VOLUME 4 – CHAPTER 7 PROJECT LANDS RESETTLEMENT STRATEGY, BUDGET AND IMPLEMENTATION SCHEDULE

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7 PROJECT LANDS RESETTLEMENT STRATEGY, BUDGET AND IMPLEMENTATION SCHEDULE

The acquisition of land and assets under Project Lands will require some relocation of houses, and thus limited population displacement. The relocation of houses will, in most cases, be for a short distance only, within the PAPs original village. Thus, the populations will not actually be 'displaced' but rather their dwellings relocated within the original village boundary. Most of the Projects impact on fixed assets is in Oudomsouk village, the District Centre of Nakai District. This District centre will be redesigned, taking into account reservoir inundation, Project Lands and spoil platforms, to create new town subdivisions.

A significant area of productive land will be impacted and require compensation in the form of in-kind replacement or livelihood restoration.

In Chapter 2 Table 2-1 provides as summary and Table 2-2 the details of impacted assets under each LPA, while Chapter 3 provides details on the PAPs thus impacted.

7.1 GENERAL PRINCIPLES OF COMPENSATION AND LIVELIHOOD RESTORATION

The underlying principle of the Nam Theun 2 Projects Social and Resettlement Program is that lost assets, livelihoods and incomes will be fully compensated. In the case of the Project Lands program, there are two general types of possible compensation:

- 1: Payment of cash compensation for lost production, income or fixed assets; or
- 2: Compensation by way of <u>direct replacement</u>, and/or by rehabilitation or income restoration.

The general principles and process of these compensation types is as follows:

- a. <u>Cash Compensation;</u>
 - i. Generally, based on the real market value at the time of actual land acquisition, assuming that there is a market;
 - ii. If land was recently purchased by the PAP, then the cash payment would be paid upon proof purchase of land;
 - iii. Cash compensation could also be based on lost productivity, based on the total for 7 years of productivity;
 - iv. The Cash payment may be paid out in kind to cover the purchase of equipment, such as power tiller, trailer, etc., for breeding cattle or for other inputs that could improve existing livelihoods.
- b. <u>Replacement Land</u>: Provision of land with equal amenity. The Project would have to develop the new land and/or provide facilities to ensure the level of productivity of the land at least for the first two years.
- c. <u>Replacement Livelihood</u>: PAPs will be fully supported to undertake enterprises that will generate the same amount of net income as those lost. Some examples of possible replacement enterprises could be the establishment of repair shops, handicraft shops or small retail shops. Equipment, training or initial supply of good for sale will be provided to ensure that income can be generated within a short time and that PAPs are not burdened with additional costs.

Preference will be given to land-based resettlement and livelihood strategies for PAPs whose livelihoods are land-based. Where land-based assets cannot be replaced with land, non-land based options which build upon opportunities for self employment will be provided, in addition to cash compensation for land and other assets lost.

These general principles and the compensation schemes presented in draft in this Chapter are based on PAP entitlements as per the Entitlement Matrix Table 5-2 (Chapter 5), which is integrated into the updated Concession Agreement. However, choice of the compensation type will reviewed with each PAP and PAV, and will depend on three main factors:

(i) The significance of the impact in relation to the remaining livelihood of the PAP family.

- for example, if the impact is small (< 10 % of the PAPs total livelihood), then a 'cash' type of compensation is an acceptable option, although the use of this cash should also be managed;
- if the impact is significant (that is, the impact would mean loss of more than 10 % of the families land and/or livelihood) then direct replacement of land or development of alternative livelihoods is the option that will be promoted.
- (ii) The concerns and proposals of the PAPs themselves. For example, if the impact is estimated to be more than 10 % of the PAP family's land and/or livelihood, yet they strongly request compensation in cash, then this will be seriously considered, on a case by case basis, by the District Grievance Committee.
- (iii) In cases where replacement, rehabilitation or relocation are not feasible or possible, due to lack of land or alternative income producing opportunities, then again cash compensation may be considered.

If cash compensation is appropriate, then the Project (GOL and NTPC) must ensure that this cash is used in an appropriate and productive manner, or even used directly to purchase useful or production inputs (eg, power tiller, buffalo, etc).

If the "land for land", "livelihood for livelihood' or "asset for asset" compensation is the appropriate path to follow, then the project is obligated as follows:

- for houses, the same entitlement as the for Nakai reservoir resettlement, which is either (a) a house of minimum size of 14m2 per person, and made of wood, or (b) if the size of original (impacted) house is larger than this, then the new house should be at least that size and of the same material;
- for other buildings, full replacement, as per original building, materials and design.; and
- for paddy, gardens, fish ponds etc, replacement land (with title) of equal productivity and net income.

7.2 **PROVISIONAL COMPENSATION FOR PCA LPAS**

The Compensation strategy for PAPS affected by those LPAs which are part of the Preliminary Construction Activities program is based on an initial calculation and payment of Provisional Compensation equivalent to the loss of one seasons productivity. The reasons for this Provisional measure are:

- (a) Consultations are still on-going with all PAPs impacted by all LPAs with respect to the type of compensation preferred by PAPs. Thus, final compensation agreements with each PAP will not be finalised until the Projects consultation with all PAPs is finished, due early 2005. Thus, a full and final consultation applicable to each PAP under each LPA cannot be finalised.
- (b) Many PCA LPAs are smaller subsets of larger LPAs, and many are in the same area as LPA for which the definition of impact, registration of assets and then consultations and negotiations are still ongoing.
- (c) A PAP may (a) have land assets or livelihoods in more than one Project Land, and (b) have a range of land assets and livelihoods in any particular Project Land. This may particularly be the case in the Gnommalath plain and Oudomsouk areas, where families may or could have assets under more than one of the LPAs of Powerhouse and Regulating Pond (PCAs), the Regulating Dam, the Downstream Channel and/or the Transmission Lines. Thus, before a final compensation agreement can be finalised with any PAP, the Project must first understand the full impact on the PAP by all LPAs, after which the final compensation agreement will be developed with each PAP.

7.3 PROJECT LANDS GROUP 1 (LPAs 1, 2 AND 3)

This group is in Khamkerd District, in the north of the Project Area is composed of:

• LPA 1a: Phou Phaphet quarry

- LPA 1b: access road to PhouPhaphet Quarry
- LPA 2: upgrade of Road 8b, north section
- LPA 3: upgrade of Road 8b, north section

There are PAP impacts only in LAP 1a, as the other LPAs are upgrades to existing roads which require no or minimal widening of the road.

7.3.1 PCA LPA 1a

A total of 17 families have lost land and the utility of the land due to the transfer of the area to the HC to develop as a quarry and quarry platform. Provisional Compensation to PAPs impacted by LPA 1a has been paid to 14 PAPs in the form of cash, equivalent to one season's harvest of the gardens that will be lost to 14 (see Table 7-1 below). A total of 11,027,500 kip (or about US\$1,070) has been paid, or an average of US\$ 76.47 per household.

Three families were not provided with Provisional Compensation as they did not have garden crops but rather rainfed rice fields, and these were not provided with provisional compensation as the land was acquired at the start of the dry season, and thus no loss of rainfed rice crops has been experienced.

					Prov. Compensation	Final Compe	nsation
	PAP ID	Asset type	Family head	Land Area m ²	(value of annual productivity)	(Kip)	US\$
1	PK01	Garden x 1	Mr. Khenmanh	980	352,000	3,052,000	290.66
2	PK02	Garden x 2	Ms. Mi	3,570	255,000	3,927,000	374
3	PK03	Garden x 3	Ms. Maivanh	1,925	628,000	5,551,000	528.66
4	PK04	Garden x 2	Mr. Xiengoune	8,040	800,000	10,424,000	992.76
5	PK05	Garden x 3	Mr. Soun Sayavong	8,405	1,600,000	16,243,000	1,547
6	PK06	Garden x 1	Mr. Gnot	2,401	183,000	6,921,600	659
7	PK07	Garden x 1	Xieng Khamta	1,505	335,000	5,348,000	509
8	PK08	Garden x 2	Mr. Khamka	7,529	862,500	13,179,900	1,255
9	PK09	Garden x 1	Mr. Hak Vorakoummane		130,000	8,155,000	777
10	PK10		Mis Say	1,260	732,000	5,880,000	560
11	PK11	Garden x 2	Mr. Khamhome	3,093	540,000	5,635,800	537
12	PK12	Garden x 2	Mr. Gnai Inthilath	17,371	3,142,500	32,665,100	3,111
13	PK13	Garden x 1	Mr. Noi	13,500	1,317,500	17,112,500	1,630
14	PK14		Mr. Khamsay	3,015		2,110,500	201
15	PK15	Rainfed paddy	Mr. Visiene	7,450		5,215,000	497
16	PK16	Rainfed paddy	Mr. Air	1,000		7,813,800	744
17	PK17	Garden x 1	Mr. Sokane Malavanh	1,800	1,500,000	1,080,000	103
			Total	96,653 m ²	11,027,500 kip	150,314,200	14,316.08

Table 7-1 :	Provisional and full	compensation]	paid to LPA 1a PA	AP for 1 season's lost	t productivity
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All PAPs affected by the acquisition of LPA1a have declared that they wish to receive compensation in the form of cash. As there is no real market for the sale and purchase of land in the area, the basis for calculation of cash compensation is the value of 7 years productivity of the land. The resulting cash compensation applicable to each household is summarised in Table 7-1 above, with the details of the productivity basis provided in Annex 7-1. In total, 150,314,200 kip or US\$14,316 will be paid to PAPs in total.

7.4 PROJECT LANDS GROUP 2 (LPAS 4, 5, 6 AND 7)

This group is in Khamkerd District, in the north of the Project Area, and is composed of:

- LPA 4: existing dam site access
- LPA 5: the Dams site, work camps, and associated quarries
- LPA 6: the access to the Dam site from road 8b
- LPA 7: a sections of road 8 b, to be upgraded

They are PAP impacts only in LPA 6. Impacts in LPA 5 are related to loss of GOL forest areas. LPAs 4 and 7 relate to upgrading of existing roads with minimal or no impact.

7.4.1 LPA 6

As the alignment of the new road to the Dam Site has not yet been finalised, an inventory of impacted assets and PAPs has not been able to be conducted. However, a temporary road has already been constructed to temporary access to the dam Site. However, as it largely follows an existing track, there has been almost no impact on PAPs. However, two households have been very marginally affected in that a small area of their rainfed paddy has been taken. These families have declared that they would prefer cash compensation, the value of which is calculated in Table 7-2, based on an agreed market value of paddy land of US\$ 1,126 per hectare.

	Name of DAD	rainfed paddy: ha		Unit price	(US\$)Cash	
Name of PAP		total ha	impact ha	(\$ /ha)	Compensation	
1	Mr. Vangnengvang	1.24	0.12	1,125	135	
2 Mr. Chonkouavang		0.86	0.08	1,125	90	
	Total		0.2		225	

 Table 7-2:
 Cash Compensation for Impacted Assets of the Temporary Road of LPA6a

7.5 PROJECT LANDS GROUP 4 (LPAS 10, 11 AND 12)

This group is in the north-western section of the Nakai Plateau Resettlement Area, and is composed of;

- LPA 10a : Ban Signo camp, access, bridge
- LPA 10b : Road 8b (new)
- LPA 11a : Access to new Rd 8b (existing)
- LPA 11b : Access to new Rd 8b (existing)
- LPA 12 : Road 8b (existing)

Only two of the LPAs, LPA 10a and the first few 100ms of LPA10b will have limited impacts on PAP household (private) assets. However, all these PAPs will also be participants in the Plateau Resettlement program, and thus impacts of these Project Lands will be relatively minor in the context of the longer term plans for livelihood development based on irrigated agriculture, fisheries and forestry. Impacts of LPA 11 and 12 are on forests of the Resettlement Area.

7.5.1 PCA LPA 10

The LPA 10a is a PCA in that the area will be required and handed over to the HC prior to Financial Close. This Project Land is located next to the village of Ban Talang, on the Nakai Plateau, a village which will be relocated some 50 to 100 metres due to reservoir inundation. The main part of the Project Land is the camp site and construction site of the future (new) Bridge across the Nam Theun river/reservoir. A total of 13 households are impacted by this LPA, mainly by the construction of access roads to the main camp and construction site.

In regard to compensation for impacts on PAP houses, if the PAP houses are rebuilt as part of the Project Land program, then the cost to this program is as calculated in Table 7-3 below, a total f US\$ 29,678. However, it is quite likely that these households will take temporary accommodation - rental for 2 years - in lieu of receiving the full house and other entitlements as part of the Plateau resettlement program.

Asset No	Family head	Area-m2	No. persons in HH	Amount (US\$)	Rental: 2 yrs x US15/pers/mth			
HU10a-1*	Mr. Khentae	71	11 people	\$6,930	\$3,960			
HU10a-2	Mr. Mone Sayavong	88	6 people	\$3,780	\$2,160			
BU10-1**		59	\$22.5 / m ²	\$1,327.5	0			
HU10a-3	Mr. Chomesy	113	7 people	\$4,410	\$2,520			
HU10a-4	Mr. Ner	120	9 people	\$5,670	\$3,240			
HU10a-5	Mr. Xiengbounthone	51	5 people	\$3,150	\$1,800			
HU10a-6	Mr. Vanna Khamphoumy	66	7 people	\$4,410	\$2,520			
	Total \$29,678 \$16,200.00							

 Table 7-3:
 Compensation of losses of houses of PAPs impacted by LPA 10a

* average cost of rebuilding a house to minimum CA standards is $45/m^2$, at $14 m^2 / person$

** average cost of rebuilding a building assumed to be $22/m^2$,

In regard to compensation for impacts on PAP productive land, Table 7-4 below summarises the calculation of the cash compensation applicable to the PAPs. This cash compensation is based on two payments, as follows:

- (a) a payment for the land, based on an agreed market value of US\$400 per hectare; and
- (b) a payment for lost productivity of the land. In the case of long term crops, based on the total annual productivity over 5 years. In the case of cassava, based on annual productivity x 3 years.

ID	Asset No	Family head	Area- m2	Affected Productive Asset	Unit Price of land	Amount (Kip)	Amount (US\$)
TL01	HL10a-1	Mr. Khentae	980	house land	$400 / ha = 400 kip / m^2$	392,000	\$39.2
				fruit trees on house land	73,000 kip x 5 years	365,000	\$36.5
TL02	HL10a-2	Mr. Mone Sayavong	1,170	house land	\$400 / ha	468,000	\$46.8
	FB10-1		7	fruit trees on house land	17,500 kip x 5 years	87,500	\$8.75
TL03	HL10a-3	Mr. Chomesy	980	house land	\$400 / ha	392,000	\$39.2
				fruit/other plants on	94,000.00 kip x 5 years	470,000	\$47
TL04	HL10a-4	Mr. Ner	489	house land	\$400 / ha	195,600	\$19.56
				fruit/other plants on	1,500 kip x 5 years	7,500	\$0.75
TL05	HL10a-5	Mr. Xiengbounthone	8,405	house land	\$400 / ha	3,362,000	\$336.2
				fruit/other plants on	24,600 kip x 5 years	123,000	\$12.3
TL06	HL10a-6	Mr. Vanna	1,188	house land	\$400 / ha	475,200	\$47.52
				fruit/other plants on	526,500 kip x 5 years	2,632,500	\$263.25
TL07	GA10a-1	Mr. Xiengkeo	1,100	Cassava	\$400 / ha	440,000	\$44
					550,000 kip x 3 years	1,650,000	\$157.1
TL08	GA10a-2	Mr. Vong Advilay	325	Cassava	\$400 / ha	130,000	\$13
					162,000 kip x 3 years	486,000	\$46.3
TL09	GA10a-3	Mr. Xiengchampa	325	Cassava	\$400 / ha	130,000	\$13
					162,000 kip x 3 years	486,000	\$46.3
TL10	GA10a-4	Mr. Santi Viravong	95	Cassava	\$400 / ha	38,000	\$3.8
	GA10a-5		2,760	Cassava	\$400 / ha	1,104,000	\$110.4
					1,475,000 kip x 3 years	4,425,000	\$421.4
TL11	GA10a-6	Mr. Khamla	3,093	Cassava	\$400 / ha	1,237,200	\$123.72
					95,000 kip x 3 years	285,000	\$27.1
TL12	GA10a-7	Mr. Tha	310	Cassava	\$400 / ha	124,000	\$12.4
					155,000 kip x 3 years	465,000	\$44.3
PK13	GA1a-20	Mr. Maiphai	250	Cassava	\$400 / ha	100,000	\$10
					125,000 kip x 3 years	375,000	\$35.7
			20,497		Total	20,445,500	\$2,005.55

Table 7-4: Compensation for loss of productive land and gardens of PAPs impacted by LPA 10a

7.6 PROJECT LANDS GROUP 6 (LPAS 16 TO 19, 20 AND 26): OUDOMSOUK DEVELOPMENT

This group is in and around the town of Oudomsouk, the Nakai District centre, and is composed of .

- LPA 16 : Road 8b (in Oudomsouk)
- LPA 17 : Access around SDs 1A/2B (new)
- LPA 18 : Saddle Dam 12 B
- LPA 19 : Saddle Dams 1A & 2 B
- LPA 20a : Intake Structure & SD 4A
- LPA 20b : Intake Structure Construction Camp
- LPA 26a : Headrace Channel, and Spoil areas
- LPA 26b : Headrace Channel Construction Camp

All of these LPAs have impacts on PAPs, although the impact of LPA 20b is only on the forests of the Resettlement Area managed by the NPVFA.

7.6.1 Provisional Compensation: PCA LPA 20a, 20b

A total of 5 houses, 6 farm buildings, 14 other buildings and 8 wells have been registered as fixed assets in (impacted by) LPA 20 a and 20 b. No productive land is registered or impacted by LPAs 20a and 20b.

The program for the resettlement of fixed assets has commenced with:

- (a) participatory design of replacement houses and wells for PAP; and
- (b) allocation of a new plot of housing land, a very short distance from the current plot.

Construction of new houses will commence in the first quarter of 2005, before the land is handed over to the HC. Ten (10) of the 'other buildings' and 2 of the wells belong to business companies, and they have asked for cash compensation for these.

Table 7-5:	Provisional co	mpensation	paid to I	LPA 20a P	PAP for 1	seasons lost	productivity
					-		

	Pro	ject Affected Household	Housing Land				
	ID	Head	Qty	Comp. (Kip)			
1	PP02	Mr. Kongmy Sisoulath	1	907,500			
2	PP03	Ms. Bounmy	1	339,500			
3	PP04	Mr. Bounta Amphavong	1	167,000			
4	PP05	Mr. Keo	1	25,000			
		Sub-Totals:	4	1,439,000			

7.6.2 Compensation (rehabilitation) for loss of land based livelihoods

The principle for compensation for loss livelihood assets, is that livelihoods will be fully restored as part of the main Plateau/Reservoir Resettlement Livelihood Program, as detailed in Volume 2 of this SDP.

7.6.3 Impacts on Fixed Assets

The total number of fixed assets which will need relocation and rebuilding is detailed in Table 7-6 and 7-7 below. Table 7-6 provides details to the level of PAP for LPA 20a, which is a PCA LPA, while Table 7-7 summarises data that is provided in full in Chapter 3, Annex 3-2.

		Houses		Farm Buildings		Other Buildings		5: Other Assets		Housing Land	
	РАР	qty	area: m2	qty.	area: m2	qty.	area: m2	qty.	area: m2	qty.	Area (ha)
1	Mr. Bounghang	1	162.00	2	21.45	1	4.00	1	1.00	1	0.1517
2	Mr. Kongmy Sisoulath	1	237.50	3	33.84	-	-	1	1.00	1	0.2785
3	Ms. Bounmy	2	132.60	1	19.74	-	-	3	3.00	2	0.3707
4	Mr. Bounta Amphavong	-	-	-	-	2	103.68	1	8.00	1	0.1080
5	Mr. Keo	1	156.52	-	-	1	3.60	-	-	1	0.1634
6	BPKP	-	-	-	-	2	528.30	2	8.50	1	6.0000
	Total	5	688.62	6	75.03	6	639.84	8	22	8	8.1246

Table 7-6:	Summary	of fixed	PAP	assets	under	LPA	20a
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Table 7-7:	Summary of fixed asset	s under Project Land	Group 6 (LPA 16	, 17, 18, 19 and 20a)
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House			no	PL16	PL18	PL17/19	PL 20a		
Туре	Wall	Roof	floors	No	No	No	No	Total	Area (m2)
Н	Concrete/Brick	Metal	1		2		14	16	4,749.42
Ι	Concrete/Brick	Tiles	2	1	5	1		7	730.48
Α	Timber	Wooden	1		10	2		12	1,159.88
Α'	Bamboo	Wooden	1		2			2	78.40
В	Timber	Metal	1	8	56	17	5	86	7,605.66
В'	Bamboo	Metal	1	1	6	4		11	592.03
D	Timber	Tiles	1		4			4	366.00
D'	Bamboo	Tiles	1		1			1	168
G	Timber	Tiles	2		1			1	141.00
Q	Timber	Grass	1		1			1	91.00
R	Bamboo	Grass	2		4	1	6	10	235
		Total		10	92	24	25	152	15,916.87

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7.6.4 Oudomsouk Town Development and Compensation for Fixed Assets loss

The strategy for compensation for loss of houses and other buildings due to impacts from LPAs 16, 17, 18, 19, 20a, 20b, 26a and 26b is that all fixed assets will be replaced (rebuilt) and included in the new urban development plan for Oudomsouk village, as the centre of Nakai District.

7.6.4.1 Oudomsouk Town Planning

The development of a new Oudomsouk town plan, in close coordination with the relocation and rebuilding of houses lost due to both Project Lands and Reservoir inundation impacts, will be undertaken in the following general steps.

(i) Topographic Survey and Mapping

The topographic survey and mapping was completed in 2004 with maps prepared to 1:2,000 scale with 0.5 m contour intervals. Thus survey also installed beacons demarcating the FSL El. 538 m and El. 540 m contours. These beacons are 1.5-m high pre-cast concrete posts painted a white colour. The base of the posts demarcates the two contours.

(ii) Phase 1 Baseline Study - Final Preliminary Project Lands Report

The "Baseline Study" Part 1 of Phase 1, dated 30 April 2004, used Quickbird satellite imagery to identify and measure land and fixed assets, and produced preliminary maps and a database which was used for the subsequent registration of land and assets potentially impacted by construction activities with the Project lands.

(iii) Project Land Asset Compensation Baseline Study, Part 2

The Baseline Study Phase 2 is a field survey of each household and their assets which:

- Collects household data and undertake livelihood assessments, as necessary, to calculate the Project's impact on a household and/or village community.
- Undertakes a survey to identify all land and infrastructural assets within those Project Lands that constitute the study area.
- Registers ownership, and where applicable, to adequately describe or record the productivity, of each of the assets identified.

(iv) Consultations

The development of the new town plans will include collaboration with Provincial and District level government as well as with the PAPs. There will be a series of public consultations undertaken in order to:

- 1. Introduce the NT2 Project and to elaborate on the impacts;
- 2. Identify and list the ideas and proposals of the PAPs with regard to the layout and other aspects of town development;
- 3. Review preliminary alternative town plans;.
- 4. Displayed the alternative layouts in suitable public places.
- 5. Decide on the preferred layout.

(v) Urban design, layout and zonation considerations

NTPC will engage a company to undertake detailed town planning, taking into account the following considerations.

existing Present and Future economy and populations

The structure of the local economy and an assessment of how it is likely to change in the future, as the zoning of the town development will reflect the expected future economic development of the town. For example, it is possible that tourism in the area will significantly increase after NT2 completion as the roads from Thakhek and Lak Sao are scenic and will be maintained in good condition by the NT2 Project. Therefore any industrial or agricultural development should be kept separate from, say, any lakeside tourism development.

Zonation

The zonation plan will include, but not limited to, the following:

- Functional zoning for houses, Government and private offices and public buildings;
- Road and drainage infrastructure plus routes of electricity network lines;
- Zoning for trading, tourism, communication and transportation networks;
- Zoning for culture and sports including public parks.
- Zoning for industrial areas.

Ethnic Issues

Ethnic issues will be considered as about 25% of the town population is from ethnic minorities. This will include:

- ethnic mapping to identify any groupings of different ethnic groups;
- Group resettlement of ethnic minorities, clans and smaller kinship units;
- Options for recent arrivals from the Nakai Plateau villages to be resettled.

House and Building Plot Sizes

Each resettled household will be provided with a new house, according to the PAPs preference for the housing entitlements which is;

In terms of house materials, this is either:

- the same materials as the current impacted house; or
- a wooden elevated house on concrete footings,

In terms of house size, this is the greater of :

- the same size as the current house and house plot ; or
- a minimum of 14m² per person and a house plot of 600m²

GoL buildings will be rebuilt of the same materials as currently built, except that a mortared brick material will be the construction standard available, if required. Plot sizes will be appropriate to the particular building.

Utilities: Water and Electricity Supplies

Oudomsouk does not have an existing central town water supply and this general situation will not change. However the development of a single source for distribution to a group of GoL buildings and the Hospital and School will be considered. This would be by pumping from either (a) the reservoir or (b) a well to a header tank. The former option however, will not be available until COD.

Every resettled household will be connected with electricity. This will require the provision of a network through the area and individual house and public building connections with meters and wiring. Houses will have the same level of fittings as the old house or at least a minimum of two fluorescent light fixtures and one power point.

Solid Waste Management

A site will be identified for dumping and sorting solid waste. The site should be away from the town and hidden from view from the main roads.

7.6.4.2 Town Planning Schedule

An indicative schedule of the town planning activities provided in Table 7-8.

Item	Activity	2005													
		Jan	nuary February				Ma	rch			Ap	oril			
		3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Assess available land for town development														
2	Studies: Existing Town situation (including link with BS2)														
3	Assess future situation														
4	First and second Nakai public consultation														
5	Prepare and analyze alternative outline town layouts, based on 4.														
6	Prepare/submit Interim Report, incl. alternative urban layouts and recommended layout														
7	NTPC & GoL reviews Interim Report and prepares comments														
8	NTPC's & GoL comments are incorporated into layouts														
9	Layouts displayed on boards in public places before second consultation. Discussions with Provincial & District Authorities														
10	3rd public consultation on alternatives & recommended layout														
11	Prepare town plans/ road layouts, incorporating consultations														
12	Prepare implementation schedule, cost est., draft final report														
13	NTPC & GoL reviews Draft Final Report, submit comments														
14	Update & submit Final Report and plans														

Table 7-8:	Indicative	Oudomsouk	Urban	Planning	Schedule

7.6.4.3 Implementation of the Town Plan – Construction

After the development of town plans, the search and clearance of unexploded ordnance (**UXO**) of the new town areas will be undertaken. Previous searches around Oudomsouk have found significant numbers of UXO. After UXO clearance, trees and vegetation will be cleared and the land levelled. Then the plots can be demarcated and land titling procedures can commence.

As stated previously, a contract will be tendered for the **design of the houses and buildings** and preparation of quantities.

As groundwater will be the source of the domestic water supply, some test wells will be undertaken to assist with the design of the water supply systems. Contracts will be tendered for the design of the access roads and drainage and electricity supply and distribution.

After design of all the elements, buildings, roads and drains, electrification and water supply and sanitation, contracts for the construction will be tendered.

Construction of roads and drainage according to the urban town layout will be a crucial early construction tasks. These roads will be connected to the main roads which will be constructed by the HC. It is most likely that these urban or subdivision roads will be constructed in stages.

The construction of the electricity network will follow after the construction of the roads.

After the construction of the roads and drains, the new houses and buildings will be constructed in two phases, as follows:

- Phase 1 will be house construction for the PAP households affected by the construction of the Saddle Dams, Road 8b and Intake Structure, from the period FC+6 to FC + 24 months.
- Phase 2 will be house construction for the households affected by Reservoir inundation, during the period FC + 24 to FC + 36 months.

7.6.4.4 Indicative Implementation (Construction) Schedule

An indicative implementation schedule is shown on Table 7-9.



Table 7 0.	Indicative Andomeoulz	Urban Dlanning	and Dovalonn	ont Implomo	ntation Schodula
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		C			

7.6.4.5 Indicative Budget for Oudomsouk Town Development as Compensation

The indicative budget for the reestablishment of houses and buildings affected by Project (construction) Lands, provided with roads and services, as part of the Oudomsouk urban development, is US\$ 1,930,873 as shown on Table 7-10 below.

The budget includes items for site preparation, roads and drains, replacement houses and buildings, water supply and sanitation, electricity supply and the development of a solid waste dump. The principal single cost is for the construction of single storey timber houses with metal sheet roofs. There are 191 of these to be replaced at a cost of nearly US\$ 749,000.

The estimate does not include any provision for developing infrastructure in sites identified for future camp followers, or for the reestablishment of houses and services for those PAPs who will be impacted by reservoir inundation .

Item	Description		Unit	Quantity	Unit Price	Amount
				m2	(US\$)	(US\$)
1	SITE PREPARATION					
1.2	Clear trees and vegetation, by slash and burn		ha	30	30	900
1.3	Remove tree stumps		ha	30	60	1,800
1.4	Land leveling (minimal required)		ha	30	100	3,000
	Sub-total, 1					5,700
2	ACCESS ROADS					
2.1	All-weather access roads with side drains		km	2	35,000	70,000
2.2	Install drainage outfalls and culverts		LS	1	25,000	25,000
2.3	Miscellaneous, road signs - warning, directional etc.		LS	1	7,500	7,500
	Sub-total, 2					102,500
3	REPLACEMENT HOUSES and BUILDINGS	no.				
3.1	Concrete and brick houses, 2 storey, tile roof	7	m2	730.48	100	73,048
3.3	Concrete and brick houses, 1 storey, tin roof	8	m2	889	85	75,569
3.4	Timber wall houses, 1 storey, tin roof	99	m2	8,594	45	386,730
3.5	Timber wall houses, 1 storey, wood roof	12	m2	1,160	45	52,200
3.6	Timber houses, 1 storey, tile roofs	4	m2	366	47	17,202
3.7	Timber houses, 2 storey (elevated)	1	m2	141	53	7,473
3.8	Timber outhouse, 1 storey, thatch roof	11	m2	246	10	2.460
3.10	Toilets	1	m2	11	50	550
3.11	Warehouses	2	m2	188	40	7,520
3.12	Shelter, metal roof	2	m2	74	20	1,480
3.13	School	2	LS	2	50,000	100,000
3.14	Hospital		LS	1	100,000	n.a
	Sub-total, 3					721,775
4	WATER SUPPLY and SANITATION					
4.1	Shallow hand dug well, 1m dia concrete rings/apron		Nr	32	500	16,000
4.2	Deep bored wells		Nr	4	1,000	4,000
4.3	TARA Hand pumps, supply and install		Nr	4	1,500	6,000
4.4	Electric pumps for hand dug wells		Nr	4	500	2,000
4.5	Pour flush latrines including shelter - houses		Nr	115	300	34,500
4.6	Pour flush latrines including shelter - public buildings		Nr	4	400	1,600
4./	Water supply to school and hospital		INT Nu	2	10,000	20,000
4.0			INI	25	1,000	25,000
-	SUD-total, 4					109,100
5 E 1	ELECTRICITY SUPPLY and DISTRIBUTION		1	2.5	5 000	12 500
5.1	Transmission Lines		Km TS	2.5	5,000	12,500
5.2	Distribution to buildings and houses		LS N.	152	7,000	7,000
5.5	Eittings to buildings and houses		INI Na	152	300	40,430
5.4	Power points etc.		INI	152	110	10,720
	Sub total 5					82 670
6	SOLID WASTE DUMD					82,070
0. 6 1	<u>SOLID WASTE DUMP</u>		lim	0.5	30,000	15.000
6.2	Clear treas and vagatation by slash and burn		ha	0.3	30,000	15,000
6.3	Bemove tree stumps		ha	2	50	120
6.4	Excavate pit and place and compact spoil on banks		m3	10,000	1.5	15 000
6.5	Fencing and gate		m	400	1.5	4 000
6.6	Incineration facilities		Nr	1	7 500	10.000
6.7	Watchman's Hut		Nr	1	3,000	3,000
0.1	Sub total 6		± 41.	1	5,000	/7 190
┣───						1 0(9 005
	IUIAL					1,068,925

Table 7-10: Budget for Oudomsouk Urban Development and rebuilding of houses impacted by LPA 16, 17, 18, 19 and 20

7.7 PROJECT LANDS GROUP 10 (LPAS 33, 34, 35, 36, 37, 38A, AND 39A)

This group (along with LPA Groups 6 - Oudomsouk town) is the most concentrated grouping of Project Lands, starting at the Powerhouse at the foot of the Phu Ark mountain ridge, extending thru the Regulating Pond to the first (northern) section of the Gnommalath plain. It is composed on the following LPAs;

- LPA 33 : Power Station, etc.
- LPA 34 : Regulating Pond, etc.
- LPA 35 : Regulating Dam, etc.
- LPA 36 : Residence Nam Theun
- LPA 37 : Road 8b (exist.) Gnom. To Reg. D
- LPA 38a : Downstream Channel A (north)
- LPA 38a.s : DC Spoil areas
- LPA 39a : Access to DS Channel (existing)

These LPAs are grouped for the following reasons:

- they are geographically close and related;
- many PAPs may have impacted assets in more than one of the LPAs; and
- compensation for impacts will have to considered taking all of the PAPs as one group,

All these LPAs will have impacts on PAP fixed and livelihood assets. However, the impact of LPA 39a will be small and as yet unknown, while the final siting of the spoils (LPA38a.s) is not yet known.

The general compensation strategy for this Project Land group is that:

- fixed assets will be replaced with fixed assets, and in the case of houses to a minimum standard;
- loss of rice and other crop fields will be replaced with land which in most cases will be irrigated paddy developed by using water from the Regulating Pond and Downstream Channel; and
- for the loss of other livelihoods, the type of compensation will be reviewed on a case by cases basis, and may be replacement livelihoods or cash.

7.7.1 Provisional Compensation for PCA LPAs

7.7.1.1 PCA LPA 34

A total of 9 households have lost their gardens, and 1 household has lost bamboo plots, under the PCA section of LPA 34, and these PAPs have received provisional cash compensation, equivalent to loss on one season's crop production, as detailed in Table 7-11.

	Project Affe	cted Household		Gardens	B	amboo
	ID	Head	Qty	Comp. (Kip)	Qty	Comp. (Kip)
1	KV059	Mr. Sing	1	35,000		
2	KV071	Mr. Dok	1	215,000		
3	LN036	Mr. Thongvanh	1	50,000		
4	LN066	Ms. Sok	1	5,000		
5	LN105	Mr. Bounsoan	1	150,000		
6	LN109	Mr. Bounsy	1	500,000		
7	LN114	Mr. Keooudone	1	90,000		
8	LN20122	Mr. Thone	-	-	1	25,000
9	NS20123	Mr. Nome	1	35,000	-	-
		Total:	8	1,080,000	1	25,000

Table 7-11: Cash payments made as Provisional Compensation to PAPs impacted by PCA in LPA 34

7.7.1.2 PCA LPA 36

The seasonal productivity of one PAP household has been affected (to date) due to acquisition of LPA 36, and this household has been paid 90,000 kip, as shown on Table 7-12.

Table 7-12:	Cash payments as	Provisional Com	pensation for PAPs	impacted b	y PCA in LPA 36
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	Project A	ffected Household	Bamboo			
	ID	Head	Qty	Comp. (Kip)		
1	KV15	Mr. Dee	1	90,000		
		Total	1	90,000		

7.7.2 Compensation for loss of fixed Assets in LPA Group 10

A total of 73 fixed assets, mainly houses and farm buildings, will be lost to Project Lands in LPA Group 10, as summarized in Table 7-13.

Table 7-13: Land and Assets Registered in Land Parcel Areas 33-36 and 8a.

Land / accet	LPA 33		LPA 34		LPA 35		LPA 36		LPA 38a		TOTAL	
types registered	No. assets	Area (ha)	No. assets	Area (ha)	No. assets	Area (ha)	No. assets	Area (ha)			No. assets	Area (ha)
Farm buildings	1	0.0004	14	0.013	12	0.01	0	0	0	0	27	0.02
Houses	0	0	0	0	9	0.06	0	0	19	0.19	29	0.19
Housing land	0	0	0	0	10	2.79	0	0	0	0	9	2.79
Other buildings	1	0.0031	1	0.0007	5	0.0035	0	0	0	0	8	0.01
									To	otal	73	

Compensation for the loss of these fixed assets (structures) consists of two main options:

- Replacement of assets for at least the same value or productivity; or
- Cash equivalent of loss asset.

The indicative cost of compensating - rebuilding - these fixed assets is provided in Table 7-14. This cost calculation applies to either compensation option since cost of replacement of assets and the cash equivalent should be approximately the same in terms of costs. This is estimated at USD\$194,250 for all structures. The replacement cost per unit is based on the average price of the minimum standard house for a family of 6 persons, based on the observation that most houses in the area of relatively poor quality and probably at or below the minimum standard house.

However, the actual building provided to each household will depend on

- (a) the number of persons in the household; and
- (b) the PAP household preference for either the minimum standard houses or their current house type.

Consultations with PAPs will determine the preferred compensation option.

Table 7-14: Indicative Cost of Com	pensating for Fixed Assets in Ll	A Group 10
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		Area	Replacement	Total replacement
Asset type	No. assets	(ha)	cost per unit	cost
Farm buildings	27	0.02	US\$1,500	US \$27, 000
Houses	29	0.19	US\$4,500	US\$130,500
Housing land	9	2.79	US\$750/plot	US\$6,750
Other buildings	8	0.01	US\$3,000	US \$24, 000
Other buildings land	8	0.01	US\$750	US\$6,000
	-		Total	US\$194,250

7.7.3 Livelihood restoration for impacted rice/crop fields by irrigation development

7.7.3.1 Introduction- the Gnommalath Plain Project Lands

The Nam Theun 2 Power Station, the Regulating Pond and the Regulating Dam are located at the base of the Nakai Plateau and north of the Gnommalath District Center and the Gnommalath Plain. From the Power House, LPA 33, the water is conveyed by a tailrace channel to a Regulating Pond, LPA 34, located on the upper Nam Kathang.

A Regulating Dam, LPA 35, then controls the releases of water from the pond to the Downstream Channel and the Nam Kathang. The Downstream Channel, LPA 38 (considered as having four sections: 38a, 38b, 38c, and 38d) is a 26.9 km long open channel that will convey water through the Gnommalath Plain to the Xe Bangfai (XBF) River north of the town of Mahaxai.

The Gnommalath Plain area includes extensive areas of agricultural land which is primarily used for paddy cultivation. Most the fields are rainfed, but some areas are able to plant two crops of rice per year due to the provision of irrigation water from either the ThaThot Dam on the Nam Gnom, or water pumped from the Nam Gnom and Nam Kathang.

The first two Downstream Channel reaches (38a and 38b) cross areas of both irrigated and rainfed paddy.

7.7.3.2 Strategy for land based compensation by irrigation development

The strategy for the provision of replacement land or livelihood restoration to PAPs whose assets on and to the north of the Gnommalath Plain are impacted, must take into account that there are two types of land take areas, as follows:

- Land Parcel Areas 33, 34, 35 and 36 are large block areas along the upper Nam Kathang River. While they are somewhat distant from villages, they are regularly accessed and used by villagers and the Project Lands will impact the productive land assets of PAPs from twelve (12) villages.
- (ii) The Project Lands of Downstream Channel, the Parallel Transmission Line, Road 8B widening and the Access Roads are long, basically linear features. This complicates the search for and development of alternative land replacement and in the vicinity of the lost lands and dwellings of the PAPs.

Nonetheless, as:

- (a) the loss of productive land is the main impact;
- (b) the PAPs are primarily agricultural peoples, and thus loss of productive land is a significant impact for them; and
- (c) the regulating pond and downstream channel provide an excellent potential source of irrigation water.

...the primary compensation strategy in and around the Gnommalath Plain is the provision of replacement land by using the Regulating Pond and Downstream Channel as the source of irrigation water for;

- (i) transforming rainfed paddy into irrigated paddy;
- (ii) bringing new land into irrigated production;
- (iii) restoring irrigation facilities directly impacted by the project; and
- (iv) the development of fish ponds.

Ideally, the PAP resettlement plans should revolve around the development of irrigation facilities and land as near as possible to villager's current land. Consequently a range of small potential irrigation systems have been identified as shown in Figure 7-2 and described later in this section. However the potential area of the full potential of irrigation schemes is far larger than the compensation requirement and co-financing will be required to investigate and develop the full schemes (see Annex 7-4).

7.7.3.3 The proposed irrigation system

The irrigation systems which will be developed, using the downstream channel as the source of water, will have the following main components

Downstream Channel Gated Pipe Outlets or Turnouts

The system will be based on gated pipe outlet structures, also called turnouts or canal intake structures, having the following features:

- A pre-cast concrete pipe through the channel bank;
- The pipe inlet discharge is controlled by a gate fixed to a reinforced concrete inlet structure, with provision for inserting stop logs as a secondary flow control;
- the gate inlet structure will require specific design parameters to ensure that the fats flowing downstream channel waters, at varying levels, can be successfully diverted into the structure and to the canal systems; and
- The pipe discharges into a reinforced concrete outlet structure.

While the waters in the DC will usually be a couple of meters above the current paddy fields, to bring new but slightly higher 'upland areas' into cultivation will require the installation (in some cases) of low head high volume pumps, to lift the water about 3 to 5 meters

Irrigation Duty

The irrigation development will be based on the dry season irrigation of paddy as there will be abundant dry season water available from the Regulating Dam and Downstream Channel. For preliminary design purposes, an irrigation water requirement of 4 l/s/ha has been assumed. Further exercises using climatic data, the results of soil investigations and various irrigation efficiencies may show that a higher duty is required. It is also assumed that the systems will have a continuous supply over a 12 hour period within a 6 day week. The NT2 Project will not generate electricity on a Sunday, and the minimum 30 cumecs flow may not be high enough to ensure flow in the irrigation system.

7.7.3.4 Land replacement requirement and Indicative irrigation area development

The actual area of paddy rice lands that will need to be either (a) developed, or (b) transformed from rainfed to irrigated rice fields, as part of compensation program, will only be known following:

- (a) a full understanding of the total land requirement for Project Lands by the NTPC/HC;
- (b) the full registration of assets and impacted peoples;
- (c) detailed consultations to define which PAPs request cash (as opposed to land based) compensation, and those that require land based compensation ;
- (d) detailed consultations and surveys to define to areaas of rainfed paddy that could be developed into irrigated paddy as compensation, and for which PAPS; and
- (e) detailed survey to confirm the availability of new areas for development into irrigated paddy.

In developing an estimate of the requirement for irrigated land development, the following assumptions are made with regard to rainfed and irrigated paddy productivity, per year :

- (i) current rainfed, wet season paddy productively is an average of 1.7 t/ha gross, or 1.7 t/ha net;
- (ii) current irrigated dry season paddy productivity is an average of 3.3 t/ha gross, or 1.65 t/ha net (due to cost of fertilizer and water required in the dry season);
- (iii) current double cropped productivity is [(a) plus (b) above] is an average of 5 t/ha gross, or 3.35 t/ha net;
- (iv) riverbank gardens, while producing vegetables and crops, are assumed to produce the equivalent of 1.2 t/ha of rice; and
- (v) upland fields identified include shifting cultivation fallows, and thus while the rice yield may be 1.2 t/ha, this has to be divided by three (3), thus a gross and net productivity of 0.4 rice /ha

The assumption w.r.t the productivity of future irrigated fields that will be developed and provided as land for and compensation is as follows

(vi) If irrigation is provided to fields which are currently upland gardens or uncultivated, then the provision of irrigation would result in new fields that could be cropped to both wet season and dry season rice paddy. In this case - double cropped rice - productivity is an average of 5 t/ha gross, but only 2.85 t/ha net (lower than current fields 3.35 t/ha as the wet season paddy component of these fields in previously upland areas will also require water and some fertiliser).

(vii) If irrigation is provided to current wet season paddy rice fields, to convert them to wet and dry season double cropped fields, then the gross increases in productivity would be the dry season irrigated crop only, at 3.3 t/ha, but net increase of 1.65 t/ha

While an indicative irrigation scheme has been identified (see Figure 7-2 and Annex 7-4), at the current stage of planning it is not possible to accurately identify how much of the land provided with irrigation is current paddy fields (and thus only producing a net benefit of dry season irrigated production) or currently (more or less) idle land, in which case the gross benefit from irrigation provision would be two crops per years.

Thus, for planning and budgeting purposes (below) it is assumed that half (1/2) of the land the will be developed by irrigation is already currently rainfed paddy fields, and the other half (1/2) will be new land brought under production. Thus, for compensation planning purposes (Table 7-15 below), the net productivity of fields provided with irrigation by the Project is assumed to be [2.85 + 1.65]/2 = 2.25 t/ha

The calculation of the area of Project Lands impacted (based on currently known polygons and registration), and the irrigated land development required to compensate for such land acquisition or loss (based on the assumption that river bank gardens and upland fields could also be replaced by irrigated and double cropped paddy) is shown in Table 7-15 below.

It should be noted that this analysis of land requirement is based on the scenario that (i) all PAPs whose land based agricultural production is impacted by the Project will request land based livelihood restoration and that (ii) those whose river bank gardens are impacted will request compensation by way of provision of irrigated paddy land. As this scenario may not actually occur, in that not 100 % of PAPs will request land based compensation, this land requirement (as per Table 7-15) may be a slight overestimate. However, on the other hand, there are likely other land requirements which are not yet known, including possible land and asset acquisition requirements for LPA 37, 38a.s and 39a, and a larger land requirement for 38a.

Thus, while about 116 ha has been identified to date (Table 7-15) as required to replace impacted fields under LPA 33 to 36 and 38a, the land requirement due to acquisition of 37, 39a and 38a.s may add to this requirement, and for planning purposes, a figure of 150 ha of irrigation development is taken as the area that the Nam Theun 2 Project will be responsible for developing, as part of the Project Lands compensation program, in the area of LPA Group 10 (Nam Kathang and North Gnommalath Plain).

		Rainfed Paddy Rice Fields		Irrigated (double cropped paddy		Riverbank Garden		Upland Field		
	LPA	Area (ha)	НН	Area (ha)	HH	Area (ha)	HH	Area (ha)	HH	Total
1	33, 34, 35 and 36	40.94	48	0	0	31.4	274	120.8	153	
2	38a	22.6	43	16.45	29					
3	37	data not yet ava	ailable							
4	39a	data not yet ava	ailable							
5	38a.s	data not yet ava	lata not yet available							
	Total	43.54 ha	91	16.45 ha	29	31.4 ha	274	120.8 ha	153	
	gross productivity	74.02 t		83.25 t		37.68 t		48.32 t		243.27 t
i	net productivity	74.02 t		55.78 t		37.68 t		48.32t		215.7 t
ii	Area of equivalent net double cropped irrigated paddy **	33 ha		25 ha		17 ha		21.5 ha		
iii	plus 20 contingency%	39.6 ha		30 ha		20.4 ha		25.7 ha		116 ha

Table 7-15: Indicative analysis of land impacted and land replacement in LPA Group 10

** assumes half the "new" land was previously wet season paddy, and half uncultivated uplands, with net productivity of 2.25 t/ha

In order to scope the activity and budget requirements for such a program, a probable scenario of four (4) irrigation scheme developments has been developed and costed as follows.

• **DC Irrigation Area 2a:** This area in the north of the Gnommalath Plaint will be serviced by the future MC1. If based on gravity alone, the alignment of MC 1 will be close to the north boundary of the current dry season paddy fields, and will bring under new paddy cultivation only a relatively

small area of upland fields which are currently just north of the paddy rice fields. In this case, the main function of MC1 will be to provide irrigation to current rainfed paddy rice fields

However, if a pump is installed at the downstream channel, or an outlet installed at the regulating pond itself, then the MC1 can run at a higher contour level and bring into irrigated production considerably more upland fields. In this case, the MC1 can have 2 functions of (i) provide irrigation to current rainfed paddy rice fields, and (ii) provide irrigation to new fields opened up in the uplands to the north of current paddy fields. This second option is the one considered for planning and budgeting purposes.

• **DC Irrigation Area 2b:** This area will be serviced by (gravity irrigation water from) MC2. Its main fiction will be to provide irrigation water to currently wet season rainfed paddy fields. It may be possible to open up some new fields for paddy due to the provision of irrigation waters from this canal.

• DC Irrigation Area 4: Rehabilitation and extension of existing Thathot Scheme

The Downstream Channel crosses the existing Thathot irrigation scheme. This scheme consists of a concrete weir built in 1988 on the Nam Gnom at Ban Thathot. The weir diverts water into a canal system that serves eight villages. The scheme 'potentially' provides water to about 500 ha of land in the wet season and 250 ha in the dry season. The Downstream Channel will (a) take about 15 ha of land from within this irrigation area, and (b) dissect the main irrigation canals, which will need to be restored. Regarding the restoration of the irrigation canals on the eastern side of the Downstream Channel, two concepts have been discussed:

- Provision of irrigation gated pipe outlets directly from the Downstream Channel.
- Construction of inverted siphon structures which would pass under the Downstream Channel.

This second concept is not considered as siphons are generally more expensive to construct than gated pipe outlet structures, and likely to become blocked and farmers reluctant to clean them out as it is a difficult, time-consuming exercise. Thus, the first option is part of the livelihood restoration plan hereby presented.

In addition to restoration of irrigation water source, the NT2 Project will provide irrigation to 50 ha of land of which 75 % will be currently wet season paddy fields and about 25 % new land brought into production, mainly from outlet at 0+700m.

• DC Irrigation Area 3b: new Thathot Irrigation Scheme.

The Area 3B is on the right bank of the Nam Gnom, and is about 104 ha, of which about 30 ha is currently rainfed wet season paddy fields. However assuming that about 35% of the area will be taken by construction of the canals, drains and access tracks and local high spots that cannot be commanded, an irrigation area of about 67 ha may be possible, although the NT2 Project will develop about 30 ha of this as compensation for land looses under the downstream channel.

It is assumed that the existing concrete weir will command the area for gravity fed irrigation and that only nominal improvement works will be required. A new main canal intake structure will be required. This will be a similar type of structure to the Downstream Channel turnouts but will require a trash rack. The canal system will include main, secondary and tertiary trapezoidal shaped open earth canals with reinforced concrete conveyance and regulating structures.

There will be a number of small streams draining surface runoff from the western hills across the proposed irrigation area to the Nam Gnom. Therefore the canals will require many cross-drainage structures in the form of culverts and siphons. The estimated cost is US\$ 210,000 at about US\$ 3,000 per ha. There are no existing bridges or other access road crossings over the upper Nam Gnom to the proposed area and a causeway will have to be constructed. The causeway will cost about US\$ 40,000.

A summary of the areas that could be developed into irrigation systems to compensate for productive land loss in LPA group 10 is summarised in Table 7-16.

Volume 4 – Chapter 7: Project Lands Resettlement Strategy, Budget and Implementation Schedule Figure 7-2: Map of Downstream Channel and potential for development of irrigation, using NT2 waters as irrigation source



March 2005

		Estimated	Area to be	Approximate	
	Total	Potential	Developed	Locations of	
	Area	Irrigation	by NT2	Downstream Channel	
Area	(ha)	Area (ha)	(ha)	Outlets	Remarks
2a	300	200	40	0+400 Right Bank	MC1 to be developed by NT2
2b	78	100	30	2+200 Right Bank	MC2 to be developed by NT2
3b	104	70	30		Thathot Scheme extension on right
					bank of Nam Gnom to be developed
4	800	550	50	0+700 Left Bank	4 turnouts to re-establish water to
				2+700 Left Bank	Thathot Scheme canals on the eastern
				3+300 Left Bank	side if the DC.
				4+050 Left Bank	Extension of canals, and one new
				5+560 Left Bank	outlet (at 0+700m) plus canal
					systems, to serve at least 50 ha
		TOTAL	150		

Table 7-16:	Summary of Irrigation Areas to be developed as compensation for losses from North
Gnommalat	Plain LPA 33-36 and 38a (and possibly 37, 39a and 38a.s).

7.7.3.5 Indicative Budget for irrigation development

The budget for the irrigation and land development works to compensation for the loss of paddy, riverbank gardens and upland rice fields is US\$ 536,650 as shown in Table 7-17. This budget is required to develop 150 ha, thus the unit cost is US\$ 3,577 per hectare.

The estimated average cost of a Downstream Channel turnout structures is US\$ 8,000. The estimated cost of the Area 2a irrigation canal including some canal structures including checks and a tail regulator is US\$ 31,800. The development of uncleared land requires the slash and burn of the area, taking out tree stumps and land leveling including some terracing. The cost of this is about US\$ 250 per ha but will vary depending on the land slope which dictates the land leveling and terracing requirement.

Table 7-17:	Budget for NT2	Project Componen	t of Gnommalath	Plain Development
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				Unit	
_			-	Price	Amount
Item	Description	Unit	Qty	(US\$)	(US\$)
1	AVERAGE COST of 1 DOWNSTREAM CHANNEL IRRIGAT	ION C	UTLET	<u>' STRUC</u>	TURE
1.1	Excavation, compacted backfill around structures	m3	100	3	300
1.2	Pre-cast concrete pipes, supply & install with mortar joints	LS	1	1,000	1,000
1.3	Cast iron gate, supply and install	LS	1	2,000	2,000
1.4	Reinforced concrete, inlet/outlet structures, including formwork	m3	16	200	3,200
1.5	Lean concrete under inlet/outlet structures and pipes, formwork	m3	6	50	300
1.6	Miscellaneous: Mobilization, camps, erosion protection, stop logs	LS	1	1,200	1,200
	average cost				8,000
2	AREA 2A: Pump Station and Irrigation Canal MC 1 (40 ha)				
2.1	Downstream Channel Outlet Structure, 0+400	LS	1	8,000	8,000
	Pumps				0
2.2	Pumps and motors, 2 sets 150 kW each, supply and install	LS	2	10,000	20,000
2.3	Electric Supply to Pump Station including transformer	LS	1	10,000	10,000
2.4	Pump Station Civil Works	LS	1	5,000	5,000
	Main Canal(3.8 km long)				0
2.5	Clearing and stripping, 20cm depth along canal alignment	m3	6,000	1	6,000
2.6	Compacted fill, canal embankment	m3	15,000	2	30,000
2.7	Reinforced concrete for canal structures including formwork	LS	12	200	2,400
2.8	Miscellaneous: Erosion protection, stop logs	LS	1	1,000	1,000
	Tertiary canals			-	0
2.9	Tertiary canal distribution to upper 40 ha	ha	40	1,500	60,000
	Sub-total 1				142,400
3	AREA 2B: Irrigation Canal MC 2 (30 ha)				
3.1	Downstream Channel Outlet Structure, 2+200	LS	1	8,000	8,000
3.2	Clearing and stripping, 20cm depth along canal alignment	m3	3,000	1	3,000
3.3	Compacted fill, main canal embankment (1.7 km long)	m3	7,500	2.5	18,750

				Unit Drigo	Amount
Item	Description	Unit	Otv	(US\$)	(US\$)
3.4	Reinforced concrete including formwork	LS	X 19 5	200	1.000
3.5	Miscellaneous: Erosion protection stop logs	LS	1	1 000	1,000
3.6	Tertiary canal distribution to 30 ha	ha	30	1.500	45.000
0.0	Sub-total 2			-,	76,750
4	AREA 3b. EXTENSION of THATHOT IRRIGATION SCHEM	ΔΕ (30)	ha)		10,100
4.1	Mobilization/de-mobilization construction camps clean up site	LS	1	3 000	3,000
	Causeway Crossing Over Nam Gnom	10	1	3,000	0
	Earthworks & Temporary Diversion: clearing, excavation &				
4.2	compacted backfill	LS	1	4,000	4,000
4.3	Reinforced concrete including formwork	m3	110	200	22,000
4.4	Downstream protection works: gabion baskets, rock, geotextile.	LS	1	4,000	3,000
	Irrigation Canals and Structures, 30 ha				0
4.5	Clearing and stripping, 20cm depth along canal alignments	m3	5,625	1	5,625
4.6	Compacted fill, canal embankment	m3	15,000	2.5	37,500
4.7	Excavation and compacted backfill around structures	m3	600	3	1,800
48	Precast concrete pipes, various diameters, supply & install with	LS	1	8 000	8 000
1.0	mortar joints	10	1	0,000	0,000
4.9	Gates for control structure, various diameters, supply and install	LS	1	10,000	10,000
4.10	Reinforced concrete including formwork	m3	30	200	6,000
4.11	Lean concrete under inlet/outlet structures and pipes including	m3	20	50	1,000
2 1 1	formwork	NI.	25	500	12 500
3.11 3.12	Farm inlet structures	INO m ²	25 44	500	12,500
5.12	Stone masonry outlet protection	111.5	44	50	2,200
	ADEA 4: DC Outlate to Debabilitate Thathat Scheme, and i				110,025
5	AREA 4: DC Outlets to Renabilitate Thathot Scheme, and I				
5 1	5 outlet structure	TS	5	8 000	40.000
511	Clearing and stripping. 20cm depth along canal alignment	3	1 500	0,000	40,000
5.1.1	Compacted fill canal embankment (1.2 km long)	m3	5,000	25	12 500
513	Reinforced concrete including formwork	LS	5,000	200	1,000
5.1.4	Miscellaneous: Erosion protection, stop logs	LS	1	1.000	1,000
5.1.5	Tertiary canal distribution to 30 ha	ha	30	1,500	45,000
	Sub-sub-total, 4.1			,	101,000
5.2	Irrigation Canals and Structures, 30 ha				
5.2.1	Clearing and stripping, 20cm depth along canal alignments	m3	8,000	1	8,000
5.2.2	Compacted fill, canal embankment (about 6 km)	m3	25,000	2.5	62,500
5.2.3	Excavation and compacted backfill around structures	m3	1000	3	3,000
524	Precast concrete pipes, various diameters, supply & install with	TS	1	12 000	12,000
5.2.4	mortar joints	LO	1	12,000	12,000
5.2.5	Gates for control structure, various diameters, supply and install	LS	1	12,000	12,000
5.2.6	Reinforced concrete including formwork	m3	50	200	10,000
5.2.7	Lean concrete under inlet/outlet structures and pipes including	m3	40	50	2,000
528	Form inlet structures	No	40	500	20.000
5.2.0	Stope masonry outlet protection	m3	40	500	20,000
5.2.7	Sub-sub-total. 4.2	111.5	00	50	132.500
-	sub-total 4				233,500
	GRAND TOTAL (sub total 1, 2, 3 and 4)				US\$569 275
I	Given (D) 101111 (Sub total 1, 2, 5 and 4)				0000,215

7.7.3.6 Indicative Budget for Temporary rice supplementation

Livelihood restoration based on the use of the irrigation waters from the Downstream Channel will have due to the time lag of 4 years between (i) date of land acquisition, and (ii) date that waters will permanently flow in the downstream channel and thus irrigation based compensation program can be implemented;

Thus, there will be a need to provide temporary compensation of rice, for about 4 years. On the assumption that all PAPs whose land based agricultural production want land based livelihood restoration, and that the required land to make up for lost production land is 116.52 ha (including a 20 % contingency,

but not including currently unknown impacts) then the lost rice production will be about 116.52 x 2t/ha (net productivity) = 233 tonnes of rice per year x US100/t = 23,000/yr.

Over 4 years this would be a budget requirement of US $$23,000 \times 4 = US$ \$92,000

7.7.4 Compensation for Gardens, Fields and Fish Ponds in LPA 33, 34, 35 and 36

The irrigation development scenario detailed in section 7.6.3.4 above assumption that all gardens and fields would be replaced as "land for land" by the development of irrigated paddy or other irrigated crop lands. However, some of the current riverbank or other garden owners may opt for cash compensation, or the provision of farming equipment up to the value of estimated cash compensation.

To scope the budgetary requirement of such cash compensation, Table 7-18 below details to total cash compensation that would be applicable if all PAPs impacted by LPA 33, 34, 35 and 36 opted for cash compensation, and if that cash compensation was calculated as the sum of (a) basic value of the land plus (b) 5 years lost productivity.

Land / asset	No.			total for		total for 5 years
types registered	assets	Area (ha)	land cost	purchase of land	productivity/yr	lost productivity
Riverbank gardens	274	31.38	US\$700/ha	US\$21,966	US \$ 25 0/ha	US\$39,225
Upland fields	153	120.81	US\$400/ha	US\$48,324	US\$ 150/ha	US\$90,000
Fishponds	2	0.16	US\$20,000/ha	US\$3,200	3,000 kg/ha, at	US \$2, 880
	5	0.10			US\$1.2 per kg	
TOTAL	591	238.9		US\$73,490		US\$132,105

Table 7-18: Indicative cost of Cash Compensation for Gardens and fields in LPAs 33 to 36

However the current Project Land budget planning (see section 7.12 below) is based on the assumption that all PAPs will request land based, as opposed to cash based compensation, and thus the budget calculated in Table 7-18 above is not currently used for budget planning purposes.

7.7.5 Compensation and Livelihood restoration for loss of common property resources

In addition to land and fixed assets, the survey of PAPs in LPA 33, 34, 35, and 36 has detailed potential losses for common property resources, consisting of NTFPs, TFPs, fisheries and hunting.

The main principle for compensation for the loss of common property resources is to provide a number of options to be discussed with households and villages. Three basic options are available that will form the basis of consultations with affected households.

- a. <u>Alternative Sources for Losses:</u>
 - i. Domestication of NTFPs and TFPs to replace collection from lost common properties;
 - ii. Alternative areas for sourcing NTFPs and TFPs, such as adjacent village areas; or
 - iii. Fish ponds to replace the loss of fisheries from rivers and streams.
- b. <u>Alternative Livelihood Options</u>
 - i. Provision of other enterprises to generate the same amount of net income. Some examples of possible replacement enterprises could consist small repair shops, handicraft shops or small retail shops. Equipment, training or initial supply of good for sale should be provided to ensure that income can be generated within a short time and that PAPs are not burdened with additional costs.
- c. Cash Compensation
 - i. Cash t compensation for lost productivity based on a total of the past 5 years of productivity;
 - ii. Cash value may also be paid in-kind to cover the purchase of equipment, such as power tiller, trailer, etc., for breeding cattle or for other inputs that could improve existing livelihoods

7.7.5.1 Non-Timber Forest Products (NTFPs)

The survey of 456 households for NTFP collection found that an estimated 68,129 kilos of NTFPs per year were harvested from LPA 333 to 36), which was approximately 77% of all NTFPs collected by these villages. 372 households (HHs) were sourcing this area with an average 143 kilograms of NTFPs gathered per year per household.

	Number	Total quantity of	Quantity sourced from	Percentage	No. of HHs that source	Av. Qty sourced from LPA 33-36 by
	HH	NTFPs	LPA 33-36	sourced from	NTFPs from	each HHs
Village name	surveyed	(kg/year)	(kg/year)	LPA 33-36	LPA 33-36	(kg/year per HH)
Ban Keovilay	107	27,876	26,049	93%	80	326
Ban Koutphadang	10	1,745	1,555	89%	9	173
Ban Korbong	45	7,412	6,690	90%	44	152
Ban Lao Na Ngam	132	25,084	16,316	65%	105	155
Ban Nong Seng	72	11,651	9,523	82%	71	134
Ban Phone Lath Khouay	33	6,216	4,789	77%	26	184
Ban Somsanouk	1	120	120	100%	1	120
Ban Thathot	1	196	40	20%	1	40
Ban Thongmang	23	2,820	337	12%	6	56
Ban That	32	5,174	2,710	52%	29	93
TOTAL	456	88,294	68,129	77%	372	143

While the data presented in Table 7-19 above is in terms of kilograms, Table 7-21 below provides data collected from 83 families, in which the individual NTFPs collected were identified. From this information, an average loss per household is calculated as representative of losses of NTFPs. This loss amounts to USD 45 per year per household. This amount is then used as a basis for calculating the total potential loss from NTFPs for all 372 households, estimated at USD 15,407 per year for compensation (see Table 7-20). If cash compensation is applicable, the 5 years loos of NTFP collection would mean USD 77,035 would be applicable compensation value, or average of US\$225 per PAP.

Table 7-20: Average Annual Harvest and	Value of Gathered of NTFPs from LPA 33-	-36
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				Rattan roots	Cardamom		
	Veg (kg)	Fruit (kg)	Damar Resin (kg)	(kg)	(kg)	Other (kg)	
Total for 83 HH	2,249	1,120	1,874	3,111	250	950	
Average per HH	27.10	13.49	22.58	37.48	3.01	11.45	
Unit cost/value	\$0.05	\$0.1	\$0.15	\$0.1	\$0.5	\$0.5	totals
Average per HH	\$1.35	\$1.34	\$11.29	\$18.74	\$3	\$5.7	US\$45/yr
Total for 372 HH	\$502.20	\$498.48	\$4,199	\$6,971	\$1,116	\$2,120	US\$15,407/yr

7.7.5.2 Timber Forest Products (TFPs)

While the quantity and type of wood products collected from the LPA 33 to 36 is still under analysis preliminary data is presented in Table 7-21 below. The calculated losses from LPA 33-36 is 514,203 kilograms of TFPs per year were harvested from impacted areas, approximately 66% of all TFPs for these Villages. 371 households (HHs) were sourcing this area with an average 1,442 kilo per year per household.

Table 7-21: Timber Forest Products (TFPs) sourced from LPA 33-36
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	Number HHs	Total quantity of TFPs	Qty sourced from LPA 33-	Percentage sourced from	Number of HHs that source TFPs	Ag Qty sourced from LPA 33-36 by each
Village name	surveyed	(kg/year)	36 (kg/year)	LPA 33-36	from LPA 33-36	HH (kg/year per HH)
Ban Keovilay	107	137,055	109,730	80%	75	1,463
Ban Koutphadang	10	8,375	7,550	90%	9	839
Ban Korbong	45	87,683	70,752	81%	43	1,645
Ban Lao Na Ngam	132	196,845	107,870	55%	104	1,037
Ban Nong Seng	72	182,586	115,471	63%	70	1,650
Ban Phone Lath Khouay	33	72,750	41,975	58%	28	1,499
Ban Somsanouk	1	1,500	1,500	100%	1	1,500
Ban Thathot	1	2,475	2,475	100%	1	2,475
Ban Thongmang	23	31,595	6,005	19%	9	667
Ban That	32	57,702	50,875	88%	31	1,641
TOTAL	456	778,566	514,203	66%	371	1,442

The detailed sample survey of 83 households identified the types and amounts of the main TFPs gathered from this LPAs. This includes timber, bamboo and firewood. From this information, an average loss per household is calculated as representative of losses of TFPs. This loss amounts to 211 USD per year. This amount is then used as a basis for calculating the total potential loss from NTFPs for all 372 households, estimated at US\$ 78,388 USD per year for compensation.

L	Timber (kg)	Bamboo (kg)	Firewood (kg)	
Total for 83 HH	60,475	24,430	37,650	
Average per HH	729	294	454	
Unit cost/value	\$ 0.25	\$ 0.02	\$ 0.05	Total
Average per HH	\$ 182.15	\$ 5.89	\$ 22.68	\$ 210.72
Total for 372 HHs	\$ 67,761	\$ 2,190	\$ 8,437	\$ 78,388

Table 7-22: Average annual harvest and value of gathered of TFPs from LPA 33-36

7.7.5.3 Fish and Wildlife

Average quantities for fish and wildlife sourced from LPA 33-36 has been calculated from based on data from the socio-economic baseline surveys, the data being presented in Table 7-23 below. The majority of households rely on fisheries in these impacted areas and an average quantity of 27 kilos per year per household is estimated as a loss. Fewer than 20% of households were engaged in hunting in the impacted area. The average loss is calculated at 21 kilos per year per household.

In the case that PAPs request cash compensation, then the annual loss of 8,904 kgs of fish, over a seven (7) year period would be a loss of 62,328 kgs of fish, which at a value of US0.8 / kg would mean an applicable cash compensation of about US9.82

In the case of lost wildlife, the annual 3,015 kgs lost harvest would be equivalent to 21,105 kgs over seven years, or a value of US\$31,658 at a unit value of US\$1.5 / kg.

Village name	Number HHs surveyed	Total Qty of fish (kg/year)	Qty sourced from LPA 33- 36 (kg/year)	Percentage sourced from LPA 33-36	Number of HHs that source fish from LPA 33-36	Av. quantity sourced from LPA 33-36 by each HH (kg/year per HH)
Ban Keovilay	107	1,293	1,293	100%	65	20
Ban Koutphadang	10	295	295	100%	9	33
Ban Korbong	45	931	894	96%	38	24
Ban Lao Na Ngam	132	2,436	2,334	96%	108	22
Ban Nong Seng	72	2,475	2,427	98%	65	37
Ban Phone Lath Khouay	33	1,075	898	84%	22	41
Ban Somsanouk	1	40	40	100%	1	40
Ban Thathot	1	20	0	0	0	0
Ban Thongmang	23	527	140	27%	5	28
Ban That	32	746	583	78%	23	25
TOTAL	456	9,838	8,904	91%	336	27

Table 7-23: Fish Sourced from LPA 33-36

Table 7-24: Wildlife sourced from LPA 33-36.

Village name	No of	Quantity	Quantity	Percentage	Number of HHs	Average quantity
	HHs	of wildlife	sourced from	sourced	that source	sourced from LPA 33-
	surveyed	(kg/year)	LPA 33-36	from LPA	wildlife from	36 by each HH
			(kg/year)	33-36	LPA 33-36	(kg/year per HH)
Ban Keovilay	107	580	580	100%	25	23
Ban Koutphadang	10	295	280	95%	5	56
Ban Korbong	45	331	296	89%	14	21
Ban Lao Na Ngam	132	895	620	69%	24	26
Ban Nong Seng	72	953	803	84%	33	24
Ban PhoneLatKhouay	33	353	353	100%	8	44
Ban Somsanouk	1	0	0	0	0	0
Ban Thathot	1	0	0	0	0	0
Ban Thongmang	23	56	4	7%	1	4
Ban That	32	114	79	69%	10	8
TOTAL	456	3,577	3,015	84%	120	21

The other compensation option would be to develop alternative fish or protein sources, but such livelihood restoration is usually at least 2 to 3 time the cost of cash compensation as calculated by lost productivity over a 7 year period.

7.7.5.4 Indicative Implementation Schedule

An indicative implementation schedule is shown on Table 7-25 below, which includes the scheduling of the two main types of compensation - cash and livelihood restoration. Cash compensation will be provided immediately before the land is required by and handed over to the Head Contractor.

However, Livelihood restoration based on the use of the irrigation waters from the Downstream Channel will have two components, due to the time lag of 4 years between (i) date of land acquisition, and (ii) date that waters will permanently flow in the downstream channel and thus irrigation based compensation program can be implemented;

- (a) a temporary compensation of rice, for about 4 years; and
- (b) the permanent compensation of irrigation land development

While the actual date at which the permanent livelihood based compensation can be provided is some 4 years after land acquisition (at COD), the development of the facilities to provide this compensation - such as the construction of irrigation outlets in the downstream channel and the construction of irrigation canals, will be undertaken over a four (4) year period between land acquisition of COD.

Table 7-25: Indicative schedule of main Project construction and the provision of Compensation in LPA Groups 10 and 11.



7.8 PROJECT LANDS GROUP 11 (LPAS 38B, 39B AND 40)

This group is located just south of old Gnommalath District Centre, and includes:

- LPA 38b : DS Channel B (mid-north)
- LPA 38b.s : DC Spoil areas
- LPA 39b : Access to DS Channel (existing)
- LPA 40 : Contractor's main camp

These LPAs are grouped for the following reason:

- they are geographically close and related.
- many PAPs may have impacted assets in more than one of the LPAs
- compensation for impacts will have to consider all of the PAPs as one group,

The main impact on PAPs is from LPA 38b. LPA 40 is a PCA and thus impacts have already occurred. The location of both LPA38b.s and LPA 39b is still not finalised - under final design in order to minimise impacts - and thus impacts cannot yet be inventoried.

7.8.1 Provisional Compensation for PCA LPA 40

The loss of seasonal productivity of the gardens of 3 PAP households and housing land (which had kitchen gardens) of 5 LPA households, plus the productivity of so-called cleared land of one PAP household, has been compensated for by cash payments as shown on Table 7-26 below.

Table 7-26: Cash payments made as Provisional Compensation to PAPs impacted by PCA in LPA 40

		Houses		Gardens		Housi	ng Land	Cleared Land	
	PAP: HoH	qty	kip	qty	kip	qty	kip	qty	kip
1	Ms. Bounkuang Viraphanh					1	123,500		
2	Ms. Kagnone Keoviset					1	54,000		
3	Mr. Soubanh Chanthasomboune					1	382,000		
4	Mr. Sone			1	127,000				
5	Mr. Thongmay				-				9,400
6	Mr. Khenmonh Chanthasomboune			1	310,000				
7	Mr. Viengkhone					1	58,500		
8	Mr. Somsy Keokhampoo					1	50,000		
9	Mr. Ouneheuane Norsouvanh			1	132,000				
	Total:			3	569,000	5	668,000	1	9,400

7.8.2 Final Compensation for loss of Fixed Assets

The estimated cost of compensation for replacement of fixed assets and land for these fixed assets is presented in Table 7-27.

Table 7-27: Compensation of PAP Land and assets impacted by LPA 40

		Houses		Farm Buildings		Other Buildings		Housin	ig Land	Total
	Head	qty	Area m2	qty	Area m2	qty	Area m2	qty	Area ha	
1	Ms. Pa	1	72.16	1	9.00			1	0.3132	
2	Ms. Bounkuang Viraphanh	1	46.16					1	0.0854	
3	Ms. Kagnone Keoviset	1	45.23			1	12.26	1	0.5740	
4	Mr. Soubanh Chanthasomboune	1	48.85			1	18.79	1	0.1582	
5	Mr. Seokham Kongmany	1	-	1	6.00					
13	Mr. Viengkhone	1	10.38					1	0.6995	
14	Ms. Ouane Sengmany									
15	Mr. Somsy Keokhampoo	1	48.50			1	46.96	1	1.0808	
16	Mr. Somphong Chanethalangsy			1	47.01			1	0.1963	
	Total	6	271.28	3	62.01	3	78.01	7	3.1074	
	Unit costs	\$4,500		\$1,500		\$2,500		\$400		
	total cost	\$27,000		\$4,500		\$7,500		\$2,800		\$41,800

7.8.3 Livelihood restoration for impacted rice/crop fields by irrigation development

7.8.3.1 Land replacement requirement

Downstream of the Thathot scheme there is an irrigation pontoon pump station on the Nam Gnom at Gnommalath that irrigates an area to the south of Gnommalath and the Nam Gnom. The pump station has two 75 kW electric pumps installed in year 1998. The pumps irrigate an area of about 81 ha in the wet season and about 70 ha in the dry season. Further south of this are rainfed paddy rice fields, uplands crop gardens, and grazing lands. It is estimated that the Downstream Channel will take about 14 ha of paddy fields and about 16.5 ha of rotational upland gardens areas (see Table 7-28) below.

Based on the gross and net productivity of current fields and the future productivity of irrigated paddy fields, which will be developed as compensation (see section 7.7.3.4 above), the amount of irrigated land that will need to be developed by the NT2 Project, as compensation for productive land loss under LPA Group 11, is about 20 ha.

Table 7-28:	Summary	Inventory	\mathbf{of}	productive	lands	impacted	by	LPA	38	b	and	LPA	40,	and
replacement	t land requi	irement												

		Area	irrigated paddy
LPA/Asset impacted	No PAP assets	impacted	rice equivalent
LPA 38b			
rainfed paddy rice plots	9	6.45 ha	3.22
irrigated paddy rice plots	11	7.85 ha	7.85
rotational gardens	10	16.4 ha	5.46
LPA 40			0
rainfed paddy rice plots	3	3.647	1.82
gardens	4	2.355	0.78
Total	30	30.7 ha	19.13 ha

While about 20 ha has been identified to date as required to replace impacted fields under LPA 38b and 40, the land requirement due to acquisition of 39b and 38b.s may considerably add to this requirement. Thus, for planning purposes, a figure of 40 ha of irrigation development is taken as the area that the Nam Theun 2 Project will be responsible for developing, as part of the Project Lands compensation program, in the area of LPA Group 11 (South Gnommalath Plain).

7.8.3.2 Indicative irrigation area development

In order to scope the activity and budget requirements for development of irrigation for 40 ha along the Downstream channel, a probable scenario of three (3) irrigation scheme developments has been developed (see Figure 7-2 above and Table 7-29 below) and costed, as shown in Table 7-30 below.

Table 7-29:	Summary	of Irrigation	Areas to be	e developed as	compensation	for losses	${\it from}$	North
Gnommalat	h Plain LP.	A 38b and LP	'A 40.					

Area	Total Area (ha)	Estimated Potential Irrigation Area (ha)	Area to be Developed by NT2 (ha)	Approximate Locations of Downstream Channel Outlets	Remarks
5	11	10	10	6+100 Right Bank	Turnout to re-establish water to existing Nam Gnom Pump Irrigation Scheme area
6	1,120	700	15	6+550 Left Bank 6+940 Left Bank	Turnouts to connect with existing Nam Gnom Pump Irrigation Scheme canals
7	200	30	15	7+400 Right bank	
		Totals	40	4 Turnouts	

				Unit Price	Amount
Item	Description	Unit	Quantity	(US\$)	(US\$)
1	AREA 5				
1.1	Downstream Channel Outlet Structure, 6+100	LS	1	8,000	8,000
	Irrigation development, canals and structures	ha	10	2,000	20,000
	Sub-total, 5				28,000
2	<u>AREA 6</u>				
2.1	Downstream Channel Outlet Structures, 6+550 & 6+940	LS	2	8,000	16,000
	Irrigation development, canals and structures	ha	15	2,000	30,000
	Sub-total, 6				46,000
3	<u>AREA 7</u>				
3.1	Downstream Channel Outlet Structure, 7+400	LS	1	8,000	8,000
3.2	Irrigation development, canals and structures	ha	15	2,000	30,000
	Sub-total, 7				38,000
	TOTAL				US\$112,000

Table 7-30:	Budget for southern	Gnommalath Plain Devel	opment (LPA Group 11))
	• • • • • • • • • • • • • • • • • • • •		1 1 1 1	

7.9 PROJECT LANDS GROUP 12 (LPAs 38C, 41, 42 AND 44)

This group is located just south of the intersection of the Nam Phit and Road No. 1, and includes.

- LPA 38c : Downstream Channel C (mid-south)
- LPA 38c.s : Spoil areas of the downstream channel, section C
- LPA 41 : Work area (for DC)
- LPA 42 : Phou Phatoung Quarry & access
- LPA 44 : Construction Camp

The main impact on PAPs is from LPA 38c and LPA 41. The location of LPA38b.s, LPA 41 and LPA 44 is not yet finalised - under final design in order to minimise impacts - and thus impacts cannot yet be inventoried at this stage, although it is expected that LPA 41 and LPA 44 will be located in an area of minimal or no impact.

7.9.1 Livelihood restoration for impacted rice/crop fields by irrigation development

7.9.1.1 Land replacement requirement

Table 7-31 below details the approximate areas of productive land, which will be lost under LPA 38c. Based on the gross and net productivity of current fields and the future productivity of irrigated paddy fields which will be developed as compensation (see section 7.7.3.4 above), the amount of irrigated land that will need to be developed by the NT2 Project, as compensation for productive land loss under LPA Group 12, is about 31.36 ha, as also shown in Table 7-31.

Table 7-31:	Compensation	for land assets in	mpacted by LPA 38c
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LPA/Asset Impacted	No PAP assets	Area	irrigated paddy
		impacted	rice equivalent
LPA 38c			
Rainfed paddy rice plots	4	1.8	0.9
Rotational gardens	30	52.8	17.6
LPA 42		0	0
Rainfed paddy rice plots	15	12.23	6.1
Rotational gardens	12	20.28	6.76
TOTAL	34	87.11	31.36

While about 31.36 ha has been identified to date as required to replace impacted fields under LPA 38c and 42, the land requirement due to acquisition of 38c.s and LPA 42 and 44 may add to this requirement. Thus, for planning purposes, a figure of 40 ha of irrigation development is taken as the area that the Nam

Theun 2 project will be responsible for developing, as part of the Project Lands compensation program, in the area of LPA Group 12.

7.9.1.2 Indicative irrigation area development

In order to scope the activity and budget requirements for development of irrigation for 40 ha along the Downstream channel, a probable scenario of two (2) irrigation scheme developments has been developed (see Figure 7-2 above and Table 7-32 below) and costed, as shown in Table 7-33 below.

	Table 7-32:	Irrigation A	reas to be dev	veloped as	compensation	for losses t	from LPA	38c and 42
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Area	Total Area (ha)	Estimated Potential Irrigation Area (ha)	Area to be Developed by	Approx Locations of Downstream Channel	Remarks
			NT2 (ha)	Outlets	
8	1,030	430	10	11+600 Left bank	
9	770	600	30	12+000 Right bank	
				13+800 Right Bank	
		Total	40	3 Turnouts	

Table 7-33: Budget for Gnommalath Plain Development

Item	Description	Unit	Quantity	Unit Price	Total (US\$)		
1	AREA 8						
1.1	Downstream Channel Outlet Structure, 11+600	LS	1	8,000	8,000		
1.2	Irrigation development, canals and structures	ha	10	2,000	20,000		
	Sub-total, 8				28,000		
2	AREA 9						
2.1	DCl Outlet Structures, 12+000 & 13+800	LS	2	8,000	16,000		
2.2	Irrigation development, canals and structures	ha	30	2,000	60,000		
	Sub-total, 9				76,000		
	TOTAL						

7.9.2 Fisheries impacts of LPA 42

Caves under the Phatoung limestone karst, LPA 42, contain water and aquatic habitats for important fish species. These fish take dry season refuge in these underground cave pools, and in the wet season, when the general area is inundated, the breeding fish travel out to the floodplains and streams to spawn and grow. The number of households and annual catch of fish which originate from this ecological system connected to the dry seasons cave pools in the limestone karst are presented in Table 7-34 below.

Table 7-34:	Village level in	entory of fisheries	s impacts from	LPA 42a,	Gnommalath
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		Village Name								
Indicator	Phathoung	Thangbeng	Kenglek	Kuanphanh	Napho	Nongping	Done Peauy	Gnommalat h Tai	Gnommalat h Neua	TOTAL
Total No. of HH in village	81	35	105	179	123	152	78	179	235	
No. of HH fishing in Phathoung area	81	35	23	39	20	90	6	90	47	431
% of HH which fish in Phathoung area	100%	100%	22%	22%	16%	59%	8%	50%	20%	
Total village fish catch (kg/yr)	2,430	17,500	1,380	1,200	1,000	4,350	35	900	10	
Total fish catch from Phathoung area (kg/yr)	2,200	1,260	184	840	500	2175	17.5	630	7	7,813
% of fish catch from Phathoung area	91%	7%	13%	70%	50%	50%	50%	70%	70%	

On the assumption that the quarry activities impact about half of these cave refuges, then half of the annual catch of 7,813 kgs, or about 3,900 kgs of fish would be impacted or lost. At a unit value of US\$0.8 per kg of fish, this would equate to an annual loss of US\$3,120. Based on 7 years lost production, these fishers would be eligible for about US\$21,840 in cash compensation. However, it is likely that these funds would used to replace the lost fish and proteins due to Project Land impact.

7.10 PROJECT LANDS GROUP 13 (LPAS 38D, 46, 47, 48, 49, 51 AND 56)

This group is composed of the following land parcels;

- LPA 38d : Downstream Channel D (south)
- LPA 38d.s : DC Spoil areas
- LPA 46 : Construction Camp
- LPA 47 : Access to DS Channel (new)
- LPA 48 : Construction Camp
- LPA 49a : Access to DS Channel (existing)
- LPA 49b : Work area and access to XBF
- LPA 51 : Road 8b (existing)
- LPA 56 : Road 12 (existing)

The location of LPAs 46, 47 and 48 49a and 49 b is not yet finalised - is under final design in order to minimise impacts - and thus impacts cannot yet be inventoried at this stage. However, it is most likely that PAP impacts due to these LPAs will be minimal.

LPA 51 and 56 are upgrades to existing roads, which are already sufficiently wide enough not to require widening. Thus, there will be no requirement for land acquisition, or related impacts on PAPs.

7.10.1 LPA 38d

LPA 38d.s is part of LPA 38d, and this inventory of impacts as noted below refer to both LPA 38d and LPA 38d-s. No buildings will be impacted by LPA38d. About 22.25 ha of gardens owned by 99 households will be lost under this LPA, as summarised in Table 7-35.

Table 7-35:	Compensation	for land assets i	mpacted by LP	A 38d, if based on	cash compensation
				,	

		average garden				
		size				
Village	no. HH	m2/HH				
Nakio	48	2,793				
Nongkheen	51	1,703				
		2,248 m2/HH	land cost	prod	x 5	Total
total	99	22.25 ha	400/ha	150/ha	750/ha/5 yr	\$25,587

If alternative gardens are developed (by pumping water from XBF or DC) then cost of compensation by this method will be about 22.25 ha x US3,000/ha = 66,750.

7.11 PROJECT LANDS GROUP 14 (LPAS 52, 53, 54, 55 AND 58)

This group is composed of the Transmission Lines and related lands and infrastructure, including;

- LPA 52 : the 115 & 500 kV Transmission Lines in parallel
- LPA 54 : the 500 kV Transmission Line
- LPA 55 : Access to 500 kV Transmission lines (mostly existing access routes)
- LPA 58 : Land for a future/possible Sub-station in Savannakhet

There are three main, and one minor impact of the TL corridors, as follows:

- (a) all fixed assets above 2 m must be removed from the corridor;
- (b) all crops or plantations above 2 m must be removed; and
- (c) land is permanently and fully required for the excavation and building of power line footings

Thus, there are impacts on fixed assets, mainly houses and farm huts, and on paddy fields lost to the tower footings under LPA 52, 53 and LPA 54.

LPA 55 is planned to use mainly existing access roads, and thus no PAP impact. Were access routes deviate from exiting tracks, or require a new road alignment is not yet known, and thus an inventory of losses cannot be undertaken.

LPA 58 is land indicatively set aside for a possible, future sub-station, in the event that another power project wishes to export power to Thailand thru the same Mekong Crossing Transmission line. In fact, the land will not be required or acquired by the NT2 Project.

The LPA 52a encompasses the approximately 28 km long corridor, from the powerhouse to the Nam Phit, in which the two Transmission Lines, the 115 domestic and the 500kV export lines, run in parallel. At the Nam Phit, the two lines split, and the 115kV domestic power line travels another 2 km to the Mahaxai substation, while the 500kV export line runs to the Savannakhet substation (the corridor of which is designated as LPA 54). The LPA 54 encompasses the approximately 112 km long corridor of the 500 kV Transmission Line, from the Nam Phit to the Savannakhet substation.

At the Nam Phit, the two lines split, and the 115kV domestic power line travels another 2 km to the Mahaxai substation, while the 500kV export line runs to the Savannakhet substation (the corridor of which is designated as LPA 54). The LPA 54 encompasses the approximately 112 km long corridor of the 500 kV Transmission Line, from the Nam Phit to the Savannakhet substation.

7.11.1 Fixed assets

As detailed in Chapters 2 and 3, 36 buildings - houses and farm huts - lie under the corridor of the future parallel Transmission Lines, LPA 52a, while about 73 houses lie under the single 500 kV Transmission Line of LPA 54. These houses would be relocated out of the Transmission Line corridors, and the indicative cost of such relocation and house construction is presented in Table 7-36 below. The budget calculation is based on the assumption that the average cost of housing land purchase is US\$400/ha, and the construction of the minimum standard and size of house as being US\$4,250 per house.

Asset type	No. assets	replacement cost per unit	total replacement cost
LPA 52			
Houses	36	US\$4,250	US\$153,000
Housing land	36	US\$400/plot	US\$14,400
LPA 54			
Houses	73	US\$4,250	US\$310,000
Housing land	73	US\$400/plot	US\$29,200
		Total	US\$506,600

Table 7-36: Indicative cost of compensating for House relocation out of the TL corridors

7.11.2 Paddy rice fields

The areas of paddy fields that are likely to be acquired in order to construct the footings of the transmission lines towers is presented in Chapter 3, Section 3.9.

In summary, the losses of paddy land are likely to be as follows:

- Under LPA 52:
 - $\circ~$ 115 kV.- 23 footing, taking and area of 0.147 ha
 - **500 kV -** 14 footings, taking and area of 0.454 ha.
- Under LPA 54:
 - 500 kV tower footings, 16 in number, taking and area of 0.5184 ha.

Thus, the total impact on paddy fields is expected 1.119 ha. If PAPs require cash compensation, and on the assumption that the paddy fields are dry season paddy fields, then the indicative cost of providing such cash compensation is about US\$ 2,402, as detailed in Table 7-37 below

Table 7-37:	Indicative	cost	of	compensating	loss	of	paddy	under	Transmission	line	tower
footings											

				total for		total for 5
Land / asset	No.			purchase of		years lost
types registered	assets	Area (ha)	land cost	land	productivity/yr	productivity
52 and 54	53	1.119 ha	US\$ 1,250	US\$1,399	1.8 t/ha x \$100/t	US\$1,007

7.12 LOSS OF RESETTLEMENT AREA FORESTS

The clearing of forests for Project (construction) Lands, and the new agricultural areas, in the designated Resettlement Area of the Nakai Plateau presents a specific instance whereby loss of community forest is significant and may require compensation.

The whole Resettlement Area (approximately 20,000 ha) has been allocated to those villagers who must be relocated as a consequence of the inundation of the Nakai plateau (see Volume 2 of the SDP). An important rationale for the allocation of this area is that (a) the villagers would be responsible for the care and maintenance of this forest, and (b) the Resettlers will harvest the forest on a sustainable, commercial basis. The profits from this commercial operation - to be paid as a dividend to each household - are an integral part of the plateau livelihood for the Resettlers. Employment in the forest management and the commercial operations will also provide income to the considerable number of Resettlers who would be employed full or part time in these operations. However, certain areas of the Resettlement Area must be clear-felled to make way for:

- (a) the agricultural lands on which Resettlers will grow crops and raise cattle; and
- (b) the construction of NT2 project related infrastructure, especially roads and saddle dams.

Such clear-felling will diminish the tree and timber resources which would otherwise be available to the villagers to conduct their commercial activities, and thus contribute to their current and future livelihoods and income. An inventory (undertaken by a joint NTPC/GOL survey in 2003) of the commercial tree resources which are currently standing in those areas that will be cleared for agricultural land or as LPAs is detailed in Table 7-38 and 7-39 below.

LPA	Description	area - ha	m3 (D > 15 cm)
10a	Ban Signo camp, access, bridge	10	103
10b	Road 8b (new)	60	1,500
11a	Access to new Rd 8b (existing)	10.99	23.65
11b	Access to new Rd 8b (existing)	14.59	40.16
21a, b,	Existing track, New road & SDs 5, 6, 7,	75.25	266.09
20a, b	Intake structure and Construction Camp	39	1,228
27	Surge Shaft access: Nakai (new)	11.66	300
28	Surge Shaft	22	550
29	Surge Shaft access: below (new)	8.6	215
30	Access Portal & Access Rd	0.67	17
	Total	252.76 ha	4,242.9 m3

Table 7-38: Inventory of commercial trees under LPA in the Nakai Plateau Resettlement Area

Thus, a total of about 19,500 m3 of commercial trees (above 15 cm diameters) may have to be cleared from the Resettlement Area, which would be the net loss of the forest resource available for the Resettlers sustainable forest management and harvest - and income - in the future.

If the NPVFA is designated as the responsible company to log, process and sell these timbers, then no compensation would be applicable to the Resettlers.

			total tim	ber, $D > 15 \text{ cm}$
	new village	ha	trees	m3
1	Sopphene	40	2,815	1,798.772
2	Talang	45	3,257	2,024.306
3	Bou Ma	50	994	696.826
4	SopOn	50	3,579	1,341.531
5	Ban Done	90	3,014	1,462.143
6	Nong Bouakham	40	1,943	1,447.581
7	Phonsavang	18	528	43.718
8	Nakaineua	60	1,984	1,240.672
9	Nakaidtai	130	2,727	2,096.079
10	SopMa	30	1,020	771.920
11	KhonKhene	40	2,991	2,326.793
	total	593	24,852	15,250.341

Table 7-39: Inventory of commercial trees under areas to be cleared for irrigated agricultural development on the Nakai Plateau.

7.13 SUMMARY OF INDICATIVE BUDGET REQUIREMENT FOR PROJECT LANDS PROGRAM

Based on the expected Project impacts as described in Chapter 3 and the strategy and indicative cost of compensation as described above, the total budget required for the Project Land compensation program is summarized in Table 7-40 below.

This budget is, however, still indicative for a number of reasons:

- (a) The extent of the actual lands requirement by the Project (NTPC and its HC) and the extent of the impacts under these lands is not yet finalised for some LPAs; and
- (b) The detailed compensation program, and thus the cost of that program, for each PAP and each LPA has not yet been developed in detail.

			Lar	nd com	pensation		F	ixed a	sset compe	nsation		Other		
		no		no		main type	no	no		main type			main type	
	LPA Group	assets	area (ha)	PAP	budget	of Comp	assets	PAP	budget	of Comp	impact	budget	of Comp	Total Budget
1	LPA Group 1	22	9.6	17	\$14,316	cash								\$14,316
2	LPA Group 2	2	0.2	2	\$225	cash			n.y.d*					\$225
3	LPA Group 4	20	20.5	13	\$2,006	cash	7	7	\$16,200	replacement				\$18,206
4	LPA Group 6	0	0	0	n.y.d*		152	135	\$1,397,010	replacement				\$1,397,010
5	LPA Group 10	547	212.19	461	\$569,275	replacement	73	73	\$194,250	replacement	forest products	\$236,942**	cash or	\$1,000,467
													restoration	
					\$111,760	temp/rice	0	0	0					\$111,760
6	LPA Group 11	30	30.7	30	\$112,000	replacement	19	9	\$41,800	replacement				\$153,800
7	LPA Group 12	34	87.11	34	\$104,000	replacement	0	0	0					\$104,000
8	LPA Group 13	99	22.25	99	\$25,587	replacement	0	0	0					\$25,587
9	LPA Group 14	53	1.12	53	\$1,007	cash	109	109	\$506,600	replacement				\$507,607
10	Resettlement Area										loss of income	n.y.d*		
	forests										from RA forest			
11	Livelihood/Agricultural				150,000									\$150,000
	Extension													
12	UXO clearance				150,000									\$155,000
13	Contingency				220,000				420,000					\$640,000
	Total	807	383.67 ha	709	\$1,460,176		360	333	\$2,155,860			\$236,946		\$4,272,978

Table 7-40: Summary of Budget Requirements for the Project Land Compensation Program.

n.y.d = not yet determined, awaiting final design of land requirement. impact on forest products is under review, and may to be less than original survey.

Annex 7-1: Schedule of Value of Produce, Forest Products and La	nd
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1 1 10	0010010				
No	Description	Unit cost (kip/kg)	Yield	Irrigated yield (t/ha)	
Α			rainfed/WS	irrigated/WS	irrigated/DS
	Rice	900	1.7	2.0	3.3
	Corn	500			

7-1-1: Cereals

Notes:

- average yield of rain fed paddy rice for Gnommalath is about 1.70 tons per hectare (average 12 years for rainfed) and irrigated paddy rice of 3.30 tons per hectare (average over 11 years average for irrigated rice field) as determined by DAFO, Gnommalath District.
- The price of paddy rice after harvesting with 14 15 % humidity is about 900 kip per kilogramme (market price)

7-1-2: Root and tubers

No	Description	Unit cost (kip/kg)	Yield (T/ha)	
1	Cassava	200	11	
2	Sweet potato	300	8	
3	Taro	500	10	
4	Yam bean	300		
5	Yam wild (Man On)	200	8	
6	Yam wild (Man Phao)	200	15	

7-1-3: Vegetables

	Description	Unit cost ** (kin/kg)	Yield (T/ha)
1	Onion	1.000	(1/114)
2	Garlic	1,000	
3	Chinese cabbage	500	
4	Lettuce	500	
5	Cauli flower	500	
6	Cabbage	500	
7	Morning glory	500	
8	Sagnae vegetable	500	
9	Coriander	1,000	
10	Home Peove	1,000	
11	Mint (Pakpeo)	1,000	
12	Mint (Homseum)	1,000	
13	Mint (Hompe)	1,000	
14	Hoary basil	500	
15	Lemon grass	500	
16	Ginger	500	
17	Gangala	500	
18	Local herb	500	
19	Pumpkin	1,000	
20	Gorge	500	

	Description	Unit cost ** (kip/kg)	Yield (T/ha)
21	Bottle gourd	500	
22	Cucumber	1,000	
23	Cantaloupe	1,000	
24	Water melon	1,000	
25	Smooth luffa	500	
26	Gourd	500	
27	Wing bean	500	
28	Long bean	100	
29	Pigeon pea	200	
30	Tomato	500	
31	Chilly	200	
32	Egg plant	1,000	
33	Wild egg plant	500	
34	Roselle	100	
35	Bitter gourd	100	
36	Lead tree	200	
37	Upland bean	1,000	
38	Tongue tree flower	500	
39	White bittle flower	1,000	
40	Bitter flower	1,000	

Notes:

- Among vegetables sold at the market, some are gathered from the forest sources shaded.
- The price of vegetables and fruits have been evaluated at on-farm price

D	Description	seedling	maintenance	Unit cost	Yield
	_	cost(kip/kg)	cost	(kip/kg)	(T/ha)
1	Papaya	1,000	2,000	500	1,000
2	Jackfruit	1,000	2,000	500	1,000
3	Mango	1,000	2,000	1,000	1,000
4	Jujube	1,000	2,000	500	1,000
5	Tamarind	1,000	2,000	1,000	1,000
6	Guava	1,000	2,000	500	1,000
7	Milk apple	1,000	2,000	500	1,000
8	Coconut	1,000	2,000	1,000	1,000
9	Gooseberry	1,000	2,000	100	1,000
10	Mak Insee	1,000	2,000		1,000
11	Banana	1,000	2,000	500	1,000
12	Orange	1,000	2,000	500	1,000
13	Lemon	1,000	2,000	100	1,000
14	Longan	1,000	2,000	2,000	1,000
15	Custard apple	1,000	2,000	2,000	1,000
16	Mak Tong	1,000	2,000	500	1,000
17	Lychee	1,000	2,000	2,000	1,000
18	Kapok	1,000	2,000	2,000	1,000
19	Wild lychee (Makhorland)	1,000	2,000	500	1,000
20	Wild lychee (Makngeo)	1,000	2,000	500	1,000
21	Betel nut	1,000	2,000	500	1,000
22	Star apple	1,000	2,000	500	1,000
23	Pin apple	1,000	2,000	500	500

7-1-4: Fruit

7-1-5: Timber forest products

Ε	Description	seedling cost(kip/kg)	maintenance cost	Unit cost (kip/kg)	
1	Big bamboo(maiphaibane)	1,000	2,000	1,000	big and thin
2	Bamboo(Maisangphai)	1,000	2,000	1,000	small ,thick

7-1-6: NTFP

G	Description	Unit cost ** (kip/kg)
	Rattan, boun shoots	1,000
	Damar resin (kisi)	1,500
	Cardamom	5,000
	Bong bark	1,300
	Mulberry	1,000
	Broom grass	1,000
	Barberrine	1,000
	Pine resin	1,000
	Pantace burmanica	2,000
	Mushroom	2,000
	Vegetables	500
	kadao	1,000
	Bamboo shoot	1,000
	Fruits	1,000
	Custarnea	1,000

G	type of land	basis for cost of lands based on gross productivity	cost per ha				
			kip	US\$			
	rainfed paddy	1,700 kgs/hs yield x 900 kip /kg x 7	10,710,000	US\$1,020			
	irrigated paddy	DS 1,700 kgs/hs yield x 900 kip /kg x 7 plus DS 3,300 kgs/hs yield x 900 kip /kg x 7	31,500,000	US \$3, 000			
	upland rice/corn fields	1,200 kgs/hs yield x 900 kip /kg x 7	7,560,000	US\$720			
	riverbank gardens			US\$400			
	other lands			US\$400			

Note:

• No tax for garden in the river bank (agricultural tax, but they customary keep the garden area for the family like Nam Kathang, but they have to pay the paddy land and other types of land tax for agriculture (Agricultural land tax is lower than the others types of lands)

Annex 7-2: Description of Project Lands in Gnommalath Plain

Regulating Pond and Dam

A summary of total polygon impact assets for LPAs 33, 34, 35 and 36 is shown in Table 7-41.

LPA	No. of Land Areas/Assets	Total Area of Land/Assets (ha)	Productive Area of Land/Assets (ha)	Total No. of PAPS/PAVs
33	59	33.24	23.88	46
34	376	118.48	82.99	342
35	189	61.89	27.30	178
36	13	25.35	2.30	16
Totals	637	238.96	136.47	582

Table 7-41: Summary of Polygon Assets, LPA 33, 34, 35 and 36

Downstream Channel

The normal operational discharge from the regulating pond is $315 \text{ m}^3/\text{s}$. However, the Downstream Channel must allow runoff from surrounding catchments to enter the Channel with the result that the design discharge in the lower reach is $495 \text{ m}^3/\text{s}$. The Downstream Channel can be divided into four distinct reaches. The first two reaches are shown on Figure 7-2 above. Also shown on Figure 7-2 are:

- Project Land Parcels.
- Downstream Channel outlets for irrigation purposes and the various potential irrigation systems that will be described later in this chapter. Also shown is the existing Thathot Irrigation Scheme and the location of five existing pump stations on the Nam Gnom.

Reach 1: From the Regulating Dam, Station 0 to an Aeration Weir at Station 8,270 m.

This Channel reach passes nearly entirely through existing agricultural land. It includes a siphon structure under the Nam Gnom at Station 5,830 located to the west of the Gnommalath District Centre. The reach will be riprap lined to minimise channel width and land taken. The bottom width is 20 m and the total width taken varies from 51 m to 97 m. Land Parcel 38a is the reach from the Dam to the Nam Gnom.

Reach 2: From the Aeration Weir to the Tunnel, Station 8,500 to 17,000 m.

This reach is unlined, will have a slower velocity and hence a wider channel width of 83 m. At about Chainage 8,900, the Channel follows the approximate alignment of the Houay Karma until just upstream of the Tunnel. Land Parcel 38b is the section from the Nam Gnom to Road 12 and Parcel 38c is the section from Road to Tunnel

This upper part of this reach passes nearby or through small areas of existing agriculture. Further downstream the areas are minimal as the Channel approaches the Tunnel. The total width taken varies from 119 m just downstream of the weir to over 173 m.

It is estimated that the rainfed paddy taken by LPA 38a and 38b is 230,298 m² (23.03 ha) and the irrigated land taken is 242,972 m² (24.3 ha), a total of 47.33 ha. It is also estimated that 19 houses or other buildings will be impacted.

Reach 3: From the Tunnel to the XBF, Station 17,700 to 26,900 m.

This is Land Parcel 38d. After the tunnel the channel merges with the Nam Phit at Station 19,600. From the Tunnel to 25,900 the Channel is unlined with a base width of 65 m. The last reach to the XBF is riprap lined with a base width of 40 m. This Channel reach does not pass through any areas of cleared agricultural land. The area suffers from frequent flooding from the XBF and the soils are of poor quality and low fertility.

Other Channel Features

Other Channel features are:

• When the channel cross-section is in both cut and fill, the channel has a top berm (levee or bank) width of 4 and 6 m and a 4 m wide gravel surface inspection and maintenance road is located along the full length of the Channel;

- Because the Channel berms will impede natural drainage of the surrounding areas, the drainage of adjacent land areas has been modified. Hence there are drainage channels excavated outside the channel banks which either drain into the Downstream Channel via inlet structures or pass under the Channel via inverted siphons;
- Also included in the design are road bridges, including one over Road 12 and one to the Thathot Irrigation Scheme and there are eight Agricultural Bridges over the Channel. However the bridges are only 2.25 or 3 m wide with low load limits of 2 or 4 tons; and
- Boat ramps will be constructed at various locations along the Channel.

It is stipulated in the NT2 Owners Requirements that the water level of the 315 m^3/s discharge, in selected sections of the lined channel, is to be above the natural surface to allow irrigation water to be extracted from the channel. The Owners Requirements also state that "the Owner will designate 16 irrigation locations to permit installation by others of irrigation pumps or gravity fed irrigation facilities". The gravity fed facility can be achieved by the installation of gated pipe canal outlet structures also known as turnouts.

Road 8B Improvements

Road 8B improvements will include widening, resurfacing and the installation of improved drainage structures. LP 37 is the section from Gnommalath to the Regulating Dam and is about 5 km long and passes through a continuous area of rainfed paddy. The total road widening will be about 10 m and it is estimated that 46 ha will be temporarily disturbed including about 2 ha of the Thathot Irrigation Scheme described later. However it is estimated that only 5 ha will be permanently lost.

LP 51 is the section south of Gnommalath to the junction of Road 12. The road length is about 5.5 km but only about 3 km passes through paddy areas, about half of which is irrigated. Consequently it is provisionally assessed that only 3 ha will be permanently lost.

Transmission Lines

The 500 kV and 115 kV transmission lines pass through the Gnommalath Plain. There is a 70 m distance between the two centrelines and 330 m between towers for the 115 kV line and 493 m between the 500 kV towers. The 115 kV line tower foundations are 10 x 10 m (100 m² or 0.01 ha) and the 500 kV tower foundation is 15 x 15 m (225 m² or 0.0225 ha).

13 foundations for the 115 kV line are located in rainfed paddy areas taking 0.13 ha. 11 foundations for 500 kV line are located in paddy areas taking 0.25 ha. The total land take is 0.38 ha.

Other Project Infrastructure and Land Parcels

Other less significant Project infrastructure and Land Parcels in the Gnommalath Plain are access roads and construction camps. The construction camps will not take any paddy areas, however the access roads will. The areas are as follows:

- LP 39a Upgrade of about 1 km of access road from Road 8B to the Downstream Channel. It is estimated that about 1 ha of rice fields will be impacted.
- LP 39b Upgrade of about 300 m of access road from Road 8b to the Downstream Channel. It is estimated that only about 0.02 ha of rice fields will be impacted.
- LP 40 Construction Camp
- LP 41 Construction work area
- LP 42 Upgrade of access road from Road 12 to, and including the Phou Phathoung limestone quarry. It is estimated that about 2 ha of rainfed rice fields will be taken.
- LP 43 Not used
- LP 44 Construction Camp
- LP 45 Not used
- LP 46 Construction Camp
- LP 47 New Access Road to Downstream Channel Tunnel. It is estimated that about 2.2 ha of rainfed rice fields will be taken.
- LP 48 Construction Camp

														Provisional	
_								_			Product	Maint.	Maint.	compen-	
Reg.		-	2		Affected			Eco.	Product	Unit	value per	unit	total	sation to be	
ID	Asset No	Family head	Spouse	Area	Asset	Unit	Amount	Life	/Year	price	year	price	cost	paid	Final Compensation
				<i>m</i> 2				Year	Kg	kip	kip				
PK01	GA1a-1	Mr. Khenmanh	Ms. Lome	980						600					588,000 lost land
				1	Chilly	plant	500	1	166	2,000	332,000			332,000	2,324,000 lost productivity
					Corn	plant	200	1	40	500	20,000			20,000	140,000 lost productivity
												Sub-	Total		3,052,000
PK02	GA1a-2 & GA1a3	Ms. Mi		3,570	Cassava					600	2,142,000				2,142,000 lost land
					Cassava	plant	200	1	1,000	200	200,000			200,000	1,400,000 lost productivity
					Sugar cane	plant	50	1	350	100	35,000			35,000	245,000 lost productivity
					Corn	plant	200	1	40	500	20,000			20,000	140,000 lost productivity
												Sub-	Total	255,000	3,927,000
PK03	GA1a-4	Ms. Maivanh		1,925						600					1,155,000 lost land
					Banana	plant	40	1	200	500	100,000			100,000	700,000 lost productivity
					Cassava	plant	500	1	2,500	200	500,000			500,000	3,500,000 lost productivity
					Sugar cane	plant	40	1	280	100	28,000			28,000	196,000 lost productivity
												Sub-	Total	628,000	5,551,000
PK04	GA1a-5 & GA1a-6	Mr. Xiengoune	Ms. Maili	8,040						600	4,824,000				4,824,000 lost land
					Chilly	plant	1,000	1	200	2,000	400,000			400,000	2,800,000 lost productivity
					Corn	plant	4,000	1	800	500	400,000			400,000	2,800,000 lost productivity
												Sub-	Total	800,000	10,424,000
PK05	GA1a- 7,GA1a-8 &GA1a-9	Mr. Soun Sayavong	Ms. Khiane	8,405						600		0	0)	5,043,000 lost land
		1			Chilly	plant	4,000	1	800	2,000	1,600,000			1,600,000	11,200,000 lost productivity
												Sub-	Total	1,600,000	16,243,000
PK06	GA1a-10	Mr. Gnot		2,401						600					1,440,600 lost land
]			Chilly	plant	200	1	40	2,000	80,000			80,000	560,000 lost productivity
					Papaya	plant	20	7	200	500	100,000			100,000	4,900,000 lost productivity
					Corn	plant	30	1	6	500	3,000			3,000	21,000 lost productivity
												Sub-	Total	183,000	6,921,600
PK07	GA1a-11	Xieng Khamta	Ms. Phouangvanh	1,505						600					903,000 lost land
					Casava	plant	100	1	500	500	250,000			250,000	1,750,000 lost productivity
					Sugar cane	plant	50	1	350	100	35,000			35,000	245,000 lost productivity

Annex 7-3: Inventory of losses and calculation of compensation (in case of cash compensation) for PL10a

														Provisional	
											Product	Maint.	Maint.	compen-	
Reg.					Affected			Eco.	Product	Unit	value per	unit	total	sation to be	
ID	Asset No	Family head	Spouse	Area	Asset	Unit	Amount	Life	/Year	price	year	price	cost	paid	Final Compensation
				<i>m</i> 2				Year	Kg	kip	kip				
					Banana	plant	20	7	100	500	50,000			50,000	2,450,000 lost productivity
												Sub-	Total	335,000	5,348,000
PK08	GA1a-12 &	Mr. Khamka	Ms. May	7,529						600					4,517,400 lost land
	GA1a-13														
					Chilly	plant	2,000	1	400	2,000	800,000			800,000	5,600,000 lost productivity
					Banana	plant	25	7	125	500	62,500			62,500	3,062,500 lost productivity
												Sub-	Total	862,500	13,179,900
PK09	GA1a-14	Mr. Hak Vorakoumma ne	Ms. May							600					7,245,000 lost land
					Chilly	plant	200	1	40	2.000	80.000			80.000	560 000 lost productivity
					Corn	plant	500	1	100	500	50,000			50,000	350,000
					00111	plane	000		100	000	50,000	Sub-	Total	130.000	8.155.000
PK10	GA1a-15	Mis Sav		1.260						600		040		100,000	756.000 lost land
				-,	Cassava	plant	350	1	840	500	420.000			420.000	2.940.000 lost productivity
					Chilly	plant	30	1	6	2.000	12.000			12.000	84.000 lost productivity
					Corn	plant	3,000	1	600	500	300,000			300.000	2.100.000 lost productivity
						I ·····	- ,					Sub-	Total	732,000	5,880,000
PK11	GA1a-16	Mr. Khamhome	Ms. Phom	3,093						600					1,855,800 lost land
					Cassava	plant	400	1	1,000	500	500,000			500,000	3,500,000 lost productivity
					Sugar cane	plant	300	1	200	100	20,000			20,000	140,000 lost productivity
					Banana	plant	40	1	40	500	20,000			20,000	140,000 lost productivity
												Sub-	Total	540,000	5,635,800
PK12	GA1a-18 , GA1a-19	Mr. Gnai Inthilath	Ms. Chanesamone	17,371						600					10,422,600 lost land
					Banana	plant	100	1	2,500	500	1,250,000			1,250,000	8,750,000 lost productivity
					Cassava	plant	400	1	2,400	500	1,200,000			1,200,000	8,400,000 lost productivity
					Vegetables	plant		1	700	500	350,000			350,000	2,450,000 lost productivity
					Pine apple	plant	100	1	50	500	25,000			25,000	175,000 lost productivity
					Chilly	plant	2,000	1	150	2,000	300,000			300,000	2,100,000 lost productivity
					Linmay	plant	100	3	35	500	17,500			17,500	367,500 lost productivity
												Sub-	Total	3,142,500	32,665,100
PK13	GA1a-20	Mr. Noi	Ms. Liang	13,500						600					8,100,000 lost land
					Banana	plant	20	1	150	500	75,000			75,000	525,000 lost productivity
					Cassava	plant	400	1	2,400	500	1,200,000			1,200,000	8,400,000 lost productivity

Reg. ID	Asset No	Family head	Spouse	Area	Affected Asset	Unit	Amount	Eco. Life	Product /Year	Unit price	Product value per year	Maint. unit price	Maint. total cost	Provisional compen- sation to be paid	Final Compensation
				<i>m</i> 2				Year	Kg	kip	kip				
					Pine apple	plant	30	1	25	500	12,500			12,500	87,500 lost productivity
					Mango	plant	10	1	0	1,000		2,000	20,000	30,000	0 lost productivity
												Sub-	Total	1,317,500	17,112,500
PK14	GA1a-21	Mr. Khamsay	Ms. Tonsy	3,015						700					2,110,500 lost land
												Sub-	Total	0	2,110,500
PK15	RF1a-2	Mr. Visiene	Ms. Khouane	7,450						700					5,215,000 lost land
												Sub-	Total		5,215,000
PK16	RF1a-3	Mr. Air	Ms. Bouakeo	1,000						700					700,000 lost land
					rice	kg		1	1,000	700	700,000				4,900,000 lost productivity
	GA1a-22			1,734						700					1,213,800 lost land
					Fence post	pcs	500			2,000					1,000,000 lost asset
												Sub-	Total		7,813,800
PK17	GA1a-23	Mr. Sokane Malavanh	Ms. Katkeo	1,800	700					600					1,080,000 lost land
												Sub-	Total		1,080,000
				96,653										10,525,500	150,314,200

Annex 7-4: Description of irrigation areas which could potentially be developed in the Gnommalath Plain using Irrigation waters from the Nam Theun 2 Project

The potential area of irrigation scheme development in the whole Gnommalath Plain, using the Regulating Pond and the downstream channel as the source of irrigation water, is summarised in Table 7-42, and mapped in Figure 7-2 above.

Table 7-42:	Summary	of all	areas	that	could	be	developed,	to	full	potential,	in	the	Gnommalath
Plain.													

		Estimated	Approximate Locations	
	Total Area	Irrigation	of Downstream Channel	
Area	(ha)	Area (ha)	Turnouts/Outlets	Remarks
1	1,860	1,250		Water from Regulating Dam Irrigation Release
2	380	300	0+400, 2+200	Turnouts on right bank (looking downstream)
3A	200	180		A. Thathot Irrigation Scheme.
3B	100	70		B. Scheme extension on right bank of Nam
				Gnom
4	800	550	0+700, 2+700, 3+300	4 lower turnouts to re-establish water to
			4+050, 5+560	Thathot scheme canals.
				Turnouts on left bank.
5	10	10	6+100	Turnout on right bank
6	1,120	700	6+550	Turnouts on left bank to connect with existing
			6+940	Nam Gnom Pump Irrigation Scheme canals
7	200	30	7+400	Turnout on right bank
8	1,030	430	11+600	Turnout on left bank
9	770	600	12+000	Turnouts on right bank
			13+800	
Totals	6,470	4,120	14 Turnouts	

<u>АREA 1: 1,860 на</u>

General

This area will only be impacted by a short length of the Transmission Line. Water from the Regulating Dam irrigation release can irrigate the area. The total area is about 1,860 ha and the land is gently sloping in a north-south direction.

Regulating Dam Irrigation Release

The irrigation release is a 2 x 2 m opening in the concrete wall with flow volume controlled by a standard AVIO gate and a regulating valve. The maximum design discharge of the outlet is 5 m^3/s and a canal located downstream will command downstream areas below elevation 170.50.

At 4 l/s/ha, the Regulating Dam irrigation release of 5 m³/s can irrigate an area of 1,250 ha. This is considered a large enough area to be developed and will require a significant community development input so that all the villages work together to effectively operate and maintain the scheme.

Canal System and Pump Station

The canal system comprises of a Main Canal (MC), about 6 km long, flowing from the Regulating Dam irrigation release in a north-south direction, mostly parallel to the Nam Kathang and stopping near to Ban Nafaimai. The MV supplies six secondary canals of total length about 22.5 km, which distribute water throughout the area.

A pump station will be required to lift water about 10 m from the MC to the first secondary canal (SC1) which can command an area of about 450 ha located below the El. 180 m contour. The discharge at the head of the canal will be about 1.8 m³/s. The pump station will need two centrifugal pumps of power 175 kW each to lift the water. An electric supply will be required.

<u>AREA 2: 380 HA</u>

General

Area 2 is located to the west of the Downstream Channel and to the north of the existing Thathot irrigation scheme. The area includes a reach of the upper Nam Gnom and a small tributary to the Nam Gnom.

The area is estimated to be about 380 ha and is gently sloping in a north-south direction from the El. 190 m contour along the northern boundary to about El. 169 north of the access road. Most of the area has been developed for rainfed paddy. The area to the west of the Nam Gnom is less cleared. The area includes two villages and there are some areas of forested hills and tracks to the two villages in the area. Hence an irrigation area of 300 ha has been assumed.

The land taken by Downstream Channel construction to the east of Area 2 is estimated to be about 18 ha.

Irrigation Systems

1. Northern Part of Area 2

The northern area is about 200 ha. The northern area is supplied by a Turnout located at about Downstream Channel Station 400 m. However a pump station will be required to lift the water about 18 m to a canal (MC1), about 4 km long, located along the El. 190 m contour with a discharge of 0.8 m³/s. Two centrifugal pumps of power 150 kW each will be required to raise the water.

2. Southern Part of Area 2

The southern area is irrigated by the second Turnout which is located at the first location on the Channel where the Channel water elevation can command an adjacent area. This location is around Station 2,200 near Ban Nongseng. Here, the Channel turnout can irrigate an area of about 100 ha by a canal (MC2), about 1.7 km long, located along the El. 170 m contour. This canal can also deliver water to the upper catchment of the Nam Gnom and hence supplement the supply to the southern Thathot irrigation scheme and a possible extension of the scheme, and extra 250 ha. Consequently the discharge should be increased accordingly to about 1.4 m³/s.

Replacement Land for Land Taken by Channel Construction

With regard to the 18 ha of paddy land taken by the Downstream Channel. The only available area where replacement land can be found is the most north-western part of Area 2, on the right bank of the upper Nam Gnom. Part of this area has already been developed but there are areas that have not.

AREAS 3A AND 3B, THATHOT IRRIGATION SCHEME

Area 3A, Existing Irrigation Scheme

Area 3A is the existing Thathot irrigation scheme and is located west of the Downstream Channel. The total area after construction of the Downstream Channel will be about 200 ha, but after subtracting area lost for the villages, irrigation canals and tracks, an area of 180 ha is more likely. It is estimated that 45 ha of the irrigation scheme will be lost by Channel construction.

The existing scheme serves eight villages. The scheme has a concrete weir with a 50 m crest length and 2 sluice gates. The main canal intake comprises of two gates located about 180 m upstream of the weir. The main canal conveys water to two secondary canals which is then conveyed to a series of tertiary canals.

The area can benefit from extra water supplied via the above Area 2 MC2. Some rehabilitation of the weir, existing canals and access road may be required.

Area 3B, Irrigation Scheme Extension

To replace the 45 ha irrigation area taken by Downstream Channel construction it is proposed to study an extension of the Thathot Scheme. There is an area of about 104 ha below the existing weir on the right bank between the western hills and the Nam Gnom. The Nam Konkouang would be the southern perimeter of the scheme. The area is gently sloping in a north-south direction and a canal located along the base of the hills should command most of it. Parts of the area have already been cleared and developed for paddy.

If topographic survey shows that the existing Thathot weir cannot command the area, then the construction of a diversion weir on the Nam Konkouang can be studied. The maps show the stream starting at the foot of the mountains so it is assumed that a spring is the stream source. Springs such as this generally have a perennial discharge.

<u>Area 4: 800 ha</u>

General

There are eight existing villages in Area 4 which is the area central of Areas 1, 2 and 3. Much of the area is farmed and part of the area includes the Thathot Irrigation Scheme canals and land that have been cut from their water supply by the Downstream Channel. The total area is near 800 ha but after deducting areas lost by Road 8B, villages, existing streams, Transmission Line footings etc., an area of 550 ha has been considered.

Irrigation Systems

It is proposed to locate five gated pipe turnouts to take water from the Downstream Channel. The most upstream canal inlet will be located on the channel at about Station 700. This will be the largest and will irrigate the northern most area including the area east of Road 8B.

Four turnouts will be located further down the channel at Stations 2,700, 3,300, 4,050 and 5,650. These structures will be located to reestablish the water supply to the Thathot irrigation scheme canals that have been cut by the Downstream Channel. In this channel reach the channel design water elevation is significantly above the natural ground with no problems involved with the command of the adjacent areas.

AREA 5: 10 HA

Area 5 is a small area of about 10 ha that is already irrigated by the Gnommalath Pump Irrigation Scheme. However the Downstream Channel will cut off the supply from the pump station and will also take about 13 ha of the irrigation scheme.

The supply to the area can be re-established by the installation of a gated pipe turnout at Channel Station 6,100. However it is difficult to identify a 13 ha replacement area in the immediate vicinity because the high ground to the south and west restrict extending the area. It may be possible to extend the area by 1 or 2 ha, but 13 ha are not possible.

<u>AREA 6: 1,120 на</u> General

Area 6 is located south-west of the Gnommalath District Center. It is the area where there is a transition from extensively cleared agricultural areas in the north to few cleared areas in the south. As stated previously, this is probably due to a mix of poorer soils, undulating land and flood prone areas.

Road 8B passes through the area and there are also some areas of high ground adjacent to this road. The total area is around 1,120 ha, however after deducting significant areas lost for villages, high ground, ponds, Transmission Line footings etc., an area of 700 ha could be considered.

Irrigation Systems

Irrigation water can be taken from the Downstream Channel by the installation of two turnouts. The upper structure, at Station 6,550, will re-establish water into the Gnommalath Pump Irrigation Scheme. The second outlet is at 6,940 intended to irrigate the more southern areas. It is difficult to locate more outlets further down the Channel because of small karst outcrops on the left side of the Channel.

<u>AREA 7: 200 HA</u>

Area 7 is an area to the south east of Gnommalath. The area is mostly uncleared but has some dispersed paddy areas estimated to be around 30 ha. It is bounded by hills to the north, the Downstream Channel to the east and more hills to the south and west. The area can be irrigated by a turnout structure located at Station 7,400 on the Downstream Channel.

<u>AREA 8: 430 HA</u>

Location and Description

There are over 1,000 ha of land located south of Road 12 and east of the Downstream Channel where the Channel mostly follows the alignment of the Houay Karma.

The eastern part of this area is sloping from high ground towards the Downstream Channel. At first the slope is significant but as the land approaches the Houay Karma it becomes flat. Therefore it is assumed that the natural drainage of the area is generally poor and perhaps explains why few areas have been cleared for rainfed paddy. However the wet season natural drainage should be improved by the NT2 construction of a new drainage channel alongside the Downstream Channel and would be improved further by the further excavation of drains in the area. The area of the flat land is about 480 ha and after deducting land lost for the construction of access tracks, canal and drains, an irrigation area of about 430 ha should be considered.

Another possible reason for the limited development of the area is that the soils are (as described in a 1996 report prepared for NTEC):

- Silt to clay loam surfaces overlying clay to gravely clay, and
- Acid silty clay loam overlying silty clay with shallow depth to bedrock.

The second soil classification describes a poor soil type and further soil investigations are required to identify the areas of soils suitable for irrigation development.

Pump Station

A gravity supply direct from a Turnout, located at Station 11,600 – immediately downstream of the Road 12 bridge over the Channel – to the area is not possible and the inclusion of a pump station is necessary. Pumping along an 80 cm diameter, 1.4 km long, steel pipeline to an outlet located adjacent to Road 12 can command the 430 ha area. The discharge would be about 1.7 m^3/s and two centrifugal pumps of power 200 kW would be required.

Canal System

A 4 km long MC taking water from the stilling basin located alongside Road 12 and flowing in a northsouth direction would command the area. The canal would prevent runoff from the eastern hills from entering the Downstream Channel. However a drainage channel could be excavated parallel to the canal and the excavated material used for canal fill if found suitable.

The layout of the tertiary blocks depends on the topography of the area and the location of the areas of better soils.

<u>АREA 9: 770 на</u>

Location and Description

Area 9 is located west of Area 8 and west of the Downstream Channel and Road 12 passes through the area. The area includes large rock outcrops, one of which will be quarried for NT2 construction. However it also includes quite extensive areas of cleared agriculture land, estimated at least to be about 600 ha. The area is irregularly shaped, pointed at the northern end and widening to the south.

There are three villages in the area which, apart from the rock hills, is nearly flat to very gently sloping in a north-south direction but with drainage lines towards the Houay Karma.

Location of Downstream Channel Turnouts

Given that the area is relatively flat, the dispersed nature of the paddy areas and none availability of topographic survey and mapping, it is difficult to be certain whether the installation of turnouts from the Downstream Channel can command the area. However, the water in the Channel is a resource that should not be wasted and two turnouts have been provisionally located.

The first turnout should be located just downstream of the planned Construction Camp at Station 12,000 to attempt to irrigate the northern paddy areas. The second turnout No. 2 should be located close to an Agricultural Bridge at Station 13,800 so that the irrigation canal can be located alongside an access road in the area.