ENVIRONMENTAL STUDY OF THE LANCANG-MEKONG DEVLOPMENT PLAN

Mitigation recommendations

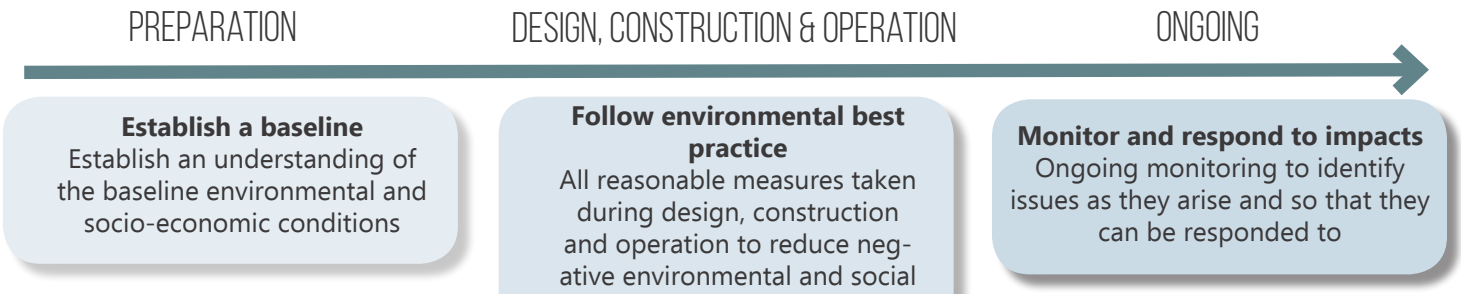
Photo: Jeremy Carew-Reid (ICEM)

1. APPROACH

This brief outlines the study approach to developing mitigation recommendations to address the main impacts of the LMDP and Pak Beng HPP, which fall into one of the mitigation stages below (Figure 1).

The design of the avoidance, mitigation and enhancement measures including the framework environmental and social management plans and guidelines for environmental monitoring and further study provides governments, provincial departments, civil society, private sector and local communities with a road map for avoiding biodiversity losses and managing the impacts of inland navigation development in the Mekong mainstream. The process of implementing the study recommendations will also enhance coordination between key actors at the national and provincial level and provide opportunities for an increased ownership of environmental protection, trans-boundary cooperation and management.

Figure 1: Mitigation stages



Key steps included:

- Identifying areas where understanding of current environmental and social conditions in the affected areas needs to be improved;
- Outlining measures that should be included in environmental and social management plans to address the main construction and operational impacts;
- Defining areas requiring special conservation management and the roles and responsibilities of the MRC, member countries, the private sector and communities;
- Outlining how the rights of ethnic minority and other vulnerable groups can be taken into account in development planning and project management; and
- Laying the groundwork for establishing environmental and social management and monitoring plans.

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1.2 Overarching strategic recommendations

Six overarching strategic recommendations are made to avoid, minimise, remedy or offset the most serious negative impacts of the LMDP and Pak Beng HPP on biodiversity and livelihoods These are:

1. **Establish an enhanced baseline**: additional detailed biodiversity and livelihoods baseline studies (to better understand their current status and spatial distribution for improved impact assessment and management of proposed developments);
2. **Develop an alternative layout and design for Pak Beng HPP dam** to avoid or minimise impacts on biodiversity and livelihoods;
3. **Embrace best practice construction and operation** requirements for the LMDP and Pak Beng HPP to avoid or minimise impacts on biodiversity and livelihoods;
4. **Establish a transboundary Mekong mainstream conservation area network** to remedy or offset biodiversity and livelihoods impacts through habitat restoration and enhancement;
5. **Conduct ongoing monitoring of biophysical and socio-economic conditions** and impacts of the LMDP and Pak Beng HPP to ensure ongoing management is effective.
6. **Provide livelihood support and ensure the rights of ethnic minority and other vulnerable groups are respected** to avoid, minimise or mitigate against unintended negative impacts on vulnerable groups.

1.3 LMDP Recommendations

Five of the key strategic recommendations (all except no. 2) address the most significant impacts of the LMDP. Prior to implementing the LMDP, it will be necessary to conduct further detailed physical, biological and livelihoods baseline studies in the impacted areas (Strategic Recommendation 1) to fill gaps in knowledge and ensure all impacts have been identified and are appropriately mitigated. Best practice construction and operation requirements for the LMDP (Strategic Recommendation 3) aims to avoid or minimise impacts of the navigation improvement works. The aim of the transboundary Mekong mainstream conservation area network (Strategic Recommendation 4) is to rehabilitate, restore or offset LMDP impacts on biodiversity and livelihoods through conservation management of selected important biodiversity areas. Ongoing monitoring of biophysical and socio-economic conditions and impacts of the LMDP (Strategic Recommendation 5) will ensure that management actions are working, adjusted as necessary and any unforeseen impacts are dealt with. It will also be important to put in place measures to ensure livelihoods and the rights of ethnic minority groups and other vulnerable groups are protected in rolling out the LMDP (Strategic Recommendation 6).

Measures under strategic recommendations 1, 3 and 5 and how they relate to hydrology and sediment, biodiversity and socio-economics, are provided in Table 1 (page 3).

Implementation of Strategic Recommendation 4 will require:

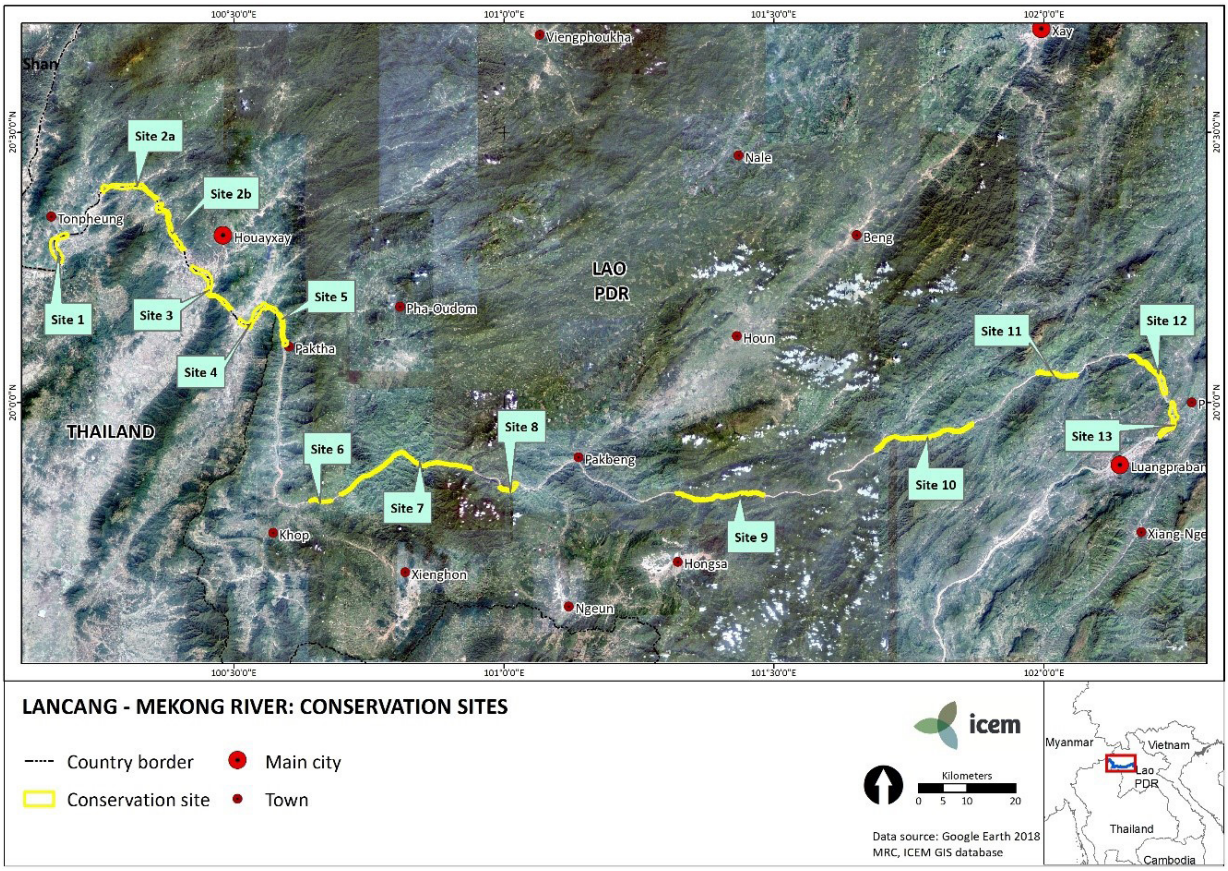
- Thorough survey, justification and boundary definition of the 14 identified sites [1] (Figure 2, page 4)
- Formal designation of the conservation network in Thai and Lao PDR protected area frameworks
- Establishing mechanisms for private sector financing of network establishment and management
- Clearly defining the role of the MRC in transboundary network facilitation, studies, management planning and monitoring
- Establishment of Lancang-Mekong Lao and Thai conservation management units
- Preparation of an overall conservation network management plan (including monitoring and evaluation requirements)
- Preparation of site-specific management plans
- Adjustment with implementation of Pak Beng HPP – as Zone 2 sites will be inundated

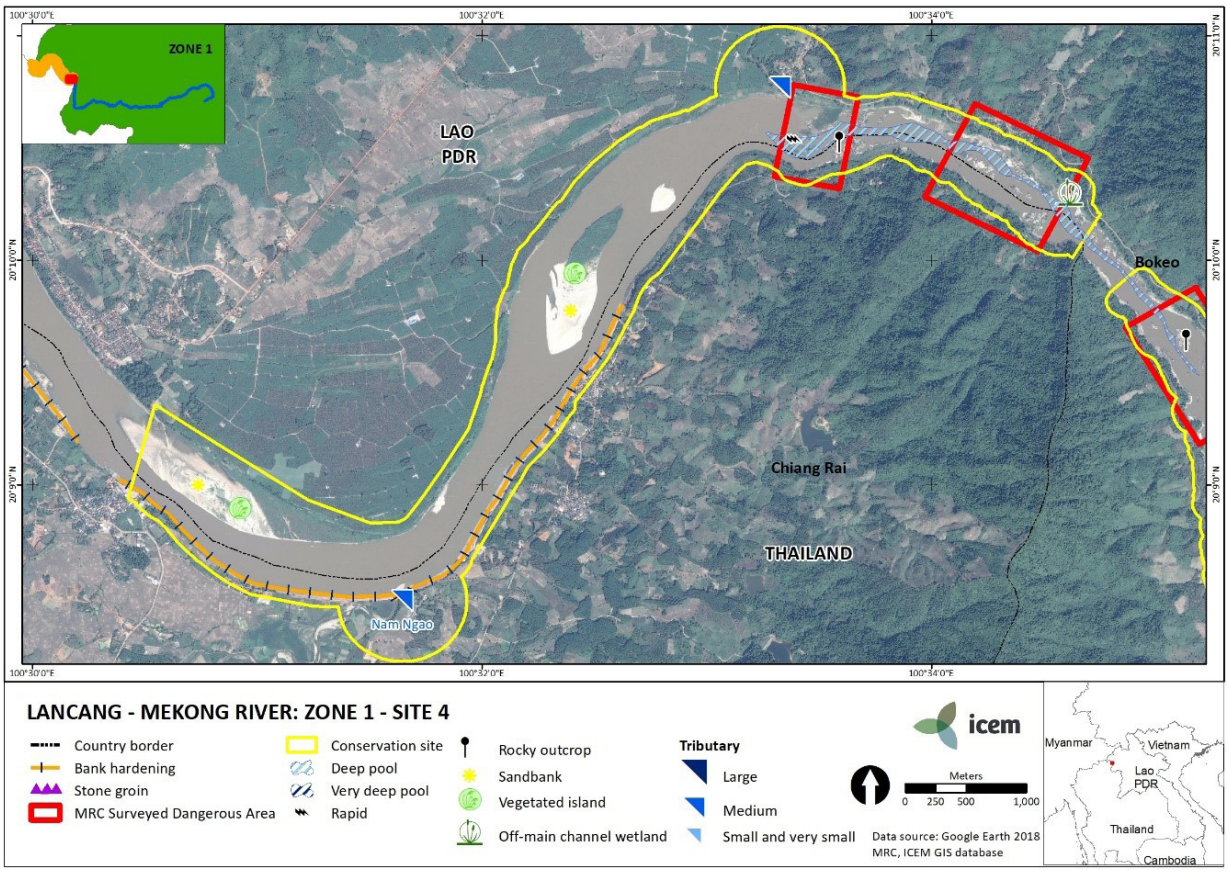
1 At this stage, sites were distinguished by identifying areas with important habitat features (rapids/shoals, tributaries/deltas, vegetated islands, off-main channel wetlands, deep pools, rocky outcrops, sandbanks) ensuring that they were representative. As more information is gathered at these sites, a more comprehensive set of species and habitat criteria will allow for detailed justification for protection, greater precision in boundaries and a thorough framework for monitoring and management.

Table 1: LMDP mitigation measures under strategic recommendations 1, 3 and 5 covering one or more themes

	Hydrology and Sediment	Biodiversity	Socio-economics
Enhanced baseline (SR1)	Additional discharge monitoring, particularly of tributaries	Comprehensive baseline survey of the pre-project avifauna and its threats, which serves as the basis to a long-term monitoring programme	Field surveys in the communities proximate to the dangerous areas to assess their ethnic compositions, to quantify areas of riparian farmland that may be at risk of erosion, to assess the financial and overall well-being of community members, and to determine community needs and aspirations with regard to improving or maintaining their livelihoods
	Monitoring of concentrations and grain size of suspended sediment concentrations for several years and across all seasons	Detailed field survey of amphibians and reptiles in forested portions of the mainstream Mekong and its tributaries	Modelling of urban growth in towns where ports will be developed
	Bed material grain size should be documented by sampling at several locations along the river at low flow		Survey of vessels using the river on how waste is currently disposed of (human waste, food waste, rubbish)
	A full geomorphology study - include repeat cross-section surveys, temporal analysis of satellite imagery and field studies	Further local fish surveys, to assess in more detail i) knowledge of fish species swimming capabilities and flow and sediment range requirements; ii) migratory patterns among the species listed; iii) requirements of endemic or endangered species for specific aquatic habitats; iv) fishers' knowledge about the ecological role of each deep pool; v) identification of the sites where blasting of rapids would create channelization and new flow conditions not passable by fish anymore	Socio-economic field surveys of those who harvest and sell kai (including an assessment of the total value of kai traded compared to agricultural crops and other produce, and the length of the river in which it grows)
			Modelling of additional urban run-off from port town expansion
Best Practice C&O (SR3)	A prioritization of the sites to be blasted, based on a multiple-objective analysis		
	The volume of sand and silt removed is minimised; the area of affected riverbank and riverbed is minimised; dredged sand and silt is placed in a location that minimises the potential downstream impacts; sand and silt mobilised during the dredging process is contained into a small area		
	Setting a limit to the size and weight of boats on the river; ensuring that boat traffic maintains a certain distance from the river banks where possible; setting speed limits for boats		
		Limit blasting in scale and to dry season to minimise underwater noise and shock wave impacts	
		Restrict discharge of wastes such as fuel and lubricants into the river during dredging operations	
		Halt dredging during the fish spawning season	
		Provide facilities for collection and disposal of waste oil and any other wastes such as garbage	
Ongoing monitoring (SR5)		Monitoring of biodiversity around the blasting and dredging sites and ports	
		Monitoring program on deep pool fish diversity and abundance	
		Water quality monitoring	
		Monitoring of macroinvertebrate populations	
		Monitoring of identified critical habitats for threatened or endangered species from detailed ESIAs	
		Increase wildlife and forestry enforcement capacity at new port developments	
			Continuous monitoring of changes in the socio-economic conditions with reference to the established baseline and broader trends

Figure 2: Selected 14 conservation sites (top) and close-up of Site 4 in Zone 1 (bottom)





Implementation of Strategic Recommendation 6 includes a range of livelihood support measures for vulnerable groups, including:

- Staged land titling starting with those living or farming within 5km of the river.
- Giving priority to ethnic minority communities in avoiding farmland loss.
- Providing communities located within 2km of blasting areas, whose average income is less than 3 times the poverty line with support and training to ensure that reduced fish stocks will not stop them maintaining livelihoods.
- Providing support to local government authorities to ensure people comply with building standards and WASH related standards to address vector, food and water-borne disease risks.
- Improving access to medical care measures including: developing a plan for universal health coverage; increasing health services at new port developments; implementing public health programs, including STD services; and, increasing public health awareness raising via community nurses.
- Offer re-training where kai harvesters are negatively impacted, so they can be actively employed in port and town construction activities.
- Supporting local governments in town planning prior to implementation of the LMDP, so that likely impacts and mitigation strategies have already been considered by planning officials.
- Enhancing new employment opportunities through: regulations for wage earners (e.g. minimum wage); and providing training in basic construction skills and in tourism-related services.

1.3.1 Roles and mechanisms for implementing the LMDP strategic recommendations

The LMDP developer is primarily responsible (under Lao and Thai government requirements) for adequately assessing and addressing impacts of the LMDP. The developer will need to provide Environmental and Social Impact Assessments (ESIAs) and Environmental and Social Management and Monitoring Plans (ESMMPs) for the navigation clearing works and for each of the planned ports under respective riparian country requirements – including implementation of developed environmental and social management plans. Transboundary impacts will also need to be considered and dealt with, covered under the MRC transboundary EIA guidelines. These assessments and management plans will build on the current study and its recommendations to improve the baseline understanding (SR 1 and 4) and impact assessment, implement construction and operational mitigation measures (SR 3 and 6), and monitor impacts (SR 5).

Thai and Lao inland navigation and conservation agencies such as the Thai Marine Department and Department of National Parks, Wildlife and Plant Conservation and Lao Department of Waterways and Ministry of Natural Resources and Environment will play a central role in managing implementation of the LMDP and its impacts. It is essential that there is close cooperation and coordination between these agencies to ensure navigation, conservation and cross border management is harmonized.

The involvement of additional agencies for implementation of some socio-economic and livelihood impact mitigation strategies will be required covering land titling, health, education, employment, agriculture, tourism and social welfare. A special purpose levy on navigation is recommended as the best way to fund ongoing management and monitoring of the LMDP impacts – potentially contributing to implementation of ESMMP requirements and beyond.

The MRC will also play a critical role in supporting Lao and Thai agencies in conducting additional baseline studies, implementation of operational mitigation measures including the conservation network and ongoing monitoring of impacts – particularly in facilitating cross border coordination. International donors may also be a source of funds for supporting additional baseline studies, the conservation network and socio-economic and livelihood impact mitigation activities. Civil society and communities can also play a role in supporting management of the conservation network, ongoing monitoring and in implementing socio-economic and livelihood programs.

1.4: Pak Beng HPP recommendations

All six key strategic recommendations are proposed to address the impacts of Pak Beng HPP. Prior to implementation of the Pak Beng HPP, it will be necessary to conduct further detailed biodiversity and livelihoods baseline studies in the impacted areas to fill gaps in knowledge and ensure all impacts have been identified and are appropriately mitigated (Strategic Recommendation 1). Then, as a key strategy to avoid the most serious impacts of Pak Beng HPP, an alternative project layout and design set out by the 2018 MRC ISH study (MRC, 2018) is proposed (Strategic Recommendation 2). Best practice construction and operation requirements for the alternative layout Pak Beng HPP (Strategic Recommendation 3) aims to further avoid or minimise impacts of the project. Ongoing monitoring of biophysical and socio-economic conditions and impacts of Pak Beng HPP (Strategic Recommendation 5) will ensure that the ongoing management actions are working, adjusted as necessary and any unforeseen impacts are dealt with. Measures to ensure the rights of ethnic minority groups and other vulnerable groups are protected will need to be established prior to implementing Pak Beng HPP (Strategic Recommendation 6).

Measures under strategic recommendations 1, 3 and 5 and how they relate to hydrology and sediment, biodiversity and socio-economics, are provided in Table 3 (page 8).

Under Strategic Recommendation 2, two fully gated low head barrages using rising sector gates (Figure 2) could replace the current single dam design for Pak Beng HPP and would capture a similar amount of energy if the cumulative head was the same (MRC, 2018). The lower head projects would provide the following environmental advantages (MRC, 2018):

- Substantial reduction in impounded water volume, potentially resulting in improved water quality, reduced temperature change and lower sediment retention;
- Lower head dams, making fish passage in either direction more feasible and survivable;
- Lower gross heads suitable for fully gated barrages;
- Lower gross heads suitable for horizontal axis low speed bulb turbines;
- Creation of impounded depths much closer to natural flood surcharge levels; and

The alternate design would also avoid many impacts and the need for most of the operational measures under Strategic Recommendation 3.

Figure 3: Rising Sector Gate – Operating Positions (from MRC, 2018)

Implementation of Strategic Recommendation 6 includes a range of livelihood support measures for vulnerable groups, including:

- Better consideration of the impacts on downstream communities, particularly how access to the reservoir will be facilitated. This will require consideration of how fisher people will get to the reservoir, as well as a methodology for ensuring that they have rights of access to fishing grounds.
- Much stronger consideration of the indirect impacts that are likely to be associated with the project. The indirect impacts have the potential to be larger and much more widespread than many of the direct impacts related to the dam. For example, there is already at least one foreign company in the area with a plantation concession. Improved roads, and shipping lanes is likely to attract more companies seeking land concessions, and with this there is likely to be pressure applied to rural communities to relinquish their rights to their customary lands (see e.g. McAllister 2015).
- Ensuring that poor and rural communities have been granted official permanent title to their lands, as per a new clause in the amended Land Law , prior to the upgrading of roads will provide additional protection to these vulnerable people, so that they can maintain their livelihoods from their own perspective.

Even though the Pak Beng HPP will transform Zone 2 of this study into a lake or lentic ecosystem there will still be opportunities to identify important biodiversity conservation areas which need to be reconstructed and maintained. The Pak Beng HPP will have a key role in establishing and maintaining the Mekong mainstream conservation area network to remedy or offset biodiversity and livelihoods impacts through habitat restoration and enhancement under Strategic Recommendation 4.

1.4.1 Roles and mechanisms for implementing the Pak Beng HPP strategic recommendations

The Pak Beng HPP developer is primarily responsible (under Lao PDR Government requirements) for adequately assessing and addressing impacts of the dam. The developer will need to develop an ESIA and ESMMP for the dam that adequately characterize the baseline situation, assess impacts and define required management and monitoring plans – including implementation of these plans. The current EIA and SIA are inadequate with several deficiencies on both the environmental and social baselines, impacts and mitigation strategies (actions to address these are included in Table 3). Transboundary impacts will also need to be properly considered and dealt with, covered under the MRC transboundary EIA guidelines.

The Lao PDR Government plays a central role in ensuring the Pak Beng HPP developer meets its environmental and social obligations and supporting implementation and monitoring of management plans. The MRC is also providing technical and administrative support through the PNPCA process and will also indirectly contribute to monitoring of the dam and its environmental impacts through its ongoing monitoring programs. Civil provides a critical role in independently assessing impacts (such as the International Rivers critique of the current Pak Beng HPP EIA and SIA) and contributing to ongoing monitoring of impacts and working with communities to restore or improve livelihoods (however they should not be relied on for this as it should be covered by the developer's social and environmental management programs.

Table 2: Pak Beng HPP mitigation measures under strategic recommendations 1, 3 and 5 covering one or more themes

	Hydrology and Sediment	Biodiversity	Socio-economics
Enhanced baseline (SR1)	Additional discharge monitoring, particularly of tributaries in zones 2 and 3	Comprehensive bird, amphibian and reptiles surveys in the inundation area	Improved modelling of whether aquaculture can stand in for loss of fish production
	The design of the dam should be modelled for its impact on downstream flood pulses, as well as for the amount of sedimentation that will be trapped in the reservoir	Laboratory and field studies should be carried out to evaluate the likelihood that the proposed upstream passage mitigation will be effective and the consequences of turbine passage to downstream-moving fish	Improved modelling of the expected fish stocks in the reservoir that quantitatively takes into account the loss of migratory species because of the dam wall as well as loss of wild fish production
		Collection of fish in the project area over all seasons and for at least 2 years; Monitoring should quantify the numbers and biomass of resident fish and the numbers and seasonality of upstream migrating spawners and downstream drifting fish eggs, larvae, and juveniles	Socio economic surveys should be conducted in the up and downstream communities to determine the reasons for the reported differences in incomes, as well as to disaggregate health outcomes by village, ethnicity, gender and age groups
		Further local fish surveys, to assess in more detail: i) knowledge of fish species swimming capabilities and flow and sediment range requirements; ii) species similarities and connections between the mainstream section and adjacent tributaries; iii) migratory patterns among the species listed; iv) fishers' knowledge about the ecological role of deep pools in the dam impact zones; v) the impact of a change in river hydrology on algae; vi) analysis of existing or potential riparian wetlands and definition of a target reservoir level/extent in relation to fish habitat protection	Collecting population data and livelihoods information at the household level, disaggregated by ethnicity for the 25 upstream villages
			Detailed population surveys should be completed along the roads to Muang Xay, Muang Ngeun and Pak Tha, to identify populations living along these corridors
Best Practice C&O (SR3)	Minimize reservoir size and dam wall height; Ensure that outflows approximate inflows at an hourly or at least daily scale		
	The dam design must: ensure sediment of all sizes are passed downstream and sediment is passed downstream at a rate approximating the natural state (i.e. not just a large volume of sediment released at irregular intervals); ensure the dam height and storage area are minimized to maximise flow velocities upstream of the dam and keep fine sediment suspended; include low level sediment sluices, gates or diversion channels to transport sediment through the dam; include low level outlets to enable sediment flushing to remove deposited sediment (generally sand and gravel); Minimises water levels during the flood season to ensure the natural high proportion of sediment transport through the reservoir during this time is maintained		
	Watershed management can also help to minimise sedimentation by reducing sediments produced by road construction, mining, agriculture and other land uses in the upper catchments		
	Selective forest clearing within the impoundment area could be completed before reservoir filling to mitigate the potential for poor water quality resulting from decay of flooded biomass		
	It is important that all the components of a flow regime are maintained including low flows, high flows and flow variability. For the Mekong it is essential that the flood pulse hydrology is maintained		
	If required, sedimentation upstream of the dam wall can be excavated and transported immediately downstream of the dam to re-introduce to the river		
	Designing the dam structures to avoid concentrating high flows onto bed and bank areas that may be vulnerable to erosion		

	Hydrology and Sediment	Biodiversity	Socio-economics
Ongoing monitoring (SR5)		Creation of artificial wetlands within the reservoir	
		Runoff control measures and timing and location of blasting to avoid sensitive receptors	
		Behaviour and movements of construction workers also need to be controlled to limit hunting or trade in wildlife products	
		Install a bypass fishway ensuring that the design is informed by a baseline assessment of current fish migration behaviour	
		Stocking of adults or fries of commercial species, which are well adapted to reservoirs	
		Connection to the nearby tributaries both in the upstream (Nam Beng, Nam Tha and Nam Ing) as well as the downstream (Nam Ou and Nam Xuang) of the Pak Beng Dam should be kept clear with no obstacles to fish passage	
		Development of appropriate rakers and screens (i.e. to prevent migration through turbines), optimised spill flows, and fish friendly turbines	
		Minimise the reduction in predictable seasonal variation in water levels in and downstream of the dam or deploy 'no go' safe havens above and below the zones of major impact to rebuild the already beleaguered bird populations there as an offset for the loss of habitat in the reservoir	
		The towns where workers are likely to live, eat and otherwise spend their money should be clearly identified, and local authorities should be supported to plan for the changes in these towns ahead of time	
		The local government/administration in Pak Beng and Pak Ngeui towns should be supported to plan for the influx of 3,000 – 4,000 workers	
			Provide support for those in the town who would like to use the opportunity to establish small businesses
			Planning for health complications such as STDs, vector and food borne illnesses
			Mechanisms to fully address social impacts need to be devised, including for those communities to be relocated and those who will experience disruptions to their river-based livelihoods upstream and downstream due to the dam
Ongoing monitoring (SR5)	Monitoring of discharge, sediment load and erosion immediately downstream of the dam wall to a minimum 100km downstream	Monitoring of biodiversity around the dam site, reservoir, quarries, access roads and transmission lines	
		Monitoring program on deep pool fish diversity and abundance	
		Monitoring program on fish diversity and abundance of rapid resident species such as Gerra spp. as well as some demersal species such as Yasuhikotakia modesta both within the mainstream and nearby tributaries of the Pak Beng HPP	
		Water quality monitoring in the reservoir and downstream	
		Monitoring of macroinvertebrate populations	
		Monitoring of identified critical habitats for threatened or endangered species from detailed ESIAs	
		Increase wildlife and forestry enforcement capacity at villages and towns surrounding workers camp	

References

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