

4 ENVIRONMENTAL DESCRIPTION OF THE PROJECT AREA

Savannakhet and Saravan provinces are located in the Southern of Lao PDR. Savannakhet has a total area of 21,774 km², and is bordered by Saravan Province in the south, Khammouane Province in the north, Vietnam to the east and Thailand to the west. Savannakhet is divided into 15 districts.

Saravan is about half the size of Savannakhet, with a total area of 10,691 km², which is divided into 8 districts and located to the south of Savannakhet and north of Sekong province (with Vietnam and Thailand on the east and west, respectively) (NSC, 2007).

The transmission line ROW will traverse through seven districts, four of which are in Savannakhet province (Kaysone, Champhone, Xaiphouthong and Songkhonee) districts, and three in Saravan Province (Lakhonphen, Vapi and Saravan) districts (see Figure 2-1 The Project Area). The general terrain of these areas is flat and mainly used for agricultural practices (NSC, 2007).

4.1 Physical Resources

4.1.1 Topography and Drainage

The Project is located in the Mekong Floodplain, where the topography of the land is generally flat and low-lying.

The topography of Savannakhet Province varies from the low-lying floodplains of the Mekong River in the west to foothills and the mountains of the annamite chain in the east. The average height above sea level varies across the province, from 100 masl in the west to about 1300 masl in the east (IUCN, 2008; Somphong, 2004). The Project Area is located on the floodplains in the western part of Savannakhet.

Saravan province topography is divided into three geographical areas: plains, plateau, and mountain regions. The plains region comprises 40% of the Province, and lies mainly from the northeast to northwest of the province. This area is rich with fertile soil used for agricultural. Part of the Project Area lies within this region. The plateau region makes up to 20 percent of the province area and cover only in Laongam district, which lies to the south of the province. This region is commonly used for agriculture and forestry activities. The mountain region covers two districts: Taoy and Samoi, which are located to the east of the province, and according to Department of Agriculture and Forestry, is the ideal area for short-term and mid-term industrial forestry (IUCN, 2008).

4.1.2 Climate

The Project Area is located in the Southeast Asia tropical monsoon climate. Two monsoons, the northeast and then southwest, dominate the climate conditions and create two distinct seasons. The northeast monsoon lasts from November to February, and brings cold, dry air from China into Southeast Asia. During this time, there is only infrequent light rainfall. Between March and April, the weather starts to warm, and between April and October the southwest monsoons – consisting of warm winds and humid conditions – bring seasonal rain (IUCN, 2008).

To establish a meteorology baseline of the Project Area, the data from two (2) Department of Meteorology and Hydrology (GOL) monitoring stations in the vicinity of the Project Area (one in Savannakhet and another in Saravan) was used. In general, overall meteorological parameters are the same at the two stations, with the exception of rainfall, which is about 30% higher in Saravan. A summary of meteorological data for Savannakhet is available in Table 4-1 and for Saravan is available in Table 4-2.

Table 4-1 Summary of normal meteorology of Savannakhet 2000-2008

Symbol	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max Temperature (°C)	30	31	34	35	33	32	31	31	31	31	30	29	32
Mean Min Temperature (°C)	15	17	21	24	25	25	24	25	24	22	19	16	21
Mean Temperature (°C)	23	24	28	30	29	29	28	28	28	27	24	23	27
Mean Max Humidity (%)	93	94	91	91	92	91	94	94	94	93	92	92	93
Mean Min Humidity (%)	43	46	46	51	59	65	69	71	67	59	51	49	56
Mean Humidity (%)	68	70	69	71	76	78	81	83	81	76	72	71	75
Total Rainfall (mm)	2	23	53	74	262	226	327	302	247	83	13	4	1,616

Source: Department of Meteorology and Hydrology, 2008

The average monthly temperatures in Savannakhet over the past nine (9) years (2000-2008) ranged between 23°C (in December and January) to 30°C (in April), with an average annual temperature of 27°C. The maximum recorded temperature was 35°C (April) and the minimum was 15°C (January). Temperature patterns in Saravan are consistent with those in Savannakhet, with the average monthly temperatures ranging between 24°C (December and January) and 30°C (April) and the same average annual temperature of 27°C.



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Average humidity in Savannakhet ranges from 68% (in January) to 83% (in August), and from 63% to 86% in Saravan. The average annual humidity in Savannakhet is 74% and in Saravan is 75%.

The average annual rainfall over the past 9 years is just over 1,600 mm in Savannakhet and about 2,200 mm in Saravan. In both provinces, approximately 85% of rainfall occurs between May and September.

Table 4-2 Summary of normal meteorology of Saravan 2000-2008

Symbol	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max Temperature (°C)	32	33	35	35	33	31	30	30	30	31	31	30	32
Mean Min Temperature (°C)	17	19	22	24	25	25	24	24	24	22	20	18	22
Mean Temperature (°C)	24	26	29	30	29	28	27	27	27	27	25	24	27
Mean Max Humidity (%)	90	86	84	88	92	93	95	96	96	95	93	92	92
Mean Min Humidity (%)	40	40	43	49	60	68	73	77	71	63	53	48	57
Mean Humidity (%)	65	63	63	68	76	81	84	86	84	79	73	70	74
Total Rainfall (mm)	0	20	37	82	227	292	485	563	327	154	10	2	2,199

Source: Department of Meteorology and Hydrology, 2008

4.1.3 Geology and Soils

The geological basement land in the region is the Indochina craton or crustal block (Milne-Home, et al., 2003).

The line will traverse three different geological formations. In the north, the Project Area is comprised largely of Late Mesozoic (mainly mid-late Cretaceous) with an underlying layer of sandstone. It is predominately fine-grained towards the top with thick evaporates, primarily rock salt and gypsum (Department of Geology and Mine, 1990). The southern section is comprised mainly of Mid-Mesozoic (late Triassic to early Cretaceous) rock with terrestrial sediments (primarily sandstone) and thin coals in places. Small sections of the line in both the north and south will traverse Quaternary alluvial deposits from the Mekong River and tributaries.

The soil in Savannakhet has low clay content – sixty-three percent (63%) of the total area of the province is occupied with soils with clay contents of 0-10% only. Only 20% of the province has soil with a clay content of over 20%. This clay content amount decreases generally from the eastern to western regions of the province, and



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therefore, the soils of the Project Area are likely to have low clay content (Inthavong, et al., 2008).

Soils in Saravan Province are largely consistent with those in Savannakhet. The soils are considered to be well drain but less fertile, particularly in the lower areas because of over cultivation and farming (EDL, 2006).

4.1.4 Hydrology

The transmission line ROW is located in the watershed of the Mekong River, though sections of line also traverse sub-catchments of the Mekong, including: Xe Bangkeing, Xe Nouan and Xe Done watersheds.

The Mekong River is the longest river in South East Asia and the 12th longest in the world. It is the 10th largest river in the world by discharge (MRC, 2008). The Mekong starts on the Tibetan Plateau and flows south through China, Myanmar, Lao PDR, Thailand, Cambodia and Vietnam to the South China Sea. Where the Mekong is adjacent to the Project Area, this stretch of the River creates the international border between Lao PDR and Thailand. The Mekong has a total catchment area of 795,000 km².

The hydrology of the Mekong is dependent on the monsoon cycle described in section 4.1.2 – discharge in the wet season (May to November) can be up to twenty times greater than during the dry season (December to April). The source of flow also varies by season – with 40% of dry season flow, but only 15% of wet season flow coming from China. In general, Lao PDR comprises 25% of the total catchment area of the Mekong and contributes 35% of the flow (MRC, 2005).

Approximately 50% of sediment discharged into the South China Sea comes from China (MRC, 2008).

The Mekong can be split into 6 reaches based on hydrology, physiography, land use and development. The Project is located in Reach 3, which extends from Vientiane / Nongkhai to Pakse. In Reach 3, the influence of flow from China is minimised by the increasing flow contributions from large left bank tributaries – Nam Ngum, Nam Theun, Nam Hinboun, Xe Bang Fai, Xe Bang Hieng and Xe Done Rivers (MRC, 2005).

The available water levels data is only for two rivers, the Xe Banghieng and Xe Done Rivers. At Xe Banghieng River, the data was collected from Lahanam and Sopnam stations. For Xe Done River, it was collected from Saravan and Khongsedone stations. Table 4-3 and Table 4-4 present the water level of the two rivers collected from mentioned stations. The water level of both rivers rises from 3 m to 6 m during raining season, particularly from July to September of each year. At other times of the year the water level can rise up to 1.5 m per month. Comparing between the two rivers, the water level of the Xe Banhieng River (6.2 m) tends to be higher than in the Xe Don (5_m).

Table 4-3 Average Water Level (m) of Xe Banghieng River 2000-2007

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
2000	2.31	2.19	2.13	2.31	3.15	3.12	4.95	4.53	6.14	4.43	3.14	2.61	3.42
2001	1.91	1.62	1.69	1.62	2.03	3.31	4.70	6.96	5.65	2.79	2.50	2.17	3.08
2002	1.76	1.53	1.41	1.44	2.13	3.35	6.66	7.12	6.55	3.28	2.52	1.20	3.24
2003	1.79	1.54	1.36	1.52	1.88	2.68	2.83	5.21	6.05	3.14	2.43	2.11	2.71
2004	1.62	1.88	1.52	1.73	1.95	2.53	3.15	5.92	6.93	2.53	2.12	2.01	2.82
2005	1.50	1.30	1.28	1.30	1.64	1.84	4.40	9.12	8.31	5.26	2.89	2.55	3.45
2006	2.04	1.68	1.73	1.76	1.70	1.48	4.29	6.83	3.52	5.06	1.92	1.81	2.82
2007	1.69	1.44	1.47	1.47	2.02	2.01	3.04	4.23	3.71	7.34	4.24	2.40	2.92
Mean	1.83	1.65	1.57	1.64	2.06	2.54	4.25	6.24	5.86	4.23	2.72	2.11	3.06

Source: Department of Meteorology and Hydrology, 2008

Table 4-4 Average Water Level (m) of Xe Done River 2000-2008

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
2000	2.06	1.93	1.86	1.99	2.93	3.41	5.69	4.54	5.05	1.67	1.54	2.30	2.91
2001	2.11	2.01	1.95	1.90	2.45	3.48	4.40	4.96	4.64	3.15	2.64	2.35	3.00
2002	2.12	1.95	1.87	1.89	2.14	2.98	5.32	5.48	4.69	3.06	2.45	2.23	3.01
2003	2.07	2.00	1.97	2.00	2.44	3.20	3.23	5.06	5.58	3.00	2.35	2.17	2.92
2004	1.42	1.35	1.28	1.38	1.58	2.39	3.28	5.14	4.33	2.44	1.89	1.78	2.36
2005	1.92	1.83	1.78	1.86	2.13	2.38	3.83	5.90	4.89	4.00	2.42	2.20	2.93
2006	2.08	1.96	1.90	1.98	2.20	2.28	5.10	5.42	3.92	4.39	2.60	2.26	3.01
2007	2.12	2.02	1.98	1.97	2.46	2.51	3.74	4.42	3.59	4.50	2.70	2.37	2.87
2008	2.05	2.02	1.96	2.04	2.50	2.91	2.83	4.26	3.98	2.86	2.39	1.85	2.64
Mean	2.00	1.90	1.84	1.89	2.31	2.84	4.16	5.02	4.52	3.23	2.33	2.17	2.85

Source: Department of Meteorology and Hydrology, 2008

4.2 Biological Resources

4.2.1 Vegetation Along the Transmission Line Route

Preliminary investigations indicate that remaining vegetation along the proposed transmission line route is generally fragmented and degraded, with the majority of the vegetation along the route having been cleared for agricultural land such as rice paddies (see section 5.3.2). Nonetheless, field vegetation mapping along the transmission line route identified several currently forested areas (see Figure 4-1).

Within Saravan Province, approximately 7 significant patches of forest were identified along the proposed route, covering about 22 km along the alignment. This forest primarily occurs where the alignment passes in the vicinity of Phou Xieng Thong NPA and Xe Bang Nuan NPA within Lakhonpheng District.

In Savannakhet Province, approximately 8 significant patches of forest were identified, covering about 18 km of the alignment. These forested areas are primarily located in Kaysone Phomvihane District close to Pakbo sub-station.

Available vegetation mapping from the Lao PDR Forest Inventory Planning Department (FIPD 2002) indicates that, in both provinces, the most common vegetation type present along the proposed route is Dry Dipterocarp Forest (see Table 4-5). Other vegetation types present in smaller areas include Unstocked Forest and Lower Mixed Deciduous Forest. Each of these vegetation types are described below based on GOL classifications (FIPD 2002).

Table 4-5 Forest in the Right of Way

District	Line distance on village land (metres)	Total area of TL ROW (m ²)	Estimated land (Forest land)		Estimated land (Agricultural land)	
			Mixed deciduous forest	Dry dipterocarp and unstocked	Rice Paddy	Plantation
Champhone	25382	634550	0%	86%	14%	0%
Kaysone	4654	116350	36%	16%	43%	4%
Xaiphouthong	23786	594650	3%	32%	65%	0%
Songkhonee	54327	1358175	17%	39%	44%	0%
Lakhonpheng	52803	1320075	9%	48%	44%	0%
Vapi	31952	798800	1%	21%	78%	0%
Salavan	24814	620350	0%	35%	65%	0%
Total	217718	5442950	9%	40%	50%	1%

Source: FIPD 2002

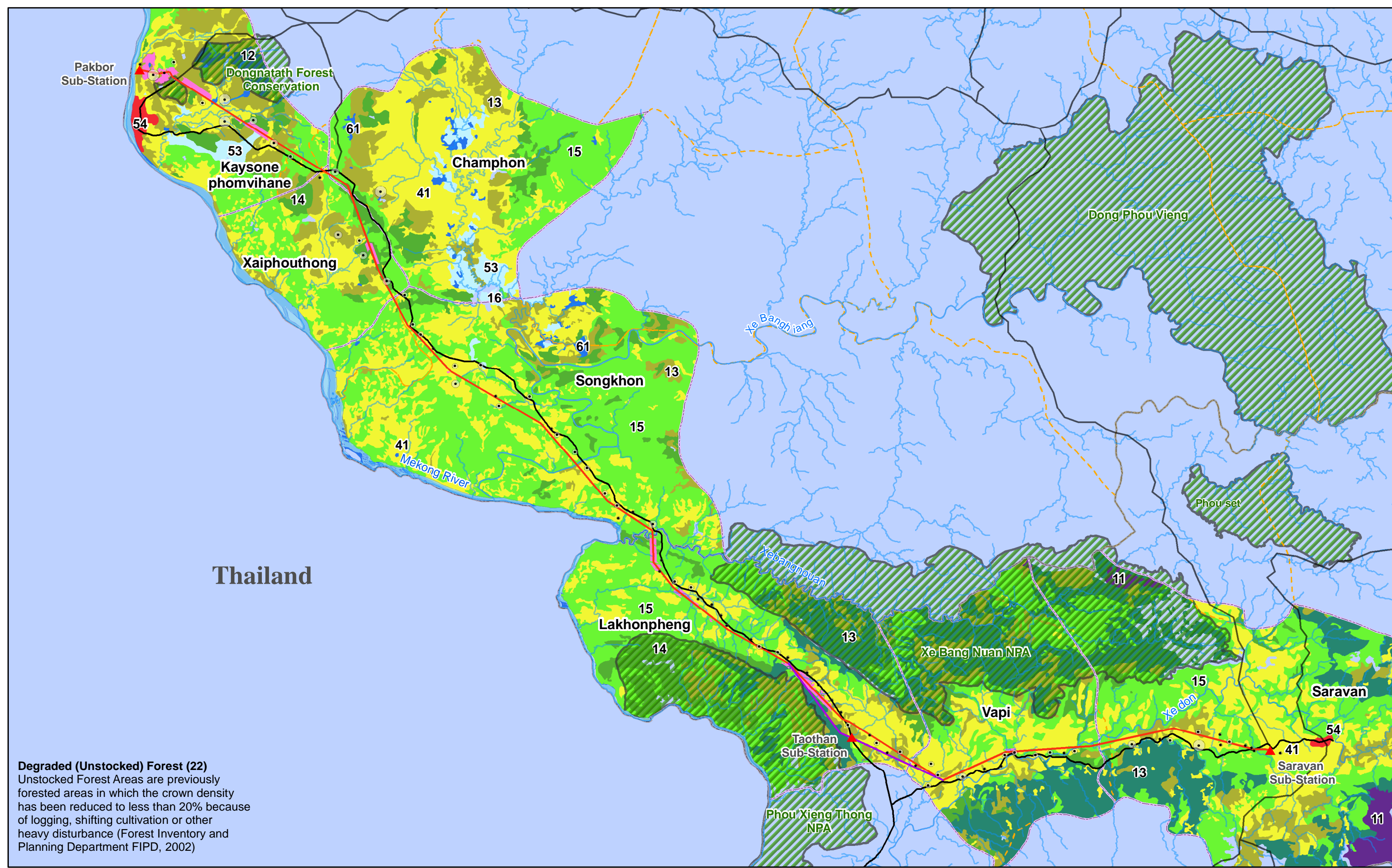
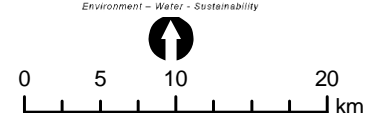
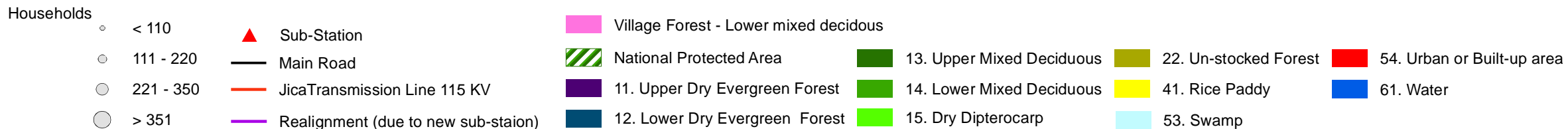


Figure 4.1 Land Use in the Project Area



Scale: 1:500,000 (A3)
 Projection: Wgs 84, UTM Zone 48 North

- **Dry Dipterocarp Forest**

Dry Dipterocarp Forest occurs in open stands. The tree diameter is comparably small and the height of the stand varies from 8 to 25 m. The crowns do not spread out widely. This type of forest is typically found in places with shallow soil, where the hard pan emerges above the ground, and on laterized soil. On the most poor and shallow soils the trees are crooked and do not exceed 10m in height. Many species within Dry Dipterocarp Forests are characterised by being fire resistant and having thick bark. Examples of such species include Mai Sabeng (*Dipterocarpus intricatus*), Mai Chick (*Shorea obtuse*), Mai Sat (*Dipterocarpus obtusifolius*), Mai Suak (*Terminalia tomentosa*) and Mai Hang (*Shorea siamensis*).

- **Unstocked Forest**

Unstocked Forest Areas are previously forested areas in which the crown density has been reduced to less than 20% because of logging, shifting cultivation or other heavy disturbance. If the area is left to grow undisturbed it becomes forest again. Abandoned ray areas and disturbed stands with a crown density less than 20% are also classified as Unstocked Forest.

- **Lower Mixed Deciduous Forest**

Lower Mixed Deciduous Forest occurs at an altitude below 200 m, and deciduous tree species represent more than 50% of the stand. The forest storeys are not as dense as those of evergreen types and most of the seedlings and saplings are deciduous trees. Most often bamboo occurs in this type of forest.

4.2.2 Village Forest affected in Phou Xieng Thong Buffer Zone

In Saravan Province, the proposed transmission line route passes through a significant stretch of forest, which is adjacent to Phou Xieng Thong NPA. The forest covers a stretch of approximately 9.5 km of the transmission line route between the village lands of Ban Phonedinsai and Ban Nongsano, which each have a small area of forest potentially impacted along the route.

Villages within this buffer zone with the largest areas of forest potentially impacted due to vegetation clearance for the transmission line are Ban Lak 94, Ban Lak 90 and Ban DaoCheng Gnai. A smaller part of the transmission line alignment also passes through forest within Ban Nathom village land. A variety of forest types occur within this general area including Dry Dipterocarp Forest, Unstocked Forest and Lower Mixed Deciduous Forest (FIPD 2002). The socio-economic surveys of villages along the transmission line found that forest resource use was of great importance to the livelihoods of local villagers (see Section 5.3.3).

4.2.3 Protected Areas

Meetings with government officials and surveys in villages indicate that there are no provincial and or district level project areas within the project area. This will need to be confirmed at DMS stage.



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The proposed transmission line passes between two National Protected Areas (NPAs), Phou Xieng Thong NPA and Xe Bang Nuan NPA.

Based on currently available information regarding the NPA boundaries, the proposed transmission line passes within approximately 400 m of Phou Xieng Thong NPA, and the proposed alignment is less than 5 km from the north eastern side of the NPA for approximately 25 km of its length. Phou Xieng Thong NPA covers approximately 1,003 km². The Park has important biodiversity values as it is the only Lao NBCA on the Mekong River, extending along some 100 km of its course and incorporating both rocky and sandy river banks. Extensive tracts of high quality semi-evergreen forest occur in the Park. The Park also contains characteristic rocky flats at elevations of 300-500 m, which are a rare habitat in Lao PDR. The vegetation of the NPA is primarily Mixed Deciduous Forest which is generally in very good condition. Wetlands within the NBCA provide important habitat for a range of wildlife. Village surveys indicate that endangered Asian elephants and Tigers are present in the Park. Other species of conservation significance include the Green peafowl, the Asiatic black bear, Banteng, gibbons and gaur.

For Xe Bang Nuan NPA, the proposed transmission line is located on the south-western side of the park. Based on currently available information regarding the NPA boundaries the transmission line passes within approximately 5 km of the NPA, and is within 6 km of the south-western boundary for approximately 30 km of its length. Xe Ban Nouan NBCA covers approximately 1,260 km² and includes a range of vegetation types including Mixed Deciduous Forest, Dry Dipterocarp Forest and Evergreen Forest. Important habitat is also provided by the rocky flats in western and central areas of the NPA, and by numerous saltlicks. A large number of threatened wildlife species occur in the Park, including endangered Asian elephants and Tigers. Other species of conservation significance include the Banteng, Gaur, Clouded leopard and the Dhole. Birds of conservation significance recorded in the Park include the Siamese fireback and the Red collared woodpecker.

4.2.4 Biodiversity in Agricultural Landscapes

As a significant portion of the proposed transmission line route passes through agricultural land. Lao PDR is also known for harbouring a high genetic diversity of rice species. Lao PDR and northern Thailand are recognised as the centre of origin of the glutinous rice types (STEA, 2004). Since the early 1990s, more than 13,500 rice samples have been collected in Lao PDR, representing more than 3,000 rice varieties. Lao PDR's contribution to the International Rice Genebank at the International Rice Research Institute (IRRI) ranks the second highest. It is also recognised that there is substantial Indigenous knowledge of the traditional rice varieties in Lao PDR (ADB 2006). The high agricultural diversity within rice paddies in the project region is demonstrated by a study of agricultural biodiversity in Savannakhet Province. A total of 184 wild herbaceous species and 17 cultivated species were recorded in paddy vegetation within two villages. Nineteen of the wild species were used by local people (Kosaka et al. 2006).



Aquatic diversity is also known to be high within agricultural landscapes in Lao PDR. For example a study of rice paddies in three villages in northern Lao PDR identified 23 species of fish, 10 amphibians, 7 reptiles, 16 insects, 5 crustaceans, 8 molluscs and 16 aquatic plants (FAO 2003). Studies indicate that a total of almost 200 aquatic species are consumed in agricultural areas in Lao PDR (James 2006). The consumption of such species within agricultural areas is thought to make a significant contribution to the diet of rural communities in Lao PDR.

A large study currently being undertaken by the FAO on aquatic biodiversity and human nutrition has indicated that 50% of fish consumed by households comes from rice-based ecosystems. In the project region, a study of 11 villages in Atsaphangtong district, Savannakhet province, found that every household surveyed used the ricefield fishery to some extent (Newman-Meusch, 1996).

4.2.5 Aquatic Habitats and Resources

Although socio-economic data for the potentially impacted districts indicates that fishing is not a major livelihood activity in the project area (e.g. Table 5-3), aquatic resources may be of significant importance to local villagers for both subsistence use and trade. Many aquatic habitats within Lao PDR are also known to harbour a high biodiversity of both flora and fauna. Aquatic habitats within agricultural landscapes are discussed in Section 4.2.4 above.

Field surveys along the proposed transmission line route identified that approximately 500 metres of the alignment intersects a wetland in the central part of Kaysone Phomvihane District within Savannakhet Province. The transmission line route will also cross three major rivers (Xe Banghiang, Xe Bang Nuan and the Xe Don) as well as many smaller tributaries which may support aquatic resources. The route also passes within approximately 2.5 km from the Mekong River. The Mekong river and its tributaries are of global significance for fisheries and aquatic biodiversity, with approximately 500 indigenous fish species identified within Lao PDR (STEA, 2004).

Xe Banghiang is one of the largest rivers in Lao PDR with a catchment area of 19,400 sq.km and average annual runoff of 16,000 MCM. The river contains a high diversity of fish species, including several species of catfish (Kottelat 1997) and is considered a significant migration route for fish species which travel up the river from the Mekong river to spawn. The river is also one of the few remaining locations of the Critically Endangered Giant Ibis (*Thaumatibis gigantea*) and White Shouldered Ibis (*Pseudibis davisoni*) (IUCN 2008).

Limited information is publicly available regarding the aquatic habitats and resource use of the Xe Bang Nuan and Xe Don. Xe Bang Nuan is a tributary of the Mekong river, and forms part of the border between Saravan and Savannakhet Provinces. The river also runs through the Xe Bang Nuan NPA within Lao PDR. Previous surveys conducted on the river identified at least 28 fish species (Kottelat 1997). The Xe Don is also a large river which drains into the Mekong. The river is known to support a range of significant birdlife. Birds present in the river system include the



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river lapwing which is only one of a community of declining birds of sandbar habitats (Duckworth et al 1998).

5 SOCIO-ECONOMIC DESCRIPTION OF THE PROJECT AREA

This section provides a summary of the detailed socio-economic information provided in the Resettlement Action Plan (RAP). It draws upon secondary information, such as national, provincial and district census data and primary data collected during stakeholder consultation meetings and household surveys undertaken in June and July 2009. Stakeholder consultation meeting and household surveys included:

- Meetings with Central, Provincial and District Government of Lao PDR officials;
- Village-level meetings (i.e. meetings with the village committees) with the 19 villages with settlement areas located within 500 metres of the selected transmission line alignment and with an additional 62 villages where the transmission line ROW affects land within the village boundary.
- Household surveys of 250 randomly selected households in 37 of the 81 villages affected by the transmission line project.

More information on the methodology is provided in Section 6 of this report and in the attached RAP.

5.1 Social Setting

Savannakhet has the second largest population in Lao PDR with 825,902 people (NSC, 2005). The province is divided into 15 districts and has a total of 1,543 villages and 131,216 households, with an average household size of 6.3 people. The average size of each village in Savannakhet is 14 km².

Saravan has a population of 324,327 people (NSC, 2005). Saravan is divided into 8 districts and has 724 villages and 53,013 households, with an average household size of 6.1 people. The average size of each village in Saravan is 15 km².

The transmission line ROW will traverse through seven districts, four of which are in Savannakhet province (Kaysone, Champhone, Xaiphouthong and Songkhonee) districts, and three in Saravan province (Lakhonphen, Vapi and Saravan) districts (see Figure 2-1).

5.1.1 Affected Population

The ROW will affect land within the village boundaries of 81 villages. Within these 81 villages, 904 households will be directly affected by construction and presence of the transmission line – a small number will experience loss of land and / or assets. Table 5-1 presents a summary of the geographic distribution of the affected population.

Table 5-1 Summary of households impacted by the proposed line

Province	District	Villages	No. of Affected Households
2	7	81	904
Savannakhet	4	35	462
	Kaysone	8	101
	Champhone	2	22
	Xaiphouthong	6	96
	Songkhone	19	243
Saravan	3	46	442
	Lakhonpheng	21	211
	Vapi	13	137
	Saravan	12	94

Source: ESL Village-Level Surveys 2009

The average household size for the project affected villages is 7.8 persons per household, which is higher than the Savannakhet and Saravan provincial averages of 6.3 and 6.1 persons per household respectively (NSC, 2006).

Based on information provided by nineteen (19) villages, the average growth rate was 12 percent, with individual village growth rates ranging from 2% to 50%. The number of births over the last 12 months was more than double the number of deaths; and number of people migrating to these villages was about 30% higher than the number of people emigrating. The primary reasons for immigration were marriage and looking for new economic opportunities and land. The main reasons for emigration were marriage and moving closer to relatives.

5.1.2 Ethnicity, Religion and Cultural Heritage

Lao PDR's population is characterised by significant ethnic diversity. The 2005 Population and Household Census identified 49 different ethnic groups (NSC 2006). In Savannakhet, the main ethnicity is the Tai Family or 'Lao Loum' consisting of Lao (62%), Phou Thai (15%), and Makong (9%). In Saravan, the main ethnicity is the same as in Savannakhet consisting of Lao (61%), Katang (13%) and Souay (8%) (NSC 2005, 2006 & 2007).

Ethnicity in the project area is similar to the provincial wide statistics. The majority of people (92%) are from the Tai Family and practice Theravada Buddhism mixed with elements of animism (see Table 5-2).

Other ethnic groups present in the Project Area include Katang, Ta-Oy and Xuay / Suiy which are all members of the Mon-Khmer language family. In the Project Area, these groups are almost entirely located in Saravan Province. The Saravan District of



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Saravan Province was the most diverse, with 52% Lao, 18% Xuay / Suiy, and 28% Ta-Oy (see Table 5-2)

The majority of people in the project area are Buddhist (96%), followed by Christian (3%). Those practicing the Christian faith are located entirely within the Savannakhet Province in Xaiphouthong, Champhone and Songkhonee Districts.

Table 5-2 Main Ethnicity and Main Religion by village in the Project Area.

Province	District	Ethnicity						Religion	
		Lao	Phouthai	Xuay/ Suiy	Katang	Ta- Oi	Other	Buddhist	Christian
Savannakhet	Kaysone Phomvihane	84%	11%	0%	0%	0%	4%	100%	1%
	Xaiphouthong	100%	0%	0%	0%	0%	0%	89%	11%
	Champhone	96%	0%	0%	0%	0%	4%	96%	4%
	Songkhonee	100%	0%	0%	0%	0%	0%	96%	5%
Saravan	Lakhonpheng	95%	0%	0%	5%	0%	0%	100%	0%
	Vapi	100%	0%	0%	0%	0%	0%	100%	0%
	Saravan	52%	0%	18%	1%	28%	2%	90%	0%
Average		90%	2%	3%	1%	4%	1%	96%	3%

Source: ESL surveying 2009

Village level surveying found all ethnic groups to have a long association with the local area and the minority groups have generally been absorbed into the mainstream Lao-speaking society and are treated without discrimination as Lao citizens within the administration and civic society

The following cultural related aspects that are relevant to the Project and the planning of social mitigation measures were observed:

- Buddhists practice cremation, and therefore, do not tend to have important burial sites.
- Some communities still practice elements of Animism and spirit forests do exist in project villages.
- The traditional Lao principle of the husband moving to live with and work for his wife's parents is still widely practiced in the project area.
- Both Lao Loum and Mon-Khmer households in the project area generally own wooden houses with corrugated iron roofs positioned on high wooden (or concrete) poles. Some houses have bricked in lower levels.
- Approximately 5% of houses are concrete/brick with tiled roofs and were constructed fairly recently (within the past 5 years).
- The majority of Lao Loum villages have a temple which is used both for religious events and village meetings.



Pakbo – Saravan 115 kV Transmission Line

Important Lao Loun and Buddhist cultural celebrations that take place in the project area include:

- Lao New Year (Boun Pi May), celebrated in mid April and lasting for a week, this is a festival to welcome the new Buddhist calendar year.
- Rocket festival (Boun Bang Fay) is celebrated at the start of the rainy season (mid May). It is known as a celebration calling for rain and fertility.

Additional important Buddhist holidays are listed in the RAP. Some of the people in the project area still practice elements of animism including the following ceremonies:

- Annual ceremony for the spirits of ancestors;
- Ceremonies in case of natural calamities; and
- Funeral ceremony, practiced immediately after the death of a villager practice, must ensure that the spirit is erased from and not disturbing the house.

5.2 Economic Overview

5.2.1 Regional Economy

Savannakhet Province

According to the Savannakhet Socio-Economic Development Plan 2008 (Savannakhet Province, 2009), the economic growth rate for the province in 2007-2008 was 13.8%.

Agriculture is the largest sector in the economy. Rainfed rice is by far the largest crop cultivated covering an area of 162,242 ha with an average production of 3.5 ton/ha and a total annual production of about 567,000 tonnes. Irrigated rice (28,256 ha) and dry season crops (19,115 ha) are also important.

The province has 29 companies investing in tree and crop plantations, such as, rubber, Eucalyptus, Acacia, sugar cane, and cassava. In 2008, across the province, a total of 30,000 ha of land were cleared for these plantations.

In 2008, there were 2,801 factories registered within the province including, 28 considered large, 50 medium, 2,195 small and 528 family sized factories. The numbers of factories has increased since 2007; however, the total value of production has decreased by 50% compared to last year. In 2008 the province imported more than \$200 million worth of goods, which was more than double the previous year.

Saravan Province

According to the Saravan 2007-2008 Socio-Economic and Development Plan (Saravan Province 2008), the economic development objective of the province is to shift the economy from subsistence production toward market products. In 2008, the province recorded a 9% economic growth rate and a GDP of \$202 million.



Pakbo – Saravan 115 kV Transmission Line

Agriculture is the largest sector in the economy and is focused on crop cultivation and tree plantations. Rice is the key crop, and annual production in 2007-08 was recorded at 256,500 tonnes. Coffee is also an important crop that is grown in the southern parts of the province. Coffee production was reported at 16,474 tonnes in 2008. Crop and tree plantations include cassava, which has increased ten-fold in recent years – now covering an area of 2,119 ha and producing about 53,000 tonnes – and rubber and other tree plantations, which cover approximately 4,400 ha.

The services sector in the province is growing with a focus primarily on tourism. Tourism arrivals have increased three-fold – from about 8,000 people in 2005 to 24,000 people in 2008.

Industry in the province is focused on the development of energy and mineral resources (eg. Xeset II Hydropower Project). In 2008, there were 74 licensed factories in the province, the majority of which process wood for exporting to other provinces and across the border to Thailand and Vietnam. Total export value for the province was about \$11 million in 2008. In addition to wood, other exports include energy and coffee and other agricultural products. Import value is about five times higher than export value at about \$49.4 million in 2008.

5.2.2 Project Area

Employment

As described above, the regional economy in both provinces is still predominately agriculture based. See Table 5-3 for information on the distribution of occupation in agriculture, fishery and non-farm activities at the national, provincial and district levels.

According to the national census (NSC 2005), in the seven districts that comprise the Project Area, over 80% of the total active population work as farmers. With the exception of the Kaysone Phomvihane District in Savannakhet, where only 45% of workers are farmers, the other six districts reported at least 90% of residents engaged in farming activities. Kaysone Phomvihane District has such a significant proportion of non-farming activity because it contains the provincial capital and trading centre of the province, Savannakhet City.

Results of village level surveying follow the general employment trends outlined above, i.e. all villages surveyed regard agriculture and agricultural trading as their top two important economic activities.

Table 5-3 Percentage distribution of occupation in agriculture, fishery and non farm activities by province and district of the project area

Level		Total Active Population	Farmer	Fisher-man	Livestock farmer	Mixed farmer	Non-farm activity
			%				
Country	Lao PDR	2,738,892	63%	0.1%	0.2%	13%	24%
Province	Savannakhet	431,045	86%	0.0%	0.1%	1%	13%

Level		Total Active Population	Farmer	Fisher-man	Livestock farmer	Mixed farmer	Non-farm activity
			%				
District	<i>Kaysone Phomvihane</i>	49,466	45%	0.2%	0.2%	1%	54%
	<i>Xaiphouthong</i>	26,201	95%	0%	0%	0%	5%
	<i>Champhone</i>	52,144	91%	0%	0%	0.2%	9%
	<i>Songkhone</i>	46,163	94%	0%	0%	0%	6%
	Sub-Total	173,974	79%	0.1%	0.1%	1%	20%
Province	Saravan	167,166	80%	0.0%	0.0%	13%	7%
District	<i>Lakhonpheng</i>	21,140	93%	0%	0%	0.1%	7%
	<i>Vapi</i>	15,606	93%	0%	0%	0%	7%
	<i>Saravan</i>	42,667	90%	0%	0%	0.1%	10%
	Sub-Total	79,413	91%	0%	0%	0.1%	9%
Total Project Area Districts		253,387	83%	0%	0%	0%	17%

Source: NSC, 2005

Wealth and poverty in the villages

During village level surveying in the Project Area, village chiefs were asked to group village households into three categories – wealthy, average and poor, and then estimate the average annual income of households in those categories. Table 5-4 summarizes the collective perceptions of wealth among the survey participants in the Project Area. Of the 81 affected villages, approximately 17% of families are considered very well off, 70% sufficiently well off and 13% considered not well off (or poor). Of the poor families, most are ‘poor with some land’, which generally means they have some means to grow food such as rice; and a very small percentage are ‘poor with no land’. The socio-economic survey showed that poor households with no land were generally those of elderly people who had ceased to be active in farming, and had, for example, allocated land to sons and daughters. There is little if any evidence of landlessness as a causal factor in poverty. Kaysone Pomvihane District, Savannakhet Province and Saravan District, Saravan Province recorded higher percentages of poor families than the other districts. Kaysone Phomvihane district also recorded the highest percentage of landless families. Respondents in Champhone District, Savannakhet did not consider any of the families in these villages as poor.

Table 5-4 Perceptions of wealth and Income of families in the Project Area

District	Very well off		Sufficiently well off		Poor with SOME land		Poor with NO land		Avg income p.a
	%	Avg income p.a	%	Avg income p.a	%	Avg income p.a	%	Avg income p.a	
Kaysone Phomvihane	13	15.0	67	9.4	19	4.1	2	5.0	20.8
Xaiphouthong	20	15.0	68	12.8	11	5.1	2	2.0	26.7



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District	Very well off		Sufficiently well off		Poor with SOME land		Poor with NO land		Avg income p.a
	%	Avg income p.a	%	Avg income p.a	%	Avg income p.a	%	Avg income p.a	
Champhone	18	20.0	82	10.0	0	0.0	0.0	0.0	20.0
Songkhonee	12	30.3	75	13.4	11	4.3	2	1.2	39.1
Lakhonpheng	10	31.7	78	13.8	10	3.3	2	2.1	43.9
Vapi	27	24.8	66	10.9	6	2.9	1	0.7	39.2
Saravan	18	26.2	53	12.2	24	4.8	5	3.8	40.4
Average	17	23.3	70	11.8	11	3.5	2	2.1	32.9

Source: ESL surveying 2009

Income and expenditure

The majority of families in the project area source income from the sale of agricultural products. The estimated average yearly income for families in the project area is 32.8 million kip ranging from 20.8 million kip in Kaysone Phomvihane District, Savannakhet Province to 43.9 million kip in Lakhongpheng District, Saravan Province (see Table 5-4). Village surveying indicates that this income is mainly spent on food. Other expenses include medical health care, education and other household items. For many villages, another significant expenditure is land tax.

Vulnerable households

Village surveying in the 81 project villages indicates that 12.5% of households are considered vulnerable. The categories of vulnerability and the percentage of households within each category in each district are provided in Table 5-5. The two most common vulnerabilities are single female-headed households and landless households.

Table 5-5 Vulnerable households in the Project Area

Province	District	Single female-headed	No labour	Infirm / elderly	Landless	Other	Total
Savannakhet	Kaysone Phomvihane	14.3%	0.8%	1.1%	9.6%	0.4%	26.2%
	Xaiphouthong	4.0%	1.3%	2.5%	1.5%	1.5%	10.7%
	Champhone	1.7%	0.2%	0.5%	0.2%	0.0%	2.5%
	Songkhonee	10.8%	2.7%	0.8%	4.1%	0.4%	18.9%
Saravan	Lakhonpheng	5.7%	2.1%	0.7%	2.6%	0.0%	11.1%
	Vapi	3.6%	0.8%	0.6%	0.9%	0.0%	6.0%
	Saravan	4.4%	2.0%	0.1%	5.5%	0.0%	11.9%
Average		6.4%	1.4%	0.9%	3.5%	0.3%	12.5%

Source: ESL surveying 2009

Rice sufficiency

Results of surveying in 19 of the project villages indicate that 77% of households in the project area have rice sufficiency year round. A further 15% of households are rice sufficient for at least 9 months of the year. The remaining 8% are spread out across Kaysone Phomvihane, Xaiphoutong, Songkone, Lakongpeng and Salavan districts – of these households, 50% are able to buy rice during times of shortage, 30% borrow and 15% trade or provide labour in exchange for rice. Insufficiency is not seen as an issue in the more urban villages of Kaysone Phomvihane District where all households can buy the rice they need.

Table 5-6 Rice Insufficiency in the Project Area

District	Rice insufficiency in a given year			
	No insufficiency	1 to 3 Months	4 to 6 months	7+ Month
Kaysone Phomvihane	60%	11%	7%	21%
Champhone	83%	17%	0%	0%
Xaiphoutong	69%	26%	6%	0%
Songkone	77%	12%	5%	6%
Lakongpheng	83%	15%	2%	0%
Vapo	95%	5%	0%	0%
Saravan	68%	21%	5%	5%
Total	77%	15%	4%	5%

Source: ESL surveying 2009

5.3 Agriculture and Land Use

5.3.1 Land Tenure

All land in Lao PDR is ultimately owned by the state. The state, however, has a range of instruments with which it can allocate land rights and ownership of land and forests to villages and individuals.

Land and Forest Allocation Program (LAFAP)

Since 1996, a nation-wide program, under the direction of the Ministry of Agriculture and Forests (MAF), has been aimed at devolving most decisions about land use and land allocation to the village level through its Land and Forest Allocation Program (LAFAP). In most cases, nine land use categories are applied to villages including five forest categories three agricultural (village land reserves, production land, and highland agricultural land) and one for the site of the village settlement. These

agreed uses are then roughly mapped and a map of the allocation plan is often displayed in a central place in the village.

Of the nineteen surveyed villages in the Project Area, sixteen villages have been part of the LAFA. The majority of the land area in the village is allocated for agricultural purposes, following by residential and/or commercial activity and different types of forest resources.

Land Titling

In Lao PDR, land is owned by the national community and the State is charged with its management (Land Law 2003). The Government uses a range of instruments to allocate land rights and ownership of land and forests to villages and individuals. Those common in the project areas include (DOF2007):

- Land Title, issued by the Provincial or Municipal Land Management Authority gives permanent land use rights
- Temporary Land Use Certificate, issued by the district government through the land use planning and land allocation process, gives a land use deed for 3 years after which time a land title applied for.
- Certificate for Original Acquisition of Land, issued by the agriculture and forestry sector, gives permanent land use rights

The governments land titling program is currently being implemented in the project area. 56 of the 81 project villages have had the land titling conducted. In 49 of these villages, activities have concentrated on settlement land areas, with over 96% of this land being titled. Agricultural land titling is also underway in 32 of these villages although the percentage of land titled averages only 22%. All villages have land certificates for agricultural land and pay annual tax.

Note: Legal ownership of land is based on recognised rightful occupation and use or inheritance, so that the lack of a formal title is, under Lao land law and WREA guidelines, not necessary for recognition of ownership and for compensation in involuntary land loss.

Table 5-7 Land Titling Activities in the Project Area

Prov.	District	No.	Village name	Land Titling	% Land Titling (settlement)	% Land Titling (Agriculture)	Land Certificate tax payment
SVK	Kaysone	6	Ban Pakbor	..	n/a	n/a	..
		5	Ban Nongduern	..	n/a	n/a	..
		1	Ban Dongnakham	..	n/a	n/a	..
		2	Ban Phonsim	..	n/a	n/a	..
		4	Ban Dongmakyang	..	n/a	n/a	..
		3	Ban Houay	..	n/a	n/a	..



Prov.	District	No.	Village name	Land Titling	% Land Titling (settlement)	% Land Titling (Agriculture)	Land Certificate tax payment
SLV		7	Ban Somsa-at	..	n/a	n/a	..
		8	Ban Xokvang-Tai	..	n/a	n/a	..
	Champhone	16	Ban Lak 35	..	100	90	..
		15	Ban Nateuy	..	100	90	..
	Xaiphouthong	9	Bna Khamxan		0	0	..
		11	Ban Khasavang+Khoua		0	0	..
		12	Ban Sisavang		0	0	..
		10	Ban Dongmakfai		0	0	..
		13	Ban Phonsikeo		0	0	..
		14	Ban Nakae+++		0	0	..
	Songkhonee	28	Ban Oumnamkhong	..	100	0	..
		18	Ban Nongnokkhan	..	100	0	..
		32	Ban Nonesomphou	..	100	0	..
		33	Ban Nonesomboune	..	100	0	..
		20	Ban Lattana	..	100	0	..
		17	Ban Thongsymouang	..	100	0	..
		19	Ban Malaythong	..	100	0	..
		27	Ban Khummouan		0	0	..
		31	Ban Hintek		0	0	..
		34	Ban Nonesavang	..	100	0	..
		24	Ban Salaleio	..	100	0	..
		26	Ban Nongkhangou	..	100	0	..
		25	Ban Nontaothanh	..	100	0	..
		30	Ban Kengtanganh	..	100	0	..
		21	Ban Naoudom	..	100	0	..
		29	Ban Houaypian	..	100	0	..
		23	Ban Nakhanhom		0	0	..
	35	Ban Donxat	..	100	30	..	
	22	Ban Senouan Nuea	..	100	0	..	
	Lakhonepheng	47	Ban Phouangsavanh	..	97	10	..
		54	Ban Phouangmalay	..	98	7	..
		37	Ban Okart	..	95	16	..
36		Ban Nonsavang	..	99	33	..	
55		Ban Nongkhitom		0	0	..	
39		Ban Donvay		0	0	..	
38		Ban Nathom	..	95	10	..	
46		Ban Lakhonsy-Tai	..	98	23	..	
53		Ban Houaykaphoxay	..	98	14	..	
52		Ban Xokpheng	..	98	12	..	
51		Ban Nadoukao	..	99	7	..	
41		Ban Nonedinsai	..	99	29	..	
44		Ban Lak 94	..	96	14	..	
48		Ban Lak 90	..	99	20	..	
43		Ban Phoudaochang	..	99	8	..	
45	Ban Nongsano	..	95	8	..		
49	Ban Tangbeng	..	98	20	..		
50	Ban Phonepheng		0	0	..		

Prov.	District	No.	Village name	Land Titling	% Land Titling (settlement)	% Land Titling (Agriculture)	Land Certificate tax payment	
		42	Ban Nanglao	..	45	10	..	
		40	Ban Lakhonsy-Kang	..	96	23	..	
		56	Ban Donelay		0	0	..	
	Vapi		69	Ban Vapi	..	100	15	..
			57	Ban Phaylom	..	10	0	..
			67	Ban Nonkho	..	100	10	..
			64	Ban Nakoktan	..	100	10	..
			68	Ban Nongngong	..	100	15	..
			63	Ban Bangkhanam	..	100	10	..
			62	Ban Phakha	..	100	10	..
			66	Ban Sapath	..	100	10	..
			65	Ban Mouang	..	100	10	..
			58	Ban Kengsouthi	..	100	10	..
			59	Ban Lao	..	100	10	..
			60	Ban Kengkou		100	10	..
			61	Ban Mai oudomxai	..	100	0	..
	Salavan		70	Ban Bungkham		0	0	..
			74	Ban Nongsai		0	0	..
			71	Ban Bungxai		0	0	..
			79	Ban Donekeo		0	0	..
			77	Ban Thongnakham		0	0	..
			75	Ban Nonbouhin		0	0	..
			81	Ban Phakphaewthong		0	0	..
			80	Ban Nadonkoua	..	100	100	..
			76	Ban Tong-noi		0	0	..
			78	Ban Maisivilay		0	0	..
72	Ban Nathon		0	0	..			
73	Ban Tong-Ngai		0	0	..			
			TOTAL	56	96	22	79	

Source: District Government Information 2009

5.3.2 Agricultural Land Use Patterns

Agricultural and land use patterns in the project area are dominated by traditional Lao Loum lowland sedentary agriculture practices. A small amount of upland rotating agriculture is practiced, primarily in the villages in the Saravan province. There is only limited irrigation infrastructure in the Project Area and a majority of villages rely on seasonal rain in the months of May to October.

Rice production

Permanent rain-fed rice production is the most common agriculture activity in the project area. Upland agriculture (rice and other crops) is only practiced in 4 of the surveyed villages, one in Savannakhet and other 3 in Saravan province.

Average yield of rainfed rice cultivation per district and in the project affected villages is presented in Table 5-8. Average yield of rainfed rice in the project area is lower than average provincial levels. Production per household varies from 3.3 tonnes per ha per year in Vapi District to as low as 2 tonnes per ha per year in Kaysone Phomvihane, Songkone and Saravan Districts.

Table 5-8 Average productivity of rainfed rice by district and villages in the project area

Province and District	Total Number of household **	District statistics*	Project area**	
		Average Productivity of Rainfed Rice (t/ha/yr)	Average Productivity of Rainfed Rice (t/ha/yr)	Average of Area of Rice Paddy per HH (Ha)
Savannakhet		3.5	2.2	6.6
Kaysone Phomvihane	241	3.9	2	2.6
Xaiphouthong	225	n/a	2.5	11.7
Champhone	n/r	n/a	n/r	n/r
Songkhone	581	n/a	2	5.5
Saravan		3.8	2.5	3.7
Lakhonpheng	648	3.2	2.1	4.9
Vapi	654	3.5	3.3	2.8
Saravan	238	3.7	2	3.4

*Source: agriculture production statistics

**Source: ESL surveying 2009

Vegetable and Fruit gardens

The majority of villages in the project area produce fruits and vegetables. Some of the common vegetable grown are cucumber, leafy steam vegetables (lettuce, salad), chilly and banana etc. These vegetables are generally grown for household consumption rather than for trade.

Plantations

Over 60% of surveyed villages in the project area have allocated land for tree plantations. Eucalypt plantations are the most common (present in 8 of the 19 villages) however these are relatively small ranging from 1 to 30 ha in size. Teak plantations are grown in 4 villages and range between 1 and 5 ha. Two villages have rubber plantations, both over 100 ha. These plantations are either collectively owned by the village or by private households. There is one Kapok plantation located near Nongduern Village, Kaysone District which falls within the transmission line ROW. This plantation is owned by an individual resident, Mr. Bounlieng. The full plantation is 26 ha, and it was planted in 1999.

5.3.3 Forest Resource Use

The majority of forest in the project area is degraded deciduous or unstocked forest in agricultural landscapes. Small pockets of higher quality deciduous forests do exist (see section 4.2 Biological resources).

Forests form a crucial economic base and cultural asset for the rural communities, particularly people who live in very remote areas. Forests provide a variety of products for local villages including wildlife, Timber Forest Products (TFPs) and Non-Timber Forest Products (NTFPs) which at the local level provides an important supplementary subsistence for household consumption and usage, and for income generation.

Village surveying found that 5 of the 19 villages did not have any forest resources. Of the remaining 14 villages 23 separate forest resources were identified including production forests, protection forests, spirit forest and degraded forests (see Table 5-9). Average land areas give an indication of the size of these forest by forest type, although individual forested areas were found to range significant between 1 ha and 400 ha.

Table 5-9 Forest resources in the Project Area

Forest type	Percentage of villages with forest type	Average land (ha)
Village production forest	21%	16.3
Village protection forest	32%	86.7
Village spirit forest	47%	5.3
Village degraded forest	21%	66.3

Source: ESL surveying 2009

5.3.4 Land Disputes, Issues and Concerns

In the Project Area, land disputes between family members are most common. Other disputes include concerns regarding compulsory land acquisition, inadequate compensation (road, construction mining, etc.) and disagreements with forestry officials over encroachment or use of forest resources.

The top five (5) land issues and concerns for the villagers in the Project Area include (in order of importance) limited water resources, pests, poor soil quality, lack of labour, and no or limited suitable available agricultural land.

5.3.5 Livestock

For the majority of farmers in Lao PDR, the sale of livestock is an important source of cash income. Common livestock raised include buffalo, cattle, pig and poultry. When



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faced with rice-shortage or the need for “emergency” spending, households usually sell a cow or buffalo.

In the project area, livestock are raised as a source of income for the villagers and during surveying this was ranked 3rd behind the sale of rice and labouring. On average, there are about 13 chickens/ducks, 1-2 pigs and 1-2 cattle per household.

5.4 Social Conditions and Services

5.4.1 Health

In Savannakhet there are 15 hospitals and 105 village group health care centres and 854 medicine boxes covering about 97.93% of villages in the province.

In Saravan there are 8 hospitals and 43 village group health care centres and 456 medicine boxes covering about 67% of villages in the province.

There are a number of NGOs working specifically on health related issues in the project area including:

- Belgian Technical Co-operation (BTC): Strengthening National Water Supply and Sanitation Strategy
- Village Focus International (VFI): Health, Education and Leadership (HEAL)

All project villages recorded regular visits from the government vaccination programme.

Sick villagers within the project area generally first seek treatment from the closest district health care centre and travel to the provincial hospital only if the issue is severe. Villagers tend to travel to district health centres, instead of getting treated at home or with the assistance of a village health volunteer, because district health centres are easily accessed via roads.

The main causes of death in the Project Area were reported to be liver disease (infection or cancer), followed by general cancers (unidentified), diabetes, malaria, lung infection and old age. For the past 12 months, reported health issues including, malaria, dengue, diarrhea, infant mortality and HIV / AIDS have been mainly concentrated in the villages in Saravan Province. Villages in Savannakhet reported very few health issues although one village reported two cases of HIV / AIDS.

5.4.2 Sanitation

Access to clean water is a key determinate of household health. Available water sources in the Project Area include tap water; deep and shallow wells; river or stream; and rain water. While the majority of the villages located in Savannakhet Province rely on wells for their water supply, in Saravan sources of water include a mixture of gravity fed water, well and river / steam (see Table 5-10).

Table 5-10 Sources of household water in the project area

Province	Gravity-fed	Well (deep and shallow)	River/ stream	Rain
Savannakhet	0%	95%	0%	5%
Saravan	21%	62%	16%	0%

Sanitation infrastructure in the project area is still relatively poor. High numbers of households in Savannakhet (54%) and Saravan (78%) were reported to still use the forest and or agricultural fields as their latrine – despite the majority of villages having permanent house structures. The use of bucket toilets is significantly higher in those villages located in Savannakhet (46%) than in Saravan Province (22%).

5.4.3 Education

According to the 2005 census, 73% of the Lao population aged 15 years and above were literate, with more men literate (83%) than women (63%). Literacy rates varied significantly across the country with Savannakhet and Saravan reporting literacy rates of 69% and 62%, respectively (NSC, 2006). Literacy levels in project area districts range from 88% in Kaysone Phomvihane District to 67% in Saravan district.

There are a number of NGOs working specifically on education and literacy in the project area including:

- Global Association for People and the Environment/Village Focus International (GAPE/VFI): VESL (Village Education in Southern Laos)
- Action with Lao Children (ALC): Reading Promotion Project
- Room to Read Laos (RtR): Enhancing the Education of Lao Children
- Shanti Volunteer Association (SVA): Improving Education Environment for Children

In terms of education infrastructure, all but one village surveyed had its own primary school, and for secondary school education, the majority of children travel to larger villages or the district centre. Tertiary and vocational education facilities are located in the provincial capitals of Savannakhet, Saravan and Pakse; and in Vientiane Capital.

High levels of school attendance among youth in the project area were recorded with male and female school enrolment 89% and 74% respectively.

Table 5-11 provides school enrolment by district for children aged 5 to 16 years. Non enrolment is highest in Xaiphoutong and Songkhone districts, Savannakhet. These same two districts have low levels of lower and higher secondary school enrolment. Significantly high levels of higher secondary school enrolment were found in Champhone District, Savannakhet.

Table 5-11 School enrolment (5-16 yrs)

Province	District	Not enrolled	Primary	Lower Secondary	Higher Secondary
Savannakhet	Kaysone	20%	46%	26%	9%
	Champhone	25%	25%	25%	25%
	Xaiphouthong	32%	54%	11%	3%
	Songkhone	37%	53%	5%	6%
Saravan	Lakhonpheng	26%	58%	12%	4%
	Vapi	28%	38%	28%	6%
	Saravan	28%	53%	18%	3%
	Total	28%	47%	18%	8%

The most common barriers to regular school attendance in the Project Area include the need to assist the family with livelihood / income generating activities and household work and insufficient numbers of schools, teacher and teaching material

Language is not seen as a major barrier to the environmental and social assessment process. The vast majority of people in the project area speak Lao Tai as their first language. The few villages where Mong-Khmer is spoken were found to also have excellent Lao Tai language skills, with the exception of some women of minority ethnic sub-groups.

5.4.4 Gender Considerations

Field surveying included consideration of gender-specific issues, and where possible, collected data was disaggregated by sex. Key gender-specific findings of the Project Area include:

- Approximately 6% of households in the Project Area are single woman-headed households;
- There are pockets of the Project Area, particularly in Saravan province, where enrolment is very low, particularly among women;
- Women in the project area are less likely to have the ability to understand complex language, particularly in written documents; and
- HIV / AIDS cases were reported in both Provinces.

5.4.5 Energy Consumption, Generation and Electrification

According to the National Census (NSC 2005) 53% and 42% of households in Savannakhet and Saravan, respectively, have access to grid electricity. The survey found levels of connection in the project villages to be well above these census figures.

All villages surveyed are connected to the electricity grid. Individual household connection varies from 90% connection in villages in Savannakhet Province to 73%



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connection in villages in Saravan Province. Perhaps due to the high levels of connection, alternative sources of electricity in the project area are not common.

Electricity is mainly used for lighting and household appliances (eg TV and radio). Very few households use electricity for cooking purposes, the majority relying on fuel wood (59%) or charcoal (31%) as their main source of energy.

5.4.6 Road Access

Road access in the Project Area is generally good. Villages in Savannakhet Province and Lakhongpheng District, Saravan Province are all close to the National Highway No. 13 – a paved road with all season access. Village roads leading off this main highway are unsealed and therefore may prove to be difficult during the wet season.

Villages in the Vapi and Saravan Districts, Saravan Province are located on or close to National Road 15. This road is unsealed and has a number of ferry river crossings. During the peak of the rainy season access to these villages along this road becomes extremely difficult.

5.5 Unexploded Ordinance

Lao PDR is one of the most heavily bombed countries in the world with over 2 million tonnes of bombs and weaponry deployed over the country during the Indo China War between 1963 and 1974. Almost 30 percent of UXOs (Unexploded Ordinance) failed to explode as designed. Since that time and event after the war ended in 1975, the country remains littered with UXO's (includes big bombs, mortar, cluster munitions and sub-munitions, and landmines).

Parts of the Project Area may still be contaminated; however generally, UXO's were not recorded as a significant issue during village surveying. More than half of the surveyed villages reported that no land within the village boundaries was affected by UXO. Those villages that did report UXOs were mainly in Saravan and Vapi district. These villages also reported that land mine clearance teams had completed work in their villages and that over the last five years, few UXO incidents had occurred.

6 PUBLIC INVOLVEMENT

Throughout the IEE process, formal and informal consultations were undertaken with key stakeholders, including Central, Provincial and District Government Officials and affected persons and communities. Informal consultation included the regular discussion and the inclusion of local residents and local Government staff in field surveys. Formal consultation included structured meetings with Government authorities and village authorities, as well as individual household surveys.

This chapter summarises the process undertaken and the outcomes of the community and government consultation undertaken for the IEE.

The primary objectives of stakeholder consultation include:

- Provide information on the transmission line project, describing:
 - Purpose of the project;
 - Layout of the project and project infrastructure elements;
 - Schedule and method of construction;
 - Likely environmental and social impacts of the project construction, operation and closure.
- Inform them of the IEE being undertaken including:
 - The nature and schedule of field investigations and surveys;
 - A description of the stages of environmental and social assessment in project development in Lao PDR).
- Collect environmental and social information and data on the project area,
- Record public concerns about the Project; and
- Record public ideas for impact mitigation and maximizing any environmental/social benefits of the Project.

6.1 Project Stakeholders

Key project stakeholders include Project Affected Persons (PAPs); affected villages; Government authorities (Central, Provincial, District); the Project Owner; and non-Governmental Organisations (NGOs). Each group of stakeholders is discussed in detail below.

6.1.1 Project Affected Persons

PAPs include persons losing land and / or assets to the Project. Such individuals need to be distinguished from other residents within the affected communities because they suffer specific losses of land and / or assets. Loss of land may be

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permanent (where towers and sub-stations will be located) or temporary – during construction and vegetation clearance activities.

Initial surveying has identified around 904 households and 6,147 people that have either land and / or assets located within the ROW.

6.1.2 Affected Communities

The preliminary survey of the transmission line ROW indicates that eighty-one (81) villages have land within the ROW.

6.1.3 Government

The Government of Lao PDR is a major stakeholder. The key Ministries and Departments involved in this Project include:

- Ministry of Energy and Mines:
 - Department of Electricity
 - Department of Energy Promotion and Development;
 - Electricite du Laos (power utility owned by the Government of Lao PDR).
- Water Resources and Environment Administration
- Ministry of Finance

Other Ministries, Departments and mass organisations that may be involved in environmental and social management include the Ministry of Agriculture and Forestry, the National Land Management Authority, Ministry of Health, Ministry of Education and the Lao Women’s Union.

Ministries and departments involved at the Central level will often rely on their Provincial and district counterparts for implementation, and therefore the Savannakhet and Saravan Provincial Governments as well as the District authorities of the seven affected districts are also key stakeholders. Government employees at the village level (village chiefs and committee members) also have an interest in the impacts on the people they represent.

6.1.4 Non Government Organisations

Initial consultation identified at least 6 NGOs that operate within the Project Area. These NGOs have invested time and resources in the Project Area, and therefore have an interest in Project activities and potential impacts, particularly impacts on livelihoods and biodiversity in the Project Area.

6.1.5 The Company, Developer and Financier

Electricite du Lao, Tokyo Electric Power Company, Nippon Koei and the Japan International Cooperation Agency as the project owner, developer and financier of the project, are also key stakeholders.

6.2 Summary of Public Involvement Activities Undertaken during the IEE

Consultation with stakeholder groups took the following forms:

- Formal meetings with concerned Central, Provincial and District Government departments;
- Interviews with village heads;
- Community/village focus group meetings;
- Household surveys and interviews with heads of households with land or built assets likely to be directly impacted by the project;
- Formal meetings with concerned NGOs and development agencies.
- Two open consultation sessions to report the findings of the IEE, the next steps in the environmental approvals process and to get feedback from stakeholders.

To aid in this process Lao/English language information briefs about the Project and IEE and large maps showing the project layout were used to support stakeholder consultation. The information briefs used in consultation are provided in Appendix 1.

6.2.1 Government Consultations

Meetings were conducted with government officials at the central, provincial and district level:

- Central Government:
 - Department of Electricity (DOE)
 - Water Resources and Environment Administration (WREA)
 - National Land Management Authority (NLMA)
 - Ministry of Agriculture and Forestry (MAF)
- Provincial Government
 - Savannakhet
 - Governors Office
 - Department of Electricity & Mines
 - Provincial WREA



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- Provincial Land Management Authority
- Provincial Agriculture and Forestry Office
- Saravan
 - Governors Office
 - Department of Electricity & Mines
 - Provincial WREA
 - Provincial Land Management Authority
 - Provincial Agriculture and Forestry Office
- District Governments in the 5 districts:
 - Governors Office
 - Land Management Authority
 - Agriculture and Forestry Office

At each meeting, a brief description of the project was provided, and the IEE process was explained (using the project information brochure – see Appendix 1). Participants were given an opportunity to provide comments, advice and information relevant to the project. Standard forms were used to record discussions.

Provincial and District Government officials were also asked to provide relevant environmental and social information to the study team, such as District census data, land use allocation information, etc. District Government officials accompanied the teams during village surveying.

Appendix 2 provides a full list of government officials consulted.

6.2.2 Community Consultations

Community consultations were conducted in three (3) phases during two field missions during June and July 2009:

- Phase 1 Village level meetings with the village committees of 19 identified affected project villages within 500 metres of the proposed transmission line;
- Phase 2 Village level meetings with the village committees of and additional 62 villages identified as affected project villages; and
- Phase 3 Village level meetings and interviews with 250 randomly selected households in 37 of the 81 villages affected by the transmission line project.

During each consultation, a brief description of the project was provided, and the IEE process was explained using the project information brochure. Participants were given an opportunity to provide comments, advice and information relevant to the project. Standard survey questionnaires were used to record discussions. Photos were taken of village level meetings.

Appendix 2 provides a full list of villages and households consulted.

6.2.3 Open Stakeholders Consultations

Two open stakeholder consultations were held in Savannakhet and Saravan Provinces during the first week of August 2009. The aim of these consultations was to report the findings of the IEE, outline the next steps in the environmental approvals process and to get feedback from stakeholders.

An advertisement for these consultation sessions was placed in 3 national newspapers, the Vientiane Times, Vientiane Mai, Pasa Son (see Figure 6-1)

Appendix 4: Workshop Report, provides the agenda, minutes and a full list of workshop attendees.



Figure 6-1 Stakeholders workshop advert

7 IDENTIFICATION OF BIOPHYSICAL AND SOCIO-ECONOMIC IMPACTS AND MITIGATION MEASURES

7.1 Introduction: Impact Matrix

Environmental and social impacts that may result from the construction or operation of the proposed transmission line are summarised in Table 7-1. Initiating action and impact duration is also provided. More detailed descriptions of these impacts, significance and mitigation measures are outlined in the following sections.

Table 7-1 Environmental and social impacts

Issue	Impact	Initiating project action	Impact duration
Biodiversity	Loss of habitat	ROW and easement establishment	Permanent
	Loss of wildlife (eg flying birds)	Presence of power line and tower structures	Permanent
Erosion	Erosion	Vegetation removal and ground disturbance; forming embankments	Permanent
Air quality	Dust emissions	Construction activities	Temporary
Noise	Noise emissions	Generation replacement	Permanent
Water quality & soil	Pollution of water and soil	Hazardous materials storage and handling; sub-station	Permanent / Temporary
Waste	Disposal of construction debris and wastes	Construction activities	Permanent / Temporary
Land acquisition and land use change	Loss of settlement	Construction activities	Permanent
	Permanent land use change	Tower construction; sub-station construction	Permanent
	Land use restriction	Temporary access tracks; batching plant operation; tower construction; line stringing; line maintenance	Temporary

Issue	Impact	Initiating project action	Impact duration
	Crop and land disturbance	Temporary access tracks; batching plant operation; tower construction; line stringing; line maintenance	Temporary
	Loss of tree resources	Easement establishment	Permanent
	Encroachment into village properties (eg cemetery)	Construction activities	Permanent
Health and safety	Injury and sickness of workers and members of the public	Construction activities	Permanent / Temporary
	Construction hazards (UXO)	Construction activities	Temporary
	Electrocution	Electricity train & distribution	Permanent
	Radio and TV interference	Electricity train & distribution	Permanent
	Electromagnetic fields	Operation	Permanent
Cultural and archeological heritage	Visual and cultural impact	Line structures	Permanent
Local Activities	Interference with local villagers' activities	Construction activities	Temporary
Local Infrastructure	Interference with other infrastructure	Construction activities	Temporary

Source: Adapted from MEM & KEPC 2006

7.2 Biophysical Impacts and Mitigation Measures

7.2.1 Biodiversity

Issues and Findings

The construction of a transmission line can have similar impacts to the construction of roads, which in Lao PDR has been responsible for severe, widespread, and irreversible impacts on biodiversity especially where these roads bisect Protected Areas or where their “zones of influence” extend into Protected Areas or important biodiversity corridors. In this case, the transmission line will be constructed along existing roads (Road 13 S and Road 15), from a biodiversity perspective, the



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additional impact of the clearance of a transmission line ROW and the construction of towers will is likely to only have a minor additional impact.

The primary potential impact of the project on biodiversity is likely be related to vegetation clearance for the ROW establishment. Table 7-2 provides a summary of the forest land impacted by the project

Table 7-2 Impact on Forested and Plantation Areas

District	Number of villages	Line distance on village land (m)	Total Area within TL ROW (Ha)	Forested Land* within ROW clearance (m ²)		Agricultural land within ROW clearance (m ²)
				Mixed deciduous forest	Unstocked forest (dry diptrocarp and unstocked)	Plantation
Kaysone	8	25382	63.46	22.76	10.25	2.27
Champhone	2	4654	11.64	0.00	10.01	0.00
Xaiphouthong	6	23786	59.47	10.10	23.41	0.00
Songkhonee	19	54327	135.82	4.10	43.15	0.00
Lakhonpheng	21	52803	132.01	11.55	62.95	0.00
Vapi	13	31952	79.88	0.90	16.97	0.00
Salavan	12	24814	62.04	0.00	21.96	0.00
-	81	217718	544.30	49.41	188.70	2.27

(*source: FIPD 2002)

The current project design stipulates that tall trees within 12.5 m on both sides of the centre line will be cut to ground level (on government land) and on private land a 2.48 m clearance below the conductors will be maintained with pruning. Trees beyond the 12.5 m area on both sides will also be trimmed and pruned to maintain clearance.

The proposed alignment does not directly intersect a National Protected Area (NPA), however it does pass within 400 m of the Phou Xieng Thong NPA, and is less than 5 km from the north eastern side of the NPA for approximately 25 km. The line also passes within 5 km of the Xe Bang Nuan NPA, and is within 6 km of the south-western boundary for approximately 30 km of its length. Although there is already a major road between Phou Xieng NPA and Xe Bang Nuan NPA, the proposed transmission line will add to the barriers between the two national parks, and may potentially have a cumulative impact on the migration of fauna between the two areas.

There is also potential for the two nearby NPAs to be indirectly impacted by increased wildlife exploitation, erosion, fragmentation and edge effects (ADB, 2005), particularly as the village use forests adjacent to the Phou Xient Thong NPA will be affected by the Project, and therefore, local residents may start to use the NPA to collect for forest resources. The presence of construction workers including migrant labour may place pressure on the timber and Non-timber Forest Products (NTFPs), particularly for Phou Xieng Thong NPA due to its close proximity to the alignment. The potential impact of construction workers on protected areas may also be an issue for the construction of the sub-station at Taothan.



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There is also the potential for impacts on birds, particularly migratory birds, due to collision and electrocution from transmission lines. The whole of Lao PDR is within the East Asian–Australasian Flyway, which is a major migratory route for waterbirds. This may also be a concern for bird species of conservation significance within the nearby NPAs. Mammals such as monkeys also have the potential to be electrocuted through climbing the transmission line towers.

Specific potential impacts include:

- Approximately 49 ha of deciduous forested area and 188 ha of dry diptocarp and unstocked forest will be affected due to the establishment of the transmission line ROW (see Table 7-2). A small area of vegetation clearance (approximately 1 ha) may also be required for the establishment of the Taothan sub-station however satellite imagery reveals that this area is mostly cleared already (Google 2009);
- The establishment of the ROW will also result in forest loss and fragmentation in forested areas near Ban Lak 90 and Ban Lak 94 that act as a buffer zone for the Phou Xieng Thong NPA. Approximately 12 ha of forest within this buffer area will be affected;
- Loss of natural vegetation and habitat through harvesting of firewood by construction workers;
- Noise impacts on fauna species associated with construction activity (heavy vehicles, use of construction equipment etc);
- Soil erosion and consequent impacts on water quality and habitat of aquatic species during construction;
- Impacts of the project on agricultural areas may lead to impacts on aquatic biodiversity food resources for local communities;
- Avifauna and mammal fatalities during operations due to direct impact and electrocution;
- Creation of physical and visual barriers to wildlife movement corridors and home ranges resulting in a reduction of the effective habitat area of wildlife species;
- Introduction of invasive species of animals and plants; and
- Increased extraction of forest products by construction workers for personal use and trade.
- Impacts on water quality and soil fertility due to the use of herbicides.

Avoidance, Mitigation and Management Measures

Measures to mitigate the potential impacts on terrestrial and aquatic biodiversity could include:

- Ensure that the alignment is as far from the NPAs and other environmentally sensitive sites as possible.



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- As part of the 'Detailed Measurement Survey' (DMS), conduct detailed vegetation mapping to accurately assess the amount of each vegetation type potentially impacted by the vegetation clearance required for the transmission line corridor, particularly the area adjacent to the NPA.
- Carefully monitor land clearance activities throughout the construction phase to ensure that vegetation is not cleared beyond pre-defined project boundaries. This should include clear marking of the boundaries of vegetation clearance prior to clearance.
- Ensure that ground vegetation and shrubs are not disturbed in the ROW below the required clearance height (7.5 m). Prune trees that can survive pruning to less than 3 m within the ROW, rather than removing them where possible.
- Ensure appropriate design of infrastructure to minimise erosion and potential disturbance to drainage lines;
- Establish camps, depots, quarries and borrow pits in locations that will minimize their environmental impact and during clearing for camps and depot areas, stockpile surface soils from areas of depot to enable rehabilitation these areas on Project completion;
- Use endemic and non-invasive plant species for revegetation and rehabilitation work;
- Prohibit the use of herbicides to control vegetation along the ROW.
- Prohibit the use of burning to clear and control vegetation along the ROW.

To minimise impacts on wildlife:

- Construction workforce will be restricted from fishing, hunting and trading wild animals and ensure that adequate alternate sources of food are available; and
- Supply alternative fuel for cooking and heating in the labour camp or ensure fuel wood supplies are purchased from village sources. Collection of firewood and other forest products should be prohibited.
- Location of towers will be adjusted to avoid wetlands.
- Consider the implementation of measures to minimise impacts on birds and mammals due to electrocution and wire strikes, particularly where the transmission line alignment passes in the vicinity of the NPAs. Measures could potentially include:
 - Coloured markings on conductors visible to birds such as aerial marker spheres.
 - Attachment of silhouettes of birds of prey to conductors.
 - Modifications to mitigate electrocution such as perch guards and conductor installation.
 - Screens to prevent arboreal mammals from climbing towers.
 - Monitoring of fauna deaths associated with the transmission line.

Impact Assessment

In this case, the transmission line will be constructed along existing roads (Road 13 S and Road 15) where the land and forest adjacent to the roads has already been affected by human activities, from a biodiversity perspective, the additional impact of the clearance of a transmission line ROW and the construction of towers is expected to have only a minor additional impact. The exception to this is the NPA buffer area near Ban Lak 90, where the clearance of the transmission line ROW and the construction of towers will result in further fragmentation of habitat and possible increased encroachment into the NPA.

Careful management and monitoring will be required, particularly during clearance and construction in the NPA buffer area, to ensure that impacts are minimised.

7.2.2 Other Impacts

The following impacts are primarily short-term construction impacts that, if managed properly, will have no lasting impact on the environment or local residents.

Erosion and Sediment Transport

Earthworks associated with tower construction will be limited to excavation for four sunken concrete footings, so soil disturbance will be confined to the immediate tower base. Limited cut and filling will also be required for access tracks and sub-station sites. The engineering design will ensure that the towers are not located on in areas prone to erosion.

Erosion and sediment transport from construction of the transmission line towers and sub-stations may result in the loss of some productive land immediately adjacent to the tower and sub-station footprint. Sediment deposition can also impact the quality of water in community water resources (such as open wells).

Erosion and sediment transport measures will focus largely on preventing the loss of adjacent productive land and impacts on water resources. The following measures will be implemented to minimise impacts associated with erosion and sediment transport during the construction phase of the Project:

- Schedule construction activities during the dry season (low rainfall), where possible.
- Minimise the area of land cleared for project construction work, and retain vegetation in riparian and other suitable locations to maximise filtration of sediment from turbid runoff, during and post construction.
- Carefully monitor land clearance activities throughout the construction phase to ensure that vegetation is not cleared beyond pre-defined project boundaries.



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- Install drainage control structures at suitable locations to divert clean runoff away from disturbed land surfaces, and to allow for frequent and safe discharge where runoff is concentrated, but without creating deeply incised scour paths.
- Install erosion and sediment control structures such as silt fences and sediment ponds at suitable locations to filter or collect eroded sediments from turbid runoff, where necessary.
- Once construction activities are complete, progressively revegetate disturbed land surfaces at the sub-station and tower sites as soon as practicable, to facilitate long term stabilisation.
- Compensate villagers for any lost land, assets and livelihood, associated with sediment deposition.
- Implementation of the above measures will minimise the potential for erosion and sediment transport. Progressive rehabilitation will ensure that cleared areas are stabilized prior to the onset of the wet season.

Noise

During the construction phase, there will be some nuisance noise impacts associated with the tower and sub-station construction, as well as the cutting of trees within the ROW. Noise emissions will result from earth moving equipment, graders and other heavy vehicles used in construction and chainsaws used in vegetation cutting. There are 19 villages located with 500 m of the ROW, which may be affected by nuisance noise during construction. Noise from construction activities may also result in migration of sensitive fauna species away from construction areas.

At the sub-stations, large-sized transformers may produce some moderate noise, though generally, this noise is less than 85 decibels. Project sub-stations are located at least 200 metres from the nearest settlement area, so nuisance noise impacts should be negligible.

Construction and vegetation cutting activities will be restricted to daytime, which will minimise the impact of nuisance noise at night.

Air quality

During the construction phase, air emissions include exhaust fumes from earthmoving equipment, as well as dust from construction activities and cleared areas. The population most likely to be exposed to this air pollution is the construction workforce, though some dust deposition may occur on adjacent agricultural land.

Potential air quality impacts can largely be mitigated with careful management of equipment operators and contractors and implementation of the above mitigation measures.

Climate and Energy

Greenhouse gases are believed to contribute towards global warming and climate change. The major greenhouse gases include carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), as well as perfluorocarbons (PFCs), hydrofluorocarbons (HFC), Chlorofluorocarbons (CFCs) and sulphur hexafluoride (SF₆).

A major benefit of the project is that it will reduce greenhouse gas emissions compared to the baseline through the displacement of fossil fuel based electricity imports from Thailand in the Central 2 grid (see section 3.2)

However, the project is likely to have minor impact from the emission of greenhouse house gases. Of particular interest to the electric power sector is sulfur hexafluoride (SF₆). SF₆ is used as an insulator for circuit breakers, switch gear, and other electrical equipment. The electric power industry uses roughly 80% of all SF₆ produced worldwide. SF₆ is inadvertently emitted into the atmosphere during various stages of the equipment's life cycle and has a very high Global Warming Potential (GWP) – 23,900 times the warming effect of carbon dioxide per ton emitted. Therefore, even small amounts of SF₆ emissions can constitute a significant carbon-equivalent emission tonnage.

In the transmission and distribution system, some of the energy supplied by the generator is lost due to the resistance of the wires and equipment that the electricity passes through. Transformer loss is one of the significant components accounting for energy loss in transmission and distribution. Depending on anticipated load characteristics, poor system power factor may also increase the line resistive losses.

There is great potential for improving the energy efficiency of the transmission system. It is essential to that industry best practice management is practiced for the project to ensure that greenhouse gas emissions are met within Lao PDR and international guidelines. The implementation of technologies designed to boost efficiency in transmission and reduce greenhouse gas emissions can maximise economic and environmental benefits. Potential measures include the installation of energy efficient transformers, power factor correction equipment and the implementation of SF₆ recycling and leakage elimination programs. Some measures also have the possibility of generating carbon credits through the Kyoto Protocol's Clean Development Mechanism.

Surface and Ground Water

Oil leakage from machinery, oil products and other chemicals can penetrate to the groundwater or run off to surface waters. There is also the potential for the remains of concrete mixing to run-off into adjacent streams and rivers.

Concentration of suspended solids could increase in surface waters due to construction work nearby. There is also the potential for water contamination from the discharge of grey water and sewage from campsite facilities.

The Project may use herbicides to control ground vegetation, and if used, these are likely to run-off into adjacent water bodies.

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These potential impacts can be mitigated by:

- Proper storage and handling of hydrocarbons, including the installation of bunding and appropriate drainage around storage and use facilities.
- Implementation of erosion and sediment control measures (see above).
- Use of herbicides will be prohibited, but if deemed necessary, use will be strictly in accordance with the instructions for use.

Waste

The generation of general waste materials at the Project will result from construction activities and general construction camp maintenance and operation.

The primary waste generated by the Project will be vegetation waste created by the clearance of the ROW. Burning of vegetation waste will not be permitted. Waste will be piled, and residents provided the opportunity to use the vegetation waste for firewood, making charcoal or other uses (e.g. making fences).

In total, approximately 6,000 m³ of spoil will be generated by excavation for construction of the towers. Some of the spoil will be used to rehabilitate the tower bases, but a majority will have to be transported off site for disposal. The Project will identify spoil disposal sites in consultation with the District Authority. Spoil will be stacked, contoured and revegetated to minimise erosion and sediment transport. Spoil disposal areas will be located at least 100 m from surface water resources (streams, rivers, ponds).

In addition to the above waste streams, there could be an increase in the generation of litter due to the presence of the Project employees and contractors. Waste that is uncollected or improperly disposed of could have adverse effects on human and environmental health. Waste is likely to include:

- Packaging materials;
- Food waste; and
- Human and sanitary waste.

Solid waste remaining from construction activities will be collected on site, and transported off-site for disposal and / or reuse / recycling. Recycling and reuse of waste materials will be maximised where possible. The potential for litter will be minimised by the presence of waste bins at the site, as well as the regular clean-up of the terminal by maintenance staff.

Hazardous materials and waste present on site during construction will include oils and hydrocarbons. Any oils and hydrocarbons (including oily waste) that is stored at the construction site will be stored in a fully bunded area with appropriate drainage installed to prevent the runoff of oil-contaminated water. Oil and hydrocarbon storage areas and containers will also be clearly labelled. Hazardous waste will be removed from site following the completion of construction, and disposed of properly off-site or sold for reuse.

7.3 Socio-Economic Impacts and Mitigation Measures

The total area of the ROW for the length of the proposed transmission line is 5.5 km². The ROW travels through the land of 904 households within 81 villages. The level of impact will vary between villages depending on the proximity of the village settlement and land uses within the proposed ROW.

The key socio-economic impacts of the transmission line will be the resettlement of households within the ROW, the loss of productive land (forests and agricultural land) within the footprint of the sub-station and the towers and the loss of forests and commercial trees within the ROW. These impacts are discussed in detail in the sections below.

7.3.1 Resettlement and Land Acquisition

Issues and Findings

Initial surveying indicated that of the 81 villages with land within the ROW, 8 will have settlement land or other build assets affected, 27 will have village forest land impacted and 80 may have agriculture land affected.

Table 7-2 above provides information on estimated forest land that will be impacted by the transmission line.

Table 7-3 below provides information permanent impacts caused by towers and sub-station development by district.

Table 7-4 provides more detailed information on villages with settlement land impacted.

With information provided on the affects on settlement land, the developer has made adjustments to the proposed alignment so that no settlements are impacted. This realignment will need to be confirmed during the detailed measurement survey.

Specific potential impacts include:

- *Land acquisition* - Permanent structures including the transmission line towers and sub-station at Taothan in Lakhongpheng District will require the acquisition of land. At this stage it is estimated that 544 towers each with a footprint of 50.21 m² will require approximately 2.88 ha across the ROW. Land required for the sub-station totals approximately 1 ha.
- *Loss of settlement areas* - Any structures (houses, storage areas, shops, etc.) directly within the ROW will need to be relocated. Surveying has identified 8 villages which will require the relocation of some settlement assets as a result of the proposed transmission line (see Table 7-4).
- *Loss of forested areas* – Forest resources, either privately or communally owned such as village use and spirit forest will be removed and converted into other land uses. Surveying has identified 27 villages which will experience some loss of village forest assets as a result of the proposed transmission line.

Table 7-3 Land and assets impacted by tower and sub-stations in the ROW

Prov.	District	Number of villages	Line distance on village land (metres)	Estimated land loss to towers* (Ha)	Estimated land loss to towers# (Forest land) Ha		Estimated land loss to towers (Agricultural land)# Ha		Estimated land (residential)	Estimated land loss to sub-stations^	Number of Villages with Houses impacted^*	Established other structures
					Mixed deciduous forest	Unstocked forest (dry diptrocarp and unstocked)	Rice Paddy	Plantation				
SVK	Kaysone	8	25382	0.34	0.12	0.05	0.14	0.01	0.00	0.00	1	1
	Champhone	2	4654	0.06	0.00	0.05	0.01	0.00	0.00	0.00	0	0
	Xaiphouthong	6	23786	0.32	0.05	0.12	0.14	0.00	0.00	0.00	0	0
	Songkhone	19	54327	0.72	0.02	0.23	0.46	0.00	0.01	0.00	3	1
SRV	Lakhonphen	21	52803	0.70	0.06	0.33	0.30	0.00	0.00	0.01	2	0
	Vapi	13	31952	0.42	0.03	0.09	0.33	0.00	0.00	0.00	0	0
	Salavan	12	24814	0.33	0.00	0.12	0.21	0.00	0.00	0.00	0	0
TOTAL	-	81	217718	2.88	0.29	1.00	1.59	0.01	0.01	0.01	6	2

* assumes average footprint of 52.99

* assumed tower spacing of 400m

land use breakdown calculated by village using GoL FIDP data

^ Taothan sub-station is on government land and will not require compensation

^* After receiving this information EDL completed realignment of the transmission line to avoid these residential areas

Table 7-4 Villages with residential and / or commercial structures within the current TL ROW.

Province	District	Village No.	Village Name	No. HH and / or Assets Affected
Savannakhet	Kaysone	1	Dongnakham	1
		2	Dongmakyang	1
	Songkhonee	3	Nongnokkhen	4
		4	Thongsimeuang	1
		5	Khummouan	17
		6	Nakangom	1
Saravanh	Lakhonepheng	7	Puangsavanh	3
		8	Puangmalay	5

Source: ESL Surveying 2009

Avoidance, Mitigation and Management Measures

Measures to mitigate the potential impacts from the acquisition of land and land use change include:

- Fair compensation paid for acquired land based on current market rates, taking into account land capability
- Land used for settlement should be avoided. If unavoidable, fair compensation paid for acquired settlement assets in addition to a well supported resettlement program.
- Replace or re-install utilities and facilities (such as ground water pumps, fishing ponds, access tracks) disturbed by the Project.
- Village use and spirit forest land should be avoided. If unavoidable, commercial, livelihood and cultural value of these resources should be assessed in detail, villages consulted and suitable compensation / mitigation actions agreed to.

Impact Assessment

Most of the land required for the transmission towers is village or individually held agricultural land. Impacts will be minimal if land loss is properly compensated and crop options for underneath the towers are properly communicated and supported by the project. Impacts to those settlement areas and forests falling within the ROW will be greater and adequate compensation will be required.

EdL have already entered into an agreement with the Saravan Province to acquire 1 ha of land for the proposed sub-station at Taothan. More detailed information on land and assets affected within the ROW and the proposed compensation and mitigation measures is provided in the RAP.

7.3.2 Land Use Restrictions and Loss of Commercial Trees

Issues and Findings

Land use restrictions will be placed on all land within the ROW. Trees and vegetation in the ROW will be removed or restricted to a height of 3 m and no structures will be permitted within the easement.

Specific potential impacts include:

- *Loss of commercial tree species* – As mentioned in the previous section, tall trees within 12.5 m on both sides of the centre line will be cut to ground level or maintained below a height of 3m to maintain the required clearance of 2.98m below the conductors will be maintained. This may lead to the loss of valuable commercial tree species such as eucalypt, teak plantations and rubber plantations. Within the ROW it is estimated that a total of 15,700 economically valuable trees.

- *Loss of land capability - tree species:* While rice and other crops will generally be able to grow in the ROW area, the 3 metre restriction will reduce the agricultural capability of land by denying the growing of most trees.
- *Loss of land capability - urban or industrial land:* The easement will reduce land use capability by restricting the type of structures that can be built.

Avoidance, Mitigation and Management Measures

Trees:

- Trees that can survive pruning to less than the 3 metres will be pruned, not cleared, to provide the required line of clearance;
- Vegetation and trees to be cleared shall be marked before clearance to ensure that minimal clearance occurs;
- Provide adequate compensation to local villagers for loss of access to timber and NTFPs within their village land.
- Felled trees and other cleared or pruned vegetation will be made available to the owner (individual or village), or will be removed if requested by the owner.
- Compensation for removed or pruned trees will be paid at fair market value based on tree type and age.

Land capability

- A one off payment shall be made to affected land owners to offset the devaluation of land within the ROW due to reduced land capability.

Impact Assessment

With proper implementation of the management and mitigation measures, the residual impact is likely to be minimal.

7.3.3 Crop and Land Disturbance

Issues and Findings

Disruption of farming activities and disturbance to crops, paddy bunds, canals, drains and other farming infrastructure will mainly occur during the construction period. The main cause of disturbance during construction will be the construction of the Taothan sub-station, establishment of temporary access roads to each tower site; construction of each tower; and conductor stringing.

A key issue of tower construction will be the spoil created from excavation of tower footings. Spoil disposal areas have not been identified.

Regular line and tower maintenance works during the operation period are likely to cause similar disturbances, however these works will be site specific and occur only

during the dry season months when agriculture activity along the ROW is at its minimal.

Avoidance, Mitigation and Management Measures

- Construction activities will be timed to avoid disturbance of field crops where possible. Where crop disturbance is unavoidable, compensation for loss of production will be paid prior to harvest based on market or agreed price.
- Access track construction will be minimised. Established roads will be used for construction and maintenance where possible. Where construction of access routes is required, they will be restricted to a single carriage way within the ROW unless more direct and lower impact access can be gained.
- Erosion and sediment issues associated with construction and maintenance activities will be mitigated as outlined in section 7.2.2
- Temporary concrete batching plants will be located on disturbed sites or areas of low production value (eg grass land where possible).
- Spoil disposal areas will be identified prior to beginning construction. Productive land areas and areas important for biodiversity will be avoided.

Impact Assessment

Disruption to crops is largely a temporary impact. With proper compensation and implementation of the mitigation measures, the residual impact is likely to be minimal.

7.3.4 Other Issues

Health and safety

There are a number of health and safety impacts associated with the transmission line.

a) Labour force

A temporary influx of migrant labour during the construction period increases the risk of sexual transmitted diseases incidents in the project area. Secondary issues include sanitation, water supply and waste.

Mitigation:

- The use of local labour can reduce these issues. The head contractor shall commit to the use of local labour where feasible.
- Construction contractor will prepare an Occupation Health and Safety Plan and provide related training and instructions to staff and sub contractors during induction.

- Construction workforce facilities will include proper sanitation, water and waste facilities.
- Public health information will be provided to the construction workforce and community before commencement of works – including information on STIs.
- Support existing provincial STD HIV/AIDS awareness and prevention programmes and apply them specifically to the TL construction.

b) Construction hazards

Health hazards from construction activities are associated with the use of heavy machinery, handling of hazardous materials and general practice of workers on the construction site.

Mitigation:

- Construction sites will be well marked and access well controlled. Warning signs will be presented where necessary

c) Unexploded Ordinance

While villages reported low incidence of UXOs in the project area they may still exist, particularly in Saravan Province, and therefore pose a safety hazard.

Mitigation:

- Areas of high likelihood of UXO contamination will be surveyed prior to commencing construction activities. Surveyed and cleared areas will be clearly marked.

d) Electrocutation

Electrocutation can occur from contact with the live conductors, flashover from the conductor to a tower or person and through conductor breakage.

Mitigation:

- EDL standards for safe clearance to live conductor for a 115 kV transmission line will be adhered to.
- *Danger* and *Warning* Signs will be erected on every tower as well as on conductors where the line is crossing a road or river.
- Appropriate conductor materials will be used to minimise health and safety risks.
- An exclusion perimeter around the Taothan sub-station of at least 12 metres will be maintained with a fence.

e) Electromagnetic fields

Electromagnetic fields from transmission lines can pose health issues to people living and working in close proximity to the line.

Mitigation:

- EDL standards for safe clearance to live conductor for a 115 kV transmission line will be adhered to.

- Appropriate conductor materials will be used to minimise health and safety risks.
- An exclusion perimeter around the Taothan sub-station of at least 12 metres will be maintained with a fence.

Cultural heritage and archaeology

No sites of archaeological sites or cultural significance were identified during the surveying. As a majority of the residents in the Project Area are Buddhists (who practice cremation), it is not likely that there will be any cemeteries or gravesites affected. There is the potential for chance finds to occur during construction activities.

Mitigation:

A 'Chance Find' procedure will be prepared and implemented during the construction phase. In the case that a site or article of historical, cultural and religious importance is encountered by chance during excavation activities, work will be stopped and the Provincial Cultural Office will be notified. Construction will be resumed after inspection and approval by the authorities.

Local infrastructure - roads

The major impact on local infrastructure will be the use of existing roads during construction and maintenance activities. Roads may be blocked by line stringing or damaged by heavy loads and safety issues may increase during peak construction times.

Mitigation:

- When roads are blocked, alternative access routes will be identified.
- Head contractor will adopt road safety practices including posting warning signs and appropriate management of traffic.

8 ENVIRONMENTAL PLAN (EMP)

8.1 Institutional Structure for Management

There are three (3) key organisations involved in the implementation of environmental and social mitigation measures. These three (3) organisations, and a brief description of the responsibilities of each organisation, include:

1. **Project Environmental Management Committee (PEMC)** – This committee consists of officials from relevant Government agencies at the Provincial and District levels. The PEMC will be responsible for deciding compensation conditions, and monitoring the social and environmental aspects for the Project. The PEMC will consist of at least 10 representatives from the different concerned agencies from Savannakhet and Saravan including Provincial EdL Branches, Provincial WREA, Provincial Energy and Mines Department, Provincial Land Office, Provincial Agriculture and Forestry Department (Provincial Forestry Section), Provincial and District Cabinets and other related officials. The PEMC will form subcommittees to focus on particular aspects of the Project such as Environmental management, Forest Clearing, Grievance management and Compensation, etc.
2. **EDL Environment Office** – EDL Environmental Management Office (EO) will be the primary organisation responsible for the planning, implementation and monitoring of all environmental management and compensation measures. EDL EO will ensure that the Project complies with best environmental practices and meets the mitigation and monitoring requirements described in the IEE report. EDL will also set up two Provincial level Environmental Management Units (EMU) – one based in Saravan Province and the other to be based in Savannakhet Province. This report will be submitted to Department of Electricity. The loan should provide funding for institutional support to strengthen EDL's environmental capacity, particularly at the Provincial and District levels.

The main duties of the EDL EO and EMU are to:

- Implement relevant Lao PDR policies, laws and regulations.
- Prepare and revise rules and regulations of environmental management and to carry out supervision.
- Check the operational condition of the environmental protection equipment and safety equipment.
- Set up and perform the environmental protection program and to upgrade the environmental protection equipment when appropriate.
- Be responsible for the environmental monitoring and management, and assisting the superior authorities in the inspection of environmental management measures.

- Promote and apply advanced environmental technologies.
 - Arrange environmental training for employees.
 - Provide advice on waste treatment and report accidents.
3. **Environmental Management Office of the Construction Contractor** – The Environmental Management Office of the construction contractor will be responsible for implementation of environmental measures to avoid or minimise environmental impacts during construction. Environmental management reports will be prepared by the construction contractor on a monthly basis as part of the Project's monthly reports for submission to EDL.

The specific responsibilities of the Environment Department of the Construction Contractor include:

- Ensuring compliance is achieved with relevant legislation and company policy by establishing and maintaining appropriate management and monitoring systems.
- Ensuring the management practices described in this EMP are implemented effectively.
- Monitoring the performance of ESMMP strategies.
- Regular liaison with EDL, government, community and other stakeholders.
- Reporting.

In addition to the above groups, the **Environment and Social Management Division (ESD)**, **Department of Electricity (DOE)**, **Ministry of Energy and Mines** and the **Environmental and Social Impact Assessment Division (ESIAD)**, **WREA** will be involved in monitoring the implementation of environmental and social management and mitigation measures, and coordinating activities between different groups. The primary involvement will be through their representatives in the PEMC.

8.2 Management and Mitigation Program

The Environmental Management Plan for the Project is summarised in Table 9-1. This plan is based on the result of the impact assessment (Chapter 8) and the Environmental Checklist provided in Appendix 4.

Table 8-1 Environmental Management Plan

Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
DESIGN AND CONSTRUCTION				
Terrestrial Biodiversity	Impact on terrestrial vegetation, terrestrial fauna, forest resources and protected areas	Minor - Moderate	Management clearing of the ROW:	
			<i>Avoid clearance of mixed deciduous forest wherever possible.</i>	EDL Project Management Office
			<i>Minimise the amount of land cleared for the Project.</i>	EDL Project Management Office
			<i>Use of herbicides will be prohibited.</i>	Contractor
			<i>Burning will be prohibited.</i>	Contractor
			<i>Identify sensitive habitats and important NTFP areas close to construction areas and designate these as 'no go' areas.</i>	Contractor
			<i>Maintain forest cover as close as possible to the edge of all Project components.</i>	Contractor
			<i>Only use local, non-invasive plant species in revegetation work.</i>	Contractor
			<i>Carefully monitor land clearance activities throughout the construction phase to ensure that vegetation is not cleared beyond pre-defined project boundaries.</i>	EDL EO/EMUs
			<i>Ensure that ground vegetation and shrubs are not disturbed in the ROW below the required clearance height</i>	Contractor
	Ensure that the alignment of the transmission line is sited as far as possible from NPAs and other designated environmentally sensitive areas.	EDL Project Management Office		



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Consider the implementation of measures to minimise impacts on birds and mammals due to electrocution and wire strikes, particularly where the transmission line alignment passes in the vicinity of the NPAs.	EDL Project Management Office
			Prohibit staff and contractors from hunting or trading of wildlife as well as the collection of timber and NTFPs in the vicinity of the NPAs..	Contractor
			Selling of logs by the Contractor and by EdL will be prohibited. Logging and logs selling process will be based on the Forestry Law No.6 (24/Dec/2007) Article 49 and conducted by the Forest and Forestland Management Organizaions.	Contractor EDL EMUs
			Forestry Clearing Committee, District Forestry Unit and land owners to list and mark big trees or commercial tree species and cut before ROW clearing.	PEMC District Forestry Unit
Land use	Impact on land use	Moderate	Provide compensation for productive land and residential land lost as a result of the Project.	PEMC EDL EO / EMUs
			Replace or re-install utilities and facilities (such as ground water pumps, fishing ponds, access tracks) disturbed by the Project.	PEMC EDL EO / EMUs
			Construction activities will be timed to avoid disturbance of field crops where possible.	Contractor
			Where crop disturbance is unavoidable, compensation will be paid.	PEMC EDL EO / EMUs



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Access track construction will be minimised. Established roads will be used for construction and maintenance where possible. Where construction of access routes is required, they will be restricted to a single carriage way within the ROW.	Contractor
			Temporary concrete batching plants will be located on disturbed sites or areas of low production value (eg grass land where possible).	Contractor
			Spoil disposal areas will be identified prior to beginning construction. Productive land areas and areas important for biodiversity will be avoided.	EDL Project Management Office
			Felled trees and other cleared or pruned vegetation will be made available to the owner (individual or village), or will be removed if requested by the owner.	EDL EO / EMUs
			Compensation for removed or pruned trees will be paid at fair market value based on tree type and age.	PEMC/EDL EO/EMUs
Aquatic Biodiversity	Impact on local aquatic flora and fauna	Negligible	Prohibit hunting and fishing, and species introduction by employee of contractor and Project staff	Contractor EDL EO / EMUs
			Control erosion and sedimentation from Project activities. (See below).	Contractor
Erosion and Sediment Transport	Erosion and sediment transport during project construction	Minor	Where possible, schedule construction activities during the dry season (low rainfall).	Contractor
			Towers will be located on flat to gently sloping terrain (i.e. slopes of less than 30°).	EDL Project Management Office



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Minimise the area of land cleared for project construction work, and retain vegetation in suitable locations (e.g. riparian) to maximise filtration of sediment from turbid runoff, during and post construction.	Contractor EDL EO / EMUs
			Progressively revegetate disturbed land surfaces at the Project site as soon as practicable, to facilitate long term stabilization.	Contractor
			Compensate villagers for any lost land, assets and livelihood, associated with increased sediment transport rates downstream of project areas.	PEMC EDL EO / EMUs
Water Quality	Increased total suspended solids (TSS) and turbidity downstream of construction areas.	Minor	See above measures for 'Erosion and sediment transport'	EDL EO/ EMUs
	Changes to pH downstream of project areas.	Negligible	Install sedimentation ponds to collect runoff from concrete preparation and construction sites.	Contractor
			Treat (neutralise) runoff from concrete preparation and construction sites, if necessary, prior to off site discharge.	Contractor
			Prevent washing of excess concrete/ cement from vehicles or equipment adjacent to or in streams.	Contractor
	Accidental release of oil or hydrocarbons	Minor	Store liquid hydrocarbons (fuels, oils and lubricants) in leak-proof containers within suitably designed bunded areas.	Contractor
			Provide temporary shelters to prevent rainfall entering bunded areas.	Contractor
			Store absorbent material in hydrocarbon storage areas.	Contractor



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Store spill response kits at suitable locations, in case of spills outside bunded areas.	Contractor
			Conduct regular maintenance of vehicles and equipment to prevent hydrocarbon leaks.	Contractor
			Conduct vehicle / equipment maintenance in designated areas where contaminated runoff can be contained.	Contractor
			Park vehicles and equipment on sealed surfaces where contaminated runoff can be contained.	Contractor
Air quality	Dust emissions	Minor	Disturb only the minimum area necessary. Leave ground vegetation, such as grasses and shrubs, under the line within the ROW	Contractor
			Water roads and / or construction areas to minimise generation of wind-blown dust.	Contractor
	Vehicle exhaust	Negligible	Use low emission trucks and mechanical equipment	Contractor
Noise	Nuisance noise impacts	Minor	Limit the hours of operation to daylight hours. Local residents will be consulted if some evening work is required.	Contractor
Climate and Energy	Greenhouse gas emissions and energy loss	Minor	Implement measures designed to reduce greenhouse gas emissions and energy loss in transmission systems (including energy efficient transformers, power factor correction and SF6 recycling and elimination strategies)	EDL Project Management Office
General Waste and Hazardous Material	Potential health and safety impacts	Minor	Minimise the production of waste.	Contractor
			Site worker camps at least 1 km from NPAs and other areas of conservation significance, 50 m from surface water bodies and 1 km from villages and sites of cultural significance.	Contractor



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Sewage and solid waste will be stored in septic tanks or treatment ponds.	Contractor
			Maximise waste recycling and reuse.	Contractor
			Waste will be properly disposed and buried on a daily basis.	Contractor
			Clearly label hazardous materials and waste storage sites with appropriate signage in both English and Lao.	Contractor
			Maintain an inventory of all hazardous materials on site and update regularly.	Contractor
Construction Waste	Health, safety and nuisance impacts of improperly disposed waste.	Minor	Vegetation debris from the ROW will be stacked outside the ROW. Burning is not permitted.	Contractor
			Packaging waste will be recycled or disposed of in the local landfill.	Contractor
Archaeology	Loss of physical cultural resources	Minor	Suspend excavation and take appropriate counter-measure according to the instruction or guidance of the Provincial Culture and Tourism Directorate (PCTD) when historical, cultural or archeological property or heritage is discovered or identified at construction site for authorities' inspection.	Contractor
			Compensate for the loss of community's cultural properties such as village cemeteries.	PEMC EDL EO / EMUs
Health and Safety	Increased spread of diseases, including sexually transmitted infections	Minor	Where possible, local labour will be used.	Contractor
			Public health information will be provided to the construction workforce and community before commencement of works – including information on STIs.	EDL Environment Office



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Support existing provincial STD HIV/AIDS awareness and prevention programmes and apply them specifically to the TL construction.	EDL Environment Office
	Sanitation and waste	Minor	Construction contractor to prepare an Occupation Health and Safety Plan and provide related training and instructions to staff and sub contractors during induction.	Contractor
			Construction workforce facilities will include proper sanitation, water and waste facilities.	Contractor
	UXO	Minor	Areas of high likelihood of UXO contamination will be surveyed prior to engaging in construction activities. Surveyed and cleared areas will be marked.	EDL Project Management Office
	Electrocution risk and effects of electro-magnetic radiation	Minor	EDL standards for safe clearance to live conductor for a 115 kV transmission line will be adhered to.	EDL Project Management Office
			Danger and Warning Signs will be erected on every tower as well as on conductors where the line is crossing a road or river.	EDL EMO / EMUs
			Appropriate conductor materials will be used to minimise health and safety risks.	EDL Project Management Office
	Occupational health and safety	Minor	Construction contractor to prepare an Occupation Health and Safety Plan and provide related training and instructions to staff and sub contractors during induction.	Contractor
			Employees will be provided with training and appropriate PPE (personal protection equipment)	Contractor
	Roads and Access	Temporary loss of road use and access routes	Minor	Post warning signs to indicate slowing traffic, merging lanes and change of route.



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
			Identify alternative access routes when roads are blocked.	Contractor
OPERATIONS				
Terrestrial Biodiversity	Impact on terrestrial vegetation, terrestrial fauna, forest resources and protected areas	Moderate	Maintenance of the ROW:	
			Maintain forest cover as close as possible to the edge of all Project components.	EDL Branch Office (Saravan and Savanakheth) EDL Branch Office
			Plantation trees and crops with higher than 3 m will not be allowed.	EDL Branch Office (Saravan and Savanakeht Branch Office)
			ROW checking and maintenance of ROW should be conducted at least once or twice a year.	EDL Branch Office (Saravan and Savanakheth) EDL Branch Office
			Use of herbicides, burning to clear and control vegetation will be prohibited.	EDL Branch Office (Saravan and Savanakheth) EDL Branch Office
			The boundary of the NPA will be regularly patrolled to ensure that local residents are not utilising protected area forests.	EDL Branch Office in cooperation with PAFO
Water Quality	Contamination from leakage of oils from transformers	Minor	Transformers will be constructed within a concrete bunded area to contain any spills or leaks.	EDL Branch Office (Saravan and Savanakheth) EDL Branch Office
			Transformers will be periodically inspected.	EDL Branch Office (Saravan and Savanakheth) EDL Branch Office
	Contamination from use of herbicides	Minor	Use of herbicides will not be permitted.	EDL Branch Office (Saravan and



Potential impact area	Project issue / impact	Significance	Mitigation and management measures	Responsibility
				Savanakhet) EDL Branch Office
Health and Safety	Electrocution risk	Minor	EDL standards for safe clearance to live conductor for a 115 kV transmission line will be adhered to.	EDL Branch Office (Saravan and Savanakhet) EDL Branch Office
			Danger and Warning Signs will be maintained on every tower as well as on conductors where the line is crossing a road or river.	EDL Branch Office (Saravan and Savanakhet) EDL Branch Office
			An exclusion perimeter around the Nongsano sub-station of at least 12 metres will be maintained with a fence.	EDL Branch Office (Saravan and Savanakhet) EDL Branch Office
	Effects of electro-magnetic field	Minor	25 m ROW will be maintained through period inspection.	EDL Branch Office (Saravan and Savanakhet) EDL Branch Office