

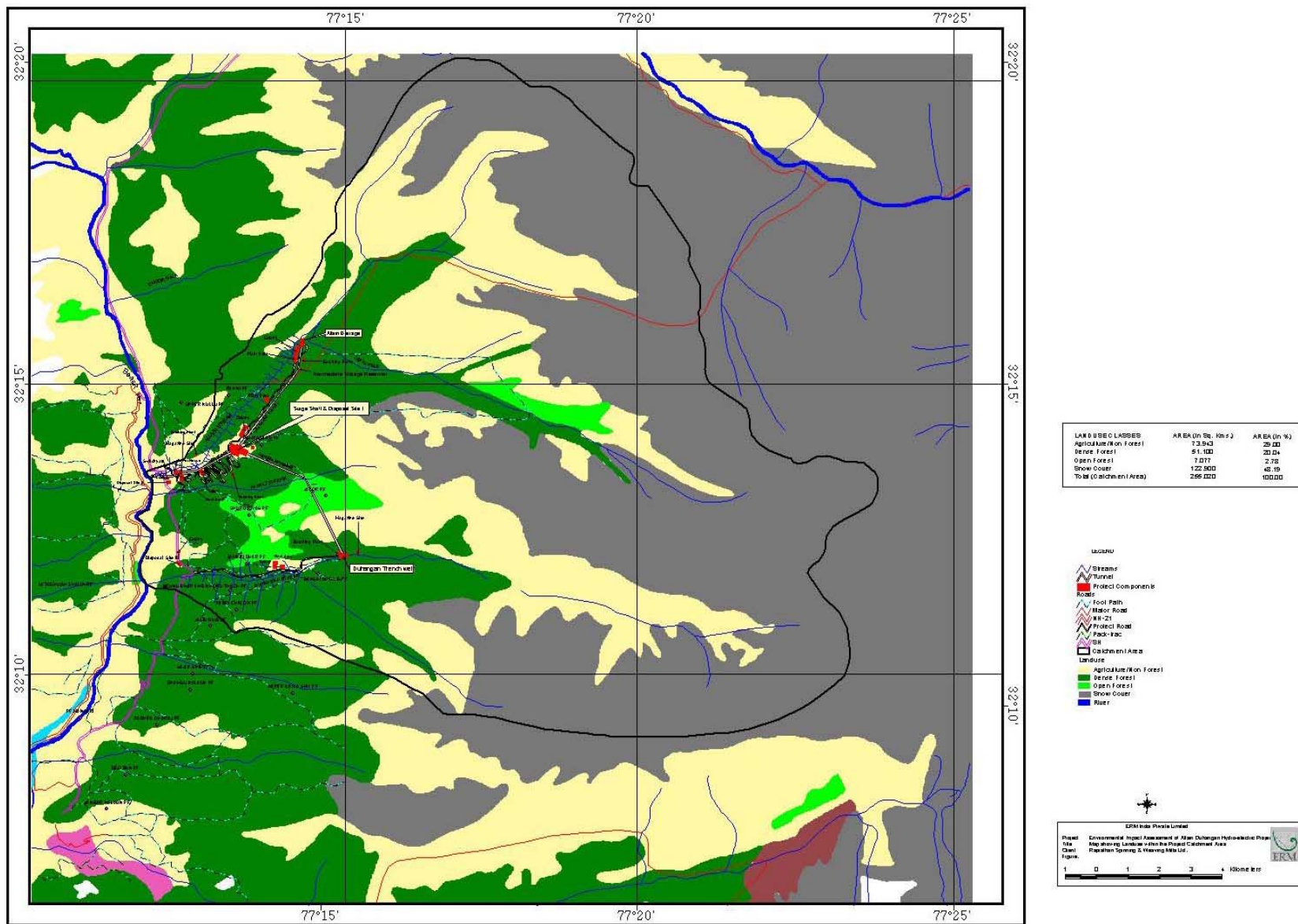


Figure 4.6: Map showing Landuse within the Project Catchment Area

The following environmental and social resources will be potentially impacted during the pre-construction, construction and operation phases:

- Landuse, Topography, Soil Erosion/Sedimentation;
- Water Resources & Quality - Hydrology, Hydro-geology and Surface & Groundwater Quality;
- Ambient Air Quality;
- Ambient Noise Quality and Ground Vibrations;
- Ecology - Forests, Terrestrial wildlife, Aquatic Biology and Fisheries;
- Health & Sanitation;
- Local Cultural and Tourism
- Socio-economic - Land , assets and livelihood

In addition, natural Hazards like flood, cloudburst, forest fire, earthquake, landslides/ avalanche and safety issues may be aggravated.

The specific impacts due to the transmission line could not be assessed as the final route of the line is yet to be finalised. However a framework for impact assessment and mitigation has been proposed. A detailed environmental and social assessment will be done following finalisation of route for transmission of power.

Legal and Regulatory Requirements

Allain Duhangan Hydroelectric Project is governed by various legislative rules and regulations set by Himachal Pradesh State, Himachal Pradesh State Environment Protection & Pollution Control Board (HPSEPPCB) and Ministry of Environment and Forests (MoEF). Various specifications and guidelines of Central Pollution Control Board (CPCB) are also applicable. The project has obtained techno-economic clearance from the CEA, environmental clearance and clearance for diversion of forestland for the project, from the Ministry of Environment and Forests

The contents of the ESIA report have been designed to meet the documentation requirements of the International Finance Corporation (IFC). A hierarchy of requirements, which include safeguard policies, specific guidelines and reference documents, guide environmental reviews undertaken by IFC. The IFC's safeguard policies applicable to the proposed ADHEP include:

- OP 4.01 for Environmental Assessment
- OP 4.04 for Natural Habitats
- OPN 11.03 for Management of Cultural Property
- OD 4.30 on Involuntary Resettlement
- OP 4.36 on Forestry
- OP 4.37 Safety of Dams
- OP 7.50 on Projects on International Waterways
- Statement on Forced Labour and Harmful Child Labour
- Policy on Disclosure of Information

3.1

ENVIRONMENTAL IMPACTS

3.1.1

Impacts on Land use, Topography and Soil Erosion/Sedimentation

A summary of potential impacts on land use, topography and soil erosion/sedimentation are described in the Table below.

Table S 3.1

Summary of Impact Assessment: Land-use and Soil

IMPACT AREA	NATURE OF IMPACT ¹	TARGETS/INTERESTS ²	MAGNITUDE AND EXTENT ³	OVERALL SIGNIFICANCE ⁴
Land use	Change in original land use, land degradation, (major)	Reduction of vegetation, loss of top soil	Within Project component areas, small; beneficial effect in terms of compensatory afforestation with higher success percentage expected	• Moderate
Topography	Excavation of tunnels, development of other areas and construction of roads, irreversible	Physiography of the area	Within Project component areas, small; long term impact, irreversible	• Moderate
Derogation of soil quality	Cumulative contamination with dust, surface run-off during construction phase; reversible	Soil quality, flora and fauna, including grazing livestock	Localised near sources; small contribution to existing background levels, provided dust control and overburden is managed	○ Minor
	Physical effects on soils due to topsoil removal, nutrient loss; irreversible	Soil quality, flora	Site areas only	• Moderate
¹ Description; short or long term; reversible or permanent; associated with construction, operation, decommissioning; cumulative, accidental, etc ² Targets and interests potentially affected. ³ Adverse or beneficial; small, large, etc; very localised (Project component sites only), local, regional national. ⁴ Overall significance against criteria (○ minor; • moderate, some significance; ● major)				

A total of 77.272 ha of land is required for the project which includes 24% in roads, 28.54% in plant areas and dumping sites, 20.3% in major project components, 19.4% in colonies and transit camps and remaining in construction of magazines and other structures. Out of total land, demand for forestland is about 40%, while 47% is private land and rest state government land.

It is expected that project would generate solid waste in form of muck including overburden generated to the order of approximately 10,35,000 m³ of which about 30% would be reused in backfilling. The remaining 708,000 m³ will be disposed-off in areas identified near village Hamta, Jagatsukh, Prini and on way to the proposed Duhangan site. The other waste disposal will be done as per the norms of HPSEPPCB.

3.1.2

Hydrology, Hydro-geology and Water Quality

The construction of diversion structures during operation phase will result in disturbance of the existing flow pattern and water quality due to escape of suspended solids from construction activities finding their way into the two streams.



Watershed Development by Forest Department on Prini Nala

During operation phase, there will be permanent submergence of flat forestland to the tune of 2.01 ha near proposed Allain barrage. Another low probable potential impact on hydrology during operation phase can be due to failure of intermediate reservoir impoundment resulting in high soil erosion, loss to ecology and structures along its path with a risk of accidents. A summary of impact on hydrology, hydrogeology and water quality is described in the Table that follows.

Table S 3.2 **Summary of Impact Assessment: Water Resources**

IMPACT AREA	NATURE OF IMPACT ¹	TARGETS/INTERESTS AFFECTED ²	MAGNITUDE AND EXTENT ³	OVERALL SIGNIFICANCE ⁴
Surface Water				
Physical impact	Long term Submergence of Land in the vicinity of Allain barrage structure	Local wildlife and ecology on nearby flat land	Local	• Moderate
	Change in Hydrological Regime - Long term Flow modification due to diversion of water and installation of structures on the river streams	Local inhabitants depending on the downstream water of Allain and Duhangan streams	Local	•• Moderate/ Major
	Increase in siltation load due to construction activities	Allain and Duhangan Streams within the catchment area	Regional	•• Moderate/ Major
	Failure of Intermediate Reservoir impoundment	Increase in siltation load due to high soil erosions, destruction of ecology, accident	Local/Regional but risk of occurrence very low	O Minor, but would have major impact if occurred
	Short term contamination of surface water flows due to de-siltation and thermal stratification.	Tailrace outlet at Allain stream	Local, small scale	O Minor
Potential for Decreased dissolved Oxygen	Short term depletion of DO in reservoir due to reduced turbulence	Tailrace Discharge point at Allain stream	Local, small scale	O Minor
Ground Water				
Groundwater quantity	Long term, medium reduction	Aquifers along Allain stream beds stretch (5.6km) between diversion point and tailrace outlet; and Duhangan stream beds stretch (6.5km) between diversion point to confluence of Beas River	Local/Regional	O Minor
¹ Description; short or long term; reversible or permanent; associated with construction, operation, decommissioning; cumulative, accidental, etc ² Targets and interests potentially affected. ³ Adverse or beneficial; small, large, etc; very localised (project component sites only), local, regional national. ⁴ Overall significance against criteria (O minor; • moderate, some significance; •• major)				

A summary of impacts on ambient air quality is described in the Table below.

Table S 3.3 *Summary of Impact Assessment: Air Quality*

IMPACT AREA	NATURE OF IMPACT ¹	TARGETS/INTERESTS ²	MAGNITUDE AND EXTENT ³	OVERALL SIGNIFICANCE ⁴
Derogation of air quality	Potential impacts would largely be reversible. Emissions of SPM (dust) and to a smaller extent SO ₂ , NO _x would occur during all stages of the project construction phase (of 66 months); and increase in traffic on Nagar – Manali Road	Nearby villages. Workers onsite. Vegetation and Wildlife.	Generally Local/Regional impact. Dust emissions should be quickly suppressed to insignificant levels. Impact on site accommodation some distances from project component locations.	• • Major significance
Deposition of pollutants, SPM (dust) in human beings and in local area	Potentially impact due to accumulation of SPM deposition	Potential effect on human health due to SPM deposition in the lungs; Potential effect on land and soil quality of nearby agricultural fields (Apple Orchards); Minor/Moderate effect on flora and fauna	Localised adverse effect. Magnitude dependent on emissions and management of dust control. Impacts will be restricted to construction phase only. Operation phase will result in positive impacts on Ambient Air Quality.	• Moderate (In case of human health, as immediate consequences of dust will be on human beings) ○ Minor/ moderate significance, in case of land, flora and fauna. However, should the control measures fail, the potential impact could be of major significance)
¹ Description; short or long term; reversible or permanent; associated with construction, operation, decommissioning; cumulative, accidental, etc ² Targets and interests potentially affected. ³ Adverse or beneficial; small, large, etc; very localised (within the project component locations only), local, regional national. ⁴ Overall significance against criteria (○ minor; • moderate, some significance; •• major)				

Potential impacts on ambient air quality will be mainly confined to construction phase of the project. The major sources of the impacts can be due to project power generation using DG sets in the event of unavailability of reliable power from state electricity board. Another potential impact on air quality will be due to de-fuming of blasting operations undertaken during tunnel development and project vehicular movements, open excavations, road construction and emissions from hot mix plants and concrete mixers. The operation phase will result in positive impact on ambient air quality as hydroelectric power generation will be free of fossil fuel combustion.

The average ambient air quality monitored in villages show SPM being within 49.6 to 66.9 µg/m³ as against a CPCB standard of 200 µg/m³ for residential, rural and other areas. Similarly, SO₂ and NO_x concentrations in AAQ ranged from 15.4 to 26.3 µg/m³ and 24.7 to 31.6 µg/m³ respectively as against corresponding CPCB limits of 80 µg/m³ both for SO₂ and NO_x for residential, rural and other areas. With the addition of incremental levels in the baseline, it is expected that the AAQ will remain within the prescribed limits. The prevailing winds in Manali blow from N, NE, E and SE directions. The probability of transporting of pollutants to villages in the west lie with easterly winds. There is

advantage of elevation differences for project components as such are located at higher elevations than Prini and Jagatsukh villages, which are comparatively populated in the study area.

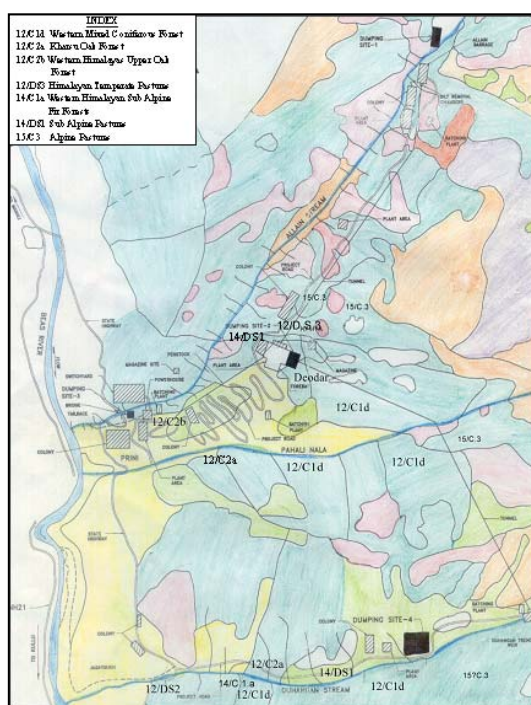
3.1.4 Noise Quality & Ground Vibrations

Noise attenuation with respect to distance in all directions has been worked out through a standard mathematical model for sound wave propagation. An input of 95dB(A) as the resultant noise level generated from the construction activities including DG set operations in the vicinity of major project component locations was considered. It is expected that during construction activities noise level of 65 dB (A) (day time national standard) will be achieved at a distance of 150 m from the source while 55 dB(A)(nighttime national standard) will be achieved at a distance of 300 m from the source. There will not be any noise impact from the project components during night-time as the construction activities will be restricted to two shifts only and no machinery operation will take place during night time.

3.1.5 Ground Vibrations

Due to blasting, the vibrations may cause damage to the nearby structures if appropriate control measures are not adopted. The calculations done for 20kg of explosive charge per delay, showed the ground particle velocity up to 81m is above the permissible level for hard rock (of 70 mm/sec). However, at subsequent distances the ground particle velocities are expected to be within the safe limits for any structures. It can be concluded that the ground vibrations generated by blasting during the tunnel excavations will not likely to effect the structures proposed in the vicinity of > 81m from the point of blast with 20 kg of charge per delay.

3.1.6 Ecology



There will be significant impact of the project on ecology as the project will require diversion of 32.167 ha of forestland and felling of about 1352 trees from such forestland.

Minor impact to the wildlife due to the construction of various project components is expected. However, on the positive side, there will be an increase in forest area due to afforestation programme to be implemented by the project.

Forest types within the Project Catchment Area

3.1.7 Impact on Fish

The baseline on fish catch attempted twice in the months of January and April 2003 showed no presence of fish in the Allain and Duhangan streams. However, in early April 2003, before confluence of Duhangan stream with Beas River, a few fish fingerlings were observed as a result of migration from Beas to the Duhangan river. The Allain and Duhangan streams flow with many abrupt falls leaving

fewer chances for migrating fish to traverse upstream. However, during peak flow or monsoon season, there is possibility of fish migrating upstream for some distance.

The average inflow observed at diversion sites in the past indicates variation in flows ranging from 1.54 to 21.78 m³/sec in Allain and 1.38 to 7.31 m³/sec in Duhangan streams. A 90% dependability flow (a flow which is available during 9 years out of 10 years) of 3.028 m³/sec is available in Allain while 1.301 m³/sec is available in Duhangan stream.

It is recommended that RSWML maintain a minimum flow of 0.150 m³/sec (i.e. 150 liters per second or 12,960 m³/day) downstream the Allain barrage all the time. This flow along with minimum flow available through other channels downstream the Allain would make the available flow to be more than 0.376 m³/sec i.e. 32,466 m³/day, which is about 21% of the minimum flow ever observed on Allain at Aleo.

Similarly, it is recommended that RSWML also maintain a minimum flow of 0.150 m³/sec (i.e. 150 liters per second or 12,960 m³/day) downstream the Duhangan-weir structure all the time. This flow along with minimum flow available through other channels downstream the Duhangan would make the available flow to be more than 0.510 m³/sec i.e. 44,064 m³/day, which is approximately 40% of the ever observed minimum flow on Duhangan stream at Jagatsukh.

This flow is suggested keeping in mind small perennial streams like Jabri Nala on Allain and Kala Nala on Duhangan running at 50 m and 3500 m downstream respectively the diversion structures. The minimum recommended discharges downstream the Allain and Duhangan are to be maintained by RSWML to ensure ecological sustenance and to meet local demand downstream. RSWML is to monitor the minimum recommended water flow by installing electronic and manual measurement devices at the diversion structures.

3.1.8

Tourism and Cultural Property

The Nagar - Manali, near Manali area comprises of a few hotels, two trekking lines and an ancient temple each at Prini and Vashist. A few springs also exist in Vashist and Jagatsukh. Another area of tourism interest is skiing undertaken at about 5 km upstream the Allain barrage location. In this area skiing is done by foreigners who directly fly to this region through helicopter service available in Manali. None of the project components fall in areas of known tourism interest. The project during construction phase may have some minor impact on trekking for which adequate mitigating measures are to be followed.



"Panduroopa", a wetland with mythological significance - on way to the site selected for Allain barrage, from Sethan village.

Problems could arise due to differences in customs of outside workers and local residents. These risks could be reduced by providing adequate facilities in workers camps and by employment of preferably local labour. The cultural aspects located near to the project components include the ancient temple at village Prini, a Tibetan Monastery near village Saithan, Lord Shiva's Temples at Jagatsukh, Pandurupa pond of historical importance up the village Saithan and a graveyard under the bridge on Nagar - Manali road near village Jagatsukh. The project road for an access along Duhangan stream is proposed to start from the bridge area near graveyard area, for which RSWML has already taken steps to change the road path to minimize hindrances to the graveyard.

3.1.9 *Impact on Health & Sanitation*

Health risk includes potential disease hazards due to lack of hygienic/ sanitation (water supply and human waste disposal), vector and water borne diseases and spread of sexually transmittable diseases like AIDS. Incidences of Malaria, Dengue, Jaundice, Dysentery etc are reported in and around the project area. With the development of project, potential health risks would also grow if left unchecked. Mitigation measures include proper sanitary health care and human waste disposal facilities. Sanitation facilities are included in the project estimate to take care of cost to be borne towards human waste disposal facilities.

3.1.10 *Impact of Project Road Construction - Increase in Traffic and Road Safety*

It is expected that during construction phase approximately 58 truck trips per day will be added apart from other project traffic on Nagar - Manali Road. The increase in traffic volume poses potential for additional safety risks to other users of the road. Presently, Nagar - Manali road has lower traffic volume as it is longer than alternative roads between Kullu and Manali.

3.1.11 *Natural Hazards*

Adequate provisions need to be taken up right at the design stage of the project, particularly to counter natural hazards like earthquake, dam failure, cloudburst, risk due to forest fire, landslides, and avalanches.

3.1.12 *Cumulative Impacts*

The ESIA study has attempted to identify potential impacts of the proposed hydroelectric project, which when acting together with other possible existing or future foreseeable impacts of activities on the same environmental resource or receptor will achieve higher significance and gravity of such impacts.

The present project is a run-of-the-stream project on Allain and Duhangan streams, which are perennial tributaries of Beas River. The possible cumulative impacts can be due to present and future foreseeable projects in the project catchment area, either upstream or downstream or both. The area above diversion points is mostly snow covered with lesser availability of head, difficult topography/ access or having catchment running towards other side of watershed i.e. leading to Chenab river in the Lahul Spiti District, thereby lowering the feasibility of future projects upstream, either in Allain or in Duhangan streams. However, there are several projects that have been identified downstream of the Beas River. Some of the major ones include of Malana (86MW), Parbati Stage I, II & III (750+800+501 MW), Larji (126 MW) and Uhl stage III 100 MW. (There are also over 65 small scale hydropower projects (≥ 3 MW) identified on Beas Catchment). All these projects in the Beas Catchment pose high cumulative impacts on the Beas River. It is therefore important that RSWML is aware of these possible scenarios and implements the Environmental Action Plan carefully to minimise cumulative impacts on the Beas Catchment.

3.1.13 *International Waterways*

The proposed project will be on Allain and Duhangan streams, which are tributaries of River Beas. River Beas is a tributary of River Satluj and river Satluj is finally a tributary of Indus river, a subject falling outside Indian territory i.e. into the territory of neighbouring country Pakistan. The present project being on tributaries of River Beas/Satluj requires formalities to be meted with as per the Indus Water Treaty, 1960 undertaken by India and Pakistan in the presence of World Bank.

The Indus System of Rivers comprises three Eastern Rivers (the Satluj, the Beas and the Ravi) and three Western Rivers (the Indus, the Jhelum and the Chenab). Any project on western rivers requires prior intimation to the Pakistan authorities. The present project being run-of-the-river-stream project on

tributaries of eastern River Beas/Satluj requires no such formalities as per the Treaty. The proposed project being a run-of-the-streams project, there would be insignificant impacts on Indus River.

3.2

SOCIO-ECONOMIC IMPACTS

The project will require land in three villages of Prini, Jagatsukh and Aleo in Tehsil Manali, District Kullu. A fourth village, Hamta, will be affected by the proposed road through that village, whose alignment has still not been finalised. The project has prepared an assessment of total land under different categories to be acquired. The total land requirement is envisaged as 77.272 ha of which 36.565 ha is Private land, 8.54 ha is Government land and remaining 32.167 ha is Forestland.

Project Area

The Project Affected Families are located in 3 villages of Prini, Jagatsukh and Aleo (70,50 and 20 families respectively), and are primarily dependent on agriculture and apple plantations. Jagatsukh and Aleo fall on the main road while Prini is about 0.5 km from the main road. The total population of the 3 villages according to village records is approximately 2806.

It is estimated that a total of 140 families will be directly impacted by the project through acquisition of 36.565 ha of private land, of which a sample survey was conducted for 62 families (25% sample of the total).

The major impacts of the project would include:

- Loss of private property
- Loss of asset including plantations
- Loss of livelihood and income directly linked to the above two losses
- Other indirect losses

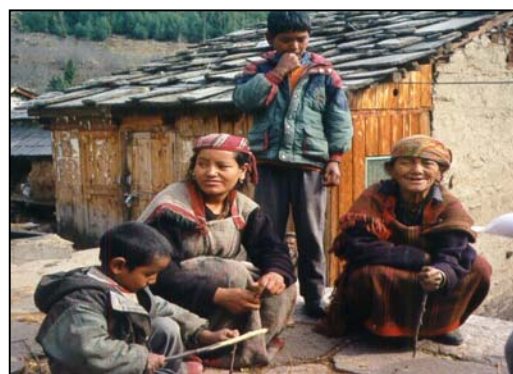
It is important to note that the project would not impact any homestead land or residential structures, hence no physical rehabilitation is envisaged.

By the land records, no PAF will either become landless nor will have less than .08 ha of land after acquisition. However it was observed that in some cases, ownership, as indicated by the land records, did not reflect the actual or *de-facto* use and ownership of land. Through the sample survey it is estimated that of 140 families, 90 families were losing less than 25% of their total land, while about 5 families stand to lose between 75 and 100% of their total land owned. This latter category of PAFs fall in the “most vulnerable” category.

Apple trees are the main assets that would be impacted in this project, as primarily plantation land is being acquired. Approximately 19 families will be losing more than 100 apple trees while a majority of the PAFs stand to lose less than 50 trees. Though agriculture is practised in the area, it is mostly for subsistence and not for income.

In terms of household income, the sample survey showed that 82 of families would be losing less than 25% of their incomes because of the project while some 9 families would be losing between 75% and 100% of their total family income.

The project has made every effort to avoid any impact on common property like places of worship, grazing grounds etc. The local land revenue department in each village has affirmed through a written document that no such property is getting affected in any of the three villages of Aleo, Prini and Jagatsukh.



Women in Aleo, a Village in the Project Area

Table S-1 Potential Environmental and Social Impacts of Proposed Allain Duhangan Hydroelectric Project (with mitigation measures in Place)

Sl. #	Environmental Resources	Potential Impact																	
		CONSTRUCTION PHASE									OPERATION PHASE								
		Type		Scale			Duration		Nature		Type		Scale			Duration		Nature	
		Adverse	Beneficial	Major	Moderate	Minor	Long Term	Short Term	Reversible	Irreversible	Adverse	Beneficial	Major	Moderate	Minor	Long Term	Short Term	Reversible	Irreversible
1	Land use, Topography and Soil Characteristics	*	-	*	-	-	*	-	-	*	*	-	-	-	*	*	-	-	*
2	Hydrology (Diversion Change of Water Course)	*	-	-	-	*	-	*	*	-	-	-	-	-	-	-	-	-	-
3	Hydrology (Flow Variation)	-	-	-	-	-	-	-	-	-	*	-	*	-	-	*	-	-	*
4	Hydro-geology (Groundwater Charging)	*	-	-	*	-	*	-	-	*	*	-	-	-	*	*	-	-	*
5	Water Quality	*	-	-	*	-	-	*	*	-	*	-	-	-	*	*	-	*	-
6	Air Quality	*	-	-	*	-	-	*	*	-	-	*	-	*	-	*	-	*	-
7	Noise Quality	*	-	-	*	-	-	*	*	-	*	-	-	-	*	*	-	*	-
8	Flora – Forests	*	-	*	-	-	*	-	-	*	*	-	-	-	*	*	-	*	-
9	Fauna - Terrestrial Wildlife	*	-	-	*	-	-	*	*	-	*	-	-	-	*	*	-	-	*
10	Aquatic Biology On Allain & Duhangan Streams	*	-	-	-	*	-	*	*	-	*	-	-	*	-	*	-	*	-
11	Aquatic Biology and Fisheries On Allain Barrage and Forebay Reservoir	*	-	-	-	*	-	*	*	-	*	-	-	-	*	*	-	*	-
12	Socio-economic (Employment/indirect opportunities)	-	*	*	-	-	-	*	*	-	-	*	-	*	-	*	-	-	*
13	Socio-economic - Land Acquisition/ Rehabilitation/ Compensation	*	-	*	-	-	*	-	-	*	-	-	-	-	-	-	-	-	-
14	Tourism	*	-	-	-	*	-	*	*	-	-	*	-	-	*	*	-	-	*
15	Public Health	*	-	-	*	-	-	*	*	-	*	-	-	*	-	*	-	*	-
16	Cultural/Historical	*	-	-	-	*	-	*	*	-	-	-	-	-	-	-	-	-	-
17	Infrastructure Development (including power generation)	*	-	-	*	-	-	*	*	-	-	*	*	-	-	*	-	-	*
18	Natural Hazards (Flood, cloudburst, Forest Fire, Earthquake & Avalanche)	*	-	-	-	*	-	*	-	*	*	-	-	-	*	*	-	*	-

Note The reversible impacts can be achieved by taking adequate mitigation measures to counter the adverse impacts

The ESIA recommends specific mitigative measures to be adopted for the implementation of the proposed project. This Environment and Social Mitigation and Management and Monitoring Plan (ESMMP) includes the following specific plans:

- Environmental Activities;
- Resettlement Action Plan;
- Community Development Plan;
- Public Consultation and Disclosure Plan
- Catchment Area Treatment Plan;
- Construction Labour Management Plan including Health Management Plan;
- Traffic Management Plan;
- Muck Disposal Plan;
- Emergency Response Plan;
- Fisheries Monitoring Plan; and
- Transmission line Impact Mitigation Framework

4.1

RESETTLEMENT ACTION PLAN

It is estimated that approximately 140 families will be directly impacted through land acquisition and there may be few more indirectly impacted families (wage labourers and sharecroppers). A full census will be carried out in the beginning of the implementation

Policy Objective

The policy objective influencing the Resettlement Action Plan (RAP) is to *avoid or minimize, to the extent possible, the hardships and impoverishment that land acquisition may cause, and to mitigate any adverse impacts thereof at the household and community levels*. These objectives are detailed and made more specific in terms of the principles and guidelines to be followed for land acquisition, adoption of compensation/entitlement policies and planning and implementation of rehabilitation activities in the ESIA document.

stage of the project that will identify all the directly and indirectly impacted families. In case of transmission line, the ESIA has prepared a framework, on the basis of which the detailed social assessment would need to be carried out at the time of implementation. The framework broadly follows the principles, definitions and entitlements of this RAP.

4.1.1

Entitlement for Loss of Land

Compensation for the acquired lands and assets will be paid at costs negotiated on the basis of the approved state Government norms. Families losing more than 75% of their land after acquisition will be identified as most vulnerable and the project will provide them an option of cash compensation or alternative land. All affected Scheduled Tribe families will be provided a similar option of land for land.

4.1.2

Rehabilitation for Loss of livelihood

Rehabilitation assistance is to be provided to all vulnerable PAFs (women-headed households, families with aged and physically and mentally challenged members, and families below the poverty line). In addition PAFs who will be rendered vulnerable losing more than 25% of their total landholding and whose livelihoods and incomes are to be affected by the loss of land and asset (mainly trees) will also be eligible for rehabilitation.

The rehabilitation assistance will allow the PAFs to tide over the transition period immediately after incurring the loss and till the time they are able to re-establish their original economic activities or initiate new ones.

Rehabilitation support will consist of the following provisions:

- Transition Allowance for a specified period of time for loss of income and livelihood as defined in the entitlement framework.
- Income restoration programmes as well as Land Purchase Assistance.
- A broader Community Development Programmes, targeted at all the village community in the four villages influenced by the project

The income restoration strategy will have the following components.

- Land Based Livelihoods
 - Restoring Apple Orchards
 - Improving Productivity of land
- Non-land based livelihoods
 - Employment during construction phase
 - Skill Upgradation and micro-enterprise

Focus on Women

The entire rehabilitation exercise will undertake immediate and practical initiatives to ensure that the lives of women in the area are significantly improved and that they are able to adapt to the potential changes that the project may bring about in the local environment and economy. Some of these steps include:

- Ensuring that women play an equal role in decision making on the utilisation of compensation money.
- Reducing workloads of women by encouraging and enabling the village development programme to focus on basic necessities like provision of drinking water, access to fuelwood and fodder, improved household appliances, specially for cooking and agriculture and most importantly, access to better health services.
- Increasing incomes of women by setting up micro-credit and Self Help Groups, training and improving access to markets.

4.1.3

Community Development Plan

The Community Development Plan will be initiated for the project villages, and prepared through detailed consultation with and capacity building of the villagers. The specific components of the CDP include:

- Stakeholder consultations for identify the programmes and processes, as well as the community's willingness and ability to contribute to the same.
- Trust Building measures: Small and low cost initiatives to generate support for the CDP and to meet immediate needs of the village.
- Development of village specific micro plans, through Participatory Rural Appraisal (PRA) methods and training of the village community to develop microplans
- Develop village funds with contribution from villagers and project proponents
- Monitoring and evaluation of the CDP

4.1.4

Implementation Mechanism for RAP

The RAP requires for an implementation mechanism to be set in place for the delivery of the entitlement package, as well as to meet the objective of the rehabilitation action plan. The strategy of implementation includes the delineation of roles and responsibilities of organisations/institutions, as well community groups, the procedures to be followed along with the support facilities available and finally a monitoring and evaluation plan.

4.1.5 *Public Consultation and Disclosure Plan*

The PCDP has recorded the issues that were raised at public consultations and lays out a detailed plan for consultation with different stakeholders at different stages of the project. It also suggests medium and forums for such interactions and information dissemination processes.

4.2 *CATCHMENT AREA TREATMENT PLAN - LAND MANAGEMENT, AFFORESTATION & SOIL EROSION*

The Catchment Area Treatment Plan which extends from the Prini village near the proposed underground Power House up to and beyond the Allain Barrage Site and from Jagatsukh Village up to and beyond the Duhangan Weir Site.

Afforestation under CAT is proposed on 800 ha of double degraded forestland land pasture development on 200 ha of land as identified with Forest Department. Among a variety of trees to be planted under the afforestation scheme using identified species, which are commonly found in the area.

To prevent incidences of soil erosion, details of various types of 9 spurs, 77 check walls, 65 check dams will be provided at locations in support of local forest department.

Adequate provision for soil erosion like proper compaction of dumps and rip-rap stabilization of areas reduced of vegetation.

Monitoring and Implementation of Environmental Safeguards for CAT

The state and project level committees will be monitoring the progress achieved on catchment area treatment plans etc as approved by the Ministry of Environment & Forests, Government of India, both in terms of funding by the project authorities and implementation in the field by the State Government Forest Department. In addition to participation of local people in the implementation of environmental mitigation measures will also be ensured.

The Govt. of Himachal Pradesh has also taken necessary action to ensure that the commitments made by the implementing Agency to the Ministry of Environment & Forests, are implemented at site.

4.3 *CONSTRUCTION LABOUR MANAGEMENT PLAN*

The key features are:

- Provision of Labour Accommodation for which RSWML proposes to arrange for a short term lease for a period not exceeding 10 years of Government land for temporary works for the construction of the project.
- Fuel Arrangement for Construction Labour for which following actions will be taken up by RSWML:
 - Need to undergo a construction phase purchase agreement with Government agencies like the Indian Oil or Bharat Petroleum Ltd to provide regular kerosene oil at the project site for distribution to the labour engaged for work at site.
 - Similarly purchase orders for fuel wood / charcoal, to be placed before the State Forest Department for regular fuel supply to the labourers from authorized fuel/wood/charcoal depots of the district.

- Arrangement for coal supply during peak labour involvement
- Provisions shall be made to establish a fuel depot at the project site for supplying regular fuel to the workers;
- RSWML will construct sheds using non-forest products such as bricks and cement.

4.4

HEALTH MANAGEMENT FOR CONSTRUCTION LABOUR AND PEOPLE IN THE VICINITY

About 2000 people (including dependants) will be working during the construction period. According to the criteria of Ministry of Health and World Health Organisation, one Health Centre with one doctor and minimum five health personnel (nurses, compounders etc) will be required with at-least ten beds. Additional provisions recommended include:

- Three Mobile Dispensary i.e. ambulances will be procured and provided by the project for meeting immediate and urgent medical calls in and around the project area including emergency calls from local villages.
- Infrastructure on medical/health assistance like testing/diagnostic, emergency operating and recuperating facilities etc.
- Employment of services of Medical Officers, Compounders, Lab Technologist, Epidemiologist, Drivers and other helping staff to provide the medical facilities.
- Construction of buildings for housing a permanent hospital and a separate Field Hospital.

During operation phase, the stagnant water and vegetation provide favourable breeding conditions for mosquitoes and snails. In the proposed project, water storage will be at Allain barrage location, inside the tunnels and at intermediate reservoir. During operation phase, RSWML will make regular field surveys and take necessary actions to curb the disease if thriving in the area with additional budget.

4.5

TRAFFIC MANAGEMENT PLAN

It is expected that there will be increase of about 58 truck trips per day in the traffic on the Nagar – Manali Road once the construction activities are started. This would disturb local people in the area and also increase chances of road accidents. It is therefore necessary that a detailed traffic management plan is prepared prior to start of construction activities. The traffic management is to be monitored on daily basis to evenly spread traffic flow during a day so as to avoid congestion and minimise chances of road accidents.

4.6

MUCK DISPOSAL PLAN

A total of 10,35,000 m³ of muck would be generated due to excavation of rocks and soil. Of this about 655,000 m³ of muck from excavation of rocks and soil will be disposed and reused at the five identified sites. The following steps shall be used for proper disposal of muck:

- a) Retaining walls or wire-crates would be built at each disposal site to retain the muck in the specified area;
- b) Provision of adequate drainage to avoid any hindrance to catchment area water flow;
- c) The disposal sites shall be filled leaving 5m berms for filling. The angle of repose for muck has been considered as 35°;
- d) The muck would be brought to the site using the tipper and further spread out and compacted by use of bulldozers, where required. For the purpose of calculating the size of muck disposal sites, the bulk volume of muck has been used. However, after

compaction the muck volume can be further reduced by 15-24% depending on type of compaction;

- e) After complete filling of the site, the muck disposal site shall be stabilised by planting indigenous plant species like Fir, Blue pine, Walnut, Horsechestnut, Kharsu, Poplar etc. Grasses like festuca grass etc would also be planted on the filled disposal sites for stabilisation;
- f) Depending on the type of land, rip-rap treatment of the filled muck surface could be undertaken using boulders and soil from the muck and further consolidated by planting grasses, etc. This kind of treatment would be especially effective to prevent erosion due to running surface water;

4.7 *EMERGENCY RESPONSE PLAN (ERP)*

The project requires detailed Emergency Response Plan both for probable hazards likely to take place during construction and operation phases. During the construction phase, the ERP should address hazards associated with handling of heavy machinery and explosives required for excavation of about 14 km of total tunnels.

Following natural/ accidental hazards may occur during construction phase of the project:

- slope failure at the project component locations including en-route proposed roads;
- accident due to explosives handling;
- accident due to heavy equipment/ machinery;
- sabotage in case of magazine; and
- accidents due to fly excavations/ drilling.

In order to take care of above hazards/ disasters, suitable safety and control measures and action plan, along with reporting requirements would need to be drawn up according to the recommendations in the ESMMP report..

Similarly in the operation phase, although the probability of natural or manmade threats to the proposed project would be very low, RSWML must prepare an elaborate and detailed emergency response plan to counter any event like earthquake, landslides, avalanche, forest or other fires and any accident related to the project. Elaborate procedure on do's and don'ts have to be worked out with reporting mechanism, emergency preparedness team and tie up with local administration.

4.8 *FISHERIES MONITORING PLAN*

In order to demonstrate RSWML's commitment to downstream users, it is proposed that flow measuring devices both electronic and manual measurement basis are installed on both Allain and Duhangan streams.

To preserve water quality downstream due to flushing from de-silting chambers, the flushing is to be done over longer period and during high flow periods like afternoon period or depending upon flow pattern for each month.

As mentioned in section 3.1.7, it is recommended that a minimum flow of 0.150 m³/sec (i.e. 150 liters per second or 12,960 m³/day) downstream the diversion structures on Allain and Duhangan is maintained at all times by RSWML. This flow along with minimum perennial flow available through other channels downstream the Allain and Duhangan would ensure ecological sustenance and meet local demand downstream. RSWML is to monitor the minimum recommended water flow by installing electronic and manual

measurements devices at the diversion structures also ensure that suitable temperature and velocity in both Allain and Duhangan streams are uniformly maintained for sustenance of any biological life.

Adequate sewage treatment plant for domestic wastewater from the project should be maintained to assure safe water quality.

4.9 *COMPLIANCE UNDER STATUTORY APPROVALS*

Various provisions as stipulated in the Environmental Clearance, Forest Clearance and other approvals as issued by Ministry of Environment and Forests (MoEF), Himachal Pradesh State Environment Protection and Pollution Control Board (HPSEPPCB) and other agencies will be adhered to without failure.

4.10 *TRANSMISSION LINE IMPACT MITIGATION FRAMEWORK*

An environmental and social reconnaissance study of the proposed transmission line was done at this stage, as the final route selection is not yet complete. The reconnaissance survey identified issues and actions that would impact the environment and local communities. The mitigation framework broadly follows the ESMMP in terms of mitigation measures, monitoring mechanism and institutional arrangements. The framework emphasises on avoiding impacts on homesteads, sensitive areas, cultural and ecological sites through appropriate changes in the design and routes of the line, wherever feasible. Other impacts would need the mitigation measures to be closely monitored and included into contracts with sub-contractors. Stakeholder engagement would be a vital component through the entire process.

Table S – 2 at the end of this summary, describes Environmental & Social Mitigation and Management Plan recommended to be implemented under the proposed project.

4.11 *INSTITUTIONAL ARRANGEMENTS OF ESMMP*

The project proponent will establish dedicated cells for environment and social issues within the RSWML institutional structure to address all social and environmental impacts of the project, as well as ensure proper implementation of the Public Consultation and Disclosure Programmes, the Rehabilitation Action Plan and Community Development Plan. The cell will be adequately staffed by specialists and support staff through the project period and would be responsible for both implementation as well internal monitoring of the programme.

Apart from the institutional support to be provided by the RSWML personnel, an implementing agency (an effective social organisation/institution or an NGO) will be appointed for the implementation of the RAP and for consultation and participation with the local communities. In case RSWML believe that they have internal capacity to manage the RAP, then they should ensure that there is full-time dedicated staff and senior officials responsible for the rehabilitation and community development programmes.

4.11.1 *Grievance Redressal Mechanism*

A Grievance Redressal Cell will be established in the Project/Field Office. The cell will have representation from RSWML, local administration, civil society and the Project Affected Families.

The GRC will look into complaints and concerns about ownership disputes, inheritance of assets, distribution of compensation among heirs, missing affected assets and persons in the census etc. The procedure will not replace existing legal processes but will, based on consensus, seek to resolve the issues quickly in order to expedite the receipt of compensation, without resorting to expensive and time-consuming legal actions.

In addition to the above, if there are any grievances related to environmental management issues in the project area, the GR cell will record these grievances and suggestions and pass it on to the relevant authorities for necessary action and follow-up.

4.11.2 *Monitoring & Evaluation Cell*

Internal and external monitoring is proposed in the project. Internal monitoring of the ESMMP implementation will be the responsibility of a special Monitoring & Evaluation cell within RSWML. This M&E cell will regularly interact with Social and Environmental Units and will report to the Manager (Social and Environment).

Mid term and end term external monitoring would be conducted by an independent agency.

4.11.3 *Reporting*

RAP

The internal monitoring process will share its findings through monthly monitoring reports in the first year of the project, which it will share with the Manager (Social and Environment). This report will be shared with the corporate office on a quarterly basis. RWSML will report to IFC on a half-yearly basis.

The external monitoring for Resettlement Action Plan will be held every quarter during the implementation process. Evaluations will be conducted once in mid term (1.5 years) and once at the end of the rehabilitation process (3 years). The reports will be shared with the corporate office and IFC simultaneously.

EAP

External auditing will be carried out half yearly during the construction phase. These reports should be forwarded to IFC for necessary review.

During Operation phase, the external auditing can be done on an annual basis.

4.11.4 *Estimated Budget for ESMMP*

The Estimated budget for ESMMP would be INR 101.96 million excluding costs of land acquisition. The budget doesn't include mitigation measures, which are integrated with the project costs.

Table S 2: Environmental and Social Mitigation and Management Plan

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
A	Pre-Construction Phase			
A.1	Land acquisition for the project components	Loss of land, livelihood, assets etc. broader socio-economic impacts	• Compensation for land and assets negotiated on the basis of approved Himachal Government norms • Rehabilitation assistance (transitional allowance, income restoration measures and employment) for vulnerable families and families losing more than 25% of their total land • An option of land for land or cash compensation for ST families and families losing more than 75% of their land • Community Development Programmes in the Project area	Local Administration in co-ordination with RSWML RSWML with Implementing agency RSWML with Implementing agency
A.2	Forestland diversion for establishing project components	Loss of 32.167 ha of forestland and removal of trees and other vegetation	• Compensatory afforestation 64.334 ha of double degraded land.	RSWML Ecologist/Env. Engr. DFO MOEF
A.3	Establishment of Camp Provision of civic amenities for construction labour and movement of truck drivers for transporting construction material.	Health Risks due to lack of health and sanitation conditions through disposal of sewage on open land which may cause mosquito nuisance, water borne diseases etc. Chances of spread of sexually transmittable diseases like AIDS	• Construction of toilet facilities and sewage collection system for treatment. • Provision of treatment plant for sewage before its disposal, meeting the stipulated standards of discharge. • Arrangements for first aid, • Awareness programmes on AIDS etc.	RSWML Local Health Administration HP Factory Inspectorate
A.4	General	Health, Safety, Solid Waste Disposal (domestic and project)	• Develop codes of practice for safety and disposal of muck and solid waste prior to taking up of construction activities	RSWML, HPSEPPCB Factory Inspectorate

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
		project)		
B	Construction Phase – Construction Activities			
BA	Temporary Occupation by Construction Labour			
BA.1	Establishment of buildings, storage facilities, workshops for maintenance of vehicles and machinery/equipment	Deterioration in surface water quality or soil and ground water quality when discharged untreated	Treatment plants for wastewater generated from workshop etc and domestic wastewater generated from camp and colony	RSWML Construction Engineer Environment Engineer HPSEPPCB
BA.3	Water supply	Impact due to drawing of water for domestic purposes	Emphasis on optimisation water usage.	RSWML Construction Engineer
BA.4	Fuel requirement of workers during construction phase	Pressure on forest produce for fuel use	Provision of fuel allocation to construction workers so as to reduce pressure on forest produce	RSWML Construction Engineer
BA.5	Solid waste disposal	Diseases, rats etc.	Arrangement for kitchen waste disposal – identify locations for establishing humus pits, which can be covered with soil.	RSWML Construction Engineer
BB	Site Preparation – Construction of Roads etc.			
BB.1	Demolition and Removal of structures, if any	Noise disturbance and dust	- Water sprinkling and - Demolition limited to day time only	RSWML Construction Engineer
BB.2	Construction of Roads and Development of other areas	Dust raised during various construction activities; Soil erosion; Reduction in water quality	- Realignment of road, where feasible to avoid cutting of large trees and area falling under forest / devbans. - Sprinkling of water on unpaved roads to reduce incidence of dust in air. - Proper engineering designs of access roads.	RSWML Construction Engineer Environment Engineer DFO

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
			Provide adequate culverts and drainage channels	
BB.3	Transportation -Vehicular movement, Loading/unloading	Causes dust nuisance as well as NO _x pollution due to vehicular emissions	Traffic Management through daily arrangements for fleet management, sprinkling of water on construction road	RSWML Safety Officer
BC	Diversion of water			
BC.1	Diversion of Allain and Duhangan streams for construction of Allain Barrage and Duhangan weir.	Soil erosion and Reduction in water quality	Adequate provision for proper channel for carrying diverted water from both streams.	RSWML Construction Engineer Environment Engineer
BC.2	Construction equipment for Diversion of water	Noise generation	- Day time operation of high noise generating equipment - Regular maintenance of equipment - Provision of enclosures for high noise generating equipment	RSWML Construction Engineer Environment Engineer
BD	Construction of Other Project Components			
BD.1	Excavation and blasting during tunnel development	High Impulsive Noise levels	Adopting optimised blasting techniques using delay detonators, blasting in confined areas (inside the tunnels)	RSWML Construction Engineer Safety Officer Blasting Specialist
BD.2	Blasting Operations for Tunnel Development	Impulsive ground vibrations. Impacts short term and reversible.	Adopting optimised blasting techniques using delay detonators, blasting in confined areas (inside the tunnels)	RSWML, Construction Engineer, Safety Officer, Blasting Specialist
BD.3	Blasting Operations for Tunnel Development	Affects wild life through air & noise pollution. Short term and reversible impacts	- Optimised blasting operation. - Controlled Traffic management. - Provision of enclosures and other measures for high noise generating machinery/equipment	RSWML, Construction Engineer, Blasting Specialist, Environment Engineer, Safety Officer

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
BD.4	Excavation and blasting during tunnel development	Occupational health hazards Deteriorates workers health (occupational health hazards) due to air & noise pollution, accidents & injuries. Restricted to construction phase – short term and reversible	- Optimised blasting restricted to tunnels (confined area) only provided with adequate exhaust system - Compulsory use of respiratory personal protective equipment. - For those working in deep caverns, arrangement of life line should also be made. - Use of fire proof cables inside the tunnels for lighting during construction phase.	RSWML Construction Engineer Safety Officer
BD.5	Excavation and blasting during tunnel development	Occupational safety hazards Construction place safety hazards	- Provision of safety management on daily basis under direct supervision of a permanent safety officer on site during construction and operation phases; Provision of adequate safety personal protective equipment like safety helmets, safety goggles, gum boots, gloves etc. - Provision of fireproof cables inside the tunnels to prevent any short- circuiting during construction phase. - Develop code of practice for safety during construction phase.	RSWML Construction Engineer Safety Officer
BD.6	Excavations, drilling, transportation and other project activities	Soil erosion/sedimentation during construction phase	- Reuse of over 30% of muck in road construction, Proper staking and their compacting, afforestation, improvement of landscape measures and catchment area treatment to reduce incidence of soil erosion. - Provision of measures to control silt/sediments during construction phase, provision of check walls, check dams and spurs	RSWML Construction Engineer Environment Engineer
BD.7	Water withdrawal for construction purposes i.e. for dust suppression, workshop, domestic supply at construction site and colony etc.	Reduced flow - Impact due to drawing of water reversible	- Optimise Water Requirement – Avoid Spills - Emphasis on reuse of water during wet drilling of tunnels.	RSWML Construction Engineer Environment Engineer HPSEPPCB
BD.8	Muck and other solid waste including	Impact on landuse, topography, soil etc.	Muck disposal only as per muck disposal plan as given in the main ESIA document.	RSWML, Construction Engineer, Environment

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
	associated overburden disposal	topography, soil etc.	- Reuse of maximum solid waste. Minimum 30% of muck to be reused in road construction, improvement of landscape measures - Further possibility for reuse of muck is to be considered by getting it tested for feasible strength and other features.	Engineer, HPSEPPCB
BD.9	Stock piling of solid waste (spoil) and muck their disposal	Increase in SPM level during high winds	- Proper staking and compacting of muck and spoil, - Proper management of muck transportation to the disposal sites – transportation should be done only during non peak hours; - Afforestation and improvement of landscape as per catchment area treatment plan - Other dust preventive measures like water sprinkling etc to reduce incidence of high SPM during windy conditions.	RSWML Construction Engineer Environment Engineer Ecologist
BD.10	Construction phase – DG Set operation for power generation in case of abrupt power supply form State Electricity Board	Increase in SO ₂ and NO _x levels	- Standby operation during construction phase only - Provision of stipulated stack height, DG set operations at dispersed locations - DG sets will be spread at 4 locations within the project area	RSWML Construction Engineer Environment Engineer HPSEPPCB
BD.11	DG sets, Concrete Mixing Plants and other machinery generating noise and vibrations	Increase in noise and vibrations	- Provision of enclosures for high noise producing machinery like concrete mixing plants, DG sets and other equipment, - Provision of mufflers (silencers) on DG sets - Provision of temporary but proper foundation supported with rubber padding to control vibrations. - Optimised operation of construction related machinery	RSWML Construction Engineer Environment Engineer HPSEPPCB
BD.12	Transportation – vehicular movements	Increase in noise levels Adverse effect due to air and noise pollution due to vehicular traffic Adverse impact of dust and air emissions	- Fleet management on daily basis - Restricted vehicular movement during night time - Vehicles carrying construction material will be properly covered and water sprinkling, - Vehicular traffic is mainly confined to project area and DG sets will be spread at 4 locations within the project area., vehicles carrying construction material will be properly	RSWML Construction Engineer Environment Engineer Safety Officer

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
		air emissions.	covered and water sprinkling will be done at construction areas to minimise incidence of dust and air emissions	
BD.13	Transportation - Due to increase in vehicular Traffic on Manali - Nagar roads	Increase of traffic will lead to increased incidences of road accidents Blocking of roads due to transportation on the Nagar - Manali Road	- Regulated traffic on daily basis with the help of local administration so as to avoid blocking of the roads. - Nagar - Manali road although not commonly used by tourists en-route Manali. Regulated traffic on daily basis with the help of local administration so as to avoid blocking of the roads.	RSWML Safety officer Local Traffic Administration
BD.14	Deployment of construction labour not belonging to the project area and restriction on employment of child labour	Influx of people of various cultures will have substantial effect on local culture. Employment of Child labour would be in violation of IFC norms.	Regular check and measures to control through supervisors that construction labour does not interfere with the local inhabitants for their cultural values. No child labour will be employed for the construction.	RSWML Social Scientist
C	Catchment Area Treatment			
C.1	Repair of slope failures and erosion	Reduced downstream sedimentation	Strict implementation of Catchment Area Treatment Plan (Refer to Section 10.12 of ESIA for Details)	RSWML Construction Engineer Environment Engineer
C.2	General maintenance and ecological protection	Improvement of terrestrial habitation by compensatory afforestation conservation of flora and fauna Conservation of water resources	- Strict implementation of Catchment Area Treatment Plan - Although no fish found in Allain and Duhangan streams, a Fish survey is to be done for 12 months of the year and as discussed above minimum flow 150 ltrs per second must be ensured at diversion structures downstream users and ecological life protection.	RSWML Construction Engineer Environment Engineer Ecologist DFO
D	Demobilisation of Temporary Construction Infrastructure			

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
D.1	Demobilisation and removal of all temporary buildings and magazines	Aesthetics, health, safety, reduction in water quality	- Convert accommodation to schools/local welfare activities if close to any village else demolish or remove such temporary building from site - Re-vegetate bare areas - Remove all construction equipment from project site - Remove all waste from site and appropriately dispose off as per the requirement of HPSEPPCB - Rehabilitate muck and other spoil dumping sites.	RSWML Construction Engineer Environment Engineer Ecologist Safety Officer
E	Operation Phase			
E.1	Water diversion for hydroelectric power generation	Impact due to diversion of water for power generation during operation phase and reduced flow in stretches between diversion structure and tail race discharge point on Allain and downstream of the Duhangan stream.	- Provision of maintaining minimum flow of 150 ltrs per second both in Allain and Duhangan streams immediately after diversion points - Installation of flow measuring gauges both electronic and manual measurement basis.	RSWML Environment Engineer
E.2	Wastewater generation from project workshop and domestic supply including flushing of sand accumulated in the de-silting chambers	Deterioration in surface water if wastewater from project workshop and domestic source when discharged untreated	- Sewage Treatment plant for domestic wastewater - Controlled discharge of flushing from desilting chambers	RSWML Environment Engineer
E.3	Vehicular movement and hydropower generation	Minor increase in noise levels	- Limited vehicular movement during operation phase - Regular maintenance of company owned vehicles	RSWML Safety Officer
E.4	Development of Reservoir	Beneficial impacts to avi-fauna	- Regular cleaning and maintenance of the reservoir - Pasture Development and Afforestation in the reservoir surroundings	RSWML Environment Engineer

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
E.5	Reduction of water flow in the stretch between diversion point to tailrace discharge in Allain stream while in Duhangan stretch between diversion point to its confluence in Beas River	Reduced flow and increased silt level during operation phase	- Provision of maintaining minimum flow of 150 ltrs per second both in Allain and Duhangan streams immediately after diversion points; - Sewage Treatment plant for domestic wastewater; - Controlled discharge of flushing from de-silting chambers over pro-longer period or during high flow periods; - Provision of check walls with boulders, stones and with/without meshes at 5 locations, check dams with boulders & stones at 4 locations and spurs at 5 locations as per details given in Section - on Catchment Area Treatment.	RSWML Environment Engineer HPSEPPCB DFO
E.6	Illumination - provision of light along all the project component areas	Poses potential of disturbance to mammals and birds at nights	Minimum light will be maintained for safe and secured project operations	RSWML Security Officer Safety Officer
E.7	Development of water storage reservoir and submergence area near Allain diversion point	During project operation water storage poses potential to provide breeding grounds for vector and water borne diseases - Impacts will be long term and irreversible if not controlled.	- Provision for control of water borne diseases vectors through regular health monitoring and taking up necessary mitigative measures - Regular Cleaning and maintenance of the area to attract avi fauna	RSWML Health Officer Environment Engineer
E8	Natural Hazards	Any incidence of natural hazards can hamper with local resources and affect people in the surroundings	- Provision of detailed engineering by taking adequate engineering measures of earthquakes, cloudburst in the detailed engineering design aspects for project components like Allain barrage, intermediate reservoir sites. For other components also measures of landslides, avalanche, forest fires etc. will be taken - Provision of automatic shutoff of powerhouse in case of natural calamity - Linkage of cut off of water from diversion points into the	RSWML Security Officer Safety Officer Emergency Response Team Independent Engineer appointed under OP4..37

SL.#	ISSUE - PROJECT ACTIVITIES	ASSOCIATED IMPACTS	MITIGATIVE MEASURES - ACTION PLAN	RESPONSIBILITY
			intermediate reservoir • Regular dam safety design inspection and maintenance; • Appointment of an independent engineer as required by IFC under OP4.37 safety of dams for design verification and regular audits • Provision of warning system for any major release due to any natural hazard/accident • Regular education to downstream users or likely affected people about do's and don'ts in case of any mishap • Provision of appropriate emergency response plan	
F	Decommissioning/ Abandonment			
F.1	Demobilisation/ Abandonment Restoration of Area	Smooth Flow Area Restoration	• Slow De-watering of Intermediate reservoir, connected tunnels and Allain barrage; • Remove sediments and dispose of properly; • Demolish structures like Allain Barrage, Duhangan weir, intermediate reservoir, surge shaft and connected project components; • Re-vegetate exposed areas at Allain barrage and Duhangan weir and intermediate reservoir sites; • Convert surge shaft area back to an agricultural field or re-vegetate in discussion with the local administration.	RSWML Civil Engineer Contractor Safety Officer Ecologist