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ENERGY AND MINES

# Ministry of Energy and Mines Department of Energy Policy and Planning

## Lao Mekong Sanakham Hydropower Project introduction

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- ✓ Design and investigation process
- ✓ Project layout
- ✓ Design standards
- ✓ Project study

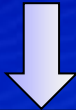
➤ **Design and investigation process**

## ➤ Design and investigation process

MOU signed in 2007



The ESIA was approved by GoL



F/S for Peer Review complied with PDG 2009



The Updated F/S Report was finally acknowledged by Ministry of Energy and Mines, Lao PDR.

## ➤ Project Layout



## ➤ Project Layout

An aerial photograph of the Sanakham Hydro Power Project. The image shows a large concrete dam structure across the Mekong River. The river is a vibrant blue-green color. The surrounding landscape is lush green with dense forest. A road or path runs along the riverbank, and there are some structures near the dam. The sky is clear and blue.

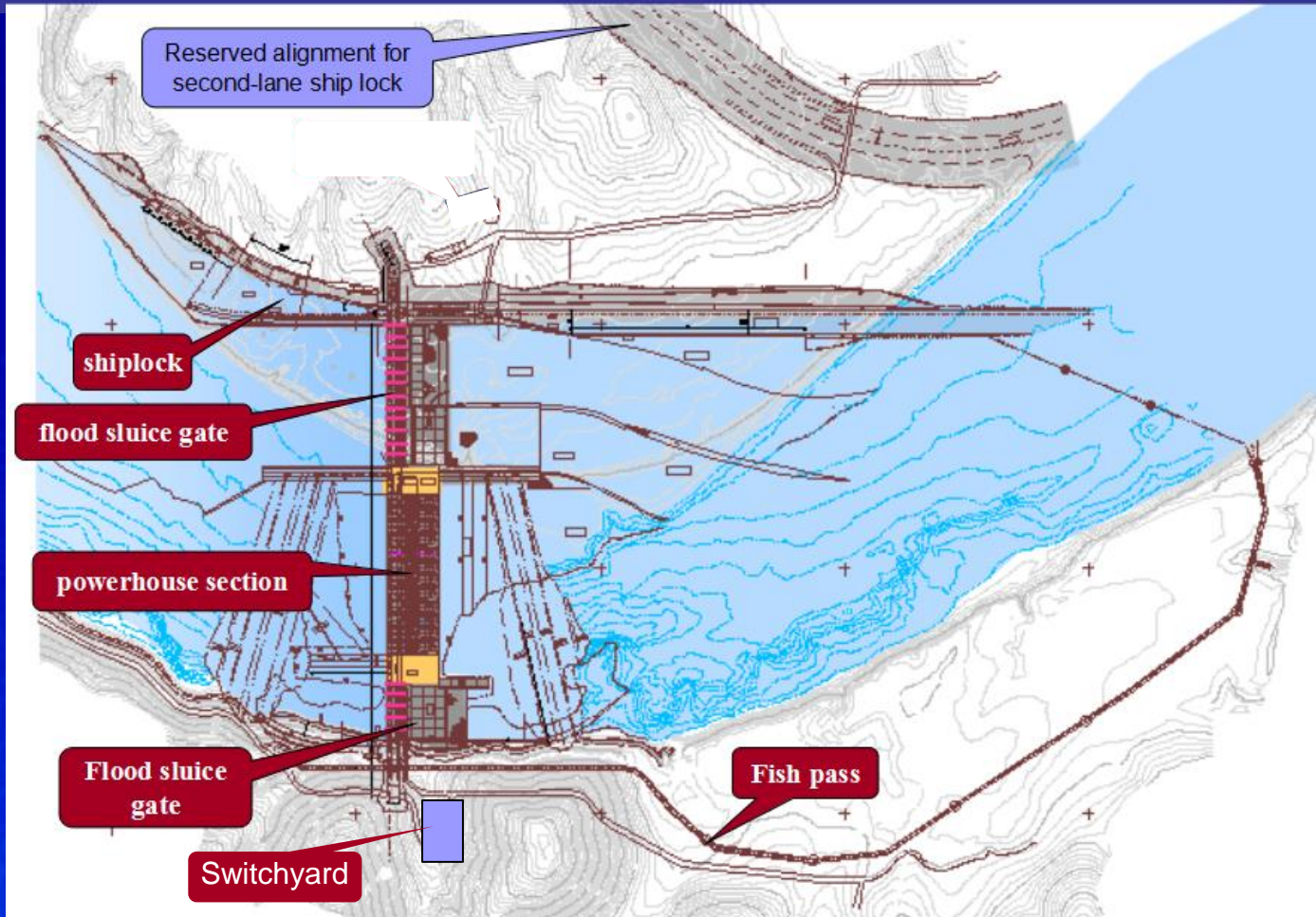
Sanakham HPP is the 5th cascade project planned on the main stream of the Mekong River in Laos. The Mekong River at the project site is on border of Province Sayaburi and Province Vientiane. District Kenthao of Province Sayaburi is located at the right bank, District Sanakham of Vientiane Province is located at the left river bank. The dam site is located about 1737km away from the Mekong estuary, about 155km away from the downstream Vientiane, 81km away from the upstream of the Pak Lay project, and about 25km to the Sanakham county seat.

The normal water level is 220MSL, the total installed capacity is 684MW, the average annual energy output is 3803GW·h. The total construction duration is 85 months.

Furthermore, after completion, the project shall sell power to Thailand and it will help develop tourism and promote the social and economic development of the country.



## ➤ Project Layout



Dam type: Concrete dam

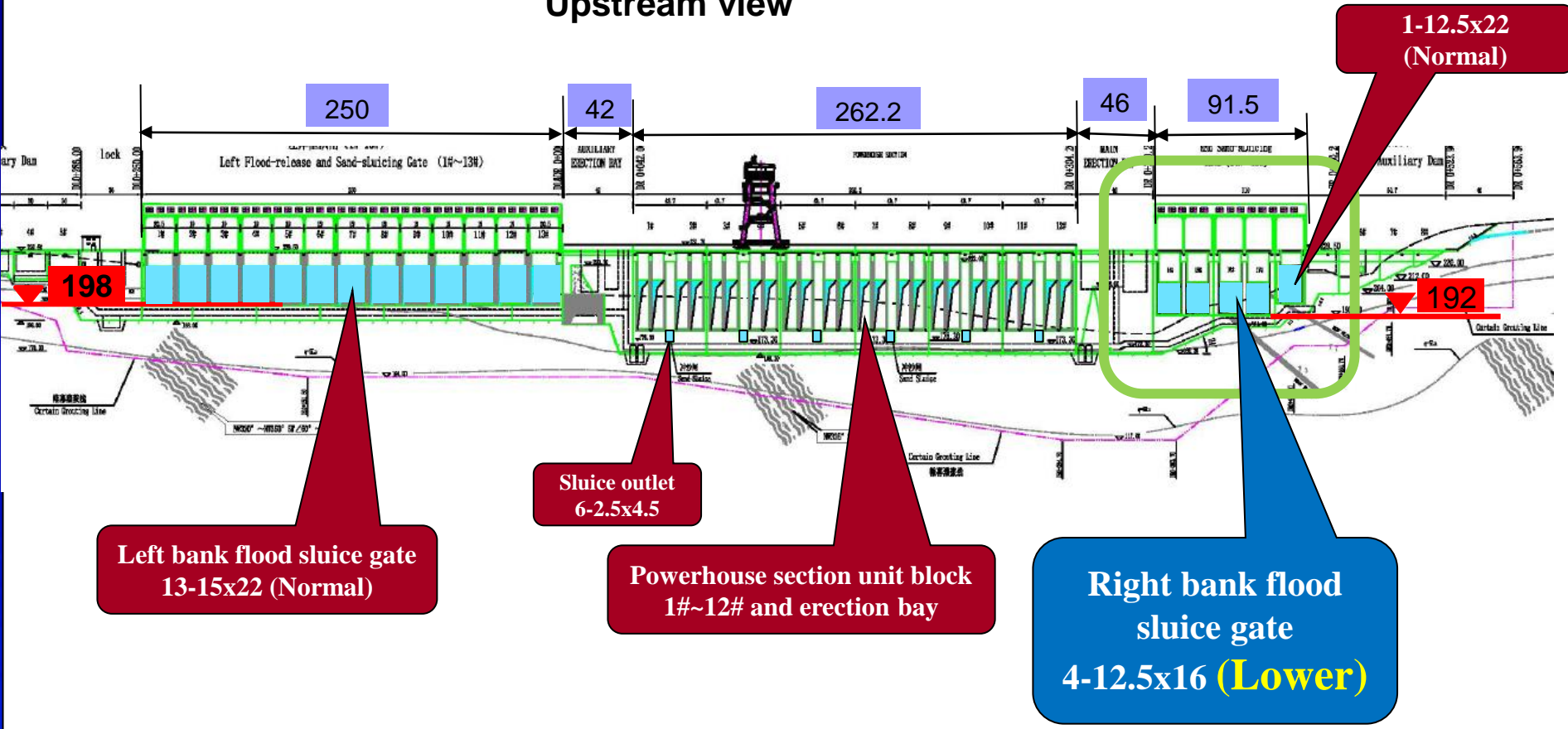
Water retaining structure: Left auxiliary dam, ship lock, left flood sluice, powerhouse, right flood sluice, fish pass, right auxiliary dam

Dam crest length: 909.9m

Max. dam height: 56.2m

# Project Layout

## Upstream view



In order to improve sand flushing efficiency, the bottom elevation of the right four outlets has been lowered to 192.0m, from 198.0m.



## ➤ Design Standards

## ➤ Design Standards

**Updated FS Report is in compliance with following standards:**

- ✓ Lao Electric Power Technical Standards;
- ✓ Preliminary Design Guidance for Proposed Mainstream Dams in the Lower Mekong Basin, and related MRC regulations;
- ✓ Periodic Technical Bulletins on the Safety of Dams issued by the International Commission on Large Dams (ICOLD) ;
- ✓ World Bank, Operational Policy 4.37;
- ✓ International standard: ACI, ASTM, US Army Corps of Engineers, United States Bureau of Reclamation, etc.
- ✓ China Power Industry Standard;

## ➤ **Project study**

- 1. Hydrology**
  - 2. Sediment & Water quality**
  - 3. Dam safety**
  - 4. Navigation**
  - 5. Fish way**
  - 6. Resettlement**
  - 7. Transboundary study**
-



# ➤ Project study

## ● 1. Hydrology

### Hydrological data

	Previous FS Report	Updated FS Report	Latest Data
Run off data	1923~2004	1923~2019	1923~2019
Flood data	1923~2004	1923~2008	1923~2019

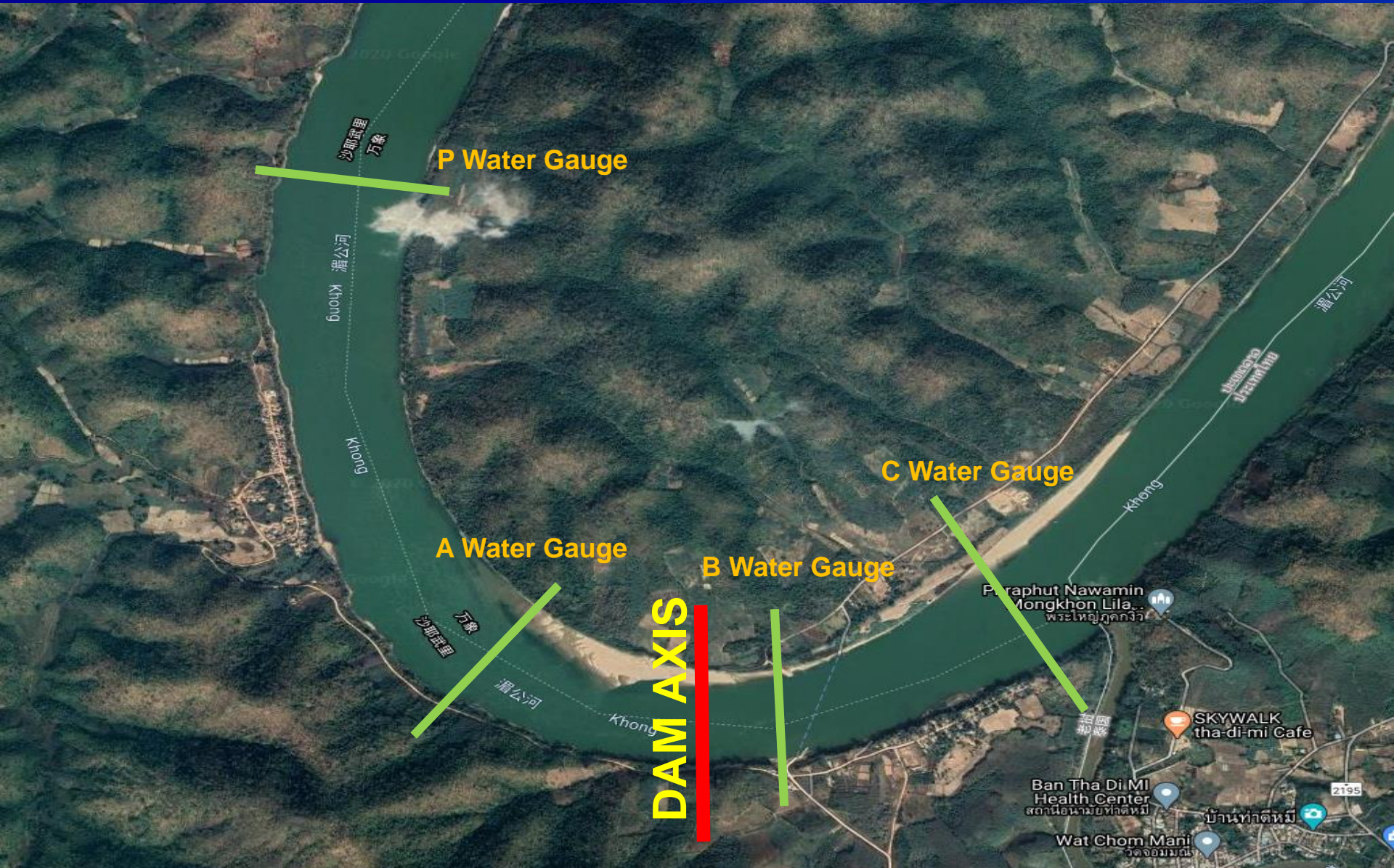
- ✓ **During 2009~2019, 4 sets of water gauges had been established at the damsite, mainly to measure water levels;**





# ➤ Project study

## Hydrological data gauges location



# ➤ Project study

## Runoff

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	Remark
1680	1340	1150	1160	1670	3390	6860	11600	10900	6600	3840	2360	4400	This Review (1923-2008)
1690	1340	1150	1160	1650	3420	6920	11800	10900	6570	3840	2350	4410	Feasibility Study in 2011 (1923-2004)
1700	1360	1160	1160	1650	3430	6920	11800	10900	6590	3860	2360	4410	Latest Data (1923-2019)

**It can be found that this review result of the long term monthly average discharge is similar to the result of the feasibility study in 2011.**



# ➤ Project study

## Flood

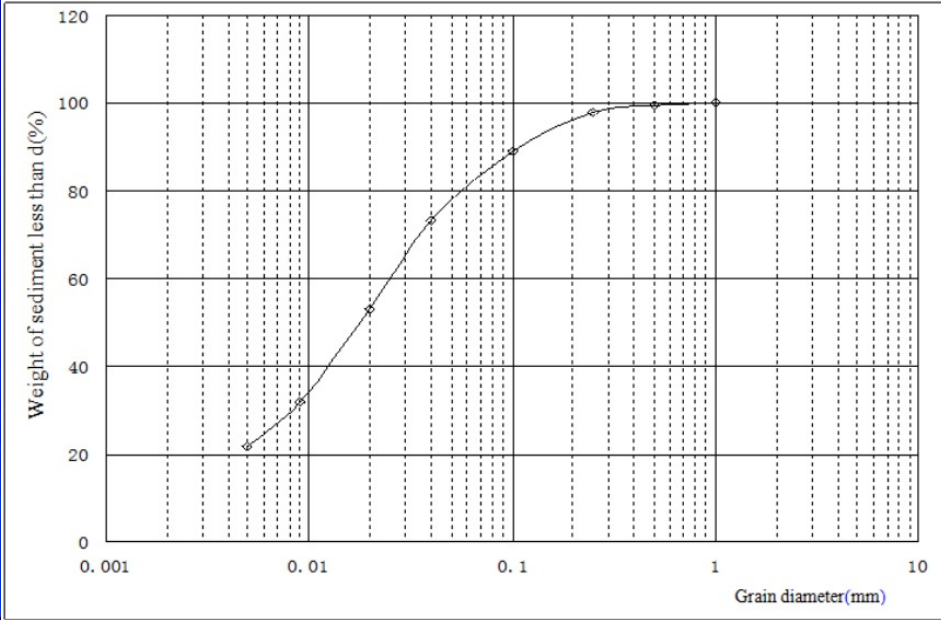
Exceedance Probability(%)	T(years)	Flood Flows at Sanakham project		
		1994 Study Estimations	NWE Estimations	MRC-CNR Estimations
50	2		16300	16200
20	5		19400	19000
10	10	23580	21300	21100
5	20		22900	23000
2	50		25000	25500
1	100	28780	28400	27200
0.5	200		29900	29000
0.2	500		31700	
0.1	1000	33880	33100	33000 (30900-34900)
0.05	2000		34400	34700 (32500-36850)
0.02	5000		36100	37000 (34550-39450)
0.01	10000		37300	38800 (36150-41400)

It can be seen that the flood calculation method adopted by NWE is similar to the calculation method adopted by MRC-CNR and the difference between the developer estimations and MRC-CNR estimations is very small, the maximum of which is less than 3.87%, the minimum is only 0.86%.

# ➤ Project study

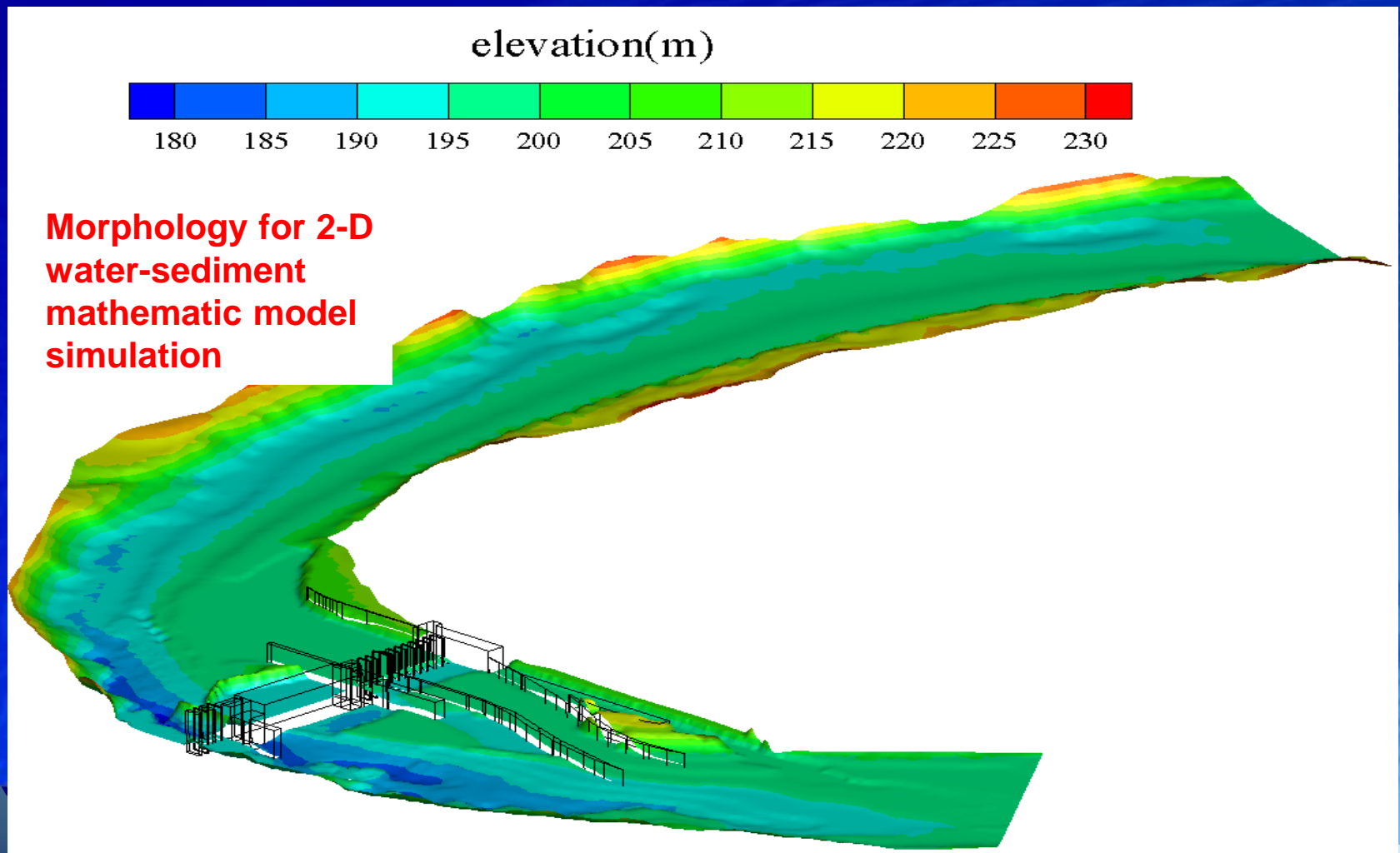
## ● 2. Water quality and Sediment sampling

- Taking samples twice per month.



# ➤ Project study

Calculation with mathematical model





## ➤ Project study

### Physical Model Test in Chong Qing, P.R.C



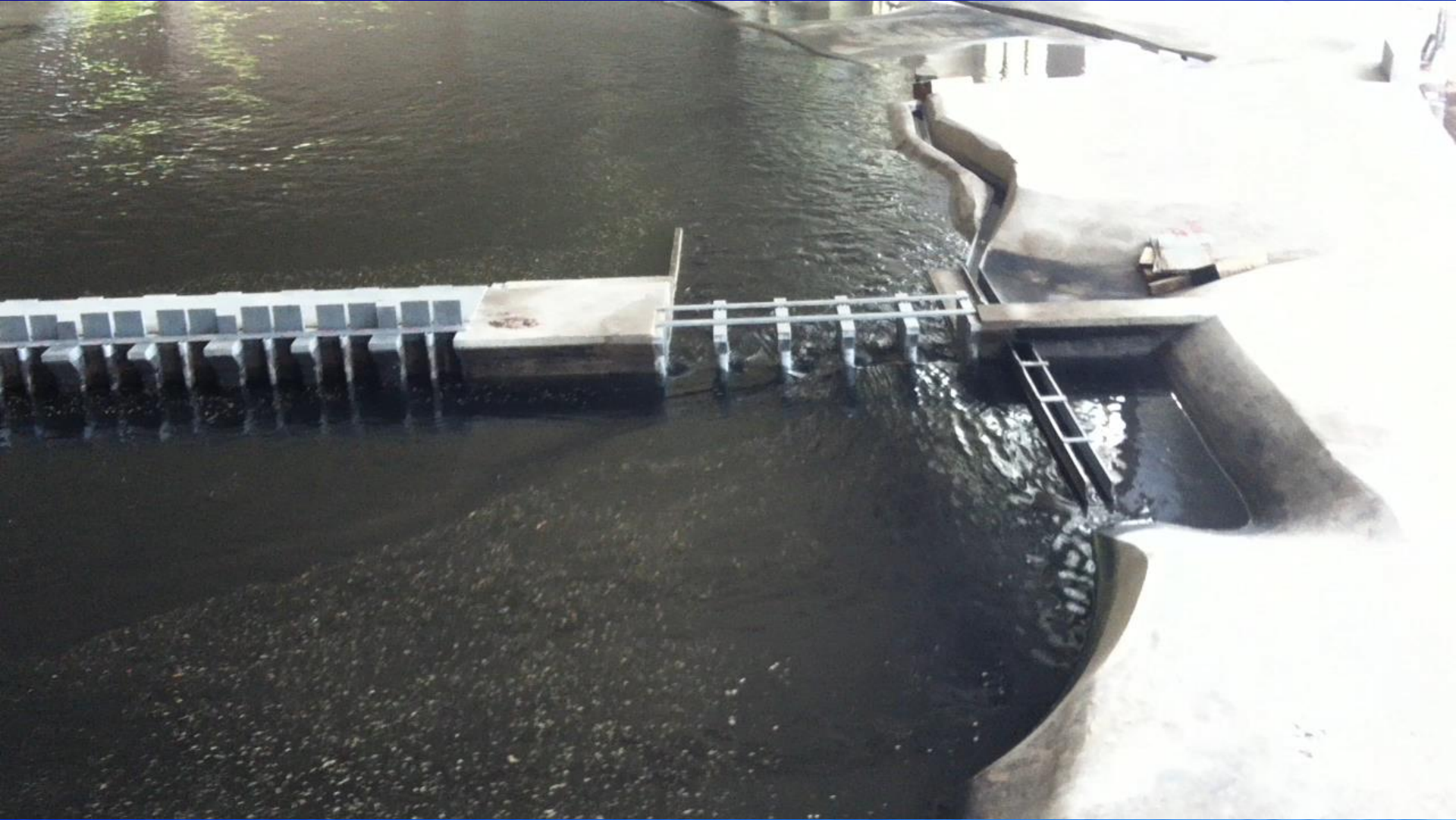
**Integral Model Test**



**Semi-Integral Model Test**

**Research scope of the model test is: 2.5Km from the upstream of the dam site and 1.7 Km from the downstream of the dam site with the 1:100 of model test scale.**

# ➤ Project study





# ➤ Project study





# ➤ Project study

## ● 3. Dam safety

### 1. Earthquake safety

- No earthquake above 5 magnitude has ever occurred within 100km of the dam site in 553 years;
- Seismic safety evaluation had been completed by the Earthquake engineering research institute of Yunnan (China);
- The horizontal seismic peak ground acceleration for standard of design and check is  $0.063g$  ( $a_h$ ) and  $0.1g$  ( $a_h$ ), respectively.

## ➤ Project study

- **Flood Standard**

Dam type	Work condition	Return period (year)	Flood discharge (m <sup>3</sup> /s)
Gravity dam	Design flood	2000	34700
	Check flood	10000	38800

The proposed maximum navigable water level for navigation structures is based on 3-year frequency floods.

# ➤ Project study

## ● 4. Navigation

- The envisaged second-stage ship lock arrangement and estimated cost are included.
- Navigation design during construction period is included.
- Sanakham HPP will be operated for power generation at inflow rate without consideration of reservoir capacity regulation and dead water level is designed for multiple operation choices. Generally, the normal operation level is maintained at EL.220.0m.
- The one-way lockage time:  
 $T = 5 \text{ (entrance)} + 2 \text{ (lock closing)} + 10 \text{ (filling or water release)} + 2 \text{ (lock opening)} + 4 \text{ (exit)} + 5 \text{ (interval)} = 28 \text{ min} < 30 \text{ min}$



## ➤ Project study

Ship lock scale: 500t level

Effective dimension of the lock chamber:  $120 \times 12 \times 4\text{m}$

Max. flotilla:  $1+2 \times 500\text{t}$  (two row in-line) compoundable ship

Max. overhead clearance for navigation: 8m

Number of ship lock lines: single-line ship lock is designed; second-line ship lock is reserved in appropriate place.

Guarantee rate of navigable stage: 95% for lowest navigable stage

The effect depth of riverbed incision is 1.0m



## ➤ Project study

### ● 5. Fish way

With reference to the latest investigation on fish and historical data, we studied the kinds, quantity of fish resource, and living habit. And referring to the experience on the world, A natural-like fishway is selected.

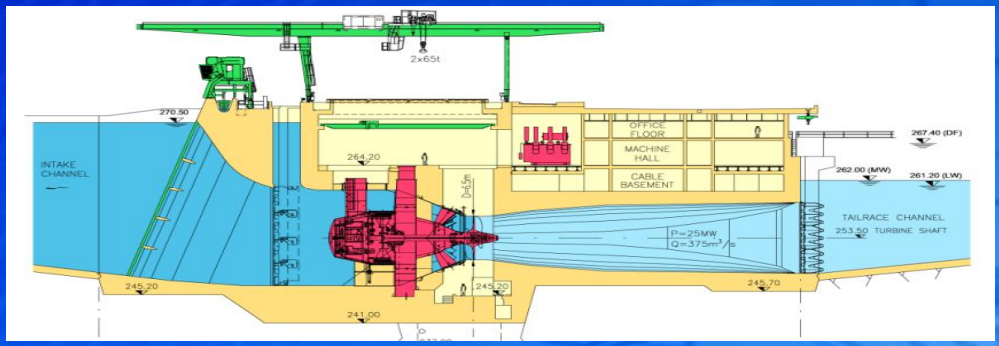




# ➤ Project study

- Fish way

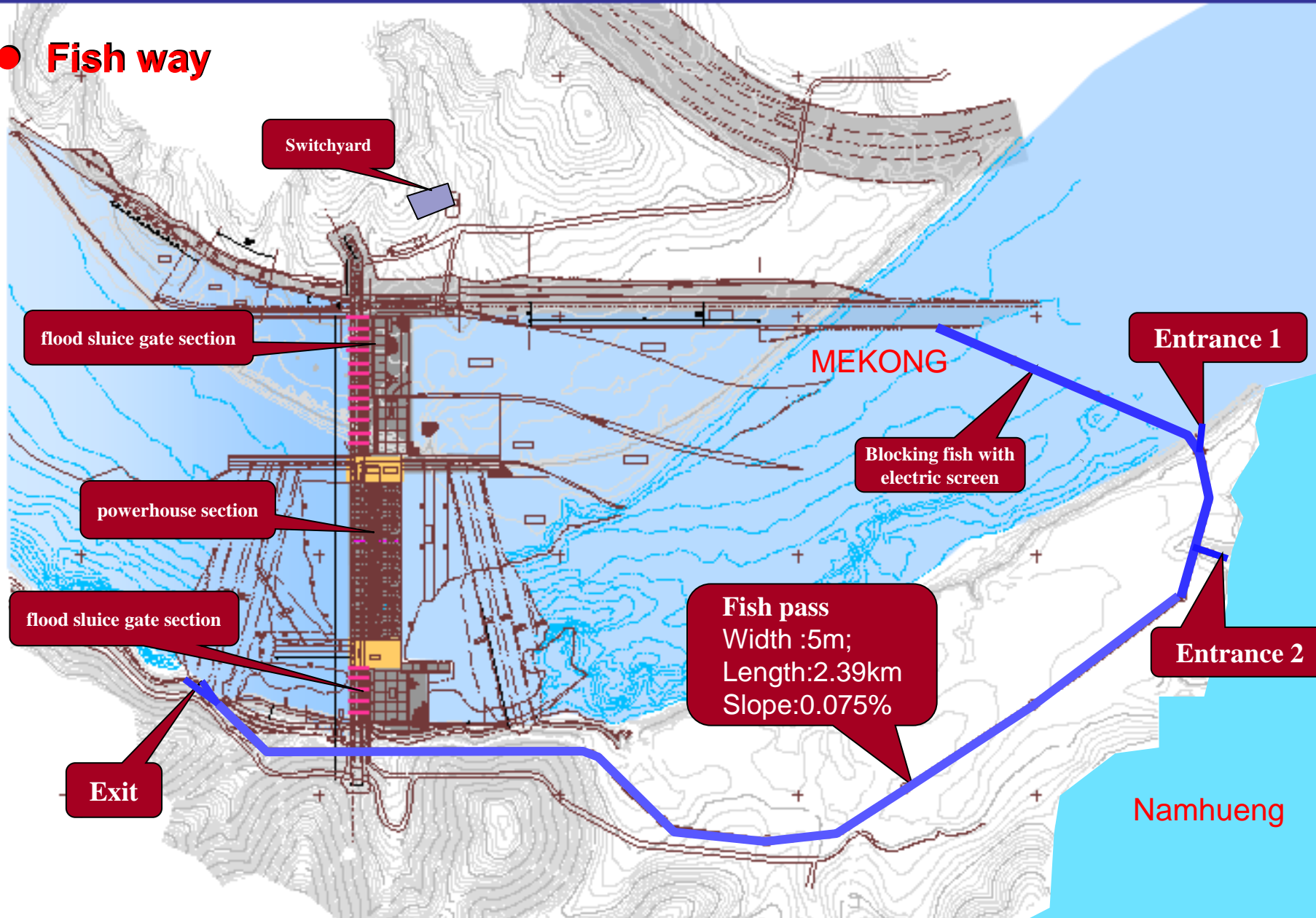
Passages for fish passing through Sanakham dam: fishway, turbine, sluice.  
Turbine generators for Sanakham are bulb type units, which are environmental friendly.  
With 18 flat-bottom flood sluices arranged for Sanakham, the upstream-downstream level difference during the flood release period would be not much.





# ➤ Project study

## ● Fish way



# ➤ Project study





# ➤ Project study





## ➤ Project study

### ● 6. Resettlement

NWH and NCG company have identified and assessed the potential positive and negative impacts of the project, by field investigations with topographic maps and GPS. The more detailed information is in ESIA documents.



# ➤ Project study

## ● 7. Transboundary study

**MEKONG SANAKHAM  
HYDROELECTRIC POWER PROJECT**

**TBESIA & CIA -  
Transboundary Environmental and  
Social Impact Assessment &  
Cumulative Impact Assessment**

**FINAL REPORT – JULY 2017**



In March 2013, company was entrusted to initiate the Cumulative Impact Assessment ("CIA") and Transboundary Environmental Impact Assessment ("TEIA") of Sanakham hydropower project. In September 2013, the TEIA report and CIA report were submitted to the Ministry of Natural Resources and Environment and approved by the GoL.

In Aug 2017, the updated "CIA" & "TEIA" were submitted to Ministry of Natural Resources and Environment and approved by the GoL.

Now developer hire external consultant to collect data information regarding to Thailand territory.



## ➤ Project study



Northwest Institute was invited to cooperate with NCG to carry out the physical index investigation of Sanakham project. Meanwhile, Northwest Institute studied hydrology, fish migration and fishery, sediment subsidence, navigation, water quality and dam safety in cumulative and transboundary impacts that The National Mekong Committees ("NMCs") concerned. The results show that the Sanakham project will not have significant transboundary and cumulative impacts on the above areas.



## ➤ Project study



We have fully considered the concerns of the NMCs and invited the Northwest Institute to conduct a detailed study on the above issues. At present, no specific scheme has been formulated. We will invite the Northwest Institute to offer detailed answers to relevant questions when the PNPCA is initiated.



An aerial photograph of a dam and reservoir. The dam is a long, narrow structure with a central spillway. Overlaid on the image are various technical diagrams: a purple-shaded area representing a reservoir or floodplain extending upstream, a green-shaded area representing a downstream channel or floodplain, and a white structure with orange gates representing the dam's spillway. A small sign is visible on the left side of the dam. The surrounding landscape is lush green with some agricultural fields and a few buildings.

**Thank you for your attention!**