EXECUTIVE SUMMARY REPORT

1. INTRODUCTION

M/S Gati Infrastructure Limited (GIL) proposes to develop Bhasmey Hydroelectric power project (51 MW) located between Latitude 27°11’12” N to 27°11’45’’ N and Longitude 88°33’16’’E to 88°36’45”E for harshening the power potential of river Rangpo, in East district of Sikkim. The Bhasmay project envisages a peaking power plant comprising one intake with a storage reservoir, a headrace tunnel, surge shaft, surface penstock, an open air powerhouse and an outdoor switchyard. The maximum gross head of the scheme is 113.0 m and the nominal discharge 55 m^3/s. Based on these parameters the plant will have an installed capacity of 51 MW and a total average annual energy production of 244.1 GWh (=MUs, Million Units). The annual peaking energy production is expected to be161.1 GWh with an annual base energy production of 83 GWh.

2. ENVIRONMENTAL BASELINE STATUS

Before carrying out EIA study for the project, a" Scoping Matrix" was formulated to identify various issues likely to be considered as a result of the proposed project. Environmental baseline data has been collected from primary as well as secondary sources in order to comprehend its impact. The baseline status has been categorized in the following categories:

• Physico-chemical Aspects

• Biological Aspects

• Socio-economic Aspects

2.1 Physico-chemical Aspects

Water resources

The Bhasmey project is a run off the river project. The Rangpo river is essentially rain fed with only a small part is contributed through snow in upper reaches. As per the DPR, average annual inflow would be 1,626 M cum with average discharge of 50.9 cum/s. The total storage volume of the reservoir is estimated to be 1.019 M cum and active storage volume of 0.575 M cum.

Water quality

There are no water polluting industries in and around the project area thereby the river is unpolluted from these sources. It was also revealed from the analysis of water samples collected that the concentration of BWQC, Free CO_2, Alkalinity, BOD, D.O., pH, TS etc is well within the permissible limits.

Meteorology

The average annual rainfall recorded in Bhasmey HEPP catchment is about 3,771 mm with maximum being 4,167mm and minimum as 3,280. The maximum temperature is recorded usually during July and August and minimum during December and January. Fog is a common feature in the entire state from May to September. The mean temperature in the lower altitudinal zone varies from 1.5 to 9.5 degree centigrade. The average maximum and minimum temperature of the East district is 27.2^0 and 1.6^0C, respectively.

Ambient air quality

From the ambient air quality monitored in the study area at two locations, it has been observed that SPM, RPM, SO2 and NOx levels are well within the permissible limit specified for residential, rural and other areas.

Noise Level

Noise levels have been monitored in the study area and recorded within 30-70 dB with an average of 50 dB (L_{eq}) which is well within permissible limit of 65 dB(L_{eq}).

Land use Pattern

The landuse/land cover has been prepared using IRS-P6 LISS-III data procured from the National Remote Sensing Agency (NRSA), Hyderabad. The satellite data has been processed using ERDAS Imagine software supported with ground checks and ground truth verification. Area and distance calculations have been carried out using GIS software after geo-referencing the interpreted data with the help of SoI topographical maps of the scale 1:50,000. The study revealed that more than 48 % of the total area falls under medium to dense forest category with about 20% falling in degraded forest.

Geology

The project area forms a part of the inner belt of Lesser as well as Higher Himalayan Crystalline Complex which consists of various lithostratigraphic units of low grade to high grades metasedimentary and meta igneous rocks. Stratigraphically, these rocks have been grouped into Kanchanjunga, Chungthang, Darjeeling, Daling and Lingtse formations.

The area is characterized by low-grade metamorphic rocks, which are grouped into Daling Formation. These low-grade metamorphic rocks developed fine grained fabrics during green schist facies of metamorphism, which show a highly foliated character due to poly-phase ductile and brittle deformation. Folding, faulting, fracturing, penetrative foliation and mineral lineation indicate that the area has undergone poly-phase structural deformation showing unique internal textures of the phyllites/quartzite, broad zones of intersecting brittle faults and a suite of internally fractured quartzites and phyllites.

Seismicity

As per IS: 1893:2002, the entire Sikkim falls in Zone-IV. As far as MSK intensity scale is concerned, the region lies within the high damages risk zone (VIII) corresponding to a magnitude of 6.7 in the Richter scale.

Soil

The soils of Bhasmay project catchment area predominantly are coarse loamy, thermic type which account for about 40% of the catchment area (Fig. 6.3). Moderately shallow soils are found on very steep slopes (30-50%) covering more than 27.64% of the Catchment area with a coarse loamy surface and are excessively drained. The coarse loamy, Mesic soils are moderately deep and spread over more than 27% of the catchment area and are excessively drained. This type of soil is found mainly on moderately steep slope (15-30%) with coarse loamy surface. The soil of loamy skeleton thermic type is found to exist over more than 6.2% of the catchment area and found mainly on very very steep slopes (50%) with loamy skeleton surface. These are prone to severe erosion.

2.2 BIOLOGICAL ENVIRONMENT

Vegetation

The project area reflects a botanical paradise with a wide range of flora and fauna due to the suitability of the habitat for a wide range of organisms. Large varieties of trees such as fuel, fodder, gums, timber, resins, medicinal and dyes- yielding are obtained from this forest. The stratification of the flora is well marked due to the presence of herbs, shrubs and trees in a uniform manner of increasing height and canopy cover. This stratification allows uniform sunlight to each plant type. Lower plants of the group of algae, fungi, bryophytes, pteridophytes, etc are also present in the area.

Wildlife

The fauna of the catchment area of Bhasmey power project is comprised of 14 species of Mammals, 45 species of Avifauna, 60 species of butterflies, 19 species of fishes, and 5 species of reptiles. The diversity of the species of different group produces a clear picture of the approximate number of species found in the catchment area of the proposed hydro-electric project. It includes all the aspects needed to be taken under study such as status and distribution of each species. However, the study reveals that there are no rare and endangered species observed in the project area.

2.3 SOCIO-ECONOMIC ASPECTS

The total population of the study area is of the order of about 1,589 including 832 males and 757 females. The average sex ratio (number of females per 1000 males) and family size is 910 and 5.0 respectively. The average literacy rate 62.4 %. However, male literacy rate (70.7%) is more than the females (53.2%). The SC and ST population in the area is 260 and 36 respectively within a total village area of 687.274 ha. The total cultivable area is nearly 50% of the total village area however; irrigated area is small (~ 10% only). 65% of the total population is engaged in only agriculture whereas 20% is engaged in agriculture and service or labour. Majority of the household have 1-2 earning members.

The village has only 8.33% of the population having income mare than Rs. 20,000/- per annum.

3.0 PREDICTION OF IMPACTS

Based on the project details and the baseline environmental status, potential impacts as a result of the construction and operation of the proposed project have been identified.

3.1 WATER ENVIRONMENT

Water Resources

The construction of proposed Bhasmey HE project would not result in drying up of portion of Rangpo Chu in the downstream stretch, but, would have implications on some of the physical, chemical and biological characteristics of water in the stretch. The reduced water discharge might have an impact on the aquatic ecosystem in terms of increase in water temperature, decrease in oxygen contents with resultant decrease in biological productivity and fish fauna. However, immediately downstream of dam after a distance of about 100 m, Rishi chu join Rangpo Chu on its left bank. Similarly, at two small stream at a distance of 50 and 250 m join the Rangpo Chu on its right bank. It is therefore, assumed this would contribute enough discharge to Rangpo Chu sufficient for aquatic ecosystem to function. in the downstream stretch. Therefore the impact would be limited only to a small stretch of about 50 m downstream of the proposed Bhasmey dam site.

Water quality

a) Construction phase

Sewage from labour camps

Average per capita solid waste generated per day is estimated to be 425 g (dry weight). No dumping of solid waste will be allowed near any water body or in stream. The solid waste will be collected in masonry vats of at least 25 cum capacity

at suitable sites near the colony area. The garbage would be transported to the landfill site located at least` 0.5 km away from the colony area. The organic waste will be suitably processed to form compost, which can be used as manure. The wastewater generated from the colonies will be collected and disposed of in specifically designed soak pits. Waste water and sewage generated will not be allowed to flow into the river or any stream.

b) Operation phase

Effluent from project colony

Since, only a small number of O&M staff will reside in the area in a well designed colony which will have a Sewage Treatment Plant (STP) and other infrastructure facilities. The problems of water pollution due to disposal of sewage are not anticipated.

Impacts on water quality

The assessment of water quality of the Rangpo river shows that the water is of pristine quality. The different construction activities during the implementation of the project may contribute to marginal negative impacts on the water quality parameters. It is anticipated that once the construction activities are over it is likely that the quality of water will return to its present level, however during the construction period necessary steps must be taken to prevent any possible contamination of river water.

3.2 AMBIENT AIR QUALITY

The increase in the vehicular traffic, installation of stone crusher machines, drilling activities, construction of dams & infrastructure facilities is likely to increase the level of suspended particulate matter, NOx, SO2, CO, which may cause slight deterioration of the ambient air quality. It is anticipated that once the construction activities are over the quality will improve, however during construction period all environmental regulations should be followed to minimize air pollution.

Emissions from various crushers

Since the query sites would be away from the settlement the impact on account of crushing of stones will be negligible. The labour camps, colonies, etc. will be located away from the impact zone.

3.3 NOISE ENVIRONMENT

The increase in the vehicular traffic and also the use of dynamites, drilling machines, stone crusher, community noise during the construction stages will result in the increase in noise level thereby posing adverse effect on the noise environment. However, well equipped workshop and well managed fleet of vehicles will be utilized to reduce the noise level. In order to reduce the noise through blasting, delay detonators shall be used. With the completion of project, it is expected that the level of noise shall come down.

3.4 IMPACTS ON LAND ENVIRONMENT

Land requirement

About 45.20 ha of land including about 20 ha forest land and 25 ha of private land is required for various project components. Appropriate compensation measures will be taken as per the ownership. None of the land oustee will become landless as only a small part of their land would be acquired.

Construction Operations

As most of the major construction sites are located away from the habitation, no significant impact is anticipated.

3.5 IMPACTS ON TERRESTRIAL ECOLOGY

The construction workers and nearby villagers may use fuel wood, if no alternate fuel is provided. The project authorities would provide fuel wood/ kerosene/ LPG from the depots available with the other HEP project (Chuzachen) of the same owner.

Diversion of forest land

About 20.60 ha of forest land for surface work and 3.13 ha for the underground works will be required. No rare or endangered species are reported in the forest land to be diverted for the project. Appropriate management measures have been recommended for compensation in lieu of the forest land to be acquired. The objective of the aforestation programme will be to develop natural areas in which ecological functions could be maintained on sustainable basis.

Disturbance to wildlife

The impacts on terrestrial fauna are not expected to be significant as only common species of fauna are identified in the area and none of the species seems to be affected by the project.

3.6 IMPACTS ON AQUATIC ECOLOGY

Impacts on migratory fish species

The obstruction created by the dam would hinder the migration of certain migratory species. Hatchery, propagation, development of nursery ponds and Stocking of selected river stretches is recommended in the EMP report as a mitigation measure.

3.7 SOLID WASTE MANAGEMENT

Impacts due to sewage disposal

The project authorities will take sufficient precautions for developing proper system for the sewage treatment for the colonies of workers. Septic tanks and soak pits shall be provided for individual dwellings. The project authorities will ensure proper waste disposal by adopting various disposal methods like composting, etc.

3.8 SOCIOECONOMIC IMPACTS DURING CONSTRUCTION PHASE

Employment potential

Apart from direct employment, the opportunities for indirect employment like shops, food-stall, tea stalls, etc. besides a variety of suppliers, traders will also be generated which would provide great impetus to the economy of the local area. However, none of the families would be displaced from the land. This will enhance the quality of living of the local population.

Impacts on infrastructure

The widening and strengthening of road between Rangpo to Rongli is in progress for Chuzachen hydroelectric project which lies upstream of the proposed project. A small stretch of the road is coming under submergence which will be diverted accordingly.

Impacts due to land acquisition

Although about 25 ha of private land is to be acquired for the proposed project, no family is likely to be displaced.

4. ENVIRONMENTAL MANAGEMENT PLAN

Following facilities are recommended for the labour camps:

* Labour camp site shall have electricity and ventilation system, water supply and community latrines with semi-permanent structures for their workers

* Commissioning of community toilets and construction of septic tanks are proposed.

* Adequate facilities for collection, conveyance and disposal of solid waste shall be developed for solid waste disposal.

* Proper medical facilities would be developed which includes strengthening of existing PHEs, provision of one mobile dispensary/ambulance, free medicines with medical and paramedical staff.

4.3 RESTORATION PLAN FOR QUARRY SITES

The construction material for dam site will be obtained from quarry sites located nearby river-beds near Rorathang, Bhasmey and at the confluence of Rangpo and Teesta river near Rangpo village which are already in operation. No quarrying would be done in the project area.

4.5 COMPENSATORY AFFORESTATION & GREENBELT DEVELOPMENT

An area of about 42 ha land (double the land falling in forest area) is proposed to be developed under compensatory afforestation plan. Apart from this, the project authority will carry out plantation in and around the project area i.e. areas along reservoir periphery, project appurtenances, site office, road side, etc.

4.6 PUBLIC HEALTH ASPECT

To take care of public health in the project area it is proposed to strengthen the existing medical facility and also to create more facilities like providing medical and paramedical staff, ambulance / mobile dispensary and distribution of free medicines to not only directly employed labour but also for the villagers in the area. The project authorities would also hold screening camps where rapid blood tests for disease like AIDS, TB, malaria etc.

4.7 CONTROL OF AIR POLLUTION

The increase in the vehicular traffic, installation of stone crusher machines, drilling activities, construction of dams & infrastructure facilities is likely to increase the level of suspended particulate matter, NOx, SO2, CO, which may cause slight deterioration of the ambient air quality. It is anticipated that once the construction activities are over the quality will improve, however during construction period all environmental regulations should be followed to minimize air pollution.

4.8 CONTROL OF WATER POLLUTION

The water is of pristine quality. The different construction activities during the implementation of the project may contribute to marginal negative impacts on the water quality parameters. Water quality parameters like taste, colour, turbidity, sediment content, dissolved oxygen, BOD may change besides with an increase in toxic substances, coliforms, oil & grease etc., the BWQC may change due to human interferences. However, necessary steps would be taken to prevent any possible contamination of river water It is anticipated that once the construction activities are over it is likely that the quality of water will return to its present level

4.9 WATER MANAGEMENT

The construction of proposed Bhasmey HE project would not result in drying up of portion of Rangpo Chu in the downstream stretch. The reduced water discharge might have an impact on the aquatic ecosystem in terms of increase in water temperature, decrease in oxygen contents with resultant decrease in biological productivity and fish fauna. However, immediately downstream of dam after a distance of about 50-100 m, two small stream join the Rangpo Chu and continuously provide water. In addition to this, minimum 10% of the discharge rate would always be maintained for aquatic life.

4.10 ESTABLISHMENT OF AN ENVIRONMENTAL MANAGEMENT CELL

It is recommended that project proponents establish an Environmental Management Cell (EMC) at the project site with requisite manpower. The task of the Cell will be to coordinate various environmental activities with local authorities such as PCB, State Forest department Fisheries etc., to carry out environmental monitoring and to evaluate implementation of environmental mitigatory measures

5.0 REHABILITATION & RESETTLEMENT PLAN

As no family is anticipated to disturbed and displaced from the project, there will be no resettlement and rehabilitation for the project. Although about 25 ha of private land will be acquired, the land owners who will surrender part of their land have enough land to

survive. Multi-fold compensation will be paid to land oustees in consultation with State authorities.

6.0 CATCHMENT AREA TREATMENT PLAN

The project lies downstream of Chuzachen HEP project for which extensive CAT Plan has been laid. Basically the catchment area for this project is common to that of Chuzachen with some additional area in the downstream. In the present study `Silt Yield Index' (SYI), method has been used to prioritize the various watersheds. The area is under various categories of erosional intensity. A provision of Rs. 41.17 lacs has been kept for treatment within the project area with an additional provision of Rs. 80 lac to strengthen the catchment area of Chuzachen project for which a provision of Rs. 168.93 lac has already been made.

7.0 FOREST PROTECTION PLAN

It is recommended that project proponents can compulsorily ask the contractor to make semi-permanent structures for their workers. These structures could be tin sheds. These sheds can have internal compartments allotted to workers. The labour camp site shall have electricity and ventilation system, water supply and community toilets. Fuel wood/ kerosene and LPG would be provided to the labourers to prevent cutting of forest trees.

8.0 MUCK DISPOSAL PLAN

A sum of 1.22 lac tonne of muck including soil, hard rock and stones will be generated from various developments (underground & surface). The project authorities propose to utilize most of the generated muck as construction material and the remaining quantity of muck will be disposed off on the selected sites of river terrace close to dam and powerhouse site for raising the terraces to the road levels and beautifying it with development of parks/tourist places. The left over muck will be utilized for the development of road pavements for the safety purpose. The filled-up depressions and barren land will also be developed as green belt by using remaining muck.

9.0 COST ESTIMATES

The total amount to be spent for implementation of the Environmental Management Plan (EMP) is Rs. 309.89 lacs as per the Table 1. This does not include the following costs:

- NPV towards forest land diversion
- Cost of trees in forest area to be diverted

Table 1: Total cost estimates for the implementation of EMP

S.No.	Plans	Amount (Rs lakh)
1	Compensatory aforestation and creation of green belt	23.24
2	Catchment area treatment plan	121.17
3	Biodiversity conservation and management plan	37.25
4	Fisheries development	09.54
5	Management and Monitoring of Geohazards	17.00
6	Solid waste management	10.19
7	Provision for fuel wood and energy conservation	10.00
8	Landscape and Restoration	09.00
9	Land acquisition (resettlement & rehabilitation)	34.00
10	Muck Disposal	8.50
11	Medical facilities	27.00
12	Rehabilitation of Quarry Sites	03.00
	TOTAL	**309.89**