1.0 EXECUTIVE SUMMARY

1.1 Project and Public Purpose

Velcan is an investment group and independent power producer developing and operating hydroelectric concessions in countries such as India, Indonesia and Brazil. Velcan is headquarter at Luxemburg and operates administrative and financial offices in Singapore, Mauritius and Dubai. In India Velcan Energy (India) has its main office in New Delhi, and have local offices and operations at Itanagar, Aalo and Mechuka.

The Tato-I HE Project is one of the 3 schemes located on the Yarjep (Shi Shito) River and entrusted to Velcan Energy Group by the Government of Arunachal Pradesh for implementation of the Project vide MoAs signed on 30th June 2007 and 31st July 2009. The two other projects developed by Velcan Energy Group on the Yarjep (Shi Shito) River are Pauk HEP and Heo HEP. M/s Siyota Hydro Power Private Limited (SHPPL) is wholly owned by Velcan Energy Group, is now the Special Purpose Vehicle dedicated to the development of the Tato-I HEP on Build Own Operate Transfer (BOOT) basis.

Tato-I Hydro Electric Project is the most downstream project of a cascade of three projects developed by M/s Siyota Hydro Power Private Limited in Mechuka and Tato circles. It is a run of the river scheme proposed on Yarjap (Shi) River near Tato and Heyo villages in West Siang district of Arunachal Pradesh (near the confluence of Yarjap (Shi Shito) and Siyom rivers). The Tato-I HEP will have an installed capacity of 186 MW of power potential by utilizing a gross head of 164 m. It is located immediately downstream of the Heo Hydroelectric Project and largely utilizes its discharged water (130.2 cumecs) along with additional discharge (2.8 cumecs) accumulated by the Yarjap (Shi Shito) tributaries between Heo Dam and Power House.

Tato-I HEP is a slave project to Heo because directly connected to the Power house outlet of Heo HEP Master project. The additional flow used to reach the design discharge of Tato-I is tapped from the riverbank into a transverse water intake. The water is then routed through an 1100 m long channel along the terrace of Meying village area. At the end of the channel, the flow is fed into a pressurized tunnel. The headrace tunnel runs on 3.9 km up to the terminal part of the scheme. The flow is then routed to the turbines through a pressure shaft. All components of the project are situated on the left bank of the Yarjep (Shi Shito) River with nearly 3.9 kilometers long head race tunnel followed by an open to sky surge shaft and a surface power house near Heyo village (opposite to Tato village). It is situated along side of the road connecting Aalo and Mechuka.

A detail of salient features of Tato-I H.E. Project is given in Table: ES 1. Detailed layout plan of Tato-I H.E. Project indicating the location of various project components is given in **Figure: ES 1.**

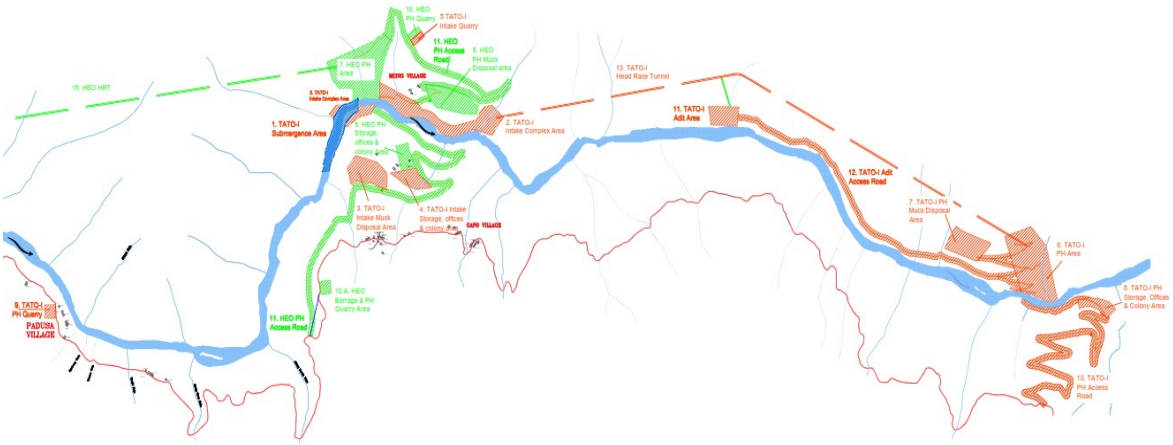

Figure: ES 1 - Tato-I HEP across Yarjep (Shi Shito) river

Table: ES 1- Salient features of Tato-I H.E. Project in West Siang district of Arunachal Pradesh

1.	**LOCATION**	
(i)	State	Arunachal Pradesh
(ii)	District	West Siang
(iii)	Village	Gapo
(iv)	Access Road	Road from Tato to Mechuka
(v)	Geographical Coordinates of Water Intake	
	Longitudes	94°18’43’’E
	Latitudes	28°32’32’’N
(vi)	Geographical Coordinates of Power house	
	Longitudes	94°21’31’’E
	Latitudes	28°31’53’’N
2.	**HYDROLOGY**	
(i)	Catchment area at the water intake (km^2)	1 154
(ii)	River	Yarjep (Shi Shito) River
(iii)	Average Annual Rainfall (mm)	2 621 mm
(iv)	Min-Max temperature (°c)	1°c – 40°c
(v)	Min-Max humidity (%)	39% - 100%
(vi)	PMF (m^3/s)	4100
(vii)	SPF (m^3/s)	3400
3.	**TRENCH WEIR**	
(i)	Type	Raised trench weir
(ii)	Length of Weir	55m
(iii)	Weir Top	1195.50 m and 1197.0 m
(iv)	River Bed Level	1188 m

(v)	Maximum Weir height above riverbed level	7.5 m and 9.0 m
4.	**INTAKE CHANNEL**	
(i)	Length	115 m
(ii)	Width	2.0 m
(iii)	Depth	3.0 m
(iv)	Design discharge	10 m^3/s
5.	**SHINGLE FLUSHING DUCT**	
(i)	Type	Concrete box
(ii)	Size	1.5 m(W) x 1.83 m (H)
(iii)	Length	89 m
6.	**HEAD RACE CHANNEL**	
(i)	Type	Concrete box
(ii)	Shape	Rectangular
(iii)	Length	840 m
(iv)	Width	6.6 m
(v)	Depth	5.0 m to 7.53 m
(vi)	Design discharge (m^3/s)	132.88 m^3/s
(vii)	Invert Level (m) at inlet at Chainage Zero	1180 m
(viii)	Invert Level (m) at the end of ramp just upstream of Inlet of Head Race Tunnel	1174 m
7.	**LATERAL ESCAPE WEIR**	
(i)	Chainage	From 550 m to 634.5 m
(ii)	Crest Length	84.5 m (75 m clear width)
(iii)	Crest Level	EL 1189.30 m
(iv)	Design discharge (m^3/s)	132.88 m^3/s
8.	**INTAKE STRUCTURE AT INLET OF HEAD RACE TUNNEL**	
(i)	Invert Level	EL 1174 m
(ii)	Level of Trash Rack Cleaning Machine operating platform	EL 1193.50 m
(iii)	Size of Trash Rack	4 number each of 3 m width x 19.5 m height
9.	**HEAD RACE TUNNEL**	
(i)	Length	3641 m
(ii)	Shape (Excavated)	Modified inclined legs horse shoe
(iii)	Shape (Finished)	Circular
(iv)	Diameter (m)	6.5 m
(v)	Design discharge (m^3/s)	132.88 m^3/s
10.	**ADIT**	
(i).	Type	D-Shaped
(ii).	Adit-1 to HRT	6.0 m x 6.0 m, Length=199 m
(iii).	Adit-2 to Bottom of Surge Shaft	7.5 m (W) x 8.0 m (H),

		Length=135 m and 6.0 m (W) x 6.0 m (H), Length=88 m
(iv).	Adit Top of surge shaft	6.0 m x 6.0 m, Length=72 m
(v).	Connecting Adilt tovalve house Bottom	48.0 m
(vi).	Connecting Adilt tovalve house Top	147.0 m
(vii).	Connecting Adilt to Bottom of Pressure shaft	7.5 m (W) x 8.0 m (H), Length=170 m
11.	**SURGE SHAFT**	
(i)	Type	Restricted Orifice
(ii)	Diameter (m)	15.5
(iii)	Orifice Diameter (m)	4.0
(iv)	Vertical height (m)	73
12.	**VALVE HOUSE**	
(i)	Type	Underground
(ii)	Length	20.25 m
(iii)	Width	11.0 m
(iv)	Height	17.0 m up to top of Crown
(v)	Number of Valves	1
(vi)	Diameter	5.75 m
13.	**PRESSURE SHAFT**	
(i)	Number	1
(ii)	Type	Underground Steel lined
(iii)	Internal Diameter	5.75 m
(iv)	Length	495 m
(v)	Thickness (mm)	Varies from 16 mm to 40 mm
(vi)	Grade of Steel	ASTM 537 Class-II
14.	**UNIT PENSTOCK**	
(i)	Number	3
(ii)	Diameter (m)	2.4
(iii)	Length (ml	Average 20 m each
(iv)	Thickness (mm)	20 mm
(v)	Grade of Steel	ASTM 537 Class-II
15.	**POWER HOUSE**	
(i)	Type	Surface
(ii)	Head (m)	
	a. Gross Head (m)	164 m
	b. Net Head (m)	153.3 m
(iii)	**Size of power house:**	
	a. Length (m)	80 m
	b. Width (m)	19.6 m
	c. Height (m)	33.38 m
(iv)	Installed capacity (MW)	186 (3 x 62 MW)

(v)	Turbine (s):	
	a. Type	Francis vertical
	b. Number	3
	c. Turbine C/L Elevation	El 1018.22 m
	d. Min Tail Water Level	El 1023.22 m
	e. Normal Tail Water Level	El 1025 m
16.	**GENERATOR STEP-UP TRANSFORMERS**	
(i)	Number	10 (including one spare)
(ii)	Type	Single Phase
(iii)	Capacity/Rating	25.5 MVA
(iv)	Voltage	11 kV/ 220/√3 kV
(v)	Location (Elevation)	EL 1034 m
17.	**POTHEAD YARD**	
(i)	Outgoing Lines	220Kv Double circuit Line
(ii)	Size	80 m x15 m (Approx)
(iii)	No. of Bays	4 (including space for two future Bays)
18.	**GIS HALL**	
(i)	Bus Arrangement	Double bus with bus coupler
(ii)	Size	45 m x15 m (Approx)
(iii)	Voltage	220 kV
(iv)	Type	GIS
(v)	No. of 220 kV bays	8 (3 Generating bays, 2 outgoings bays, 1, bus coupler bay, 1 Bus Reactor Bay, 1 Station Transformer Bay)
(vi)	Space for spare bays	2 nos. in GIS area
19.	**TAILRACE**	
(i)	Type and Shape	Open Rectangular Channel
(ii)	Length from center line of units (m)	34.0 m
(iii)	Number of draft-tube gates	3
(iv)	Size of draft Tube gates	6.4m (W) x 3.5 m (H)
(v)	Sill Level of Draft Tube Gates	EL 1013.00 m
20.	**CONSTRUCTION PERIOD**	
(i)	Total construction period	50 months
(ii)	Commissioning of units	48 months
	Unit-1	49 months
	Unit-2	50 months
	Unit-3	
21.	**POWER &ENERGY BENEFITS**	
(i)	Installed capacity (MW)	186 MW
(ii)	Annual energy (M U)	822.08

(iii)	Design energy (M U)	802.59
(iv)	Load factor (%)	50.45 %
22.	**COST (as per TEC)**	
(i)	Hard Cost (Sept 2014 P.L) (Rs. Crores)	982.56
(ii)	Hard Cost per MW (Rs. Crores)	5.28
(iii)	Completed Cost including Escalation, IDC, Financial Charges (Rs Crores)	1493.55
(iv)	Completed Cost per MW (Rs Crores)	8.03
(v)	Levelized Tariff at completion cost (Rs/kWh)	4.40

The construction of Tato-I Hydro Electric Project is classified in ***Section 2 (I)(b)(i)*** i.e. all activities or items listed in the notification of the Government of India in the Department of Economic Affairs (Infrastructure Section) number 13/6/2009-INF dated 7th October, 2013 listed under Annexure 1 "Updated Harmonized Master List of Infrastructure Sub-Sectors" under category Energy and Infrastructure sub-sector Electricity Generation, for public purpose according to the RTFCTLARR ACT 2013.

1.2 Location

The project is located in the Tato and Mechuka circles of West Siang district in Arunachal Pradesh as shown in Figure ES 2. Tato is a central village of the area, which is about 132 km from Aalo, the district headquarters. The intake site is downstream of Meying village (opposite to Gapo village) located between 28^0 32' 32''N latitude and $94^0$18'43''E longitude. Its power house site is upstream of Heyo village located between 28^0 31'53''N latitude and $94^0$21' 31''E longitude. The Tato-I hydroelectric project site is accessible through a motor able road from Aalo up to Gapo village, at a distance of about 148 km. The project site connected to National Highway-52 at Aalo via state road (Tato – Aalo), and is about 298 km from Akajan in Assam or about 252 km from Pasighat (Akajan to Pasighat NH-52 distance 103Km). For Tato-I project the nearest broad gauge rail head is at Silapathar (Approx. 296 km) and extending railroad upto Pasighat is under construction. From the project site, the nearest operational airport is 441 km, located at Likhabali in North Lakhimpur district of Assam and the nearest international airport is 830 km located at Guwahati, the capital city of Assam.

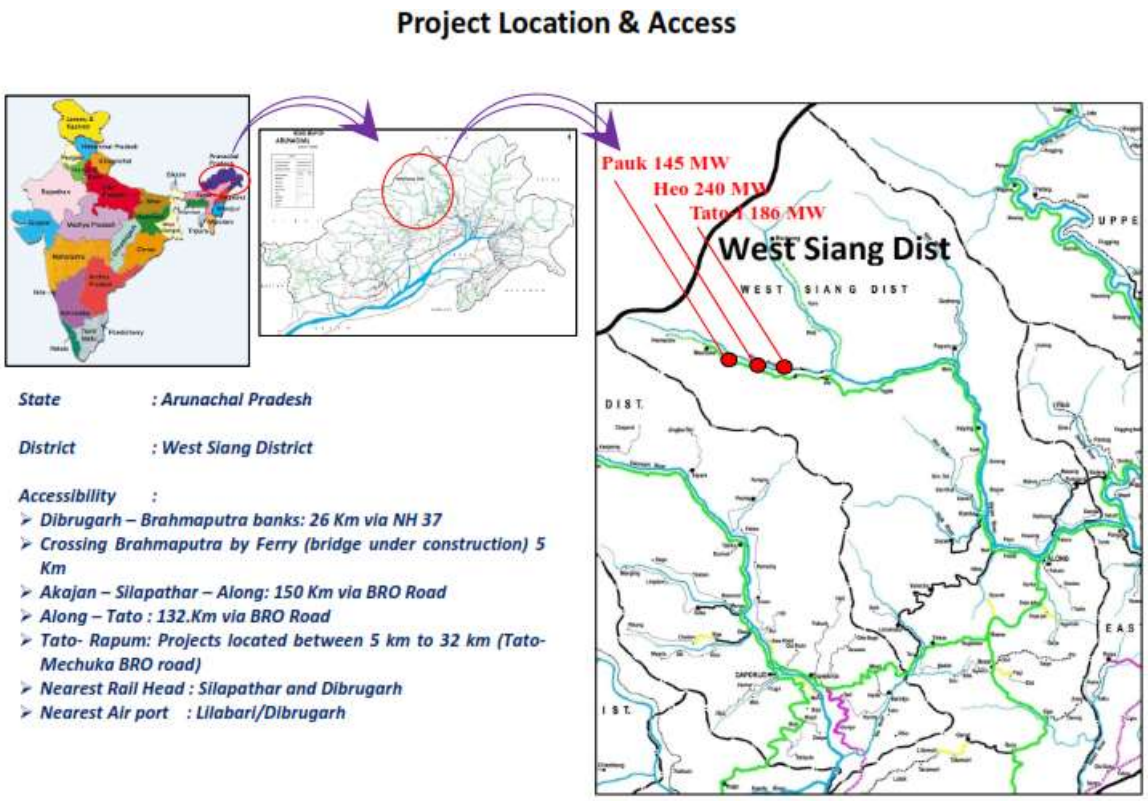

Figure : ES 2–Location Map & Access to Tato-I HEP

1.3 Size and Attributes of Land Acquisition

Total land required for the various components of Tato-I H.E. project is 52.8 ha, in which 47.7 Ha is surface land, 2.3 Ha is riverbed and 2.8 Ha is underground. The entire land is categorized as Unclassified State Forest/Community Forest land as shown in Table: ES 2. The total submergence area is 3.0 ha including 1.8 ha of riverbed and 1.2 ha of surface land. The impacted surface & including river bed is 50.0 ha

Table : ES 2- Project component wise break up of land in Tato-I H.E. Project

S.No	Project Component	Surface Area (Ha)		Underground Area (Ha)	Total Area (Ha)
		Surface Land	River Bed		
1	Submergence area	1.2	1.8		**3.0**
A	**Surface Structures**				
2	Intake complex area	8.2	0.5		**8.7**
3	Intake Muck Disposal area and construction platform	3.2			**3.2**

S.No	Project Component	Surface Area (Ha)		Underground Area (Ha)	Total Area (Ha)
		Surface Land	River Bed		
4	Intake Storage and Colony area	1.7			**1.7**
5	Intake Quarry site	0.3			**0.3**
6	Power House Area (including penstocks and Tail Race)	8.8			**8.8**
7	PH Construction Platform and Muck Disposal	3.2			**3.2**
8	PH Storage Area, Office and Colony	1.4			**1.4**
9	PH Quarry Site	0.5			**0.5**
10	PH Access Road	10.7			**10.7**
11	Adit Area	1.9			**1.9**
12	Adit Access Road	6.6			**6.6**
	Total of surface area	47.7	2.3		**50.0**
B	**Under Ground Structures**				
13	Head Race Tunnel (including Adit tunnels)			2.8	**2.8**
	Total	**50.0**		**2.8**	**52.8**

The project is located in Tato and Mechuka administrative circles of West Siang with total surface land requirement including riverbed is 50.0 Ha. The total surface land including riverbed in affected villages for which the land acquisition has been initiated under LA R&R Act, 2013 are as under:

Table : ES 3- Affected Village wise Land Requirement

S.No	Name of Village	Surface Land (Ha)	River Bed (Ha)	Total (Ha)
1	Tato HQ (W)	10.30	0.0	10.30
2	Heyo	22.30	0.0	22.30
3	Gapo	6.30	1.15	7.75
4	Meying	8.30	1.15	9.45
5	Padusa	0.50	0.0	0.50
	Total	**47.70**	**2.30**	**50.00**

1.4 Alternatives Considered

There is no known other alternative to generate electricity with such capacities in area, where the potential resides in hydropower. Hydropower being site specific no alternative has been identified to generate 186 MW power in the area. However, the Developer has been requested to describe the design / technical alternatives envisaged for the project.

1.4.1 Intake

Regarding the intake site, the Developer has informed that various locations for weir site have been worked out in the preliminary stages. Two sites have been particularly investigated. The selected site is the most upstream one. The selection of site is mainly based on the geological and economical reasons. In the alternative option located 500 m downstream, a landslide has been identified in the weir site area leading to important excavations and soil consolidation. In the upstream option, geological and geotechnical investigations showed that bed is apparent at the surface on the right and left banks. Moreover, a technical and economical optimization leads to the selection of the most upstream solution. The submergence is also less, and almost totally confined within the river bed of the river. The upstream option presents quite limited impact on both local activities and environment.

Additionally, the valley at the intake site of upstream option is much narrower than the valley at the downstream option. Thus, topography and geological constraints are favorable to the upstream option. The upstream option is the better one regarding geological, socio-environmental and cost effective issues. Both local topography and geology allow the construction of a concrete weir with overflowing spillway. Construction schedule has been worked out in order to minimize the cost of diversion works. Main structures shall be constructed during lean season, work area being protected from the flows by rock and earth-fill cofferdams. In this way, no diversion tunnel is required.

1.4.2 Power House

Regarding the power house site, the Developer has informed that there is only one option for location of a surface power house due to topographical reason. The power house is located nearby Heyo village area, on the left bank, with no impact on houses and habitation. The head race tunnel is located on the left bank valorizing the natural available head between the Meying and Heyo villages. The Head Race Tunnel is crossing various layers of suitable rocks, mainly banded gneisses.

1.5 Social Impacts

The social impact for the acquisition of land for the construction of proposed (186 MW) Tato-I Hydro Electric Project has been classified as:

- ✓ Impact during Pre- construction stage.
- ✓ Impact during Construction Stage.
- ✓ Impact during Operation stage

The main aim of the Social Impact Assessment is to identify the project specific impacts and some of impacts have already been identified in Tato-I EIA report, which are the basis to frame a Social Impact Management Plan which will ensure that the various adverse impacts are mitigated and the positive impacts are enhanced. The social impact management measures shall be implemented during the various stages of the project viz. Construction Stage and Operational Stage. A description of the various impacts is identified during different stages of construction, which is presented in Table 7.1.

Table :ES 4- Identification of Social Impacts at different stages

Pre-construction	Construction	Operation
Acquisition of land Acquisition of trees Construction activities of access roads, colonies, offices and stores, movement of vehicular movement may enhance noise and dust/air pollution. Change in scenic beauty of landscape Influx of migrant population related to construction activities begins. Generation of water and solid wastes Enhancement of Commercial establishments to meet need of additional people and construction activities	Change in land environment Migrant population estimated as 1160 population at peak construction stage Increase in vehicular movement, machinery and deployment of DG sets Dust and noise pollution Change in water quality Increase in water waste and solid waste Human health and visual impacts Fuel Social evil activities and new diseases. Better employment and business opportunities for locals.	Depletion of migration workers during construction. Demolition of temporary camps Green belt development restoration of quarries. Beautification of project area Work force required for maintenance and operation of Project stays in permanent colonies, offices and stores. Social Development Economic Development Infrastructure development Improvement of quality of life Livelihood opportunities and self-employment. Benefits extended under LADF are permanent. Uninterrupted power supply, infrastructure and

Job opportunities to locals	Technical enhancement of such as communication system, modern facilities of life styles. Better social qualities due to cultural fusion.	communication facilities to surrounding villages will lay new opportunities.

Total number of landowners in the project area referred to as Project Affected Families is 105 nos. Most of the people of the area are dependent on Community Forest Land for their livelihood and Forest produce collection. The impact on livelihood could be mitigated with the intervention of Rehabilitation measures as per the RFCTLARR Act 2013 and Mitigation measures under the Environment Act as already committed by the developer. Further explorative technique has been used to assess social impacts on families, understand social and demographic profile the project affected families.

In view of social impacts, rehabilitation of the PAFs has been proposed. During site social survey, choice and desire of affected people have also been collected through survey questionnaires. Mitigation measure of the adverse impacts shall be following:

- Payment of compensation for lost asset as per LARR Act, 2013
- Preference to the landowners in getting jobs during project construction period as per MoA entered between GoAP and project developer.

1.6 Mitigation Measures

It appears from the analysis and overview of the provisions of compensation for land acquisition under RTFCTLARR, 2013 will be sufficient to manage the social issues.

In addition to compensation for land, Rehabilitation package for the affected families and Compensation against Diversion of Unclassified State Forest (USF) as per applicable Govt. of Arunachal Pradesh Rehabilitation & Resettlement Policy, 2008

Table : ES 5- Analysis of the Various Possible Social Impacts

S.No	Type of Impact	Status	Mitigation Measures
1	Loss of land	Yes there will be loss of land and is direct impact.	Compensation as per RFCTLARR Act, 2013 and Rules 2015
2	Livelihood and Income	This is an indirect impact. At	Compensated in

		present no livelihood activity exists on proposed land under acquisition except some forest produce if any	R&R procedures as per RFCTLARR and Rule 2015.
3	Physical Resources	Change in land environment Change in scenic beauty Noise and dust pollution Deterioration of water quality Generation of water and solid waste Influx of migrant workers during construction Pressures on Fuel wood	Mitigation measures as per Approved Tato-I EMP recommendation
4	Private Assets	There are houses in affected villages, but not falling in land required for acquisition. However, there are trees, which can be considered as assets	Project affected and nearby villages private assets of locals will be increased to meet demand during construction and maintenance stage
5	Public Services and Utilities	There is no loss on any public services and utilities. Instead infrastructure facilities including communication system will be increased with better amenities.	Good road connectivity by BRO and developer (project internal roads) and communication system will be established.
6	Health	There will be no possible negative impacts on health to land owners and surrounding villages due to construction activities	Mitigating measures were discussed in Public Heath Management chapter of Approved Tato-I EMP

1.7 Assessment of Social Cost and Benefits

Though, it is very difficult to quantify actual cost of social impact based on severity of land acquisition. However efforts were made to minimize negative impacts through intervention of R&R measures. However, the project will entail a multitude of benefits to

the entire area. The project will have following benefits for the people:

Social costs are calculated by comparing project benefits and negative impacts, from construction of Tato-I HEP in Mechuka sub-division of West Siang District of Arunachal Pradesh. The compensation of land as per RFCTLARR Act & Rules towards land acquisition for the development of proposed project, LADP as per Hydro Policy and GoAP RR policy will be the benefits to the affected families/persons.

Positive and negative aspects of the project have been discussed in detail in the following Table no: 8.1

Table: ES 6- Comparative Analysis of Positive and Negative Impacts

S.No	Positive Impact	Negative Impact	Remarks
1	Enhanced payment towards land acquisition	Loss of Community Forest land	After careful examination of various parameters of cost and benefit of positive and negative impacts, it is found that the project would come as a net benefit the locals community to a large extent
2	Social Development		
3	Infrastructure Development		
4	Economic Development		
5	Improvement of quality of life		
6	Employment generation		

This project will help the local people in infrastructure development, social development and will increase livelihood opportunities & self-employment sources.