DIRECTORATE OF ENERGY
GOVERNMENT OF HIMACHAL PRADESH
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No. DoE/CE (Energy) /Tundah-II/2025- 8748-49 **Dated:** 20/12/2025

From

Director (Energy)
Government of Himachal Pradesh

To

The Principal Chief Conservator of Forest & HoFF,
Government of Himachal Pradesh,
Shimla

Subject: - **Proposal for seeking prior approval of the Central Government Under section 2(1)(ii) of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 in favour of the Sai Eternal Foundation, non-forestry use of 13.3082 hectares of protected forest for the construction of Tundah-II Hydro Electric Project (24 MW) within the juridication of Bharmour Forrest Division, District Chamba, Himachal Pradesh. Proposal No. FP/HP/HYD/49283/2020**

Sir,

This is in reference to the letter dated 10.03.2025 issued by the Assistant Inspector General of Forests addressed to the Principal Secretary (Forests) regarding the subject cited above forwarded to this office by the project developer of Tundah-II HEP. In this connection, it is informed that the project developer, vide letter dated 28.06.2025, has submitted point-wise replies to the observations raised. The relevant clarifications with respect to the observations are as under:-

Observation Sr. No. (ii): In the component-wise break-up, an area of 4.2877 hectares has been proposed for 15 muck dumping sites. Justification for proposing 15 muck dumping sites needs to be submitted by the State Government. Possibility of reducing the area to the barest minimum may be explored and the revised area, if any, may be intimated to the Ministry.	**Clarification:** It is clarified that all viable alternatives were examined during the detailed surveys and investigations of the project. Considering the volume of muck likely to be generated and the steep hilly terrain of the project area, approximately 5 hectares have been provisioned for muck disposal in the approved DPR relevant chapter at **Annexure-A.** It is stated by the project developer that at present, further reduction in the proposed area is not feasible. Further, any surplus land, if available, shall be surrendered after completion of construction activities. The proposed muck dumping sites and corresponding areas are strictly in accordance with the approved DPR, and any further reduction would adversely affect project implementation.
Observation Sr. No. (iii): In the component-wise break-up, an area of 3.2102 hectares has been proposed for roads within the project area above FRL. The State Government may inform whether the area sought is the barest minimum. Possibility of reduction	**Clarification:** The matter has been examined in detail, and all feasible alternatives to optimize the road layout have been explored. It is respectfully submitted that the proposed area of 3.2102 hectares is required essentially for construction of access roads to various project components and is bare minimum.

may be explored and any revision may be intimated to the Ministry.	These roads are indispensable for transportation of heavy machinery, equipment, and construction materials, and are integral to the smooth, timely execution and future maintenance of the Tundah-II HEP. The road alignments and corresponding area are as per the approved DPR, and any further reduction is not feasible without adversely affecting project execution.
Observation Sr. No. (vii): The State Government is requested to intimate the status of approval from the State Dam Safety Authority (SDSA) and National Dam Safety Authority (NDSA) for Tundah-II HEP. Other approvals pertaining to dam safety may also be intimated.	**Clarification:** The Tundah-II HEP is a run-of-the-river scheme involving a small-capacity barrage. In view of the limited scale of the hydraulic structure and as per prevailing regulatory provisions, approvals from the SDSA and NDSA are not applicable to this project.

Further, the project developer has forwarded an inspection report for site inspection carried out by the officers from the Ministry of Environment, Forest & Climate Change (MoEF&CC) , Government of India, the Deputy Director General of Forests (Central), Chandigarh and Government of HP. A copy of the inspection report issued by the Deputy Director General of Forests, Chandigarh, is enclosed as **Annexure-B.**

Additionally, the project developer has submitted details of muck dumping sites for Tundah-II HEP (24 MW) along with the general layout plan, wherein all dumping sites are clearly demarcated. The total area of muck dumping sites has been worked out as 42,877 sqm. As per the approved DPR, considering an average dump height of about 3.5 metres in hilly terrain, approximately 5 hectares (50,000 sqm) area is required for disposal of excavated material.

This is submitted for your kind information and necessary action in the matter, please.

Yours faithfully,

DA : As above

Chief Engineer (Energy)
Directorate of Energy, GoHP,

Copy to the M/s Sai Eternal Foundation, Sai Bhawan, Sector-4, New Shimla-171009, Himachal Pradesh

Chief Engineer (Energy)
Directorate of Energy, GoHP,

CHAPTER – 11

ENVIRONMENTAL AND ECOLOGICAL ASPECTS

11.1DETAILED BASIC INFORMATION AFFECTING THE ENVIRONMENT

Baseline information of the project area Chamba district in general such as data on flora and fauna, demography and human population, health, water resources, water-use, water quality, soil, geology, climate and land-use has been collected and is being analyzed to carry out this study. The details of the study are as follow:

Summary of environmental baseline studies for pre-project conditions including physical, biological and socio-economic parameters. Potential positive and negative impacts are presented.

Expected negative impacts are listed under the following headings:

i) Impacts due to project location.
ii) Impacts due to project design.
iii) Impacts due to construction works.
iv) Impacts due to project operation.

These include issue such as loss of land, change in water quality and quantity, change in vegetation profile and socio-economic problem due to the development of the proposed hydropower project.

Based on the expected negative impacts, the project authority has prepared an environmental management strategy and post-project monitoring program as outlined in later sections of this report. The strategy includes measures and alternatives to reduce or eliminate significant negative impacts. Finally, a summary of the cost of the environmental management and monitoring plans is also presented in this chapter.

Data on the project was collected through on site survey, consulting local individuals during field visits as well as from literature and survey maps.

The Tundah II HEP Project falls in the **Bharmaur** Tehsil of **Chamba** district. The basin above the barrage site is located between longitude $76^0$25'5.92" to $76^0$37'52" East and $32^0$29'24" to $32^0$40'4.61" North. The total catchment area lies in between 1625.00 m at weir site to EL 5840 m above Mean Sea Level.

Practically there will be no adverse impact on forest, wild or aquatic life if this project is implemented. No ecological disturbances and adverse climatologically changes are anticipated. Only a small portion of land will be involved for the construction of this project. Plantation will be done in the project area for which adequate provision has been made in the project cost estimate.

The information presented in this chapter is collected from various sources. The majority of the data on physiography, geology and water resources has been taken from the various sources as well as geotechnical survey and investigations while data on vegetation and fauna was mainly collected from the state forest sources and field visits. Meteorological data has been collected from various reports. The methodology adopted for data collection is highlighted wherever necessary. Identification of the environmental parameters, data collection and impact prediction form the core of the impact assessment process. In this report, the environmental impacts due to the project have been predicted from the available baseline data. These have been quantified wherever possible. Negative and positive impacts have also been reported in this report.

11.1.1 PHYSIOGRAPHY

The Chamba district in which the project is proposed is bound by districts Lahaul and Spiti in North, Kangra in South, and Kullu in the South-east directions. The project components lie between latitudes $32^0$29'24" to $32^0$40'4.61" North and longitudes $76^0$25'5.92" to $76^0$37'52" East. The Tundah flows in the south direction before joining river Ravi. The Tundah nallah originates at an altitude of El +2742 m at the confluence of Bhansar Nallah and Gai Nallah. It traverses a distance of about 23 km before it joins Ravi River at El +1400 m. On an average,

this stream has a steep gradient of 1.3:10. This indicates the suitability for hydropower generation. However, such steep gradients are prone to soil erosion.

11.1.2 SOIL

The proposed project is located in Lesser Himalayas in Ravi Basin and is characterized by sharp crested ridges and deeply dissected valleys. Geologically, the region exposes rocks ranging in age from early Proterozoic to Mesozoic. The rocks of the area are extensively covered by slope debris, fluvial Terraces and fan deposits of Quaternary to Recent origin.

The rock formations are part of the pre-tertiary belts of thrust sheets and are believed to be the northern part of the Indian peninsula. The geological complexity of this zone is primarily due to the continued deformation, intermittent igneous instructions, successive thrusting and repeated cycles of metamorphism. The complexity of the structures and intensive metamorphism has led to divergent views on the genetic evolution of this belt.

The regional geological studies carried out by Geological Survey of India (GSI) have revealed that the Tundah project area consists of the following:

a) Rocks of Katarigali formation and bonds of phyllites with shear at places are exposed.
b) Right bank slope is steep and might pose a problem during construction.

11.1.3 WATER RESOURCES AND WATER QUALITY

The Tundah nallah is a perennial Stream originating at the confluence of Gai Nallah and Bhansar Nallah at an Altitude of 2737 m amsl. Bhansar Nallah originates from the slopes of the Kalicho pass in the mid- Himalayas at an elevation of about +5300 m and the Gai Nallah originates from the glaciers on the slopes of the highest mountain (Bada Kanda Elevation about 5840 m) in the Catchment area of Tundah Stream. Tundah nallah transverses a stretch of around 23 km before it merges with the waters of the Ravi river near Kharamukh. A number of small nallah join the Tundah stream enroute. These include streams that:

a) Join the Right bank

1	Mander Nallah
2	Thanala Nallah
3	Charola Nallah

b) Join the Left bank

1	Cho Nallah
2	Bhadra Nallah
3	Thalnu Nallah
4	Raskundi Nallah

Out of the above, the Charola, Thanala and Cho nallahs carry substantial discharge.

11.1.4 HYDROMETEOROLOGY OF THE CATCHMENT

The Tundah nallah drains a catchment area of 265 km^2 upto the diversion works of Tundah II HEP out of which 146.85 km^2 is under permanent snow cover. The inflow in the nallah comes from snow melt and rainfall. The catchment are contributing to surface runoff is 118.15 km^2.

The Tundah valley receives heavy rains due to the impact of the South-west monsoon from June to September. Precipitation during winter occurs in the form of snow or rain depending upon the altitude. Snow cover at higher altitudes gives rise to the gradual buildup of the glacier and it results in major run-offs during summer.

There are twelve main rain gauge stations in the Ravi Catchment out of which two main rain gauge stations are at Chitrari & Bharmour. Annual rainfall at Chitrari and Bharmour varies from 600 to 1500 mm and 600 to 2200 mm respectively. On an annual basis, the rainfall in the region follows the pattern:

Pre-monsoon March to May 25%
Monsoon June to September 65%
Winter rains October to February 10%

The permanent snow line lies above +4000 m, but it has been observed that at in the northern slopes of the catchment, snow exists even at elevations of +3050 m. The average annual snowfall for the area is around 111.88 cm.

11.1.5 CLIMATE

Climate of the project area is cool and dry. In general, three seasons are prevailing in the area; winter (October to March); summer (April to June) and monsoon (July to September). Snowfall generally occurs in December and January at high elevations and most of the region gets cut off from the district head quarters. The Chamba area as a whole reaches a minimum ambient temperature as low as -5^{o}C in winter. Temperatures recorded at Chamba town show variations between 5.2^{o}C to 32.5^{o}C. However, at Bharmour and Harsar, the temperatures taper down and lie mostly in the region of 0^{o}C to 25^{o}C. In winter, the area gets covered with snow and temperatures further slump down.

August is the wettest month throughout the district. Monsoons are occasionally extended up to South West monsoon. Rainfall is very heavy during monsoon and very little in the winter and spring seasons.

The major portion of the monsoon rainfall in lower reaches of the catchment finds its way as surface run off due to steep slopes, contributing to high river discharge in this season. The winter precipitation falls either as rain or snow depending upon the altitude and other meteorological conditions. It does not contribute directly to the stream discharge significantly and mostly feeds the snow/glacier bound area of the Catchment.

11.1.6 VEGETATION

The forests of Himachal Pradesh are known for their grandeur and majesty and are like a green pearl in the Himalayan crown. According to the National Forest Policy (1988), at least two thirds (66%) of the geographical area should be under forest in the hilly states like Himachal Pradesh. However, keeping in view that land is a limiting factor and other factors are also not

congenial, the State Government has decided to bring at least 50% of the geographical area under forest cover.

Himachal Pradesh has a diversified and rich flora because of diverse physio-climate. With the variation in altitudes, the eco-zone also varies in terms of their vegetative cover, land use and land capabilities. The forest around project site could be classified broadly into:

- Typical Coniferous forests, and
- Broad-leaved forests.

Out of a total of 45,000 species of plants found in the country, as many as 3,295 species (7.32%) are reported in the State. The state has legally classified 37,591 Km^2 under forests About 8,911 Km^2 dense forests and 2,869 Km^2 open forest is reported in Himachal Pradesh This is about 21% of geographical area of the state It has been observed that the topography of the weir site on either side of the river is steep sloping almost to vertical. The species observed around project site and in the district are summarized in Table-11.1.

Table 11.1 Major floral species observed in the Chamba District

S.No	Scientific Name	Vernacular Name
1	Cedrela serrata	Dhauri
2	Aesculus indica	Goon
3	Acer caesium	Mandar
4	Rhus cotinus	Tung
5	Rhus parviflora	Tungla
6	Dalbergia sissoo	Tailor Shis Shinshu
7	Pyrus communis	Nakh
8	Pyrus malus	Seo (Green Oak)
9	Cotoneaster bacillaris	Rheuns
10	Rubus biflorus	Akhre (Raspberry Red)
11	Rubus niveus	Akhre (Raspberry Yellow)

12	Rhododendron arboreum	Cheo
13	Fraxinus floribunda	Sanooh (Ash)
14	Morus alba	Karun (Mulberry)
15	Ficus roxburghii	Trambal
16	Ficus religiosa	Pipal
17	Populus ciliata	Chaloon (Wild pomegranate)
18	Alnus nepalensis	Piak (Alder)
19	Quercus semicarpifolia	Kharsu (Red Rhododendron)
20	Taxus baccata	Barmi
21	Cedrus deodara	Diyar (Deodar)
22	Abies pindrow	Rai (Silver Fir)
23	Picea smithiana	Tosh (Chilgoza pine)
24	Cupressus torulosa	Devidiyar (Cyprus)

11.1.7 FAUNA

The mountains, forests, streams, abundant food availability, large stretches of inhabitation and comparatively inaccessible terrain provide favorable factors for sheltering of many kinds of wildlife. Geographical area of the catchment is large and human population is very low, which provides a good harbor for the wild life.

The state has 2 National Parks, 3 Game Reserves and 30 Wild Life Sanctuaries. The area under National Parks and sanctuaries is 1,295 sq km and 3,267 sq km respectively. About 8.2% of State area is covered by wild life conservation sites against 4% fixed by the Government of India. The Forest Division in which the project is planned has two wildlife sanctuaries viz Kugti Wildlife Sanctuary & Tundah Wildlife Sanctuary.

The Tundah Wildlife sanctuary is the nearest conservation area to the project site and is at a distance of about 1.4 km from the project intake and the Kughti Wildlife sanctuary is at a

distance of 15.5 km from the project site. The NOC is obtained from the local wildlife authorities for the same. The common terrestrial and avian fauna found in this Forest Division is detailed in Tables-11.2 &1 1.3 below.

Table 11.2 List of faunal species observed in the Chamba District

S.no	Scientific Name	Vernacular Name	English Name
1	Nemorthaedus goral	Ghoral	Himalayan Ghoral
2	Muntiacus muntjak	Kakkar	Barking Deer
3	Moschus moschiferus	Kastura	Musk Deer
4	Panthera pardus	Baghera	Leopard
5	Selenarcios thibetanus	Kala Bhallu	Himalayan Black Bear
6	Ursus arctos	Lal Bhallu	Himalayan Brown Bear
7	Martes flavigula	Gorthu	Himalayan Pine Martin
8	Hystrix indica	Saahi	Indian Porcupine
9	Hylopetes	Ean	Flying Squirrel

Table 11.3 Avian Fauna of the Area

S.No	Scientific Name	Vernacular Name	English Name
1	Lophophorous impeianus	Monal	-
2	Alectoris gracca	Chukor	-
3	Gallus gallus	Junglee Murga	Red Jungle Fowl
4	Genuocus albicratatus	Kalesha	-
5	Caterus wallichi	-	Cheer pheasant
6	Varasis macrolopha	Koklas	Koklas pheasant
7	Francolinus francolinus	Titar	Black Partridge
8	Chalcuphaps indica	Ghugi	Dove
9	Couurnix conurnix	Koyal	Grey Quail

Chamba district is honey combed by the perennial river and streams with considerable flow of water. There is scope for pisciculture in the district. Species of Brown Trout are found in flowing streams and Ravi River.

11.1.8 SEISMICITY

Chamba region shows active and prolonged seismic history. The project area falls in Zone – V of the seismic zoning map of India. As per the seismicity studies carried out by the Geological Survey of India (GSI) within the Himalayan Belt, the northernmost conspicuous structural element is the Main Central Thrust.

The area has experienced the Kangra earthquake of 1905 having epicenter located about 44 km south of the project area and having a magnitude of 8.6. This earthquake was one of the four great earthquakes of the Himalayan region, which took a toll of 20,000 human lives and caused colossal loss in the form of complete damage to buildings and generation of numerous landslides and earth fissures. The other important earthquake is the Chamba earthquake of 22nd June, 1945 having magnitude 6 on the Richter scale and located about 20 km east of the project area. Recently, the area had experienced micro-earthquake activity in the Dharamshala earthquakes of 1978 and 1986, having magnitudes 5 and 5.7 respectively. The next Chamba earthquake occurred in 1995 and caused partial collapse and development of cracks in the buildings.

The project area lies to the north of the Main Boundary thrust, the Drang thrust and the Vaikrita thrust. The Jwala Mukhi thrust passes below Dharamshala, south-west of the project area. The project area lies north of the Dhauladhar range while all the active thrusts namely the Krol thrust, main boundary fault and tear faults lie south of the range. A major lineament picked up from lands/imagery, trending N10'E-S10"W and having extent more than 300 km passes through the project area and lies north of the range and does not cross it. The exact nature and seismic activity of this lineament has not been investigated. There are two prominent seismic active zones; one is about 50 km south of the project area, i.e. the Dharamshala - Kangra zone

and the second zone lies 30 to 40 km north of the project area where an earthquake of a magnitude greater than 5 has taken place. In addition, earthquakes of magnitude 7 (Richter scale) occurred on 28.02.1908 about 60 km east of the project area. In view of the devastating earthquakes within the radial distance of 20 to 60 km of the project area, it is necessary that suitable seismic coefficients should be adopted in the project design.

Detailed geological investigations should be carried out at the project site including borehole investigations and seismic traverse etc. Based on the available data and the studies that were carried out, the highest safety factors are being adopted in the design of the project structures.

11.2 ENVIRONMENT STATUS

Environment Impact Assessment (EIA) is an exercise to be carried out before any project or major activity is undertaken to ensure that it will not in any way harm the environment on a short term or long term basis. Any developmental endeavor requires not only the analysis of the need of such a project, the monetary costs and benefits involved but most important, it requires a consideration and detailed assessment of the effect of a proposed development on the environment. The environment impact process was introduced with the purpose of identifying /evaluating the potential beneficial and adverse impacts of development projects on the environment, taking in to account environmental, social, cultural and aesthetic considerations. All of these considerations are critical to determine the viability of a project and to decide if a project should be granted environmental clearance. An EIA concentrate on problems, conflicts and natural resource constraints which might affect the viability of a project. It also predicts how the project could harm to people, their homeland, their livelihoods, and the other nearby developmental activities. After predicting potential impacts, the EIA identifies measures to minimize the impacts and suggests ways to improve the project viability. Due to public pressure on the government to accept accountability for the activities of its agencies the National Environmental Policy Act (NEPA) was formed in USA during 1970. This was the basis for the development of a mechanism which came to be known as Environmental Impact Assessment (EIA). EIA was made mandatory since 27th January, 1994. As on date it has been made

mandatory for thirty two categories of development activities. Taking into consideration the current developments in the field of the environmental impact assessment for prediction and analysis, the Questionnaires for EIA has been prepared which is also useful to appraising agencies and decision makers, both at Central and State levels. Ministry has taken a number of steps including statutory amendments to streamline the appraisal process in terms of simplification of procedures, involvement of stakeholders through public hearing, regular meetings of Expert Committees etc. This has resulted in expeditious decision on project clearances.

11.2.1 THE NEED OF EIA

Every anthropogenic activity has some impact on the environment. More often it is harmful to environment than benign. However mankind as it is developed today cannot live without taking up these activities for his food, security and other needs. Consequently there is a need to harmonize developmental activities with the environmental concerns. Environmental Impact Assessment (EIA) is one of the tool available with planners to achieve the above- mentioned goal. It is desirable to ensure that the development options under consideration are sustainable. In doing so environmental consequences must be characterized early in the project cycle and accounted for in the project design.

The objective of EIA is to foresee the potential environmental problems that would arise out of proposed development and address them in the projects planning and design stage. The EIA process should then allow for the communication of this information to:

i) The project proponent
ii) The regulatory agencies and
iii) All stakeholders and interest group.

EIA integrate the environmental concerns in the developmental activity right at the time of initiating for preparing the feasibility report. In doing so it can enable the integration of environmental concerns and mitigation measure in project development.

11.2.2 THE EIA CYCLE AND PROCEDURES

There are two 'tiers' of assessment which should be applied to the project before proceeding with a full scale EIA, Screening and preliminary assessment. Where these first tiers of assessment are a regulatory requirement, the developer normally does the work and submits the results to the regulatory agency. The agency may then decide that either there is nothing to be concerned about or the evaluation should proceed to the next tier. The most important step in the process of obtaining environmental clearance under the EIA notification is for the project proponent to conduct an environmental impact assessment of the project. For this purpose the project proponent engages an environmental consultant to prepare an EIA report. The EIA report must be prepared by incorporation of data during all the four seasons of the year. Such an EIA is termed a "comprehensive EIA". However, there is provision for a single season collection of data, but this should not be done during the monsoon season. Such an EIA reports is termed a "Rapid EIA". There are two tiers of assessment which should be applied to the project before proceeding with a full scale EIA – Screening and Preliminary Assessment. Wherever these first tiers of assessment are a regulatory requirement, the developer normally does the work and submits the results to the regulatory agency. The agency may then decide whether there is anything to be concerned about or whether the evaluation should proceed to the next tier.

i) SCREENING: The screening is the first and simplest tier in project evaluation. Screening helps to clear those types of projects, which from past experience are not likely to cause significant environmental problems. The activity may take one of the following several forms:

- Measurements using simple criteria such as size or location.
- Comparing the proposal with list of projects rarely needing an EIA (e.g. schools) or definitely needing one (e.g. coal mines).
- Estimating general impacts (e.g. increased in infrastructure needed) and comparing these impacts against set thresholds.
- Doing complex analyses, but using readily available data.

ii) ASSESSMENT: If screening does not clear a project, the developer may be required to undertake a preliminary Assessment. This involves sufficient research, review of available data and expert advice in order to identify the key impacts of the project on the local environment, predict the extent of the impacts and briefly evaluate their importance to decision makers. The preliminary assessment can be used to assist early project planning (for instance, to narrow the discussion of possible sites) and it can serve as an early warning to the serious environmental problems that the project may cause. It is in the developer's interest to do a preliminary assessment since, in practice, this step can clear projects of the need for a full EIA.

iii) FORMATION OF AN EIA TEAM: If after reviewing a preliminary assessment the competent authority deems that a full EIA is needed, the next step for the project developer is the preparation of the EIA report. This entails

- Commissioning and briefing an independent co-coordinator and expert study team.
- Identifying the key decision makers who will plan, finance, permit and control the proposed project, so as to characterize the audience for the EIA.
- Researching laws and regulations that will affect these decisions.
- Making contact with each of various decision makers.
- Determining how and when the EIAs finding will be communicated.

iv) SCOPING: The first task of the EIA study team is scoping the EIA. The aim of scoping is to ensure that the study address all the issues of importance to the decision makers. First of all the team's outlook is broadened by the discussions (with the project proponents , decision makers, the regulatory agency, scientific institutions , local community representative and others) to include all the possible issues and concerns raises by various groups. Then the study team selects primary impacts for the EIA to focus upon depending on the basis of magnitude, geographical extent, significance to decision makers or because the area is special locally (e.g. soil erosion, the presence of an endangered species or nearby historical sites) or is an eco-sensitive area.

v) MAIN EIA: After "scoping" the main EIA begins. The EIA attempts to answer five questions basically:

- What will happen as a result of the project?
- What will be the extent of the changes?
- Do the changes matter?
- What can be done about them?
- How can decision makers be informed of what needs to be done?

The EIA becomes a cyclic process of asking and further asking the first four questions until decision makers can be offered workable solutions.

- Identification means the answer to the first question, i.e. "what will happen as result of the project?" If a preliminary assessment has been done it will have broadly reviewed the projects effect, also scoping will have focused the study on the most important issues for decision makers. Taking these findings in to account the full EIA study now formally identifies those impacts which should be assessed in detail. This identification phase of the study may use these or other methods
- Compile a list of key impacts (e.g. changes in air quality, noise levels, wild life habitats, species diversity, landscape views, social and cultural systems, settlement patterns and employment levels from other EIAs for similar projects)
- Name all the projects sources of impacts (e.g. smoke emissions, water consumption, construction jobs) using checklists of questionnaires, then list possible receptors in the environment (e.g. crops, communities using same water for drinking, migrant of labour) by surveying the existing environment and consulting with interested parties.
- Identify impacts themselves through the use of checklist, matrices, networks, overlays, models and simulations.
- Prediction:The next step called predictions answers the EIA's second question: "what will be the extent of the changes". As far as is practicable, prediction scientifically characterizes the impacts causes and effects and its secondary and synergetic consequences for the environment

and the local community. Prediction follows an impact within a single environmental parameter (e.g. toxic liquid effluents) in to its subsequent effects in many disciplines (e.g. reduced water quality, adverse impacts on fisheries, economic effects on fishing villages, and resulting socio-cultural changes). Prediction draws on physical, biological, socioeconomic and anthropological data techniques .In quantifying impacts, it may employ mathematical models, physical models, socio cultural models, economic models, experiments or expert judgments.

- All prediction techniques by their nature involve some degree of uncertainty. So along with each attempt to quantify an impact, the study team should also quantify the predictions uncertainty in terms of probabilities or margins of error.

vi) EVALUATION: The third question addressed by the EIA – do the changes matter is answered in the next step. Evaluation is so called because it evaluates the predicated adverse impacts to determine whether they are significant enough to warrant mitigation. Thus judgment of significance can be based on one or more of the followings.

- Comparison with laws, regulations or accepted standards.
- Consultation with the relevant decision makers.
- To preset criteria such as protected sites features of species.
- Acceptability to the local community or the general public.

vii) MITIGATION: In this phase the study team formally analyses mitigation. A wide range of measures are proposed to prevent, reduce, remedy or compensate for each of the adverse impacts evaluated as significant. Possible mitigation measures include:

- Changing project sites, routes, processes, raw materials, operating methods, disposal methods, disposal routes or locations, timing or engineering designs.
- Introducing pollution controls, waste treatment monitoring, phased implementation, landscaping, personal training, special social services or public education.
- Offering (as compensation) restoration of damaged resources, money to affected persons , concessions on other issues, or off site programmes to enhance some other aspects of the environment or quality of life for the community.

viii) DOCUMENTATION: The last step in the EIA process, which answers the question – how decision makers be informed of what needs to be done? In documenting an EIA, this means identifying the key decisions makers, perceiving the question they will be asking and providing them with straight forward answers formatted for easy interpretation in relation to

their decision making (e.g. tables, graphs, summary, points). Successful EIA documentation is more readily produced if the audience and their needs are established at the start of the EIA, and then made to affect how the research is focused and reported. It is the job of the study team's communications expert to make this happen. An EIA report should contains:

- An executive summary of the EIA findings.
- A description of the proposed development projects.
- The major environmental and natural resource issues that needed clarification and elaboration.
- The projects impacts on the environment (in comparison with a base line were identified and predicated.).
- A discussion of options for mitigating adverse impacts and for shaping the project to suit its proposed environment, and an analysis of the tradeoffs involved in choosing between alternative actions.
- An over view of gaps or uncertainties in the information.
- A summary of the EIA for the general public.

Once the EIA reports has been completed, the project proponent needs to submit 20 copies of the copy of executive summary of the proposed proposal containing the salient features of the project, the form XII prescribed under water rules, 1975, form I prescribed under Air rules, 1983 and other information or documents to the SPCB for getting the non-clearance certificate (NOC). On receiving the required documents from the project proponents it is the responsibility of the SPCB to conduct the public hearing. After completion of the public hearing the project proponents submit the report to the secretary of MOEF for the environmental clearance.

11.3 EIA FOR SMALL HYDROPOWER PROJECTS

EIA is an activity designed to identify, predict and describe in appropriate terms the primary and secondary changes due to a proposed action (policies, plans, programs and projects). EIA is required not only for a particular hydropower project but also for a set of projects (existing and proposed) under a plan or a programme.

The MOEF Gazette Notification dated 14th September, 2006 specifies screening criteria for new projects and for expansion/modernization of existing projects. According to the MOEF

specification, a small hydropower project (capacity<25 MW) does not require environmental clearance from the regulating authority. However, there are conditions under which EIA and environmental clearance may become necessary. These conditions are:

i) If the project is located in side or within 10 km distance from boundary of

a) Protected area under wild life (protection) Act

b) Critically protected area

c) Notified Eco sensitive area

d) International boundary

ii) If expansion or modernization of existing unit results in increase in plant capacity beyond 25 MW threshold limit. The MOEF notification detailed 14th September 2006 states:

All applications seeking prior environmental clearance for expansion with increase in the production capacity beyond the capacity for which prior environmental clearance has been granted under this notification or with increase in either lease area or production capacity in the case on mining projects or for the modernization of an existing unit with increase in the total production capacity beyond the threshold limit prescribed in the Schedule to this notification through change in process and or technology or involving a change in the product-mix shall be made in Form I and they shall be considered by the concerned Expert Appraisal Committee or State Level Expert Appraisal Committee within sixty days, who will decide on the due diligence necessary including preparation of EIA and public consultations and the application shall be appraised accordingly for grant of environmental clearance.

iii) If the cumulative impacts of proposed project in conjunction with existing or proposed hydropower projects in vicinity are expected to be significant.

iv) If the funding agency specifies EIA as a precondition for funding of the project. For example, an international funding agency may specify such condition.

11.4 ENVIRONMENTAL IMPACT

In pursuance of the global goals of nature conservation and protection of environment to which India is committed since its participation in the 1972 Stockholm Conference, State Governments have initiated plans, schemes and actions to implement the various legislation, primary among them being the Environmental Protection Act, 1986 of the Ministry of Environment and Forests (MOEF), Government of India (GOI). On May 1994, MOEF has issued a notification on Environmental Impact Assessment (EIA) of Development Projects. Schedule -I of this notification lists 29 types of development projects including hydropower projects that need environmental clearance from MOEF if the project capacity exceeds 50 MW. Accordingly, the Tundah II HEP Environment Report would be evaluated at the state level as its capacity is below than 25 MW and not at the central level.

During this study, the following Acts, Rules and Standards issued there under were consulted:

Water (prevention and Control of Pollution) Act 1974, amended in 1978 and 1988. Forest (Conservation) Act 1980 amended in 1988.Air (prevention and Control of Pollution) Act 1980 amended 1988. Environmental (Protection) Act 1986, Himachl Pradesh Environment Protection and Pollution Control Board .The Wildlife (Protection) Act, 1972, amended 1993, The Wild Life (Protection) Amendment Act, 2002.With rapid strides in economic development particularly in the field of power development, the need for rationalizing and developing hydropower is imperative. In the process of development, there has been intensive use of natural resources very often leading to ecological imbalances. Apart from water resources, conservation of flora and fauna is an important aspect of eco-development.

11.4.1 NEGATIVE IMPACT ASSESSMENT

Negative impacts likely to result from the proposed development have been listed under the following headings:

i) Impacts due to project location.

ii) Impacts due to project design.

iii) Impacts due to construction works.

iv) Impacts due to project operation.

v) Prediction of Impacts.

vi) Erosion and Siltation Risks.

For each of the above factors potential impacts have been assessed, while recommendations for mitigating measures have been enumerated 11.5.1 of this chapter

11.4.1.1 IMPACT DUE TO PROJECT LOCATION

Activities like site preparation, approach roads, excavation, drilling, blasting, foundations, tunneling, deployment of machinery, erection, transportation, dumping is taken up during construction phase. The likely impacts on the environment due to these activities may involve:

- Resettlement and rehabilitation, if any
- Loss of land
- Encroachment into forestland and loss of forest produce,
- Encroachment into nature reserves and wildlife
- Risks Due to Earthquakes

a) Resettlement and Rehabilitation

There is no rehabilitation problem in the project area. There is no reservoir, no reservoir induced seismicity no uprooting of population.

b) Loss of Land

The project layout map has been superimposed on land use map and the land lost due to construction of weir, reservoir, roads, powerhouse, offices, colony etc. have been worked out.

c) Encroachment into Forest Land and Loss of Forest Produce

No illegal tree felling is expected to increase, as there is no access to the forest and most of the alignment is underground. The local population cannot collect (legally and illegally) a variety of

wood and non-wood products from these areas as no access road is proposed to forest area. It is proposed to install ropeway to various components to carry the construction materials.

d) Encroachment into Nature Reserves and Wildlife

The entire project catchment consists of dense forest. Thus, to avoid encroachment on these forests, the maximum project components are proposed to be underground. There are no rare or endangered species in the project area.

No remarkable environmental changes will occur due to this project. Further, except colony, roads, buildings, weir, Desanding chamber and switch yard all other water conductor systems penstock and power house are underground. Moreover, the construction and operation activities of head race tunnel, valve house will be underground. Therefore, it is not expected that the project will impede wildlife movement, if any. By virtue of the small and underground components, the forest area shall also be saved.

e) Risk Due to earthquake

The project area falls within the seismic zone V as per Seismic Zoning Map of India (IS: 1893 - 1975) where shocks of the intensity of 6 to 7 on Richter scale have been reported. These are expected to correspond to basic horizontal seismic co-efficient of 0.18 g. Necessary safety factors have been incorporated in designing the structures under the worst combination of forces.

11.4.1.2 IMPACTS DUE TO PROJECT DESIGN

The impacts considered due to project design are the disruption of hydrological balance and risk due to earthquake.

It is proposed that a minimum inflow will be released downstream into the Tundah stream for maintenance of ecological function below the barrage. The gradient is quite steep and velocity of water is very high and turbulent and there are number of falls along the length of the stream.

11.4.1.3 IMPACT DUE TO CONSTRUCTION WORKS

Although environmental hazards related to construction works are mostly temporary in nature, this does not mean that these should not be considered. Appropriate measures need to be included in the work plan and budgeted for. The most likely hazards related to the construction works are:

- Soil erosion at construction sites
- Pollution by construction spoils and muck
- Health risks and cultural hazards

a) Soil Erosion at construction Sites

Runoff from unprotected excavated areas and quarry sites can result in soil erosion. Mitigation measures include careful planning and selection of borrow pits, timing of cut and fill operations and re-vegetation campaigns. In general, construction works are stopped during monsoon season.

b) Pollution by construction spoils and muck

The construction material will be required for various structures. Generally, such materials are collected from quarry. Solid waste production because of excavation operation is summarized the Table.11.4

Table 11.4 Muck Generation

S.No	Component	Excavated muck (m^3)
1	Roads	16200
2	Diversion structure	7119.63
3	Power Channel	4465.45
4	Desilting Tank	7927.30
5	Head Race Tunnel And Audits	13653.66
6	Surge Shaft	2408.62
7	Penstock Tunnel	9276.44
8	Power house	15020.25
	Total	**76071.35**

c) Health Risk & Cultural Hazards

Health risks include disease hazards due to lack of sanitation, water supply and human waste disposal, vector-borne diseases and hazards to local carriers. Mitigation measures include proper sanitary health care and human waste disposal facilities. Sanitation facilities are included in the project estimate to take care of cost to be borne towards waste treatment/disposal facilities.

Problems could arise due to differences in customs of workers and local residents. These risks could be reduced by providing adequate facilities in workers camps and by employment of preferably local labour.

11.4.1.4 IMPACTS DUE TO PROJECT OPERATION

There would be little environmental and ecological changes during the operational phase. The main activities that may cause environmental impact on the surrounding environment during project completion and after during operation are:

a) Transportation of excessive solid waste material (muck)
b) Dumping of solid waste material
c) Removal of temporary facilities, cleaning etc.

During the project completion the likely potential environmental impacts are due to dust and noise.

11.4.1.5 PREDICTION OF IMPACTS

The impact on environment during the construction of Tundah II HEP may include

- Impact on air environment
- Impact on water environment
- Impact on noise environment
- Impact on land environment

The construction activity may cause some adverse impacts on the surrounding environment unless proper environmental management plan is adopted.

a) Impact on Air Environment.

Considerable amount of air pollution will be caused during different stages of construction of tunnels, weir, roads and other operations such as excavation, drilling, blasting, loading and transportation of material. Suspended Particulate Matter (SPM) is the main pollutant during construction. Most of the dust arises from drilling, blasting, excavation, crushing and transportation operations. Large quantities of dust become wind borne and are carried away from overburden dumps. The fugitive dust released during the construction activities may cause immediate effect on the construction workers who are directly exposed to the fugitive dust. Vegetation will also be adversely affected as deposition of dust on the leaves will choke the photosynthesis activity, which, in turn, will have adverse effect on the health of the plants.

b) Impact on Noise Environment

The noise will be generated at the time of construction of weir, powerhouse, tunnel boring machine operations, pumps, drilling machines, dumpers, etc. Continuous exposure of workers to high level of noise may result in annoyance, fatigue, and may cause temporary shift of threshold limit of hearing and even permanent loss of hearing. During operational phase, noise level will be increased due trouncing machinery and vehicular movement in the area. However, these impacts are only localized.

c) Impact on Water Environment.

During the construction of diversion weir, tunnel, and power house surface water (river water) may get polluted due to the generation of large quantities of suspended particulate matter at the time of transportation of muck and waste water (sewage) coming from temporary arrangements like offices, labour camp sheds, etc. The change in water quality due to leached soil nutrient and runoff sediment may sometimes lead to eutrophication of still surface waters(Lake and Ponds). Eutrophication is mainly due to the presence of nutrients such as nitrate and phosphate.

d) Impacts on Land Flora and Fauna

The various plant and animal species available in the region have already been described. There are no endangered species in the region. There are Five Wild Life Sanctuary in the Chamba

district but are very far from project area except Tundah wildlife sanctuary 2KM Arial distance. Every Plant species and wild life species whether mammal, bird, reptile, aquatic or amphibian plays an important role in the maintenance of balance of nature and is useful to mankind in many ways. Every individual animal, bird or insect has been endowed with certain specific protective measures so that it can protect itself and reproduce, thus ensuring the existence of the species. However, the project activities will not have any significant effect on the Forest and Wild Life except for removal of bare minimum number of trees. However, Compensatory afforestation will be done as per the general stipulations given by the Government of India MoEF Ministry of Forest & Environment at the time of sanction of diversion of Forestland.

11.4.1.6 EROSION AND SILTATION RISKS

It can be expected that most of the silt load of the main area will come from runoff. As mentioned earlier, Power House location will be vegetated and provided with riprap stabilization.

The silt load does not pose any siltation risk to water storing structures. The project being run-of-the-river scheme, the sediment will be washed-off along with the water by hydraulic flushing involving the release of water from Desilting Tank through outlet gates.

11.4.2 ASSESSMENT OF POSITIVE IMPACTS

Based on project particulars and the existing environmental conditions, potential positive and negative impacts have been identified that are likely to result from the proposed project, and where ever possible these have been quantified The negative impacts were discussed in the previous section. This section deals with the positive impacts that have been listed under the following headings:

i) Higher power generation
ii) Employment opportunities
iii) Recreation and tourism potential
iv) Additional habitat for aquatic wildlife

v) Reduction in fuel consumption

vi) Reduction in air pollution,

vii) Benefits to economy.

11.4.2.1 HIGHER POWER GENERATION

The construction of Tundah II HEP will add another 24 MW to the power generation capability of this region. The scheme would therefore be useful for improving power scenario in Himachal as well as in Northern Region. If this project is not implemented, the power potential of Tundah Stream shall remain unutilized for several years.

11.4.2.2 EMPLOYMENT OPPORTUNITIES

The project will provide short and long term employment opportunities, as the project is likely to be completed in 3 years. During this period manpower will be needed to take part in various project activities. About 300 people are likely to work during peak construction activity. In the post-construction phase, maximum no of people will be employed for operation and maintenance of the project. Employment will be at all levels starting from unskilled worker to administrator to plant operator. Thus the project would provide substantial direct employment and in addition to these, more people would be indirectly employed for allied activities.

11.4.2.3 RECREATION AND TOURISM POTENTIAL

The project area is having tourism potential and required to be developed so that tourist resorts could be made functioned and recreation facilities could be provided around the area.

11.4.2.4 ADDITIONAL HABITAT FOR AQUATIC WILDLIFE

Increase in the area covered with water surface will create additional habitat for aquatic wildlife especially in or near the diversion weir. The water in Tundah Nallah is turbulent receding water outlines will create breeding habitat for resident species.

11.4.2.5 REDUCTION IN FUEL CONSUMPTION

In a coal or oil fired thermal power plant, about 1 kg of coal or 350 ml of oil per KWh is required. To generate 31.17 MU about 31177 tonnes of coal or 10911950 liters of oil will be

required. The development of project will facilitate a saving of about Rs. 54 million per year. As the process involves combustion, in a thermal power plant, air pollution is bound to take place. This project is environmental friendly and it is proposed to implement this project with carbon credit facility in accordance with Kyoto Protocol.

11.4.2.6 REDUCTION IN AIR POLLUTION

In case alternate energy source were to be provided, 6340 tonnes per year of air pollutant will be emitted to generate 15 MW of power from diesel. The pollutants likely to be emitted per year from the Diesel fired power plant will be as Table 11.5.

Table 11.5 Reduction of air Pollution

1.	Particulate Matter	1,229 tonnes
2.	Sulphur Di-oxide	446 tonnes
3.	Carbon mono-oxide	670 tonnes
4.	Nitrogen Oxides	2476 tonnes
5.	Hydrocarbons	1,517 tonnes

With the implementation of the project, the cumulative reduction in pollutants will be about 0.32 million tonnes in 50 years life span of project. This will have a positive impact at global level, by reducing global warming, green house effect and ozone depletion. However, if coal fired power plant is used, the pollutants will be much more than Diesel fired as reported above.

11.4.2.7 BENEFITS TO ECONOMY

Since water is a renewable resource it can be effectively harnessed for sustainable socio-economic development purposes. Hydropower development planning based on the sustainable development strategy would be necessary for careful exploitation and utilization of these natural resources. The development strategy would incorporate and maintain balanced harmony with the prevailing ecosystem Thus, hydropower development would play a vital role in the overall economic, social and industrial development in the region. The country will gain 31.17 MU energy annually. It will also provide employment to approximately 300 people during construction and operation phases of the project respectively. Thus, this will benefit the economy at natural and local levels.

11.4.3 CHECKLIST OF IMPACTS

Based on the positive and negative impacts as discussed in the above sections, a checklist of positive and negative impacts has been prepared and is presented in Table 11.6

Table 11.6 Checklist of Impacts

S.No.	Project Phase/ Environment	Impacts		
		Positive	Negative	No Change
A.	**Impact due to project location**			
i)	Rehabilitation and Resettlement			*
ii)	Loss of forest land		*	
iii)	Loss of land		*	
iv)	Encroachment into nature reserves		*	
v)	Loss of historical / cultural monuments			*
vi)	Risks due to earthquakes		*	
B	**Impact due to project design**			
i)	Disruption of hydrological balance		*	
ii)	Impact on fish population		*	
C	**Impact due to construction works**			
i)	Soil erosion at construction sites		*	
ii)	Pollution by construction spoils		*	
iii)	Health risks		*	
D	**Impact due to project operation**			
i)	Soil erosion risk		*	
ii)	Change in water quality		*	
iii)	Risk of eutrophication		*	
iv)	Water borne diseases		*	
v)	Vector-borne disease		*	
E	**Positive Impacts**			
i)	Power generation	*		
ii)	Employment potential	*		
iii)	Recreation and tourism potential	*		
iv)	Additional habitat for aquatic wildlife	*		

Impacts are further classified as short term and long term impacts. These are presented in Table-11.7. It is evident from these tables that most of the negative impacts are short-term in nature.

Table 11.7 Term vise Impacts

S.No.	Environment	Long Term	Short Term
A.	**Negative impacts**		
i)	Loss of forest land		*
ii)	Loss of land	*	
iii)	Soil erosion at construction sites		*
iv)	Pollution by construction spoils		*

v)	Health risks		*
vi)	Disruption of hydrological balance		*
vii)	Impact on fish population		*
B.	**Positive Impacts**		
i)	Power generation	*	
ii)	Employment potential	*	
iii)	Recreation and tourism potential	*	
iv)	Additional habitat for aquatic wildlife		
v)	Less Fuel Consumption	*	
vi)	Less Air Pollution	*	

11.5 COST OF ENVIRONMENTAL STUDIES AND PROJECT MANAGEMENT

The Tundah II HEP will provide opportunities for employment, enhancement in career opportunities for the local rural population and will herald a positive move towards less fossil fuel consumption, low air pollution and greater generation of power. However, to maintain the sustainability of the project, certain environmental problems due to the project shall also be dealt with by techniques like reforestation to reduce/curb soil erosion, proper disposal of muck, etc. The environmental issues likely to develop during project construction and operation phases could be minimized by making necessary provisions in the project design and adopting an Environmental Management Plan (EMP).

Based on planned project activities, environmental baseline data and impacts assessed, in earlier sections, this section enumerates the set of measures to be taken during implementation and operation, to eliminate, avoid or offset adverse environmental impacts or to reduce them to acceptable levels, together 'With the action to be taken for their implementation.

11.5.1 MITIGATION MEASURES

Based on the impact assessment study, it is proposed to prepare the mitigation measures for the following:

i) Compensatory Afforestation

ii) Catchment Area Treatment

iii) Provision for Fuel wood

iv) Muck Dumping

v) Water supplies and Sanitation

vi) Health Facilities

vii) Mitigation Measures due to Tunnel Blasting

11.5.1.1 COMPENSATORY AFFORESTATION

The Department of Forest, Government of Himachal is responsible for the construction and management of forests in the project area. The Forest Conservation Act of 1980 stipulates strict forest protection measures and outlines procedures (Guidelines 1/08 -1 (ii)) for compensatory afforestation if the department accepts" conversion of forestlands for non-forest purposes:

- If non-forest land is not available, compensatory forest plantation is to be raised on degraded forest land to the extent of twice the affected or lost forest area.

- If non-forest land is available, compensatory afforestation is to be raised over an area equivalent to the affected / lost area of the forest.

According to the results of the present study it is found that less than 5 Ha of forest land will be involved in this project major portion of land is unaffected by the construction activity like tunnel and open structures are located where there is no tree and land is comparatively flatter. No non-forest land is available. However, double the area has to be reforested in degraded forest available nearby. Thus, compensatory afforestation will be carried out in an area twice of the acquired forest land.

In addition to this, efforts need to be made to plant trees at appropriate places on completion of the works along the road. The objective of the reforestation program is to develop natural areas in which ecological functions could be maintained on substantial basis. Therefore, planning of miscellaneous indigenous tree species shall be carried out.

11.5.1.2 PROVISION OF FUEL WOOD FUEL SUPPLY PLAN

There is no rehabilitation of oustees from the project. The construction/ operation of the project will not render anyone homeless/landless. However, in order that influx of labourers in the project area does not lead to deforestation, necessary arrangements for supply of coal/LPG/kerosene to the labourers on an individual basis will be made by the developer in association with its contractors with the help of the local Government. Long-term orders will be placed on Government agencies like the Indian Oil or Bharat Petroleum Ltd. to provide LPG/kerosene at the project site for distribution to the labour engaged for work at site. Similarly, purchase orders for fuel wood/ charcoal will be placed for regular fuel supply to the labourers from authorized fuel wood/ charcoal depots of the district.

It is estimated that about 0.5 kg of Coal is required per day per person for cooking etc. Thus considering arrangements for 300 people for 3 years of peak construction, the total coal requirement works out to 0.5 x 365 x 300 =54,750 kg = 54.75 MT per year. The total peak requirement for coal works out to 164.25 MT in 3 years since 300 people would be staying in the project area only during the peak project construction stage including the families of the construction force (assuming family size to be two). During the first year of construction, an estimated 15 people would be at the project site for whom the coal requirement would be 0.5 x 365 x 15 = 821.25 kg = 0.82 MT. Thus, total coal consumption is estimated at 110.32 MT@ Rs.5000/MT. A provision of Rs.5,00,000 for supply of coal has been made in the project budget for the 3 year construction period.

Provisions have to be made to establish a fuel depot at the project site for supplying coal/ LPG to the workers. The project authority will construct sheds using non-forest products such as brick and cement. This will facilitate in saving wood from activities like shed construction. Hence no load on the forest is anticipated.

11.5.1.3 COMPENSATION FOR PRIVATE LAND

The compensation for the loss of private land shall be paid as per circle area rate. The compensation on crops shall be paid to the farmers through land and Revenue Department of Government of Himachal from the project funds or directly with their consent.

11.5.1.4 MUCK DISPOSAL

Construction of project is a specialized and complex task Soil collection, transposition, disposal and its treatment needs to be carried out in a systematic manner. The soil collection should be in containers from the dredging sites/ places. These containers should be such that soil should not spill during movement to disposal sites. The excavated soil will be first collected at dumping ground and then transferred to disposal sites.

Dumping sites are essential to store the excavated earth temporarily for back filling at later date and final disposal. Out of the total excavated quantity mostly will be reused in construction of roads, back filling and concreting and the balance will be disposed off at disposal sites.

It is proposed to have the height of dumps about 3.5 m being hilly area. About 5 ha of land will be required to dispose of the excavated earth.

The final dumping sites shall be first cleaned for vegetation. Then the surface shall be treated to make it impervious to avoid any leaching of chemicals. After filling the disposal area, it needs to be leveled and revegetated.

11.5.1.5 Water Supply and Sanitation

The public health facilities, such as water supply, sanitation and toilets would be provided as required at the project sites. The Central Public Health and Environmental Engineering Organization (CPHEEO) has recommended a provision of 45 litres of water per day per person for such work sites. Water sources will be treated before use upto WHO drinking water standards. For people working in the powerhouse during project operation phase, about 4,500 litres of water per day would be made available at the site. A conventional water treatment plant will be provided for this purpose. The collection and safe disposal of human wastes are among the most important

problems of environmental health. The sewerage carried in water solves the excreta disposal problems. The individual sewerage disposal problems through septic tank could be adopted for sewage disposal.

11.5.1.6 REFUSE DISPOSAL

Refuse includes many different substances such as garbage, rubbish, and ash. Health problems may arise since some of the refuse attracts insects and rodents. The disposal shall be made in pits.

The refuse disposal program should include waste segregation, storage, collection and disposal. The solid waste from contractor's camp needs special attention. The solid waste will be segregated into organic and in-organic waste in separate collection containers. The organic waste will then be converted into compost and used as fertilizer for horticulture purpose in colony areas as well as muck disposal sites.The capacity of these containers should not exceed 120 liters and these should be equipped with side handles to facilitate handling. The containers used for garbage storage should not exceed 50 liters and should preferably be equipped with a flexible cover. To avoid odor and accumulation of fly – supporting materials, garbage containers should be washed at frequent intervals. The remaining inorganic solid waste would be disposed at designated disposal sites.

11.5.1.7 HEALTH FACILITIES

The medical infrastructure available at Bharmour would be used for BHEP-II. About 150 people will be working during the peak construction phase. According to the criteria of Ministry of Health, GOI and World Health Organisation (WHO), one Health Center (HC) with one doctor and minimum one health personnel (nurses, compounders, etc.) will be required with atleast one bed. In addition, several provisions towards providing a comprehensive health plan have been made.

One ambulance will be procured and provided by the project for meeting immediate and urgent medical calls in and around the project area including emergency calls from local villages.