



# **WATER CHALLENGES FOR THAILAND MAJOR CITIES**





# SUSTAINABLE DEVELOPMENT GOALS: SDGS (THAILAND'S STATUS)



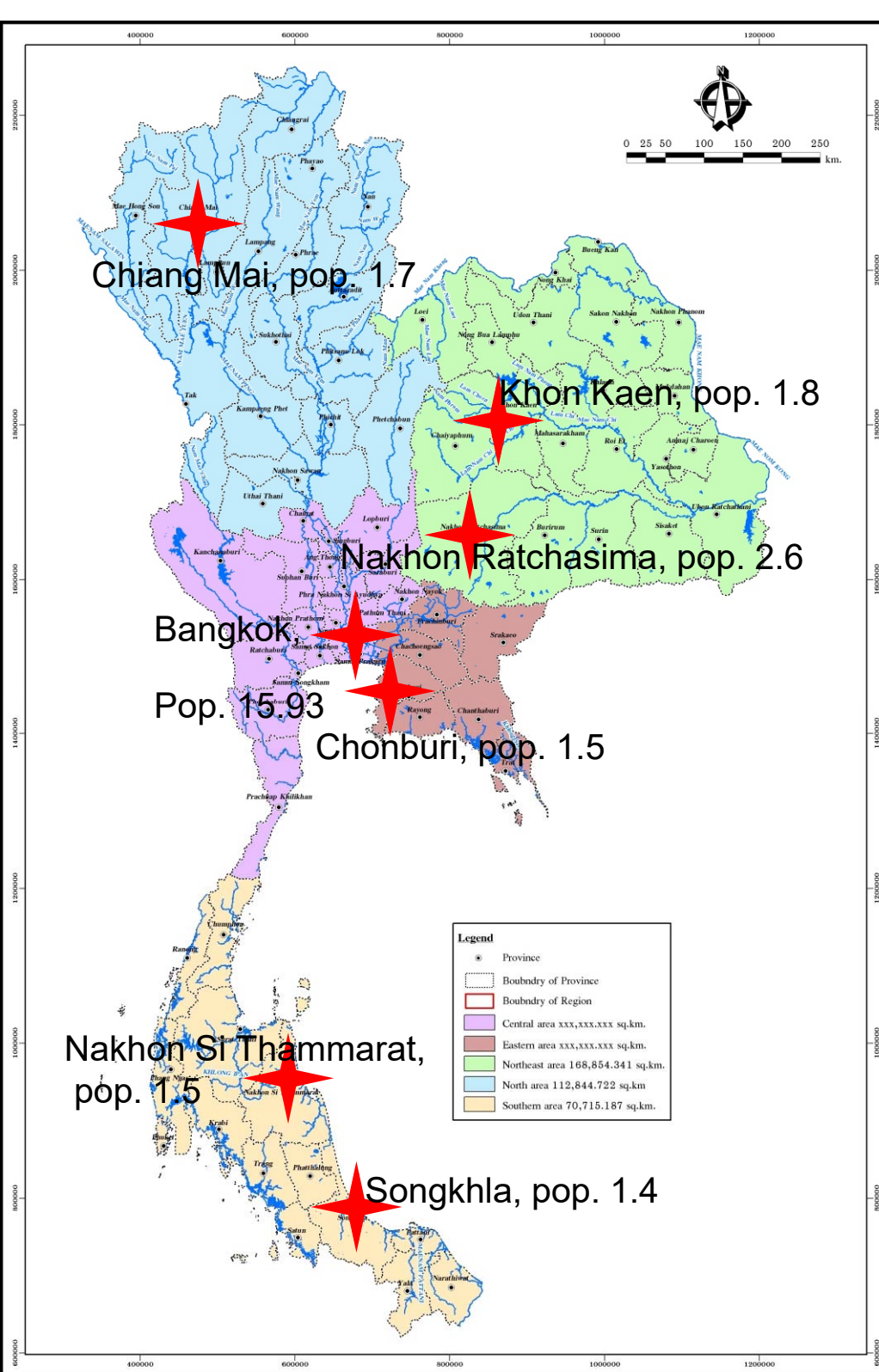
- 1) Goal 6 Ensure availability and sustainable management of water and sanitation for all
  - **Thailand aims to achieve 100 % coverage of safe drinking water services by 2030.**
- 2) Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable
  - **reduced the impact of water related disasters through planning and implementation**



# SUSTAINABLE DEVELOPMENT GOALS: SDGS (THAILAND'S STATUS)

## 3) Goal 13 Take urgent action to combat climate change and its impacts

- **13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries**  
- Thailand has the National Disaster Prevention and Mitigation Plan 2015
- **13.2 Integrate climate change measures into national policies, strategies and planning**  
- Thailand has integrated the measures into 20-year National Strategy, 12<sup>th</sup> National Economic and Social Development Plan, Thailand Climate Change Master Plan.
- **13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning**  
- Many government and non-government institutes had organized trainings courses with the aims to build knowledge and capacity on climate change mitigation, adaptation, impact reduction and early warning.



# Major Cities in Thailand

- Cities are the economic heart and the most densely populated places
- Characteristics of cities are:
  - Low level of sustainability
  - Large consumers of energy and natural resources which need to be transferred from elsewhere
  - Generate more pollution, more waste production
- Thailand 2016 population : 66.19 million
- Bangkok ranks 24<sup>th</sup> in 2016 world megacities table, a population of 15.93 million people. Bangkok is a primate city, the next largest cities are in the range of 1.8 - 2.6 million people.
- Thailand urban population increased from 29% in 1990 to 49% in 2014, and expected to increase to 72% in 2050.



# WATER CHALLENGES FACING CITIES

## 1) Vulnerability due to their geographical locations

- **For example delta cities such as Bangkok are prone for flooding**

## 2) Rapid Population Growth and Urbanization

- **Large influx of people and rapid expansion of urban area placed a strain on city's infrastructure systems. Unplanned and rapid growth of urban area overwhelmed water infrastructure led to service interruptions, insufficient treatment and infrastructure failure.**
- **Loss of green spaces, water retaining areas and permeable surfaces**
- **Greater water demands to serve population and economic expansions**



# WATER CHALLENGES FACING CITIES

## 3) Inadequate Water Infrastructure

- Inadequate water and wastewater infrastructure due to limited funding or lack of planning to match city's growth.

## 4) Water Scarcity

- Insufficient water supply due to limited natural water resources and growing demand.

## 5) Flood

- Floodplains, coastal areas, land subsidence

## 6) Climate Change

- Increased intensity of rainfall, drought, frequent extreme weather, storm surge

## 7) Business Continuity

- Resilience and preparedness for adverse events for fast recovery

## 8) Water Management Challenge

- Difficulty in efficiently managing scarcer and less reliable water resources to serve more people



# WATER CHALLENGES FOR SUSTAINABLE CITIES

## 1) Adaptivity/Resiliency

- **Water Security**
  - Adequate and Reliable Supply
  - Water Reserve
- **Measures to Mitigate Water-related Disaster Risks**
  - Flood
  - Drought
  - Storm
- **Measures to Improve Resilience and Reduce Vulnerabilities**
  - Green Spaces, Water Retaining Areas, Permeable Areas
  - Flood Warning
  - Flood Defences

## 2) Efficiency

- **Water Leakage**
- **Water Service Interruptions due to Infrastructure Failure**
- **Low Level of Wastewater Reuse/Recycled**
- **Low Level of Social Education to Promote Rational Water Use**

## 3) Water Quality

- **Water Pollution**
- **How to improve waterways aesthetically to attract investment and tourism**





# BANGKOK

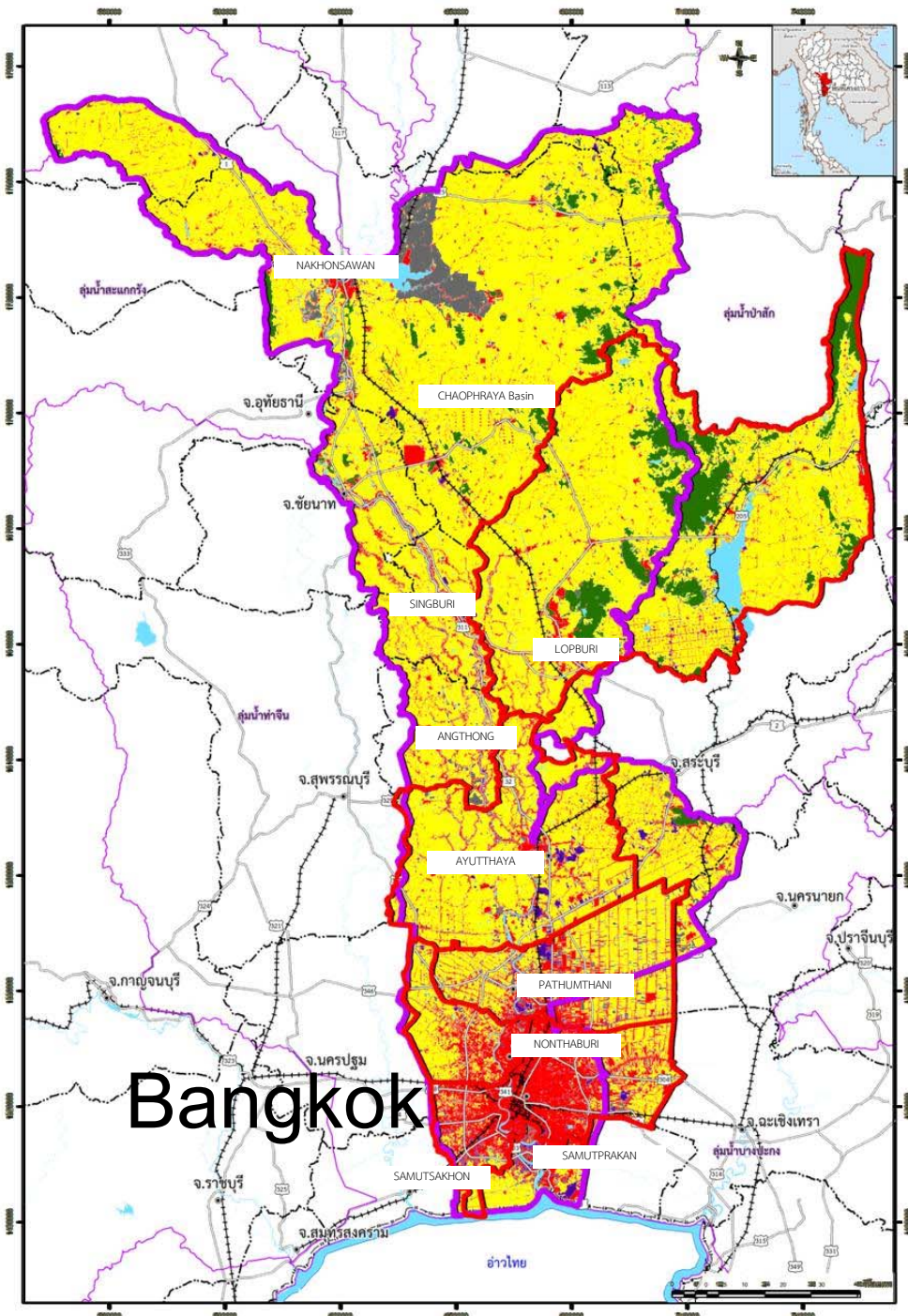
- A delta city lies on the banks of the Chao Phraya River, in the Chao Phraya Basin
- Area : 1,569 sq.km.
- An average elevation of 0+00 to +1.50 m. msl
- Population : registered 5.68 million people, plus non-registered and commuters totals 15.93 million people
- Water Challenges:
  - Flood :
    - Major flood which caused extensive damage, caused by major storms
    - Frequent floods which disrupt city life, caused by low lying topography, tidal influence, insufficient drainage system, blockade from rubbish and debris
  - Water Shortage
    - Drought
    - Saline Intrusion
  - Water Pollution



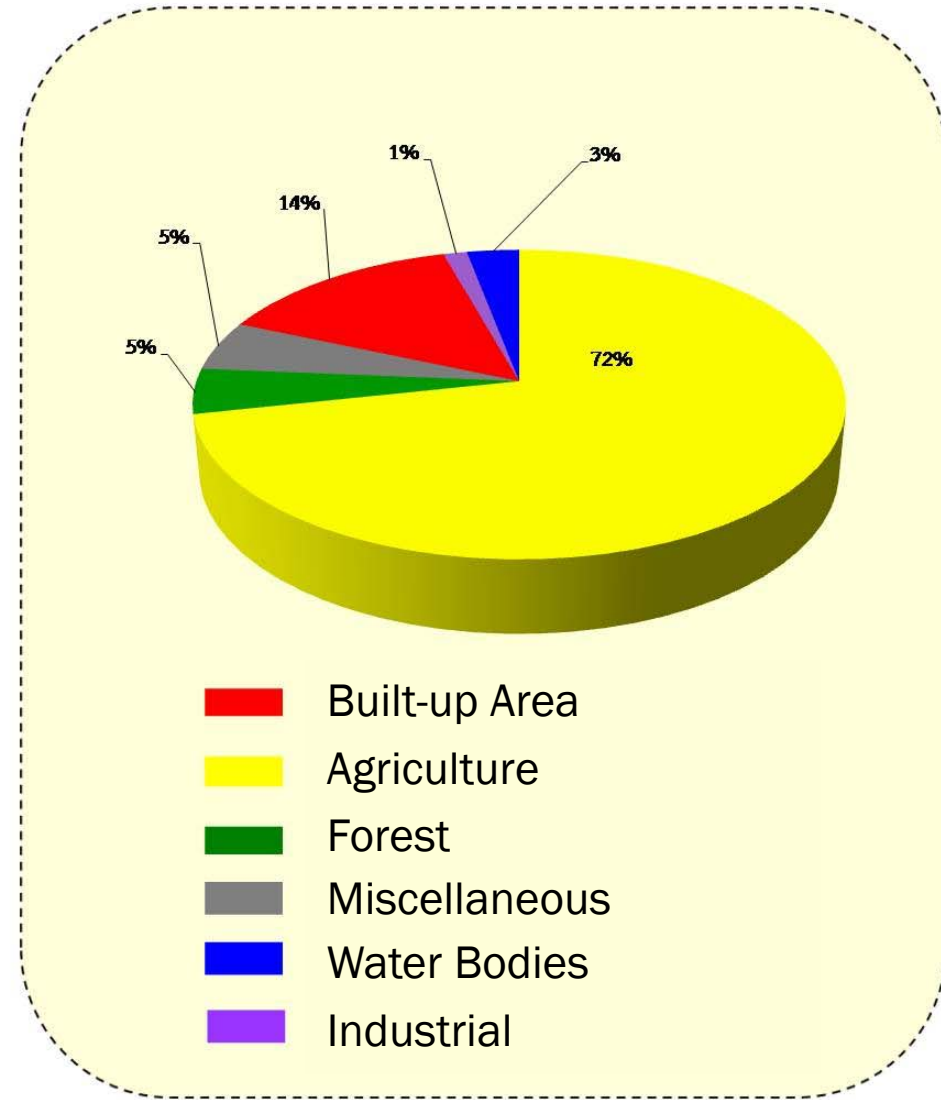




# Land Use in Chao Phraya Basin



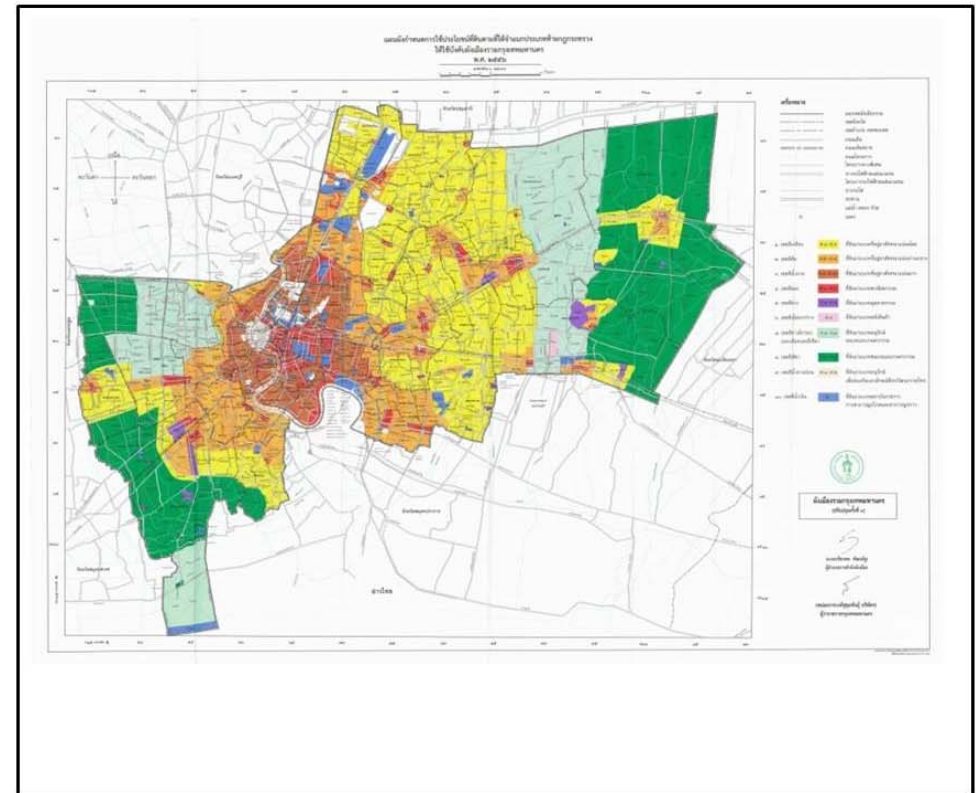
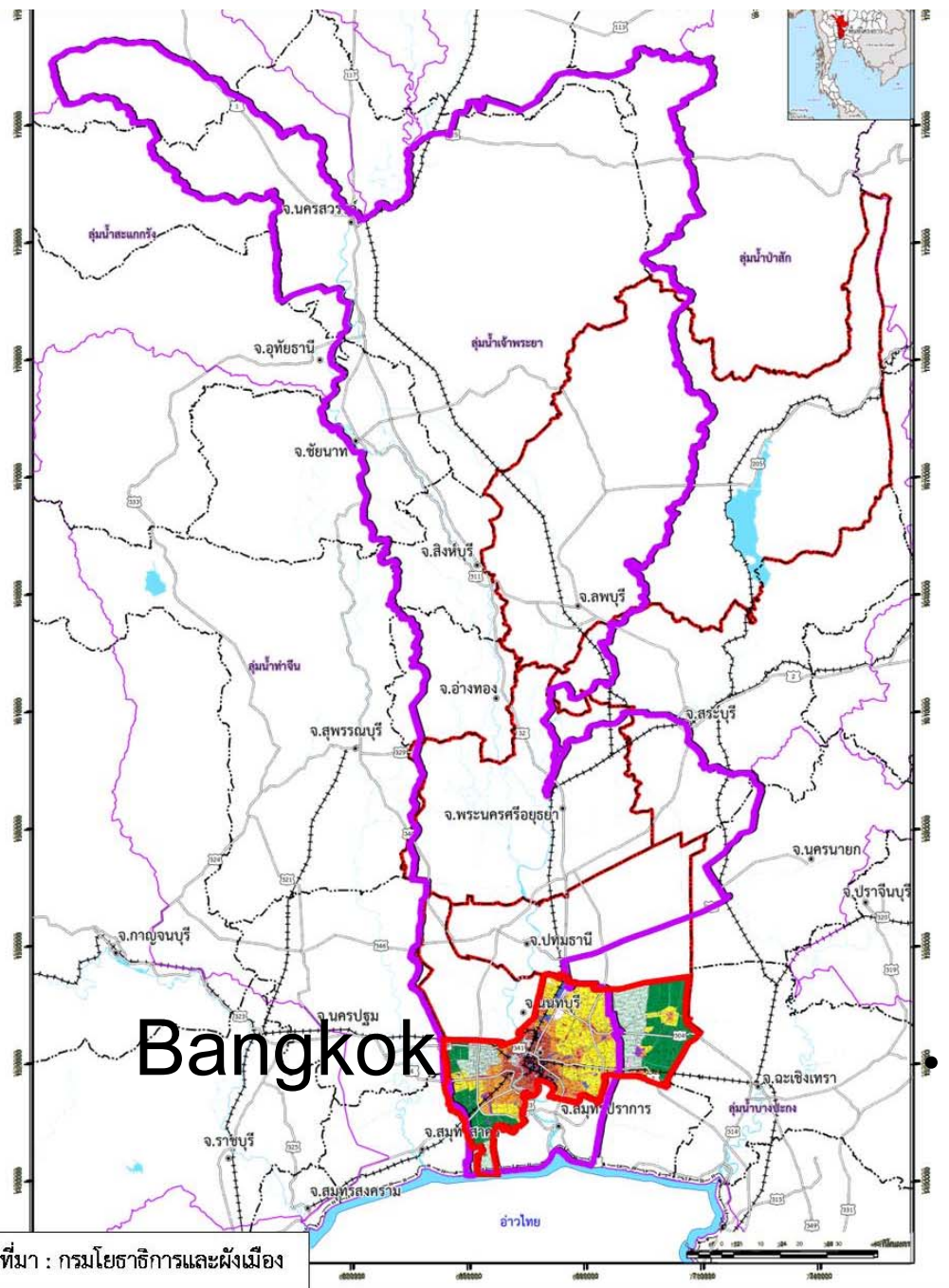
## Current Land Use



# Bangkok Comprehensive Plan

## Comprehensive Plan

- Regulate Land use



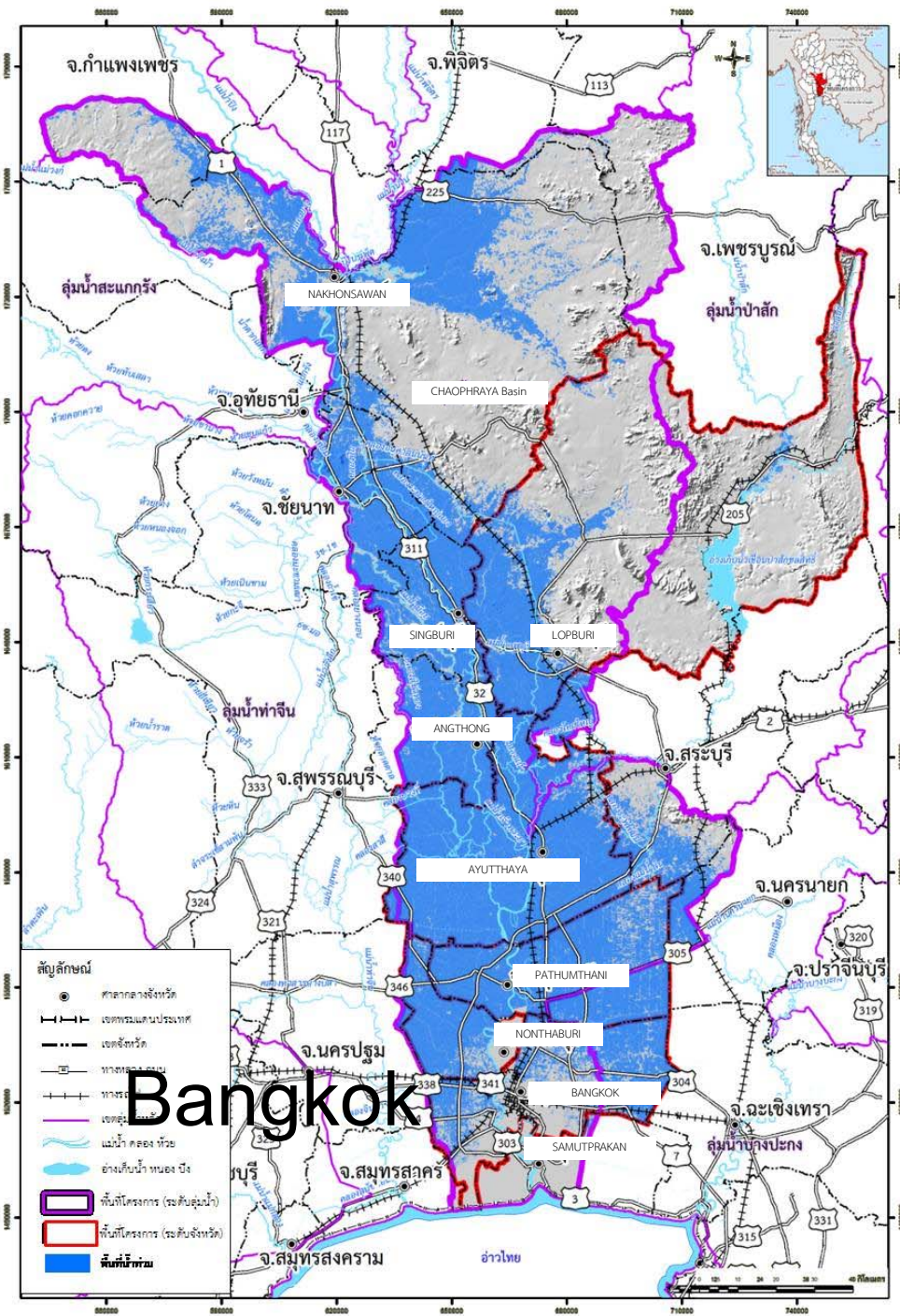
City has expanded into planned floodway





# Chao Phraya Basin Flood in 2011

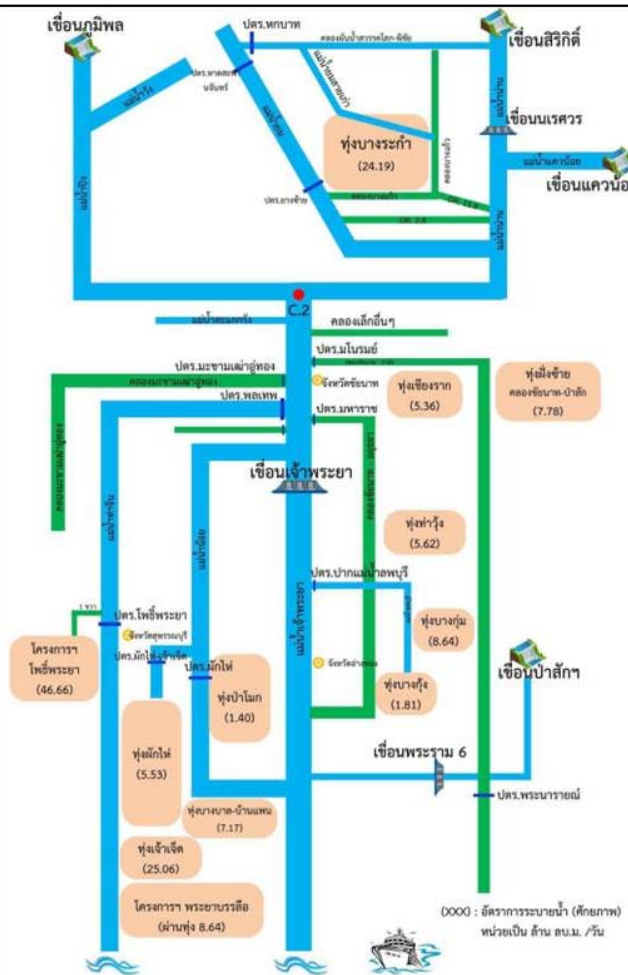
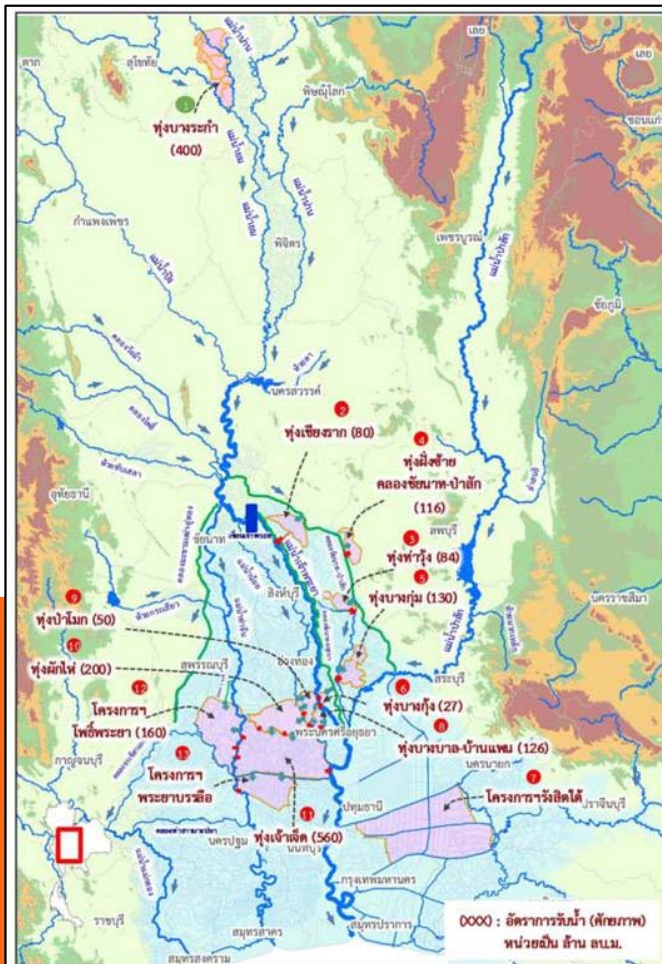
Damage cost 45.7 billion USD





# FLOOD PREVENTION AND ALLEVIATION MEASURES

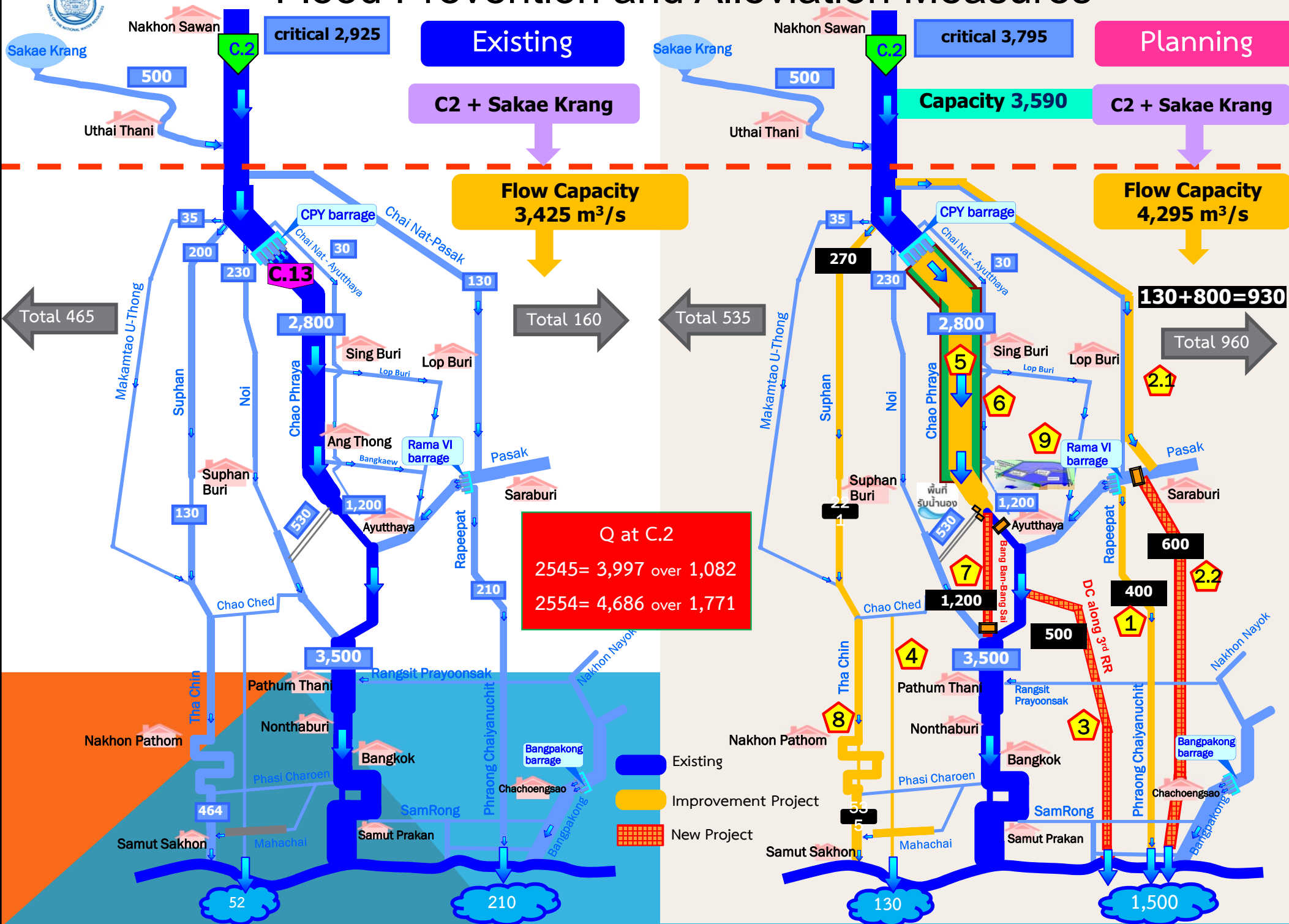
- Flood diversion canals are planned in the Chao Phraya Basin to divert excess flow from the Chao Phraya River
- Utilizing natural low lying areas in the river basin to retain excess flood waters, i.e. flood management
- Improve city flood protection and drainage systems



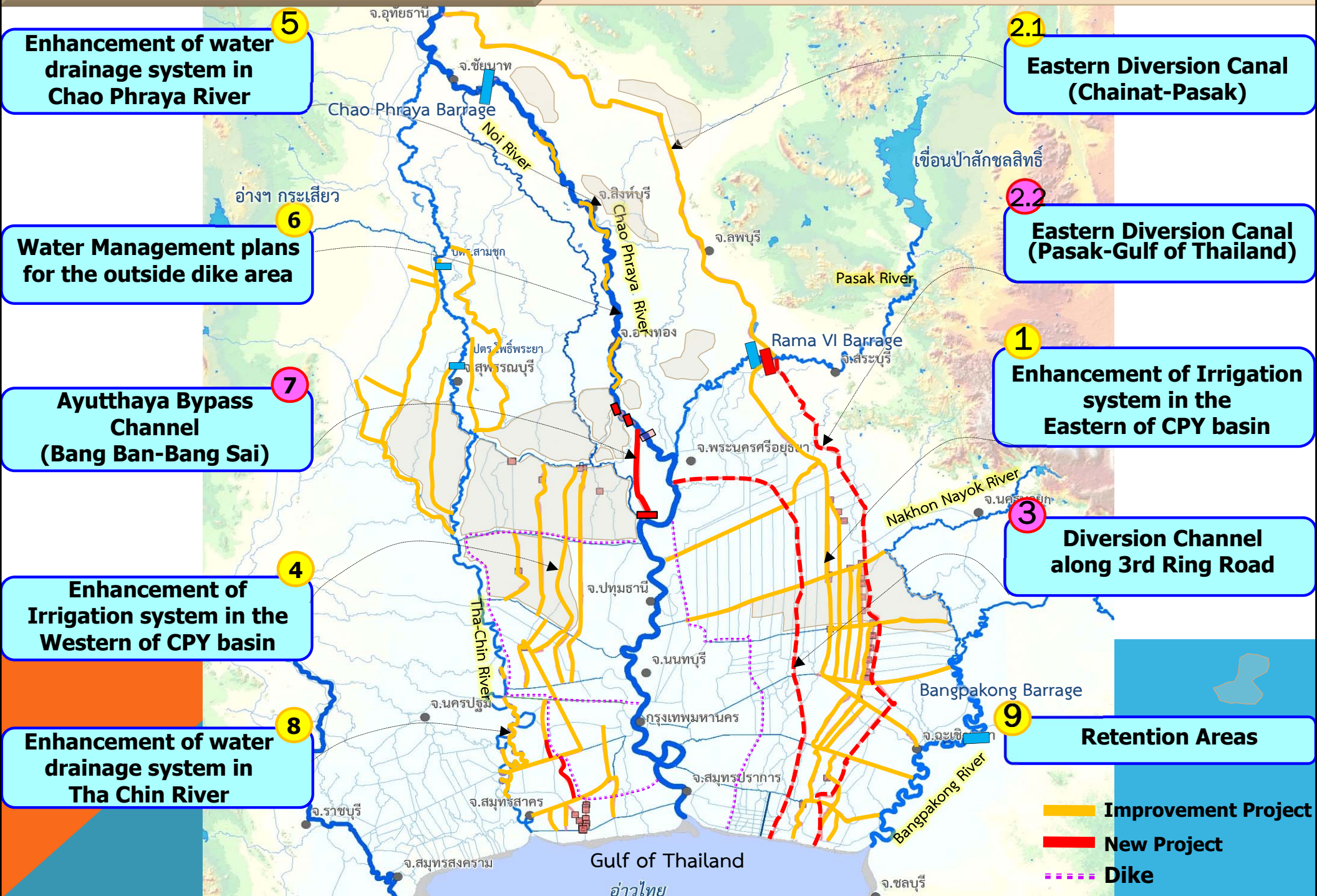
Utilizing natural low lying areas for flood management



# Flood Prevention and Alleviation Measures







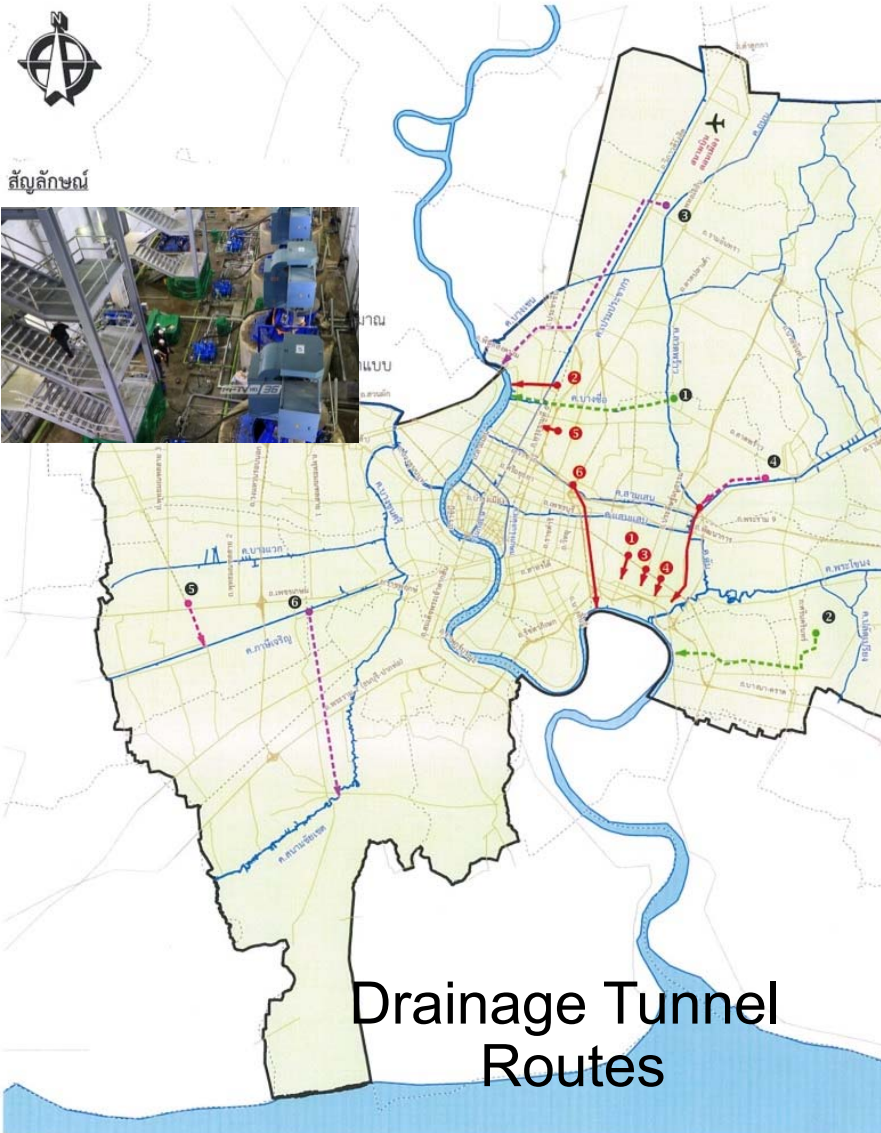




# FLOOD PREVENTION AND ALLEVIATION MEASURES

## Bangkok Flood Defence

- Polder system to protect against riverine flood and overland flow from the North
- Internal drainage systems for local drainage



## Challenges

- Tidal Effect
- Decreased green spaces
- Loss of canal systems
- Obstructed waterways
- Old and insufficient drainage systems
- Land subsidence

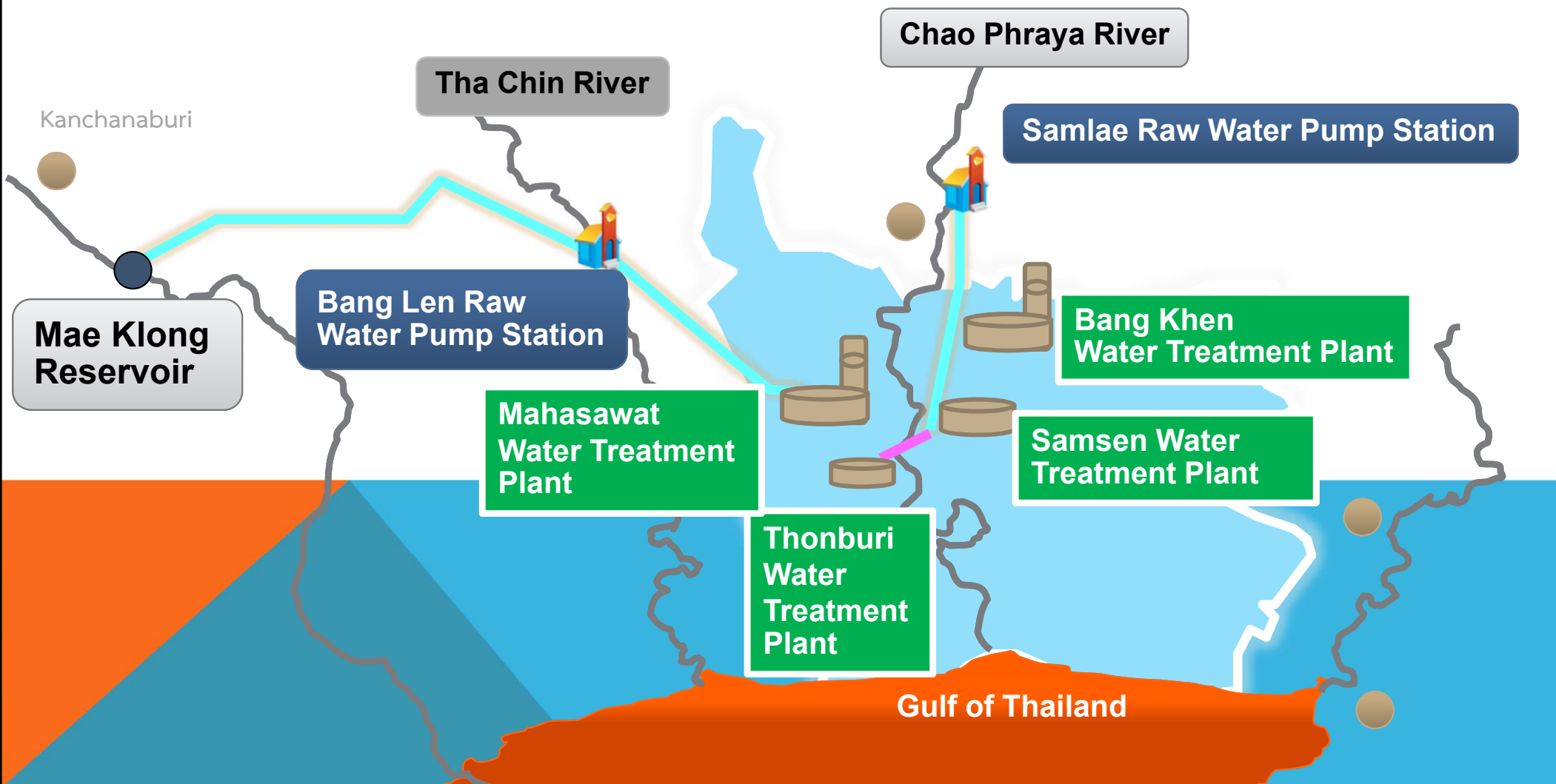
## Prevention and Alleviation Measures

- Construction of drainage tunnels and large pump stations
- Improve polder system, fill in existing gaps or weakness in flood wall
- Improve canal drainage capacity



# Water Supply System

- Two sources of water resource : Chao Phraya River and Mae Klong River (different river basins)
- Prone to saline intrusion in Chao Phraya River during drought years





# **WATER POLLUTION**

- **Currently there are 8 centralized wastewater treatment plants in operation, and treated wastewater is approximately 32% of total wastewater generated.**
- **There are 13 more centralized wastewater treatment plants planned for Bangkok which will bring total treated wastewater to 77%.**
- **One of the main difficulties is finding plant location which is approved by the local. Solution is to construct plants to blend in with the environment as well as offer added benefits to local communities such as public building with wastewater treatment plant underground.**

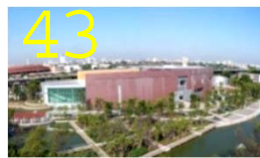


# Bangkok Wastewater Treatment Plants



## Rattanakosin

41 In operation since 2000  
51 Service area 4.1 sq.km  
61 Population 70,000 people  
71 Two-stage Activated Sludge  
81 Capacity 40,000 cu.m./day



## Bang Sue

1. In operation since 2013  
2. Service area 20.7 sq.km  
3. Population 223,900 people  
4. Capacity 120,000 cu.m./day



## Chatuchak

41 In operation since 2005  
51 Service area 33.4 sq.km.  
61 Population 432,000 people  
71 Cyclic Activated Sludge System (CASS)  
81 Capacity 150,000 cu.m./day



## Nong Khaem

41 In operation since 2002  
51 Service area 44 sq.km.  
61 Population 520,000 people  
71 Vertical Loop Reactor AS  
81 Capacity 157,000 cu.m./day



## Din Daeng

41 In operation since 2004  
51 Service area 37 sq.km.  
61 Population 1,080,000 people  
71 Activated Sludge with Nitrogen removal  
81 Capacity 350,000 cu.m./day



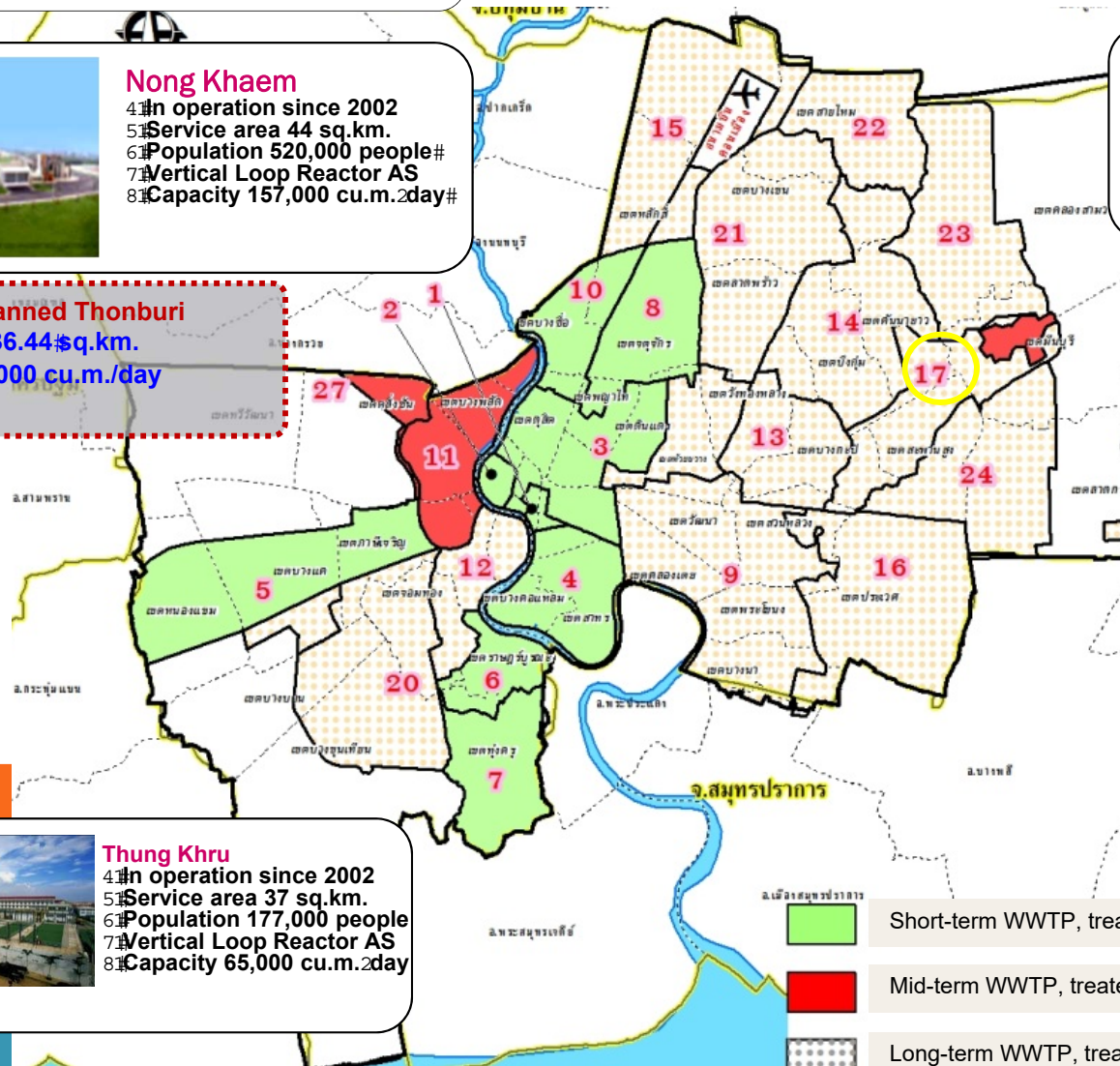
## Si Phraya

41 In operation since 1994  
51 Service area 2.7 sq.km.  
61 Population 120,000 people  
71 Contact Stabilization AS  
81 Capacity 30,000 cu.m./day



## Choeng Nonsi

41 In operation since 2000  
51 Service area 28.5 sq.km.  
61 Population 580,000 people  
71 Cyclic Activated Sludge System (CASS)  
81 Capacity 200,000 cu.m./day



## Thung Kru

41 In operation since 2002  
51 Service area 37 sq.km.  
61 Population 177,000 people  
71 Vertical Loop Reactor AS  
81 Capacity 65,000 cu.m./day



## 17. Minburi

Service area : 4.43 sq.km.  
Capacity : 10,000 cu.m./day

Short-term WWTP, treated up to 45% of wastewater generated

Mid-term WWTP, treated up to 52% of wastewater generated

Long-term WWTP, treated up to 97% of wastewater generated



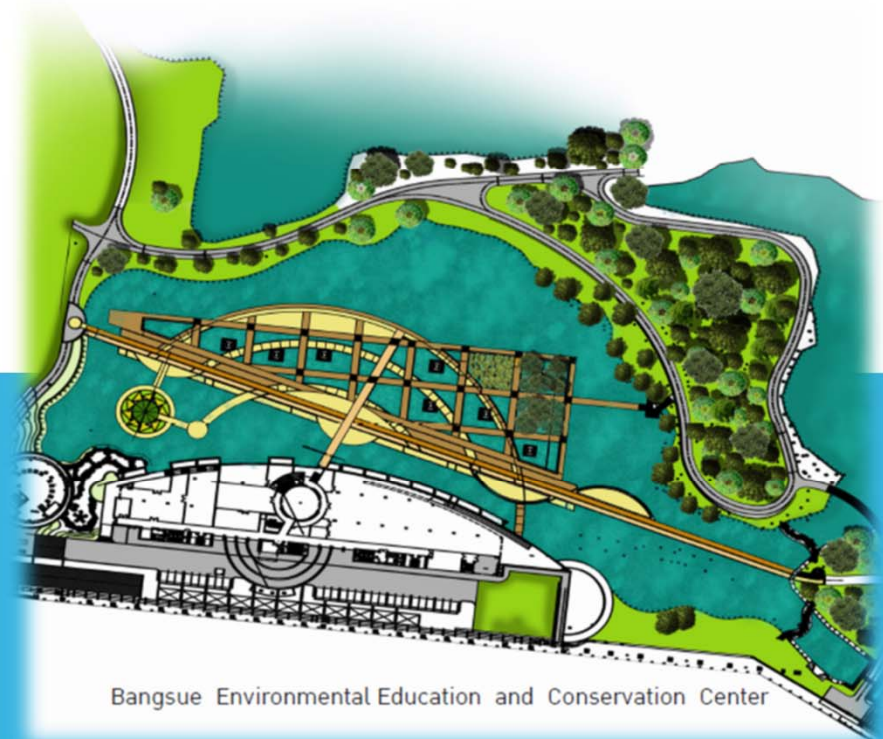


# Wastewater Treatment Plant in the Park



**Bang Sue Educational Center + Wastewater Treatment Plant**





Bangsue Environmental Education and Conservation Center





# Reviving Urban Canal System

- Bangkok was once a city crisscrossed with canal networks
- However, many canals were filled in to make way for roads. Most of canals left were encroached upon, houses were built in the canals or on their banks which obstructed drainage flow as well as caused water pollution.
- The City wants to revive old canals to eliminate encroachment and water pollution, improve drainage flow conditions and contribute towards flood protection, as well as improve social condition, and promoting water transport to supplement public transport such as the underground train, allowing fast boat-train connection to reduce commuting time.
- An example is the Lad Phrao Canal Community Development Project.

