

# ENVIRONMENTAL IMPACT ASSESSMENT FOR DHAMWARI SUNDA H.E PROJECT (2 x 35 MW)



## EXECUTIVE SUMMARY (ENGLISH)

### PROJECT PROPONENT:

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### PROJECT CONSULTANT:

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*EXECUTIVE SUMMARY*

**REGARDING**

**ENVIRONMENTAL IMPACT ASSESSMENT**

**FOR**

**2 X 35 MW “RUN-OF-THE-RIVER”**

**DHAMWARI SUNDA HYDRO ELECTRIC PROJECT**

**1.0 INTRODUCTION**

Hydro Electric Project is a renewal, non-polluting and Environment friendly source of energy. It does not generate any waste products or release harmful hydrocarbons, others gases or emission in the atmosphere. It keeps the Environment neat and hygienically healthy.

Himachal Pradesh is endowed with a network of five perennial rivers (Satluj, Beas, Ravi, Chenab and Yamuna) and glaciers. The State, therefore, has huge potential of 20070 MW for harnessing Hydro power. A large number of Hydro Electric Projects like Nathpa, Jhakri, Baspa-II, Chamera-I, Chamera-II, Pong Dam etc. have already been commissioned Similarly large number of Hydro Projects are at various stages of execution.

As per the Master Plan prepared by Himachal Pradesh State Electricity Board in collaboration with Swed Power, Sweden, Pabbar Valley has Hydro potential of about

402 MW. 2 x 35 MW “Run-of-the-River” Dhamwari Sunda Hydroelectric Project on River Pabbar is one of the nine Hydroelectric Projects identified in the study.

## **2.0 PROJECT LOCATION AND APPROACH**

The Project is located in Chirgaon Tehsil, Shimla District, H.P. and is 165 km from Shimla and is approachable by National Highway NH-22 up to Theog and by Theog - Rohru State Highway followed by fair weather motorable HP PWD road up to Romai. The area is located in Great Himalayan ranges and lies between Longitude 30°-15'-08" N to 31°-15'-42" N and Latitude 77°-57'-10" E to 77°-59'-20" E and is covered in the Survey of India Toposheet Nos. 53E/15, 53E/16, 53 I/3 & 53 I/4. The nearest Rail Head on Narrow gauge is at Shimla and Broad gauge is at Kalka. The nearest Airport is at Shimla.

## **3.0 PROJECT FEATURES**

2 x 35 MW “Run-of-the-River” Dhamwari Sunda Hydroelectric Project will comprise a 92.4 m long & 28 m high Diversion Structure (near village Romai), 3 m dia & 10.14 km long Head Race Tunnel, four Adits, 9.7 m dia & 61 m high Surge Shaft, 2.1 m dia & 943.78 m long Pressure Shaft, a surface Power House (at village Chirgaon on the right bank of Pabbar), 220 KV Switchyard, net work of Approach Roads, Muck Dumping Areas etc.

There is no reservoir except 0.214 MCM small capacity diurnal storage for peaking power. There is no displacement of inhabitants. Therefore, no body will be rendered homeless due to the diurnal storage. There is no Resettlement & Rehabilitation (R&R).

Himachal Pradesh Power Transmission Corporation Limited (HPPTCL) will lay a Common Corridor at 220 KV for power evacuation from all the Hydroelectric Projects in

the Pabbar valley including Dhamwari Sunda Hydroelectric Project. This arrangement would drastically reduce the land to be acquired by each Hydroelectric Project IPP for their power evacuation system independently and thus alleviate impact on the Environment.

#### **4.0 ENERGY**

The Plant will generate 274.02 MU per annum gross energy. Out of this, 40.70 MU per annum @ 15% energy will be given to the Government of Himachal Pradesh as Royalty (free of cost) for the first 12 years of the Project Commercial Operation Date and 54.26 MU per annum @ 20% for the next 28 years.

#### **5.0 PROJECT COST**

The Project is estimated to cost Rs. 537.33 crore as on January 2010 price level. This includes Rs. 291.30 crore civil and hydro mechanical works, Rs. 115.80 crore for electro-mechanical works, Rs. 81.86 crore for IDC and financing costs, Rs. 40.44 crore as escalation during construction period and Rs. 7.94 crore for Local Area Development Charges (LADC). Levellised tariff for 90% dependable year for 40 years operation at 9.78% discounted rate works out to Rs. 4.15 per unit without considering CDM benefit.

#### **6.0 CONSTRUCTION SCHEDULE**

The Project is programmed to be completed in a period 42 months from the day of the commencement of work.

#### **7.0 ENVIRONMENTAL IMPACT ASSESSMENT**

Based on the EIA Notification dated September 14, 2006, Ministry of Environment & Forest, Government of India has approved Term of Reference (ToR) vide Letter No. J-12011/16/2009-IA.I dated August 17, 2009 to undertake an Environmental Impact

Assessment (EIA) Studies and to formulate Environment Management Plan (EMP) for Dhamwari Sunda Hydroelectric Project.

International Testing Centre (ITC), Panchkula, an organization approved by MoEF vide The Gazette of India (Extraordinary) Part II, Section 3, sub-section (ii) dated January 09, 2008 has been assigned the Consultancy. They have carried out comprehensive study to cover all the aspects as set out in the approved ToR dated August 17, 2009.

## **8.0 METHODOLOGY**

Standard procedures including collecting primary data were used to assess the following:

- Physical environment such as land use changes, air, water, noise and wind
- Biological environment such as flora, fauna of both terrestrial and aquatics
- Social environment for the affected villages and Project affected families

The data has been compiled for: Water Environment, Air Environment, Noise Environment, Ecological Environment, Land Environment and Socio-economic Environment. Base line data for air, noise, water and soil was collected during the field studies conducted in the EIA Project Study Area (within a 10 km radius around the proposed site for various Project components) for three seasons January 2009 (winter), June 2009 (Pre-monsoon) and August, 2009 (Monsoon) and from the secondary sources.

## **9.0 ENVIRONMENT BASE LINE STATUS OF PROJECT AREA**

### **9.1 Air Environment**

#### **9.1.1 Meteorology**

The climate of the region is temperate and has four seasons. The area experiences severe winter from December to March, summer from April to June, monsoon from July to September and autumn during October & November.

#### **9.1.2 Temperature & Humidity**

The daily maximum temperature in the EIA Project study area was observed to vary from 6°C to 12°C in winter season, 28°C to 33°C in pre-monsoon season and 19°C to 25°C in monsoon season. The daily minimum temperatures ranged from -1.2°C to 2.5°C during winter season, 9°C to 12°C during pre-monsoon season and 6°C to 8°C during monsoon season. The relative humidity ranged between 26% and 39% during winter, 32% and 48% during pre-monsoon season and 55% and 80% during monsoon season.

#### **9.1.3 Rainfall**

The average annual rainfall in the region is of the order of 1301 mm. Highest rainfall is observed during monsoon months of July & August.

#### **9.1.4 Ambient Air Quality**

Ambient air quality monitoring stations were set up at 12 locations. Air quality test results indicate that the concentration of air pollutants viz. SPM, RSPM, SO<sub>2</sub>, NO<sub>x</sub> in the EIA Project study area are well within the National Ambient Air Quality Standards prescribed by CPCB. SPM levels range between 10 to 60.3 µg/m<sup>3</sup> during three seasons against the permissible limit of 200 µg/m<sup>3</sup>. RSPM levels range between 2.8 to 10.6 µg/m<sup>3</sup> against the permissible limit of 100 µg/m<sup>3</sup>. SO<sub>2</sub> levels range between 0.7 to 3.8

$\mu\text{g}/\text{m}^3$  against the permissible limit of  $80 \mu\text{g}/\text{m}^3$ .  $\text{NO}_x$  levels range between 1.0 to 9.3  $\mu\text{g}/\text{m}^3$  against the permissible limit of  $80 \mu\text{g}/\text{m}^3$ .

The air quality is quite good in the area. Absence of any polluting source and low population density near Diversion Structure site are the attributing factors for excellent quality of the ambient air.

#### **9.1.5 Wind Speed and Wind Direction**

Wind monitoring stations were set up at two locations. Wind rose for monitoring the predominant wind direction during monsoon collection shows the prevalent wind direction as North-east at 8:30 hours and South-west at 17:30 hours.

### **9.2 Noise Environment**

Noise quality monitoring stations were set up at 12 locations. The prevalent noise levels in the EIA Project study area observed ( $<55 \text{ dB}$ ) from the collection of baseline data during the three seasons are within threshold permissible limits specified for residential areas & industrial areas. The day time noise levels range between 35 dB to 54.6 dB and nighttime noise levels vary from 30 dB to 41.50 dB in the EIA Project study area spread over three seasons. The main source of noise is attributable to the flowing water in River Pabbar and its tributaries. Occasional vehicular movement also contributes to noise in the area.

### **9.3 Water Environment**

The inhabitants in the EIA Project study area use surface water for their domestic, irrigation, animal and other daily needs. Surface water is available in plenty in the form of perennial springs, streams and tributaries. In addition, I & PH Deptt. supplies surface water to all inhabitants through pipe line system in the area. Ground water facility has also been created by I & PH Deptt. in the form of road side hand pumps. Based on

analysis of 16 surface water samples collected from River Pabbar & its tributaries and 13 ground water samples from within the EIA Project study area, it was established that surface water as well as ground water in the EIA Project study area are in conformance with Drinking Water Standards (IS:10500:1991) & Tolerance Limits for inland surface water quality and is, therefore, suitable for the sustenance of aquatic life, human consumption and other purposes.

#### 9.4 Land and Soil Environment

Parameters involved in land environment are soil quality, land use pattern, soil erosion etc.

##### 9.4.1 Catchment Area & Land Use Pattern

Catchment area of the Project at Diversion Structure site is 212.48 sq. km. As per the records of All India Soil and Land Use Survey report, Department of Agriculture and Cooperation, Ministry of Agriculture, (Govt. of India), the land use is summarized in

**Table 1.**

**TABLE: 1  
LAND USE DETAILS OF CATCHMENT AREA**

S. No.	Type of Land Use	Area (Ha)	Percentage of Total Area
a)	Cultivation (Cropland)	480	2.26
b)	Orchards	42	0.20
c)	Moderately Thick Forests and Grasslands	3750	17.65
d)	Grazing Land with Trees	1235	5.81
e)	Grazing land without Trees	223	1.05
f)	Thaches	300	1.41
g)	Ghasnis (Grasslands)	407	1.92
h)	Gair Mumkin	129	0.61
i)	Alpine Pastures	14654	68.97
j)	Glaciers	28	0.12
	<b>Total</b>	<b>21248</b>	<b>100.00</b>

*(This does not quantify the area under snow or alpine pastures).  
(Source: All India Soil and Land Use Survey Organization)*

### 9.4.2 Soil Quality

Soil samples were collected at 10 locations and analysed. The soils in the area vary from sandy loam to sandy clay loam. Soil test results show that pH of the soil in Project area is near to neutral; the conductivity indicates low salt content, available Nitrogen content is poor i.e. less than 0.4%. Soil has low Cation Exchange Capacity and low electrical conductance thereby indicating low fertility / production potential. pH value of soil ranges between 7.0 to 8.5 and organic matter ranges between 0.37 to 1.8%. The agricultural soil of Project area showed medium to moderate fertility.

### 9.4.3 Land Required for the Project

23.3025 Ha area will be required for the Project components and all other Associated Components/activities like construction of approach & haulage roads, quarry sites, contractor's area, labour camps, workshops and stores. Out of the total 23.3025 Ha, private land to be acquired is 5.1795<sup>#</sup> Ha while Govt. land (Classified as Unlisted Forest Land) to be taken on lease for 40 years, is 18.1230 Ha. The details are summarized in **Table 2.**

**TABLE: 2**  
**DETAILS OF LAND REQUIRED FOR THE PROJECT**

S. No.	Description	Area (Ha)	
		Underground	Surface
a)	Privately Owned Land	-	5.1795 <sup>#</sup>
b)	Total Government Land (Classified as Unlisted Forest Land)	-	13.2578
c)	Land falling under ground works such as HRT, Feeder Tunnel, Diversion Tunnel, Adits Access Tunnels, Surge Shaft Pen Stock etc	4.8952	-
	<b>Total</b>	4.8652	18.4373
	<b>Grand Total</b>		<b>23.3025</b>

# 1.44 Ha additional private land for muck dumping area 1A will be taken on lease / rent basis

## 9.5. Ecological Environment

### 9.5.1 Flora of the Project Area

The area represents a storehouse of a large array of floristic diversity. The field study was carried out for terrestrial ecology for three seasons near the proposed Diversion Structure site, near Head Race Tunnel and near Power House complex to prepare an inventory of flora, listing of economically important and medicinal plant species and to determine frequency, abundance and density of different vegetational components using Quadrat Method. Important Value Index (IVI) for different trees species, shrubs and herbs were determined by summing up Frequency, density and cover (Basal area) of each species. IVI values were used for the computation of Shannon Index of General Diversity and Evenness Index. The Shannon Diversity Index ranges between 0.95 to 0.96 for trees, 0.743 to 0.92 for shrubs and 0.78 to 0.92 for herbs. It can be seen that the vegetation in and around the Project area is not very rich in bio-diversity. The Evenness Index for trees ranges between 0.954 and 0.964, which indicates that the species are distributed evenly. The vegetation of the EIA Project study area comprises 60 trees species, 42 shrubs and 39 herbs.

#### 9.5.1.1 Forest Types

According to the classification given by Champion and Seth, the forests in the Project catchment area fall under the following types:

- Type 12 CI/DSI/lc : Moist – Deodar Forests (*Cedrus deodara*)
- Type 12 CI/DSI/ld : Western Mixed Coniferous Forests (Spruce, Blue, Pine, Silver, Fir)
- Type 12 CI/DSI/le : Moist Temperate Deciduous Forests
- Type 12 CI/DSI/lf : Low lever Blue Pine Forest (*Pinus wallichiana*)
- Type 15 CI : Birch Rhododendron Scrub Forests

### **9.5.2 Terrestrial Fauna**

Most of the wildlife is found in the higher reaches of catchment area. The main wildlife species found are Brown Ghoral, Black Bear, Snow Leopard, Himalayan Brown Bear, etc while the pheasant species are Himalayan Snow Cock, Monal Pheasant, Kaleej, Chukor, and Common Hill Partridge. However, the proposed EIA Project study area (10 km radius) does not encroach into Wildlife Sanctuary or any other type of Nature Reserve. In fact, there is no National Park, Wildlife Sanctuary, Nature / Bio Sphere reserve in or near the Project area. Sangla Valley Wildlife Sanctuary in Satluj River catchment area is located in Kinnaur District. However, due to mountain ranges, there is no migration of the Wildlife (Fauna) to the Project area.

### **9.5.3 Aquatic Ecology**

Due to turbulent character of the river flow and turbidity of the water, rooted aquatic vegetation is very sparse. No free floating aquatic weed species are observed in the Pabbar River. Brown trout (*Salmo trutta fario*), Rainbow trout (*Salmo gairdneri*), Mahseer (*Tor-putitora Ghypotothrox*) and Snow trout (*Schijothorax Richardsoii*) are found in the Pabbar River and its tributaries upto village Dhamwari. Each year about 60 to 70 thousand fingerlings of brown front are released in the River Pabbar near village Sandhasu and Andhra Khad. As per the report of HP Fishery Department, 88.428 MT fish was caught in the River Pabbar during the financial year 2008 – 09 and 23.894 MT during financial year 2009 – 10 (up to August 2009). Commercial fishing does not exist in the Project area.

## **10.0 IDENTIFICATION AND PREDICTION OF IMPACTS AND CORRECTIVE MEASURES**

The proposed Project will involve large scale construction activities. The impact of these activities on the sensitiveness of the important environmental aspects such as

environment conservation, ecological environment, prevention of soil erosion, lands & water pollution prevention etc. have been studied. Potential positive and negative impacts as a result of construction and operation of the Project have been discussed in the succeeding paragraphs and various corrective measures stipulated therein under Environment Management Plan (EMP).

### **10.1 Impact of Land Acquisition / Diversion**

Consequent to considering various alternatives for Project alignment, the chosen alignment was found to be economically viable, geologically compatible, technically feasible and with least impact on the Environment in the Project area. Accordingly, 5.1795 Ha private land will be acquired (1.44 Ha to be taken on rent for MDA-1A) and 18.1230 Ha Govt. Land (Classified as Unlisted Forest Land) will be diverted & taken on lease for 40 years.

Acquisition of private land will not render the owners homeless or will not displace them as there is no submergence due to any reservoir being created except for a small diurnal storage of 0.214 MCM capacity. There will be no R & R.

Diversion of Govt. land (Classified as Unlisted Forest Land) will not lead to degradation of forests as there are no forests in the said Govt. land.

### **10.2 Ambient Air Environment**

Dust levels may slightly increase during construction of Project components and approach roads. Emission levels of pollutants like SPM, SO<sub>2</sub>, NO<sub>x</sub> etc. may temporarily rise due to increased vehicular movement, and operation of construction machinery. However, the impact on ambient air quality will be temporary, short lived and insignificant, since the dust generated is confined to the immediate vicinity of the proposed Project construction area. Increase in concentration of air pollutants would

remain well within prescribed permissible limits of CPCB and the overall impact on ambient air quality insignificant. Nevertheless certain mitigation measures such as timely removal of debris and its disposition in the designated Muck Disposal Areas , sprinkling of water on roads during construction; construction material stacks; stone crushers etc., installation of pollution control devices at stone crushers, mandatory installation of cyclones in the stone crushers, installation of concrete batching plants in the vicinity of Project component construction sites, covering of dumpers carrying muck, regular maintenance of DG Sets & Construction machinery, Engineering Measures and Biological and Bio-technology Measures followed by plantation at all the ten Muck Disposal Areas etc. shall be adopted further to ameliorate the air pollution under EMP.

### **10.3 Noise Environment**

Tunnel drilling, blasting, vehicular traffic, operation of various machinery & DG Sets (as & when required) are the primary sources of noise generation in the Project construction sites. The probable noise level due to accumulated effect of noise generating sources at the Project construction sites will range between 70 dB(A) to 47 dB(A) measured at a distance of 100 m to 3000 m respectively. However, the estimated increase in noise level will be of the order of 10 dB(A) and limited to a distance of 50 m to 250 m. The noise impact is temporary in nature and will quickly dissipate.

Despite this, various noise attenuation measures such as timely and regular maintenance of construction machinery & vehicles, avoiding surface drilling / blasting during night, providing special acoustic enclosures for DG Sets, issue of personal protective equipment (earplugs, earmuffs etc) to the workers & technical staff, stagger drilling, blasting and excavation activities, undertaking controlled blasting, plantation barriers for attenuating noise etc. will be implemented under EMP.

## **10.4 Water Environment**

During the Project construction, surface water may get polluted due to the generation of waste water (sewage) coming from office, labour camps etc. and inflow of large quantities of suspended particulate matter from excavated soil, stone crusher sites and construction material if left unchecked. These impacts are temporary in nature and have no permanent effect on surface water. However, mitigation measures such as sewage treatment plants, septic tanks and soak pits to neutralize water from labour camps and residential colony and removal of suspended solids from effluents generated from other sources will be adopted in order to ameliorate the impact to within the permissible limits.

### **10.4.1 Impact on Water Resources**

It is observed that surface water from Pabbar River between Diversion Structure site and confluence of Tailrace Channel is not drawn for any use such as domestic, animals, irrigation or any kind of industrial use. All the inhabitants use water from springs, streams and tributaries flowing adjacent to their settlements for meeting their domestic, agriculture, animal and other water requirements. In addition, most of the villagers get surface water supply through pipeline laid by I & PH Department, Govt. of H.P. In order to avoid any adverse impact of diversion of water through Head Race Tunnel on the aquatic life in River Pabbar, minimum 1 cumec sacrificial water (more than 15% of the minimum average discharge during the lean months i.e. from December to February i.e. 0.72 cumecs), as per MoEF Norms will be continuously released down stream of the Diversion Structure. for sustenance of aquatic life and other requirements.

## **10.4.2 Control of Water Pollution**

### **10.4.2.1 Wastewater Treatment Facility for Labour Camps**

The sewage generated from various labour camps will be treated through net work of septic tanks / soak pits. Portable sewerage treatment plant will be provisioned and used, as required. The septic tanks / soak pits shall be located so as not to pollute any drinking water source. Norms of Central Pollution Control Board would be followed for neutralizing and discharging treated effluent into natural water bodies.

### **10.4.2.2 Sanitation in Residential Colony**

A properly designed sewage treatment plant is proposed to treat the sewage generated from the permanent residential colony. Treated water from sewage treatment plant and sludge will be used for gardening and will not be allowed to flow into adjoining water bodies.

### **10.4.2.3 Effluent from Construction Activities**

Effluents containing suspended solid impurities from various construction activities such as tunneling, stone crushers etc. and equipment would be treated through settling tanks before discharging it into the water bodies and the settled sludge / muck disposal off in the nearby designed Muck Disposal Areas.

Check dams, wire crate, spurs, vegetative spurs etc. will be provided on all the tributaries both upstream and down stream, as required to control silt and flow of the suspended solids into River Pabbar.

## **10.5 Solid Waste**

### **10.5.1 Muck Generation**

8,73,523 m<sup>3</sup> (with 45% swell factor) muck is expected to be generated during the construction of various Project components. About 2,48,633 m<sup>3</sup> muck will be used for backfill and other construction works. The remaining quantity of 6,24,890 m<sup>3</sup> muck shall

be disposed off at pre-identified, designated ten Muck Disposal Areas as indicated in **Table 3**. The Muck Disposal Areas will be designed, developed and managed properly. They will be rehabilitated, stabilized and reclaimed by adopting various “Engineering Measures and Integrated Biological & Bio-Technological Measures”.

**TABLE: 3**  
**MUCK DISPOSAL AREAS (MDAs)**

DESCRIPTION		AREA	VOLUME	MUCK TO BE DUMPED
PROJECT COMPONENT TO BE SERVED	MDA NO.	m <sup>2</sup>	m <sup>3</sup>	m <sup>3</sup>
Diversion Structure, Diversion Tunnel, Feeder Tunnel, De-silting , Intake Structure, Approach road and HRT (from RD 0.000 m to RD 1730.0 m)	MDA-1	22968	172260	172260
	MDA 1A	14400	110144	109737
	MDA-2	12077	92055	92055
<b>TOTAL (MDA-1 + MDA-1 A + MDA-2)</b>		<b>49445</b>	<b>3,74,459</b>	<b>3,74,052</b>
Adit-I, Adit-I Approach road and HRT (from RD 1730.0 to RD 4410.0 m)	MDA-3	<b>4780</b>	<b>52970.5</b>	<b>38740</b>
Adit-II, to Adit-II, Approach road and HRT (from RD 4410.0 m to RD 7011.5 m)	MDA-4	6778	30800	30800
	MDA-5	2713	11812	11651
<b>TOTAL (MDA-4 + MDA-5)</b>		<b>9,491</b>	<b>42,612</b>	<b>42,451</b>
Adit-III, Adit-III Approach road and HRT (from RD 7011.5 m to RD 9351.5 m) and Part of Muck from Diversion Structure	MDA-6	<b>14855</b>	<b>27732.3</b>	<b>27161</b>
Surge Shaft and Approach road to Surge Shaft	MDA-7	<b>17671</b>	<b>20463.7</b>	<b>20463.7</b>
Adit-IV, Approach road to Adit-IV and HRT (from RD 9351.5 m to 10140 and Pressure Shaft) and Part of Muck from MDA – 1 & MDA - 2	MDA-8	<b>21040</b>	<b>29958.8</b>	<b>25336.3</b>
Power House, Switch Yard and Tail Race Channel	MDA-9	<b>8951</b>	<b>97898.6</b>	<b>96686</b>
<b>GRAND TOTAL</b>		<b>126233</b>	<b>6,46,095</b>	<b>6,24,890</b>

Source: Dhamwari Sunda Hydro Electric Project Detailed Project Report – January 2010

### **10.5.2 Other Solid Wastes**

During Project construction phase, about 1950 people (construction labour & technical staff) are likely to congregate in the Project area. The average per capita solid waste generated would be of the order of 0.35 kg/person/day i.e 682.5 kg per day. This solid waste consist of combustible waste like paper, rags, wooden waste etc., degradable and compositible waste like vegetable matter, kitchen waste etc. and some non-degradable waste like glass / glass bottles, cans, plastics etc. The solid waste will be collected daily from pre-designated disposal locations in the Project area and segregated into combustible, degradable and non-degradable wastes as per H.P. State Pollution Control Board norms. Segregated degradable and combustible materials will be disposed off in the properly designed twin chamber incinerator. Non-degradable material will be sold to the recycling vendors authorized by the H.P. State PCB and the Local Administration.

### **10.5.3 Refuse Disposal from Residential Colony**

The power generation process does not generate any solid waste. However, about 25 kg per day of solid waste would be generated from residential colony and offices. Refuse includes different substances such as garbage, rubbish and sweepings which would be collected, segregated & disposed as described under para 10.5.2 above.

## **10.6 Soil Erosion**

Runoff from unprotected excavated areas, muck disposal sites, quarry sites etc, would result in increased soil erosion. However, all the sites will be properly protected and slope stabilization ensured by undertaking construction works such as check dams, spurs, vegetative spurs, crate walls, retaining walls, break walls etc. followed by vegetations, afforestation etc. through CAT Plan.

## **10.7 Health Delivery System**

It is proposed to establish first aid posts & two mobile vans for immediate medical needs at the Project component construction sites. Moreover, the existing medical facilities will be strengthened by providing extra support towards cost of medicines for supply to labourers and local people and by constructing more rooms in these centres.

### **10.7.1 Bio Medical Waste Management**

All requisite measures will be taken to ensure that the bio-medical waste generated from health centres, first aid posts etc. shall be handled within 48 hours without any adverse effect to the human health and Environment. The waste generated after segregation will be disposed off in twin chamber incinerator which will be installed at Govt. Hospital at Rohru by DPC.

## **10.8 Impact on Flora & Fauna**

### **10.8.1 Deforestation**

Influx of migrant labour in the area will increase the requirement of fuel wood for heating and cooking, which in turn will put pressure on the adjoining forests. On an average, 1-2 Ha of forest area per year could be cleared off to meet the fuel requirement. In order to avoid such an impact of deforestations, adequate measures such as community kitchens have been recommended. The community kitchens shall use pressure cookers and consume LPG / kerosene as fuel. Also, it is proposed to provide Kerosene and LPG at subsidized rates to labour and staff by establishing depots within the Project area. Similarly, labour colonies / camps will be constructed so as to avoid adverse impact on terrestrial flora. Water heaters and room heaters will also be provided during winter so as to avoid likely tendency to cut / fell tree for heating, cooking etc.

No rare or endangered specie or medicinal plant or specie of economic importance are observed in the private land to be acquired or Govt. land to be diverted for the Project.

Thus, no significant impacts on Flora & Fauna on account of land acquisition / diversion are anticipated.

### **10.8.2 Wildlife**

The field observations and the discussions with the local people indicate that the Project area does not function as a corridor for movement of wildlife. It could, therefore, be concluded that the Project would not have any impact on the wildlife habitat or corridor. Incidentally, there is no wildlife sanctuary in the Project area. No major impacts on fauna are expected in the Project area.

### **10.8.3 Compensatory Afforestation**

About 18.123 Ha of Govt. land (Classified Un-Listed Forest Land) is to be diverted for various Project appurtenances. Compensatory afforestation over an area of 2 x 18.123 i.e. ~37 Ha in the nearby degraded forest area will be undertaken by State Forest Department. 55,500 plants @ 1500 plants per Ha will be planted commencing 2010-11 and maintained for subsequent five years including betting up of the failed plants. Plantation will be selected in consultation with local Forest Officials. Necessary funds will be provided by Dhamwari Power Company Pvt. Ltd. under EMP.

### **10.8.4 Green Belt Development**

It is proposed to develop greenbelt around the periphery of various Project appurtenances. The plantation area will be fenced and the fence maintained properly so as to protect the plantation till they attain the reasonable height above the grazing level.

## **10.9 Clean and Renewable Source of Energy**

It is estimated that  $274.02 \times 10^6$  KWH energy at 90% dependability will be generated per annum as a non-polluting and renewable source of energy from the Project. It will reduce emission @ 221,956 tCO<sub>2</sub> per annum and other greenhouse gases in the

Environment. In 40 years life span of the Project, the cumulative emission reduction works out to 8,878,240 tCO<sub>2</sub>. Other indirect benefits include reduction in water pollution, noise pollution, fly-ash, thermal etc. vis-à-vis Thermal Power Plants. Its availability to the rural areas will reduce the dependence of the locals on alternative energy sources namely forests.

### **10.9.1 Employment Opportunities**

The Project would provide substantial direct employment in the Project and indirect employment for allied activities. As per the laid down norms, a member from each family whose land is acquired will be provided employment. Similarly, local Himachalis will be given job preference during project construction and Plant operations.

Development of infrastructure and availability of reliable power supply as a result of the Project realization would contribute to the stimulation of economic activities like small scale industries in the area. Additional power generation will mitigate the power shortage in the country. Northern grid will be the biggest beneficiary. Long term stay of permanent staff would lead to allied economic activities in the Project area. The Project will benefit the economy at both local and national level.

## **11.0 CATCHMENT AREA TREATMENT PLAN**

A Catchment Area Treatment (CAT) plan has been proposed for Dhamwari-Sunda Hydroelectric Project, which will essentially ensure conservation of soil, enhancing productivity and reduction of sediment load flowing through Pabbar River and its tributaries by Engineering Measures such as check dams, contour staggered Trenchers and effective soil conservation measures. It will help in protecting stream bank erosion, landslide control, sedimentation reduction & control, stabilization against future erosion, rehabilitation of degraded forest, treatment of pasture lands, natural re-generation,

saving & conservation of forests & forest based fuel, conservation & rehabilitation of riverine flora, good practices in agriculture & horticulture land treatment, compensatory afforestation etc. CAT Plan shall be implemented by the HP Forest Department as per the Govt. of India stipulations and funded by Dhamwari Power Company Pvt. Ltd. Implementation, Monitoring and Evaluation of CAT Plan will be undertaken by constituting two Committees. The Committees will comprise members from Forest, Agriculture, Horticulture, Animal Husbandry Department representatives from Panchayati Raj Institutions, Dhamwari Power Company Pvt. Ltd. and others under the Chairmanship of Conservator of Forests, Shimla.

## **12.0 LOCAL AREA DEVELOPMENT**

In consonance with the Hydro Power Policy-2006 by Govt. of Himachal Pradesh, Clause No. 24 has been incorporated in Supplementary Implementation Agreement dated March 26, 2009 wherein Dhamwari Power Company as an Independent Power Producer (IPP) is required to make an obligatory provision @ 1.5% of the final Project cost for the development of the Project affected area. Govt. of Himachal Pradesh will constitute a Local Area Development Committee (LADC) under the Deputy Commissioner of the Project area as its Chairman and will also nominate other members of LADC, which will include the representative(s) from effected Panchayats & Dhamwari Sunda HEP. SDM, Rohru will be the Member Secretary. The Deputy Commissioner as the Chairman of LADC may co-opt other members as he deems fit.

LADC will be entrusted with but not limited to restoration of facilities affected due to implementation of the Project, oversee implementation of CAT Plan, compensatory afforestation, local developments related to Agriculture, Horticulture, Animal, Husbandry, Fisheries, Rural development, I & PH, Health, Forest, Education, PWD, Power, Social, Religious & Cultural activities etc.

### **13.0 ENVIRONMENTAL MONITORING PLAN**

Environmental Monitoring Plan will be implemented both during Project construction and operation phase so as to achieve effective results for water quality, air quality, noise quality, soil erosion and sedimentation, land use, compensatory afforestation, meteorological aspects, fishery, public health, agriculture, horticulture, forestry, water flow monitoring, effluent treatment etc. Environment Management Cell of the Project will liaise with various Regulatory bodies such as State Forest Department, HP PCB, CPCB, MoEF etc. for implementation, continuous monitoring and assessment of environmental parameters as per the Norms and Regulations and institute necessary corrective measures periodically.

### **14.0 ADVANTAGES**

Advantages construction of new community halls etc., Establishing and operating the Project in Pabbar valley will lead to the following overall advantages:

- No inhabitant will be rendered homeless. Himachalis will be given jobs.
- Roads will be constructed in the Project area.
- Afforestation will be carried out.
- Catchment Area Treatment Plan will be implemented to conserve soil, rehabilitate degraded forest, treat both Govt. & Private pasture lands, rehabilitate reverine flora, implement agriculture & horticulture, control land slides, protect stream bank erosion, save & conserve forest and forest based fuel, plantation of medicinal plants, timber plantation, fodder plantation, non timber forest produce (NTFP) plantation etc. Such plantation will be undertaken by engaging local residents, their samitis & agencies.
- Local Area Development will be undertaken. This will include additional schools, Post office, dispensaries, road, bridges, pedestrian path, renovation of temples, repairs of existing community facilities, local development related to agriculture,

horticulture, animal husbandry, fisheries, rural development, I & PH, health, forest, education, PWD, Power, social, religious and cultural activities etc.

- Inhabitation will be engaged for Environment and eco-logical monitoring during Project construction and Operation.
- Soil erosion will be arrested, sedimentation load reduced through soil conservation measures.
- Low lying areas will be reclaimed through muck dumping, land scaping through Engineering & bio-logical and Bio-technical measures.
- Besides free power to Govt. additional availability of power will help setting of cottage industries, small scale industries and other business in the area.
- Abundance of power availability will reduce dependence of the local on alternate energy source namely forests.
- Funds allocated for development and preservation of aquatic life in the Project area.
- Availability of ambulance and first aid post in the Project area.
- Construction to two crematories in the Project area.
- Installation of Incinerator in the Project area.
- Pressure cookers and LPG will be provided to inhabitants.
- Standards and levels of education will improve.
- The Project will usher in overall prosperity in the Project area and therefore stimulate economic activities by the inhabitants.

## **15.0 SUMMARY**

Based on the findings of the Environmental Impact Assessment study, various Environment Management Plans viz Catchment Area Treatment Plan, Compensatory Afforestation Plan, Construction Staff & Labour Management Plan, Land Environment

Management Plan, Muck Management Plan, Health Management Plant, Flora & Fauna Management Plan, Disaster Management Plan, Environment & Ecological Monitoring Plan, Local Area Development Management Plan etc. have been proposed. In order to monitor the impact and efficacy of these plans, monitoring of a host of parameters has been proposed during the Project construction and operation phases and necessary funds allocated thereto. Utilization of these funds judiciously and effectively will usher in prosperity in the area, develop the Project area and improve eco-system & Environment.

## **16.0 COSTS TOWARDS IMPLEMENTATION OF ENVIRONMENT MANAGEMENT PLAN**

Dhamwari Power Company Private Limited will make provision of **Rs. 1505.00 Lacs**, to be spent for Environment Management Plan. The details of funds to be provided towards Environment Management Plan are given in **Table 4**.

**TABLE: 4**  
**FUNDS TOWARDS IMPLEMENTATION OF ENVIRONMENT MANAGEMENT PLAN**  
**(EMP)**

S. No.	Particulars	Amount (Rs . in Lacs)
<b>1</b>	<b>Construction Staff and Labour Management Plan</b>	
	a) Fuel for Staff & Labour and Energy Conservation Devices	50.00
	b) Water Supply & Sewage Treatment	50.00
	c) Solid Waste Management	30.00
	d) Health Management	140.00
	e) Bio - medical Waste Management	15.00
<b>2</b>	<b>Land Environment Management Plan</b>	
	a) Muck Management Plan	190.00
	b) Rehabilitation and Resettlement Plan	100.00
	c) Net Present Value	200.00
<b>3</b>	<b>Air Environment Management Plan</b>	
	a) Water Sprinkling System for Hauling Roads	50.00
	b) Water Sprinkling System for Construction materials and Dumping areas	50.00
	c) Hazardous Waste Management	10.00
<b>4</b>	<b>Management of Flora and Fauna</b>	
	a) Green Belt Development	20.00
	b) Land Scaping	10.00
	c) Compensatory Afforestation	40.00
	d) Reclamation of Muck Dumping Areas	20.00
	e) Development and Preservation of Aquatic Fauna	70.00
<b>5</b>	<b>Disaster Management Plan</b>	10.00
<b>6</b>	<b>Catchment Area Treatment Plan</b>	300.00
<b>7</b>	<b>Environment and Ecological Monitoring during Project Construction and Operation Phases #</b>	150.00
<b>TOTAL</b>		<b>1,505.00</b>

**Note:**

- Rs. 794.00 Lacs @ 1.5% of the Project Cost provisioned separately for LADA.
- # Rs. 100 Lacs earmarked in the Environmental Monitoring Plan for State PCB.

The above estimates include the recurring and non-recurring costs of each component of Environment Management Plan (EMP).