



Himachal Pradesh Power Corporation Limited  
(A State Government Undertaking)  
Office of General Manager  
Triveni Mahadev (78 MW) & Thana Plaun HEP (191 MW),  
Kotli, Distt. Mandi-175003  
Tel. No. 01905-281081, Email: - gmtpbnhppcl@gmail.com

**HPPCL/GM-TM&TPHEP's/TP-E&F/K-1-2020- 1189-92 Dated: 25-2-21**

To,

The Director-cum-Member Secretary (EAC-RV&HEP),  
Director-IA-I, MoEF&CC, GOI,  
Indira Prayavaran Bhawan, Jor Bagh Road,  
New Delhi- 110003.

Sub: - Gyspa 300MW Hydro Power Project on River Bhaga in Lahaul & Spiti, District of Himachal Pradesh by M/s Himachal Pradesh Power Corporation Ltd. - **Regarding Terms of Reference**

**F.No.: J-12011/8/2011-IA.I & J-12011/11/2016-IA.I(R)**

**Proposal No.: IA/HP/RIV/50633/2016, dated 29<sup>th</sup> February, 2016**

Sir,


Kindly refer to the 4<sup>th</sup> meeting of Expert Appraisal Committee for River Valley and Hydroelectric Projects held on dated 4<sup>th</sup> December, 2020 vide which additional information was sought.

In this context, the point wise submission to the information sought is hereunder:

1. Details regarding total land requirement including submergence area to the present proposal and prior to grant of TOR dated 21-11.2011: Attached as Annexure-I.
2. Comparative Chart having details on the project configuration: Attached as Annexure-II.
3. PFR prepared as per the Ministry guidelines dated 30.12.2010 having details of Site Analysis: Attached as Annexure-III.

It is therefore, requested to kindly grant fresh TOR in favour of the project so that the project activities can be taken up in earnest.

Yours faithfully,

  
General Manager  
TM & TP HEPs HPPCL  
Kotli, Distt. Mandi (H.P.)

**CC:**

1. The Director (Civil), HPPCL, Himfed Building, BCS, New Shimla-09.
2. The General Manager (CP), HPPCL, Himfed Building, BCS, New Shimla-09.
3. The Chief Environment Specialist, HPPCL, Himfed Building, BCS, New Shimla-09.



**ANNEXURE-I**

**Comparison of Submergence Area & Other Features**

#	Description	As per the presentation before 43 <sup>rd</sup> EAC (RV&HEP), dated 12-13 <sup>th</sup> Nov. 2010 i.e. Before TOR granted on 21 <sup>st</sup> Dec. 2011.	As per Present Proposal submitted on 24.11.2020
1	Location of Project	Storage scheme on River Bhaga, tributary to Chandra Bhaga River in Distt. Lahaul & Spiti of Himachal Pradesh	Storage scheme on River Bhaga, tributary to Chandra Bhaga River in Distt. Lahaul & Spiti of Himachal Pradesh
2	Dam Axis	Near Village Gyspa	Shifted 3.2 Kms. Upstream of Gyspa Village as per EAC Recommendations.
3	Total Land Requirement	1635 Ha	1322.95 Ha
4	Submergence Area	1500 hectares	1220 Hectares
5	Villages to be Submerged	5	4
6	No. of families to be displaced	131 families	74 families
7	Dam	200 meters high	200 meters high
8	HRT	11.75 Kms. long	14.96 Kms. long
9	Power House Complex	R/B of River Bhaga at EL 3025m at 300m upstream of village Stingri.	R/B of River Bhaga at EL 3025m at 300m upstream of village Stingri.
10	FRL	EL 3439.62	EL 3466
11	MDDL	EL 3313	EL 3335
12	Gross Storage of Reservoir	1.151 Maf	0.74 Maf
13	Live Storage of Reservoir	1.0 Maf	0.65 Maf



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14	Length of Reservoir	The length of reservoir at El.3439.62 m is $\pm 11$ km upstream of the Dam and has an average width of $\pm 0.750$ km.	The length of reservoir at EL 3466m will be 5 km Upstream of dam with average width of 0.75 km.
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**ANNEXURE-II**

**Comparison of Features w.r.t. TOR granted on dated 21<sup>st</sup> Dec. 2011**

#	Description	As per old TOR granted on 21 <sup>st</sup> Dec. 2011	As per new proposal submitted on 24.11.2020	Remarks
1	Location of Project	Storage scheme on River Bhaga, tributary to Chandra Bhaga River in Distt. Lahaul & Spiti of Himachal Pradesh.	Storage scheme on River Bhaga, tributary to Chandra Bhaga River in Distt. Lahaul & Spiti of Himachal Pradesh.	Same as Previous
2	Dam Axis	3.2 Kms. Upstream of Gyspa Village	3.2 Kms. Upstream of Gyspa Village	Same as Previous
3	Total Land Requirement	1322.95 Ha (1253.70 ha forest land and 69.25 ha private land)	1322.95 Ha (1253.70 ha forest land and 69.25 ha private land)	Same as Previous
4	Submergence Area	1220 hectares (1160 ha forest land and 60 ha private land)	1220 hectares (1160 ha forest land and 60 ha private land)	Same as Previous
5	No. of Affected Villages	14	14	Same as Previous
6	Villages to be Submerged	4	4	Same as Previous
7	No. of families to be displaced	74 families (365 persons and 162 houses)	74 families (365 persons and 162 houses)	Same as Previous
8	Dam	200 m high	200 m high	Same as Previous
9	HRT	14.96 Kms. long	14.96 Kms. long	Same as Previous
10	Power House complex	R/B of River Bhaga at EL 3025m at 300m upstream of village Stingri	R/B of River Bhaga at EL 3025m at 300m upstream of village Stingri	Same as Previous
11	FRL	EL 3466	EL 3466	Same as Previous



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12	MDDL	EL 3335	EL 3335	Same as Previous
13	Gross Storage of Reservoir	0.74 Maf	0.74 Maf	Same as Previous
14	Live Storage of Reservoir	0.65 Maf	0.65 Maf	Same as Previous
15	Length of Reservoir	The length of reservoir at EL 3466 m shall be 5 km Upstream of dam with average width of 0.75 km.	The length of reservoir at EL 3466 m shall be 5 km Upstream of dam with average width of 0.75 km.	Same as Previous
16	Project Cost	2968.37 crore	3386.25 crore	<b>Project Cost Revised</b>

**Registered Office: Himfed Building, BCS, New Shimla- Himachal Pradesh-09**

**CIN: U4010HP2006SGC030591, Ph. No.; 0177-2670716, Fax No.: 0177-2671821, website: [www.hppcl.in](http://www.hppcl.in)**

# **GYSPA DAM PROJECT**

**(300 MW)**



**HIMACHAL PRADESH POWER CORPORATION LTD.**

**(A State Govt. Undertaking)**



## **PRE-FEASIBILITY REPORT**

**CORPORATE PLANNING CELL  
SHIMLA**

**JANUARY, 2021**



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### SALIENT FEATURES

<b>Location</b>	
State	Himachal Pradesh
District	Lahaul & Spiti
River/Khad	Bhaga (A Tributary of river Chenab)
Vicinity	Storage dam $\pm 200$ m high upstream of village Jispa with river bed at an EL $\pm 3272$ m and Power House on right bank of Bhaga at an EL. $\pm 3025$ m about 300m u/s of Stingiri village in Distt. Lahaul and Spiti.
Sol Topo Sheet (1:50000)	50 H/2
Co-ordinate	Dam site- Latitude $32^{\circ}37'51''$ Longitude $77^{\circ}10'30''$ Power house site- Latitude $32^{\circ}33'41''$ Longitude $77^{\circ}04'40''$
<b>Hydrology</b>	
Catchment area	
i) Catchment area at Gemur (Discharge observatory site)	$\pm 1311$ Sq Km
ii) Catchment area at Dam site	$\pm 1205$ Sq Km
iii) 90% run off	$1\ 119.4$ M.m <sup>3</sup>
iv) 50% run off	$1361.42$ M.m <sup>3</sup>
<b>River diversion works</b>	
<b>Coffer Dams</b>	
Type	Rock fill with impervious core
Upstream	70m high
Downstream	30m high
<b>Storage Dam</b>	
Type	Rock fill, approx. $\pm 200$ m
Top of Dam	EL. $\pm 3472$ m
FRL of Dam	EL. $\pm 3466$ m
MDDL of Dam	EL. $\pm 3335$ m
River Bed Level	EL. $\pm 3272$ m





<b>Water Conductor System</b>	
Type	Head Race Tunnel, Modified Horse shoe & concrete lined
Size & length	5.7m dia, ±14.964 km long
Design discharge	81.5 cumecs
Velocity	3.25 m/s
<b>Surge Shaft</b>	
Type	Open to Sky, Restricted Orifice type
Size	± 20m in diameter, ±200m deep
<b>Pressure Shaft</b>	
Type	Single, steel lined shaft bifurcating to four branches near power house
Size	4.5m dia
Length	±520m
Velocity	5.22m/s
<b>Power House</b>	
Type	Underground
Installed capacity	300 MW ( 4 x 75 MW)
Type of turbine	Francis
Gross Head	430.33m
Net Head	407.33m
<b>Tail Race Tunnel</b>	
Type	Tail Race Tunnel, Horse shoe shaped & concrete lined
Length	±965m
Normal TWL at Outlet	2992m
<b>Energy Generation</b>	
Energy generation in 90% Dependable year	±894.86GWh
Energy generation in 50% Dependable year	±1021.03GWh
<b>Cost Estimate (Tentative)</b>	
Civil & Hydro Mechanical works	2968.37 Crore.
E & M Works	362.88 Crore.
T- Transmission	55.00 Crore.
Total Cost of Project	3386.25 Crore.

## **1. EXECUTIVE SUMMARY**

### **(i) Introduction:-**

The water of Indus system is shared between India and Pakistan as per the Indus Water Treaty. India has full rights on the eastern rivers i.e. Satluj, Beas and Ravi but limited rights on western rivers of the system i.e. Chenab, Jhelum and Indus. River Chenab consists mainly of two rivers namely Chandra and Bhaga and the name Chenab comes into existence only after both these rivers meet at a place called Tandi. The Chandra rises from the South-East and Bhaga from the North-West of the Baralacha pass. It enters Pangi valley of Chamba district near Bhujind and leaves the district at Sansari Nala to enter Padar valley of Kashmir. It flows in Himachal for 122 km. With its total length of 1,200 km., it has a catchment area of 61,000 sq km, out of which 7,500 sq km lie in Himachal Pradesh.

Storage of 3.6 MAf (million acre feet) is allowed for India in the treaty on western flowing rivers out of which 1.7 MAf is allowed on Chenab and 0.4 MAf and 1.9 MAf on Indus and Jhelum respectively. Sector wise 2.85 MAf is for conservation storage and 0.75 MAf for flood storage. It was decided in the committee of Secretaries meeting that an action plan will be charted out for full utilization of waters of rivers flowing into Pakistan. In the meeting of the Committee held under the Chairmanship of Cabinet Secretary, Govt. of India, New Delhi, it was deliberated that enough storage schemes are not available in Chenab basin for the utilization of the Storage provided in the Indus Water Treaty. The Cabinet Secretary, GoI stressed that Govt. of J&K & Govt. of H.P. should identify storage schemes of 1.70 MAf as no suitable storage site is available for Bursar Dam Project in J&K.

Gyspa Dam Project is proposed on Bhaga River. The Project was earlier envisaged as a Storage scheme for power generation at top of the basin to ensure availability of adequate water for downstream projects for power generation. In view of directions of Govt. of India as mentioned above, the fresh studies were initiated and the present proposal was finalized.

### **(ii) Project:-**

The proposed Gyspa Dam project is a storage type of scheme with multiple benefits proposed in Distt. Lahaul and Spiti, Himachal Pradesh. The Project envisages construction of a  $\pm 200$  m high storage dam on Bhaga River upstream of Gyspa village in Keylong Tehsil of Lahaul & Spiti District of Himachal Pradesh. The water so stored shall be fed into 5.70m dia,  $\pm 14.964$  Km long HRT, a surge shaft  $\pm 20$  m diameter &  $\pm 200$  m deep, a pressure shaft 4.50m dia,  $\pm 520$  m long, to feed four Vertical shaft Francis turbines each of 75 MW capacity. An underground Power House is proposed at an EL  $\pm 3025$  m about 300m u/s of Stingri GREF House, on the right bank of river Bhaga. The scheme

shall utilize a gross head of 430.33 m for generating 300 MW of power with annual generation of  $\pm 894.86$  MU in 90% dependable year.

The storage dam will impound 0.65 MAF of water and shall also provide irrigation benefits in riparian States besides flood storage benefits. In view of the perennial hostilities with Pakistan it will also give strategic advantage to India and a foreign policy tool.

The scheme is located between latitude  $32^{\circ}37'51''$  and longitude  $77^{\circ}10'30''$ . The project is located on Chandigarh-Mandi-Leh highway at about 70 km from Manali Town (famous tourist place). The Dam site is upstream of Keylong town, the district head quarter of Lahaul Spiti and Power House site is downstream of Keylong just near the confluence of Chandra with Bhaga on the right bank of Bhaga at an EL  $\pm 3025$ m about 300m u/s of Stingri .

Access to Lahaul & Spiti district by road can be made from two different locations one is Sumdo through (Kinnaur District) for entry into Spiti valley and another is through Manali (Kullu District) for entry into Lahaul valley. The connectivity has been greatly enhanced with commissioning of Atal Tunnel completely bypassing the Rohtang Pass and reducing the road distance by 46 km. The nearest airport is Bhuntar Airport (Kullu) & nearest broad gauge railhead is Kiratpur.

### **(iii) Climate**

Since the valley is situated in rain shadow area, north of the Pir Panjal ranges the weather remains pleasant and quite comfortable during summers i.e. from May to mid Oct. This is the best season to visit this valley. It seldom rains, and the Mercury level does not exceed  $30^{\circ}\text{C}$  and never falls below  $15^{\circ}\text{C}$  throughout the period mentioned above. There is little or no rain in monsoons. The climate remains dry & invigorating. The days are hot and nights are extremely cold. During winter, i.e. from Nov. last to April because of western disturbances it snows heavily and the temperature goes down below minus.

In the winter season, the higher regions of the Himalayas receive precipitation as snow while moderate rainfall occurs in the foothills and adjoining plains. The main source of winter precipitation is the Western disturbances, which approach India from the west through Iran, Afghanistan and Pakistan. The summer period is the transitional period before the onset of the south-west monsoon. Disturbances do occur in this season as well, but are, on the average, less frequent. The temperature in the project area varies from  $0.7^{\circ}\text{C}$  to  $21^{\circ}\text{C}$ . The climate of the area is generally cold; it is warm in summer and cold in the winter. The lowest and highest temperature is  $0.7^{\circ}\text{C}$  to  $21^{\circ}\text{C}$ . respectively.

### **(iv) Water availability**

The Project is located on river Bhaga. The catchment area of River Bhaga at Gemur (Discharge observatory site) and Tandi is 1311 sq.km and 1525 sq.km

respectively. The shape of the catchment area at the proposed dam site is wide spread truncated leaf shape. The catchment area at Dam Axis is about 1205 sq. km. River Bhaga is being gauged at Tandi near the proposed Gyspa power house site by Central Water Commission (CWC) and 31 years (1974-75 to 2007-08) discharge data is available. Based on this available discharge data 31 years discharge series at diversion site is derived by proportional catchment area basis.

**(v) Power Generation**

The provision of a storage scheme on River Bhaga is of utmost importance to avail the benefits under Indus Water Treaty. It will also firm up the power generation in the Hydro Projects proposed downstream of this project in H.P. & J&K. Accordingly, the live storage planning for Gyspa Dam reservoir is proposed to be carried out for 50% availability corresponding to mean year pattern of inflows. The annual inflow works out to  $\pm 1361.42$  MCM.

The recommendations of Indus Water Treaty regarding the releases of water during the balance period have been taken in to consideration during the reservoir operation study. While filling the reservoir, attempts have been made to at least run one unit at 40 % load. Taking reservoir filling from 21st June to 31st August, 9 cumecs of releases (discharge for one unit at 40 % load) are maintained through this period generating 28 MW to 32 MW of power. Power generation during 50% mean year would be  $\pm 1021.03$  MU. The firm power during lean months (Oct. to March) would be around 118 MW. During 90% dependable year, the releases during 21st June to 31st August have also to be restricted to 9 cumecs. Power generation during 90 % dependable year works out to be about 894.86 MU.

An installed capacity of 300 MW is proposed so that it enables exploitation of about 91.50 % of energy potential in 90 % dependable year and 72.83 % of energy potential in 50 % dependable year. Further increase in installed capacity is not justified with the additional energy benefits. The energy generation restricted to installed capacity of 300 MW works out to 894.86 MU in 90 % dependable year and 1021.03 MU in 50 % dependable year. However, the installed capacity shall be reviewed when detailed engineering studies along with economic aspects are attempted at DPR stage.

**(vi) Cost Estimate**

The estimated cost of this project at January - 2011 price level has tentatively been worked out at Rs 3386.25 crore comprising Rs 2968.37 crore for civil works, Rs 362.88 crore for generating plant and equipment and Rs 55 crore for transmission line and associated transmission network.



## **2. INTRODUCTION OF THE PROJECT/ BACKGROUND INFORMATION**

### **(i) Identification of Project and project proponents**

Himachal Pradesh is a small hilly state in the northern part of India located in the western portion of the Great Himalayan Mountain Range. It is bounded by the State of Jammu-Kashmir to the north, Tibet to the east, and the plains of northern India to the south and west, with a population of about 7 million. The State has five major rivers flowing through it, namely Satluj, Ravi, Beas, Chenab and Tons (Yamuna). Hydro power potential of the order of 23,000 MW has been identified for development from these five rivers and their tributaries. The Chenab River is one of the major rivers of the Indus basin draining through this region, originating in the Dhauladhar ranges of the Himalayas at elevation of 5800 m above mean sea level.

Gyspa Dam Project (300 MW) was contemplated as a storage scheme essentially for Power generation on river Bhaga, a tributary of river Chenab near village Jispa. However Govt. of India decided to utilize the storage of water in Chenab basin provided in the Indus Water Treaty. Accordingly, the project has been declared as “National Project” by Ministry of Water Resources, Govt. of India vide No. 27/1/2009-PR, dated: 26.02.2009.

The Project has been allocated to execution to Himachal Pradesh Power Corporation Ltd. (HPPPCL) a Govt. of HP PSU.

### **(ii) Brief Description of nature of the project**

The proposed Gyspa Dam project is a storage type of scheme proposed in Distt. Lahaul and Spiti, Himachal Pradesh. The Project envisages construction of a  $\pm 200$  m high storage dam on Bhaga River upstream of Gyspa village in Keylong Tehsil of Lahaul & Spiti District of Himachal Pradesh. The water so stored shall be fed into 5.70m dia,  $\pm 14.964$  Km long HRT, a surge shaft  $\pm 20$  m diameter &  $\pm 200$  m deep, a pressure shaft 4.50m dia,  $\pm 520$  m long, to feed four Vertical shaft Francis turbines each of 75 MW capacity. An underground Power House is proposed at an EL  $\pm 3025$  m about 300m u/s of Stingri GREF House, on the right bank of river Bhaga. The scheme shall utilize a gross head of 430.33 m for generating 300 MW of power with annual generation of  $\pm 894.86$  MU in 90% dependable year. The storage dam will impound 0.65 MAf of water and shall also provide irrigation benefits in riparian States besides flood storage benefits.

Extensive geo-technical investigations have to be carried out for the finalization and feasibility of structures.

### **(iii) Need for the project and its importance to the country and or region**

Electrical power is the most vital and essential input for the agricultural, industrial and overall economic development of any country. The standard of living of

people and status of industrialization of any country largely depends upon the extent of the use of electricity, and can be judged by the per capita consumption. In India, concrete efforts have been made to increase the availability of power to give stimulation to its economy.

Gyspa Dam Storage Project is of immense significance for the optimum utilization of Power potential of Chenab basin and further to augment power generation in all the downstream developments below Stingiri (GREF House) on the main river Chenab in H.P and J&K. The Gyspa Dam project shall help in firming up power generation during the period of lean inflows from Dec. to March too, which otherwise is a critical period for power supply requirement in the Northern Grid.

In addition to the power benefits the created storage will provide indirect irrigation benefits in the riparian states which are yet to be fully identified. Considerable sotrage of 0.65 MAf will also contribute towards flood moderation in the basin.

In the wake of the continued hostilities with Pakistan high functionaries of GoI has been advocating the need of creation of adequate storage in the basin which can also be used a strategic tool to thwart the evil designs of a rouge and hostile neighbour State.

#### (iv) Demand and supply Gap

A fast growing power sector is crucial to sustain India's economic growth. India has an assessed hydropower potential to the tune of 145320 MW out of this only about 31 % has been developed so far. Projection of electricity demand is a prerequisite for power sector planning. A periodic Electric Power Survey (EPS) of the country is conducted by the Central Electricity Authority (CEA) to assess the state-wise/union territory (UT)- wise/region-wise and all-India electricity demand on medium- and long-term basis. As per the 19th Electric Power Survey, the projected Peak Demand is 226 GW and Energy requirement is 1,566 BU at the end of year 2021-22.

India being signatory to the Paris Convention of Climate Change has committed to bring fossil fuel based generation to less than 40% by 2030 which currently stands at 62%. The target which the country has set for itself is even stiffer which aims at following energy mix by 2030.

1. Thermal+lignite+Gas	= 35%
2. Nuclear	= 2%
3. Hydro	= 9%
4. Solar	= 36%
5. Wind	= 17%
6. Bio mass	= 1%

Towards this end India has set up a renewable (solar +wind) target of 1.75 GW by 2022 and 4.5 GW by 2030. This much of intermittent and variable power when injected into the grid will require a huge amount of hydro to balance the grid and in view of this aspect Govt. has set a target to achieve hydro installation capacity of 73000 MW by 2030 which currently stands at 45699 MW.

Necessity of irrigation cannot be overemphasized in an agrarian society like India and is the time tested method of uplifting the living standards of masses.

**(v) Imports vs Indigenous production.**

The project envisages construction of a conventional hydro electric scheme, technology of which is entirely available in India. Only a few E&M equipments like GIS etc can be thought of importing which also depends upon the vendor selected for the Project. Some foreign companies have set up manufacturing facilities in India and produce these equipments in India itself.

**(vi) Export possibility.**

Electricity generated shall be for sole consumption in India keeping in view the grid stability requirement. However, should the need arise the electricity can also be exported to neighbouring countries.

**(vii) Domestic and export Markets.**

The energy generated shall be used domestically only.

**(viii) Employment generation (Direct and indirect) due to the project.**

Multi Purpose Projects due to their very expanse and nature provide huge employment to the local people. This project is expected to provide direct employment to  $\pm 1500$  people spread over its construction period of five to six years. During operation phase employment of  $\pm 100$  people is expected to be provided. These figures are over and above the regular employment in the establishment of the implementing agency i.e. HPPCL. As a matter of policy contracts of value less than 5 lakh are given to affected persons on preferential basis. Affected people are technically trained at the cost of implementing agency to increase their employability and enable them to make full use of employment opportunities generated in their area. Besides other businesses and support activities to the main project construction activities thrive which give huge push to the local economy but which have not been formally quantified so far.

Employment generation in irrigation component is yet to be quantified as the irrigation potential is yet to be identified fully.

### 3. PROJECT DESCRIPTION:-

(i) **Type of Project including interlinked and interdevelopment projects**

The Gyspa Dam Project is a multipurpose Project with benefits of power, irrigation and flood control. The estimated Hydropower Potential in Chenab Basin is about 8000 MW within the Indian Territory. About 34 % of this potential has been identified in Himachal Pradesh and balance in Jammu and Kashmir. A number of large and small hydroelectric projects have been identified in the Chenab Basin. The total identified potential is about 3137.80 MW excluding mini-micro projects. So far 5.3 MW has been developed and remaining 3132.50 MW is under investigation as shown in the table below:-

Sr. No.	Name of the Project	Installed capacity (MW)	Status
1	Thirot HEP	4.5	Under operation
2	Billing HEP	0.4	
3	Shansha HEP	0.2	
4	Killar HEP	0.3	
5	Sissu HEP	0.1	
6	Sach HEP	0.90	
	<b>SUB-TOTAL</b>	<b>6.40</b>	
7	Chhatru HEP	126	Under Investigation
8	Shangling	44	
9	Teling	94	
10	Bardang	120	
11	Seli	400	
12	Reoli Dugli	430	
13	Purthi	210	
14	Sach Khas	267	
15	Dugar	449	
16	Miyar	120	
17	Gyspa HEP	300	
	<b>SUB-TOTAL</b>	<b>2560</b>	
18	Lujai	45	Identified Project
	<b>SUB-TOTAL</b>	<b>45</b>	
19	Rashil	130	Recently Advertised Projects
20	Tandi	104	
21	Jankar	24.50	



22	Me	7.50	
23	Kutoi	6.20	
24	Ur-I	5.80	
25	Galwat	12.80	
26	Lower Mahal	8.0	
29	Upper Mahal	9.0	
28	Dheda	8.9	
30	Dheda-I	9.4	
	<b>SUB-TOTAL</b>	<b>326.10</b>	
31	Potential from small hydro project below 5 MW of Himurja	64.45	
	<b>SUBTOTAL</b>	<b>64.45</b>	
	<b>GRAND TOTAL</b>	<b>3001.95</b>	

Gyspa dam project (300MW) is a storage river scheme and no trans-basin diversion of waters is involved. The water from tailrace is again discharged in Bhaga River.

The storage created in the Project shall be used by downstream projects mainly in Jammu and Kashmir for increasing the irrigation benefits/stabilization of command.

**(ii) Location**

The Bhaga river originates from the Baralacha La of the Himalayas in Northern Himachal Pradesh in India at a height of  $\pm 5450\text{m}$  and flows for a length of 95 km before joining with the Chandra River at Tandi to form chenab River. The project is located on Chandigarh-Mandi-Leh highway at about 70Km from Manali Town ( famous tourist place). The dam site is 3 km upstream of Keylong town, the head quarter of District Lahaul and Spiti Himachal Pradesh. Power House site is on the downstream of Keylong town on right bank of Bhaga at an EL  $\pm 3025\text{m}$  about 300m u/s of Stingri GREF house.

The latitude longitude of the dam and Power house site are as follow

	<b>Latitude</b>	<b>Longitude</b>
Dam site	32°37'51"	77°10'30"
Power house site	32°33'41"	77°04'40"

An index map showing the project location and vicinity map is shown in drawing No.Gyspa –PFR-01.

Access to Lahaul & Spiti district by road can be made from two different locations one is Sumdo through (Kinnaur District) for entry into Spiti valley and another through Manali (Kullu District) for entry into Lahaul valley. The nearest airport is



Bhuntar Airport (Kullu) & nearest broad gauge railhead is Kiratpur. The distances of the proposed power house site from important towns are as under:

<b>From</b>	<b>To</b>	<b>Distance</b>
Keylong	Powerhouse	8 km
Manali	Powerhouse	62 km

**(iii) Detail of alternate site considered and the basis of selecting the proposed site, particularly the environmental considerations gone in to should be highlighted**

Gyspa Dam Project was contemplated as a storage scheme essentially for Power generation on river Bhaga, a tributary of river Chenab near village Gyspa. Initially, different alternatives studies were carried out on the following parameters and some geological exploration were also carried out along the Dam axis during 1981-84.

**STAGE-I**

Stage-I comprised a  $\pm 165$ m high earth cum rock fill dam near village Gyspa at an elevation of  $\pm 3245$ m with a gross storage of 0.74 MAf and live storage of 0.65 MAf; head race tunnel of 5m dia  $\pm 8.4$  km long, a surge shaft and an underground Power House near Shiti Nallah with an installed capacity of 100 MW.

**STAGE-II**

Stage-II development comprised a collection chamber near power house of Stage-I, a head race tunnel  $\pm 4.4$  km. long & a Power house near village Stingiri with an installed capacity of 70 MW. The operation of Stage-II Power house was planned to be at tandem with Stage-I Power house.

Yet another proposal was planned in the light of the meeting of the Committee of Secretaries held under the Chairmanship of Cabinet Secretary, Govt. of India, New Delhi, regarding Action Plan of full utilization of waters of rivers flowing in to Pakistan, wherein it was deliberated that enough storage schemes are not available in Chenab basin for the utilization of the Storage provided in the Indus Water Treaty. The Cabinet Secretary, GoI stressed that Govt. of J&K & Govt. of H.P. should identify storage schemes of 1.70 MAf as no suitable storage site is available for Bursar Dam Project in J&K.

In view of above, the fresh studies were initiated. A joint inspection was conducted along with Chief Engineer (I&P), HPSEB Sundernagar, Addl. Superintending Engineer Planning Circle No-I and Geologist on dated 22nd & 23<sup>rd</sup> October, 2008 to examine the possibility of various Alternate Proposals and to finalize the Project layout. Two numbers of alternatives were considered feasible. In light of the joint inspection, various alternatives/ proposals were studied

## PROPOSAL-I

The proposal comprised a Storage Dam at an elevation  $\pm 3245\text{m}$  with height of 200m dam with live storage of 1.00 MAf near village Gyspa, a 5.70m dia  $\pm 12.100\text{ Km}$ . long head race tunnel, a surge shaft, a surface penstock of 4.50m dia.,  $\pm 750\text{m}$  long to feed four units of 75 MW each with vertical shaft Francis turbines in a surface power house located at an El.  $\pm 2980\text{m}$  near village Kyor, on the right bank of river Bhaga, utilizing a gross head of  $\pm 333\text{m}$  to 460m for generating 300MW(+) of power. The annual generation from the project would be  $\pm 855.47\text{ MU}$  &  $1521.78\text{ MU}$  in 90 % and 50 % dependable years respectively.

Suitable bench with slight hill slope cuttings was available for accommodating surface power house and the river course is also straight at this location. Flood protection works would be required around the powerhouse site. The surface penstock passed mainly through glacial deposits. Bed rock configuration in this reach was required to be extensively investigated. Alternately, the penstock could pass through a vertical shaft and subsequently made open on stable bench through some soft ground tunneling, for which extensive geological and geotechnical investigations was required to clearly define the bed rock configuration through detailed sub- surface explorations.

## PROPOSAL-II

In this proposal the power house was proposed to be located  $\pm 1.30\text{ Km}$  u/s of the location in Proposal-I at an El.  $\pm 3000\text{m}$ , with no change in the location of the Dam site with dam height 200m. The proposal comprised a Storage Dam at an elevation of  $\pm 3245\text{m}$  near village Gyspa, head race tunnel of 5.70m dia;  $\pm 11.750\text{ Km}$ . long, a surge shaft, a pressure shaft of 4.50m dia;  $\pm 470\text{ m}$  long to feed four units of vertical shaft Francis turbines, 75 MW each, in an underground power house at an El  $\pm 3000\text{m}$  about 300m upstream of Stingri GREF house, on the right bank of river Bhaga, utilizing a gross head of 313m to 440m for generating 300 MW of power. The annual generation from the project would be  $\pm 714.62\text{ MU}$  &  $1454.21\text{ MU}$  in 90 % and 50 % dependable years respectively.

At the proposed Power house site the rocks are folded and sheared at places. There are number of foliation shears of thickness varying from 1cm to 5cm. Some exploratory works were required to determine the sub- surface features of rock.

As discussed above, all the above proposals were required to be evaluated on topographical, geological, ecological and economical considerations. However, Proposal-II with underground power house at an El.  $\pm 3000\text{m}$  was found comparatively better on economic & Engineering scale.

### **PROPOSAL NO-III (FINAL PROPOSAL)**

Gyspa Dam Project (300 MW) was declared as a Project of National Importance and has been allotted to Himachal Pradesh Power Corporation Ltd (HPPCL) for execution by GOHP vide letter No.MPP(F)2-1/2008 dated 22-09-2009. The HPPCL started with the survey & investigation of the project. The work of preparation of Detailed Project Report (DPR) was sourced to a consulting firm M/s Scot Wilson India Pvt. Ltd. on dated 09.09.2010.

A joint inspection of the project site headed by Managing Director (MD), HPPCL, along with Design Engineers, representatives of consulting firm and Field Engineers was conducted in the month of Aug-Sep 2010. During the joint inspection it was concluded to conduct fresh studies w.r.t the location of dam axis so as to minimise the submergence and displacement of people and revise the PFR.

*Further EAC (RVP), MOEF during the presentation of Gyspa HEP held on 12.11.2010 at Delhi stressed to bring down the submergence and displacement of people to minimum level. In view of the decision of HPPCL management and similar observations of EAC (RVP) fresh studies were conducted and accordingly the location of dam axis have been shifted about 3.5 km upstream of village Gyspa thus avoiding submergence of two major revenue villages namely Gyspa and Gyspa Tingal at an elevation  $\pm 3272m$ . Although at this location, the live storage has reduced from 1.00 MAf to 0.65 MAf.*

#### **(iv) Size or Magnitude of Operation:-**

From the perspective of a Dam it would be big dam since very few dams with such height have been constructed so far. However from the perspective of output it would be a moderate sized project since projects with installed capacity as high as 1500 MW and substantially more storage are already in operation in India. Project would be having an expanse over 4 villages although all the components except dam being underground hence very less would be visible to eyes.

#### **(v) Project description with the process details (a schematic diagram/flow chart showing the Project Layout components of the project etc.**

The proposed Gyspa dam project is a storage scheme. This scheme involves utilization of the waters of Bhaga River located in Distt. Lahaul and Spiti, Himachal Pradesh. The project envisages the construction of rock fill dam across river Bhaga approximately  $\pm 200m$  high (above river bed level) and conveying the waters so diverted through 5.70m dia modified horse shoe shaped, concrete line tunnel to an underground restricted orifice type surge shaft. From the Surge shaft, the water shall be conveyed

through a steel lined pressure shaft to a surface power house housing four machines of 75 MW ( total 300 MW ) installed capacity located on the right bank of river Bhaga near Stingri village.

**Dam:-**

A dam was proposed across river Bhaga, a tributary of river Chenab. A most famous populated Village Jispa is also coming under submergence. Some geological exploration i.e drill holes, drifts on the old dam axis were explored and live storage capacity 1.00 MAf with 200 meter high dam was envisaged at EL 3245. But due to submergence of most populated village in the valley, the dam axis has been shifted to 3.2 Km. upstream of village Jispa. New proposal has been accepted to proceed further for detailed investigation.

**Head Race Tunnel**

The Tunnel alignment takes off from the right abutment upstream of dam axis. The tunnel is likely to pass through 3 to 4 nallahs or cross drainages along the tunnel route, which have deeply dissected the area, hence, it should be taken up to the required depth to get the permissible lateral cover. The tunnel will be driven through granites followed by inter-bedded sequence of quartzitic phyllites, quartzites and phyllitic quartzites of Batal formations which are folded to minor anticlines/ synclines and form a synclinal basin. The dip of foliation varies from 150 to 450 towards both NE-SW directions which are 50 to 500 askew to the tunnel alignment.

**Surge Shaft, Penstock**

Since the area is inaccessible due to steep topography therefore only transverse mapping was carried out along the existing highway, around Vill. Stingri. Surge Shaft opens to sky & penstock will be located in phyllitic quartzites & quartzitic phyllites type of formations. These are folded and sheared (at places). The traverses were taken around the village Stingri to locate the Power House site, is discussed as under:

**Power House**

An underground location for Power House is available about 300 m U/S of Stingri GREF office. At this location power house cavity can be located  $\pm 200$  m in to the hill. It comprises of rocks Batal formation i.e. phyllitic quartzites interbedded with quartzitic phyllites. The trend of formations varies NE-SW with dips of 100 to 400 in SE direction to N 400 W to S 400 E with dips of 450 in N 500 E direction. There are number of foliation shears whose thickness varies from 1cm to 5cm. The rocks are folded and

sheared, at places. For carrying the detailed study a few exploratory works shall be taken up during the preparation of detailed project report.

(vi) **Raw material required along with estimated quantity likely source, marketing area of final product, mode of transport of raw material and finished product**

Survey on the availability and suitability of construction materials such as coarse and fine aggregates etc. required for the construction of various components of the project will be done in the surrounding area during DPR preparation stage. Construction materials required for different components of the project will be computed to assess the quantities required. As a matter of practice the materials obtained from excavations of different project sites are recycled to the extent possible to use them in the construction of the project and reduce the environmental footprint to the minimum possible.

Cement for the project can be procured from A.C.C. cement factory located at Barmana on NH-21 in District Bilaspur or Ambuja cement Plant at Darlaghat and shall be the main source of the cement for meeting the entire requirement of the project. Trucks shall be used for transportation of bagged cement. Cement bags shall be stored in cement stores as per specifications. Small quantities of cement can also be procured from local market.

Steel can be brought from steel stockyard at Pathankot which shall be the main source of structural steel and reinforcement/tor steel. Sizeable quantities of reinforcement and structural steel shall have to be stored at site. Penstock steel plates, however, may have to be procured from the manufacturers as per design specifications.

Considering the amount of power to be evacuated and the distance involved, it has been proposed to inject the power generated at Gyspa power house through LILLO in between Tandi and Gondola HEPs sites, through 400 kV transmission line, and finally to Northern Grid depending upon over all evacuation arrangement. The station service supply is proposed to be taken through 33 kV Local Distribution system. In addition, for reliability, 2X1000 KVA- DG sets shall also be provided for the black start capability. This will also feed local area, Colony, head works etc. The unit auxiliaries shall be fed through 11/0.415 kV, 1 MVA transformers connected to each generator. The auxiliaries can also be fed from 2 Nos., 33/0.415 kV, 1 MVA station auxiliary transformers, which are connected to 33 kV bus connected to 33 kV local supply.

(vii) **Resource optimization/ recycling and reuse envisaged in the project, if any, should be briefly outlined.**

Sand and gravels obtained from excavation of river bed shall be used for the construction of dam in the form of filter materials. Similarly materials obtained from

cutting of abutments can be used a rip rap in the dam and proceeds of underground excavations can be used as aggregates for concrete works subject to their suitability. In such large projects efforts are always made to reuse the materials after proper recycling to affect economy and reduce environmental foot print to the extent possible.

**(viii) Availability of water its sources, energy/power requirement and source should be given**

Consumptive use of water during construction of the Project is usually insignificant which can be sourced from local sources or the river on which the project is to come up. During operation stage requirement of water even reduces further and only water for domestic consumption in project townships is required. The station service supply of power is proposed to be taken through 33 kV Local Distribution system. In addition, for reliability, 2X1000 KVA- DG sets shall also be provided for the black start capability. This will also feed local area, Colony, head works etc. The unit auxiliaries shall be fed through 11/0.415 kV, 1 MVA transformers connected to each generator. The auxiliaries can also be fed from 2 Nos., 33/0.415 kV, 1 MVA station auxiliary transformers, which are connected to 33 kV bus connected to 33 kV local supply.

**(ix) Quantity of wastes to be generated (liquid and solid) and scheme for their management**

**Disposal of Muck**

Few dumping sites for the project have been identified. The exact location and sizes of the dumping sites will be finalized once the detailed survey is completed. Around 7,50,000 m<sup>3</sup> muck is likely to be generated from excavation work of project. The dumping sites of adequate capacities have been identified keeping in view following considerations e.g. minimum vegetation, away from habitated areas, mild slopes and least requirement of additional road as shown in the Drawing No. Gyspa-PFR-07.

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

Drawing No. Gyspa-PFR-06 is attached.



#### **4. SITE ANALYSIS:-**

##### **(i) Connectivity**

The project is located on Chandigarh-Mandi-Leh highway at about 70 Km from Manali Town ( famous tourist place). The dam site is 3.5 km upstream of Keylong town, the HQ of district Lahaul and Spiti, Himachal Pradesh. Power House site is ahead of Keylong on the right bank of Bhaga at an EL  $\pm$  3025m about 300m u/s of Stingri GREF House . Access to Lahaul & Spiti district by road can be made from two different locations one is Sumdo through (Kinnaur District) for entry into Spiti valley and another is through Manali (Kullu District) for entry into Lahaul valley. The nearest airport is Bhuntar Airport (Kullu) & nearest broad gauge railhead is Kiratpur. The distances of the proposed power house site from important towns are as under:

<b>From</b>	<b>To</b>	<b>Distance</b>
Keylong	Powerhouse	8 km
Manali	Powerhouse	62 km

##### **(ii) Land form, Land use and land ownership**

1160 hectare of forest land comes under submergence and 33.70 hectare forest land is required for other components of the Project. Four revenue villages are falling in submergence area. Private land to be acquired is 69.25 hectare. The impoundment of Bhaga River is not a threat to any rare or diversified habitat for plants and animals. So far as the construction of project components downstream of dam site is concerned, no village is going to be affected. However, keeping in view the job facilities to be provided, small patches of private land will be acquired. As per the information collected so far, there is no historic, cultural or scientific monument in the area, to be flooded by the reservoir.

To compensate for transfer of forest land, twice as much area of degraded forest land will be provided with forest cover and the plants nursed for a period of 3 years. The afforestation work will be carried out by the Himachal Pradesh Forest Department and the cost charged to the project.

##### **(iii) Topography**

The geomorphological set up of the area is highly complex. The terrain has an immature topography and is traversed by deep valleys and high hill ranges. The district can be divided into two major geomorphological unit viz. Structural hills and valley fills. Structural hills are underlain by rocks belonging to pre-cambrian, palaeozoic, Mesozoic



and Cenozoic eras. The rocks are generally trending in NNE-SSW and NE-SW direction with steep slopes. Escarpments and hogbacks are common features.

Valley fills include both fluvial deposits and moraines. These deposits occur as narrow and elongated strips along the main streams. The glacial deposits are under the influence of running water and have been termed as glacio-fluvial deposits. Fluvial terrain is demarcated in the lower reaches of both the Chenab and Spiti rivers. These are having thick vegetation.

The Survey of India topo-sheet in 1:50,000 scale is available for the project area. Topo sheets 50 H/2, covers the project area.

- (iv) **Existing land use pattern (agriculture, non-agriculture, forest, water bodies (including area under CRZ), shortest distances from the periphery of the project to the periphery of the forest, national parks, wild life sanctuary, eco sensitive areas, water bodies (distance from HFL of the river ) CRZ. In case of notified industrial area, a copy of the gazetted notification should be given**

The area of the proposed project is almost barren to sparsely cover. There are almost no natural forests. Most of the vegetation is planted. Some natural associates have also come up. There is practically no wild life in the area. Some important plant species such as Charm civic thorn, cisky, juniper, sanjal thuma, Rosa machete, (Podophyllum hexandrum (Ban Kakri), Koru, Aconitum heterophyllum (Pettish), Betula alnoides found in the area. In the project area the trout fish species can be seen in very small number.

- (v) **Existing Infrastructure:-**

The project falls entirely on Manali-Leh National Highway. The approach roads up to the Dam top on both the banks of river Bhaga are required to be constructed. Also road for different adit headings will be required. The alignment of the existing Manali-Leh road has to be altered from a suitable location downstream of the Dam site up to some location above top of Dam near village Chhika as the same will get submerged in the reservoir. The work of realignment of the road shall need to be completed before the start of actual construction of the Dam.

- (vi) **Soil Classification**

In the vicinity of the proposed new dam site, the river Bhaga flows through 620m wide 'U' shaped glacial valley filled up with glacial and fluvioglacial material. The abutments are rather steep and are made up of granite rock at the dam site. Between river bed level to above EL 3350m on both bank, the slopes are covered with fluvioglacial and scree material. The project area is occupied by interlayer sequence of phyllites, quartzites

and phyllites quartzites belonging to Batal Formation of Pre-Cambrian age, intruded by granites of Devonian age. In the valley portion and lower parts of the slopes the bed rock is extensively covered with thick overburden. In the exposed sections the bed rock shows foliation planes, trending generally in N30<sup>0</sup>W-S30<sup>0</sup>E to N70<sup>0</sup>W-S70<sup>0</sup>E direction and dipping 20<sup>0</sup>-40<sup>0</sup> in due north east direction. The phyllites and quartzites have undergone folding and shearing which is more prominent in the vicinity of proposed power house area. At the proposed dam site large part of the area is occupied by dome shaped granite batholiths.

**(vii) Climate data and from secondary source**

The climate of Chenab basin is affected by the hot tropical weather systems and the cold weather systems known as Western Disturbances. The chief sources of moisture of these disturbances are Mediterranean and the Caspian seas. The Western disturbances have their origins near the Mediterranean Sea and move in the westerly wind regime along Himalayan latitudes during the winter season. These disturbances may be in the form of a depression or a low-pressure area or an upper air cyclonic circulation or a trough in lower isobaric level. These shift to more northerly latitudes as the summer season approaches.

The Southwest monsoon is dominant during July to September and in this season most of the precipitation is in the form of rainfall. Though total precipitation recorded in this season is only about 29% of the annual precipitation, extreme rainfall floods are also experienced during this season. Severe floods are sometimes recorded during first week of October also.

The minimum temperature recorded at Tiller station in Chenab basin, having an altitude of 2128 m is 0.70 C during January whereas maximum temperature recorded is 20.20 C in July month. Western disturbances are more pronounced in the northern parts of North India like J&K and Himachal and basically responsible for the winter rain and snowfall at higher altitude. The permanent snow line of the basin is considered at El 4400m elevation keeping in view the pronounced effect of western disturbances in the project basin.

**(viii) Precipitation**

The available rainfall data for Koksar in Chandra catchment have been analyzed. This station is having an altitude of 3125m and is located at highest elevation as compared to other rain gauge stations in the Chenab basin. Both forms of precipitation are being observed at this station. The average annual rainfall and snow fall estimated at this station is 627mm and 388 mm respectively. About 82% rainfall occurs June to

September. The September receives highest amount of rainfall approximately 26% over the year followed by April where rainfall amount is 18% of the annual value.

Reference from the above is drawn to the following facts:

- The average annual rainfall at Koksar is 627 mm
- The highest amount of rainfall and snowfall is received in the month of September and February respectively i.e. 26% of the average annual values.
- Precipitation in the catchment area of this project is mainly in the form of rain with contribution from snow at higher elevation. The mean monthly percentage of rainfall and snowfall at Koksar located in Chenab basin is tabulated below:

Sr. No.	Month	Average Monthly rainfall		Average Monthly snowfall	
		Value (mm)	% of annual value	Value (mm)	% of annual value
1.	January	0	0	67	17
2.	February	0	0	100	26
3.	March	0	0	88	23
4.	April	15	2	44	11
5.	May	58	9	12	3
6.	June	65	10	3	1
7.	July	134	21	0	0
8.	August	155	25	0	0
9.	September	164	26	13	3
10.	October	35	6	14	4
11.	November	1	0	13	3
12.	December	2	0	35	9
		627		388	

**(ix) Social Infrastructure**

As per the information collected so far, there is no historic, cultural or scientific monument in the area, to be flooded by the reservoir.

## **5. PLANNING BRIEF**

### **(i) Planning concept (type of industries, facilities, transportation etc.) Town and Country Planning/Development Authority Classification**

The Project is proposed in rural area with no stringent planning requirements to be complied. As part of the Project construction activity substantial infrastructure in the shape of roads, hospital, school etc will be built which will also benefit local communities. Tourism industry in the area will be benefitted and other small scale industries will also benefit due to increased demand and consumption.

### **(ii) Population Projection**

As per 2011 census, the district has a population of 31,564 persons with population density of 2 persons per sq km. Population wise it ranks last i.e. 12<sup>th</sup> in the State. The male and female population in the district is 16,588 and 14,976 respectively with a female/male sex ratio of 903/1000.

### **(iii) Land use planning (breakup along with green belt etc.)**

The provision for acquisition/purchase of land for permanent works, approach roads, camp sites, workshops, stores, offices and permanent colony for the maintenance staff etc. shall be made in the Detailed Project Report. The provision shall also be made for compensation of houses, trees etc. and cost to resettle the displaced families.

### **(iv) Assessment of Infrastructure Demand (Physical and social)**

Provision has been made for permanent and temporary residential buildings for various categories of staff, non-residential buildings for offices, workshops, stores, rest houses and field hostels and other service buildings such as hospital, school, police station and utility services etc. Provisions for land development, lawns and gardens, fencing, internal water supply, sanitation and electrical fittings have been made as per norms for various types of buildings as per norms.

### **(v) Amenities/Facilities**

The provisions will be made for the following items:-

- Capital cost of electrification, water supply, sewage disposal and drainage.
- Fire fighting equipment, telephone, telegraph, wireless and other communication facilities.
- Recreation facilities and beautification of project area.



- Maintenance services for electrification, water supply etc. and other services including security arrangement and fire fighting arrangement.
- Running of inspection vehicles, transport of staff, school buses and ambulances.
- Other items such as visit of dignitaries, technical record of works, power supply, compensation to workmen, writing of completion report and history of project etc.
- Construction power arrangements for construction of civil works and for camp sites and workshop etc. during the construction period.

**(vi) Maintenance**

The provision has been made for maintenance of buildings and roads, and main civil works during the construction period

## **6. PROPOSED INFRASTRUCTURE**

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

The project components, dumping areas and borrow sites will be connected with katcha roads to facilitate construction. After commissioning of Project the roads connecting operational points like Dam, Intake, Butter Fly Valve, Power house etc will be metalled. These establishments shall also be provided with other basic amenities like water supply, sanitation, canteens, rest rooms etc. etc. The alignment of the existing Manali-Leh road has to be altered from a suitable location downstream of the Dam site up to some location above top of Dam near village Chhika as the same will get submerged in the reservoir. The work of realignment of the road shall need to be completed before the start of actual construction of the Dam.

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

Provision has been made for permanent and temporary residential buildings for various categories of staff, non-residential buildings for offices, workshops, stores, rest houses and field hostels and other service buildings such as hospital, school, police station and utility services etc. Provisions for land development, lawns and gardens, fencing, internal water supply, sanitation and electrical fittings have been made as per norms for various types of buildings as per norms.

### **(iii) Green Belt**

Provision has been made for green belt development around the project area, townships, dumping sites, roads and other parks in the project area. As a primary measure for mitigating the impacts of land use change and promoting sustainable development measures like compensatory afforestation, catchment area treatment, establishment of fuel depots etc. etc. have been made.

### **(iv) Social Infrastructure**

Although any social structure/monument is not going to be adversely affected still the need for creation of new social infrastructure can be assessed during project construction stage in due consultation with affected people. Required social infrastructure shall be created in the new settlement colonies as per requirement.

### **(v) Connectivity (Traffic and Transportation Road/ Rail/Metro/ Water ways etc)**

Provision has been made for construction of roads and bridges including approach roads and remodelling and strengthening of existing main highway and bridges to make them suitable for transport of heavy equipment for power station.



**(vi) Drinking Water Management (Source & Supply of water).**

Drinking water for Project construction staff and subsequently for running and maintenance staff shall be sourced from local sources or river.

**(vii) Sewerage System**

Sewerage system for project construction staff and later for operation staff shall be in the form of septic tanks. System for permanent housing colonies for operation and maintenance staff shall be in the form of sewerage treatment plant with appropriate technology to cater for the requirement of given load.

**(viii) Industrial waste Management**

No waste is generated from hydro projects as such except for oils etc from generator transformers etc which shall be disposed off as per prevailing guidelines.

**(ix) Solid Waste Management**

No solid waste is generated from hydro projects except some waste from housing colonies etc. which shall be disposed off by proper burning in incinerators or any other suitable non polluting method.

**(x) Power Requirement & Supply/ source:-:**

The station service supply is proposed to be taken through 33 kV Local Distribution system. In addition, for reliability, 2X1000 KVA- DG sets shall also be provided for the black start capability. This will also feed local area, Colony, head works etc. The unit auxiliaries shall be fed through 11/0.415 kV, 1 MVA transformers connected to each generator. The auxiliaries can also be fed from 2 Nos., 33/0.415 kV, 1 MVA station auxiliary transformers, which are connected to 33 kV bus connected to 33 kV local supply.

## **7. REHABILITATION AND RESETTLEMENT (R&R ) PLAN**

Since the project is a storage Project therefore, there is submergence of four villages with total 74 families as detailed below. Resettlement and Rehabilitation of displaced families shall be done at appropriate places in consultation with affected people.

Sr No	Name of Village coming under submergence	No of families likely to be displaced/affected as per Panchayat Parivar register
1	Rangyo Baryo	18
2	Limkeyung	5
3	Darcha Sumdo	15
4	Darcha Dangma	36
	<b>Total</b>	<b>74</b>

HPPCL will improve the life of people living in the area besides mitigating any hardships that may arise due to construction. The quality of life of the people of the area will improve through better infrastructure, sustainable income and skill up-gradation to enhance their employability. Each project affected family will be suitably and adequately compensated to ensure replacement of assets lost or acquired, opportunity of employment for local people through direct employment in project construction work, self employment or indirect employment in project activities. In addition direct help will be provided to vulnerable people. Project area will be developed by building or improving infrastructure such as roads, paths, bridges, water supply, irrigation through public participation and community development works etc. The local population in the project affected area will be provided guidance and counselling education through scholarships, sponsorships guidance for better living conditions and better livelihood including training in the area of common occupations like agriculture and horticulture etc. The friendly contact with the public through regular meetings, public information centre, printing material, PAF identity card, functions etc will be maintained.

Following are the highlights of HPPCL R&R policy.

- Employment to atleast one person of the Project Affected Family (PAF) in project construction works as per his/her qualification/availability of positions.
- PAFs not getting employment shall be entitled to one time grant equivalent to 1000 days minimum wage rate.
- Each ST family will get an addition one time financial assistance of 500 days minimum wages for labour for loss of customary rights for usage of forest produce.



- **Scheme for skill up-gradation of local youth – sponsoring candidates from Project Affected Families in Industrial Training Institutes (ITI):** Vocational training will be provided in various trades to the persons from Project Affected Families through Industrial Training Institutes. Full fee of the course alongwith monthly scholarship to the candidates will be paid by HPPCL.
- **Merit and Support Scholarship Scheme for wards of PAFs:** The scheme aims to enhance educational standards and employability of the wards of PAFs; minimize dropouts of meritorious students through providing scholarships from Middle School to degree/professional courses.
- **Self-employment Scheme:** This scheme is based on self-employment through small business venture. Financial assistance will be provided by HPPCL to PAFs for this purpose.
- **Training-cum-Awareness Camps:** Training on various aspects such as agriculture, horticulture food preservation, Non-Timber Forest Produce bee-keeping (apiculture), animal husbandry, rural artisan, and handicraft etc. will be provided to PAFs for enhancing their living standards or livelihoods.
- Employment to PAFs on outsource basis in the establishment of HPPCL as per qualification and availability of seats.
- Petty contracts (uptoRs. 5.0 lakh) will be awarded to PAFs on preferential basis.
- **After commissioning of project, revenue received from 1% power sale proceeds will be provided to local area development fund (LADF) and will be distributed by local area development committee (LADC) in the form of cash transfer to all the families of project affected area every year during the entire life span of the project. This will ultimately result in the regular stream of income to the people of project affected area (PAA) including those of PAFs.**
- 100 units of free electricity to affected people for 10 years after commissioning of the project.
- Each PAF of ST followed by SC categories shall be given preference in allotment of land, if any, against the acquired land subject to maximum of 5 Bigha.
- **Medical Fund:-** Medical fund with corpus equivalent to 0.25 % of the Project cost is created to provide reimbursement of expenditure incurred on undertaking treatment in any hospital.

## **8. PROJECT SCHEDULE & COST ESTIMATES**

### **(i) Likely date of start of construction and likely dated of completion**

The project shall be taken in to construction after completion of preconstruction activities such as Survey, Geological Investigation and preparation of Detail Project which is expected by start of 2025. Project will be completed in six and half years from the date of construction say 2031.

### **(ii) Estimated Cost of the Project**

The estimates of cost have been prepared to arrive at the total capital cost of the project. The estimates are based on the prices prevailing in Jan- 2011, for materials, equipments, labour, etc.

### **(iii) Broad sub-head-wise provisions for civil works**

The provisions under various sub-heads are based as per guide lines for preparation of detailed project reports of Irrigation and Multipurpose Projects issued by Ministry of Water Resources, Government of India. Broad provisions made under various sub-heads of civil works are briefly described below

#### **A – Preliminary**

Under this head provision has been made for topographical surveys, geological and geophysical investigations including drilling and drifting, field and laboratory tests on rocks, construction material investigations and testing, collection of hydrological and meteorological data, hydraulic model studies for dam and intake etc., environmental and ecological studies. Provision has been made for consultant's fees for preparation of the project report and other reports. The total provision under this sub-head is Rs. 20Cr. which is within 2% of the I-Works as per guidelines.

#### **B – Land**

This sub-head covers the provision for acquisition/purchase of land for permanent works, approach roads, camp sites, workshops, stores, offices and permanent colony for the maintenance staff etc. The provision has also been made for compensation of houses, trees etc. and cost to resettle the displaced families. The total provision under this sub-head is Rs 22 Crore.

#### **C – Works**

This covers the cost of river diversion works and diversion barrage including cost of hydraulic gates and hoists and upstream and downstream protection works.

The total provision under this sub-head is as below:

i) Dam, Diversion. and Intake Rs.1843 crore.

**J - Power plant civil works**

Under this sub-head provision has been made for the following works:

<b>Component</b>	<b>Amount in Rs. Crores</b>
Head Race Tunnel	300.00
SURGE SHAFT	60.00
Pressure shaft/Penstock	80.00
Power House complex, switch yard & TRT	150.00
<b>Total</b>	<b>590.00</b>

**K - Buildings**

Provision has been made under this sub-head for permanent and temporary residential buildings for various categories of staff, non-residential buildings for offices, workshops, stores, rest houses and field hostels and other service buildings such as hospital, school, police station and utility services etc. Provisions for land development, lawns and gardens, fencing, internal water supply, sanitation and electrical fittings have been made as per norms for various types of buildings as per norms.

The total provision under this sub-head is Rs 26 Cr. which is less than 5 % of the I-Works (Civil and Electrical works). This is well within permissible limit.

**M - Plantation**

A lump sum provision of Rs one Cr. has been made under this sub-head for plantation near the Barrage and reservoir area, colony and camp sites etc.

**O - Miscellaneous**

Under this sub-head provision has been made for amenities and facilities for the project. The total provision under this sub-head is Rs. 26 Cr. which is within 4% of the I-Works (Civil and Electrical works) as per guide lines.

**P - Maintenance**

The provision has been made under this sub-head for maintenance of buildings and roads, and main civil works during the construction period. The total provision is Rs 25.84 Cr. which is about 1% of (C-Works+ K building+ R-communication).

**Q - Special Tools and Plant**

Provision has been made under this sub-head for vehicles such as cars, jeeps, buses, ambulances etc. Provision for major construction equipment for civil works has not been made under this head, as the construction of civil works will be carried out

by a separate construction agency. This is as per recent guidelines of CWC in respect of private sector power projects. The total provision under this subhead is Rs 3 Crore.

#### **R - Communications**

Provision has been made under this sub-head for construction of roads and bridges including approach roads. Provision has also been made for remodelling and strengthening of existing main highway and bridges to make them suitable for transport of heavy equipment for power station. The total provision under this subhead is Rs. 75 Crore.

#### **X - Environment and Ecology**

Provision under this sub-head has been made for compensatory a forestation, measures for maintaining environment and ecological balance of the area, public health measures, establishment of fuel depots etc. Provision has also been made for treatment of catchment area for prevention of soil erosion etc. The total provision under this sub-head is Rs100 Crore

#### **Losses on Stock**

Provision under this sub-head has been made at 0.25% of I-work less A - preliminary, B - land and Q - special T & P.

#### **Establishment**

Provision has been made @ 8% of I-Works less B-land. This provision also includes establishment for carrying out detailed designs, site supervision, quality control and cost control cell.

#### **Tools and Plants**

Provision @ 1/4 of P-Maintenance has been made to cover survey instruments, camp equipment, office furniture, office equipment etc. as per guidelines.

#### **Receipts and recoveries on capital account**

Under this head estimated recoveries by way of transfer of temporary buildings @ 15%, resale of special T & P @ 75% have been provided.

#### **Audit and Accounts**

It has been taken as 0.25% of the cost of I-Works.

#### **(iv) Cost Of Electromechanical Works**

Cost of generating plant and equipment is based on current market prices for the proposed machinery of 300 MW capacities which comes out to be Rs 362.88 Crore. A provision of 5% for initial spares has been made along with the cost of equipment. Prices of major auxiliary equipment and services are based on current budgetary prices while that of some minor items are based on prices for similar equipment procured in the past for similar projects.



Provisions for duty, insurance and transport to site are based on prevailing rates. Erection and commissioning charges have been taken as 10% of the cost of equipment based on the experience gained on similar installations in the country.

Provisions of other items like Establishment, Audit and Account charges, etc. have been made as per prevailing norms of Central Electricity Authority (CEA).

(v) **T-TRANSMISSION**

Cost of transmission net work from Gyspa Power house to pooling station Bajaura in Distt Kullu is based on current market price which comes out to be Rs 55 Crore.

**Estimated Cost of The Project**

Total cost of the Project at Jan, 2011 price level works out as under:

<b>Sr. No.</b>	<b>Description</b>	<b>Amount (Rs Crore)</b>
1.	Civil Works	2968.37
2.	E-M Works (Generating plant and equipment)	362.88
3.	Transmission works	55.00
	<b>Total</b>	<b>3386.25</b>

Cost estimate is based on prevailing of rates, however at DPR stage the detail cost shall be worked out based on detail item rate analysis, use rate of machinery, material rate etc.

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## 9. ANALYSIS OF PROPOSAL (FINAL RECOMMENDATIONS)

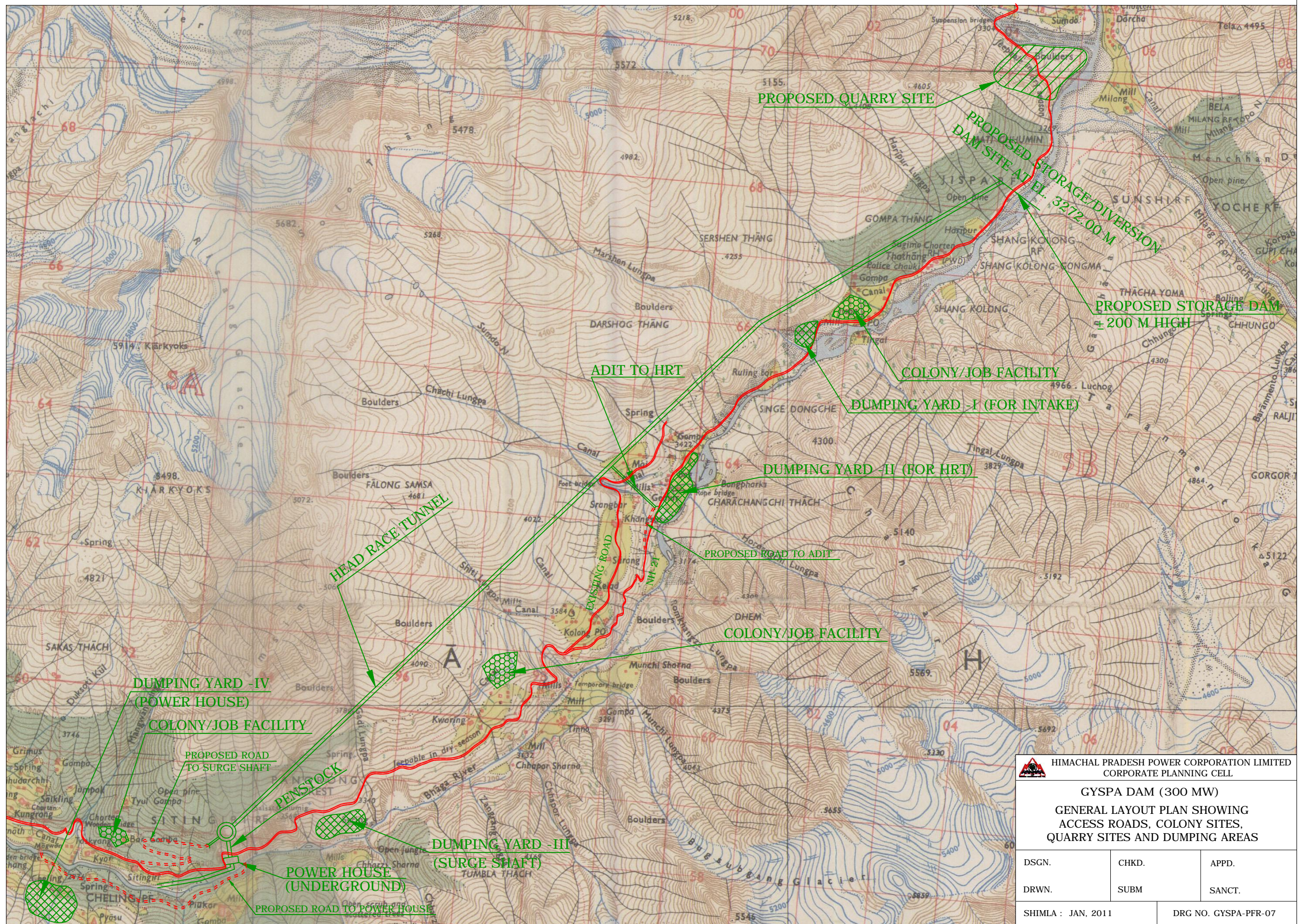
Like any other infrastructure project a multipurpose project brings huge development in the society. The power generated in the Project is a prime mover for the development of industry in any region. With the connectivity of grid this regional dimension has also got blurred and power can now be transmitted to any region in the country and used for development of that region. With the new configuration of the power sector where increasing emphasis is being given to non polluting renewable power the necessity of hydro has increased further and it has in-fact become an essentiality for the stability of the broader grid. With substantial potential available in the scheme itself and its capability to provide assured flows to the schemes situated downstream, contribution of this project to the overall development of the region will be immense.


Irrigation benefits it will give to the basin states will also have substantial positive effect on the lives of the people. With ever increasing hostilities with Pakistan the project will also give a strategic tool in the hands of India to be used as a foreign policy instrument. Flood storage is also an important attribute and its importance is even more in this time of climatic change resulting in unpredictable climatic events.

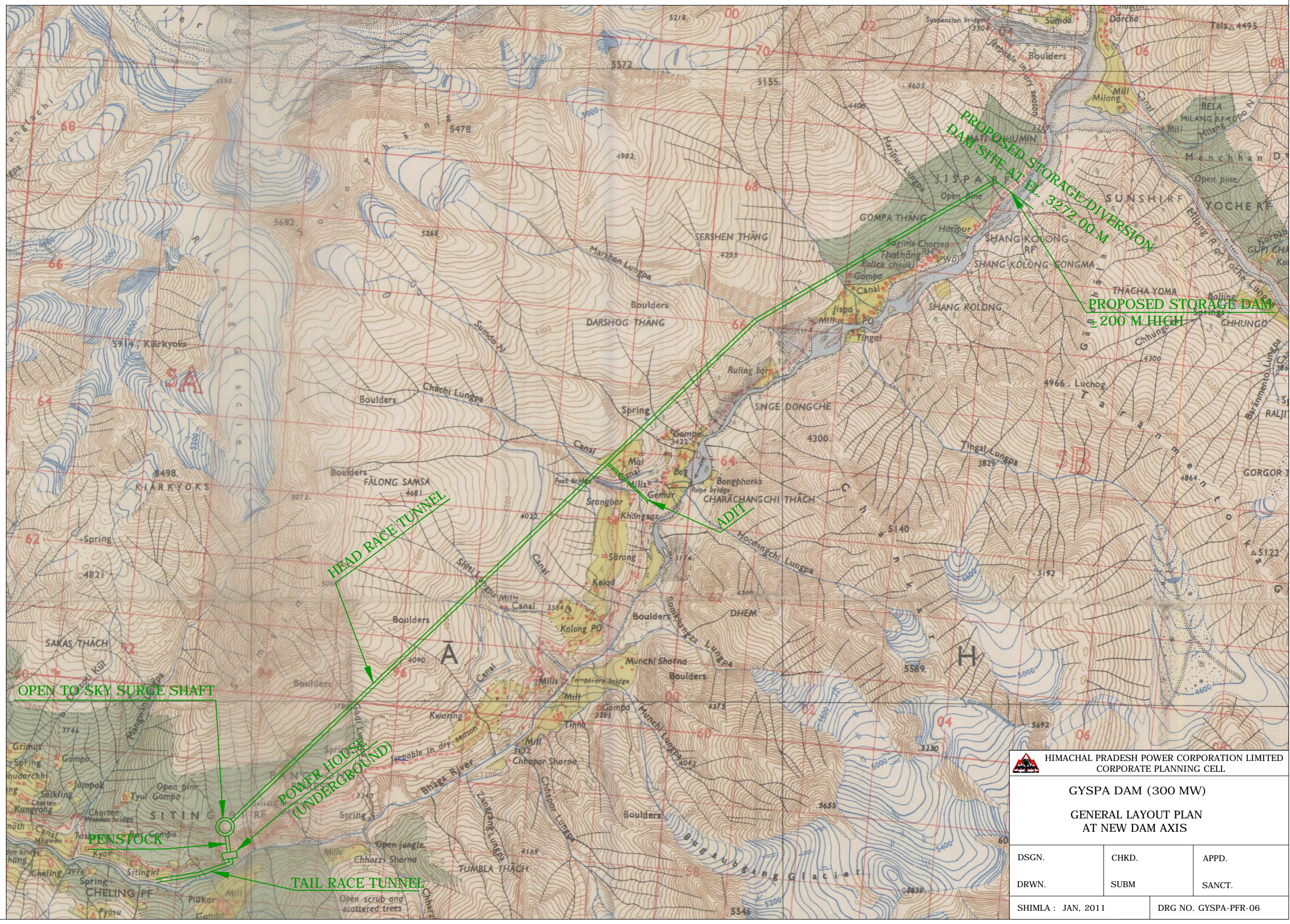
In addition to these substantial long term direct benefits to the Country as a whole the project of this size gives direct and indirect benefits to area where it comes up. These benefits accrue in the form of infrastructures development such as roads, bridges for connectivity, markets, civic facilities etc. and direct benefits like job prospects in construction works, merit and support scholarship schemes for the students, training-cum-awareness camps for general public, self employment scheme annual sports event etc. etc. play a pivotal role in socio-economic development of particular region.

Earmarked allocation towards local area development fund amounting to 1.5% of the project cost enhances the quality and reach of the infrastructure in the area substantially and improves the living standards of the people. Direct benefit transfer of one percent (1 %) of generation revenue to the affected persons after commissioning of the Project works as a continuous stream of funds for posterities to come and uplifts the living standard of people for all time to come. Medical fund facility also eases the hardships of the local people to great extent.

**In view of above it is strongly recommended that the ToR may please be issued to the project enabling start of investigation activities and further assessment of likely impacts and required mitigation measures.**



 <b>HIMACHAL PRADESH POWER CORPORATION LIMITED</b> CORPORATE PLANNING CELL		
<b>GYSPA DAM (300 MW)</b> GENERAL LAYOUT PLAN SHOWING ACCESS ROADS, COLONY SITES, QUARRY SITES AND DUMPING AREAS		
DSGN.	CHKD.	APPD.
DRWN.	SUBM	SANCT.
SHIMLA : JAN, 2011		DRG NO. GYSPA-PFR-07

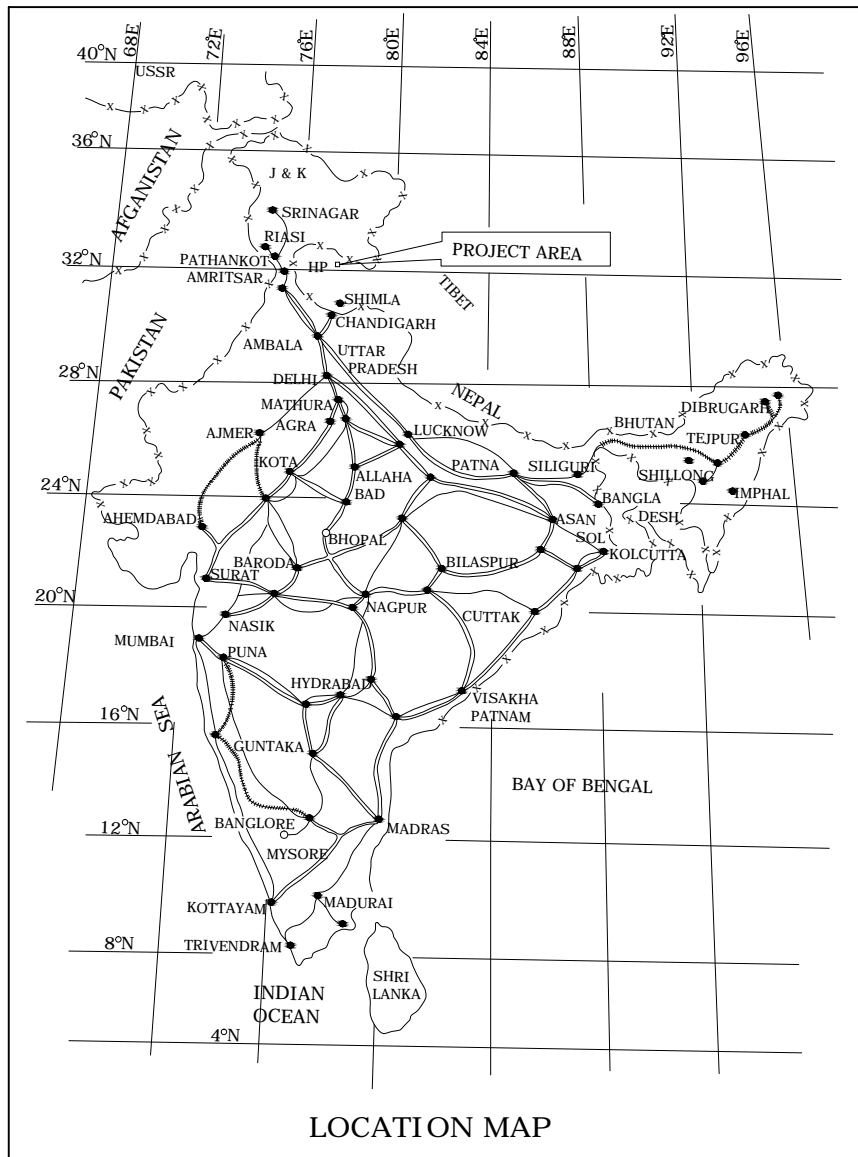
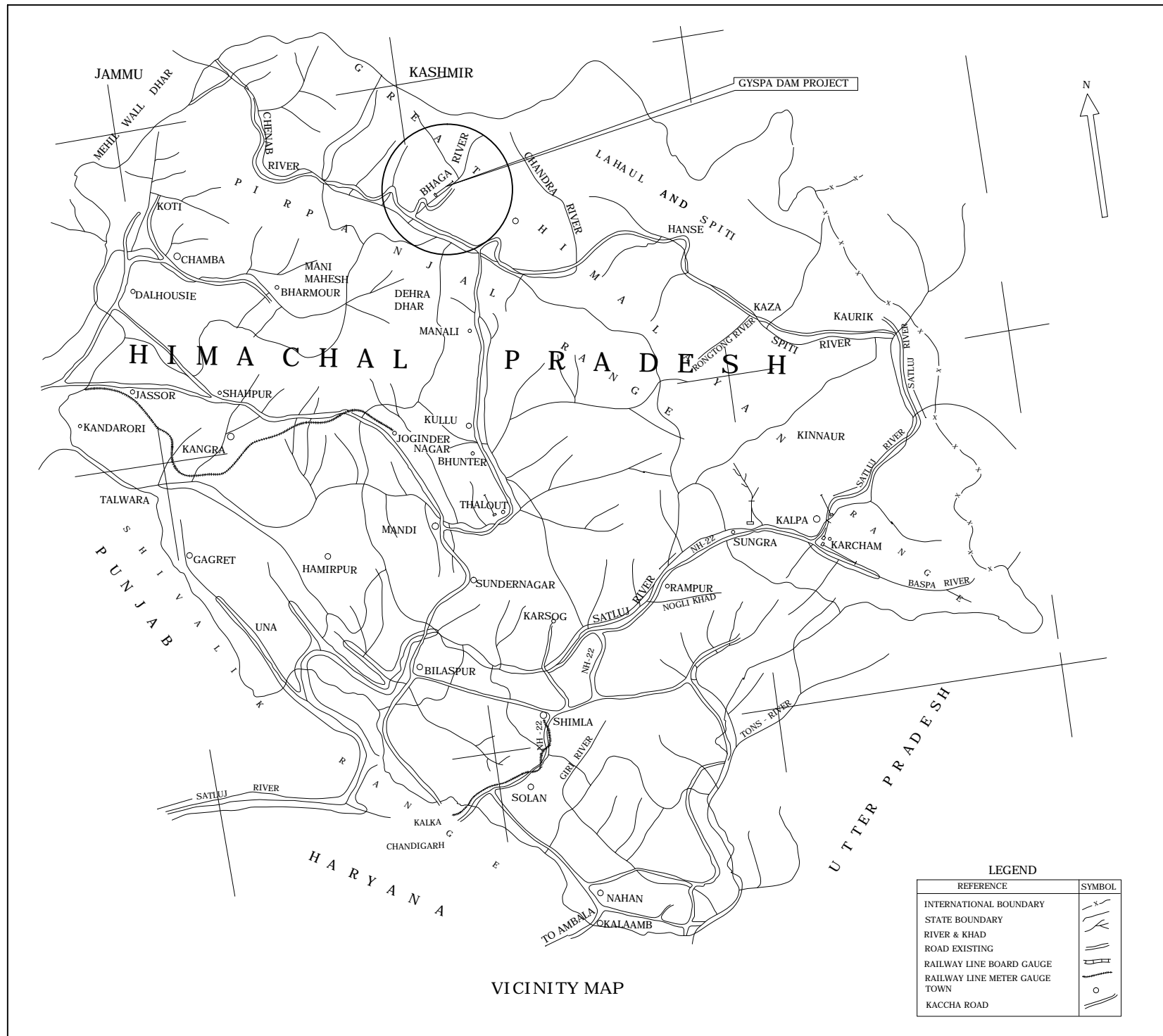


**HIMACHAL PRADESH POWER CORPORATION LIMITED**  
CORPORATE PLANNING CELL


**GYSPA DAM (300 MW)**  
GENERAL LAYOUT PLAN  
AT NEW DAM AXIS

DSGN.	CHKD.	APPD.
DRWN.	SUBM	SANCT.
SHIMLA : JAN, 2011		DRG NO. GYSPA-PFR-06





**FOR PFR ONLY  
NOT FOR CONSTRUCTION**

 HIMACHAL PRADESH POWER CORPORATION LIMITED  
CORPORATE PLANNING CELL

**GYSPA DAM PROJECT (300 MW)**

**LOCATION & VICINITY MAP**

DSGN.	CHKD.	APPD
DRWN.	SUBM.	
SHIMLA JAN, 2011		DRG. NO. GYSPA-PFR-01