

ICID WG-SDTA Workshop 2011

Catchment Water Quality Management Planning for Sustainable Development of Tidal Areas

Joong-Dae CHOI, Kyong-Jae Lim,
and Cheol-Hee Won

Dept. of Regional Infrastructures Engineering
Kangwon National University, Korea

October 17, 2011

IRIB International Conference Center (IICC), Tehran, Iran



Kangwon National University

Necessities for Catchment Management Planning

- **What is the Catchment management?**
 - It is the effective and economic control of the factors that affect the runoff and pollution discharges
 - Catchment management is a combination of engineering and art
- * **Successful catchment management practices =**
f(technology development and transfer, education and public relation (local officers and residents), incentives, legal and administrative system, voluntary participation, cooperation among stakeholders, ...)



Kangwon National University

Necessities for Catchment Management Planning

- How can we reduce the nutrient discharges or pollution load?
 - Need to completely understand the mechanisms of pollution through surface flow and groundwater in a catchment
 - Catchment Pollution Load = $f(\text{hydrology, population, livestock, industry, agriculture, forest, rainfall, natural attenuation process, wastewater treatment, deposition from the air ...})$
 - Chesapeake Bay TMDL in USA considers air deposition in the watershed management
 - TMDL in Korea does not consider air deposition
- Objectives of CMP for SDTA:
 - to reduce nutrient discharges from catchment and
 - to conserve the water quality of the freshwater lake created by a SDTA



Planning for Catchment Management

- Pollution management strategy = $f(\text{point source pollution, non-point source pollution})$
- Pollution management targets
 - Point source pollution = 100% elimination by adopting cutting-edge treatment technologies and management
 - NPS pollution = minimization by effective and strong CMPs
 - NPS pollution (BOD) in Korea 30~45% in 2005 to about 70% in 2015
 - NPS pollution (N and P) in the USA (Chesapeake TMDL) 74~82%
- Successful catchment management practices = $f(\text{technology development and transfer, education and public relation (local officer and resident), incentives, legal and administrative system, voluntary participation, ...})$
- Understanding of runoff and pollution mechanism = $f(\text{generation, transport, natural attenuation, wastewater treatment, impact on water quality, participatory catchment management, ...})$



Experiences in Korea

- Current Status

- Many sea dikes and estuary barrages
- Freshwater lakes created
- All experiences serious water quality problems

- Cause

- Catchment management - neglected
- Wastewater treatment - incomplete
- NPS pollution - not managed

- Result

- Give up of maintaining freshwater lake
- Typical example is the Sihwa Lake




PROJECT SYNOPSIS

SHIHWA SEA DIKE


- ❖ Construction of seadike 12.7 km (1986~1994)
 - Development of Agricultural and Industrial Areas
- ❖ Purpose change (Fresh Lake -> Sea Lake) (1994~2002)
 - Serious Pollution- Industrial & Urban Waste Water
- ❖ Government Permission to Develop TPP (2002~2004)
 - Feasibility Study, Basic & Detailed Designs
- ❖ Development of Tidal Power Plant (2004~2011)
 - Improvement of Water Quality, Production of Clean Energy



Current Status




•July, 2010




•August, 2011

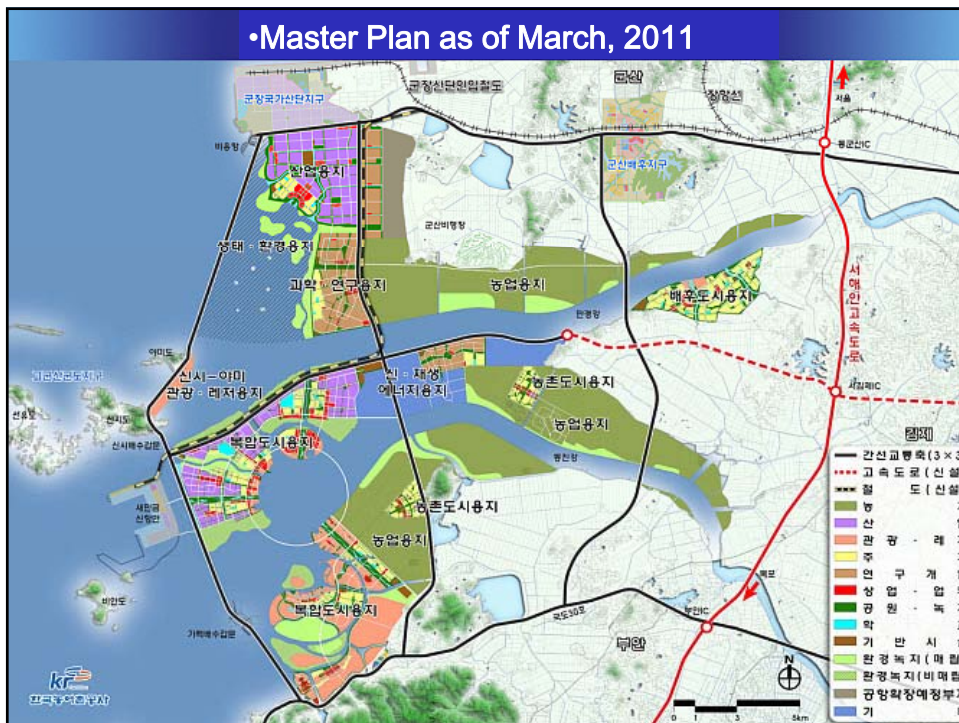
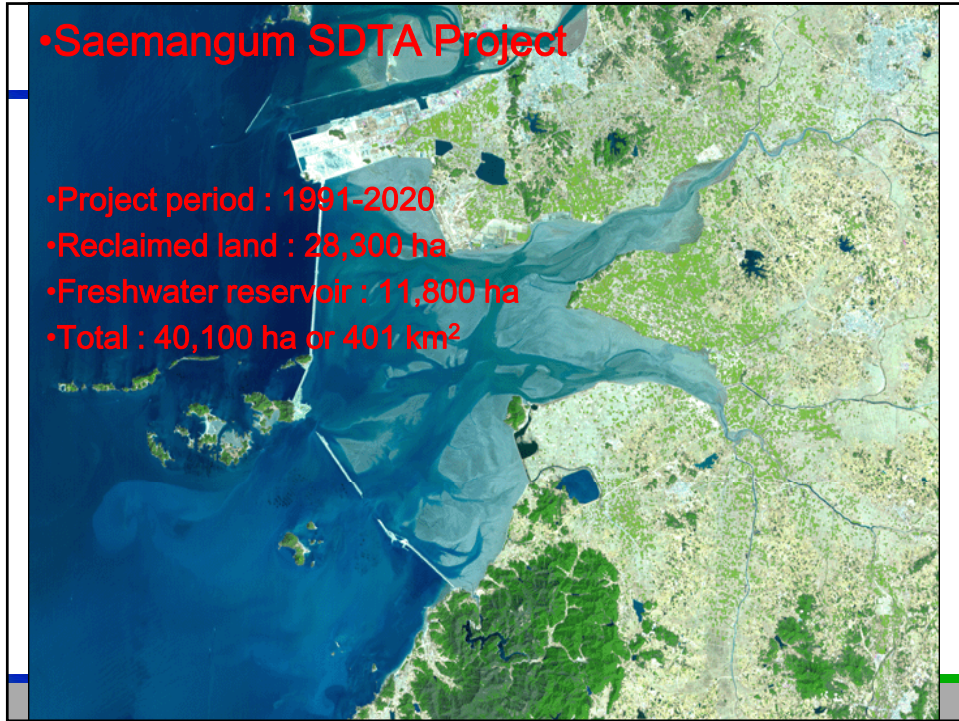
- Electricity generation : 550 M. kWh/y
- Cost : US\$ 2.5 B.

 Kangwon National University

Lessons and Learned for Saemanguem Project

- It was clearly understood that catchment water quality management is a key to the success of tidal land reclamation
- Urban wastewater treatment plants are actively updated with cutting edge technologies to improve the water quality of discharge, especially for T-P (0.2 mg/L)
- Large CAFOs are mostly closed and/or relocated
- Large scale 6 year research projects (AgBMP) are being conducted to reduce agricultural NPS pollution
- Aggressive environmental protection policies are performed to reduce pollution loads to water bodies
- TMDL is planned in the near future for further improvement of the quality of rivers and streams

 Kangwon National University



Strategies for Catchment Water Quality Mgmt

- Point source pollution : 100% elimination
- NPS pollution : must be minimized economically by catchment management policies based on technology development and transfer, education and public relation, incentives, legal and administrative system, voluntary participation, cooperation among stakeholders and other factors
- Strategies for catchment management, effect of land use on water quality, and principles of BMPs must be well understood before a catchment water quality management is planned



Closing Remarks

- Catchment management does not have a direct relationship with dike construction and tidal area development
- But it plays a key role in conserving the water quality of freshwater lake created by a tidal area development project
- Catchment management must be comprehensive and holistic including engineering, legal and incentive system, education, public relation and participatory involvement, etc.
- Catchment management must be planned and managed not only by construction engineers but also by catchment experts in close cooperation with all stakeholders from the beginning of a SDTA project



- Korea is trying very hard to keep the water quality within the target. And Korea's experiences, lessons and learned from tidal land reclamation projects will be a great resource for those who wish to develop tidal areas sustainably and economically.

