

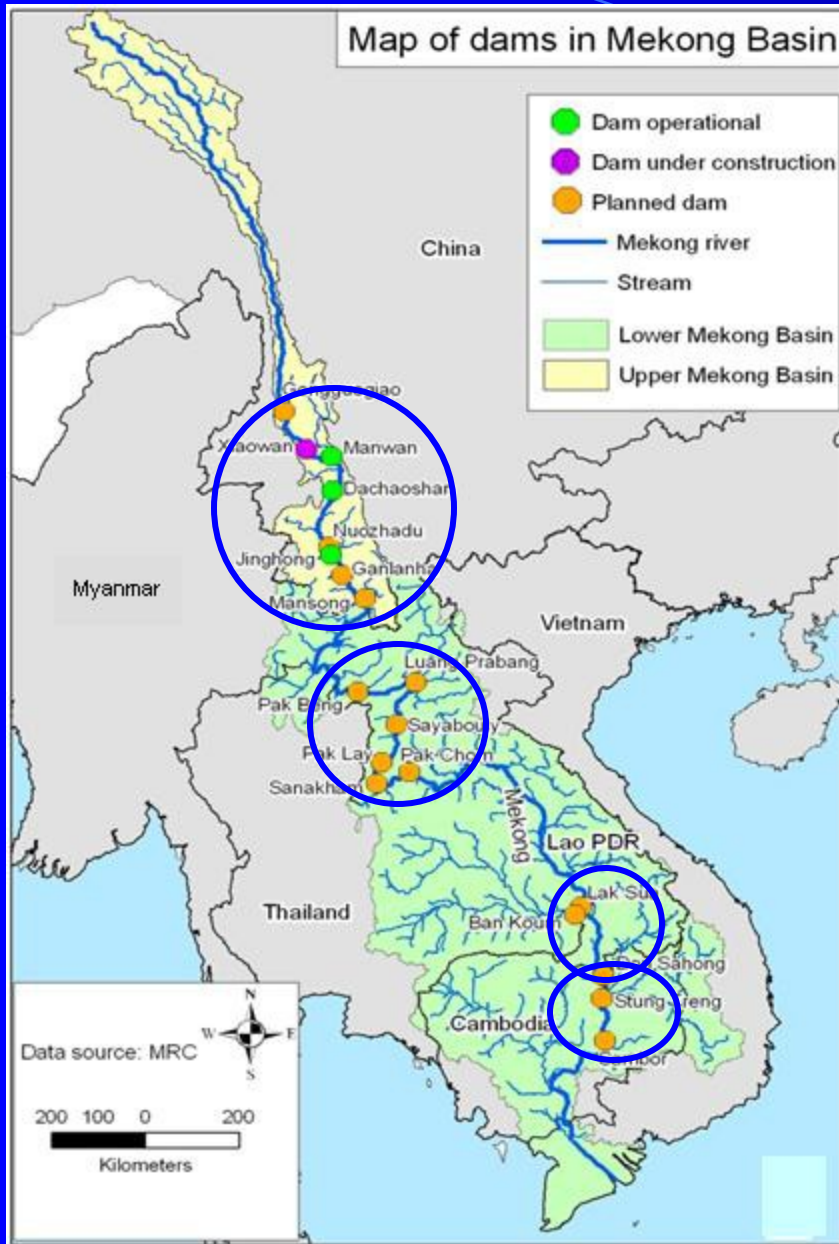


Profiles of 12 proposed Mainstream developments in the LMB

**MRC SEA of Mekong mainstream hydropower
REGIONAL IMPACTS ASSESSMENT WORKSHOP**

Vientiane, April 2010

**Presentation by
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SEA TEAM
Initiative on Sustainable Hydropower (ISH)**



Dams on the mainstream Mekong

Upper Mekong – 8 existing or planned
Lower Mekong – 12 proposed

Dams on Mekong Tributaries

Existing and planned – 94 (only hydro dams – does not include irrigation dams)

Potential Markets for Mainstream Dams



Installed Capacities (MW)
subject to change

PRC

8 in operation, under construction and planned, total 16,460 MW

Thailand

Pak Beng	1,230 MW
Xayaburi	1,260 MW
Pak Lay	1,300 MW
Sanakham	1,200 MW
Ban Khom	1,827 MW
Lat Sua	800 MW
Don Sahong	360 MW

Myanmar

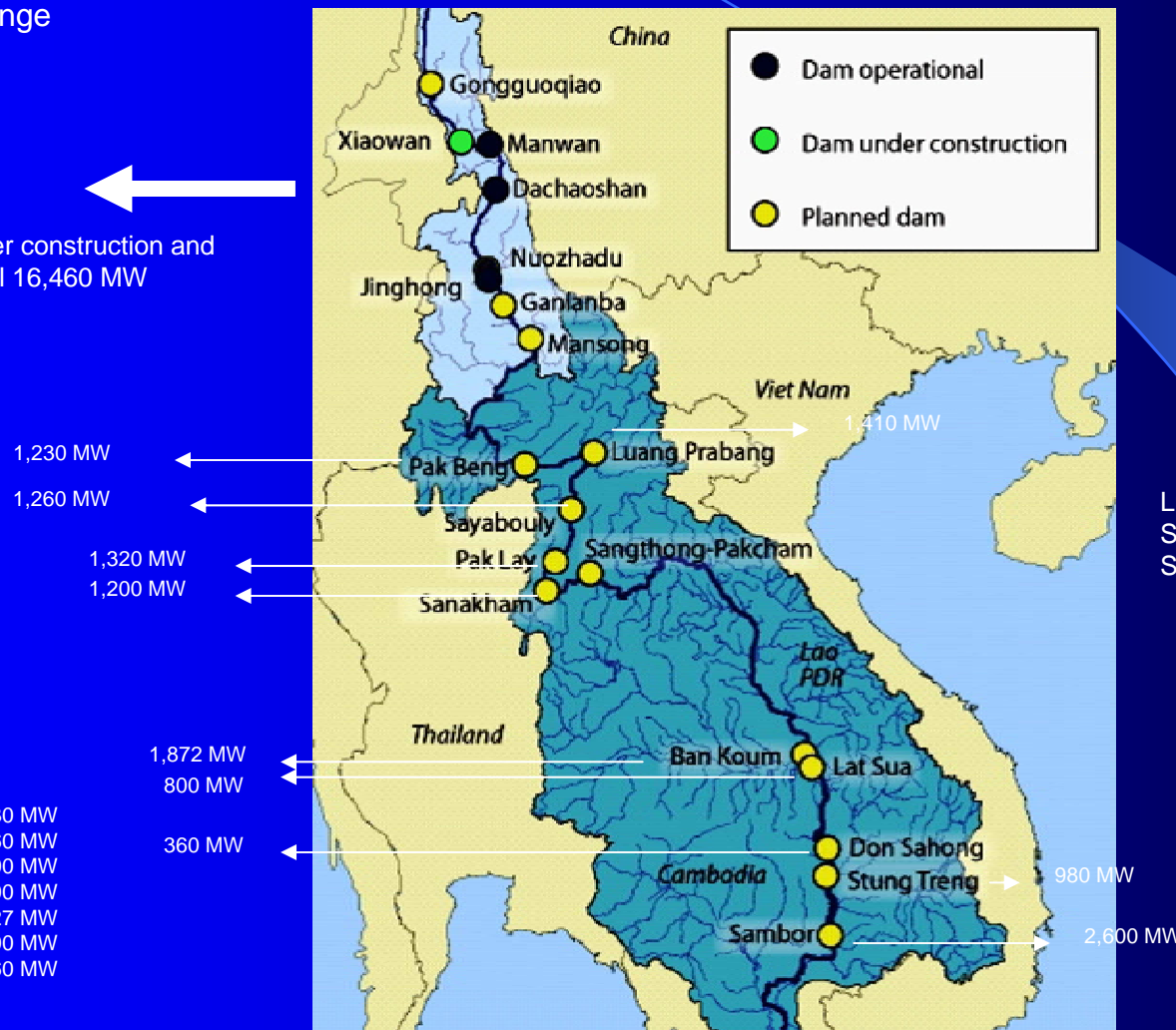
- No mainstream projects proposed

Viet Nam

Luang Prabang	1,410 MW
Sambor	2,600 MW
Stung Treng	800 MW

Lao & Cambodia

- A proportion of generation for domestic power expansion
- Units from schemes, subject to agreements



Where is accelerated interest in LMB hydropower coming from?



Expanding the role of electricity in Mekong society & the economy:

- Meeting high electricity demand growth:
 - e.g. for underpinning and boosting growth,
 - diversifying the economy,
 - population expansion,
 - urbanization trend and “energy poverty”
- Recognition demand-side management is critical, but supply-side expansion is needed
- Power sector role in regional economic integration, cross-border power trade to reduce investment and operating costs overall

Where is accelerated interest in hydropower coming from? Cont.

Optimizing the role of hydropower in development nationally and the GMS region:

- Maximizing indigenous, renewable resource (at different scales)
- Importing countries: supply diversity – e.g. conventional hydrocarbons (natural gas, coal and oil) are finite and international energy market prices are volatile
- Exporting Countries - Foreign investment (FDI) upwards of \$US 24 Billion and revenue generation opportunities

Where is accelerated interest in hydropower coming from? Cont.

C. Other Factors

- Net Exporting countries:
 - Current policies and regulatory frameworks to attract FDI to power sector
 - Private sector / investor response to date (high)
- Net Importing countries:
 - Avoiding hydrocarbon (gas, coal and oil) generation, reduce operating costs (fuel)
 - GHG emission reduction (reducing fossil fuel use)
 - Capacity benefit and power system operation benefits unique to hydropower (voltage stability, ancillary benefits)
- All countries:
 - Realizing opportunities for development synergies in other sectors, e.g. irrigation and navigation
 - Concerns of future electricity price stability

Where is accelerated interest in hydropower coming from? Cont.

D. Upstream reservoir development in China

- Engineering / Hydrology:
 - Higher low season flow improving power generation in dry season in proposed LMB mainstream schemes
 - Impact of tributary storage releases (dry season – to a lesser extent)
 - Improving project economics

Wider regional energy picture (GMS)



Energy poverty widespread

- Dependence on traditional sources of energy (e.g. fuelwood)
- 20 % of GMS population (74 mil.) no access to electricity
- Energy consumption in GMS is only 2/3 of the world average for developing countries

Energy vulnerability high and rising

- 1993-2005 8% annual growth in energy consumption
- 21% of total energy consumed in the region imported
- Volatile energy prices and limited alternative energy sources mean the region is vulnerable

Energy productivity and policy

- Energy supplies low and unpredictable – overall quality low
- Lack of competitive pressure on energy suppliers
- Policy regimes inadequate to address emerging challenges

Source: Building a sustainable energy future the GMS, ADB 2009

Developers of Proposed LMB Projects



Dam	Developer	Country
Pak Beng	Datang International Power Generation	China
Luang Prabang	Petro Vietnam Power Corporation	Vietnam
Xayaburi	SEAN & Ch. Karnchang Public Co Ltd	Thailand
Pak Lay	CEIEC and Sino-Hydro	China
Sanakham	Datang International Power Generation	China
Pak Chom	Feasibility study jointly funded by Ministries of Energy from Thailand and Laos	Thailand/Laos
Ban Koum	Italian Thai Asia Corp. Holdings	Thailand
Latsua	Charoen Energy and Water Asia Co Ltd	Thailand
Don Sahong	Mega First	Malaysia
Thakho	CNR (Compagnie Nationale du Rhône) and EDL	France
Stung Treng	Song Da Co.	Vietnam
Sambor	China Southern Power Grid	China

Status of Proposed LMB Projects in National Regulatory Systems

(commissioning dates in MOUs do not reflect current situation)



Dam	Status	Environmental study status	Commission date (in MOUs)
Pak Beng	MoU, feasibility	IEE submitted	2016
Luang Prabang	MoU, feasibility	Feasibility study,	2016
Xayaburi	MoU, feasibility	Feasibility and full ESIA submitted	2016
Pak Lay	MoU, feasibility	IEE submitted	2016
Sanakham	MoU, feasibility	IEE in preparation	2016
Pakchom	Feasibility in prep.	Not yet	2017
Ban Koum	MoU, feasibility	Not yet	2017
Latsua	MoU, pre-feasibility	Not yet	2018
Thakho	MOU	ESIA in preparation	2014
Don Sahong	PDA. detailed planning	Full EIA submitted, Additional studies requested	2016
Stung Treng	MoU, pre-feasibility	Not yet	N/a
Sambor	MoU, pre-feasibility	Pre-feasibility submitted	2020

Statistics: Of Proposed LMB dams

(Upper 5 Lao dams revised based on Lao PDR optimization study)



Project Name	Full Supply Level mamsl	Low Supply Level mamsl	Live Storage mcm	Reservoir area sq km
Pakbeng	340	334	442	87
Luang Prabang	310	308	734	90
Xayaburi	275	270	225	49
Paklay	245	242	384	108
Sanakham	220	215	106	94
Pak Chom	192	190	12	80.3
Ban Kum	115	115	n/a	132.5
Latsua	97.5	90	n/a	13
Thakho diversion	71	62	na	na
Don Sahong	75	72	115	290 ha
Stung Treng	55	50	70	211
Sambor	40	39	465	620
TOTAL				1367

Statistics: Of proposed LMB dams



Project	Rated Head m	Plant Design Discharge m ³ /s	Installed Capacity MW	Peaking Capability MW	Mean Annual Energy GWh	Firm Annual Energy GWh
Pak Beng	31	7,250	1,230	1,230	5,517	4,073
Luang Prabang	40	3,812	1,410	1,412	5,437	4,205
Xayaburi	24	6,018	1,260	1,260	6,035	5,139
Paklay	26	4,500	1,320	1,320	6,460	4,252
Sanakham	16	5,918	700	700	5,015	3,210
Pak Chom	22	5,720	1,079	1,079	5,318	5,052
Ban Koum	19	11,700	1,872	1,872	8,434	8,012
Latsua	10	9,600	800	800	3,504	2,452
Thakho	15	380	50-60	Cont.	360	
Don Sahong	17	2,400	240	240	2,375	1,989
Stung Treng	15	18,493	980	591	4,870	2,937
Sambor	33	17,668	2,600	2,030	11,740	9,150
TOTAL			14,111		64,706	51,239

Dimensions (details change as design proceeds)



Project	Length of dam (m)	Height (m) Foundation to crest	Reservoir area (sq.km)
Pak Beng	943	76	87
Luang Prabang	1,106	68	90
Xayaburi	810	32	49
Pak Lay	630	35	108
Sanakham	1,144	38	94
Pak Chom	1,200	55	80.3
Ban Koum	780	53	132.5
Latsua	1,300	22	13
Thakho	No dam	0	0
Don Sahong	1820-720-2730	10.6-8.2-8.3	290 ha
Stung Treng	10,884	22	211
Sambor	18,002	56	620

People to be resettled

Comparison shows how optimization could reduce numbers of people to be resettled

No estimates yet of downstream affected people

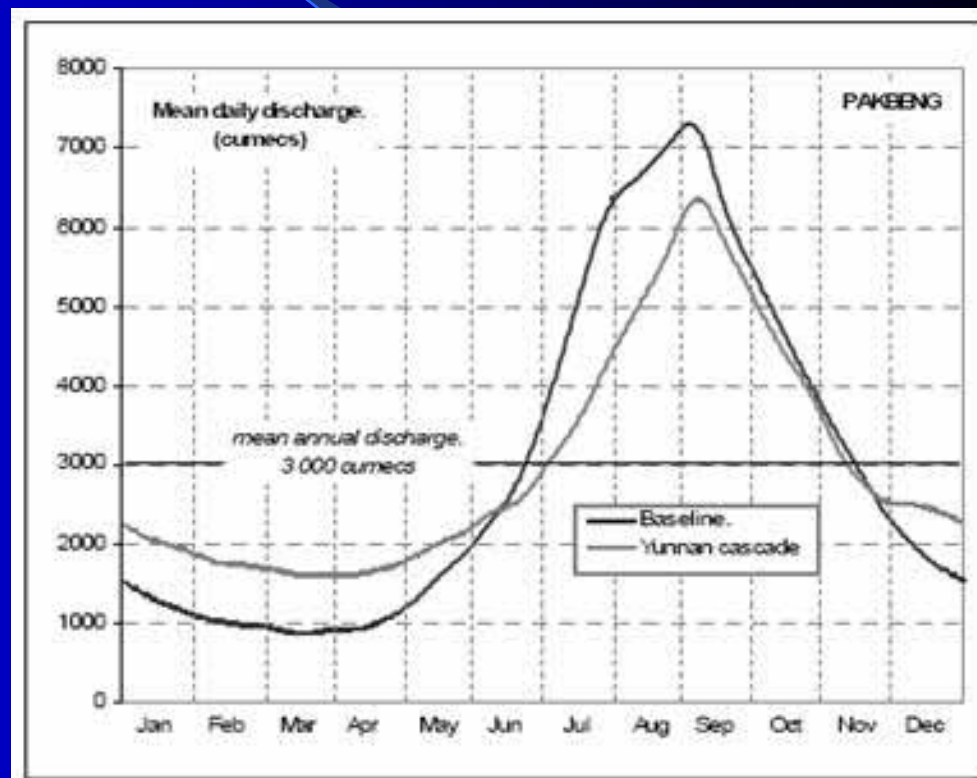
* Proposed to move Latsua dam downstream to eliminate / reduce resettlement with 1m head loss

Dam	Original estimates	Lao PDR Optimization study
Pak Beng	6,694	4,250
Luang Prabang	17,700	5,920
Xayaburi	2,151	2,440
Pak Lay*	18,000	5,010
Sanakham	12,950	1,890
Pakchom		575
Ban Koum	2,570	935
Latsua		None?
Thakho		NA
Don Sahong	66	66
Stung Treng	9,160	9,160
Sambor	19,034	19,034
TOTAL	88,325	49,276

Illustration of the influence of Yunnan dams on the lower mainstream

Pak Beng example

- Minimum dry season flow increase by about 58% from 950 m³/sec March/April to 1,750 m³/sec
- Wet season peaks delayed by about one month from July/August to August/September
- Mean wet season peaks reduced by about 1,000 m³/sec



Quick profiles

12 proposed hydropower developments in the LMB

Pak Beng (1,230 MW)



As shown on the cover of developers feasibility study:

Developer: Datang International Power Generation, China

- Upper most dam in proposed LMB cascade
- Dam in Lao PDR
- Reservoir in Lao PDR

Original Pak Beng design

FSL = 345 masl

MDL = 339 masl

Area = 86.51

Length = 130 – 145 km

Operating 8 – 12 hrs/day

Now revised design

FSL at 340 masl to avoid
backwater in Thailand



Core sampling at the dam site

Luang Prabang (1,410 MW)



Developer:
Petro Vietnam
Power Corporation

Dam in Lao PDR
Reservoir in Lao
PDR

Xayaburi (1,260 MW)



Developer:

SEAN & Ch. Karnchang
Public Co Ltd, Thailand

Dam in Lao PDR

Reservoir in Lao PDR

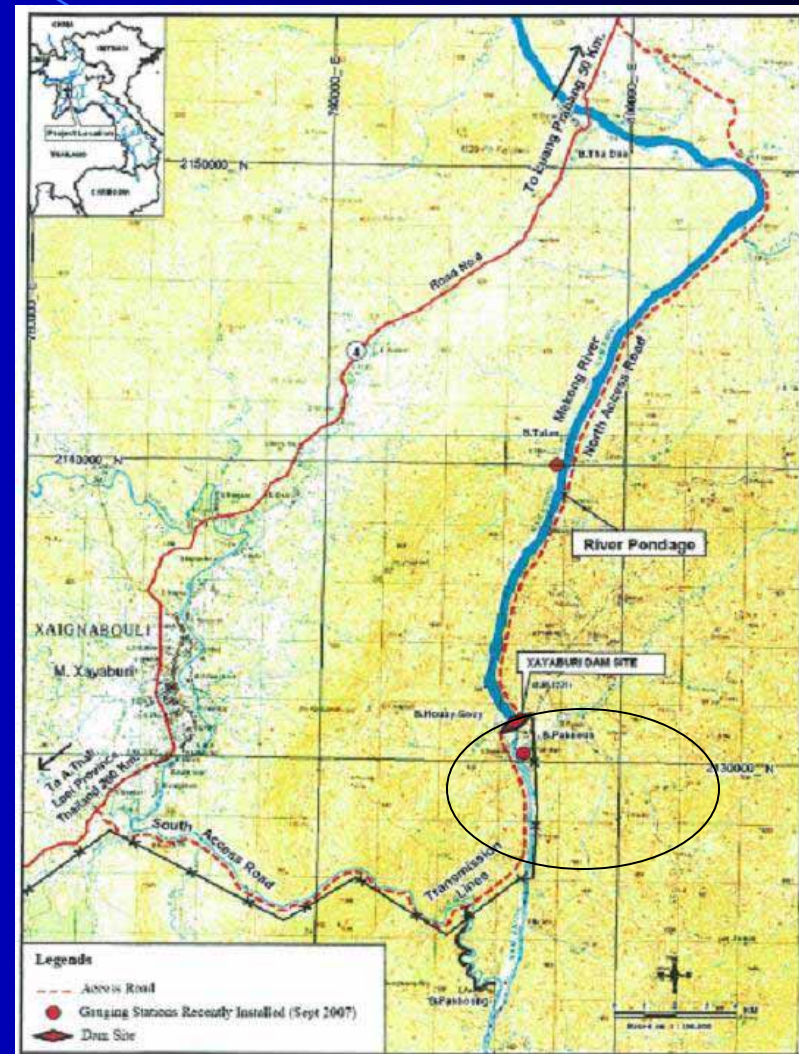
FSL = 275 masl

MDL = 270 masl

Area = 49 sq.km

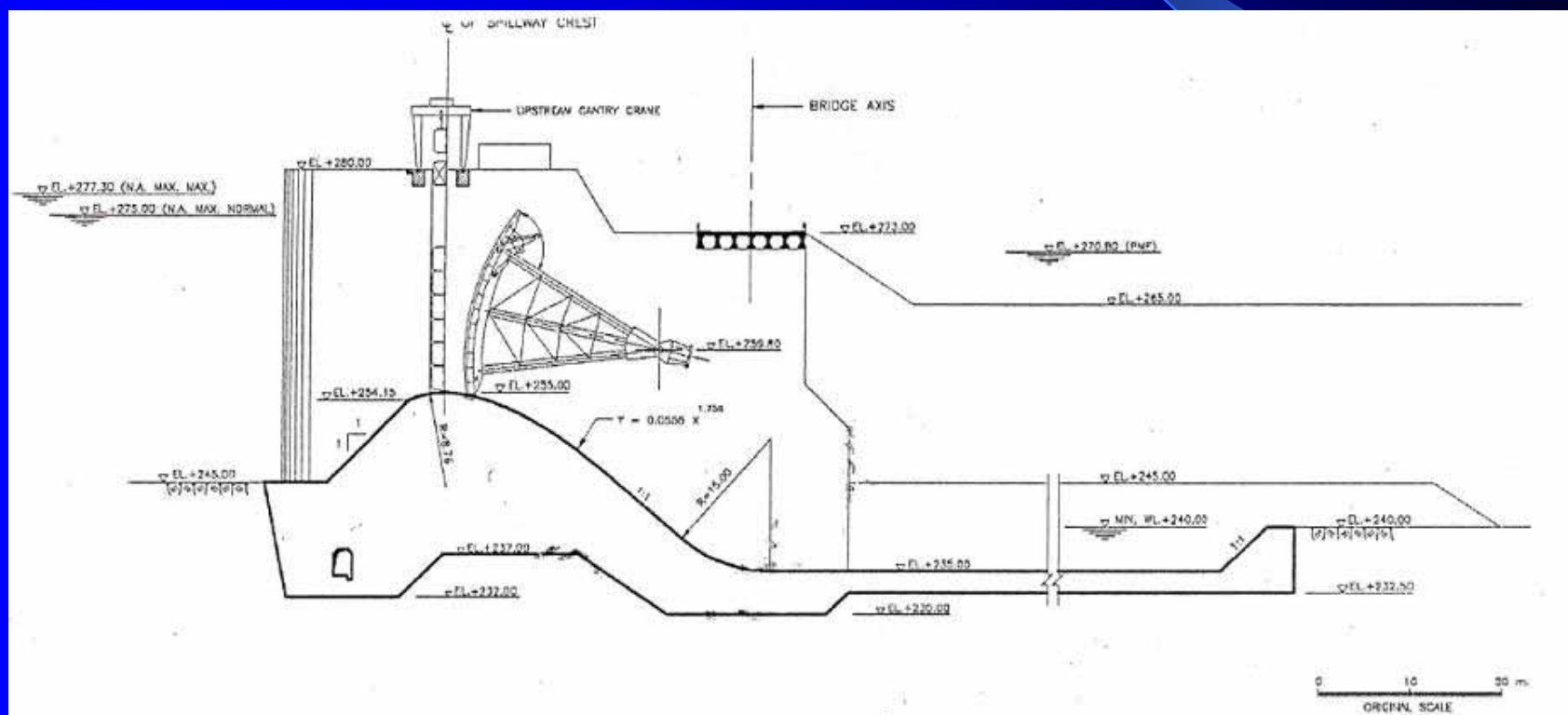
Extends 150km to Luang Prabang

Continuous operation, (no peaking)



Xayaburi Spillway Configuration

Similar to most proposed designs



Proposed Xayaburi dam site Looking upstream



Pak Lay (3,320 MW)

Developer:

CEIEC and Sino-Hydro China

Dam in Lao PDR

Reservoir in Lao PDR



Proposed Pak Lay dam site looking upstream



Sanakham (700 MW)

Developer:

Datang International
Power Generation,
China

Dam in Lao PDR

Reservoir in Lao PDR



Pak Chom (1,079 MW)

Developer:

Joint feasibility study:

- Commissioned by Ministry of Energy in Thailand and Ministry of Mines and Energy in Lao PDR
- Panya consultants

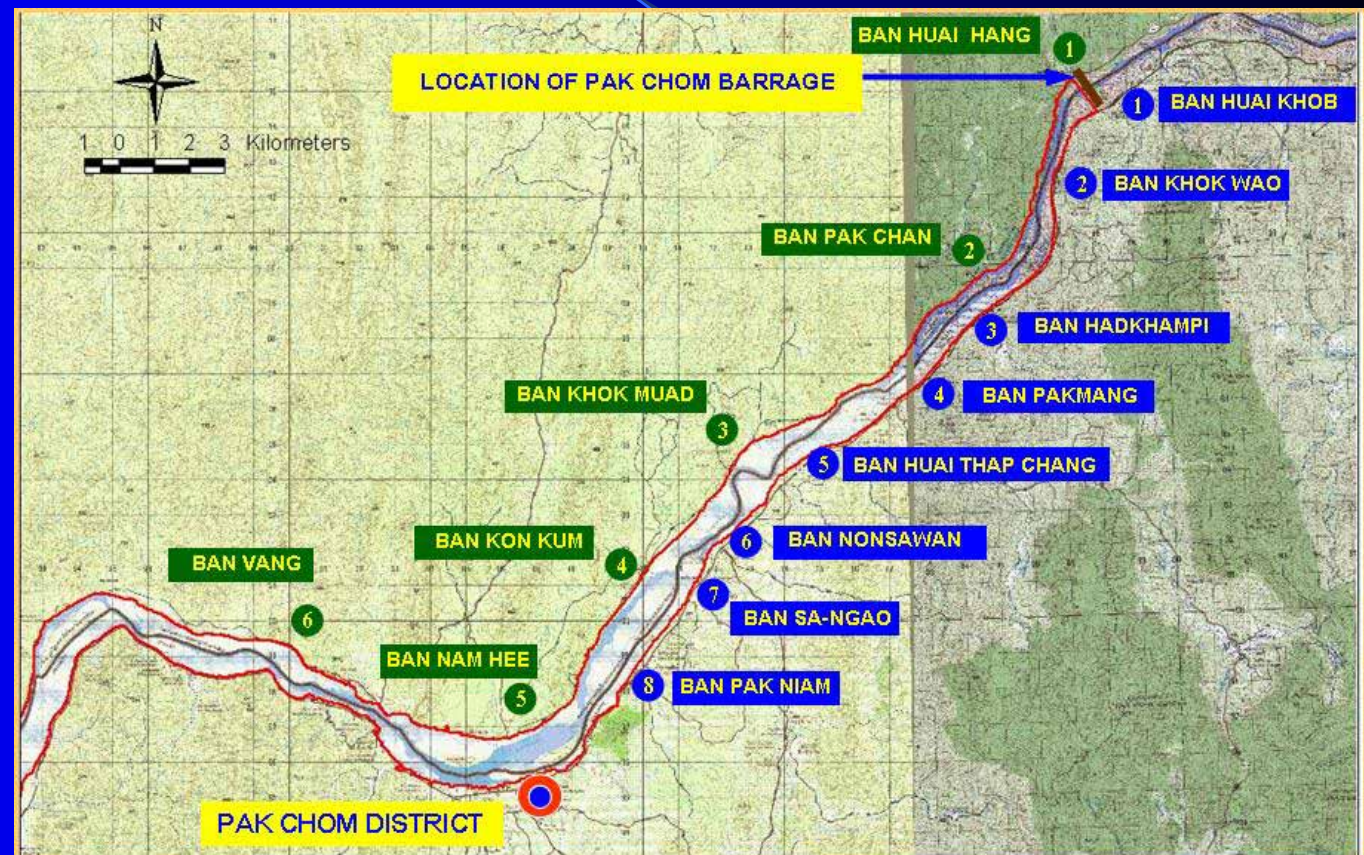
Dam in Lao PDR and Thailand



VILLAGES ALONGSIDE STORAGE LEVEL OF PAK CHOM BARRAGE

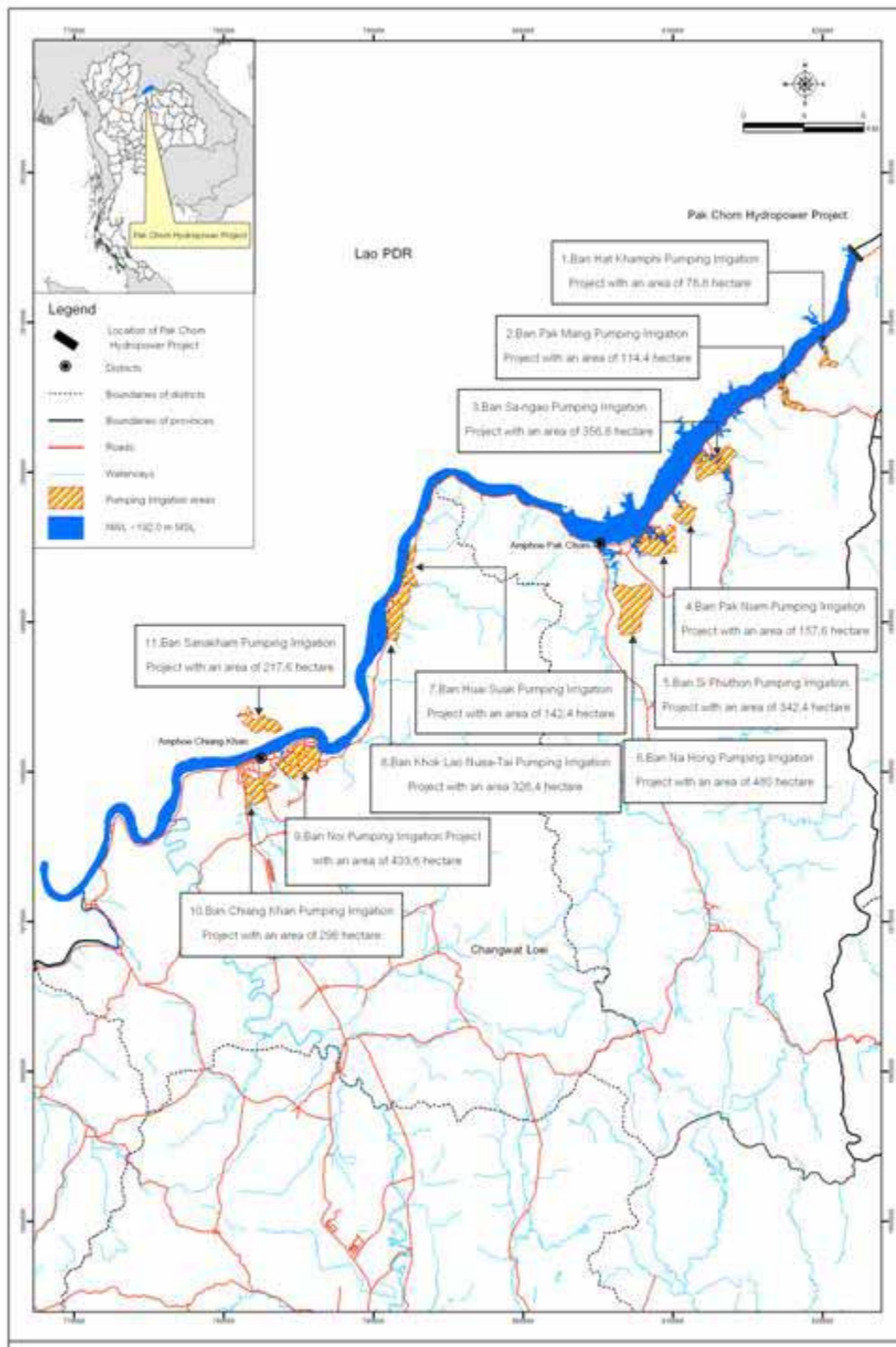
Villages affected –

- 1 Laos –
 - 37 households
- 1 Thailand –
 - 70 households

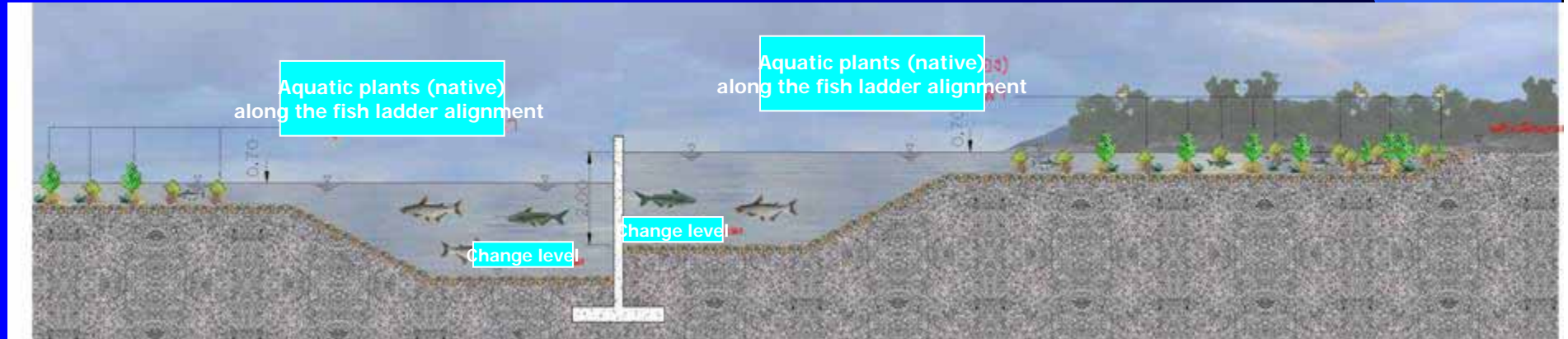
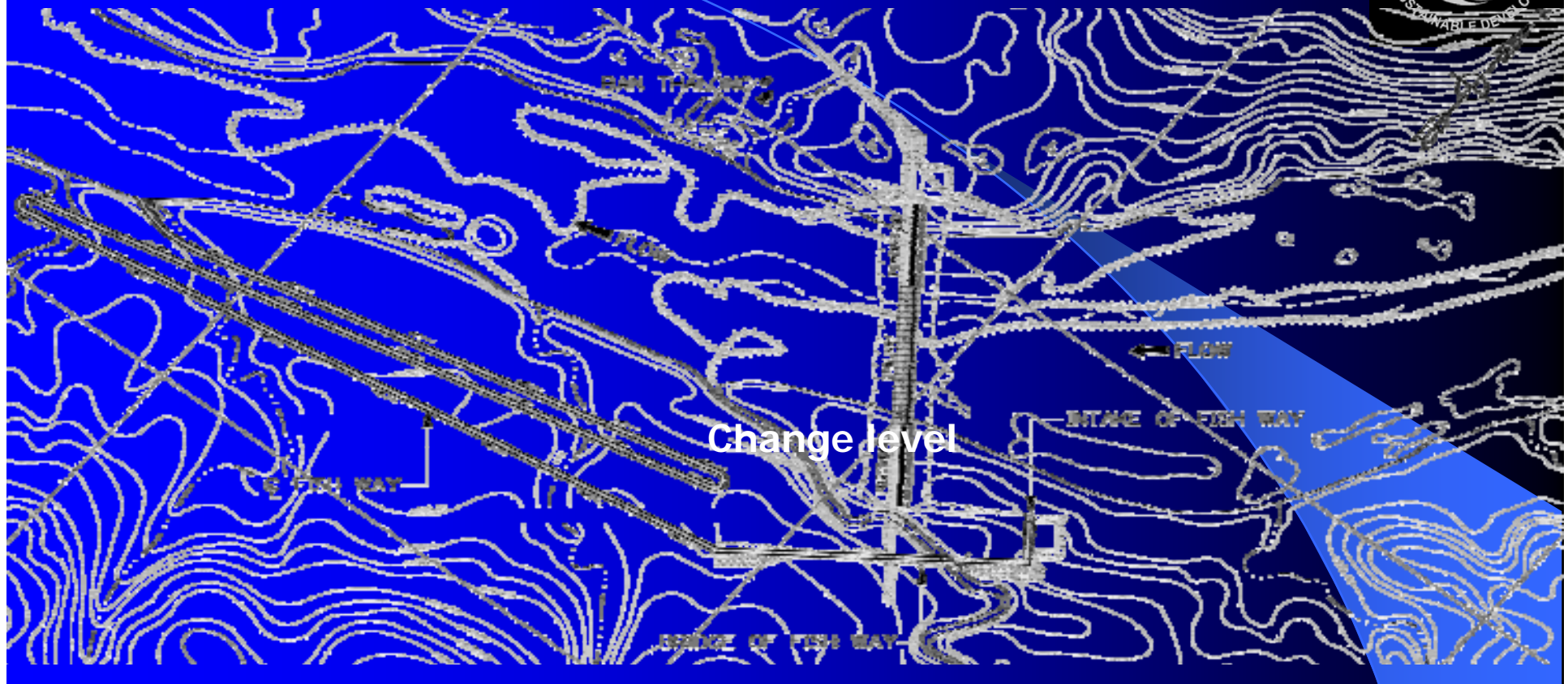


Other water resources development aspects

- 11 pumping irrigation projects with a total area of 2,944 hectare and
- irrigation area of 2,706.4 hectare



Fish Ladder of Pak Chom and Ban Koum



Ban Koum (1,872 MW)



Developer:
Charoen Energy
& Waters Asia
Co. Ltd

Dam: Thai-Lao
Reservoir: Thai-Lao



VILLAGES ALONGSIDE STORAGE LEVEL OF BAN KOUM BARRAGE



Reservoir 133 km²

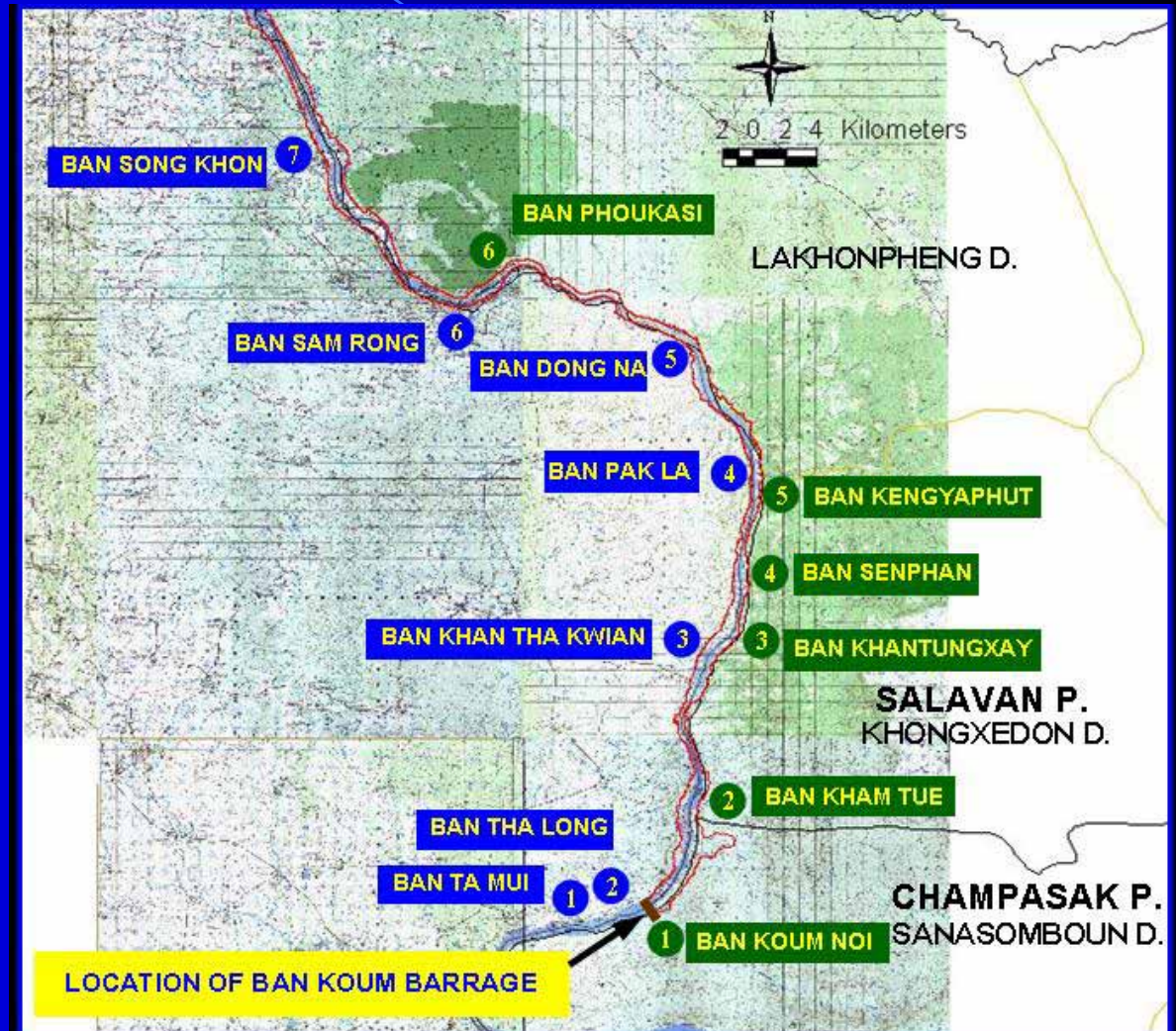
Villages affected

Thailand - 1

– 29 households

Laos - 3

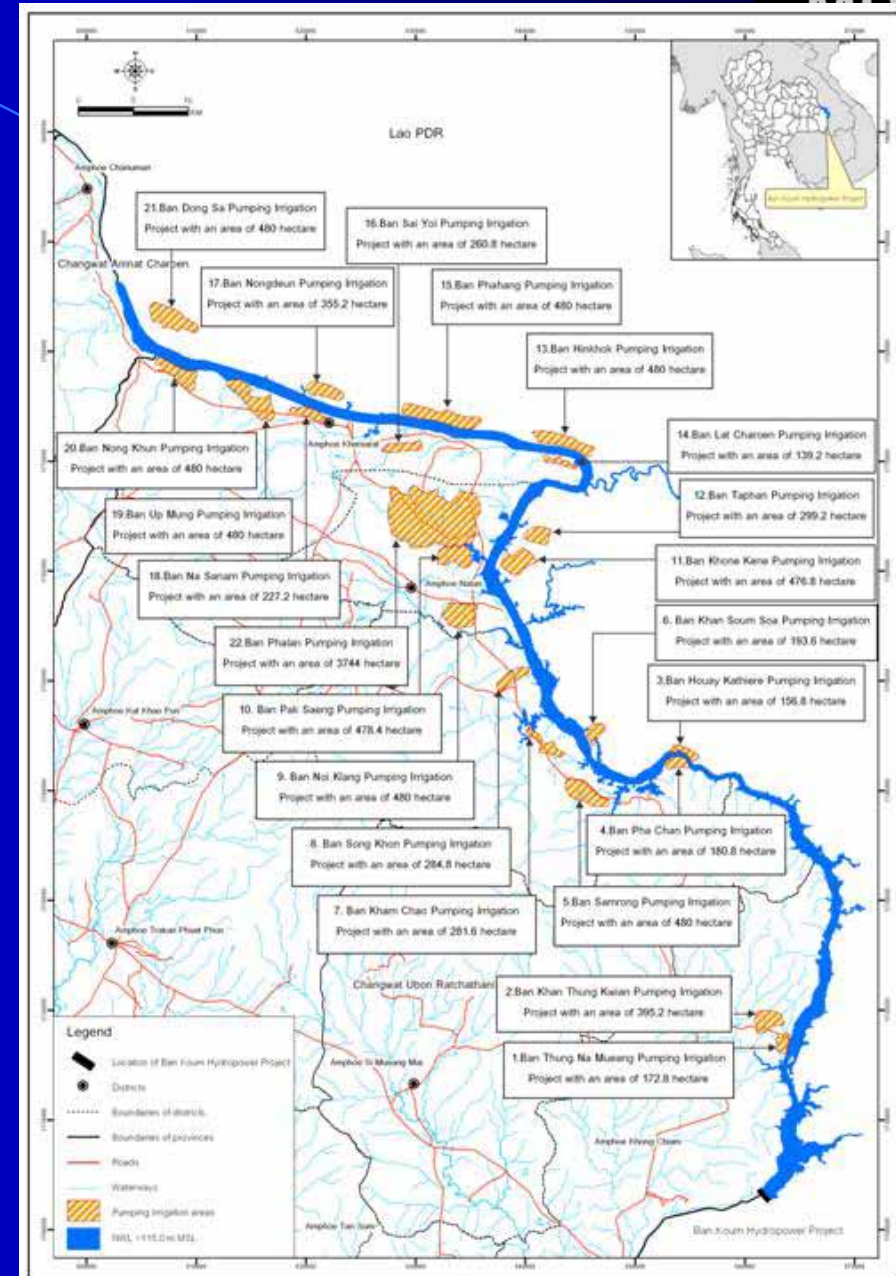
– 158 households



Other water resources development aspects of Ban Koum

Irrigation

- 22 lift irrigation projects
11,006.4 hectare
- irrigation area of 7,870
hectare



Latsua (686 MW)

Developer:

Italian Thai Asia
Corp. Holdings
(Thailand)

Dam in Lao PDR

Reservoir in Lao PDR

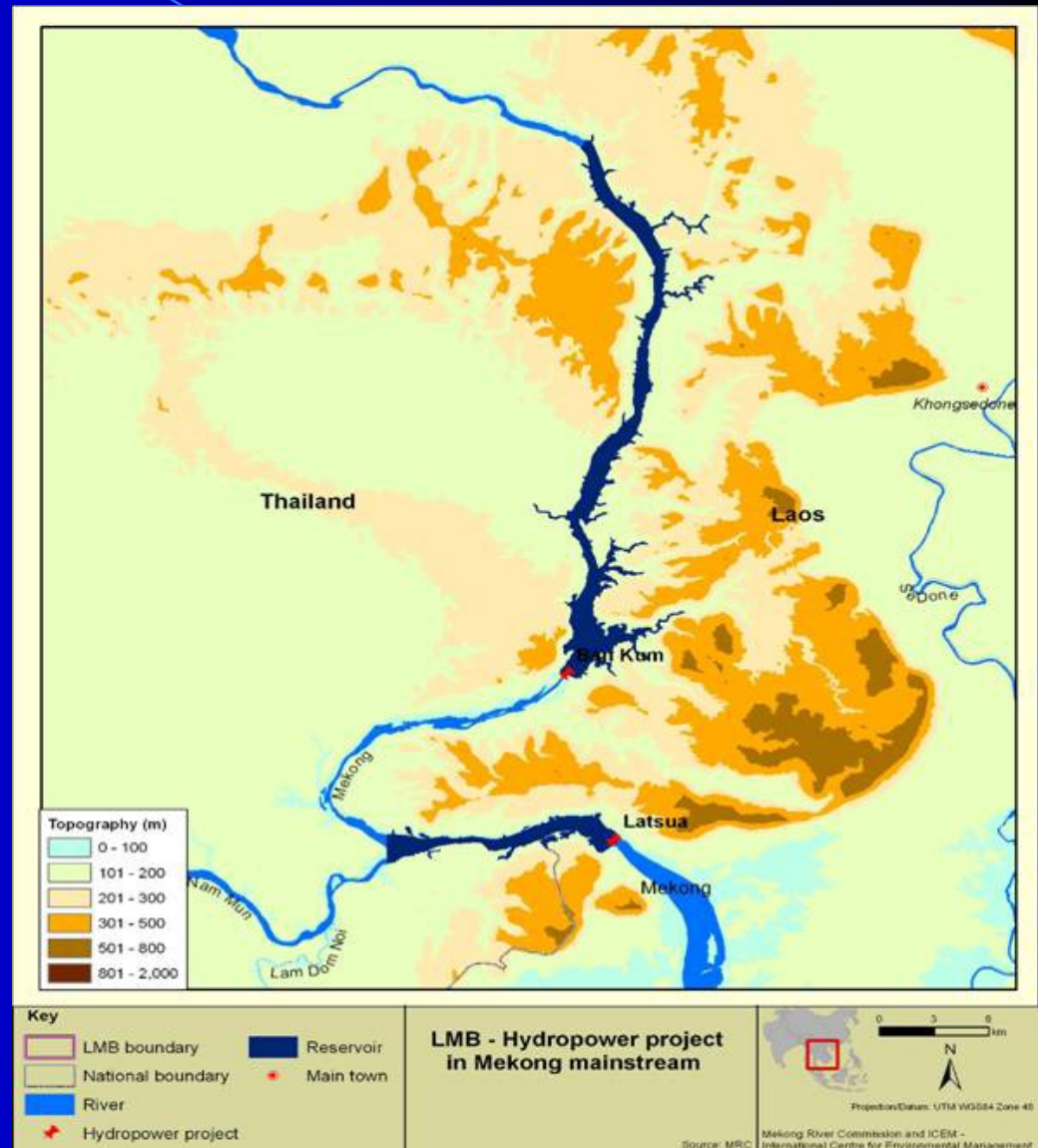


Ban Koum and Latsua 1



Latsua recently moved downstream

- Site 1 Reservoir 13 sq km
- Possible flooding villages in Thailand and impacts on Pak Mun dam



Latsua site 2

Latsua recently moved downstream

- Site 2 - 10 km south of Pakse
- Avoids flooding villages in Thailand and impacts on Pak Mun dam
- But possibility of flooding impacts upon Pakse
- Irrigation of 7,300 ha

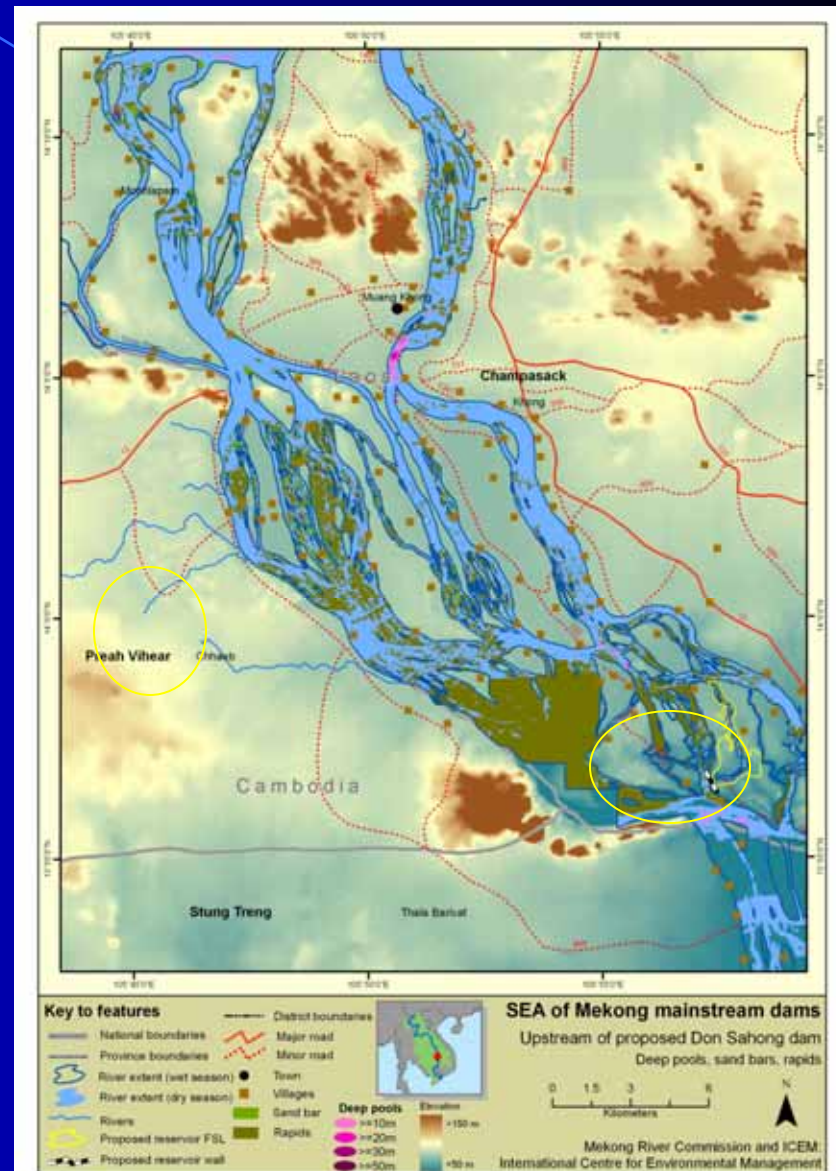


Don Sahong (240 MW)



Developer:
Mega First,
Malaysia

Has PDP
Dam in Lao PDR
Reservoir in Lao PDR



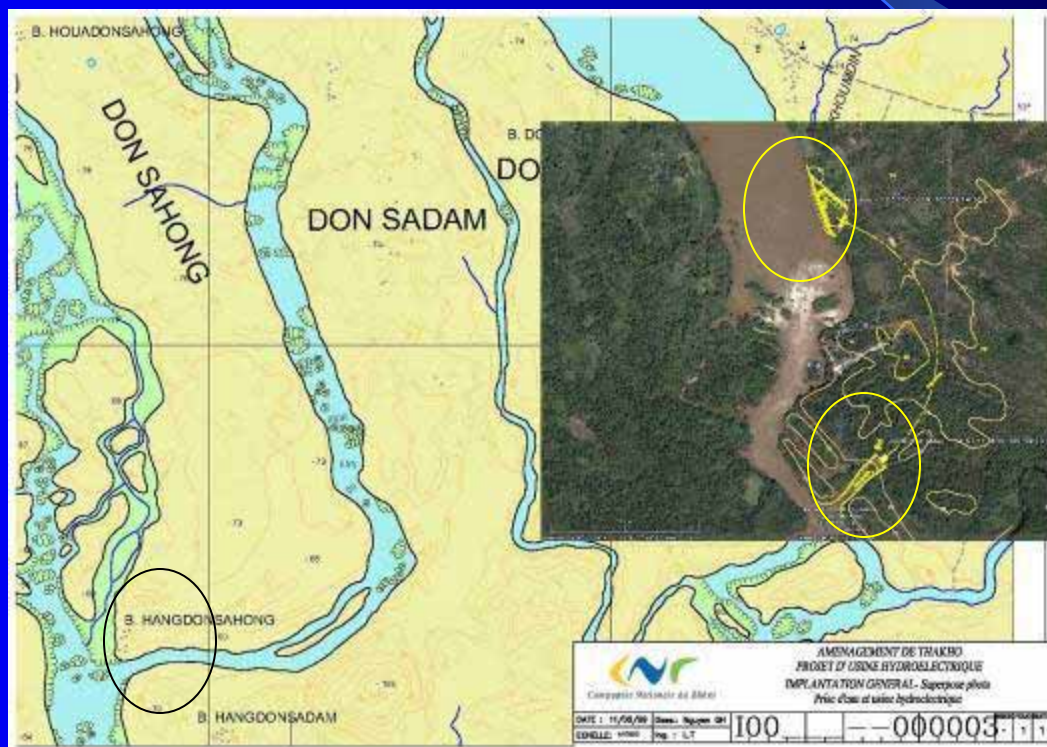
Don Sahong dam site



Thakho Diversion (50-60 MW)

- Developer is CNR, France)
- Run of river, diversion scheme
- No dam involved
- Diversion of 380 m³/s through canal around Khone Phapheng Falls
- With the Chinese dams, dry season flows increased
 - increased diversion of 470 m³/sec,
 - Increased power generated to 450 GWh/year

Thakho and Don Sahong



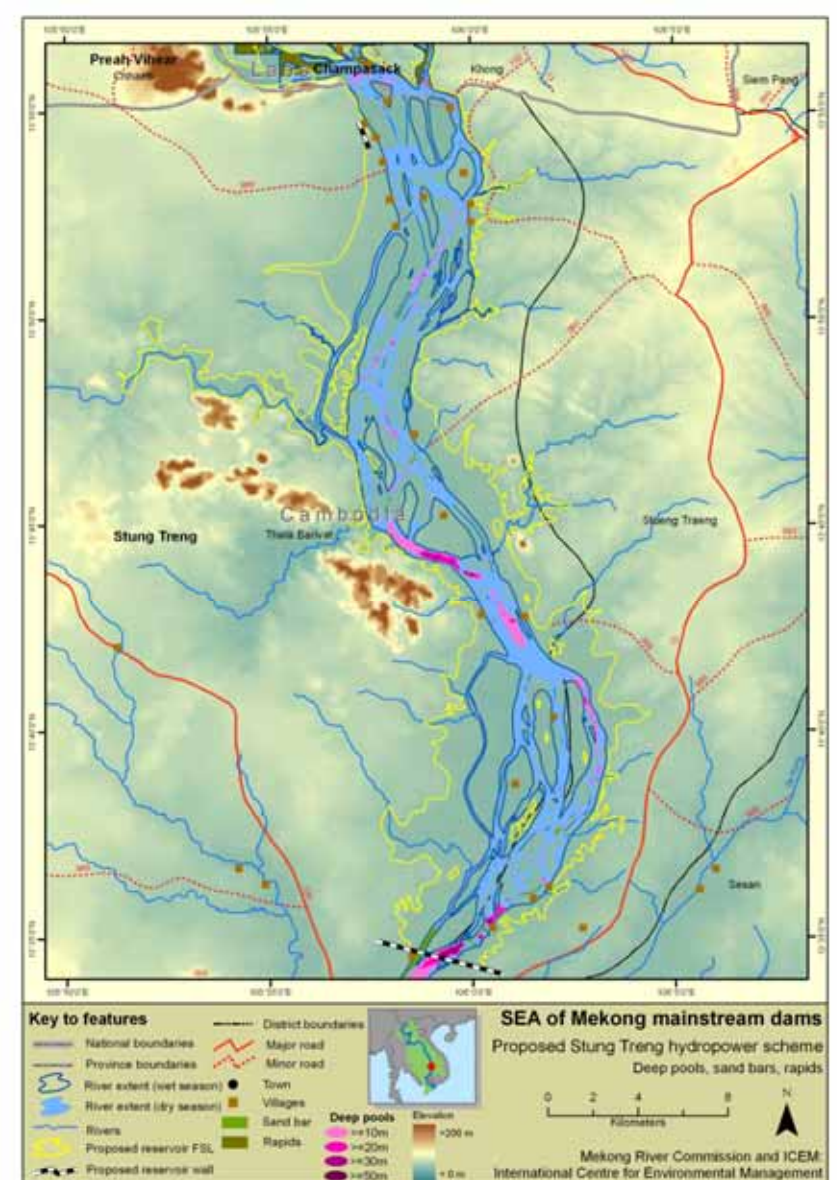
Stung Treng (980 MW)



Developer:

Song Da Co,
Vietnam

Dam and
Reservoir
In Cambodia

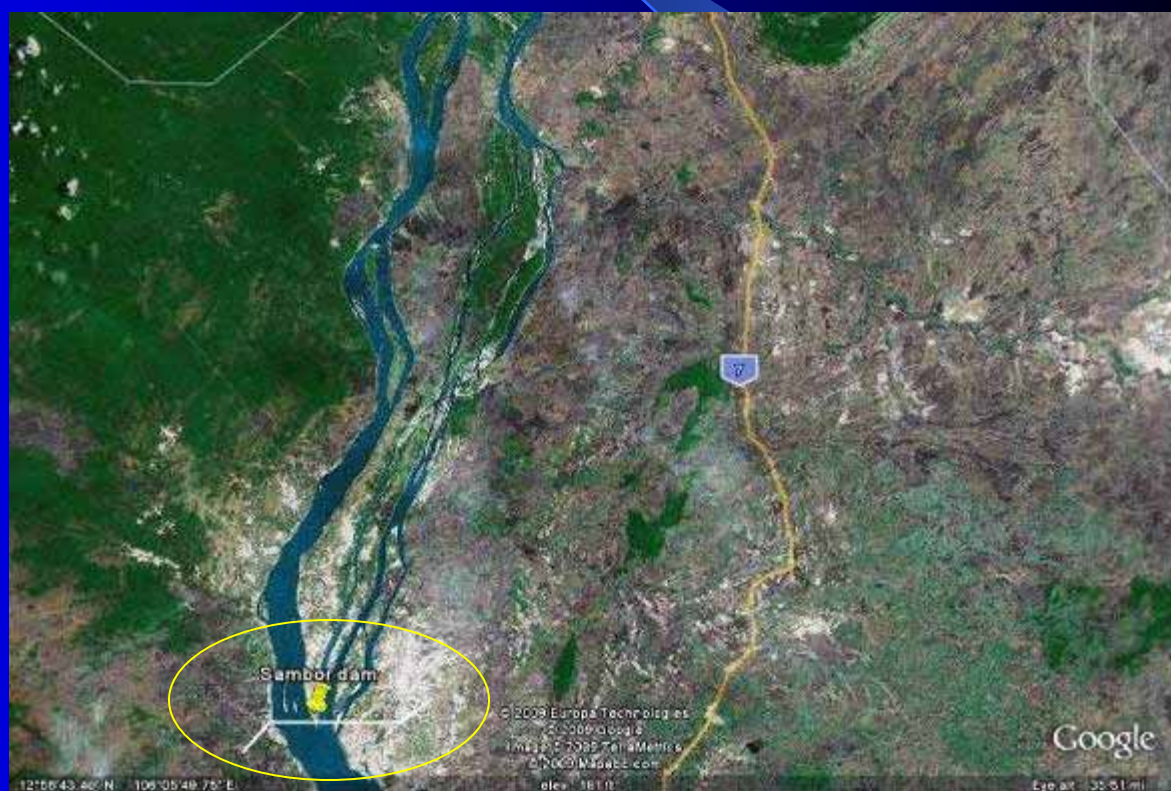


Sambor(2,600 MW)

Developer:

China Southern
Power Grid

Dam and
Reservoir in
Cambodia



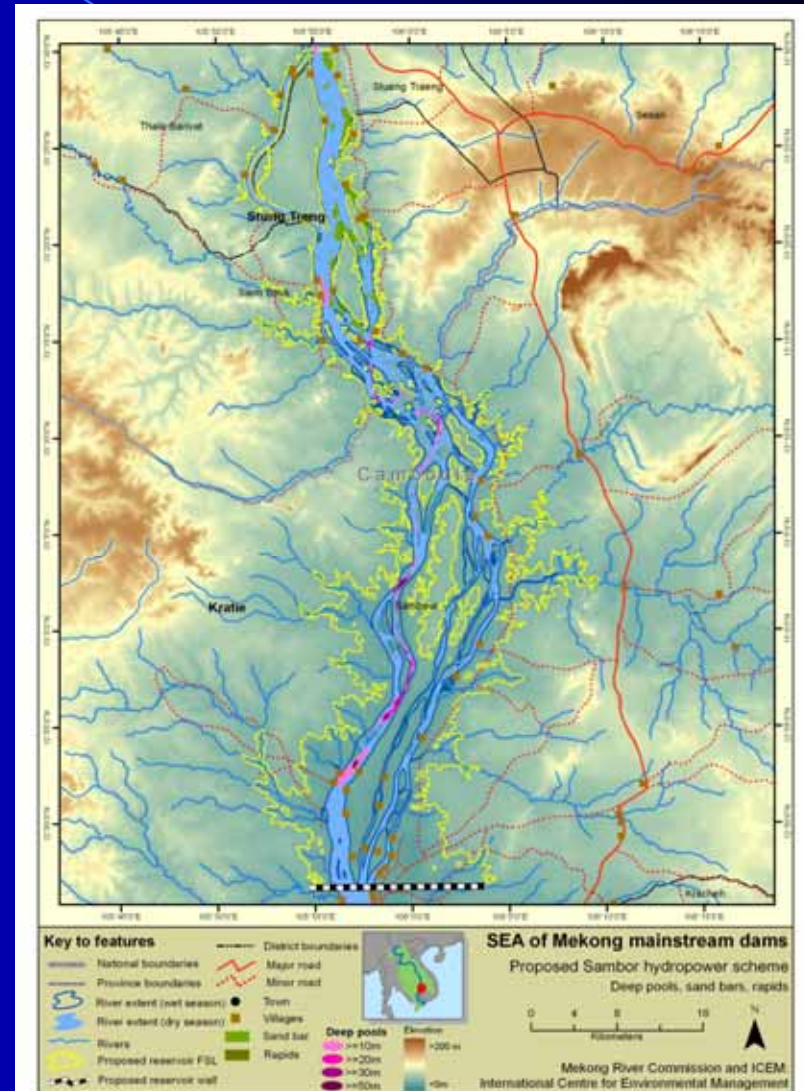
Proposed site of Sambor dam

FSL = 40 masl

MDL = 39 masl

Area = 880 sq km

Population affected
19,034



Reservoirs of proposed dams in Cambodia

Stung Treng

- Dam + Embankments
10 km
- 22 m high (15 m head)
- Reservoir 211 sq km

Sambor

- Dam + Embankments
18 km
- 56 m high (33 m head)
- Reservoir 620 sq km

