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Environmental Baseline Data Studies for the EIA of Dhaulasidh Hydroelectric Power Project, Himachal Pradesh

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***Abstract*—Hydroelectric power plays a very critical and important role in the power sector, as it helps in meeting the energy demand of a country. Worldwide, it is a crucial power supply contributing about 16% of global electricity, a share that is expected to increase. But hydropower development poses complex risks and difficulties. It is only recently that environmental concerns have paved their way into decision-making to help develop hydropower resources. The increasing scarcity of area untrammeled by industrial development, an increased awareness of impacts of dams on ecosystems and the increased political power of organizations that support environmental causes have all contributed to this change. One of the tools used for the sustainable development of such projects is Environmental Impact Assessment (EIA). The Government of India through its EIA Notification, 2006 has made the preparation of an EIA report mandatory for clearance of hydropower projects (of capacity greater than or equal to 50 MW) for proper safeguard of the environment.**

The objective of this research paper is to establish baseline status for the environmental attributes viz. water, air, noise biological and socio-economic environment for the Dhaulasidh Hydropower Project (66 MW) which is proposed to be located in Himachal Pradesh. The study period for the collection of the baseline data is from December (2015) to February (2016). Both primary (field studies) and secondary sources have been used to establish the baseline status of the study region. The impacts on water, air and noise environment vary from low to medium. Impacts on air and noise environment are limited to the construction phase only.

Keywords— Hydropower, environmental impacts, socio-economic environment, biological environment, dams.

I. INTRODUCTION

Hydropower is the most mature, reliable and cost-effective renewable power generation technology available [1]. Hydro power projects are generally categorized into two segments i.e. small hydro and large hydro. While Ministry of Power, Government of India deals with large hydro power projects, the responsibility of small hydro development rests with Ministry of New and Renewable Energy (MNRE) [2]. In India, hydro projects up to 25 MW station capacities have been categorized as Small Hydro Power (SHP) projects. Small hydropower schemes are more likely to be run-of-river facilities, but reservoir (storage) and run-of-river hydropower plants of all sizes utilize the same basic components and technologies. The total hydroelectric power potential of India is assessed at about 150,000 MW which is equivalent to 84,000 MW at 60 per cent load factor [3].

Though dams are considered as the 'Temples of Modern India', this notion is changing in a dismissive way these days. Casual and unscientific clearance of river valley projects has created numerous problems both environmentally and socially. Large scale displacement of people, destruction of the aquatic life especially fisheries, hydrological changes, adverse impacts on the flora and fauna, political agendas have all created an unsustainable environment These past failures of development planning processes to take notice of the detrimental impacts of economic development activities has led to led to the advent of Environmental Impact Assessment (EIA). As a policy instrument for sustainable development, EIA ensures the decision-makers and the public that the environmental implications of a proposed project are anticipated and minimized. The concept of EIA originated in the 1970s with the passing of the US National Environmental Policy Act (NEPA) which has been referred as the Magna Carta for the environment in the United States [4]. As per the EIA Notification, 2006 issued by the Ministry of Environment and Forests (MoEF), Government of India (GoI), EIA reports are compulsory for hydropower projects of ≥50MW (Category 'A') while projects between 25 and 50 MW (Category 'B') are screened as to whether an EIA is considered necessary or not.

Before the start of any EIA study, it is necessary to ascertain the baseline levels i.e. the present environment or status of relevant environmental attributes which are likely to be affected as a result of the construction and operation of the project. Collection of baseline data generation forms a vital part of an EIA study as it helps to evaluate the predicted impacts on the various environmental attributes in the study area. It assists in preparing an Environmental Management Plan (EMP) outlining the measures for improving the environmental quality and scope of future expansions for sustainable development. It also helps to identify critical environmental attributes required to be monitored during and after the proposed improvements.

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II. PROJECT DESCRIPTION

The Dhaulasidh Hydroelectric Power Plant is proposed to be located on river Beas, in districts Hamirpur and Kangra of Himachal Pradesh (H.P.). This project has been proposed by Satluj Jal Vidyut Nigam Limited (SJVNL), formerly known as the Nathpa Jhakri Power Corporation (NJPC). SJVNL is a joint venture of the Government of India and the Government of Himachal Pradesh. The project has been planned at about 10 km. downstream of Sujanpur Tihra Bridge. The project has been planned as a run of the river scheme with a small pondage to utilize it for peaking purpose during lean period. The live storage is sufficient to provide a diurnal peaking of minimum 3 hours. This project envisages the construction of a 51 m high concrete gravity dam , at latitude 31°48'23.1" N and longitude 76°26'30.7" E, having Flood Reservoir Level (FRL) at an elevation of 520 m. The length of the dam at the top will be 195.14 m consisting of 6 nos. of breast wall sluices located in the dam. The project is expected to acquire 28.30 hectares (ha) of government land, 57.74 ha of forest land and 252.53 ha of private land, for various project appurtenances. Hence, the total land area to be acquired for the development of this project is 338.27 ha.

III. METHODOLOGY

The methodology for conducting the baseline environmental survey considered the 'Draft Guidance Manual for Environmental Impact Assessment and Clearance of River Valley Projects', by the Ministry of Environment & Forests (MoEF). Baseline information with respect to water, air, noise, biological and socio-economic quality status in the study area were collected by conducting primary sampling / field studies during the winter season i.e. from December, 2015 to February, 2016. Appropriate samples were collected and experiments were carried out in the State Environment Protection and Pollution Control Board, Una, H.P. Secondary data has been obtained from published sources, various government and semi-government agencies and public sector organizations. Data on forest type has been collected from the Himachal Pradesh Forest Department, Shimla. The assessment of fauna has been done on the basis of secondary data collected from different government offices like forest department, wildlife department, fisheries department etc. The presence of wildlife was also confirmed from the local inhabitants depending on the animal sightings and the frequency of their visits in the catchment area. The information on the following socio-economic parameters has been collected from the Primary Census Abstract, 2011: demographic profile, educational levels and occupational profile.

IV. BASELINE ENVIRONMENTAL DATA

- *Water Environment*

There are no major sources of organic pollution loading in the basin. The project catchment has low population density with low cropping intensity. Low cropping intensity coupled with low agro-chemical dosing also means that the pollution load due to agro- chemicals is quite low. The absence of industries implies that there is no pollution load from this source as well. The assessment of present status of water quality within the study area was conducted by collecting water samples from surface water sources (River Beas) and groundwater resources (hand pumps). The sampling locations were identified on the basis of their importance within the study area. Collection and analysis of the samples was carried out as per established standard methods and procedures, prescribed by CPCB, relevant IS-Codes. The various sampling locations covered as a part of the study to assess the surface water quality are: **W1**- upstream of dam site, **W2**- near dam site, **W3**- downstream of dam site; and **W4**- Pung khad. For the study of groundwater, following locations were selected: **GW1**- Village Baleth, GW2- Sujanpur Tihra, **GW3**- Village Chauki and **GW4**- Village Balla. The results so obtained are given from Tables 1 to 6.

Table 1 Results of water quality analysis for December (2015)

Parameter	Unit	W1	W2	W3	W4
p^H	-	7.2	7.2	7.2	7.3
EC	µS/cm	95	94	94	98
Temperature	°C	17	17.5	18	20
TSS	mg/L	<5	<5	<5	<5
TDS	mg/L	69	68	68	72
Chloride as Cl^-	mg/L	19	20	21	22

Table 2 Results of water quality analysis for January (2016)

Parameter	Unit	W1	W2	W3	W4
p^H	-	7.2	7.2	7.2	7.3
EC	µS/cm	95	94	94	98
Temperature	°C	13	12	12.5	15
TSS	mg/L	<5	<5	<5	<5
TDS	mg/L	69	69	68	72
Chloride as Cl^-	mg/L	19	20	22	22
Total Hardness	mg/L	54.8	56.7	53	55.4
DO	mg/L	8.9	8.8	8.8	8.6

Table 3 Results of water quality analysis for February (2016)

Parameter	Unit	W1	W2	W3	W4
p^H	-	7.2	7.1	7.1	7.2
EC	µS/cm	94	93	93	96
Temperature	°C	14	15.5	13.5	16
TSS	mg/L	<5	<5	<5	<5
TDS	mg/L	67	67	66	69
Chloride as Cl^-	mg/L	19	19	21	22
Total Hardness	mg/L	53.2	55	52.3	54.5
DO	mg/L	8.9	8.8	8.7	8.6

Table 4 Results of Groundwater quality for December (2015)

Parameter	Unit	Sampling Stations			
		GW1	GW2	GW3	GW4
p^H	-	7.0	7.3	7.2	7.6
Temperature	°C	10	10.5	11	12
Total Hardness	mg/L	240	255	235	230
DO	mg/L	6.1	6.0	Nil	6.0
TDS	mg/L	67	62	69	70
Chlorides as Cl^-	mg/L	27	25	240	290

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Table 5 Results of Groundwater quality for January (2016)

Parameter	Unit	Sampling Stations			
		GW1	GW2	GW3	GW4
p^H	-	7.2	7.4	7.0	7.3
Temperature	°C	8.5	9.2	9	9.5
Total Hardness	mg/L	266	243	250	255
DO	mg/L	6.3	6.1	Nil	6.4
TDS	mg/L	66	69	75	73
Chlorides as Cl^-	mg/L	32	34	234	282

Table 6 Results of Groundwater quality for February (2016)

Parameter	Unit	Sampling Stations			
		GW1	GW2	GW3	GW4
p^H	-	7.1	7.2	7.0	7.5
Temperature	°C	9.2	9.5	9.6	10
Total Hardness	mg/L	240	230	245	243
DO	mg/L	6.2	6.0	Nil	6.3
TDS	mg/L	68	67	74	75
Chlorides as Cl^-	mg/L	30	35	245	271

- *Ambient Air Quality*

The study area represents rural environment. The sources of air pollution in the region are vehicular traffic, dust arising from unpaved village roads and domestic fuel burning. The sampling stations covered were the dam site, Sujanpur Tihra and Power house site. Ambient air sampling was performed continuously for 8-hours to determine 8-hour average concentrations. Ambient air quality monitoring was carried out with a frequency of one day per week at all the three locations. The results so obtained are shown from Tables 7 to 8.

Table 7 Results of ambient air quality analysis in the study area for December (2015)

Sampling Station	SPM (µg/m^3)	PM_{10} (µg/m^3)
Near dam site	51	27
	48	25
	56	30
	49	26
Sujanpur Tihra	51	27
	70	36
	70	37
	72	37
Power House site	56	29
	61	32
	68	35
	51	26

Table 8 Results of ambient air quality analysis in the study area for January (2016)

Sampling Station	SPM (µg/m^3)	PM_{10} (µg/m^3)
Near dam site	55	33
	50	35
	57	39
	55	32
Sujanpur Tihra	52	29
	72	36
	71	38
	72	39
Power House site	57	35
	69	36
	73	36
	60	30

Table 9 Results of ambient air quality analysis in the study area for February (2016)

Sampling Station	SPM (µg/m^3)	PM_{10} (µg/m^3)
Near dam site	56	35
	49	37
	55	40
	50	33
Sujanpur Tihra	54	26
	71	33
	75	41
	73	40
Power House site	58	37
	65	38
	69	32
	55	34

- *Noise Environment*

Baseline noise data has been measured using a Data Acquisition, Integrating Sound Level Meter, Model 2001. The survey was carried out in calm surroundings. The hourly equivalent noise levels have been monitored during 10:00 a.m. to 11:00 a.m, 2:00 p.m. to 3:00 p.m. and 5:00 p.m. to 6:00 p.m for three different sampling locations.

Table 10 Hourly Equivalent Noise Levels in the study area for December (2015)

Location/Duration	Near dam site	Sujanpur Tihra	Power house site
10-11 a.m.	39	41	41
1-2 p.m.	40	40	41
5-6 p.m.	35	40	40

Table 11 Hourly Equivalent Noise Levels in the study area for January (2016)

Location/Duration	Near dam site	Sujanpur Tihra	Power house site
10-11 a.m.	37	37	38
1-2 p.m.	35	38	36
5-6 p.m.	31	38	34

Table 12 Hourly Equivalent Noise Levels in the study area for February (2016)

Location/Duration	Near dam site	Sujanpur Tihra	Power house site
10-11 a.m.	35	38	37
1-2 p.m.	33	34	35
5-6 p.m.	34	37	38

- *Biological Environment*

Flora-. As per the Himachal Forest Statistics, 2013, the major tree species in Mandi district are Chil, Deodar, Kail, Oak and Fir and that in Kangra district are Chir, fir and Spruce. Some of the important medicinal plants of Hamirpur are Agar Kali, Amla, kheera, Akash bel, Dhoodhli, Basooti etc.

Fauna- The major wildlife species in the study area include jackal, leopard cat, mongoose, wild boar, sambhar, Indian fox, Indian hare, Indian porcupine and common langur. Among the bird species, Indian myna, chukor patridge, eagle, owl, rock pigeon, Indian koel, vulture, woodpecker, Indian parakeet and bulbul have been reported.

Fisheries- The major species reported in the study region are snow trout, catla catla and mahseer. The construction of this project would restrict the upward migratory movement of these fishes. The Mahseer is one of the important freshwater

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game fish of Himalayan Rivers. The fish is endangered and migratory; therefore, the protection of this fish is important.

- *Socio-Economic Environment*

The study area for DhaulaSidh Project comprises of villages, which includes two towns, namely, Tira Sujanpur and Nadaun. The study area is spread over tehsils Sujanpur Tira (29 villages and 1 town) and Nadaun (2 villages and 1 town) in district Hamirpur, and tehsils Khundian (5 villages), tehsil Thural (3 villages) and Jai Singhpur (12 villages) of district Kangra.

Table 13 Demographic details of the study area villages

Study area villages	No. of households	Total population	Total Males	Total Females
District Hamirpur				
Tehsil Tihra Sujanpur	2,869	14,116	7,143	6,973
Tehsil Nadaun	1,088	5,317	2,684	2,633
Total District Hamirpur	**3,957**	**19,433**	**9,827**	**9,606**
District Kangra				
Tehsil Khundian	305	1,499	706	793
Tehsil Thural	275	1,219	568	651
Tehsil Jai Singhpur	990	4,227	1,999	2,228
Total District Kangra	**1570**	**6945**	**3273**	**3672**
TOTAL	**5,527**	**26,378**	**13,100**	**13,278**

Table 14 Occupational Profile in the study area

Study area villages	Total working population	Main workers	Marginal workers	Non working population
District Hamirpur				
Tehsil Tihra Sujanpur	4,349	2,996	1,353	9,767
Tehsil Nadaun	1,746	1,454	292	3,571
Total District Hamirpur	**6,095**	**4,450**	**1,645**	**13,338**
District Kangra				
Tehsil Khundian	957	636	321	542
Tehsil Thural	526	253	273	693
Tehsil Jai Singhpur	1,850	793	1,057	2,377
Total District Kangra	**3,333**	**1,682**	**1,651**	**3,612**
TOTAL	**9,428**	**6,312**	**3,296**	**16,950**

V. CONCLUSIONS

- *Water Environment*

The p^H level of surface water in the project area ranges from 7.1 to 7.3 at various sampling locations, and is within the permissible limits specified for meeting drinking water requirements (IS: 10500-2012). The TDS (Total Dissolved Solids) level ranges from 68 to 72 mg/L which is well below the permissible limit of 500 mg/L specified for drinking water. The total hardness level varies between 51.8 to 56.7 mg/L indicating soft nature of the water. This is well below the permissible limit of 200 mg/L specified for drinking water. Chlorides occur in all natural waters in widely varying concentrations. The chlorides level ranges from 19 to 22 mg/L, which is well below the permissible limit of 200 mg/L, specified for meeting drinking water requirements. The low COD (Chemical Oxygen Demand) values indicate absence of chemical pollution loading in the area. The marginal quantity of pollution load which enters river Beas gets diluted. The DO (Dissolved Oxygen) levels ranges from 8.6 to 8.9 mg/L which are very close to saturation limits in water, indicating that quality of surface water in the study area is very good. The p^H level of the groundwater ranges from 7.0 to 7.6 at various sampling locations, indicating neutral nature of the groundwater, and is within the permissible limits specified for meeting drinking water requirements. The total hardness ranges from 230 to 266 mg/L, which is higher than the permissible limit of 200 mg/L, but is within the cause for rejection limit of 600 mg/L. The chlorides levels ranges from 25 to 300 mg/L. The chlorides level in ground water at villages Chauki and Balla was higher than the permissible limit of 200 mg/L, specified for meeting drinking water requirements, but was within the cause for rejection limit of 600 mg/L. The TDS level ranges from 62 to 75 mg/L, which is well below the permissible limit of 500 mg/L specified for drinking water.

- *Air Environment*

From Tables 7 to 9, it can be observed that the average SPM levels at various sampling locations ranges from 52.2 $\mu g/m^3$ to 66 $\mu g/m^3$. The maximum SPM level observed in survey conducted is 75$\mu g/m^3$ during February, 2016. The maximum PM_{10} level observed is 41 $\mu g/m^3$ during February, 2016, which is well below the permissible limit of 60 $\mu g/m^3$, as per Ambient Air Quality Standards. Hence, it can be concluded that ambient air quality is quite good in the study area. The values of these parameters are well below the permissible limits. The absence of industries, low vehicular traffic and low population density can be attributed for good ambient air quality in the project area.

- *Noise Environment*

The study region is mostly residential area for which the day-time ambient noise standard level is 55 dB (A). From Tables 10 to 12, it can be concluded that these noise levels are within the permissible limits as specified for residential areas by CPCB.

- *Biological Environment*

Proper mitigation measures are required to conserve the biodiversity and wildlife in the region. Fisheries Management Plan, Biodiversity Conservation Plan and Afforestation, Greenbelt Development around Reservoir, are some of the management plans in this direction.

- *Socio-economic Environment*

As per the National Rehabilitation and Resettlement Policy, 2007 if the number of Project Affected Families (PAF) is 200 or more in hilly regions, then proper

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compensation and grants have to be provided to the displaced people. It is estimated that around 427 PAFs will be affected by the construction of this project. Hence, a proper Resettlement and Rehabilitation Plan has to be implemented.

REFERENCES

[1] Ellebban, O., Blaabjerg, F. & Rub, H. A., 2014. Renewable energy resources: Current status, future prospects and their enabling technology. *Renewable & Sustainabe Energy Reviews*, Volume 39, pp. 748-764.
[2] Website of Ministry of New and Renewable Energy.
[3] Saxena, P., 2013. Small hydropower development in India. *Renewable Energy Akshay Urja*, Volume 6, Issue 5 & 6.
[4] Canter, L. W., 1996. *Environmental Impact Assessment.* 2nd ed. New York.