

ANNEX 1: PROJECT DESCRIPTIONS

1 Nam Mang 3

The project is located in a catchment with limited biodiversity value. Due to hunting pressure and general habitat degradation the area seems devoid of rare or endangered species. The reservoir area consists of grass and scrublands and open pine woodlands with secondary broad leaved woodland and bamboo on the steep valley sides.

Aquatic weed infestation is anticipated to be a significant threat to the project. The Tat Than waterfall is located just downstream of one of the planned dams and already provides a natural barrier to migrating fish. Thus the project will not create additional obstacles to fish migration.

The 2002 Environmental Impact Analysis identified 2 villages with a total of 60 household structures in the reservoir area occupied by around 420 people. The 9.5 km² large reservoir will flood around 140 ha of paddy land representing 44 percent of all paddy land in the project area. Ban Phoukhaokhouay village will lose 67 percent of its paddy, while Ban Vanghua will lose 37 percent. In addition some 6,400 fruit trees along with around 1,000 ha of grazing land will be submerged.

Construction of the Nam Mang 3 Hydropower Project started in November 2001.

2 Xeset 2

The project itself will only cause small loss of land consisting of secondary forests. These are, however, contiguous with the Phou Set District Conservation Area, and control of encroachment into these forest areas will require special attention.

The fish fauna in Xe Set is determined by the series of waterfalls, which obstruct migration and lead to a decrease in number of species in the higher reaches. The project is therefore not expected to have a serious negative impact on fisheries. However, in the 4.5 km long reach between the head pond and the power station the river will be dry and lose its aquatic fauna and flora. In addition it will dry up the Tat Kolo waterfall.

No resettlement will be required for this project. However, one village is located in the proximity of the lower head pond and careful location of the construction camp and construction activities will be required to avoid undesirable impacts for this village.

3 Xeset 3

The Phou Maak Nak conservation area has been established on the right bank of the Xe Set river opposite Ban Setkhot. Investigations have shown that due to intense hunting pressure no significant wildlife are now found in the forested part of the conservation area. A large portion of the forest is disturbed and classified as being regeneration or secondary forest, though some areas of primary forest still remain. The 4.1 km culvert/canal will pass through this area and approval for any clearing will need to be obtained. Due to the significance of forest disturbance associated with the canal a tunnel alternative has been considered to minimise forest area loss.

The head pond and powerhouse construction is not expected to have any significant negative impact on the terrestrial biodiversity due to the poor quality of existing habitat and resident wildlife populations.

The fish fauna in Xe Set is determined by the series of waterfalls, which obstruct migration and lead to a decrease in number of species in the higher reaches. The project is therefore not expected to have any serious negative impact on fisheries. However, in the reach between the head pond and the power station the river will be dry and lose its aquatic fauna and flora, and dry up the Tat Hia and Tat Xang waterfalls.

No resettlement will be required for development of the project. However, the proximity of Ban Sekhot to the head pond makes it vulnerable to negative social and environmental impacts associated with construction activities and the influx of workers.

4 Houay Lamphan Gnai

The planned project is located within the proposed Boloven Northwest NBCA Area. Studies have indicated that a substantial reach of dense evergreen forest would be inundated by the project. This area is less accessible than other parts of the proposed NBCA, and are therefore likely to be of high importance for the biodiversity in the area. The loss of this forest and the riverine habitats could represent a serious threat to wildlife in the area.

Two access routes have been assumed. Proposing two separate routes avoids the need to traverse the steep (and likely forested) lower slopes of the Boloven. Both of the proposed routes follow existing tracks. Some agricultural land will be lost but no significant losses in primary forests are foreseen.

A river reach of 21 kilometres downstream from the dam will have reduced flows, particularly in the first ten kilometres where only two tributaries enter. It is assumed that aquatic life in this reach will be lost. Upstream fisheries will be affected by changes in production and species composition due to the creation of the reservoir.

No resettlement is anticipated as a result of the project as the reservoir, damsite and powerhouse are planned on uninhabited lands.

5 Thakho (Phapheng Falls)

Phapheng Falls on the Mekong are located in the southernmost part of Lao PDR in Champasak province. The Mekong river south of Don Khong Island have 13 kilometres of powerful rapids with several sets of cascades, the largest of which is Phapheng Falls located near the eastern shore close to the village of Thakho. There are a small number of restaurants on the eastern bank that cater for the tourists who visit the falls.

The vegetation in the area is mainly monsoon forest, which in some places are flooded during the wet season providing an important food source and spawning ground for many species of fish. The area is also breeding ground for rare bird species such as the Great Thick-knee (*Esacus magnirostris*) and River Tern (*Sterna aurantia*), and the Grey-headed fish-eagle (*Ichthyophaga ichthyaetus*).

Loss of vegetation is not expected to be significant given the small footprint of the proposed project.

It is reported that the wetlands of this area contain up to 400 species of fish many of which are expected to be rare. Migration of many fish species over the falls occurs in most months of the year. The proposed project is not expected to adversely affect fish stocks if suitable measures are taken to prevent fish entering the intake and power house and the design discharge remains relatively small in comparison to dry season flows.

The falls are also the habitat of a small population of Irrawaddy Dolphin. The danger that the construction and the operation of the hydropower plant can have negative impact on this unique and threatened species is a serious concern.

The project has no storage and utilises only a small part of the total river flow and has thus no significant adverse downstream impacts.

The project will not inundate any agricultural land or settled areas. The project will require limited construction activities and the assumed small size of the labour force is unlikely to pose any serious health or socio-cultural problems.

6 Nam Lik

According to the 1996 EIA study the 42 km² reservoir will submerge tropical primeval forest. There is however, not reported any loss of valuable and/or rare vegetation or wildlife.

The dam will be an obstacle to fish migration in a river where there is no other dams. Release of poor quality and colder water into the downstream river is expected to reduce the fishery production further, although higher low season flow (in average) may increase the production. By including the reservoir the project is assumed to, at least temporarily, increase the total fish production.

There are no villages in the reservoir area and thus no resettlement is expected.

Nam Song, which has been diverted into Nam Ngum, joins Nam Lik 42 km downstream of Nam Lik Dam. In the dry season the direct impact of Nam Lik and the combined impact of both projects further downstream would make inconveniences for water supply, irrigation and livestock for 22 villages along the river.

7 Theun Hinboun Extension (Nam Theun 3)

The proposed Nam Theun 3 reservoir will inundate areas of the proposed Nam Chuan NBCA. The reservoir branches off in several deep and narrow arms and will submerge the riparian forests, which may provide significant habitat to terrestrial fauna and flora. The construction activities and improved access to previously remote forest areas might increase the stress to the forest ecosystems and biodiversity values.

It is assumed that that fish populations in the reach below the dam and down to the Theun-Hinboun head pond, will be negatively affected.

It is reported that 13 villages with about 1,200 persons, are located in the reservoir area. No details of their ethnicity are given but the area is inhabited by both

upland Thai groups and Hmong. Intense agricultural have caused severe deforestation and erosion in the project area. Ban Sene Si is known to be an ethnic Tai Mene village. So far no assessments have been made to identify resettlement site options.

All villages in the project area depend upon subsistence agriculture supplemented with fishing and collection of forest products. The valley floor is important for rain fed rice production. The reservoir will inundate almost all of the most valuable cultivated land in the area. This will have implications also for populations living above the reservoir rim.

8 Nam Mo

The biodiversity values in the reservoir area and the power station has not been studied but in view of the widely destroyed original habitat, and the present cultivation practice, wildlife is not expected to be of particular interest. Neither the construction works nor the inundation of the reservoir area is assumed to have significant adverse impacts on wildlife or valuable flora.

Even though survey studies have not been conducted it is assumed that the upper part of the catchment area would be of great biodiversity value. Due to the high altitude and the generally undisturbed condition of the forest, very interesting and possibly unique wildlife and flora, are expected to be found. No project works are planned in the upper catchment. Construction workforce influx and improved access might, however, facilitate destructive activities.

No migratory fish are expected to live in the Nam Mo upstream of the high water fall. Effects from the project on the fish population is expected to be small overall, and mainly restricted to a short river stretch just below the dam and the underlying waterfall. Fish species diversity is likely to decline in the reservoir. The production might, however, result in the development of reservoir fisheries, which would provide food and income for the resident population.

The situation of existing settlements and thus the resettlement requirements remain unclear. Earlier reports has indicated no need for resentments but mentions that significant loss of productive land will occur. More resent studies anticipates resettlement of Ban Muang Ngat 1.

The local population of the village has established 20-25 ha of irrigated rice fields for subsistence farming. All or most of these fields will be inundated. No other agricultural lands or forests of commercial interest will be affected.

9 Nam Theun 2

The most significant habitat loss in the inundation area is the riverine habitat on the Nakai Plateau. The project area is bordering the Nakai Nam Theun NBCA and the increased activities and population might impact the valuable wildlife of the NBCA. Of particular concern are the population of elephants and white-winged ducks, both endangered species. It will also impact the livelihoods and cultures of some 6,000 ethnic minorities that will need to be resettled on the Nakai Plateau with new livelihood systems. There will also be impacts on the Watershed that comprises the Nakai-Nam Theun NBCA in the form of *in situ* development (ca. 6,000 ethnic minorities – Makong, Vietic and Brou).

In the Nam Theun between the NT2 dam to the Theun-Hinboun head pond, the 2 m³/s minimum release will be critical for maintaining aquatic life. Significant changes in resident populations of fish will occur with the loss of those species that require fast flowing waters. Mitigation for households utilising this stretch of the river will be carried out based on existing baseline information.

In the receiving Xe Bangfai basin, existing fisheries conditions will undergo changes because of the continuous inflow of 210 m³/s of turbined water. The general effect on fish production is expected to be negative and there are plans to mitigate this through alternative livelihood options, including fishponds and fish in rice paddies as well as other income-generating activities. There will also be losses of riverside gardens and access (opposite bank).

Approximately 60 households will be affected by loss of agricultural land for the construction of the downstream channel. Powerhouse and weir construction may similarly affect some family forest gardens. There will also be loss of land and production for camps, saddle dams on the Nakai Plateau, road upgrades and along transmission line corridors. The planned Public Health Action Plan will address all health and safety issues.

10 Xepon

The Xepon project is located in the upper reaches of the Xe Pon river some 220km east of Savanakheth close to Lao's border with Vietnam. The catchment area is 464km² and the planned reservoir area 30km².

The project is located on the northern border of the Xe Sap NBCA. The proposed reservoir is not assumed to have a direct impact on the flora and fauna of this NBCA. However, possible access roads from the south and the influx workforce could put pressure on its flora and fauna.

Vegetation within the proposed reservoir area consists mainly of secondary vegetation due to the use of defoliants during the Vietnam War and the practice of swidden cultivation. Areas of primary forest occur in patches on the higher slopes of surrounding hills and along steep sections of the river valley.

The diversion of inflow to the powerhouse will significantly reduce flow and aquatic habitat in a 22 km stretch of river downstream of the dam. It is not likely that the project will have an impact on migratory fish from the Mekong River.

Changes in riverine ecology due to reduced flow downstream of the dam may affect the variety and quantity of fish available in the river and therefore availability of valuable nutrition to local people. Villages downstream are likely to experience decrease in overall availability of water, loss of fishing grounds, and changes in river fauna.

Villages in and around the reservoir region are inhabited by Pako people (Lao Theung). The total population of Pako people in Lao PDR is reported to be not more than 15,000 and the entire population live in Samouy district and neighbouring areas.

The village Asim Simboun, located within the reservoir area was established in 1995 under a planned district development program, total 100 to 150 households will have to be relocated. Another 100 households may lose part of their swidden

cultivation lands and grazing grounds. Resettlement would mean serious disruption in the life of this small minority group.

The district centre, Phin 1 village, is located at the edge of the reservoir and may be partially affected. Partial/full relocation of the entire government offices and public facilities such as schools, medical centres etc, may be necessary.

11 Nam Ngum 3E

In the larger catchment a rich wildlife has been reported. Of the species recorded are the threatened Chinese big-headed turtle, Asian wild dog, the clouded leopard, tiger and serow. The creation of the reservoir will reduce available habitat and the improved access will also threaten forest and habitat integrity. An increased hunting and poaching pressure are envisaged during the construction period.

Water quality downstream of the power house will be affected by the release of deoxygenated water. The water will, however, soon be aerated as the riverbed falls steeply further downstream. If the Nam Ngum 3 project is constructed together with Nam Ngum 2, such waters would be released directly into the Nam Ngum 2 reservoir, adding to the water quality problems and postponing stabilization in that reservoir.

Only one village is located at the Nam Ngum 3 reservoir. It is anticipated that reservoir fisheries will provide valuable protein supply to the resident population.

Ban Xiengdet is located next to the lower powerhouse site. The surrounding area is used for agricultural activities. The village consists of some 90 houses with a total population of about 500 people. Most villagers are Lao Theung. The Feasibility Study anticipates resettlement of Ban Xiengdet to a new location. More recent studies indicate, however, that resettlement will not be required, and that losses of agricultural lands to the reservoir may be compensated by further development of existing lands.

The location of Ban Xiengdet close to one of the construction sites has a potential for causing changes to the health and environmental quality of the village. However, the improved access, and commercial opportunities presented by project roads and population influx can provide economic benefits to the village.

12 Nam Ngum 2B

No valuable and/or rare vegetation types are found in the reservoir area. Consequently the reservoir area provides poor wildlife habitat and the risk of damage to wildlife and especially rare and endangered species is low.

It is predicted that water quality within the reservoir will be problematic. Release of poor quality waters into the downstream Nam Ngum 1 reservoir poses a severe threat to the significant fisheries of that reservoir. This is particularly important, as the area of the reservoir receiving the outflows is a primary breeding ground for many of the reservoirs' commercial species.

Inundation will require the resettlement of about 1000 people. Potential resettlement sites have been identified both within and outside the basin. Surveys of the

potentially resettled reservoir population indicate that they are strongly integrated into regional market economy.

13 Nam Ngum 5

It appears that the inundated areas would be primarily degraded forest areas. The biodiversity values reported for the larger catchment and referred to in the description of Nam Ngum 3 might therefore not be relevant for the impact area of Nam Ngum 5. Although the inundation area may not support threatened wildlife, remaining forested areas may. Losses of inundation areas, and the improved accessibility to the remaining ones would increase threats to wildlife.

It is anticipated that fish migrations in the project area are not significant this high into the headwaters.

The village of Muang Chim is located on the upper part of the Nam Sout. An area of about 200-300 ha is used for agriculture, mainly as rice paddies. The village itself is located well above the reservoir level, but the fields are at elevations some 50-100 m lower and some of them might be flooded. Although it appears that no resettlement will be required, there will be a loss of about 10 % of the productive lands.

Ban Xiangdet is located next to the lower powerhouse site. The village has a total population of about 500, most of them Lao Theung. The location of Ban Xiengdet close to one of the construction sites has a potential for causing changes to the health and environmental quality of the village. However, the improved access, and commercial opportunities presented by project roads and population influx can provide economic benefits to the village.

14 Nam Ngum 4A

The area to the south of the proposed project area is covered by a mixture of Pine Forest, Mixed Deciduous Forest, with and bamboo on steep slopes. Secondary forest, cleared forest and savannah are found in low-lying areas. Similar vegetation occurs in the proposed reservoir area with a prominent strip of deciduous forest along the riverbank. Given the relatively small area of inundation the loss of forest is not expected to represent a significant impact.

Rich wildlife has been reported from the region (see Nam Ngum 3E). Given the relatively small area proposed for inundation, the project is not expected to have a significant impact on species diversity or population size. However, the influx of workers and improved access would increase dangers to animal populations through hunting.

Upgrading of the gravel surface access road and construction of new access road is not expected to cause a significant impact on land use or vegetation. However, problems associated with illegal logging in neighbouring areas are expected to be more serious given the improvement in access to the area.

Inundation of a 40 km stretch of river would directly affect the type of species present in this part of the river Nam Ngum. Changes in the downstream flow regime will also have an impact on species diversity.

The location of the proposed dam site in the far upper reaches of the Nam Ngum and the existence of a major dam in the lower reaches make it unlikely that the project would have an impact on migratory fish.

The information about resettlement is conflicting. It has been assumed that the reservoir would be confined to the narrow and uninhabited part of the Nam Ngum valley but newer estimates indicates that the need for resettlement will affect 7 villages, with an estimated population of 1470.

15 Nam Ngum 4B

The impacts on forests and biodiversity will be more or less identical with what is predicted for Nam Ngum 4A

The project would create only a small reservoir in a mountainous and uninhabited valley. No resettlement is assumed to be required as a result of reservoir creation.

It is likely that the project construction camp will be located close to a local village and that access roads will pass a further two villages. Negative impact on social structure and health might be experienced but at the same time these communities may receive potential benefits from increased trade.

16 Nam Bak 2B

The area of proposed inundation is relatively steep and inaccessible. It is therefore likely that areas of primary forest still remain within the proposed project area and it is likely that Nam Bak valley still contains wildlife of ecological importance. Improved access will therefore have an adverse impact on any remaining area of primary forest and on the wildlife.

The impact of diverting flow from the Nam Bak into the neighbouring Nam San basin will result in a decrease in flow in the Nam Bak downstream of the proposed dam site. This is likely to significantly affect the aquatic habitat for at least 10.5 kilometres immediately downstream of the dam. It is not expected that the project would affect migratory fish as their passage from the Mekong River are already blocked by the Nam Ngum 1 dam further downstream. However, it may affect migration and spawning opportunities for the fish stocks in the Nam Ngum 1 reservoir. Fish provide the primary source of protein for the people in the project-affected area.

The reservoir will not inundate any populated areas or cultivated land. More than 80% of the reservoir inundation area is classified as swamp. The upper catchment is denuded and there are very few village settlements in the area.

As the plans include an inter-basin transfer of waters, reduction in the Nam Bak flow could cause water shortages downstream. However, the downstream reach is in a steep valley with little habitation and the reduced flow is unlikely to cause any significant social problems.

17 Nam Pot

The proposed area of inundation is small, relatively flat and contains many villages. It is unlikely that significant areas of primary forest still remain in the area and that wildlife of ecological importance exists.

Access to the project area will probably follow an existing track from the north along the Nam Pot valley. This would pass through numerous villages before reaching the project site. It is unlikely that the proposed access road will have a significant impact on flora.

The water flow in Nam Pot downstream of the dam site will be severely reduced due to the diversion for power generation. The location of the proposed dam site in the upper reaches of the Nam Pot-Nam Siam-Nam Nhiep river system makes it unlikely that the project will have an impact on migratory fish from the Mekong River. There are no villages downstream of the dam and no significant impact on human population is indicated. The dam will, however, disrupt the migratory routes of fish from Nam Siam up Nam Pot and therefore reduce the availability of fish to villages located in the catchment area.

The Nam Pot dam is proposed to be located south of village Ban Pha Tai. For several kilometres upstream of the proposed dam, the river runs through a long, narrow valley with terraced paddy fields. There are 8 villages with a total population of 1500 located on the left bank of the river. They cultivate about 167 ha of paddy land located on both sides of the river. At the proposed inundation level the reservoir will not inundate any settlement areas, it appears, however, that about 20 percent of the total 167 ha paddy land might be lost.

18 Xe Kaman 3

In the upper catchment 70% of vegetation cover consists of degraded forests. It is, however, still recognised as an area of high biodiversity and may provide habitat of rare and endangered species. The small reservoir would not influence such populations, but the improved accessibility by upgraded access roads, might increase the impact on wildlife due to better access.

No significant changes are anticipated to the downstream habitats except for the 5 km below the dam where flow will be significantly reduced. Fish of the upper Xe Kaman are expected to be resident species, and thus the dam is unlikely to create any obstacles with regard to fish migration.

No resettlement will be required for the reservoir.

19 Xe Kaman 1

The project will cause a significant loss in primary forest and likely wildlife habitat. Forest cover in the reservoir is estimated at about 80 percent, and the area is recognised as a significant wildlife habitat through its designation as the Dong Amphan NBCA, and the adjacent proposed Phou Kathong NBCA. Loss of forests land for the reservoir and hunting associated with the influx of construction workers and improved access to the area will increase the present threats to wildlife in the project area.

The diversion of water from the main river channel will result in a loss of virtually all resident aquatic populations in the reach between the dam to the confluence with the Nam Vong (4 km).

The reservoir inundation will require the resettlement of over 800 people from ten villages. There are indications that resettlement of reservoir populations is already proceeding, possibly as part of the existing provincial highland resettlement program.

Declines in flow during reservoir filling will significantly affect river water uses such as fishing, waste disposal, washing and gardening. Flow reductions imply a greater concentration of pollutants (including human wastes) and pathogens in the reduced volumes flowing past the riverside villages.

20 Xe Kong 5

Approximately half of the planned reservoir of 70 km² lies within the Xe Sap NBCA. This inundation area has about 90% forest cover, most of which is dense, mature forest. This area is considered the most important wildlife area in the region, although this is not yet confirmed. The loss of this habitat is considered to be highly significant, particularly as remaining primary forests are most commonly found in areas, which would be inundated.

The downstream aquatic environment might potentially be degraded due to changes in flow patterns, chemistry and temperature. The dam would also present a barrier to fish migrations in the area and isolate upstream fish populations. The potential for benefits from the development of reservoir fisheries is estimated as low.

No ground census has been made for estimation of people living in the project area. A rough estimate for resettlement need includes six small villages and 980 people. The affected resettlers belong to Mon-Khmer ethnic minorities of the Katiuic or Bahnaric groups.

No resettlement sites have so far been identified. There is little land available within the project area, and it is likely that much of the resettlement will be outside the valley (approximately 30 km away).

The dam will create a barrier to navigation along the Se Kong. On the other hand the reservoir will ease navigation and provide a link to the all weather road from the damsite.

21 Nam Kong 3

Approximately 60 percent of the reservoir and upstream catchment is secondary forest. The reservoir covering 38 km² will result in the loss of approximately 23 km² of forested lands. No information is available on the biodiversity value of the area but it might host significant wildlife populations as a national park has been designated for the adjacent forest areas in Cambodia.

The project is located in the upper reaches of the Nam Kong and it is unlikely that it will significantly influence important upstream fisheries even though the dam would create an obstacle to migration routes.

The review of the downstream Nam Kong 1 project indicates that there is no road access to the site.

Based on 1998, map studies, three villages, with a rough estimate of 1,550 people would need to be resettled from the reservoir area. According to the provincial relocation plans these people would at this stage have moved from the highlands of Attapeu District to the lowlands.

22 Xe Xou

The reservoir (115 km²) would inundate parts of the Dong Amphan NBCA. The area is heavily forested, with approximately 35 percent primary and 55 percent secondary forest. It is assumed that the NBCA supports significant wildlife populations. The creation of a reservoir will significantly reduce the available habitat and the improved access might increase the danger of illegal logging and hunting.

The intake has been designed to prevent the release of anoxic waters downstream. No information is available on the fish population of the Xe Xou.

Topographic maps indicate that the upstream areas of the Xe Xou are sparsely populated. The reservoir would require the resettlement of two villages (estimated to about 500 people). There are no villages indicated on the downstream river until its confluence with the Xe Kaman.