

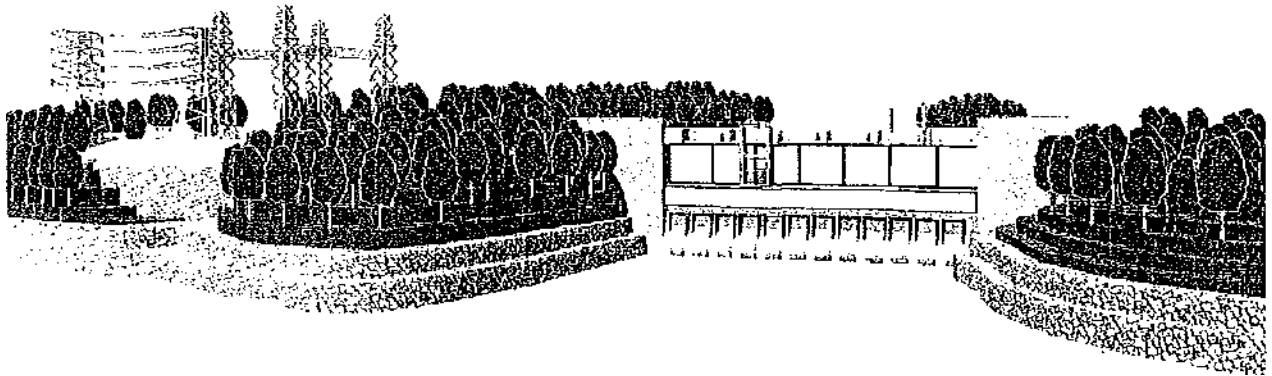
MEGA FIRST CORPORATION BERHAD

Don Sahong Hydropower Project

Lao PDR

Environmental Impact Assessment

Volume 1 – Report



Submitted by:



PEC Konsult Sdn Bhd

and



Australian Power and Water

DON SAHONG HYDRO-ELECTRIC POWER PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT

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EXECUTIVE SUMMARY (EIA)

E.1. INTRODUCTION

A Memorandum of Understanding ("MoU") was signed between the Government of Laos ("GoL") and Mega First Corporation Berhad ("MFCB") on 23 March 2006 which gave MFCB exclusive rights to investigate the technical, environmental and economic feasibility of the Don Sahong Hydro Electric Project ("the Project"). Figure E.1 shows the general location of the Project.

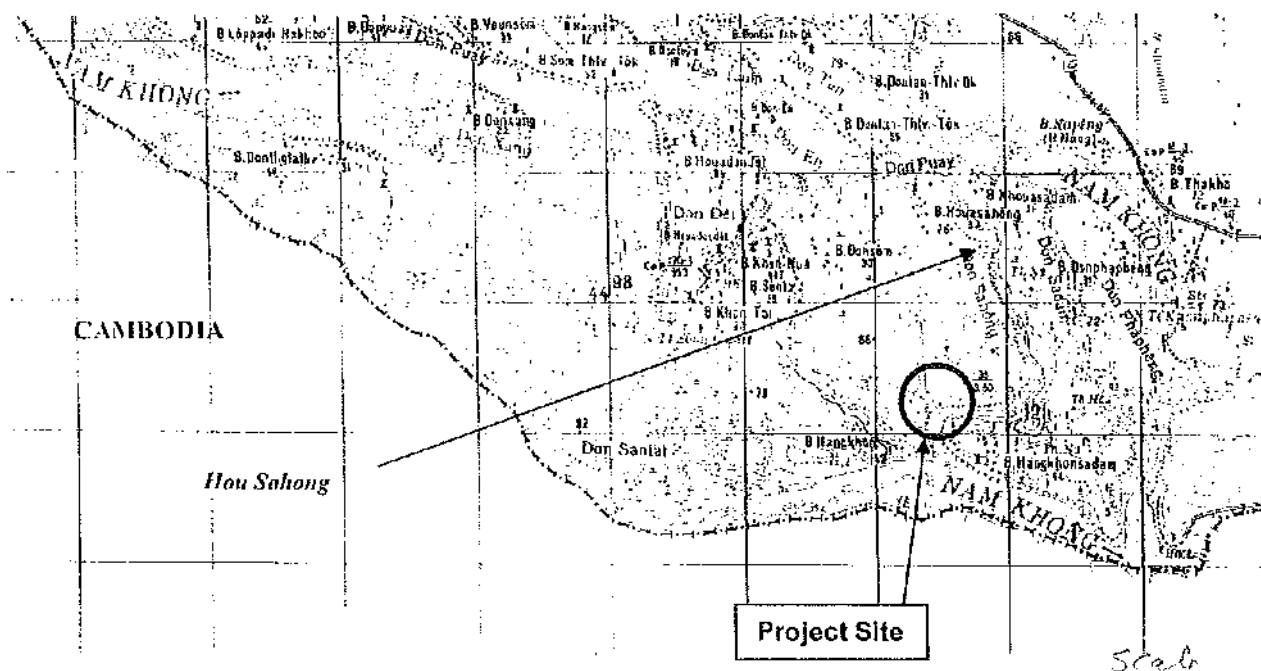


Figure E.1 —Location of Don Sahong Hydro Electric Power Project

The MoU stipulates that the Feasibility Study ("FS") Report and the Environmental Impact Assessment are to be presented to GoL within 16 months. Upon acceptance and approval of these reports, the Project Development Agreement (PDA) would be negotiated and executed. This would enable MFCB to undertake further activities to develop the Project and to negotiate and execute Power Purchase Agreement(s) (PPA) for the export of energy to Thailand and/or Cambodia, leading ultimately to the signing of a Concession Agreement (CA) and the construction and subsequent operation of the power station for a period of 30 years on a build, operate and transfer (BOT) basis. The GoL would also be a shareholder in the Project.

The project proponent, MFCB, is a company listed on the Kuala Lumpur Stock Exchange. The activities of MFCB and its associate companies include engineering, manufacturing of automotive components, property developments, operation of power plants and quarries and production of lime and calcium carbonate products. Operations of the Group are carried out in Malaysia, Cambodia, South Africa, United Kingdom and People's Republic of China.

This Executive Summary relates to the EIA Study for the Don Sahong Hydroelectric Project ("DSHEP") in Champasak Province on the Mekong River. The project is a run-of-river scheme with a nominal plant of 360 Megawatts (MW) and annual average energy production of 2375 GWh. The Power station is located on Hon Sahong, just above the Lao PDR and Cambodian border. The DSHEP is hilly in line with GOL policy to export electricity and the MRC Hydropower development strategy.

This EIA Report was prepared in conjunction with the Feasibility Study Report of the Don Sahong Hydropower Project and should be read with that document which studies a range of installed capacities from 180 MW to 480 MW and lowering of the entrance to the Hou Sahong. While DSHEP will not vary the flows in the Mekong River downstream of Veunkham, there will be alteration to the discharge over Khone Phapheng by the diversions to the power station, which are addressed in the Feasibility Study.

This EIA Report describes the impacts and suggests mitigating actions for the DSHEP, nominally for a 360 MW installation and covering the following: Project Description and Proponent, Institutional and Legal Framework, Baseline Information on Project Area, Impact Analysis and Mitigation Measures, Resettlement and Social Action Plans, Environmental Management Framework, Alternatives to and Within the Project and Conclusions and Recommendations.

E.2 PROJECT DESCRIPTION

E.2.1 Project Construction

The DSHEP is located on the middle reach of the Mekong River in the southern area of Khong District, Champasak Province, 150 km downstream of the provincial capital, Pakse. This area is generally known as Siphandone (Four Thousand Islands), an island complex in the Mekong River from Khong Island to the Cambodian border. There are two waterfalls - Khone Phapheng and Lippi Falls, as well as numerous channels and cascades, flowing in the wet season and mainly dry in dry season.

The DSHEP is located on the Hou Sahong (Figure E.1), the third largest of the perennial water courses and the largest branch without a waterfall. There are a series of rapids at about two-thirds of the distance along its six (6) km long course. The DSFIEP occupies just under 1% of the total area of the Siphandone Wetlands with direct impacts on adjoining areas of Don Sadam and Don Sahong. The dam is a concrete box-like structure about 150 metres upstream from the exit of the Hou Sahong. It will need excavation about 15 m below the existing channel floor and will contain bulb-type hydro turbine generators and associated control and protection equipment in a semi-outdoor arrangement. Three phase transformers will be located on the powerhouse deck with cables delivering the power to a switchyard on the right abutment and thence to a 230 kV transmission line which will traverse Don Sahong and Don Tan before crossing to Nakasang and on to the Electricite du Laos (EdL) Ban Hat substation. While the water retained by the power station will remain mostly within the existing banks of the channel, embankments are required in several locations at the downstream end of the channel to contain the water.

Based on 82 years of streamflow records at Pakse and staff gauge readings from Thakho and Khone Tai, in operation since 1995, the level of the reservoir will vary according to the Mekong River level within a range of 2.5 metres with levels higher in the wet season from June to December and at their lowest in April. The existing rock levels at the inlet of the Hou Sahong would restrict flow into Hou Sahong, particularly during the low flow periods, and reduce power station output. To remedy this, it is proposed that the riverbed of the Hou Sahong will be excavated a maximum of 5 m deep from the intake to about 2 km down stream in the Hou Sahong to increase flow. It is also proposed that the river bed be excavated downstream of the powerhouse, to a depth of one metre, as far as the southern tip of Don Khone to reduce downstream head loss.

Excavation is proposed in Hou Xang Peuk and in Hou Sadam to provide additional flow in the two channels as alternative low flow period fish migration routes as the DSHEP would block the Hou Sahong.

The extent of the DSHEP pondage, the embankment and transmission line locations are shown on Figure E.2.

E.2.2 Project Operations

The Don Sahong Power Station will be a run-of-river scheme, operated using water from the Mekong River, with no storage. This means that it will have negligible effects on any of the upstream channels such as the Hou Det, which leads to the Lippi Falls, or the channels further west of Don Det, Don Xang and Don Tholathi. However, with flow diverted to the DSHEP there will be less water flowing over the Phapheng Falls. During the high flow season, the diverted water is only a fraction of the existing flow, while, in the low flow season, a minimum flow, considered to have no noticeable affect on the appearance of the falls, will be guaranteed. Only water in excess of this minimum flow over the Phapheng Falls and for the minimum flow in the alternative channels for fish migration ("environmental flow") would be diverted down Hou Sahong and the power station would be operated at reduced output during the dry season. This would be achieved by installing an automatic water level measurement device at Thakho to continuously transmit data on levels to the power station control room and adjusting automatically the flow through the generating units accordingly.

Figure 2.5 in the EIA Report indicates the variation in monthly energy output throughout the year based on simulated operation and shows that the dip in energy in the high flow months reflects the restriction on turbine output due to reduced net head from the high tailwater levels downstream of the power station due to water coming from the west. Beyond Don Khone there will be little impact as the flows are absorbed into the Mekong River and downstream of Veunkham there will be no impact as river flows are unchanged.

E.2.3 Site Access, Borrow Areas and Logistics

The project site is along Highway 13, 150 km south of Pakse the provincial capital. The highway was reconstructed in 2001. Highway 16 runs west from Pakse to the border with Thailand at Chong Mek and thence to Ubon Ratchatani. An alternative access route for materials and heavy equipment could be by barge up river from Phnom Penh port. The river is not navigable in all seasons and would have to be investigated more fully. The Mekong River Commission published its "Navigation Strategy" in 2003 and this indicates that the carrying capacity of the river drops off

sharply upstream of Stung Treng and the Mekong is navigable only for 70 DWT vessels in the high flow and 15 DWT vessels at low water. Access to the DSHEP itself involves crossing the Mekong River by boat or barge from either immediately north of Khone Phapheng Resort to Ban Houa Sad am or from Veunkham to the power station site near Ban Hang Sadam. In either case there will be excavation of rock from the river bed to provide a deep and safe passage for barges at all times during the year.

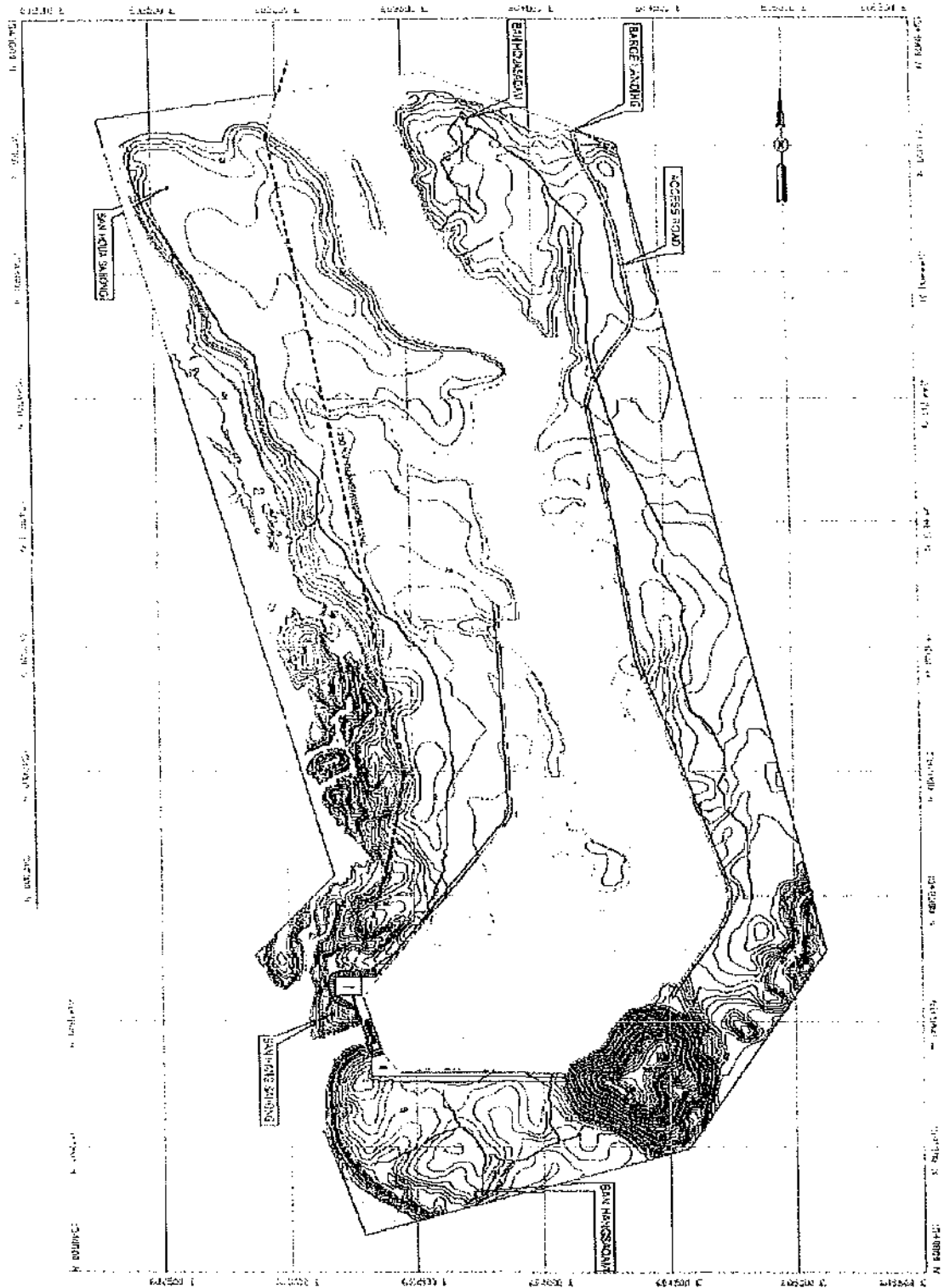


Figure E.2 - Project Layout, showing inundated area

Sufficient good quality rock is available for coarse concrete aggregate and for embankment fill (the impermeable membrane will be a concrete face slab) from the excavations required for the

powerhouse and the deepening of the Hou Sahong entrance. There will be a disposal requirement for more than a million cubic metres of surplus rock from these excavations and it is proposed that it be dumped on low-lying non-agricultural areas. Sand and fine gravel for concrete aggregate and filters will be dredged from the Mekong River at upstream locations where large deposits are known to exist.

A major temporary construction facility will be located on the mainland and will include offices, accommodation, workshops, storage and holding areas so that only personnel and immediate requirements need to be transhipped to the project site.

E.3 LEGAL AND INSTITUTIONAL FRAMEWORK

Section 3 outlines the legal and institutional framework required for the development of DSHEP. It comes under the full set of environmental legislation relating to such projects. This GOL policy and legislation is recent, and compliance with these requirements are in some areas open to interpretation. Sufficient data and studies are presented in this EIA Report for STEA and DoE - MEM to consider and approve the implementation of the DSHEP.

E.4 OFFICIAL STAKEHOLDERS' MEETINGS

An official letter requesting the co-operation of the Champasak Province and Khong District authorities was sent by the Director-General of the Department of Electricity of the Ministry of Mines and Energy (DoE-MEM) on 18 October 2006. The initial Stakeholders' Meetings were then held in Pakse and Muang Khong on 24 and 25 October 2006. Discussions with the relevant District agencies and all local communities were included in the field investigations. All communities were involved in the second Stakeholders' Meeting held in the DSHEP area at Ban Hang Sadam on January 30, 2007 with over 115 attendees. Details of both these Stakeholders' Meetings are contained in Appendixes K and L.

E.5 LEGAL POLICIES AND RELEVANT ENVIRONMENTAL GUIDELINES

There are a number of laws and regulations of the Lao PDR applicable to hydroelectric developments and these are discussed in Appendix N. The main legislation relates to Decrees and Regulations relating to Environmental Protection (1999 & 2001); Power Sector EIA and Environmental Management Plans (EMP) (2001 and 2002) and Compensation and Resettlement (2005). All this legislation provides for approvals by the Science Technology and Environment Agency (STEA) and MEM-DoE. Proposed hydro power projects are required to submit an EIA report including sections on biodiversity management, dam safety, mitigation and restoration of the environment and the establishment of an Environmental Protection Fund.

This legislation for hydropower projects requires project sponsors to prepare an EIA Report in accordance with the Regulation for Implementing Environmental Assessment for Electricity Projects in Lao PDR (2001). This would include aspects such as Environmental Management Monitoring Plans, public involvement of stakeholders, submission of and approval of EIA and EMP by STEA including comments from MEM-DoE, other GOL ministries and agencies,

stakeholders and provincial and local administrations, issuance of an Environmental Certificate by STEA and monitoring of EMP by STEA and MEM-DoE throughout project life.

Recent laws, policies, regulations and guidelines compiled for the Prime Minister's Office and STEA in 2005 have been complied with by DSHEP including the preparation of a Social Action Plans ("SAP") and Resettlement Action Plan ("RAP") and liaison with the relevant line ministries. The SAP and RAP are presented in Appendices B and C, respectively.

Two other relevant documents have been considered during preparation of the EIA Report. The first is the Mekong River Commission's (MRC) Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin. One requirement of the Agreement is that all member countries be advised of projects that will affect them and, for some projects, all member countries must approve its development. Literal interpretation of the Agreement indicates that for DSHEP, approval is not necessary but member countries only need to be advised of the project.

The second is the proposal to ratify the Ramsar Convention and nominate the Siphandone Wetland for inclusion in the Ramsar "*List of Wetlands of International Importance*", The Ramsar Convention is an United Nations International Treaty and has been signed by Thailand, Cambodia and Vietnam, the other Lower Mekong Basin countries, as noted in Appendix J. Nomination of the Siphandone Wetland would not preclude development of the DSHEP, but would require discussion and concurrence with other bodies, principally the Ministry of Agriculture and Forests and its advisors.

E.6 LIAISON WITH STEA AND MEM-DOE

Liaison with STEA and MEM-DoE has been maintained during the course of preparation of this EIA Report. The national and provincial authorities were involved in the initial Stakeholders Meeting in Pakse and consulted in relation to the onsite Stakeholders' Meeting of the DSHEP area. Notes on venues, attendance, organizations represented and topics discussed were kept for these two meetings and are included as Appendixes IC and L.

E.7 BASELINE INFORMATION ON THE DSHEP

Section 4 of the EIA Report outlines the various features of the DSHEP area in terms of their physical features, biological resources and its communities and cultural aspects, including a household socio-economic survey covering six villages surrounding the DSHEP. The important descriptions relate to the hydrology of the Mekong River and the site, the fisheries aspects and the status of the island communities directly affected.

E.7.1 Physical Features

The physical features of the DSHEP area are described as:

- The topography of the region and the site, Don Sadam and Don Sahong have common features where Hou Sahong falls 20 m as it crosses the Great Fault Line (GFL). The Hou Sahong and has seasonal variations of 22 m to 14 m in water levels between its entrance and its exit back to the Mekong River. The islands are relatively flat and are generally at 74 to 77m elevation. They are subject to seasonal flooding, and much of the land is being cultivated as paddy land.
- The geology and soils of the region and the Hou Sahong channel from the geotechnical investigations of the region show details of the hard rock to be excavated and the various sources of materials for construction.
- The climate of the DSHEP area show the controls, constraints and uncertainties that the seasonal patterns of high rainfall periods would put on the project.
- The hydrology of the Mekong River and its variation and show that during the dry season, flows over Khone Phapheng water tails is about 90% of the Mekong flow at Pakse while in the wet season it is about 25% of the Mekong flow while the Don Sahong flow varies between 4% (wet season) and 2.5% (dry season) of the Mekong flow. This emphasises the critical nature of the hydrology, the proposed diversions and the effects of the investigated low season "environmental flows" as shown in Table E. 1.
- The water quality analysis readings refer to the MRC data collection at Pakse, the recent MRC publication on water quality and the DSHEP water sample measurements, all of which explain and show that this Mekong River stretch to be of good quality and unpolluted. The river has seasonal nitrogen and phosphate levels with associated algal blooms that make this a good and productive aquatic environment for fish. The Mekong River also has an annual bloom of filamentous algae from late December through March which increases its food capacity for fish.

Table E.1 - Estimated Long Term Average Monthly Flows over Khone Phapheng (Thakho)
(Flow in m³/s)

	Jan	Feb	Mar	Apr	May
Flow at Pakse					
- Average Flow Rate	2805	2156	1815	1781	2870
- Minimum Flow Rate	1756	1812	1163	1068	1313
Estimated flow at Khone Phapheng (Thakho)					
- Average Flow Rate	2075	1595	1670	1639	2129
- Minimum Flow Rate	1616	1667	1070	983	1104

E.7.2 Biological Resources

The biological resources emphasises the fisheries aspects (more than 1,300 species identified in the Mekong River) and the significance of Hou Sahong as a major fish migration channel. While it is difficult to state the exact migration patterns of fish in Hou Sahong based on actual data / observations:

- At least nine (9) species of medium to small sized Cyprinids are dry season upstream migrants plus a large migration of lunar dependent *Henichorychus* spp. significant to the upstream fishery throughout the Siphandone Wetland
- Another 35 species of larger catfish and cyprinids migrate upstream and made up of Pangasidae, Bagridae, Siluridae and Sisoridae species use this channel along with others in the wet season, which yield most of the catch in traps
- Several species of Cyprinidae migrate downstream as waters rise from June to December.

These migrations are illustrated on Figure B.3..

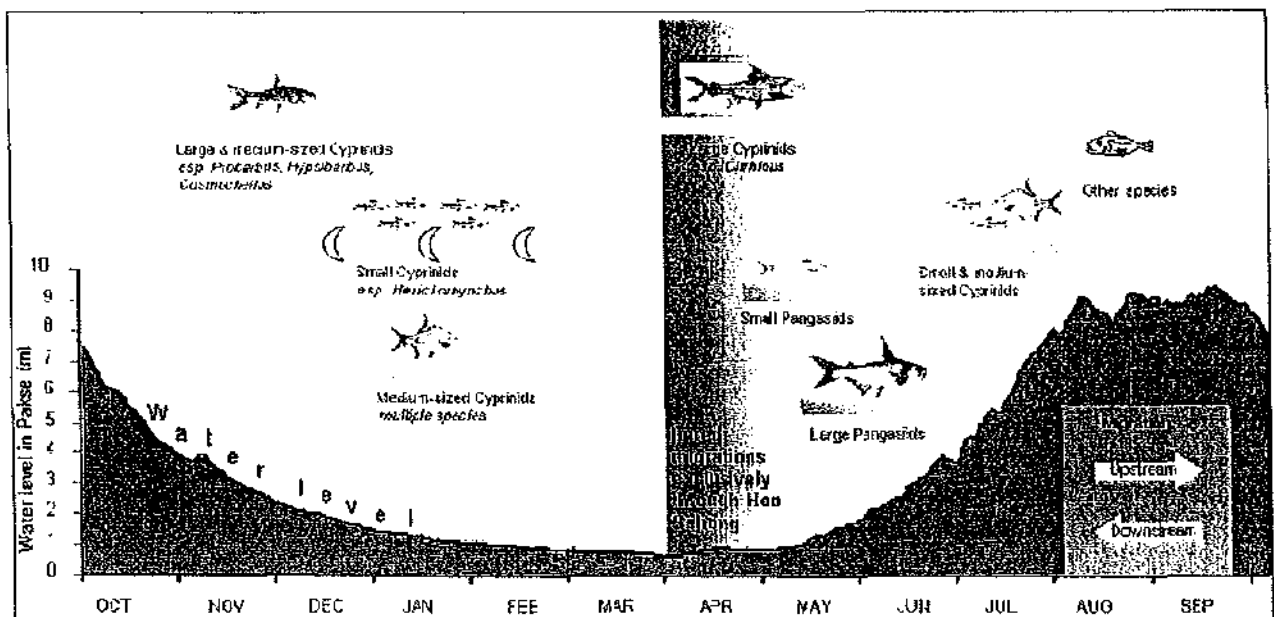


Figure E.3 - Fish Migration Patterns at Great Fault Line (after Baran 2007)

Fishing in all sections of the Mekong River and inter-island channels takes place using a vast range of fishing equipment and methods during every month of every year but intensify markedly in the periods of fish migration, especially in Hou Sadam, Hou Sahong and Hou Xang Peuk. Most of the families resident on the islands of the Siphandone region are involved in fishing to some extent and the use of various methods are described in Appendix G and construction of the DSHEP with no mitigation measures would adversely affect fishing to some extent in areas such as:

- The Mekong River zone below in the vicinity of Ban Hang Khone and Ban Hang Sadam
- The whole of Hou Sahong channel
- The barge paths in the Mekong River north of Don Sadam and Don Sahong
- Other areas up and down the Mekong River in the Siphandone Wetland, and down the Mekong into Cambodia.

The terrestrial ecology was assessed in terms of remaining vegetation, forestry and land systems and the effects of DSHEP on these resources are outlined in Section 4.3 of the EIA Report. According to forest cover maps, the field reconnaissance survey and villagers' interviews, many areas of Don Sahong and Don Sadam have been disturbed already by use of forests near villages and along Hou Sahong for use as firewood and making offish traps, conversion of forest land into agricultural land and residual areas. Mixed Deciduous Forests (MDF) occurring on the upper slope of Don Sadam. Many of the big trees have been removed by local residents for timber for housing construction and only small diameter regenerated trees remain.

The effects of the DSHEP pondage and associated works are indicated in Table E.2.

TABLE E.2- Estimated Areas of Agricultural and Forestry Lands on Don Sadam and Don Sahong Affected by DSHEP Pondage and Works

Location & Land Use	Natural Conditions - ha	Affected by DSIIEP-ha
Don Sadam - Agricultural	139.9	7.1
- Forestry/ Other	334.1	95.1
- Subtotal	474.0	102.2
Don Sahong - Agricultural	104.2	23.3
- Forestry /Other	211.3	77.6
- Subtotal	315.5	100.9
Two Island Land Systems	789.5	203.1
Hou Sahong - Small Islands	11.3	11.3
Hou Sahong - Water	76.3	76.3
Total Ecosystem of Islands	j 876.5	290.7

The wildlife and birdlife of the islands and Hou Sahong were inventoried and the status of these resources in the DSHEP is indicated to be poor, largely through isolation and predation on the island environments. Of concern to the DSHEP would be the presence in Hou Sahong of any Smooth-coated otters, a protected species, and possibly small mammals, amphibians and reptiles.

The EIA Report lists a total of 48 species of bird occurring in the general DSHEP project area but none of the bird species for the Don Sadam and Don Sahong are listed as Endangered Species of Category I of Regulation No. 360, which is a Department of Forestry Regulation on Species Listed for Conservation Purposes in Lao PDR. However, some are indicated for the transmission line corridor and the exact effects on these species are to be confirmed when data are available. There is no data on numbers and these species relate mainly to birds that are hunted by local populations.

E.7.3 Communities and Cultural Aspects

Section 4.3 of the EIA Report outlines the results of the Household Survey covering four island communities and two on the mainland which are in the DSHEP area, the public health status in the region in general and in the three (3) directly affected communities in particular and general comments on the tourist situation of the DSHEP area, the risks of Unexploded Ordnance and the proposal for the Siphandone Wetlands as a Ramsar site.

E.7.3.1 Household Survey

Essentially, the Household Survey as (described in Section 4.3 and in detail in Appendix A) covers the full range of socio-economic data, group discussions, gender analysis and vulnerable groups. The important points used in formulating the RAP and the SAP include:

- Regionally, some 134 villages, population of 72,922 person and a predominant Lao Loum culture with small rice paddy holdings for sustenance and fishing for protein consumption and as cash income
- Non-registered landholdings on Don Sadam and Don Sahong with the two islands having a total of 628 ha for tax purposes
- Limited local facilities and infrastructure with boats presently providing the means of access to the islands
- Some 117 families out of 662 families sampled including approximately 20% of the families classified as below self-sufficiency
- Estimated two island population of 149 families of which 30 families or 12% classify themselves as being insufficient and 21 families as female-headed households
- Very limited infrastructure and vehicles except for boats on the islands and poor communications and education facilities with 482 primary students but only 44 secondary level students
- Limited sanitation with only 21% of households having access to a toilet, of which 18% are pour/ flush toilet types all using the Mekong River as a supply source
- Some 80% of persons classify themselves as farmers because of their land ownership and rice cultivation are critical although fishing is seen as a source of cash income along with livestock raising.
- Cash incomes and expenditure vary considerably but fishing which accounts for 70% of earnings and 74% of participating households excluding business and sale of forest product income as exemplified in Table E.3
- The average annual expenditure per household is 8,800,000 Kip or USD 880 and is for medicine (1), rice for subsistence (2) and transportation (3): accounting for some 35% and another 40% of household income is expended on items such as clothes (4), house construction (5), education (6), meat (7) fish (8) and energy (9).

Table E.3 - Sources of Income from Household Survey

No.	Source of income	Rank	Total Income for All Households
1	Sale of fish	1	USD 68,900
2	Sale of livestock	2	USD 21,500
3	Sale of agricultural products	3	USD 7,500
4	Casual labor	4	USD 5,900
5	Cash remittances	5	USD 5,100
6	Business and service	6	USD 88,900*
7	Sale of forest products	7	USD 11,400* Veunkham Only

Notes; 1 - very important to 7 - less important
* - mainland only

E.7.3.2 Local Village Administration

This aspect is considered most important as it is these organizations the DSMEP would have to liaise with on a day-to-day basis. Village administration includes:

- Villages are headed by a village head and two deputies
- Administration is organized into healthcare, education, finance and land tax, culture, forestry, statistics, quasi-police, and quasi-military
- Two important village organizations are Lao Wo mens' Union and Lao Youth Organization; with roles in assisting in village development activities
- Village elders' organization assist in village administration, conflict resolution and building awareness for local development programs
- Specific fishery group or resource development committees are organized for political, security, socio-economic development purposes

E.7.3.3 Gender Roles and Patterns in Local Villages

No women are found to be in any designated village authority leadership positions, however at the individual household level there are shared responsibilities such as men being involved in ploughing (88%), canal maintenance (83%), rice threshing (68%) and transportation (67%) and women dominate all the other tasks such as:

- Rice sowing, weeding, harvesting and hulling (62 to 95%)
- Cooking, looking after children and sewing clothes (94 to 99%)
- Fetching water and maintaining water supply systems (76% and 91%)
- Fire wood and fodder collection (78%) and livestock raising (77%)
- Selling home products or trading, shopping (80 to 84%) .

Women also dominate the decision making relating to household needs and expenditure.

E.7.3.4 Village Rights to Natural Forests and Their Management

This is an important issue for DSHEP as project proponents. Villages in the project area are under a system of traditional ownership, including both land and forest resources. Even though these are not officially marked they are known by common knowledge to locals. Customary user rights are legally recognized by the GOL and village authorities have the duty to enact local Riles within the local village boundaries. The rights of traditional management systems apply to village forests and a land-use plan would include a local forest management plan.

E.7.3.5 Land Use and Tenure and Livelihoods

Land holdings are small (less than 1.2 ha per household), untitled and rice productivity is low due to the poor soils. The number of fruit trees are minimal and largely for domestic consumption. Capture fishery is an integral part of the daily activities of local households for their daily supply of food and for cash income. It ranks first among economic activities and local people do not travel beyond 3 km from their village. They take whatever is caught, regardless of species and size. High season for fishing in Mekong is mainly during the rainy season around May to July and low season usually occurs around December to March. Fish are reported to be dramatically declining compared with the situation 10 years ago and reasons stated include:

- Over fishing, mostly due to an increasing number of fishermen
- Increased market demand from outside the area and improved buying
- Placement of net barriers along Mekong River in Cambodia during upstream fish migrations, especially during April to June of every year

E.7.3.6 Villagers' Perceptions on Effects of DSHEP

At the time of the Household Survey local residents were not fully informed about the DSHEP and its potential effects on their lives. The households were aware of critical issues such as:

- Impacts on fish population and fishing opportunities
- Potential loss of household assets due to flooding of Hou Sahong
- General negative social impacts, including problems relating to prostitutes, sexually transmitted diseases, and other social disruptions.

However, there is a general willingness to have the dam constructed, in principle. All households expected that they would get access to electricity, which they feel to be important for their livelihoods. At the time of interviews, local villagers do not have any idea if their land and other assets would be flooded but most prefer to move to non-flooded parts within their villages or islands.

E.7.3.7 Public Health Survey

A public health survey was executed by the Centre for Malariology, Parasitology and Epidemiology (CMPE) and is included as Section 4.4 in the EIA Report and Appendix D, in detail. All the main diseases such as malaria, dengue fever, STD and HIV Aids and helminth infections are reviewed on a provincial and district level. The organization and operations of the Champassak

Provincial Health Office (PHO) and the Khong District Health Office (DHO) are outlined and focus on curative medicine and prevention and health promotion.

This Khong District hospital has 25 beds and 6 Health Centres (HC) with a total of 22 beds and a total staff of 76 persons including 6 medical doctors and some 52 public health staff at Health Centres (HC) such as Ban Khone Hang being one of these. At the three local villages in the DSHEP area there are Village Health Volunteers (VHV) and most of these have limited training. An overview of health indicates that malaria (5th) and dengue fever (7th) are among the frequently treated at provincial, district and local health facilities. The Other main points include:

- Malaria is the most common arbo-virus, it fluctuates from year to year, is carried by *Plasmodium falciparum* mosquito (over 98% of cases) and is much more common in newly cleared areas to the north
- Dengue fever is carried by the *Aedes aegypti* mosquito and associated with stagnant pools of water
- STD and HIV Aids infection rates are low in the region but people are wary of these diseases
- The whole area bordering the Mekong River is endemic for *Schistosoma mekongi* and *Opisthorchis viverrini*: two helminth infections with the former dependent on transmission to humans by small snails in the Mekong River and the second on the eating of infected uncooked Cyprinid fishes, a tradition in the DSHEP area and both diseases are under control by treatment of infected parties and communities with drugs.

The DSHEP area has not been included in previous areas in which stool samples were undertaken by the various medical teams doing the studies, so the communities of Don Sadam and Don Sahong, were sampled. All patients were examined by doctors and treatment was administered for both intestinal parasites and *S. mekongi*, using Praziquantel and other minor ailments treated. The three villages in the EIA survey all had similar socio-economic backgrounds including agricultural pursuits and fishing activities. Similarly their history of public health including 3 recent rounds of Mass Dmg Administration (MDA), programs of Insecticide Treated Nets (ITN) and the presence of local Village Health Volunteers (VHV).

There is no significant difference between the three communities in terms of the prevalence of helminth infections and more importantly, these rates are acceptable except for *Opisthorchis viverrini* or Liver Fluke infections. In general the health standards of these three communities are good given that they use the Mekong River as their main water source. The latrine situation in all villages is poor varying at around 20% of families having some facility but this can be rectified by an intensive supply and fit program.

E.7.3.8 Unexploded Ordnance

DSHEP study team engaged Gerbera Demering, a UXO Consultant to assess the situation in respect of Khong District and the project area, which are reported in Section 4.5 and Appendix F (including maps) of the EIA Report and includes evidence that: .

- Khong District is the lowest UXO contaminated area in" Champasak Province

- There are no reported incidence of UXO in Khong District or the project area nor are B 52 bombing raids reported on the area
- The nearest affected areas are in Cambodia straight south of Ban Han Khone and high intensity area is near Kampong Sralau, opposite Don Tan.

The report concludes that there is "no need for specialized surface or sub-surface UXO clearance before starting earth works in the DSHEP area" but to better ensure safety a technical survey of the actual construction works areas should be undertaken.

E.7.3.9 Regional Tourism

Tourism is outlined in Section 4.6 of the EIA report and in Appendix E and is based on discussions with all operators of tourist facilities in the DSHEP project area and collection of information from Lao and Thai authorities and discussions with tourists. Due to its unique and impressive waterfalls, extensive wetland areas, natural diversity, fishing activities and historical sites dating back to colonial times the area is a major attraction of Champasak Province. In recent years using access via the Chong Mek/Vung Tao border crossing and the Pakse bridge, Thai tourists come to visit the area in large numbers on day-trips by vans and tourist coaches. Also, in the past 5 years, the area has become a destination for western backpackers for simple life, authentic local livelihoods, nature and the traces of the colonial period. Don Det and Don Khone have accommodation and are recommended destinations for backpackers' holidays. Most tourism occurs from December through April.

In 2006, it is estimated that 113,684 tourists visited Champasak Province an increase from 63,963 in 2004 and 99,044 in 2005. Recent data from the Thai immigration authority shows that the number of visitors from Ubon Ratchatani to Southern Laos is currently more than 140,000 and has increased by about 12% from 2005 to 2006.(Table 4.32) Approximately 70% of the total visitors from Thailand visited Khon Phapheng Waterfalls as the main attraction.

E.7.3.10 Proposed Siphandone Wetlands Ramsar Site

While DSHEP occupies a small area, it is located in a major zone for conservation and protection of endangered species, being in the southern part of a currently proposed Ramsar site, the Siphandone Wetlands. . This proposal has been ongoing for several years and is being proposed by the GOL Department of Foreign Affairs and would be administered by the Ministry of Agriculture and Forests (MOAF). This proposed Ramsar site has considerable momentum within the Laos government framework. Currently STEA, the Lao National Mekong Committee (LNMC), the MRC and IUCN are all active advisors to the relevant Lao authorities.

This Siphandone Wetland proposal is about conservation and sustainable resource management for a 400 km² area which is upstream of a similar area, already declared on the Cambodian border and embracing the Mekong River. It includes all of the Mekong River below Khong Island, its numerous channels and a 1 km wide buffer zone on the banks of the Mekong River including a 40,000 ha central zone. The DSHEP is integrally involved as it affects one of the year round migration routes for fish migration around Khone Phapheng Falls. Its direct effects on the resident residual population of Irrawaddy dolphins could also be a problem.

Both the IUCN and WWF are actively involved in resource management in Laos and are promoting the declaration of the Siphandone Wetlands as a Ramsar site. IUCN intends to inventory the Siphandone Wetland once it is declared. This is a step towards preparing a development plan for the area and would involve consultation with the local communities on Don Sahong and Don Sadam. Of particular interest for the Siphandone Wetlands would be the role of fishing management in the long-term development plans for the area. The role of DSHEP and its implications to fisheries in this location is self-evident. IUCN has a "vision" for the future whereby the established Stung Treng Ramsar site and the proposed Siphandone Ramsar site would merge, leading to a trans-boundary Ramsar site - one of only a few worldwide.

E.8 IMPACT ANALYSIS AND MITIGATION MEASURES

The impacts and mitigation are inter-related and dependent on each other but due to little impact or a lack of full information, some descriptions are lacking in details. The main impacts on the fisheries and mitigation measures are emphasized. Project activities are subdivided into construction (Section 5.1), operation (Section 5.2) and de-commissioning (Section 5.3) in Section 5 of the EIA Report. Because of its importance, impact on the fisheries is further discussed in Section 5.4.

E.8.1 Impacts and Mitigation Actions during Construction

The construction stage of the DSHEP will have far greater impacts, with the upstream preliminary coffer dam being built early and the project's impacts on the fish resources taking effect.

The interference with local transport on Highway 13 appears to be limited except during peak periods of moving major equipment to the DSHEP site. The actual impacts of actions such as barging operations are difficult to assess except in general terms including:

- Operation of a limited number of barges of varying capacities and sizes on a set schedule for the entire construction stage
- Risks of minimal damage to the fish during blasting for barge paths during the first few months of the construction through stunning or killing of fish, interference with fishing and spillage incident during operations

The mitigation measures associated with the **barging operations** would focus on the zone in the Mekong River channel between the Ban Napeng area and Don Sadam and Don Sahong. Local fishermen would be directly affected and mitigating actions would include:

- There are no practical mitigation actions from these effects on the fish populations in the specific work locations.
- Safety mitigating actions associated with barge operations, including flagged exclusion zone and a warning siren in advance of blasting including development and implementation of a safety code and emergency action response code to cover all barging operations are recommended to prevent potential accidents.

The clearing of lands for project works is an issue that requires negotiation with the three local Village Committees and the relevant District authorities and includes payment of compensation as outlined in the Entitlement Matrix (see Table E.4) and include the following:

- Loss of lands indicated as within the respective village areas
- Loss of trees including payments for initial works such as roads and the flood zone of the pondage
- Discussion and negotiations over losses of non-village area trees with the Khong District and Champasak Province forestry authorities.

The impact areas required for land clearing are 202.4 ha of non-village lands required on Don Sadam and Don Sahong including 29.4 ha of paddy land and 169.9 ha of forest lands but does not include any lands for spoil dumps either temporary or permanent. The impacts of the DSHEP pondage and associated works are summarized in Table E.2 with a total of 290.7 ha are affected out of a total of 876.5 ha or 32.2%. This has a significant impact in terms of the local environment of Don Sadam and Don Sahong. The mitigation actions considered to be absolutely essential for the DSHEP relate to mapping and liaison with the local communities

The construction and operation of the cofferdams and channel excavation last for the entire construction period. They are integrally linked with spoil disposal either in the embankments or in separate locations and totals some 1.35 million cu m of mostly hard rhyolite rock, over 1.05 million cu m of waste to be disposed of and will require detailed negotiation with local village officials. This mitigating action is essential in order to avoid conflict and ensure good local planning and it is suggested that any spoil areas would have adequate drainage and should be designed with restoration in mind, if possible. The possibility of disposing of all this material within the embankment of the project's pondage should be considered.

**Table E.4 - Estimates of Land Requirements & Use in Areas Affected by the DSHEP Project
(All Area in ha)**

Project Features	Location	Village Area & Household (HHs)	Rice Paddy Lands		Forestry Lands		Island Rock & Vegetation & Water	Total Area
			In Use	Disused	Good	Degraded		
A. Right Bank - Working & Reservoir Areas								
1. Dam, Works & Switchyard	Hang Sahong	15 (10 HHs)	-	-	0.5	2.7	-	4.7
2. Embankments 2.1km x 10m	Don Sahong	-	-	-	1.5	0.6	-	2.1
3. Land Flooded at EL 75m	Don Sahong		4.5	1.5	54.3	35.5		94.8
B. Left Bank - Working & Reservoir Areas								
1. Dam, Plant Sites & Facilities	Hang Sadam	0.3 (2 HHs)	2.3	2.8	-	2.7	-	8.1
2. Lower Embankment 2.4 km X 10m	Hang Sadam		1.1	0.7	-	0.6	M	2.4

3. Land Flooded at EL 75 m	Don Sadam		3.1	6.3	45.2	23.2			77.8
4. Island Barge Landing	Houa Sadam	-	1.5	-	-	-	-	-	1.5
5. Road to Damsite (10mx5,700 m)	Houa Sadam to Hang Sadam	-	2.9	0.8	1.6	0.4	-	-	5.7
6. Access Site at Coffe Dam	West of Houa Sadam	-	1.2	-	-	0.7	-	-	1.9
7. Upstream Coffe Dam & Islands for Flow Channels	Houa Sadam to Houa Sahong	-	-	-	-	-	-	3.2	3.2
Subtotal Don Sahong & Don Sadam			1.7 ha & 12 HHs	16.6	12.4	103.1	66.5	3.2	203.3
C. Mainland Barge Landing									
1. Nominated Landing site	North of Resort	0.3 (2 HHs)	0.4	-	0.2	0.4	-	-	1.2
D. Reservoir Water Areas -- Nominal not Official									
1. Community Fishing Zone	Hou Sahong		-	-	-	-	-	29.2)
2. Traditional Traps	Lee Hou Sahong		-	-	-	-	-	10.0)
3. Other Fishing Zones	Hou Sahong		-	-	-	-	-	37.1)
4. Two Island Flooded	Hou Sahong		-	-	-	-	-	11.3	11.3
5. Aquatic Habitats in Downstream Channel	Mekong River		-	-	-	-	-	5.0	5.0
Subtotal			-	-	-	-	-	92.6	92.6
Total DSHEP Areas		2.1 14 HHs	17.0	12.4	103.3	66.9	92.6	92.6	296.7
E. Transmission to Ban Hat Substation									
1. On Don Sahong (30m x 2,980m)	Don Sahong	-	4.4	2.3	-	3.2	-	-	8.9
2. On Don Tan Tok (30m x 2,400 m)	Don Tan Tok	-	2.6	2.9	1.0	0.7	-	-	7.2
3. Over Mekong River Channel (30 x 1,200 m)	2 Channels	-	-	-	-	-	-	3.6	3.6
4. On Mainland Nakasang To Ban Hat Substation (30m x 15,300 m)	East of Road No. 13	-	11.8	18.7	6.3	9.1	-	-	45.9
T/L Subtotal – 20,680mx30m	Don Sahong to Ban Hat	-	18.8	23.9	7.3	13.0	3.6	-	65.6
TOTALS		1.3 ha (14 HHs)	35.8	36.3	110.6	79.9	96.2	-	359.2

Source: Map interpretation and ground surveys by EIA Team, January to April 2007

The effects and amelioration measures required for the DSHEP during construction phase with regard to **air and water quality** protection are several and mitigation measures would form an integral part of the Contractors' obligations under CEMPs and the involvement of district STEA office regarding monitoring. Similarly, the transport, handling and storage of fuels and explosives with a split between mainland and island sites and several work sites simultaneously on the islands, detailed attention would have to be given to these matters and appropriate mitigation measures formulated.

The impacts and mitigating measures relating to forestry **and** wildlife of the DSHEP are largely preventative and remedial to compensate for the losses of the channel ecosystem, particularly of trees of use to the local communities and possibly to District or Provincial forest authorities. There are no indications of endangered forestry species and all forest lands within the DSHP reservoir below RL 75m would be under water. However these areas have to be inventoried, confirmed and losses assessed by the provincial forestry authorities prior to commencement of the DSHEP project. There is a possibility of some endangered species such as otters and amphibians not found during EIA surveys would have their habitat destroyed. USD 300,000 has been budgeted for preventative and remedial actions including plantation planning .

The villages of Ban Hang Sadam, Ban Houa Sad am and Ban Houa Sahong would bear the direct and indirect impacts on **local communities**. The impacts of road construction on both islands warrant attention with regard to associated mitigation measures such as public safety issues, traffic separation near villages and compatibility with local villagers' drainage needs in their agricultural fields. Other mitigating actions which need to be resolved through consultation with local communities include:

- Water supply sources, both temporary during construction and permanently because many villagers use the Hou Sahong as their water source
- Noise emissions and their effects on community activities
- Policies on use of roads by local residents and public warning signs where appropriate along all access roads

The dominant **socio-economic impacts** of the DSHEP on village communities are outlined above. The means of implementing mitigation are uncertain at this time but it is suggested that the scope of the Village Consultative and Grievance Redress Committee (VCGRC) be expanded to cater for all three communities, as well as the RAP for the Hang Sahong hamlet. Another key issue relates to employment from local communities during construction of the DSHEP and its related questions of local low skill levels and availability due to agricultural activities during the wet season. It is recommended in the RAP that one person from each household be offered suitable employment on the DSHEP during construction. Detailed mitigating actions should be investigated during the detailed design phase and are included in the above referred sections

The existing situation and potential impacts to the **public health** of the island communities were investigated because little was known about the project area, including the risks associated with *Schistosoma mekongii* and other helminth infections. These concerns have generally proven unfounded and the general health of the communities is on a par with other regions along the Mekong River. The office of Public Health at Muang Khong has achieved this through active treatment programs and despite the transportation and communications problems, prevailing in the project area. What is needed is for the DSHEP to assist and not to create any further disease risks.

Hydro power projects with their camps, external labor forces and alteration to local aquatic habitats sometimes aggravate local public health situations.

The impacts and mitigation measures are outlined in detail in Appendix D and section 5.1.5 of the EI A Report and focus on:

- Medical surveys of all employees as a condition of engagement and treatment of any infections
- Problems of Malaria mosquito vectors due to location of the project, with controls on *Anopheles maculatus* and *An. minimus* and requiring remedial actions such as provision of treated nets to all local communities and camps, residual spraying of all worksites and camps and monitoring programs of disease vectors and diseases
- Control programs for *Aedes aegypti* as the main vector for Dengue and Dengue Hemorrhagic Fever (DFHF) including elimination of small standing pools as breeding habitat
- Routine treatment program for *S. mekongi* and other intestinal disease with appropriate drugs for both the local communities and workers in camps
- Discouragement of workers through public awareness programs of linkage of eating local raw fish dishes to *Opisthorchis viverrini* (Liver Fluke) and regular testing and treatment of workers and local residents
- An active program including community and worker awareness and treatment for Sexually Transmitted Infection (STI) and HIV infections
- Engagement of a medical consultant to prepare a detailed plan for their construction operation in co-operation with the provincial health authorities.

The location of the **mainland camp** area is uncertain at this stage but a riverfront area north of Khone Phapheng Resort is one site and an alternate site is near Veungkham. The impacts include generation of "camp followers" due to the relatively low income levels of the local residents, with attendant problems of poor standards of development, water supply and sanitation and periodic traffic problems on Highway 13. The impacts and required mitigating actions for mainland camp operations are incomplete and need review based on final decisions on the project, It is suggested that this aspect be re-addressed during the DSHEP negotiation with EPC Contractors.

For the purposes of this EI A Report only a 230 kV transmission line as far as Ban Hat substation from the power station needs to be addressed because no decision has been made as to whether the power will be exported to Thailand alone or also to Cambodia. The total length of this transmission line right-of-way (RoW) is 20.7 km and its width is 30m. There are no major environmental issues with the open paddy, disused paddy, regrowth forest or open water sections accounting for some 89% of the transmission line RoW. The remaining 11% located in good forests would need to be inventoried by the Provincial Department of Forests staff to determine its status and quantity of timber to be cut once the RoW is surveyed.

K.8.2 Impacts During Operation Phase

In general, the impacts during the operational phase of DSHEP would be considerably less.

Once the construction phase is finished, land use rehabilitation for the DSHEP and its contractors would be a priority for Don Sadam and Don Sahong and may also apply to land used in the camp and outside for temporary works on the mainland. It is suggested that site re-use of any facilities or salvage of building supplies for local communities and scarification and planting with trees of any temporary worksites negotiated by the contractors should be undertaken. It is considered advisable that as much land as possible should be returned to the local village authorities in as good a state as possible. To effect this DSHEP would have to make site clean-up and rehabilitation a condition of engagement for all contractors onsite.

During the operational phase of DSHEP the overall effects on hydrology will be minimal and acceptable provided that agreed "environmental flows" are maintained downstream of the entrance to Hou Sahong to ensure the visual appearance of Khone Phapheng waterfall and flows down adjacent channels to enhance fish migration.

The operational phase of the DSHEP may see alterations to the species distribution of fish, both seasonally and over the long term and probably in numbers. Related to this are changes which would occur in the patterns of use and returns of local fishing communities, possibly extending further upstream and downstream. These aspects should be investigated and documented as suggested below in the mitigation measures proposed. However, it is likely that the DSHEP project will "be perceived as the cause of all upstream fishing problems", whether this is factual or not.

There is a more detailed description of the long-term risks on fish migration associated with the DSHEP contained in Section 5.4 of the EIA Report and Appendix G.

Many of the island communities directly affected by the DSHEP can be expected to benefit through employment in either the project workforce or associated work but the impacts on fishermen have to be monitored. Employment in the DSHEP is anticipated to be small and the overall socio-economic consequences should be monitored so remedial actions can be taken. One of the main long-term impacts on the communities' livelihoods would be through the benefits flowing from increased education facilities on the islands.

During the operational phase it is not anticipated that any adverse public health impacts would occur in the communities on the two islands affected by the DSHEP. By that time normal operating procedures of the District and Provincial health authorities would be in place.

Normally transmission lines have very limited impacts after construction and this would appear to be true for the proposed DSHEP power station to Ban Hat 230 kV line if located properly

The impacts of the DSHEP project on tourism for both the construction and operational phases are minimal. Don Sadam and Don Sahong are not present tourist destinations and unlikely to be so in the immediate future. Any tourism development would tend to focus on Khone Phapheng and controlled by the Department of Tourism authorities. Implementation of the DSHEP will enhance

tourism development in the region through improved infrastructure as well as providing another focus for visitors.

The declaration of a Ramsar site for the Siphandone Wetland appears to be imminent. Development of DSHEP is not excluded by such a proposal. However, in the long term the presence of the project would have some implications to the overall management plan of the Siphandone Wetlands and the DSHEP is advised to cooperate with all authorities involved, particularly with the natural resource management planning.

E.8.3 Impacts During De-commissioning

The Concession Agreement between the GOL and DSHEP has not been discussed in detail, but the present MoU indicates that the concession period will be 30 years from commercial operation, after which the power station will be handed over to the GOL and they will continue to operate the facility for many years. There are small power stations that have been removed from streams in the United States and other countries, specifically to restore aquatic ecological balance.

If decommissioning and removal of the power station was required, the basic actions involved could include:

- Restoration of the natural controls on the Hou Sahong and dumping rockfill into the stream to replace the rock removed during lowering of the upper reaches
- Removal of electrical/ mechanical plant at the base of the dam
- Demolition of the concrete structures to allow fish to pass freely
- Extensive tree planting program for the sides of the channel to restore vegetation.

E.8.4 Aquatic Ecology and Fisheries Impacts and Mitigation Actions

The impacts on fisheries of the proposed DSHEP are by far the most important. It has been raised as a major issue in all discussions with concerned agencies such as MRC, IUCN, WWF and LNMC in Vientiane and has dominated all discussions at Stakeholders' Meetings. The significance of the Mekong River fishery is documented in Appendix G. The importance of the Hou Sahong channel as the major existing year-round channel for fish migration can not be over-emphasized. Without implementation of mitigation measures, blocking of the Hou Sahong would reduce the dry season migration of fish and have some impact on the wet season migration of fish.

E.8.4.1 Fisheries Data Availability

As noted above, the assessment of environmental impacts of the DSHEP on fish migration is central to decision-making about the project. Definitive data are not available on fish migration through Hou Sahong but major movements occur in both the dry season and wet season. Detailed information over time is available for two Mekong River sites, upstream through catch data at Ban Hat/Khong Island and through the wet seasons on a smaller channel at Hou Som Yai, just east of Khone Phapheng.

E.8.4.2 Fish Impacts and Mitigation Measures

The DSHEP presents the classic case of water resource management dilemma in decision-making. The Hon Sahong is a major dry season migration channel and an important wet season migration channel as it has no waterfalls and provides an open-water path across the Khone Phapheng complex of waterfalls and cascades in all seasons. Cofferdams will be constructed at the upstream and downstream ends of Hou Sahong in the initial four (4) months of the construction period. Therefore, interference to fish migration through Hou Sahong occurs from the outset of construction through its operational phase.

It is difficult to assess the details of the effects of DSHEP on fisheries and Appendix G lists many examples of the possible effects on fish migration. The exact delineation of all species and exactly how they are affected is not determined but the main species affected are indicated in Table 5.3 of the EIA Report. The unknowns in the effects on fisheries are summarized as follows:

- Numerous species of small fish would be affected and these are crucial to the diet of local communities in terms of regular protein inputs and generate local income
- Numerous species of middle size fish, particularly Cyprinoids, would be adversely affected to an undetermined degree
- The impacts of effects on large wet season migrating species are unknown but may not be serious due to existence of other channels.

The number of migrating species is estimated at between 35 and 60 major species.

E.8.4.3 Mitigation Options

Channel Improvements to Hou Sadam and Hou Xang Peuk for Fish Migration

One of the prime uncertainties about fish migration in the complex of channels, islands, waterfalls and cascades is whether or not fish migrate in only one channel. It is understood that upstream migrating fish separate at the falls and, after recuperation and attempt to navigate in any of the 18 channels where they are attracted by the flow conditions. If that channel proves to be impassable, they try another channel as outlined in the main EIA report.

Hou Sadam is narrower and shallower than Hou Sahong, (historically reported to cease flow over certain rapids) and its exit is some six (6) km from Hou Sahong. It may not be effective an alternative to Hou Sahong as is Hou Xang Peuk. Construction activities to improve Hou sadam's ability to carry fish in the low flow season will cost about USD 7 million.

The Hou Xang Peuk and associated channels are larger than Hou Sahong, with the main channel followed from the Hou Sahong confluence to east of Don Xsom to the entrance in the Mekong River mainstream near the southeast corner of Don Det. This channel has more fish traps than Hou Sahong and is the most feasible alternative to Hou Sahong but would require streamlining. The required channel improvements will be confirmed by topographic survey and hydraulic engineering design with input from experienced fisheries biologists to ensure that the resultant channels will replicate the conditions in the Hou Sahong. This should be initiated immediately. The preliminary estimated cost of the Hou Xang Peuk channel improvement works to facilitate year around fish migration is USD 10.5 million.

Fishing controls

Fishing controls on these 2 channels, located on either side of the Hou Sahong will be required as fish migration patterns are uncertain. Only limited knowledge of fish caught during the wet season trapping is available primarily on these areas by Baird. There are the precedents of "Fish Conservation Zones" (FCZ) to protect the dolphin pool below Ban Hang Khone/Ban Hang Sadam and others in the Siphandone area of the Mekong River complex. The proposed control programs for the Hou Sadam and Hou Xang Peuk would have to be supervised by the District Fisheries Department staff. The costs of this program should be funded by the DSHEP project because the requirement is a direct impact and the budget is USD 600,000.

Fish lifts

The effectiveness of fish lifts in tropical rivers such as the Mekong, with its multitude of fish species and migration patterns is unproven. In fact, few have worked effectively and none had to deal with the volume and variety of species involved at the Great Fault Line. The improvements to the Hou Sadam and Hou Xang Peuk will be more effective for fish migration.

Fisheries Research

A fisheries research program based on the DSHEP area and its immediate surrounds is required. This research program should be based on a new Research Station established in the project area, devised by a senior fisheries biologist experienced with the island, waterfall and cascade area of the Mekong River. It would need to include a variety of tasks to determine the inter-relationships of these three (3) channels with fish, fish caught and seasonal patterns of fish migration in the channels as outlined in the EIA Report. The estimate for the fish research program is also preliminary and would be discussed and agreed with relevant authorities (national, provincial and district fisheries). The basic estimated cost for fisheries research is USD 500,000.

Also fisheries research needs to include investigation into the feasibility of reservoir cage culture, which is proposed as a livelihood replacement option for the fishermen displaced by the project. This would depend on factors such as fluctuations in reservoir over the year, access to and feasibility of net cages and suitable Mekong River native species for growing in cages. The study would cover the early period of operation of the DSHEP and is estimated to cost USD 750,000 depending on an assessment of its feasibility by a fisheries expert.

E.8.4.4 Fish and Dolphins of the Lower Pools

Blasting of a tailrace channel in lower Hou Sahong and downstream for 1 km is also required as part of the project. Mitigation measures include:

- Care must be undertaken not to do blasting during fish migration periods and recovery of killed fish for local residents
- Concern to the residual population of the "conservation sensitive" Irrawaddy dolphin which are sensitive to underwater percussion charges and are resident in the pools of the Mekong River

- Consideration of an underwater exclusion net made of visible heavy netting around the area of operations as determined by dolphin experts from conservation groups such as WWF and IUCN. .

E.8.4.5 Construction Phase Mitigation

The construction phase mitigation measures include:

- Immediate commencement of remedial actions on the Hou Sadam and Hou Xang Peuk, to facilitate movement of fish in the upstream direction with work to be completed prior to construction of the coffer dams on the Hou Sahong
- Put in place on the two (2) adjacent waterways of Hou Sadam and Hou Xang Peuk, proactive "controls on fishing" during the construction period
- Separation of boat traffic and fishing operations in all affected sectors of the project.

E.8.4.6 Estimation of Fishermen Affected by DSHEP

Before estimates of compensation can be made, the number of fishermen indirectly and directly affected, have to be assessed. While the number of fixed traps on Hou Sahong can be determined, determination of exact numbers of mobile and seasonal traps and open-water fishermen is difficult. It is proposed that the mitigation actions should include also Hou Sadam and Hou Xang Peuk, as their resident fishermen are directly affected by DSHEP.

As the mitigation measures proposed will replicate the Hou Sahong, it is assumed that there will be no significant impacts on the fishing industry beyond the immediate area of the project. The results of estimates of the number of fishermen and their families or other households directly and indirectly affected are summarized in Table E.5. The EIA Report indicates that some 434 fishermen are directly affected and an additional 730 persons involved in fishing or fish processing or trading could be indirectly affected.

Table E.5 - Estimates of Number of Fishermen Affected by DSHEP

Area of Project	Directly Affected Fishermen	Indirectly Affected Fishermen or Others	Reasons for Inclusion
Don Sadam & Don Sahong ¹	243	280	Resident in impacted area & included in HH Survey
Bans Hang Khone, Napeng, Veunkham & Don Som ²	84	17	Resident of barge path and downstream dredging
Miscellaneous users along Hou Sadam & Hou Xang Peuk ³	50	10	Estimates only
Don Tan, Don En, Don Som & Don Khon Nua & Don Det Ok ⁴	57	38	Residents affected by barge & channel works
Totals Affected	434	345	Directly & indirectly affected by DSHEP

Notes: (1) Total population of 3 villages and 20% of total population of 1400

(2) Based on 49 fishermen in Hang Khone, 25 affected in Don Som & 10 each in Napeng & Veunkham

(3) Based on estimated population migrating to areas to work including traditional owners of fish traps

(4) Based on estimated total population of 380 families being 15% directly and 10% indirectly affected by northern barge path and Hou Xang Peuk channel works

E.8.4.7 Evaluation of Fish Mitigation Options

Table E.6 indicates in general terms the effects of a barrier across Hou Sahong on fish migration and is presented on the basis of suggested criteria listed in Section 5.4.7 of the EIA Report.

Table E.6 - Assessment of Effects of DSHEP on Fish Migration at the Great Fault Line

	Dry Season	Wet Season	Comments
Case 1 - No Project on Hou Sahong			
Upstream migration offish	No effects on migration patterns	No effects on migration patterns	Fisheries management and controls on traps might be necessary to prevent over fishing
Downstream migration of fish	No effects on migration patterns	No effects on migration patterns	
Case 2 - DSHEP - No Mitigation Measures			
Upstream migration offish	Seriously affected	Moderately affected	Considered probable that dry season upstream migration would be affected by at least 60%
Downstream migration of fish	Moderately affected	Low effects	Downstream larval drift of fish could be mitigated by by-pass arrangement in powerhouse allowing drift to occur
Case 3- DSHEP Mitigation - Improvements to Hou Xang Peuk and/or Hou Sadam for Fish Migration			
Upstream migration offish	Minimally affected	Minimally affected	Dry season migrations dependent on replicating Hou Sahong type channel
Downstream migration of fish	Minimally affected	No effect	Limited problems in wet season upstream as several other channels cater under present regime
Case 4- DSHEP - As Cases 3 plus Temporary Catch and Transfer			
Upstream migration offish	Minimally affected	Minimally affected	Need to consider time extension to program, depending on success of altered channels
Downstream migration of fish	Minimally affected	No effect	Limited effect even if altered channel only partially effective

E.8.5 Estimates of Fishing Compensation Payments

The numerous parties involved and negotiations for compensation and mitigation make an assessment of these factors difficult. The directly and indirectly impacted local fishermen would have to be compensated and the mitigation actions on Hou Sahong, Hou Sadam and Hou Xang Peuk funded. These estimates are summarised in Table E.7.

Table E.7 - Fisheries Compensation and Mitigation Cost Estimates (Costs in '000 USD)

	A. Compensation Estimates	Cost Estimates	Comments
1.	Actual Traps Lost in Hou Sahong due to DSHEP - 71 traps	146	Costs based on RAP - Attachment C-4
2.	5 Years Fishing based on direct impacts on 779 fishers HHs and to be spent on re-equipping them for cage fisheries in Don Sahong	3,270	\$1200/year for directly affected HH \$400/year for indirectly a fleeted HH
	Total Compensation	3,416	
	B. Project Internal Mitigation & Management Costs		
3.	Controls on Hou Sadam and Hon Xang Peuk fishing	600	Lump sum to control & mitigate
4.	3 Year Research program for cage culture fisheries in Don Sahong	750	\$250,000/year
	Internal Mitigation	1,350	
	C. External Mitigation & Management Costs		
5.	Study and actions to improve Hou Sadam for fish passing	7,000	Lump Sum -req'd from diversion for 3 Years
6.	Study & actions to improve Hou Xang Peuk for fish passing	10,500	Lump Sum -req'd from diversion for 3 Years
7.	Fish Ecology Study Li Phi Falls to Khone Phapeng	500	Lump Sum -req'd from diversion for 3 Years
8.	3 Year post-implementation fish ecology study for DSHEP	500	After project completion
	External Mitigation	18,500	
	TOTAL ESTIMATED COMPENSATION & MITIGATION	23,266	

E.9 RESETTLEMENT AND SOCIAL ACTION PLANS

The DSHEP on Hou Sahong and its impacts will cover an extensive area in the centre of Don Sadam and Don Sahong including a need to relocate the Hang Sahong hamlet (10 HHs) and other households in the Hang Sadam area. A Resettlement Action Plan (RAP) and a Social Action Plan (SAP) has been prepared and focuses on Don Sadam and Don Sahong, as the most seriously impacted areas and contains suggestions for mitigating actions for the future public involvement program to be undertaken by the DSHEP. The full Resettlement Action Plan (RAP) for DSHEP is produced in Appendix C and the Social Action Plan (SAP) in Appendix B. These documents comply with the recent Lao guidelines on Resettlement issued by GOL in November 2005 and are summarized below.

E.9.1 Resettlement Action Plan

The RAP is based on maps, the Household Survey, inventorying of the affected communities and discussions with locally affected groups and is a guideline for the GOL and the DSHEP proponent for implementing compensation and resettlement for the project and is based on policy, principles of resettlement, entitlement to compensation, livelihood restoration, monitoring and evaluation including institutional and management arrangements of required resettlement.

The DSHEP will acquire land for project construction with the total area of 268.9 ha, including works areas (30.1 ha), mainland barge landing site (1.2 ha), project pondage area on Hou Sahong (172.6 ha) and transmission line (65.6 ha). Recent ground surveys indicate that 4 villages, namely Don Sahong (Houa Sahong and Hang Sahong hamlets), Houa Sadam, Hang Sadam and Thakho would be affected and that about 14 households (66 persons) from 3 villages need to be relocated as shown in Table E.8.

Table E.8 - Affected Houses, Residential Lands, and Persons by Village/Hamlet

Name of Village	Affected Houses	Residential Areas (ha)	Affected Persons
1. Don Sahong (Hang Sahong)	10	1.5	46
2. Hang Sadam	2	0.3	10
3. Thakho	2	0.3	10
Total	14	2.1	66

Source: Ground survey by EIA Study Team, January/February 2007

A socio-economic profile of these communities and people shows that among the 10 affected households in Ban Hang Sahong only 6 have any agricultural land and people are poor and disadvantaged. Fishing is the main source of non-agricultural cash income. Perceptions of the DSHEP among the local community include general agreement with the GOL plans for the DSHEP, a need to have electricity at their village, recognition that DSHEP would create loss of village agricultural lands and if relocation is required, preference for cash compensation and resettlement within Don Sadam island

The basic entitlements of affected persons are indicated in Table E.9 and DSHEP will formulate a Resettlement Policy on this basis.

Table E.9 Basic Entitlement Matrix for RAP for DSHEP

TYPE OF LOSS	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
Dwellings	Registered taxpayer or occupant identified during survey	Full replacement cost so as to enable affected persons to have a dwelling of at least similar size and standard	Stakeholder consensus on replacement value assessment
Residential land	Registered taxpayer or occupant identified during survey	Replacement land if relocating to other site or compensation in cash at replacement cost for household who can move back onto existing site	Stakeholder consensus on suitability of replacement land and/or compensation
Expense of residential relocation	Registered taxpayer or occupant identified during survey	Lump sum payment sufficient to cover all relocation cost as agreed with the affected persons	Stakeholder plus Resettlement Committee consensus on definitions and rates used
Rice storage	Owner identified during survey	Lump sum payment sufficient to cover all relocation cost as agreed with the affected persons	Assessment of suitability of relocation site
Retail shops	Owner identified during survey	Lump sum payment sufficient to cover all relocation cost as agreed with the affected persons	Review of shops recorded during the survey
Agricultural land	Owner or person with usage rights identified during survey	Compensation in cash at full replacement cost	Consensus among stakeholders on valuation assessment and methods
Crops and trees	Owner or person with customary usage rights	Full replacement cost of anticipated harvest at market value	Consensus among stakeholders on valuation assessment and methods
Fish traps	Owner identified during survey	Compensation in cash at full replacement cost	Consensus among stakeholders on valuation assessment and methods
Common property resources	Community losing the resources	Restoration of affected community buildings and structures to at least previous condition	Consensus among Village Committee members on resources and rates used
Temporary impact during construction	Owner or person with usage rights identified during survey	Care by contractors to avoid damaging properties; where damage do occur, the contractor would be required to pay compensation; and damaged property would be restored immediately to its former condition on completion of project	Consensus among stakeholders and Village Committee

Consultation with the main affected community, Ban Hang Sahong, accepted relocation within the Don Sahong Island approximately 1.5 km north from their existing hamlet. Each of the two households at Hang Sadam and mainland Thakho villages would be relocated within their main community areas, including a planned proposal by the District administration for Thakho on Highway 13. Specific development for the proposed Hang Sahong resettlement site would include:

- 10 house plots of 0.075 ha each (25m x 30m)
- Village main road (4m x 800m)
- Pump for a gravity fed water system

- Electricity supply
- Village market.

The most important issue of rehabilitation and livelihood restoration is recovery of the income loss of resettlers and ensuring that affected vulnerable groups such as landless families are given priority for income generation. Fishing is the main source of income of all affected households in Hang Sahong and 4 households have no agricultural land. It is assumed that the relocatees can fish at Hou Xang Peuk or other Mekong River channels and supplementation of household incomes for 3 years and employment with DSHEP during construction would be available as shown in Table E.10.

Table E.10 - Present and Projected Income of Ban Hang Sahong Residents

Source of Household Income	Before Resettlement (USD)	After Resettlement (USD)
1. Fishery	3,247	2,270
2. Livestock	183	170
3. Orchard	-	130
4. Vegetable	-	210
5. Employment in DSILP	-	950
Total	3,430	3,730

The following committees would need to be set up by DSHEP management for the assessing, implementation and arrangements for the compensation and resettlement action plan. This would include development of policies for the construction, and supervision of programs such as the EMP, RAP and SAP and running of the following 4 committees as outlined in Section 6.1.7 of the EIA Report:

- Provincial Environmental and Social Committee (PESC)
- District Compensation and Resettlement Committee (DCRC)
- Village Consultative and Grievance Redress Committees (VCGRC)
- Project Environmental and Social Management Unit (PESMU).

The operation of the Grievance Redress Committee is essential to the success of the DSHEP and would need to be set up to include representatives from each village as these are remote and inexperienced island communities. This committee will address any and all problems and is a forum for expressing villager's comments and feedbacks to DCRC and the DSHEP's Manager and indirectly to GOL. Any local village or affected parties that are dissatisfied may address matters such as project compensation and Resettlement Action Plan performances and all complaints by project affected persons are registered officially with this committee and it is obliged to raise these issues at higher levels.

DSHEP internal and external monitoring systems will be set up to provide feedback on the effectiveness and progress of implementation of various EMP, RAP and SAP programs and would need to involve groups such as PESC and DCRC in external supervision and PESMU and other appropriate monitoring consultants.

One year after finishing implementation of the RAP, a specific evaluation should be conducted by an independent body to determine compliance with and achievement of RAP and SAP objectives. A similar post-evaluation of the EMP is also a legal obligation of the DSHEP project owner.

A basic schedule for implementation of the RAP is included in Section 6.1.10 and gives recognition to the need to implement both the committees and the resettlement plan due to the DSHEP construction schedule as outlined in Feasibility Study report.

A tentative budget for the RAP for the DSHEP has been estimated but this is subject to change as project plans evolve and would need to be upgraded before approval by the GOL. The budget summary is included in Table E. 11.

Table E.11 - Estimated Budget for Resettlement Action Plan (RAP) for DSHEP

1. Compensation Compensation costs for land, housing structures, crops and trees, fish traps and other assets	USD 335,000
2. Resettlement Information disclosure and consultation, land clearing & development, village road construction & improvement, community supporting facilities, house construction and rehabilitation & livelihood development	USD 361,000
3. Costs, travel & accommodation for consultants	USD 60,000
4. External monitoring agency	USD 54,000
5. Administrative & operational costs (10%)	USD 75,000
6. Contingencies (10%)	USD 82,500
7. TOTAL COST ESTIMATE	USD 967,500

E.9.2 Island Communities Public Involvement, Plans and Programs

As noted in Section 6.2 of the EIA, the present villages on the islands of Don Sadam and Don Sahong do not have any plans for development other than those operating under the Village Committees. The DSHEP is going to be a major development for them. These villages also have rights to resources within the DSHEP area which would be directly affected. The DSHEP would have to liaise and consult with these communities and it is recommended that it do so through a committee involving all three communities, without reference to the District and Provincial Governor's offices.

The exact make-up of this committee is uncertain but it is suggested that the Village Consultative and Grievance Redress Committee (VCGRC) would be the most appropriate body. It would play the dual roles of overseeing the RAP for Ban Hang Sahong hamlet and day to day liaison and decision-making relating to all actions on Don Sadam and Don Sahong with the DSHEP managers. District and provincial authorities could be consulted on an "as needed basis." It is recognised that this arrangement has risks but if it is supervised by representatives of the three communities it should operate satisfactorily. This committee would report to the Provincial Environmental and Social Committee (PESC) proposed under the RAP. This is suggested as the best alternative given

the low status of local development and the fact that all project decisions would affect all local communities.

A mechanism for discussion is needed for ongoing public information about the Project, its immediate and near-future needs and effects on local communities. It is also self-evident that the DSHEP project would require a Community Liaison Officer (CLO), or as many as are needed. The setting up of regular company and community discussion meetings targeted towards "effects on individual communities and company needs" are required. These would be arranged and paid for by the DSHEP project proponent, including the building of a meeting hall in Ban Hang Sadam.

E.9.3 Social Action Plan (SAP)

The Social Action Plan (SAP) for DSHEP is summarized in Section 6.3 of the EIA Report, produced in its entirety in Appendix B and these documents should be referred to for more detail. The SAP has been prepared as a guideline for the GOL and the DSHEP's management and is targeted to improve the social welfare of the general project area as well as mitigating the project's main long-term negative impacts. Six villages, namely Thakho, Veunkham, Hang Khone, Hang Sadam, Houa Sadam and Houa Sahong, are located in proximity to the DSHEP project and are likely to be affected to some degree by project development.

For all local communities and people the effects of DSHEP would be different and to varying degrees, as indicated in Section 6.3.2 but in the main can be classified as

- Group I - The: households having to be relocated as per the RAP outlined above and including an estimated 14 households from 3 villages
- Group H - The other remaining households of the directly impacted villages, namely Ban Hua Sahong, Ban Hang Sadam and Ban Hua Sadam
- Group III: The households living on the mainland, namely Veunkham hamlet (part of Ban Bung Ngam), Ban Thakho and Ban Hang Khone on southern part of Khone Island.

The local perceptions of DSHEP are varied but overwhelmingly include reduced fish abundance, loss of fishing assets due to flooding and access to fishing opportunities. This will affect all villages to some degree. Some villagers are also worried about the negative social impacts (e.g. problems with prostitutes and STD) and other social disruptions to their way of life. However, there is a general willingness to have the dam constructed without knowing all the impacts on them directly, as obtained through household, group and village level interviews. Household level interviews show that many villagers are afraid the DSHEP will not be realized.

Community preferences for livelihood improvement are to have suitable amount of land for agriculture with appropriate extension support plus necessary public facilities for education, healthcare, market areas and a secure water supply. The natural resources and the rich biodiversity of the area including fish stocks and natural attractions create an environment that sustains human life and produces a basic quality of life. Therefore, any investment projects such as DSHEP while aiming at generating financial benefits should also yield additional social benefits and not degrade the social and economic livelihood of the villagers. This is basic GOL policy. All six villages are impacted from the proposed DSHEP development but the three island villages from Don Sahong and Don Sadam are the main focus of regional development measures including: (see Section 6.3.5 for details),

- Livelihood training and awareness raising, including programs for gender, agricultural, health, education and other local groups
- Construction of additional infrastructure, including electricity supply, schools, health facilities, water supply and local markets
- Support for livelihood and economic development, including agricultural extension, tree plantations, sanitation and micro-credit schemes.

As for implementation of the RAP, formation and operation of local committees would be the key agencies in the implementation and arrangement for DSHEP's environmental and social works included in its SAP. The composition of the committees is essentially the same as those outlined in Section 6.1 of the EIA Report and indicated above. Similarly, the operation of the VCGRC would play a key role in addressing any land use disputes and inequities in development perceived by various local populations as noted in Section 6.3.7 of the EIA Report. .

The program for the implementation of the SAP would of necessity be longer, with the program starting later and extending for 3 years and including similar monitoring groups and activities for DSHEP and other parties as indicated for the RAP and a preliminary budget, subject to revision is included as Table E.12.

Table E.12 - Indicative Budget Estimate for SAP

1. Information Disclosure & Consultation re: Final SAP and Monitoring and Evaluation

Information disclosure & consultation and implementation expenses **USD 90,000**

2. Livelihood Training Costs

Gender training, HIV/AIDS and STD awareness, agriculture & livestock training, non-formal education for women and youth, primary health education & teachers' training, scholarships for best students and entrepreneur ship and SME promotion training **USD 60 000**

3. Social Infrastructure Costs

Electrification of villages, secondary school, health centres, water supply & community market **USD 540,000**

4. MV Distribution Line to Ban Hona Don Det

USD 320,000

5. Livelihood & Economic Development Costs

Land use planning & titling, promotion of second rice crop, vegetable & fruit trees plantation, plantation of fast growing fuel wood trees & bamboo & sanitation (latrines) program **USD 200,000**

6. External Monitoring Agency

USD 54,000

7. Administrative & Operational Costs (-10%)

USD 120,000

8. Contingencies (~ 10%)

USD 138,000

7. TOTAL COST ESTIMATE

USD 1,522,000

E.9.4 Public Involvement Program for Project

The requirement for public meetings are outlined in the MEM and STEA guidelines for both Environmental Impact Assessments and for the Resettlement Plans. The DSHEP has accepted this and has held two Stakeholder's Meetings to date. The documentation relating to these Stakeholder's Meetings are presented in Appendix K and Appendix L, respectively. These meetings were arranged through the offices of the Social and Environmental Management Division of the MEM's Department of Electricity (DoE) and the Champasak Province DoE and included:

- 1st Meeting- Pakse and Muang Khong- 25 & 26 October, 2006 with representatives of Provincial and District authorities and over 25 participants attended both meetings
- 2nd Meeting - Ban Hang Sadam - 30 January 2007 - included representatives from Provincial and District authorities, local Sub-district and Village officials and representative of organizations and over 110 participants attended this meeting.

All aspects were covered and included many queries as outlined in Section 6.4 of the EIA Report.

There is a STEA requirement in the environmental guidelines that the Draft EIA should be available to the public for review and it is the intent of the DSHEP proponent to hold this meeting in Vientiane. Issues raised would be answered at that meeting and addressed in the Final EIA Report.

E.9.5 Integration with Provincial and District Programs

The plans and proposals of the Champasak Province and Muang Khong District for the immediate Project area have not been fully canvassed or documented. The proposal for projects suggested in the SAP would need to be integrated with the District authorities, including education and agricultural bodies. Similarly, further discussions on the extent and locations of projects would require further consultation with relevant village authorities. Likewise all fisheries programs outlined as mitigation measures would require liaison with both the provincial and national Departments of Fisheries.

The declaration of the Siphandone Wetland as a Ramsar site would generate a number of issues for the IUCN or other organizations involved in planning for the resource management of the area, particularly for fisheries sustainability as noted in Section 4.3.6 of the EIA Report.

It is indicated that the Khong District development plans include a new village along Highway 13 South to be located in the vicinity of Khone Phapheng Resort to resettle the villagers from Ban Napeng. A village plan has been drawn-up, lots have been allocated but the timing of development is dependent on funding. Confirmation of these plans are required as they may affect the selection of a main campsite. Planning and integration of the proposed DSHEP works and proposed mitigating programs require liaison and coordination with the provincial and district authorities and DSHEP intends to do this during the detailed design stage of the Project.

E.10 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

An Environmental Management Plan (EMP) will have to be devised for the DSHEP according to the MEM-DoE's Environmental Management Standard (EMS) (EM05/00). This is considered an integral part of the Final Environmental Assessment process but many of its specific requirements are uncertain at this time. Consequently, only an outline of the overall organization and parties involved and estimates of the budgets required are presented in this EIA Report in Section 7. A full EMP will be compiled and presented by the DSHEP proponent or its representatives prior to tendering for contracts.

E.10.1 Institutional Framework for EMP

As outlined in Section 7.1 and Table 7.1 of the EIA Report, these needs as outlined in Requirement 4 of the EMS, would be set up for the duration of DSHEP and the basic institutions would include:

- GOL agencies at all levels including STEA and MEM- DoE, and the Independent Panel of Experts (POE)
- The DSHEP proponent or its representatives such as a Environmental Management Office (EMO) operating on its behalf
- Consulting Engineer's representative or Environmental Advisor (EA)
- Various Environmental Officers associated with the main Contractors

E.10.2 Management Arrangement and Staffing

The make-up of EMO is important as it ensures that the project conforms with the environmental criteria of the various legislation and as required by the Final EIA. Preliminarily, it is proposed that a full-time experienced Environmental Manager (EM), with appropriate staff and budget be appointed who will be responsible to the DSHEP Project Manager. His role is outlined in Section 7.2 of the EIA Report.

E.10.3 Project Environmental Management Plan including Monitoring

Under Requirements 5, 6, 7 and 8 of the EMS, the compilation of a detailed EMP needs to be comprehensive and include documentation aspects and programs for each of the following tasks, as outlined in Section 7.3 and including: .

- Management Arrangements such as the administrative and technical arrangements for the EMO, and its integration into plans and schedules for the DSHEP, including the Project owner and management for construction and operation, the nominated environmental staff and secondments or supervision by DoE, STEA and contractors and make-up of Advisory Panels and Consultative Committees
- Environmental Management Measures such as the proposed environmental protection measures and monitoring programs to ensure impacts are properly managed and the project is sustainable
 - « Monitoring Measures such as the type of monitoring (ambient, validation, effectiveness and compliance), the sampling parameters, locations, frequency and timing of

monitoring and reporting schedules for each monitoring task whether physical, biological or social aspects and reporting schedules.

It is noted that for compliance monitoring, DoE is required to report to STEA, the project owners and relevant stakeholders.

E.10.4 Contractor's Environmental Management Plans (CEMP)

All main contractors on hydropower projects are required to develop and implement a CEMP for their respective works and these must conform with the approved plan. These plans would need to be completed prior to tender documents being prepared for the DSHEP. The DoE, STEA and the EMO would be responsible for approving and monitoring of all the CEMPs associated with project construction and operation.

E.10.5 Public Involvement and Corrective Actions for EMP

A Public Involvement Process for developing and implementing the EMP is outlined in Requirement 10 and outlined in Section 7.4 of the EIA Report. For the DSHEP, fisheries and diversion of dry season flows and the proposed management measures have not been discussed at any Stakeholders' Meetings held to date; so public involvement requirements are lacking.

There are provisions in the EMS for corrective actions to be applied to the EMP, if the results of monitoring indicate problems or inaccuracies exist. Only then can appropriate corrective actions be applied and the responsibilities defined.

E.10.6 EMP Implementation and Costs

Preparation of the EMP for DSHEP is dependent on the final configuration of the Project. There are 4 different phases for the EMP, these being:

- Organization of the DSHEP's Environmental Management Office and Advisory Committees
- Design Phase and Pre-impoundment Environmental Measurements as indicated in the EIA
- Environmental Measures During the Construction Phase
- Environmental Measures During Operation Phase.

Table E.13 summarizes the main costs for each of these phases and is based on the agencies responsible for and executing each of the actions as outlined in Table 7.2 of the EIA Report. This table is far from definitive of the tasks and is considered preliminary until the Final EMP is prepared and submitted for approval. The overall cost estimate is approximately US \$ 2,000,000 but this would be altered in the Final EMP as items are added and scopes of the activity and monitoring finalized.

Table E.13 - Estimated Cost of Basic Environmental Management Plan and Implementation for DSHEP

Phase of Project	Main Responsible Agencies	Main Executing Agencies	Total Estimated Cost
Organization of the Environmental Management Office (EMO) and Various Committees	GOL/PP/ STEA	EMO/ STEA/ SEMD/Consultants	USD 195,000
Design Phase and Pre-impoundment Environmental Measurements as per EIA	GOL/PP/ STEA/ Fisheries Dept/ MRC	EMO/ SEMD/ Consultants	USD 329,000
Monitoring Measures During Construction Phase	GOUPP/ EMO/ STEA/CEMP	EMO/ STEA/ SEMD/ Consultants/ CEMP/ Fisheries Dept/ PESO DCRC	USD 1,058,000
Monitoring Measures During Operation Phase	GOL/PP/ EMO/ STEA/ CEMP/ MRC	EMO/ STEA/ SEMD/ Consultants/ CEMP/Fisheries Dept/ PESO POE	USD 295,000
TOTAL ESTIMATED EMP COSTS			USD 1,877,000

NOTE : CEMP = Contractor's Environmental Management Plan
DCRC = District Compensation and Resettlement Committee (Khong District)
EM = Environmental Manager
EMO= Environmental Management Office
EMP = Environmental Management Plan
GOL = Government of Laos
MRC = Mekong River Commission
POE - Panel of Experts (Independent")
PP = Project Proponent
PESC = Provincial Environment and Social Committee (Champasak Province)
SEMD= Social and Environmental Management Division (Department of Electricity)
STEA = Scientific, Technology and Environmental Agency (Prime Minister's Department)

E.11 ALTERNATIVES TO AND WITHIN THE PROJECT

Section 8 outlines two alternatives to the proposed DSHEP, neither of which has been investigated in detail, which would leave the Hou Sahong channel untouched and have minimal impact on low season fish migration. It is acknowledged that the Project Proponent only has a mandate to investigate the DSHEP but the two other projects are; development of the following hydro power projects:

- Based on a diversion around Khone Phapheng waterfall
- Based on the Hou Xang Peuk, the tributary immediately to the west.

E.11.1 Khone Phapheng Alternative

This alternative is listed in the "Power System Development Plan for Lao PDR" (PSDP) completed for the GOL by Maunsell/Lahmeyer in August, 2004 and

- Is based on an intake upstream of the falls, a single 12 m diameter headrace tunnel, and underground power station with two 30 MW units and tailrace tunnel
- Would not be visible to the general public visiting Khone Phapheng waterfall
- Has benefits to the ecological consequences on fish migrations which are limited at Khone Phapheng
- Has advantages during construction and operational phases, of a mainland-based operation rather than an island-based operation serviced by barges

This development is not comparable to DSHEP as it has a lower installed capacity (60 MW vs 360 MW) and the consequent lower energy production (402 GWh vs 2375 GWh). Underground works are also generally higher in cost than surface works. It would be possible to increase the capacity and energy output by using multiple tunnels, but this present study has not attempted to optimise the arrangement.

E.11.2 Hou Xang Peuk Alternative

The Hou Xang Peuk alternative is unexplored at this time and presents some problems in that it would also require enlargement of its entrance from the Mekong River and have adverse impacts on the wet season migration of fish and its fishery.

This project concept would have the power station just above the confluence of Hou Xang Peuk with Hou Sahong. No topographic survey have been carried out on the area west of Don Sahong but there would be considerable excavation at the entrance to Hou Xang Peuk and on the water falls mid way down to provide a waterway capable of carrying the required flow to the power station, and substantial embankments to retain the water on the western side. Although the power station capacity and output would be comparable with DSHEP, the cost of the rock excavation and retaining embankment construction is likely to make it economically unviable. Construction would be difficult because of the many braided channels in the area west of Don Sahong and the construction period would be at least one year longer.

E.11.3 Within the Project Alternatives

The engineering study investigated a range of alternatives for the DSHEP and these are illustrated on Figure 11.10 through to Figure 11.21 of the Feasibility Report, showing the impacts on installed capacity and annual average energy of, amongst other variables:

- number, size and type of units,
- varying degrees of channel improvements at the Hou Sahong mouth,
- quantum of environmental flows,
- effects of peaking generation,
- effects of reduced inflows to pondage (due to upstream development).

Apart from the impact on fish migration and its effect on the local inhabitants on Don Sahong, Don Sadam and surrounding islands, the most sensitive aspect of the development is the blocking of Hou Sahong, its level of the "environmental flow" and the visual impact of the Khone Phapheng waterfalls. A minimum environmental flow of 1,000 m³/sec has been suggested, a discharge that is

more than the minimum historic flow over the falls, which is interpreted from the historical minimum recorded flow at Pakse.

E.11.4 No Project Option

From an environmental viewpoint, the "no project" option is the best solution to the dilemma of "effects on blocking Hon Sahong's role as a major fish migration channel." Not to construct the project would, however, reduce the export earnings of the Lao Government, impacting on the government's development plans to alleviate poverty countrywide. If implemented, it would also enable social and lifestyle improvements to the villages directly impacted by the project and would boost economic and tourism development through the extension to surrounding areas of a reliable electricity network.

E.12 CONCLUSIONS AND RECOMMENDATIONS

E.12.1 Social and Environmental Impact

A detailed technical and economic feasibility study has been conducted on the DSHEP, considering various arrangements of hydroturbines in a powerhouse structure at the lower end of the Hou Sahong. This study has indicated that a power station with an installed capacity of 360 MW and exporting a majority of its energy production to Thailand, with the remainder for export to Cambodia and for domestic consumption, is technically and economically the most viable option.

A comprehensive study has been undertaken on the social and environmental issues associated with the project, as required by the various regulations of the Science Technology and Environmental Agency (STEA) and Ministry of Energy and Mines (MEM). The social and environmental impact of this project compared with other current or potential hydro project of similar capacity in Lao PDR is very small in terms of:

- 1) minimal inundation of land.(11 hectares only)
- 2) minimum displacement of people.(14 families only)
- 3) minimal impact on Flora & Fauna
- 4) only one of the 18 channels in the river is blocked.
- 5) no diversion of the river/water

The likely impact of the project on Mekong River fisheries has raised many concerns. However unlike other run-of-the river hydro power plants requiring a barrier across the whole river, the DSHEP is situated between two islands in the Siphandone (four thousand island) area of the Mekong River where many channels exist. The proposed improvement works coupled with fishery controls in the natural water channels adjacent to Hou Sahong would minimise the impact of DSHEP on fish migration along the main stream Mekong River.

Notwithstanding the possible impacts as detailed above and in the EIA Report, the implementation of the DSHEP would be of considerable economic benefit to the Lao PDR and would provide improved infrastructure and stimulation for growth in the Champasak Province.

Numerous suggestions and recommendations in the EIA Report are proposed for the benefit of implementation of DSHEP, including:

- Additional studies during detailed design stage to confirm the minimum "environmental flows" of the Mekong River to safeguard the flows over Khone Phapheng and the flows in streams adjacent to Hou Sahong.
- Budgets for and implementation of recommended mitigating actions for the fisheries component
- The Resettlement Action Plan (RAP) for relocating communities such as Ban Hang Sahong hamlet and others affected by DSHEP
- The Social Action Plan (SAP) as revised in consultation with GOL, including Khong District authorities and representatives of affected villages

The social action plan recommended will improve infrastructure (water supply, sanitation, education, health facilities and electric power) in the six affected villages. Further, electrification will be extended to a number of other islands, including Don Det and Don Khone, which will enhance their tourist potential, as well as improving the living conditions for the residents.

E.12.2. Notification of LNMC and MRC

The LNMC has been notified and progress of the studies reported by the DSHEP management. However, there exists a need to specifically notify the DSHEP to the MRC either directly or indirectly through the LNMC, under Articles 1, 3 and 5 of Chapter III Objectives and Principles of Cooperation of the *"Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin"* (MRC, 1995). This requirement is so that the MRC can raise the DSHEP with the Joint Committee, as to its potential effects to other members of the Lower Mekong Basin (LMB) countries; namely Cambodia, Thailand and Vietnam. It should be noted that Article 5 deals specifically with "intra-basin use of the Mekong River"; whether the DSHEP qualifies to this is uncertain at this stage.

E.12.3 Siphandone Wetlands Declaration

The proposal for the GOL's first Ramsar site covering the Siphandone Wetlands is ongoing. This declaration would make no difference to the DSHEP other than to require additional consultation with the management agency, the Ministry of Agriculture and Forests, and its advisers regarding its position in the Wetlands development program. The DSHEP proponent will, therefore:

- Cooperate with the GOL and authorities such as LNMC in the Ramsar declaration of the Siphandone Wetland in providing information on the DSHEP
- Permit the appointed planning organization for the Siphandone Wetland to review and comment on any specific proposals by DSHEP proponent to undertake monitoring and management of the natural resources of the impact area.

1. INTRODUCTION

This document relates to an Environmental Impact Study (EIS) for the Don Sahong Hydroelectric Project (DSHEP) in Champasak Province on the Mekong River. This project is a run-of-river scheme, is nominated at 300 Megawatts (MW) and is located on Hou Sahong, a channel between the island of Don Sadani and Don Sahong, just above the Lao PDR and Cambodian border.

The EIA has been based on reference data and field work by technical experts between October, 2006 and March, 2007. It also must be read in conjunction with the Feasibility Study Report for the Don Sahong Hydroelectric Project (APW, 2007) prepared by the Engineering Consultant, PEC and APW. The DSHEP is sponsored by the Mega First Corporation Berhad (MFCB) of Malaysia.

Little previous detailed data is available on the DSHEP, other than preliminary engineering scoping studies for Lao PDR and numerous publications on fisheries in the Lower Mekong Basin, largely published by the Mekong River Commission (MRC) or its predecessor. There is considerable interest in the general area with an evolving tourism trade based primarily on sight-seeing visits to Khone Phapheng, a waterfall located east of the site. The Government of the Lao PDR (GOL) is encouraging this development.

This EIA has been compiled based on the data gathered, according to recent (i.e. 2000 to 2005) environmental legislation and guidelines of the Scientific, Technology and Environment Agency (STEA) and the concerned agency, the Ministry of Energy and Mines (MEM) and its Department of Electricity. The work has been carried out in consultation with both these agencies and their guidelines have been followed in preparing this document.

1.1 Layout of EIA Report

The layout of this report is mainly controlled by the data available from specific investigations for this EIA Report for the DSHEP. The Feasibility Study investigates a range of installed capacities from 180 MW to 480 MW for the Project. All options in the range involve lowering of the entrance to the Hou Sahong and excavation of the upstream channel to some extent. While the construction and operation of the DSHEP will not vary the flows in the Mekong River downstream of Veunkham, the studies have assumed that there will always be a minimum discharge over Khone Phapheng and a range of flows between 800 m³/s and 1400 m³/s have been assessed. These aspects would need to be studied from the Feasibility Study report, which should be read in conjunction with this EIA Report.

This EIA Report describes the impacts and suggests mitigating actions for a nominal 300 MW installation and the following topics are documented;

- Section 1-Introduction
- Section 2 — Project Description and Proponent
- Section 3 - Institutional and Legal Framework
- Section 4 - Baseline Information on Project Area
- Section 5 - Impact Analysis and Mitigation Measures
- Section 6 — Resettlement and Social Action Plans
- Section 7 - Environmental Management Plan
- Section 8 - Alternatives to and Within the Project
- Section 9 - Conclusions and Recommendations.

A number of appendixes has also been produced and include the reports by the various sub-consultants. Some, such as the Fisheries, Resettlement Action Plan (RAP), the Household and Socioeconomic Survey and Public Health Survey, all being important documents in their own right. The appendixes are:

- Appendix A - Household Survey and Census Report
- Appendix B - Social Action Plan (SAP)
- Appendix C-Resettlement Plan (RP)
- Appendix D - Public Health Survey
- Appendix E - Tourism
- Appendix F - Unexploded Ordinance Survey
- Appendix G - Fisheries and Aquatic Ecology, including Water Quality
- Appendix H - Forestry Survey
- Appendix I - Wildlife and Birdlife Survey
- Appendix J - Impact of Ramsar Convention
- Appendix K— Public Disclosure Meetings 25 and 26 October 2006
- Appendix L - Public Disclosure Meeting 30 January 2007
- Appendix M - Environmental and Resettlement Legislation

1.2 Key Personnel Involved

The following have assumed a key role in the preparation of this EIA Report. However the responsibility for its compilation rests with the Environmental Coordinator, Mr J Prosser; as many of the impacts and mitigation measures vary somewhat from those advocated by the individual sub-consultants.

- Household Survey and a Socioeconomic investigations by ATM Consulting of Vientiane, headed by Mr Lam Ngeunh Phakaysone
- Resettlement Action Plan prepared by Dr Montri Suwanamontri, an EIA Study team member
- Aquatic Ecology and Fisheries Study based on existing information and a fish resource and use survey of local communities by Mr Terry Warren
- Public Health Study based on data collected from the region and a field testing program of local communities by Dr Bouasy Honthavong
- Basic Forest Resources Survey by Dr Sengdouane Wayakone of the Lao National University
- Basic Wildlife and Birdlife Study by Mr Sengrath Phirasack
- General co-ordination and responsibility for the EIA Report compilation by Mr J Prosser, of the EIA Study Team with the assistance of Mr Rod Vincent, Project Manager.

2. PROJECT DESCRIPTION AND PROPONENT

2.1 Project Location

The Don Sahong Hydroelectric Power Project (DSIIEP) is located on the middle reach of the Mekong River in the southern area of KJiong District, Champasak Province (Figure 2.1), 150 km downstream of the provincial capital, Pakse. This area is generally known as Siphandone (Four Thousand Islands), a complex of islands covering about 10 km length of the Mekong, which have been formed in ancient geologic times by a sequence of predominantly volcanic (andesitic) lithologies with some interbedded sedimentary sequences. The whole series has been folded and thermally metamorphosed and then subsequently eroded to form a planar land surface. In this, the Mekong has eroded numerous channels. There are two water falls - Khone Phapheng on the eastern bank and the Lippi or Samphamit Falls further west, as well as numerous channels and cascades, most of which flow only in the high flow period and are mainly dry in the low flow period.

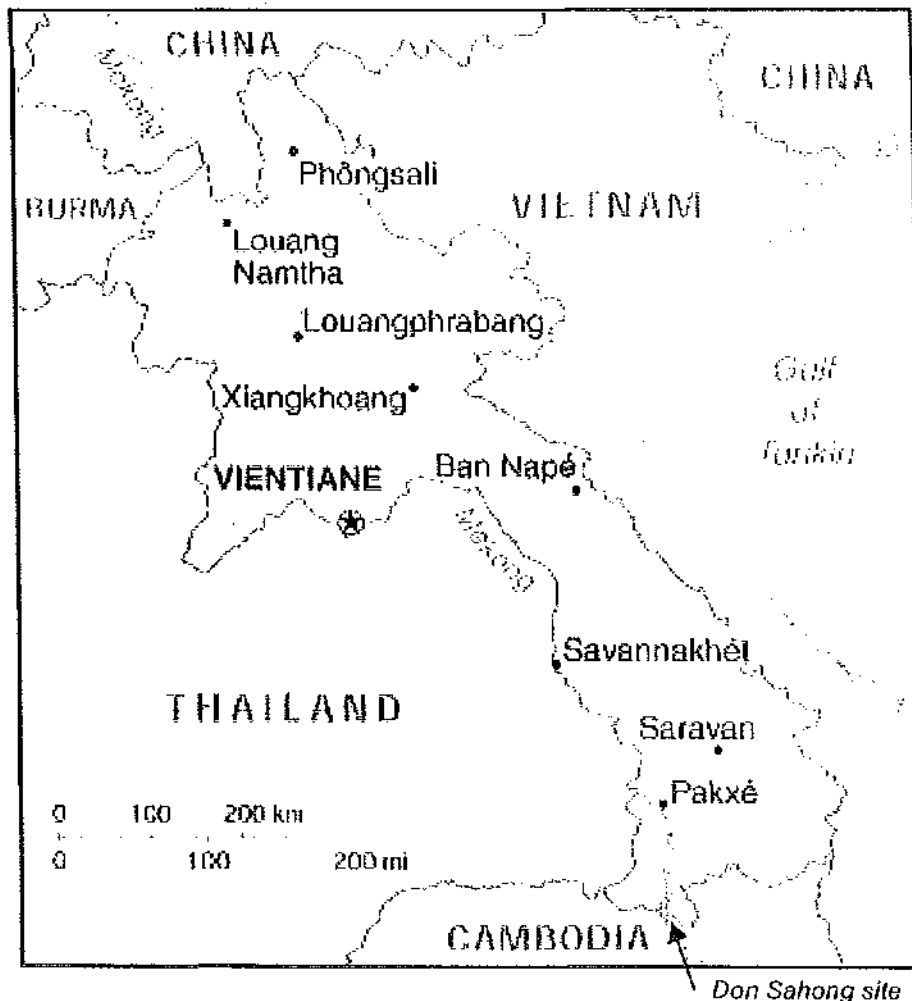


Figure 2.1 – Project Location

In the project area the Cambodian border lies on the west bank of the Mekong and crosses the river about 2.5 km downstream of the power station site, just beyond the village of Veunkham.

The project itself is located on the Hou Sahong, the third largest of the perennial water courses that penetrate the rock mass, the larger streams being the branch that cascades over the Phapheng Falls and the Hou Det, leading to the Tad Samphamit. During the high flow season other branches, particularly the channels closer to the right bank carry higher flows, but Hou Sahong is the largest branch without a major waterfall between the upstream and downstream sections of the Mekong; it has a relatively even fall from upstream to downstream with only a series of rapids at about two-thirds distance.

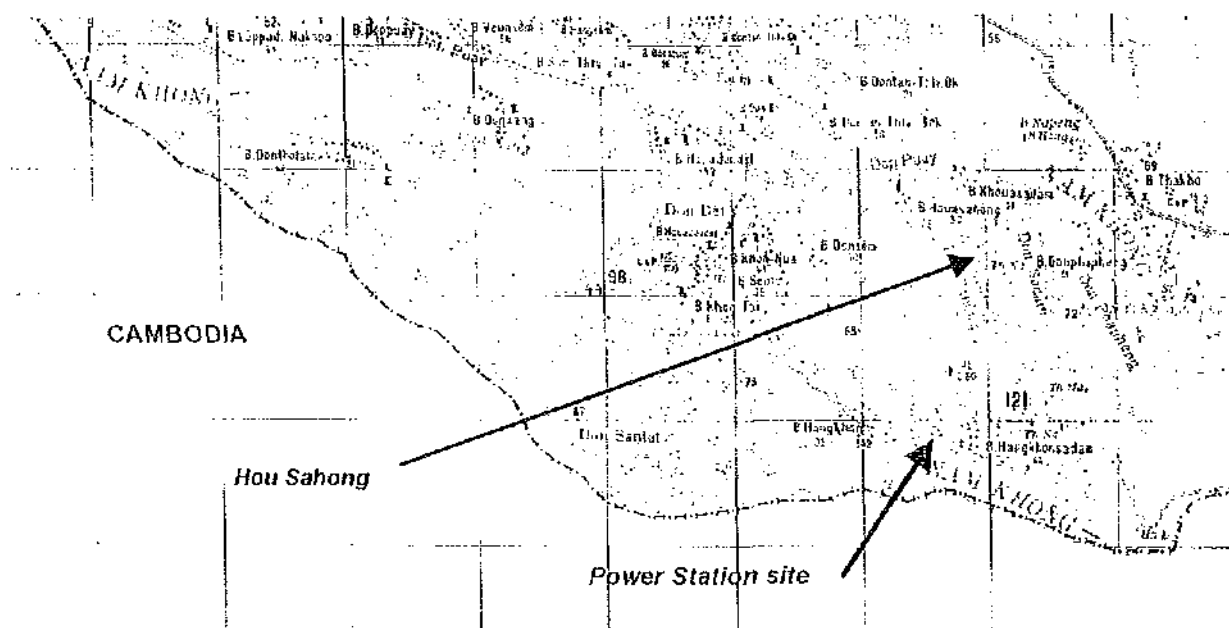


Figure 2.2 - Location of Don Sahong Hydro Electric Power Project

2.2 Project Description

The Project occupies little total area in the Siphandone complex as it is situated entirely within Hou Sahong, with direct impacts on adjoining sections of Don Sadam and Don Sahong.

The project layout envisaged is for a concrete box-like structure to be constructed about 150 metres upstream from the exit of the Hou Sahong. This structure, to be excavated about 15 m below the existing channel floor will extend to both banks and will contain bulb-type hydro turbine generators and associated control and protection equipment in a semi-outdoor arrangement. Three-phase transformers will be located on the downstream side of the powerhouse, with cables taking the high voltage power to the substation adjacent to the right of the powerhouse (Figure 2.3).

Construction of the powerhouse will cause water to back up in Hou Sahong, creating a reservoir, whose water level will vary with the level of the Mekong upstream. The top of the powerhouse has been set at RL 75, estimated to be above the maximum level that the Mekong will achieve at the entrance to the Hou Sahong. Because the topography in the vicinity of the powerhouse is less than this level, embankments are required on both sides of the channel to retain the water. These are shown on Figure 2.4, which also indicates the extent of flooding on Don Sadam and Don Sahong.

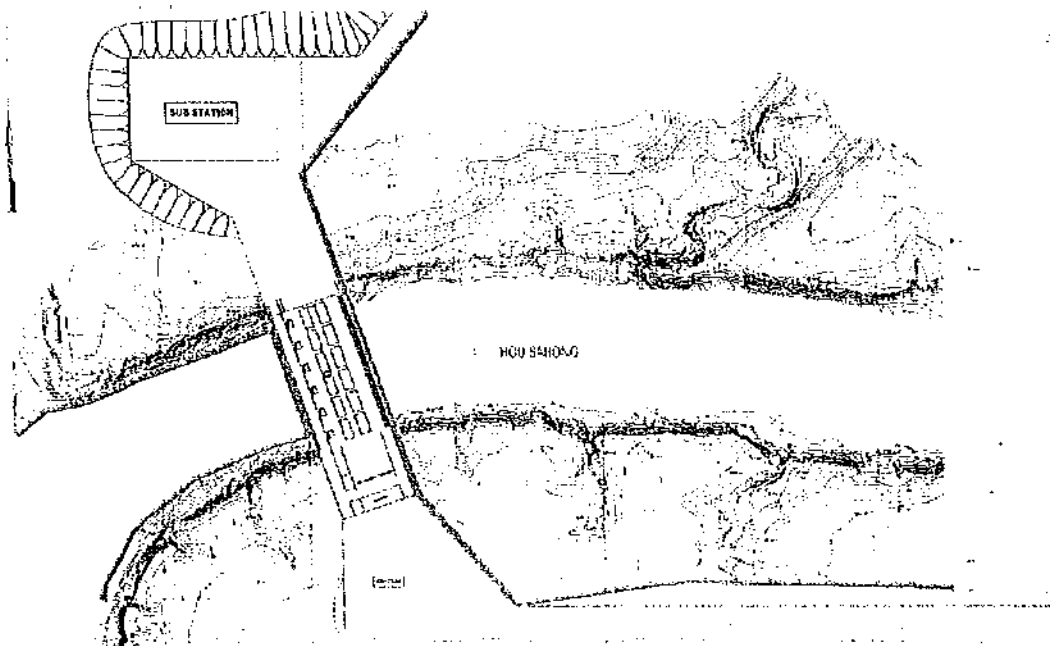


Figure 2.3 - Power Station Layout

Based on the records from the daily read station at Thakho, in operation since 1995, the level of the reservoir is expected to vary within a maximum range of 2.5 metres, being higher in June to December and at its lowest in April, each year.

In its natural state, the high bed levels in the upper reaches of the Hou Sahong would restrict flow into the channel, particularly in the low flow periods, and the power station would not be able to operate at its design capacity. To overcome this, the bed of the Hou Sahong will be excavated a maximum of 5 m deep for a length of about 2 km and there will also be a similar depth of excavation into the Mekong around the entrance to the Hou Sahong. This excavated material will be used for concrete aggregate and to construct the retaining embankments, with excess rock to be disposed at appropriate locations on Don Sadam and Don Sahong.

There will also be excavation downstream of the powerhouse, to a depth of one metre, as far as the southern tip of Don Khone.

Excavation is proposed in Hou Xang Peuk and in Hon Sadam to provide alternative low flow period migration routes to replace the Hou Sahong which will be blocked for upstream movement of fish.

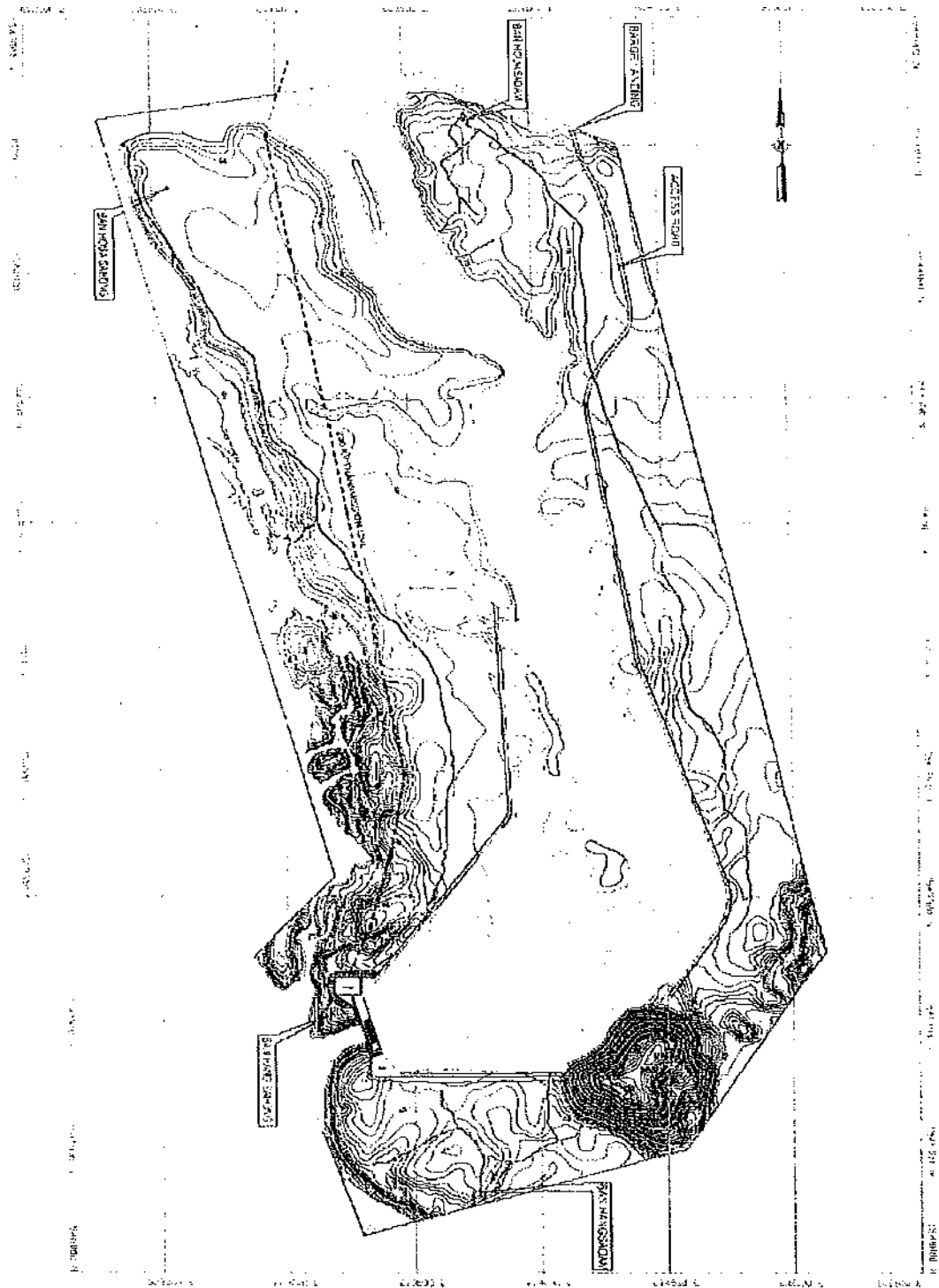


Figure 2.4 - Project Layout, showing inundated area

2.3 Power Station Operation

The Don Sahong Power Station will be a run-of-river scheme, operating using the available water in the river, with no storage. This means that it will run at a more-or-less constant outflow on a daily basis.

Water will be diverted from the Mekong River upstream of the Phapheng Falls. As such, it will have negligible or no effect on any of the channels that branch from the Mekong further upstream, such as the Hou Det, which leads to the Samphamit Falls, or the channels further west of Don Det and Don Det, Don Xang and Don Tholathi. However, there will be less water flowing over the Phapheng Falls throughout the year. During the high flow periods this will not be noticeable as the diverted water will be only a small proportion of the total flow over the falls. In the low flow periods a larger proportion will be diverted away from the falls, but the feasibility study has been based on the assumption that a minimum "environmental flow" will always pass over the falls throughout the day so as not to detract from the visual aspects of the falls and their tourist potential. Only water in excess of this "environmental flow" would be diverted to the power station and the station would operate at reduced output under these conditions. This would be achieved by installing an automatic water level measurement device at Thakho which would continually transmit levels and flows (derived from rating curves established by a series of river gaugings) to the power station control room and adjust the flow through the generating units accordingly. Figure 2.5 indicates the variation in monthly energy output throughout the year, based on simulated operation using the 82 years of flow record at Pakse, which have been adjusted to reflect actual flows at Thakho. The dip in energy in the high flow months of August and September reflects the restriction on turbine capacity due to the high tailwater levels downstream of the power station.

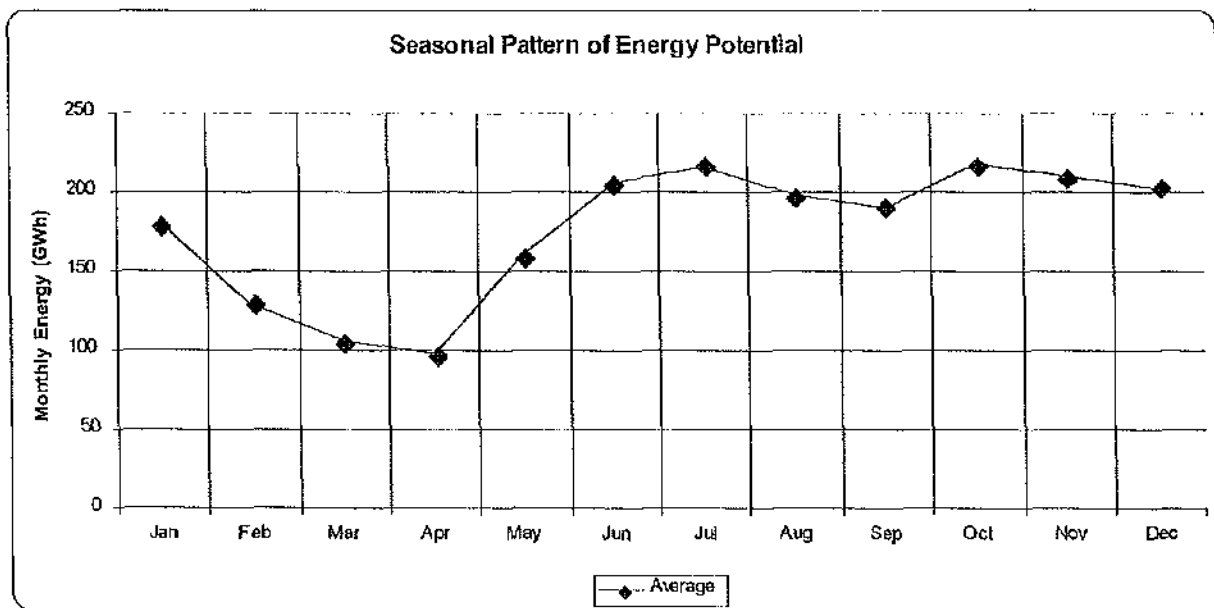


Figure 2.5 - Variation in Average Energy Output

Operation of the power station will also affect the river downstream of the power station. It is difficult to judge the change in the high flow season because there is no measurement of the flow down the Hou Xang Peuk and Hou Don Wai, which converge with the Hou Sahong 150 metres downstream of the power station and continue to join the main Mekong 700 metres further at the

southern end of Don Khonc. However in the low flow periods when those other channels virtually dry up and the flow in the Hon Sahong is less than 100 m³/sec, there will be substantially more flow. Beyond Don Khonc there will be little impact as the Hows are absorbed into the Mekong which is several kilometres wide at this point. Downstream of Veunkham there will be no impact at all as there is no change to the total flow in the Mekong. Figure 2.6 indicates that average monthly flows through the power station throughout the year, compared with the Pakse flows.

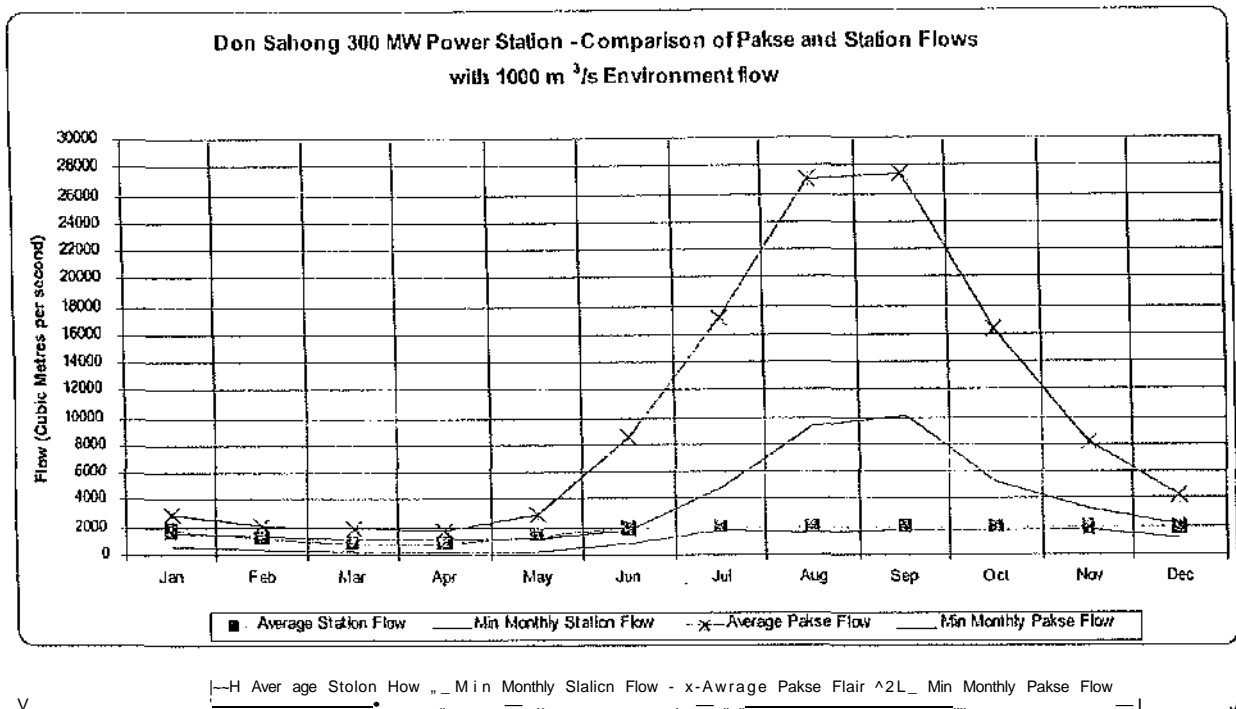


Figure 2.6 - Average Discharge Through the Power Station

Mathematical modelling of the discharge indicates that the levels in the channel immediately downstream of the power station might be 2.5 m higher than at present levels in the low flow season and one metre higher in high flow seasons, tailing to tens of centimetres at Ban Hang Sadam,

2.4 Transmission Line Size and Location

From the substation a 230 kV double circuit transmission line will run north across Don Sahong and Don Tan before reaching the mainland in the vicinity of Ban Nakasang and continuing to Ban Hat substation. At Ban Hat energy for EdL will be fed to the existing Southern Lao Grid (115 kV).

The majority of the energy generated will, however, be exported and the primary targets for export are Thailand and Cambodia. The terminal in Cambodia, Stung Treng, is only 60 km distance from Ban Hat, considerably closer than the Thailand delivery point, Ubon (250 km), and so would be the logical destination because of lower capital costs and transmission losses, but the projected demand in Cambodia will not be large enough to accommodate the full output from Don Sahong for many years. Although no negotiations have taken place with either EGAT or EDC regarding purchase of the energy, it is likely that export will be to both utilities.

The transmission to Ubon would be via a 230 kV double circuit line, which is proposed to run beside the existing 115 kV line to Pakse, and then parallel to the existing Pakse-Ubon 115 kV line. Another option is to connect to the existing 230 kV line from Ilouay Ho to Ubon, but this would depend on (a) agreement being reached with the owner of that line and (b) whether the line has sufficient spare capacity to carry the load.

A 115 kV line is presently proposed to connect Ban Hat and Stung Treng and this could carry a limited export load. Alternatively, a 230 kV line could be built adjacent to that line to minimise land resumption and other environmental problems.

As there is no preferred destination for energy export at this time, neither possible route has been subject to environmental or social evaluation.

2.5 Site Access, Borrow Areas and Logistics

2.5.1 Site Access

Access to the project area is direct along Highway 13, 150 km south from the provincial capital, Pakse. The highway was reconstructed in 2001 and has a 7 m double Hush seal pavement on a 9 m carriageway. The numerous bridges on the highway are designed to AASHTO HS-24 +25%. Pakse can be reached by Highway 13 south from Vientiane or along Highway 10 from the Thailand border crossing 45 km west at Vang Tao/Chong Mek and the Lao Nippon Bridge across the Mekong River.

Pakse is also served by multiple daily flights from Vientiane, Phnom Penh and Siam Reap and less frequent flights from Bangkok.

An alternative route for materials and heavy equipment could be by barge up river from Phnom Penh port or 724 km from the mouth of the Mekong. The river may not be navigable in all seasons and would have to be investigated more fully. During the French colonial period, river transport was significant, with vessels coming to Ban Hang Khone, where their cargo was off-loaded and carried by railway to Ban Don Det where it was reloaded onto smaller vessels for caniage upstream to Vientiane, Luang Prabang and beyond. Although this transshipment ceased decades ago, markers defining the channel approaches to the wharf at Ban Hang Khone still exist.

The Mekong River Commission published its "Navigation Strategy" in August 2003 and this indicates that vessels of 5,000 DWT can navigate to Phnom Penh in high flow conditions (3,000 DWT is limit at low water), but that the carrying capacity drops off sharply upstream and between Stung Treng and the project area the Mekong is navigable only for 70 DWT vessels in the high flow and 15 DWT vessels at low water. However, special purpose air cushion vessels (Hovercraft) may be able to carry larger loads.

Access to the site itself is not as straightforward and involves crossing the Mekong River by boat or barge as there are no bridges to the islands. Two crossing sites have been identified (Figure 2.7):

^a upstream of the falls, from immediately north of Khone Phapheng Resort to Ban Houa Sadam (Photographs 2.1 and 2.2)

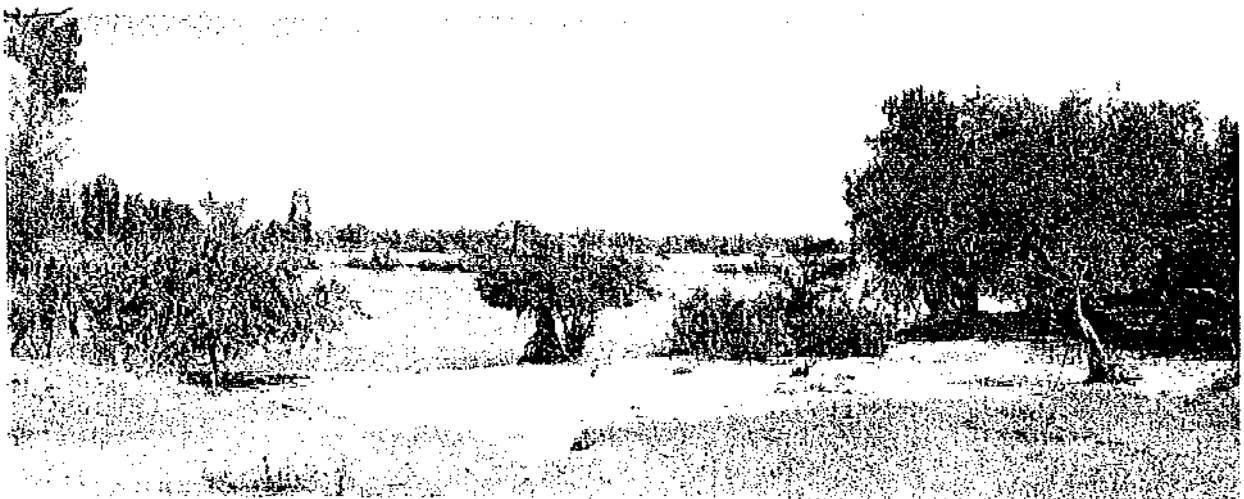
- downstream of the falls from Veunkham to either the power station site near Ban Hang Sadam or the southern end of Don Sadam.

In either case there will need to be excavation of rock from the river bed to provide a deep enough and safe enough passage for barges at all times during the year.

A further option is to construct a bridge to the south-east corner of Don Sahong from the vicinity of Veunkham. This would only be for light traffic and heavier loads would have to be barged.



Photograph 2.1 - Proposed Barge Landing Site at Ban Houa Sadam, from Mekong

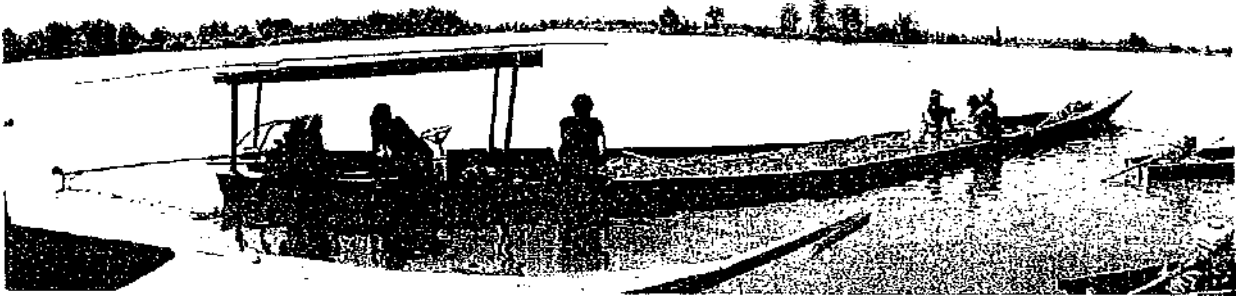


Photograph 2.2 - Proposed Barge Landing Site at Ban Houa Sadam

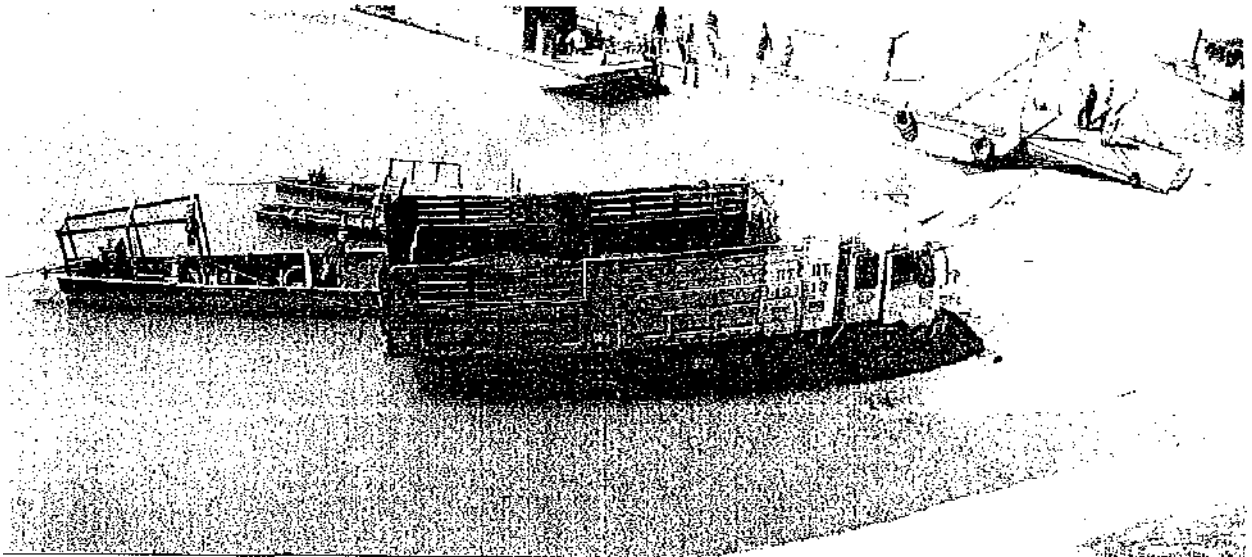
2.5.2 Borrow and Disposal Areas

There is no need to borrow material for the construction of the project. More than sufficient good quality rock is available for coarse concrete aggregate and for embankment fill (the impermeable membrane will be a concrete face slab) from the excavation required for the powerhouse and for the deepening of the Hon Sahong entrance (Section 2.2). In fact, there will be a requirement to dispose of more than a million cubic metres of surplus rock from these excavations. Some will be used for roads on both adjoining islands while most will be dumped in low-lying, non-productive areas.

Sand and fine gravel for concrete aggregate and filters will be dredged from the Mekong River upstream where there are large deposits that are currently being used on a small scale for construction purposes (Photographs 2.3 and 2.4).



Photograph 2.3 - Dredged Material Waiting to be Unloaded at Ban Nakasong



Photograph 2.4 - Unloading Gravel at Ban Hat Ferry

2.5.3 Logistics

It is proposed that a major temporary construction facility be located on the mainland. This facility would contain offices, accommodation, workshops, storage and holding areas so that only immediate requirements need to be transhipped to the project site.

Three possible sites have been identified (Figure 2.7)

- the preferred site, between the river and Highway 13, immediately north of the Khone Phapheng Resort.
- NE of Highway 13, opposite the preferred site, with an access to the river
- West of Veunkham

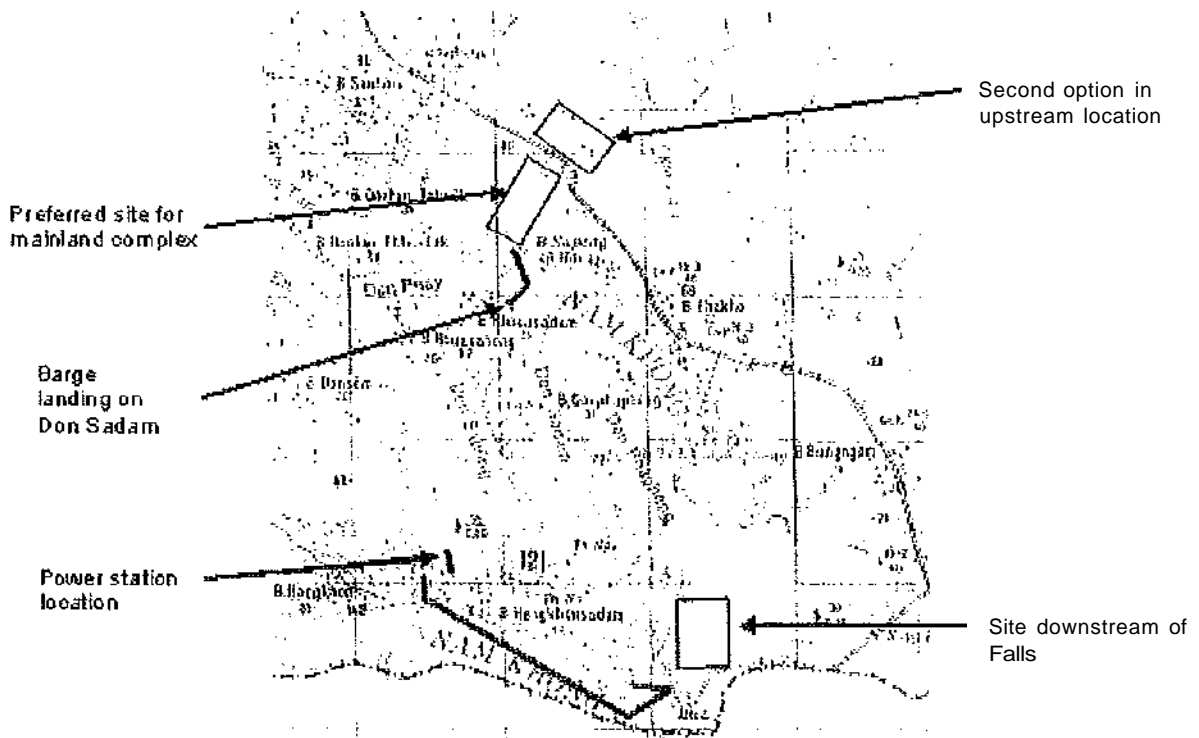


Figure 2.7 - Alternative sites for Mainland Complex

With the main facility on the mainland, there will be only limited storage areas at the project site, with rock crushing, concrete batching and basic workshops.

2.6 Project Proponent

The project proponent is Mega First Corporation Berhad (MFCB), a company listed on the Kuala Lumpur Stock Exchange (Bursa Malaysia). MFCB and its associated companies principal activities are engineering, designing and manufacturing of automotive components, building and operation of power plants in Malaysia and China and property development. Other activities are quarrying and production of quicklime, hydrated lime and calcium carbonate products and investment holding. Operations of the Group are carried out in Malaysia, United Kingdom, People's Republic of China and other countries throughout the world.

3. INSTITUTIONAL AND LEGAL FRAMEWORK

The DSHEP is required to satisfy the full set of environmental legislation pertinent to such projects. As much of this GOL policy and legislation is recent, the ways and means of compliance with these requirements are open to interpretation.

3.1 Memorandum of Understanding and EIA Agreement

A Memorandum of Understanding (MOU) governing the "development of the Don Sahong Hydroelectric Power Project for producing and exporting electric power to neighbouring countries such as Thailand, Cambodia, and Vietnam as well as for domestic consumption" was signed between the GOL and the DSHEP project proponent, Mega First Corporation Berhad (MFCB) on 23 March 2006. Subsequently, MFCB and PEC Konsult Sdn Berhad (PEC) and Australian Power and Water (APW) signed a contract for engineering and EIA studies in June 2006. An appraisal study for Don Sahong HEP and was prepared by the consultant and was accepted by MFCB in August 2006. Subsequently PEC and APW was commissioned to proceed with a full Feasibility Study program for the DSHEP including preparation of an Environmental Impact Assessment (EIA) which complies with the Government of Lao PDR (GOL) guidelines and requirements. On the advice of the GOL it was decided to proceed directly with the EIA. A Terms of Reference (TOR) for the EIA was required for approval by the Ministry of Industry and Handicraft's¹ Department of Electricity (MIH(DOE)) and the Science, Technology and Environment Agency (STEA) before proceeding with the EIA.

The DSHEP EIA Terms of Reference (TOR) were officially approved by STEA on 10 October 2006. Copies of these approvals are contained in Appendix M.

3.2 Official Stakeholders Meetings

An official letter requesting the co-operation and assistance of the Champasak Province (CP) and Klong District authorities was sent by the Director- General of the Department of Electricity of the Ministry of Mines and Energy (DoE-MEM) on 18 October 2006. This action preceded the initial Stakeholders Meetings held in the Pakse and Muong Khong on 24 and 25 October 2006. A letter requesting the co-operation by District and local authorities and assistance in executing of the village household surveys was sent by the CP Department of Electricity and approval was obtained before any field investigations were initiated.

Considerable negotiation with and relevant letters were sent by CP Department of Electricity to all local communities involved in the second Stakeholders' Meeting held at Ban Hang Sadam with over 115 attendees on January 30, 2007. Details of both these Stakeholders' Meetings are contained in Appendixes K and L.

3.3 Legal Policies and Relevant Environmental Guidelines

There are a number of general and recent main laws and regulations of the Lao PDR applying to hydroelectric developments that have to be observed. These are presented in more detail in Appendix N and include:

¹ Under a ministerial reorganisation in July 2006, the responsibility for the energy sector was transferred from the Ministry of industry and Handicrafts (MIH) to a new Ministry of Energy and Mines (MEM).

3.3.1 Main Laws Applicable to DSHEP

- The **1994 Foreign Investment Law** pertaining to property of foreign investors, including their rights and settlement of related disputes
- The **1997 Electricity Law** is applied differently to generation according to installed plant capacity, rights associated with concessions and build, transfer and lease, (BTL) type projects
- **The Water Resources Law of 1997** ensures responsible and sustainable use of water for "large" project, and imposes requirements on project sponsors for a feasibility study and a socio-environmental plan; contributions to watershed protection, prohibition of logging in the catchment and assistance in and contributions towards the cost of associated resettlement.

3.3.2 Environmental and Resettlement Legislation

The main legislation relates to Decrees and Regulations relating to Environmental Protection (1999 & 2001); Power Sector Environmental Impact Assessment (EIA) and Environmental Management Plans (EMP) (2001 and 2002) and Compensation and Resettlement (2005). All this legislation provides for approvals of the Science Technology and Environment Agency (STEA) and MEM-DoE.

Both existing and proposed hydropower projects are required to submit an Environmental Assessment reports including sections on biodiversity management, dam safety, mitigation and restoration of the environment, and the establishment of an Environmental Protection Fund.

This legislation is summarised for hydropower projects and requires project sponsors to prepare an EIA in accordance with the **Regulation for Implementing Environmental Assessment for Electricity Projects in Lao PDR (2001)** and include:

- TOR for EIA and approval of these by STEA
- Feasibility Study EIA and EMP including Compensation & Resettlement
- Environmental Management Monitoring Plan covering project construction, operation and closure phases including budget estimates
- Public Involvement of Stakeholders (PI) (at least twice)
- Submission of and approval of EIA and EMP by STEA including comments from MEM-DoE, other GOL ministries and agencies, stakeholders and provincial and local administrations
- Issuance of an Environmental Certificate by STEA
- Monitoring of EMP by STEA and MEM-DoE throughout project life.

Further details are given in the following specific articles and summarized in Appendix N.

- **Article 7** - relating to the Public Involvement process
- **Article 12** - relating to the EIA process and need for Project Owner to provide details on Consultants and to obtain approval of TOR from both STEA and MEM-DoE

- **Article 13** - relating to coverage in the EI A of at least two alternatives (plus "no project") and any implications to international treaties
- **Article 14** - relating to the review and approval of EIA reports by STEA
- **Article 15** - relating to preparation of Environmental Management Plans (EMP) including resettlement, compensation, schedules, budgets and endorsement by STEA and MEM-DoE
- **Article 16** — relating to obligations by Project Owners to ensure EMP is included in Contracts and is executed
- **Article 17** - relating to monitoring and evaluation including designation of an Environmental Management Office (EMO) and associated reporting
- **Article 20** - relating to sanctions for non-compliance including fines, withholding Contractor's payments or prohibitions on future bidding in Lao PDR.

Recent laws, policies, regulations and guidelines directly relating to compensation and resettlement activities including the preparation of Resettlement Action Plans (RAP) and Social Action Plans (SAP) and the relevant roles of line ministries and STEA are covered by:

- **Decree on the Compensation and Resettlement of the Development Projects, (Prime Minister's Office, No 192/PM (7 July, 2005)**
- **Regulations for Implementing Decree 192/PM on Compensation and Resettlement of People Affected by Development Projects (STEA)**
Technical Guidelines on Compensation and Resettlement in Development Projects (November 2005).

Expansion of the more pertinent articles of these acts are presented in Appendix M. It is acknowledged that all these regulations would have to be concurred with during the finalization of the EIA and EMP for STEA and MEM-DoE,

3.3.3 Other Lao PDR Legislation

There are a number of other policies and legislation applicable to Lao PDR that the DSHEP would have to pay attention to, including:

- Lao PDR Constitution (1991)
- Forestry Law (No. 01/1996)
- Land Law (1997)
- Road Law (1999)

Expansion of the selected articles and conditions relevant to these acts are included in Appendix N.

3.4 Other Relevant International Institutions

The DSHEP is very close to the international border between the Lao PDR and Cambodia and while construction and operation of the project will have little direct impact on Cambodian Territory *per se*.

3.4.1 Mekong River Commission (MRC)

These potential impacts are yet to be assessed and would affect agreed policies such as the Mekong River Commission's (MRC) **Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin**. In particular a number of the articles apply in general and the project would adhere to these as a matter of course such as:

- * **Article 3** - Protecting the environment and natural resources
- **Article 7**-Need for effort to avoid, minimize and mitigate harmful effects on the environment, especially on water quantity and quality, the aquatic (ecosystem) conditions, and ecological balance of the Mekong River system.

Also, under **Article 5**, Section B 1(a) and under Section B.2 (a), the DSHEP would require prior notification and approval to and by, the Joint Committee. Article 6 may not be relevant as the Project operation, as present plans would only marginally affect or modify the natural flows in either dry or flood seasons. These international obligations should be noted as the associated notification and approval procedures could cause delays in Project implementation.

It should be noted that the MRC is formulating environmental guidelines relating to Strategic Environmental Assessments (SEA) especially for trans-boundary projects and is negotiating with member countries for their acceptance of these guidelines.

3.4.2 International Treaties and Organizations

The DSHEP is within the Siphandone Wetland, an area proposed to be nominated as a Ramsar Site (Appendix J) The Ramsar Convention is an United Nations sponsored treaty specifically tasked with developing and maintaining "*an international network of wetlands which are important for the conservation of global biological diversity and for sustaining human life through the ecological and hydrological functions they perform*" and has been signed by Thailand, Cambodia and Vietnam, the other Lower Mekong Basin countries, together with 141 other countries. While declaration of the Siphandone Wetlands under the convention would not preclude construction of the DSHEP, there are indicated conflicts with the Ramsar objectives of conservation and sustainability as far as fisheries is concerned, as noted in later sections and Appendix J.

TUCN-Laos and WWF-Laos, two international conservation organizations operating in Laos, would be involved in administration and development of the Siphandone Wetland and the DSHEP would need to liaise with these groups, as well as the relevant GOL ministries.

3.5 Liaison with STEA and MEM-DoE

Liaison with STEA and MEM-DoE has been maintained during the course of preparation of this EIA. The national and provincial bodies were involved in the initial Stakeholders' Meeting in Pakse. These parties were consulted in relation to the second Stakeholders Meeting in the DSHEP area and their equivalent organizations at the Champasak Province and the District level were invited to the meeting.

Notes on venues, attendance, organizations represented and topics discussed were kept for these two meetings and are included as Appendixes K and L.

4. BASELINE INFORMATION ON PROJECT AREA

This section briefly outlines the main physical, biological and social features of the DSHEP area. There is considerable general information and some new data collected by this EIA which are contained in the Appendixes and are referred to throughout this section. Also there is considerable data relating to the Mekong River hydrology and DSHEP site geology contained in the Feasibility Report.

4.1 Physical Features

The DSHEP is located on the Hon Sahong, a 6 km long year-round channel which runs between the island of Don Sadam and Dong Sahong (Figure 4.1). These islands are of relatively low relief with the only prominent features being a hill at the south end of Don Sahong. The islands are inhabited by three (3) communities and contain approximately one-third of their land as agricultural lands, primarily rice paddy lands. Figure 4.1 clearly shows the paddy and forested areas, but here have been some changes since the aerial photographs were taken in December 1994. The Hou Sahong is a dominant feature of the local landscape as its levels vary by approximately 2.5 to 3.0 m between the dry season and the wet season. It is essential as a small ecosystem to the two islands and to the greater Siphandone Wetlands complex.

4.1.1 Topography and Setting

The topography of Don Sadam and Don Sahong varies between 48m at the lower end of the channel to 78m on the north ends of the islands, except for the single prominent hill near Ban Hang Sadam, which has an elevation of some 115m. The fall in the Hou Sahong channel is about 20 m over its 6 km length (i.e. from 72m to 48m in January). The relative elevations would be less in the wet season and greater in the dry season. There are no major barriers in this channel, only rapids and rocks, unlike most of the other channels across the Greater Mekong Faultline, which have waterfalls of varying heights. Its upper entrance is characterised by a rocky outcrop for 300m downstream and Hou Sahong has three main islands, one at each of the top, central and lower ends. The islands are relatively flat land not subject to flooding, generally at 74 to 77m elevation, and much has been cleared as paddy land.

4.1.2 Geology and Soils

(a) Geology and Gcomorphology

The geology including the geomorphology of the surrounding area and of the damsite is described in detail in Section 5.2 of the Feasibility Report. This is based on evaluation by the DSHEP Project Geologist and detailed field investigations including drilling of boreholes and digging test pits in the immediate damsite area by ASA Engineering of Vientiane.

(b) General Geomorphology

The Mekong River runs in a well defined river course above Khong Island where it bifurcates and develops into a multi-channel and islands and cascades feature down to the Cambodian border. Much of the river flow is across planar rock surfaces rather than in alluvial soils, especially in the west. The flow is perpendicular to the rock beds and crosses numerous lithologies.



Figure 4.1 - Aerial Photograph of Hou Sahong

In the dry season, the flow is confined to several defined channels which are characterised by abrupt changes in direction as shown on the aerial photographs of the region. The geological controls on stream courses is demonstrated in the lower reaches of the Hou Sahong, where the final bend in the stream is dictated by a change in strike of the rocks and streamflows are along a series of weaker sedimentary rocks. The natural surface slopes very gently to the south, at much the same gradient as the river channels.

One aspect of this unusual geomorphology is that normal valley profiles have not developed and river bank heights do not increase along channels such as the Hou Sahong. A second is the presence of former erosion channels on either side, as either dry or infilled channels and are taken as evidence of earlier stream paths.

Obviously, former channels have affected the choice of the damsite which is downstream of all such features. At times of high flows, the channel level rises to around RL 60m at its lower exit point, due to water in the main Mekong River, up from RL 48m in the low flow season.

(c) Dam Site Geology

Geological maps at 1:1,000,000 scale provide a general picture of the geological conditions, with folded Mesozoic rocks striking east-west. More recent geological records available for southern Laos and indicate an east-west trend in the geological sequences. Extrapolation from these maps, air photographs and field observations suggest the land between the Phapheng Waterfall, to the east, and the waterfall near Sipheng, to the west, comprise Triassic Age rocks ranging from generally massive metavolcanics (rhyolites) to thinly bedded sedimentary rocks (shales, siltstones, sandstones and some limestones). The massive rhyolites tend to dominate the project area and there are sedimentary rocks along the left bank of the Hou Sahong at the proposed dam site. The general strike of the rocks is east-west and the dip is consistently to the south at around 30 - 50°. The shales represent continuous planes of weakness in the rock mass although the geometry of the beds does not make their presence a problem of major concern for the proposed dam structure.

At the upstream entrance to the Hou Sahong channel, a wide bar of massive rhyolite is present as seen on the aerial photographs. This also strikes east-west across the entrance and dips to the south. Drilling has confirmed its massive and hard nature. Further zones of hard rock are indicated along the length of the channel by the presence of rapids and intermittent rock outcrops in the various waterways.

(d) Geotechnical Investigations

The geotechnical aspects were undertaken by ASA Engineering, using drilling and seismic sub-contractors. The drilling work was undertaken by sub-contract and was supervised by a drilling engineer and a geologist. Local labour was used for the test pit excavations and the laboratory testing was carried out at Khon Kaen University in Thailand. Reports on this work are contained in Appendix B of the Feasibility Report and were comprised of the following activities:

- Geological and geomorphological traverses
- Drilling, both vertical and inclined boreholes
- Seismic traverses of both banks

- Test pit excavations
- Laboratory testing of both soil and rock samples.

Estimates of the quantities of rock to be excavated from the various worksites are preliminary only, as were investigations into potential borrow areas and disposal sites. In summary, all geotechnical investigations confirm a solid damsite, substantial excavation work at the damsite and entrance to Hou Sahong and considerable additional work to be undertaken on the geotechnical side during the design phase of the DSHEP.

(e) Sources of Materials

i. Clay Materials

Test pits were excavated on the lowermost slopes of the small hill, upstream of the dam site on the left bank in search of impervious core material for the pondage enclosure embankments. This material was found to be limited in extent, unsuitable due to its potential for piping and so the concept of clay cores for the embankments was abandoned in favour of concrete linings on the interior surfaces of embankments.

ii. Alluvial Sands

Small sporadic pockets of alluvial sands occur along most of the channels of the Mekong River. In the dam site area, these are of fine, uniform grading, with a mica content of perhaps 5%. The broad sand deposits, located at the upstream end of Khong Island are coarser in grain size, rounded, and reasonably well graded, with a mica content of 2 - 3%. Sands of this environment should be suitable for exploitation for concrete, although quantities are unknown at this stage. Most of the river alluvium in the area of the dam site is coarse silt and its distribution pattern alters each year with rising and falling of wet season water levels.

iii. Rockfill

Large volumes of rock excavation are anticipated for the DSHEP project. Rock excavated for the entrance of the Hou Sahong would be composed largely of hard quartzite. Potential quarry sites were identified on both banks of the Hou Sahong, at the upstream end of the first major bend above the dam site. The isolated ridge on the right bank would provide a source of hard rock within the reservoir area and would be used for construction of the lower dam site. Excavation of the channel downstream of the dam will generally encounter more bedded rock strata, is likely to comprise smaller rock fragments but could be used for the outside zone of any rockfill embankments.

iv. Coarse Aggregates

Two major lithologies are identified as possible sources of aggregate in the immediate project area: Massive (silicified) rhyolite and quartzite. Both rock types are hard to extremely hard and samples were taken from the quarry sites at the upstream end of the major channel bend, from the entrance area to the Hou Sahong, and from the two investigated dam sites.

v. Soils of the Islands

As noted above the underlying geology of Don Sadam and Don Sahong is planar and is quite hard. The soils are essentially thin layers of silty sands and are of low natural fertility. These soils have very low moisture retention capacities, which further decrease their capability. No soils maps were available or were drawn because of the above factors. There is little variation in the distribution of soils even in the few low lying drainage lines present on both islands. The use of such soils is limited to crops grown during the wet season with its frequent rains. Dry season use is severely limited to grazing by local livestock; as is done at the present time. Wet season cropping of rice is characterized by low yields and fertilizer demands to increase these yields but the use of fertilizers is limited.

4.1.3 Climate

Climate is not a factor of any consequence to the DSHEP, rather feasibility studies are focussed on the water flows in the Mekong River and Hou Sahong, in particular. General climatic data is available for regional locations such as Pakse, in Laos and Stueng Treng, in Cambodia. Daily factors such as rainfall, evaporation rates, sunshine hours or wind speed and direction do not influence the project.

The climate in the project area is characterized by a pronounced wet season from May to October. However, the rain generally falls in relatively short, heavy storms, which are expected to cause only minor disruptions to most construction activities. However, there are risks associated with the temporary flooding of the dewatered Hon Sahong channel. The DSHEP is small and would not affect any climatic factors to any degree.

4.1.4 Hydrology of Mekong River and Site

Detailed analysis of the Mekong River's hydrology is critical to the planning of the DSHEP. The MRC's record of 82 years of flow data is from Pakse and this has been checked against the recent 6 years of data from Steung Treng. The complicating factor is the relative distribution of flows between the various channels through the island and cascade complexes from Khong Island southwards. The percentage flow down any one channel also varies seasonally. For instance flows over Khone Phapheng are estimated at 25% for peak flows (i.e. 16,000 m³/s), 75% for average flows (i.e. 2500 m³/s) and >90% for low flows (i.e. 1570 m³/s) of the corresponding Pakse flow rates. The flow in the Hou Sahong was measured at 79 m³/s (4% of the 2,000 m³/s average flows in the Mekong River at Pakse) in January, 2007 and at 40 m³/s (2.5% of the 1,622 m³/s low rate flows) in March, 2007.

The analysis of hydrology and related flow rates for the Hou Sahong are explained in detail in Section 3 - Hydrology and Hydraulics - of the Feasibility Study Report. The explanation presented in this EIA only highlights the main aspects of the Mekong River flow and regime in terms of the affects on these of the DSHEP.

The most important aspect is the proposal to divert flow from the main Mekong River channel, which downstream flows over Khone Phapheng waterfall, into the Hou Sahong for generation of electricity. The Feasibility Report has assumed that diversion will only be flow in excess of a minimum "environmental flow" that will always be left in the river to maintain flow in the Hou Sadam, Hou Som Yai/Noi and to be discharged over Khone Phapheng. The "environmental flows" considered in the study ranged from 800 m³/s to 1400 m³/s and the economic evaluation is based on a flow of 1.000 m³/s. As Khone Phapheng is a tourist resource with many stakeholders including

the GOL, the "environmental flow" will have to be agreed by GOL. The quantum is of little importance during the high flow season when the natural Mekong River flow at Thakho is well in excess of the minimum and only a small proportion is diverted (2,400 m³/s maximum). However, in the low flow season, the flow will be less than the natural flows (Table 4.2), although it is expected that at these lower flows, the visual appearance of the falls will not be reduced.

The long-term average monthly flow data for Pakse is presented in Table 4.1. This data has been used to estimate the flows over KJione Phapheng for the low flow period and comparing that with the anticipated environmental flows used for engineering estimates in the Feasibility Report. This data shows that:

- The average monthly flow through Thakho varies from 1600 m³/s to 2100 m³/s in the low flow months (Table 4.2)
- The historical minimum flow recorded at Pakse is less than 1100m³/s (Table 4.2)

Table 4.1 - Long Term Average Monthly Flow (m³/s) at Pakse 1924-2006

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Average	2805	2156	1815	1781	2870	8648	17215	27137	27536	16435	8136	4266	10156
Maximum	4350	3096	2425	2492	7202	17551	28706	42477	40031	27423	15366	6262	14306
Minimum	1756	1812	1163	1068	1313	3210	9236	16150	16327	7400	4458	2705	6836
Median	2854	2211	1834	1754	2666	8502	17090	27481	27000	15971	7821	4110	10103

Table 4.2 - Estimated Discharge over Khone Phapheng with Varying Environmental Flows

	Jan	Feb	Mar	Apr	May
Flow at Pakse					
-Average Flow Rate	2805	2156	1815	1781	2870
- Minimum Flow Rate	1756	1812	1163	1068	1313
Estimated flow at Khone Phapheng (Thakho)					
-Average Flow Rate	2075	1595	1670	1639	2129
- Minimum Flow Rate	1616	1667	1070	983	1104
Environmental Flow at 800 m ³ /s					
- Ave Flow Diverted to DSHEP	1275	795	870	839	1329
- Min Flow Diverted to DSHEP	816	867	236	183	375
Environmental Flow at 1000 m ³ /s					
- Ave Flow Diverted to DSHEP	1075	595	670	639	1129
- Min Flow Diverted to DSHEP	616	667	136	0	175
Environmental Flow at 1200 m ³ /s					
-Ave Flow Diverted to DSHEP	875	395	470	439	929
- Min Flow Diverted to DSHEP	416	467	0	0	0
Environmental Flow at 1400 m ³ /s					
- Ave Flow Diverted to DSHEP	625	195	270	239	729
- Min Flow Diverted to DSHEP	216	267	0	0	0

While it is recognized that the Khone Phapheng waterfall is best viewed at lower flows, the amount of reduction in low season flows, the peak tourism months, is critical. Photograph 4.1 shows the waterfall at various discharges and, visually, there is little difference in appearance.



27 May 2006 - Pakse flow = 2,100 m³ / s



13 June 2007 - Pakse flow = 4,130 m³ / s



27 November 2006 - Pakse flow = 3,600 m³ / s



19 January 2007 – Pakse flow = approx 2,300 m³/s



19 April 2006 – Pakse flow = 1,450 m³/s

Photograph 4.1 - Khone Phapheng at Various Discharges

4.1.5 Water Quality of Mekong River

The Mekong River is, by international standards a very clean and unpolluted river, as indicated in the data of Table 1 in Appendix G~ Attachment A. This data is a summary of water quality data provided by the MRC's Environment Programme covering six years from 2000 to 2005 inclusive compiled at the Pakse Water Quality monitoring station. This data shows that there are seasonal and annual differences in all the parameters measured but the levels of variance are small when seasonal factors are considered. As expected the greatest differences relate to the following:

- Temperature, which has an annual minimum of 20.1 to 22.8°C and of a maximum of 28.0 to 29.1 °C
- An annual pH variance of 7.1 to 8.1, with absolute variance of 6.1 to 9.6
- An annual Total Suspended Solid variance in mean of 70 to 130 ppm, with the annual rang between 18 ppm and 364 ppm
- Both conductivity and dissolved oxygen values arc high at 18.4 to 20.2 pS/cm and 6.9 to 8 mg/l, respectively.

These and other factors such as nitrogen and phosphate make this a good and productive aquatic environment for fish. The Mekong River also has an annual bloom of filamentous algae, which provides food for fish, from late December through March. A water quality sampling program was initiated under the EIA for Hou Sahong and the results of one of those data are given in Table 4.3.

Table 4.3 Water Quality Data from Hou Sahong

No	Test	Unit	Results						Analysis Methodology
			HSH1	HSH2	HSH3	HSH4	HSH5	HSH6	
A	Physical								
1	PH		8.3	8.2	7.8	7.9	8.2	8.1	pH probed by Session meter
2	Conductivity	uS/cm	532	534	530	530	538	539	Conductivity probed by Session meter
3	Dissolved Oxygen	mg/l	8.9	9.1	8.8	8.7	8.6	8.1	Dissolved Oxygen probed on Session meter
4	Total Dissolved Solids	mg/l	287	288	286	286	290	291	Photometric
B	Chemical								
5	Total Phosphorus	mg/l	0.12	0.12	0.07	0.06	0.08	0.21	Phosver 3 with Acid Persulfate Digestion (TNT)
6	Total Nitrogen	mg/l	0.2	0.5	0.2	0.6	0.2	0.5	Persulfate Digestion (TNT)
C	Micro-biological								
7	Total Coliforms	MPN/100 mL	12,000	14,000	14,000	34,000	17,000	18,000	MPN (Most Probable Number)

Data collected at six points along Hou Sahong on February 17 2007 by Asa Power Engineering Co., Ltd

The higher dissolved oxygen levels are expected in the Hou Sahong due to the turbulence of the rapids. Also of interest are the relatively low numbers of Total Coliform counts as Most Probable Number/100 mL, again reflecting water turbulence and a remote site.

4.2 Biological Environment

The biological environments of the damsite and of the transmission line route are the most important aspects for the DSHEP. The aquatic and fisheries environment for the Hou Sahong are an integral part of the Mekong River and Siphandone ecosystems and can not be overemphasized. The land environments along the proposed transmission line between the damsite, across the Mekong River and to Ban Hat are comprised of a mixture of paddy land and disturbed forest.

4.2.1 Aquatic Ecology including Fisheries

(a) General Mekong River

The Mekong River basin is host to an estimated 1,300 described species of fish. The number of species appears to be increasing with each passing year, as taxonomic experts reclassify existing fishes and find new species in mountainous areas of Mekong tributaries. This is reduced to 300 plus for the exclusively freshwater sections of the middle Mekong, most of them of commercial, social and economic importance. Most of these are definitely migratory to some degree. Some move only 100 m from mainstream habitats to floodplains

to breed and others move hundreds of kilometres to reach critical habitats. All migrations are cyclical in one form or another. It is obvious that any stoppage or disruption to cyclical migration events causes reductions of varying degrees in affected fish population numbers.

For residents of the Mekong basin, their main source of essential nutrient intake comes from aquatic resources, particularly fish; both large and very small. For local people, the sale of aquatic products is essential to generate household income in terms of cash money. Alteration to their access or disruption to this resource means fishing village communities disintegrate to some degree, so protection of aquatic resources is important.

Hou Sahong is one of many channels where the Mekong River experiences a drop in elevation across the Great Fault Line (GFL) but, unlike most, it has a reasonably even gradient with no significant cascades or waterfalls. Most of the other 18 channels across the width of the Mekong have such features, with only Hou Sadam and Hou Som Yai being accessible for upstream, low flow period movement. Downstream movement occurs in all channels in the high flow season and in the above and some others in the low flow period.

(b) Fisheries Migration Perspective on Hon Sahong

The main aspects of fish migration are complex and migration is being studied over a long periods of time as noted in Appendix G Section G.3. The migration of fish through the Hou Sahong is an issue of substantial interest to the DSHEP, as this channel is open to year round fish migration. It is not closed off by either waterfalls or rock barriers. Fish migration in the Hou Sahong is described as follows:

- Upstream fish migrations from Cambodian waters take place up and over the GFL during the dry season months and fish continue on into Laotian territorial waters and definitely into Thai territorial waters
- During the early to the middle of the wet season months, May and June, another important and different upstream fish migration takes place up and over the GFL. Cambodia is also the origin of the migration and destination habitats are in Laotian and Thai territorial waters at least and perhaps for some species possibly even up into China.
- Downstream (return) fish migrations take place, but over protracted periods and are less clearly defined in terms of time-scale and duration.

Figure 4.2 (from Baran, 2007) graphically indicates the migration pattern across the Great Fault Line.

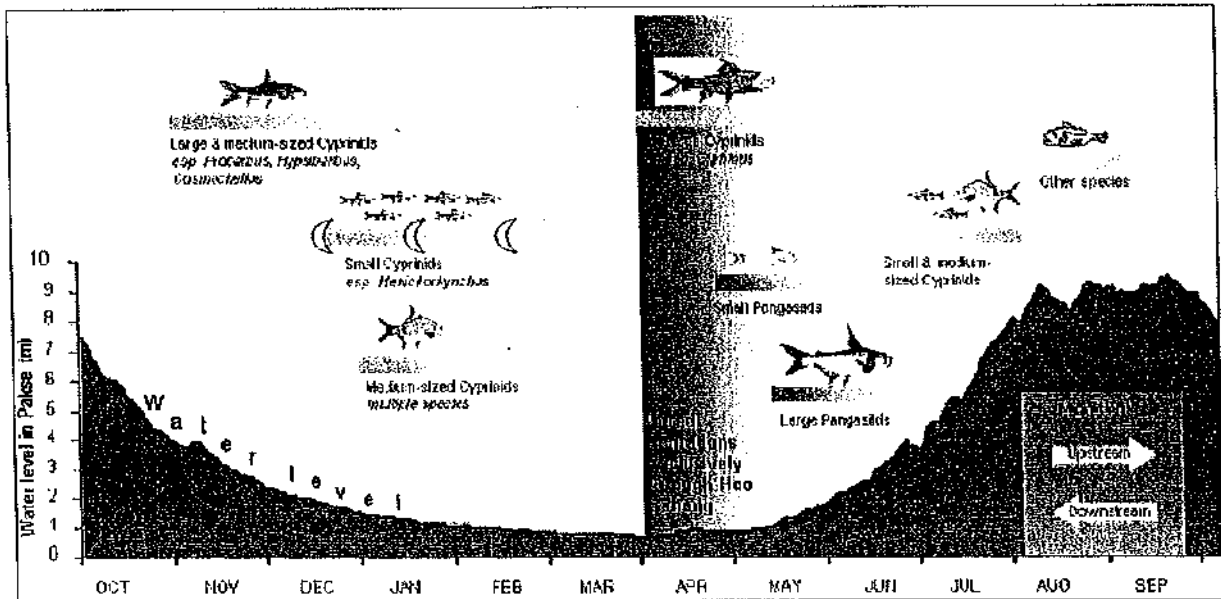


Figure 4.2 - Fish Migration Patterns at Great Fault Line (after Baran 2007)

(c) Main Fish Species Involved in Migration through Hon Sahong

It is difficult to delineate the exact fish species migrating through Hon Sahong at various times of the year. A basic listing of the major species and times of their migration is presented in Table 4.4, which includes nine (9) species in the dry season. However the 35 species listed would be affected to some degree.

Table 4.4 - Partial List of Main Fish Species Migrating Through Hou Sahong

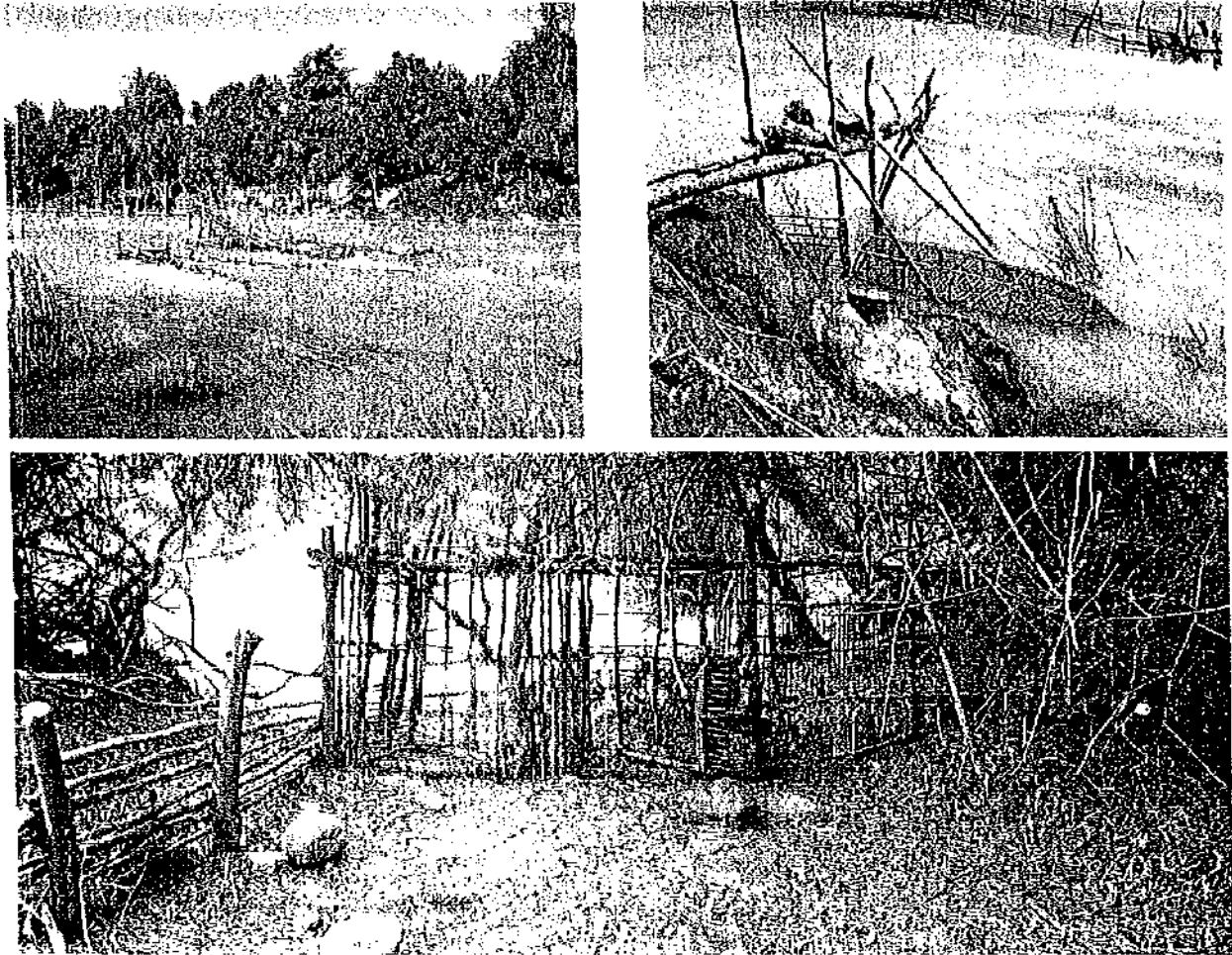
Scientific Name	Lao Name	Major Species
Dry Season Upstream Migration - 4 Months December to April		
Cyprinidae		
<i>Scaphogenus bandanesis</i>	Pa Pien 9	+
<i>Scaphogenus steinegri</i>	Pa Pien 13	+
<i>Cirrihinus microlopis</i>	Pa Pawn	+
<i>Cirrihinus nolitreila</i>	Pa Geng	
<i>Labeo erythropterus</i>	Pa Wa Soong	
<i>Bengana behri</i>	Pa Wa Na Noor	
<i>Erythropterus melangira</i>	Pa Srae	
<i>Hysibarbus sp.</i>	Pa Pak Nout	+
Numerous Small Cyprinids - Estimated at X Species	Pa Saew,	+
Gyrinocheilidae		
<i>Gyrinocheilus pennolri</i>	Pa Goh	

Wet Season Upstream Migration - 3 Months - mid-May to mid July		
Pangasidae		
<i>Pangasius conchophilus</i>	Pa Por / Gae	+
<i>Pangasius larnaudii</i>	Pa Beung	+
<i>Pangasius krempfi</i>	Pa Sooai Hang Leuang	+
<i>Heicophaqus waandersii</i>	Pa Noo	+
<i>Pangasius macronema</i>	Pa Nyawn	+
<i>Pangasius pleurotaenia</i>	Pa Nyawn Tawng Khom	+
Baqnidae		
<i>Hemibaqrus filamentosous</i>	PaKot	+
<i>Hemibaqrus wyckiodes</i>	Pa Kung	+
Siuridae		
<i>Belodonthichthys dinema</i>	Pa Khop	+
<i>Hemisiturus mekongensis</i>	Pa Nang Deng	+
<i>Micronema spp</i>	Pa Nang	+
<i>Kryptopterus spp.</i>	Pa Peekgai 1 & 2	+
<i>Ompok hypothalamus</i>	Pa Peekgai 3	+
<i>Ompok bimaculatus</i>	Pa Seum	+
Sisoridae		
<i>Baqarius yarrelli</i>	Pa Khe Yai	+
<i>Baqarius baqarius</i>	Pa Khe Noi	+
Cyprinidae		
<i>Cyprinus carpio</i>	Pa Nai	
Numerous Small Cyprinids - Estimated at X Species		
Downstream Migration - 6 Months - June to December		
Cyprinidae		
<i>Henichorychus iobatus</i>	Pba Soi Hua Lem	+
<i>Henichorychus siamensis</i>	Pba Soi Hua Bo	+
<i>Labiobarbus spp.</i>	Pba Lang Khon	+
<i>Paralabuca spp.</i>	Pba Dtep	+
<i>Lobocheilus melanotaenia</i>	Pba Kiang	+
<i>Crossocheilus sp</i>	Pba Tok Toi	+
<i>Probarbus julHeni</i>	Pba Eun	+
<i>Labeo erythropterus</i>	Pba Wa Soong	
Minimum Total Estimate - At Least 35 Major Species		

For many years, the GFL was considered to be a zoo-geographical barrier to fish movement (migration). This is true for about eight fish species which are not found above the GFL. There are a very large number of migratory fish species that make bi-directional movements (migrations) up and over the GFL and back down again on an annual basis. The Hou Sahong is by far the most important fish migration route of any channel at the GFL, mainly because of its physical dimensions, and permitting bi-directional fish migrations take place during both the dry and wet seasons.

(d) Fishing Perspective

Fishing in all sections of the Mekong River, and its tributaries and inter-island channels, takes place using a vast range of gears and methods during every month of every year. It is mainly during the periods of fish migration that fishing operations intensify, when often special types of gear are deployed to intercept fish on their migratory pathways,. Hou Sadam, Hou Sahong and Hou Xang Peuk. This is exemplified by the number of different fish traps employed throughout the year (Photograph 4.2).



Photograph 4.2 - Fish Traps in lower Hou Sahong (top) and Hou Sadam (bottom)

Most of the families resident on the islands of the Siphandone region are involved in fishing to some extent and the use of various methods are described in Appendix G. A project such as DSHEP, without mitigation measures, would adversely affect:

- All fishing activities including the Mekong River zone below in the vicinity of Ban Hang Khone and Ban Hang Sadam
- The whole of Hou Sahong
- The barge paths in the Mekong River north of Don Sadam and Don Sahong
- Other areas up and down the Mekong River in the Siphandone area at least and down the Mekong into Cambodia.

4.2.2 Terrestrial Vegetation of Islands and Transmission Line

The investigations into terrestrial vegetation covered both the areas affected on Don Sadam and Don Sahong along the general route of the proposed transmission line from the damsite to Ban Hat substation. This study was carried out by Dr Sengdouane Wayakone of the Faculty of Forestry, National University of Laos and officers from the Champasak Province Department of Forests. These investigators also undertook with the assistance of the EIA team's Birdlife Expert an

evaluation of the wildlife resources in relation to these two areas. Their report is included as Appendix H.

The Forest Department maps forests according to a specific classification in Laos. The relative areas of these forest types for Khong District and for the Project Affected Areas including the transmission line are summarised in Table 4.5. This table shows that the Project could affect some 0.9% of the Khong District forests.

Table 4.5 - Forest Type Comparison Khong District and Project Areas

	Land Use and Forest Types	Khong District	Indicated Project Areas	
		Area (ha)	Area (ha)	%
Land Use and Forest types within the Reservoir and Transmission line	Mixed Deciduous Forest (MD)	27,491.0	63.88	0.23
	Gallery Forest (G)	1,247.8	11.38	0.91
	Unstocked Areas (T) incl Agriculture	10,281.8	346.39	3.37
	Swamp Forest (S)	2,902.8	320.40	11.04
	Dry Dipterocarpus Forest (DD)	47,227.2	77.49	0.16
	Total	89,150.6	819.54	0.92

According to forest cover maps, the field reconnaissance survey and villagers' interviews, many areas of Don Sahong and Don Sadam have been disturbed already by:

- Use of forests near villages and along Hou Sahong for activities such as firewood and making of fish traps
- Conversion of forest land into agricultural land use types and burning for hunting, especially within and around the proposed pondage
- The remaining areas covered by Mixed Deciduous Forests (MDF) occur on the upper slope of Don Sadam and some on the two small islands of Don Kieu and Don Khouak, in Hou Sahong.

Within these relatively undisturbed areas the are main tree species with commercial value include Mai Don (*Pterocarpus macrocarpus*), Mai Pouya (*Lagerstromia balansae*), Mai Deang (*Xylia keirii craib*), Mai Te (*Aszelia x*), Mai Khao (*Adima cordifolia*), Mai Sanen (*Dalbergia hupeana var. laccifera*) and Mai Tieu (*Cratoxylou formosum*). Some Mai Nhang (*Dipterocarpus alatus*) remain in the paddy fields and on private lands. Many of the big trees have been removed by local residents for timber for housing construction and only small diameter regenerated trees remain.

Table 4.6 shows the total area of forest types and the indicated affected areas on Don Sadam and Don Sahong, which shows that Swamp Forests (56%) are the most seriously affected and the other three categories range between 12.6 and 17.1%. However it would be necessary to confirm these figures by detailed inventorying of all forests during the detailed design phase.

Table 4.6 - Comparisons of Don Sadam and Don Sahong and Affected Areas

Land Use and Forest Types	Don Sahong	Don Sadam	Total (Ha)	Total Affected Areas excl Trans Line	
	Area	Area	Area	Area	%
Mixed Deciduous Forest (MD)	-	145.5	145.5	22.8	15.6
Gallery Forest (G)	-	66.6	66.6	11.4	17.1
Unstocked Areas (T) incl Agricultural	253.5	185.0	438.5	55.4	12.6
Swamp Forest (S)	62.4	80.6	142.8	80.0	56.0
Total	315.9	477.7	793.3	169.6	21.3

Note: * Affected areas exclude transmission line

The effects of the DSHEP pondage and associated works are listed in Table 4.7 , which illustrates a number of interesting points from the environmental viewpoint, including;

- Some 25.7% of the land systems of the two islands are affected including over 32% of their forests and between 5.0 and 22.4% of their agricultural lands
- The quantity affected increases to 33.2% directly affected if the two islands and water body of Hou Sahong are included, that is the total island ecosystem which is going to be altered
- A total of 290.7 ha are affected out of a total of 876.5 ha; this is considered a significant impact in terms of the local environment of Don Sadam and Don Sahong.

There are no ways of mitigating these affects as all areas are required for various and other infrastructure and the pondage.



Photograph 4.3 - Secondary growth on right bank, lower Hou Sahong

In addition to these effects on local vegetation is the proposed transmission line, The 20.7 km long transmission line right-of-way (ROW) (30m) has a total land area of some 62.0 ha, including 42.7 ha of agricultural land and 16.3 ha of forest lands This right-of-way has not been decided and would involve tower locations and selective clearing in some forests. As with the effects of the impacts on forests of Don Sadam and Don Sahong this aspect requires detailed inventorying in the design phase of the project.

Table 4.7 - Estimated Areas of Agricultural and Forestry Lands on Don Sadam and Don Sahong Affected by DSHEP Pondage and Works

Location & Land Use	Natural Conditions -ha	Affected by DSHEP-ha	Percentage of Area Affected
Don Sadam - Agricultural	139.9	7.1	5.1%
- Forestry/ Other	334.1	95.1	28.5%
- Subtotal	474.0	102.2	21.6%
Don Sahong - Agricultural	104.2	23.3	22.4%
- Forestry / Other	211.3	77.6	36.7%
- Subtotal	315.5	100.9	32.0%
Two Island Land Systems	789.5	203.1	25.7%
Hou Sahong ~ Small Islands	11.3	11.3	100%
Hou Sahong - Water	76.3	76.3	100%
Total Ecosystem of Islands	876.5	290.7	33.2%

4.2.3 Wildlife Resources

The status of the wildlife resources in the DSHEP are indicated to be poor, largely through isolated environments on the islands and predation of any wildlife. The islands are small and have been inhabited for at least 60 years. Discussions with local residents confirm the various wildlife aspects. Of concern to the DSHEP would be the presence in Hou Sahong of any Smooth-coated otters, a Protected Species. Only occasional visiting wildlife other than for small mammals, amphibians and reptiles as indicated in Table 4.8.

Table 4.8 - Wildlife Status Within and Around the DSHEP Project Area

NO	Common Name	Scientific Name	Local Name	Sahong Sadam	River Bank	Tran Line	Remark
1	Slow Loris	<i>Nycticebus coucang</i>	ລິງລົມ				✓
2	Sunda Pangolin	<i>Manis javanica</i>	ມົ້ນ				✓
3	Long-tailed Macaque	<i>Macaca fascicularis</i>	ລິງແສນ				✓
4	Smooth-coated Otter	<i>Lutrogale perspicillata</i>	ນາກຂົນລຽບ				✓
5	Eurasian Wild Pig	<i>Sus scrofa</i>	ໝູ່ປາ				✓
6	Sambar	<i>Cervus unicolor</i>	ກວາງ				✓
7	Red Muntjac	<i>Muntiacus muntjak</i>	ຝາມຫ້າມະດາ				✓
8	Small Indian civet	<i>Viverricula indica</i>	ຜັງນ້ຳ				✓
9	Water Monitor	<i>Varanus bengalensis</i>	ເກີຍ				✓
10	Bangal Monitor	<i>Varanus Bengalensis</i>	ແລນ				✓
11		<i>Physignathus cochinensis</i>	ກະສາງ				✓
12	Monocled Cobra	<i>Naja Kaouthila</i>	ນູເຂົ້າ				✓
13	King Cobra	<i>Ophiophagus hannah</i>	ຈູງຄວາ				✓
14	Reticulated Python	<i>Python reticulatus</i>	ຈູນາເຮັກ				✓
15	Rat snake	<i>Ptyas mucous</i>	ຈູຜິ່ງ				✓

Evidence of bird present in literature review and interviews

- Observed during in the field survey
- 0 Not Evident in the field survey

4.2.4 Birdlife

The assessment of birdlife was completed in conjunction with the Forestry aspects, included the same areas and was undertaken by Mr Sengrath Phirasack of the Division of Forest Resource Conservation. The DSHEP study area was divided into three parts, including transmission line, Mekong River Banks and Don Sahong and Don Sadam including the Hou Sahong channel area. A list for comparison is included for the nearby area of Xe Pian National Biodiversity Conservation Area (NBCA in Appendix I.

Field work was executed with a representative of the Provincial Agriculture Forestry Office (PAFO), local village headman and a local hunter to conduct onsite surveys of birds. The survey team slowly walked along transmission line, Mekong River bank and affected areas of Don Sahong and Don Sadam observing and recording birds noting any signs thereof. There were also interviews with local people during evenings and stops. Birds identification used A Guide to the Bird of Thailand (*Lekagu! et al. 1991*).



Photograph 4.4 - Intermediate Egrets (*Egretta intermedia*) at Ban Houa Sadam

Table 4.9 lists 48 species of bird occurring or potentially occurring in DSHEP project area (including five (5) species listed as Endangered Species of Category T of Regulation No. 360, which is a Department of Forestry Regulation on Species Listed for Conservation Purposes in Lao PDR). Some 41 of these species were found or reported from Don Sahong and Don Sadam, 38 species from the transmission line corridor and 19 species from the Mekong River areas. To some extent this reflects the effort put into the observation periods with only limited time spent at the river areas. None of the bird species for the Don Sadam and Don Sahong are indicated to be Protected Species in the DSHEP project island area. However, some are indicated for the transmission line corridor and the exact effects on these species are to be confirmed when more details are available on project plans, especially for the transmission line.

Table 4.9 - List of Bird Species of Don Sahong HEP Project Areas

N0	Common Name	Scientific Name	Local Name	Sahong Sadani	River Bank	Tran Line	Remark
1	Chinese Francolin	<i>Francolinus pintadeanus</i>	ນົກທະຫາທົ່ງ	*		*	✓
2	Bar-backed Partridge	<i>Arborophila brunneopectus</i>	ນົກທະຫາສີນ້ຳຕານ	*		*	❖
3	Red Junglefowl	<i>Gallus gallus</i>	ໂກ່ປາ	*		*	✓
4	Green Peafowl	<i>Pavo muticus</i>	ນົກບູງ	*			✓
5	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	ນົກເຮັດແດງ		*		✓
6	White-winged Duck	<i>Callina scutulata</i>	ນົກເຮັດທາ		*		✓
7	White-bellied Woodpecker	<i>Dryocopus javensis</i>	ນົກເປັດຂາຍຳສາມສາວ	*		*	✓
8	Grey-headed Woodpecker	<i>Picus canus</i>	ນົກເປັດທົ່ງສີດຳ	*		*	✓
9	Greater Yellownape	<i>Picis flavinucha</i>	ນົກເປັດໄຂ່ສອນແສງ	*		*	✓
10	Common Flameback	<i>Dinopium javanense</i>	ນົກເຊຊຶ້ງຄຳ	*		*	✓
11	Lineated Barbet	<i>Megalaima lineata</i>	ນົກທະລິນສຳມະດາ	*		*	✓
12	Green-eared Barbet	<i>Megalaima falostriata</i>	ນົກທະລິນສຸຂຽວ	*		*	❖
13	Oriental Pied Hornbill	<i>Anthraceroceros albirostris</i>	ນົກແກງ	*			✓
14	Great Hornbill	<i>Buceros bicornis</i>	ນົກກົກ	*			✓
15	Indian Roller	<i>Coracias benghalensis</i>	ນົກທະລາຍທົ່ງ	*		*	❖
16	Common Kingfisher	<i>Alcedo atthis</i>	ນົກທະເທັດສາມສາວ		*		❖
17	Dollarbird	<i>Eurystomus orientalis</i>	ນົກທະລາຍເຖິງ	*		*	✓
18	Common Kingfisher	<i>Alcedo atthis</i>	ນົກທະເທັດສາມສາວ		*		❖
19	Indian Cuckoo	<i>Cuculus micropterus</i>	ນົກຫຸກຸຍິນແທນ	*		*	❖
20	Asian koel	<i>Eudynamis scolopacea</i>	ນົກກາເຜົາ	*		*	❖
21	Drongo Cuckoo	<i>Surniculus lugubris</i>	ນົກຫຸກຸແຊວແຊວ	*		*	❖
22	Greater Coucal	<i>Centropus sinensis</i>	ນົກກິດ	*	*	*	❖
23	Lesser Coucal	<i>Centropus bengalensis</i>	ນົກກິດນ້ອຍ	*	*	*	❖
24	Vernal Hanging Parrot	<i>Loriculus vernalis</i>	ນົກແກ່ງຟາກອນ	*		*	❖
25	Barn Owl	<i>Tyto alba</i>	ນົກເຄົ້າແມວ	*		*	❖
26	Oriental Bay Owl	<i>Phodilus badius</i>	ນົກເຄົ້າສີນ້ຳຕານ	*		*	❖
27	Collared Scops-Owl	<i>Otus lampiji</i>	ນົກເຄົ້າຫຼຸ	*		*	✓
28	Brown Fish Owl	<i>Kalupa zeylonensis</i>	ນົກເຄົ້າປາສີນ້ຳຕານ		*		✓
29	Brown Wood Owl	<i>Strix leptogrammica</i>	ນົກສີດຳ	*		*	✓
30	Spotted Dove	<i>Streptopella chinensis</i>	ນົກເຂົ້າຕູ້	*	*	*	❖
31	Red Collared Dove	<i>Streptopella tranquebarica</i>	ນົກເຂົ້າທອງ	*		*	✓
32	Emerald Dove	<i>Chalcophaps indica</i>	ນົກເຂົ້າປັກລຽວ	*		*	✓
33	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	ນົກເປົ້າຕີນແສງ	*		*	✓
34	Pin-tailed Green Pigeon	<i>Treron apicauda</i>	ນົກເປົ້າຫາງແຫຼມ	*		*	✓
35	Green Imperial Pigeon	<i>Ducula aenea</i>	ນົກເປົ້າທະກະສຸຂຽວ	*		*	✓

36	White-rumped Vulture	<i>Gyps bengalensis</i>	ແຫງຄໍຍາວ	*	*	*	✓
37	Red-headed Vulture	<i>Sarcogyps calvus</i>	ແຮງຫົວແດງ	*	*	*	✓
38	White-rumped Falcon	<i>Polliferax insignis</i>	ແຊວນອຍທໍ້ຂາ	*		*	✓
39	Great Egret	<i>Egretta alba</i>	ນົກຍາວໃຫຍ່	*	*	*	❖
40	Intermediate Egret Plumed	<i>Egretta intermedia</i>	ນົກຍາວກາງ	*	*	*	❖
41	Black Drongo	<i>Dicrurus macrocercus</i>	ນົກແຊວຄໍ	*	*	*	❖
42	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	ນົກແຊວກາງກວນແອຍ	*	*	*	❖
43	Oriental Magpie Robin	<i>Copsychus saularis</i>	ນົກເດີນຍາມ		*		❖
44	Common Myna	<i>Acridotheres tristis</i>	ນົກລຽງໂມງ	*		*	❖
45	Hill Myna	<i>Gracula religiosa</i>	ນົກສາສິກາ	*		*	❖
46	Stripe-throated Bulbul	<i>Pycnonotus flinlaysoni</i>	ນົກຂວກຄໍລາຍ	*		*	❖
47	Oriental Darter	<i>Anhinga melanogaster</i>	ນົກຄໍຈູ		*		❖
48	Streak-eared Bulbul	<i>Pycnonotus blanfordi</i>	ນົກຂວກແກນສຸພຸຊາ	*		*	❖

- ✓ Evidence of bird present in literature review and interviews
- ❖ Observed during in the field survey
- 0 Not Evident in the field survey

4.3 Communities and Cultural Aspects

The community and cultural aspects of the DSHEP have been studied in several ways including:

- Undertaking a household socio-economic survey of the main communities affected by the Project - see Appendix A
- Preparing a detailed Resettlement Action Plan (RAP) for the moving of 14 families from Ban Hang Sahong, Ban Hang Sadam and Ban Thakho - see Appendix C
- Preparing a preliminary Social Action Plan (SAP) for the DSHEP - see Appendix B
- Completion of a Public Health Survey for the main communities in the DSHEP area — see Appendix D
- Undertaking investigations and reporting on the Unexplored Ordinance (UXO) (Appendix F), and
- tourism in the surrounding areas of DSHEP - see Appendix E.

In addition the EIA Study Team undertook discussions and research investigations with the staff of international NGOs including MRC, IUCN and WWF relating to the communities and natural resources likely to be affected by the DSHEP. The proposal for the Siphandone Wetlands as a Ramsar site has been included in this section, as it currently being advocated by a number of institutions within Laos - see Appendix J.

This section highlights the findings of these reports to give a summary of the importance, not only of the DSHEP project area, but also to attempt to show that the communities, their residents and uses of local resources are an integral part of the region.

4.3.1 Regional Setting

The DSHEP is situated in Khong District, one of the ten districts in Champasak Province and is located in the extreme south bordering Cambodia. Administratively, Khong District is divided into eleven clusters of villages of which five (5) are situated on the eastern bank of Mekong River and six (6) among the islands in the Mekong River. The general makeup of Khong District is:

- Total land area covering about 149,600 ha of which 103,250 ha is forest area and 33,370 ha is agricultural land
- 134 villages with some 13,147 households and a total population of the district is 72,922 persons of which 37,947 are females
- Ethnic diversity is dominated by people of Lao Loum (98.3%) and a small proportion of Brou(Mon Khmer) (1.7%)
- Main livelihood are a combination of cultivation of rainfed paddy, which is for their families sustenance and fishing which is for sustenance and cash incomes with cattle raising and small businesses also important on the mainland.

With numerous islands Khong District is difficult to administer especially when the high levels of the Mekong River during the wet season are considered as many of them rely on boats as their only means of access, the DSHEP area included.

Highway 13 South is the prime access route in the region, provides access to the DSHEP and increases in importance with daily increases in traffic volume. Major developments within this part of Khong District include extraction of forest resources and tourism. The latter is essentially based on the attractions of the islands focussed on accommodation facilities on Don Det and Don Khone and the attractions of Khone Phapheng waterfall.

4.3.2 Island Communities

The DSHEP is on Hou Sahong, the channel which separates Don Sadam and Don Sahong. The other two main channels on either side are Hou Sadam and Hou Xang Peuk. All three are major channels of the Mekong River and are passable throughout the year with Hou Xang Peuk having many barriers to fish passage and Hou Sadam is much narrower the Hou Sahong.

The islands of Don Sadam and Don Sahong are essentially subsistence communities based on agriculture and fishing with limited local trading opportunities other than for minor agricultural products such as fruit crops and small livestock. Only small shops with limited stock made up of essentials (eg soap products and petrol) and refreshments exist in these island communities. All major items are bought on trips by boat to mainland Mekong River communities.

The general land areas under control of the village administrations are indicated in Table 4.10 but as noted this is complicated by lack of registration of Town Plans as yet, with the Khong District authorities. Hang Khon, Hang Sadam and Veunkham villages share the border with Cambodia. The planned project site on the Hou Sahong involves both Don Sadam and Don Sahong and three village administrations in total.

Table 4.10 - Indicated Land Area of Project Area Communities

No.	Village	Total - ha	Remarks
1	Hang Sadam	369.1	No registered plan with District
2	Houa Sadam	133.0	No registered plan with District
3	Don Sahong	125.6	No registered plan with District
Affected Communities		627.7	
4	Thakho	424.0	Part of village subject to moving
5	Bung Ngam/ Veunkham	8,171.8	This is a merged village between Veunkham and Bung Ngam
6	Hang Khon	643.1	Has registered Town Plan
Total		9,866.6	

Source: Annual Report of Khong District, 2006

Notes: Because no Town Plan is registered with the Khong District only land claimed by residents for tax can be used; it approximates the calculated land for Don Sadam (502.1 vs 474 ha) but underestimates the area for Don Sahong (125.6 vs 316.0 ha).

These island communities are important to not only their local residents but to the entire make-up of Khong District as they are based on carefully balanced exploitation of local natural resources and any disruptions to that balance, for example by the construction of the DSHEP, could have consequences to the integrity of the island systems.

4.3.3 Socio-economic and Household Surveys of Project Area

(a) Introduction and Methodology

ATM Consulting Co. Ltd. was sub-contracted to carry out a socio-economic baseline survey in the general project area. The company designed the data collection, methods and details, while for the actual data collection, data processing and analysis it was assisted by a team from National Agriculture and Forestry Research Institute (NAFRI). The survey team consisted of 10 persons; two from ATM Consulting Co. Ltd., six from the (NAFRI) and two from Khong District Agriculture and Forestry Extension Office (DAFEO) This survey included a household survey of six villages in and around the DSHEP including

- Three villages on the islands of Don Sadam and Don Sahong
- One village on an adjacent island: Ban Hang Klione Tai
- Two villages on the mainland at Ban Thako and Veunkham/ Bung Nam.

The household (HH) surveys included 60 interviews from the island communities and 57 from the mainland communities or 117 out of 551 households or 21% sampling rate. Analysis of the HH Survey was executed using the SPSS system. The overall socio-economic survey included group discussions with village administrations, gender groups and guesthouse, restaurant and boat service operators as outlined in Table 4.11 and selection of interviewees in Table 4.12. The details of the socio-economic survey including results of the household survey are included in Appendix A.

The sample is considered representative of the DSHEP project area and any preliminary overall results accepted. It is to be noted that an additional 10 household in the community of Ban Hang Sahong were interviewed and the results of that household survey are contained in the Resettlement Action Report (Section 6).

Table 4.11 - Existing Activity & Business Groups in Project Area Communities

Activity Groups	Village Name					
	Thakho	Veunkham/ Bung Ngam	Hang Sadam	Houa Sadam	Hang Khon	Don Sahong
Village Administrations	Yes	Yes	Yes	Yes	Yes	Yes
Gender Groups	Yes	Yes	Yes	Yes	Yes	Yes
Guesthouses	NE	Yes	NE	NE	NE	NE
Restaurants	Yes	Yes	NE	NE	Yes	NE
Boat t Service	NE	Yes	NE	NE	Yes	NE

Note: NE denotes "Not exist" in the local village.

Table 4.12 -Number of Individual Households Selected for Household Survey.

Villages	Household Sustainability Category				Total Household Selected
	Sufficient		Below Sufficient or Poor		
	Actual Number	Selected	Actual Number	Selected	
Thakho	100	24	74	7	31
Veunkham	188	16	10	10	26
Hang Sadam	93	12	3	3	15
Houa Sadam	67	9	7	6	15
Hang Khon	42	11	7	4	15
Don Sahong	61	11	10	4	15
Number of Households	551	82	111	35	117
Percentage of Household Category	83	15	17	32	100

(b) Analysis of Household Survey

i. Population Characteristics

A complete analysis of the Household Survey is included in Appendix A and only the main factors are summarized in this section, with the emphasis on (he island residents.

The history of the island communities is mixed with some coming during the colonial period (1890s to Don Sahong) to assist with transmission of goods and people and others from outlying areas such as Khong Island migrating for new opportunities such as availability of land and for fishing (1930s and 1940s) to Don Sadam.

The population of the island communities is 1398 persons with a male:female ratio of 1:1.05 and makes up a little over 36% of the project areas population. The average family size is approximately 5.8 persons. The majority of the island residents are Lao Loum at 98.7% with a small number of Mon Khmer persons at 1.3%, as shown in Table 4.13.

Table 4.13 - Village Populations and Ethnicity

No.	Village	Population Numbers				Ethnic Composition	
		Total	Male	Female	Families	Lao Loum (%)	Mon Khmer (%)
1	Hang Sadam	527	284	243	96	100	0
2	Houa Sadam	426	220	206	74	99.6	0.4
3	Don Sahong	445	213	232	71	95.9	4.18
Subtotals		1398	717	681	241	98.7	1.3
4	Thakho	1156	580	576	174	100	0
5	Veunkham	998	481	517	198	100	0
6	Hang Khon	282	135	147	49	100	0
Total		3834	1913	1921	662		-
Percentage of total		100	49.9	50.1		99.2	0.8

ii. Sufficiency and Disadvantaged Groups

Some 12% of the island households directly affected are indicated to be "below sufficiency levels" but this increases to almost 22% for mainland residents, reflecting their lack of agricultural lands or recent migrant status in Thakho. (Table 4.14) Also of concern is the 9% level of female headed households on the island, which would warrant particular attention when trying to implement a social action plan to help these communities. There is a relatively high incidence of orphans in the mainland communities which reflects their functions with the recent presence of transient populations. Particular attention would be given to these groups during further planning for DSIIIEP.

Table 4.14 - Living Standards and Disadvantaged Groups of Project Area

No.	Village	Total HHs	Sufficiency		Number of Disadvantaged		
			Below	Enough	Female Headed HH	Orphans	Physical or Mental Handicap
1	Hang Sadam	96	3	93	5	1	4
2	Houa Sadam	74	7	67	10	3	1
3	Don Sahong	71	20	51	6	10	3
Island Subtotals		241	30	211	21	14	8
4	Thakho	174	74	100	5	10	4
5	Veunkham	198	10	188	16	14	8
6	Hang Khon	49	7	42	6	0	1
Other Subtotals		421	91	330	27	24	13
Total		662	121	541	48	38	21

Note: Criteria developed by the Poverty Alleviation Program and are based on permanent house, self-sufficiency in agricultural production and access to school, safe drinking water and health treatment.

iii. Electricity, Transportation and Communications

Only one village (Thakho) has been connected to the electricity network while poles have been erected to extend supply to Veunkham, although conductors are not strung. There are no plans for any connections to the island communities as the market is too small and connection costs excessive. Two villages, Thakho and Veunkham are accessible through sealed roads connected to the paved Highway 13 South. Houa Sadam, Hang Sadam, Don Sahong and Hang Khone are situated on the islands and can only be accessed by boat. Both motorized and paddle boats are important transportation means in the area with some 202 motor-boats and 149 paddle boats available mainly to island residents. Some 160 motorcycles and 320 bicycles are also available with only small numbers in the island communities. Two telephone networks; Lao GSM and ETL exist in the project area but only about 4% of the population have mobile phones. These have facilitated people in accessing information for businesses and for communicating with village people, although the number of mobiles owned by the island residents is still small. It is obvious that motorcycles, bicycles and mobiles dominate the mainland and boats the island communities.

Fish processing is the only cottage industry of any note in the project area.

Table 4.15 - Retail Facilities, Transportation and Communications in Project Area

Descriptions	Numbers
Retail shops	40
Restaurants	25
Small drum-based petrol outlets	14
Drug stores	3
Tailor shops	2
Mechanical repair and battery charging shops	3
Hand tractors	41
Cars and Trucks (light vehicles)	5
Motorcycles	160
Bicycles	320
Boats (paddle)	202
Boats (motorized)	149
Mobile phones	182

iv. Access to Education Facilities

Education background of majority of the interviewed families is very low with about 57% having primary school level, 20% having lower secondary level 8% having upper secondary or vocational level schooling. Illiteracy rate was high at 8.5%..

Every village in the project area has a primary school. There are some 482 students in primary schools with 19 teachers. Beyond primary level only Houa Sadam has a lower secondary school or children have to stay with relatives at Nakasang and Khinak. Most students stop studying after primary school and engage in fishing and farming activities. There are only 28 students studying at lower secondary and 16 at upper secondary from all the six villages in the project area.

v. Access to Water, Sanitation and Health Services

Over the project area, there are only 25 deep wells and all are located in mainland villages. The majority of the population especially in all island villages are still dependent on Mekong water as a single source for boiled drinking water and other domestic uses. None of these island villages has a deep or shallow well. The number of sanitary toilets is limited and only 21% of households have access to a toilet, of which 18% are pour/ flush toilet types and the remaining 79% do not have any type of toilet. These two aspects of good water supplies and toilet facilities also should be noted and rectified in the regional social action plan, if the DSHEP is implemented.

In the project area, there is only one primary healthcare centre at Ban Khone Yai . There were 15 midwives, 6 health workers, 8 traditional healers, 4 drug revolving funds and 3 pharmacies. Most villages had traditional healers and midwives of varying capabilities. People with serious illness attend either Khong District Hospital located about 19 km (to nearest village) to 45 km (farthest away village) or Khinak healthcare or Pakse Provincial Hospital). Village health workers are trained in primary health care service, are provided with drug revolving funds and are supported by government funds or NGOs' projects. Campaigns are run for vaccination for children, malaria, tuberculosis and diarrhoea prevention and visits from the District Health Office follow up on health care activities and pre-season of disease outbreaks.

Detailed comments on the health "aspects including the incidence of diseases are contained in Section 4.4 and differ somewhat from the data collected from household survey, but show that:

- Malaria was the most common disease reported with more than 19% of people having been infected but has improved with mosquito nets
- The incidence of diphtheria (5%) and diarrhoea (4%) are also common
- No cases of HIV/AIDS are reported.

The Social Action Plan for the DSHEP include suggestions for supporting key health activities.

vi. Occupations

Some 80% of persons classify themselves as farmers because land ownership and rice are the keys to their well-being but fishing is seen as source of cash income. Also related farming pursuits such as livestock raising. They are actually farmer/ fisherman, although only 6% classify themselves as fishermen only. Small numbers of mainlanders (11%) state retailers, traders and casual labourers as their main occupations.

This has serious implications to the DSHEP not only from the viewpoint of fisheries being affected but also from (he unwillingness of local residents to forgo their annual agricultural pursuits. This would require detailed planning by the project to overcome this and the apparent lack of skills in local population for employment.

vii. Food Consumption

Rice and vegetable are the two main food items consumed daily and fish is the main protein source at rates of 19 to 21 times a week. Eggs and fruits intake are found to be low at 3 to 6 times per week and a few households consume milk.

viii. Trade

As noted earlier, local trade is very limited and most items are acquired in regional centers such as Nakasang or Khinak and Veunkham, where they travel by boat especially from the island communities and have contacts from their fish sales. Major items are also bought on trips by land transport to Pakse.

ix. Boat Services

The project area is dependent on its 5.5 to 13.0 horse-power boats. These are used for all personal transportation and also for tourist operations seasonally based on dolphin watching and tourism. This is a source of income to local boat operators in Veunkham and Hang Khone but not in the other communities, nor to the extent of the villages such as Nakasang and Khone Tai further north. Attention should be paid to this fact and local luring policies adopted for the island villages and Thaklio during construction activities.

x. Household Income and Expenditure Patterns

The income patterns of individual households were quite varied and small except for incomes from fishing and trading as shown in Table 4.16.

Table 4.16 - Sources of Income from Household Survey

No.	Source of income	Rank [§]	Total Income for All Households
1	Sale of fish	1	USD 68,900
2	Sale of livestock	2	USD 21,500
3	Sale of agricultural products	3	USD 7,500
4	Casual labor	4	USD 5,900
5	Cash remittances	5	USD 5,100
6	Business and service	6	USD 88,900*
7	Sale of forest products	7	USD 11,400* Veunkham Only

Notes: § 1 = very important to 7 = less important, and

* Mainland only and applies to businesses

Household income came from both on-farm and off-farm activities and are important sources of people's income. Table 4.16 shows that the most important sources for project area residents are from fish followed by livestock and agriculture production. The amount of cash income from particular sources varies greatly among households and across the type of products they sell (Table 4.17).

Although the greatest numbers of people (74%) are engaged in paddy cultivation, only limited numbers (14%) have surplus production of rice for selling. Whereas for fishing, 77% participate, 65% sell and earn 5,900,000 Kip (USD 600) per household. The other big earner is trading with 26% participating and earning for an average of 7,590,000 Kip (USD 755). The rest of the individual household earnings are quite small but are important to those benefiting to generate cash for daily expenses. These data highlight the importance of fishing as the primary source of cash income for some 65% of the project area households.

Table 4.17 - Sources of Annual Household Cash Income from Project Area

Type of income	% of HH involved in activity	% of HH getting cash income	Total cash income for surveyed households (Kip)	Ave. cash income per HH getting cash income (Kip)
Agriculture				
Rice	74	14	56,087,000	479,376
Vegetable	3	1	3,000,000	25,641
Fruit	63	27	13,790,000	117,863
Other	19	1	2,500,000	21,367
Total		-	75,377,000	644,247
Livestock				
Buffalo	46	11	70,900,000	605,982
Cattle	22	15	84,700,000	723,931
Pigs	55	33	41,420,000	354,017
Goats	1	1	200,000	1,709
Poultry	70	38	18,720,000	160,000
Total		-	215,940,000	1,845,639
Other sources				
Fish and fish products	77	65	688,325,000	5,883,120
Timber	5	5	114,300,000	976,923
Firewood and charcoal	1	1	2,000,000	17,094
Wild animals	1	1	300,000	2,564
Services	8	8	54,440,000	465,299
Wages earned	9	9	58,720,000	501,880
Trading	26	26	887,940,000	7,589,230
Handicraft	2	2	250,000	2,136
Remittances	7	7	51,200,000	437,606
Other income	16	16	112,590,000	970,603
Total		-	1,970,065,000	16,846,455

The expenditure patterns are even more difficult to determine but in general indicate where money is spent and what the project area households see as far as priorities for their spending of cash income (Table 4.18). The calculated average annual expenditure per household is 8,800,000 Kip or USD 880. Analysis indicates these to be medicine (I), rice

for subsistence (2) and transportation (3). These expenditure items account for some 35% of expenditure and are all essential to local household survival, especially those on the islands. Another 40% of household is expended on items such as clothes (4), house construction (5), education (6), meat (7) fish (8) and energy (9). These expenses are also essential and is noted that fish ranks 8th on the list, again highlighting its ready availability and importance. It is also interesting to note the relatively low ranking of education (6th), partially due to the amount of discretionary income, limited local opportunities and expense of having children away from home. In summary, the general low standards of income and expenditure reflect the general status of the DSHEP areas population, which is above poverty line but dependent on the areas natural resources, particularly its fish.

Table 4.18 - Household Expenditure Patterns in Project Area

Expenditure items	%of Households Included	Average annual expenditure per Household (Kip)	Total (Kip)
Rice	64	1,011,991	118,403,000
Maize	9	5,051	591,000
Vegetable	51	289,504	33,872,000
Fish	50	591,205	69,171,000
Meat	85	638,333	74,685,000
Oil/spices	85	380,025	44,463,000
Firewood/charcoal	32	147,880	17,302,000
Electricity	25	79,726	9,328,000
Kerosene	55	422,111	49,387,000
Medicine	91	1,323,162	154,810,000
Education	67	658,598	77,056,000
Clothes	94	772,957	90,436,000
Tools for production	46	215,487	25,212,000
Household items	52	147,726	17,284,000
Construction of house	25	723,589	84,660,000
Transport	60	902,478	105,590,000
Communication	37	415,247	48,584,000
Others	10	207,413	24,060,000
Total	-	8,799,391	1,044,303,591

xi. Energy Patterns

Firewood and charcoal are the main sources of energy used for cooking purpose. Fire wood is easily collected from adjacent degraded forest and there are no specific sites nominated for this purpose. Other sources of firewood include drift wood in the Mekong River during flood season. Generally, collection is for home consumption but not for sale and a permit is required if collected for sale or commercial charcoal making. Charcoal is used in the wet season on the islands and many residents make their own charcoal. Charcoal is made commercially as a by-product of logging operations, past or present, and is available only on the mainland. It is sold onsite at about Kip 10,000 per 50 kg bag and 32% of households

were reported to spend more than Kip 150,000 per year on buying charcoal or firewood for cooking.

For lighting purpose, three (3) sources including electricity, kerosene, and battery are identified. No one was reported to use solar energy. Only Thaklio has been electrified to date and kerosene has been traditionally used for lighting but is gradually being replaced by small gas generators but to a limited degree on the islands. About 55 % of households are reported to spend an average of about Kip 420,000 per year on kerosene for lighting. Batteries are used to a limited extent in Veunkham, for TVs and lights where charging facilities exist.

(c) Local Village Administration

This aspect is considered most important as it is these organizations the DSHEP would have to liaise with on a day-to-day basis. The administrative make-up of the village authority units include:

- Villages are headed by a village head and his two deputies; with the village head elected every two years and a new team formed
- Administration is organized into several functions such as healthcare, education, finance and land tax, culture, forestry, statistics, quasi-police, and quasi-military with a villager as leader
- Two important village organizations are Lao Womens' Union and Lao Youth Organization; with roles in assisting in village development activities
- Village elders' organization whose role is to assist in village administration, in conflict resolution and building awareness for local development programs.
- Under certain circumstances, specific fishery group or resource development committees can be organized to perform tasks for political, security, socio-cultural and economic development purposes.

The whole village authority is set up under the leadership of the village party committee, who provide overall guidance and in principle, should officially report directly to the District Governor. However, in practice, special District teams are formed to oversee local matters in terms of specific village clusters or zones to which the each village reports. This administrative set-up is constantly changing and project site managers and supervisors would commence with contacting these bodies prior to initiating any work and establishing a firm relationship with village authorities.

(d) Gender Roles and Patterns in Local Villages

No women are found to be in any designated village authority leadership positions, however, at the individual household level there are shared responsibilities and involvement for all household and economic activities. There are clear connections between types of activity and gender as shown in Table 4.19. Men are engaged more in activities needing more physical strength associated with agricultural land preparation such as ploughing (88%), canal maintenance (83%), rice threshing (68%) and transportation (67%). Women tend to dominate all the other 16 tasks included in the HH Survey such as:

- Rice sowing, weeding, harvesting and hulling (62 to 95%)
- Cooking, looking after children and sewing clothes (94 to 99%)
- Fetching water and maintaining water supply systems (76% and 91%)
- Fire wood and fodder collection (78%)
- Livestock raising (77%)
- Selling home products or trading, shopping (80 to 84%).

It is to be noted that relative roles in fishing activities were not asked in the HH Survey but fishing is dominated by men although women play an active role in fishing, especially during the dry season and for smaller species, as well as having a major role in fish processing.

Table 4.19 - Gender Share in Household Activities in Project Area

No.	Activities	Share in labor (%)	
		Male	Female
1	Ploughing/digging	88.4	11.6
2	Manuring/Fertilizing	47.5	52.5
3	Land preparation	76.4	23.6
4	Plantation/Sowing	25	75
5	Weeding/Hoeing	15	85
6	Canal maintenance	83.4	16.6
7	Harvesting	38.4	61.6
8	Transportation/Storing	66.6	33.4
9	Threshing grain	68.4	31.6
10	Fuel wood/fodder collection	22.5	77.5
11	Rice hulling	5	95
12	Livestock raising	23.4	76.6
13	Agricultural labor	47.5	52.5
14	Cooking	0.8	99.2
15	Fetching water	24.2	75.8
16	Maintaining water supply system	8.4	91.6
17	Looking after children	5.8	94.2
18	Weaving or sewing clothes	3.4	96.6
19	Shopping	15.8	84.2
20	Selling/Trading	19.2	80.8

Of particular interest is the dominant role women assume in decision-making affecting all household activities as exemplified by Table 4.20. This does not include the sale of assets such as land and houses and probably fishing activities. This fact should be acknowledged in the planning of development activities for the social action plan and by project authorities operating in the area.

Table 4.20 - Gender Share of Decision making in Households of Project Area

No.	Activities	Ave. share in decision making (%)	
		Male	Female
1	Choices of crops	35.8	64.2
2	Purchase/ sale of livestock	43.3	56.7
3	Purchase/Saie of house/land	58.3	41.7
4	Purchase/sale of ornaments	27.5	72.5
5	Purchase/sate of crops	27.5	72.5
6	Purchase/sale of fruits	10.8	89.2
7	Purchase/sale of livestock products	45	55
8	Purchase/sale of forest product	30	70
9	Marriage	50	50
10	Family planning	38.3	61.7
11	Education of children	43.3	56.7

(e) Village Rights to Natural Forests and their Management

This is an important issue for DSHEP project proponents. Villages in the project area are under a system of traditional ownership, including both land and forest resources within stated village boundaries. Even though the boundaries of villages such as" Hang Sadam, Houa Sadam and Houa Sahong are not officially marked they are known by common knowledge to locals. Customary user rights are legally recognized by the GOL and village authorities have the duty to enact local rules that are specific to local traditions, customary rights of use and regulate land use within the village boundary. The rights of traditional management systems apply to village forests and a land-use plan would include a local forest management plan. This includes certain rules and sanctions established by local villagers for certain uses like collection of firewood and charcoal making as stated previously. Villagers freely enjoy traditional rights for collecting NTFPs, fire wood, and other materials for household use from the existing forests. DSHEP will impact on the three village forests.

(f) Land Use and Tenure

The total land covered by those households interviewed for the project is around 9,870 ha. Of which about 5,000 ha was forested areas; about 680 ha was agriculture; 3,770 ha was grazing land and 430 ha was residential areas (Table 4.21). Only three villages: Thakho, Veunkham and Hang Khon have completed land use planning at village level since this program was implemented in 1997-98. This requires boundaries of villages and of major land use types such as forest, agriculture and residential areas to be delineated on village maps. No legal allocation of land to families has been done in any of these three villages. Tenure over land has been obtained through two different ways, including inheritance and purchase. There are no legal titles to land in villages in the project area but residents who use any piece of land have to pay land tax on annual basis to the village authority and District government. This is based on measurements of agricultural plots where people declare their tenure.

Table 4.21 - Land Use in Project Area

No.	Village	Area (ha)					
		Forest	Lowland paddy	Fruit Trees	Grazing land	Settlement	Total
1	Hang Sadam	300.0	61.6	2.5	-	5.0	369.1
2	Houa Sadam	5.5	77.5	10.0	-	40.0	133.0
3	Don Sahong	28.7	72.3	1.0	0.7	22.9	125.6
Subtotals		334.2	211.4	13.5	0.7	67.9	627.7
4	Thakho	-	175.6	24.2	-	224.2	424
5	Veunkham	4300	234.4	4.3	3500	133.1	8171.8
6	Hang Khon	354	11.5	5.3	265	7.3	643.1
Subtotals		4654	421.5	33.8	3765	398.4	9238.9
Totals		4988.2	632.9	47.3	3765.7	432.5	9866.6

Note: Based on interviews made with the village leaders

Results of HH Surveys at individual villages show that majority of population had land for cultivation but the size varies greatly among households. Land for agriculture production was indicated to be insufficient, considering the current land productivity (paddy yield of 1.6 tonnes per hectare). Acute shortage of agriculture land are indicated for Houa Sadam and Don Sahong, where not enough is available for the people resident in the communities.

The land use, ownership and rights of local residents is of concern to DSHEP, particularly as formal village land use plans have not been completed for the three villages on Don Sadam and Don Sahong. This aspect would require considerable negotiation at both the village and District levels to consolidate information and clarify the rights to parcels of land required for the project.

(g) Local Livelihoods

i. Rice Production System

As noted earlier 74% of local residents are rice paddy farmers and neither irrigated cultivation nor upland cultivation are reported. Rainfed paddy cultivation involves all members of the family at this subsistence level. Hand tractors are being increasingly used in paddy cultivation but the total units is small, with rented tractor use, and tractors also being used for pumping water and transportation of produce and travelling between villages. Glutinous rice of both improved and traditional rice varieties are used and investment in rice production is high among household being about a million kip per hectare to yields. Constraints include poor (infertile) soils, poor soil improvement and low quality seed, periodic drought and flooding and lack of adequate supportive extension services which combine to produce low yields of 1.6 tons per hectare.



Photograph 4.5 - Fallow rice field near Ban Houa Sadam, January 2007

ii. Rice Sufficiency

Rice production in the project area was estimated to be in shortage based on annual per capita consumption of 350 kg / person / year and the total rice requirement is 1,342 tons per year, while the production is estimated at only 1,076 tons. The 266 tons is filled up by purchases at trading centres in Klion^ District. At household the level, only 14% of total households are found to have surplus production is sold. Some 50% are just sufficient in rice and about 14% buy rice due to insufficiency.

iii. Livestock Raising

Small livestock raising for pigs and poultry forms a part of the cash income flow for some families in the project area as seen from Table 4.22. It was among the top of household cash earning activities. Major livestock raised include buffalo, cattle, pig, and poultry. Goat has recently been introduced into the area but only a few households are involved. Buffalo are kept mainly for ploughing and as a reserve for sale when emergencies occur and chickens are mainly for domestic consumption.

Table 4.22 - Livestock Population in Project Area

No.	Type of Animal	Numbers	Percent of Households Involved	Average Numbers of Animals per HH Involved
1	Buffalo	847	46	13
2	Cattle	791	22	30
3	Pig	637	55	10
4	Goat	83	1	83
5	Chicken	7,698	70	94
6	Duck	505	38	12
7	Total:	10,561	-	-

iv. Fishing and Fish Processing

Capture fishery is an integral part of the daily activities of local households for their daily supply of food and for cash income. It ranks first among economic activities in which most people were involved. Villagers do not travel far for fishing and their fishing grounds are less than 3 km from their village. They mainly catch fish and take whatever is caught, regardless of species and size. High season for fishing in Mekong is mainly during the rainy season around May to July with the low season from December to March.

Fish and other aquatic animal populations are reported to be dramatically declining compared with the situation in the 10 years ago and reasons stated include:

- Over fishing, mostly due to an increasing number of fishermen
- Increased market demand from outside the area and improved buying
- * Placement of net barriers along Mekong River in Cambodia during upstream fish migrations, especially during April to June of every year
- * Reduced water quality due to turbidity of water causing decline in general fish populations.

The diversity of aquatic resources is also reported as changing since 1980s. Fishing regulations involving the prohibitions of fishing during spawning periods and on the use of methods such as explosive and electric shock, as reported from the Cambodia, have been developed but are not strictly implemented. Some fish species such as Pa Seua, Pa Buk and Pa Leum are reported as extinct from the project area. Other highly threatened species include Pa Kheung, Pa Klioon, Pa Pian, Pa Erun and Pa Khae are also reported to be under depletion. Main fishing gears used by local people are mainly "gill nets (*inoiig*) and wing traps (*Lee*)". Wing traps are used only during certain periods (April to July) while *Mong* are used throughout the year and include smaller fishing gear, particularly traps, are used throughout the year.

Most people do fish processing at a small scale, mainly for self consumption but also for sale at local and outside markets. About 27% of households are reported to have processed fish for sale in their families (Table 4.17). Processing at the household level is restricted to dried fish (including pakatao) and different kinds of fermented fish (padekand pasom, etc.). Women are involved in these processing activities.

(h) Villagers' Perceptions on Effects of DSHEP

At the time of the Household Survey local residents were not fully informed about the DSHEP and its potential effects on their lives. As shown in Table 4.23, households were aware of critical issues such as:

- Impacts on reducing fish abundance and fishing opportunities
- Potential loss of household assets due to flooding of Hou Sahong
- General negative social impacts, including problems relating to prostitutes, sexually transmitted diseases, and other social disruptions.

However, there is a general willingness to have the dam constructed,

Table 4.23 shows the different perceptions based on interviews at liousehold, group and village. All households expected that they would get access to electricity, which they feel to be important for their livelihoods. With electricity people feel that, apart from lighting and other home use purposes, they would also be able to use it for different production purposes and would bring them better opportunities for employment. This may be true or it may not be. They also foresee that, if the project is approved, it would bring better civilization, more tourists and generally better economic conditions. Household level interview showed that many villagers were afraid the project would not be realized.

At the time of interviews, local villagers do not have any idea if their land and other assets would be flooded, since they do not know the extent of flooding. However, they did have different opinions when asking about resettlement. Most of them do not want to move to other places but prefer to move to non-flooded parts within their villages or islands.

In all cases, appropriate compensation was requested for house reconstruction and clearing suitable land for agriculture production. Compensation in kind or in cash can be accepted on the conditions that it should be equivalent at least to their losses. Their preferences for livelihood restoration were to have suitable land for agriculture with appropriate extension support and necessary public facilities at the new resettlement sites for education, healthcare, market, secure water supply and electricity.

Table 4.23 - Villagers Perceptions on Impacts of DSHEP

Perceptions	HH Level	Group Level	Village Level
Negative Impacts			
1. Reduced fish abundance	1	1	1
2. increased flooding	3	2	2
3. Resettlement problems	1	1	1
4. Degradation of environment	3	2	2
5. Fear of social disruption and sexually transmitted diseases due to increased workers in the project areas	3	3	3
6. Fear that the project would not be implemented	1	4	4
Positive Impacts			
1. Access to electricity for lighting and domestic use	1	1	1
2. Access to electricity for agriculture production	2	1	1
3. Job opportunities	3	2	1
4. Better opportunity for socio-economic development	1	1	1
5. Bring more tourists	3	3	3
6. More business opportunity	3	2	2
Sites for Possible New Resettlement			
1. Khinak, Veunkham and Nakasang	3	1	1
2. Along Highway No. 13 South	3	2	2
3. Resettle on non-flooded parts of the same village and island	1	2	2
4. Up to the government decision	2	2	1
Compensation			
House reconstruction	1		1
Land suitable for agriculture	1		1
Compensation type			
In cash equivalent to value of affected asset plus cost for reconstruction.	1		1
Cost of transportation	1		1
In kind (government provide new house and land)	2		1

Notes: 1 - High
2 - Medium
3 - Low
4 - Very Low

4.4 Organization and Structure of the Public Health in Project Area

Public health infrastructure of Champasak Province is comprised of the Provincial Health Office (PHO) and 10 district health offices (DHO). There is one provincial hospital with 250 beds in Pakse. In each of the other nine districts, there is a district hospital and a District Health Office (DHO) and a small district hospital. There are a total of 58 health centres of which 23 are fully operational, 14 are semi-functional and 21 are non-operational. The ratios of health staff to the general population are as follows: 1:4,313 for general practitioners, specialists and university graduates, 1:1,954 for mid-level staff and 1:1,327 for lower level staff.

There are six (6) main programs being implemented by the PHOs and DHOs:

- * Disease prevention and health promotion
- * Curative medicine and rehabilitation
- * Food and drug control
- Development of human resources
- Research
- Administrative and technical management

With a similar structure and organization to the PHO, Khong District Health Office (DHO) focuses on two main activities; curative medicine and prevention and health promotion.

This one district hospital has 25 beds and 6 Health Centres (HC) with a total of 22 beds and a total staff of 76 persons including 6 medical doctors, 19 assistant doctors, 44 nurses and auxiliary personnel. There are some 52 public health staff with 27 assigned to the hospital and 25 at the Health Centres (HC), Ban Khone Hang being one of these. At the three local villages in the project area there are Village Health Volunteers (VHV) and most of these have limited training.

4.4.1 Overview of the Health Situation in Champasak Province

Collection of health statistics during the field surveys for this EIA report are based on 2004-2005 data and show the top ten diseases for the province in Table 4.24. These data also reflect the leading causes of hospitalization in the province. Intestinal parasitic infections are rarely reported in the health services, unless the cases are severe or life-threatening as in general the disease does not present any symptoms and self-treatment is very common for most of the Helminth infections.

Table 4.24. Top Ten Diseases Reported in Champasak Province

cat	Disease	Provincial Hospital	District Hospitals	Health Centres	Private Clinics	Totals
1	Influenza	1408	6434	4890	2311	15043
2	Sore throats	1783	2182	744	4172	8881
3	Gastrointestinal tract complaints	2021	302	2119	3834	8276
4	Respiratory infections	886	2246	1844	1558	6534
5	Malaria	580	3462	1457	863	6362
6	Neuropathy	1579	827	175	1938	4519
7	Dengue fever	307	491	0	2397	3195
8	Diarrhoea	504	198	1383	931	3016
9	Accidents	1203	472	29	0	1704
10	Circulatory system	1201	140	0	135	1476
	Totals	11,472	16,754	12,641	18,139	59,006

The main leading causes of death reported by the health services throughout the province are due to malaria, new born babies, Acute Respiratory Infections (ARI), hypertension, encephalitis, dengue, peritonitis, tetanus infection, diarrhoea and trauma.

4.4.2 Malaria and Dengue Situation in Champasak Province

(a) Malaria Incidence in Champasak Province

Like other provinces, Champasak Province still reports malaria cases but the incidence has significantly decreased in most of its endemic areas over the past 20 years. However, as the provincial hospital at Pakse has become a regional reference hospital for the other three southern provinces of Attapeu, Sekong and Saravane. The incidence of malaria in Champasak Province is dominated by *Plasmodium falciparum* (PI) cases with this vector accounting for over 99% of all cases in all years. Expansion of coffee plantations is considered to be one of the causes of high malaria incidence in the country. Most of the malaria cases are considered to be uncomplicated and patients are treated in the Out Patients Department

Table 4.25 summarizes the trend of malaria in Champasak Province from 2000 to 2005 and Figure 4.3 shows the distribution of malaria among its districts.

Table 4.25 - Malaria Statistics in Champasak Province from 2000-2005

	2000	2001	2002	2003	2004	2005
tot. of blood examined for malaria	26,717	26588	38217	40523	65891	34398
no. of positive for mal	4,341	3666	3305	2596	2467	1002
no. of Pf cases	4,338	3663	3302	2592	2463	995
no. of Pv. cases	2	3	3	4	3	2
no. of hospitalized malaria	2510	2771	2151	1560	1567	558
no. of death	68	70	67	55	22	15

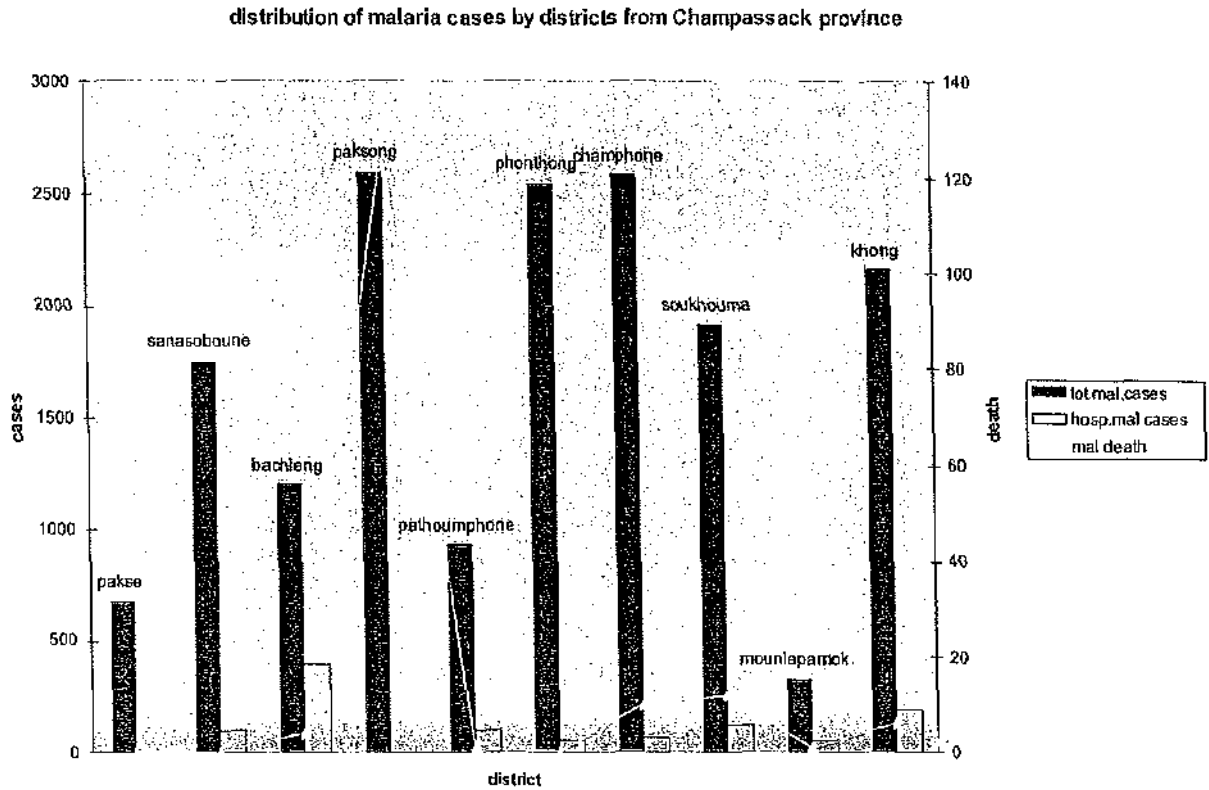


Figure 4.3 - Distribution of Malaria cases in Champasak Province

(b) Dengue Status in Champasak Province

Dengue fever (DF) prevails throughout the year, mainly in the urban areas such as Pakse. However the trend of disease transmission pattern has increased through the use of large concrete jars for water storage in the cities and semi-rural surrounds and along important roads linking the districts. These zones are the focal points for development and result in additional ground-base water being available as breeding habitat for the main vectors of Dengue Fever (*Aedes aegypti*).

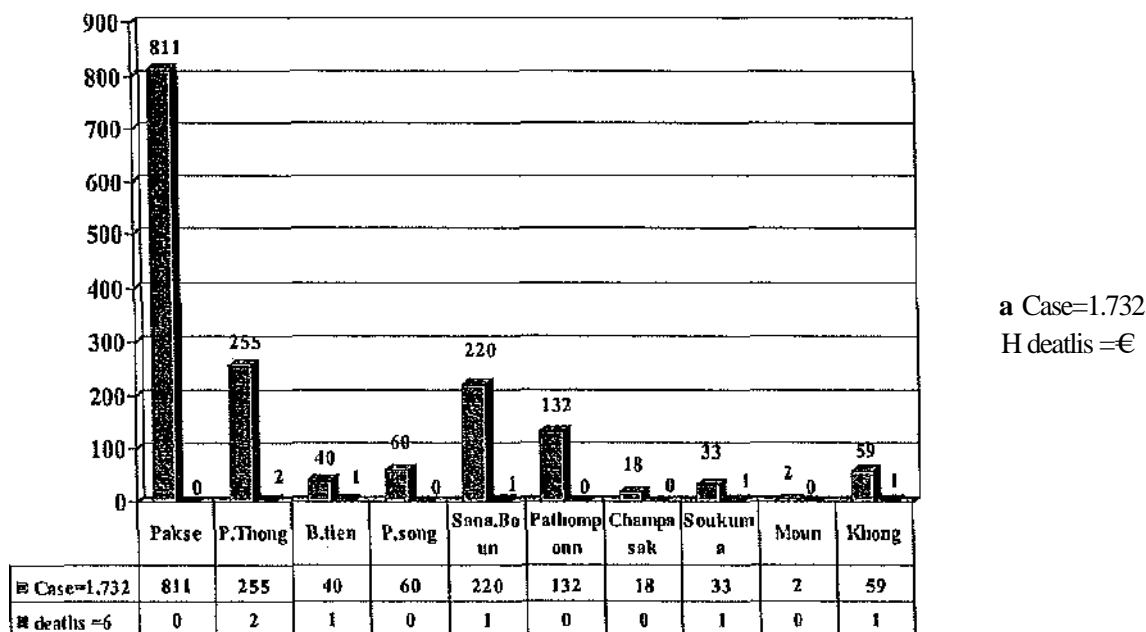


Figure 4.4 - Distribution of Dengue Cases in Champasak Province (data 2002)
(Source: Epidemiology-HIV/AIDS Section, Champasak Provincial Public Health)

Every year there has been reported an outbreak of dengue fever in Champasak Province and imported cases are endemic in areas sharing the border with Cambodia. The most recent outbreak occurred in Champasak (Pakse) and in Bachieng Districts in 2001 with more than 1,500 cases reported.

4.4.3 Malaria and Dengue Fever Situation in Khong District

(a) Malaria Incidence in Khong District

Based on data collected from the DHO at Khong District, it has been found that malaria remains a public health concern. However it has been substantially reduced from over 290 cases in 2002 to 60 cases in 2005 with the increase coverage of Insecticide Treated Nets (ITN) in all endemic areas in 2002/2003. Treatment of the early malaria cases through the use of village health volunteers, (VTIV). *Plasmodium falciparum* is the main vector and shows a decreasing trend in the Khong District. It seems that *P.vivax* is absent in the region. There have been no deaths reported due to malaria during the last 5 years at the district hospital located on Khong Island.

(b) Dengue Fever Situation in Khong District

Over the past decade dengue fever was not prevalent in Khong District. However with the upgrading of Highway 13 southwards, an influx of tourists to the area and development of tourist facilities, there has been an increase in dengue cases reported by the Khong District hospital. The incidence of dengue fever has increased two fold in 2005 with a total of 36 cases, four of these cases showed hemorrhagic signs, three showed shock and one resulted in death. (Table 4.26).

Table 4.26 - Dengue Situation in Khong District from 2001 to 2005

activities	2001	2002	2003	2004	2005	2006
tot. of DF		19	13	9	36	
tot. of DHF		1	1	1	4	
tot. DHF with schock		0	0	0	3	
no. of deaths due to dengue		0	0	0	1	

4.4.4 STI & HIV/AIDS Situation in Champasak Province & Khong District

The country's first cases of HIV infection were detected in mobile and transient populations and sex workers in the early 1990s. According to the Lao National HIV Surveillance System for work done in 2004, it was found that sex industry women were the highest group infected with Chlamydia or gonorrhoea at 27.9% and the HIV prevalence rate was found to be 1% within Champasak Province. No data is available at the district or village levels of the Project area.

Table 4.27 - Results of STI/HIV infection Rates in Champasak Province 2004

	Chlamydia or gonorrhoea	HiV	Syphilis
Military	3.7%	0%	.003%
Long distance truck drivers	5.5%	0%	0%
Electricity workers	—	0%	0%
Sex industry women	27.9%	1%	.01%

Source: National STI/HIV Prevalence Study (2004)

According to the health statistics from the Provincial Health Office (PHO) of Champasak Province there were a total of 35 HIV cases in the whole province and 26 of these had AIDS and 8 had died in 2003-2004. Data collected from all health services have show that 88% of women attending the STI services have contracted the diseases compared with only 12% of men infected. This does not mean that men are lesser at risk of contracting certain diseases (eg Chlamydia) but also because many chose to go to the private pharmacies for self medication.

4.4.5 Intestinal Parasitic Infections in Champasak and Khong District

(a) Status of Helminthic Situation in Champasak Province

Schistosoma mekongi has a focal point on Khong Island and other important intestinal parasitic diseases, such as liver fluke, round worm, whip worm, hook worm are also prevalent in the region. The prevalence of Helminthic infections varied from 40% to 79% depending on the year and the quantity of sampling. However true prevalence of this type of infection as people do not go for stool examinations and lack of awareness of the infections implications. Once infected they treat themselves with antihelminthic drugs directly from local pharmacies. The main types of helminths found in the area include *Opisthorchis viverrini* (O.v.), *Ascaris lumbricoides* (Asc.l.), *Trichuris trichiura* (Tr. Tr.), *Taenia* (Tae.) and Hookworm (H.w.). The main ones dominating this area are O.v., H.w and Asc.l. *Opisthorchis viverrini* is a problem in the high intake of freshwater fish by the local population, especially through the consumption of uncooked fish dishes.

Table 4.28 - Helminth Infection Rates for Champasak Province 2001-2005

	2000	2001	2002	2003	2004	2005	2006
tot. of stool examined		2346	8579	2816	2950	5071	
no. of positive		356	6747	1034	1868	2033	
no. of s.mk (+)			559	186	56	290	
no. of o.v. (+)			4100	480	1150	1001	
no. of asc.!(+)			1091	131	151	474	
no. of Tr. tr(+)			233	13	28	256	
no. of H.w(+)			2383	176	424	909	
no. of Taen.!(+)			128	34	43	0	
no. of people treated with Praz		190000	8500	10500	100300	6444	

(b) Situation of *S.mekongi* and Liver Fluke in Klong District

Schistosoma mekongi was found in one Laotian, who originated from the southern part of Laos. In 1960 the first missions were sent by WHO for the survey of the Mekong River banks at above Khong Island and in Vientiane did not show the existence of Schistosomiasis in Laos. Later in 1961, it was confirmed that Schistosomiasis existed in the Khong Island zone.

The small snail of the genus of *Neotricula*, is the intermediate host for *S.mekongi* a new species was found along the Mekong River banks of the village Chomthong of Khong Island. Malacological surveys during the high water levels found that most of the snails collected possessed 3- 3.5 spirals and were attached to the rocks submerged 2-3 m under the water. During lower water levels, *Neotricula* snails collected had a spotted shell with an average of 4 to 5.4 spirals and were found at depths between 10 and 60 cm on rocks beneath local water levels.

The reservoir hosts of *S. mekongi* are found in dogs, domestic pigs and water buffalo as well as other mammals having contact with Mekong River waters of the Mekong in this area.

Historically, the control programs for *Schistosoma mekongi* can be divided into two important periods:

- * A control program from 1989 to 1999, during which a stool survey of 34 villages of Khong Island with a total of 2,519 children under 15 years being examined and some 42% found positive for *S. mekongi*.
- The second program from 1999 until the 2006, during which the prevalence in the villages surveyed varied from the lowest at 15.3% to the highest at 94% positive. Table 4.29 summarizes the intensity of *S. mekongi* infestation from 1989 to 1990.

Table 4.29 - Intensity of *Schistosoma mekongi* around Khong Island Area 1989-1990

Village Surveyed	Means of	Village Surveyed	Means of
Sene Lam	47.6	Hine Siu	43.6
Ban Dong	40.5	Ban Houay	49.0
Sene Hhat Ngay	47.5	Sene Tay	57.8
Sene Hat Noy	45.5	Som Van Ok	72.1
Xiengvang	31.2	Tha Kham	59.6
Kang Khong	38.2	Th Mak Hep	56.1
Ban Na	36.8		

Stool surveys were carried out by the Aid for Study on Schistosomiasis in China and Asian Countries (ASSCA) in May 2004 in eight (8) villages of the Khong Island. The survey revealed that 28.1% of *S.mekongi* occurred among a total of 548 people examined. This compares with an overall rate of 5.4% in DSHEP villages in 2007.

Liver fluke infection was found in 5.3%, Hook worm in 13.5% and *Ascaris lumbricoides* in 10.0% during this survey. Stool surveys in 2003 in 63 villages of Khong District demonstrated that there was a prevalence rate of 11% for *S. mekongi* and 50.2% for *O. viverrini*. Analyses of data demonstrates that although there has been a decrease in *S.mekongi* infections due to several MDA rounds, the infection rates of liver fluke remains relatively unchanged as it is associated with the fish eating habits of the local population.

4.4.6 Distribution of Intestinal Parasites and *S.mekongi* in Project Area

The general area of the DSHEP has not been included in previous areas in which stool samples were undertaken by the various medical teams. Consequently it was decided to undertake field and stool samples in the communities of Don Sadam and Don Sahong, these being the two main islands involved. The study team was made-up of personnel from Khong District DHO under the supervision of doctors from the CMPE in Vientiane and the PHO of Champasak Province. A base laboratory was set-up on Don Khong at the local Health Centre there and stool samples were analyzed at this site. All patients were examined by doctors and treatment was administered for both intestinal parasites and *S. mekongi*, using Praziquantel and other minor ailments treated and medical advice given.

The three villages in the EIA survey all had a similar history of occupation, religion, education availability, housing standards, agricultural pursuits and fishing activities. Similarly their history of public health including 3 recent rounds of Mass Drug Administration (MDA), programs of Insecticide Treated Nets (ITN) and the presence of local Village Health Volunteers (VHV). The socioeconomic parameters of these villages are outlined in detail in Appendix A, Section 1.1.2. The main points concerning the population of each village are:

- Ban Houa Sadam - Population 424 and Families 74
- Ban Hang Sadam - Population 543 and Families 90
- Ban Don Sahong - Population 441 and Families 71

The results of the stool sample survey are shown on Table 4.30:



Photograph 4.6 - Preparing stool samples for examination

Table 4.30 - Results from Stool Survey in Three Villages of DSHEP - March, 2007

Location & Samples	Positive Stools	S.m	O.v.	Asc.l.	Tr.tr.	H.w.	Tae.
Houa Sadam 250	141 (56.4%)	16 (6.4%)	68 (27.2%)	43 (17.2%)	13 (5.2%)	20 (8%)	5 (2.0%)
Hang Sadam 311	152 (48.9%)	15 (4.9%)	61 (20%)	51 (17%)	6 (2%)	20 (6.5%)	10 (3.3%)
Don Sahong 147	80 (54.4%)	7 (4.8%)	32 (21.8%)	30 (20.4%)	7 (4.8%)	5 (3.4%)	4 (2.7%)
3 Villages 708	373 (52.7%)	38 (5.4%)	161 (22.7%)	124 (17.5%)	26 (3.7%)	45 (6.4%)	19 (2.7%)

This shows that there is not any significant difference between the three communities in terms of the prevalence of helminth infections and more importantly, these rates are acceptable except for *Opisthorchis viverrini* or Liver Fluke infections.

In general the health standards of these three communities are good given that they use the Mekong River as their main water source. The latrine situation in all villages is low varying at around 20% of families having some facility but this can be rectified by an intensive supply and fit program. The residents from the villages currently go to Nakasang or Kiiinak rather than local Health Centres in case they referred to the district or provincial hospitals and for ease of road access.

4.5 Unexplored Ordinance (UXO) in Project Area

Unexplored Ordinance (UXO) is a concern throughout Laos. UXO receives considerable funds from both multi-lateral and bi-lateral aid programs. UNDP focuses on regions and districts and related programs. Countries such as USA, Belgium, Japan and Germany and private organizations such as Handicap International are all involved. UNDP provides a UXO Lao Annual Report which summarizes the current situation in terms of Community Awareness, Area Clearance, Roving Teams Programs and UXO Accidents. Tabic 4.31 from the 2005 the UXO Lao Annual Report highlights the data for Champasak Province with the problem areas focussing on the Bolovens Plateau, Bachiang and Pakxong Districts.

Table 4.31 - UNDP UXO Activities 1973-2005 - Champasak Province

Operational Unit	Number of Villages	Number of Beneficiaries	Land Clearance - ha	Numbers of UXO Destroyed	Number of UXO Found
Community Awareness	69	16,812			
Survey	154				3,130
Roving	130			4,309	
Clearance			145.5	927	

DSHEP engaged Gerbera Demering, a UXO Consultant to assess the situation in respect of Khong District and the project area, which reports the following: (Appendix F)

- ⁰ Khong District is the lowest report UXO contaminated area in Champasak Province
- There arc no reported incidence of UXO in Khong District or the project area nor are B 52 bombing raids reported on the area
- The nearest affected areas are in Cambodia straight south of Ban Man Khonc and the highest intensity area is near Kampong Sralau; opposite Don Tan on Mekong River about 24 km northwest of Ban Hang Khone

The general distribution of bombing raids are shown in Appendix F.

The report concludes that there is "no need for specialized surface or sub-surface UXO clearance before starting earth works in the DSHEP area" but to better ensure safety a technical survey of the actual construction works areas should be undertaken before construction starts.

4.6 Tourism in DSHEP Project Area and Surrounds

This section on tourism is an abridged version of Appendix E, which was prepared by the Lao socio-economist and the Thai resettlement expert. It is based on discussions with all operators of tourist facilities in the DSHEP project area and collection information from Lao and Thai authorities and discussions with several tourists, as noted.

Due to its unique and impressive waterfalls, extensive wetland areas, natural diversity, fishing activities and historical sites dating back to colonial limes and livelihood of communities is a major attraction of Champassack Province.

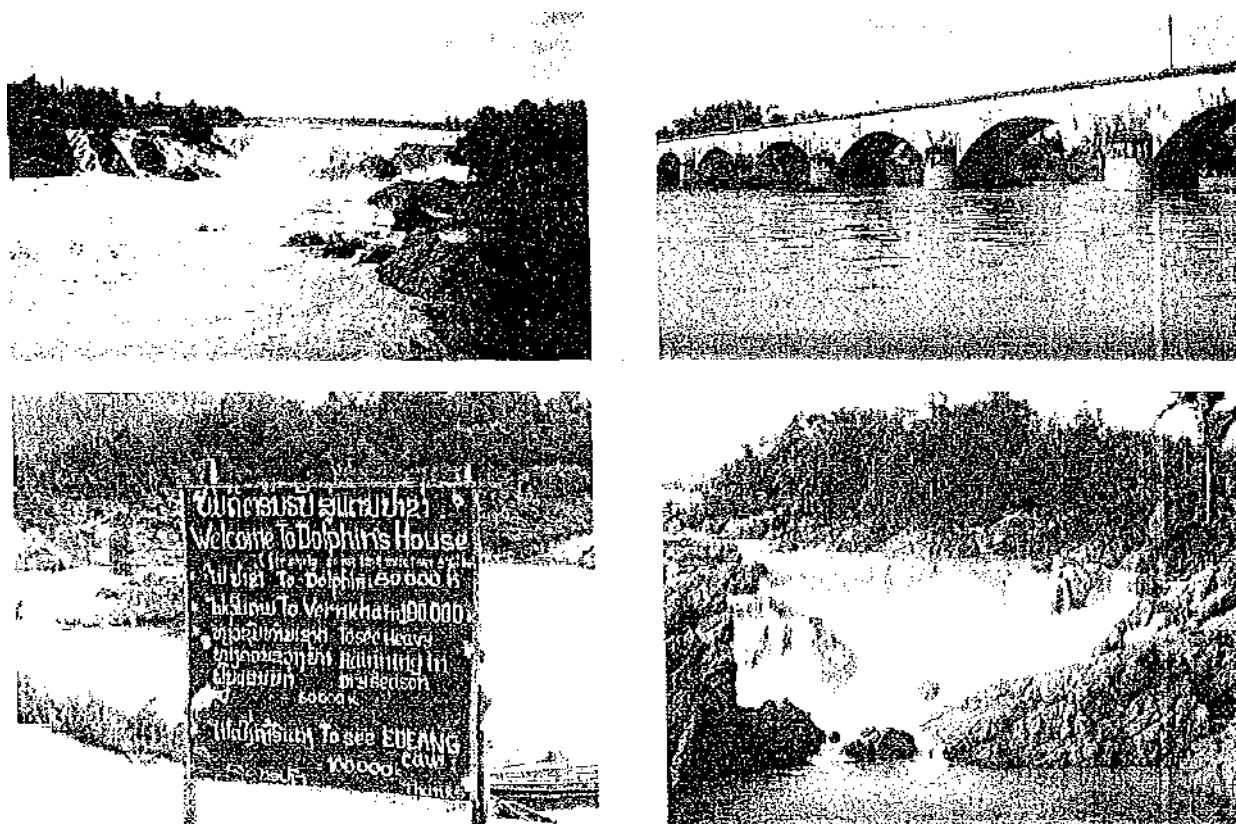
Taking advantage of the bridge over the Mekong in Pakse, Thai tourists come visit the area in large numbers on day-trips by vans, tourist coaches via the Vangtao/Chongmek Lao/Thai international

border. In the past 5 years, the area has become a destination for western backpackers searching for simplicity of life, authentic local livelihoods, nature and the traces of the colonial period. Don Det and Don Khone are recommended destinations for backpackers' holidays.

4.6.1 Tourist Attractions

The popular tourist attractions of the area are:

1. Khon Phapheng (water fall)
2. Li Phi / Somphamit waterfall
3. Irrawaddy dolphin watching
4. Don Det
5. Don Khon
6. Veunkham and Cambodia border
7. Bridge and remnants of first locomotive in Laos dating from colonial times
8. Mosaic of natural islands and wetland areas

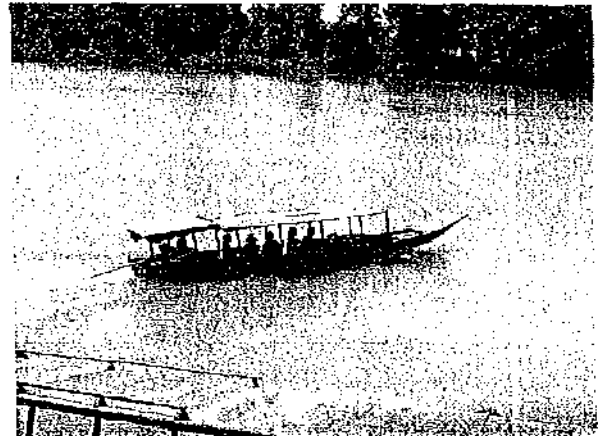


Photograph 4.7 - Tourist attractions (clockwise from top left) Khone Phapheng, colonial rail bridge at Don Det/Don Khone, Tad Samphamit Falls, Dolphin Watching

Don Sadam and Don Sahong are not primary destinations for tourists of any type but are a small part of the tourist resource base of the area.

4.6.2 Boat Landings

Tour operators take tourists to the islands areas through many boat landing points: Veunkham, Don Song Hang, Thamouang, Nakasang, Phiangdy. Veunkliam landing point is controlled by Phoudoi Travel Company. Under the arrangement, Phoudoi pays an annual fee to Kpong District with the condition that all boat services to visitors are exclusively to be provided by Phou Doi Travel Company. In similar arrangements, Thamouang is run by Pakse Travel, Phiangdy by Lanexang Travel but Nakasang is co-run as a shared facility by Phoudoi, Lanexang and Indochina Travel companies.



Photograph 4,8 ~ Jetty at Thamouang and tourist party departing for Don Det

4.6.3 Main Tour Operators

Five tour operators are operating in the areas surrounding the DSHEP, mainly:

1. Phoudoi Travel
2. Lanexang Travel
3. Indochina Travel
4. Pakse Travel
5. Xedon Travel

These are Lao companies of which Phou Doi Travel and Lane Xang Travel companies have their headquarters in the capital, Vientiane.

4.6.4 Boat Associations

Three boat service associations are reported to operate in the area:

1. Nakasang boat service association
2. Don Det boat service association¹
3. Hang Khone boat service association

¹ Don Det guesthouses and boat service operators are organized under one association

4.6.5 Guesthouse Associations

Two guesthouses associations are organized in the area, north of the DSHEP:

1. Don Det guesthouse association
2. Don Khon guesthouse association

4.6.6 Tourism Activities in Villages of Area

The villages offer different tourists activities at different levels. The tourism activities are more intense on the main land in the area of Klione Phapheng water fall and on the linked islands of Don Det and Don Khone.

Don Sahong and Don Sadam so far are visited only by a few foreign tourists present an undeveloped potential tourist attraction due to its pristine natural environment, authentic village life, fishing related activities along Hou Sahong, Hou Sadam and Hou Xang Pheuak. A guesthouse is currently being built at Houa Sadam

Section 2.6 of Appendix E provides basic descriptions of the individual tourist facilities and attractions in the overall area. This region is also part of an ADB major project on "Tourism in the Mekong River Region" and this study is ongoing.

4.6.7 information on Tourists and Visitors

(a) Champasak Province Level

The tourist flow in the Champasak Province has increased dramatically since 1999 with the National Lao Tourism Year Campaign. The number has further jumped to a high record with the completion of construction of the bridge over the Mekong River in Pakse two years ago, allowing Thai tourist coaches easy access to Champasak Provinces tourist areas.

In 2006, it is estimated that 113,684 tourists visited Champasak Province an increase from 63,963 in 2004 and 99,044 in 2005. Data from the Thai immigration authority shows that the number of visitors from Ubon Ratchatani to Southern Laos passing through Chong Mek Border is currently more than 140,000 and has increased by about 12% from 2005 to 2006.(Table 4.32) Approximately 70% of the total visitors from Thailand visited Khon Phapheng Waterfalls as the main attraction.

Table 4.32 -Tourist Arrivals from Thailand

Category	2005	2006
1) Passport	41,024	57,283
2) Border pass	84,550	84,102
Total	125,574	141,185

Source: Ubon Immigration Office al Phlbun Mangsahan, 2006

As expected the peak season for tourists in the province was recorded in November through February. Thai tourists represented some 68% of incoming tourists corresponding to 66,124 persons, followed by westerners (including New Zealand and Australian) and Lao visitors, both at 16% and corresponding to 16,181 persons (Figure 4.5).

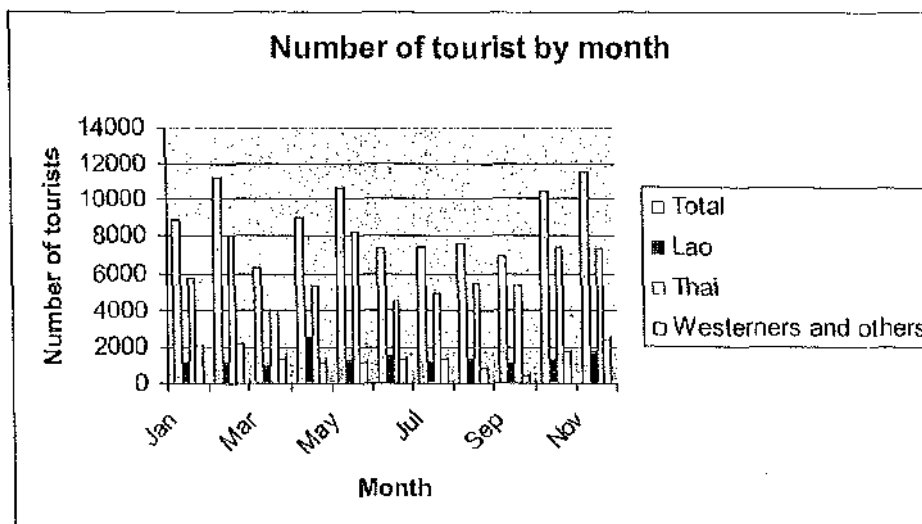


Figure 4.5 - Tourist Arrivals

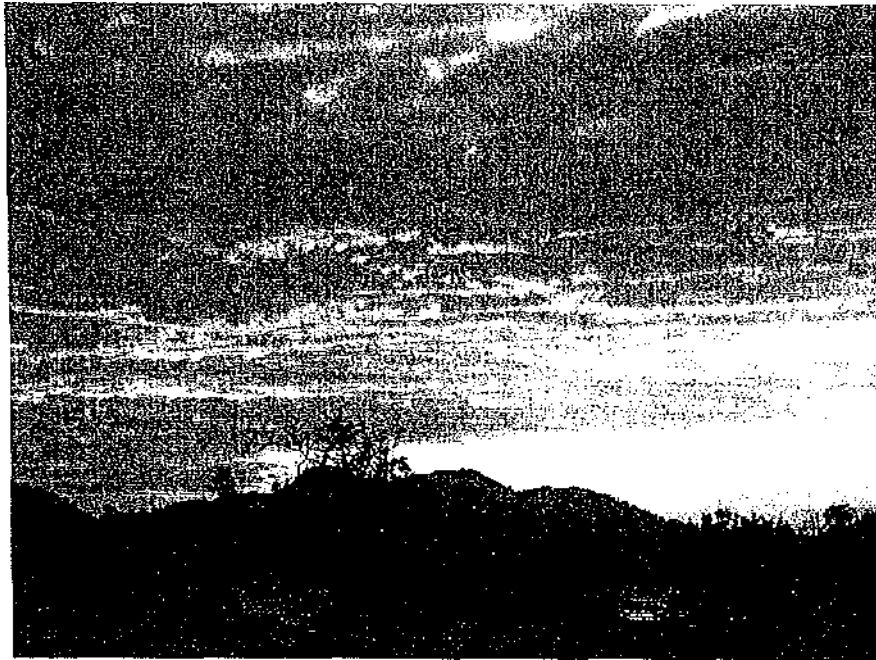
Among westerners, French tourists were the highest corresponding to 25% of the total of 16,181 or 4,045 persons. It is to be noted that these figures for westerners are conservative, as many backpacker tourists visit the area individually and might not be recorded in the official statistics.

(b) At the Project Area Level

It is difficult to get exact information of number of all types of tourists visiting the lower Siphandone Wetland area in general and the individual islands in particular. It is assumed that over 90% of foreign tourists coming to Champasak Province visit at least Khone Phapheng waterfall. Under this assumption, over 80,000 foreign tourists have visited the general DSHEP project area in 2006 but few have visited Don Sadam or Don Sahong, most being restricted to the Khone Phapheng area and a few dolphin watching.

(c) Preferences of Tourists

Though the main groups of foreign tourist have different preferences and levels of service offered, they all share common views that the rich natural diversity, the impressive waterfalls, the pristine nature, the authentic simple village life, hospitality of the local villagers and the peaceful life are the main attractions for them.



Photograph 4.9 - Sunset over the Mekong River

4.7 Proposed Siphandone Wetlands Ramsar Site

4.7.1 Background

While DSHEP occupies a small area, it is located in a major zone for conservation and protection of endangered species, being in the southern part of a currently proposed Ramsar site, the Siphandone Wetlands. This proposal has been ongoing for several years and is being proposed by the GOL Department of Foreign Affairs and would be administered by the Ministry of Agriculture and Forests (MOAF). This proposal to ratify the Ramsar Convention and declare the Siphandone Wetlands as the first Ramsar site in the Lao PDR has considerable momentum within the Laos government framework. Currently STEA, the Lao National Mekong Committee (LNMC), the MRC and IUCN are all active advisors to the leading Lao authorities. Most recently, in 2006, the following actions were undertaken:

Acceptance of a MRC and IUCN prepared "Information Sheet on Ramsar Wetland (RIS) - 2006-2008 Version on Siphandone Wetlands" including a map showing the proposed boundaries of this proposed site. Figure 4.6

A joint "Meeting on Transboundary Wetland Management in Champasak and Steung Treng" held on 24 March, 2006 and chaired by the Vice-Governors of the respective provinces and sponsored by the National Mekong Committees

A familiarisation tour of Vietnam's Ramsar sites by GOL MOAF representatives and others sponsored by the MRC and IUCN in December, 2006.

Appendix J is included to indicate the significance of the Ramsar site declaration which is regarded as a major step in the GOL's international conservation policies.

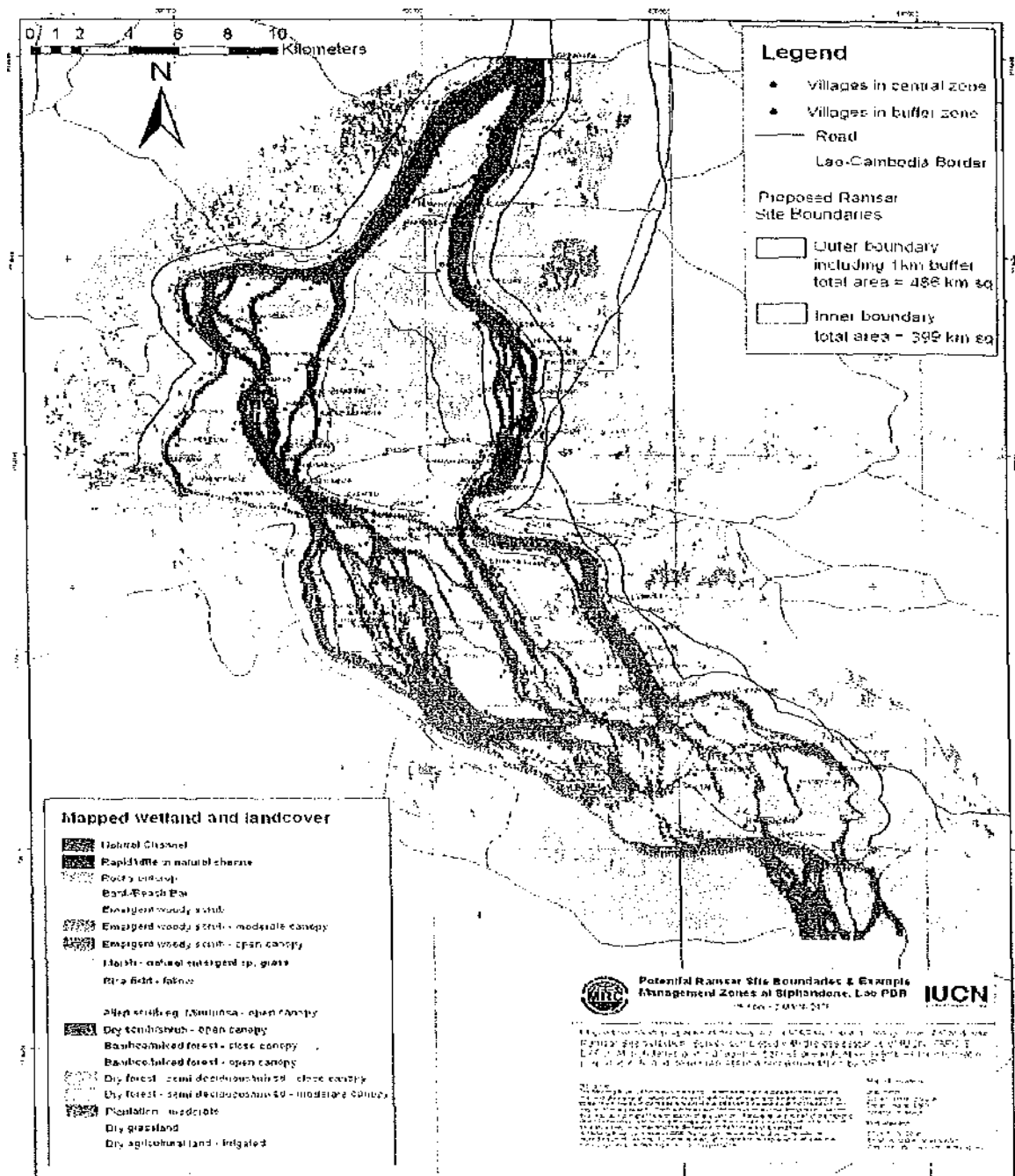


Figure 4.6 - Map of the proposed Ramsar site in Southern Laos on the border with Cambodia to the south.

This Siphandone Wetland proposal is about conservation and sustainable resource management for a 486 km² area which is upstream of a similar area, already declared on the Cambodian border and embracing the Mekong River. It includes all of the Mekong River below Klong Island, its numerous channels and a 1 km wide buffer zone on the banks of the Mekong River including a 40,000 ha central zone.

The DSHEP is integrally involved as it affects one of the year-round routes for fish migration around Khone Phapheng Falls and other barriers in the Mekong River.

4.7.2 Conservation Concerns

The Ramsar ratification proposal is not a public document at this time, so no reference can be made to its content. The minutes of a joint meeting of Champasak and Stung Treng provincial governors makes reference to the following trans-boundary issues:

- * Fisheries management including illegal methods, zoning, spawning area and fishing season
- * Tourism management, including Anloun Chou Teal, boat traffic and fees
- * Dolphin pool management, including impacts of fishing, demarcation of known important areas to the dolphin population
- * Development management, particularly the zone around Veunkham/Anloun Chhou Teal.

Both the IUCN and WWF are actively involved in resource management and they are promoting the declaration of the Siphandone Wetlands and its declaration would permit their interest to be further pursued and the site would include the DSHEP site. The nomination of this first Ramsar site has considerable momentum with the GOL and is acknowledged as definitely probable. Also the possibility of a declared "trans-boundary Ramsar site"¹ between Laos and Cambodia is a strong eventuality. DSHEP/flou Sahong would be viewed as a critical area in the planning of the Siphandone Wetlands for its value as the major year round fish migration channel in the Khone Phapheng area.

IUCN intends to inventory the Siphandone Wetland once it is declared. This is a preliminary step to preparing a development plan for the area and would involve consultation with the local communities on Don Sahong and Don Sadam. Of particular interest for the Siphandone Wetlands would be the role of fishing management in the long-term development plans for the area. The role of DSHEP and its implications to fisheries in this location is self-evident.

This is a key issue for consideration and rationalization of any approval of DSHEP by the GOL. The IUCN Ramsar Convention legislation as briefly included in Appendix J does not exclude hydropower proposals from being included. It is a question of compatibility with the proposal with the conservation issues of the Ramsar site, many of which remain undocumented to date.

IUCN has a "vision" for the future whereby the established Stung Treng Ramsar site and the proposed Siphandone Ramsar site would merge, leading to a trans-boundary Ramsar site - one of only a few worldwide.

5. IMPACT ANALYSIS AND MITIGATION MEASURES

The impacts and mitigation measures are included in a single section of this EIA on the DSHEP because they are inter-related and dependant on each other. The main impact on the aquatic ecology and the complicated mitigation measures are emphasized. Others such as the resettlement and social issues and action plans are discussed in Section 6.

The account is subdivided into impacts and mitigation actions during construction (Section 5.1), during operation (Section 5.2) and during de-commissioning (Section 5.3). However, because of its importance, the impact on the aquatic ecology in all three phases is discussed in Section 5.4.

5.1 Impacts and Mitigation Actions during Construction

The construction stage of the DSHEP will have far greater impacts, than the operational stage. Once construction starts and heavy equipment reaches the two islands and the upstream preliminary coffer dam is built the main impacts have commenced. This is true particularly with respect to the project's impacts on the fish resources.

5.1.1 Impacts on Land Use and Local Infrastructure

There is very little infrastructure existing in the project area other than road access provided by Highway 13 South on the mainland. Land use on the two islands of Don Sadam and Don Sahong is traditionally held but untitled and agricultural land is relatively scarce, so spoil dump locations are critical to local residents. The actual impacts of actions such as barging operations are difficult to assess except in general terms. Similarly, the interference with local transport on Highway 13 is uncertain but appears to be limited except during peak periods of moving major equipment to the DSHEP site.

(a) Barging Operations

The preparation work for the barging involves major works, such as:

- Development of a barge channel between the mainland site and sites on Don Sadam and Don Sahong, with the amount of excavation in the Mekong River uncertain
- Development of barge depots including concrete ramps and associated storage areas
- Operation of an unknown number of barges of varying capacities sizes on an undetermined schedule for the entire construction stage.

The impacts are largely associated with the following during the four-year construction period:

- Risks of damage to the fish during blasting for barge paths in initial months of construction through stunning or killing offish
- Slight risk of interference with normal fishing operations by local island residents
Risks of collision or accidents at the barge depots and would include potential spills of contaminants such as fuel or cement into the Mekong River.

The mitigation measures associated with the barging operations would focus on the zone in the Mekong River channel between the Ban Napeng area and Don Sadam and Don Sahong. This operation would require the use of a small barge, underwater blasting and removal of material from a 3.5 km barge path between these points. The local Fishermen from communities such as Ban Napeng, Ban Houa Sadam, Ban Sahong and Ban Don Tan Thiv Tok, who fish these waters, would be directly affected. Mitigating actions would include:

- There are no practical mitigation actions from these effects on the fish populations in the specific work locations.
- Safety mitigating actions associated with barge operations, including flagged exclusion zone and a warning siren in advance of blasting are recommended to prevent potential accidents
- Development and implementation of a safety code and emergency action response code to cover all barging operations.

The handling and dumping of spoil from the excavated barge path would be included in a spoil and waste plan to be devised for Don Sadam by the nominated barging contractor as supervised by the main contractor and the DSIIEP project sponsor.

(b) Land Clearing, Embankment and Road Construction

The clearing of lands for project works is an issue that requires negotiation with the three local Village Committees and the relevant District authorities. This will include payment of compensation for the following;

- Loss of lands indicated as within the respective village areas
- Loss of trees including payments for initial works such as roads and permitting local communities to salvage any residual trees for firewood from those areas within the flood zone of the pondage
- Discussion and negotiations over losses of non-village area trees with the Klong District and Champasak Province forestry authorities. Negotiations for any areas required for spoil disposal and the restoration of those areas as soon as practical.

The impact areas required for land clearing and their current status are indicated in Table 5.1, which shows that some 202.4 ha of non-village lands are required for the DSHEP on Don Sadani and Don Sahong. This includes some 29.4 ha of paddy land and 169,9 ha of forest lauds of which about 40% are degraded. This figure does not include any lands for spoil dumps either temporary or permanent. Estimates of these areas arc included in the following section.

**Table 5.1 - Estimates of Land Requirements & Use in Areas Affected by the DSHEP Project
(All Area in ha)**

Project Features	Location	Village	Rice Paddy Lands		Forestry Lands		Island RockS Vegetation S Water	Total Area
		Area& Household (HHs)	In Use	Grazing Disused	Good	Degraded		
A. Right Bank - Working & Reservoir Areas								
1.0am, Works & Switchyard	Hang Sahong	15 (10 HHs)	-	-	0.5	2.7	-	4.7
2. Embankments 2.1km x 10m	Don Sahong	-	-	-	1.5	0.6	-	2.1
3. Land Flooded at EL 75m	Don Sahong		4.5	1.5	54.3	35.5		94.8
B. Left Bank - Working & Reservoir Areas								
1. Dam, Plant Sites & Facilities	Hang Sadam	0.3 (2 HHs)	2.3	2.8	.	2.7	-	8.1
2. Lower Embankment 2.4 km X 10m	Hang Sadam	-	1.1	0.7	-	0.6	•	2.4
3. Land Flooded at EL 75 m	Don Sadam		3.1	6.3	45.2	23.2		77.8
4. Island Barge Landing	Houa Sadam	-	1.5	-	-	-	-	1.5
5. Road to Damsite (10mx5,700m)	Houa Sadam to Hang Sadam	-	2.9	0.8	1.6	0.4	-	5.7
6. Access Site at Coffe Dam	West of Houa Sadam	-	1.2	-	-	0.7	-	1.9
7. Upstream Coffe Dam & Islands for Flow Channels	Houa Sadam to Houa Sahong	-	-	-	-	-	3.2	3.2
Subtotal Don Sahong & Don Sadam		1.7 ha& 12 HHs	16.6	12.4	103.1	66.5	3.2	203.3
C. Mainland Barge Landing								
1. Nominated Landing site	North of Resort	0.3 (2 HHs)	0.4	*	0.2	0.4	-	1.2
D. Reservoir Water Areas - Nominal not Official								
1. Community Fishing Zone	Hou Sahong		-	•	-	-	29.2) 76.3
2. Traditional Lee Traps	Hou Sahong		-	-	-	-	10.0	
3. Other Fishing Zones	Hou Sahong		-	-	-	-	37.1	
4. Two Island Flooded	Hou Sahong		-	-	-	-	11.3) 11.3
5. Aquatic Habitats in Downstream Channel	Mekong River		-	-	-	-	5.0	5.0
Subtotal							92.6	92.6
D. Total DSHEP Areas		2.1 14 HHs	17.0	12.4	103.3	66.9	92.6	296.7
E. Transmission to Ban Hat Substation								
1. On Don Sahong (30m x 2,980m)	Don Sahong	-	4.4	2.3	-	3.2	.	8.9
2. On Don Tan Tok (30m x 2,400 m)	Don Tan Tok	-	2.6	2.9	1.0	0.7	-	7.2
3. Over Mekong River Channel (30 x 1,200 m)	2 Channels	-	-		-	-	3.6	3.6
4. On Mainland - Nakasang To Ban Hat Substation (30m x 15,300 m)	East of Road No. 13		11.8	18.7	6.3	9.1		45.9
T/L Subtotal- 20,680mx30m	Don Sahong to Ban Hat	-	18.8	23.9	7.3	13.0	3.6	65.6
TOTALS		1.3 ha (14 HHs)	35.8	36.3	110.6	79.9	96.2	359.2

Source: Map interpretation and ground surveys by EIA Team, January to April 2007

The impacts of the DSHEP pondage and associated works are summarized in Table 5.2, which illustrates a number of interesting points from the environmental viewpoint, including:

- Some 25.7% of the land systems of the two islands are affected including over 32% of their forests and between 5.0 and 22.4% of their agricultural lands
- The quantity affected increases to 33.2% directly affected if the two islands and water body of Hou Sahong are included, that is the total island ecosystem which is going to altered
- A total of 290.7 ha are affected out of a total of 876.5 ha or 32.2%; this is considered a significant impact in terms of the local environment of Don Sadam and Don Sahong.

It is impossible to define these in terms of effects on actual village lands lost as registered plans are not available or approved by District authorities.

Table 5.2 - Estimated Areas of Agricultural and Forestry Lands on Don Sadam & Don Sahong Affected by DSHEP Pondage and Works - 2007

Location & Land Use	Natural Conditions ha	Affected by DSHEP ha	Percentage of Area Affected
Don Sadam - Agricultural	139.9	7.1	5.1%
- Forestry/ Other	334.1	95.1	28.5%
-Subtotal	474.0	102.2	21.6%
Don Sahong - Agricultural	104.2	23.3	22.4%
- Forestry / Other	211.3	77.6	36.7%
- Subtotal	315.5	100.9	32.0%
Two Island Land Systems	789.5	203.1	25.7%
Hou Sahong - Small Islands	11.3	11.3	100%
Hou Sahong - Water	76.3	76.3	100%
Total Ecosystem of Islands	876.5	290.7	33.2%

The mitigation actions considered to be absolutely essential for the DSHEP project sponsor to deal with this major impact will include the following:

- Complete an inventory and mapping of all of Don Sadam and Don Sahong including confirmation of village areas and other reserves
- Prepare a map for all project works areas including all spoil disposal and quarry areas and temporary land use needed for storage
- Present the above data to the Village Committees and other interested parties including the resettlement committee
- Negotiate and discuss payment for compensation and make a commitment to undertake mitigating actions such as replacement or additional agricultural land clearing
- Continue to keep all concerned parties informed of any changes to plans, including the setting up of a project-based land authority for the construction period to record such data and deal with it day-to-day.

(c) Cofferdam Construction, Channel Excavation and Spoil Dumps

The construction and operation of the DSHEP's cofferdams and channel excavation are complicated works which last for the entire construction period. They are integrally linked with spoil disposal either in the embankments or in separate locations. Also the upper coffer dam requires temporary dams to effectively excavate the required channel and a sloping entrance into the Mekong River. The estimated quantities of materials to be excavated to RL 66 and for approximately 2 km downstream of the entrance and to be disposed of are:

- Stage 1 - 700,000 cu. m.- Extending downstream from the main upstream cofferdam and can proceed after completion of the dam
- Stage 2 - 250,000 cu. m - involving excavation in the area between the main cofferdam and initial cofferdam and to be done during a period of low-flow
- Stage 3 - 60,000 cu. m - involving excavation of the river occupied by the main cofferdam and also done in a period of low flow and after the Power Station has reach "water-tight" stage
- Stage 4 - 20,000 cu. m - involving the removal of the upstream cofferdam and excavation of under-lying rock to provide a transition from RL 60 into the main stream of the Mekong River
- Downstream of power station - 70,000 cu m - involving excavation to reduce the headloss through the station and increase energy.

This totals some 1.35 million cu m of mostly hard rhyolite rock of which approximately 250,000 cu m of the excavated can be used in addition to rock from the Power Station structure for construction of the Containment Dams and Saddle Dam and for rip-rap protection and streamlining of the entry into Hou Sahong. Nevertheless there are over 1.05 million cu m of waste excavated rock to be disposed. Locations for this will require detailed negotiation with local village officials.

The mitigating actions required are not as burdensome in respect to coffer dam and channel excavation but similar discussions and negotiations based on definite plans for the spoil disposal sites should occur with local village administrations. This is essential in order to avoid conflict and ensure good local planning. In fact, it is suggested that any spoil areas would have adequate drainage and should be designed with restoration in mind, if possible. The possibility of disposing of all this material within the embankment of the project's pondage should be considered.

5.1.2 Impacts and Mitigation Measures for Air and Water Quality

The effects and amelioration measures required for the DSHEP during construction phase with regard to air and water quality protection are several but as yet not completely known.

(a) Dust Suppression

Extensive quantities of excavation in hard rock are required and frequent traffic are obvious sources of dust and need to be rectified. Also there would be numerous sources with several worksites scattered between Don Sadam and Don Sahong and to a lesser degree the mainland camp and storage area. With its embankments and roads (including ancillary access roads) minimizing entrained dust is going to be a problem for all contractors. The damsite and main works area are very close to all three villages so the wetting of all

travelled surfaces should be imposed on all operations. This would be required as matter of DSHEP policy and each contractor should be requested to prepare a "dust suppression plan" before the implementation.

(b) Transport, Handling and Storage of Fuel and Explosives

Another important aspect relates to the transport, handling and storage of fuels and explosives. With a split between mainland and island sites and then again with work ongoing at several sites simultaneously on the islands, detailed attention would have to be given to these matters, not only to protect the environment but also from the public safety viewpoint. It is mandatory that the DSHEP and its contractors have policies, safeguards and emergency response plans in place. This will receive priority in Tender Documentation and project planning during detailed design.

(c) Water Quality Protection

Little information is available on specific sites where water quality protection is required. However with multiple construction works proceeding on and around the pondage, which is enclosed by coffer dams, it should be possible to plan runoff control system. Any site releases will have sediment traps installed and operating to protect the Mekong River, particularly in the dry season when clear water prevails. Bunding of vulnerable zones outside the pondage will also be proposed.

Monitoring of releases of onsite water bodies and releases would be the responsibility of the main contractors and would be reported by the DSHEP monitoring authority.

The need for comprehensive mitigation action required for air and water quality protection are obvious as the DSHEP is in close proximity to existing villages, particularly Hang Sadam. This community also draws water from the Mekong River downstream of the damsite and this aspect needs to be consider in mitigation. The main mitigation measures envisaged include:

- Development of a dust suppression systems, possibly including paving of the main road from Hang Sadam but, if not, watering schedules for all roads and works areas within 1 km of these villages
- Each contractor to devise a comprehensive fuels and explosives transport, handling and storage plan including bunding of tanks and an emergency response plan with DSHEP responsible overall
- Preparation and implementation of an overall water quality protection plan based on using the pondage area to collect, treat and release all waste waters and to include a detailed monitoring program.

This is an important aspect and one in which the contractors and DSHEP will need to liaise with the Champasak Provincial office of STEA, both for planning and during operational stage for construction.

5.1.3 Impacts and Mitigating Actions on Forestry and Wildlife

The impacts and mitigating measures relating forestry of the DSHEP are largely preventative and remedial to compensate for the losses of the channel ecosystem, particularly of trees of use to the local communities. These forest resources include bamboo and suitable species for poles and firewood. There are no indications of endangered species but, depending on village plans, some compensation may be payable to District or Provincial forest authorities.

(a) Forest Resources

Generally, the clearance of vegetation within the dam site, powerhouse and reservoir can lead to further fragmentation of already diminishing areas of natural forests and wildlife habitats. Based on the land use and forest map and conducting field survey, most vegetation type covered within the project area are swamp and Unstocked Forest. However, there are some Mixed Deciduous Forest and Gallery Forest, although severely degraded in the Hou Sahong riparian zone. All forest lands below RL 75m are indicated to be affected and it is probable that vegetation to this level would be destroyed through flood damage during the wet season. Overall the impacts would not be significant but some resources affected by cumulative adverse impact of the project. Based on the review of forest cover maps, field reconnaissance and villagers' interview, it indicated that most of the vegetation that will be affected by flooding was Swamp Forest covering 80.0 ha, followed by Unstocked Forest 55.4 ha, 22.8 ha of Mixed Deciduous Forest and 11.4 ha Gallery Forest. However these areas have to be inventoried, confirmed and losses assessed by the provincial forestry authorities by the commencement of the DSHEP project.

(b) Wildlife Resources

Wildlife and wildlife habitat, as noted in Section 4.2 involved field survey, local villagers' interview and discussions with authorities concerned and showed that the only significant habitats remaining occur on the steep slopes of the Don Sadam conservation area. In other more accessible lower slopes where forests have been destroyed, wildlife and wildlife habitat have also been disturbed including the taking of logs, poles and bamboo over the years. All the fauna communities within the flooded areas will be lost once the DSHEP is initiated and would change once the Project becomes operational when the dam site is completed. There is a possibility that some endangered species such as otters and amphibians would have their habitat destroyed but these animals were not found during EIA surveys.

(c) Mitigation Measures

The mitigation measures required to protect the remaining forest and wildlife resources during construction are indicated to include:

- Undertake a complete forest inventory of the two islands, highlighting forest losses, any compensation to traditional owners and a plan for salvage of forest resources by local communities
- Completion of a detailed survey focused on the DSHEP pondage area of wildlife resources and any necessary plans for rescue prior to clearing of riparian vegetation

- Prepare a plan for selective planting of forest species in consultation with the representatives of the three local communities and forestry authorities and to include bamboo and other suitable pole species, in particular. None of these mitigation actions have been costed in detail and this is considered as a separate pre-construction forestry substudy. The total estimated costs of such a program are estimated as a lump sum at USD 300,000.
- Invoke controls on all workers through the contractors to be aware of the limited wildlife resources of the islands' ecosystem, to refrain from exploiting these resources and to actively support co-operation in protection and preservation of these resources.

5.1.4 Impacts and Mitigating Actions for Island Communities

(a) Physical Impacts on Villages

The villages of Ban Hang Sadam, Ban Houa Sadam and Ban Houa Sahong would bear the direct and indirect impacts of the DSHEP. The hamlet referred to as Ban Hang Sahong and at least two outlying household of Ban Hang Sadam would need to be relocated. These communities comprised of a total of twelve (12) households and two (2) from the mainland and their associated specific Resettlement Action Plan (RAP) are outlined in Section 6.1 and discussed in detail in Appendix C. All communities are close to some of the construction actions, for example:

- Hang Sadam; within 1.0 km of the main damsite and has agricultural lands directly affected by the construction facilities and by the downstream dredging for the tailrace channel
- Houa Sadam, within 0.3 km and directly affected by the main barge landing site, its agricultural lands by the main road and traditionally used and cultural areas by the eastern upstream coffer dams and channel excavations
- Houa Sahong, within 0.5 km and directly affected by construction of the barge landing and western upstream coffer dam and channel excavation..

Because the selected site for relocating the Hang Sahong hamlet is one-half way up the island of Don Sahong, the western embankment is 250m to west of the main track and works such as forest clearing and channel excavation affect the northern part of the island it is probable that an access road would be constructed on Don Sahong. This is in addition to the access road-cum-embankment to retain the pondage on Don Sadam, While these roads would be assets beneficial to the local communities it is envisaged that separation of village traffic and DSHEP traffic may be necessary on Don Sadam. Also the drainage arrangements for all project access roads needs to be planned to be compatible with local villagers' drainage needs in their agricultural fields. These issues would be a source of local complaints.

Other mitigating actions which need to be resolved through consultation with local communities include:

- Water supply sources, both temporary during construction and permanently because many villagers use the Hou Sahong as their water source
- Noise emissions and their effects on community activities, such as the operation of the Wat at Houa Sadam which fronts Hou Sahong

- Policies on use of roads by local residents and appropriate warning signals by DSHEP and contractors' vehicles and public warning signs where appropriate along access roads
- Arrangements and use of DSHEP emergency health facilities and vehicles for local residents.

(b) Social Impacts on Villagers

The dominant impacts of the DSHEP on village communities would be to their livelihoods as outlined above in Section 5.1.3 and 5.1.4. It is proposed that not only appropriate compensation and other mitigation actions would be applied to alleviate such disruptions to their fishing activities **but** also this would require constant monitoring and continued consultation. The exact means of implementing this are uncertain but it is suggested that the scope of the Village Consultative and Grievance Redress Committee (VCGRC) be expanded to cater for all three communities, as well as the RAP for the Hang Sahong hamlet.

Another key issue relates to employment from local communities during construction of the DSHEP and this is a particularly sensitive issue as the three communities are in close contact. Also there are the questions of local low skill levels and availability due to agricultural activities during the wet season. It is recommended in the RAP that one person for each household be offered suitable employment on the DSHEP. The following mitigating actions should be investigated during the detailed design phase:

- Complete inventory all resident households to determine any skills relevant to the project
- Selection of best fishermen for involvement in catch and transfer and other fisheries mitigation actions
- Selection of local boatmen for as many tasks as possible with a view towards continuity of employment
- Selection of persons with limited skills for training in tasks such as security guards, employment in plantations or general labour
- Selection of presently skilled or persons with aptitude for employment by the various contractors and for further training toward long-term employment by DSHEP for the operational phase.

While it is recognized that these mitigation actions are general and preliminary they need to be carefully considered by DSHEP to construct and implement a sound beneficial project to the local communities. DSHEP needs to provide a local employment factor in its overall approach to avoid local resentment against the project.

5.1.5 Impacts and Mitigating Actions for Public Health

(a) Village Public Health

The existing situation and potential impacts of the DSHEP to the public health of the island communities were investigated because little was known about the project area, including the risks associated with *Schistosoma mekongii* and other helminth infections. As noted in Section 4.2.3 these concerns have generally proven unfounded and the general health of the communities is on a par with other regions along the Mekong River. The office of Public

Health at Muang Khong has achieved this despite the transportation and communications problems prevailing in the project area.

What is required is to maintain and improved these standards of public health and for DSHEP to assist in such improvements and not to create any further disease risks, particularly those that are epidemic or to worsen the local situation through a careless approach. Hydropower projects with their camps, external labor forces and alteration to local aquatic habitats sometimes aggravate local public health situations.

(b) Mitigating Actions

The impacts and mitigation measures are outlined in detail in Appendix D. The mitigating actions appropriate for the DSHEP management in relation to public health are several and quite specific, including:

- Medical surveys of all employees as a condition of engagement and treatment of any infections
- Problems of mosquito vectors due to location of the project, with two species *Anopheles maculatus* and *An. minimus* being present and requiring remedial actions such as provision of treated nets to all local communities and to all camps, residual spraying of all worksites and camps and monitoring programs of disease vectors and diseases
- Controls programs for *Aecies aegypti* as the main vector for Dengue and Dengue Hemorrhagic Fever (DHF) including elimination of small standing pools as breeding habitat
- Routine treatment program for *S. mekongi* and other intestinal disease with appropriate drugs for both the local communities and workers in camps
- Discouragement of worker bathing in the Mekong River at all times and provision of alternative ablution facilities to control the risk of *S. mekongi* infections, which are transmitted by very small snails, as intermediate hosts, and the Mekong River is an established habitat
- Discouragement of workers through public awareness programs of linkage of eating local raw fish dishes to *Opistorchis viverrini* (Liver Fluke) and regular testing and treatment of workers and local residents
- An active program including community and worker awareness and treatment for Sexually Transmitted Infection (STI) and HIV infections, as the existing rates of infection are low, transient worker populations are proposed and the GOL actively encourages such prevention and control programs.

Operating in the project area requires that the DSHEP engage a medical consultant to prepare a detailed plan for their construction operation. This would be done in co-operation with the provincial and district health authorities. The medical plan for the DSHEP project should be pro-active, consider the exact role of DSHEP and contractor health and emergency response facilities with relation to local communities and should be a priority for investigation. It is commonly linked with the overall safety program but in this case may warrant special attention, at least initially.

5.1.6 Impacts and Mitigating Actions for Mainland Operations

The exact location of the mainland camp area is uncertain at this stage but a riverfront area north of Khone Phapheng Resort is the preferred site. Development of a fenced-off main camp at this location would require the relocation of two households but this aspect requires verification when the site is established. There are several uncertainties surrounding the mainland camp including:

- Exact status along Highway 13 South in this zone as land appears to be locked-up by the military, Khone Phapheng Resort including its expansion and a proposed resettlement area for Ban Napeng as directed under the District Governor's office
- It is likely to generate considerable uncontrolled land occupation on the periphery by "camp followers" due to the relatively low income levels of the local residents; with attendant problems of poor standards of development, water supply and sanitation
- It could generate traffic problems across and on Highway 13 South, if located to the north of the highway
- Re-use of the constructed facilities should be considered in camp layout including the needs for and operation of a permanent camp for operating the DSHEP over the long term; this includes the possibility of use of barging facilities for tourism and local fishing operators.

The impacts and required mitigating actions for mainland camp operations are incomplete and need review based on final decisions on the project, It is suggested that this aspect be re-addressed during the DSHEP design stage.

5.1.7 Impacts and Mitigating Actions for Transmission Line

For the purposes of this EIA Report only a 230 kV transmission line as far as Ban Hat substation from the power station needs to be addressed in a preliminary fashion. This is because no decision has been made as to whether the power will be exported to Thailand or Cambodia or, less likely, Vietnam. The total length of this transmission line right-of-way (RoW) is 20.7 km and its width is 30m, with the following indicated as land use types on the RoW, as shown in Table 5.1:

- 6.3 km crossing open paddy land
- 8.0 km crossing disused paddy or scrub land
- 1.8 km crossing good forest land
- 4.3 km crossing regrowth or poor forest land
- 1.2 km crossing open water sections of the Mekong River.

There are no major environmental issues with the open paddy, disused paddy, regrowth forest or open water sections accounting for some 89% of the transmission line RoW. The remaining 11% located in good forests would need to be inventoried by the Provincial Department of Forests staff to determine its status, quantity of timber to be cut and sold and compensation payable. This action can only be done once the actual centre line of the RoW has been determined. As a consequence there are no estimates of compensation included in this EIA Report.

There are indicated to be approximately 50 towers to be located along the RoW, actually affecting a total of 0.5 ha of land. However construction techniques for transmission lines can be disruptive and the following general mitigation actions proposed for design and construction:

- Avoidance of the transmission line passing over any houses or other built structures
- Avoidance of or proper clearance for telecommunication towers or radio antennae

- Checking on the status of land along RoW to minimize any impacts on forest or other reserves; not believed to be a problem
- Checking on bird migration flyways to determine what effects, if any
- Ensuring that all long reaches between high towers (e.g. across Mekong River channels) are adequately marked according to GOL Department of Aviation (DOA) or international standards.

In view of only preliminary information being available, it is suggested that supplementary EIA of the transmission line be prepared at an appropriate time when sufficient data is available.

5.2 impacts During Operation Phase

In general, the impacts during the operational phase of DSHEP would be considerably less than those imposed on the ecosystem of the two islands and experienced by the three communities directly involved. There are uncertainties over how much land will be altered on Don Sadam and Don Sahong and what type of remedial measures to compensate the local communities for associated resource losses.

This section outlines the nature of some of the operational phase impacts and mitigating actions but it is not complete and will need to be updated when more information on the engineering design, including the actual size of the proposed DSHEP, is finalised.

5.2.1 Impacts and Mitigating Actions on Land Use

Once the construction phase is finished, the DSHEP and its contractors would have to consolidate and clean-up their land holdings on Don Sadam and Don Sahong. This condition may also apply to land used in the camp and outside for temporary works on the mainland. It is suggested that site rehabilitation and re-use of any facilities or salvage of building supplies for local communities would be priority items. Similarly scarification and planting with trees of any temporary worksites negotiated by the contractors should be undertaken. It is considered advisable that as much land as possible should be returned to the local village authorities in as good a state as possible. To effect this DSHEP would have to make site clean-up and rehabilitation a condition of engagement for all contractors onsite.

5.2.2 impacts on Hydrology and Downstream Flows

(a) Environmental Flows atThakho

During the operational phase of DSHEP the overall effects on hydrology will be minimal and acceptable provided that agreed "environmental flows" are maintained downstream of the entrance to Hou Sahong to ensure the visual appearance of Khone Phapheng waterfall and flows down adjacent channels.

This matter of environmental flows and what is an appropriate quantity to be diverted is complex and further studies required during the design stage will include:

- Collection of further data on flows down the three major channels in the Don Sadam/ Don Sahong region and over Khone Phapheng, including sill levels on adjacent watercourses.
- Analysis by a hydrologist based on the four (4) dry season months and indicated flows down adjacent channels and over Khone Papheng,

- A further detailed study of the options for alteration to Hou Sadam and Hou Xang Peuk to replicate the Hou Sahong so as not to disturb fish migration patterns through the GFL.

(b) Downstream Releases from the Power Station

The actual increases in water volumes and their dispersion downstream would have minor effects on fish netting activities affecting the fishermen who traditionally use these areas, believed to include the Ban Hang Sadam, Ban Hang Sahong and Ban Hang Khonc communities.

It is considered that the above suggested additional hydrological studies are urgently needed.

5.2.3 Impacts and Mitigation Actions on Aquatic Ecology and Fisheries

The main impacts and mitigation actions proposed relating to aquatic ecology and fisheries are discussed in Section 5.4; where this topic is treated in its entirety for convenience and continuity.

The operational phase of the DSHEP may see alterations to the species distribution of fish, both seasonally and over the long term and probably in numbers. Related to this are changes which would occur in the patterns of use and returns of local fishing communities, possibly extending further upstream and downstream for certain species and associated use patterns. These aspects should be investigated and documented and there is some provision for this in the mitigation measures proposed. However, despite the mitigation effects put in place and the on-going depletion of fish stocks due to improved methods and overfishing, any long-term changes on the fisheries is likely to be blamed on (the DSHEP project as the blockage of a major migration channel (Hou Sahong) will "be perceived as the cause of all upstream fishing problems", whether this is factual or not.

There is a more detailed description of the long-term risks associated with the DSHEP contained in Appendix G and this should be read in conjunction with this section.

5.2.4 Impacts and Mitigating Actions for Island Communities and Livelihoods

Many of the island communities directly affected by the DSHEP can be expected to benefit through employment in either the project workforce or associated work. This would extend throughout the construction period but jobs would gradually disappear. While some may acquire new skills and have to move to gain further employment there would be others in a position of locally unemployed. Minor numbers could still be employed on the DSHEP but the opportunities for unskilled workers are limited in modern power stations.

These persons would be seeking cash incomes and the mitigating actions proposed for engagement in the fishing industry are:

- Employment in cage culture in the DSHEP pondage,
- Re-employment in the gill net fishing industry in traditional waters.

It is advisable that all fishermen directly affected comprised of those on the Don Sadam and Don Sahong (243) and surrounding islands (84), a total of about 330, are carefully monitored as their livelihood could be seriously affected. Post construction this group should be interviewed and a

report made on their occupations and incomes and any necessary plans drawn-up to ensure that individuals have not become disadvantaged. This is suggested at this time but definite plans need to be devised in the project's monitoring program.

One of the main long-term impacts on the communities' livelihoods would be through the benefits flowing from increased education facilities on the islands. This is part of the Social Action Plan (SAP) outlined in Section 6.3.

5.2.5 Impacts and Mitigating Actions on Public Health

During the operational phase it is not anticipated that any adverse impacts would occur in respect to the communities on the two islands affected by the DSHEP. By that time normal operating procedures of the District and Provincial health authorities would be in place including programs and budgets. The communities would benefit from public health programs devised for the construction phase and from improvement in access to the islands. However, it is also anticipated that any health treatment facilities and emergency response for the power station would be reduced and would be based on safety for the DSHEP employees. Only a minor monitoring program is required for public health in operational phase and this would be done by sampling of residents of the three communities.

5.2.6 Impacts and Mitigation Actions for Transmission Line

Normally transmission lines have very limited impacts after construction and this would appear to be true for the proposed DSHEP power station to Ban Hat 230 kV line. Once operational the transmission line if located as stated would only have minimal interference with radio and TV and unlikely to seriously affect local communities. As indicated in Section 5.1.6 there is, as yet, no defined route. It is suggested that further discussion on the operational impacts and mitigation measures be included in the Transmission Line EIA Report, to be prepared when the line route is finalised.

5.2.7 Impacts & Mitigation Actions for Tourism and Ramsar Site Management

(a) Tourism Aspects

The impacts of the DSHEP project on tourism for both the construction and operational phases are minimal. Don Sadam and Don Sahong are not present tourist destinations and unlikely to be so in the immediate future. The improvements of the accessibility to the two islands would improve slightly their possibility of becoming tourist areas for:

- Limited attraction of the hydropower station and pondage
- Development of a circuit nature trail from Ban Hang Sadam across Ilou Sahong to Don Phapeng and to the west side of Khone Phapheng waterfall and back to Ban Houa Sadam.

Such a development would tend to focus on Don Phapheng and accommodation there, closer to the waterfall. The implications of this may need to be considered by Department of Tourism authorities as part of the long-term development plans of the Khone Phapheng area. The DSHEP will enhance tourism development in the region.

(b) Ramsar Site Management

As noted in Section 4.3.6 the declaration of a Ramsar site for the Siphandone Wetland appears to be imminent. Development of DSHEP is not excluded by such a proposal. However in the long term the presence of the project would have some implications to the overall management plan of the Siphandone Wetlands, including:

- ° Direct impacts on fisheries management through a need to consider what the effects of damming the Ilou Sahong have been and exactly how it affects local and regional fishermen
- A certain loss in the overall "ecological integrity" of an unspoilt natural area of man living with the resources of the region
- A need to accurately assess the forestry, wildlife and fisheries losses associated with DSHEP, so that data is available to conservation groups and MRC on the full implications of in-stream hydropower development on the Mekong River. This is an environmental issue required for future reference in both Laos and Cambodia.

As the preparation of long-term sustainable management plans for the Siphandone Wetland require community consultation including stakeholders' meetings to formulate the plans, these would need to be integrated with the actions and objectives of DSHEP. Therefore, the co-operation of the project sponsor with conservation groups and MRC on the role of DSHEP should commence immediately on any approval to proceed. Exchanges of information and ideas on optimizing the long-term benefits to the local communities should be the prime objective of this consultation process.

5.3 Impacts During De-commissioning

The Concession Agreement between the GOL and DSHEP has not been discussed in detail, but the present MoU indicates that the concession period will be 30 years from commercial operation, after which the power station will be handed over to the GOL and they will continue to operate the facility. Hydropower station, such as Don Sahong, have useful lives of decades - there are hydro station operating more than 100 years after first commissioning - so there is no technical reason why the power station should ever be decommissioned. On the other hand, there are small power stations that have been removed from streams in the United States and other countries, specifically to restore aquatic ecological balance.

If decommissioning and removal of the power station was required, the basic actions involved would require the following:

- Restoration of the natural control at the entrance of the Ilou Sahong and dumping rockfiH (taken from the water retaining embankments) into the stream to replace the rock removed during lowering of the upper reaches
- Removal of electrical/ mechanical plant at the base of the powerhouse
- Demolition of the concrete structures (although this would not be absolutely necessary as the turbine waterways, once the mechanical and electrical equipment is removed, will allow fish to pass freely and the structure will provide permanent access from Don Sadam to Don Sahong).
- Extensive tree planting program for the sides of the channel to restore vegetation to these zones.

5.4 Aquatic Ecology and Fisheries Impacts and Mitigation Actions

The impacts on fisheries of the proposed DSHEP are by far the most important. It has been raised as a major issue in all discussions with concerned agencies such as MRC, IUCN, VAVF and LNMC in Vientiane and has dominated all discussions at Stakeholders' Meetings. The significance of the Mekong River fishery is documented in Appendix G. The importance of the Hou Sahong channel as the major existing year-round channel for fish migration can not be over-emphasized. Without implementation of mitigation measures, blocking of the Hou Sahong would reduce the dry season migration offish and have some impact on the wet season migration offish.

Descriptions of exact effects on individual species offish are not possible. Mitigating actions have been proposed but fisheries experts may disagree with some of these proposals and their true potential. Nevertheless these mitigation actions are documented for discussion of this EIA report.

Rather than presenting the impacts and mitigating measures as construction phase and operational phase components, the consolidated assessment and possible solutions are presented as one below as this is such an extensive issue. It involves a comprehensive approach to the various options available to the Project proponent and an evaluation of potential compensation to not only local fishermen but the wider fishing community of the Mekong River ecosystem.

5.4.1 Fisheries Data Availability

As noted above, the assessment of environmental impacts of the DSHEP on fish migration is central to decision-making about the project. As definitive data is not available on fish migration through Hou Sahong, and major movements occur in both the dry season and wet season, this assessment has to be made in the light of that limited data. Detailed information over time is available for two sites, some 15 km upstream through catch data at Ban Hat/Khong Island and through the wet seasons on a smaller channel at Hou Som Yai, just east of Khone Phapheng. Extrapolation of this data and other general data has been the basis of information presented in Appendix G.

5.4.2 Fish Impacts and Mitigation Measures

The Hou Sahong is a major dry season migration channel and an important wet season migration channel as it has no waterfalls. It provides an open-water path across the Khone Phapheng complex of waterfalls and cascades in all seasons. It is, therefore, ecologically imperative that a range of mitigation measures be undertaken as part of the implementation program for the DSHEP. The DSIEP concept is centred around construction of a barrier to fish migration in the form of a powerhouse structure across the lower reach of the Hou Sahong. Preceding the powerhouse construction, cofferdams will be constructed at the upstream and downstream ends of Hou Sahong in the initial four (4) months of the construction period. Therefore, interference to fish migration through Hou Sahong occurs from the outset of construction through its operational phase.

It is difficult to assess the details of the effects of DSHEP on fisheries. In Appendix G there are numerous examples of the possible effects on fish migration. The exact delineation of all species and exactly how they are affected is not determined. However, it is determined that the migration effects would seriously affect fish species such as those indicated in Table 5.3. The unknowns in the effects on fisheries are summarized as follows:

- Numerous species of small fish would be affected and these are crucial to the diet of local communities in terms of regular protein inputs and generate income
- Numerous species of middle size fish, particularly Cyprinoids, would be adversely affected to an undetermined degree
- The impacts of effects on large species is unknown but would be serious due to their needs for deeper migration channels and lack of knowledge on migration patterns.

The effects would have varying effects on all migrating species conservatively estimated at between at least 35 and 60 major species, which could be considerably higher and in the order of 90-120 species.

Table 5.3 - Partial List of Main Fish Species Affected and Migrating Through Hou Sahong

Scientific Name	Lao Name	Major Species
Dry Season Upstream Migration - 4 Months December to April		
Cyprinidae		
<i>Scaphogenus bandanesis</i>	Pa Pien 9	+
<i>Scaphogenus steinegri</i>	Pa Pien 13	+
<i>Cirrihinus microlopis</i>	Pa Pawn	+
<i>Cirrihinus nolitrella</i>	Pa Geng	
<i>Labeo erythropterus</i>	Pa Wa Soong	
<i>Bengana behri</i>	Pa Wa Na Noor	
<i>Erythropterus melangira</i>	Pa Srae	
<i>Hysibarbus sp.</i>	Pa Pak Nout	+
Numerous Small Cyprinids including 2 Species of <i>Heinchorchus spp.</i>	Pa Saew	+
Gyrinoichelidae		
<i>Gyrinoichetius pennolri</i>	Pa Goh	
Wet Season Upstream Migration - 3 Months - mid-May to mid July		
Pangasid, Silurid, Bagntdae & Sisoridae Catfishes - Estimated 18 Species		+
Numerous Small Cyprinids - Undetermined at this stage		4
Downstream Migration - 4 Months - April to mid July		
Cyprinidae - Estimated 8 Species		+
Minimum Total Estimated Major Species - 35		

5.4.3 Mitigation Options

(a) Channel Improvements to Hou Sadam and Hon Xang Peuk for Fish Migration

One of the prime uncertainties about fish migration in the complex of channels, islands, waterfalls and cascades is the extent of dry and wet season flow, its characteristics and whether or not fish can migrate in only one channel. It is understood that upstream migrating fish gather at the falls and, after recuperation, attempt to navigate in any of the 18 channels where they are attracted by the flow conditions. If that channel proves to be impassable, they try another channel. At the peak of the low flow season, Hou Sahong is the only route for larger fish (and at times for all fish when there is no flow in Hou Sadam). However, improvements to Hou Sadam and Hou Xang Peuk will provide routes that can be passable for all fish at all times. Improvements would not be carried out haphazardly, but would be done in such a way that conditions of current velocity, depth of flow would be similar to those existing in Hou Sahong. Deep pools and other areas that can provide refuge for fish will also be provided.

Hou Sadam is narrower and shallower than Hou Sahong, (historically reported to cease flow over certain rapids) and its exit is some six (6) km from Hou Sahong. However, in colonial times the Hou Sadam was a route for vessels carrying timber downstream for export and the navigation markers and concrete bases for winching the vessels are still in place (Photograph 5.1). The channel must have carried a higher flow in those days and has subsequently silted up. While possibly not as effective an alternative to Hou Sahong as is Hou Xang Peuk, construction activities to improve its ability to carry fish in the low flow season, in particular, would include:

- Removal of rock at the upstream entrance from the Mekong to increase low season flow
- Desilting where appropriate
- Clearing of vegetation and other obstacles from river banks at the lower end, where the stream is overgrown.

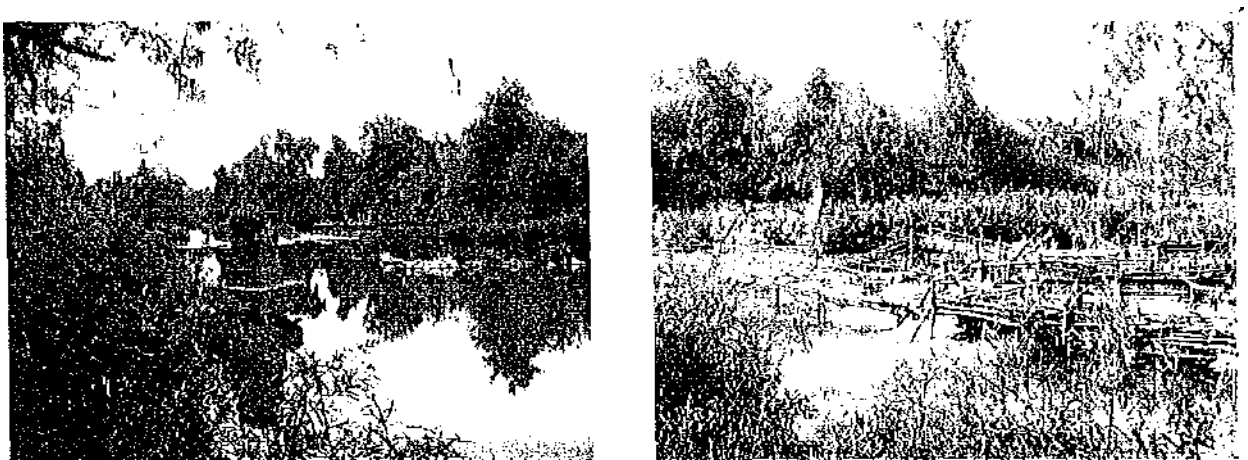


Figure 5.1 - Navigation Pylons in Upper Hou Sadain (in each case with fish traps)

The Hou Xatig Peuk and associated channels are larger than Hou Sahong, with the main channel followed from the Hou Sahong confluence to east of Don I-Som to the entrance in the Mekong River mainstream near the southeast corner of Don Dct. This channel appeared to have more fish traps than Hou Sahong (Photograph 8.1) and is the most feasible alternative to Hou Sahong but would require streamlining in terms of:

- Removal of fish traps blocking the lower section of Hou Xang Peuk
- Removal of Klione Lam waterfall and grading of the riverbed profile
- Removing and regrading of the channel in the vicinity of the island complex above Klione Lam (possible to whole river section)
- Removal of rock at the entrance of Hou Xang Peuk at the northern end of Don 1-Som to increase dry season flow.

This description of the required channel improvements is basic and will be confirmed by topographic survey and hydraulic engineering design with input from experienced fisheries biologists to ensure that the resultant channels will replicate the conditions in the Hou Sahong. This should be initiated immediately. The preliminary estimated costs of the Hou Sadam channel improvement works to facilitate year around fish migration are USD 5.5 million and for the Hon Xang Peuk is USD 8.5 million.

(b) Controls on Hon Sadam and Hou Xang Peuk

Fishing controls on these two (2) channels, located on either side of the Hou Sahong will be required. The status of fish migration patterns on all these channels is uncertain. Only limited knowledge of fish caught during the wet season trapping is available primarily on these areas by Baird. The most effective means of implementing a "Control Program" on fishing and the extent of that program are uncertain. There are the precedents of "Fish Conservation Zones" (FCZ) to protect the dolphin pool below Ban Hang Khone/Ban Hang Sadam and others in the Siphandone are of the Mekong River complex. This could be part of the Siphandone Wetlands program when it is initiated. Also these FCZ programs have to be set-up by the Champasak Province and Kliong District fisheries departments as agreed by and in conjunction with the local fishermen of these two areas. This is not an easy task.

The proposed control programs for the Hou Sadam and Hou Xang Peuk would have to be supervised by the District Fisheries Department staff and this requires their presence in the area: boats, motors and petrol, reporting procedures and staff administration and support. As with other components of this mitigation the costs of this program should be funded by the DSHEP project because the requirement is a direct impact of the Project.

The anticipated budget for the "control program on Hou Sadam and Hon Xang Peuk" for the four (4) year construction program is USD 600,000.

(c) Temporary Fish Capture and Transfer

At the same time (i.e. first 4-5 years) as the first above action is taking place, the DSHEP proponent will finance a detailed research program into the exact role the other (2) channels of Hou Sadam and Hou Xang Peuk, have in terms of fish migration patterns (i.e. numbers of fish, seasonality of migration, sizes of fish, numbers of fishermen and methods of catching fish).

To provide a back-up to the channelisation of the Hou Sadam and Hou Xang Peuk, a proactive fish capture and transfer program would be based on the DSHEP supplying selected fishermen from the three (3) villages of Ban Hang Sadam, Ban Houa Sadam and Ban Houa Sahong with equipment and means necessary to carry out this four (4) year construction phase program, including:

- Payment of wages for ten (10) fishermen and for rental of their boats
- Provision of a range of net with mesh sizes between 2 to 6 inches, including replacement nets
- Provision of storage pits and tanker or boxes to hold fish caught with a circulating fresh water supply
- Provision of a specially constructed tanker truck or a pick-up truck supplied with suitable storage for transfer fish to Ban Houa Sadam and release to the Mekong River mainstream
- Provision of other equipment as needed and budgeted for
- Provision of a fisheries biologist and assistant to monitor the data on fish caught below the lower cofferdam and released to the Mekong River.

The above is the basics of the program but a proper fish capture and released program would need to be developed on any approval of the DSHEP to proceed. The estimated cost for this program for four (4) years is USD 1,500,000.

(d) Option of Fish Lifts in DSHEP

The effectiveness of fish lifts in tropical rivers such as the Mekong, with its multitude of fish species and migration patterns is unproven. In fact, few have worked effectively and none had to deal with the volume and variety of species involved at the Great Fault Line.

After consideration of this option it is recommended not to consider the installation of a fish lift or similar facility in the powerhouse structure.

(e) Fisheries Studies Program

As noted above, a research program based on the DSHEP area and its immediate surrounds is required. Ideally this research in the status and significance of the three (3) main channels, Hou Sahong, Hon Sadam and Hou Xang Peuk should commence immediately the decision on project implementation is made.

This research program should be based in a new Research Station established in the project area, probably on Don Sadam upstream of the powerhouse, and devised by a senior fisheries biologist experienced with the island, waterfall and cascade area of the Mekong River in Laos. It would need to include a variety of tasks to determine the inter-relationships of these three (3) channels with fish, fish caught and seasonal patterns of fish migration among the channels and with the Mekong River overall, It would need to include investigations into factors such as:

- Investigations into fish trap locations; both permanent and mobile traps?
- Are mobile traps always put at one location?
- Who own various traps and how many do they own?
- How many do they place each year and where located?

- How many in place and at what season and for how long?
- What species are caught in fish traps?
- What species are caught by nets and in what season and how many?
- What percentage of fish caught by fishermen are caught in nets?
- What is percentage of Mekong River of fish traps located in area?
- What is percentage of local fishery is affected by removal of Hou Sahong?
- Are these species caught further upstream and if so in what quantity?
- What are the dry season migrations of these species in other two (2) lious?
- Who are the fishermen ? Names and records of fishing in three (3) Hous?
- Who are the fishermen ? Names and records of net fishing in local areas?
- Are there any foreign owners of traps in Hou Sahong?
- How many outside people come to the three (3) Hous to assist each year?
- Is it feasible to close Hou Sadam to dry season fishery or close it partially?

The above are only some of the questions requiring resolution before a complete picture on local fishing can be made and appropriate compensation with all those potentially directly affected made. It is realized that this is an onerous demand on the DSHEP proponent but this research data is needed to protect the fish resources using the Hou Sahong and equitable treatment of those directly involved.

The estimate for the fish research program is also preliminary, needs to be confirmed by a comprehensive and detailed program and needs to be discussed and agreed with relevant authorities (national, provincial and district fisheries). The basic estimated cost for fisheries research is USD 1,500,000.

In addition to this fisheries program a three year program overlapping the construction and operational phases should be undertaken to investigate the feasibility of reservoir cage culture. This would depend on factors such as fluctuations in reservoir over the year, access to and feasibility of net cages and suitable Mekong River native species for growing in cages. The estimated cost of this study is USD 1,500,000.

5.4.4 Fish and Dolphins of the Lower Pools

Blasting of a tailrace channel in lower Hou Sahong and downstream for 1 km is also required as part of the project. This would have the same impacts as the upstream action and would require the same pre-cautionary and warning safety measures. Care must be undertaken not to do blasting during fish migration periods because of the effects on the fish populations. Recovery of killed fish should be by the resident fishermen of Ban Hang Sadam and Ban Hang Khone.

The proposed operations also include a concern to the residual population of the "conservation sensitive" Irrawaddy dolphin resident in the pools of the Mekong River. The main area where these dolphins are usually seen is some 2-3 km from the zone of this anticipated activity. Dolphins are known to be sensitive to underwater percussion charges and limiting of the blasting charges should be considered in planning of these operations. An underwater exclusion net made of visible heavy netting around the area of operations has been considered and appears not to be necessary. However this condition could be invoked if deemed necessary to protect the local dolphin population. A suitable location for this exclusion net would be determined in conjunction with dolphin experts from conservation groups such as WWF and IUCN.

The costs associated with all the safety measures including warning systems and exclusion net are considered to be part of the barge path and downstream channel's contractors expense and so are not included in the EIA.

5.4.5 Construction Phase Mitigation

In summary, the mitigation measure proposed include:

- Immediately commence remedial actions on the Hou Sadam and Hou Xang Peuk, to facilitate a year round fish migration capacity. This work to be completed prior to construction of the coffer dams on the Hou Sahong
- Planning for and implementation of an active "capture and transfer" to upstream waters based on all fishes caught in a multi-mesh sized at the mouth of the Hou Sahong and lasting the whole four (4) year construction period and make provision for extending this program, if DSHEP necessitates by an extension to the construction period.
- Put in place on the two (2) adjacent waterways of Hou Sadam and Hou Xang Peuk, proactive "controls on fishing" during the construction period, either year around (preferable) or during migration periods, yet to be determined

Another action requiring mitigation actions in respect of local fishing use of the upstream and downstream sectors of the Mekong River is the minimization and separation of fishing and project-related boat traffic. This would occur primarily during four (4) year construction period of the DSHEP and relates mostly to the upstream zone wet of Don Sahong to Ban Napcng. Mitigating actions are limited and are in the form of clear marking of the work zones and separating the activities of fishermen with that of the project. No costs are included in the EJA for this which is essentially a safety issue.

5.4.6 Estimates of Fishermen Affected by DSHEP

Before estimates of compensation can be made, the number of fishermen indirectly and directly affected, have to be assessed. While the number of fixed traps on Hou Sahong can be determined, determination of exact numbers of mobile and seasonal traps is difficult. Not only are actual locations and numbers and types of traps desired but there is the ongoing transfer of technology from traditional to nets and motor-operated boats to be evaluated. An attempt was made to gather some of this data but it is incomplete and inconclusive. As noted above, there is the problem of place of residence and actual use of not only Uou Sahong but other channels, both dry and wet seasons, and the extent of the implications to these local area fishermen. It is proposed that the mitigation actions should include also Hou Sadam and Hon Xang Peuk as these areas and resident fishermen are directly affected by DSHEP through mitigation actions noted above.

The fishermen and their families of Hang Sadam, Houa Sadam and Hang Sahong village areas are directly affected. Similarly, it is general knowledge that the fishermen of Don En and Don Tan would be affected by the proposed construction of upstream barge paths and losses in migrating fish. Also some of the fishing families of Ban Hang Khonc and possibly Veunkham, would be directly affected by the downstream dredging of their traditional fishing grounds.

As the mitigation measures proposed will replicate the Hou Sahong, it is assumed that there will be no significant impacts on the fishing industry beyond the immediate area of the project.

The results of estimates of the number of fishermen and their families or other households directly and indirectly affected are summarized in Table 5.4. This summary indicates that some 434 fishermen are directly affected and an additional 345 persons involved in fishing or fish processing or trading could be indirectly affected. Of course these preliminary estimates should be confirmed prior to commencing any negotiations on fisheries compensation.

Table 5,4 - Estimates of Number of Fishermen Affected by DSHEP

Area of Project	Directly Affected Fishermen	Indirectly Affected Fishermen or Others	Reasons for Inclusion
Don Sadam & Don Sahong ¹	243	280	Resident in impacted area & included in HH Survey
Bans Hang Khone, Napeng, Veunkham & Don Som ²	84	17	Resident of barge path and downstream dredging
Miscellaneous users along Hou Sadam & Hou Xang Peuk ³	50	10	Estimates only
Don Tan, Don En, Don Som & Don Khon Nua & Don Del Ok ⁴	57	38	Residents affected by barge & channel works
Totals Affected	434	345	Directly & indirectly affected by DSHEP

Notes: (1) Total population of 3 villages and 20% of total population of 1400
 (2) Based on 49 fishermen in Hang Khone, 25 affected in Don Som & 10 each in Napeng & Veunkham
 (3) Based on estimated population migrating to areas to work including traditional owners of fish traps
 (4) Based on estimated total population of 380 families being 15% directly and 10 % indirectly affected by northern barge path and Hou Xang Peuk channel works

5.4.7 Evaluation of Fish Mitigation Options

The assessment of impact of a barrier across llou Sahong on fish mitigation arc summarized as follows:

- The impacts are independent of height of the coffer dams and the final DSHEP dam height
- Damage would be done to the fish species migrating if permanent mitigation actions of are not implemented
- Clearance of other channels such as Hou Xang Peuk or Hou Sadam are proposed as the primary mitigation measure
- A capture and transfer program should be introduced during the constriction period as a further measure.
- Controls must be introduced on fishing in the Hou Sadam and Hou Xang Peuk.

The extent and nature of tiiese projected impacts is difficult to assess and can only be put forwarded in general terms at this stage as summarized in Table 5.5.

Table 5.5 - Assessment of Effects of DSHEP on Fish Migration at the Great Fault Line

	Dry Season	Wet Season	Comments
Case 1 - No Project on Hou Sahong			
Upstream migration of fish	No effects on migration patterns	No effects on migration patterns	Fisheries management and controls on traps might be necessary to prevent over fishing
Downstream migration of fish	No effects on migration patterns	No effects on migration patterns	
Case 2 - DSHEP - No Mitigation Measures			
Upstream migration of fish	Seriously affected	Moderately affected	Considered probable that dry season upstream migration would be affected by at least 60%
Downstream migration of fish	Moderately affected	Low effects	Downstream larval drift of fish could be mitigated by by-pass arrangement in powerhouse allowing drift to occur
Case 3- DSHEP Mitigation - Improvements to Hou Xang Peuk and/or Hou Sadam for Fish Migration			
Upstream migration of fish	Minimally affected	Minimally affected	Dry season migrations dependent on replicating Hou Sahong type channel
Downstream migration of fish	Minimally affected	No effect	Limited problems in wet season upstream as several other channels cater under present regime
Case 4- DSHEP - As Cases 3 plus Temporary Catch and Transfer			
Upstream migration of fish	Minimally affected	Minimally affected	Need to consider time extension to program , depending on success of altered channels
Downstream migration of fish	Minimally affected	No effect	Limited effect even if altered channel only partially effective

5.4.8 Estimates of Fishing Compensation Payments

The numerous parties involved and negotiations for compensation and mitigation make an assessment of these factors difficult. The directly and indirectly impacted local fishermen would have to be compensated and the mitigation actions on Hou Sahong, liou Sadam and Hou Xang Peuk funded. These estimates are summarised in Table 5.6.

Table 5.6 - Fisheries Compensation and Mitigation Cost Estimates (Costs in '000 USD)

	A. Compensation Estimates	Cost Estimates	Comments
1.	Actual Traps Lost in Hou Sahong due to DSHEP-71 traps	146	Costs based on RAP - Attachment C-4
2.	5 Years Fishing based on direct impacts on 200 fishers HHs and to be spent on re-equipping them for cage fisheries in Don Sahong	3,270	\$1200/year for directly affected HH \$400/year for indirectly affected HH
	Total Compensation	3,416	
	B. Project Internal Mitigation & Management Costs		
3.	3 Year trial program of capture & transfer of fish during diversion and trials in cages at top & bottom of Don Sahong Channel	1,500	\$500,000/yr using boats & trucks
4.	Controls on Hou Sadam and Hou Xang Peuk fishing	600	Lump sum to control & mitigate
6.	3 Year Research program for cage culture fisheries in Don Sahong	750	\$250,000/year
	Internal Mitigation	2,850	
	C. External Mitigation & Management Costs		
7.	Study and actions to improve Hou Sadam for fish passing	5,500	Lump Sum -req'd from diversion for 3 Years
8	Study & actions to improve Hou Xang Peuk for fish passing	8,500	Lump Sum -req'd from diversion for 3 Years
9.	Fish Ecology Study Li Phi Falls to Khone Phapeng	1,500	Lump Sum -req'd from diversion for 3 Years
10	3 Year post-implementation fish ecology study for DSHEP	1,500	After project completion
	External Mitigation	17,000	
	TOTAL ESTIMATED COMPENSATION & MITIGATION	23,266	

6. RESETTLEMENT AND SOCIAL ACTION PLANS

The DSHEP project location on Hou Sahong and its impacts are such that the Project would cover an extensive area in the centre of Don Sadam and Don Sahong. This includes the need to relocate the Hang Sahong hamlet (10 HHs) and other households in the Hang Sadam area. A Resettlement Action Plan (RAP) has been prepared for this need. Similarly, a Social Action Plan (SAP) has been prepared for the project area but focussing on Don Sadam and Don Sahong, as the most seriously impacted areas. This section also contains suggestions for mitigating actions for the future public involvement program to be undertaken by the DSHEP and for the overall integration with the long-term planning for development being undertaken by the Champasak Province and the Khong District authorities, in relation to the project area.

The social impacts of the DSHEP are anticipated to particularly intensive in three local communities of Ban Hang Sadam, Ban Houa Sadam and Ban Houa Sahong which are inhabited by farmer/fishermen households, whose livelihoods are directly affected. Also depleted is their traditional access to the riverine forests base of Hon Sahong and major disruptions to their daily activities during the construction period.

6.1 Resettlement Action Plan and Implementation

The Resettlement Action Plan (RAP) for DSHEP is produced in its entirety in Appendix C. This summary details some of that RAP but the Appendix should be referred to for more detail. The RAP was prepared by the DSHEP Resettlement Expert, Dr Monlri Suwanamontri and it complies with the recent Lao guidelines on Resettlement issued by GOL in November 2005. He was assisted by the Household Survey team and staff of the Khong District administration.

6.1.1 Background to RAP

Information and data used in planning the Resettlement Action Plan (RAP) are available from seven (7) main sources including:

- Interpretation of land use maps at a scale 1:5,000 for the villages that may directly/indirectly affect by the project.
- Three (3) stakeholder's meetings at Pakse, at Muatig Khong and at Ban Hang Sadam.
- Socio-economic census of a potentially households to be relocated
- Preliminary inventory of assets of households to be relocated,
- Household surveys using interviews of 111 household heads and representatives of potentially directly/indirectly affected villages in project area.
- Focus group on social issues among interest groups in the village including Lao Women's Union and other interest groups.
- Consultation with village leaders and women groups on resettlement site for Hang Sahong and related developments at hamlet to be relocated,

This RAP has been prepared as a guideline for the GOL and the Don Sahong HEP's Proponent to use for implementing compensation and resettlement for the project. It has addressed policy, principles of resettlement, entitlement to compensation, livelihood restoration, monitoring and evaluation including institutional and management arrangements of the resettlement works.

Table 6.1 - List of Key Technical Terms Used for RAP

Compensation	Payment in cash or kind for an asset to be acquired or affected by a project at replacement cost.
Entitlement	Range of measures comprising compensation in cash or kind, income restoration, transfer and other assistances depending on type and degree of losses.
Household	All persons living and eating together in one house.
Income restoration	Re-establishing income sources and livelihood of affected persons
Land acquisition	Process whereby a person is compelled by a public agency to alienate all or part of the land traditionally owned or used to the ownership and possession of that agency, for a public purpose in return for compensation.
Rehabilitation	Assistance provided to affected persons due to loss of productive assets, incomes, employment or sources of living, to supplement payment of compensation for acquired assets in order to improve living standard.
Relocation	Physical shifting of affected persons from his/her pre-project place or residence to other locations,
Replacement cost	Amount needed to replace an asset, and is the value determined as compensation for: Agricultural land at the pre-project or pre-displacement level, whichever is higher and is the market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing that land to levels similar to those of the affected land, plus the most of any registration and transfer taxes; Houses and other related structures based on current market prices of materials, transportation of materials to construction site, cost of labor and contractor's fee and any cost of registration and transfer taxes. In determining replacement cost, depreciation of assets and value of no deductions are made to value of benefits to be derived from the project; Crops, trees, and other perennials based on current market value or damage ; and Other assets such as fish traps based on replacement cost or cost of mitigating measures.
Right-of-way	Project road on Don Sadam - 5 m either side of the centre line. Project 230 kV transmission line to Ban Hat Substation - 15 m either side of the center line.

6.1.2 Project Impact and Scope of Resettlement

(a) Project Impact

As listed in Table 5.1, the Don Sahong HEP **will** acquire five (5) main types of land for project construction with the total area of 268.9 ha, they include:

- Right Bank - Don Sahong Works Areas - 6.4 ha
- Left Bank - Don Sadam Works Areas - 23.9 ha
- Mainland Barge Landing Site -1.2 ha
- Project Reservoir Area on Hou Sahong to EL 75m - 172.6 ha
- Transmission Line from Dam Site to Ban Hat Substation - 65.6 ha

In addition there are 81.3 ha of water areas of Hou Sahong and 11.3 ha of two islands to be considered from the acquisition and compensation viewpoint.

(b) Number Households & Persons to be Relocated

Recent ground surveys by the EIA study team found that 4 villages namely Don Sahong (Hua Sahong and Hang Sahong hamlets), Hona Sadam, Hang Sadani and Tha Kho will be affected by the project from using the above lands. The project direct resettlement impacts indicate that there will be 14 households (76 persons) from 3 villages need to be relocated. but the figures for Hang Sadam and Thakho can not be determined at this stage, so the RAP focuses on Hang Sahong (Table 6.2)

Table 6.2 - Affected Houses, Residential Lands, and Persons by Village/Hamlet

Name of Village	Affected Houses	Residential Areas (ha)	Affected Persons
1. Don Sahong (Hang Sahong)	10	1.5	46
2. Hang Sadam	2	0.3	10
3. Thakho	2	0.3	10
Total	14	2.1	66

Source: Ground survey by EIA Study Team, January/February 2007

6.1.3 Socio-Economics and Livelihood of People to be Relocated

(a) Village Profile of Haug Sahong Hamlet

This social assessment of Hang Sahong Hamlet is derived from a Socio-economic Census of the village taken in January/February 2007 and supported by a complete census of all Hang Sahong households as shown on Figure 1. The Hang Sahong Hamlet is administratively under Ban Don Sahong which is comprised of three (3) main communities: I-loua Sahong or Sahong Head (44 households), Sahong Kang or middle Sahong (17 households) and Hang Sahong or Sahong Tail (10 households) for a total of 71 households.

Located about 4 kilometres from Houa Sahong, the main community, Hang Sahong has no social infrastructure and has to rely on the few social facilities available in Houa Sahong (e.g. elementary school).

Children have low opportunity to access educational facilities where the village primary school is located 4 km to the north at Fiona Sahong Village and secondary school located at Don Khon, another island on the west. From households interviews, many of them have no schooling.



Photograph 6.1: Children at Hang Sahong Hamlet

Hang Sahong community was the first established on the two islands, the village shows little increase in terms of population due to lack of paddy land. There were five (5) houses some 54 years ago compared to 10 houses at present. The community has a total population of 46 people living in 10 households with a size varying from 2 to 7 members and the average size is 4.6 persons/household. Detailed information on households' size and age of head of households are included in the Village Census undertaken.

(b) Community Land Use and Production in Hang Sahong

i. Agricultural Land

The area in Hang Sahong hamlet is undulating terrain and little suited for paddy field development. In the northern part of the community itself there is less than one hectare of paddy land. Most of the village paddy fields are located in the central part of the island. Garden and orchards are present in Hang Sahong and most fruit trees are planted only at the individual house properties,

Among the ten (10) households, only six (6) households own paddy cultivation land ranging in size from 0.5 to 1.00 ha. (See details in *Appendix C, Attachment B-2*). Four households (Mr Kamsouk, Mr Suy, Mr Seuth, and Mr Pony) are identified as a Vulnerable Group because of they do not own any agricultural lands.

ii. Rice production

Due to poor land fertility, of Don Sahong the yield of rice production is rather low; at less than 3 tonnes per hectare. Compared to national standards of minimum paddy requirement of 350 kg/person/year, all households resident in Don Sahong face several months of rice shortage.

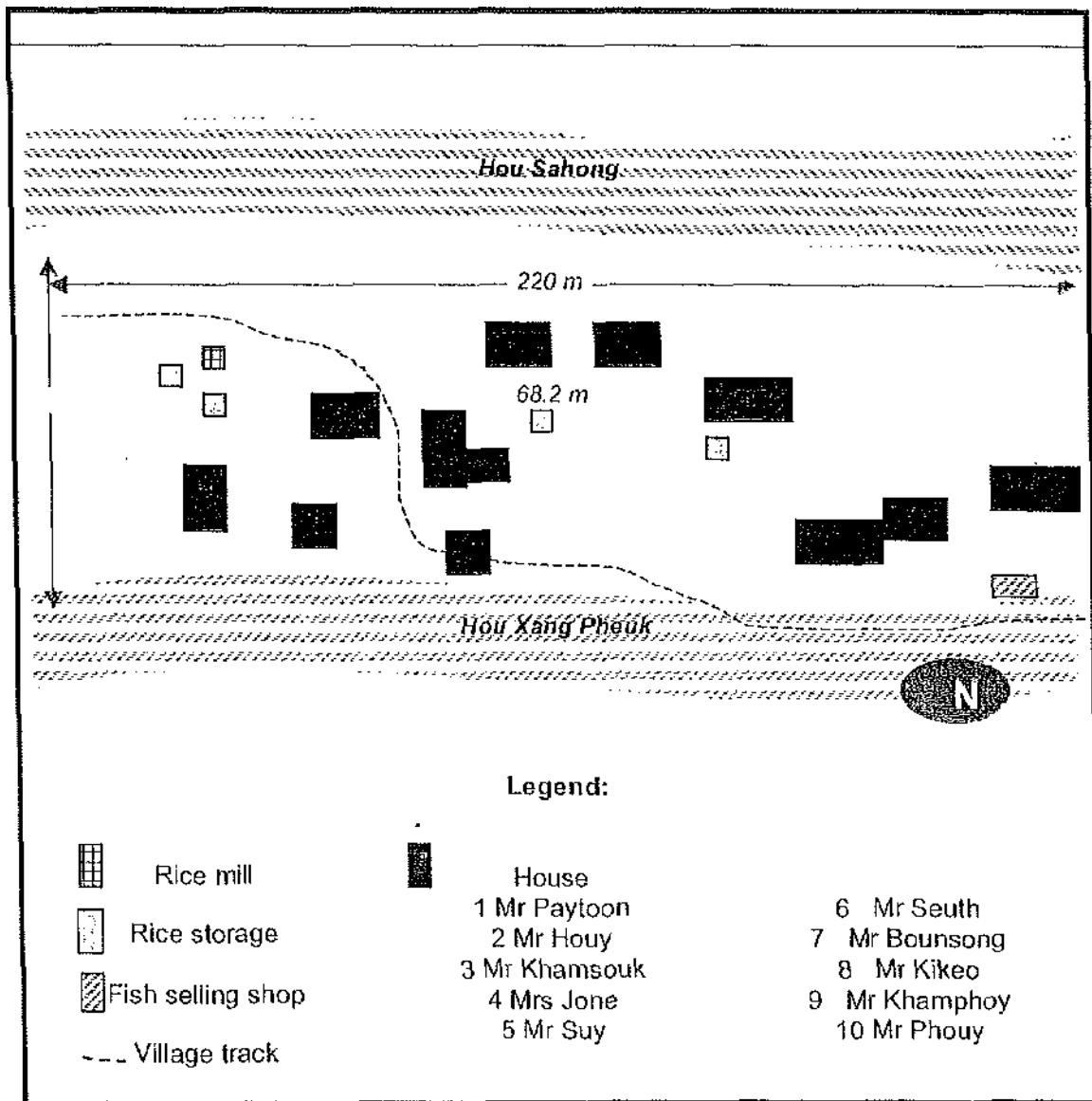


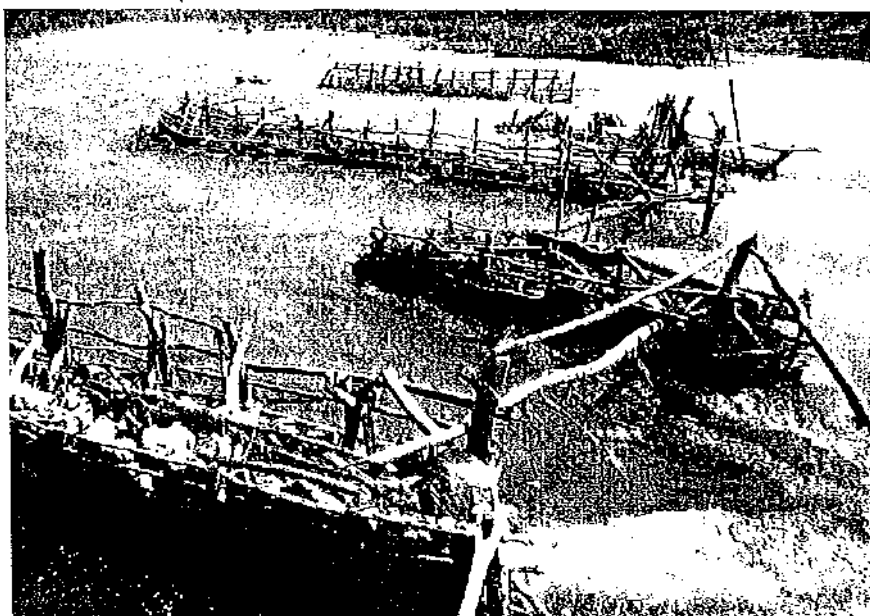
Figure 6.1: Location of Households at Hang Sahong Hamlet

iii. Fishery of Hang Sahong

Rice production is insufficient for households' consumption and the community relies heavily on fishing for both consumption and for income generation,

Every household is involved in fishing; the catch varies from one to 5 tonnes per household per year and about 60% to 80% of the catch are sold while the remaining is used for household consumption and for processing for further use.

For fishing each household has nets, small fish traps and some richer households have larger sized fish traps. In total the Hang Sahong hamlet owns 3 large and 10 small fish traps in Hou Sahong.



Photograph 6.2: Hang Sahong Village Fish Traps on the Hou Sahong Channel

iv. Livestock Holdings

Livestock is not an important activity for this community. Only four (4) households raise buffalo (13 heads in total) and only one household raises cattle (one head only). Pigs also are raised by 50% of the households with a total of 33 heads, and these same households also raise chickens with the present total population of 207 animals.

Buffaloes are usually left grazing in the forest, while pigs and chicken are raised within the housing compound. Buffaloes are both raised for traction and occasional sale while pigs and chicken are raised for sale, ceremonies and also for domestic consumption.

v. Community Income

Though rice production is limited and the number of animals are low, the household income is reasonably high; averaging 32.6 million Kip or USD 3,430/household/year and the expenditure also high ranging from averaging 18.4 million Kip or USD 1,940/household/year. The average income from fishing is estimated at 30.8 million Kip and contributes, 94% of the average total income.

The average figures are inflated by the inclusion of a major fish trader who buys fish and non-timber forest products from local villagers and sells these in Veunkham. Fish is the main reliable means of income and source of protein for the community.

vi. Perceptions of Villagers to Resettlement

The Hang Sahong community was informed about the hydropower project about five (5) years ago. To local villagers, this island is the best place to live as the places for fishing and trading are nearby. The lack of social infrastructure and services are a problem, as children

leave the community in search of education and jobs. However, the community seems contented with this setting and is satisfied with this simple life style.

vii. Attitude towards Relocation

Unofficial consultation with the affected people of Hang Sahong inquired whether they accept relocation and where is your preferred resettlement site. The answer is that should the resettlement for the DSHEP, they accept and the whole community wishes to be relocated within Don Sahong Island.

(c) Socio-economics & Livelihood of Hang Sadam/Thakho

Hang Sadam is located on the island (Don Sadam) while Thakho is located on the mainland next to the Mekong River. Hang Sadam and the Thakho have the populations of 96 households (527 persons) and 174 households (1,165 persons, respectively. Thakho has electricity supply, deep wells and a telephone line and is located near Highway 13 but Hang Sadam has none of these facilities.

Table 6.3 - Land Use Situation in Hang Sadam and Thakho {Unit: ha}

Village	Lowland	Forest	Garden	Grazing	Residential
Hang Sadam	61.61	300.00	2.50	-	5.00
Thakho	175.61	-	24.17	-	133.09

Socio-economic and livelihood problems in the two villages include:

- Hang Sadam is concerned that the Cambodian border is not finalized as it affects fishing in the Mekong River
- Thakho has inadequate agricultural land for crop production

The top three income sources for these villages include:

- Selling fish and fish products
- Selling of livestock
- Selling of other agricultural products

Perception of the DSHEP are as follows;

- Hang Sadam
 - Agree with the government plans for the DSHEP
 - Need to have electricity at their village
 - " The DSHEP would create loss of village agricultural lands
 - ^H If relocation is required, preferring cash compensation and resettling within Don Sadam island
- Thakho
 - Agree with the government plans for the DSHEP
 - Need to have electricity supply extended
 - If relocation is required, the local residents would prefer a site that is convenient, suited to crop production and cash compensation.

6.1.4 Policy Framework for Compensation and Resettlement

(a) Relevant Resettlement Laws and Regulations

This RAP is prepared based on the recent laws and regulations on resettlement of the Lao PDR, including the following:

- Decree No 192/PM on the Compensation and Resettlement of Development Project dated 7 July 2005.
- Regulations for Implementing Decree No.192/PM on Compensation and Resettlement of People Affected by Development Projects which include the Technical Guidelines for Compensation and Resettlement issued in November 2005.

Other relevant laws and regulations related to compensation and resettlement that are also employed include; -

- The Constitution of Lao PDR (1991)
- The Land Law, May 1997
- The Electricity Act, 1995
- The Forest Law, 1993

These laws and associated regulations are described in detail in Appendix M.

(b) Project Eligibility Policy

The proposed DSHEP will have to formulate a Resettlement Policy and many aspects of compensation policy and implementation need to be included and are outlined in Section 4.2 of the main RAP. Only the consolidated basic Entitlement Matrix is included in this report as Table 6.4.

Table 6.4 Basic Entitlement Matrix for RAP for DSHEP

TYPE OF LOSS	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
Dwellings	Registered taxpayer or occupant identified during survey	Full replacement cost so as to enable affected persons to have a dwelling of at least similar size and standard	Stakeholder consensus on replacement value assessment
Residential land	Registered taxpayer or occupant identified during survey	Replacement land if relocating to other site or compensation in cash at replacement cost for household who can move back onto existing site	Stakeholder consensus on suitability of replacement land and/or compensation
Expense of residential relocation	Registered taxpayer or occupant identified during survey	Lump sum payment sufficient to cover all relocation cost as agreed with the affected persons	Stakeholder plus Resettlement Committee consensus on definitions and rates used
Rice storage	Owner identified during survey	Lump sum payment sufficient to cover all relocation cost as agreed with the affected persons	Assessment of suitability of relocation site
Retail shops	Owner identified during survey	Lump sum payment sufficient to cover all relocation cost as agreed with the affected persons	Review of shops recorded during the survey
Agricultural land	Owner or person with usage rights identified during survey	Compensation in cash at full replacement cost	Consensus among stakeholders on valuation assessment and methods
Crops and trees	Owner or person with customary usage rights	Full replacement cost of anticipated harvest at market value	Consensus among stakeholders on valuation assessment and methods
Fish traps	Owner identified during survey	Compensation in cash at full replacement cost	Consensus among stakeholders on valuation assessment and methods
Common property resources	Community losing the resources	Restoration of affected community buildings and structures to at least previous condition	Consensus among Village Committee members on resources and rates used
Temporary impact during construction	Owner or person with usage rights identified during survey	Care by contractors to avoid damaging properties; where damage do occur, the contractor would be required to pay compensation; and damaged property would be restored immediately to its former condition on completion of project	Consensus among stakeholders and Village Committee

6.1.5 Resettlement Site and Development

As noted above, consultation with the main affected community, Hang Sahong, accepted relocation within the Don Sahong Island approximately 15 km to the North from their existing hamlet. While each of the two households at Hang Sadam and mainland Thakho villages would be relocated within their main community areas, including a planned proposal by the District administration for Thakho on Highway 13.

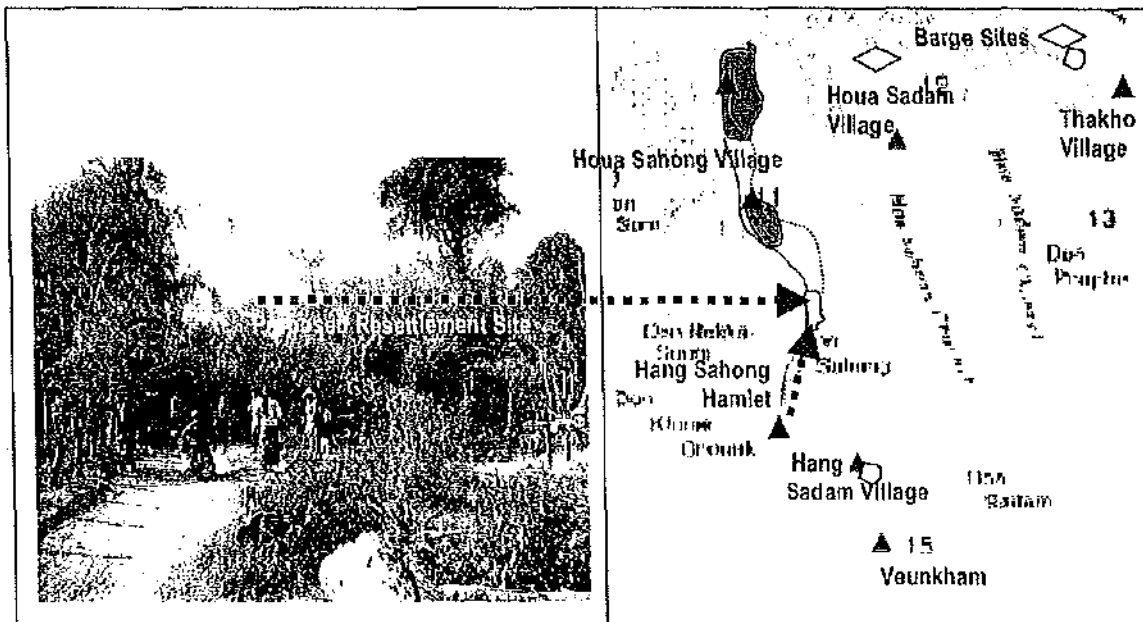


Figure 6.2 - Location of Resettlement Site

Specific development proposal for the resettlement site on Don Sahong would be included under the DSHEP and better village infrastructures and facilities compared to the pre-project conditions would be included. A conceptual layout of the Hang Sahong Resettlement Site is shown in Figure 6.2 and would include:

- 10 House plots of 0.075 ha each (25m x 30m)
- Village main road (4m x 800m)
- One primary school
- Pump for a gravity fed water system
- Electricity supply
- Village market.

6.1.6 Livelihood Restoration and Development

The most important issue of rehabilitation and livelihood restoration is recovery of the income loss of resettlers and ensuring that affected vulnerable groups such as landless families are given priority for income generation. Fishing is the main source income of all affected households in Hang Sahong and four households have no agricultural land. The average household income is considered very high compared to average rural household in Laos, indicated to be below USD 400.

It is assumed that the rlocatees can fish on other Mekong River channels, with income about USD 2,270. Supplementary income for 3 years would be available for employment with DSHEP (1 household 1 job of 30,000 Kip/day for 300 days/year) at about USD 950. Other potential income-generating livelihood programs include vegetable garden and mixed orchards, as noted in the main RAP. This is preliminary only and can be revised in the detailed design phase of DSHEP.

Table 6.5 - Present and Projected Income of Hang Sahong Residents

Source of Household Income	Before Resettlement (USD)	After Resettlement (USD)
1. Fishery	3,247	2,270
2. Livestock	183	170
3. Orchard	-	130
4. Vegetable	-	210
5. Employment	-	950
Total	3,430	3,730

6.1.7 Institutional Arrangements

The following committees would be the key agencies in the implementation and arrangement for DSHEP's compensation and resettlement action plan.

(a) Provincial Environmental and Social Committee (PESC)

The DSHEP would need to develop policies for setting up the PESC would have responsibility for the compensation policies, the construction, supervision and implementation of programs such as the EMP, RAP and SAP, in particular,. The following organization structure of PESC is recommended:

Chairman:

- Champasak Provincial Governor

Membership:

- Office of Champasak Provincial Governor
- Muang Khong District Governor
- Provincial Lao Women's Union
- Provincial Energy and Mines Office
- Provincial Science, Technology and Environment Agency
- Representative of Champasak University
- Representative of DSHEP
- Other concerned provincial or public organizations

(b) District Compensation and Resettlement Committee (DCRC)

The above PESC shall appoint a Muang Khong District committee called the District Compensation and Resettlement Committee (DCRC) to implement the following programs:

- Consultation and communities involvement programs;
- Detailed inventory of all affected lands and other property assets;
- Compensation entitlement matrix and rates to be used;
- Survey and detailed design of DSHEP Resettlement Plan;
- Construction of resettlement housing, infrastructures and facilities;
- Relocation of affected persons to new land, including subsistence;
- Rehabilitation programs for relocatees ;
- Grievance Redress issues and Committee meetings; and
- RAP and SAP monitoring & evaluation to GOL approvals..

The DCRC structure may consist of:

Chairman:

- Muang Khong District Governor

Membership:

- Office of Champasak Provincial Governor
- Muang Khong District Governor
- District Lao Women's Union
- Related Muang Khong District Departments
- Provincial Energy and Mines Office
- Head of Don Sahong Village
- Head of Hang Sadam Village
- Head of Thakho Village
- Project Supervision Consultants
- Representative of DSHEP

(c) Village Consultative & Grievance Redress Committees (VCGRC)

The villager involvement in project implementation is important for the two-way communication and ensuring that all rights and concerns of relocates and villagers are dealt with promptly. The village VCGRC would be organized with representatives from Don Sahong, Don Sadam and Thakho:

Chairman:

- Village Heads

Membership:

- Representative of Village Elders
- Village Lao's Women Unions
- Village Lao Fronts for National Construction
- Village Lao Youth Movements
- Representative of Fishermen including all types of traps
- Representative of DSHEP

Apart from being involved in the DSHEP project RAP and SAP implementation the VCGRs would look after complaints and dissatisfaction issues raised by the directly affected persons relating to land and resources and other issues.

(d) Project Environmental & Social Management Unit (PESMU)

The DSHEP shall set up Project Environmental & Social Management Unit (PESMU) as a key organization to assist and facilitate the works of PESC, DCRC, and VCGR. Another main responsibility of the PESMU is to manage and to follow up all works relating to the Environmental Management Plan, Resettlement Action Plan and Social Action Plan. The PESMU would be financed by the DSHEP and would be staffed and equipped with the following resources:

- * Qualified PESMU Manager having similar experiences in field of environment and social issues associated with hydropower projects
- * Qualified monitoring consultants hired by DSHEP;
- * Qualified GOL's specialist/representative from Provincial STEA and/or the District Planning Department;
- * Efficient local support staff and sufficient budget from the DSHEP project sponsor for meetings and associated transportation
- * Adequate office space at the DSHEP, equipment and supporting facilities such as vehicles, boats and motorcycles.

6.1.8 Consultation and Grievance Redress

(a) Consultation and Involvement of Affected Persons

Three (3) pre-project regional consultation and stakeholder's meetings were held at Pakse, Muang Klong and Hang Sadam village where information about the DSHEP including resettlement have been discussed and disclosed to concerned parties, an unofficial consultation meeting on resettlement was held at Hang Sahong hamlet on 1 February 2007. Village leaders, women and youth were involved and generally discussed about the DSHEP's resettlement issues.



Photograph 6.3: Resettlement consultation with village leaders and women and youth at Hang Sahong Hamlet at pre-project Stage on 1 February 2007

It was noted that all heads of households at Hang Sahong had discussed the resettlement issues and agreed to relocate on Don Sahong Island. The ideal location of resettlement site is about 1.5 km north of the existing hamlet.

More information on DSHEP project disclosure and specific resettlement consultation meetings need to be organized for the actual parties to be relocated in each village in the next stage and after project approval. This will be the responsible of the DCRC and VCGR but should be initiated by DSHEP.

(b) Grievance Redress

The Village Consultative & Grievance Redress Committee (VCGRC) will be set up with representatives from each village from the DSHEP project area. This committee is a focal-

point for any and all problems and a forum for expressing their comments and feedbacks to DCRC and the DSHEP's Manager and to GOL at the village, district and provincial levels..

Any local village or affected parties that are dissatisfied may address matters such as project compensation and Resettlement Action Plan performances and all complaints by project affected persons can be registered officially with this committee and it is obliged to raise these issues at higher levels,

6.1.9 Resettlement Monitoring and Evaluation

DSHEP internal and external monitoring systems should be set up to provide feedback on the effectiveness and progress of implementation of various EMP, RAP and SAP programs. It would also identify any problems and account for actions taken in response to these and measure the success of the project. To ensure that compensation, relocation and rehabilitation are carried out to good performance standards, the following organizations will be involved in monitoring and supervision of the DSHEP programs.

Type of Monitoring	Supervision	Monitoring
Internal	PESC	DCRC/PESMU
External	DCRC	Consultants

After one year of finishing implementation of RAP, a specific evaluation should be conducted by Cliampasak University or similar organization to determine the objective achieving of RAP and SAP. A post-evaluation of the EMP is also a legal obligation of the DSHEP project owner.

6.1.10 Implementation Schedule

It is difficult to draw-up a detailed schedule of the various components of a RAP at this stage due to uncertainties concerning the exact number of persons directly affected and the probable programs involved. Rather a general schedule is proposed for the DSHEP as follows:

TASKS	Years/Months	1 st Year				2 nd Year
		1-3	4-6	7-9	10-12	13-24
1. Set-Up Committees & organizations		■				
2. Consultation & participation programs			■			
3. Set-Up Internal/external monitoring			■			
4. Detailed assets measurement survey				■		
5. Update compensation rates/entitlement				■		
6. Compensation payment				■		
7. Development of resettlement site				■		
8. Relocation & assist in relocation				■		
9. Livelihood development & rehabilitation				■	■	■
10. Monitoring & evaluation				■	■	■

The following Committees & Organizations will be set up in the first three months:

- Provincial Environmental and Social Committee (PESC)
- District Compensation and Resettlement Committee (DCRC)
- Village Consultative & Grievance Redress Committee (VCGRC)
- Project Environmental and Social Management Unit (PESMU)
- Internal & external monitoring team & system for compensation and resettlement

The PESMU is very important. It roles as the mechanism for successful compensation and resettlement implementation that requires careful organisation, budgets and implementation are discussed in Section 9.3 of Appendix C.

6.1.11 Budget

The total budget estimated to implement the DSHEP Resettlement Action Plan is USD 967,500 including contingencies, as outlined in Table 6.6. However, this estimate must be reviewed and updated along with the RAP when further details are available.

Table 6.6 - Estimated Budget for Resettlement Action Plan (RAP) for DSHEP

1. Compensation	
a) Compensation cost for land	USD 101,400
b) Compensation cost housing structures	USD 34,000
c) Compensation cost for crops and trees	USD 3,600
d) Compensation cost for fish traps	USD 146,000
c) Compensation cost for other assets	USD 50.000
Subtotal- Item 1	<u>USD 335.000</u>
2. Resettlement	
a) Information disclosure and consultation	USD 20,000
b) Land clearing & development	USD 12,000
c) Village road construction & improvement	USD 20,000
d) Community supporting facilities	USD 112,600
e) House construction	USD 148,400
f) Rehabilitation & Livelihood development	USD 48,000
Subtotal- Item 2	<u>USD 361.000</u>
3. Costs, travel & accommodation for consultants	<u>USD 60.000</u>
4. External monitoring agency	<u>USD 54.000</u>
5. Administrative & operational costs (10%)	<u>USD 75.000</u>
6. Contingencies (10%)	<u>USD 82.500</u>
7. TOTAL COST ESTIMATE	<u>USD 967.500</u>

6.2 Island Communities Public involvement, Plans and Programs

At present the villages on the islands of Don Sadam and Don Sahong do not have any plans for development other than those operating under the Village Committees. None of these three communities has registered a Village Plan with the KJiong District authorities. Consequently, the DSHEP is going to be a major development for them. These villages also have rights to resources within the DSHEP area which would be directly affected. The DSHEP would have to liaise and consult with these communities. It is recommended that DSHEP undertakes their liaison and consultation through a committee involving all three communities, without reference to the District and Provincial Governor's offices.

6.2.1 DSHEP Village Liaison Committee

The exact make-up of this committee is uncertain, as there are three committees already proposed to under the RAP as discussed in Section 6.1 above. It is suggested that the Village Consultative and Grievance Redress Committee (VCGRC) would be the most appropriate body and would play a dual role:

- Overseeing the RAP for Ban Hang Sahong hamlet ,as noted
- Day to day liaison and decision-making relating to all actions on Don Sadam and Don Sahong with the DSIIEP managers.

This is considered essential because of the transportation problems and would allow the Village Plans to be dynamic. District and provincial authorities could be consulted on a "as needed basis." It is recognised that this arrangement has risks (e.g. individual jealousy and accusations of corruption) but if it is supervised by representatives of the three communities it should operate satisfactorily. Many of these decisions are of direct local concern and need to have any grievances by individuals associated with them to be prevented. This would require senior residents of the three communities to be involved in the committee. It would need the approval of the district and provincial authorities but could operate satisfactorily and report to the Provincial Environmental and Social Committee (PESC) proposed under the RAP. This is suggested as the best alternative given the low status of local development and the fact that all project decisions would affect the local communities.

6.2.2 Public Involvement of Villagers and Programs

It is obvious from the above, that a mechanism for discussion is needed for ongoing public information about the Project, its immediate and near-future needs and effects on local communities. It is also self-evident that the DSHEP project will require a Community Liaison Officer (CLO), or as many as are needed. The setting up of regular company and community discussion meetings targeted towards 'effects on individual communities and company needs' are required. These would be arranged and paid for by the DSHEP project proponent, including the building of a meeting hall in Ban Hang Sadam.

The arrangements for the community meetings and for the management of public involvement are tentative at this time. However this would be a most important part of DSHEP management. This is also essential for implementation on approval of the DSHEP in order to avoid delays in decision-making and promote good wilt with the local communities of Ban Hang Sadam, Ban Houa Sadam and Ban Hang Sahong.

6.3 Social Action Plan

The Social Action Plan (SAP) for DSHEP is produced in its entirety in Appendix B. This summary details some of that SAP but Appendix should be referred to for more detail. The SAP was prepared by the DSHEP resettlement expert and the counterpart Lao socioeconomist. It complies with the recent Lao guidelines on Resettlement issued by GOL in November 2005.

6.3.1 Background

This Social Action Plan (SAP) is prepared based on the following sources:

- Three stakeholder's meetings at Pakse, at Muang Khong and at Hang Sadam village.
- Household surveys using interviews of household head or representatives of potentially directly/indirectly affected villages in project area.
- Focus group discussions on social issues among interest groups in the village including Lao Women's Union and other interest groups.
- Consultation with village leaders and authorities on project development.
- Tourism survey using interviews with tour companies operating in the area and local boat service association and guesthouses associations.

The SAP has been prepared as a guideline for the GOL and the DSHEP's management and tries to improve the social welfare of the general project area. This includes improving the beneficiary aspects of DSHEP as well as to mitigating the project's main long-term negative impacts.

6.3.2 Social Impacts of DSHEP

Six villages, namely Thakho, Veunkham, Hang Khonc, Hang Sadam, Houa Sadam and Houa Sahong, are located in proximity to the DSHEP project and are likely to be affected to some degree by project development.

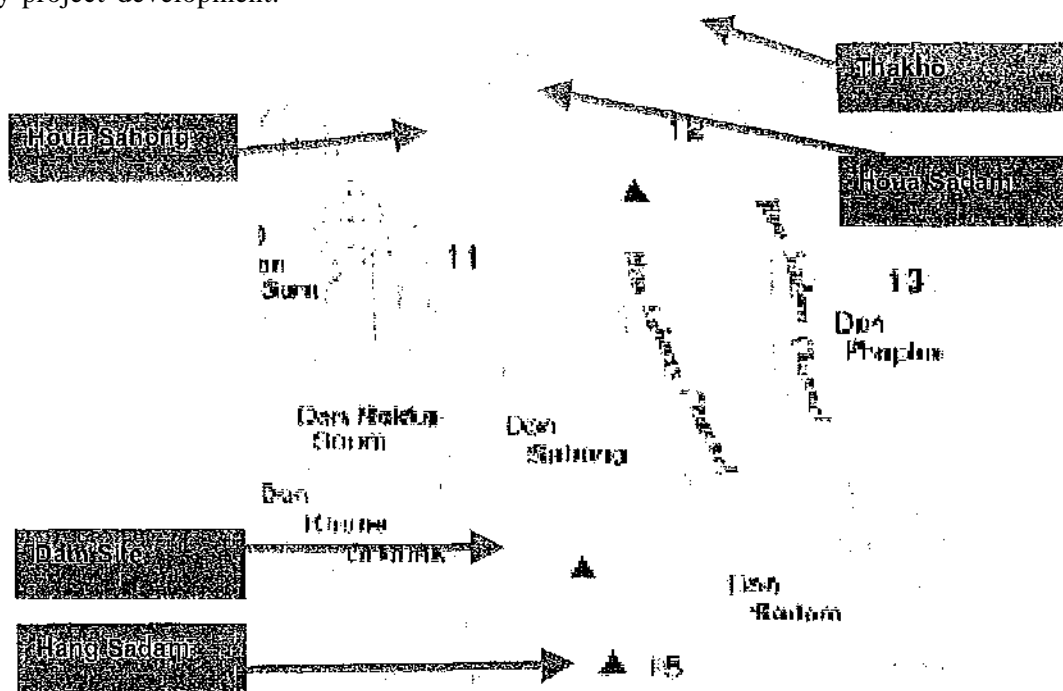


Figure 6.3 - Location of Villages Sampled and Included in SAP

The baseline demographic information of these villages is included in Appendix B - Attachment B1. Among these villages, three villages, namely Ban Houa Sahong, Ban Hang Sadam and Ban Houa Sadam are located on the two islands of Don Sadam and Don Sahong and Thakho village. All four villages would be directly impacted by the DSHEP, as noted earlier.

The households within these communities and to be affected by the Project can be classified into three different groups according to the level of impact:

- **Group I** - The: households having to be relocated to other locations including an estimated 14 households (66 persons) from 3 villages to be relocated and dealt with in Section 6.1, above
- **Group II** - The other remaining households of the directly impacted villages, namely Bans Hua Sahong, Hang Sadam, Hua Sadam
- **Group III:** The households living on the mainland, namely Veunkham hamlet (part of Ban Bung Ngam), Ban Thakho and Ban Hang Khone on southern part of Khorie Island.

For all groups, changes and disruption in livelihood are expected to occur to different degrees.

For Group II, the following impacts on livelihood are to be expected;

- 1- Drastic decreases in cash income from fishing which is the major source of income and affecting most households, including loss of traps in Hou Sahong
- 2- Important loss of daily sources of protein from fish
- 3- Loss of bamboo forest along Hou Sahong channel which provides both edible shoots and poles for purposes of construction of fishing gears, houses and other uses
- 4- Loss of part of the existing traditional forest, which provides construction material and fuel wood for the communities
- 5- Construction of landing points on the island and mainland which could take some fruit trees plantation and traditional forests
- 6- Construction of road from of Hua Sadam village southward to the damsite close to Hang Sadam village could remove some paddy areas
- 7- A change from isolated island communities to host communities for project workers and visitors;
- 8- Possible increased public health risks from incoming visitors.

Of these, one of the most significant losses is the income generated from fishing and the source of inexpensive protein form fish and aquatic products.

For Group III living in villages located further away from the DSHEP but sharing the same resources base on the Mekong River, the following impacts on livelihood are to be expected:

- 1 - Change of fish stocks in the general area and of fish migration patterns which are difficult to assess and predict
- 2- Slight decreases in volume of fish purchased and re-sold at Veunkham, as fish caught by Hang Sadam and Hang Sahong are sold in Veunkham
- 3- Unknown effects on boat operators in Veunkham associated with viewing Irrawaddy dolphins
- 4- Possible minor effects on border trade with Cambodia and trade (mainly fish and household items) focussed on Veunkham

- 5- Similar effects on Hang Khone village, as the economy depends on fishing and providing boat services to tourists from Hua Khone and Don Det for dolphin watching .
- 6- The majority of households of Thakho and Veunkham/ Bung Ngam would not directly be impacted from project development as most practice paddy cultivation and are not involved with tourism business
- 7- Slight impact on residents located along Highway No. 13 South through increased noise and traffic flow during construction period.
- 8- Increased public health risks from construction work force and visitors due to increased risks of STD and HIV/AIDS
- 9- Residents of Ban Thakho are indirectly affected as they are advised by local authorities to evacuate resettle to make way for expansion of the resort and general development of the area.

6.3.3 Perceptions of Villagers over DSHEP

Reduced fish abundance, loss of fishing assets due to flooding and access to fishing opportunities seem to be the main worries of local villagers when asked about the impacts of dam construction at Hou Sahong. This will affect all villages to some degree. Some villagers are also worried about the negative social impacts (e.g. problems with prostitutes and STD) and other social disruptions to their way of life.

However, there is a general willingness to have the dam constructed without knowing all the impacts on them directly. A number of reasons are obtained through household, group and village levels interviews but all expressed their willingness to have the hydropower dam with the expectation that they would have access to electricity. They feel this to be important for their livelihoods and provide better opportunities for employment. Household level interviews show that many villagers are afraid the DSHEP will not be realized.

Villagers do not have exact ideas if their land and other assets would be flooded, since they do not really know exactly where the extent of flooding would be in their locality. Also they have limited opinions when asked about resettlement. Most of them do not want to move to other places but prefer to move to non-flooded part within their villages or islands.

Appropriate compensation was sought for house reconstruction and development of suitable land for agriculture production to replace any losses in their lands. Compensation in kind or in cash is acceptable on the conditions that it should at least be equivalent to such losses. Their preferences for livelihood restoration are to have suitable amount of land for agriculture with appropriate extension support. Also they indicated that necessary public facilities at the new resettlement sites for education, healthcare, market areas and a secure water supply..

6.3.4 Social Action Plan

Up to now the majority of residents in zones to be impacted by the Project have managed on their own to provide their basic needs and livelihoods. They are neither rich nor poor but feel happy and secure in their own social and environment setting. The natural resources and the rich biodiversity of the area including fish stocks and natural attractions create an environment that sustains human life and produces a basic quality of life. Therefore, any investment projects while aiming at generating financial benefits to the local population should also yield additional social benefits and should not degrade the social and economic livelihood of the villagers. This is basic GOL policy.

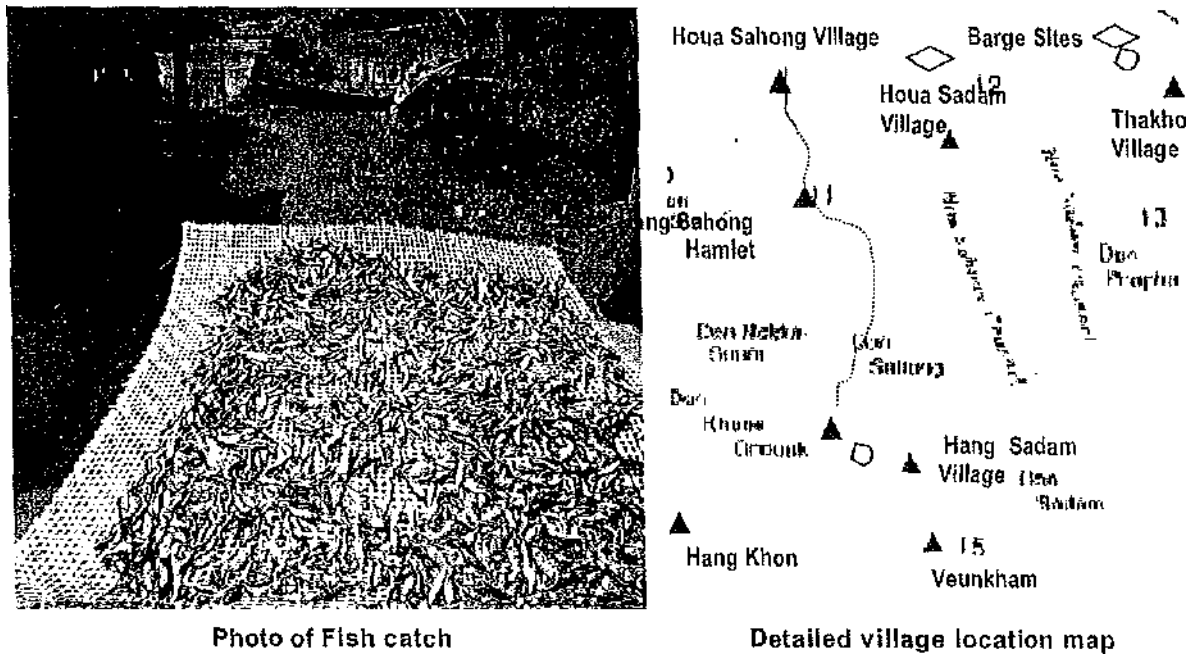


Figure 6.4 - Social Action Plan Villages

6.3.5 Proposed Development

While all six villages are impacted from the proposed DSHEP development, the three villages on the islands of Don Sahong and Don Sadam are expected to be affected the most. Therefore, they should receive the most assistance and mitigation actions, including:

- 1- Livelihood training and awareness raising
- 2- Construction of infrastructure
- 3- Livelihood development

(a) Livelihood Training and Awareness Raising

This component consists of various training and capacity building as follows:

- Gender training
- HIV/AIDS and STD awareness campaign
- Vocational (agriculture, livestock) training
- Non-formal education for women and youth
- Primary health education
- Primary and secondary teachers' training
- Provision of scholarships for best students for tertiary education or high level technical education
- Entrepreneurship and SME promotion training
- Other professional skills training.

This component involves relevant villagers in all six target villages.

(b) Construction of Infrastructure

This component consists of following interventions and is focused on the three island villages e.g. Ban Houa Sahong, Houa Sadam and Hang Sadam.

- Electrification of villages - all households given opportunity
- Secondary schools - two secondary schools constructed in Houa Sadam and in Veunkham/ Bung Ngam
- Health centers - health centers improved in Hang Klione and Hang Sadam
- Water supply - reliable supply systems to be built in all six villages
- Irrigation systems - to be trialled in Houa Sahong, Houa Sadam and Hang Sadam;
- Community market - to be constructed in Houa Sadam

In addition to the infrastructure program specifically targeted at the affected villages on Don Sahong, Don Sadam and the adjacent mainland, it is proposed to extend a 22 kV distribution line to Ban Houa Don Det, via Ban Hang Klion and Ban Khon-Tai. This will enable electrification of these villages that have a strong tourism industry. Settlements on Don Tan will also have access to electricity via the 22 kV construction power line.

(c) Livelihood and Economic Development

This component consists of the following interventions:

- Land use plan / land zonation and titling
- Promotion of a second crop
- Promotion of vegetable plantation
- Promotion of fruit tree plantation
- Plantation of fast growing trees for fuel wood and fodder
- Plantation of bamboo
- Sanitation equipment (latrines)
- Establishment of village development and revolving micro-credit funds

All of the activities are focused on Houa Sahong, Houa Sadam and Hang Sadam while the last two activities are planned for all the six villages.

Apart from the above components, the DSHEP is advised to commit to the following obligations for the construction period:

- To offer suitable employment to at least one person in construction phase from each family of the three communities
- To establish a food supply store at Hang Sadam and to allow purchases of food and agriculture products produced by villagers from project area.

6.3.6 Institutional Arrangements

As for implementation of the RAP, the following committees would be the key agencies in the implementation and arrangement for DSHEP's environmental and social works including its SAP. The composition of the committees is essentially the same as those outlined in Section 6.1.1, above:

- Provincial Environmental and Social Committee (PESC)
- District Compensation and Resettlement Committee (DCRC)
- Village Consultative & Grievance Redress Committees (VCGR)
- Project Environmental & Social Management Unit (PESMU)

6.3.7 Consultation and Involvement of Villagers

More information disclosure and specific consultation meetings need to be organized with the relevant households and village administration in each village after official approval of DSHEP. This will be the initial responsibility of the DCRC and VCGR.



Photograph 6.4 - Consultation with Village Leaders

This SAP is based on the baseline survey conducted in the six (6) villages in addition to pre-project consultation and stakeholder's meetings at Pakse, Mouang Khong and Hang Sadam village where information about the project including resettlement have been informed and disclosed to concerned parties.

A Village Consultative and Grievance Redress Sub-committees would be set up in each village including Don Sahong, Hang Sadam, Houa Sadam, Thakho, Veunkham/ Bung Ngam and Hang Khone.

This Sub-committee is a focal forum for expressing all comments and feedbacks to DCRC and DSHEP's management. Any dissatisfaction about the DSHEP project implementation and operation of the SAP, the aggrieved or affected persons can complain to and officially notify the VCGR through these Sub-committees.

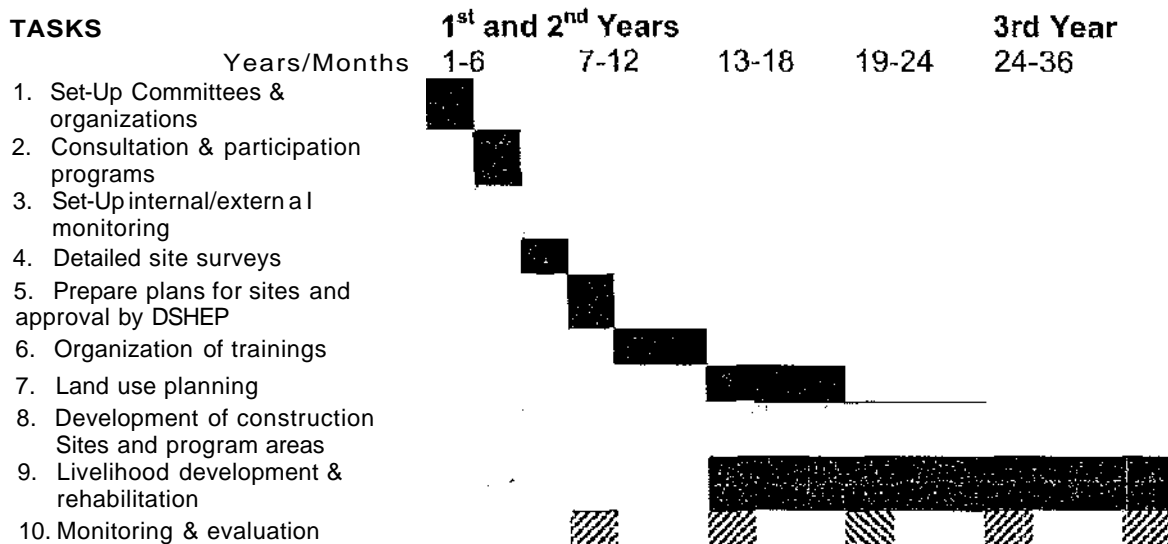
6.3.8 SAP implementation Monitoring and Evaluation

Internal and external monitoring systems should be set up to provide feedback on implementation and also to identify problems and success of the project. To ensure that all SAP programs are being carried out in good order and with efficient performance by the concerned organizations. This would included monitoring and supervision, as follows:

Type of Monitoring	Supervision	Monitoring
Internal	PESC	DCRC/PESMU
External	DCRC	Consultants

After one year of finishing the implementation of the SAP, a specific evaluation should be conducted by Champasak University to determine the overall effectiveness and the achieving of success of the SAP objectives.

6.3.9 Implementation Schedule



Only a general schedule can be proposed at this stage. The SAP would have to be approved by the GOL and DSHEP and is considered likely to alter significantly. It is also pointed-out that no arrangements have been made for the DSHEP side of staffing for the SAP.

The PESMU is very important as it controls the mechanism for a successful SAP implementation and controlling all the committees under its jurisdiction.

6.3.10 Budget Estimate

The costs indicated on Table 6.7 are preliminary and do not include any travel and accommodation costs for the staff or consultants involved but are indicative of the type of budget required for the SAP for the DSHEP.

Table 6.7 - Indicative Budget Estimate for SAP

1 Information Disclosure & Consultation and Monitoring and Evaluation (details in Appendix B-Attachment 1)

a) Information disclosure & consultation	USD 20,000	
b) Implementation and monitoring	<u>USD 70.000</u>	
Subtotal		<u>USD 90.000</u>

2. Livelihood training costs (details in Appendix B -Attachment 2)

a) Gender training		
b) HIV/AIDS and STD awareness campaign		
c) Vocational (agriculture, livestock) training		
d) Non-formal education for women and youth		
e) Primary health education		
f) Primary and secondary teachers' training		
g) Provision of scholarships for best students		
h) Entrepreneurship and SME promotion training		
i) Other professional skills training		
Subtotal		<u>USD 60.000</u>

3. Social infrastructure costs (details in Appendix B Attachments)

a) Electrification of villages		
b) Secondary schools		
c) Health centres		
d) Water supply		
e) Irrigation systems		
f) Construction of community market		
g) Other village programs		
Subtotal		<u>USD 540,000</u>

MV distribution line to Ban Houa Don Det (16 km @ \$20,000) **USD 320,000**

4. Livelihood Development Cost (details in Appendix B -Attachments)

a) Land use plan / land zonation and titling		
b) Promotion of second rice crop		
c) Promotion of vegetable plantation		
d) Promotion of fruit trees plantation		
e) Plantation of fast growing trees for fuel wood		
f) Plantation of bamboo		
g) Sanitation equipment (latrines)		
Subtotal		<u>USD 200,000</u>

5. External monitoring agency	<u>USD 54,000</u>	
6. Administrative & operational costs (-10%)	<u>USD 120,000</u>	
7. Contingencies (-10%)	<u>USD 138,000</u>	
8. TOTAL COST ESTIMATE		<u>USD 1,522,000</u>

6.4 Public Involvement Program for Project

The needs for public meetings are outlined in the MEM and STEA guidelines for both Environmental Impact Assessments and for the Resettlement Plans. The DSHEP has accepted this and has held two Stakeholder's Meetings to date. The documentation relating to these Stakeholder's Meetings are presented Appendix K and Appendix L, respectively. These meetings were arranged through the offices of the Social and Environmental Management Division of the MEM's Department of Electricity (DoE) and the Champasak Province DoE. This documentation includes an Agenda of Meeting, List of Attendees and Minutes on Discussion for the meetings. These meetings were entitled "Public Disclosure Meetings" and included the following:

- 1st Meeting- Pakse and Muang Khong - 15 & 26 October, 2006 -included representatives of Provincial and District authorities include persons from STEA and MEM in Vientiane, in which data on DSHEP as available at that time were presented; over 25 participants attended both meetings
- 2nd Meeting - Ban Hang Sadam - 30 January 2007 - included representatives from Provincial and District authorities, local Sub-district and Village officials and representative of organizations such boat operators and guesthouse operators in which information on the DSHEP was presented; over 110 participants attended this meeting.

Representative of the project proponent (MFCB) and the Feasibility Report attended the meeting in Ban Hang Sadam but only the Company's Laos representative and the EIA Study attended the Pakse and Muang Khong meetings.

All aspects were covered and many queries were raised and concerns expressed by participants at these meetings and representatives answered these to their capacity. The outstanding topics included the following:

- Project timing, identification of project owners and size of project ?
- What are the impacts on fishing for the local communities ?
- What species and populations of fish are affected by the dam ?
- To what extent are local communities required to relocate ?
- How will compensation issues be addressed and be paid ?
- Will local communities get electricity supplies ?
- Local people are not against the Project but are worried about livelihood?
- How can local villagers deal with foreigners and public health issues ?

There is a STEA requirement of the environmental guidelines that the draft EIA should be available to the public for review and a meeting held. It is the intent of the DSHEP project proponent to hold this meeting in Vientiane pending completion of this document. Issues raised would be answered at that meeting and addressed in the Final EIA.

6.5 Integration with Provincial and District Programs

The plans and proposals of the Champasak Province and Muang Khong District for the immediate Project area have not been fully canvassed or documented. The proposal for projects suggested in the SAP would need to be integrated with the District authorities, including education and agricultural bodies. Similarly, further discussions on the extent and locations of projects would require further consultation with village authorities.

The objectives and definite terms of reference are needed for all the suggested fisheries programs outlined as mitigation measures. This would involve both the provincial and national Departments of Fisheries. These negotiations are likely to be extensive and would need a Project fisheries consultant to facilitate and finalise.

The declaration of the Ramsar site for the Siphandone Wetland would generate a number of issues for the IUCN or other organizations involved in planning for the resource management of the area, particularly for fisheries sustainability as noted in Section 4.3.6.

It is indicated that the Klong District development plans include a new village along Highway 13 South to be located in the vicinity of Khone Phapheng Resort to resettle the villagers from Ban Napeng. A village plan has been drawn-up, lots have been allocated but the timing of development is dependent on funding. All the facts of this development are important to DSHEP as the project needs land in this area and if not developed it may promote unplanned camp followers to settle around the Project's main campsite.

Similarly, the plans for the provincial EDL's electricity supply system would have to be updated in the context of the project's requirements. Roads are required by the project and liaison will be necessary with the provincial road agencies.

Planning and integration of the proposed DSHEP works and proposed mitigating programs present situations requiring liaison and coordination with the provincial and district authorities. The DSHEP intends do this during the detailed design stage of the Project.

7. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

An Environmental Management Plan (EMP) will have to be devised for the DSHEP according to the MEM-DoE's Environmental Management Standard (EMS) (EM05/00). This is considered an integral part of the Final Environmental Assessment process. It is needed for project implementation but many of its specific requirements are uncertain at this time. Consequently, only an outline of the overall organization and parties involved and estimates of the budgets required can be presented in this EIA Report. Also affecting this are unknowns about the extents of involvements of the Consulting Engineer and the various contractors. A full EMP will be devised by the DSHEP or its representatives prior to tendering contracts and implementation of the Project.

7.1 Institutional Framework for EMP

These needs are outlined in Requirement 4 of the EMS and set the regulatory framework and administrative needs that the project must comply with and outlines jurisdiction of the agencies involved. It should include references to the following:

- GOL's National Policies and Environmental Regulations
- The jurisdiction of agencies involved such as line ministries or departments at the national, provincial and district levels and any NGOs
- The organizational framework and the enforcement regime of the project
- Any International Treaties (e.g. Ramsar) or Agreements of which Lao PDR is a signatory and are applicable
- Details set out or established during the EIA process.

The basic institutions involved would include:

- GOL agencies at all levels including STEA and MEM- DoE, and any Advisory or Steering Committee and Independent Panel of Experts (POE)
- The DSHEP or its representatives such as a project - established Environmental Management Office (EMO) operating on its behalf
- Consulting Engineer's representative or Environmental Advisor (EA)
- Various Environmental Officers associated with the main Contractors
- Any EMP consulting services.

All these parties' roles and responsibilities as executing agencies would be allocated for the entire EMP.

7.2 Management Arrangement and Staffing

The make-up of EMO is important as it ensures that the project conforms with the environmental criteria by the legislation and as required by the Final EIA. Preliminarily, it is proposed that a full-time experienced Environmental Manager (EM) be appointed who will be responsible to the DSHEP Project Manager. His role would include:

- Liaison with the GOL agencies including STEA, DoE, Provincial and District agencies and other parties concerned with day-to-day EMP matters
- Represent the DSHEP interests at meetings all environmental matters
- Coordination of the EMP activities and supervision of parties involved, including temporary staff from government'agencies and consultants

- Responsibility for all environmental reports
- Responsible for public relations and communication, including stakeholders meetings and involvement with local communities and authorities on environmental matters.

It is probable that the Environmental Manager would require a staff to assist him in these duties and this been included, in the budget for the EMP.

7.3 Project Environmental Management Plan including Monitoring

Under Requirements 5, 6, 7 and 8 of the EMS, the compilation of a detailed EMP needs to be comprehensive and include documentation aspects and programs for each of the following tasks.

7.3.1 Management Arrangements

The EMP should outline the administrative and technical arrangements for the EMO, and its integration into plans and schedules for the whole DSHEP, including:

- Project owner, management for construction and operation and various main contractors
- Nominated environmental staff including main EMO and secondments or supervision by DoE, STEA and contractors
- Make-up of Advisory Panels and Consultative Committees.

7.3.2 Environmental Management Measures

The EMP should define the proposed environmental protection measures and monitoring programs in terms of ensuring that impacts are properly managed and the project is sustainable. Each management measure requires details to be provided according to a schedule (see Table 7. 1) and includes

- Clear and distinct description of the measure
- Methods and their implementation
- Maps and drawings to assist with implementation
- Arrangements for data collection, analysis and storage.

7.3.3 Monitoring Measures

Details will be provided on the type of monitoring (ambient, validation, effectiveness and compliance), the sampling parameters, locations, frequency and timing of monitoring and reporting schedules for each monitoring task. This includes whether they are physical, biological or social aspects. It is noted that the Project should be self contained for its manpower and equipment needs.

Reporting is a major requirement of all monitoring and requires that recipients be identified in the EMP and there are provisions for additional monitoring requirements.

It is noted that for compliance monitoring, DoE is required to report to STEA, the project owners and relevant stakeholders.

Table 7.1 - Information Required for each Environmental Management Measure

INFORMATION REQUIRED	DETAILS
Project Phase	<i>Design, Construction, Operation, or Decommissioning</i>
Environmental Aspect	<i>e.g. road construction, land clearing, transmission line erection, reservoir filling, release of water from dam etc.</i>
Environmental Component	<i>e.g. water quality, soil, wildlife, cultural, resettlement etc...</i>
Environmental Impact and its Significance	<i>as per the EIA</i>
Cause	<i>Something or event that produces an environmental impact.</i>
Consequence	<i>Potential effect or result of the impact if it is not managed.</i>
Environmental Objective/s or Standard's to be met.	<i>The objective to be achieved by implementing an environmental management measure. It can involve standards such as the water quality standards or objectives such as e.g. all resettled peoples will have an improved standard of living. There can be more than one objective for each environmental management measure. These should, as much as practicable, be measurable.</i>
Environmental Management Measure. This is the environmental protection measure, monitoring measure (ambient or validation monitoring measure) and other measures required to ensure the impact is appropriately managed.	<i>This will include providing details of</i> <ul style="list-style-type: none"> • <i>Clear distinct description of the measure, design details</i> » <i>The methodology to implement the measure and involving a step by step process, the frequency, location etc, operating procedures</i> » <i>Locality Maps, drawings and other descriptive measures to assist implementation</i> » <i>Parameters, sampling technique, data collection, analysis and storage requirements.</i>
Performance Criteria/Targets	<i>The criteria- "targets_ that the performance of the environmental management measure can be measured against.</i>
Effectiveness Monitoring	<i>Monitoring requirements to ensure the environmental management measure is effective and meeting its objective/s.. Shall include methodology, parameters to be monitored, sampling technique, frequency and timing, location, data collection, analysis and storage, reporting requirements.</i>
Manpower	<i>Both technical and administrative (non technical) manpower (including details of the required experience and qualifications) needed for implementation of the requirements.</i>
Training	<i>The training required of those involved in the implementation of the environmental management measure to ensure the measure is effectively implemented.</i>
Facilities, Equipment, Material and Supply	<i>The facilities, equipment, material and supply requirements that are needed to ensure the management measure and its requirements are effectively implemented.</i>
Responsibility	<i>Details of all responsibilities of the project owner; contractors etc. That is who will be responsible for each aspect or stage of implementing the Environmental Management Measure. For many management measures there will be more than one responsibility e.g. coordination, implementation, monitoring, corrective action etc.</i>
Stakeholders	<i>Details of the stakeholders relevant to the implementation of the environmental management measure</i>
Public Involvement Activities	<i>Details of all the public involvement activities that are associated with the implementation of the environmental management measure</i>
Implementation Schedule	<i>Environmental management measure commencement date, duration and frequency. To include procurement (equipment, materials and supply), training and reporting schedules.</i>
Costs	<i>Detail costings of all requirements, including the timing of the costs to ensure the measure's effective implementation</i>
Reporting Requirements	<i>What aspects of the measure and its monitoring that need reporting, the frequency, to whom, timing etc.</i>

Source: Appendix A, Table 1 of the document EM/05/00 ENVIRONMENTAL MANAGEMENT STANDARD, ENVIRONMENTAL MANAGEMENT PLANS FOR ELECTRICITY PROJECTS, issued by Department of Electricity 26 July 2001

7.3.4 Contractor's Environmental Management Plans (CEMP)

All main contractors on hydropower projects are required to develop and implement a CEMP for their respective works and these should conform with the overall plan, as approved for the project. Of necessity this overall EMP by the Project Proponent would need to be completed prior to tender documents being prepared for the DSHEP. The DoE, STEA and the EMO would be responsible for approving and monitoring of all the CEMPs associated with project construction and operation. This EIA Report is the first step in the preparation of the EMP.

7.4 Public Involvement and Corrective Actions for EMP

A Public Involvement Process for developing and implementing the EMP are outlined in Requirement 10. It should be noted that this process is indicated to be part of the EIA process but for the DSHEP this can not be completed until some of the main issues have been finalized, such as fisheries and diversion of dry season flows. This is considered to be an evolving process with changes during EMP implementation. However, none of the proposed management measures have been discussed at Stakeholders' Meetings held to date and public involvement is to include, as examples:

- All stakeholders including directly and indirectly affected persons
- Information on the proposed activities included in Table 7.1 and consultation with stakeholders
- Any changes proposed to the EMP and stakeholders' opinion's on these
- Reporting requirements for the EMP.

It is deemed premature to discuss or propose any public involvement for the DSHEP at this time and for the Project Proponent to commit to preparation of a detailed EMP at a later date.

Also, there are provisions in the EMS for corrective actions to be applied to the EMP, if the results of monitoring indicate problems or inaccuracies exist in the project design, construction and implementation. Appropriate corrective actions can be applied and the responsibilities for undertaking these actions need to be defined. The reporting framework needs to be defined for any corrective actions.

7.5 EMP Implementation and Costs

Preparation of the EMP for DSHEP is dependent on the final configuration of the Project to be negotiated with the GOL. It is obvious that there are four (4) different phases for the EMP, these being:

- Organization of the DSHEP's Environmental Management Office and Advisory Committees
- Design Phase and Pre-impoundment Environmental Measurements as indicated in the EIA
- Environmental Measures During the Construction Phase
- Environmental Measures During Operation Phase.

Table 7.2 lists the various environmental measures important for each project phase, the agencies responsible for and executing each measure and indications of the durations of activity and unit costs and total costs. This table is far from definitive of the all tasks and should be treated as preliminary and basic only of the Final EMP required to be prepared and submitted for approval.

The overall cost estimate is approximately US \$ 2,000,000 but this would be altered in the Final EMP as items are added, scope of the activity and monitoring finalized.

Table 7.2 - Estimated Cost of Basic Environmental Management Plan and Implementation for DSHEP

A. Organization of the Environmental Management Office (EMO) & Committees

No	Environmental Measures	Responsible Agency	Executing Agency	Duration of Activity (months)	Cost Estimate (US\$) LS/Mo	Total Cost for Period (US\$)
		GOL/PP	STE A	12.0		
A1	Appointment of EM & Constitution of EMO	GOL/PP	STE A/ SEMD	3.5	35,000	35,000
A2	Create & capacity building of EMO and creation of Advisory Committees	STE A/PP	EMO Consultants	6.0	45,000	45,000
A3	Preparation of detailed EMP tasks & working program including budget	GOL/PP	EM/ STE A/ SEMD	6.0	60,000	60,000
A4	Appointment of independent Panel of Experts (2)	GOL/PP	STE A/EM Consultants	2.5	25,000	25,000
A5	Preparation of detailed environmental specifications for Tender Contractors	GOL/ PP	EMO/SEMD Consultants	3.5	15,000	15,000
A6	Presentation of EMP to Stakeholders and Finalization of EMP	GOL/ PP	EMO/STE A/ SEMD	3.5	15,000	15,000
SUB TOTAL A						\$195,000

B, Design Phase and Pre-impoundment Environmental Measurements as per EIA

No	Environmental Measures	Responsible Agency	Executing Agency	Duration of Activity (months)	Cost Estimate (US\$) LS/Mo	Total Cost for Period (US\$)
		GOL/PP	STE A	18.0		
B1	Monitoring of DSHEP water quality and reporting - 2 sites X 6 times	GOL/ MRC/PP	EMO & Consultant	12 X	2,000	24,000
B2	Study catch and ownership of fish traps in Hou Sahong	PP/ Fisheries Dept	EMO & Consultants	5.0X	5,000	25,000
B3	Study Hou Sadam & Hou Xang Peuk as possible fish migration routes - 2 seasons	PP/ Fisheries Dept	EMO & Consultants	8.0X	5,000	40,000
B4	Monitoring of trial catches for capture & transfer operations during pre-impoundment	PP/ Fisheries Dept	EMO & Consultants	6.0X	10,000	60,000
B5	Update Resettlement Action Plan (RAP) with budget and appoint PESU & DCRC	GOL/PP	EMO/ SEMD Consultants	3.0X	10,000	30,000
B6	Update and confirm Social Action Plan (SAP) with budget and confirm with Stakeholders	GOL/ PP	EMO/SEMD Consultant	5.0X	10,000	50,000
B7	Finalize outstanding EIA issues including Transmission Line and update RAP, SAP and EMP	GOL/ PP	EMO/ STE A/ SEMD	10.0	100,000	100,000
SUB TOTAL B						\$329,000

C. Measures During Construction Phase

No	Environmental Measures	Responsible Agency	Executing Agency	Duration of Activity (months)	Cost Estimate (US\$) LS/Mo	Total Cost for Period (US\$)
		GOL/PP	EMO	60.0		
C1	Provide operating budget for EMO	GOL/ PP	EMO	60.0	-	
C2	Initiate Independent Panel of Experts (2) and 2 visits per Year	GOL/ PP	EMO/ POE	6.0	10	100,000
C3	Monitoring of contractor's construction sites and camps - 4 times per year	GOL/ PP	EMO& CEMP	20 X	3,000	60,000
C4	Provision for compensation for accidental spill or downstream pollution	STEA/EMO/ PP	EMU	When justified	-	-
C5	Monitoring of quarries, borrow, spoil banks and embankments - 6 times per year	EMO	CEMP Consultants	30 X	1,500	45,000
C6	Monitoring of timber clearing and salvage by local communities - 2 times only	EMO	EMO /Dept Forestry	2 X	2,000	4,000
C7	Construction and monitoring of water supply facilities for local villages - 6 times per year	EMO	CEMP/ Dept Health	30 X	500	15,000
C8	Water quality monitoring in Hou Sahong and around construction sites - 4 sites x 6 times per year	MRC/EMO	Vientiane Laboratory/C EMP	120 X	500	60,000
C9	Monitoring of fisheries program at DSHEP for capture & transfer operations during construction	EMO	Fisheries Dept./ Consultants	As needed	100,000	100,000
C10	Monitoring Hou Sadam & Hou Xang Peuk controls or improvements to fish migration routes-2 seasons X 3 times per season	EMO	Fisheries Dept./ Consultants	30 X	1,000	30,000
C11	Monitoring of fish ecology study Li Phi Falls to Khone Phapheng - 2 times per year	EMO	Fisheries Dept./ Consultants	10 X	2,000	20,000
C12	Complete and monitor RAP for affected households by DSHEP incl VCGRC	EMO	PESC/ DCRC& Contractors	As per RAP for 24 months	LS	54,000
C13	Initiate overseeing Committee (VCGRC ?) and monitor SAP in DSHEP area	STEA/ SMED &EMO	EMO/ DCRC/ PESC	As Per SAP for 48 months	LS	70,000
C14	All other monitoring of construction activities (p) USD 50,000 per year	EMO/ CEMP	EMO Consultants	60.0	LS	250,000
C15	Miscellaneous monitoring, reporting and stakeholders meetings etc @ USD 50,000 per year	EMO	EMO/ CEMP/ Consultants	60.0	LS	250,000
SUB TOTAL C						\$1,058,000

D. Measures During Operation Phase

No	Environmental Measures	Responsible Agency	Executing Agency	Duration of Activity (months)	Cost Estimate (US\$) LS/Mo	Total Cost for Period <US\$)
		GOL/PP	EMO	Years 1-5 60.0		
D1	Provide operating budget for EMO	GOUPP	EMO	-	-	
D2	Water quality monitoring at DSHEP 2 sites (3 2 times per year	EMO	Vientiane Laboratory	20 X	500	10,000
D4	Monitoring of 3 year cage culture development in DSHEP pondage -	EMO	EMO Consultant /Dept Fisheries	36.0 As Determined	LS	100,000
D5	Monitoring of 3 year post-implementation fish ecology study in surrounding waters	EMO	EMO Consultant /Dept Fisheries	As Determined	LS	100,000
D6	Continue monitoring (incl Audit Report) of SAP in DSHEP area for 2 years	STEA/ SMED& EMO	EMO/ DCRC/ PESC	As Per SAP for 24 months	LS	35,000
D7	Monitoring of entire DSHEP incl. reports on restoration and forestry plantation resources for 2 years incl POE audit of project	EMO/ STEA &SMED	EMO/ POE	24.0	LS	50,000
SUB TOTAL D						\$295,000
TOTAL FOR ITEMS A, B, C & D						\$1,877,000

NOTE : GEMP = Contractor's Environmental Management Plan
DCRC = District Compensation and Resettlement Committee (Khong District)
EM = Environmental Manager
EMO = Environmental Management Office
EMP = Environmental Management Plan
GOL = Government of Laos
MRC = Mekong River Commission
POE = Panel of Experts (Independent)
PP = Project Proponent
PESMC = Provincial Environment and Social Committee (Champasak Province)
SEMD = Social and Environmental Management Division (Department of Electricity)
STEAS = Scientific, Technology and Environmental Agency (Prime Minister's Department)

8. ALTERNATIVES TO AND WITHIN THE PROJECT

There are two alternatives to the proposed DSHEP, neither of which has been investigated in detail, which would leave the Hou Sahong channel untouched and, hence, have no impact on low and high flow season migration in that channel. It is acknowledged that the Project Proponent only has a mandate to investigate the DSHEP. The two alternatives, both of which are judged to have a lesser environmental impact than the DSHEP are:

- Development of hydropower project, based on a diversion around Khone Phapheng
- Development of a hydropower project on the Hou Xang Peuk.

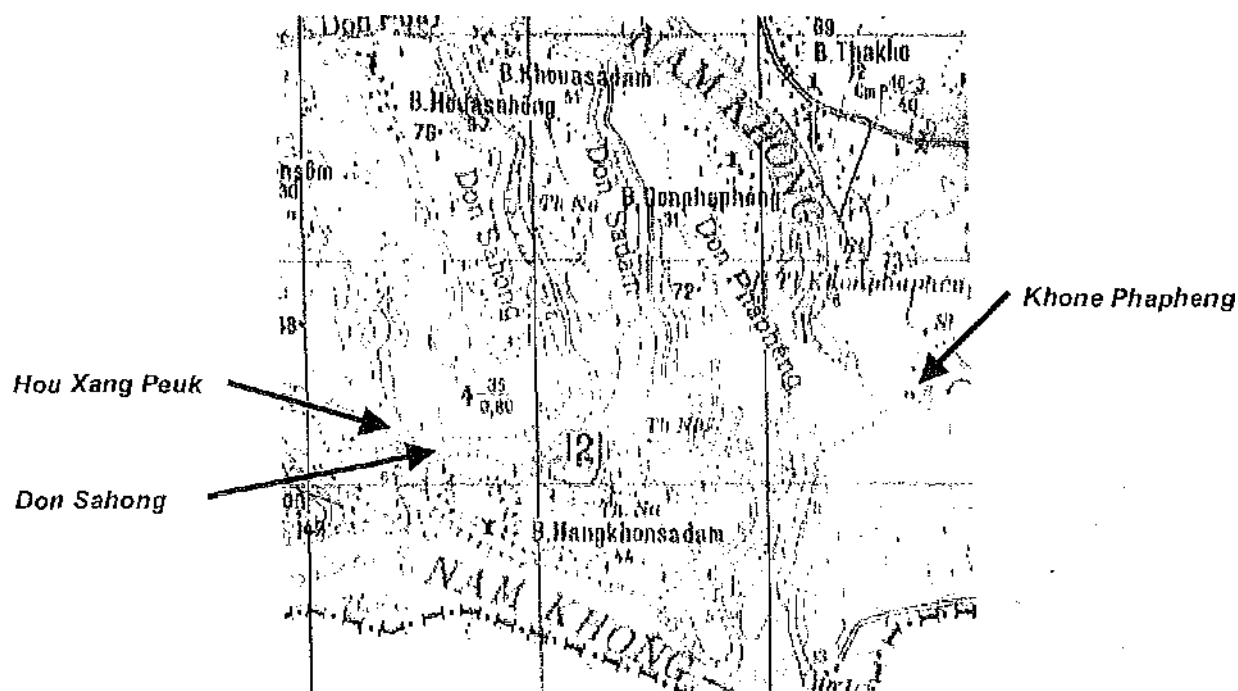


Figure 8.1 -Alternative Power Station Sites

Several options for different sized operations based on diverting different quantities of Mekong River flow down the Hou Sahong channel are addressed in the Feasibility Study of this report and include diversions of 800 m³/s through to 1400 m³/s. and power station installed capacities from 180 MW to 400 MW.

The environmental guidelines of the MEM indicate that the "no project" option should be compared with other alternatives to the scheme, as noted in Section 3.2.

8.1 Khone Phapheng Alternative

This alternative is listed in the "Power System Development Plan for Lao PDR" (PSDP) completed for the GOL by Maunsell/ Lahmeyer in August, 2004 (Figure 8.1).

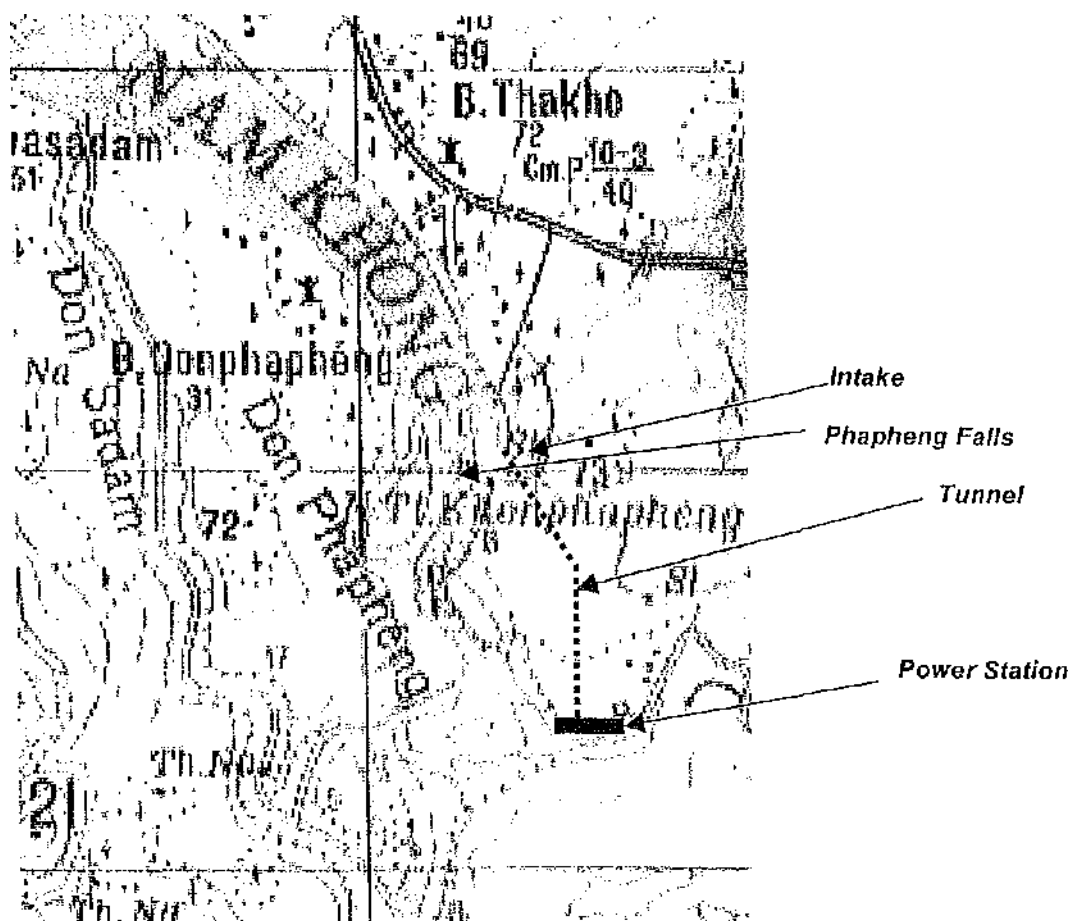


Figure 8.2 - Khone Phapheng Power Station Concept

The PSDP study of the project, done only at desk level with no site visit, was based on an intake upstream of the falls, a single 12 m diameter headrace tunnel, and underground power station with two 30 MW units and tailrace tunnel. The works, apart from the intake, would not be visible to the general public visiting Khone Phapheng waterfall. Other advantages of this option include:

- Benefits to the ecological consequences on fish migration which is limited at Khone Phapheng compared with the blocking of the Hou Sahong year-round fish migration channel and no impacts on the normal roles of all other channels with respect to fish migration
- Advantages during construction and operational phases, of a mainland-based operation rather than an island-based operation serviced by barges

However, this is not directly comparable with Don Sahong, because of the lower installed capacity (60 MW vs 300 MW) and the consequent lower energy production (402 GWh vs 2140 GWh). Underground works are also generally higher in cost than surface works. It would be possible to increase the capacity and energy output by using multiple tunnels, but this present study has not attempted to optimise the arrangement.

8.2 Hou Xang Peuk Alternative

The Hou Xang Peuk alternative is unexplored at this time and presents some problems in that it also would require enlargement of its entrance and have adverse impacts on fish migration, especially of wet season migrating fish.

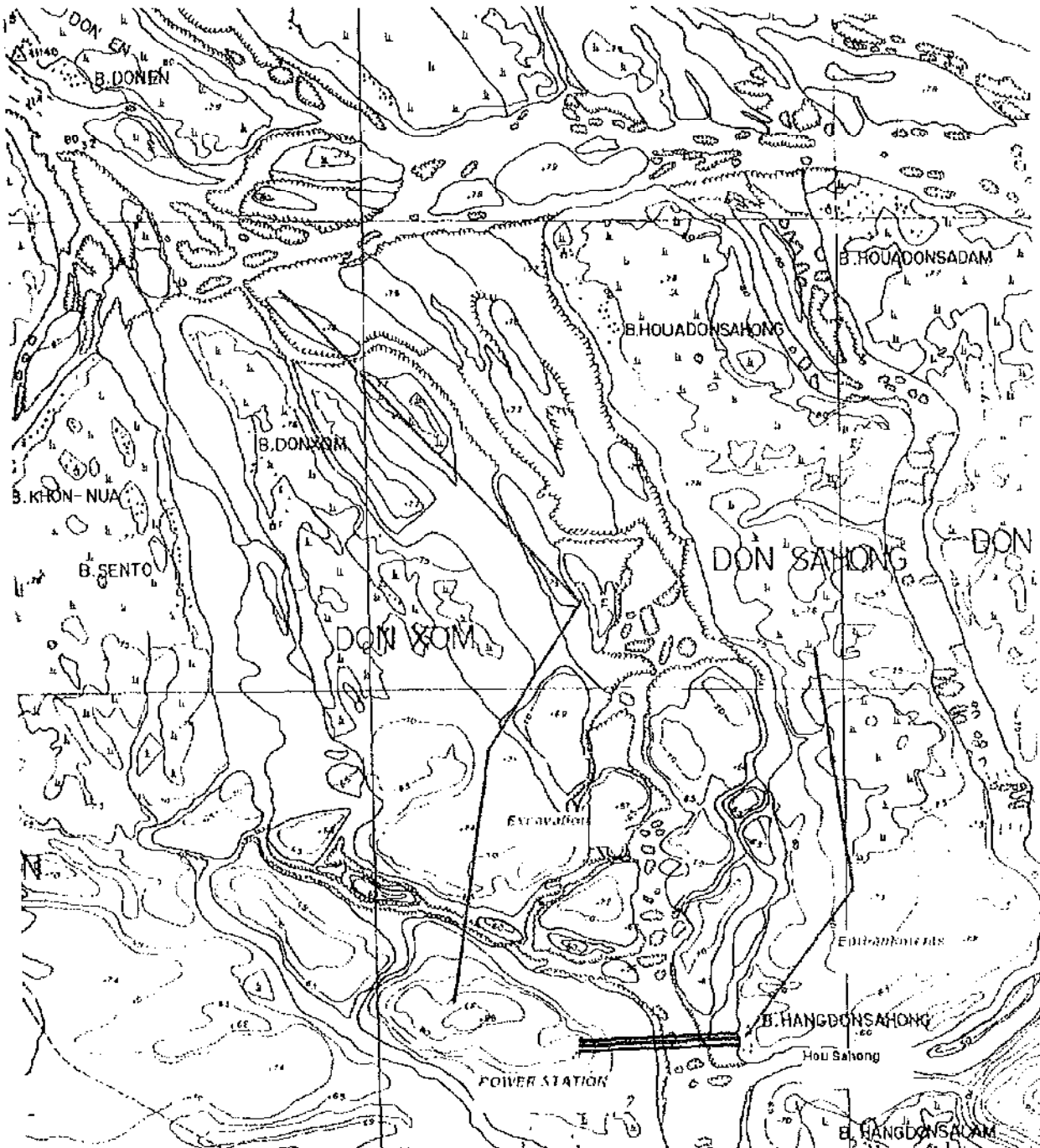


Figure 8.3 - Hou Xang Peuk Power Station Concept

This concept would have the power station just above the confluence of Hou Xang Peuk with Hou Sahong, with the left abutment adjacent to Ban Hang Sahong (the hamlet would have to be relocated as for the Don Sahong project) and the right abutment on Don KJione. No topographic survey have been carried out on the area west of Don Sahong but there would considerable excavation at the entrance to Hou Xang Peuk and on the water falls mid way down (Haew Xang Peuk Nyai, Haew Xang Peuk Noi and Khone Lam) to provide a waterway capable of carrying the required flow to the power station, and substantial embankments to retain the water on the western side.

The aerial inspection in May 2006 showed that this area had a greater density of traps, indicating that there is a heavy concentration of downstream migrating fish using this channel in the high flow season (Photograph 8.1). It is also known that it is an upstream migration route in the high flow season.

There has been no investigation or detailed study of this alternative, but, although the power station capacity and output would be comparable with DSHEP, the cost of the rock excavation and retaining embankment construction is likely to make it economically unviable. Construction would be difficult because of the many braided channels in the area west of Don Sahong and the construction period would be at least on e year longer.



Photograph 8.1 - Fish traps in Hou Xang Peuk,

8.3 Within the Project Alternatives

The engineering study investigated a range of alternatives for the DSHEP and these are illustrated on Figure 11.10 through to Figure 11.21 of the Feasibility Report, showing the impacts on installed capacity and annual average energy of, amongst other variables:

- number, size and type of units,
- varying degrees of channel improvements at the Hou Sahong mouth,
- quantum of environmental flows,
- effects of peaking generation,
- effects of reduced inflows to pondage (due to upstream development).

Apart from the impact on fish migration and its effect on the local inhabitants on Don Sahong, Don Sadam and surrounding islands, the most sensitive aspect of the development is the level of the "environmental flow", the water that is left in the Mekong downstream of the Hou Sahong entrance, its effect on the streams downstream (Hou Sadam, Hou Som Nyai and Hon Som Noi) and the visual impact of the Khone Phapheng waterfalls. A minimum environmental flow of 1,000 m³/sec has been suggested, a discharge that is more than the minimum historic flow over the falls, which is interpreted from the historical minimum recorded flow at Pakse.

8.4 No Project Option

From an environmental viewpoint, the "no project" option is the best solution to the dilemma of "effects on blocking Hou Sahong's role as a major fish migration channel."

Not to construct the project would, however, reduce the export earnings of the Lao Government, impacting on the government's development plans to alleviate poverty countrywide. Specifically, for this southern area of the Lao PDR's southernmost province, implementation of the project will drastically improve the infrastructure. It will enable social and lifestyle improvements to the 6 villages directly impacted by the project and will boost economic and tourism development through the extension to surrounding areas of a reliable electricity network

Furthermore, construction of the project has been welcomed by the inhabitants of Don Sadam and Don Sahong, who see this as a means to improve their living standards, while conceding they may lose out on their livelihood, although livelihood restoration programs are proposed.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

A detailed technical feasibility study has been conducted on the DSHEP, considering various arrangements of hydroturbines in a powerhouse structure at the lower end of the Hou Sahong. These studies have indicated that a power station with an installed capacity of 360 MW and exporting a majority of its energy production to Thailand, with the remainder for export to Cambodia and for domestic consumption, is economically viable.

A comprehensive study has been undertaken of the social and environmental issues associated with the project, as required by the various regulations of the Science Technology and Environmental Agency (STEA) and Ministry of Energy and Mines (MEM).

Only 14 households will need to be relocated and a resettlement action plan has been recommended to resettle these families either in a new village on Don Sahong (ten households) or within then-existing villages (four households) and to provide for their future welfare, where their livelihoods have been affected. In addition a social action plan is recommended that will improve infrastructure (water supply, sanitation, education, health facilities and electric power) in the six affected villages. Further, electrification will be extended to a number of other islands, including Don Det and Don Khone, which will enhance their tourist potential, as well as improving the living conditions for the residents.

The most critical issue of the environmental study is the impact on fisheries migration over the Khone Falls (Great Fault Line) due to the blocking of the Hou Sahong, a major migration route, particularly in the upstream direction in the low flow season. Mitigation measures have been recommended that will minimise the impact of this closure by creating two channels that will replicate the conditions in the Hou Sahong in both low and high flow seasons, so that there will be insignificant impact on upstream and downstream migration.

9.2 Evaluation of impact on Mekong River Fisheries

The impact Mekong River fisheries is a complex issue. There is no question that the fish industry based in the lower, middle and upper Mekong River is a huge resource with a value of hundreds of millions of dollars annually. It is also acknowledged that the Hou Sahong, while not the only route for upstream and downstream migration of fish, is a major route.

If the Hou Sahong was blocked with no mitigation measures there would undoubtedly be a severe impact on the fish population and those that depend on the fishery. However, the DSHEP is intended to include measures that will provide a passage for fish that will replicate the Hou Sahong so that there will be no adverse effect on the resource.

An indication of the cost of possible mitigating actions has been included as follows:

- A minimum sum of \$3,416,000 in compensation for the estimated 200 persons in the local fishing communities
- A minimum of \$ 19,850,000 for internal to the project mitigation and management costs, including the suggested programs

The total sum of these fisheries associated payments are \$23,266,000. These costs have been included in the economic evaluation of the project and all of these recommendations and sums are subject to re-evaluation of this Draft EIA Report.

9.3 Notification to LNMC and MRC

The LNMC has been notified of the project and progress of the studies by the DSHEP management. However, there exists a need to notify the Project to the MRC either directly or indirectly through the LNMC, under Articles 1, 3 and 5 of Chapter III Objectives and Principles of Cooperation of the "Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin" (MRC,1995). This requirement is so that the MRCS can raise the topic of the Project with the Joint Committee, as to its potential effects to other members of the Lower Mekong Basin (LMB) countries; namely Cambodia, Thailand and Vietnam. Article 5 deals specifically with "intra-basin use of the Mekong River".

Although they have not yet been ratified by the Joint Committee and the Council, MRC's proposed Guidelines for Trans-boundary Environmental Impact Assessments (TbEIA) will have an impact on the project due to its location near the international border with Cambodia.

9.4 Suggestions Relating to the Siphandone Wetlands Declaration

The preparation for nomination of the GOL's first Ramsar site covering the Siphandone Wetlands is ongoing. While declaration of the wetlands as a Ramsar site would not preclude the implementation of the DSHEP, its development would have to be managed within the overall objectives of the Ramsar Convention and the specific requirements of the managing agency, believed to be the Ministry of Agriculture and Forests, for planning for sustainable development in the Siphandone Wetlands. It is recommended that the DSHEP undertakes the following actions:

- Cooperation with the GOL and authorities such as LNMC in the declaration of the Siphandone Wetland as a Ramsar site by providing requested information on the engineering and environmental findings of the Project
- Permitting the appointed planning organization for the Siphandone Wetland to review and comment on any specific proposals by DSHEP to undertake monitoring and management of the natural resources of the impacts areas.

9.5 Recommendations

The DSHEP has aroused much interest in the Lao PDR mainly through its impacts on fisheries resources and fish migration through the Hou Sahong channel. The implications of these are indicated and mitigating actions are addressed in the EIA Report.

Notwithstanding the possible impacts, the implementation of the project will be of considerable economic benefit to the Lao PDR and will provide improved infrastructure and stimulation for growth in the Champasak Province.

There are numerous suggestions and recommendations throughout this EIA Report. These have been proposed for the benefit of Project implementation. In particular, those recommendations included for the following:

- Additional studies during detailed design to determine more exactly the minimum environmental flows of the Mekong River to safeguard the flows over Khone Phapheng and the flows in streams downstream of the entrance to Hou Sahong
- Budget for and implementation of recommended mitigating actions for the fisheries component
- The Resettlement Action Plan (RAP) as finally determined for relocating communities such Ban Hang Sahong hamlet and others affected by DSHEP
- The Social Action Plan (SAP) as revised in consultation with GOL including Khong District authorities and representatives of villages within the project area.
- Implementation of an Environmental Management Plan (EMP), yet to be finalized and as approved by STEA and MEM, Department of Electricity.

Other recommendations in Sections 5, 6, 7 and 9 should be considered by the DSHEP proponent, along with any topics recommended by the GOL agencies or other organizations reviewing this EIA Report.

In evaluating the DSHEP through the Feasibility and Environmental Impact Assessment reports and feed back from the stakeholders' and public disclosure meetings, the GOL must consider the environmental, social and economic factors at the national level.

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