ENVIRONMENTAL IMPACT ASSESSMENT STUDY

OF

LAKHWAR MULTIPURPOSE PROJECT (300 MW)

DEHRADUN DISTRICT, UTTARAKHAND

February 2020

Executive Summary

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EXECUTIVE SUMMARY

1. INTRODUCTION

Lakhwar Project is a part of Lakhwar Vyasi multipurpose scheme located on the river Yamuna in district Dehradun of Uttarakhand. Lakhwar Vyasi project has three major components-Lakhwar dam, Vyasi dam and Katapathar barrage. It is primarily a peaking power project and the reservoir of Lakhwar dam will have a live storage of 330.4 Mcum. Combined Lakhwar Vyasi project was accepted by NITI AYOG (erstwhile Planning Commission) in its Fifth five-year plan with an estimated cost of Rs. 140.97 crores on 09.01.1976.

The Ministry granted the Environmental Clearance (EC) to this combined project in February, 1987. Till 1992, substantial construction work has been done on the project such as about 40 km road, infrastructure, Dam stripping, Diversion tunnel, excavation of Intake, underground power house, Adit to control room, Adit to erection bay, Tail race tunnel, etc. NGT has issued an order dated 10.01.2019 in Application No. 431 of 2015 (Manoj Kumar Mishra & Bhim Singh Rawat Vs Union of India & Others) on the plea directed EAC to appraise the project afresh in terms of EIA notification 2006 and impose additional general and specific conditions as may be considered necessary.

EAC deliberated the issue of Lakhwar Multipurpose Project. Sub-committee of EAC has made a visit to project site during April 2019. Scoping clearance letter was issued by MoEF&CC vide letter no. J-12011/11/2019-IA-I dated 5th December 2019.

2. BRIEF DESCRIPTION OF NATURE, SIZE, LOCATION OF THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY, REGION

Lakhwar Multipurpose Project is located on Yamuna river in the Dehradun and Tehri Districts of Uttarakhand State and to be developed by UJVN Ltd. The construction of dam and underground power house for Lakhwar Multipurpose Project (300 MW) is proposed near Lohari village in Dehradun district of Uttarakhand. All the components of Lakhwar Multipurpose Projects are approachable from National Highway 507. NH 507 is one of the busiest highway in the region from May to October, connecting Dehradun to Yamunotri (a Hindu piligrim). The location of the project is shown in **Figure 1**.

3. PROJECT COMPONENTS

Lakhwar dam is a multipurpose project with 300 MW installed capacity. The main project components are a 204 m high concrete gravity dam, 3 steel lined penstocks and an underground powerhouse housing 3 vertical francis turbines of 100 MW each. The Full Reservoir Level (FRL) and minimum draw down level (MDDL) of the reservoir are El 796 m and El 752 m, respectively, with gross storage of 587.84 MCM at FRL for diurnal peaking capabilities. The total area of submergence is 9.57 sq. km.

The salient features of the project are given in **Table 1**. The layout map of the project is given at **Figure 2**.

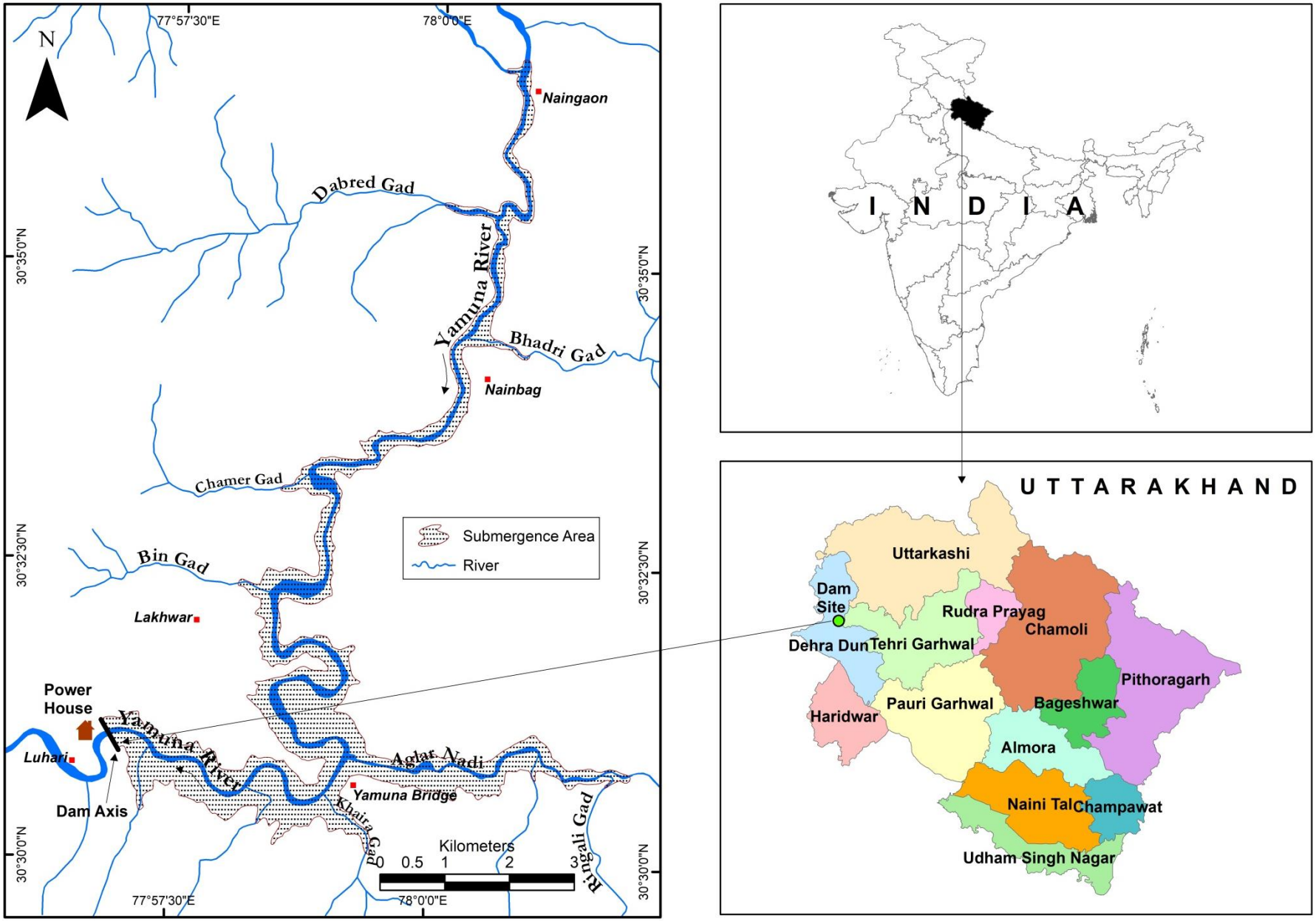

Figure 1: Location Map of Lakhwar Multipurpose Project

Table 1: Salient features of the Lakhwar Multi-Purpose Project

LOCATION		
State	:	Uttarakhand
District	:	Dehradun
River	:	Yamuna
Location of Lakhwar Dam & Power House	:	Lohari village 20 Kms. upstream of Kalsi and 72 Kms. from Dehradun
Nearest Airport & Railhead	:	Dehradun
Latitude	:	30°31'03" N
Longitude	:	77°56'58" E
HYDROLOGY		
Catchment area (including snow catchment)	:	2080 Sq. Km.
Snow catchments	:	60 Sq. Km.
Normal rainfall in the catchment	:	1150-2550 mm
Design flood (PMF)	:	8850 cumec
Maximum annual runoff (1988-89)	:	3756 $M.m^3$
Average annual runoff (1963-64)	:	2322 $M.m^3$
Minimum annual runoff (1965-66)	:	1221 $M.m^3$
DIVERSION TUNNELS		
Diversion flood - Non Monsoon (1 in 50 years)	:	350 cumec
Location	:	Left Bank
Number and size	:	2 Nos., 5 m dia Horse Shoe Shaped
Length	:	567 m and 596 m
Invert elevation at Inlet	:	633.0 m and 636.0 m
Invert elevation at Outlet	:	622.0 m
COFFER DAM		
Type	:	Rock fill
Top of Dam	:	642.25 m
U/S slope	:	1 V: 2 H
D/S slope	:	1 V: 1.5 H
DAM		
Type	:	Concrete Dam
River bed level	:	623.0 m
Expected deepest foundation level	:	596.0 m
Top of Dam	:	800.0 m
Maximum height above deepest foundation	:	204 m
Top width	:	10.0 m
Length at top	:	479.5 m
Upstream slope (Non over flow blocks)		
Between El. 800-761.667 m	:	Vertical
Between El. 761.667-695.0 m.	:	0.3: 1
Between El. 695 & foundation level	:	0.45: 1
Down stream slope		
Between El. 800-790m	:	Vertical
Between El. 790m & foundation level	:	0.76: 1
No. of main NOF blocks of 17.5 m width each	:	21 Nos.
No. of main NOF blocks of 20 m width	:	1 No.
No. of main NOF blocks of 17 m width	:	1 No.

SPILLWAYS		
Type of spillway	:	Deep seated sluice spillway
No. and size of openings	:	5 bays of 7 m x 7.5 m each
Crest elevation	:	700 m
Discharge capacity	:	8850 cumecs
No. of over flow blocks of 15 m width each	:	5 Nos.
Energy dissipater	:	Stilling Basin Type
Cistern elevation	:	607 m
Size of Stilling Basin	:	120m(L) x 70m(W)
RESERVOIR		
Full Reservoir Level (FRL)	:	El. 796.00 m
Minimum Draw Down Level (MDDL)	:	El. 752.00 m
Gross Storage at FRL	:	587.84 M.m^3
Gross Storage at MDDL	:	257.18 M.m^3
Live Storage	:	330.40 M.m^3
Reservoir Area at FRL	:	9.57 Sq. km
Reservoir Area at MDDL	:	5.65 Sq. km
Average width of reservoir	:	483 m
Length of reservoir	:	23 km
River bed slope in reservoir area	:	7.4 m per km
INTAKE AND PENSTOCK		
Design discharge through each intake	:	75 cumecs
Width of intake structure	:	48 m
Invert level of Intake	:	EL. 739 m
No. of penstocks	:	3
Diameter of penstocks	:	4.30 m circular
Length of penstocks	:	186.5 m, 211 m, 235.3 m
POWER HOUSE COMPLEX		
Underground Power House		
Size of cavern (unfinished roof EL652.95 m Finished roof EL652.30 m Cavern bottom EL 606.30 m)	:	165 m x 20 m x 48.05 m D –Shaped (unfinished) 165 m x 20 m x 48.05 m D –Shaped (finished)
Installed generating capacity	:	3 x 100 MW
Types of Turbines	:	Francis type
Gross head	:	171.5 m
Rated head	:	148.00 m
Machine hall		
Size of machine hall	:	82.5m x 18m comprising 4 floors
Size of erection bay	:	20 m x 25 m
MIV floor	:	614.5 m
Turbine floor	:	619 m
C/L of Turbine	:	616 m
Generator floor	:	623.50 m
Adit to Collection Chamber		
Size and shape	:	5.7 m D-shaped
Length	:	186 m.
Invert level at Power house side	:	644 m
Invert level at Exit side	:	641m
Adit to Erection Bay		

Size and shape	:	7.0 m. D-Shaped
Length	:	213 m.
Invert level at Power house side	:	628.5 m
Invert level at Exit side	:	642 m
Bottom adit to Pressure Shaft & lower Drainage Gallery		
Size and shape	:	6.0 m. D-Shaped
Length	:	273.50 m.
Upper drainage gallery		
Size and shape	:	2.5x3.0 m D-shaped
Length	:	201+35 m
Lower drainage gallery		
Size and shape	:	2.0x2.5 m D-shaped
Length	:	175+35 m
Draft tubes		
Nos. & Size	:	3 Nos. of size 8.5 m x 4.746 m.
Length	:	33.50 m
Collection chamber		
Size of Cavern	:	80 x 10 m D-shaped
Crown level	:	EL 652.80 m
Springing level	:	EL 649.8 m
Width of Cavern below platform	:	10.0 m
Additional collection chamber.		
Size of Cavern.	:	65 m x 10 m x 35 m D-Shaped
Crown level	:	EL. 645.0 m
Width from R.L. 642 m to 634 m	:	10.0 m
Width below R.L. 634 m	:	8.5 m.
Tail Race Tunnel		
Size and shape	:	8.25 m horse shoe shaped
Length	:	240.493 m.
Discharge capacity	:	225 cumec
Cable Tunnel		
Size and shape	:	3.50 m dia D-Shaped
Invert level	:	EL. 641.0 m.
Length	:	585.0 m
Switch Yard		
Size	:	60.0 m x 140.0 m
Elevation	:	640 m.
KATAPATHAR BARRAGE		
Location	:	13.65 km downstream of Lakhwar dam
Length	:	152.5 m
No. of Sluice bays	:	3 No.s
No. and size of weir bays	:	5 No.s, 16 m wide with 3.5 m thick piers in between
Crest level of weir bays	:	El. 501.0 m
Crest level of sluice bays	:	El. 500.0 m
Bed level of river	:	498 m
Design flood	:	8850 cumec
Pond level	:	El. 515.0 m

Source: DPR Lakhwar multipurpose project HEP

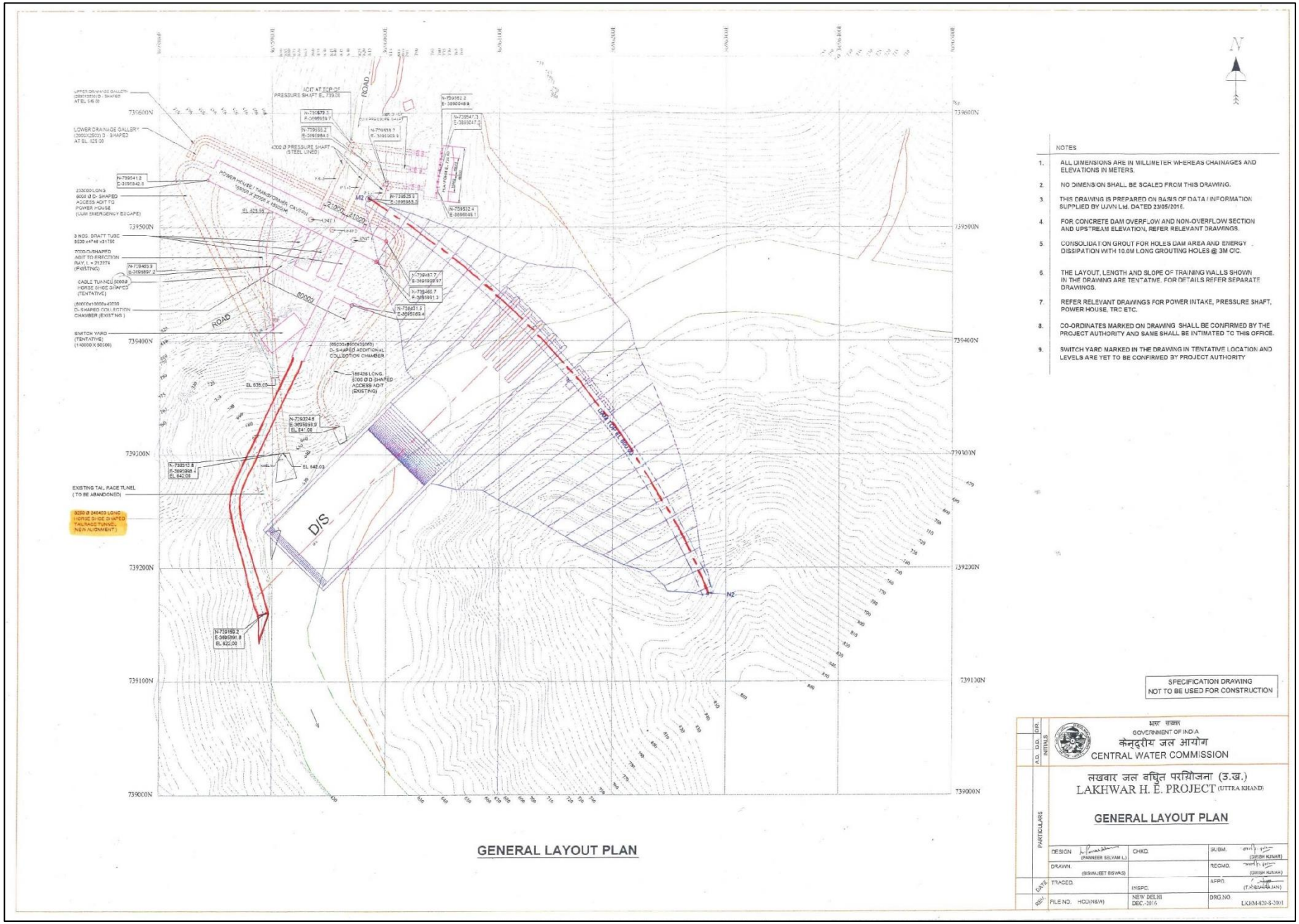

Figure 2: Layout map of Lakhwar Multipurpose Project *(Source: DPR Lakhwar Multipurpose Project)*

4. LAND REQUIREMENT

For the development of Lakhwar Multipurpose Project, land would be acquired for submergence area.

Based on the final project layout, land requirement has been finalized as **927.0822 ha**; out of which 158.927 Ha is private land and 768.1552 Ha is forest land**.** Diversion of forest land has already been completed for the project. Out of 158.927 ha of private land, 105.422 ha has already been acquired by UP Irrigation Department and same is transferred to UJVNL. A 53.505 ha of private land is yet to be acquired for the project as per directions of Government of Uttarakhand in respect to R & R for Lakhwar and Vyasi Project dated 24.06.2016 and further directions of Government of Uttarakhand regarding R & R of Lakhwar Project.

5. PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION

Construction works of Lakhwar Project are of partly surface and partly underground in nature. The project is scheduled to be commissioned in 69 months from the date of commencement.

6. ENVIRONMENTAL BASELINE STATUS

A detailed EIA study for Lakhwar MPP was conducted by GB Pant Institute of Himalayan Environment & Sustainable Development, Uttarakhand in 2007. Expert Appraisal Committee (EAC) at MoEF&CC took cognizance of this report and baseline data collected therein and accordingly sub-committee of EAC visited the project site. EAC therefore, recommended that baseline data for pre-monsoon and monsoon to be collected and the data given in the previous EIA/EMP report to be utilized for the preparation of revised EIA/EMP report.

The Project study area is delineated as the 10 Km radius area with major project components like dam site, powerhouse and submergence area at the center. 10 Km upstream from the tip of submergence on Yamuna as well as Aglar river and 10 Km downstream of the tailwater discharge point of Lakhwar dam, form part of the study area (see Figure 3).

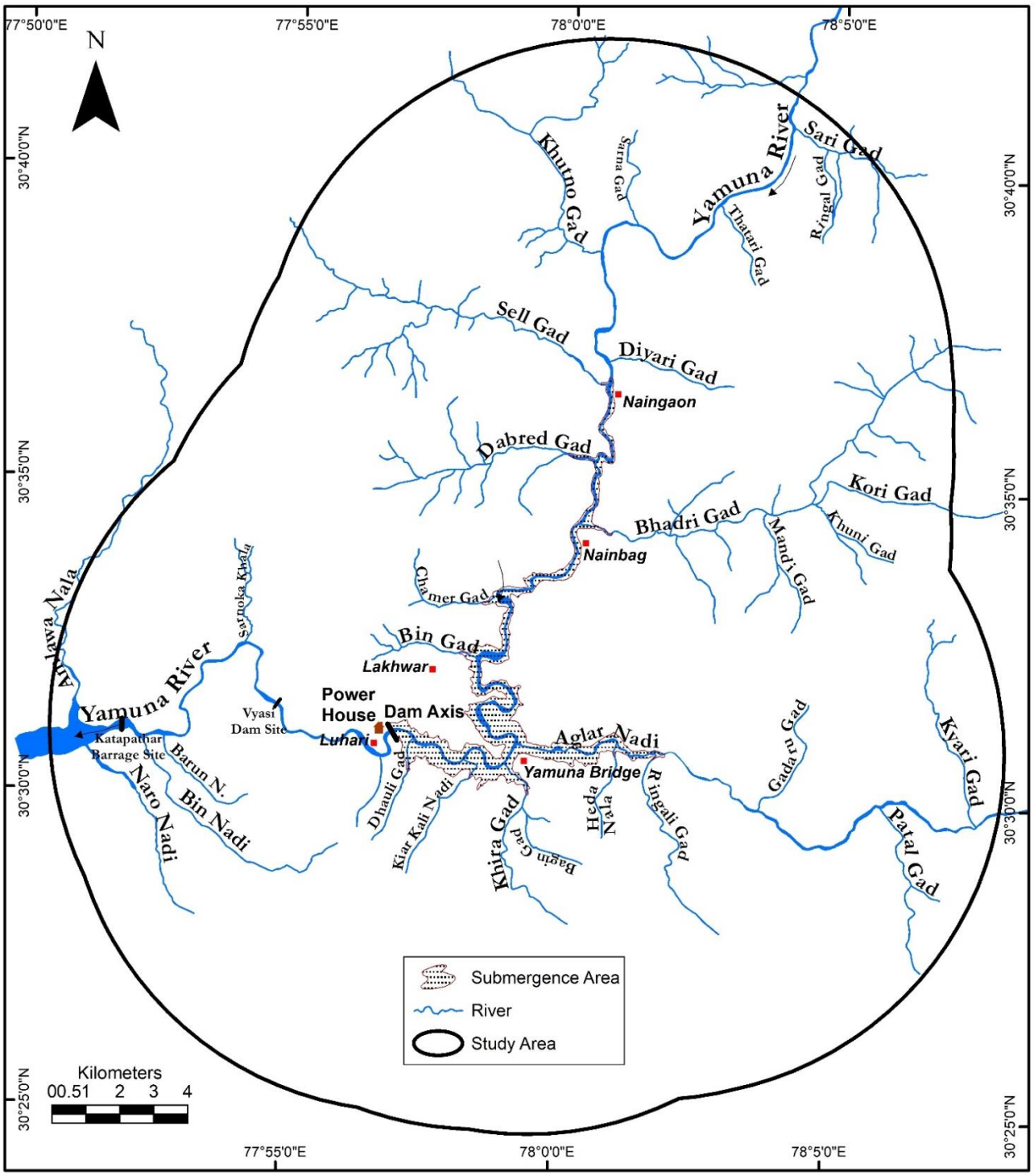

Figure 3: Study Area Map of Lakhwar Multipurpose Project

A. PHYSICAL ENVIRONMENT

6.1 Land Use and Land Cover

The land use/ land cover map of the study area is given at **Figures 4**. More than 52% of the study area is comprised of good forests and only 3.29% of the forest is scrub. Large part of the study area is also subjected to agriculture (27.33%) (**Table 2**).

Table 2: Area under different land use/land cover categories

Land use/ Land cover	Area (Sq km)	Area (%)
Forest	36242.66	52.61
Scrub Forest	2267.48	3.29
Scrub Land	5584.41	8.11
Grass Land	1602.27	2.33
Agricultural Land	18824.08	27.33
Fallow Land	3007.05	4.37
Built up area	346.10	0.50
Waterbody	1014.11	1.47
	688.88	**100.00**

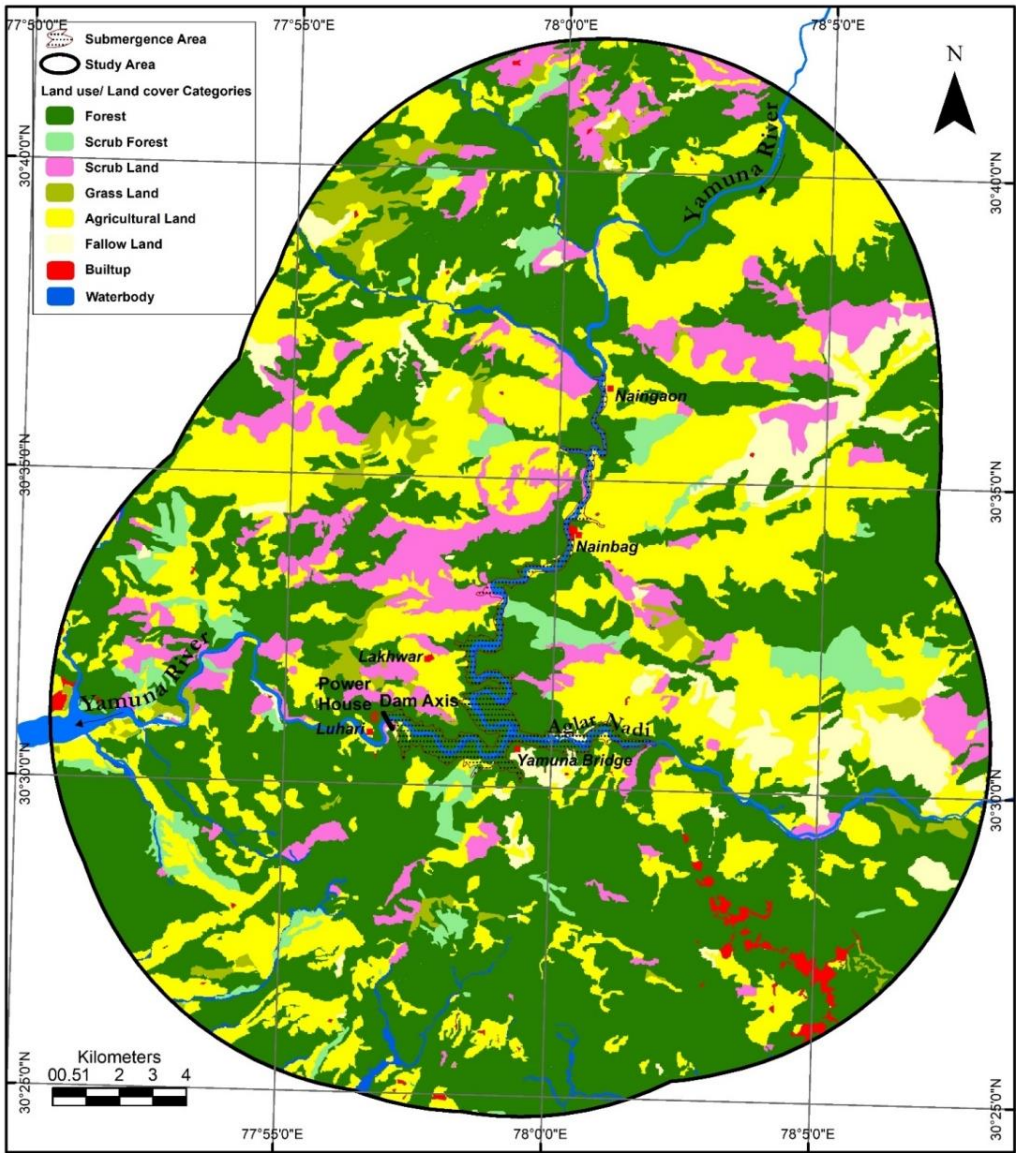

Figure 4: Land use/land cover map of the Study Area

6.2 Geology and Seismicity

The Lakhwar-Vyasi Project area comprises of rocks of Jaunsar Group belonging to Pre-Cambrians of Kumaun Lesser Himalaya. The Jaunsar Group of rocks comprise slate, phyllites, quartzites and limestones of Mandhali, Chandpur and Nagthat Formations. Intrusive comprising basic rocks, calcite, feldspar and epidote veins are observed in the project area, particularly in Lakhwar Dam.

The earthquakes upto the magnitude of 8.5 on Richter scale have been recorded in the

Himalayas. Focal depths of these earthquakes are shallow to medium deep (less than 100 km). However, their distribution is non-uniform with Central Himalaya being relatively less active region. The project area falls in seismic zone IV (IS 1893:2000) as per the seismic zonation map of India.

6.3 Hydrology

River Yamuna, after flowing approximately 95 km from its source at Yamunotri passes through a narrow gorge at village Lohari (near Lakhwar). The catchment area of river Yamuna upto the proposed dam site is 2080 sq km The snow line in the catchment is assumed as El. 4360 m, and the snow-covered area is estimated as 60 sq km. The Yamuna river catchment up to Lakhwar dam has two main tributaries Kamla Nallah and Aglar Nallah. The region is mountainous, partly covered with vegetation and varying in elevation from about EL 620 m to EL 5500 m. The river bed slope is comparatively steeper in its upper reaches, being of the order of 13.3 m/km (1 in 75) from Yamunotri to Lakhwar.

The long term 10-daily series at the project site has been worked out for the period from 1971 to 2003. The consistency of the flow series of various sites, used in deriving the flow series at the project site has been approved by CWC vide letter no: Hydrology (N) Direct./1/97/81/1-2/171 dated: 25.03.2011.

6.4 Physiography

Accordingly, Digital Elevation Model (DEM) was generated from SRTM data and the same is given at **Figure 5** and according to it the study area lies between 479 m and 2541 m elevation. From the DEM, then relief map of the study area was prepared and according to it, more than three-fourth of the project study area lies in 500 to 2500 m elevation band (refer **Figure 6** and **Table 3**) and 20% of project components are restricted to 500 to 1000m elevation band.

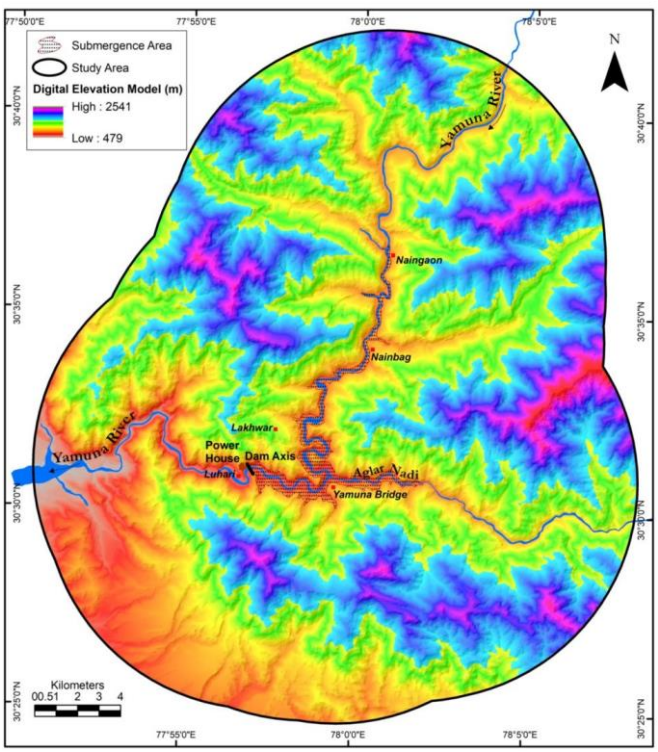

Figure 5: Digital Elevation Model (DEM)

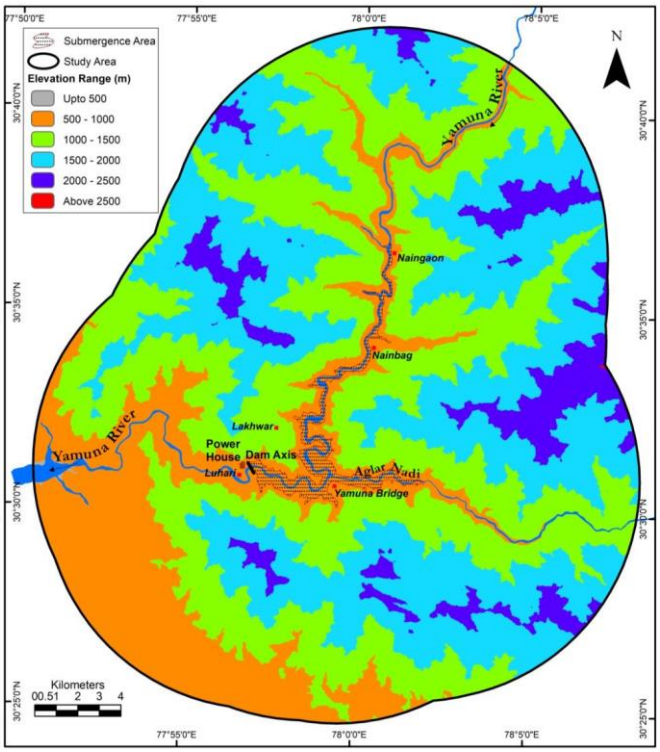

Figure 6: Relief Map of the Study area

Table 3: Area under different elevation bands in the Study area

Elevation Range (m)	Area (%)
Up to 500	0.24
500 - 1000	20.45
1000 - 1500	37.69
1500 - 2000	34.73
2000 - 2500	6.89
Above 2500	0.01
	100

The slope map of the study area was also prepared from SRTM data and the same is given at **Figure 7**. The area falling under various slope categories (as per SLUSI) in the study area has been tabulated in **Table 4**. As seen from the map and table nearly 43% of the study area is characterised by moderately steep slopes and about 39% by steep slopes. However, around the project area the slopes are moderately steep to strongly sloping (see **Table 4**).

Table 4: Area under different slope categories in the Study area

Slope (Degrees)	Category	Area (%)
Up to 2	Gently Sloping	1.03
2 - 8	Moderately Sloping	4.70
8 - 15	Strongly Sloping	7.73
15 - 30	Moderately Steep	43.55
30 - 45	Steep	39.72
45 - 60	Very Steep	3.23
60 - 70	Extremely Steep	0.04
Above 70	Escarpments	0.00
	Total	**100**

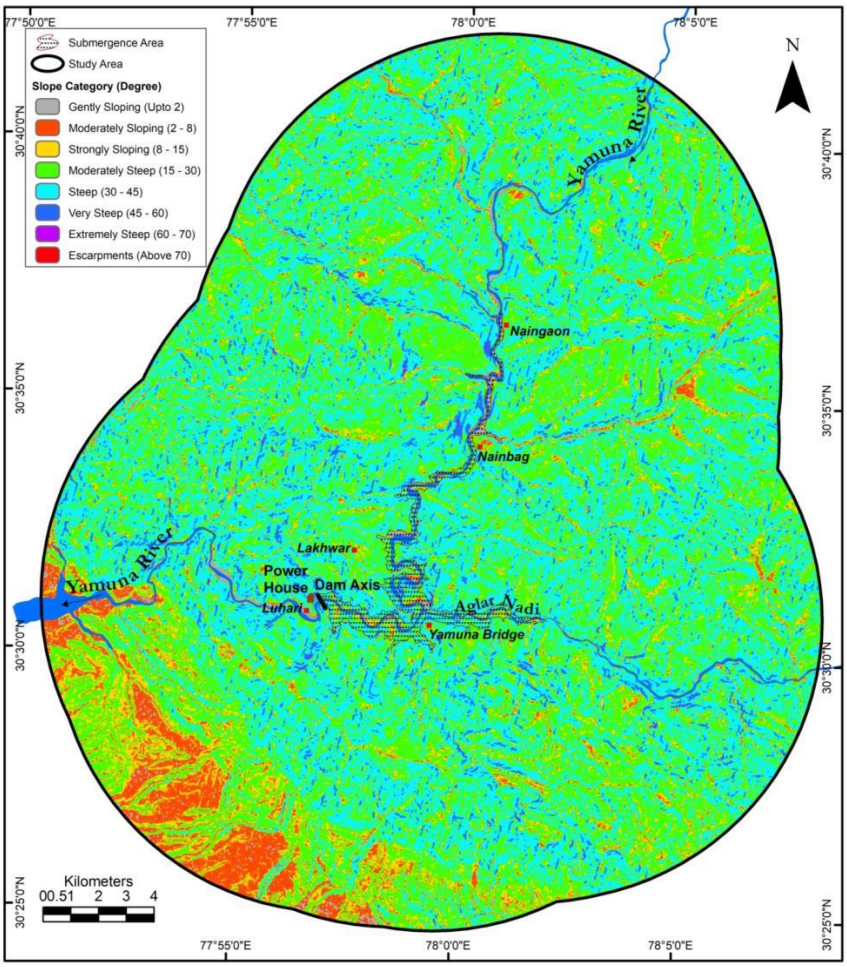

Figure 7: Slope Map of the Study area

6.5 Soil

The soil taxonomic (family) classification map of Lakhwar Multi-Purpose Project study area was prepared as per the Soil Atlas of Uttar Pradesh published by National Bureau of Soil Survey & Land Use Planning (NBSS&LUP). Majority of project study area i.e. more than 61% falls under Typic Udorthents of Entisols and Entic Haplumbrepts of Inceptisols. Lithic Udorthents are characterized by Moderately Shallow, excessively drained, thermic, loamy skeletal soils on moderately steep slopes with loamy surface, moderate erosion and moderate stoniness.

The bulk density of soil varied from 1.35 to 1.48 (g/cc) at various locations in the study area indicating soil in general is suitable for plant growth. Porosity of the soil samples varied between 34.3% and 41.1% which also is good for plant growth. The soil of the area is brown and black and the texture of soil in general is predominantly clayey. The soil fertility in the study area based upon Nutrient Index in terms of NPK as above in case of Nitrogen and Phosphorus is Medium (1.00) while in case of Potassium it is low i.e. NI is between 1.00.

6.6 Ambient Air Quality

The sources of air pollution in the study area are vehicular traffic, dust arising from unpaved village roads and domestic fuel burning. The air environment around project site is free from any significant pollution source. Air quality monitoring was carried out as per the air quality parameters conforming to the National Ambient Air Quality Standards for Industrial Residential, Rural & Other Areas.

The results of ambient air quality monitoring carried out during 2004-06 can be concluded that the air quality is quite good in the project area. The values of SOX, NOX, SPM and RSPM were well within the permissible limits as per Ambient Air Quality Notification of 1994 for 24 hours. Similarly based on the results of monitoring done in the year 2019, the concentrations of PM2.5, PM10, SOx and NOx during at all the sites were well within the Residential & Rural area permissible limits prescribed by National Ambient Air Quality Standard 2009 notified by CPCB.

6.7 Noise Levels

Main source of noise pollution in the study area are regular vehicular movement. Levels were compared with the Ambient Air Quality Standard in respect of Noise, given in Schedule as part of The Noise Pollution (Regulation and Control) Rules, 2000 (amended to date). Being on the route to Yamunotri on NH 507 it can be seen from the table that noise levels in the study area are little more than the threshold levels prescribed by CPCB as major source of noise in the study area is vehicular movement only.

6.8 Water Quality and Aquatic Ecology

Water quality of both surface and ground water was assessed in the study area.

6.8.1 Surface Water

During the present water quality monitoring surface water quality was better which was recorded in the earlier report. The physical parameters like pH, Total Suspended Solids

(TSS), Electrical Conductivity (EC) and Total hardness in terms of Calcium and Magnesium are indicative of the moderate to good quality of Yamuna water as well as Aglar water. The range of values of Dissolved Oxygen (DO), BOD levels not being detected along with low to negligible COD levels are indicative of the absence of any organic pollution source in Yamuna in the project area. This is primarily due to absence of any industrial establishment in the project area. Only at one sampling location in Aglar river there is inflow of organic pollutants in the river because at this location only BOD could be detected along with higher concentration of coliform bacteria.

Surface water quality of the samples collected during Pre-Monsoon and monsoon season was compared with the Water Quality Criteria of Central Pollution Control Board (www.cpcb.nic.in/Water_Quality_Criteria.php). The surface water in the study area at most of the locations fall under Class 'B' i.e. designated best use of outdoor bathing (organized) according to CPCB, Water Quality Criteria.

6.8.2 Ground Water

Ground water quality assessment was done during 2019 field surveys by collecting water samples from 2 locations in the study area. According to BIS standards for Drinking Water (2012) all the water samples collected from the study area fall within permissible limits of the same.

Analysis results of ground water samples were compared with drinking water standards IS-10500:2012 to assess the status of ground water taken from spring as this water is used for drinking purpose in villages. All the samples were found within permissible limits as per drinking water standards prescribed by CPCB.

B. BIOLOGICAL ENVIRONMENT

6.9 Forest Type

The forests study area of Lakhwar multipurpose project can be classified in to following types of forests according to Champion and Seth (1968). Study area is mainly represented by Dry Siwalik Sal Forests (5/B/C la), Northern Dry Mixed Deciduous Forests (5B/ C2), Dry Deciduous Scrub (5/DS1) and Sub-Tropical Himalayan Chir-Pine Forest (9/C1b).

6.10 Floristic Diversity

6.10.1 Taxonomic Diversity

During the field surveys and also based upon secondary data and available information an inventory of 324 plant species in the study area has been prepared. This list includes 283 species of angiosperms, 5 species of gymnosperms, 21 species of pteridophytes, 7 species of bryophytes and 8 species of lichens. 283 species of angiosperms include 56 tree species, 82 shrub species, 125 herb and 14 species of climber. The dominant families in the study area are Fabaceae with 26 species followed by Asteraceae (25), Poaceae (16), Rosaceae (14), Lamiaceae (14) and Urticaceae (10).

As per IUCN Red list of Threatened Species Version 2019.2 out of 324 species only 61

species have been assessed till date. All the assessed plant species belong to Least Concern category.

6.10.2 Density, Diversity and Dominance

The overall tree density throughout the study area ranged from minimum of 330 number of trees/ha to maximum of 370 trees/ha. The shrub layer was quite prominent on scrub land and forest area. The density of shrub layer varied from 2630 plants/ha to 3500 plants/ha. The density of herbaceous plant species varied from season to season amongst all sampling sites. During sampling maximum density of herb was recorded in the monsoon season.

To understand the species diversity Shannon Weiner Diversity was calculated separately for trees, shrubs and herbs. Among the tree species diversity Index was lowest at sampling site V4 located between Yamuna bridge and Lakhwar Band (2.20) and highest at sampling site V6 located in the downstream of Power house area near Juddo village (2.47). Among shrubs the highest species diversity was recorded at site V1 located near Naingaon (2.69) and lowest at site V4 along the NH 507 between Yamuna bridge to Lakhwar Band (2.36). Among the herbs highest species diversity was found maximum during monsoon season varies from 2.13 to 2.57. During pre-monsoon season sampling diversity of herb varies from 2.27 to 2.51.

Based upon the Importance Value Index (IVI) the trees in the project area like *Anogeissus latifolia, Bauhinia variegata, Dalbergia sissoo, Celtis australis, Corymbia citriodora* and *Mangifera indica* were most dominant tree species.

6.11 Faunal Elements

The data on mammals reported from the study area was compiled from Forest Working Plan (2010) of Mussoorie and Chakrata Forest Divisions. Common mongoose, Common Langur and Five-striped palm squirrel are the species frequently sighted in the study area. According to the list prepared as described above, 15 species of mammals are reportedly found in the area.

A total of 60 species of birds belonging to 33 families were recorded from the study area. Most commonly found birds are drongo, house sparrow, crows, thrushes, redstarts, bulbuls, mynas, pigeon, dove and forktails. While, a list of 110 species of birds was compiled based upon sighting done during field survey as well as secondary data given in earlier EIA report.

The area is rich in the diversity of insects, moths and butterflies. During the field survey, inventory of 31 species of insects and butterflies were compiled found in the study area. Out of 31 species, 17 species were of butterflies and moths belonging to 5 families and 14 species were of insects.

The herpetofauna were sampled on the same transects marked for mammals. During the survey, Garden lizard, Indian Monitor lizard and Agama were commonly sighted species in the area.

6.11.1 Threatened & Endangered Fauna

As per IUCN Red list of Threatened Species Version 2019.2 the avifaunal species sighted from the study area only one species *Gyps himalayensis* is listed as Near Threatened (NT) under IUCN 2019.2, rest of the species fall under Least Concern (LC) category. As per Indian Wildlife Protection Act (IWP Act) both *Semnopithecus entellus* and *Macaca mulatta* are listed as Schedule II species. While all the species recorded from the area are listed as Schedule IV except House crow and Jungle crow which are listed as Schedule V species.

6.11.2 Mussoorie Wildlife Sanctuary

The project is located within 10km from Mussoorie Wildlife Sanctuary. A map of Mussoorie WLS showing location of project components vis-à-vis boundaries of Mussoorie WLS was prepared based upon the map provided by the project proponent procured from the PCCF Wildlife Office, Dehradun. No land is proposed to be acquired in the Mussoorie Wildlife sanctuary as no part of the project lies within the sanctuary, however, due to project component falling within 10 Km and in the absence of Ecosensitive Zone notification; a separate application has been filed seeking wildlife clearance.

6.11.3 Aquatic Ecology

Among the aquatic organisms sampling for Phytoplankton and phytobenthos, zooplankton and macro-invertebrates was undertaken during the field surveys in two seasons in Yamuna river and its tributaries.

i) Total 32 species of periphyton and 46 species of phytobenthos were recorded from Yamuna river and its tributaries during field sampling conducted in two seasons in the study area.
ii) During sampling 8 species of zooplankton were recorded. These are represented by 3 species of Protozoa; *Daphnia* sp. of Cladocera, *Cyclops* sp. of Copepoda and 3 species of Rotifers. *Vorticella* sp., *Daphnia* sp., *Cyclops* sp., *Trichocera* sp. and *Keratella* sp. were found during all seasons.
iii) A total of 13 genera of macro-invertebrates (MI) were recorded from various sampling site. Maximum numbers of macro-invertebrate taxa (11) were recorded during pre-monsoon sampling.

6.11.4 Fish & Fisheries

During the experimental fishing *Schizothorax richardsonii, Barilius bendelisis* and *Tor tor* were landed in the net. Based upon the field surveys and information gathered from fishermen, 10 fish species are reported from the Yamuna river and its tributaries in the study area.

During field survey it was observed that villagers in the area celebrate fish festival in Aglar river. Villagers from Jaunpur Garhwal region congregate in Aglar River, 20 km from Mussoorie to celebrate the historic fishing festival popularly called “Maund” held annually on June 28th. The festival was unique and historical as it was rooted in tribal traditions dating back to the times of the Maharaja of Tehri. The festival is being held from past 152 years.

6.12 Social Environment

6.12.1 Socio Economic Profile of the Study Area

The Study Area for the collection of data on socio-economic status has been delineated as the area within 10 km radius of the main project components like proposed reservoir area, powerhouse, muck dumping site etc. The study area of proposed Lakhwar Multipurpose project falls in four sub-divisions falling under two districts; Tehri Garhwal and Dehradun of Uttarakhand state. Components like Dam and Power house falls in Dehradun district, while submergence of proposed project falls in Tehri and Dehradun districts. Socially the study area of proposed Lakhwar project is spread over two different cultural regions i.e. Jaunpur region of Tehri garhwal and Jaunsar-Bawar region of Dehradun district. Jaunpur is State declared OBC region of Uttarakhand. While Jaunsar-Bawar was included in the list of ST by the government of India in 1967.

The villages, where the families are residing whose land and structures are likely to be affected by the proposed project activities, have been categorized as affected villages. A total of 35 villages (22 in Tehri District and 13 in Dehrdun district) are affected due to land acquisition for various components of proposed project. Private land of 105.422 ha was acquired up to 1992 from 29 villages. Out of these, land from 2 villages viz. Katapathar and Bosan was acquired for the Katapathar barrage, which is one of the components of the multipurpose project. In addition to already acquired 105.422 ha, about 53.505 ha of private land is to be acquired.

The affected villages have 1616 households with a total population of 9386; however, not all the households will be affected. Average Sex ratio is 957 females per 1000 males.

In Jaunpur region (Tehri Gahwal) General category consist of 76.28% of the total population of the project affected villages. Sechdule caste and Schedule tribe population consist of 21.26% and 2.46 % of the total population of the project affected villages. While in the project affected village's lies in Jaunsar region of Dehradun district Schedule Tribe is the most common social categories among the affected households with 47.12% of the total population, closely followed by Scheduled caste (36.07%).

7. ASSESSMENT OF IMPACTS

7.1 Ambient Air Quality

7.1.1 Construction Phase Impacts

The air environment around project site is free from any significant pollution source at present. The sources and activities that might affect air quality in the project area during construction phase are vehicular traffic, material handling and storage, dust arising from unpaved village roads, construction activities including operation of construction plant and machinery and domestic fuel burning.

Vehicles and stationary equipment will impact air quality at the construction site through emissions from the engines and equipment, fugitive emissions due to material handling, etc.

Additionally, construction activities including operation of crushers, concrete batch plants, construction work and movement of vehicles along unpaved road will generate dust & gaseous emission and impact air quality. The burning of waste will also affect air quality. In absence of proper fuel, construction workers at the project site may use wood for fuel burning and space heating. This will also impact air quality.

7.1.2 Operation Phase Impacts

In hydropower project, air pollution occurs mainly during project construction phase. During operation phase, no major impacts are envisaged on air environment.

7.2 Noise Environment

7.2.1 Construction Phase Impacts

Sources of noise will be the vehicles and equipment for excavation and construction at the project site. Due to construction activity in the area, noise levels will increase during the period of construction, however, they will remain limited to the work area mainly where large-scale construction activity will progress. Additionally, noise levels will increase on approach roads due to increased traffic. Impact of noise generation due to operation of construction machines and equipment is the exposure of workers operating these machines and other who are working in the surrounding. Such impacts can become significant if they are exposed to high noise for long hours continuously.

7.2.2 Operation Phase Impacts

No major impacts are envisaged on noise environment during project operation phase.

7.3 Water Environment

7.3.1 Construction Phase Impacts

Water is used in construction activities leading to wastewater generation with high suspended solids. Similarly, effluents due to washing from truck or equipment etc. would have high concentration of oil and grease. Assessment of quantum of wastewater from such activities is difficult however, they can impact the nearby water bodies if surface run off with high suspended solid is washed into them. Domestic waste water will be generated from worker's colony to be set up during construction phase, which if finds its way to river/ground water without any treatment will become significant impact on water environment.

Conservation of water should be implemented at construction sites to minimize the generation of waste water. Adequate care should be taken so that excess suspended solids as well as oil and grease contents in the waste water are removed before these are disposed into water body or over land. Any effluent/waste water discharged from the project should comply with the General Discharge Standards.

7.3.2 Operation Phase Impacts

Construction of dam and storage of water for power generation will lead to permanent change in flow regime of the river – both upstream as well downstream. This will obstruct the path of

migratory fish species in the river such as *Tor tor, Tor putitora, Schizothorax richardsonii* and will permanently alter their habitat. This is an irreversible impact and cannot be mitigated.

7.4 Land Environment

7.4.1 Impact Due to Muck Generation

For construction of different components of the project, surface excavation in earth mixed with boulders, soft/disintegrated rock and hard rock would be carried out. The excavation shall result in large quantity of excavated material i.e. muck which shall have to disposed to such designated areas where the muck piles do not substantially interfere with either environment / ecology or the river flow regime and cause negative impacts on the aquatic ecosystem of the river. Muck generation can significantly impact not only land environment but also air and water environment, if not managed properly. However, by implementing a well-designed muck management plan, this impact can be mitigated to a large extent.

Muck disposal needs to be carefully planned else it becomes a major impact from construction of project. The plan should focus on reuse of the muck as far as possible and dump of the surplus muck at pre-designated sites with well-designed retention structures.

7.4.2 Impact due to Waste Generation

In the absence of proper solid waste management plan, there can be serious impacts of land and water pollution due to indiscriminate disposal. Therefore, It is essential that from the planning stage, sewage management and solid waste disposal facilities for labour camps should be conceptualized to maintain the health of the people and the environment. Construction activities are associated with 3 types of waste generation:

i) Sewage and Solid Waste from labour camps and permanent colonies
ii) Construction and Demolition Waste
iii) Hazardous and Biomedical Waste.

Solid waste generated from temporary and permanent colonies during construction and operation phase will be disposed off as per Solid Wastes Management Rules, 2016 issued by MOEF vide S.O.1357 (E) dated 8th, April 2016.

7.4.3 Impact due to Land Requirement and change in land-use

Major impact of land acquisition is permanent change of land use, which is irreversible impact. These impacts cannot be mitigated, however, compensation in terms of implementation of Compensatory Afforestation Plan, Biodiversity Conservation Plan and R&R Plan will help in managing and reducing the magnitude of such impacts.

7.5 Impact on Forests and Forest Land

The project construction would require 768.1552 ha of forest land, which has already been acquired, transfer for lease to UJVNL. All the vegetation will be cleared for construction of project components. This shall lead to loss of some of the plant species used for various economic purposes like medicine, timber, fuelwood, etc. especially because of submergence of forested areas. This impact is partially mitigated by implementation of Compensatory Afforestation Plan as well as Biodiversity Management Plan.

7.6 Flora and Fauna

7.6.1 Construction Phase

Increase in human interference could have an impact on terrestrial ecosystem. The workers may also cut trees to meet their requirements for fuelwood, construction of houses, furniture. Large number of machinery and construction workers create disturbance to wildlife population in the vicinity of project area. Thus, it is necessary to maintain cooking fuel supply and implement adequate surveillance to mitigate the adverse impacts on terrestrial flora during project construction phase.

The project construction would require 768.1552 ha of forest land, which has already been acquired. All the vegetation will be cleared for construction of project components. This is a permanent impact and can only be compensated by compensatory afforestation.

7.6.2 Operation Phase

As discussed under water environment, construction of dam across Yamuna river will change the flow regime permanently and therefore impact on aquatic flora and fauna will be of permanent nature and cannot be mitigated. Only compensation is implementation of fisheries management plan so that creation of river body can be used for fishery activities.

7.7 Socio-Economic Environment

Construction phase of projects is generally associated with impacts related to labour congregation in an area causing social insecurity among natives and increased threats to the health of the community. One of the major social & economic impact of the project is the acquisition of private land coming under submergence and also for construction of project components/infrastructure. Private Land of 158.927 ha (105 ha of land has been already acquired and 53.505 ha is to be acquired) is coming under acquisition for the project, affecting 1831 families out of these 1181 families are identified as PAF's from already acquired land and 650 PAFs have been identified who will be affected from yet to be acquired private land and no family will be fully affected or displaced due to acquisition of private land. Loss of agriculture land of the farmers is considered a major impact and can only be compensated as per directions of State Government of Uttarakhand in respect to Rehabilitation and Resettlement for Lakhwar Project dated 13.01.2016 and subsequent directions and government orders by Uttarakhand government regarding R & R of Lakhwar project.

Positive Impacts

A number of marginal activities and jobs would be available to local skilled and unskilled workers during construction phase and also more employment opportunities will be available to locals during operation phase with increased income.

The project will make financial provision under the Corporate Environment Responsibility (CER) and the fund will be utilized in the affected area surrounding the project site for infrastructural and social development. This will be a significant positive impact for surrounding population in terms of improvement of quality of life.

7.8 Measures for Minimizing/Offsetting Adverse Impacts

Pollution generation mainly during construction phase will be in the form of air, water and noise pollution; which will be mitigated by adopting various mitigation measures during construction activities as discussed in later section under the head, “Mitigation Measures”.

7.8.1 Muck Management Plan

Excavation work during construction will generate muck which require safe disposal. After estimating the quantity for utilization, the surplus muck would need proper disposal. As discussed in earlier sections, till 1992, when work stopped muck generated during construction has been dumped at 8 different sites. These sites have been closed, however, restoration work is recommended to be undertaken as part of updated environment management plan.

Muck generation has been estimated for the remaining work to be completed and it is worked out that a quantity of 10,74,497 cum of muck would require disposal. For disposal of above quantity, 7 additional muck dumping sites have been identified with a total area of 9.028 ha and capacity of 1082340 cum. In addition to the proposed muck disposal area, additional muck disposal area of about 2 ha has been identified at Lohari village for disposing additional muck, if required.

Restoration of Muck Dumping Areas

The overall condition of the already dumped site is quite sound as they were supported with the help of crate walls and compacted wherever necessary. However, landscaping and restoration of all the proposed disposal yards is to be carried out by engineering and biological measures.

7.8.2 Restoration of Quarry Sites and Construction Sites

Quarry Sites

For construction of Lakhwar Multipurpose Project 68 lakh cubic m of fine and coarse aggregates would be required. In order to fulfill the above requirement, the project proponent has identified quarry areas. Depending upon the area acquired/leased for each quarry site, separate environment clearance will be applicable from Centre/Sate/District Authority under EIA Notification, item 1(a) and quarry site management and restoration plan will be prepared and submitted for required clearances.

Construction Sites

Setting up of infrastructure for construction including colonies for labour will lead to clearing of vegetation and trees. These activities will result either in the modification or destruction of the existing landscape of the area. It is therefore imperative that after the project work and related activities are over restoration work should be carried out in these disturbed areas. Various engineering and biological measures will be implemented for the restoration of proposed project affected areas.

7.8.3 Public Health Delivery System

Threats to Public Health

Project construction and operation will bring about several changes in the socio-economic environment of the area including increased threats to health of the community.

i. New Diseases due to Migratory Population
ii. Chances of increase in water borne diseases as malaria, and dengue are high
iii. Chances of increase in respiratory troubles due to increase in suspended particles during the construction phase.
iv. Chances of occurrence of gastroenteritis, cholera and typhoid in the labour camps.

Medical Facilities & Health Extension Activities

A migratory population of labour force of about 2000 persons is expected to be present during construction phase, spread along construction sites in labour colonies. One part of impact is on local population due to migrant population and second part is medical needs of migrant population putting stress on existing limited medical resources in the area. Another dimension which needs to be kept in mind while planning medical services from project side is the risk of accidents during project construction and emergency medical services to respond to such incidents.

It is recommended that the developer would provide medical facility like ambulance, first aid posts and health awareness camps directly or through contractor, to ensure safe and healthy operations during the entire construction phase. This also helps in minimizing dependence of labour population on the existing medical facility. In addition, budget provisions have been made for strengthening existing facilities in the project area.

7.8.4 Sanitation and Solid Waste Management

Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management for disposal. The project authorities will ensure sewage generated from labour colonies and site office is treated and disposed as per the SPCB guidelines. Various aspects of solid waste management include:

- Reuse/Recycling
- Storage/Segregation
- Collection and Transportation
- Disposal

It is proposed to provide adequate septic tanks with soak pits for treatment and disposal of sewage. This waste will be collected, segregated and disposed off in line with the provisions laid down in Solid Waste Management Rules, 2016.

7.8.5 Energy Conservation Measures

The existing facilities will become insufficient for supply of kitchen fuel for the migrant population during the construction of the project. Therefore, the project authorities would make adequate arrangements such as Community kitchen, Supply of Kitchen fuel, efficient cooking facilities and solar lantern either directly by developer or through contractor to reduce the pressure on natural resources in the project area and minimize impacts on this count.

7.8.6 Labour Management Plan for their Health and Safety

Construction work has many associated risks and health impacts for the workers who are directly exposed to such health and safety risks. Therefore, there is a need to prepare complete health and safety documents for workers either by project proponent/contractor and proponent shall ensure its implementation. A detailed plan will be prepared covering the above activities before start of construction work.

7.9 Assessment of Significance of Impacts

Impacts, are discussed in this chapter, along with the mitigation/management measures for Construction and Operation Phase respectively.

Mitigation Measures

Lakhwar project, involves construction of dam and other associated infrastructure, and construction period is planned for 69 months. Major construction activities have serious potential of pollution generation and impacts all components of environment as discussed above. Impacts arising out of construction activities can be mitigated significantly by taking appropriate mitigation measures, as discussed below.

7.9.1 Air Pollution

The various sources causing air pollution during the construction phase are as follows.

- **Particulate Matter (PM):** Various activities such as, crushing, transportation of material in open trucks, open dumping in muck disposal sites, vehicle movements, operation of Diesel Generator Sets, etc.
- **Oxides of Sulphur (SOx):** SOx is released into the air from vehicular exhaust, Diesel Generator Sets, coal burning chulahs, etc.
- **Oxides of Nitrogen (NO_x):** Motor vehicles and fuel burning are generally responsible for the release of oxides of nitrogen into the ambient air.

Control of Air Pollution

For the control of air pollution during construction phase of the project, it is suggested that it should be made mandatory for the contractors engaged in the construction works to ensure the implementation of pollution control measures as per CPCB guidelines with regular monitoring of ambient air quality in the project area. Necessary clause shall be incorporated in the contractor's agreement.

7.9.2 Noise Pollution

Various sources of noise pollution in the project area during the construction phase include vehicular movement, operation of heavy machinery, crushing, aggregate processing plants, diesel generator sets, etc.

Impacts of Noise Pollution

Noise is generally harmful and is considered to be a serious health hazard like physical, physiological as well as psychological effects on human beings and animals. The immediate and acute effect of noise causes impairment of hearing (total deafness).

Control of Noise Pollution

Various measures for control of noise pollution in the project area are suggested below:

- Diesel Generator sets are to be placed in acoustic enclosures to reduce the noise.
- Ear protection aids such as ear plugs, earmuffs, etc., must be provided to the workers who have to work in the noise prone area.
- Proper and regular maintenance/lubrication of machines should be done.
- Noise producing machines (such as crushers, aggregate processing plants, etc.) should be provided with sound barriers.
- Salient machines and vehicles with high quality silencers should be used.
- Afforestation around the residential colonies and office complexes should be done as proposed under the Afforestation Programmes.
- Ambient noise should be monitored periodically at different locations.

7.9.3 Water pollution

Various sources of water pollution in the project area during the construction phase include disposal of effluents with high turbidity from crushers commissioned at project site and effluents from construction sites like Dam, Intake, channels, sewage disposal from labour camp, excavation and other land clearing activities, washing of oil, grease and other chemical from diesel generator sets, vehicles and other machinery etc.

Eutrophication also may result from the excessive levels of nutrients lead to excessive algal growth, including that of blue green algae, which are obnoxious in nature.

Soil erosion and siltation will be minimized by preventive measures and engineered storm water diversion on a case by case basis. All project areas will be provided vegetation cover wherever appropriate by creation of natural fences of shrubs, and grasses to reduce erosion during the construction period.

Control of Water Pollution

To avoid deterioration of water quality of the receiving water bodies following measures are suggested

- Provision of septic tank/ soak pit of adequate capacity for labour camp.
- Provision of sedimentation cum grease traps to prevent entry of contaminants to the water bodies.
- Oil interceptors shall be provided and residue of petroleum products will be disposed off in accordance with PCB guidelines.

8. ENVIRONMENT MANAGEMENT PLAN

8.1 Biodiversity Conservation & Wildlife Management Plan

Habitat degradation, land use /land cover changes, hunting and poaching, invasiveness of exotic species are main threats to biodiversity and wildlife. Keeping in view of the anticipated impacts, the main objectives of biodiversity conservation and wildlife management plan are as follows:

- Mitigation measures to be adopted during construction phase

- Conservation Measures for birds
- Awareness programme
- Fire Protection Measures
- Strengthening of Infrastructure for Patrolling, Vigilance and Monitoring

8.2 Fisheries Management Plan

The present status of Yamuna and its tributaries in the proposed project area presents a healthy environment for fisheries. The construction of Lakhwar dam, however, will create changes on aquatic environment of downstream and upstream reaches.

In order to mitigate the adverse impact of project on the aquatic ecology of the area fishes in particular the following measures shall be adopted to protect and preserve existing aquatic life:

- Development of fish hatchery
- Development of reservoir fishery
- EX-situ and In-situ conservation and Management

8.3 Green Belt Development Plan

The main objective of green belt development plan is to provide a barrier between the sources of pollution and the surrounding areas. The green belt helps to capture the fugitive emission and to attenuate the noise generated apart from improving the aesthetics

Green belt development will comprise of road side plantations, green belt around dam site, crusher plants, around the periphery of reservoir rim and at different project offices and colonies.

8.4 Reservoir Rim Treatment Plan

The construction of the Lakhwar Multipurpose Project will create huge reservoir upstream of the proposed Lakhwar dam in the Yamuna river. An area of 9.57 sq km upto 796 m elevation will be submerged in the submergence of the Lakhwar dam. The objective of the Reservoir Rim Treatment plan is to check sedimentation in the reservoirs, and to mitigate the effects of debris flow and landslides along the reservoir rim especially during the drawdown period of the reservoir. The reservoir rim is characterized by 95 seasonal or perennial streams directly draining in it and 12 landslides prone areas in the reservoir rim of Lakhwar Project.

Based on the investigations of active landslides and stream network, treatment measures such as stream training works, construction of retaining structures, slip stabilization structures and vegetative measure are proposed for the landslides and stream training works are proposed for the directly draining streams.

8.5 Disaster Management Plan

In order to visualize the worst case scenario Dam Break Modeling exercise was undertaken and an inundation map was prepared. Based upon the outputs generated from this modeling, a Disaster Management Plan has been formulated. This plan presents warning and notification procedures to be followed in case of failure or potential failure of the dam. The purpose is to provide timely warning to the population likely to be affected and alert key people who have to take respective actions in case of an emergency.

The estimated total cost of execution of disaster management plan including the equipment would be **Rs**. **275.00 lakh.**

8.6 Social Impact Assessment and Rehabilitation & Resettlement Plan

A detailed survey was carried out for the land which will come under submergence or otherwise need acquisition for setting up of project along with the identification of families who will get affected due to loss of land and/or houses. Total 35 villages shall be affected due to acquisition of land for various components of proposed project. The village wise and component wise non-forest (private) land requirement and affected families due to Lakhwar Multipurpose Project is given in **Table 5**.

Table 5: List of Project Affected Village and Project Affected Families

S.N.	Name of Village	Number of Project Affected Families (PAFs) for acquired land			Number of Project Affected Families for yet to be acquired land		
		Fully Affected	Partially Affected	Total Affected	Fully Affected	Partially Affected	Total Affected
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
District- Dehradun							
1	Chunho	0	13	13	0	0	0
2	Dhanpo	0	54	54	0	0	0
3	Lakhwar	36	169	205	0	3	3
4	Khati	0	36	36	0	6	6
5	Dwau	0	1	1	0	14	14
6	Khunna Alman	0	4	4	0	27	27
7	Ludhera	0	10	10	0	9	9
8	Laksyar	0	149	149	0	0	0
9	Katapathar	0	77	77	0	0	0
10	Lohari	0	66	66	0	0	0
11	Bosan	0	0	0	0	0	0
12	Saryana	0	0	0	0	0	0
13	Ubhau	0	0	0	0	7	7
		36	**579**	**615**	**0**	**66**	**66**
District- Tehri Garhwal							
1	Ranogi	43	0	43	0	31	31
2	Kandriyan	0	41	41	0	0	0
3	Maror	0	19	19	0	23	23
4	Gildichuk	0	56	56	0	0	0
5	Tator	0	25	25	0	71	71
6	Bel	0	48	48	0	23	23
7	Sainji	0	61	61	0	0	0
8	Kandi Malli	0	6	6	0	79	79
10	Sarab	0	3	3	0	128	128
11	Kharson Kyari	0	78	78	0	0	0
9	Kandi Talli	0	3	3	0	77	77
12	Melgarh	0	40	40	0	0	0
13	Kona	11	16	27	0	0	0
14	Bhatoli	0	50	50	0	0	0
15	Timliyan Gaon	0	38	38	0	4	4
16	Khairar	0	12	12	0	1	1

S.N.	Name of Village	Number of Project Affected Families (PAFs) for acquired land			Number of Project Affected Families for yet to be acquired land		
		Fully Affected	Partially Affected	Total Affected	Fully Affected	Partially Affected	Total Affected
17	Banogi	0	16	16	0	3	3
18	Bhediyana	0	0	0	0	29	29
19	Rayat Gaon	0	0	0	0	52	52
20	Parogi	0	0	0	0	24	24
21	Chamya Goon	0	0	0	0	16	16
22	Nain Gaon	0	0	0	0	23	23
	Total (B)	**54**	**512**	**566**	**0**	**584**	**584**
	Total (A+B)	**90**	**1091**	**1181**	**0**	**650**	**650**
Total Affected Families						**1831**	

Note:-
1. Number of families in column 5 are as per survey based on last entry date June 2013 of Panchayat Parivar Register.
2. The number of family may vary due to verification before implementation of R&R and subsequent order regarding entry date of GoU if any.

As can be seen from the above table, a total of 1831 families have been identified as PAFs, out of which 1181 have already taken compensation during earlier land acquisition process, however, land was not utilized for the project because project construction could not progress. There are 650 project affected families (PAFs) have been identified who will be affected for additional private land acquisition for the proposed Lakhwar Multipurpose project.

The Rehabilitation and Resettlement Plan has been prepared to comprehensively address the issues arising out of land acquisition, assessment of land/house/asset coming under acquisition, estimation of extent of loss and compensation to be offered in line with guidelines issued by Government of Uttarakhand regarding R&R of Lakhwar and Vyasi Project vide letter no. 66/I/2016-05/104/2005, dated 13.01.2016; letter no. 413/I/2016-05/104/2005, dated 24.06.2016; letter no. 502/I/2016-05/104/2005, dated 19.07.2016; letter no. 871/I/2016-05/104/2005, dated 25.07.2018.

8.7 Corporate Environment Responsibility

As per MoEF&CC OM of May 01, 2018, the fund allocation for CER shall be deliberated in the EAC, with a due diligence subject to maximum percentage prescribed.

UJVNL is committed to sustainable development at all its facilities and work to the satisfaction of all stakeholders through Corporate Environment Responsibility (CER). The aim of CER Plan is focused sustainable development to improve the quality of life of neighborhood communities through equitable and proactive smart initiatives in spheres of education, health, rural development, environment and livelihoods resulting in improvement of the overall local social, economic and environmental conditions.

8.8 Environmental Monitoring Programme

Environmental monitoring provides feedback about the actual environmental impacts of a project on surrounding environment after implementation of mitigation and management

measures during construction and operation phase of the project. Monitoring results help judge the success of mitigation measures in order to reduce impacts on the environment or local population. They are also used to ensure compliance with environmental standards and to facilitate any needed project design or operational changes.

8.9 Environmental Monitoring Plan

Environment Monitoring Plan deals with the administrative aspects of ensuring that mitigation measures are implemented and their effectiveness monitored. The proposed EMP aims at ensuring the implementation of proposed mitigation and monitoring measures along with the responsible agency for implementation. UJVNL is committed to ensure that all possible impacts are mitigated and shall ensure compliance to the national and state level regulatory requirements with a view to mitigate potential adverse environmental impacts resulting from the proposed project activities.

A grievance mechanism will be established where complaints and grievances of the locals as well as the labour force will be directly addressed.

8.10 Cost Estimates of EMP

The costs involved for implementation of Environmental Management Plan and Corporate Environment Responsibility Plan for Lakhwar Multipurpose Project are summarized in the table given below.

Table 6: Cost for Implementing Environmental Management Plan & CER Activities

Sl. No	Component of EMP	Capital Cost (Rs. In lakh)	Recurring Cost (Rs. In lakh)						Total Cost (Rs. In lakh)
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
1	Muck Dumping and Management Plan		40.00	40.00	40.00	40.00	20.00	5.13	185.13
2	Landscaping, Restoration of Quarry and Construction Sites					38.50	38.50	5.00	82.00
3	Public Health Delivery System	60.00	29.00	29.00	29.00	29.00	29.00	29.00	234.00
4	Solid Waste Management Plan	95.00	18.72	18.72	18.72	18.72	18.72	33.72	222.32
5	Energy Conservation Measures	63.00	20.00	20.00	19.00	18.00	18.00	18.00	176.00
6	Workers Health and Safety	50.00	11.00	11.00	11.00	11.00	11.00	6.00	111.00
7	Pollution Mitigation Measures	25.00	10.00	10.00	10.00	10.00	10.00	10.00	85.00
8	Environmental Monitoring Program	2.00	8.80	8.80	8.80	8.80	8.80	26.40	72.40
9	Rehabilitation and Resettlement Plan	23308.50	17.0	17.0	17.0	17.0	16.0	16.0	23408.50
10	Biodiversity Conservation & Wildlife Management Plan	108.50	16.60	16.60	16.60	16.60	16.60	16.50	208.00
11	Fisheries Conservation and Management Plan	157.00	32.41	32.41	32.41	32.41	32.41	32.41	351.44
12	Green Belt Development Plan		26.50	26.50	26.48	2.00	2.00	2.00	85.48
13	Reservoir Rim treatment	351.41							351.41
14	Disaster Management Plan	80.00	20.00	20.00	20.00	20.00	20.00	20.00	200.00
	Total	**24300.41**	**250.03**	**250.03**	**249.01**	**262.03**	**241.03**	**220.16**	**25772.68**
Other Costs									
15	CER Budget @ 0.5% of Rs.5747.17 crore (project cost)		479.00	479.00	479.00	479.00	479.00	480.00	2875.00
Total		**24300.41**	**729.03**	**729.03**	**728.01**	**741.03**	**720.03**	**700.16**	**28647.68**