# PRE-FEASIBILITY REPORT

**(As per "Guidelines for preparation of pre-feasibility report for obtaining prior EC in terms of the provisions of EIA notification, 2006")**

**for**

# Renukaji Dam Project in District Sirmaur of Himachal Pradesh

HP
POWER CORPORATION LTD.

**July 2022**

**Submitted by:-**

## HIMACHAL PRADESH POWER CORPORATION LIMITED (HPPCL)

## 1. EXECUTIVE SUMMARY

It has been estimated that the gap between the demand and availability of drinking water to National capital Delhi shall be 1.075 B.C.M. by AD 2001. Apprehending the seriousness of the problem, a committee under the name "Technical committee for advance long term planning to ensure adequate water supply to Delhi" was constituted. This committee suggested construction of storage dams in upper Yamuna basin as long term measures for over -coming the storage of drinking water to Delhi.

Renukaji Dam Project is one of such storage schemes. The scheme consists of construction of a dam on river Giri, a tributary of Yamuna. The entire dam complex, storage reservoir as well as catchment area falls within the territorial boundary of Himachal Pradesh. The project when completed shall store the monsoon water of river Giri to be released later on in a regulated manner as per the drinking water requirement of Delhi. The project will also generate 40 MW of power during peak flow.

The project comprises rock fill dam 148 m high (above river bed level) with central inclined impervious clay core with top of dam at El.778m, full reservoir level (FRL 766m), chute spillway on the left bank with crest El. 749 m having 5 Nos. bays controlled by 5 Nos. radial gates (14.0m x 17m) to allow a discharge of 16701 cumecs through it. 3 Nos. diversion tunnels 10.5 m $\phi$ ± 1600m long on the right bank which later shall be used for emergency dewatering, a surface Power house with 2 Nos. vertical axis Francis units of 20 MW capacity each.

The Renukaji Dam will provide a seasonal live storage of 49800 Hectare metre between El. 710.5 m and El. 766m for water supply to Delhi and a flood storage of 4553 hectare metre between El. 766 m and El. 772.50 m for moderating flood peaks.

The updated cost at October 2018 price level is 6946.99crores (Civil works = 6811.92 Crores and Electrical works = 121.81 Crores & Transmission works= 13.26 Crores) has been approved.

The project was estimated to generate 168 Mkwh of firm power besides 44 Mkwh of additional power at Majri power house in a dependable year. However as per revised power study done by CWC New Delhi the project shall generate 199.99 Mkwh in a dependable year. The Majri Power house shall generate 75.78 Gwh of additional firm power. The cost of the generation has been worked out on 275.772 Gwh (199.99 + 75.78) Gwh. This will mitigate the scarcity of power in Himachal Pradesh during winter months to some extent.

The project will ensure 0.37 maf of live water storage in its reservoir and a firm water supply to the tune of 23 cumecs to Delhi water supply & sewage Disposal Undertaking besides providing benefits by way of power generation.

As per notification issued by Govt. of H.P., the 15% of the minimum inflow observed in the lean season is to be released and maintained immediately downstream of the diversion structure. With the release of the above water from the Jateon barrage the net power gain shall be 75.78 Gwh instead of 93.83 Gwh.

**SALIENT FEATURES OF THE PROJECT**

| | | |
|---|---|---|
| **1** | **Location** | |
| i) | State | Himachal Pradesh |
| ii) | District | Sirmour |
| iii) | Tehsil | Renukaji |
| iv) | Dam site | Across river Giri about 1.50 km. u/s of Dadahu Bridge on river Giri and 375 m d/s of confluence of Jogar-ka-Khala with river Giri. |
| **2.** | **Hydrology** | |
| i) | Catchment area above dam site | 2175 Sq.Km. |
| ii) | Annual run off at dam site | |
| a) | Max. run-off (1988-89) | 318700 ha.m |
| b) | Mean year (1948-49) | 124575 ha.m |
| c) | 75% year (1982-83) | 93408 ha.m |
| d) | 90% year (1974-75) | 69161 ha.m. |
| e) | 100% year (1987-88) | 31203 ha.m |
| iii) | Maximum peak flood observedin September 1978 | 8567.65 cumecs |
| iv) | Design flood P.M.F | 16701 cumecs |
| | C.P.F | 8803 cumecs |
| v) | Mean annual rainfall in the catchment area | 1390 mm |
| **3.** | **River diversion works** | |
| **a)** | **Diversion tunnels** | 3 |
| | Finished dia | 10.5 m circular |
| | Slope | 1 in ± 400 |
| | Avg Length | ± 1600 m each |
| **b)** | **Coffer dams** | |
| i) | Upstream coffer dam | |
| | Height | 45m |
| | Top elevation | 680m |
| | U/S slope | 2.75:1 |
| | D/S slope | 2:1 |
| ii) | D/S coffer dam | |
| | Distance d/s from toe of themain dam | 60 m |
| | Top Elevation | 640 m |
| | U/s slope | 2:1 |
| | D/s slope | 2.5:1 |
| **4.** | **Main dam** | |
| i) | Type | Rock fill dam with inclined impervious central core |
| ii) | Height of the dam above river bed level | 148.00 m |
| iii) | Elevation at top of the dam | 778.00m |
| iv) | River bed level at the dam site | 630.00m |
| v) | Expected deepest foundation level | 600.00m |
| vi) | Length of dam at top | 430.00m |

| | | |
|---|---|---|
| vii) | Length of dam at river bed | 125.00m |
| viii) | Max. width of the dam at the river bed. | 844.50m |
| ix) | Upstream slope | 3:1 |
| x) | D/S slope | 2:1 |
| | | |
| **5.** | **Reservoir** | |
| i) | Minimum drawdown level (MDDL) | 710.50m |
| ii) | Dead storage capacity | 22800 ha.m |
| iii) | Maximum reservoir level (MRL) | 772.50m |
| iv) | Normal reservoir level (NRL) | 766.00m |
| v) | Live storage capacity | 49800 ha.m |
| vi) | Flood absorption capacity (between 766 m and MRL) | 4553 ha.m |
| vii) | Water spread at FRL 766 m | 1210 ha.m. |
| viii) | Length of reservoir | 24 km. |
| | | |
| **6.** | **Spillway** | |
| **a)** | **Chute spillway** | |
| i) | Crest elevation | 749.0 |
| ii) | Total width in between abutment | 86 m |
| iii) | No. of bays | 5 |
| iv) | Span of each bay | 14 m |
| v) | No. of piers | 4 |
| vi) | Thickness of piers | 4m |
| vii) | Design flood | 16701 cumecs |
| viii) | Size of Spillway gates | 14.0m X 17.0 m |
| | | |
| **b)** | **Diversion tunnels** | |
| i) | Number of tunnels | 3 |
| ii) | Type | Circular lined tunnel |
| iii) | Diameter | 10.5 m |
| iv) | PMF | 16701 cumecs |
| v) | Top elevation of intake shaft for Diversion tunnel | 703.25m |
| vi) | Diameter of intake shaft | 10.5m |
| vii) | Top elevation of gate shaft | 780.00m |
| viii) | Dia of gate shaft | 6.25m |
| ix) | Invert level of flip bucket | 640.00 |
| | | |
| **7.** | **Penstock** | |
| **a)** | **Power Tunnel** | |
| i) | Finished dia | 3.15m |
| ii) | Approximate Length | ± 750m |
| iii) | No. of tunnel | 1 |
| iv) | Top elevation of intake (submerged) | 711.50m |

| | | |
|---|---|---|
| **b)** | **Penstock (Main** | |
| i) | Type | Steel circular penstock |
| ii) | Diameter | 3.15m |
| iii) | Length | |
| | Vertical | 59.50m |
| | Horizontal | 672.50m |
| iv) | Velocity | 5.65m/sec. |
| **c)** | **Penstock (after bifurcation)** | |
| i) | Type | |
| ii) | Number | 2 |
| iii) | Diameter | 2.25m |
| iv) | Length | 12.50m each |
| **8.** | **Power House Complex** | |
| **a)** | **Power House** | |
| i) | No. of generating units | 2 |
| ii) | Capacity | 20MW |
| iii) | Max. flood level at power house site | 635.00m |
| iv) | Service bay elevation | 635.80m |
| v) | Design head | 108.00m |
| vi) | Design discharge | 44 cumecs |
| vii) | Type of turbine | Francis |
| viii) | Setting | Vertical shaft |
| xi) | Elevation of turbine at centre line | 623.00m |
| **b)** | **Tailrace channel** | |
| i) | Width | 10.00m |
| ii) | Tail water level | 627.00m |
| **c)** | **Switchyard** | |
| i) | Elevation | 680.00m |
| ii) | Site | 100mx40m |
| | | |
| | TRANSMISSION LINES | |
| | No. of circuits | Two, Double Circuit |
| | Voltage | 132KV lines to Majri |
| | | |
| | **POWER GENERATION** | |
| | Peaking capacity during lean period | 40 MW |
| | Annual energy generation in 90% dependable year. | 199.99 GWH |
| | | |
| | **COST ESTIMATE** | |
| | Capital cost of the project for Civil Works. | 6811.92 Crores |

## 2. INTRODUCTION OF THE PROJECT/ BACKGROUND INFORMATION

### i. Identification of Project and Project Proponent

Since 1942, Punjab Engineers had been trying to find the ways and means to exploit the power potential of river Giri. At the instance of Punjab Government, Punjab Irrigation Department had established discharge observation site on river Giri at Chandni in 1943. As a result of the investigations carried out by Dr. J.L. Savage in the year 1944 and later on by the surveys carried out by Survey of India and the expert advice of eminent Er. A.N. Khosla and Er. Kanwar Sain, it was proposed by the Government of Punjab in the year 1962 to construct a 120 meter high gravity dam on river Giri upstream of Chandni village. In April, 1964 the Government of Himachal Pradesh created a separate department of Multi- purpose projects and power for carrying out the investigations, planning and execution of hydel projects in Himachal Pradesh. MPP & Power Department proposed the development of Giri Hydel power in Stage-I and Stage-II. Stage-I (since completed) comprised of run-of-the river type development with a barrage on Giri River at Jateon and power house (60 MW) near Majri. Stage-II had been proposed as storage dam upstream of Jateon on Giri River with power house at the toe of the dam. Consequently the investigations were initiated for the construction of about 140m high(above river bed level) rockfill dam, on river Giri upstream of Dadahu and downstream of the confluence of river Giri and Jogar-ka-Khala, instead of previously proposed 120 meter high dam on river Giri upstream of village Chandni, so that the storage of water upstream of Dadahu dam can be utilized for the power generation (40 MW), augmentation of power at Majri power house, to ensure supply about 45000x104$m^3$ of additional water which could be either used to augment the drinking water supply of Delhi or for providing additional irrigation in Haryana/U.P. HPSEB had prepared project report of Renukaji Dam Project in the year 1976 with top of the dam at El. 771.14m which provided only for power generation and drinking water supply/additional irrigation. The project report had not been submitted to Govt. of India as it was felt that this project should inter-alia provide for flood control. Meanwhile the country faced the unprecedented flood in river Yamuna during Sept., 1978. This necessitated change of scope of the project to now provide for flood control as well. The project report was prepared in January, 1981 and submitted to CEA for approval. During scrutiny of the detailed project report, it was observed that Giri catchment area upstream of the proposed Renukaji Dam site was only 7% of the total catchment area of Yamuna River at G&D site Okhla (Delhi) and as such effect of flood at Tajewalla head works and in downstream areas upto Delhi will be marginal. Further surface and sub- surface investigations were also advised by CWC to establish the technical feasibility of the scheme. However, as Renukaji dam project was not feasible economically as a pure hydel generation scheme, further investigation works were not carried out.

Due to rapid growth of population in and around Delhi capital region the water scarcity is increasing year after year. Taking cognizance of the problem, Ministry of Water Resources directed CWC/CEA to explore the possibilities for augmenting the drinking water supply of Delhi. However, due to non availability of funds the work on the suggested investigations could not be taken up. It was during January, 1992 that a final decision on the matter was taken in the meeting called by Chairman, CWC, wherein DWS & SDU agreed to finance the remaining feasibility stage investigations & pre-construction stage investigations. Since then extensive field exploratory works have been carried out and the project report has been modified on the basis of latest hydro-meteorological data, surface and sub-surface exploration, the GSI recommendations and also the fact that the scheme will be mainly for providing the water supply to Delhi.

Detailed Project Report (DPR) of Renukaji Dam Project was again formulated by HPSEB in the year 1993 with this new objective of partially meeting drinking water requirement of Delhi. The same was submitted to Central Water Commission (CWC) on dated 31.3.93 for according techno- economic clearance. After detailed scrutiny, DPR was cleared from Hydrology (North), Gates Design Directorate, Embankment Directorate, C&MDD Directorate, Hydel Civil Design Directorate and Construction Machinery Consultancy Directorate. The project was put up to the Advisory Committee on Irrigation, Flood Control and Multipurpose Projects for consideration, in its 72nd meeting held on dated 18.01.2000, was considered and found acceptable from techno-economical angle.

Govt. of NCT of Delhi and Govt. of Haryana started giving funds for land acquisition in October 2008. Accordingly, DPR of the Project was again put up for cost updation to CWC. The CWC suggested updating of the hydrology of the Project keeping in view the availability of longer duration of discharge data and changes in design flood on the basis of probable maximum precipitation values provided by India Meteorological Department (IMD). This necessitated changes in Spillway and Diversion Tunnel parameters. Revised DPR including Revised Cost Estimate at March, 2009 PL amounting to Rs 3572.19 score submitted to CWC by HPPCL vide letter dated 13.11.09. The cost of the project was finalized by CWC as Rs. 3498.86 Crore (PL March 2009) (excluding IDC, escalation and Local Area Development Fund (LADF).

Cost updation was again taken up in 2015 and updated cost estimate of the Project (March 2015 Price Level) amounting to Rs 5242.89 Crore (including Civil, Electrical, Transmission & LADF) submitted in CWC on dated 01.05.2015 was presented to CWC. The cost was approved at Rs 4596.76 crore in 2016. Further CWC apportioned the cost between water component and power component as Rs 4325.43 crore and Rs 271.33 crore respectively.

Renukaji Dam Project (40 MW) has been declared as a project of National importance vide Ministry of Water Resources (MoWR) Letter no. 27/1/2009-PR, dated 26th February, 2009. In accordance with the extant guidelines of “National Project” the cost of water component shall be borne by Govt. of India (GoI) and other beneficiary states in the ratio of 90:10. Further, in a meeting dated 12-09-2018, held under the Chairmanship of Hon’ble Union Minister of WR,RD &GR, Govt. of Delhi has agreed to fund the cost of power component to the extent of 90%. Now the approved updated cost at October 2018 price level is 6946.99crores. (Civil works = 6811.92 Crores and Electrical works = 121.81 Crores & Transmission works= 13.26 Crores)

**ii. Brief description of nature of the project.**

Renukaji Dam Project is proposed as a storage scheme on river Giri- a major tributary of Yamuna River by constructing a 148 m high rockfill dam which has been envisaged primarily an additional source of water supply to National Capital Delhi State. The requirement of water supply by Delhi will be released from this storage reservoir in a regulated manner. The regulated discharges and additional spillage, if any, are proposed to be utilized in a power house at the toe of the dam, an additional benefit by way of generation of power.

**iii. Need for the Project and its Importance to the Country or Region**

Keeping in view the scarcity of drinking water in NCT of New Delhi, this Renukaji Dam Project has been planned purely to supply the drinking water to Delhi. The Project shall be able to

provide 0.498 BCM additional water by storing the monsoon flows of river Giri. In addition, it will have 40 MW of installed capacity and shall generate 199.99 GWH of power in a 90% dependable year. The power generation from the Project (i.e. 40 MW) is however incidental.

**iv Demand-Supply Gap**

According to Economic Survey of Delhi, 2021-22, the total requirement of water for NCT of Delhi in March 2021 was 1380 MGD for the projected population of 23 million based on the norm of 60 Gallon Per Capita per Day (GPCD). The installed treatment capacity of Water of DJB was increased to 921 MGD in the year 2021. Average potable water productions in 2021-22 was 953 MGD with raw water available from various sources: (i) Yamuna and Ravi-Beas Water (389+221= 610 MGD), Ganga Water (253) MGD and Ground Water (90 MGD).

**v. Imports vs. Indigenous Production**

Not applicable in the present project.

**vi. Export Possibility**

Not applicable in the present project.

**vii. Domestic/ Export Markets**

Not applicable in the present project.

**viii. Employment Generation**

Direct employment of people during construction period is estimated to be to the tune of 1000 to 1500 persons (averaged as 1200 persons) for about 300 days in a year. The direct employment about 250 persons would be there for maintenance and for power supply as regular employees during operation phase.

## 3. PROJECT DESCRIPTION

**(i) Type of Project Including Interlinked and Interdependent Projects, If any**

Renukaji Dam Project is proposed as a storage scheme on River Giri- a major tributary of Yamuna River. Barrage of Giri Stage –I project (60MW) commissioned during 1978 is situated 3km d/s of the proposed Renukaji Dam Project. Due to construction of Renukaji Dam Project Giri Stage –I project shall generate 75.78 Gwh of additional firm power.

**(ii) Location**

Renukaji Dam Project is proposed to be located across river Giri about 1.5 km upstream of Dadahu Bridge on Dadahu-Sangrah motor road in district Sirmaur of Himachal Pradesh. The basin upto the proposed dam site lies between longitude $77^0$03’12” to $77^0$39’10” E and latitude $30^0$36’51” to $31^0$15’23” N and elevation varying from 630 m to 3626 m above msl. The project is about 40 km from Nahan the district headquarter of Sirmaur district. Nearest rail head is at Ambala/Jagadhri about 100 kms. The proposed project location and general layout plan are shown in Figures 3.1 and 3.2**,** respectively.

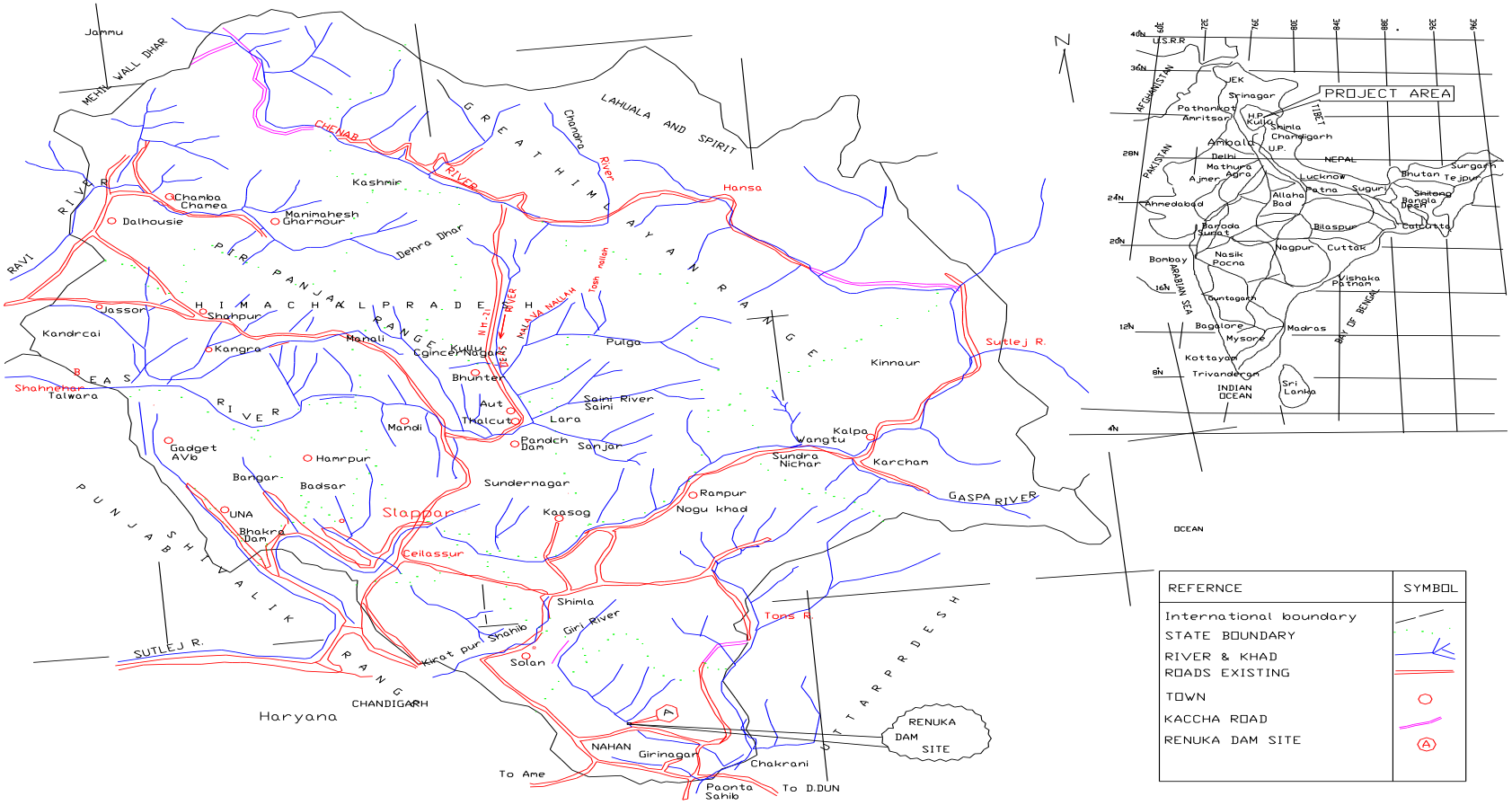



FIGURE 1.1- PROPOSED PROJECT LOCATION

Figure 3.1 –Proposed Project Location

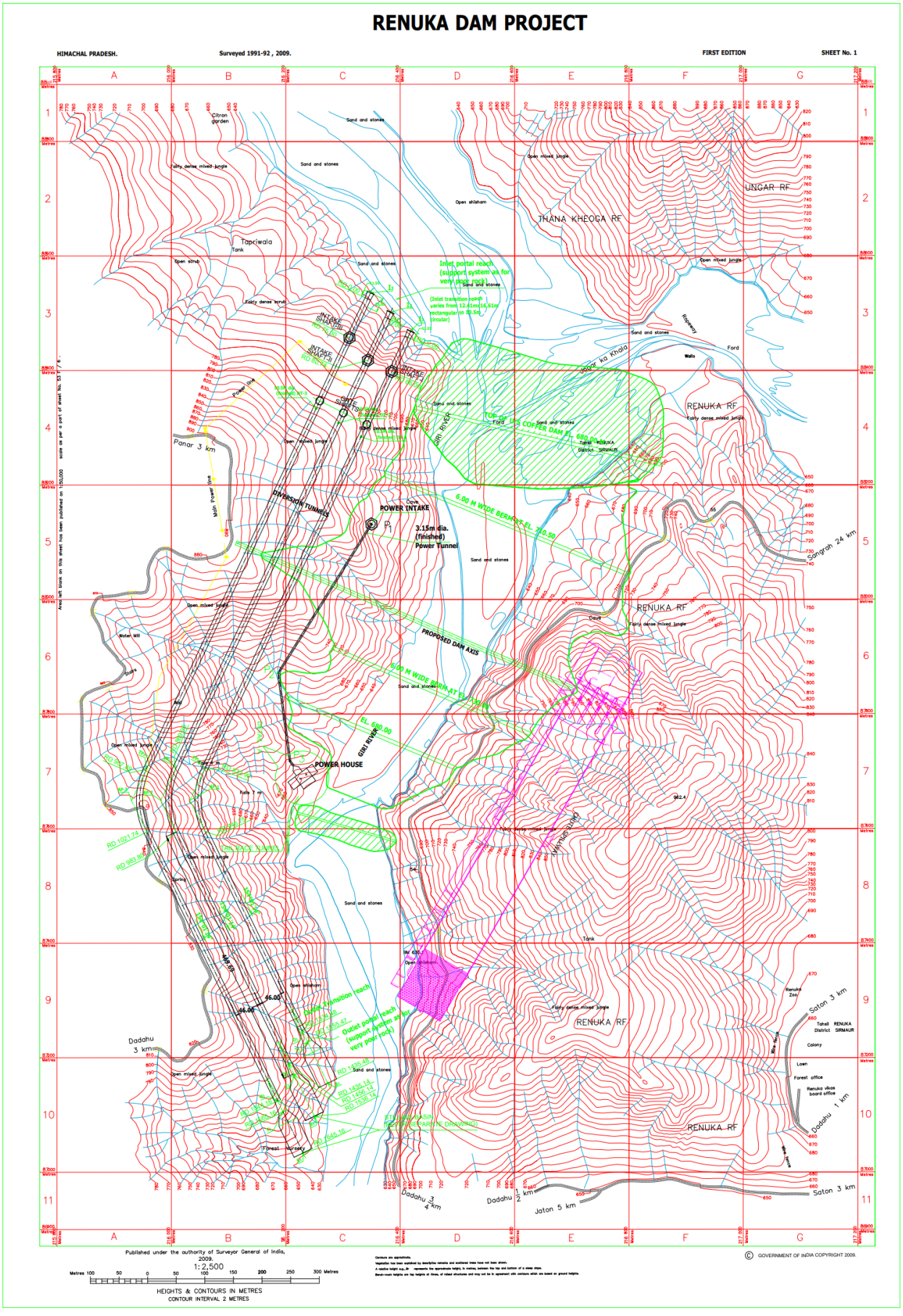



Figure 3.2 -General layout plan

**(iii) Details of Alternate Sites**

**Selection of dam site**

For the proposed storage dam across the river Giri, two alternative sites have been studied. The lower site is located about 1 km downstream of the confluence of river Giri with Jogar-ka-Khala & the other site is upstream of the previous lower site & is about 375m downstream of confluence of Giri with Jogar-ka-Khala. On the basis of surface geology & sub surface explorations conducted in the dam area, the upper site has been preferred to the lower site. Because lower site is not suitable due to occurrence of a wide fault zone in river bed & likely loss of reservoir water through the narrow divide ridge exposing krol limestone & dolomite between river Giri on one side & Renukaji lake on the other side.

**(iv) Size or Magnitude of Operation**

As per the notification from the MoEF dated 14th September 2006, construction of new project or activities or the expansion or modernization of existing projects or activities listed in the schedule to the notification shall be undertaken in any part of India only after the prior environmental clearance from the Central Government in the Ministry of Environment and Forests, New Delhi for matters falling under Category 'A' in the schedule and at state level the State Environment Impact Assessment Authority (SEIAA) for mattes falling under Category 'B' in the said schedule, the later duly constituted by the Central Government under sub-section (3) of section 3 of the said act. Though the project, a river valley project, entails generation of 40 MW of power falls in Category 'B' but has been classified as Category 'A' project in view of the provision under general condition which clearly spells that any project even specified in Category 'B' will be treated as Category 'A', if located whole or in part within 10 km from boundary of any projected area notified under the Wildlife (Protection) Act, 1972 in as much as Renukaji Wild Life Sanctuary is involved.

**(v) Project Description with Process Details**

Renukaji Dam Project envisages the construction of a 148m high rockfill dam on river Giri near Dadahu upstream of Jateon barrage (Giri Stage-I) in Sirmour district for storing the monsoon water of river Giri and then releasing the same to meet the drinking water supply of National Capital Delhi state during the lean flow period of river Yamuna. The project also utilizes the available head to create an installed capacity of 40 MW having two units of 20 MW each in the power house at the toe of the dam. As the dam is situated near the famous religious shrines of Renukaji ji, the name of the project has been kept as "RENUKAJI DAM PROJECT".

Based upon the results of detailed investigations geological, recommendations by GSI, and engineering studies made, present proposal has been formulated which comprises mainly:

(i) A rock fill dam 148.00m high (above river bed level) with central inclined impervious clay core near Dadahu village.

(ii) A chute spillway on left bank having five bays controlled by five Nos. radial gates to allow a discharge of 16701 cumecs through it.

(iii) 3 Nos. diversion tunnels 10.5m ø each ± 1600m long on the right bank. These tunnels shall also be used for emergency depletion of the reservoir during operation stage.

(iv) A surface power house with 2 Nos. vertical axis Francis Units of 20 MW capacity each.

(vi) **Raw Material Required along with Estimated Quantity, Likely Source, Marketing area of Final Product/S, Mode of Transport of Raw Material and Finished Product.**

The main components of this project are rock fill dam & coffer dams, diversion tunnels, spillway, intake structure penstock with emergency gates, power house switchyard & tail race channel.

The requirement of impervious, pervious, filter material, riprap, rockfill for earth cum-rockfill dam is as under;

| | | |
|---|---|---|
| **1)** | Impervious material | = 3314700 cum |
| **2)** | Pervious material | = 13942000 cum |
| **3)** | Filter material | = 1540000 cum |
| **4)** | Riprap material | = 1369800 cum |
| **5)** | Coarse Aggregate | = 206050 cum |
| **6)** | Fine Aggregate | = 103025 cum |

The above quantities include construction of upstream coffer dam being part of main dam & downstream coffer dam.

The following six Quarries/sources have been identified for approximately fulfilling the requirement of pervious material: -

**1)** Excavation and cutting work of Dam components i.e., DTs, Spillway, Dam foundation excavation and side stripping etc.
**2)** Mandoli
**3)** Shirumaila
**4)** Acquired River bed both u/s and d/s of dam axis.
**5)** Jataun
**6)** Sainj

**(vii) Resource Optimization/ Recycling and Reuse envisaged in the project**

It is proposed of utilize about 71% of the excavated material on the project activities. The balance 29% shall have to be disposed off away from sites so as to make available the clear site for construction activities like concreting / pitching of rip raps and shell material etc. Since, there are no stone crusher in the nearby areas and the project activities of PWD and I & PH Deptt. are also not ongoing the balance muck has to be properly stacked and roller compacted and treated to mix and match with the surrounding environment with least change in landscape.

**(viii) Availability of water its source, Energy / Power Requirement and Source**

**Water Requirement**

During construction phase, about 294KLD water would be needed for consumptive use in meeting the requirement of staff and labour during peak construction phase of the project. Water from Giri River is proposed to be used with disinfection. For construction activities, water to the tune of 500 KLD approx. would be lifted from Giri River. During operation phase, the project would have about 23 cumecs of non-consumptive use of water. However, another hydel project (Giri–Bata, HEP) owned by another utility of the state i.e. uses Giri River's water for power generation.

**Power**

Power requirement for construction activities and for consumption in residential/non-residential complexes in the project shall be met by constructing suitable infrastructure of transmission network exclusively for this project through a 33 KV sub-station at Dadahu. A 3.15 MVA transformer a/w separate feeder and 11kv HT line to inlet & outlet diversion tunnels and 2No. 630 KVA transformers proposed at both the end and 200KVA transformer have been proposed for colony. Adequate provision for stand by diesel generating sets shall be made near Dam and Power House sites to meet essential power requirement in the event of power failure.

**(ix) Quantity of Wastes to be Generated (Liquid and Solid) and Scheme for their Management/ Disposal**

Project process does not entail generation of solid or liquid waste, however, during construction phase labour and staff housing and during operation phase project colony would generate sewage and solid waste. The sewage from labour camps would be disposed in septic tanks and also that of the project colonies at Dadahu and at Jataun. Solid waste would be disposed by the local municipal body for which the project shall provide monetary assistance.

**(x) Schematic representations of the feasibility drawing which give information of EIA purpose.**

Since the EIA/EMP studies were conducted earlier Indian Council of Forestry Research and Education (ICFRE), Deharadun during 2007. Environmental baseline data on a number of parameters is already available. Environment Management Plan (EMP) has been formulated based on the findings of EIA Studies.

**4. SITE ANALYSIS**

**(i) Connectivity:**

The project is located about 2 kms upstream of Dadahu town in Sirmour district of Himachal Pradesh and is approachable from Jagadhari in Distt. Yamuna nagar, Haryana (nearest B.G. railway station) through a metalled road of about 110 km length (Jagadhari-Paonta Sahib &Paonta Sahib-Sataun-Dadahu road). Project is also connected to Ambala Cantt./ city and Chandigarh. Residential and non-residential accommodation with necessary amenities has been provided at suitable places for construction and design staff. Workshop, stores, P.O.L. pumps explosive magazine and other infrastructural facilities have also been provided. Necessary provision for telecommunication and safety/security has also been made.

**(i) Landform, Land use and Land Ownership**

**Landform**

The catchment area is characterized by steep hills and deep valleys, the dominating classes are dense forest, open forest, waste land, agriculture & settlement patches and some degraded forest.

**Land Use:**

**Agricultural Land and Settlement:**

Around 450.7 sq km (20.7%) and 66.03 sq km (3.0%) area of the free-draining catchment comes under agriculture and settlement category.

**Barren Areas:**

The waste land category only about 6.66 sq km area i.e. 0.3% of the free draining catchment is present.

**Shrubs / Bushes / Grasslands**

Around 314.28 sq km area i.e. 14.45% of total catchment area is classified under this land-use category in the free draining catchment.

**Light Vegetation**

Light vegetation area has a spread of 240.94 sq km i.e. 11.07% of the area in the free draining Giri catchment.

**Dense Vegetation**

Dense vegetation covers about 1031.11 sq km i.e. 47.40% area of the free draining catchment.

**Water Bodies / Snow Cover Areas**

Water bodies and snow cover areas approximately cover 10.49 sq km (0.48%) and 55.32 sq km (2.54%) area in the catchment of river Giri.

**Land Ownership**

Total land required for the project is 1988.27 ha, out of which 49 ha is part of Renukaji Wildlife Sanctuary, 646ha Territorial Forests and 95 ha Revenue land & other Govt land in all and 954.27 ha of private land at various places is being acquired/diverted for different purposes and 244ha for Private land on lease for temporary use.

**(iii) Topography (along with map)**

The project on River Giri lies in the hill district Sirmaur of Himachal Pradesh and physiographically the area is covered under Sub-Himalayas consisting of Shivalik ranges and quaternary sediment. The longitude of catchment are avaries from 77°03'12" to 77°39'10"E and the latitude from 30°36'51" to 31°15'23" N. Churdhar and Haripurdhar in the North-East and Saindhar range emanating from North-West of the main site of the dam area about 2 km away from Dadahu / Renukaji. Of these three mountainous ranges, Chrudhar has comparatively higher altitudes of about 3626 m. The average altitudes are generally around 3360 to 3626 m of these mountains. The lowest altitude of 630m is at the dam axis in the riverbed 1.5 km upstream of permanent bridge of Giri river at Dadahu. The location of Dadahu is 35 kms from Nahan, headquarters of district Sirmour (Himachal Pradesh). The valley is slightly narrow on upstream upto village Siyun, about 18 km away from Dam site and wider therefrom upto village Khairi 6 km. The profile of river Giri downstream dam axis is quite wider upto the confluence with Yamuna River 50 km from dam site. Both the bank spurs have very steep precipitous slopes right from the river banks to hilltops, interspersed with partly rocky portions, with the result that there is practically less habitation along the spurs. These slopes on higher reaches are supporting healthy forest of Deodar, Kail and Fir, and the slopes along the river banks contain Khair and Sheesham forests. The low lying area along the river is fairly populated and there are about 250 villages/hamlets. Besides the principle valley of Giri, Ashni and Basri River, there are numerous smaller streams cutting up the ground into numerous ridges and ravines. Elevation of free drainage catchment ranges from 630 m to 3626 m above msl.

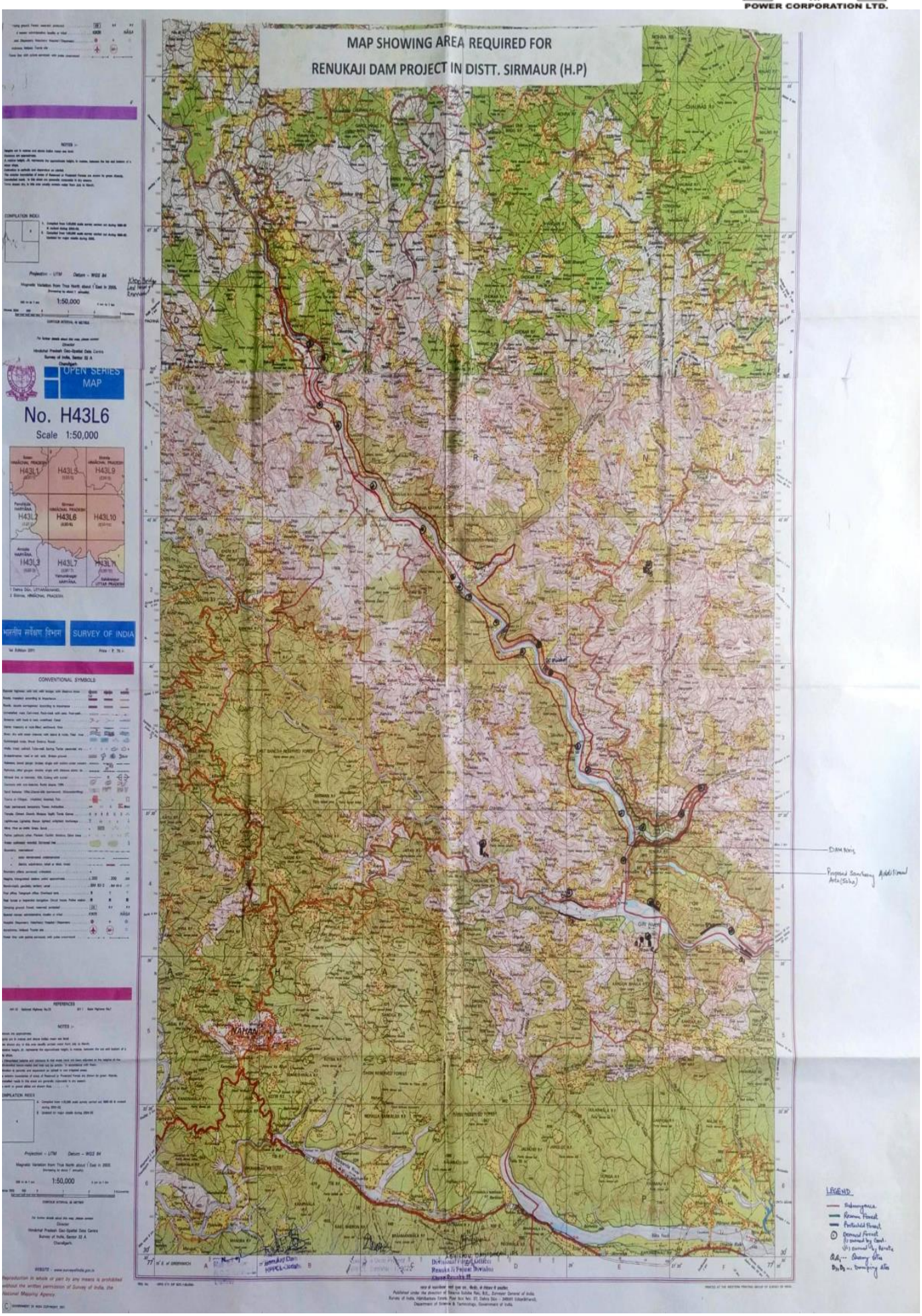



Figure 4.1Tophographic map of project area

**Seismicity**

The area falls within zone IV of the seismic zoning map of India (IS 1893- 1966). Therefore, suitable seismic factor in design of the structures would be kept under consideration.

**(iv) EXISTING LAND USE PATTERN**

The catchment area is characterized by steep hills and deep valleys, the dominating classes are dense forest, open forest, waste land, agriculture & settlement patches and some degraded forest.

**(v) EXISTING INFRASTRUCTURE & SENSITIVE ECOLOGICAL LOCATIONS**

No archaeological monument of national importance either lies in the project area or in its submergence area. There is also no structure of National Heritage in the area. The only place of importance in the area is the ancient and picturesque Renukaji lake within Renukaji wildlife sanctuary area which is about 1.5 km d/s of project and is thus not within the submergence zone of the reservoir. Renukaji Wild Life Sanctuary adjoins the project, out of which 49 ha is part of Renukaji Wildlife Sanctuary. The Apex Court has approved the diversion of area from the Sanctuary vide its order dated 17.11.2006 (CWP 202/95). Hon'ble Supreme Court of India while according approval for diversion has imposed safeguarding measures. River Giri flows at about 60 m lower elevation than of the Renukaji lake from and make a 'U" turn around the lake hills. There was no direct land route found connecting lake water and river Giri.

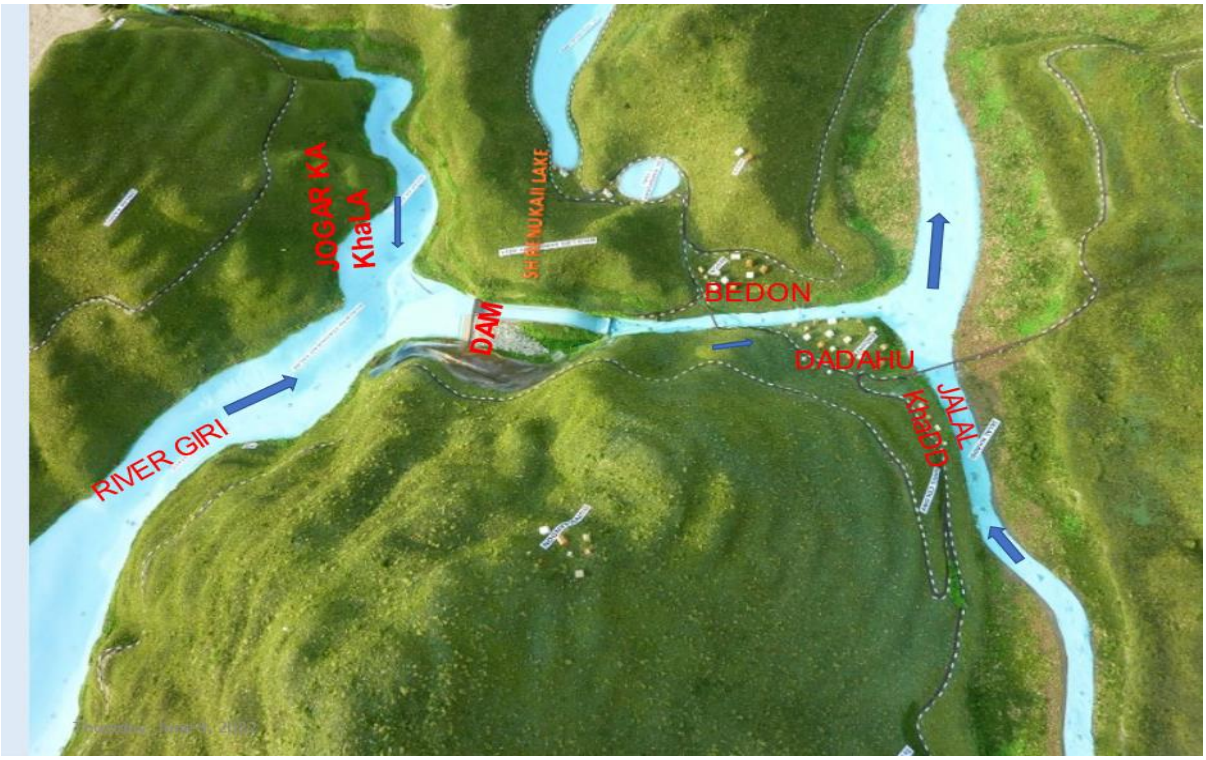



Figure4.2 Post project view and Renukaji lake

**(vi) Soil Classification**

The soil in the project area in general is quite shallow gravelly impregnated with weathered fragments of parent rock and have developed under unique environment of natural forest vegetation. The Surface layer upto 15-20 Cm is of reddish brown to yellowish brown, loamy with loose and un-decomposed organic matter and rich in humus at depth ranging from 15-50

Cm. The slope soils are composed of silt and good for vegetation / cultivation. Rock has been weathering due to heavy rainfall. The clay soil is found on river terrace due to aggradation process in river bed and thus good for paddy Cultivation. The soils of upper Giri Catchments in very steep mountains are either typic udorthents or lithic udorthents and shallow coarse loamy soil deep brown to very dark grayish.

**(vii) Climatic Data from Secondary Sources**

The climate is sub-tropical interspersed between cold weather, hot weather and southwest monsoon. The cold weather commences in November continues till the end of February and is characterized by cloudless days and very cold nights with much fog and dew. The temperature as low as (-)12.2 ºC has been recorded on 13.12.1963 at Shimla (nearest IMD station) during winter. May and June are usually the hottest months and temperature as high as 30.6 ºC has been recorded at Shimla. During monsoon period June to September the weather remains humid. Once the pollutants are discharged in the atmosphere, the meteorological factors play an important role in transport dispersion and diffusion with the environment.

**(viii) Social Infrastructure**

The social infrastructure like educational facilities, drinking water supply, public transportation and hospitals are is available in the area.

## 5 PLANNING BRIEF

**(i) Planning Concept**

For planning and design all relevant code of practices as laid down under various BIScodes and guidelines fixed for hydrological studies by the CWC were followed.

(ii) **Population Projection**

About 4200 persons during peak construction phase of the project.

**(ii) Land use planning**

An area of 1508.04 hectares (ha) would be submerged. Other area measuring about 236.23ha would be required for appurtenances of the project like Dam structure, spillway, powerhouse complex, switchyard etc, which would also be a permanent change of land use.

**(iii) Assessment of Infrastructure Demand (Physical & Social)**

The socio-economic assessment was made during Socio-economic survey for EIA study and accordingly provisions have been kept in Environmental Management Plan.

**(v) Amenities/Facilities**

**Residential/Non-residential buildings:**

Residential and non-residential accommodation with necessary amenities has been provided at suitable places for construction and design staff. Workshop, stores, P.O.L. pumps explosive magazine and other infrastructural facilities have also been provided. Sufficient provision for buildings has been proposed. This is over and above the existing building already constructed for Giri Hydel Project. The land for buildings has already been identified.

**Water Supply:**

Water requirement of projects workers & staff would be met by the project with its own

resources and its own cost by tapping some springs / streams. The water quality is good and requires minimal treatment.

**Power Supply:**

Power requirement for construction activities and for consumption in residential/non-residential complexes in the project shall be met by constructing suitable infrastructure of transmission network exclusively for this project through a 33 KV sub-station at Dadahu. A 3.15 MVA transformer a/w separate feeder and 11kv HT line to inlet & outlet diversion tunnels and 2No. 630 KVA transformers proposed at both the end and 200KVA transformer have been proposed for colony. Adequate provision for stand by diesel generating sets shall be made near Dam and Power House sites to meet essential power requirement in the event of power failure.

**Communication:**

Power station will be provided with direct and reliable source of communication, which shall cover all operational areas of the power house complex, switchyard area and dam site through an internal telephone system.

## 6. PROPOSED INFRASTRUCTURE

### (i) Industrial Area (Processing Area)

Arrangements like Workshop, stores, P.O.L. pumps explosive magazine and other infrastructural facilities will be provided.

### (ii) Residential Area (Non Processing Area)

Residential and non-residential accommodation with necessary amenities has been provided at suitable places for construction and design staff.

### (iii) Green Belt

The green belt is proposed along road side for 27.5 km length, around dam site / power house and switch yard about 10 ha land has been proposed. The green belt around residential area, office complex and reservoir periphery is also proposed. The plantation of broad leave local species will be carried out over a stretch of 60 ha on both the flanks of the periphery of the reservoir.

### (iv) Social Infrastructure

Infrastructure facilities in the Rehabilitation colony will include water supply, sewage, drainage, electricity, streets community centre, green area, park and approach path/roads at the project cost. All the project affected families are not required to be rehabilitated and relocated from the project area and rehabilitation in the project affected zone. Therefore it is proposed to strengthen the basic amenities within the villages. It is proposed that provision should be made by the project proponent, so that following infrastructure development programme in the project area as per the needs of the project affected families may be undertaken.

### (v) Connectivity

Project site is well connected to existing road. The project is located about 2 kms upstream of Dadahu town in Sirmour district of Himachal Pradesh and is approachable from Jagadhari in Distt. Yamuna nagar, Haryana (nearest B.G. railway station) through a metalled road of about

110 km length (Jagadhari-Paonta Sahib &Paonta Sahib-Sataun-Dadahu road). Project is also connected to Ambala Cantt./ city and Chandigarh.

**(vi) Drinking Water Management**

Water requirement of projects workers & staff would be met by the project with its own resources and its own cost by tapping some springs / streams. The water quality is good and requires minimal treatment.

**(vii) Sewerage System**

The sewage from the labour camps would be disposed in septic tanks and effluents from the project colony would be treated in STPs being installed by the project. However, water quality and effluent discharge would be monitored during construction and operation phases and suitable remedial measures taken should the need arise.

**(viii) Industrial Waste Management**

Not applicable, as the operation and maintenance of the completed project components shall not generate any effluent and industrial waste.

**(ix) Solid Waste Management**

The project is conceived as drinking water scheme. Therefore, it is essential to minimize such pollutants like sewerage etc. which are directly drained into the river at present and would be disposed into the reservoir after the completion of the project. Viewing this a provision of Rs. 20.00 lacs / village for 20 number of villages sited on the periphery of the reservoir has been made for solid waste management besides Rs. 100 lacs for strengthening municipal sewerage treatment works of Dadahu town.

**(x) Power Requirement & Supply/ Source**

Power requirement for construction activities and for consumption in residential/non-residential complexes in the project shall be met by constructing suitable infrastructure of transmission network exclusively for this project through a 33 KV sub-station at Dadahu. A 3.15 MVA transformer a/w separate feeder and 11kv HT line to inlet & outlet diversion tunnels. And 2No. 630 KVA transformers proposed at both the end and 200KVA transformer have been proposed for colony. Adequate provision for stand by diesel generating sets shall be made near Dam and Power House sites to meet essential power requirement in the event of power failure.

## 7. Rehabilitation and Resettlement (R&R) Plan

Whereas for the construction of Renukaji Dam Project besides the Government land, lot of private land is also required to be acquired from private persons. Due to acquisition of private land for the Project, a good number of families will be affected. The construction of the project will also involve underground works, transportation of large quantities of material, submergence of number of villages due to construction of Dam more than usual activity in the area and therefore, all this is likely to have an impact on the lives of people living in the area. H.P. Power Corporation Limited would like to improve the life of people living in the area besides mitigating any hardships that may arise due to the construction of the project. And whereas to protect the interests of the project affected people and landless family (and any other family affected during construction stage of the project).

A scheme for Resettlement and Rehabilitation of the persons affected on this account has been prepared incorporating adequate arrangements for their resettlement and rehabilitation. Now, therefore, the H.P. Power Corporation Limited hereby proposes the following scheme for Resettlement and Rehabilitation of the persons affected on account of acquisition/ of their Land Acquisition Act 1894 for the construction of Renukaji Dam Project in Sirmour District. This has been prepared by taking into consideration the R&R Policy notified by Govt. of HP vide notification No Rev(PD)F(5)- 1/1999 dated 27-4-2006 National Rehabilitation and Resettlement Policy 2007 and National Hydro Policy 2008.

## 8. PROJECT SCHEDULE & COST ESTIMATES

### (i) Likely Date of Start of Construction and Likely Date of Completion

The work of construction of project components will be undertaken in 2023. All the works are likely to be completed within 6 years, after the grant of forest clearance.

### (ii) Estimated Project Cost along with Analysis in terms of Economic Viability of the Project.

Revised updated cost of Renukaji Dam Project at October, 2018 price level for amounting to Rs. 6946.99 crores comprising Rs. 6811.92 crores for civil works, Rs. 121.81 crores for E&M works and Rs. 13.26 crores for transmission works {excluding IDC, escalation and Local Area Development Fund (LADF)} has been approved by CWC, New Delhi.

## 9. ANALYSIS OF PROPOSAL

### (i) Financial and Social Benefits with Special Emphasis on the Benefit to the Local People, If any, In the Area

**Benefits to the economy** - Revenue from Sale of Power annually. For the total project period it would increase tremendously.

**Socio-economic benefits from improved infrastructure**-Since project would improve the local infrastructure including through LADF and its own activities coupled with R&R works, awareness, education etc., it is expected that skills, transport, communication, marketing and pricing of local produce, services etc. will increase fetching higher economic returns.

**Drinking water supply**- Supply of drinking water of 437 mgd to NCR alone converts to about 7178 lakh KL annually and then a uniform rate has been applied for 50 years.

**Flood mitigation-** Cost is taken as the costs spent by all the state governments in the concerned areas downstream of the proposed project. In the parts of HP, UP, Haryana, NCR Delhi and Rajasthan.

**10. Comparative chart of critical parameters like submergence, muck disposal, EMP Cost, distribution of forest land and design considered in earlier EC and as mentioned in de-novo proposal: -**

| Comparative chart | | | | | |
|---|---|---|---|---|---|
| **Description** | **Parameter** | | **Earlier EC & amendment thereof** | **De-novo Proposal** | **Remarks** |
| **Submergence** | **Area** | ha | 1508.04 | 1508.04 | No change |
| **Muck disposal** | **Dumping sites** | No | **3** | **4** | **Change** |
| **1.** | **Total estimated muck generation** | cum | **79,00,885** | **83,26,784** | **Change** |
| **2.** | **Qty. of muck to be utilized** | cum | **56,34,109** | **57,68,050** | **Change** |
| **3.** | **Qty. of muck to be dumped** | cum | **22,66,776** | **25,58,734** | **Change** |
| **4.** | **Dumping area (Sites)** | ha | **47.00** | **64.50** | **Change** |
| | | | | | |
| **EMP Cost** | **Plan** | **Rs.** | | | |
| **1.** | **Catchment Area Treatment Plan** | lacs | **7500.00** | **16034.25** | **Change** |
| **2.** | **Resettlement and Rehabilitation Plan** | lacs | **7389.02** | **23466.13** | **Change** |
| **3.** | **WL Management & Bio Diversity Conservation Plan** | lacs | **14000.00** | **32068.50** | **Change** |
| **4.** | **Compensatory Afforestation (Revised for 909ha.)** | lacs | **2109.00** | **3920.59** | **Change** |
| **5.** | **Green Belt Development Plan** | lacs | 136.00 | 136.00 | No change |
| **6.** | **Reservoir Rim Treatment Plan** | lacs | 1941.00 | 1941.00 | No change |
| **7.** | **Muck Disposal Plan** | lacs | 960.68 | 960.68 | No change |
| **8.** | **Restoration Plan for Quarries** | lacs | 471.07 | 471.07 | No change |
| **9.** | **Landscape and Restoration Plan** | lacs | 280.00 | 280.00 | No change |
| **10** | **Health Management Plan** | lacs | 175.00 | 175.00 | No change |
| **11** | **Subsidized Fuel Scheme** | lacs | 155.70 | 155.70 | No change |
| **12** | **Solid Waste Management Plan** | lacs | 946.50 | 946.50 | No change |
| **13** | **Fisheries Development and Management Plan** | lacs | 500.00 | 500.00 | No change |
| **14** | **Disaster Management Plan** | lacs | 140.00 | 140.00 | No change |
| **15** | **NPV for 790 ha forest land** | lacs | **7982.00** | **12179.95** | **Change** |
| **16** | **Alternate area up gradation cost of 50ha** | lacs | 225.00 | 225.00 | No change |

| | | | | | |
|---|---|---|---|---|---|
| **17** | **Environment Monitoring Plan** | lacs | 74 .00 | 74 .00 | No change |
| | **Total** | lacs | **44910.97** | **93600.37** | |
| **Distribution of forest land** | **Component** | | | | |
| **A.** | **Permanent use** | | | | |
| **1.** | Submergence and project component | ha | 760.71 | 760.71 | No change |
| **2.** | Roads and Colony | ha | 4.74 | 4.74 | No change |
| | **Sub total** | ha | **765.45** | **765.45** | No change |
| | **Temporary use** | | | | |
| **1.** | Quarries | ha | 41.61 | 41.61 | No change |
| **2.** | Dumping Sites | ha | 55.85 | 55.85 | No change |
| **3.** | River Bed Area | ha | 45.34 | 45.34 | No change |
| | **Sub total** | ha | **142.8** | **142.8** | No change |
| | **Grand total** | ha | **908.25 say 909** | **908.25 say 909** | No change |
| | | | | | |
| | | | | | |
| **Design Project Features** | | **Unit** | **Quantum** | **Quantum** | |
| **1.** | **Hydrology** | | | | |
| | | | | | |
| **i)** | **Catchment area above dam site** | **Sq.Km.** | 2175 | 2175 | No change |
| **ii)** | **Annual run off at dam site** | | | | No change |
| **a)** | **Max. run-off (1988-89)** | **ha.m** | 318700 | 318700 | No change |
| **b)** | **Mean year (1948-49)** | **ha.m** | 124575 | 124575 | No change |
| **c)** | **75% year (1982-83)** | **ha.m** | 93408 | 93408 | No change |
| **d)** | **90% year (1974-75)** | **ha.m.** | 69161 | 69161 | No change |
| **e)** | **100% year (1987-88)** | **ha.m** | 31203 | 31203 | No change |
| **iii)** | **Maximum peak flood observed in September 1978** | **cumecs** | 8567.65 | 8567.65 | No change |
| **iv)** | **Design flood P.M.F** | **cumecs** | **9930** | **16701** | **Change** |
| | **C.P.F** | **cumecs** | **8700** | **8803** | **Change** |
| **v)** | **Mean annual rainfall in the catchment area** | **mm** | 1390 | 1390 | No change |
| | | | | | |
| **2.** | **River diversion works** | | | | |
| **a)** | **Diversion tunnels** | | 3 | 3 | No change |
| | **Finished dia** | **m** | **7** | **10.5** | **change** |
| | **Slope** | | 1 in ± 400 | 1 in ± 400 | No change |
| | **Avg Length** | **m** | **1300, 1475, 1575** | **+ 1600 each** | **change** |
| **b)** | **Coffer dams** | | | | |
| **i)** | **Upstream coffer dam** | | | | |
| | **Height** | **m** | 45 | 45 | No change |
| | **Top elevation** | **m** | 680 | 680 | No change |

| | | | | | |
|---|---|---|---|---|---|
| | **U/S slope** | | 2.75:1 | 2.75:1 | No change |
| | **D/S slope** | | 2:1 | 2:1 | No change |
| **ii)** | **D/S coffer dam** | | | | |
| | **Distance d/s from toe of the main dam** | **m** | 60 | 60 | No change |
| | **Top Elevation** | **m** | 640 | 640 | No change |
| | **U/s slope** | | 2:1 | 2:1 | No change |
| | **D/s slope** | | 2.5:1 | 2.5:1 | No change |
| | | | | | |
| **3.** | **Main dam** | | | | |
| **i)** | **Type** | | Rock fill dam inclined impervious central core | Rock fill dam inclined impervious central core | No change |
| **ii)** | **Height of the dam above river bed level** | **m** | 148 | 148.00 | No change |
| **iii)** | **Elevation at top of the dam** | **m** | 778.00 | 778.00 | No change |
| **iv)** | **River bed level at the dam site** | **m** | 630.00 | 630.00 | No change |
| **v)** | **Expected deepest foundation level** | **m** | 600.00 | 600.00 | No change |
| **vi)** | **Length of dam at top** | **m** | 430.00 | 430.00 | No change |
| **vii)** | **Length of dam at river bed** | **m** | 125.00 | 125.00 | No change |
| **viii)** | **Max. width of the dam at the river bed.** | **m** | 844.50 | 844.50 | No change |
| **ix)** | **Upstream slope** | | 3:1 | 3:1 | No change |
| **x)** | **D/S slope** | | 2:1 | 2:1 | No change |
| | | | | | |
| **4.** | **Reservoir** | | | | |
| **i)** | **Minimum drawdown level (MDDL)** | **m** | 710.50 | 710.50 | No change |
| **ii)** | **Dead storage capacity** | **ha.m.** | 22800 | 22800 | No change |
| **iii)** | **Maximum reservoir level (MRL)** | **m** | 772.50 | 772.50 | No change |
| **iv)** | **Normal reservoir level (NRL)** | **m** | 766.00 | 766.00 | No change |
| **v)** | **Live storage capacity** | **ha.m.** | 49800 | 49800 | No change |
| **vi)** | **Flood absorption capacity (between 766 m and MRL)** | **ha.m.** | **7504** | **4553** | **Change** |
| **vii)** | **Water spread at FRL766 m** | **ha.m.** | 1210 | 1210 | No change |
| **viii)** | **Length of reservoir** | **km.** | 24 | 24 | No change |
| | | | | | |
| **5.** | **Spillway** | | | | |
| **a)** | **Chute spillway** | | | | |
| **i)** | **Crest elevation** | **m** | **755.0** | **749.0** | **Change** |
| **ii)** | **Total width in between abutment** | **m** | **63.00** | **86 .00** | **Change** |
| **iii)** | **No. of bays** | | **4** | **5** | **Change** |
| **iv)** | **Span of each bay** | **m** | **13.50** | **14** | **Change** |

| | | | | | |
|---|---|---|---|---|---|
| **v)** | **No. of piers** | | **3** | **4** | **Change** |
| **vi)** | **Thickness of piers** | **m** | **3** | **4** | **Change** |
| **vii)** | **Design flood** | **cumecs** | **7067** | **16701** | **Change** |
| **viii)** | **Size of Spillway gates** | | **-** | 14.0mX 17.0 m | - |
| | | | | | |
| **b)** | **Diversion tunnels**[1] | | | | |
| **i)** | **Number of tunnels** | | 3 | 3 | No change |
| **ii)** | **Type** | | Circular lined tunnel | Circular lined tunnel | No change |
| **iii)** | **Diameter** | **m** | **7.00** | **10.5** | **Change** |
| **iv)** | **PMF** | **cumecs** | **9930** | **16701** | **Change** |
| **v)** | **Top elevation of intake shaft for Diversion tunnel** | **m** | 703.25 | 703.25 | No change |
| **vi)** | **Diameter of intake shaft** | **m** | 10.5 | 10.5 | No change |
| **vii)** | **Top elevation of gate shaft** | **m** | 780.00 | 780.00 | No change |
| **viii)** | **Dia of gate shaft** | **m** | 6.25 | 6.25 | No change |
| **ix)** | **Invert level of flip bucket** | | 640.00 | 640.00 | No change |
| | | | | | |
| **6.** | **Penstock** | | | | |
| **a)** | **Power Tunnel** | | | | |
| **i)** | **Finished dia** | **m** | 3.15 | 3.15 | No change |
| **ii)** | **Approximate Length** | **m** | ± 750 | ± 750 | No change |
| **iii)** | **No. of tunnel** | | 1 | 1 | No change |
| **iv)** | **Top elevation of intake (submerged)** | **m** | 711.50 | 711.50 | No change |
| **b)** | **Penstock (Main** | | | | |
| **i)** | **Type** | | Steel circular penstock | Steel circular penstock | No change |
| **ii)** | **Diameter** | **m** | 3.15 | 3.15 | No change |
| **iii)** | **Length** | | | | |
| | **Vertical** | **m** | 59.50 | 59.50 | No change |
| | **Horizontal** | **m** | 672.50 | 672.50 | No change |
| **iv)** | **Velocity** | **m/sec** | 5.65 | 5.65 | No change |
| **c)** | **Penstock (after bifurcation)** | | | | |
| **i)** | **Type** | | Steel circular penstock | Steel circular penstock | |
| **ii)** | **Number** | | 2 | 2 | No change |
| **iii)** | **Diameter** | **m** | 2.25 | 2.25 | No change |
| **iv)** | **Length** | **m(each)** | 12.50 | 12.50 | No change |
| **7.** | **Power House Complex** | | | | |
| **a)** | **Power House** | | | | |
| **i)** | **No. of generating units** | | 2 | 2 | No change |
| **ii)** | **Capacity** | **MW** | 20 | 20 | No change |
| **iii)** | **Max. flood level at power house site** | **m** | 635.00 | 635.00 | No change |

[1] The spillway tunnels shown in salient features in EIA submitted for EC are now referred to as Diversion tunnels. The whole flood (PMF) will be passed through the chute spillway and the tunnels (earlier spillway tunnels, now diversion tunnels) will only be used for diverting river/flood during construction and for emergency depletion below crest of chute spillway.

| | | | | | |
|---|---|---|---|---|---|
| **iv)** | **Service bay elevation** | **m** | 635.80 | 635.80 | No change |
| **v)** | **Design head** | **m** | 108.00 | 108.00 | No change |
| **vi)** | **Design discharge** | **cumecs** | 44 | 44 | No change |
| **vii)** | **Type of turbine** | | Francis | Francis | No change |
| **viii)** | **Setting** | | Vertical shaft | Vertical shaft | No change |
| **xi)** | **Elevation of turbine at centre line** | **m** | 623.00 | 623.00 | No change |
| **b)** | **Tailrace channel** | | | | |
| **i)** | **Width** | **m** | 10.00 | 10.00 | No change |
| **ii)** | **Tail water level** | **m** | 627.00 | 627.00 | No change |
| **c)** | **Switchyard** | | | | |
| **i)** | **Elevation** | **m** | 680.00 | 680.00 | No change |
| **ii)** | **Site** | **m2** | 100x40 | 100x40 | No change |
| | | | | | |
| | **TRANSMISSION LINES** | | | | |
| | **No. of circuits** | | Two, Double Circuit | Two, Double Circuit | No change |
| | **Voltage** | | 132KV lines to Majri | 132KV lines to Majri | No change |
| | | | | | |
| | **POWER GENERATION** | | | | |
| | **Peaking capacity during lean period** | **MW** | 40 | 40 | No change |
| | **Annual energy generation in 90% dependable year.** | **GWH** | **221.22** | **199.99** | **Change** |
| | | | | | |
| | **COST ESTIMATE** | | | | |
| | **Capital cost of the project for Civil Works.** | **Crores** | **2687.33** | **6811.92** | **Change** |

## 11. IMPACTS ON FLORA AND FAUNA OF PROJECT AREA

Renukaji area- the site of proposed dam- is in the enviable position because of its cultural, religious and social importance to the local populace besides having a diversity of natural resources. Therefore, it becomes imperative to minimize the loss of habitats and destruction of ecosystems upon which the region's social, ecological and economic well being depends. Normally, aim of the conservation strategies is to build on, improve and coordinate the existing conservation measures to increase community ownership of nature's conservation programs in the region under investigation.

**Impact on Flora (Plant Biodiversity)**

Based on the survey carried out during the EIA Study, the following impacts on flora/vegetation was predicted due to the construction of Dam across Giri River in Sirmaur District of Himachal Pradesh-

**a. Degradation/destruction of Northern Tropical Dry Deciduous Forests**

Influx of outside population during construction of dam and other project related activities will certainly affect the quality of the habitat around the project site in many ways. Besides, there is possibility of regular decline especially in the plant diversity may be in the form of collection of fuel wood and mowing away of the floristics in the study area.

**b. Impacts in the submergible area**

Since, the proposed dam will submerge a vast stretch of vegetation in about 24 km area and accordingly, a number of trees and other plant species will be felled / submerged. Therefore, there will be a sudden shift in the population density of the species, which certainly have some impact on the ecology of the region. Terrestrial Wildlife can also fell a prey to this scenario because of change in the route they follow in the forests in search of their food etc. Insect diversity presently inhabiting the site may loose their habitat and will take some time to re-establish them in the new locations, which also reflect directly upon the decrease in their population density. There will be a shift in the aquatic fauna and flora mainly because of the increase in the water level and in the process, there are chances that some aquatic life either has to loose their habitat or the survivors may have to adapt themselves in this changed ecosystem. In fact all these changes require regular monitoring of these elements over a period of time.

**c. Loss of threatened/ economically important species**

The results of baseline survey on the flora carried out during the study in the project and its adjoining area revealed that none of the species recorded from the region fall under any category of threat status (Rare/Endangered/Vulnerable) as per the Red Data Book on Indian Plants. However, one hundred and nine plant species with medicinal, timber, fuel wood, fodder, ornamental value were recorded from the study area. In other words, the proposed dam and its adjoining area provide food, fodder and fuel wood to the local people because of the presence of large number of species. The results of the social survey also showed that irrespective of caste, land-holding size and occupation pattern, the project affected people can suffer a substantial drop in their income. Hence, to sustain livelihood of the rural people, massive plantation of species having medicinal, fodder, fuel wood values should be done in suitable areas.

**d. Invasion of the habitat by exotic and Invasive species**

Due to increased biotic pressure and physical disturbances as also indicated earlier, exotic and invasive species such as *Lantana camara, Parthenium hysterophorus* and *Eupatorium* will invade the forest areas thereby resulting in decrease in the species richness and diversity. Besides these species are also not having any direct importance and relevance for the people of the region.

**Impacts on Fauna**

As the project activity is not going to submerge all the major habitats, there is little concern for these niche birds. The habitat will also available from the backwater sites in Joggar, Palar and Nait streams for coldwater hill stream fishes though the impact on migratory fishes cannot be ruled out. There is also a wildlife sanctuary, a reserve forest and wetlands present in the surrounding sites. The possible impact of the proposed dam could be in terms of more loss to aquatic environment than the terrestrial one. The expected impact on aquatic fauna and terrestrial fauna are depicted as:

- During EIA study carried out along the river Giri in a stretch of about 35 km in the influence zone of Renukaji dam in monsoon and post monsoon months, total of 135 taxa of aquatic fauna has been recorded. Out of these 135 taxa, 41 from phytoplankton and phytobenthos, 19 from zooplankton, 49 from zoo benthos invertebrate and 16 fishes among vertebrates are representing the aquatic fauna.
- It is evident from the present studies that none of the species were found in the list of the World Union of Red list 2006. However, phytobenthos, macro benthos and fishes will be completely vanished due to submergence of their habitat.
- There is no doubt that the aquatic communities present in the submergence are definitely going to vanish due to loss of habitats. However, the area downward from dam site and upward the backwater formed from its tributaries is going to support the present aquatic fauna at some extent.
- In all 16 fish species are reported from this area will face challenges from the proposed dam as they are riverine in nature. The most important are the migratory fishes Mahseer *Tor* sp. and in upper zone snow trout *Schizothorax* sp. Mahseer also known as game and food fish, which has been declared as endangered fish. Other fishes though are not commercially important but are acting as supportive communities will vanish from the site. The channels such as Joaggar, Palar and Nait will become backwater sites and need to be conserved for future fishery as the only site left behind the submergence zonefor hill stream coldwater fishes.
- There is need to establish hatcheries for seed production particularly the mahseer *Tor putitora* and snow trout *Schizothorax* spp.
- Terrestrial fauna mainly represented by insects, reptiles, birds and mammals in the vicinity of 10 sq km were assessed where 101 species of butterflies, 6 species of reptiles, 107 species of birds and 10 species of mammals were identified.
- Except for one species of bird, Hodgson's Stonechat, *Saxicola insignis*, which is a globally vulnerable species and a winter migrant to India and the study area none of the other species from insect, reptiles, birds, and mammals observed in the study area, are globally threatened as per the IUCN Red List 2007.
- However, four species of insects, one species of reptiles, most of the birds families and mammal species were enlisted in the schedule I-V of the Indian Wildlife (Protection) Act 1972.

- None of the species will be directly impacted after the construction of the dam as most of them are found nearby Renukaji Sanctuary and Kashoga Reserve Forest. These sites are the best habitats and should be protected as they can provide a refuge of displaced mammals and other species after the submergence of lower areas. It is suggested that care should be taken so that the movement of trucks, machinery should not be allowed in the habitat of the globally threatened Hodgson's Bushcat, *Saxicila insignis* habitat on the Jala Khud at Kashoga Reserve Forest as depicted in the map (red spot).

**IMPACTS ON WATER ENVIRONMENT**

The water environment of river Giri due to proposed project will have some impact on the water quality and aquatic fauna. The project is going to store sediment on the reservoir and release comparatively low sediment discharge for downstream project viz. Giri Power House. Thus, the water quality downstream of dam shall improve.

**Construction Phase**

During the construction phase of the project the river water is not supposed to catch considerable amount of sediment from the ongoing underground works as the water coming out from such area will be dislodged of sediment in the silt trapping tanks before being released to river. The silt laden water emanating from all other open air works and from the foundation works of power house, however will require sediment extraction before releasing the water into the river section. The muck disposal yards, quarry areas would be the areas of concerns for leaching of sediments during rains. The discharge coming out of batching and crushing plants would also bring considerable sediments in water due to washing of plants and aggregate material. The sewage generated at the labour camps and other residential areas may also bring considerable pollutants to river sections, if disposed off in the river section without treatment. The impoundment of reservoir may cause considerable deterioration in water quality, if the vegetation is not cleared from the reservoir before filling of the reservoir.

**Operation Phase**

In the operation phase of the proposed project the water environment in general will not deteriorate as the reservoir of the project will be continuously operated or used for power generation. However, the project reservoir will accumulate a certain amount of silt in its bottom for which silt flushing will be undertaken at periodic intervals through spillway tunnels. In view of the above the water quality deterioration is not anticipated considerably. The periodic monitoring of water quality will be required to evaluate the quality status.

For downstream usages like power generation of Giri Power House and drinking water supply, the river course will have regulated water flows all through the year as a fix quantum of water will be released from the proposed dam, will be used for power generation in the proposed project and will eventually be released for downstream usage. In fact the regulated releases will enhance the capacity of downstream power project and ensure a firm supply of 23.0 cumecs of water to Delhi at the same time ensuring minimum for meeting environment needs of the river.

**Ecological flow**

23cumecs of water shall be released continuously to the downstream which will be much more than 15% discharge of lean season as per guidelines of Himachal Pradesh state

pollution control board. This is also more than the 20% discharge (i.e. 0.78cumecs) of lean season on the 90% dependable (2003-04) year as per MoEF guidelines this condition shall be complied with during the operation stage of the project.

## 12. Details of Muck Management

About 83.27 lakh $m^3$ muck shall be generated due to excavation of various components of project. Out of this 57.68 lakh cubic meters would be used up by Project and balance muck of 25.59 lakh $m^3$ is proposed to be dumped at 4 designated sites having combined capacity 36.12 lakh $m^3$. Average height of dump would be less than 6 m.

**Table12.1 Component-wise details of the muck generation and its utilization**

| S. No. | Description of Component | Qty. of muck generated (cum) | Qty. of muck to be utilized (cum) | Qty. of muck to be dumped (cum) | Remarks | Area available for dumping |
|---|---|---|---|---|---|---|
| **1.** | Diversion tunnel | 6,69,042 | 1,53,880 | 5,15,162 | 23% quantity shall be utilized in tunnel lining and 77% shall be dumped. | Area taken=64.5ha<br><br>Avg. height of dumping = 5.6m<br><br>Area required = 3582227/5.6 =639683sqm =63.97ha |
| **2.** | Tunnel intake and gate Shaft | 1,63,734 | 16,373 | 1,47,361 | 10% quantity shall be utilized in cement concrete | |
| **3.** | Main dam | 29,18,450 | 13,72,800 | 15,45,650 | 47% shall be utilized as rip-rap and balance 53% shall be dumped | |
| **4.** | Spillway | 42,55,299 | 41,70,193 | 85,106 | 98% shall be utilized as shell material and remaining 2% shall be dumped | |
| **5.** | Intake Structure for Power House and Penstock | 74,459 | 36,485 | 37,974 | 49% shall be utilized in cement concrete work and remaining 51% shall be dumped | |
| **6.** | Power House, tail race and switch | 2,45,800 | 18,319 | 2,27,481 | 9% shall be utilized in cement concrete and remaining 91% shall be dumped | |
| | **Total** | **83,26,784** | **57,68,050** | **25,58,734** | | |
| | | Add swell factor @40% = 10,23,493<br>**Total qty. = 25,58,734+10,23,493= 35,82,227cum** | | | | |

The selection of muck disposal sites was carried out considering the quantity of the muck, landscape, cost effectiveness, nearness to source of generation, absence of ground and surface water, relief and scope for afforestation works. The details of dumping site along with their total capacity and amount of muck to be disposed are enumerated in Table 12.2.

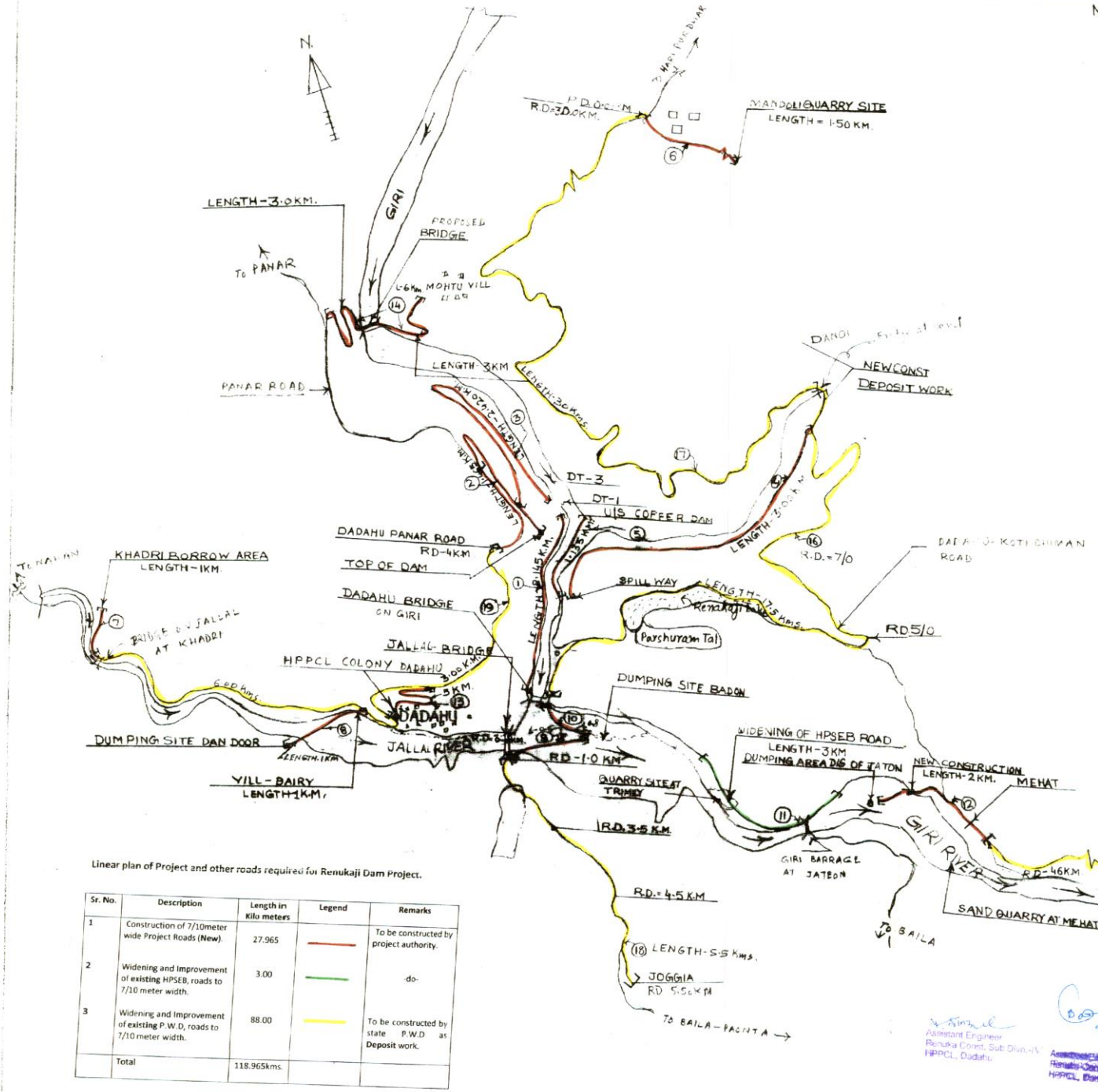
**Table 12.2 MUCK DUMPING AREA-WISE DETAIL (As per Forest Approval Case)**

| Sr. No. | Name of Dumping Site | Forest Area (In bighas) | Deemed Forest Area (In bighas) | Private Land (In bighas) | Total |
|---|---|---|---|---|---|
| **1.** | Dandoor | 207-2 | - | - | 207-2 |
| **2.** | Beari | 130-10 | 38-19 | | 169-9 |
| **3.** | Dhartaran/Badon | 125-1 | | 102-16 | 227.17 |
| **4.** | Dhartaran d/s of Giri HEP barrage | 157-19 | - | - | 157-19 |
| | **TOTAL** | **620-12** | **38-19** | **102-16** | **762-7 bigha (64.5 ha)** |

Muck dumping will be done only in the identified muck dumping sites. Before dumping the sites will be prepared and approved by HPSPCB & provided with adequate retaining structures to avoid any spillage of muck. The dumping area for muck disposal shall be stabilized and reclaimed by planting suitable species under the supervision of State Forest Department. Stabilization and reclamation of such dumping sites shall be completed before handing over the same to the State Forest Department in a time bound manner as per plan.

# LINEAR PLAN OF ROADS - REQUIRED FOR RENUKAJI DAM PROJECT

NTS.




**Details of muck to be emanated from const. of roads and its disposal**

| Sr. No. | Name of Road | Length in Km. | Total Qty. in Cum | Qty. to be used as filling for road formation | Balance Qty. in Cum | To be disposed off at dumping site No. |
|---|---|---|---|---|---|---|
| | **Roads for main components** | | | | | |
| 1. | Road from Dadahu Bridge to DT-1 | 2.145 | 30030 | 9009 | 21021 | Dumping site No.-I |
| 2. | Road from bifurcation of existing Dadahu-Panar road to top of Dam | 1.465 | 35893 | 10768 | 25125 | -do- |
| 3. | Road from top of Dam to inlet portal of DT-3 | 2.420 | 59290 | 23716 | 35574 | -do- |
| 4. | Road bifurcating from Koti Dhiman-Dhanoi to Spillway. | 3.00 | 73500 | 22050 | 50950 | -do- |
| 5. | Road from existing Dadahu-Sangrah road to u/s Coffer Dam | 1.135 | 27808 | 11123 | 16685 | -do- |
| | **Roads for Quarries** | | | | | |
| 6 | Road bifurcation from Dadahu-Sangrah road to Mandoli quarry | 1.50 | 12000 | 12000 | --- | --- |
| 7. | Road from Dadahu-Nahan road at Khadri Bridge | 1.00 | 24500 | 9800 | 14700 | Dumping site No.-IV |
| | **Roads for Dumping Sites** | | | | | |
| 8 | Road from Dadahu-Nahan road at Bairi | 1.00 | Nil | --- | --- | --- |
| 9 | Road from bifurcating from Dadahu-Baila road at Jallal Bridge to dumping site | 0.50 | Nil | --- | --- | --- |
| 10 | Road from Dadahu-Sangrah road to dumping site near Badon | 0.80 | Nil | --- | --- | --- |
| 11 | Road from HPSEB road to Vill. Badon | 3.00 | 27000 | 13500 | 13500 | Dumping site No.-I |
| 12 | Road to connect to Project road to Paonta-Sataun-Dadahu to Mehat | 2.00 | 42000 | 16800 | 25200 | Dumping site No.-II |
| | **Roads for Colonies** | | | | | |
| 13 | Road for residential/Non residential Colonies | 5.00 | 37500 | 37500 | --- | --- |
| 14 | Road on both banks of river Giri to connect Vill. Mohtu and Deed Baggar | 6.00 | --- | --- | --- | --- |
| | **State P.W.D. roads (existing) required improvements to be constructed as deposit work by P.W.D.** | | | | | |
| 15 | Widening of existing Paonta-Sataun-Dadahu road | 26.00 | To be looked after by PWD | --- | --- | --- |
| 16 | Dadahu-Koti Dhiman-Dhanoi | 17.50 | -do- | --- | --- | --- |
| 17 | Widening of Dadahu-Sangrah-Mandoli road | 30.00 | -do- | --- | --- | --- |
| 18 | Widening of Dadahu-Baila-Paonta - Tirmali road | 5.50 | -do- | --- | --- | --- |
| 19 | Widening of Nahan-Dadahu and Dadahu-Panar road | 9.00 | | | | |
| | **Total** | 118.965 | 369521 | 166266 | 265755 | |

Linear plan of Project and other roads required for Renukaji Dam Project.

| Sr. No. | Description | Length in Kilo meters | Legend | Remarks |
|---|---|---|---|---|
| 1 | Construction of 7/10meter wide Project Roads (New). | 27.965 | | To be constructed by project authority. |
| 2 | Widening and Improvement of existing HPSEB, roads to 7/10 meter width. | 3.00 | | -do- |
| 3 | Widening and Improvement of existing P.W.D, roads to 7/10 meter width. | 88.00 | | To be constructed by state P.W.D as Deposit work. |
| | Total | 118.965kms. | | |

Assistant Engineer
Renuka Const. Sub Divn.-V
HPPCL, Dadahu

Sr. Executive Engineer
Renuka Const. Division No.-II
HPPCL, Dadahu-173022

Dy. General Manager
Renukaji Const. Circle
HPPCL, Dadahu

HP POWER CORPORATION LTD.

Office of the General Manager,
Renukaji Dam Project, HPPCL, Dadahu,
Distt. Sirmour (H.P) -173022, India.
(A State Government Undertaking)

website: www.hppcl.in
PHONE NO: - 01702-267944

Email: gm_rk@hppcl.in
FAX NO: - 01702-267943

# UNDERTAKING

I hereby give undertaking that no court has passed any direction against the construction of Renukaji Dam Project (40MW) in District Sirmaur Himachal Pradesh.

06/7/2022

Authorized Signature
General Manager
Renuka ji Dam Project
HPPCL. Dadahu.
Distt. Sirmour (H.P.)

Date 06/7/2022

HP POWER CORPORATION LTD.

Office of the General Manager,
Renukaji Dam Project, HPPCL, Dadahu,
Distt. Sirmour (H.P) -173022, India.
(A State Government Undertaking)

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Email: gm_rk@hppcl.in
FAX NO: - 01702-267943

# DECLARATION

I hereby declare that no construction work has been started yet in respect of the project entitled "Renukaji Dam Project (40MW) submitted for TOR approval to MoEF&CC vide Proposal No. IA/HP/RIV/250502/2022.

06/7/2022

Authorized Signature

General Manager
Renukaji Dam Project
HPPCL Dadahu,
Distt. Sirmour (H.P.)

Date 06/07/2022

**HIMACHAL PRADESH POWERCORPORATION LTD.**
(A State Government Undertaking)
Himfed Building, BCS New Shimla

## AUTHORIZATION

The General Manager Renukaji Dam Project, HPPCL, Dadahu, Distt Sirmour is hereby authorized to file an application on behalf of Himachal Pradesh Power Corporation Limited (HPPCL) for the fresh Environment Clearance case of Renukaji Dam Project (40 MW) on the web portal of Ministry of Environment Forest & Climate Change (MoEF & CC) and to sign all the documents on behalf of HPPCL and entertain other necessary correspondence as required in the matter with MoEF & CC, Govt of India.

Dr.Ajay Sharma, IAS
Managing Director,
HP Power Corporation Limited,
Himfed Building BCS,
New Shimla-171009 (H.P)

No. HPPCL/ESMU-2/Renukaji Dam Project/Vol-VI/2019 5401 Dated: 29/6/22

Copy to:

(ii) The General Manager Renukaji Dam Project, HPPCL, Dadahu, Distt. Sirmour for information & necessary action please.