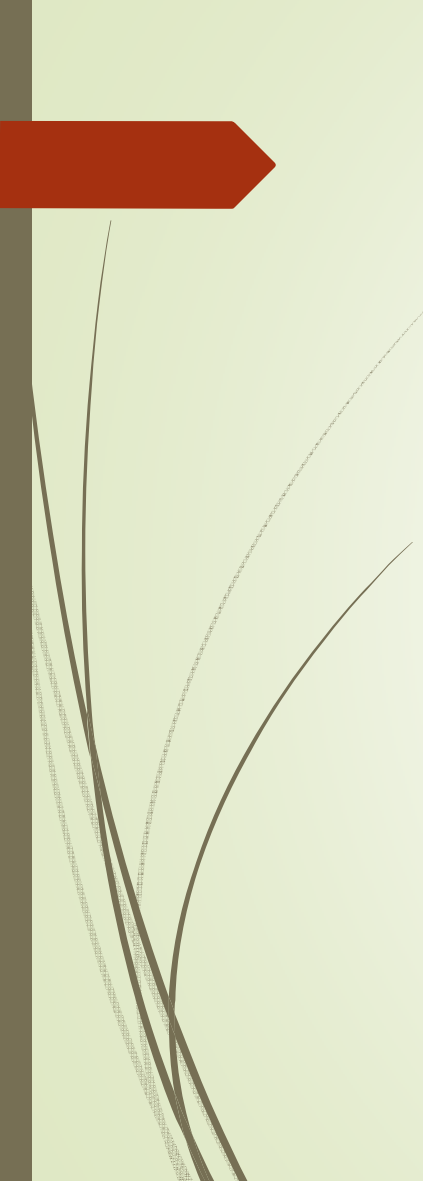




Cumulative Impact Assessment of the Nam Ou hydropower cascade

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2 March 2016



The CIA of the Nam Ou hydropower cascade – Objectives and methods

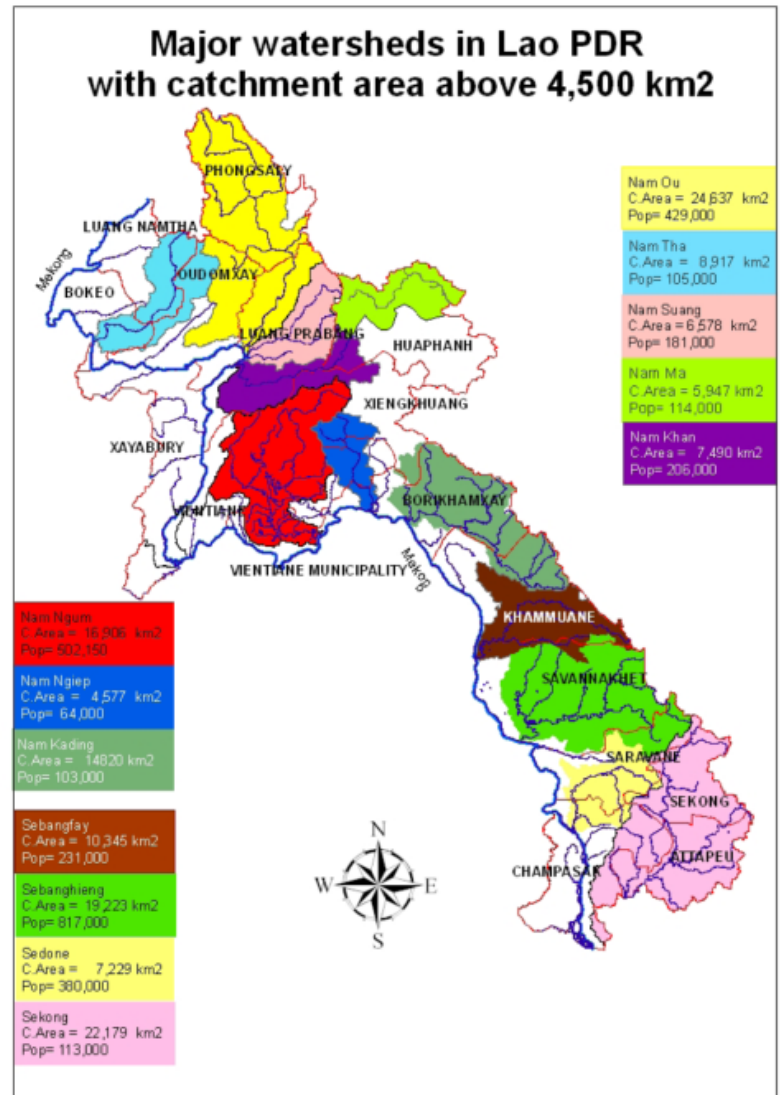
- ▶ Aim of the CIA
 - ▶ To assess the impacts of all the cascades together in a wider, basin context
 - ▶ To assess impacts upon the Mekong
 - ▶ To identify the key issues for the watershed management strategy
- ▶ Use of Rapid Sustainability Assessment Tool (RSAT) to scope the CIA
 - ▶ RSAT used internally by the consultant team based upon their detailed knowledge
- ▶ CIA draws upon the findings of the ESIA's and compiles them and compares to the wider basin, the provinces and the country
- ▶ Rapid Field survey of the river and collection of data and interviews with provincial and district officials
- ▶ Use of indicators such as Millennium Development Goals

Nam Ou - one of the most important tributaries of the Mekong

- Largest catchment area in Lao PDR
- 6th largest river in terms of its contribution to flow of water
- 2nd after the 3S rivers in terms of sediment discharge.

Nam Ou is high compared to other tributaries in the Mekong catchment

- aquatic health,
- aquatic ecology and fish and fisheries yield,
- hydropower potential,
- land use and protected areas and
- River transport and tourism





Context – about the Nam Ou River

- ▶ **Length:** 448 km from headwaters near the Lao-China border to Mekong confluence
- ▶ **Catchment:** 26,030 km² (24,637 km² about 94.6 % located in Lao PDR and the remaining 5.4% lying in Northwestern of Viet Nam).
- ▶ **Annual discharge:** 12.2 BCM
- ▶ **Mean annual flow:** 480 m³/s
- ▶ **Average minimum dry season flow:** 85 m³/s
- ▶ **3 Provinces** – Phongsali, Oudomxay and Louangprabang,
- ▶ 15 districts (6 on Nam Ou mainstream, 9 on tributaries)
- ▶ **Population** – c.450,000 of which over 70% live within 5 km of the river and tributaries



Upper Nam Ou

Fast flowing, rapids over bedrock and boulders, large sandbanks interspersed with deep pools





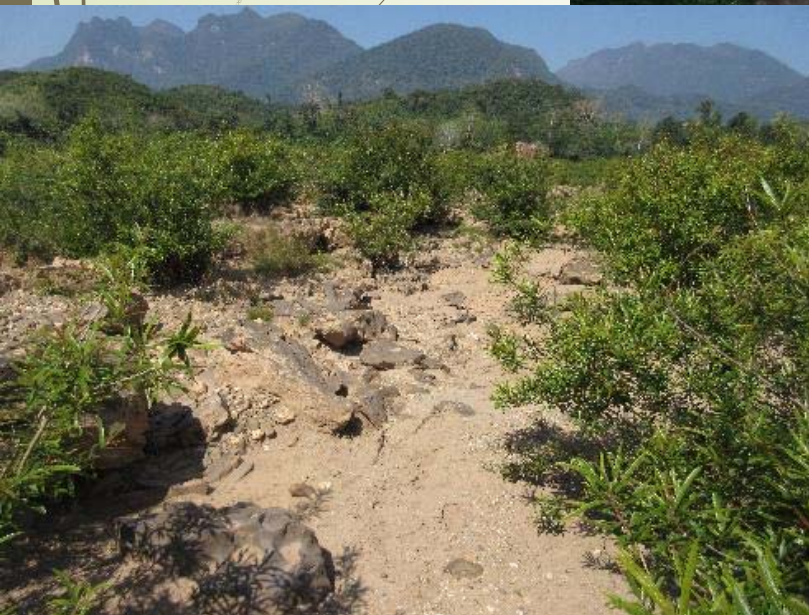
Middle Nam Ou

- Transition from sandstone to karst limestone
- Important tourism area





Lower Nam Ou to Mekong



- Limestone,
- in channel wetland areas
- important for fish spawning
- River weed collection



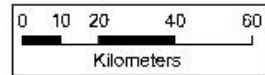
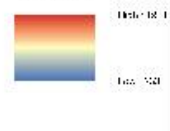
The Nam Ou hydropower projects



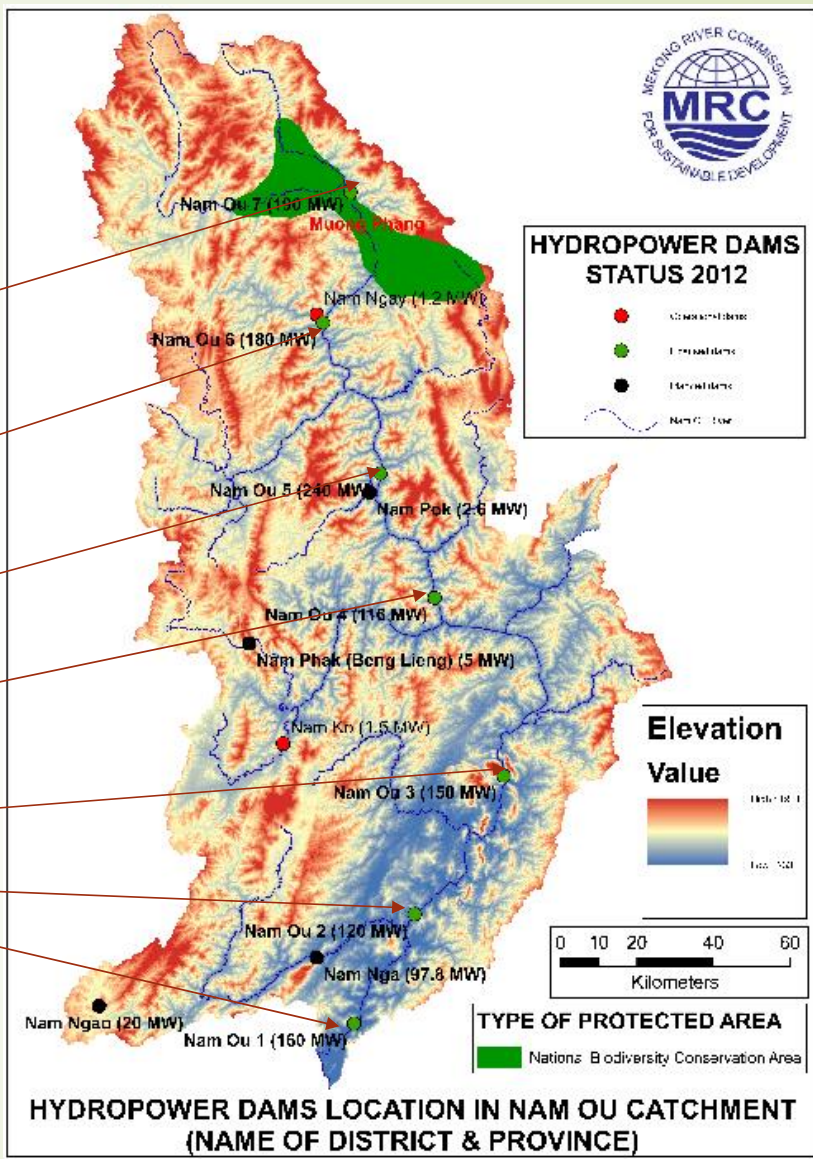
HYDROPOWER DAMS STATUS 2012

- Completed Dams
- Feasible Dams
- Identified Dams
- National Dam

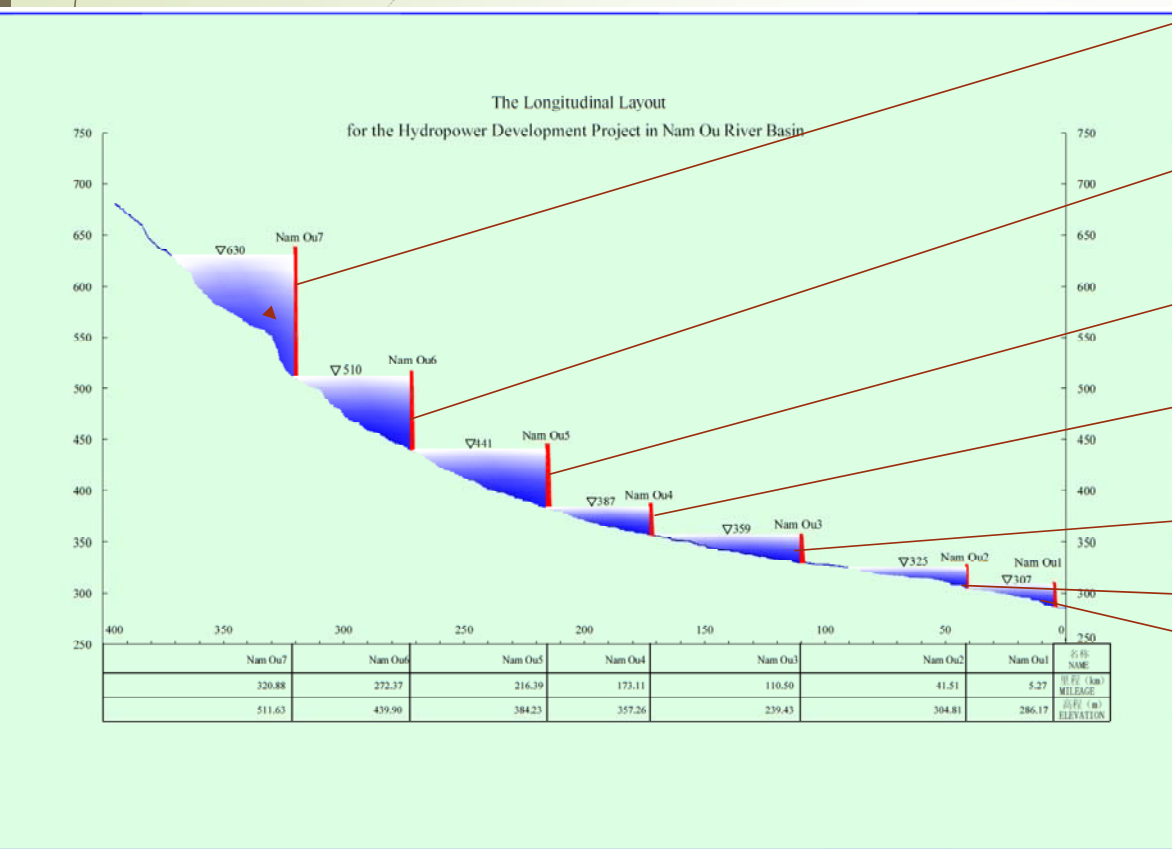
Elevation Value



- ### TYPE OF PROTECTED AREA
- National Biodiversity Conservation Area



HYDROPOWER DAMS LOCATION IN NAM OU CATCHMENT (NAME OF DISTRICT & PROVINCE)



Characteristics of the dams and reservoirs

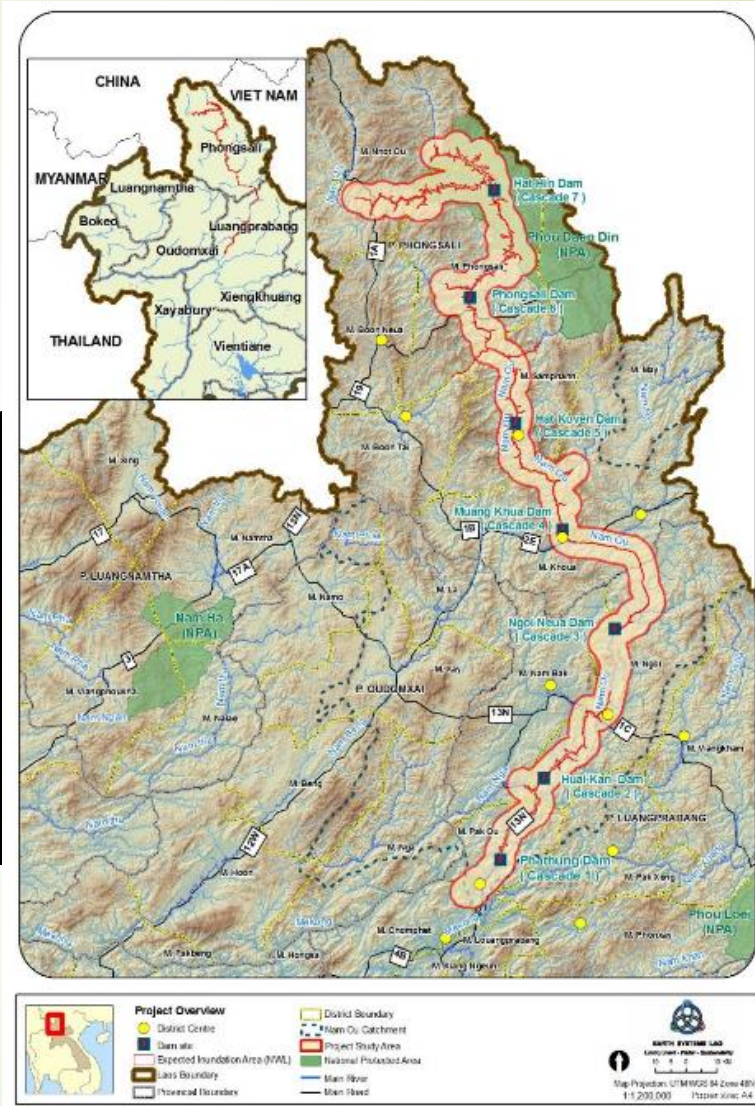
Cascade	Catchment size	Mean monthly discharge	Power house max discharge	Spillway peak design flows	Installed capacity	Annual production	Draw down	Reservoir area	Gross storage volume	Active storage volume	Distance from Mekong confluence	Villages affected	Project Affected Households
	sq km	cu.m/sec	cu.m/sec	cu.m/sec	MW	GWh	m	sq km	m.cu.m	m.cu.m	km	No	No
Nam Ou at Mekong	25,832	610									475		
Cascade 1	25,495	604	1376	19,167	160	710	2	9.56	89.1	19.1	18	17	1818
Cascade 2	22,159	515	994	17,370	120	546	2	15.67	121.7	25.4	53	25	2297
Cascade 3	19,106	442	940	15,662	150	685	7	13.26	168.6	75.8	112	22	1222
Cascade 4	11,661	302	674	11,082	116	524	6	9.37	124	48	171	14	589
Cascade 5	10,270	276	547	14,700	240	1049	6	17.22	335	85	215	14	662
Cascade 6	5,480	161	349	10,200	180	739	15	17.01	409	199	283	6	323
Cascade 7	3,448	105	220	7,330	190	811	35	38.16	1494	958	327	4	103
Total					1156	5064		120.25	2,741.40	1400.3		102	7014

Population affected indices

Active storage indicators

River Regulation indices

Cascade	MW Installed/ Reservoir area	Population affected indices		Active storage indices			River regulation indices			% Active storage/ Total storage
		Households affected/ MW installed	Households affected/ Reservoir area	Active storage/ MW installed	Active storage/ Mean annual flow	Active storage/ Mean flow at confluence	% of river below dam	% of basin regulated	MW installed/ % of basin regulated	
Cascade 1	16.74	11.36	190.17	0.12	0.032	0.031	3.8	98.70	1.62	21.44
Cascade 2	7.66	19.14	146.59	0.21	0.049	0.042	11.2	85.78	1.40	20.87
Cascade 3	11.31	8.15	92.16	0.51	0.171	0.124	23.6	73.96	2.03	44.96
Cascade 4	12.38	5.08	62.86	0.41	0.159	0.079	36.0	45.14	2.57	38.71
Cascade 5	13.94	2.76	38.44	0.35	0.308	0.139	45.3	39.76	6.04	25.37
Cascade 6	10.58	1.79	18.99	1.11	1.236	0.326	59.6	21.21	8.48	48.66
Cascade 7	4.98	0.54	2.70	5.04	9.124	1.570	68.8	13.35	14.23	64.12
All cascades combined	9.61	6.07	58.33	1.21	2.32	2.30	3.8	98.70	11.71	51.08

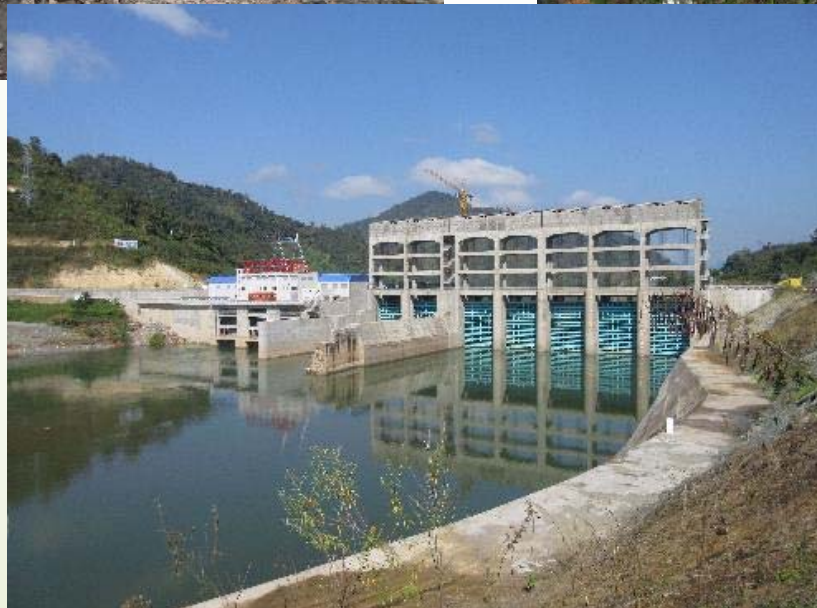




Nam Ou 6



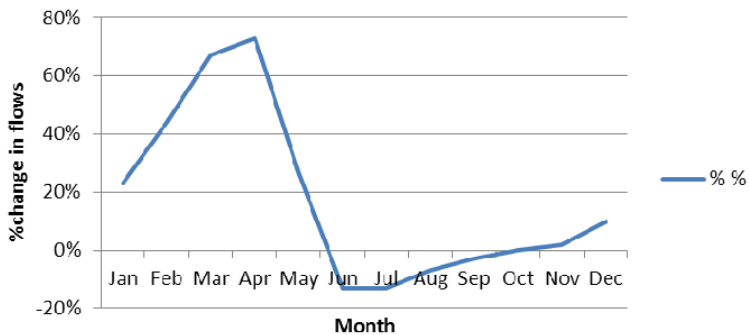
Nam Ou 5



Nam Ou 2

Cumulative Hydrological changes

% change in flows in Nam Ou below Cascade 1



- ▶ The patterns of flow down the river significantly altered, reflected in the flows downstream of cascade 1,
 - ▶ dry season flows reaching the Mekong confluence will increase by up to 73% and
 - ▶ peak wet season flows will be reduced by about 13%.
- ▶ These changes will alter the overall river morphology, aquatic habitats and productivity right through the whole river system.
- ▶ Cumulative impacts on Mekong compared to expected changes in flow resulting from
 - ▶ the Chinese dams on the Lancang River, and
 - ▶ the proposed dams on the Mekong mainstream above and below the confluence of the Nam Ou – Luang Prabang and Xayaburi HPPs.
 - ▶ Climate change

Cumulative Sediment changes

Cascade	Baseline		With cascades				
	Flow rate cu.m/sec	Sediment flux MT/Yr	Sediment trapping efficiency %	Total sediment trapped	Additional sediment from catchment MT/Yr	Total sediment inflow to cascade MT/Yr	Sediment release MT/yr
7	105	0.91	95	0.865			0.046
6	161	1.44	80 - 90	0.460	0.530	0.576	0.115
5	276	2.7	70 - 75	0.963	1.260	1.375	0.413
4	302	3.07	40 - 60	0.313	0.370	0.783	0.470
3	439	5.02	40 - 60	0.968	1.950	2.420	1.452
2	515	5.82	30 - 50	0.676	0.800	2.252	1.576
1	604	6.69	20 - 30	0.489	0.870	2.446	1.957
Total				4.733			1.957
% of total baseline sediment flux				70.7			29.3

- ▶ Nam Ou contributes 6.7 Million Tonnes per year - one of the highest Mekong tributaries - about 4.8%
- ▶ Sediment transport changed dramatically. Nam Ou cascade will trap about 70%,
 - ▶ Reducing to about 2.5 Million tonnes per year.
- ▶ With the Chinese dams in place, contribution from the Nam Ou increases to about 32%.
- ▶ With Nam Ou cascade contribution of the remaining sediment reaching the Mekong will be reduced to 10% at the confluence.
- ▶ If the Mekong mainstream dams are in place, impacts reservoir of the Xayaburi dam, reducing the total amount of sediment transported into the reservoir.
- ▶ At confluence with Mekong tendency to drop the sediment coming in from the Nam Ou, especially filling up the deep pools in the reservoir.
- ▶ Significant changes in river morphology below the confluence between Nam Ou and Mekong - impacts on bank erosion and sedimentation



Water quality

- ▶ The water quality of the Nam Ou is generally good, localised areas where for example suspended solids levels are high,
 - ▶ result of road building,
 - ▶ gold mining and
 - ▶ upstream agricultural activities e.g. on the Nam Noua in Vietnam.
- ▶ Water quality issues from Nam Ou cascade
 - ▶ thermal stratification and release of poor quality waters from the cascades 6 and 7.
 - ▶ Below Cascade 1, water quality less concern,
 - ▶ overall reduction in TSS and turbidity
 - ▶ tendency for the river to pick up sediment downstream
- ▶ During construction of the Nam Ou cascade, more significant impact upon water quality,
 - ▶ Increased suspended sediments and turbidity,
 - ▶ increases in organic pollution and accidental spillages.
 - ▶ The filling of the cascades will also increase the organic load in the waters and tend to reduce the dissolved oxygen content.

Aquatic habitats and biodiversity

- ▶ Nam Ou recognised as one of most important tributaries for its biodiversity – aquatic habitats, fish species, migrations
- ▶ Nam Ou cascade will change this completely – loss of 66% of fish biodiversity
- ▶ Loss of fish migrations will have a cumulative impact on wider Mekong
- ▶ Fisheries yields are high in Nam Ou and these will drop as soon as construction starts
- ▶ Reservoir fishery unlikely to be as high as before



Vegetation and Land cover



- ▶ High proportion of forest cover in basin, though most is unstocked forest
- ▶ Nam Ou cascade will disturb about 5000 ha of forest land – about 35% high quality forest,
- ▶ Implications of forest losses are more important locally within districts
- ▶ Nam Ou very high risk of soil erosion – 87% classified as Class 1 and 2 soil erosion risk



Protected areas and forests

- ▶ Phou Den Din NPA affected by Cascades 6 and 7 – representative NPA of Northern Laos
- ▶ Loss of 2.4% of total area – but most significant habitat loss of riverine habitats in NPA
- ▶ In wider Nam Ou basin 43% of land area classified as protection forests, but land cover may be degraded
- ▶ Cascade will reduce collection of forest products and timber resources significantly especially in riparian woodlands



Cumulative social impacts




- Population of basin is about 358,000 people
- Densities are low, poverty is high
- Within corridor, there are 128 villages, with 45,000 people, who will be affected by the changes – 10,700 physically displaced
- By year 3 of construction, 13,600 workers – 6% of Phongsali province, 17% in Phongsali district
- Employment benefits – potentially one worker for every 5 households.
- Families and camp followers 2 - 3 x worker numbers
- Livelihood impacts – loss of agricultural land, reduction in fish catches, increase in demand and prices of fish and NTFPs, pressure on wildlife
- Increased risks of contamination of water supplies
- Increase in easily transmissible diseases – TB, STDs, HIV/AIDS

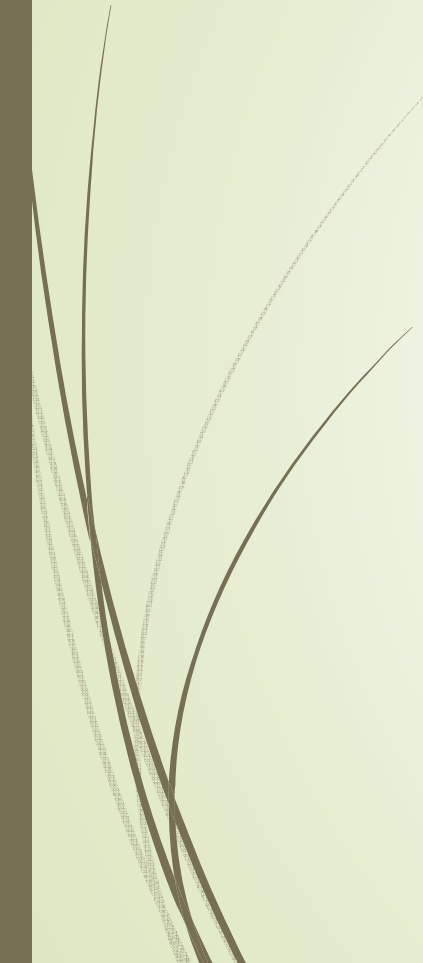


Impacts on Regional economy

- ▶ Nam Ou cascade contributes to national and local economy as per next 5 year Dev plan
- ▶ But contribution to provincial and district economy may not be as high as expected
- ▶ Cascade will tend to increase water availability e.g. for irrigation in dry season, but suitable land is limited
- ▶ Gold mining in river will be stopped
- ▶ Very significant impact upon tourism especially in the lower Nam Ou. Will start as soon as construction starts.
- ▶ Road network will be impacted by heavy traffic during construction, but overall will probably be improved
- ▶ River transport likely to decline – will be more restricted to just transport on reservoirs – with difficulties of transit around dams
- ▶ Other hydropower – loss of one existing small plant, plans for seven other small HPPs
- ▶ Complete loss of pico-hydropower potential – implications for extension of rural electrification



Cumulative Impact management – river basin management plan

- Based on findings of CIA a watershed management strategy for the river basin was produced
 - This used the RSAT framework to provide a structure
 - Recommended management measures to address the key issues
 - Recommended establishment of Nam Ou River Basin Committee, with financial contributions from the hydropower company
- 



Challenges to carrying out the CIA

- Advantage of having only one hydropower company for all 7 dams in cascade
- At the time, lack of clear guidance on what a CIA should consist of –
 - Need to define the scope at the beginning
- Lack of baseline data on many aspects of the river basin
- Uncertainty about other developments going on in the River basin, e.g. changes in land use – rubber and banana plantations
- No defined stakeholder consultation process for the CIA
- Difficulties in identifying meaningful indicators with which to assess the projected changes and impacts
 - Use of RSAT to provide a framework
 - Use of Millennium Development Goals



Thank You

