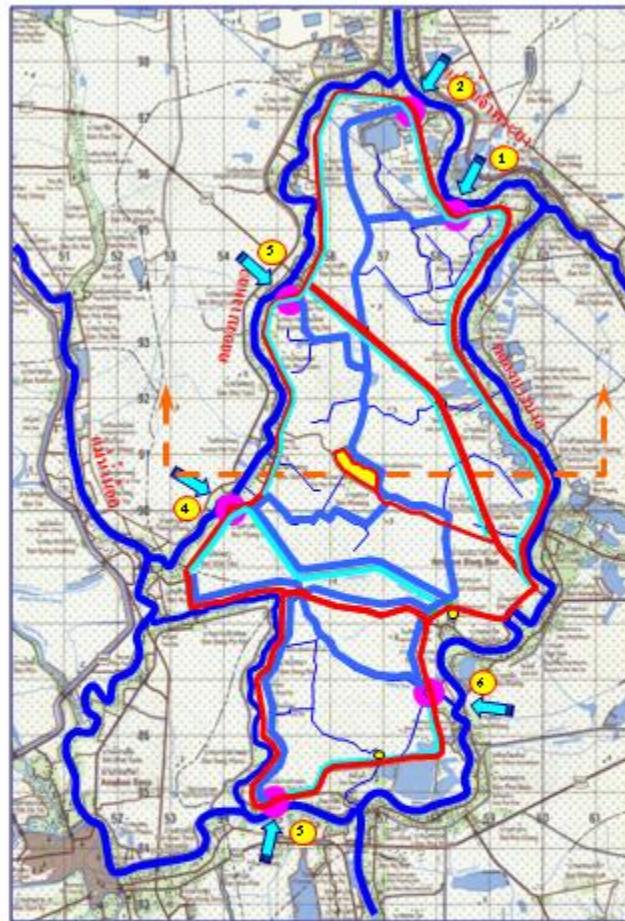
Wet Season

❖ When the water level in the river way is higher than the flood protection dike, water gates will be opened.

Excessive amount of water will be stored in the floodplain, thus helping to reduce damages from

medium and large flood.

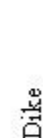
Community on
river bank



1) 6 Water Gates : controlling inflow to Bangbal 1 area when river water level is high, and outflow when river water level is lower than in floodplain.

2) pumps: when necessary, pumps will pull water out of floodplain when river water level is high,

3) Spillways : serving as channels for inflow and outflow, and storage space for consumption in dry season.



Community on river bank

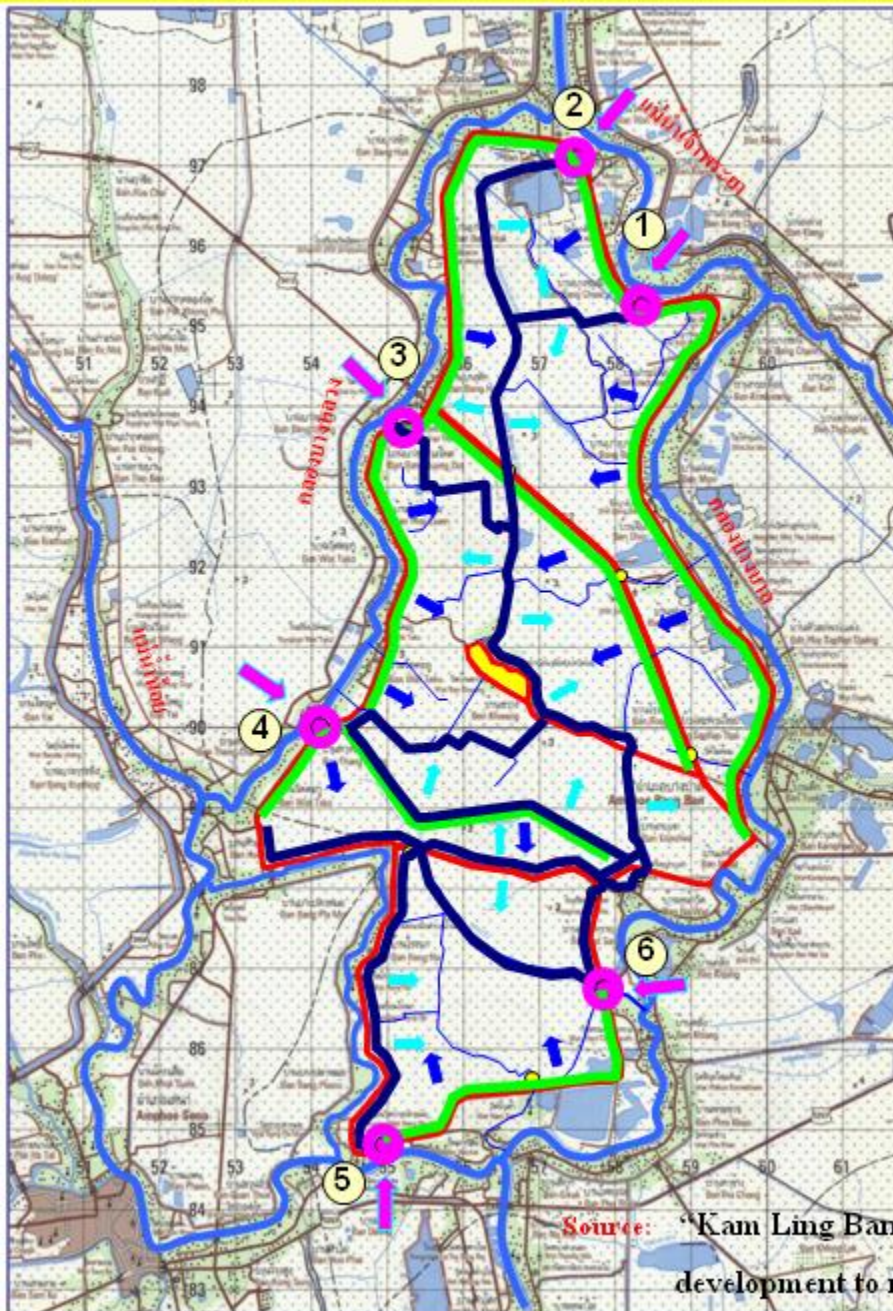


Klong Bang Bal

Ground Water Infusion

Sources: "Kam Ling Bangbal 1" The Royal pilot project for floodplain management and development to reduce damages from medium and large flood. (2008)

Floodplain Management in Dry Season



❖ After wet season, government will supply sufficient water to increase rice productivity and guarantee rice price.

Rice Crop Cycles in Floodplain

Cycle 1 : Dec - Mar

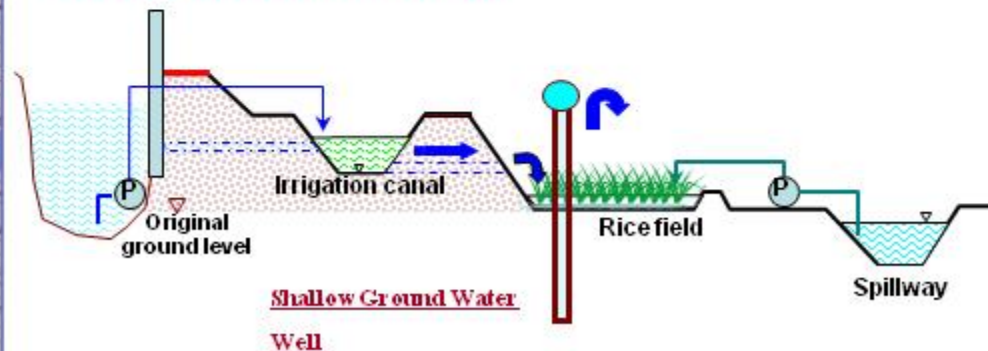
Cycle 2: Mar - Jun

Cycle 3: Jul - Dec

Pumping Stations and Irrigation Canals: Pumping water from the river into irrigated land through canals

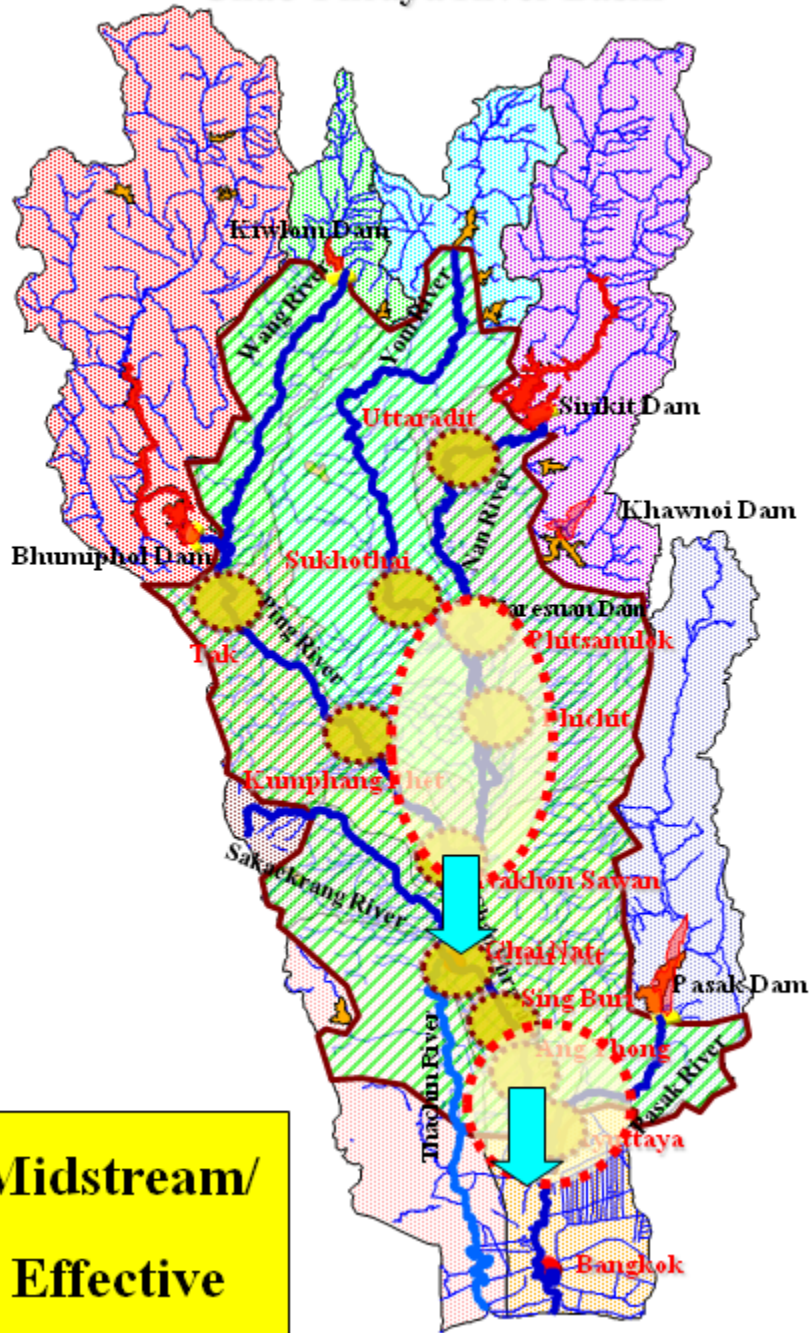
Spillways : Serve as storage of water for agricultural use. Controlled by water gates.

Shallow Ground Water Well



Source: "Kam Ling Bangbal 1" The Royal pilot project for floodplain management and development to reduce damages from medium and large flood. (2008)

Chao-Phraya River Basin



**Midstream/
Effective**

Measure

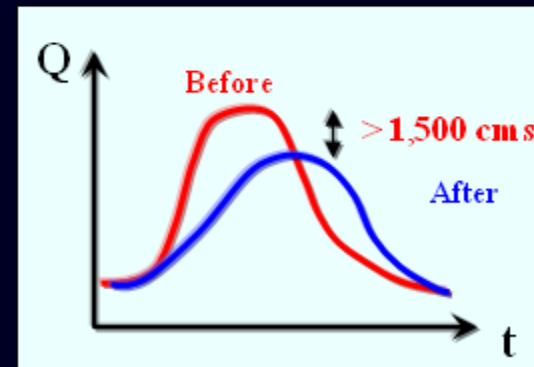
Costs (MB)

- Protection for provincial urban areas 10,000
- Flood peak absorption 60,000
- Land use/development regulation 5,000
- Others (waterway improvement, early warning system) 4,000

Total

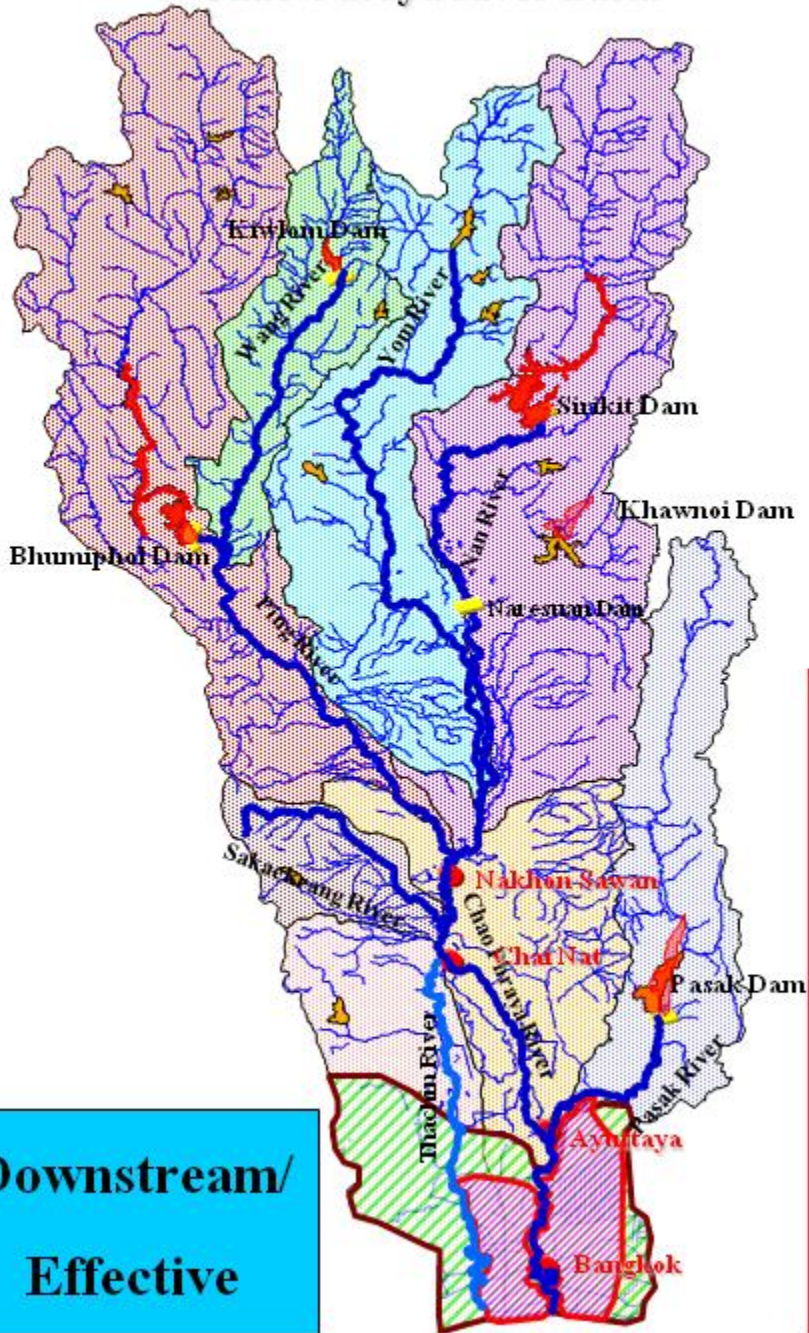
79,000

Expected Outcome



**Reducing Flood peak flow by
1,500 m³/sec**

Chao-Phraya River Basin



Measures

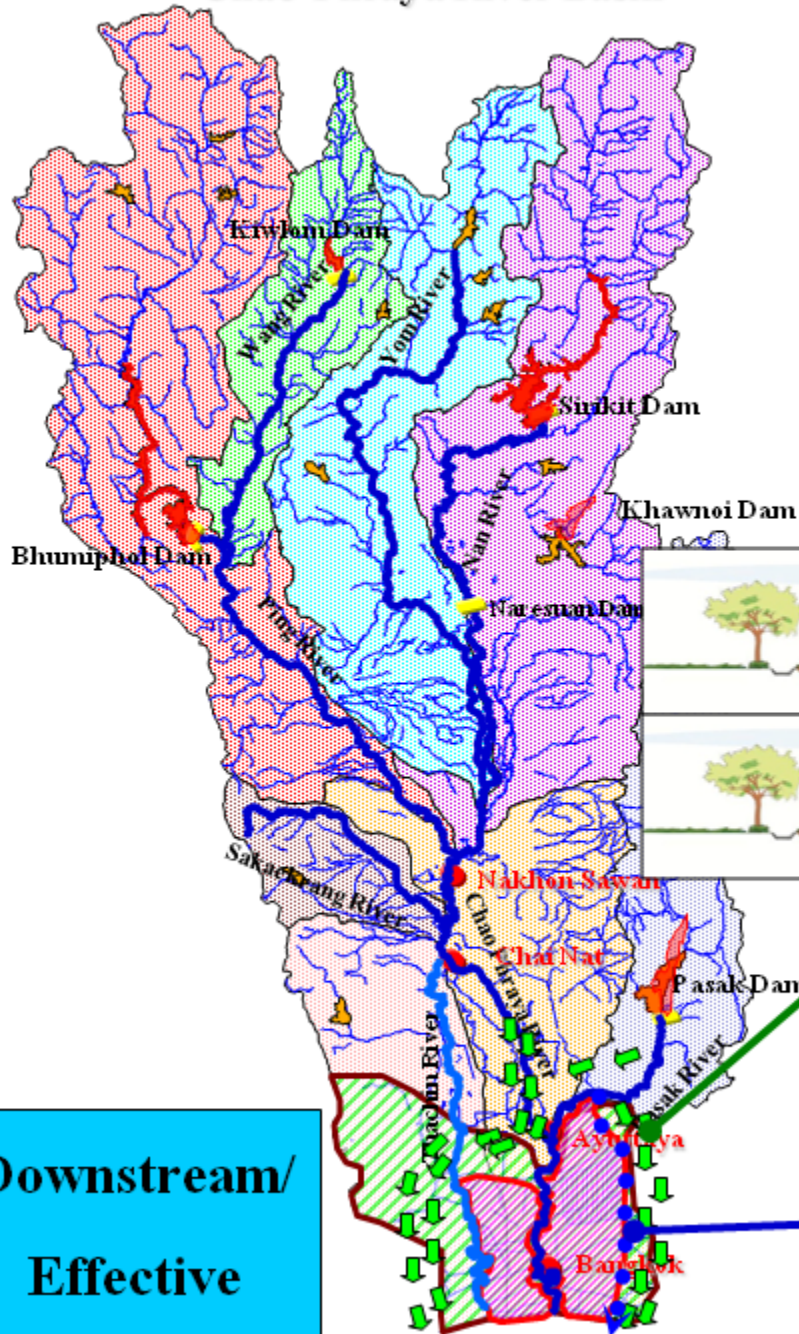
Costs (MB)

- Protection for major economic areas 10,000
- areas



Downstream/
Effective

Chao-Phraya River Basin



Measures

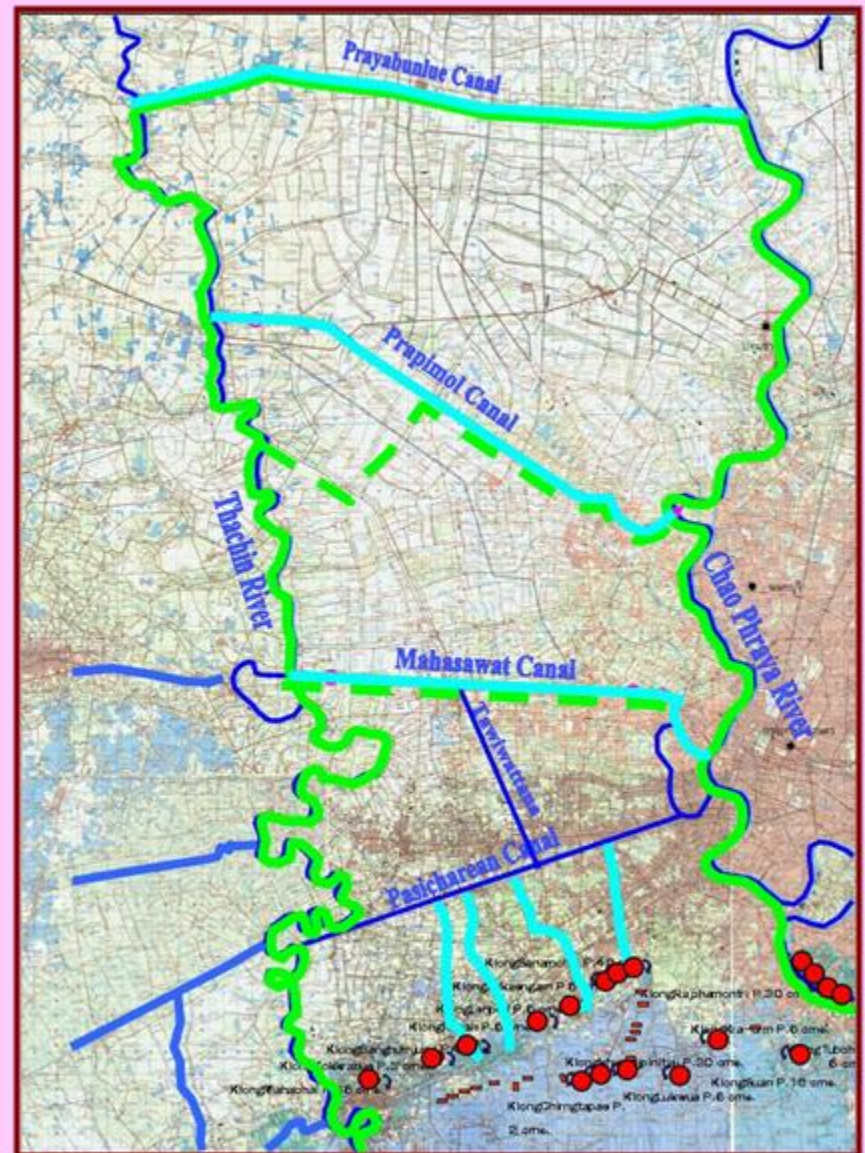
Costs (MB)

- ▶ Protection for major economic areas 10,000
- ▶ Flood Way_and Flood Diversion Channel 120,000



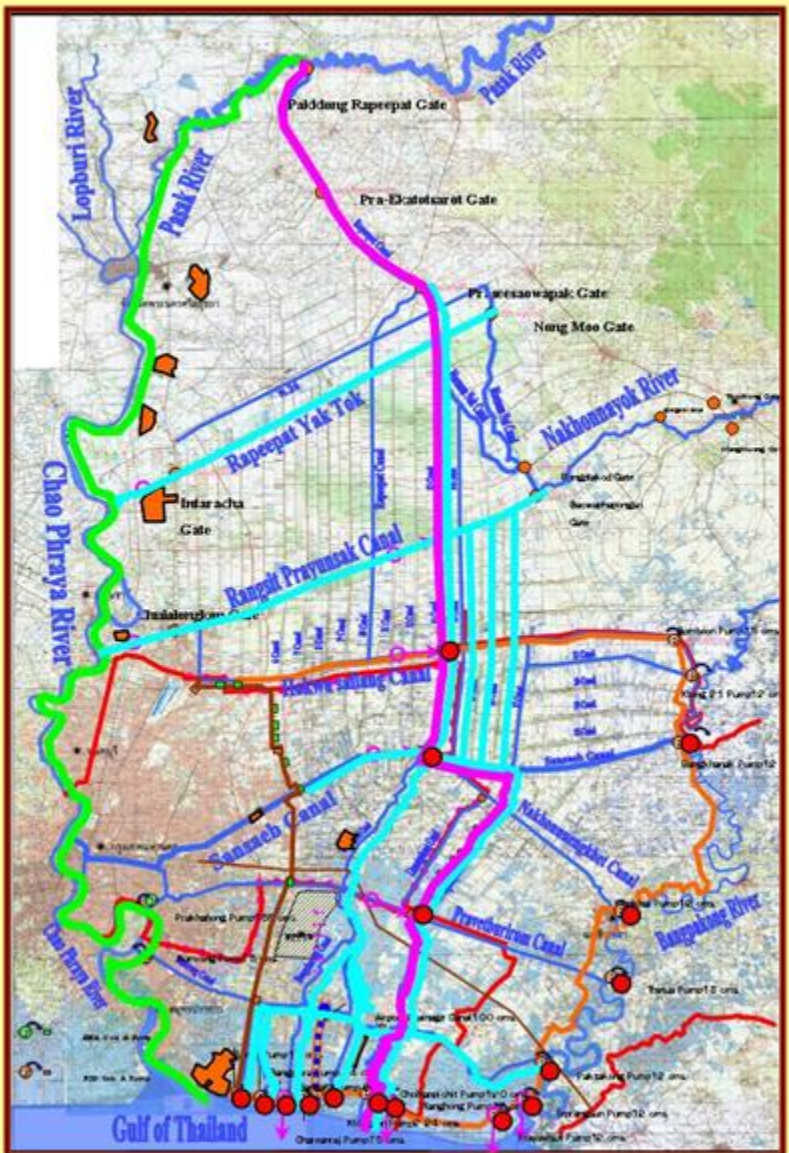
**Downstream/
Effective**

Major Economic Areas (Urban, Commercial, Industrial and Infrastructure)



West of Chao-Praya River

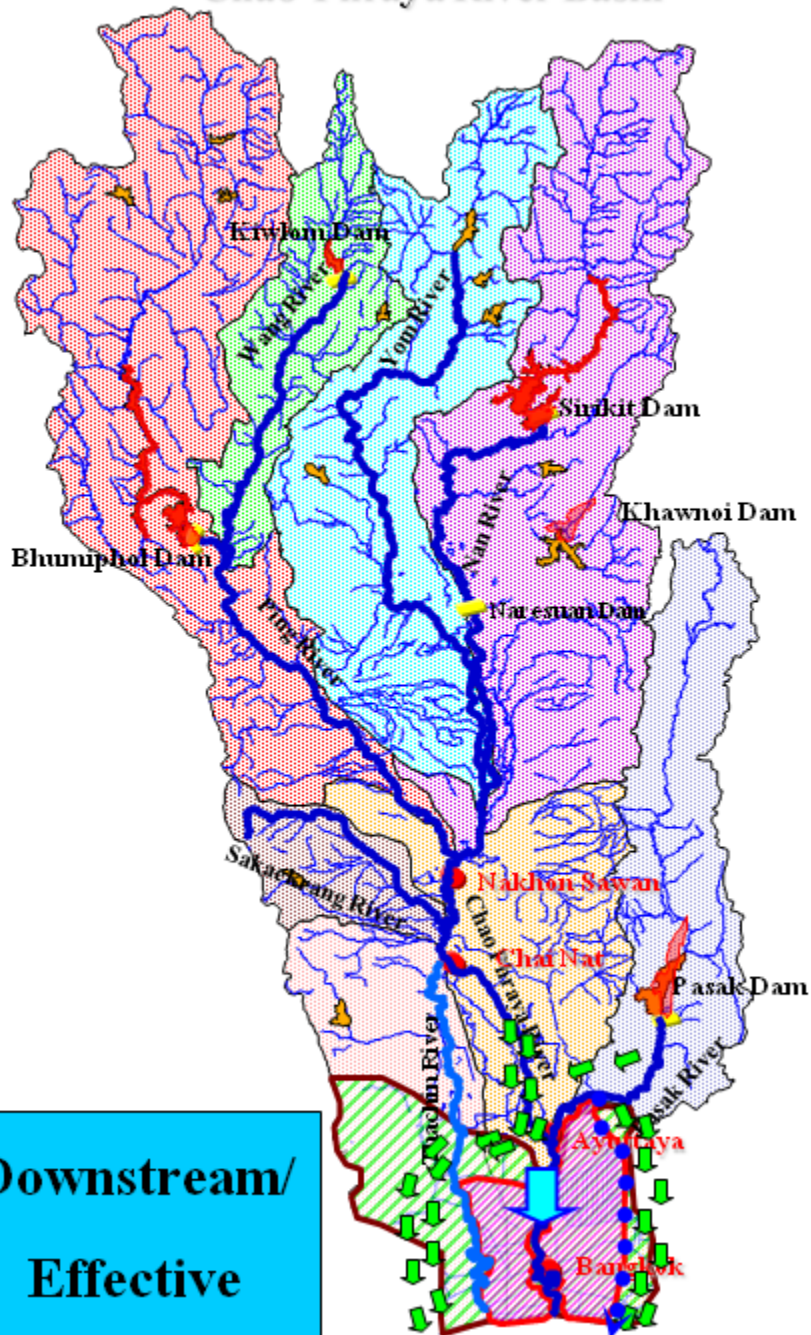
(area 2,500 km²)



East of Chao-Praya River

(area 3,860 km²)

Chao-Phraya River Basin



**Downstream/
Effective**

Measures

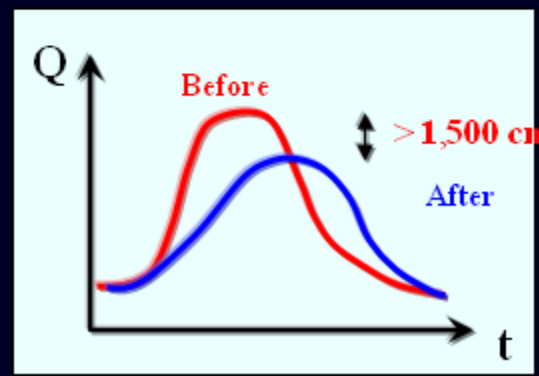
Costs (MB)

- Protection for important economic zone 20,000
- Flood Way_and Flood Diversion Channel 120,000
- Land use/development regulation 10,000
- Others (waterway improvement, early warning system) 3,000

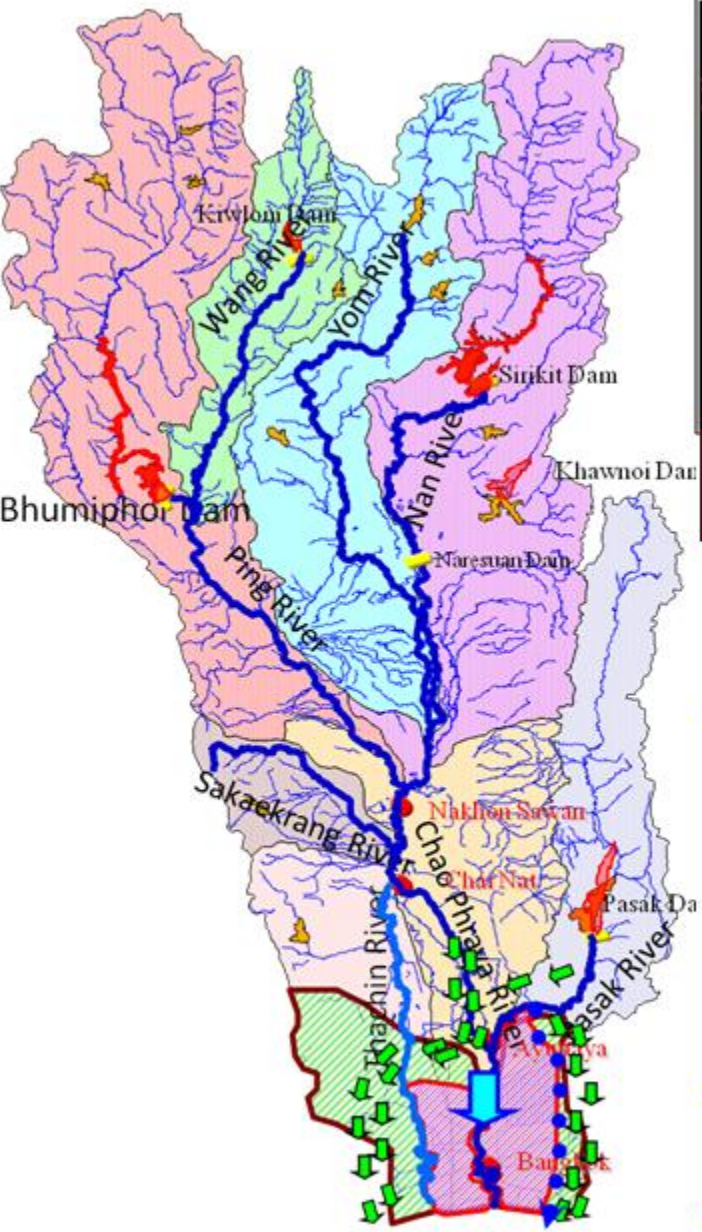
Total

153,000

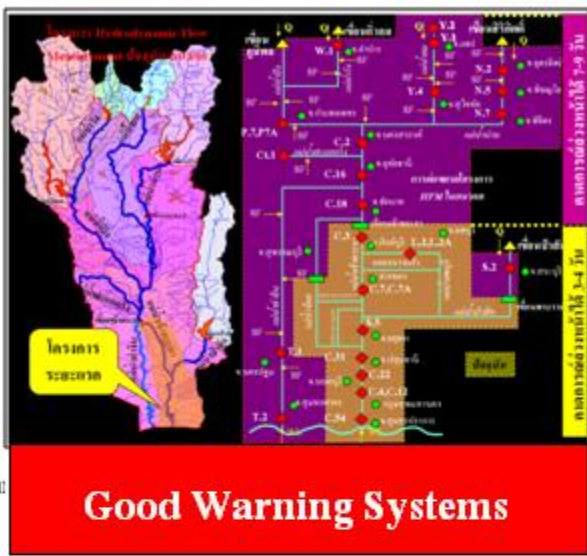
Expected Outcome



Reducing Flood peak flow by 1,500 m³/sec



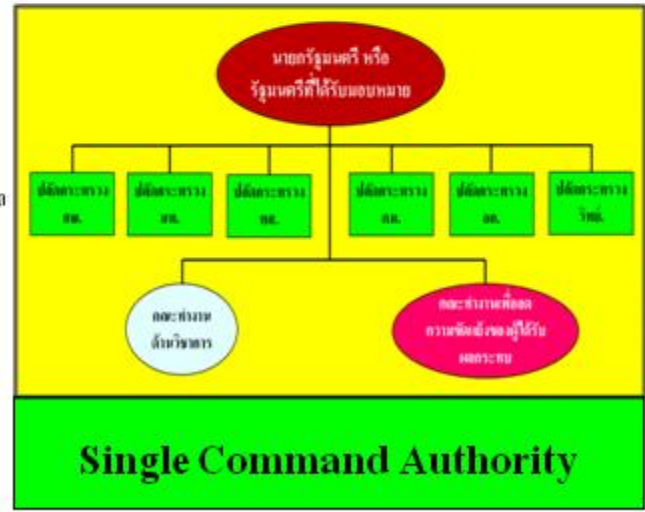
Chao-Phraya River Basin



Good Warning Systems



Effective and Realistic Regulation and Compensation Regime



Single Command Authority



Promote public awareness, participation and support

Expected Outcomes of “Back Bone Projects”

1. Increased forest land

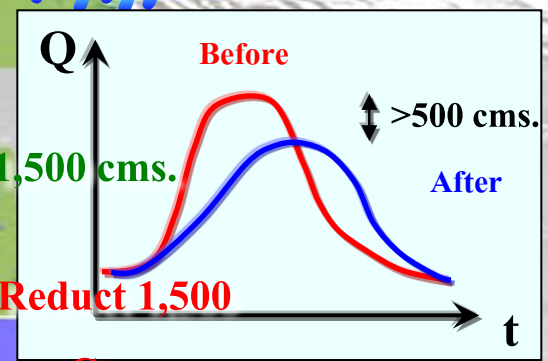
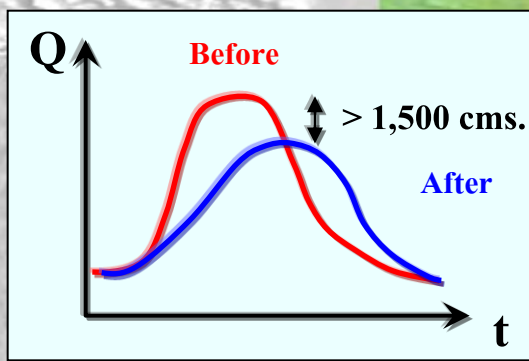
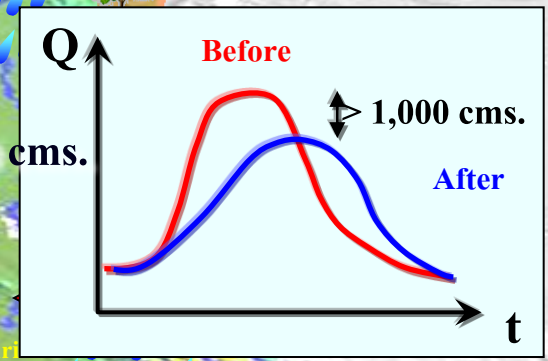
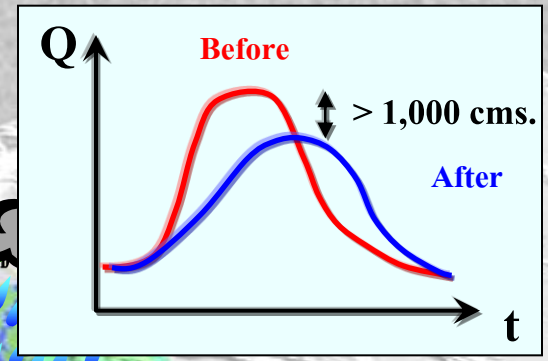
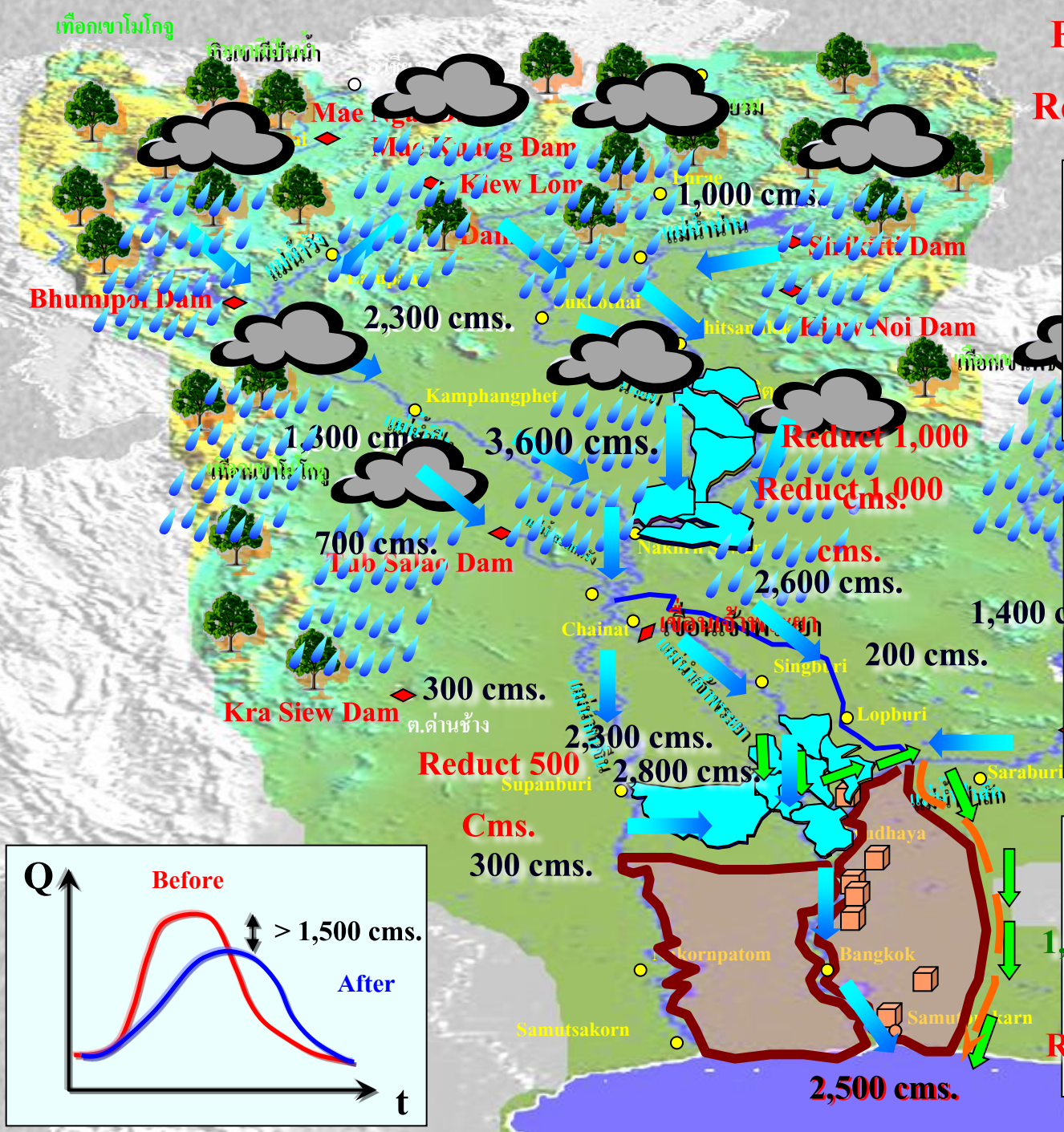
2. Increased water storage/supply → enlarged areas for non-seasonal crops

3. Improved livelihood in 2 million rai of irrigated land – increasing productivity while absorbing floodpeak

4. Effective and systematic control of land use/development

5. No flood in Major Economic Areas (Bangkok Metropolitan and provincial)

Flood Absorbing Flood Peak and Rehabilitated Flood Plain



Reduct 1,500
Cms.

Plan of Actions

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
1. Forest and Ecological System Rehabilitation and Conservation	1. Rehabilitation and conservation of upstream soil of Ping, Wang, Yom, Nan, Sakaekrang, Tachine and Pa-Sak Rivers by reforestation, check dam construction, soil conservation	10,000	from 2012 onward	Ministry of Natural Resources and Environment / Ministry of Agriculture and Cooperative
	2. Construction of Reservoirs in Ping, Yom, Sakaekrang, Nan and Pa-Sak River Basins	50,000	from 2012 onward	

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Time frame (years)	Responsible Agency
2. Major Dams' Water Management Plan and Annual Water Management Plan	Develop water management plans for major dams in important river basins and develop water management plans in different scenarios, including	Normal Budget	From 2012 onward	Department of Royal Irrigation/EGAT

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
3. Restoration and Improvement of existing infrastructure	1. Construction of floodway/flood diversion channel, with the minimum capacity of 1500 m³/sec, and relevant infrastructure, to diver flood from Pa-Sak and Chao-Praya Rivers to the East, or both East and West	120,000	From 2012 onward	Ministry of Agriculture and Cooperative/Ministry of Natural Resources and Environment/Ministry of Interior/Ministry of Transport/Office of the Prime Minister
	2. Land use zoning/ Land development regulation/ Flood protection structure for	50,000	From 2012 onward	
	3. Restoration of major waterways and flood protection walls	7,000	from 2012 onward	

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
4. Database and forecast and early warning system	Develop database and forecast and early warning system, including establishing necessary institutions and rules and promoting public participation	3,000	From 2012 onward	Office of the Prime Minister

Plan of Actions for Chao-Praya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
5. Flood preparedness plans for specific areas	Increase efficiency of water feeding for pumping stations and flood diversion tunnel, including restoring by -part cannel, King's dikes and flood protection walks along Chao-Praya River	Normal Budget	From 2012 onward	Ministry of Interior/ Ministry of Agriculture and Cooperative, Ministry of Natural Resources and Environment, Ministry of Transport

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
6. Designation of retarding basins and formulation of compensation regime	Transform 2 million rai of irrigated land into retarding basin (Kam Ling) in order to absorb 6,000-10,000 million m ³ and to enable 1 seasonal crop and 2 non-seasonal crops of rice annually - e.g. in Pitsanuloke Irrigation District, Chao-Praya Yai Projects, or using natural	60,000	From 2012 onward	Ministry of Agriculture and Cooperative/ Ministry of Natural Resources and Environment/ Ministry of Interior

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
7. Development of national institution for integrated water resources management	1. On an interim basis, establish an ad hoc committee to manage the Plan of Actions, with the mandate to make orders and follow up the 2. Establish a national committee for integrated water resources management	Normal Budget	From 2012 onward	Office of the Prime Minister/ other relevant agencies

Plan of Actions for Chao-Phraya River Basin

Programme	Project	Budget (MB)	Timeframe (years)	Responsible Agency
8. Promotion of public awareness, support and participation in flood management	Educate, inform, make people aware of and understand the progress made by the government in terms of water management plan. Promote public participation, e.g. via public hearing, in all stages including planning, decision making and implementation. Train local volunteers.	Normal Budget	From 2012 onward	Office of the Prime Minister/ other relevant agencies

Total Budget 300,000 MB

Note: Projects to commence in January 2012

Priorities among the “Back Bone Projects” for 2012

Time Frame - the next 6-8 months

Goals

 **Prevent and mitigate flood in 2012**

 **Reduce economic and social damages**

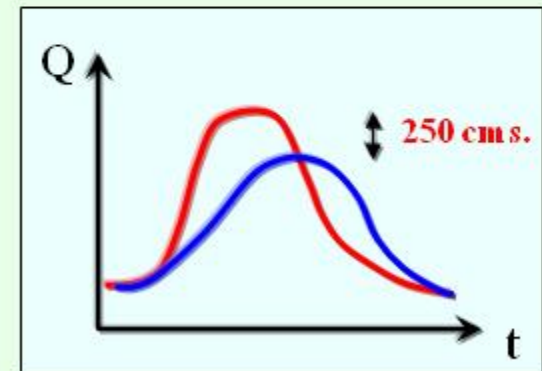
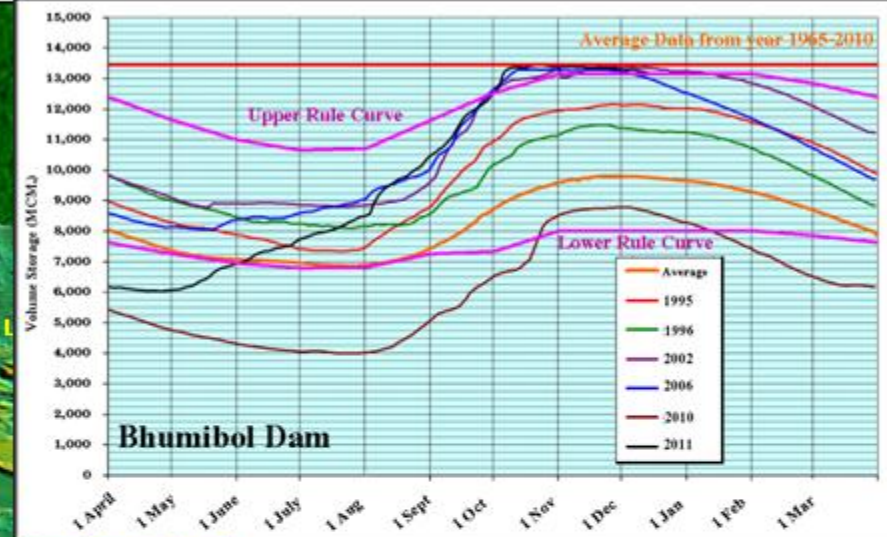
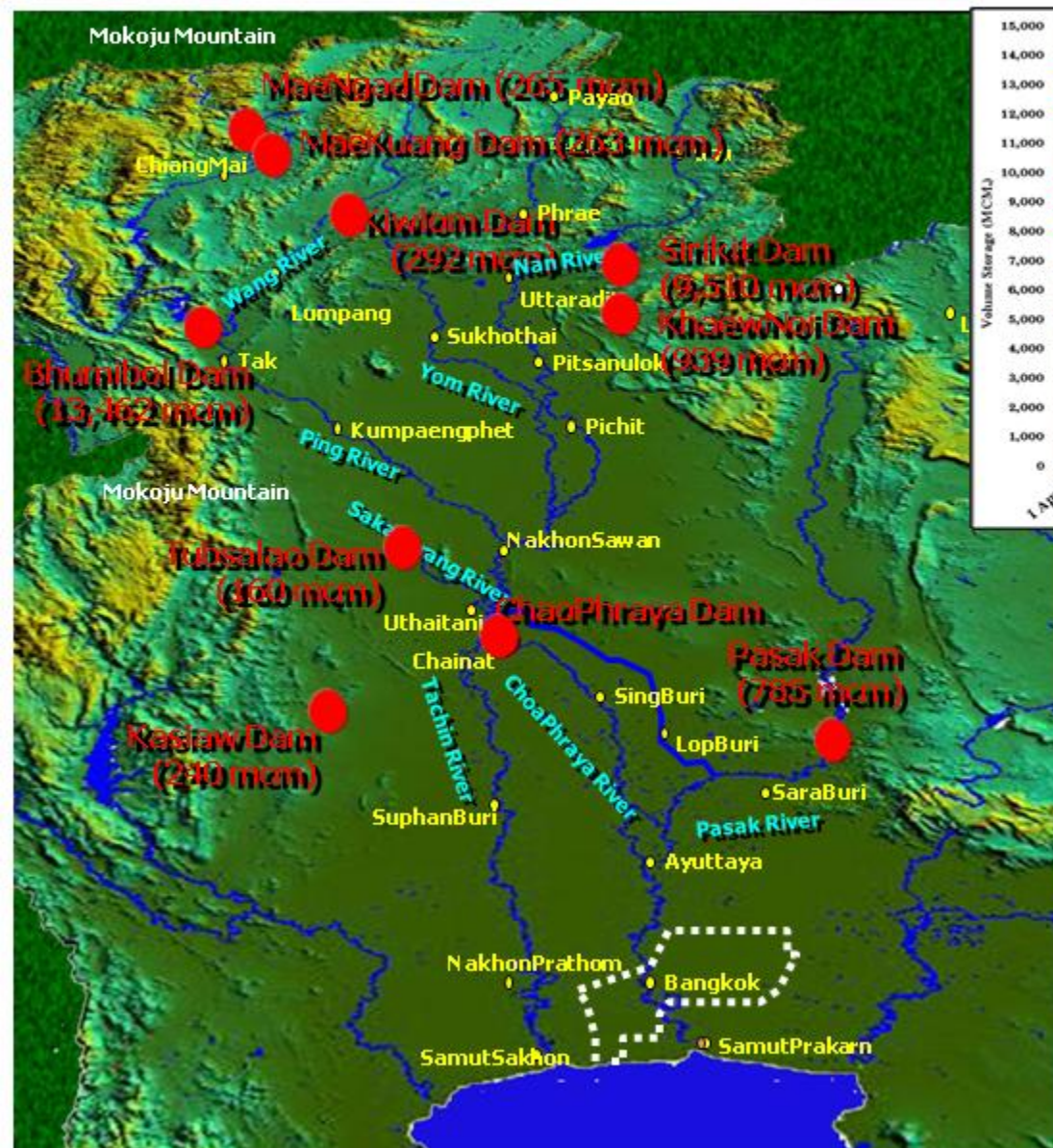
Priority Actions for 2012

1. **Improve the existing Guideline for Reservoir Management and develop an Annual Water Management Plan**
2. **Designate retarding basins and develop compensation regime**
3. **Restore and Improve the existing infrastructure**
4. **Develop the central database and the forecast and early warning systems**
5. **Develop flood disaster preparedness plan for specific areas**
6. **Develop institutions for water management**

Timeframe: 6-8 months

Budget 17,000 MB

Improve the existing Guideline for Reservoir Management and develop an Annual Water Management Plan



Reducing Flood peak flow by
250 m³/s.

Designate retarding basins and develop compensation regime

Upper Chao Phraya River Basin



No.	Places	Areas (sq.km.)
1	Bueng Boraphet-Chumsaeng	500
2	Chumsaeng-Khaoleaw-A.Muang Nakhonsawan	200
3	Taphanhin-Bangumnak-Photalay	400
4	A.Muang Pichit-A.Phopratubchang	350
5	A.Bangkatum	350
Total		1,800

Lower Chao Phraya River Basin



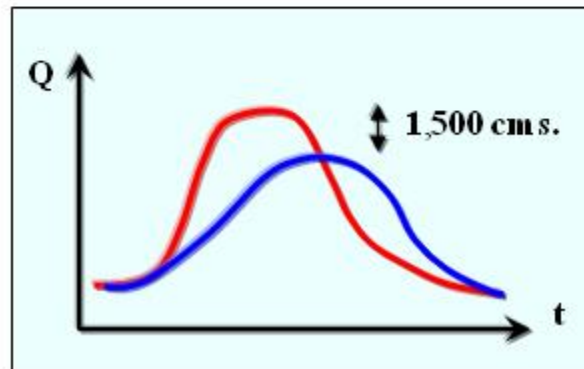
No.	Places	Areas (sq.km.)
1	Bang Ban (1)	500
2	Pamok-Phakhai	69
3	Phakhai-Bangyihon	350
4	Bang Ban (2)	160
5	Donpud-Maharaj	200
6	Phukhaothong-Bangpahan	160
7	Chaiyo-Banphrak	200
8	Western Angthong	100
Total		1,329



Designate retarding basins and develop compensation regime

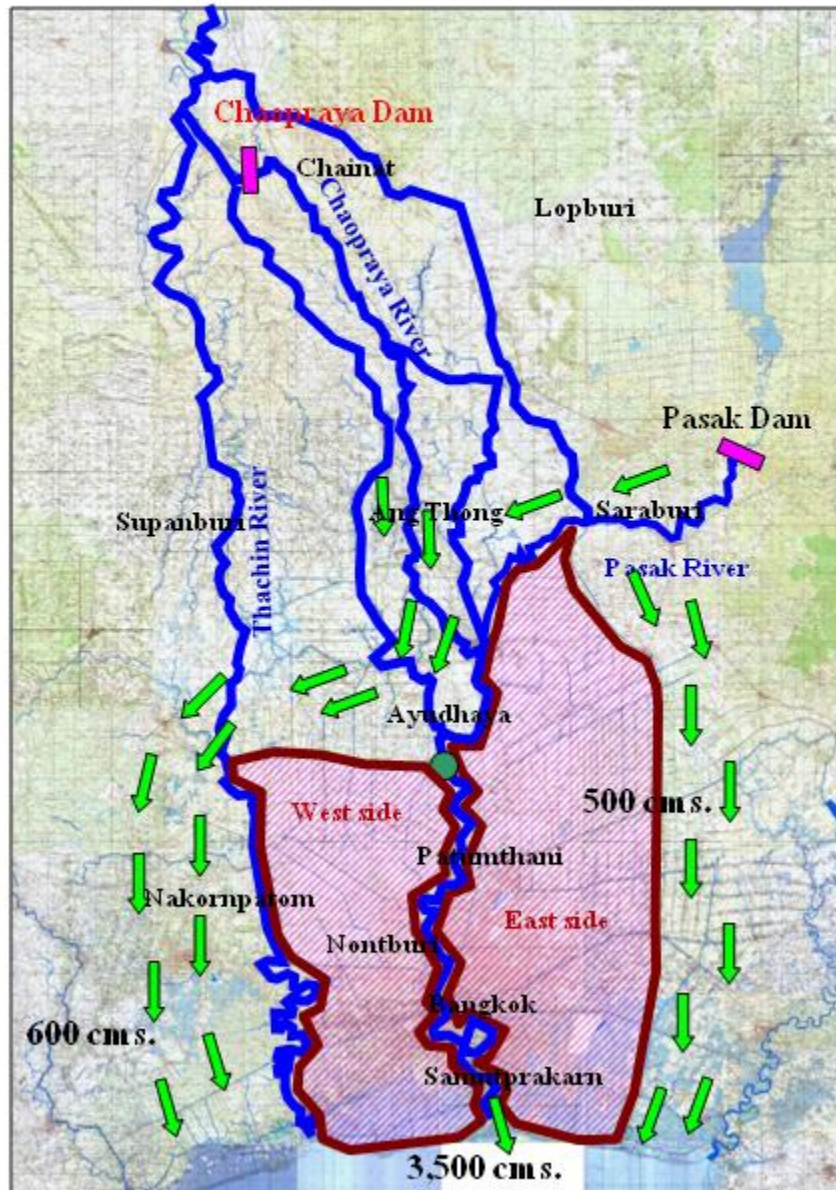


Reducing
flood peak
flow by
1,500 cms.

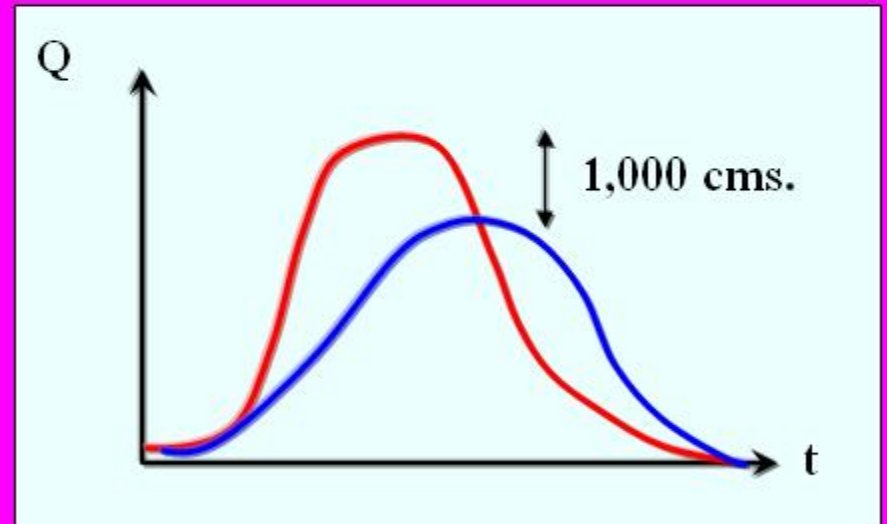


Public Hearing

Restoration and Improvement of Existing Structure

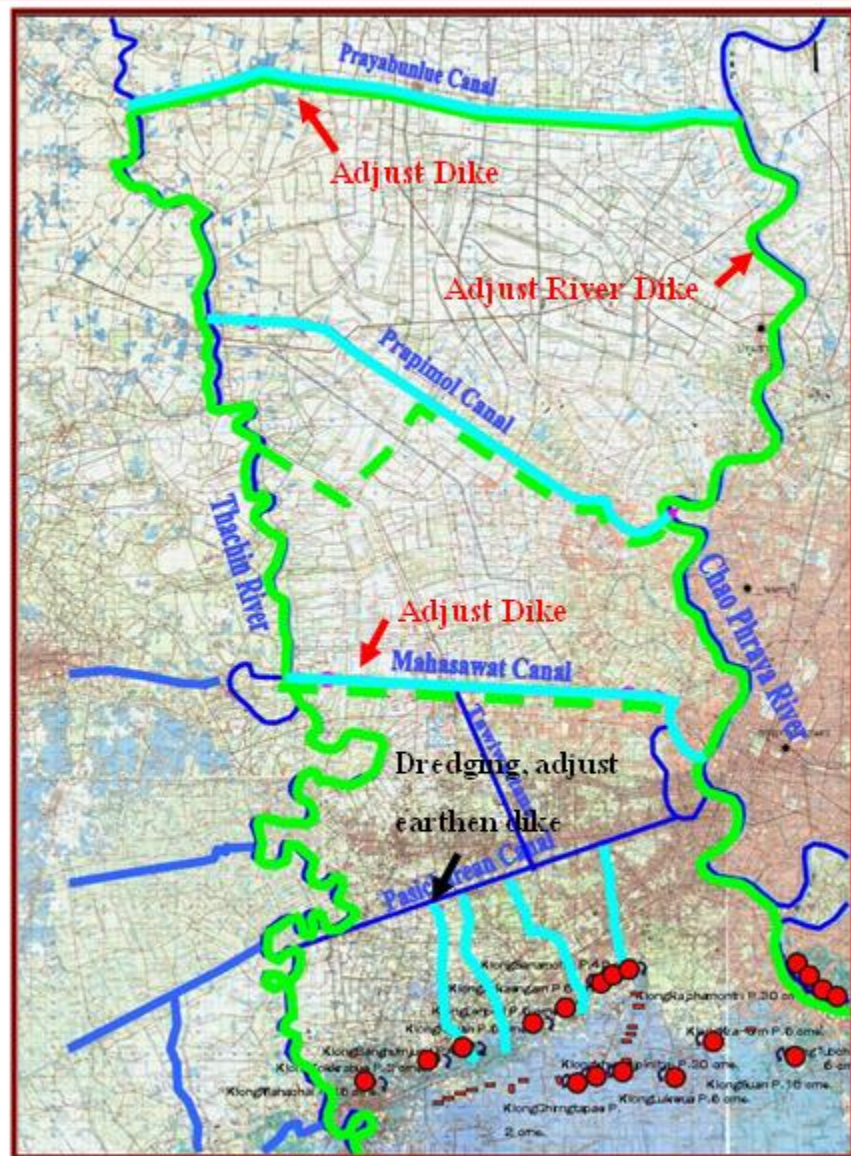
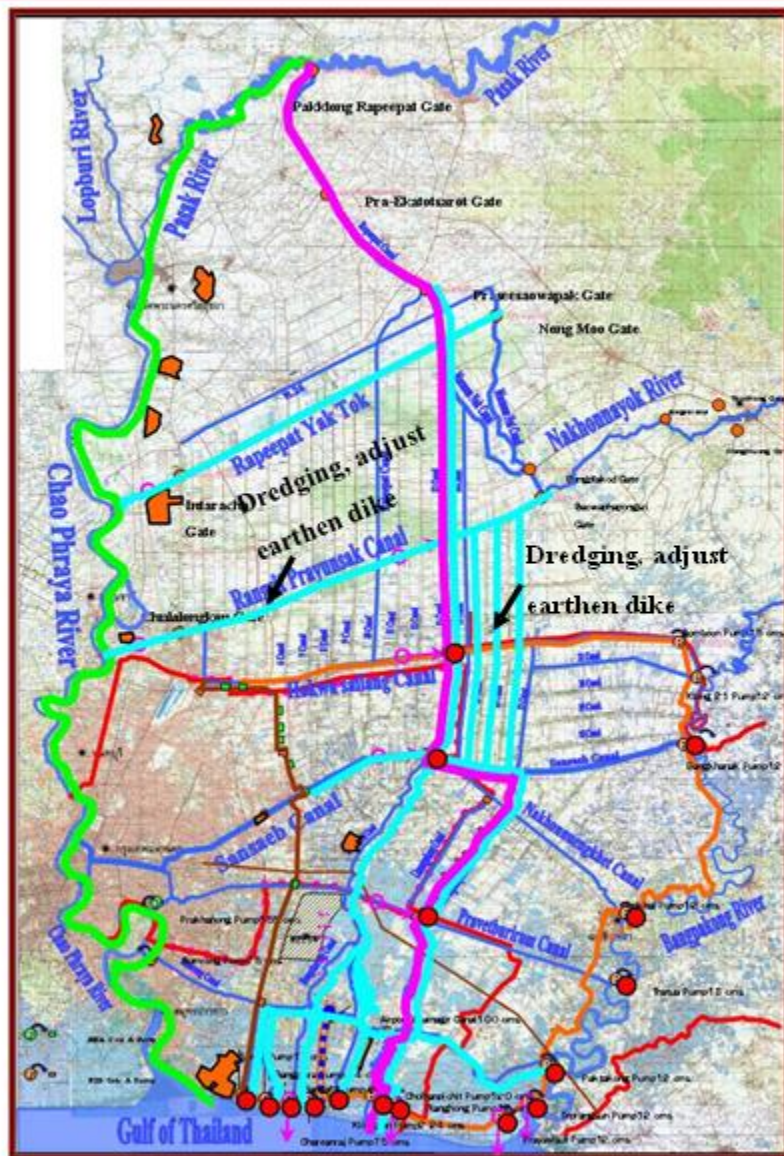


Improve floodways on the East and West sides on important economic zone



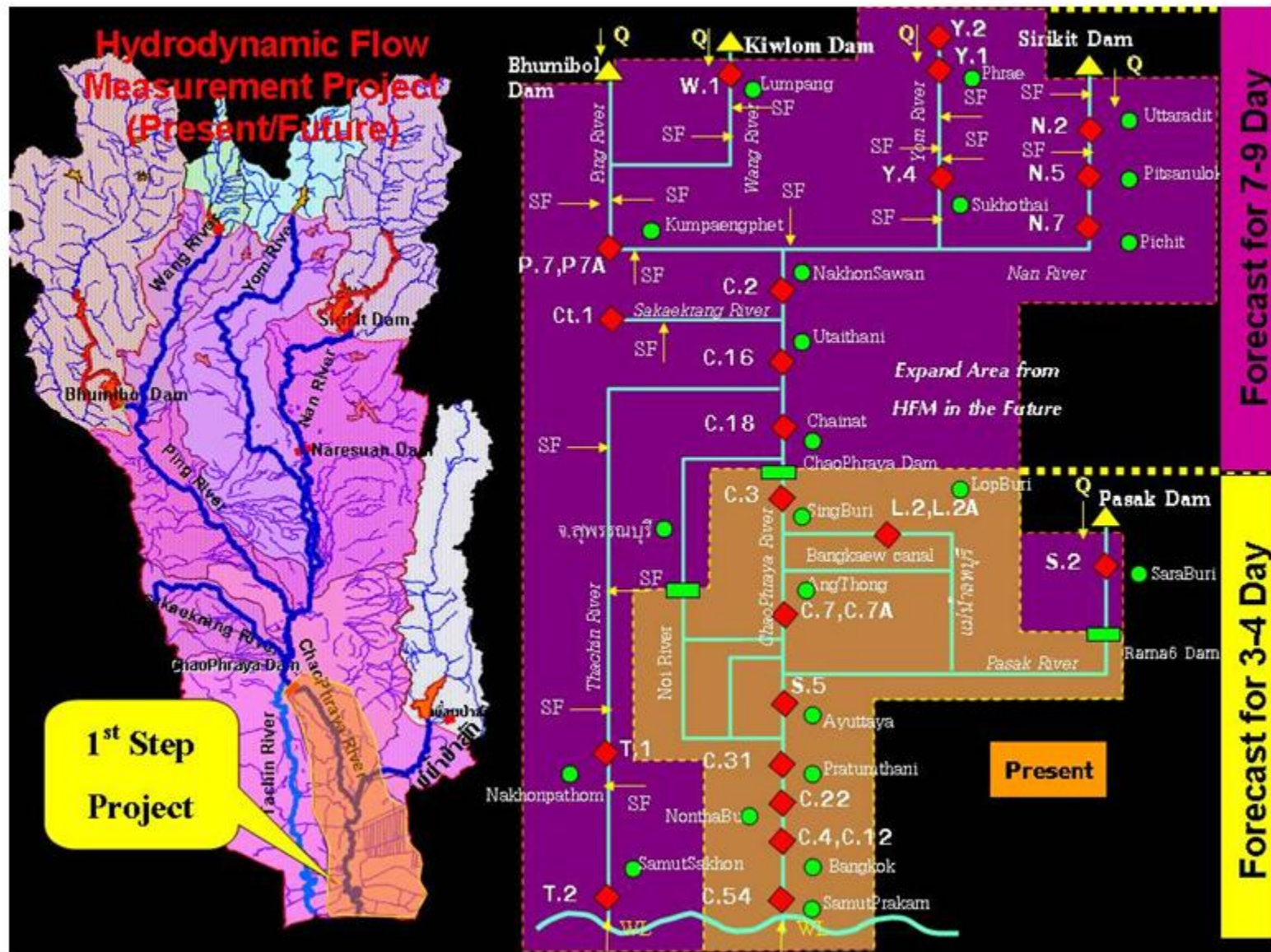
Reducing flood peak flow by
1,000 cms.

Restoration and Improvement of Existing Structure



Improve polders and drainage systems in important economic zone

Development of Database, Forecast and Early Warning Systems



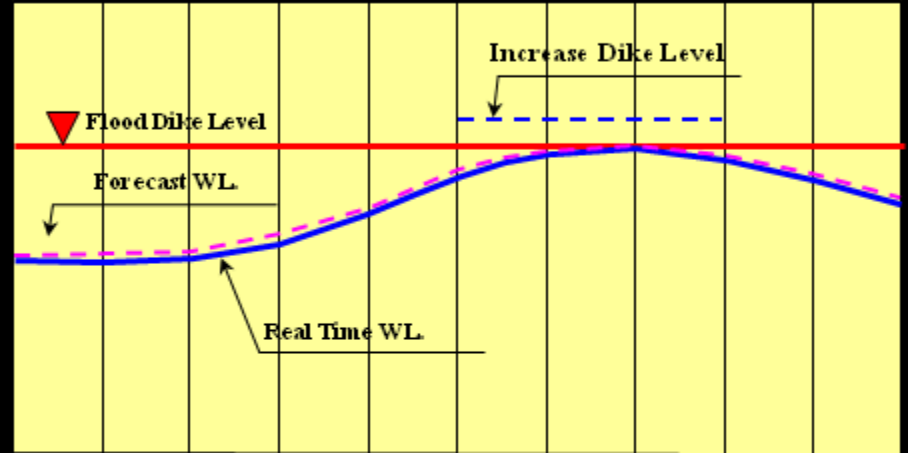
Improve the forecast and early warning system

Chao Phraya River Basin



(Target Area)

2) Flood Forecast



Activities	Forecast and Report	ติดตามข้อมูลและหาแนวทางการบริหารน้ำ	แจ้งเตือนหน่วยงานและประสานงาน	ดำเนินการบริหารน้ำหลาก	บริหารงานระหว่างออกภัย	บริหารงานหลังออกภัยผ่านพ้น				
Day	1	2	3	4	5	6	7	8	9	10

Development of Database, Forecast and Early Warning Systems

Establish trigger for floodplain storage

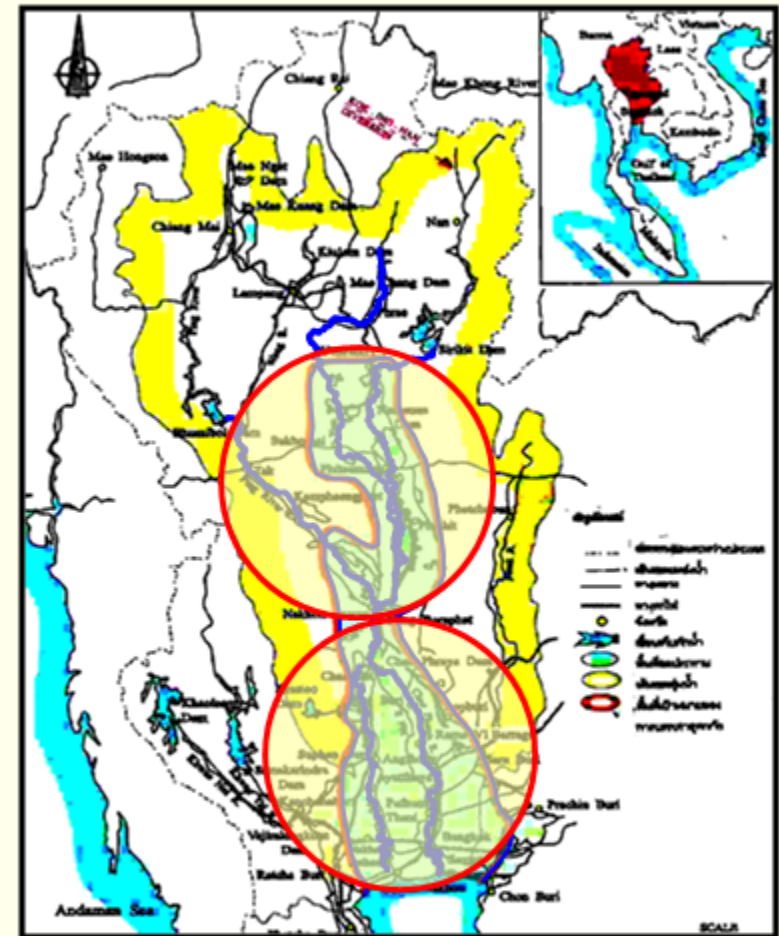
(above Nakornsawan & above Ayudhya)

Monitoring above Nakornsawan

- Trigger at A. Muang Nakornsawan
 - Water level > +25 m. m sl
 - Discharge > 3,000 cm s.

Monitoring below Nakornsawan

- Trigger at Chai Nart
 - Water Level > +16.5 m. m sl
 - Discharge > 2,500 cm s.
- Trigger at Ayudhya
 - Water Level > +4.8 m. m sl
 - Discharge at Chainart > 2,500 cm s.
 - Discharge at Rama6 Dam > 600 cm s.



factors to take into account: location + flood peak + discharge + timing

Water Gates +Dikes

Warning

Remedy

Flood Preparedness Plans for Specific Areas



Flood Rescue



Flood Restoration

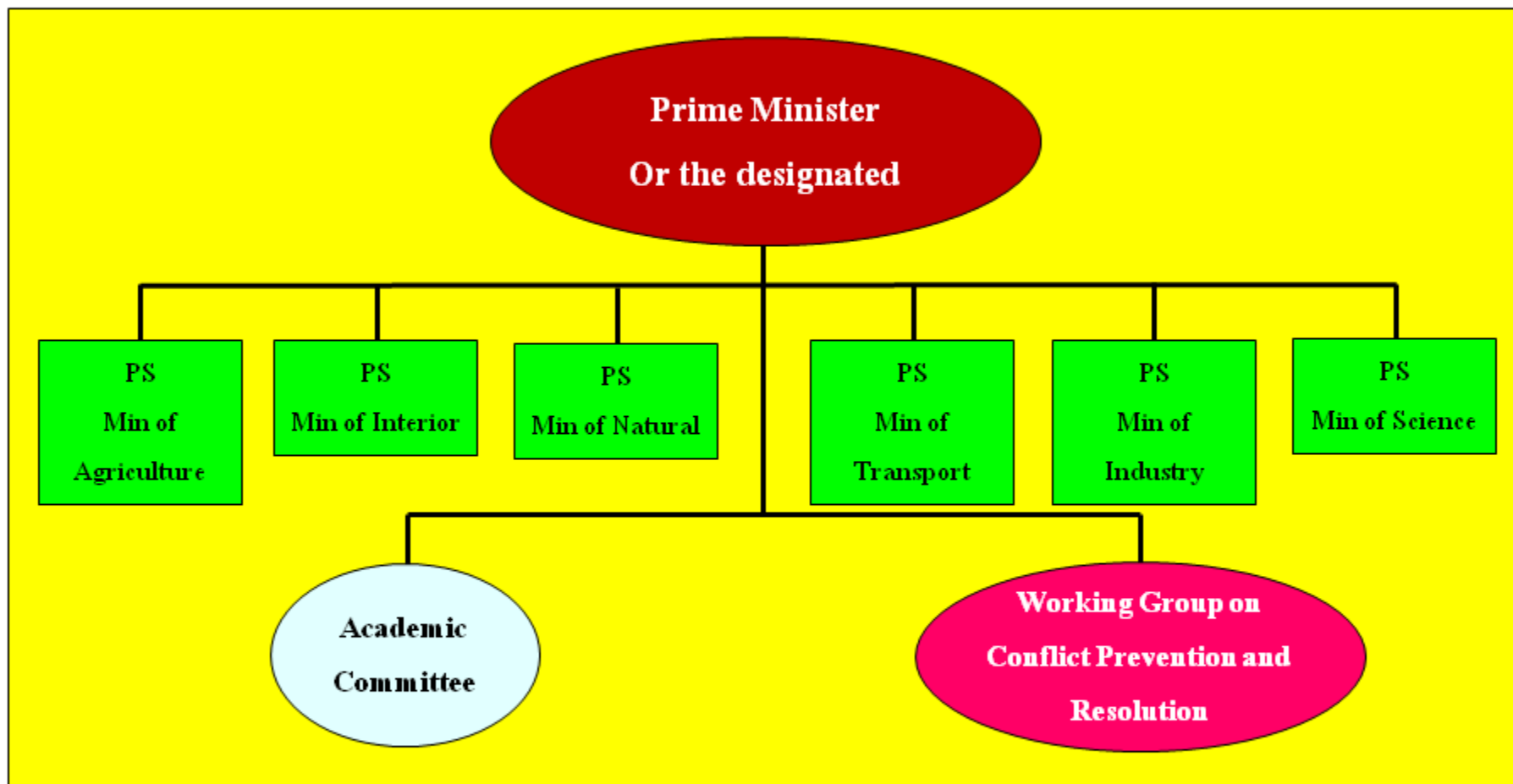


Flood Fighting



Financial Assistance

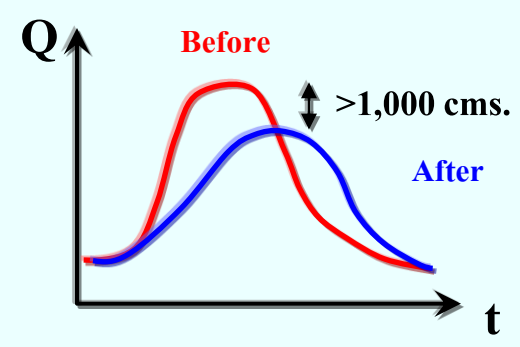
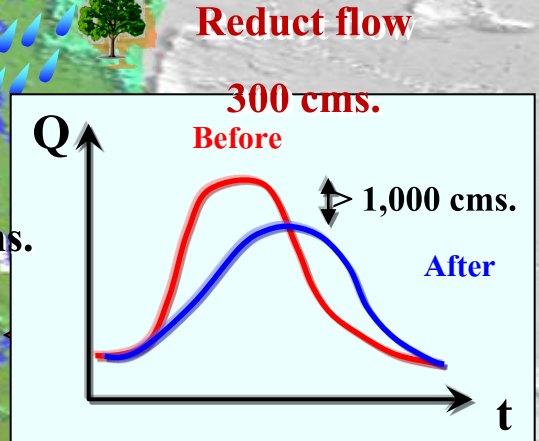
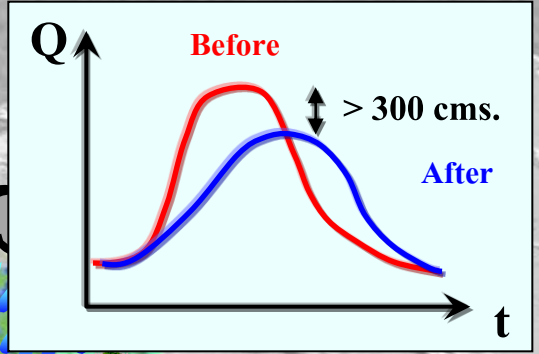
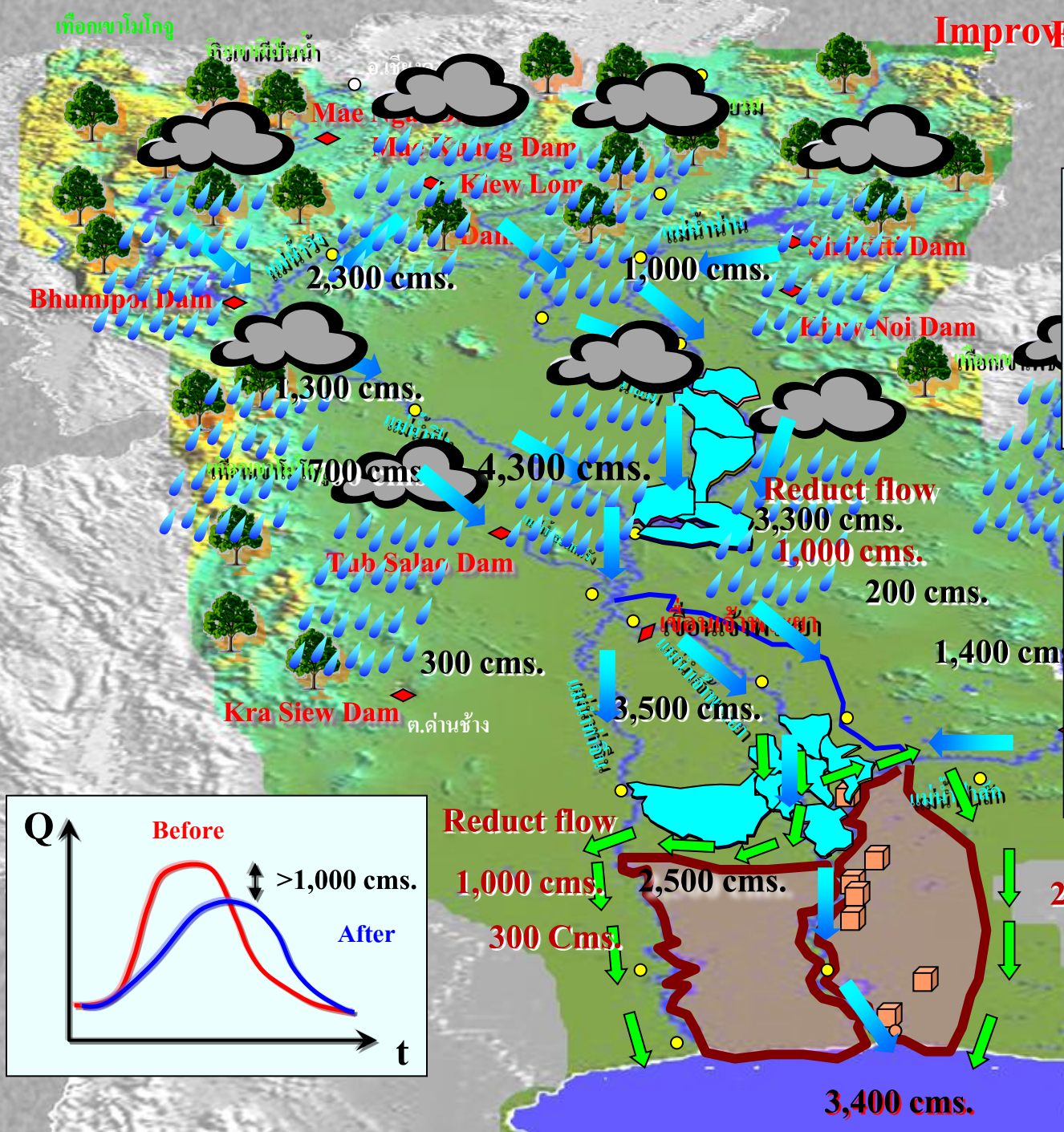
Develop institutions for water management



Example of “Single Command Authority”

Improve Absorbing Flood/Peakin

Irrigated Flood Plain





The End



Thank You