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UPDATED
FINAL REPORT
MAY, 2013

ENVIRONMENT MANAGEMENT PLAN OF JELAM TAMAK H.E. PROJECT, UTTARAKHAND

Prepared for :
THDC India Limited

CENTRE FOR INTER-DISCIPLINARY STUDIES OF
MOUNTAIN & HILL ENVIRONMENT
UNIVERSITY OF DELHI, DELHI

PREFACE

Jelam Tamak H.E. Project proposed by THDC Ltd. is located on the Dhauliganga river in Joshimath sub-division of Chamoli district, Uttarakhand. The project is run-of-the-river scheme, envisages a 28 m high barrage, a reservoir with an surface area of nearly 38 ha and 4.4 km long head race tunnel. The installed capacity of the project is 108 MW. Total land required for the various project components is 96.27 ha. The project would affect 4 revenue villages by acquiring their private naap land, van panchayat land and grazing land.

EIA report has been prepared in two volumes, the first volume essentially covers project description, baseline data on land, water, biological, air and social environments and assessment of the impacts. The second volume deals with all mitigation measures and covers various Environmental Management Plans, viz. Catchment Area Treatment plan, Biodiversity Management plan, Resettlement & Rehabilitation plan, Rehabilitation Muck Dumping Area, etc. All the mitigation measures to be undertaken by the project developers have been dealt with in detail along with cost estimates for each plan. All the chapters prepared for EIA and EMP reports have been prepared by CISMHE through primary and secondary sources except Environmental Flow Assessment study.

December, 2012 **Principal Investigator**

CISMHE

CENTRE FOR INTERDISCIPLINARY STUDIES
OF MOUNTAIN & HILL ENVIRONMENT
UNIVERSITY OF DELHI

UNDERTAKING

This is to certify that the EIA/EMP report of Jelam Tamak H.E. Project is based on the original work carried out by Centre for Interdisciplinary Studies of Mountain & Hill Environment (CISMHE), University of Delhi. We also certify that the work has not formed the part of other EIA report and/or has not been copied from other published or unpublished reports. The information taken from the secondary source is well referred to in the report.

Principal Investigator

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NABET/ EIA/ 02/ 12/52

The Director
Centre for Interdisciplinary Studies of Mountain & Hill Environment
3rd Floor, ARC Building, University of Delhi,
Patel Marg, Delhi - 110007
(Kind Attention: **Prof Maharaj Krishan Pandit**)

February 27, 2012

Dear Sir,

QCI – NABET Scheme for Accreditation of EIA Consultant Organization

This is with reference to your application for QCI – NABET Accreditation as EIA Consultant Organization.

We are pleased to inform you that based on Document & Office Assessments, the Accreditation Committee has recommended conditional accreditation of **Centre for Interdisciplinary Studies of Mountain & Hill Environment** as per the scope given in **Annexure I (A & B).** Also find attached herewith the following:

a. Detailed terms & conditions of accreditation **(Annexure II).**
b. Results of various aspects of assessment of your organization **(Annexure III).**
c. The format which is to be followed for mentioning the names of the experts involved in the EIA reports prepared by you **(Annexure IV).**

Please confirm the correctness of spellings of the names of the experts mentioned in Annexure I B. Please check the QCI website for the Minutes of the Accreditation Committee Meeting held on February 07, 2012 for observations related to your application for compliance. You are also advised to visit QCI website to check clarifications on the Scheme issued from time to time for necessary actions at your end.

The accreditation of your organization will be for a period of three years starting January 10, 2012. The annual renewal of the accreditation will be confirmed after surveillance assessment every year. Surveillance assessments will be conducted to ensure compliance with NABET Scheme including the details mentioned in your Quality Manual and the terms & conditions mentioned in Annexure II.

May we request you for an early payment of the annual fees and your confirmation of acceptance of the terms and conditions attached. This will enable us to issue you the requisite accreditation certificate.

We thank you for your esteemed support in making this scheme successful and for your participation in this national cause.

Thanks and best regards,

Yours sincerely,

(Vipin Sahni)
Director

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Annexure I-A

Name of the Consultant: Centre for Interdisciplinary Studies of Mountain & Hill Environment

3rd Floor, ARC Building, University of Delhi,
Patel Marg, Delhi - 110007

Sectors Approved – 01 Nos.

Sl. No.	Sector No.	Name of Sector	Category A/B
1	3	River Valley, Hydel, Drainage and Irrigation projects	A

Total = 01 Sector*

****Sectors allocated to individual EIA Coordinators are mentioned in Annexure I-B***

(Vipin Sahni)
Director

TEAM COMPOSITION AND EXPERTISE

S.No.	Name of Expertise	Field	Areas Approved By NABET
1.	Professor M.K. Pandit	Ecology & Biodiversity (Flora and Impact Assessment)	Coordinator
2.	Dr. J.P. Bhatt	Ecology & Biodiversity (Fauna, Impact Assessment) Water Pollution & Aquatic Ecology	Coordinator EB & WP
3.	Dr. D.C. Nautiyal	Ecology & Biodiversity (Flora)	EB
4.	Dr. Sanjay Pattanayak	Geology	
5.	Dr. Vikrant Jain	Geology & Hydrology & Ground Water	Geology, HG
6.	Dr. Dorje Dawa	Land Use/ Land Cover, Hydrology & Ground Water Risk Hazardous Management	LU & ISW
7.	Mr. R. Mehta	GIS-Remote Sensing (Land Use/ Land Cover)	LU
8.	Mr. Basudev Singh Bisht	Socio-Economic	SE
9.	Ms Sudha Tiwari	Laboratory work & Aquatic Ecology	EB
10.	Mr. Aniket	Laboratory work	EB

* All analysis work associated with CISMHE laboratory under the University of Delhi.

TOR Compliance

A. BASELINE DATA	EIA Report
1.0. Geological, geophysical and Geo-hydrological Aspects	
1.1. Geography and physiography of the project area.	Page: 3-1 to 3-9
1.2. Regional geology and structure of the catchment	Page: 5-1 to 5-7
1.3. Snow-fed and rain-fed catchment to be demarcated. Rainfall-runoff data to be assess.	Fig. 7.1, Fig. 7.4
1.4. Seismicity, tectonics and history of past earthquakes in the area.	Page: 5-16 to 5-22
1.5. Critical review of the geological features around the project area.	page : 5-8 to 5-14
1.6. Impact of the project on geological environment	Page: 5-21 to 5-22; 15-11
1.7. Hydrology of the basin	Page: 4-2 to 4-3; 3-2 to 3-4
Hydro-meteorology, drainage systems	
Catastrophic events like cloud bursts & flash floods, if any would be documented.	Page: 4-9 to 4-25
Sedimentation rate to be estimated.	Page: 4-8
Water availability for the project and the aquatic fauna. To record the inflows/outflows, historical flows, seepage at/from the upstream projects/ diversion structures of the Dhauliganga river. Measurements of flow from the tributaries in the study stretch and other surface water channels joining Dhauliganga in the study stretch.	Page: 4-4 to 4-8
The flow measurements shall be planned and executed in such a way that average, maximum, mean maximum, mean minimum and absolute lean flows will be modeled or measured.	Page: 4-4 to 4-8
Lean season release of water for downstream will be specified. The study of comprehensive downstream impact shall also include area upto 10 km downstream of the confluence of TRC with river and shall address overall ecological impact.	Page: 14-1 to 14-8
Downstream hazards (available data on floods, including design and maximum probable floods)	Page: 1-4 to 1-8
1.8 **Study of Design Earthquake Parameters**: To identify the current and potential landslide prone areas in and around the Jelam-Tamak HEP, assess the possible induced landslide risks; and design/plan for protection and management measures for preventing landslide, earthquake and erosion.	Page: 5-8 to 5-16
2.0 Biological Resources	
2.1. **Flora of the Project's Influence Area**: Survey the flora, major habitats and sub-habitats, biodiversity indices, species abundance, density, composition, growth rate and phenology.	Page: 8-1 to 8-6; 8-17 to 8-26
Prepare succinct documentation on the flora, fauna and biodiversity resources of the Dhauliganga basin and project influence area.	Page: 8-1 to 8-40; 9-1 to 9-14
Predominant flora, introduced exotic flora and the resultant impact.	Page: 8-1 to 8-40;
Forest and forest types: Total forest cover, type of forests, change in forest cover and threats and degradation of forests.	Page: 8-1 to 8-4
Vegetation profile, number of species in the project area, etc.	Page: 8-4 to 8-6; 8-6 to 8-13
Community Structure through Vegetation mapping	Page: 8-16 to 8-29
Species Diversity Index (Shanon-Weaver Index) of the biodiversity in the project area.	Page: 8-29

Importance Value Index (IVI) of the predominate species in the project area.	Page: 8-20 to 8-28
Documentation of economically important plants, medicinal as well as timber, fuel wood etc.	Page: 8-41 to 8-43
Microflora of Dhauliganga basin.	Page: 8-30 to 8-32
Endemic, endangered and threatened species and their geographical distribution.	Page: 8-39 to 8-40
Impact of impoundment and construction activities on the vegetation.	Page: 15-4
Location of any Biosphere Reserve, National park or sanctuary in the vicinity of the project, if any.	Page: 10-1 to 10-9
2.2. Fauna of the Project's Influence Area: Survey the fauna (consisting of invertebrates, amphibians, avifauna or birds, and mammals); establish biodiversity indices, such as species abundance, density, composition, structure and growth rate.	
Inventorisation of terrestrial wildlife (consisting of invertebrates, amphibians, reptiles, birds and mammals).	Page: 9-1 to 9-14
Present status of wildlife.	Page:9-8 to 9-9
Zoogeographic distribution/ affinities.	Page: 9-1; 9-2 to 9-9
Endemic, threatened and endangered species including their habitat and associations.	Page:9-8 to 9-9
Small vertebrate or invertebrate communities.	Page: 11-10
2.3. Impact on animal distribution, migration routes (if any), habitat fragmentation and destruction due to dam building activity.	Page: 15-4
2.4. Avifauna	
Status	Page: 9-5 to 9-8
Resident/Migratory/Passage migrants	Page: 9-5 to 9-8
Impact of project on threatened /endangered taxa, if any.	Page: 15-5 to 15-6
2.5. Aquatic Ecology	
Collect and examined the water samples from different sampling stations in all three season (pre monsoon, monsoon and post monsoon). Additional water quality samples will be collected from source of drinking water and each of the channel carrying sewage into the river.	Page: 11-1 to 11-24
To study the relevant literatures for existence of other rare, endangered, endemic or threatened aquatic fauna like macro-invertebrates, zooplankton, benthos etc.	Page: 11-1 to 11-24
Conservation status	Page 11-23 to page 11-24
Fish and Fisheries (verified the fish population and fish diversity by the consultation with fishery expert, local fishermen, fish sellers or fish consumers in the stretch of Dhauliganga river) impacts of managed flow scenario on the migratory and resident fish population	Page: 11-22 to 11-24
Fish migrations (particularly for anadromous fish, if any), fish passing hazards	Page: 11-22 to 11-24
Breeding grounds (identify all spawning and rearing habitats in Dhauliganga and its tributaries)	Page: 11-22 to 11-24

Impact of dam building on fish migration and habitat degradation. The study would cover project influence area of 10 km around the project. For assessment related to the managed river flow issues, the sub study would primarily concentrate on the river stretch between proposed intake structure and the tailrace outlet.	Page: 15-10
Pollution load in Dhauliganga river, the volume and quality of sewage (treated or otherwise) entering in the study stretch during the project's life.	Page: 15-5 to 15-6
2.6. Conservation areas and status of threatened /endangered taxa	
Biotic pressures	
Management plan for conservation areas and threatened /endangered taxa.	Page: 11-1 to 11-8 of EMP
2.7. Impacts of managed flow on the quality of water, shoreline vegetation, aquatic ecology, induced erosion, sedimentation, flushing and pollution load etc.	Page: 14-1 to 14-8
3.0. Remote Sensing & GIS Studies	
False colour composite map of the project area.	Fig. 7.1
Delineation of critically degraded area in the directly draining catchment on the basis of Silt Yield Index as per the methodology of AISLUS.	Fig. 8.6 of EMP
Land use and Land cover mapping.	Figs. 7.4; 7.5; 7.6
Drainage pattern/map.	Fig. 3.1; Fig. 3.2
Soil map.	Fig. 6.1; Fig. 6.2
Geo-physical features, slope and relief maps.	Fig. 3.5; Fig. 3.6; Fig. 3.8; Fig. 3.9
4.0. Socio-economic Aspects	
4.1. Use of water: To identify all direct and indirect use of water (drinking, washing/bathing, agricultural and other purposes) in the study stretch-though consultation with local communities, officials of the Government Departments.	Page: 11-10; Table 11.5
4.2. Information on water borne disease through community consultation and sample household level survey	Page: 15-7
4.3. Land details (agricultural, van panchayat or forest land required for the project)	Page: 13-5; 13-9
4.4. Demographic profile	Page: 13-3 to 13-4; 13-7 to 13-9
4.5. Ethnographic profile	Page: 13-2 to 13-3
4.6. Economic Structure	Page: 13-6; 13-11 to 13-12
4.7. Development profile	Page: 13-4; 13-6
4.8. Agriculture practices	Page: 13-6; 13-11
4.9. Cultural and aesthetic sites	Page: 13-1 to13-2
4.10. Infrastructure facilities: education, health, hygiene, communication, network, etc.	Page: 13-3 to 13-12

4.11. Impact on socio-cultural and ethnographic aspects due to dam building.	Page: 15-7
4.12. Community use of the natural flora and fauna	Page: 8-37 to 8-39
Report would include list of all the project Affected Families with their names, education, land holdings, other properties, occupation.	Page: 13-14 to 13-16
5.0. Downstream impact on water, land and human environment due to drying up of river in the stretch between dam site and power house site.	Page: 15-3; 15-11
6.0. Collection of data pertaining to water (Physico-chemical and biological parameters), air and noise environment and likely impacts during construction and post construction period.	Page: 11-1 to 11-6; 12-2 to 12-6
7.0. Positive as well as negative impacts likely to be accrued due to the project are to be listed.	Table 15.1
8.0. Air and Noise Environment	
8.1 Baseline information on ambient air quality in the project area covering aspects like SPM, RSPM, Sox, Nox.	Page: 12-2 to 12-6
8.2. Noise environment.	Page: 12-5 to 12-6
8.3. Use of TBM need to be explored. For conventional controlled blasting the charge density, amount of delay and schematic plan etc. need to be provided.	Page: 17-1 to 17-11 in EMP
8.4. Traffic density in the project area.	Page: 12-2
9.0. Construction methodology and schedule	Page: 17-1 to 17-11 in EMP
B. IMPACT PREDICTION	
Impact prediction is a way of mapping the environmental consequences of the significant aspects of the project and its alternatives. Environmental impact can never be predicated with absolute certainty and this is all the more reason to consider all possible factors and take all possible precautions for reducing the degree of uncertainty.	
The following impact of the project should be assessed:	
1.0. Air	
1.1. Change in ambient levels and ground level concentrations due to total emissions from point, line and area sources	Page: 15-6 to 15-7
1.2. Effects on soils, materials, vegetation and human health.	Page: 15-2; 15-3
If DG sets are to be used for construction power, then the impact of emissions on the vegetation and air environment.	Page: 15-6 to 15-7
2.0. Noise	
2.1. Changes in ambient levels due to noise generated from equipment and movement of vehicles	Page: 12-2
2.2. Effect on fauna and human health	Page: 15-7
3.0. Water	

3.1. Changes in quality	1Page: 15-5 to 15-6
3.2. Sedimentation of reservoir	Page 15-3
3.3. Impact on fish fauna, their population and migratory behaviour, spawning and breeding biology	Page: 15-6; 15-10
3.4. Loss of riparian vegetation	Page: 15-10
3.5. Impact of sewage disposal	Page: 15-5 to 15-6
4.0. Land	
4.1. Changes in land use and drainage pattern	Page: 15-3 and 15-9
4.2. Changes in land quality including effects of waste disposal	Page: 15-4 to 15-5
4.3. Riverbank and their stability	Page: 15-12
4.4. Land slide and flood scenario	Page 15-3
5.0. Biological	
5.1. Deforestation and shrinkage of animal habitat	Page: 15-9
5.2 Impact on fauna and flora (including aquatic species if any) due to decreased flow of water	Page: 15-4 to 15-5
5.3. Impact on rare and endangered species, endemic species, and migratory path/ route of animals, if any.	Page: 15-4 to 15-5
5.4. Impact of edge degradation and fragmentation on the natural habitats (protected or otherwise) in the vicinity of the project.	Page: 15-4
5.5. Impact on breeding and nesting grounds	Page: 15-5
5.6. Impact of impoundment and construction activities on the vegetation.	Page: 15-4 to 15-5
5.7 Indicate the nature, magnitude and extent of any direct, indirect or cumulative impacts on the terrestrial flora and fauna of the Biosphere Reserve/ other protected areas.	Page: 14-13 to 15-18
6.0. Socio-Economic	
6.1 Impact on the local community including demographic changes (including food, medicinal plants, agricultural pesticides etc.)	Page: 15-3 and 15-10
6.2 Impact on cultural properties like archaeological, paleontological, historical, religious, pilgrim properties and sacred groves.	Page: 15-7 to 15-8
6.3. Impact on economic status	Page: 15-8
6.4. Impact on human health, hygiene and communicable disease risks due to the construction and operation of the project	Page: 15-7
6.5 Impact of the immigrant labour and project personal on the local environment and on the host population, including health risks such as HIV/AIDS.	Page: 15-7
6.6. Impact of increased traffic	Page: 15-6
C. ENVIRONMENT MANAGEMENT PLAN	

On the basis of predicted environment impacts, Environment Management plans will be formulated with precise action plans incorporating year-wise physical and financial targets. The EMP shall include the following Action Plans:	**EMP Report**
1. **Catchment Area Treatment Plan**	
Delineation of micro-watersheds in the river catchment and mapping of critically degraded areas requiring various biological and engineering treatment measures. Identification of areas for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of AISLUS coupled with ground survey. The prioritization of watershed for treatment based upon SYI. Spatial information in each micro watershed should be earmarked on maps in the scale of 1:50,000. The CAT plan would be prepared with year-wise Physical and Financial details.	Page: 8-1 to 8-25; Figs. 8.1 to 8.8
2. **Creation of Green Belt Plan around the Periphery of the Reservoir**.	Page: 9-1 to 9-9
3. **Biodiversity Conservation and Management Plan** for conservation and preservation of endemic, rare and endangered species of flora and fauna (in consultation with the State Wildlife Department). The applicable policy and legal provisions related to protection and conservation of flora, fauna and biodiversity in India and in Uttarakhand.	Page: 11-1 to 11-8
4. **Reservoir fisheries development** for conservation/ management of fishes.	Page: 12-1 to 12-4
5. **Resettlement & Rehabilitation (R&R) Plan** along with social/ community development plan. R&R plan would be framed in consultation with the Project Affected Persons (PAPs), Project authorities and the State Government.	Page: 13-1 to 13-27
6. **Muck Disposal Plan** (Suitable sites for dumping of excavated materials would be identified in consultation with the State Pollution Control Board and Forest Department).	Page: 2-1 to 2-7; Figs. 2.1 to 2.4
7. Restoration and Landscaping of Working Areas: reclamation of borrow pits (quarry sites) and construction areas.	Page: 6-1 to 6-7
8. **Public Health Delivery System** establish the sewage treatment facility in the project area and minimize the spreading of water born disease in the area.	Page: 5-1 to 5-5
9. **Energy Conservation Measures**	Page: 4-1 to 4-4
10. **Solid Waste Management Plan** for domestic waste from colonies and labour camps etc.	Page: 3-1 to 3-6
11. **Water and Air Quality & Noise Environment Management** during construction and post-construction periods.	Page: 7-1 to 7-4
12. Environmental Monitoring Programme (with Physical & Financial details covering all the aspects from EMP).	Page: 15-1 to 15-8
13. **A summary of cost estimate for all the plans**	
Cost for implementing all the Environmental Management Plans including the cost for implementing Environmental Monitoring Programme.	Page: 19-1
ADDITIONAL TOR, MARCH 2007	
Three seasons (pre-monsoon, monsoon and post monsoon) data for environment baseline parameter to be provided.	Page: 2-2 of EIA

Snow-fed and rain-fed catchment to be demarcated. Rainfall-runoff data to be given	Fig. 7.1,Fig. 7.4of EIA
Sedimentation rate to be estimated.	Page: 4-8 of EIA
Lean season downstream release of water to be specified. The study of comprehensive downstream Impact shall also include area up to 10 kms downstream of the confluence of TRC with river and shall address overall ecological impact.	Page: 14-1 to 14-8;
Use of TBM need to be explored for conventional controlled blasting the charge density, amount of delay and schematic plan etc need to be provided.	Page: 17-1 to17-11 of EMP
List of microflora (Cryptogram) to be provided.	Page 8-32 to 8-32 of EIA
False colour composite map to be provided.	Fig. 7.1 of EIA
The proposed TOR does not specify any action vis-à-vis the Project area being highly sensitive to earthquake and landslide. A study of site specific earthquake design parameters is necessary for these Projects. The water availability of the Project in the PFR is based on regional model and does not take into account snowfed and rainfed catchment. Moreover no rainfall-run off data was used	Annexure-V in the supplementary information regarding site specific seismic design parameters having been finalised by IIT, Roorkee and approved by an CSDP, CWC. The site specific hydrology is based on DPR and given in Chapter 4 of EIA report.
ADDITIONAL TOR, MARCH 2011	
Revised form-I to be submitted along with revised land requirement.	Submitted
Riparian flow to be 20% of average discharge of 04 leanest month, higher during other season and 30% of the 90% dependable flow in the 10 daily periods during monsoon.	Reconsiderd
Table consisting of 10 daily discharge rainfall values for the entire year should be given. Actual rain fall data may be provided.	Secondary data is not available.
A distance of at least 1 km free river reach between the TWL discharge point of the U/S project to be maintained with normal uninterrupted river flow.	Page: 1-15 to 1-16 of EIA
The lateral distance of the base of the muck retaining structures to be at least 30 m away from the river bed at HFL with proper approach road.	Page: 2-1 to 2-7; of EMP Figs. 2.1 to 2.4 of EMP
GLOF Studies to be conducted.	Page: 4-9 to 4-25 of EIA
Study on impact on aquatic ecology due to higher submergence may be carried out.	Page: 15-3 to 15-4 of EIA
Possibility of introducing fish into the riverine stretch/ reservoir area shall be explored. Accordingly , a fish ladder may be provided.	Page: 12-1 to 12-4 of EMP
A chapter providing detailed schemes for improving the health, education and livelihood of the local people should be provided.	Page: 5-1 to 5-5; 13-8 to 13-22 of EMP
Drinking water may be provided.	Page: 13-26 of EMP

Pre work Videography of springs and overland structures along the HRT route shall me carried out and documented and any damage due to project activity and the affected people shall be compensated.	Page: 16-1 to 16-3 of EMP
REVISED ADDITIONAL TOR, APRIL 2012	
The minimum continuous release from the barrage as environmental flow during lean season will be 2.97 cumec. During other seasons the release has to be higher and during monsoon season, it will be 5 cumec. However, a site specific study should be conducted for environmental flow and whichever is higher shall be adopted Diurnal variation should be kept the minimum in releasing water from the dam.	Page: 14-1 to 14-8 of EIA

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Chapter 1

INTRODUCTION

1 INTRODUCTION

1.1 OBJECTIVE

The baseline study of environmental aspects regarding the developmental project is aimed towards the identification and prediction of likely impacts of the various activities on environmental variables. In consequence of the predicted impacts, a comprehensive Environmental Management Plan (EMP) is formulated to avoid or mitigate negative impacts. An EMP relies on the implementation of the suggested measures and regular monitoring of various plan.

1.2 IMPLEMENTATION ARRANGEMENT

EMP has been prepared to address the following issues. It describes the aim, area of the activities and responsibility of implementation of plan and monitoring system.

1.2.1 Restoration of Dumping Areas is a major issue in the hydro-electric project. A huge amount of the muck would be generated as a result of excavation of tunnels and quarry sites. The plan suggests that a part of the muck would be reutilized for various activities while remaining muck would be dumped at the environmentally sound location and rehabilitated. This plan will be carried out within project area. The plan would be implemented by the THDC India Ltd and monitored by the State Pollution control board.

1.2.2 Waste Management Plan includes the management of solid as well as liquid wastes, generated as result of migrant population for construction work. It highlights the procedure of reuse, recycle and refuse of waste in a sound manner. The plan will work within project components' area and project influence area. Project authority would implement this plan while it will be monitored by the State Pollution Control Board.

1.2.3 Fuel Wood and Energy Conservation Measures would applicable in the project component area as well as in affected villages. The main purpose of the plan is to avoid the exploitation of forest wood by coming workers. The labourers and villagers would be provided with appropriate alternatives like LPG and electricity. In addition, in order to efficient use of energy

improved chullahs, solar cookers will be distributed among the villagers and workers. This plan would be implemented by the project authorities.

1.2.4 Public Health Delivery System (PHDS) will be developed for the project workers and people of the influence area. Public health delivery system would be helpful in strengthening the health infrastructure in the periphery of the project. This activity would be confined in influence area and project components area. PHDS will be implemented by the project authorities in consultation with State Health Department.

1.2.5 Restoration of Construction Area is suggested in and around the project areas. It would include engineering works and plantation. It is a measure of reclamation of degraded sites and beautification. The areas of actions are beautification of permanent colony, rehabilitation of camp area, temporary colony after construction and rehabilitation of adit sites, etc. This plan would be implemented by the Environment Cell at the project authority.

1.2.6 Management of Water and Air Quality and Noise Level highlights mainly precautionary measures. The plan will be executed in the project component areas. These components would require monitoring at regular interval. The plan would be implemented by the project authorities and monitored by State Pollution Control Board.

1.2.7 Catchment Area Treatment Plan includes physical and biological measures of mitigation of the areas prone to severe and very severe erosion. The main objective of CAT plan is to check the soil erosion and sedimentation control management. The age of the project especially hydro-electric project relies on the strength of CAT plan. This activity would be confined in the catchment area. The progress of the work will be monitored by the Environmental Cell of THDC. Forest Department will ensure the participation of Van Panchayat and expert agency in the implementation of CAT plan.

1.2.8 Green Belt Development around the reservoir is a measure to check the siltation and stabilize the land slide in the periphery. Also, it increases the aesthetic value of the area. The plan will be implemented by the project authority.

1.2.9 Restoration of Quarry and burrow sites cover a detailed plan of reclamation of quarries and burrows. The plan will executed by project authorities with help of expertise.

1.2.10 Biodiversity Management Plan is aimed to maintain an integrated approach between local population, and forest and wildlife regarding their conservation. In order to strengthen the conservation measures, it would be helpful in providing the infrastructures and create awareness. It has been focused towards the preservation of traditional knowledge and native flora. This plan will be effective in the influence area of the project. State Forest Department will be implement biodiversity management plan. A biodiversity management committee, headed by the Chairman of State Biodiversity Board would monitor the progress of the plan.

1.2.11 Fishery Development & Downstream Management Plan would include reservoir fishery and fish ladder at the barrage while downstream management plan suggests maintenance of downstream with suitable environmental flow.

1.2.12 Rehabilitation and Resettlement Plan covers the compensation of project affected families and peripheral development. A well developed R & R plan not only establishes a congruous relationship between project authorities and local people but ensures the full participation in infrastructure development in the area. It highlights the opportunities of local people to involve directly and indirectly in the development of the project. The plan is formulated for the project affected families, affected villages and influence area, following the guidelines of National Policy on Rehabilitation & Resettlement (NPRR, 2007). It will be implemented jointly by the project authorities and district administration. A separate committee, headed by District Magistrate will be constituted to monitor the rehabilitation issues. The committee would be comprised of Member from district administration, project authorities, Panchayat, Local MLA, NGO, etc.

1.2.13 Disaster Management Plan would rely on the barrage breach scenario. In dam break condition, the plan would have provision of a well developed alarming system, rescue operation system, medical facilities, rehabilitation plan for affected area etc. The plan will be executed by district administration of Chamoli Garhwal.

1.2.14 Environmental Monitoring Programme would ensure the effective implementation of various management plans suggested in EMP report. In order to monitor the progress in the different plan state level as well as central level committees would be constituted. The committees would perform their function in consultation with different sub committees mentioned and project authorities. Also, Environmental Monitoring Programme would mention the responsibilities, assigned to various institutions.

1.2.15 Good Practice measures are proposed as precautionary measures, which would be helpful in avoiding any confliction between local inhabitants and project authorities.

1.2.16 Construction Methodology deals with the installation of various equipments at project component sites and schedule of their operation.

1.2.17 Summary of the Cost Estimates would include the cost of different plans suggested in EMP reports.

1.3 THDC ENVIRONMENT MANAGEMENT CELL (EMC)

The EMC of THDC will be responsible for the technical planning, implementation and monitoring of all environmental mitigation and compensation measures under THDC's responsibility outlined in EMP. The EMC will monitor mitigation measures that will be implemented by Contractor to ensure compliance with Constructor's Contract (CC). The EMC will work closely with the State Pollution Control Board (SPCB) and MoEF as appropriate.

Prior to the start of construction, the EMC will ensure the following:

i. The relevant environmental mitigation measures are reflected in the project contract
ii. Discussion with the government authorities participating in the project to develop procedures for inter-agency coordination and reporting
iii. Construction phase activities include appropriate environmental monitoring

During the construction and the operating phase, THDC, through the EMC, will ensure the implementation and monitoring environmental mitigation measures. The management of environment concern will include:

i. Developing and implementing the monitoring programs:
ii. Managing the subcontracts for specialist studies to ensure their performance
iii. Liaising and cooperating with the government authorities
iv. Preparing work and cost schedules for the monitoring programs
v. Conducting appropriate testing to ensure that the environmental mitigation measures are effective
v. Maintaining records for reporting to SPCB and MoEF
vi. Conducting internal and external audits to ensure compliance with the EMP and the procedures of THDC.
vii. Provide infrastructure facilities to various committees, involved in the monitoring and studies

1.4 ISO 14001 REQUIREMENTS

The criteria of ISO 14001 will be followed to improve the Environment Management System. It will include Environmental Policy, Planning, Implementation, and operation, Checking and Management review.

1.4.1 Environmental Policy

- Appropriate
- Commitment
- Framework of Environmental objectives
- Documented, implemented, Maintained
- Communicated
- Available to the Public

1.4.2 Planning

- Legal and other requirement
- Environmental aspects
- Objectives, Targets and Programme(s)

1.4.3 Implementation and Operation

- Resources, Roles, Responsibility and Authority
- Competence, Training and Awareness
- Communication
- Documentation

- Operation Control
- Emergency, Preparedness and Response

1.4.4 Checking

- Monitoring and Measurements
- Evaluation of Compliance
- Control of Records

1.4.5 Management Review

- Results of internal audits
- Communication from external interested parties
- Environmental performances
- Extent objectives
- Changing circumstances
- Recommendation for improvement
- Follow-up actions from previous reviewers

Chapter 2

RESTORATION OF DUMPING AREAS

2
RESTORATION OF DUMPING AREAS

2.1 INTRODUCTION

Project construction involves excavation and quarrying to shape many project components. The transportation and dumping of the muck trigger severe environmental consequences if not managed properly. Loose soils during transportation and in dumping piles increase the level of suspended particulate matter (SPM) in the air, it may lead to the phytoretardation, soils may leach out in nearby water bodies and high concentration of SPM becomes obnoxious. Thus, it would affect the human health, aquatic life and plant species adversely. Normally, the land is cleared before muck disposal. During clearing operation trees are cut, but undergrowth perishes as a result of muck disposal. During the process of dumping loose soils, boulders/large stone pieces move on slope and affect the water quality, benthic and fish fauna and other components of aquatic ecosystem. Generally muck disposal is carried out at low lying areas, which get filled up due to stacking of muck. This can sometimes affect the natural drainage pattern of the area leading to accumulation of water or partial flooding of some area.

To avoid adverse impacts described above, dumping area would require a proper restoration using engineering as well as biological measures. Engineering measures include the construction of retaining/sausage wall, process of compaction while biological measures includes plantation of suitable locally available soil binder species.

2.2 GENERATION OF MUCK AND UTILIZATION

A significant quantity of muck is expected to be generated as a result of construction of Dam, Head Race Tunnel (HRT), power house and other appurtenant work. The total quantity of muck including swelling factor has been estimated to be **8,06,921** cum (DPR, 2010). Based on the geological nature of the rocks and engineering properties of the soil, a part of the muck generated can be used as construction material. The balance needs to be suitably disposed.

Hence, the required raw materials would be met from the quarries and riverbed materials. Though, it is recommended that the utilization of the excavated muck from the powerhouse and dam

structures may be kept as standby for producing aggregates. Total quantity of **8,06,921** cum of muck is proposed for the restoration). Whereas capacity of these dumping sites to accommodate the muck is around **7,51,180** cum. Therefore, around **7,48,000** cum would be dumped at these sites (Table 2.1). Nearly 6,06,000 cum of muck would be dumped at DS-1, DS-2 & DS-3 (Zones 12 & 13). The muck generated from surge shaft and powerhouse complex and partially from HRT would be dumped at DS-4, DS-5 and DS-6 (Zone 14 and 9b). The capacity of these sites is **1,42,000 cum**. Nearly **59,000** cum of muck will be reutilized for various construction works.

Table 2.1 Details of muck to be generated in Jelam Tamak H.E. Project

S.No.	Area	Qty of muck to be generated (cum)	Qty of muck to be dumped	Disposal area (ha)	Dumping Zone
1	Barrage area & HRT	3,56,577	3,22,000	7.22	DS-1 & DS-2 (Zone-12a, b)
2	HRT & adits	1,28,000	2,84,000	0.85	DS-3 (Zone-13)
3	Surge shaft adits*	97,000	1,42,000	1.87	DS-6 (Zone-9b)
	Power house works*	2,25,344			DS-4 & DS-5 (Zone-14a, b)
	Total	**8,06,921**	**7,48,000**	**9.94**	

*Dumping site is common for surge shaft, adits, and power house work

2.3 DUMPING AREAS

In order to dispose off and to rehabilitate the generated muck, there is a provision of 9.94 ha of land come from 6 dumping sites (DS-1 to DS-6) (see Fig. 1.2b in EIA report). The plans for dumping areas are given in **Figures 2.1, 2.2, 2.3 and 2.4.** Total length of retaining wall for all dumping sites would be nearly 1887 m. Details of retaining wall including length and height and capacity to accommodate the muck is given in Table 2.2.

Two sites are identified for dumping of muck excavated from dam structure. The approximate distance between river high flood level and these sites are 30 m and 30-50 m, respectively (**Fig. 2.1a,b**). The muck generated from HRT and Adit would be dumped partially at DS-1 and DS-2 and partially at DS-3 (**Fig.2.2a**). The muck excavated from surge shaft, adits, and powerhouse works would be dumped at DS-4, DS-5 and DS-6 (**Fig. 2.3a,b and 2.4a**). The site is located at an approximate distance of 30 m from high flood level (HFL) of the river.

Table 2.2 Details of dumping sites and their capacity to accommodate the muck

S.No.	Area	Sites	Retaining wall		Capacity of Muck	Distance -
			Length (m)	Height (m)**	to be accommodated	HFL (m)
1	Barrage Area	DS-1, DS-2	1174	2	3,24,833	30, 30-50
2	HRT Adit	DS-3	338	2	2,84,111	30
3	Powerhouse Works*	DS-4, DS-5	-	-	-	-
4	Surge Shaft, Adits*	DS-6	375	2	1,42,236	30-50
	Total	**-**	**1887**	**-**	**7,51,180**	

*Retaining wall is common for surge shaft, adits, and power house work

** Height of base wall

2.4 SELECTION OF DUMPING SITES

During the examination of the dumping sites following standard criteria were preferred from the environment as well as economic point of view.

i) The dumping sites are located nearby the structures to be excavated to avoid the long distance transportation.

ii) The sites are free from active land slides or creeps and care was taken that the sites do not have a possibility of toe erosion related slope failure.

iii) The base levels of the sites are at higher elevation than the maximum flood level.

iv) The sites are on the concave side of a meander belt.

v) There is no water channel flowing through the dumping sites.

vi) These sites are not pristine habitats containing threatened species.

vii) Care has been taken to keep adequate distance between dumping sites and high flood level of the river.

2.5 PROPOSED PLAN OF ACTION

Muck generated as a result of excavation of any project component is required to be disposed in a planned manner so that it takes a least possible space and is not hazardous to the environment. In the hilly area, dumping is done after creating terraces thus usable terraces are developed. The overall idea is to enhance/maintain aesthetic view in the surrounding area of the project in post-construction period and avoid contamination of any land or water resource due to muck disposal.

The muck rehabilitation plan involves both engineering and biological measures that depend on the terrain and eco-climatic conditions. Stability of the loosely held muck requires appropriate

method of consolidation and biological measures so that the muck is not easily eroded leading to subsequent ecological problems.

The basic aim and objectives of the muck management plan are to:

- Protect these areas from soil erosion
- Develop these areas by afforestation
- Develop them into parks, gardens etc.
- Utilize the maximum quantity of muck for development of infrastructure of the project

For stabilization of muck dumping areas following measures of engineering and biological measures have been proposed

2.5.1 Engineering Measures

2.5.1.1 *Retaining walls*

The total length of retaining wall would be 1887 m (approx) with maximum at dumping site DS-1 and DS-2. Retaining walls of 2 m height filled with plum concrete are proposed to hold the disposed muck. The base of the retaining walls shall be of M15 concrete for all the dumping sites. Gabions mattress (0.3 m) (Boulder wire crates) filled with stone shall be placed at the side. Muck will be disposed at an angle of repose less than 25°. Wherever required slopes may be broken into terraces to ensure slope stabilization. Total volume of retaining wall would be 4717.50 m^3. The Total volume of Gabions and Gabion mattress would be 28277.53 m^3. Total budget for retaining wall with the placement of Gabion would be **Rs. 7.51 crores** (Table 2.3).

Table 2.3 Cost estimates for different engineering measures at the dumping sites.

S. No.	Works	Quantity	Unit	Rate (Rs.)	Cost (Rs.) in lacs
A. Engineering Measures					
1.	M 15 Grade con. base wall I/c S/o all material, labour, T&P etc required for proper completion.	4717.50	M^3	4300.00	202.85
2.	Gabions mattress (Boulder wire crates) I/c S/o all material, labour, T&P etc required for proper completion of work.	5119.20	M^3	1940.00	99.32

S. No.	Works	Quantity	Unit	Rate (Rs.)	Cost (Rs.) in lacs
3.	Gabions (Boulder wire crates) I/c S/o all material, labour, T&P etc required for proper completion of work.	23158.33	M^3	1940.00	449.27
	Total				**751.44**

2.5.2 Biological Measures

Vegetative cover to a loose muck gives long term stability as compared to the retaining wall. It also controls the hydrological and mechanical effects on the soils and slopes. In order to provide the long term stability to dumping sites plantation and fencing are proposed in Jelam Tamak H.E. Project.

2.5.2.1 *Selection of Plant Species*

Plant species to be selected for the plantation includes tree, shrubs and herbs. The herbs and grasses are suitable to protect the surface while trees and shrubs hold the soil up to deeper level. The care would be taken that all species for the plantation should be native to avoid any possibility of invasion. All dumping sites are located in the elevation range above 2600 m. Thus, the area has temperate climate and major part of precipitation is received during July to September. Considering all these factors as well as the existing natural vegetation in the area, the species recommended for the plantation are listed in Table 2.4.

Table 2.4 Plant species for the plantation in dumping sites

Tree	Shrubs	Herbs
Aesculus indica	*Berberis aristata*	*Chrysopogon gryllus*
Acer laevigatum	*Cotoneaster* spp.	*Pennisetum flavidum*
Fraxinus xanthoxyloides	*Prinsepia utilis*	*Panicum milaecum*
Pinus wallichiana	*Sorbaria tomentosa*	*Melica percica*
Salix acmophila	*Lonicera* spp.	*Cymbopogon caesius*

2.5.2.2 *Plantation*

Total area that will be available for the plantation would be around 5 ha including slopes and top of disposal site. Saplings will be transplanted from the nurseries prepared for the CAT plan when these are 1 – 2 years old. The plantation can be carried out in the lines across the slopes usually following the contours to prevent the development of rill and trap material moving down to the

slopes. The brush layers and palisades can be used because their use controls erosion, catches, debris and provides strong and fibrous root reinforcement. The grasses planted in a line across a slope will provide a continuous chain of support in retaining debris and reinforcing soils and increasing the infiltration capacity of the area.

The sapling will be planted at 3 m intervals along the contour and 5 m. across it. In terraces planting will be done at 3 m intervals leaving 1 m space from the edge of the terrace. About 1000 seedlings shall be planted in a ha of land. The shrubs and herbs will be planted in interspaces. The plantation should be done in the monsoon season. For trees pits of 0.45 m x 0.45 m x 0.45 m will be dug and filled with some soil rich in nutrients. Compost from the local organic waste can be used for this purpose. For shrubs pits of 0.3 m x 0.3 m 0.3 m will be dug while trenches of suitable size in inter space will be used for the herbs. Thus total number of pits for tree species and shrubs would be nearly 10,000. The work plan formulated for revegetation of the dumping sites through Integrated Biotechnological Approach', is based on following parameters:

i) Evaluation of dumped material for their physical and chemical properties to assess the nutrient status to support vegetation.

ii) Formulation of appropriate blends of organic waste and soil to enhance the nutrient status of rhizosphere.

iii) Isolation and screening of specialized strains of mycorrhizal fungi, rhizobium, azotobacter and phosphate solubilizers (biofertilizers inoculum) suitable for the dumped material.

v) Plantation of dumping sites/areas using identified blend and biofertilizer inoculum

The break up of budget for biological measures is given in Table 2.5.

Table 2.5 Total financial outlay for the biological measures at dumping sites of Jelam Tamak H.E. Project

S.N.	Particulars	Quantity	Rate (in Rs)	Amount (Rs. in lakhs)
1.	Rolling of Muck	Lump sum	-	6.50
2.	Pitting for trees (0.45 m x 0.45 m x 0.45 m)	5,000 pits	Rs. 33.00/pit	1.65
3	Pitting for shrubs (0.30 m x 0.30 m x 0.30 m)	5,000 pits	Rs. 33.00/pit	1.65
3.	Raising of plants (including nursery cost, manure,	10,000 plants	Rs. 30.00/plant	3.00

	transport etc.)			
4.	Biofertilizers	-	Lump sum	2.50
5.	Maintenance, watering, transport etc	(lump sum)		2.50
	Total			**17.80**

2.5.2.3 *Fencing*

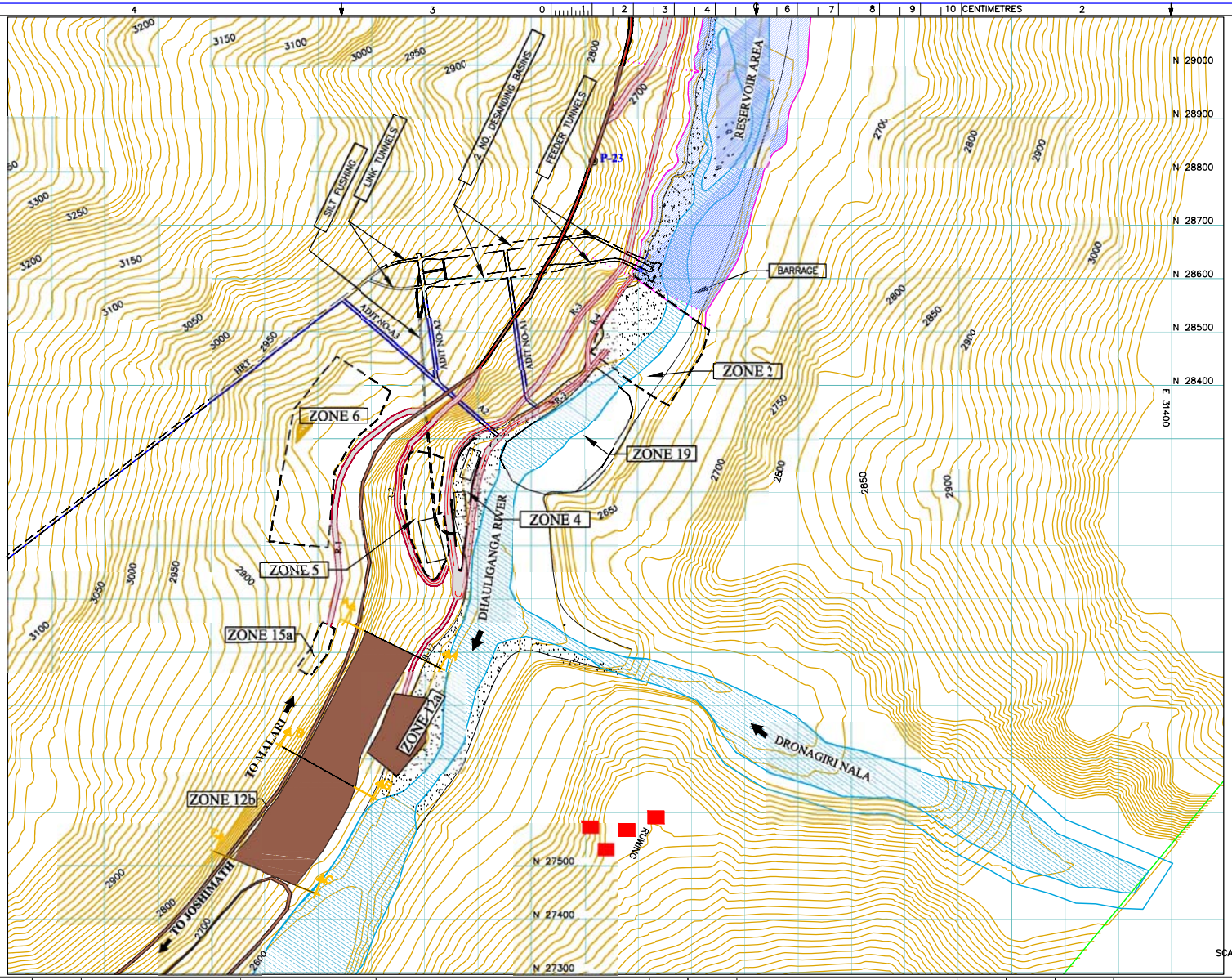
After plantation all dumping sites will be protected from the grazing by domestic animals and human disturbances. In order to the protection the fencing over the muck deposits is required temporarily. Barbed wire strands with 2 diagonal strands, clamped to wooden/concrete posts placed 3 m. apart is proposed for this purpose. Both the ends of the wooden fence posts should be coated with coal tar to ensure longevity of the intervention. Total budget for the fencing would be **Rs. 2.20 lakhs**.

2.6 COST ESTIMATES

Total cost for the restoration of dumping sites would be **Rs. 771.44 lakhs** only. It includes construction of retaining wall, gabions, plantation and fencing. The year wise break up of the budget is given Table 2.6.

Table 2.6 Year wise break up of the budget (Rs. In lakhs) for restoration of dumping areas

Particulars	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
1. Retaining wall						
Retaining wall	101.40	101.45	-	-	-	202.85
Gabions and Gabions mattresses	120.00	150.00	278.59	-	-	548.59
2. Plantation						
Rolling of Muck	-	-	-	6.50	-	6.50
Pitting	-	-	-	-	3.30	3.30
Raising of plants	-	-	-	-	3.00	3.00
Use of biofertilizers	-	-	-	-	2.50	2.50
Maintenance	-	-	-	-	2.50	2.50
3. Fencing	-	-	-	-	2.20	2.20
Total	**221.40**	**251.45**	**278.59**	**6.50**	**13.50**	**771.44**



AREA OF ZONE-12a =10680 Sq. m.
AREA OF ZONE-12b =53738 Sq. m.
TOTAL =64418 Sq. m.
=6.44 Ha.

CAPACITY=11.56 Lac Cum.

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. FOR DETAILS OF CIVIL STRUCTURES, REFER RELEVANT CIVIL DESIGN DRAWINGS.
3. REFER PLATE VI B–12.1 & VI B–12.2 FOR CROSS SECTIONS.

SCALE 1 : 7500 (75 0 75 150 225 300 375m)

Fig.2.1 Plan of muck dumping site DS-1 & DS-2 (Zone-12a & 12b) of Jelam Tamak H.E. Project

Issue	Revision	Date	Distribution & Status	Drawing No.	Title	Revision	Date	Description	By	Verified	Approved
ISSUE REGISTER				REFERENCE DRAWINGS		REVISIONS					

SNC•LAVALIN Engineering India

V.Batta, Project Director	18.10.2012, Date
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Zkirullah, Drawn	Antu P.K., Verified
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Client: THDC INDIA LIMITED

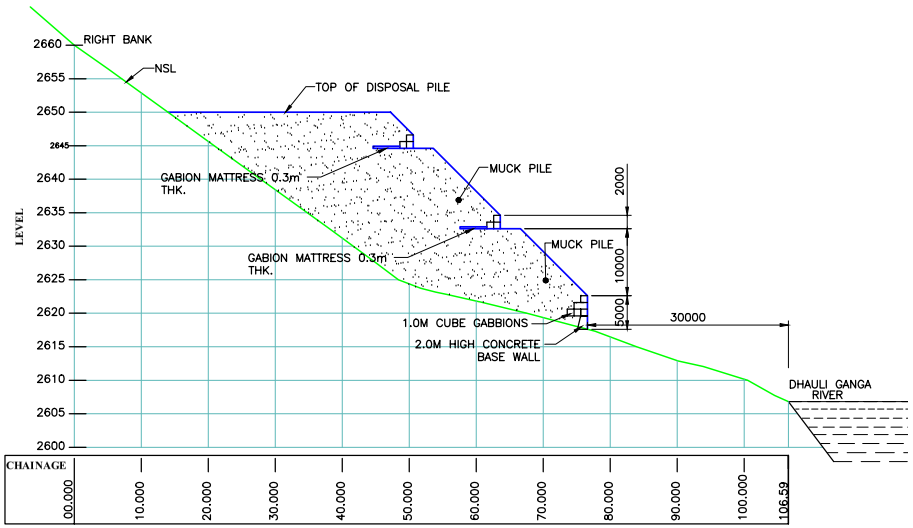
Project: JELAM TAMAK HYDROELECTRIC PROJECT Uttarakhand, India.

Title: ZONE–12a & 2b MUCK DISPOSAL AREA

Drawing No.

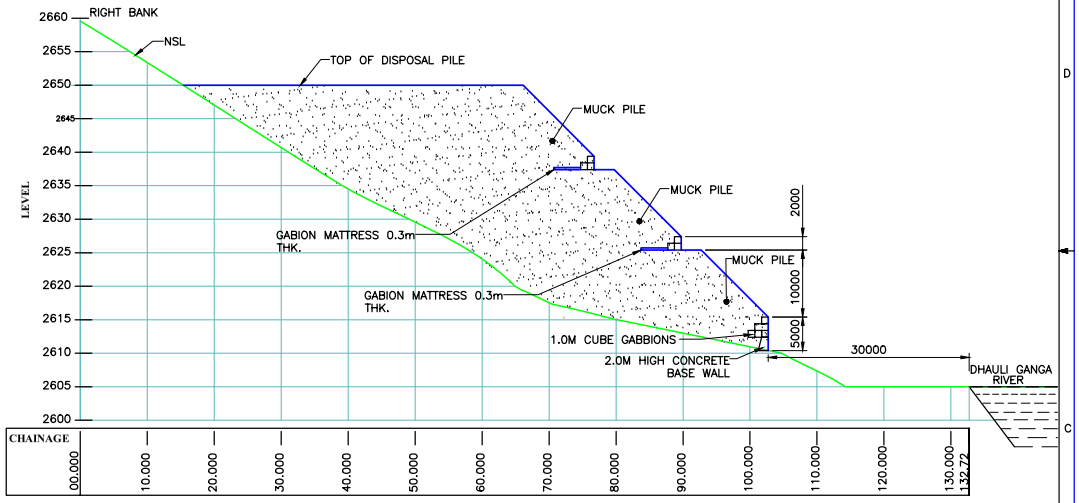
169101	JT–34 | 41DD	1014	00
Project No.	Drawing Code.	Serial.	Rev.

Format A3 (mm)



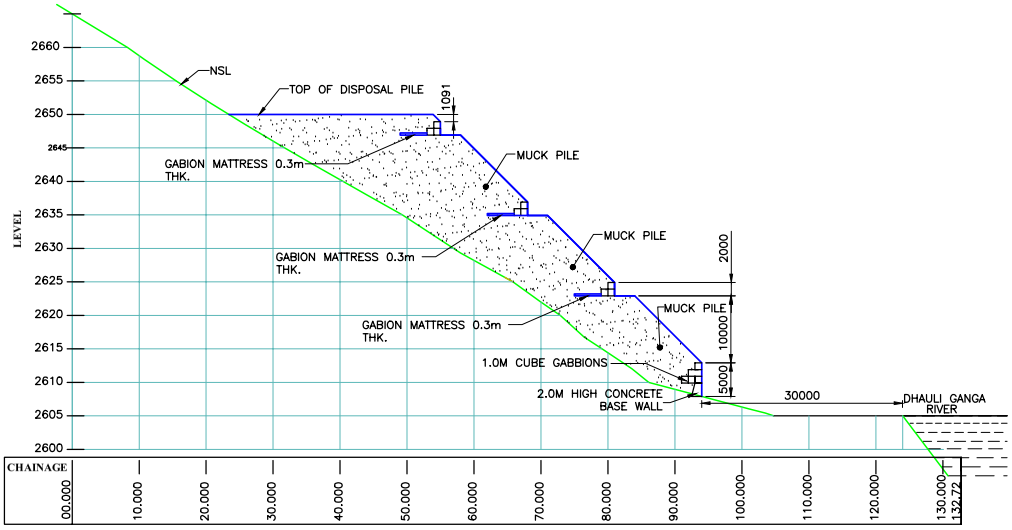
SECTION X-X DISPOSAL AREA ZONE 12a =822 Sq.m.

(SCALE 1:750)



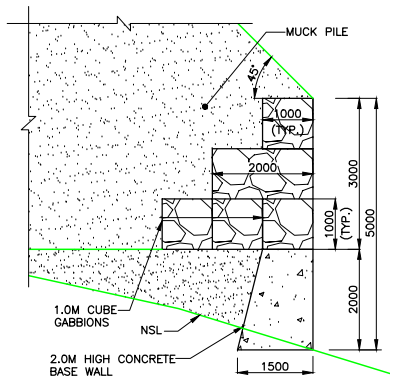
SECTION Y-Y DISPOSAL AREA ZONE 12a =1428 Sq.m.

(SCALE 1:750)



SECTION Z-Z DISPOSAL AREA ZONE 12a =754 Sq.m.

(SCALE 1:750)



TYPICAL DETAIL OF CONCRETE BASE WALL

(SCALE 1:100)

AREA AT SEC A (SQ.M)	AREA AT SEC B (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
822	1428	1125	73	82125

AREA AT SEC B (SQ.M)	AREA AT SEC C (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
1428	754	1091	70	76370

VOLUME OF DISPOSAL ZONE 12a = 158495 Cum.

NOTE:–

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS REFER PLATE VI B–12.
3. REFER PLATE VI B–12.2 ALSO.

SCALE 1 : 100 — 1.0 0 1.0 2.0 3.0 4.0 5.0m

SCALE 1 : 750 — 7.5 0 7.5 15.0 22.5 30.0 37.5m

Fig.2.1a Cross section of muck dumping site (DS-1) (Zone-12a)

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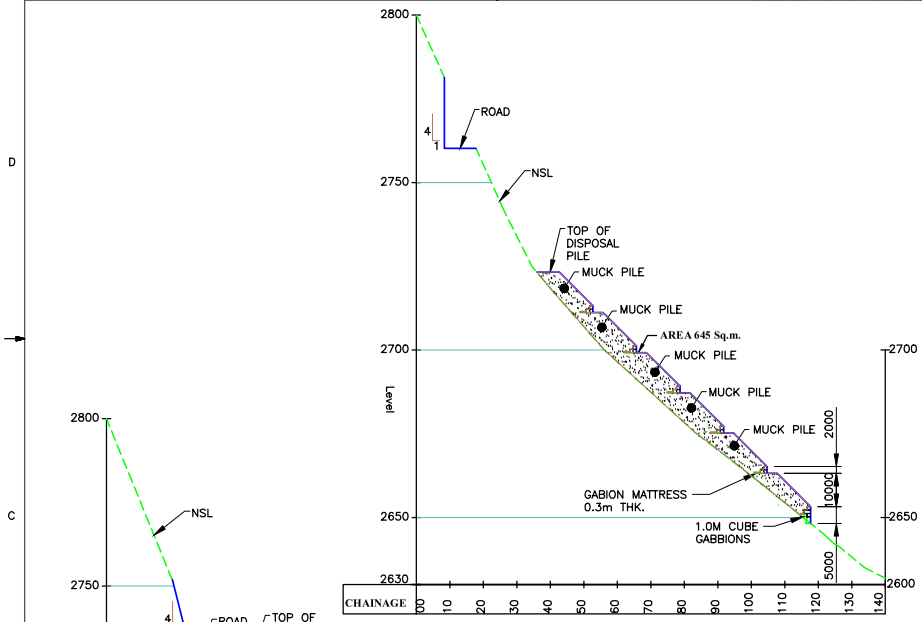
Project: JELAM TAMAK HYDROELECTRIC PROJECT Uttarakhand, India.

Title: ZONE–12a MUCK DISPOSAL AREA CROSS SECTIONS

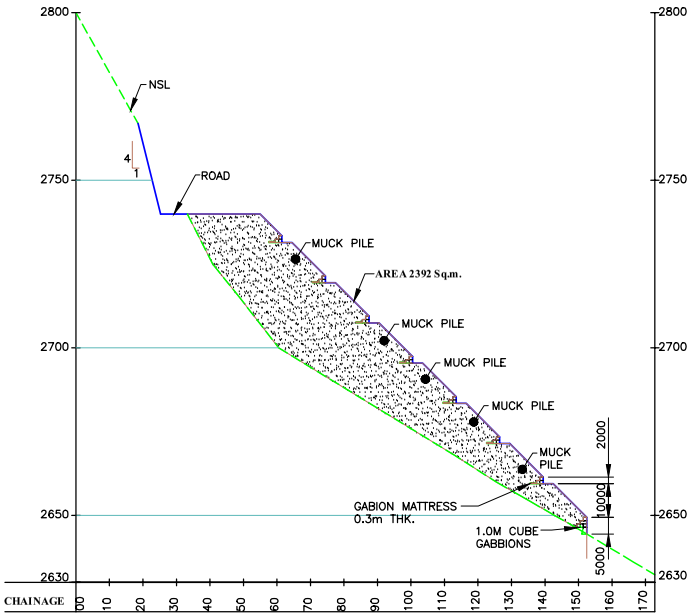
Drawing No.

169101	JT–34	41DD	1015	00
Project No.	Drawing Code.		Serial.	Rev.

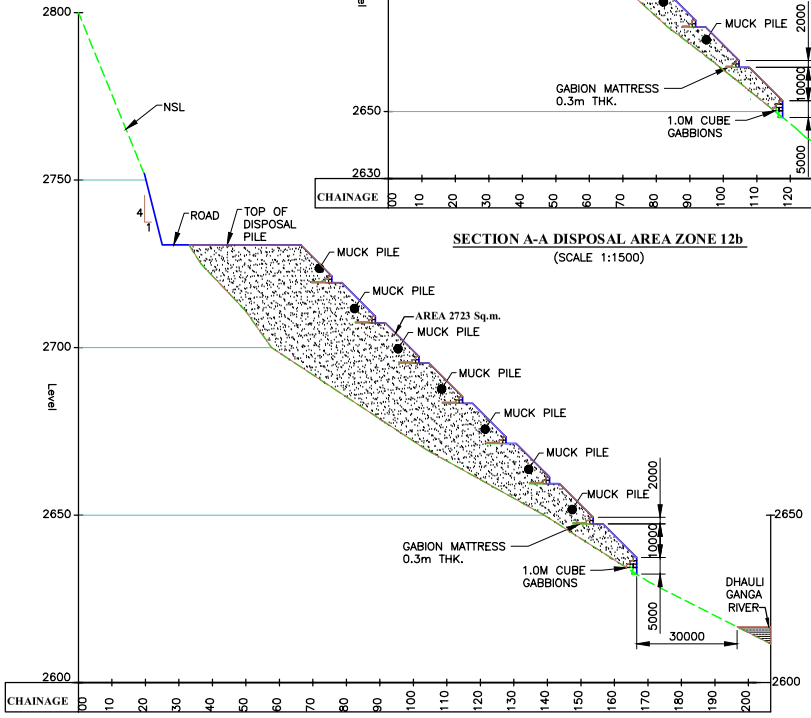
Format A3 (mm)



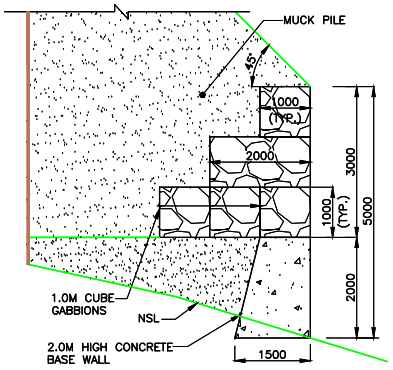
SECTION A-A DISPOSAL AREA ZONE 12b
(SCALE 1:1500)



SECTION B-B DISPOSAL AREA ZONE 12b
(SCALE 1:1500)



SECTION C-C DISPOSAL AREA ZONE 12b
(SCALE 1:1500)



TYPICAL DETAIL OF CONCRETE BASE WALL
(SCALE 1:100)

AREA AT SEC A (SQ.M)	AREA AT SEC B (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
645	2392	1519	268	407092

AREA AT SEC B (SQ.M)	AREA AT SEC C (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
2392	2723	2558	231	590898

TOTAL VOLUME OF DISPOSAL = 997990 Cum.
=9.98 Lac Cum.

TOTAL VOLUME OF ZONE-12a & ZONE-12b
=1.58 +9.98
=11.56 Lac Cum.

NOTE:–
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS REFER PLATE VIB–12.

SCALE 1 : 100 — 1.0 0 1.0 2.0 3.0 4.0 5.0m

SCALE 1 : 1500 — 15 0 15 30 45 60 75m

Fig.2.1b Cross section of muck dumping site (DS-2) (Zone-12b)

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Zikrullah	Antu P.K.	Drawn / Verified
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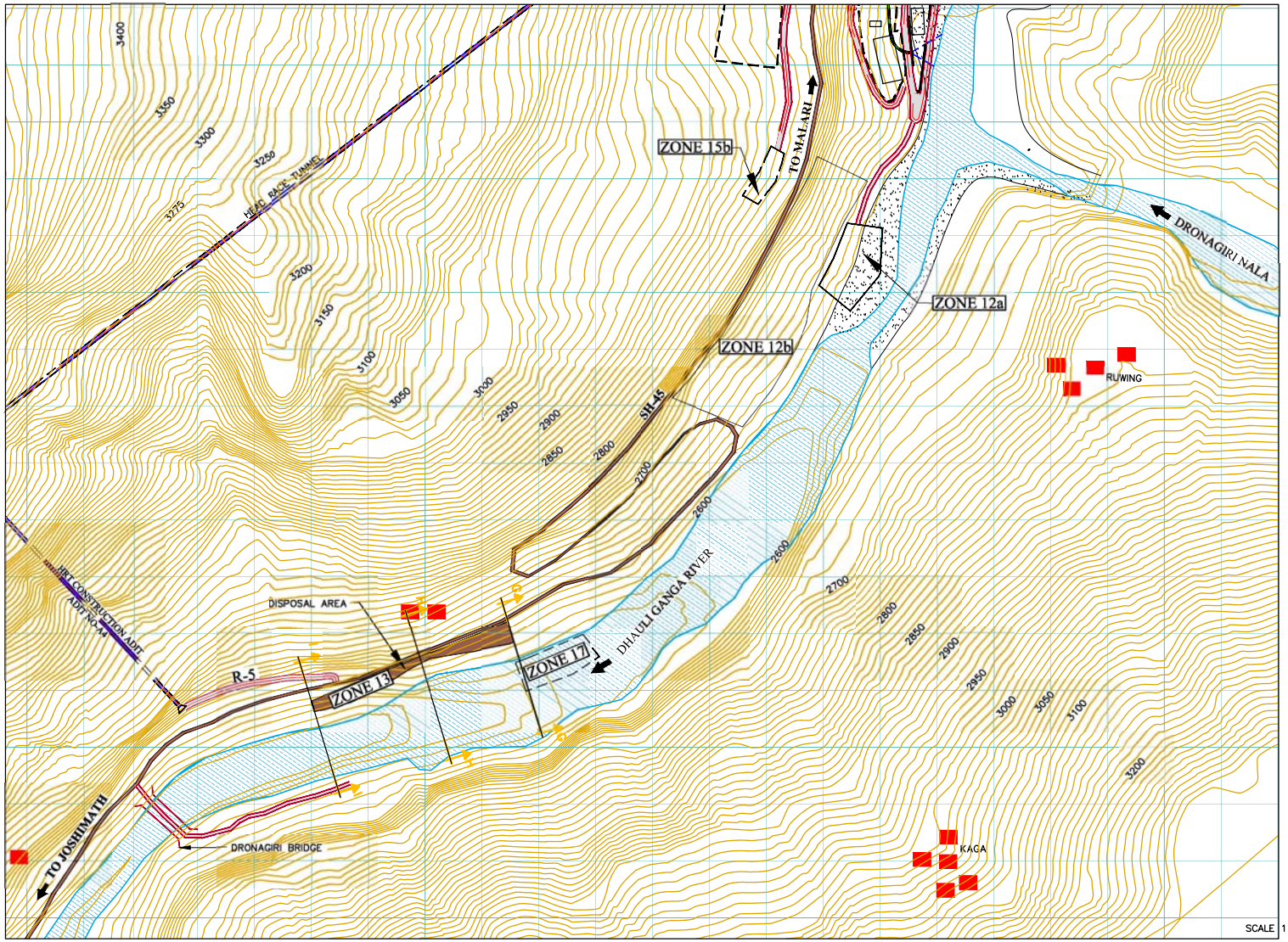
Project: JELAM TAMAK HYDROELECTRIC PROJECT
Uttarakhand, India.

Title: ZONE–12b
MUCK DISPOSAL AREA
CROSS SECTIONS

Drawing No.

Project No.	Drawing Code.	Serial.	Rev.
169101	JT–34 | 41DD	1016	00

Format A3 (mm)



AREA OF ZONE-13 =0.85 Ha.
Capacity =0.48 Lac Cum.

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. FOR DETAILS OF CIVIL STRUCTURES, REFER RELEVANT CIVIL DESIGN DRAWINGS.
3. REFER PLATE VI B–13.1 FOR CROSS SECTIONS.

SCALE 1 : 7500 — 75 0 75 150 225 300 375m

Fig.2.2 Plan of muck dumping site DS-3 (Zone-13) of Jelam Tamak H.E. Project

Issue	Revision	Date	Distribution & Status	Drawing No.	Title	Revision	Date	Description	By	Verified	Approved

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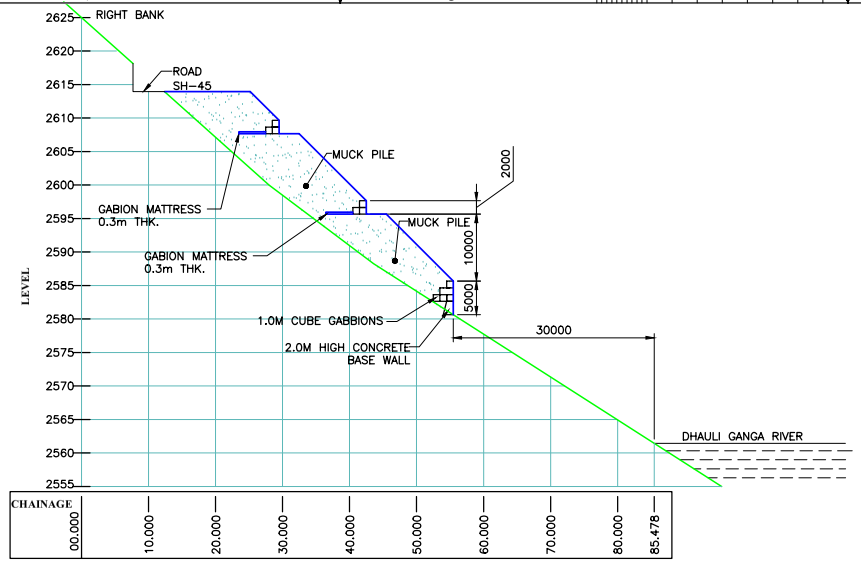
Uttarakhand, India.

Title: ZONE–13 DISPOSAL AREA

Drawing No.

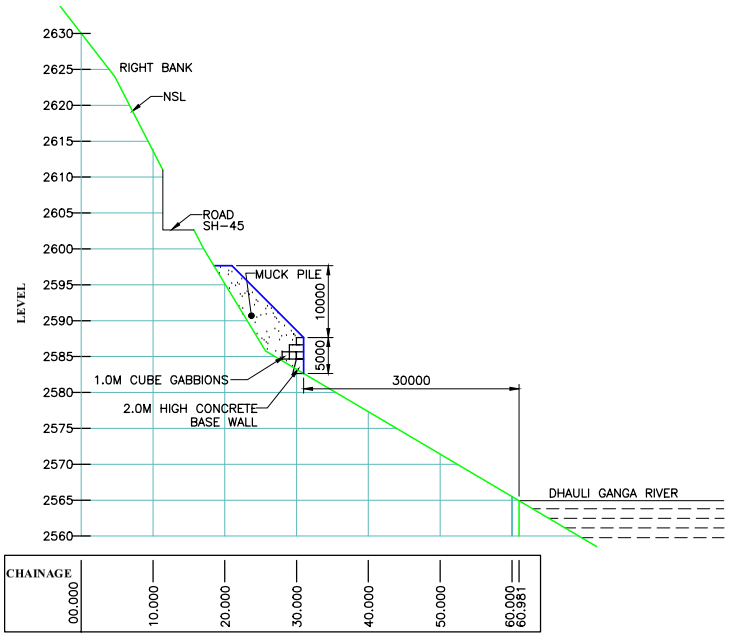
169101	JT–34	41DD	1017	00
Project No.	Drawing Code.		Serial.	Rev.

Format A3 (mm)



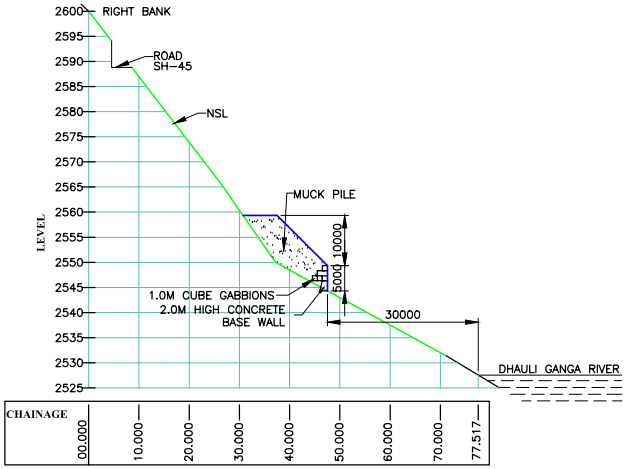
SECTION G-G DISPOSAL AREA ZONE 13 = 324 Sq.m.

(SCALE 1:750)



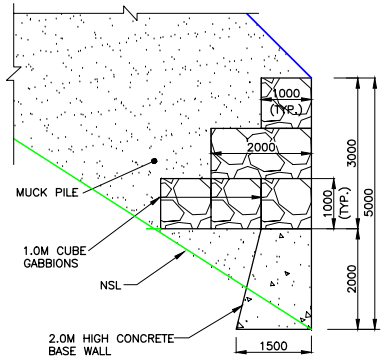
SECTION H-H DISPOSAL AREA ZONE 13 = 56 Sq.m.

(SCALE 1:750)



SECTION I-I DISPOSAL AREA ZONE 13 = 98 Sq.m.

(SCALE 1:1000)



TYPICAL DETAIL OF CONCRETE BASE WALL

(SCALE 1:100)

AREA AT SEC G (SQ.M)	AREA AT SEC H (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
324	56	190	166.88	31707

AREA AT SEC H (SQ.M)	AREA AT SEC I (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
56	98	77	205.46	15820

TOTAL VOLUME OF DISPOSAL = 47528 Cum.

NOTE:–
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS REFER PLATE VI B–13.

SCALE 1 : 100 — 1.0 0 1.0 2.0 3.0 4.0 5.0m

SCALE 1 : 750 — 7.5 0 7.5 15.0 22.5 30.0 37.5m

SCALE 1 : 1000 — 10 0 10 20 30 40 50m

Fig.2.2a Cross section of muck dumping site DS-3 (Zone-13)

Issue	Revision	Date	Distribution & Status	Drawing No.	Title	Revision	Date	Description	By	Verified	Approved
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V.Batta	18.10.2012	
Project Director	Date	
Mallappa S.M./ S. Aggarwal	R.K.Aeri	
Designed	Verified	
Zkrullah	Antu P.K.	
Drawn	Verified	169101–JT–34–41DD–1018–00
AS SHOWN	AutoCAD No.	
Scale		

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Client: THDC INDIA LIMITED

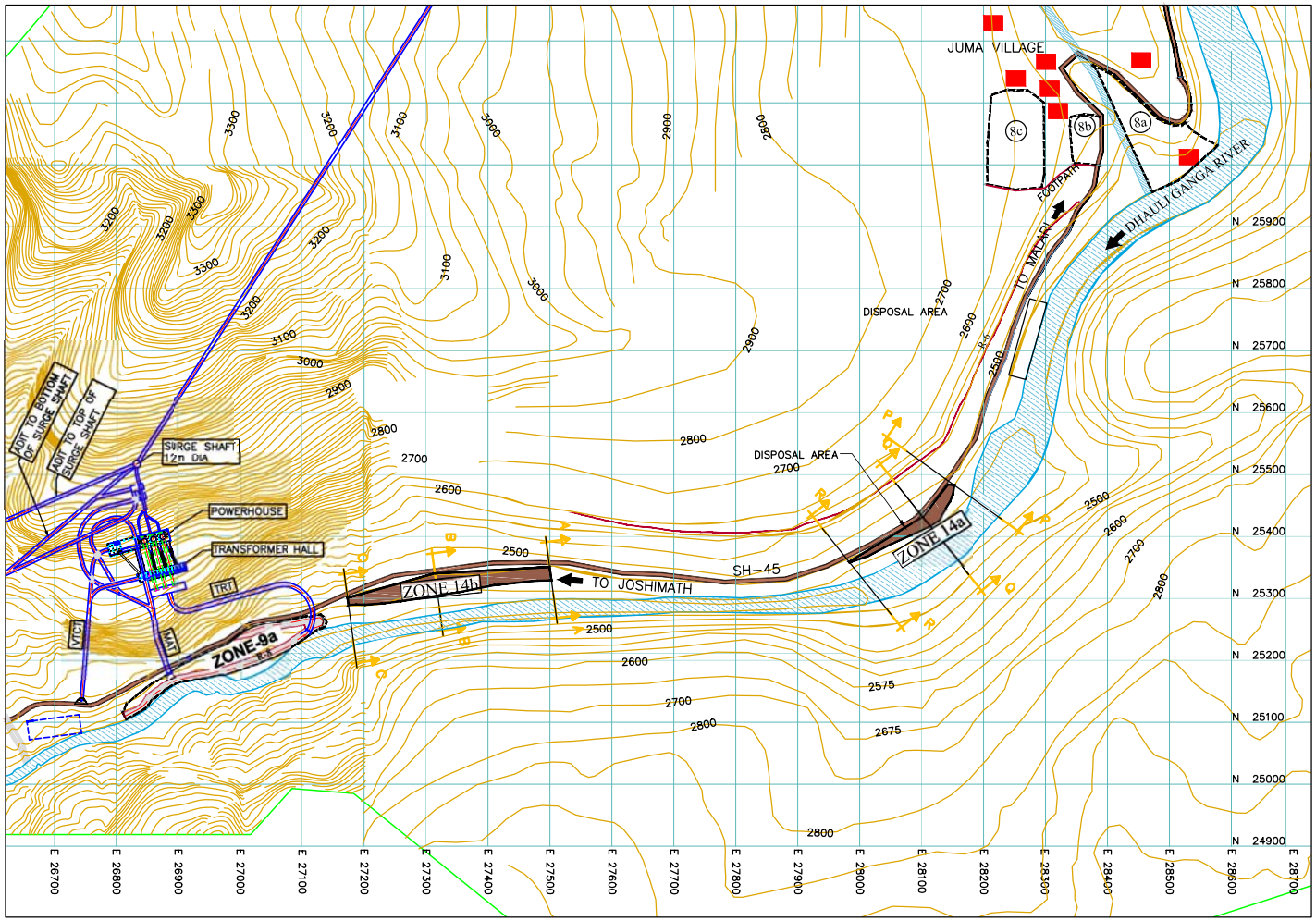
Project: JELAM TAMAK HYDROELECTRIC PROJECT Uttarakhand, India.

Title: ZONE–13 MUCK DISPOSAL AREA CROSS SECTION

Drawing No.

169101	JT–34	41DD	1018	00
Project No.	Drawing Code.		Serial.	Rev.

Format A3 (mm)



DISPOSAL AREA FOR MUCK FROM SURGE SHAFT AND POWERHOUSE COMPLEX
(APP. QUANTITY = 264.000 Cum)

AREA OF ZONE-14a = 0.30 Ha.
AREA OF ZONE-14b = 0.87 Ha.
TOTAL AREA OF ZONE-14 = 1.17 Ha.

CAPACITY OF ZONE-14a = 0.05 Lac Cum.
CAPACITY OF ZONE-14b = 0.45 Lac Cum.
TOTAL CAPACITY OF ZONE-14 = 0.50 Lac Cum.

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. FOR DETAILS OF CIVIL STRUCTURES, REFER RELEVANT CIVIL DESIGN DRAWINGS.
3. REFER PLATE VI B–14.1 & VI B–14.2 FOR CROSS SECTIONS.

SCALE 1 : 7500
75 0 75 150 225 300 375m

Fig.2.3 Plan of muck dumping site DS-4 & DS-5 (Zone-14a & 14b) of Jelam Tamak H.E. Project

Issue	Revision	Date	Distribution & Status	Drawing No.	Title	Revision	Date	Description	By	Verified	Approved
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Zikrullah	Antu P.K.	
Drawn	Verified	
1:7500	169101–JT–34–41DD–1019–00	
Scale	AutoCAD No.	

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Client: THDC INDIA LIMITED

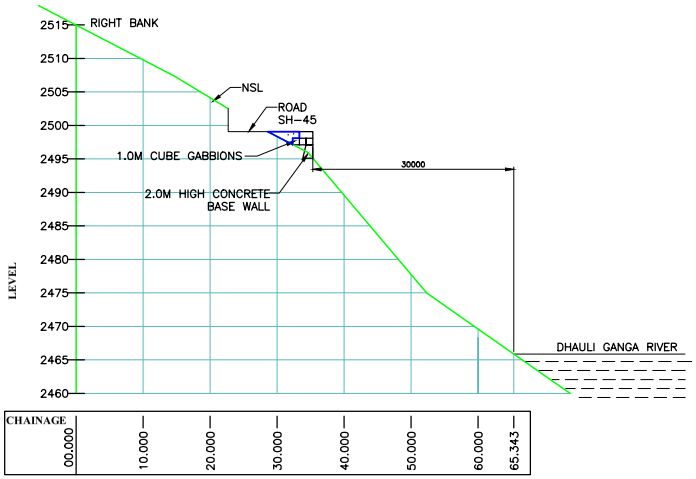
Project: JELAM TAMAK HYDROELECTRIC PROJECT
Uttarakhand, India.

Title: ZONE–14
DISPOSAL AREA NEAR JUMMA VILLAGE FOR SURGE SHAFT & POWER HOUSE

Drawing No.

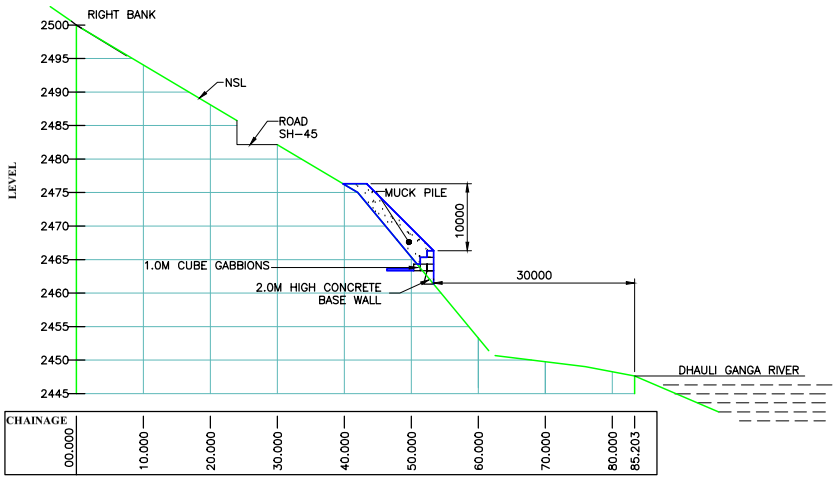
169101	JT–34	41DD	1019	00
Project No.	Drawing Code.		Serial.	Rev.

Format A3 (mm)



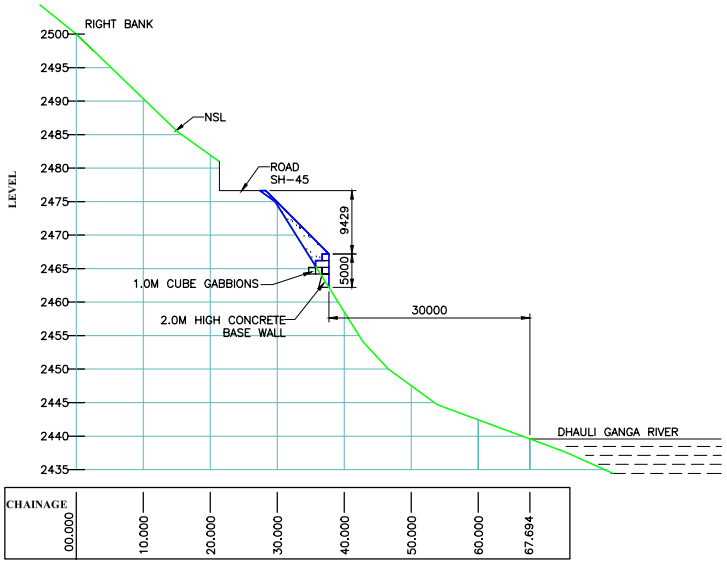
SECTION P-P DISPOSAL AREA ZONE 14a= 5 Sq.m.

(SCALE 1:750)



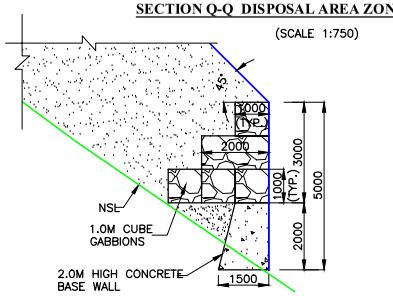
SECTION Q-Q DISPOSAL AREA ZONE 14a= 37 Sq.m.

(SCALE 1:750)



SECTION R-R DISPOSAL AREA ZONE 14a= 16 Sq.m.

(SCALE 1:750)



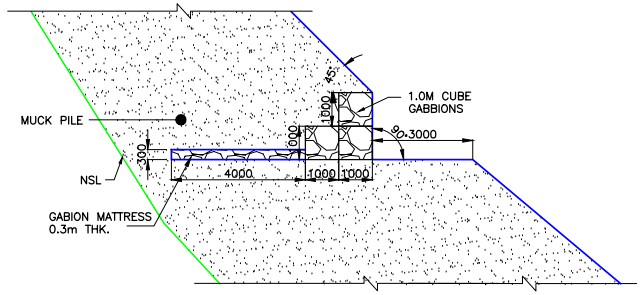
TYPICAL DETAIL 'A' OF CONCRETE BASE WALL

(SCALE 1:150)

AREA AT SEC P (SQ.M)	AREA AT SEC Q (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
5	37	21	74	1554

AREA AT SEC Q (SQ.M)	AREA AT SEC R (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
37	16	26.50	141	3736.50

TOTAL VOLUME OF DISPOSAL =0.05 Lac. Cum.



TYPICAL DETAIL 'B'

(SCALE 1:150)

NOTE:-
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS REFER PLATE VI B-14.
3. REFER PLATE VI B-14.2 ALSO.

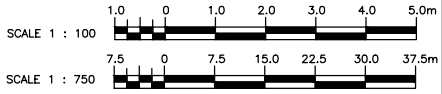


Fig.2.3a Cross section of muck dumping site DS-4 (Zone-14a)

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V.Batta	18.10.2012	
Project Director	Date	
Mallappa S.M./ S. Aggarwal	R.K.Aeri	
Designed	Verified	
Zikrullah	Antu P.K.	
Drawn	Verified	
AS SHOWN	169101-JT-34-41DD-1020-00	
Scale	AutoCAD No.	

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Client: THDC INDIA LIMITED

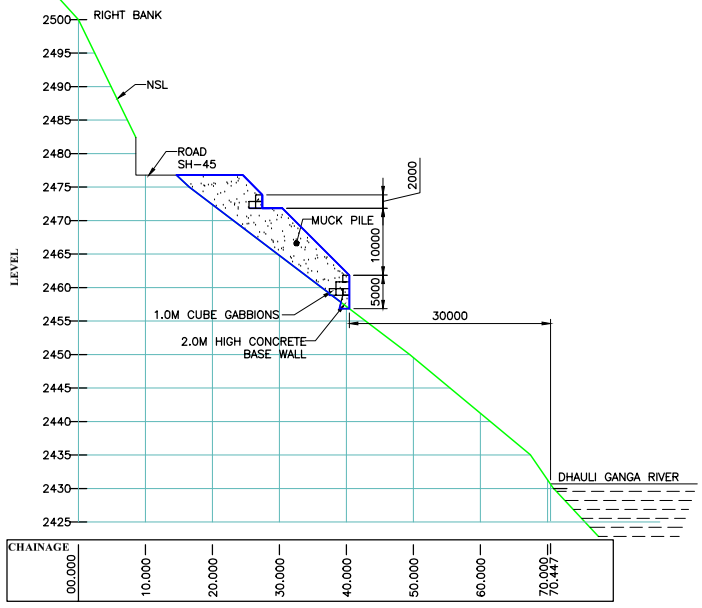
Project: JELAM TAMAK HYDROELECTRIC PROJECT Uttarakhand, India.

Title: ZONE-14a MUCK DISPOSAL AREA CROSS SECTION

Drawing No.

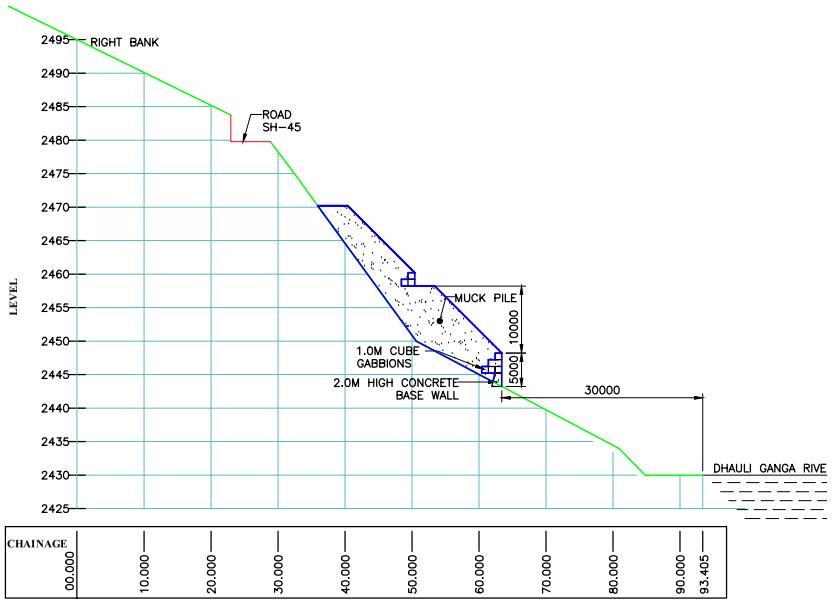
169101	JT-34 | 41DD	1020	00
Project No.	Drawing Code.	Serial.	Rev.

Format A3 (mm)



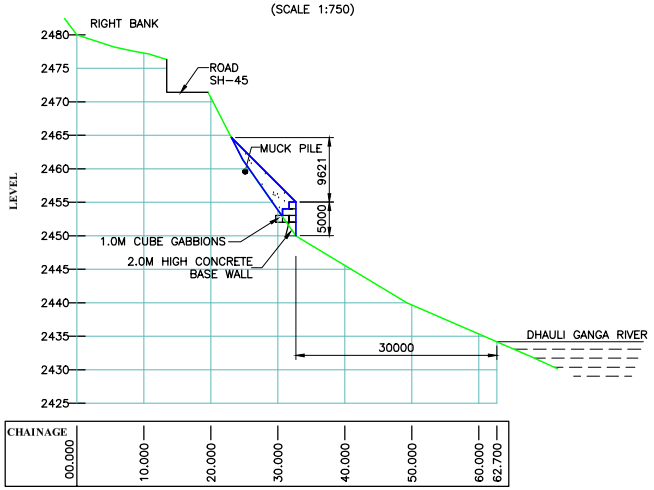
SECTION A-A DISPOSAL AREA ZONE 14b= 143 Sq.m.

(SCALE 1:750)



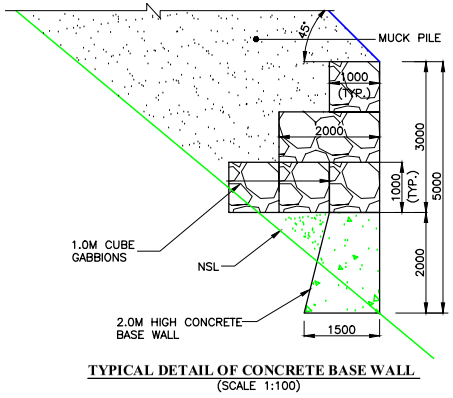
SECTION B-B DISPOSAL AREA ZONE 14b= 183 Sq.m.

(SCALE 1:750)



SECTION C-C DISPOSAL AREA ZONE 14b= 21 Sq.m.

(SCALE 1:750)



TYPICAL DETAIL OF CONCRETE BASE WALL

(SCALE 1:100)

AREA AT SEC A (SQ.M)	AREA AT SEC B (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
143	183	163	185	30155

AREA AT SEC B (SQ.M)	AREA AT SEC C (SQ.M)	AVERAGE AREA (SQ. M.)	LENGTH (M)	VOLUME (Cum.)
183	21	102	145	14790

VOLUME OF DISPOSAL 14b = 0.45 Lac Cum.

TOTAL VOLUME OF DISPOSAL ZONE 14a & 14b

0.05+0.45=0.50 Lac Cum.

NOTE:-

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS REFER PLATE VI B-14.
3. REFER PLATE VI B-14.1 ALSO.

SCALE 1 : 100 — 1.0 0 1.0 2.0 3.0 4.0 5.0m

SCALE 1 : 750 — 7.5 0 7.5 15.0 22.5 30.0 37.5m

Fig.2.3b Cross section of muck dumping site DS-5 (Zone-14b)

Issue	Revision	Date	Distribution & Status	Drawing No.	Title	Revision	Date	Description	By	Verified	Approved

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V.Batta	18.10.2012	Client:	THDC INDIA LIMITED
Project Director	Date		
Mallappa S.M./ S. Aggarwal	R.K.Aeri	Project:	JELAM TAMAK HYDROELECTRIC PROJECT Uttarakhand, India.
Designed	Verified		
Zikrullah	Antu P.K.	Title:	ZONE-14b MUCK DISPOSAL AREA CROSS SECTION
Drawn	Verified		
AS SHOWN	169101-JT-34-41DD-1021-00	Drawing No.	
Scale	AutoCAD No.		

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Project No.	Drawing Code.	Serial.	Rev.
169101	JT-34 41DD	1021	00

Format A3 (mm)

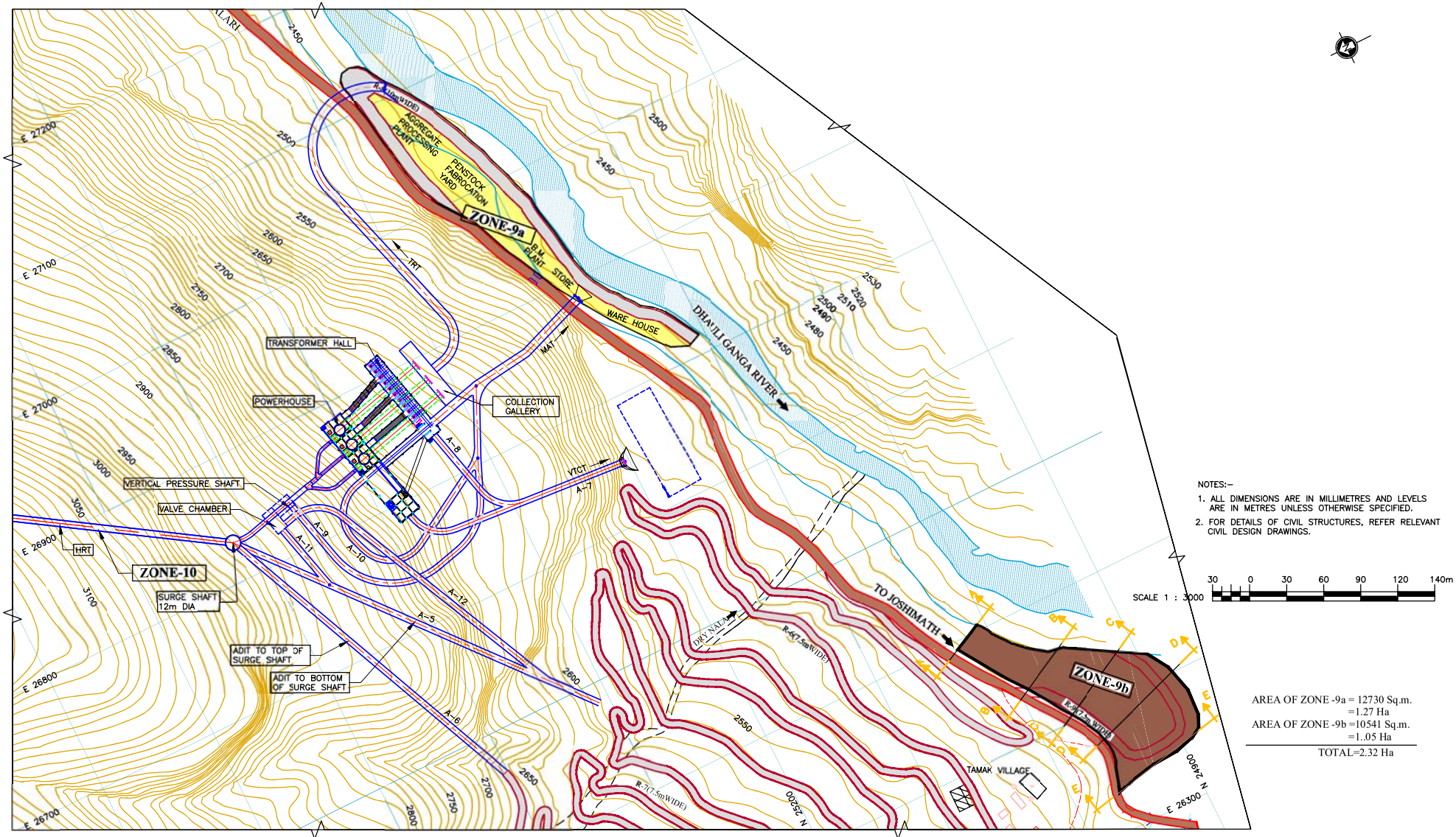

Fig.2.4 Plan of muck dumping site DS-6 (Zone-9b) of Jelam Tamak H.E. Project

Issue	Revision	Date	Distribution & Status	Drawing No.	Title	Revision	Date	Description	By	Verified	Approved

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Zikrullah, Drawn	Antu P.K., Verified
1:3000, Scale	169101-JT-34-41DD-1010-00, AutoCAD No.

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Client: THDC INDIA LIMITED

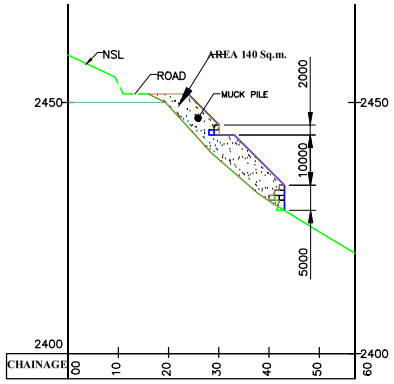
Project: JELAM TAMAK HYDROELECTRIC PROJECT Uttarakhand, India.

Title: ZONES–9a & 9b PENSTOCK FABRICATION YARD,CENTRAL WAREHOUSE, APP & BM PLANTS DISPOSAL AREA

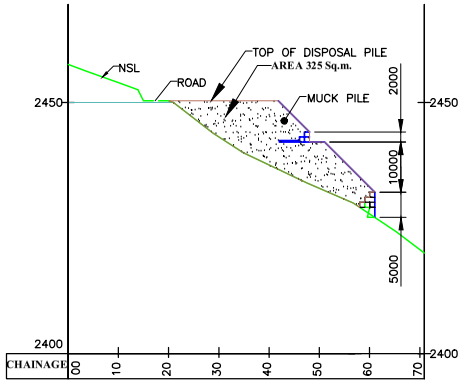
Drawing No.

Project No.	Drawing Code.	Serial.	Rev.
169101	JT–34 | 41DD	1010	00

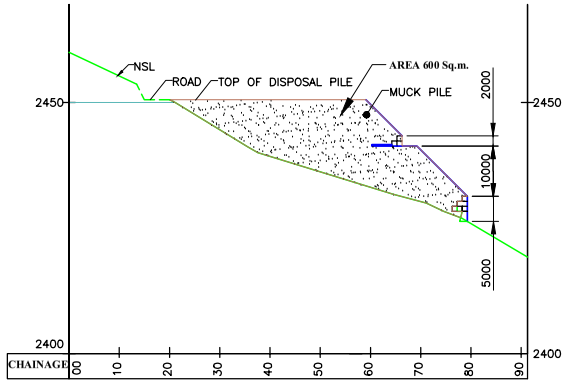
Format A3 (mm)



SECTION A-A DISPOSAL AREA ZONE 9b
(SCALE 1:1000)



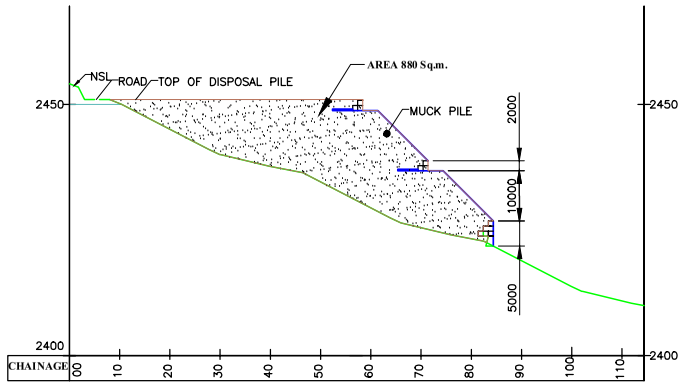
SECTION B-B DISPOSAL AREA ZONE 9b
(SCALE 1:1000)



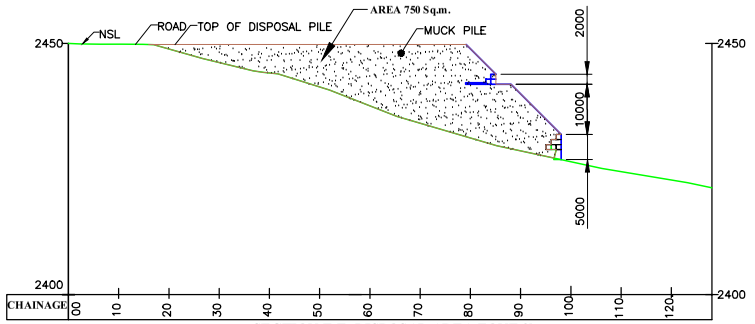
SECTION C-C DISPOSAL AREA ZONE 9b
(SCALE 1:1000)

S.NO.	LENGTH (M)	AREA AT SEC A1 (SQ.M)	AREA AT SEC A2 (SQ.M)	AVERAGE AREA (SQ. M.)	VOLUME (Cum.)
1	64.74	140	325	232.50	15052
2	40.56	325	600	462.50	18759
3	36.73	600	880	740.00	27180
4	45.65	880	750	815.00	37205

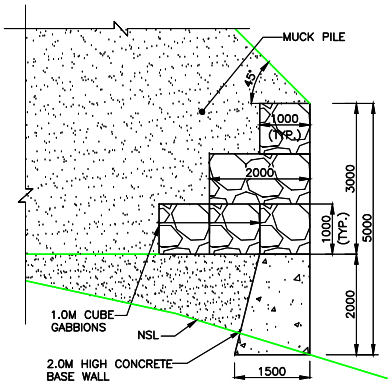
TOTAL VOLUME OF DISPOSAL = 98196 Cum.
=0.98 Lac Cum.



SECTION D-D DISPOSAL AREA ZONE 9b
(SCALE 1:1000)



SECTION E-E DISPOSAL AREA ZONE 9b
(SCALE 1:1000)



TYPICAL DETAIL OF CONCRETE BASE WALL
(SCALE 1:100)

SCALE 1 : 100 — 1.0 0 1.0 2.0 3.0 4.0 5.0m

SCALE 1 : 1000 — 10 0 10 20 30 40 50m

Fig.2.4a Cross section of muck dumping site DS-6 (Zone-9b)

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Zikrullah, Drawn	Antu P.K., Verified
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Client: THDC INDIA LIMITED

Project: JELAM TAMAK HYDROELECTRIC PROJECT
Uttarakhand, India.

Title: ZONE–9b
MUCK DISPOSAL AREA
CROSS SECTIONS

Drawing No.

Project No.	Drawing Code.	Serial.	Rev.
169101	JT–34 | 41DD	1011	00

Format A3 (mm)

Chapter 3

WASTE MANAGEMENT

3
WASTE MANAGEMENT

3.1 INTRODUCTION

Waste management is related to the solid as well as liquid wastes. The management of the waste can be approached in two phases, viz. the locations where it is generated and area where it is dumped. Disposal of solid waste is a serious environmental consequence, which deteriorate not only the air, soil and water qualities but promotes the growth of microorganisms and vectors that spread diseases and produce noxious odours. The solid waste generally comprises of plastic, glass, papers, kitchen wastes, chemicals etc and can be grouped into biodegradable and non biodegradable. Thus, approach of a most fit waste management would also consider the waste composition. Generally waste management plan is based on the following two approaches.

i). Integrated waste management

ii). Disposal of residue in least harmful manner

3.2 MIGRANT POPULATION AND WASTE GENERATION

The project area is sparsely populated. A few families have proper sanitation facilities while most of them have not proper measures of disposal of waste. The construction of the project would require additional work force to execute the work. The additional workers are here termed as migrant population. The additional work force would include labourers, technical staff, officers etc., some of them will be along with their families. The migrant population would generate additional waste. The total migrant population load has been calculated taking into the topography of the area and periodic labour requirements into account, which is based on the following assumptions.

(i) It is assumed that 30% of the married labourers and 10% married technical staff are likely to have families,

(ii) 30% of the labour population will comprise of husband and wife,

(iii) 10% of the technical staff will have families and only husband will work,

(iv) 2% of the total migrating population are assumed as service providers, and

(v) 50% of service providers will have families.

(vi) The average family size for labourers as well as for technical staff is assumed to be of 5 persons.

Table 3.1 gives the details of migrant population in the region. Based on the above mentioned assumptions, the peak time migrant population on calculation comes out to be 2370 (say 2400) persons. This total population would probably reside in the project area at any given time.

Table 3.1 Total migrant population expected in the Jelam Tamak H.E. Project

Sl.No.	Particular	Family/Population
A.	**Migrant Labourers**	
	i) Peak migrant workers	1000
	ii) Single migrant workers (40% of 1000)	400
	iii) Married migrant workers with families (30% of 1000)	300
	iv) Labourers with spouse (30% of 1000)	300
Total Population of A = 400 + (300 x 3) + (300 x 2)		**1900**
B.	**Migrant Technical staff**	
	i) Total migrant technical staff	300
	ii) Single technical staff (80% of 300)	240
	iii) Married migrant technical staff (10% of 300)	30
	iv) Number of families (10% of 300)	30
Total population of B = 240 + (30 x 2) + (30 x 3)		**390**
C.	**Service Providers**	
	C. Service Providers	
	i) Total service provider (2% of the total population, i.e., A+B)	60
	ii) Single persons (50% of 60)	30
	iii) Married service providers (50% of 60)	30
D	**Itinerant Staff**	**50**
Total population of C = 30 + (30 x 3)		**120**
Grand Total of A+B+C+D		**2370**

3.3 GENERATION OF WASTE

In India, the average dry weight per capita solid waste generated per day is around 500 g in large town, here, 500 g of waste per capita per day has been assumed because all workers will settle

at a new place and most of them will be outsiders. Thus, for a population of 2400 persons for the Jelam Tamak H.E. Project, the solid waste generated annually would be approximately 4,38,000 kg (0.500 x 2400 x 365 days = 4,38,000 kg). Of the total waste 42% (nearly 1,84,000 kg) is expected to be compostable while metal, glass and plastic would account for 35,000 kg (World Bank urban development sector, Unit Solid Waste Management in Asia, 1999). The recyclable waste is expected to account for 13 – 20% of total (UNEP, 2001).

In addition to the solid waste, liquid waste also contributes significantly to the total waste. Nearly, 140 litre per capita per day is used in urban area in India for various purposes like drinking, washing, bathing etc. Of which about 100 litre per capita per day is directly drained as liquid waste. For a population of 2400 persons for the Jelam Tamak H.E. Project at any time, the liquid waste generated annually would be approximately 8,76,00,000 litres (100 litre x 2400 x 365 days = 8,76,00,000 litre).

3.4 PROPOSED PLAN

The project area is part of a pristine ecosystem, environmental consequences due waste, therefore, are expected to be more profound. The proper collection and disposal of the waste, besides providing proper sanitary facilities to the labour colonies in the project area would be ensured by the project authorities. The proposed plan has been formulated considering the peak labour force in the construction phase. In operation phase most of the labourers and technical staff will be homed, therefore, all sanitation structure for labourers and in labourers colonies will be temporary so that after the completion of the project, the structure could be dismantled. The following measures are suggested for the waste management.

3.4.1 Collection of Solid Waste

Nearly 1200 kg of solid waste per day would be generated in and around the project areas. The authorities are suggested to install dust bins in the colony area, working sites and alongside the roads. There would be two types of bins, recycle bins and non recycle bins. There must be instructions and guidelines for residents and workers to dispose off the waste in respective bin. The capacity of each bin would be 100 kg. Thus, to collect 1200 kg of solid waste, there would be requirement of 1200 bins in the project sites. Total cost of bins would be nearly **Rs. 15.00 Lakhs**. It includes maintenance cost, replacement cost etc. The cost is estimated for 5 years.

3.4.2 Establishment of Compost Pits

Disposal of the waste itself requires an appropriate management. One of the best way to manage the waste is to reuse. Nearly 42% of total waste (500 kg) is compostable. The project authorities are suggested to construct compost pits in village lands. The villagers would be the beneficiaries of the generated compost. The capacity of each compost pit would be 20 cubic meter, which can accommodate nearly 20,000 kg of compostable waste. In order to accommodate the compostable waste for a year, a total of 10 pits would required. Total cost of these pits would be **Rs. 10.00 lakhs**.

3.4.3 Septic Tanks

The septic tank is constructed for treating domestic sewage from individual households both in suburban and rural areas, where a piped sewage system (i.e., a public sewer) is not available. Septic tank serves two purposes: deposition of settling solids in sewage by sedimentation, and partial or complete digestion of the sludge prior to its disposal. Septic tank utilises the septic action by anaerobic bacteria, by which proteins, carbohydrates, cellulose and fatty matter present in sewage are broken down to simpler compounds. The nitrogen is converted to ammonia, while the colloidal matter is flocculated, then liquefied and finally digested.

The sanitary facilities proposed for the colonies would be of standard municipal design for the hill areas. Septic tanks of not less than $25m^3$ would be constructed at appropriate sites in the colony areas. The organic waste generated would be decomposed and used as manure while landscaping the project area. The garbage would be used as landfills. One to two tanks or soak pits are proposed for each set of toilet. A soak pit is a covered pit dug in the ground, in which effluent from the septic tank is discharged. It is generally dug in the pervious soil which can absorb the effluents. Neither the organic waste nor the garbage would be dumped in or around the project area. The total budget allocated for the purpose is around **Rs. 50.00 lakhs**.

3.4.4 Community Toilets

In order to prohibit open defecation in the region, community toilets will be provided for a population of 2020 migrant labourers and service provider (for the project staff, this facility will be available in hostel and colony). Because majority of the migrant labourers will stay up to the construction phase, therefore, community toilets in labour camps would be of low cost and most of

the sets will be dismantled after the construction work. Nearly 40 low cost public toilet sets have been proposed for labourers' colony. Each set will have 4-6 seats. Total budget allocated for this purpose is around **Rs. 22.00 lakhs** including maintenance.

3.4.5 Community Bathrooms and Washing Places

Proper facilities for bathing and washing clothes would be provided in the labour camp areas. Around 50 bathrooms/ washing places with proper water supply have been proposed for the labour colony areas. The total budget allocated for this activity is around **Rs. 21.00 lakhs** including maintenance.

3.4.6 Sewage treatment plant

If the waste water generated from the kitchens, bathrooms and washing places, is not managed properly would end up in the nearby streams or river channels in hilly areas and triggers the deterioration of water quality. To avoid the deterioration of water quality of rivers and nallahs, a small sewage treatment plant is proposed for the colony areas during the construction as well as operation phase). Properly treated water should either be reused or released into the draining channels. Total allocated budget for a sewage treatment plant is around **Rs. 30.00 lakh**. The cost for running this plant for five years will be around **Rs. 15.00 lakhs**.

3.4.7 Incinerators

Dustbins of good and long-lasting quality would be installed at different places to collect organic, inorganic (plastic, glass etc.) garbage separately. The organic garbage would be converted into organic manure. Metal and glass garbage should be sent for recycling and other garbage may be incinerated. **Rs. 5.00 lakhs** is allocated for the installation and maintenance of incinerators and the dustbins in colony area for seven years.

3.4.8 Dumper and Wheel barrows

For the collection and transportation of garbage from colony areas and working sites dumper and wheels barrows will be required. Provisions for one dumper and four wheel barrows (double wheel) are made in the plan. Total budget including purchase and maintenance of dumper and wheel barrows will be around **Rs. 26.00 lakhs**.

3.4.9 Working Staff

The maintenance, cleaning and upkeep of different facilities at various places like colony areas, construction sites, etc. would require some staff. Operating staff for garbage collection, dumping, sewage treatment plant and incinerators are also proposed in the plan. A total budget of **Rs. 40.00 lakhs** has been proposed in the plan to be utilized as the salary for the staff of 6 persons who would be employed to keep the project area clean.

3.5 BUDGET

Total financial outlay for the waste management would be **Rs. 249.00 lakhs.** The break up of estimated cost for the waste management for Jalam Tamak H.E. Project is given in Table 3.2.

Table 3.2 Year-wise cost estimates for the Waste Management Plan of Jalam Tamak H.E. Project. The year-wise cost includes the running and maintenance costs

S.N.	Particulars	Years-wise budget (Rs. in lakh)					
		1st yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
1.	Collection of Waste	11.00	1.00	1.00	1.00	1.00	15.00
2.	Compost Pits	10.00	-	-	-	-	10.00
3.	Septic Tanks	50.00	-	-	-	-	50.00
4.	Community Toilets (@ Rs. 40,000/- per set)	16.00	1.50	1.50	1.50	1.50	22.00
5.	Community Bathrooms (@ Rs. 30,000/- per set)	15.00	1.50	1.50	1.50	1.50	21.00
6.	Sewage Treatment Plan	30.00	3.00	3.00	4.00	5.00	45.00
7.	Incinerator	5.00	-	-	-	-	5.00
8.	Dumper/Wheel barrows	18.00	2.00	2.00	2.00	2.00	26.00
9	Salaries/wages of staff	8.00	8.00	8.00	8.00	8.00	40.00
10.	Miscellaneous	3.00	3.00	3.00	3.00	3.00	15.00
Total		**216**	**22**	**22**	**22**	**22**	**249**

Chapter 4

FUEL WOOD & ENERGY CONSERVATION

4
FUEL WOOD & ENERGY CONSERVATION

4.1 INTRODUCTION

One of the major impacts foreseen in the surroundings of the project is wood collection as cooking fuel by the labourers. It has various environmental consequences on the forest resource. Also, the fuel wood is the main source of energy in the surrounding area, therefore, an additional pressure due to coming labourers is anticipated in the area, if not managed properly. In order to mitigate the predicted impacts and to develop a system of efficient use of energy, the proposed plan is warranted in Jelam Tamak H.E. Project. The plan would ensure the provision of fuel and energy saving measures not only in the camp and working sites but in the vicinity villages as a function of good practices.

The implementation of this plan would contribute to the improvement in the quality of life of community, conserve the biomass, reduces the deforestation and its consequences like soil erosion, flash floods etc.

4.2 PROPOSED PLAN

Taking the number of migrant workers, technical staff and number of affected families into account the following provisions have been suggested for the fuel wood and energy conservation and.

4.2.1 Provision of LPG

Nearly 700 LPG connections would be required for the families of workers and technical staff of the project. Project authorities are advised to sign an agreement with the contractor(s) to ensure the distribution of LPG to the labourers. Also, project authorities would provide LPG connection to the technical staff in the colony. In addition to the labourers and technical staff, this facility would be extended to the affected households and BPL households (card holders) in the influence area. The provision is suggested for 100 households including 76 affected households. In addition, project authorities are suggested to establish a LPG depot in the area. The depot would

provide the services to project staff, labourers, and all villages of influence area. Total financial outlay for the provision of LPG would be **Rs. 8.00 lakh**. It would be one time grant.

4.2.2 Community Kitchen

About 400 labourers and 250 project staff would come without families; hence, the provision of community kitchen is suggested for the bachelors. The community kitchen is a measure of efficient energy use and plays an important role in the energy conservation. Project authorities would provide only infrastructure in the camp, working sites and colony area. The infrastructure facilities include place, water facility, electricity, utensils, chairs, tables, etc. About 4 community kitchens are suggested at various work sites. Total budget for the community kitchens would be **Rs. 5.00 lakh** only.

4.2.3 Construction of Solar Water Heater

The winter season would be highly non conducive for the project staff and labourers. To cop the low temperature in winter season project authorities are suggested to develop passive solar housing system in the colony area for the staff and labour colonies, which works on a convection air flow system. The house may be *pucca* (in colony) and *kachcha* (in labour colony and work site). It aims at taking advantage of solar radiation during the cold season to heat the inner space of a building. Through south facing walls and large south facing windows the house collects solar radiation during the day and enables the rooms to remain warm both during day and night. In the absence of alternatives worker may use charcoal, LPG and fuel wood for space heating in winter season, which would result into biomass loss and deterioration of the environment. The passive solar house system would save nearly 70% of the energy and is also environmentally sound. The passive solar house costs about 10% more than normal house. Project authorities would hire expertise from a reputed and experienced institution like Group Energies Renewable Environment Solidarities (GERES) to develop the passive solar houses. The proposed budget does not include the construction cost of houses as this provision is made in project cost. Only **Rs. 20.00 lakh** is suggested as consultancy fee and charges towards the expertise.

4.2.4 Distribution of Improved Chullahs

Traditional chullahs in the area are not efficient in the energy conservation and are relatively non hygienic. Alternatively, the improved chullahs would play an important role in the biomass

conservation. They are smokeless and more hygienic. This plan is suggested especially for those families which are not able to afford the monthly expenditure of LPG and use the fuel wood for cooking and other purposes. There is a provision of about 400 chullahs to distribute in the households located in the influence area. Total budget for the improved chullahs would be **Rs. 4.00 lakh** only.

4.2.5 Distribution of Solar Cookers

Solar cooker is a measure of efficient use of energy and conservation of biomass. The provision is made for about 400 solar cookers to distribute in the affected and vicinity villages. Total cost estimates for solar cookers is **Rs. 12.00 lakh** only.

4.2.6 Kerosene Depots

At least two kerosene depots near Jelam and Tamak villages will be opened by the project authorities. These depots will cater to nearly 500 households of the affected and vicinity villages. The project authorities would provide only infrastructure facilities in the depots. The cost estimates for Kerosene depots would be **Rs. 1.00 lakh** only.

4.3 BUDGET

Total financial outlay for the fuel wood and energy conservation is **Rs. 50.00 lakh** (Table 4.1). The plan will be implemented in 5 years excluding 1 preconstruction year. LPG connection, improved chullahs and solar cookers will be distributed in 5 phase. Project affected families will be considered in 1st phase while poor and BPL families will be taken in 2nd phase. Thereafter, this plan will be extended in influence area.

Table 4.1 Budget allocation for the fuel wood and energy conservation measures for Jelam Tamak H.E. Project

Sl.No. Particulars	Amount (Rs. in lakhs)					
Particulars	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
1 Provision of LPG						
(a) Construction of LPG Depot (1Nos.)	3.00	-	-	-	-	3.00
(b) LPG connection for nearly 100 households	1.00	1.00	1.00	1.00	1.00	5.00
2. Community Kitchen / Canteens (1 Nos.)	5.00	-	-	-	-	5.00
3. Passive solar housing system	-	20.00	-	-	-	20.00
4. Distribution of improved chullahs	1.00	1.00	1.00	1.00	-	4.00
5. Distribution of solar cookers	3.00	3.00	3.00	3.00	-	12.00
6. Kerosene Depots (2 Nos.)	1.00	-	-	-	-	1.00
Total	**14.00**	**25.00**	**5.00**	**5.00**	**1.00**	**50.00**

Chapter 5

PUBLIC HEALTH DELIVERY SYSTEM

5
PUBLIC HEALTH DELIVERY SYSTEM

5.1 INTRODUCTION

The development of public health delivery system is one of the measures of peripheral development taken by the project authorities as well as takes into account health facilities to the project workers and labourers. It would provide the safeguard measures against the diseases hitherto unknown in the area and strengthen the existing health facilities in the region.

The focus on the public health delivery system in EMP report becomes much warranted because this sector is much neglected in all states including Uttarakhand in India. The status of health infrastructures in rural areas especially in hilly areas is more awful due to the lack of health institutions, transport facilities, lack of awareness, inaccessibility to the villages and lack of strong referral system. The joint efforts of project authorities and state Government may contribute significantly in the area health amenities. The suggestive measures of Public Health Delivery System are given with following objectives.

i) Establishment of new health care centre like hospital, primary health centre, child care centre etc.
ii) Reduction in infant mortality rate and maternal mortality ratio
iii) Universalize the access to public health service for Women's health, child health, hygiene, sanitation and nutrition
iv) Prevention and control of communicable and non communicable diseases.
v) Promotion in vaccination/ immunization and post natal check up programmes in the surrounding areas.
vi) Promotion of referral system, transportation system and mobile medical unit.

5.2 EXISTING FACILITIES

The surrounding area of Jelam Tamak H.E. Project is poor in health facilities. Regarding the modern health care system Joshimath is nearest place, where health facilities are relatively in good state. There are governmental as well as private clinics. In addition, Tapovan is another location where private clinics play an important role in health care of people. The surrounding area houses a

varieties of medicinal plants, therefore, people have also a traditional health care system for many diseases like fever, headache, dyspepsia, jaundice, pregnancy complications, asthma cold and cough.

5.3 PROPOSED PLAN

The construction activities would lead to the high concentration of suspended particulate matter, and obnoxious gases. A chunk of the population including project workers and local people would be exposed to these pollutants. Also, the increase in water fringe area would provide suitable habitats for the growth of water borne disease vectors. The workers may invariably come up with injuries caused by accidents at working sites. The health related problem may be caused by the migrant or additional population in the area. The proposed plan therefore, would be formulated keeping all these issues in the focus. The following measures are suggested to improve the health facilities in the surroundings of Jelam Tamak H.E. Project.

5.3.1 Health Centre

Project authorities are expected to establish a health centre with all basic facilities for its workers. The facilities of the centre would be extended to the local people inhabiting the influence area of the project. The workers and BPL villagers would be entertained at no cost while other would pay minimum fee to avail hospital facilities. The health Centre would be run and maintained by the project authorities. There is no separate budget for the hospital under the public health delivery system.

Proposed colony area would be an ideal place for the primary health centre because it is located along the road site and accessible throughout the year. The provision of budget has been made only for 5 years. After 5 years, It would be born from other head of the project. Total financial outlay for the primary health centre would be **Rs. 140.50 lakhs** only. The break up of the budget is given in Table 5.1.

Table 5.1 Budget allocation for the proposed primary health centre in Jelam Tamak H.E. Project

S.No.	Particulars	Amount (Rs. In lakhs)
A.	**Non-Recurring Cost**	
	i) Building 1x 500 sq m x @ Rs. 6000/-	30.00
	iii) Equipments for laboratory facility, furniture etc. (Lump sum)	30.00

	Total (A)	**60 .00**
B.	**Recurring Cost** **Salaries/wages**	
	i) Medical Staff	
	(a) Doctors @ Rs. 40,000/- 2 doctors x 5 years x Rs. 40,000/- x 12 months +AI	60.00
	(b) Pharmacist @ Rs. 30,000/- 1 Pharmacist × 5 years × Rs. 30,000/- × 12 months +AI	24.00
	(d) Nurses @ Rs. 20,000/- 1 nurses × 5 years × Rs. 20,000/-× 12 months +AI	15.00
	ii) Non-Medical Staff	
	(a) Helpers @ Rs. 10541/- 1 Ward boys × 5 years × Rs. 10541/- × 12 months +AI	9.00
	iii) Medicines and miscellaneous expenditure @ Rs. 2 lakh per annum for 5 years	10.00
	iv) Maintenance Rs. 0.5 lakh per annum per ambulance	2.50
	Total (B)	**120.50**
	Total (A+B)	**180.50**

Allocation of salary budget includes annual increment (AI) on lump sum basis
Total financial budget is prepared for 5 years only, however, project authorities would run it permanently
The salaries are lump sum basis considering the revised pay band

5.3.2 Immunization and Vaccination Programmes

A total of 475 households reside in the influence zone of the proposed project. In addition nearly a large number of workers with their families would congregate in the project area. In order to follow a quarantine procedure a programme of immunization and vaccination would be run in these households, labour camps and project colony. Since the proposed hospital of the project would be under construction, so that the programme would be run with the help of nearly located hospital in consultation with State Health Department. For this reason, door to door contact will be made by the hospital staff with an interval of 3 moths or 6 months. This programme will be run at least for 5 years. The total financial outlay for this programme would be **Rs. 10.00 lakh** only.

5.3.3 Medical Camp

Project authorities are suggested to organize medical camps at least one in year in the area. These camps would have a team of Doctors, specialist of various native diseases. This scheme would be run with the help of State Health Department for 5 years. Total budget for free medical camps would be **Rs. 25.00 lakh** only.

5.3.4 Distribution of First Aid Boxes and ORS packs

Project hospital would organize a training programme on first aid for the educated youths of surrounding villages. After the training, first aid boxes would be distributed to these villages. The boxes would contain the medicines of some common diseases like fever, injuries, cold, headache and ORS packs. The trained fellows could receive medicines from the nearby health centres after submitting utilization records of the medicines used. The trained fellows will be paid by a nominal amount as incentive. This scheme would last at least for five years. Total financial outlay for this head would be **Rs. 20.00 lakh** only.

5.3.5 Ambulance

One ambulance is suggested in the region. The ambulance would help the patients especially children and women to take at nearby health centre or hospital. The ambulance will be connected to mobile phones with a specific numbers. The project authority has already been facilitated this facility in the project affected area. Total budget only for the running cost and salaries of supporting staff would be **Rs. 50.00 lakh**. This facility would be available at least for five years, however, if project authorities are interested, it can continue.

5.4 SAFEGUARD MEASURES

The following measures are suggested to minimize the incidence of vector born diseases.

i) Before joining the project, the migrant labourers and technical staff will have to pass through medical check up, in order to prevent communicable diseases like AIDS, Hepatitis etc. This plan would be arranged by the project authorities.
ii) The site selected for labour camps should not be located along any natural drainage.
iii) Adequate arrangements should be in place to dispose storm water from the labour colonies.
iv) Adequate vaccination and immunization facilities to be provided for the workers at the construction sites.

v) Rapid deployment of sanitary inspectors and teams to disinfect an area of concern.

vi) The labour camps and resettlement site to be located sufficiently away from any water body.

These are only precautionary measures, therefore, no separate budget has been allocated for safeguard measures.

5.5 FINANCIAL PACKAGE

Total financial package for the health delivery system for the proposed Jelam Tamak H.E. project would be **Rs. 285.50 lakh** only. It includes establishment of a health centre, immunization scheme, distribution of first boxes in the surrounding villages, free medical camps, ORS depots in the villages, medical van and safeguard measures.

Chapter 6

RESTORATION OF ROAD & OTHER CONSTRUCTION AREAS

6
RESTORATION OF ROAD & OTHER CONSTRUCTION AREAS

6.1 INTRODUCTION

Restoration of construction areas refers to the ecological restoration of degraded areas triggered by various activities of the proposed project. The activities necessary to bring a disturbed site into former or original state involves manipulation of nature to recreate species composition and ecosystem processes close to the state that existed before disturbance. It recovers the ecological processes and functions of the original community.

The proposed Jelam Tamak HE Project would involve construction of colonies for staff and laborers, roads linking to various components of project, offices, workshops, etc. During construction these activities could also result in accumulation of large amount of unused material at various sites which require proper restoration measures. Total area likely to be disturbed due to these activities is around 96.27 ha. This land also includes areas likely to be disturbed due to quarries, submergence and dumping of unused muck, barrage axis and powerhouse. At present, the proposed project area is covered with open/dense coniferous forest particularly at barrage and power house site. The proposed colony area and office complex at present is covered with an open/ dense mixed coniferous forests. This existing landscape will be totally modified or changed due to proposed project. It is, therefore, important that after the project work and related activities are over, these disturbed areas are restored to bring them back to their similar or near to similar pre-construction condition or in improved state. It will be essential for the project authorities to restore the area to its natural/ original state after completion of the project. All areas disturbed by construction activity will be landscaped to reflect natural contours, restore drainage paths and encourage the reestablishment of vegetation.

6.2 DISTURBED SITES AND THEIR RESTORATION

Around 96.27 ha of land will be directly disturbed due to various construction activities of the proposed project, like submergence area, roads, muck dumping sites, quarry sites, colonies, offices, etc which will change the existing land cover in the region. After completion of the

construction work, it is required to restore the disturbed area to its original condition. Restoration of dumping sites and reservoir area are given in separate chapters of EMP volume, respectively. Here restoration of colony area, office complex and roads is discussed and a detailed plan is given for the landscaping of the region. Various engineering and biological measures have been suggested for the restoration of these areas. Proposed mitigation measures will also help to arrest soil erosion in the region.

6.3 RESTORATION OF COLONY AND OFFICE COMPLEXES

A total area of 13.31 ha of land will be disturbed due to construction of colony area, office complex, magazine building, workshop etc. (Table 6.1 and Fig. 1.2b of EIA report). Except contractor colony and explosive magazine area all other sites are in the downstream of the dam. Colonies are proposed on the right bank of Dhauliganga river along the Border road which is connected to National Highway 58. The land at these sites will be cleared of vegetation for the movement of heavy equipments required for different project related activities which would lead to degradation of slopes, etc.

Table 6.1 Area and location of colonies, workshop, job site and other sites in the proposed Jelam Tamak H.E. Project

Sl. No.	Site specification	Area
1	Central workshop, Fuel pump, Auto repair shop	1.44 ha
2	Owner's colony	4.83 ha
3	Explosive magazine area	0.03 ha
4	Contractor's colony	3.00 ha
5	Plants, ware house, Penstock, repair house, etc.	2.60 ha
6	Aggregate processing plant	1.41 ha
	Total	**13.31 ha**

On account of various developmental activities viz., road construction, office complexes, sand mining, deforestation, etc some area of right bank near Bhapkund, Jelam and Juma will be disturbed. Engineering and biological measures are suggested for the stabilization and beautification of the disturbed area. Following measures should be adopted for the restoration and landscaping of colony areas and construction sites.

1) Proper roads and lanes would be provided inside the colony area. Open area should be covered with vegetation. Ornamental plants and avenue trees should be planted along the roads and lanes.
2) The choice of the tree species for plantation will depend on agro-climatic conditions of the area.
3) Retaining walls should be built to avoid landslides and slips. Proper drainage would be provided inside colony for the outlet of the domestic/rain water.
4) Parks and play grounds would be developed.
5) After the completion of all the construction activity, the construction sites and other temporary settlements would be covered with the top soil which would support the growth of plant species.

Engineering Measures : During construction phase, some locales in the right bank area are likely to be prone to soil erosion. Construction of retaining walls would be necessary to stabilize the slopes. The budget kept for the construction of retaining walls and for other engineering measures is around **Rs. 9.00 lakh**.

Biological Measures : During construction there will be potential for workers to damage the forest. To control sediment erosion and to provide viable habitats for species that are decline, it is important to use the locally adapted plant species for revegetation purpose. There is possibility that after construction, these degraded forests existing in the area will be further destroyed or damaged. Plantation of the tree species and shrubs are suggested in the colony area. Some of the local plant species are mentioned in Table 6.2. Total budget allocated for the purpose is around **Rs. 10.00 lakh** which includes maintenance cost also (see Table 6.3).

Table 6.2 Some important plant species for plantation in the colony area/office complex and along the road sides

	Botanical name	Local name	Family	Use
1.	**Colonies/ Office complex**			
Trees				
1	*Acer caesium*	Kanchula	Aceraceae	landscaping
2	*Aesculus indica*	Pangar	Hippocastanaceae	landscaping
3	*Buxus wallichiana*	Papri	Buxaceae	landscaping
4	*Juglans regia*	Akhrot	Juglandaceae	landscaping
5	*Juniperus recurva*	Bittaru	Cupressaceae	landscaping
6	*Pinus walllichiana*	Kail	Pinaceae	landscaping
7	*Pyrus malus*	Seb	Rosaceae	landscaping

8	*Taxus baccata*	Thuner	Taxaceae	landscaping
Shrubs				
1	*Asparagus filicinus*	Jhinjan	Liliaceae	landscaping
2	*Cornus capitata*	Bhmore	Cornaaceae	landscaping
3	*Ephedra gerardiana*	Som valli	Ephedraceae	landscaping
4	*Rosa sericea*	Gulab	Rosaceae	landscaping
5	*Zanthoxylum armatum*	Timru	Rutaceae	landscaping
Herbs				
1	*Allium stracheyi*	Faran	Liliaceae	landscaping
2	*Angelica glauca*	Choru	Apiaceae	landscaping
3	*Astragalus candolleanus*	Rudravanti	Papilionaceae	landscaping
4	*Carum carvi*	Kala jeera	Apiaceae	landscaping
5	*Fagopyrum dibotrys*	Jangli ogal	Polygonaceae	landscaping
6	*Impatiens scutata*	-	Balsaminaceae	landscaping
7	*Occimum sanctum*	Tulsi	Lamiaceae	landscaping
8	*Panicum miliacum*	China	Poaceae	landscaping
9	*Pennisetum flavidum*	-	Poaceae	landscaping
10	*Saussurea costus*	Kuth	Asteraceae	landscaping
11	*Tegetus minuta*	*Genda*	Asteraceae	landscaping
12	*Zingiber officinale*	Adarak	Zingiberaceae	landscaping

2. Roadside/Avenues

Trees				
1	*Cedrus deodara*	Deodar	Pinaceae	landscaping
2	*Cupressus torulosa*	*Surai*	Cupressaceae	landscaping
3	*Fraxinus xanthoxyloides*	Repchu	Oleaceae	landscaping
4	*Morus serrata*	Sahtut	Moraceae	landscaping
5	*Populus ciliata*	Popular	Salicaceae	landscaping
6	*Pinus wallichiana*	Kail	Pinaceae	landscaping
7	*Prunus armenica*	Khumani	Rosaceae	landscaping
Shrubs				
1	*Berberis aristata*	Kingore	Berberidaceae	landscaping
2	*Cotoneaster integerrima*	-	Rosaceae	landscaping
3	*Prinsepia utilis*	Bhekal	Rosaceae	landscaping
4	*Rosa macrophylla*	Gulab	Rosaceae	landscaping
5	*Sorbaria tomentosa*	Barun	Rosaceae	landscaping

Herbs

1	*Bupleurum falcaum*	Tirmiri	Apiaceae	landscaping
2	*Cymbopogon caesius*	-	Poaceae	landscaping
3	*Cynodon dactylon*	Doob	Poaceae	landscaping
4	*Phleum alpinum*	-	Poaceae	landscaping
5	*Tagetus minuta*	Genda	Asteraceae	landscaping
6	*Themeda anathera*	-	Poaceae	landscaping
7	*Viola betonicifolia*	Vanfsa	Violaceae	landscaping

6.4 MANAGEMENT MEASURES FOR ROAD CONSTRUCTION

The approach road in order to access the construction sites will constructed on either bank of river (mainly on right bank). About 7.5 km permanent and 6 km temporary roads acquiring 13.94 ha land will be constructed. As a result a huge amount of the muck will be generated. Thus, its impacts on the air, water are flora are anticipated. In addition road construction would trigger the land slides on the steep slopes. The impacts identified for road construction are Land slides, surface erosion, generation of muck and geophysical impacts. All these impacts are required to mitigate properly. Following measures are suggested to mitigate the impacts under discussion.

6.4.1 Construction Measures

Area for the clearing and grubbing shall be kept minimum subject to the technical requirement of the road. The clearing area shall be properly demarcated to save desirable trees and shrubs and to tree cutting to the minimum. The method of balanced cut and fill formation shall be adopted to avoid large difference in cut and fill quantities. The cut slopes shall be suitably protected by breast walls, provision of flat stable slopes, provision of catch water and intercepting drains and treatment of slopes. Road construction shall be executed with a controlled manner. Total financial outlay for these activities would be **Rs. 40.00 lakh** only.

6.4.2 Drainage

The drainage of water from hill slopes is very necessary measure to check the soil erosion and to provide the stability. All constructed drains shall be linked with the existing natural drainage system. Check dams with silting basins shall be constructed so that soil could be prevented to be carried away by high velocity flows. Culverts should be chosen at suitable location and be given suitable alignment. Total budget for the drainage would be **Rs. 20.00 lakh**.

6.4.3 Prevention of Surface Erosion

Surface erosion will be prevented through biological measures. Some of the excavated muck are likely to form thin apron on mountain slopes along the road. Provisions are made to cover such slopes with vegetation. Tree saplings and shrubs should be planted along the road. Seeds of herbs and grass species should be spread over the loose soil. Some plants for plantation are suggested in the Table 6.2. Total budget for the plantation alongside the road is given in Table 6.3.

6.4.4 Muck Disposal and Restoration

As a result of road construction, the generated muck would require an appropriate disposal and restoration measures. A detailed plan of muck disposal and reclamation is given in a separate chapter. The same disposal area shall be used to dispose off and rehabilitate the muck of road construction. There is no separate budget under this head.

6.5 COST ESTIMATES

Cost estimates for different components of the landscaping and restoration and road construction are given in the Table 6.3. Around **Rs. 121.2 lakh** would be required to restore the disturbed area to its near original state.

Table 6.3 Cost estimates for Restoration Works and Landscape Designing

S.No.	Item of Work	Amount (Rs. in lakh)
A.	**Colony Area, Office Complexes**	
	(i) Engineering measures	
	(a) Retaining walls	9.00
	(b) Leveling the area	4.00
	(c) Development of parks, etc. (suggested in Muck disposal chapter)	Nil
	(iii) Biological measures	
	(a) Planting of trees and shrubs	7.00
	(b) Planting of flowering plants and other herbs	3.00
	Total (A)	**23.00**
B.	**Roads**	
	Engineering	
	(i) (a) Retaining walls (360 m3 @ 1211/m^3)	4.40
	(b) Wire crates (3 x 2 x 1.5 cum 50 / 2400.00)	10.80

	(ii) Biological measures – Planting trees, shrubs and herbs	5.00
	Total (B)	**20.20**
C.	**Development of Nursery**	
	(i) Infrastructure including land cost (Provision has been made under the CAT plan)	Nil
	(ii) Collection of seeds (Lump sum)	3.00
	(iii) Raising of plants (Lump sum)	10.00
	(iv) Manpower to maintain the nursery (Lump sum)	5.00
	Total (C)	**18.00**
D.	**Construction Measures for Roads**	**40.00**
E.	**Drainage**	**20.00**
Total (A + B + C)		**121.20**

Chapter 7

MANAGEMENT OF AIR & WATER QUALITY AND NOISE LEVEL

7
MANAGEMENT OF AIR & WATER QUALITY AND NOISE LEVEL

7.1 INTRODUCTION

The project activities like excavation, blasting, drilling, road construction, dumping and transportation of muck etc. lead to the immense impacts on the water, soil and air quality. In addition, new settlements, increasing vehicular movement and increasing sound level due to heavy equipments result into generation of huge amount of wastes, depravation of soil, water and air quality and high noise level. The release of effluents from working sites, SPM, NOx and SOx from heavy machines, vehicles and transportation of muck deprave not only the water, noise and air quality but biodiversity and habitat in the surrounding and is hazardous to human health.

A part of the water, air and noise management is covered under the various plans like waste management, downstream management, restoration of muck, public health delivery system etc., which address major issues only. In this contribution, some precautionary measures are suggested, which play an important role in maintaining the water and air quality and noise level.

7.2 MITIGATION MEASURES

The following industry standards and practices will be required of the contractors and to be adhered to:

7.2.1 Water Quality Management

The following mitigations are suggested to be followed during the construction of the project.

Construction Phase

- Accumulation of oil wastes in depressions should be minimized in order to avoid possible contamination of the ground water system.
- Surface runoff from oil handling areas/devices should be treated for oil separation before discharge into the river. If oil wastes are combined with sanitary sewage, oil separation will be necessary at the wastewater treatment facility.

- All effluents containing acid/ alkali/ organic/ toxic wastes should be processed by treatment methods. The treatment methods may include biological or chemical processes.
- The impact due to the suspended solids may be minimized by controlling discharge of wastes that contain suspended solids; this includes sanitary sewage and other wastes. Also, all activity that increases erosion or contributes nutrients to water (thus stimulating algal growth) should be minimized.
- For wastes containing high TDS treatment methods include removal of liquid and disposal of residue by controlled land filling to avoid any possible leaching of the fills. All surface runoffs around quarries and excavation areas should be properly channelised and taken care of.

Operation Phase

- Adequate river water shall be secured to meet the requirements of riparian people, livestock, and wild animals and to sustain the aquatic ecosystem.
- The growth of aquatic weeds is to be monitored in the reservoir and excess weeds will be removed.
- Fish (after introducing in the reservoir) production in the reservoir will be monitored for any possible decrease. If any unexpected negative impact occurs, fish will be restocked. Technical support will be provided to the fish farming activities in the reservoir.

The budgetary provision has been made under the waste management section of EMP, however, a budget of **Rs. 30.00 lakh** only is kept for the miscellaneous activities.

7.2.2 Air Quality Management

The contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust. These measures are applicable only in construction phase

Construction Phase

- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.

- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.
- Pre wetting of the ground to the depth of anticipated cuts should be followed.
- Use of water sprinklers prior to the transportation of muck and other activities
- The grading operation shall be suspended when the speed of wind is very high.
- The water shall be applied prior to any land cleaning and on the roads of frequent movements.
- The roads near the residential areas shall be paved.
- All storage piles shall be adequately wetted or covered with plastic to ensure that no visible dust cross the residential areas.
- The wind barriers of 50% porosity shall be installed three sides of all storage piles.

Most of the measures are precautionary while a few are included in the construction methodology. However, financial outlay for the miscellaneous work towards the maintenance of air quality would be **Rs. 30.00 lakhs** only.

7.2.3 Noise Level Management

The management of noise level will be executed in construction phase only. The following measures are suggested for noise level management.

- The construction work occurring within 100-150 meter of a residential area, the work hours should be limited depending on convenience of the local people.
- The construction equipment must be designed, has a high quality muffler system
- All stationery noise generating equipment such as air compressor, power generator should be away from the residential area.
- Regular monitoring of equipment and vehicles shall be carried out.
- The total sound power level, Lw of a DG set should be less than, $94+10 \log_{10}$ (KVA), dB(A).
- Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the enclosure acoustically.
- The Acoustic Enclosure should be made of CRCA sheets of appropriate thickness and structural/ sheet metal base. The walls of the enclosure should be insulated with fire retardant

foam so as to comply with the 75 dBA at 1m sound levels specified by CPCB, Ministry of Environment & Forests.

- The DG set should also be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).
- Proper efforts to be made to bring down the noise levels due to the DG set, outside its premises, within the ambient noise requirements by proper siting and control measures.
- A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

All the measures are precautionary, therefore, no special budget has been provided for the maintenance of noise level.

It is advisable to the project authorities to appoint an officer, not below the rank of Senior Manager to look after these precautionary measures in and around the project components' area. A total budget of **Rs. 40.00 lakh** is suggested for the monitoring work. It includes miscellaneous work. Total financial allocation towards the water, air and noise management would be **Rs. 100.00 lakh** only. Under this budget, the project authority can purchase a few equipments like High Volume Air Sampler, Sound Level Meter (CYGNET), Computer, and other small equipment like pH Scan, Tempscan, TDSscan, etc for in house monitoring.

7.3 MONITORING

In addition to the management of water, air quality and noise level, a monitoring of these parameters would be carried out in construction and operation phase. Monitoring will be carried out by State Pollution Control Board, which can hire a reputed institution/University for the purpose. The funds for the monitoring will be provided by the Project authorities. The allocation of funds for this head is given under the chapter Environmental Monitoring in the report.

Chapter 8

CATCHMENT AREA TREATMENT PLAN

8
CATCHMENT AREA TREATMENT PLAN

8.1 INTRODUCTION

In the developing world the competition for land to meet its various requirements has often led to the degradation of natural resources. The majority of the developmental projects are involved in number of related activities like deforestation, urbanization and faulty management practices, etc. which cause land degradation of the catchment. The related consequent processes damage the soil environment which ultimately leads to rapid sedimentation of reservoirs. Accelerated soil erosion in the catchment areas of the reservoirs and transport of detached material through the drainage network gives rise to a series of problems, notably depletion of flow capacity, steady loss of storage capacity, consistent drop in hydro-electric power generation and frequent floods. The loss of dead and live storage leads to heavy economic losses due to reduced life span of reservoirs. Therefore, extensive soil conservation and watershed management programmes are needed to minimize the damage to the catchment and mitigation of soil erosion problems.

For any soil conservation plan or catchment area treatment plan watershed is chosen as the basic unit for implementation of such schemes. This is necessary because watershed is a natural hydrological and geographic unit. It covers a specific aerial expanse of land surface from which the rainfall-run off flows to a defined drain, channel, stream or river at any particular point. It is delineated by a line joining the highest points on the boundary of drainage basin with reference to specific point drainage. However, watershed below the ground surface does not always coincide with the surface watershed. The boundary between two adjacent watersheds is the drainage line. Delineation of the watershed depends on the catchment drainage pattern of the watershed. This in turn depends on the relief of the area considered.

As watershed characterizes optimum interaction and synergistic effects of land and water resources, its management primarily involves collection of basic information on a wide range of parameters of static and dynamic nature related to geology, hydrology, soil, geomorphology, topography, drainage conditions, land use, land cover, climate, etc.

8.2 CATCHMENT AREA TREATMENT PLAN

The proposed Jelam Tamak HE Project catchment receives lesser precipitation in the form of snowfall in the upper catchment, but a higher rainfall, mainly received in the middle and lower parts. The terrain comprises very steep slopes to escarpments. These two factors are responsible for soil erosion by way of sheet erosion, rill erosion, gully erosion, bank erosion by streams and glacier. In addition to these natural erosion processes that are active in the region, various project related construction activities are likely to accentuate the erosion process. One or combinations of all these factors are known to cause landslides in the rainy season. Recurrent blasting for tunneling, etc. during the construction period are also likely to trigger off minor slips/ landslides due to the reduction of shear strength of rock material.

In view of the above, the catchment area treatment (CAT) plan for the free-draining catchment area has been formulated with the main objective of arresting soil erosion in the catchment area up to the dam site. The CAT plan will be implemented in the free-draining catchment because of an upstream river valley project, namely Jelam Tamak HE Project, which is being developed. Based on the topographic factors, soil type, climate, land use/vegetation cover in the catchment area, various measures, both engineering/mechanical and biological are being proposed to be undertaken with the aim to check the soil erosion, prevent/check siltation of reservoir and to maintain its storage capacity in the long run. The engineering measures will comprise construction of a number of check dams/walls, retaining walls, wire crates, etc. for gully control, stabilization of flood prone streams, landslides/slopes, river banks, roads, etc.

8.2.1 Objectives

The Jelam Tamak H.E. project catchment area treatment plan has been prepared with the following objectives:

i) Checking soil erosion and land degradation by proposing adequate and effective soil conservation measures in erosion prone areas (very severe and severe) in the catchment.
ii) Restoration on of degraded forest areas through afforestation and facilitating natural regeneration.
iii) Restoration of degraded slopes and landslide prone areas, wherever, necessary and possible.

8.2.2 Soil Erosion and Estimation of Soil Erosion

Different types of erosion that are observed in the catchment are: i) sheet erosion, i.e. washing of surface soil from arable land; it is considered to be the first step in soil erosion, ii) gully erosion; it is the aggravated form of rill erosion, and iii) stream bank erosion.

Water, which comes in the form of precipitation or drainage, is the single most important agent of erosion. Whenever water moves, it erodes the boundaries alongside. Rainfall, streams and rivers all scour soil with their action. The erosion, therefore, is essentially a process of smoothening or leveling in which soil and rock particles are carried, rolled or washed down the slope under the influence of both gravity and water.

In order to formulate appropriate soil conservation measures, it is essential to estimate the extent of soil erosion and its spatial context in the catchment area. Brief descriptions of various factors that are responsible for soil erosion are being discussed below.

8.2.2.1 *Drainage system and sub watershed delineation*

The head water of the main river channel Dhauliganga originates from the glacier clad and snow capped peak of Ganesh Parvat, which is elevated at a height of 6531 m asl (meters above the sea level) see **Fig 8.1**. Initially the river is called as Ganesh Ganga when it originates from Ganesh Parvat from Greater Himalayan range in the northern part of the catchment. It is called as Dhauliganga river after Shepak Kharak. The Dhauliganga river in the free draining area has a length of 17 km up to the barrage site. Kosa Gad and Pangti Gadera are the prominent tributaries systems in the free draining area. Kosa river which originates from Hathi Parbat glacier elevated at the range of 5600-5900 m asl. It flows for 11.7 km before it drains into Dhauli Ganga river near Kosa village. Pangti Gadhera is another prominent stream in the free draining area with a length of 4.9 km from the head water region to the point of confluence. Besides there are several small seasonal tributaries along left bank.

For the demarcation of sub-watersheds, hierarchical delineation system developed by AIS & LUS (AIS&LUS Technical Bulletin 9) was followed in this study. The codification system as given in Watershed Atlas of India (AIS&LUS) was followed for Jelam Tamak catchment at 1:50,000 scale. Based on this delineation scheme, Jelam river comprised of 3 sub-watersheds, which have been

designated as Dg1 to Dg3. Nallahs and streams from Dg1 to Dg3 sub-watersheds drain in the Dhauliganaga river catchment (see **Fig. 8.1**). The Catchment Treatment Plan has been limited to the free-draining catchment of the proposed Jelam Tamak H.E. Project as mentioned earlier. Therefore, for the preparation of CAT plan, all the three sub-watersheds have been delineated in the free-draining catchment area only as per the codification system given in Watershed Atlas of India (AIS&LUS) (see **Fig. 8.1**). Sub watershed coded with Dg1 is the largest sub watershed in the free draining area with an area coverage of 10465.20 ha, it is followed by sub watershed Dg3 with an area coverage of 2742.77 ha and lastly Dg2 with lesser area coverage of 2557.4 ha. The total area of the free draining area is 15765.38 ha.

8.2.2.2 *Slope and Relief*

The slope has major influence on the loss of soil and water from the watershed and thereby influences the land use capability. The percentage slope determines the erosion susceptibility of the soil depending on its nature. This helps in classifying various lands for suitable capability classes, which enables us to formulate suitable conservation measures for the prevention of soil erosion. The following slope classes and ranges are recommended by All India Soil & Land Use Survey (AIS&LUS) and the same have been followed here in this study.

SLOPE CLASS	SLOPE RANGE	DESCRIPTION
A	0 - 2%	Gently sloping
B	2 - 8%	Moderately sloping
C	8 - 15%	Strongly sloping
D	15 - 30%	Moderately steep
E	30 - 50%	Steep
F	50 - 70%	Very steep
G	Above 70%	Escarpments

The slope model for the proposed Jelam Tamak HE Project area was generated from the contours of Survey of India (SOI) toposheets at 1:50,000 scale following a 40 m contour interval. The contours were digitized using ArcGIS 9.0 From the digital data, Digital Elevation Model (DEM) was also generated for the entire project area as well as for the sub-watersheds using ArcGIS 9.1. Thereafter, the TIN models were also generated for all the constituent sub-watersheds in the free-draining catchment area of Jelam Tamak H.E. project. From these thematic maps slope of the free-

draining catchment area of Jelam Tamak H.E. project was generated (**Fig. 8.2**). These thematic maps were then used for erosion mapping and for forest cover mapping.

Our analysis shows that about 30.18% of the total free draining area falls under very steep category. It is followed by escarpment, which is spread on 22% of the free draining area. Steep is also prevalently spread in the area. In the sub watershed of Dg2, very steep is spread on 40.2% area of the sub watershed. In sub watershed of Dg1 the very steep class is spread on an area of 2932.04 ha of land. Likewise, very steep class in the sub watershed of Dg3 is spread on an area of 29.09% of its area. Other extreme slope classes like steep and escarpment are also prevalent in the free draining area. Both the classes' accounts for 41.6% of the total free draining area. Strongly slope accounts for 10.27% of the total free draining area. The remaining slope classes are scarcely spread in the three sub watershed of Dg1, Dg2 and Dg3.

Table 8.1 Area (ha) under different slope categories of Jelam Tamak H.E project catchment area

Slope class	**Area (ha)**	**Percent**
Flat	429.45	2.72
Gently Slope	412.24	2.61
Moderately Slope	732.15	4.64
Strongly Slope	1255.74	7.97
Moderately Steep	1619.55	10.27
Steep	2993.02	18.98
Very Steep	4758.44	30.18
Escarpments	3564.78	22.61
Total	**15765.37**	

8.2.2.3 ***Land use/ land cover***

Land use and land cover mapping was carried out by standard methods of analysis of remotely sensed data followed by ground truth collection and interpretation of satellite data. For this purpose digital data on CDROMs were procured from National Remote Sensing Agency, Hyderabad. Digital image processing of the satellite data and the analysis of interpreted maps were carried out at the Computer Centre at CISMHE using ERDAS Imagine 8.7.

Digital data of IRS P6 LISS-III and Landsat ETM+ were used for image processing and thematic map preparation (see **Fig.8.3** & Table 8.2). For the secondary data, Survey of India toposheets on 1:50,000 was referred for the preparation of base map and drainage map.

Table 8.2 Details of satellite sensor sources, path/row and date of image acquisition

Satellite	Sensor	Path/Row	Date	Data type & Bands
IRS P6	LISS-III	097/49	15-10-2006	Digital (1,2,3,4)
LANDSAT	ETM+	145/39	03-09-2005	Digital (1,2,3,4,5,7)

8.2.2.3.1 ***Classification Scheme***

With the objective of preparation of environment management plan and an action plan for watershed management and a catchment area treatment, the classification scheme adopted for the preparation of land use/ land cover maps and related thematic maps on 1:50,000 scale is as follows. Two forest density classes were interpreted for the forest cover mapping. The forests with >40% canopy cover were delineated as dense forests and between 10% and 40% crown density as open forest. Furthermore, degraded forests (with <10% canopy cover) and scrubs were also delineated for the purpose of erosion mapping. The cropland (agriculture) was also delineated for the calculation of erosion intensity classification. The non-forest land cover in the form of glaciers, lakes, moraines, etc. was also delineated.

The base map, drainage map and land use/land cover map prepared using the satellite data were digitized on computer for further processing and analysis using combination of ArcGIS 9.0 and GeoMedia Professional 5.2. The sub-watershed boundaries were then overlaid on the drainage map and land use map of the Jelam Tamak river watershed up to dam site in order to extract the drainage and land use of the sub-watersheds, which were further used for overlay analysis by Geographic Information System (GIS) techniques.

As shown in the **Figure 8.4** free draining area is majorly covered with snow and glaciers with area coverage of 34% of the total free draining area. Dense forest and Open forest also forms prominent land cover in the free draining area. The corresponding classes cover 18.8% and 17.05% of the free draining area respectively. Barren land and Moraines together constitute 17% of the free draining area. Rest of the land cover/ land uses are spread in lesser area with area coverage of less

than 10 ha. The head water region of Kosa Gad in sub watershed Dg1 is largely covered with snow and glaciers. Both the classes constitute 50% of the total area of the sub watershed. Barren land constitutes 15% the total area of the sub watershed Dg1. However, dense forest and open forest in the sub watersheds of Dg2 and Dg3 are largely spread with an area coverage of 58.2% in the Dg2 and 91% in the Dg3 (see Table 8.3). Large part of the land in the free draining area is characterized with less susceptible to soil erosion except of barren and moraines land cover. Besides in the higher altitude much of the land is covered with snow and glaciers where treatment and preventive measurements are not feasible as well as not required.

Table 8.3 Area (ha) under different land use/ land cover categories in free-draining catchment area of Jelam Tamak H.E. project

Land use/ land cover	Area (ha)	Per cent
Dense Forest	2929.61	18.58
Open Forest	2687.58	17.05
Scrub	754.58	4.79
Alpine Scrub	561.58	3.56
Cultivation	39.59	0.25
Barren	1855.9	11.77
Moraines	1064.23	6.75
River	368.22	2.34
Snow	4385.16	27.82
Glacier	1118.93	7.10
Total	**15765.38**	

8.2.2.4 *Soils*

The soil classes in free draining area of Jelam Tamak H.E. Project is comprised of 4 soils associations (**Fig. 8.5**; and Table 8.5). Soil classification and characteristics are given in Table 8.4. Soil association S7 is largely spread in the free draining area; S7 is characterized with the association of Typic Cryorthents and Lithic Cryorthents. This soil class is characterized with excessively drained coarse loamy on steep slope and is susceptible to severe erosion. It covers an area of 47.61% of the total free draining area. In sub watersheds of the Dg2 ad Dg3 it amounts to more than >50% of the total corresponding areas of sub watersheds of Dg2 and Dg3.

Association of Glaciers and Rock outcrop (S1&S2) is also prevalent in the free draining area. It is largely spread in the Dg1 with area coverage of ~ 40% of the sub watershed Dg1. It is also spread in small area of sub watershed Dg2 along the right bank of Dhauliganga river.

It is followed by association of Lithic Cryorthents – Lithic Cryorthents (S3) which is also predominant in head water region of the Kosa Gad in sub watershed Dg1. It covers an area of 11.3% of total free draining area. This soil class is completely devoid in Dg2 and Dg3. It is very shallow, excessively drained, loamy soils on very steep slopes with loamy surface and very severe erosion.

Lastly the soil class (S8) is largely spread in sub watershed Dg3 and meager area of sub watershed Dg2. However it is completely devoid in the large sub watershed (Dg1) (see **Fig 8.5**).

Table 8.4. Soil associations of the catchment area of Jelam TamakH.E. project

Soil Unit	Main Group	Sub Group
1	**Glaciers; *associated with***	Rock outcrops
2	**Glaciers**	-
3	**Lithic Cryorthents** Rock outcrops; *associated with*	**Lithic Cryorthents** Very shallow, excessively drained , sandy-skeletal soils on very steep slopes with sandy surface, very severe erosion and strong stoniness.
7	**Typic Cryorthents** Moderately shallow, excessively drained, coarse loamy soils on steep slopes with loamy surface, severe erosion and moderate stoniness; *associated with:*	**Lithic Cryorthents** Shallow, excessively drained, loamy skeletal soils on very steep slopes with loamy surface, very severe erosion and moderate stoniness.
8	**Typic Cryorthents** Moderately shallow, excessively drained, sandy-skeletal soils on moderate slopes with sandy surface, moderate erosion and strong stoniness; *associated with:*	**Typic Cryorthents** Rock outcrops.

Table 8.5 Area (ha) under different soil classes in free-draining catchment area of Jelam Tamak H.E. project

Soil Class	Area	Percent
S 1- S 2	5367.18	34.04
S 3	1782.24	11.30

S 7	7506.65	47.61
S 8	1109.31	7.04
Total	**15765.38**	

8.2.2.5 *Erosion Intensity Mapping*

A Composite Erosion Intensity Unit (CEIU) map on 1:50,000 scale was prepared using the thematic maps of slope, drainage, soil and land use (**Fig. 8.6** and Table 8.6). This composite map was then superimposed on the drainage map with sub-watershed boundaries in order to obtain sub-watershed-wise CEIU maps.

Table 8.6 Legend for the Composite Erosion Intensity Unit

Erosion	Slope Land cover	Land use/ depth	Soil DR Unit	Weightage/Intensity
Very Severe (a)	Very very steep >50%	Open forest, scrub forest	Shallow	20/0.95
Severe (b)	Steep to very steep 25 -50%	Open forest, scrub, cultivation	Moderately shallow	18/0.90
Moderate to slight (c)	Strongly sloping to moderately steep 10-25%	Dense forest, open forest, cultivation	Moderately deep	13-15/0.90
Slight to Negligible (d)	Gently sloping to moderately sloping 5-10%	Dense forest, open forest	Deep	11/0.85

8.2.2.6 *Sediment Yield Index*

To calculate sediment yield index, methodology developed by All India Soil & Land Use Survey (Department of Agriculture, Govt. of India) was followed, where each erosion intensity unit is assigned a weightage value. When considered collectively, the weightage value represents approximately the relative comparative erosion intensity. A basic factor of K = 10 was used in determining the weightage values. The value of 10 indicates a static condition of equilibrium between erosion and deposition. Any addition to the factor K (10+X) is suggestive of erosion in ascending order whereas subtraction, i.e. (10-X) is indicative of deposition possibilities.

Delivery ratios were adjusted for each of the erosion intensity unit. The delivery ratio suggests the percentage of eroded material that finally finds entry into dam/reservoir or river/stream. Area of each composite unit in each sub-watershed was then measured.

Sediment yield index (SYI) was calculated using following empirical formula (for SYI of individual sub-watersheds see Annexure-I).

$$SYI = \frac{\sum (A_{ei} \times W_{ei} \times DR)}{AW} \times 100$$

where,

SYI = Sediment yield index
A_{ei} = Area of composite erosion intensity unit
W_{ei} = Weightage of composite erosion intensity unit
DR = Delivery ratio
AW = Total area of the sub-watershed

8.2.2.7 *Erosion Intensity and Delivery Ratio*

Determination of erosion intensity unit is primarily based on the integrated information on soil characters, physiography, slope and land use/land cover. This is achieved through super-imposition of different thematic map overlays. Based on the ground-truth, carried out during the field work, weightage value and delivery ratio were assigned to each erosion intensity unit.

Delivery ratio, which depends on the type of material, soil erosion, relief length ratio, land cover conditions, etc. were assigned to all erosion intensity units depending on their distance from the nearest stream. The criteria adopted for assigning the delivery ratio are as follows:

Nearest Stream	Delivery ratio
0 - 0.9 km	1.00
1.0 - 2.0 km	0.95
2.1 - 5.0 km	0.90
5.1 - 15.0 km	0.80
15.1 - 30.0 km	0.70

8.2.3 Prioritisation of Sub-watersheds for Treatment

Based on the Sediment Yield Index (SYI), sub-watersheds that require treatment measures were prioritized using the simple rule that the sub-watersheds with a higher SYI were ranked higher in priority for treatment (Table 8.7). The sub-watersheds Dg1, Dg2 and Dg3 would be treated on

priority basis in the treatment scheme to be followed (Table 8.7). An index map giving physical targets of the year-wise treatment measures to be undertaken in different sub-watersheds prepared according to their priority ranking for treatment was prepared and is given in **Figure 8.6**.

Table 8.7 Prioritization of sub-watersheds for catchment area treatment measures

Sub watershed	SYI	Area (Ha)	Priority ranking
Dg1	1207.52	113.15	II
Dg2	1185.19	474.93	III
Dg3	1317.69	549.18	I
Total		**1137.26**	

8.2.4 Area to be taken up for Soil Conservation Measures

The prioritized areas in the different sub-watersheds of the free-draining catchment of Jelam Tamak H.E. Project that require treatment were delineated and their areas calculated from the composite erosion intensity unit map. For this, a number of simple as well as complex spatial queries were run in a step-wise manner using GIS softwares (ArcGIS 9.0 & GeoMedia Professional 5.2). These queries included different attributes of parameters that have been defined earlier in the chapters, *viz*. slope, soil, land use, etc. For executing these queries all the thematic maps of different attributes and parameters were geo-referenced to maintain the accuracy of the resultant outputs. In case of slope, the spatial queries were undertaken for different slope categories ranging from gently sloping category to escarpments with different soil classes like shallow soils, deep soils, etc. The subsequent queries were executed with resultant outputs from the first level queries with different attributes of land use/ land cover. From these queries a thematic map of areas susceptible to erosion in the entire free-draining catchment area was prepared. The area under different erosion intensity categories is given in Table 8.8. From the thematic map of erosion intensity, areas that require treatment measures were extracted with the help of further spatial queries. Areas which were classified as inaccessible, i.e. areas with more than 45^{o} (100%) slope and areas above 3,000 m with natural ecosystems having less human interference were excluded from the treatment measures even though these areas may have ranked high in prioritization for treatment. After taking out the areas where it was not feasible to carry out treatment, the total area that will require treatment

under this CAT plan is of the order of 1137.26 ha (**Fig.8.7**). The total area earmarked for the treatment comprises 7.21% of the free-draining catchment area, and the treatable area is about 21.62% of the total area under very severe and severe erosion intensity categories requiring treatment measures.

Table 8.8 Area (ha) under different erosion intensity categories in sub-watersheds of Jelam Tamak H.E. project area

	Slight	Moderate	Severe	Very Severe	River	Snow	Glacier	Total
Dg1	18.88	329.86	1313.38	988.68	330.79	6417.97	1065.65	10465.2
Dg2	35.56	238.58	1156.21	144.25	36.45	893.06	53.28	2557.39
Dg3	63.8	930.1	1590.67	67.44	0.98	89.8	0	2742.79
Total	**118.24**	**1498.54**	**4060.26**	**1200.37**	**368.22**	**7400.83**	**1118.93**	**15765.4**

8.2.5 Year-wise Treatment of Watersheds

Silt yield index (SYI) has been calculated for all the three sub-watersheds, following the All India Soil and Land Use Survey (AISLUS) method and accordingly prioritized for treatment (**Fig.8.8** & Table 8.9).

Table 8.9 Year-wise treatment of the sub-watersheds

Year	Sub-watersheds	Area to be treated	%age
Ist	Dg3	284.20	24.99
		284.20	
IInd	Dg3	213.27	18.75
		213.27	
IIIrd	Dg3	51.71	4.55
	Dg1	113.15	9.95
	Dg2	82.48	7.25
		247.34	
IVth	Dg2	208.15	18.30
		208.15	
Vth	Dg2	184.30	16.21
		184.30	

8.2.6 Activities to be undertaken

For undertaking soil conservation measures in the Jelam Tamak-H.E. project catchment area up to dam site various indirect or preventive measures like biological measures and direct or

remedial measures like engineering measures (Table 8.10) have been discussed in the following paragraphs. Even as suggestions have been made regarding certain specific treatment measures to be undertaken in a particular sub-watershed, these measures, however, may require further micro-planning during the implementation stage.

8.2.6.1 *Preventive Measures*

It is always better to undertake preventive measures than to mitigate the factors that ultimately lead to soil erosion. Such preventive measures will indirectly help to conserve soil in the long run, keeping in view the importance of integrating eco-restoration strategy with socio-economic needs of the local community wherein both ecology and economics are developed. The preventive measures that are suggested for the project area have been discussed below.

8.2.6.1.1 *Afforestation*

In the upland region like this project area, the trees and vegetation cover play an important role in the conservation of soil and ecology. Afforestation programme would be taken up in such forest areas that contain large patches of barren grassy slopes and are generally devoid of trees and are honey-combed by cultivation. In critically degraded areas, plantation of locally useful, diverse and indigenous plant species such as *Cedrus deodara, Cupressus torulosa, Fraxinus xanthoxyloides, Pinus wallichiana, Taxus baccata,* etc. would be undertaken. Afforestation measures would be taken up under catchment area treatment plan on 383.78 ha. An outlay of Rs.147.37 lakhs has been provided to cover various areas under afforestation in different sub-watersheds.

a) *Afforestation Programme*

Different types of plantations would be undertaken under afforestation programme according to the methodology described below. The plantations that would be undertaken in the forest blanks would have a planting density of 1600 plants per ha and vegetative hedge in contour trenches. Contour planting conserves soil and enhances moisture regime and adverse effect of surface run off of rain water is reduced considerably. Trenches, pits and plants along the contour reduce velocity of water, increase soil moisture and facilitate seepage of water in soil and reduce soil loss resulting in better growth of plants. Hence, soil working and planting along contours would be strictly followed in the project.

Table 8.10 Watershed-wise details of various activities

Sl. No.	Name of Component Sub-Watershed	Engineering Measures			Biological Measures				Total
		Gully Control		Bench Terracing	Afforestation	Assisted Natural Regeneration	NTFP Regeneration/ Medicinal Plants Cultivation	Pasture Improve-ment	
		Brushwood Check dams	DRSM						
1.	Dg1	34	23	13.50	25.75	18.85	26.55	28.50	**113.15**
2.	Dg2	45	65	88.25	152.20	110.15	85.50	38.83	**474.93**
3.	Dg3	68	62	110.50	205.83	145.48	61.25	26.12	**549.18**
	Total	**147**	**150**	**212.25**	**383.78**	**274.48**	**173.30**	**93.45**	**1137.26**

In the afforestation areas, the digging of trenches and pits would be along the contour. About 20 to 30 m long contour trenches would be dug leaving a space of 50 cm (septa) between the two consecutive trenches. Soil would be dug on the lower side of the trench and after removing pebbles and weeds, the trench to be half refilled with soil and remaining soil would be collected to form berm on lower side of trench. On the berm, seeds of shrubs/hedges like *Berberis petiolaris, Cotoneaster microphyllus, Ephedera gerardiana, Hippophae salicifolia, Olea cuspidata*, etc. would be sown to raise vegetative barrier. The size of trench/pits would be 45 cm^3. The contour trenches would be at an interval of 5 m.

For digging 1600 pits per ha, pits would be dug 15 cm uphill side from the contour trenches. The spacing of pits along contour trench will not be closer than 1.25 m. In afforestation areas soil working would be started in October-November and to be completed by March. It is important that filling of pits and half filling of trenches to be completed before the onset of monsoon, otherwise dug soil will be washed away by rains leaving only stones and pebbles near the pit. Extreme care would be taken in transporting the plants from nurseries to the plantation site to avoid any damage. Planting would be completed before the monsoon period is over. With a view to conserve not only soil and water but also for fuelwood production, it is important to raise the vegetative barrier of hedge plants. The seeds of hedges like *Ephedera gerardiana, Hippophae salicifolia, Olea cuspidata,* etc. will be sown in contour trenches before the onset of monsoon. When the water of surface run-off reaches the line of hedges its speed is checked and silt is stopped by the hedge plants and only percolated water passes down slowly. Hedges spread and grow well in the silt left behind and form a natural terrace. The plants planted in the pits near contour trenches get more moisture and grow fast.

b. *Choice of Species*

The species for plantations would be selected after considering altitude, aspect, biotic pressures, soil depth, moisture, etc. As there is great pressure of cattle grazing, non-fodder/ fuelwood species would also be planted in suitable proportion in between the fodder species.

The tree species that would be planted under this programme are : *Aesculus indica (Pangar), Cedrus deodara (Deodar), Cupressus torulosa (Surai), Fraxinus xanthoxyloides (Repchu), Juglans regia (Akhrot), Juniperus recurva (Bittaru), Pinus wallichiana (Kail), Prunus armenica (Chulu), Quercus leucotricophora (Banj), Q. dilatata (Mopru), Taxus baccata (Thuner),* etc.

The plant species which are suitable for fodder/ fuelwood plantations are: *Aesculus indica, Hippophae salicifolia, Populus ciliata, etc.*

The important legumes and grasses that would be planted are *Astragalus candolleanus, Caragana gerardiana, Danthonia cachemeriana, Festuca rubra, Phleum alpinum, Trifolium repens,* among legumes.

The plant species suitable for avenue and ornamental purposes are: *Aesculus indica, Cedrus deodara, Juniperus recurva, Pinus wallichiana* and *Taxus baccata.*

c. *Fencing/Biofencing*

Stone wall 120 cm high and 45 cm wide or 4 strand barbed wire fencing would be erected during first year along with soil working. The cooperation of local villagers would be sought for the success of the plantation programmes. Bio fencing is not possible in the region because most of the throny xerophytic plant species like *Agave sisalina, Euphorbia royleana, Opantia* sp., considered suitable for bio fencing can not survive in the high altitude area.

d. *Weeding and Mulching*

Weeding, hoeing and mulching would be carried out during October-November. Weeding and loosening of soil by hoeing breaks the capillary action in soil and thus reduces the moisture loss. Mulching reduces evaporation and conserves soil moisture and adds humus to soil. Cut and uprooted weeds and grasses used as mulching material would be spread around the plant.

e. *Watch and Ward and Fire Protection*

Protection of plantation is the greatest challenge in hills as villagers and their livestock damage the plantation before it is established. Hence the protection of plantation particularly in the juvenile stage is of paramount importance and watchmen/ chowkidars would be engaged from the nearby villages for the required job. Besides the above, other appropriate measures would be adopted to ward off these potential threats.

f. *Assisted Natural regeneration in existing forest*

In some of the forest areas, conditions are conducive to natural regeneration provided some sort of assistance is provided. Such areas shall be taken up under this component. The areas shall be

closed to exclude biotic interference. Forest floor will be cleared of slash; debris and felling refuse to afford a clean seedbed to the falling seed. At certain places some soil raking may also have to be done to facilitate germination of seeds. Where natural regeneration is found deficient, it will be supplemented by artificial planting. Patch sowing in suitable areas may also be done. Bush cutting & cleaning operations are done depending on necessity. Up to 800 plant or patches per hectare will be planted /sown to hasten the process of regeneration in the area uniformly. An outlay of Rs.61.82 has been made to cover 284.48 ha.

g. ***Non Timber Forest Produce (NTFP) Regeneration***

Uttaranchal Forest Department is rich in a variety of non timber forest produce (hereafter NTFP). However, because of over-exploitation of NTFP in the past there has been depletion of this valuable resource. Therefore, in order to augment natural stock of NTFP in the forests, it is proposed to take up planting of NTFP and establishing nursery. An outlay of Rs.97.04 lakhs @ Rs.48000/- per ha has been suggested to cover about 173.30 ha for establishing (Rs.83.18 lakhs) and its maintenance (Rs.13.86 lakhs) of this facility for 5 years.

h. ***Grazing Land/Pasture Improvement***

The livestock owned by the local communities exert significant pressure on the natural habitats. In order to improve the grazing areas/ pastures and to make these sustainable, the degraded areas, particularly among community lands will be taken up for treatment under silvi-pastoral model. An outlay of Rs.23.01 lakhs has been earmarked for this purpose and it will cover about 93.45 ha of land for development at a cost of Rs.19.99 lakhs and its maintenance will cost Rs.3.02 lakhs for 5 years.

i. ***Forest infrastructure development***

For efficient management of forest resources, it is essential that field infrastructure of the State Forest Department of the area is adequately developed. Given the rugged mountainous terrain, there is a need to improve the existing forest roads and paths. Jeepable roads would be avoided in the forests of the catchment area as this would lead to habitat fragmentation, degradation and increased siltation. Only bridle paths, inspection paths and footbridges shall be constructed or improved for which an amount of Rs.91.38 lakhs has been earmarked. Similarly, in remote localities of the Forest divisions there are no places for shelter for the staff, local people, tourists or trekkers.

8.2.7 Treatment Measures

8.2.7.1 *Engineering Measures*

a) *Gully Control*

The gullys would be treated with the help of engineering/ mechanical as well as vegetative methods. Check dams would be constructed in some of the areas to promote growth of vegetation that will consequently lead to the stabilization of the slopes/area and prevention of further deepening of gullys and erosion. For controlling the gullys, the erosive velocities are reduced by flattening out the steep gradient of the gully. This is achieved by constructing a series of checks which transform the longitudinal gradient into a series of steps with low risers and long flat treads. Different types of check dams would be required for different conditions comprising different materials depending upon the site conditions and the easy availability of material at local level. The following types are recommended for this area:

i) Brushwood check dam
ii) DRSM (Dry Rubble Stone Masonry) - Check dams with stones available at the site
iii) Combination of DRSM and crate works. For moderate to deep gullys with stones available at the sites

In addition to the vegetative measures used for stabilisation of gullys, temporary or permanent mechanical measures will be used as supplementary measures to prevent the washing away of young plantations by large volume of run off. The gullys get stabilised over a period of time with the establishment and growth of vegetation cover. With the passage of time mechanical structures weaken and vegetative measures get strengthened.

For engineering measures following types of checkdams are suggested.

i) Brushwood check dams

The main advantage of brushwood checkdams is that they are quick and easy to construct and are inexpensive as they are constructed by using readily available materials at the site. In brushwood checkdams, small branches preferably of coppiceable species are fixed in two parallel rows across the gully or nala and packed with brushwood between the rows of these vertical stakes. The vertical stakes are tied down with wires or fastened with sticks across the top. The important consideration in erecting brushwood checkdams is to pack the brushwood as tightly as possible and to secure it firmly. This type of checkdam is generally constructed over small gullys or at the starting stretch of

gullys. In all, 147 brushwood checkdams/ vegetative spurs would be constructed to check gully erosion, stream bank protection and slope stabilisation works.

ii) Dry Rubble Stone Masonry (DRSM) checkdams

The site where DRSM check dams are to be constructed is cleared and the sides are sloped 1:1. The bed of gully is excavated for foundation to a uniform depth of 0.45 m to 0.60 m and dry stones are packed from that level. Over the foundation, DRSM super structure of check dam is constructed. The stones are dressed and properly set in with wedges and chips. The width of checkdam at the base should be approximately equal to maximum height and successive courses are narrower so the section is roughly a trapezium. It is common to find upstream face of checkdams vertical with all slopes on the downstream face but while there is sound engineering reason for this in case of large checkdams but it is not of any consequence in small gully control dams. In the centre of the dam portion sufficient waterway is allowed to discharge the maximum run off. The dry stone work should go up to 0.30m to 0.60m in the stable portion of the gully side to prevent end-cutting. Sufficient apron is provided to prevent scouring of the structure. The thickness of the apron packing would be about 0.45 m and gully sides above the apron have to be protected with packing to a height of at least 0.30 m above the anticipated maximum water level to prevent side scour being formed by the falling water. For gully control measures 150 DRSM checkdams would be constructed.

b. *Slope modification by Stepping/Bench Terracing*

Bench terracing is one of the most popular mechanical soil conservation practices adopted by farmers in India and many other countries. It is constructed in the form of step like fields along contours by half cutting and half filling and would result in the conversion of the original slope into levelled fields. Thus, hazards of erosion are eliminated and manure and fertilizers applied are retained in the levelled fields. The sloping fields in the valley need to be bench terraced by cutting and filling with the latter supported by retaining stone wall. While making bench terraces, care will be taken not to disturb the top soil by spreading earth from the lower terraces to higher terraces. The vertical intervals between the terraces will not be more than 1.5 m and cutting depth would be kept at 50 cm. The minimum average width of the terrace would be 4 to 5 m to enable the usage of prolong hinge. The shoulder bunds of 30 x 15 cm would also be provided. The excess water from the terraces will be drained off by staggered channels. An area of 212.25 ha will be covered under this plan.

c. Administrative Setup

The catchment area treatment (CAT) project involves intensive and highly technical operations, which require the expertise of technical personnel. It is, therefore, recommended that the existing forest staff of Uttranchal Forest Division in the area will look after all the works to be carried out under the CAT plan including plantation and maintenance as all the areas to be covered under CAT plan fall under these divisions. However, temporary staff may be engaged for the purpose during the project implementation period, i.e. for about 5 years.

8.2.7.2 ***Nursery Development***

Proper development of nursery and allied services, like drip irrigation or micro-irrigation, will be crucial for successful execution of CAT plan. It will be important to prepare a stock of plant material for the supply of saplings for afforestation programme and various other activities. Main nursery may be developed near dam site, proposed colony areas, preferably along the road side for easy accessibility. The nurseries may be developed within 5 km radius of the project area (barrage site to powerhouse site) because of its proximity to both the upstream and downstream part of the CAT plan area as it lies in the middle of catchment. Besides, this area possesses necessary infrastructure and various raw materials for nursery development can be easily made available. In addition, provision will also be made for two green-houses/chick houses for maintaining plant saplings. The estimated cost for the development of nursery and greenhouses will be around **Rs. 50 lakh** (Table 8.11). Development of nursery will start from the zero year and will continue for 5 years. During maintenance year nursery will supply plants wherever required for the replacement.

Table 8.11 Cost for the Nursery Development

Amount (Rs. in lakhs)

Components	Development	Maintenance	Total
Shed House for raising saplings (one time grant)	1.20	0.70	1.90
Seeds collection procurement grant	5.00	-	5.00
Compost, soil, fertilizer and other materials	4.00	-	4.00
Shed House/ Chickhouse for maintaining and storing saplings (Nos 2)	3.50	1.25	4.75
Poly bags, pots, trays for raising saplings	3.50	-	3.50
Nursery Equipments	4.00	-	4.00
Glass wares and other laboratory wares	2.00	0.45	2.45
Chemicals, pesticides, and other plant growth regulators	1.50	0.50	2.00
Hand held trollies (Nos. 10) for transporting plant saplings	0.75	0.15	0.90

Mini-truck for transporting plants	5.00	1.50	6.50
Contingency grant for all recurring expenditure	5.00	-	5.00
Personnel/ staff	10.00	-	10.00
Total	**45.45**	**4.55**	**50.00**

8.2.7.3 *Forest Infrastructure Development*

The works of the catchment area treatment plan will be executed by the Forest Department, Government of Uttaranchal. These works will be an added responsibility for the Forest Department that may not have adequate facilities and infrastructure to execute the work as suggested in the plan. Provision has, therefore, been made in the CAT plan to develop the infrastructure of Forest Department in the region and accordingly a budget of **Rs. 91.38 lakhs** is proposed for this purpose (Table 8.12).

Table 8.12 Budget for development of State Forest Department infrastructure

Amount (Rs. in lakhs)

S.No.	Components	Qty./Unit	Total
1.	Forest Office Establishment (one office)	-	25.25
2.	Forest Fire Fighting System	-	5.00
3.	Office Vehicle	2 No.	12.00
4.	Road and Foot Path Development	-	6.58
4.	Machinery & Equipment*	-	20.00
4.	W & W	8 Nos.	5.35
5.	Monitoring & Evaluation	-	5.00
6.	Adm. Cost	-	6.20
7.	Contingency	-	6.00
	Total		**91.38**

8.2.7.4 *Eco-restoration and Local Area Development*

There is urgent need to reduce the dependency of local population on the forest and other natural resources which are under severe pressure. The eco-restoration works and other activities related to area development and employment regeneration are suggested and should be carried out through community welfare committees (CWC) of local villages. These should include the following measures, which would help in rejuvenating the ecosystems and in reducing the soil erosion in the region.

1. Plantation in the degraded patches of community/civil/ forest land.
2. Water conservation and harvesting in the villages.
3. Soil conservation measures in village areas.
4. Improvement in agricultural and horticultural practices.
5. Technical and financial support for harnessing alternate energy sources such as micro-hydel and non-conventional energy (solar power and solar heating) to reduce pressure on the forest for fuel wood
6. Rural technology support programmes.
7. Awareness programmes for conservation of wildlife and natural resources.
8. Promotion of income generating schemes like ecotourism.

The total cost estimate for these activities is proposed as **Rs. 49.27 lakhs** (Table 8.13).

Table 8.13 Budget for Eco-restoration and Local Area Development

Activities	Amount (Rs. in Lakh)
Plantation of avenue trees in the villages and towns	5.00
Cooking gas supply and energy conservation measures	6.02
Maintenance of hygiene in the villages and towns	7.25
Training, awareness, extension and other activities	10.00
Income generating schemes	6.00
Contingency	15.00
Total	**49.27**

8.2.7.6 *Schedule of Treatment Plan*

The total time schedule for the execution of the planned CAT works has been kept at 6 years. Accordingly, areas from each sub-watershed have been prioritized for treatment and a year-wise plan has been assigned (**Fig. 8.8**). Zero year has been kept for the development of nursery and raising sapling for plantation. 3 sub-watersheds have been suggested to be taken up for treatment in each year and accordingly area for treatment in each year is allotted. Maximum area for treatment will be taken up in Ist year and minimum will be taken up in the Vth year. In the second and third year the area taken up for treatment is 213.27 ha and 247.34 ha, respectively and in the fourth year the area to be taken up for treatment is 208.15 ha (**Fig. 8.8**).

8.2.7.7 ***Micro-planning***

A separate budget of **Rs. 15.72 lakh** is allocated for the micro-planning. This will help in designing a suitable treatment type, biological or engineering measure, required for a particular location.

8.2.8 Monitoring and Evaluation

Monitoring and evaluation will be developed as in built part of the project management. Thus, a process of self-evaluation at specified intervals of time will ensure the field worthiness and efficacy of the CAT plan.

Annual work plan for each sub-watershed would be prepared well in advance specifying physical and financial targets, sites, locations and beneficiaries of each component of the project activity. Month-wise work scheme of various items of each component for the financial year would also be prepared in advance and its timely implementation would be ensured. Monthly progress report on all activities would be submitted by the Range Officers to Divisional Forest Officer for its subsequent submission to the project authorities and Ministry of Environment & Forests, Government of India. The monitoring committee appointed for this purpose would also monitor on a regular basis the quality and quantity of works carried out in the area.

For monitoring, reference points of silt load observation in the river are suggested to install silt recording station upstream of dam site in Tamak river to evaluate the impact of the soil conservation measures. A sum of **Rs. 30.00 lakhs** has been provided for monitoring and evaluation.

8.2.9 Period and Schedule of Implementation

The execution of CAT plan in Jelam Tamak-H.E. project area would require extensive efforts on the part of executing agencies. Keeping in view the local topography and climate, it is being estimated that the entire treatable area would require at least 5 years to complete. However, the maintenance of plantations would continue for one year and accordingly CAT plan has been prepared for 6 years. All these works would have to start with the pre-construction activities especially the studies in respect of micro-planning for each sub-watershed, which would require further detailed investigations. The year-wise index map of schedule of implementation of different

conservation measures under CAT plan has been given in Fig. 8.8. Table 8.15 gives the year-wise physical details of various engineering and biological treatment measures to be undertaken.

8.2.10 Cost Estimates

The total estimated cost of catchment area treatment plan to be spent over a period of 6 years is **Rs. 773.43.** The details of cost estimates and physical work schedule as well as phasing of expenditure are given as follows in Table 8.14. All the costs towards the administration during the implementation work have been included in the cost estimates of CAT (Table 8.14).

Table 8.14 Component-wise cost estimate for catchment area treatment works

S. No.	Item of Work	Unit	Qty.	Rate (Rs.)	Amount (Rs. in lakhs)
A.	**Engineering Measures**				
1.	Gully Control				
	a) Brushwood checkdams	Nos.	147	1375/-	2.02
	b) DRSM checkdams	Nos.	150	16560/-	24.84
2.	Bench terracing	ha	212.25	7500/-	15.92
	Total (1+2)				**42.78**
	Add 5% for maintenance of structures				2.14
	Sub-total (A)				**44.92**
B.	**Biological Measures**				
1.	Afforestation				
	i) Creation	ha	383.78	34000/-	130.48
	ii) Maintenance			4400/-	16.89
2.	Assisted natural regeneration in existing forests				
	i) Creation	ha	274.48	19450/-	53.39
	ii) Maintenance (see Table 2.14)			3070/-	8.43
3.	NTFP Regeneration				
	i) Creation	ha	173.30	48000/-	83.18
	ii) Maintenance (see Table 2.15)			8000/-	13.86
4.	Pasture development				
	i) Creation	ha	93.45	21390/-	19.99
	ii) Maintenance			3230/-	3.02
5.	Nurseries				50.00
6.	Landslide Treatment (Lump sum)				100.00
	Sub-total (B)				**479.24**
	Sub-Total (A+B)				**524.16**
C.	**Micro-planning @ 3% of (A+B)**				**15.72**
D.	**Establishment Cost @ 7%**				**36.69**

E.	**Forest Infrastructure** Vehicles, machinery & equipment, paths, etc.	**91.38**
F.	**Eco-restoration and Local Area Development**	**49.27**
G.	**Contingency @ 5%**	**26.21**
H.	**Monitoring and evaluation**	**30.00**
	Grand Total (A to H)	**773.43**

8.3 DETAILED CAT PLAN

In order to prepare CAT plan on the micro watershed level, a detailed study will be carried out in the free draining catchment of Jelam Tamak H.E. Project. The plan will be prepared by the State Forest Department. All the measures including engineering, biological and bio-engineering will be applied in the CAT plan. Thus, the proposed budget allocated for CAT plan is not final because after a detailed study the budget may be enhanced significantly.

Table 8.15: Year-wise physical and financial layout plan of Jelam Tamak H.E. Project **Amount (Rs. in lakhs)**

S. No.	Item	Unit	0th Year		I st Year		II nd Year		III rd Year		IV th Year		V th Year		VI th Year		Total	
			Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin
A.	**ENGINEERING MEASURES**																	
1.	a) Brushwood checkdams	Nos.	-	-	37	0.51	28	0.39	32	0.44	26	0.36	24	0.32	-	-	**147**	**2.02**
	b) DRSM checkdams	Nos.	-	-	38	6.29	28	4.64	33	5.46	27	4.47	24	3.98	-	-	**150**	**24.84**
2.	Bench Terracing	ha	-	-	53.06	3.98	40.32	3.02	46.70	3.51	38.21	2.86	33.96	2.55	-	-	**212.25**	**15.92**
	Total (1 + 2)																	**42.78**
	Add: 5% for maintenance of structures																	2.14
	Total (A)																	**44.92**
B.	**BIOLOGICAL MEASURES**																	
	a) Afforestation	(ha)	-	-	95.95	32.62	72.92	24.79	84.43	28.71	69.08	23.49	61.40	20.87	-	-	**383.78**	**130.48**
	Maintenance		-	-	-	-	-	4.22	-	3.21	-	3.72	-	3.04	-	2.70	-	**16.89**
	b) Assisted Natural Regeneration	(ha)	-	-	68.62	13.35	52.15	10.14	60.38	11.74	49.41	9.61	43.92	8.55	-	-	**274.48**	**53.39**
	Maintenance		-	-	-	-	-	2.11	-	1.60	-	1.85	-	1.52	-	1.35	-	**8.43**
	c) Pasture Improvement	(ha)	-	-	23.36	5.00	17.75	3.80	20.56	4.40	16.83	3.60	14.95	3.19	-	-	**93.45**	**19.99**
	Maintenance		-	-	-	-	-	0.75	-	0.57	-	0.66	-	0.54	-	0.50	-	**3.02**
	d) NTFP Regeneration	(ha)	-	-	43.32	20.79	32.93	15.81	38.13	18.30	31.19	14.97	27.73	13.31	-	-	**173.30**	**83.18**
	Maintenance		-	-	-	-	-	3.46	-	2.63	-	3.05	-	2.50	-	2.22	-	**13.86**
	e) Nursery Development		-	11.36	-	8.64	-	10.00	-	8.18	-	4.55	-	2.72	-	-	-	**45.45**
	Maintenance		-	-	-	1.14	-	0.86	-	1.00	-	0.82	-	0.46	-	0.27	-	**4.55**
	f) Landslide Treatment (Lump sum)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**100.00**
	Total (B)																	**479.24**
	Total (A + B)																	**524.16**
C.	**Micro-planning @ 3% of A+B**		-	-	-	3.18	-	2.42	-	2.80	-	2.29	-	2.03	-	-	-	**15.72**
D.	**Eco-tourism & Local Area Development**		-	-	-	12.32	-	9.36	-	10.84	-	8.87	-	7.88	-	-	-	**49.27**
E.	**Establishment Cost @ 7% of A + B**		-	-	-	7.42	-	5.64	-	6.53	-	5.34	-	4.76	-	-	-	**36.69**
F.	**Forest Infrastructure Development**		-	-	-	22.85	-	17.36	-	20.10	-	16.45	-	14.62	-	-	-	**91.38**
G.	**Contingency @ 5% of A + B**		-	-	-	5.30	-	4.03	-	4.67	-	3.82	-	3.39	-	-	-	**26.21**
H.	**Monitoring and Evaluation**		-	-	-	7.50	-	5.70	-	6.60	-	5.40	-	4.80	-	-	-	**30.00**
GRAND TOTAL																		**773.43**

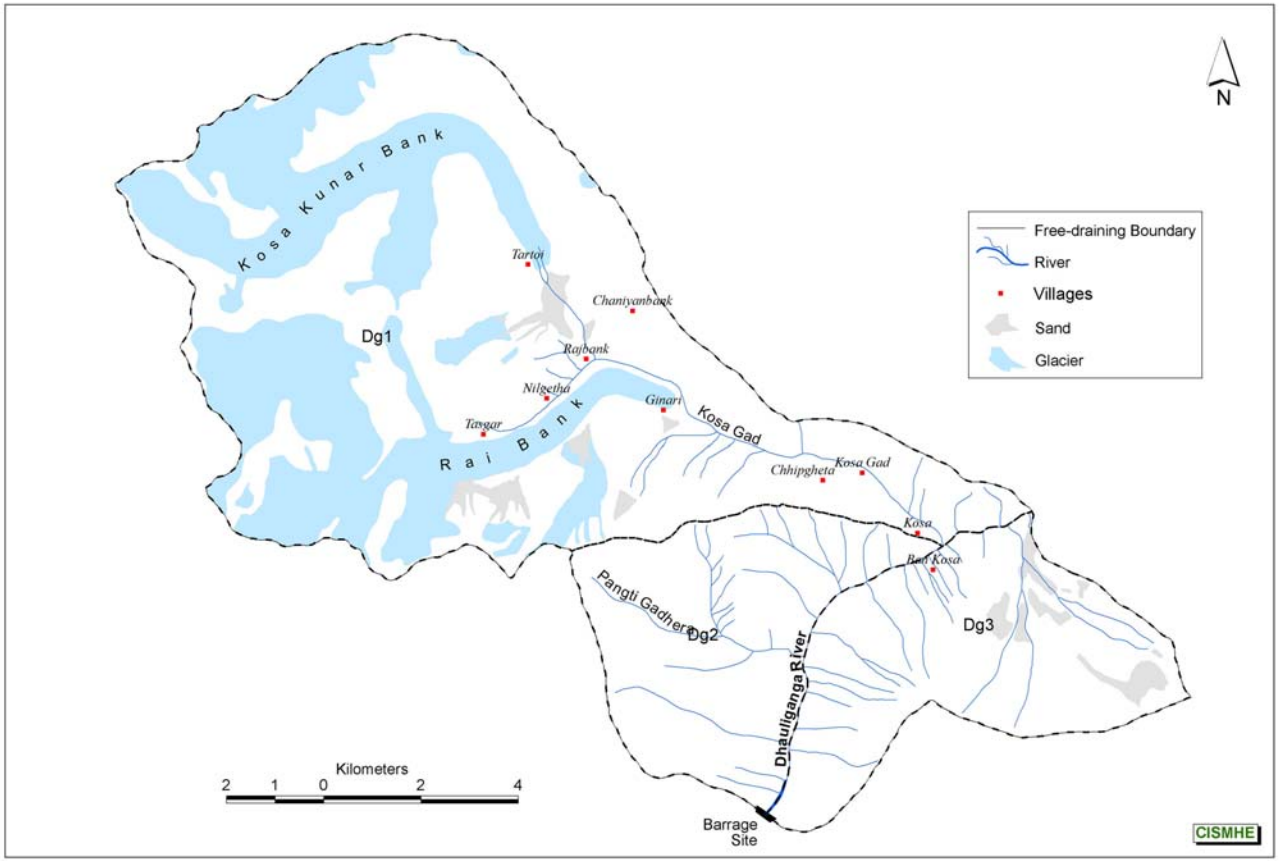

Fig.8.1 Drainage map of free-draining catchment area of the proposed Jelam Tamak H.E. Project

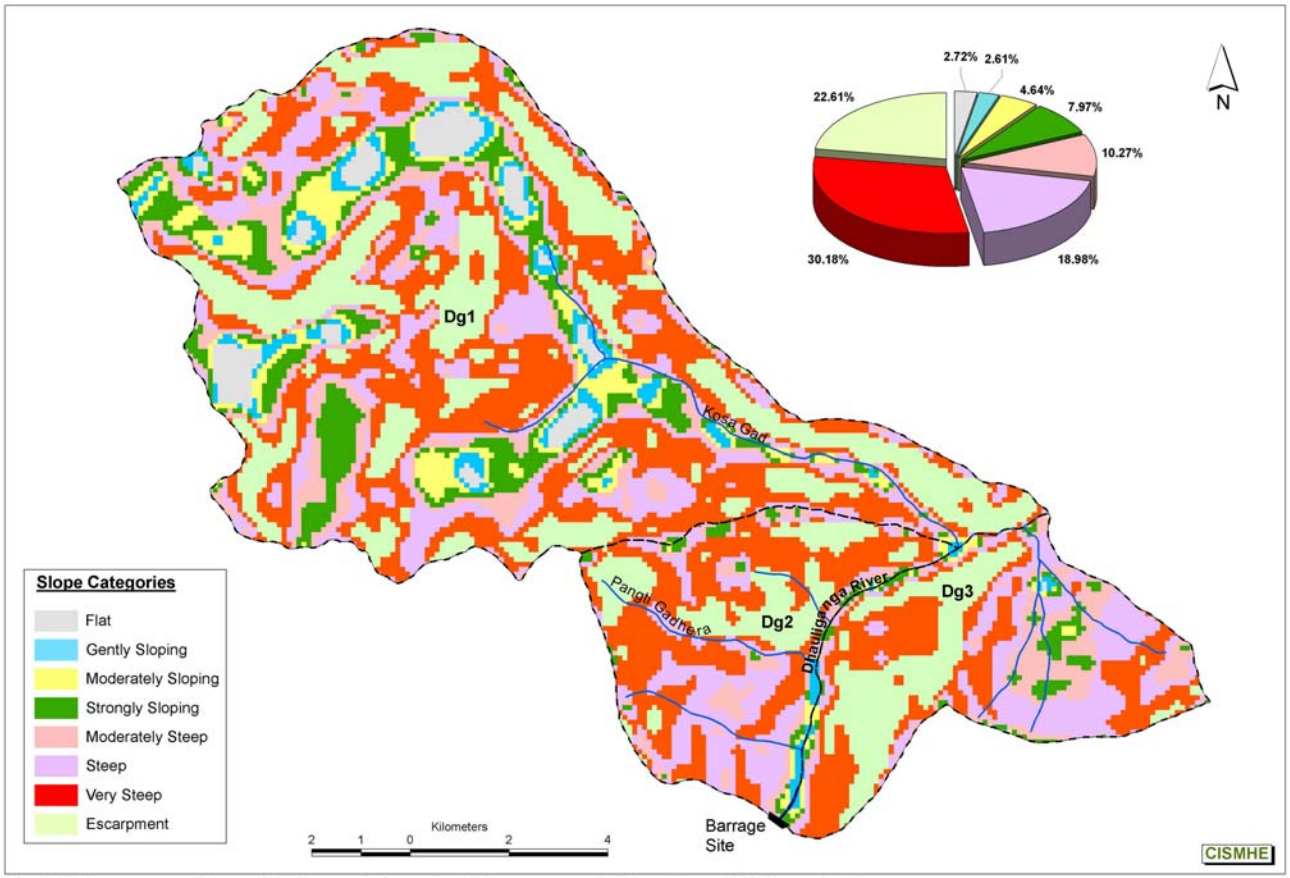

Fig.8.2 Slope map of free-draining catchment of the proposed Jelam Tamak H.E. project

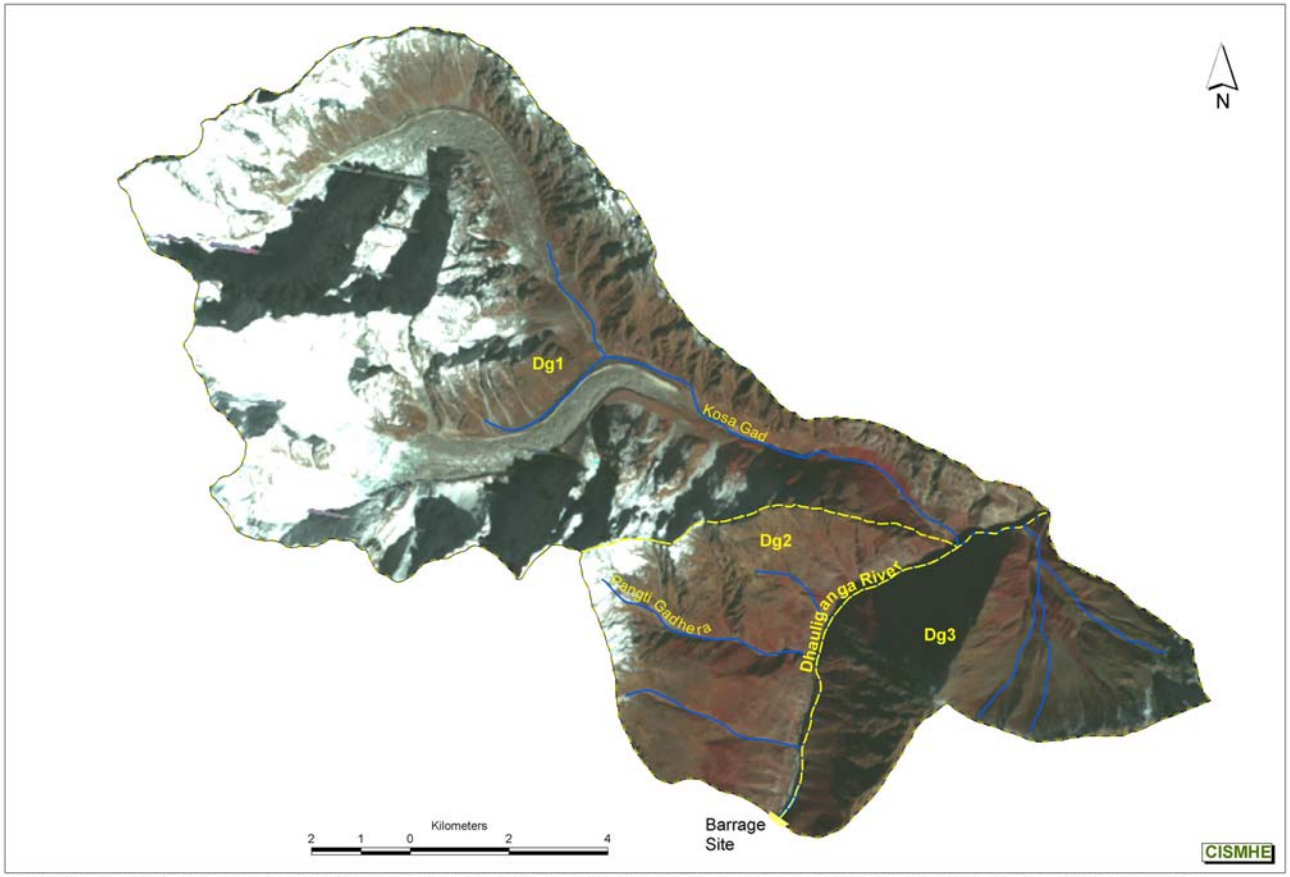

Fig.8.3 False Color Composite (FCC) map generated from IRS-P6 LISS-III, November 2006 scene for free-draining catchment of the proposed Jelam Tamak H.E. project

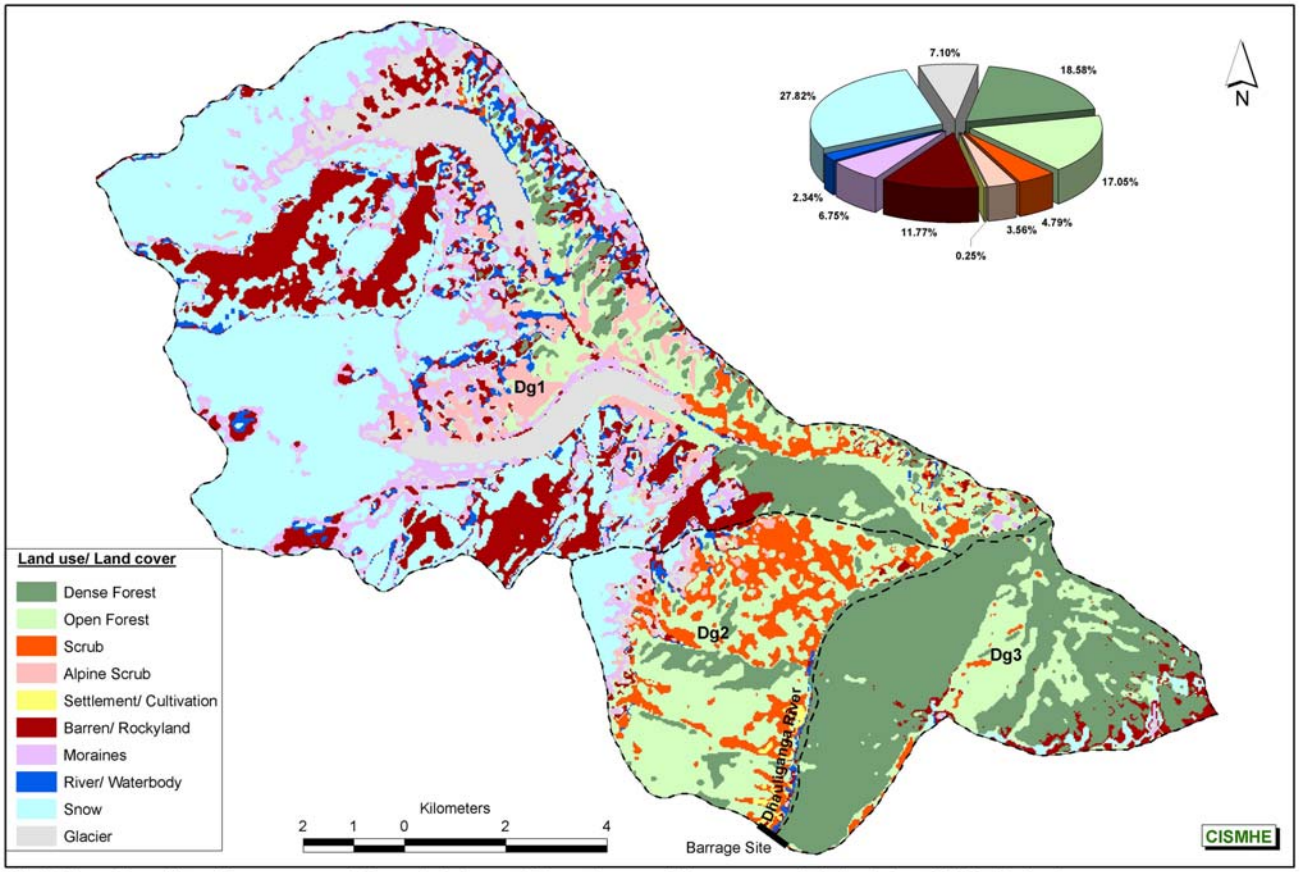

Fig.8.4 Land use/ Land cover map of free-draining catchment area of the proposed Jelam Tamak H.E. Project

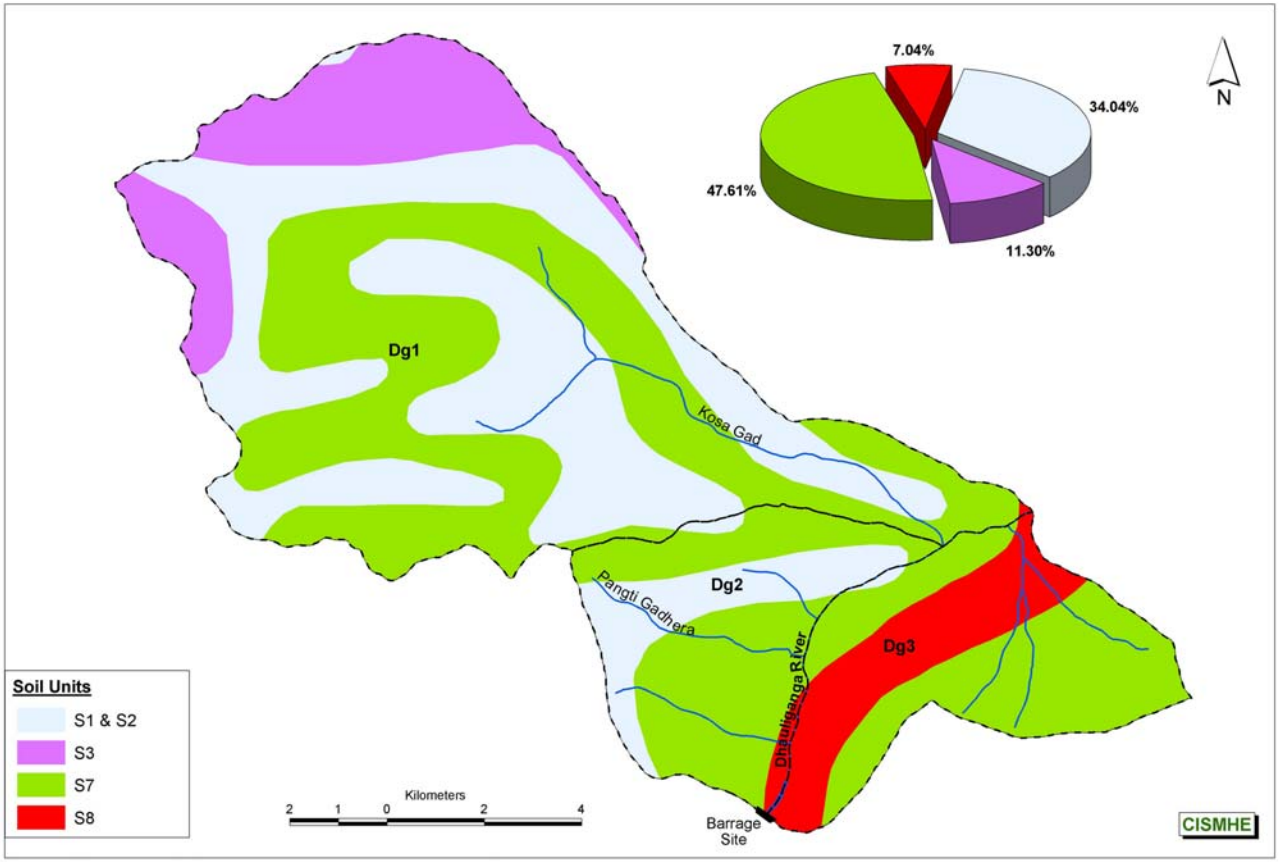

Fig.8.5 Soil map of free-draining catchment area of the proposed Jelam Tamak H.E. Project

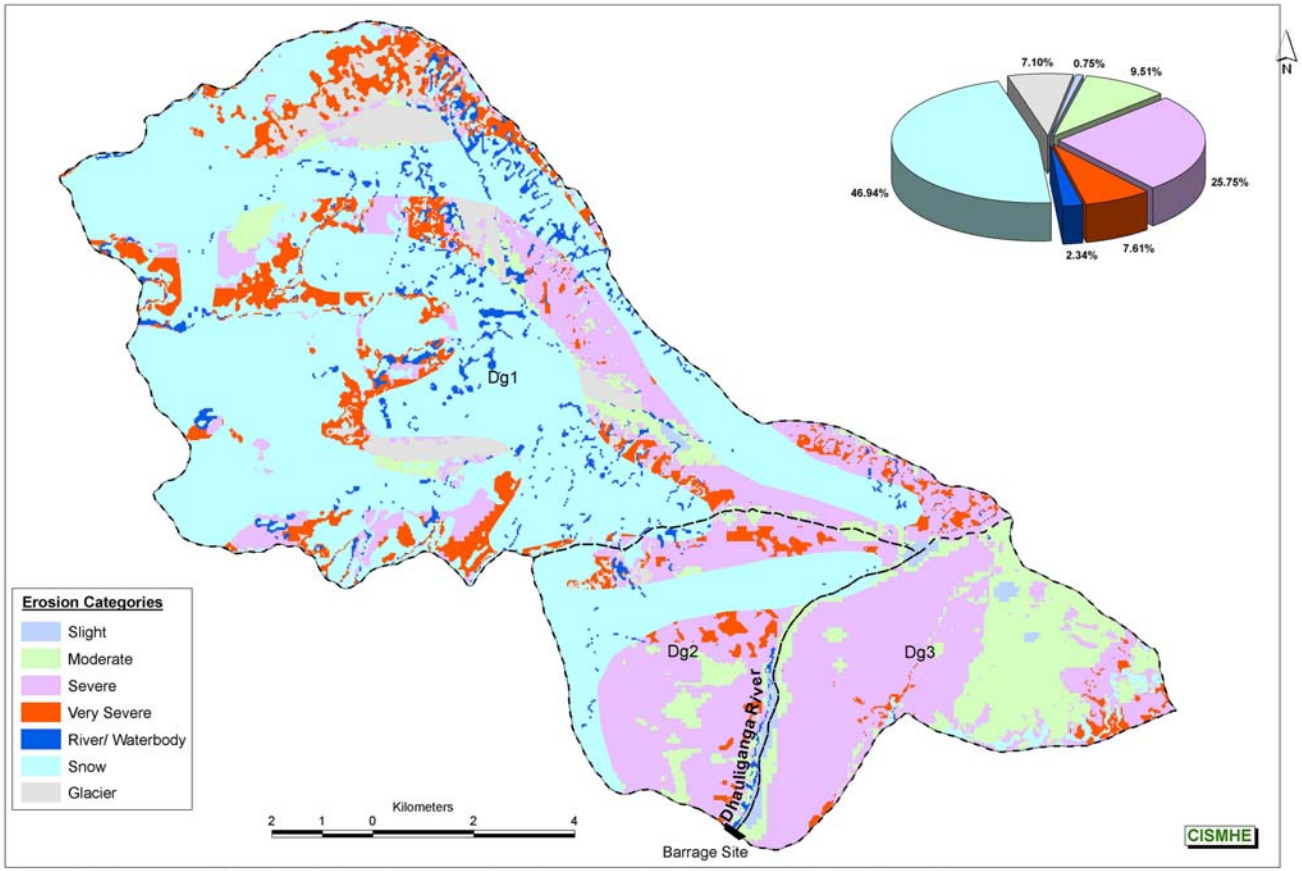

Fig.8.6 Erosion intensity map of free-draining catchment of the proposed Jelam Tamak H.E. Project

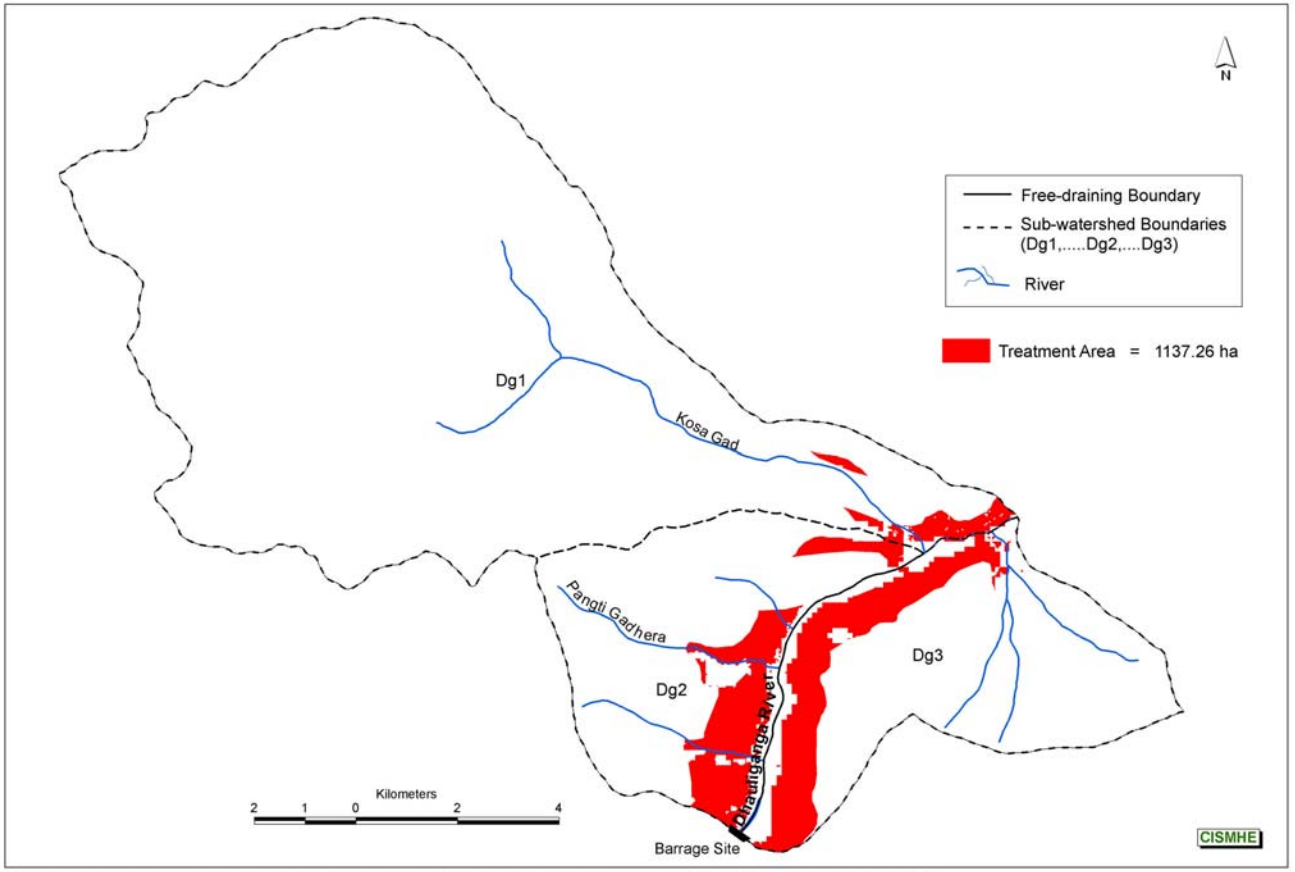

Fig.8.7 Treatment map of the free-draining catchment of the proposed Jelam Tamak H.E. Project

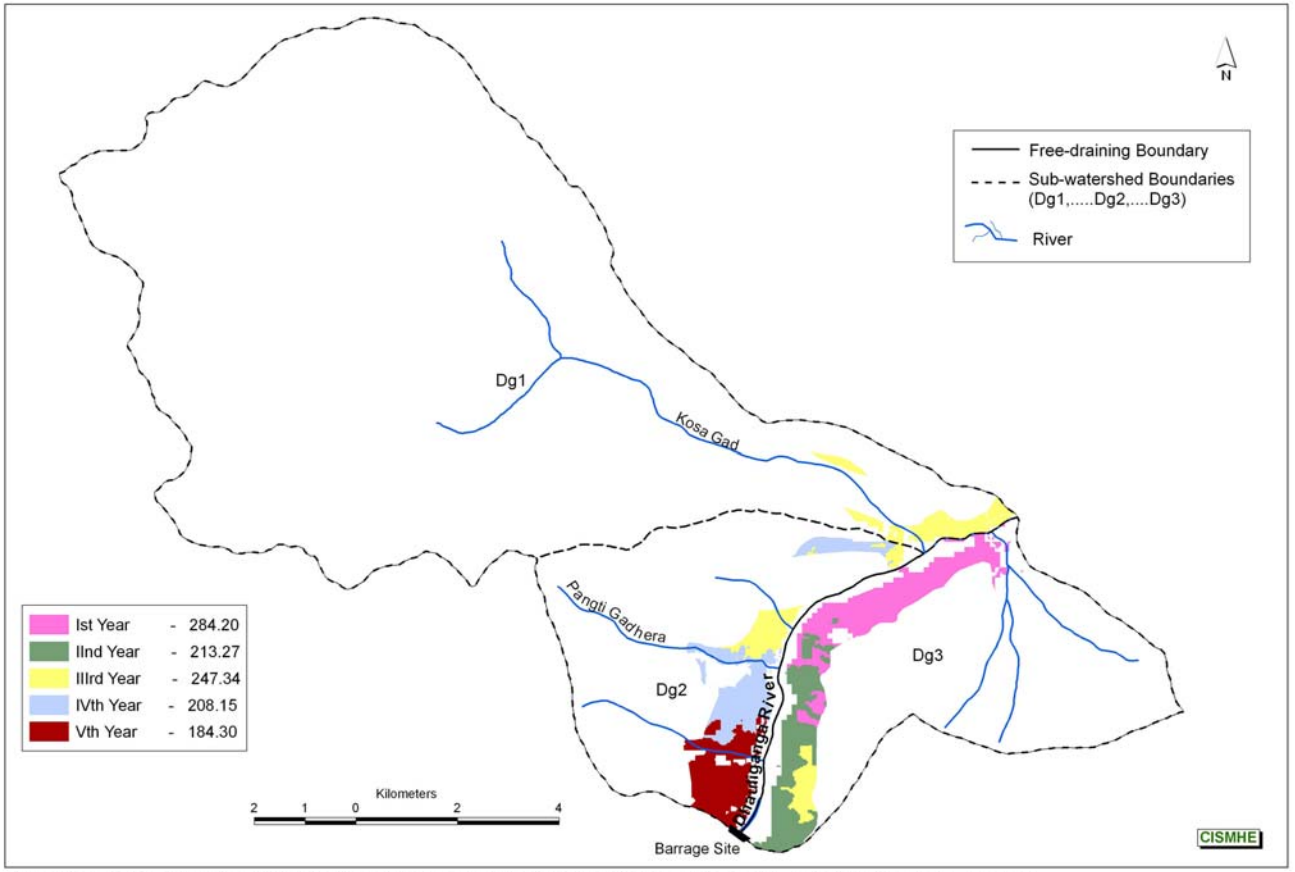

Fig.8.8 Year-wise treatment map of the free-draining catchment of the proposed Jelam Tamak H.E. Project

Chapter 9

GREEN BELT DEVELOPMENT PLAN

9
GREEN BELT DEVELOPMENT PLAN

9.1 INTRODUCTION

The purpose of the green belt development around the perimeter of various project sites of hydro electric power is to protect environmentally sensitive land as the project construction process emanates lot of dust due to excavation works, crushing of material and batching of aggregates. The air pollution also takes place due to vehicular movement during construction and operation phases. The green canopy has the inherent capacity to absorb pollution, increase water retention by soil and decrease sediment transport. Jelam Tamak HE Project envisages construction of a 28 m high barrage over river Dhauliganga in the downstream of Jelam village and will create a reservoir of 37.90 ha (at FRL 2648.5m elevation). During the construction period of around four years the area will be disturbed, vegetation in the immediate vicinity will be destroyed and soil will become prone to erosion. There will be increased silt flow in the river from these surrounding areas. In addition to providing environmental protection, the green belt contains important natural resources and supports wide range of recreational, tourism and cultural opportunities. The plantation along the reservoir periphery will serve many purposes, such as it will protect the reservoir from soil erosion and shall provide a shelter to birds and wildlife. Therefore, a green belt development plan has been proposed around the project area and along the project components in particular using the local flora.

9.2 DEVELOPMENT OF GREEN BELT

The green belt is proposed to be developed within the project area at the following places viz., barrage site, power house site and around the periphery of reservoir. Different kinds of strategies will be necessary for developing green belt around different components of the project. The general considerations involved while developing the green belt are :

- Generally local/native fast growing trees should be planted around various project appurtenances of the proposed project.
- Planting of trees should be undertaken in appropriate encircling rows around the project site.
- The trees should be protected by plantation of non palatable shrub species to avoid grazing by animals.

- The Plantation should be at a spacing of 2.5 x 2.5 m and about 1000 trees per hectare should be planted.

Total area for the creation of green belt around the reservoir rim is around 38.33 ha which is divided into two layers/ zones for the purpose of plantation taking into consideration the microclimatic condition that will develop after the creation of reservoir in the region (**Fig. 9.1**). The length of the green belt on left bank of Dhauliganga will be around 2 km, while the length of green belt at right bank will be around 1.85 km. It is proposed that densification plantation in a two zones around the periphery of the reservoir will be done and this will cover an area of 38.33 hectares.

9.2.1 Species to be Planted

Extensive survey in the project area was undertaken to observe the vegetation types and its density. The soil characteristics were also kept in mind. Based on this survey and environmental conditions suitable plant species have been proposed for green belt development. To meet the requirement of plants sapling for development of green belt, the nursery proposed in CAT plan will be used. A list of indigenous tree, shrubs and herbs was made after identification of species suitable for raising in nurseries and for development of green belt around the project area and along the periphery of reservoir. The species wise details of the plant are presented in Table 9.1a to 9.1c indicating their season of flowering and method of propagation and other characteristics.

9.3 PROPOSED PLAN OF ACTION

9.3.1 Green belt around Barrage Site

Plantation at the barrage site for about 4 ha has been proposed for control of erosion and siltation of the reservoir and aesthetic importance. The total cost of planting 4400 saplings @ Rs. 20.00 (including transportation) per sapling work out to be Rs. 88,000.

9.3.2 Green belt around Power House

Plantation around powerhouse need to be done in 3 lines i.e. first line of only flowering herbs/shrub, second line should be of shrub/hedge in close spacing and along the road of powerhouse a row of small trees. The planting cost of 2000 saplings @ Rs. 20.00 work out for Rs. 44,000.

9.3.3 Green Belt around Reservoir Periphery

The green belt comprising two layers of 0.30 km or less width will have species that are favoured by the microclimatic conditions around the reservoir rim (**Fig. 9.1**). Water loving plants like *Aesculus indica, Populus ciliata, Salix acmophylla*, and many shrubs and herbs have been suggested for plantation in the first layer (GB1) (Table 9.1). The upper layer (GB2) will be planted with species of mesic and semi dry habitats like *Acer laevigatum, Cedrus deodara, Cupressus torulosa*, *Taxus baccata*, and many shrubs and herbs. In all 41844 plants over a stretch of 38.33 ha on both the flanks of the periphery of the reservoir will be done by planting 1100 saplings per ha. The planting cost for 41844 saplings works out for Rs. 8.36 lakhs @ Rs. 20.00/ sapling (Table 9.1).

Table 9.1 Physical and financial break up for the creation and maintenance of green belt around the periphery of reservoir Jelam Tamak HE Project

Item		Ist layer (GB 1) (18-30 months) 22.27 (ha)	IInd layer (GB2) (30-42months) 15.77 (ha)
Biological measures (Afforestation and Maintenance)			
1.	**Raising plants**		
	i) Physical (Nos) (@ Rs. 1100 plants/ha)	24497	17347
	ii) Financial (Rs. in lakhs) (@ Rs. 11.51/plant)	4.89	3.46
2.	**Watering, maintenance and transport** (Rs. in lakhs)	1.50	2.50
	Total (Rs. in lakhs)	**6.39**	**5.96**
Grand Total (Rs. in lakhs) (L1+L2+L3)			**12.35**

9.4 SCHEDULE

The construction period of the project is around 50 months. All engineering measures like retaining walls, wire crate walls, etc to stabilize landslips around reservoir will be carried out under the CAT plan. Plant sapling will be required for biological treatment measures. Plantation and maintenance will be carried out between 18-54 months from the date of inception of the projects. Between 1-18 months all the engineering measures for stabilization of slopes will be carried out under the proposed CAT plan.

Table 9.1 (a) Species wise details of trees indicating planting techniques and their uses

SN	Botanical name	common name	Fruit/seed collection season	Seed Longevity	Pre-sowing seed treatment	Sowing season	Germina-tion %	Age of normal planting stock (months)	Planting season	Method of planting	Uses
1	2	3	4	5	6	7	8	9	10	11	12
1	*Aesculus assamica*	Panger	June-July	Short lived(1-3 months)	Not required	July-Aug.	60-70	2	Sept.-Oct.	Direct sowing, entire planting	Ornamental
2	*Acer caesium*	Kanchula	Apr.-Nov.	Short lived (1-2 months)	Not required	July-Aug.	50-60	2-3	August	Direct sowing, entire planting	Timber, medicine, fuel wood
3	*Cedrus deodara*	Deodar	Aug.-Nov.	Long lived (1-2 years)	Not required	Sept.-Nov.	60-80	2-3	June-July	Direct sowing, entire planting	Timber & Fuel-wood
4	*Cupressus torulosa*	Surai	Apr.-Sept.	Long lived (6-12 months)	Not required	June-July	50-60	2-3	Aug-Sept.	Direct sowing, entire planting	Timber & Fuel-wood
5	*Fraxinus xanthoxyloides*	Repchu	May-June	Short lived(1-3 months)	Not required	June-Aug.	60-70	3-4	July-Aug.	Direct sowing, entire planting	Fuel-wood
6	*Juglans regia*	Akhrot	May-June	Long lived (1-2 years)	Not required	Aug.-Sept.	40-50	2	Sept.-Oct.	Direct sowing, entire planting	Timber & Fuel wood

7	*Pinus wallichiana*	Kail	Sept.-Nov.	Very long lived (>2years)	Not required	Nov.-Dec.	70-85	3-4	July-Aug.	Direct sowing, entire planting	Ornamental, Fuel wood
8	*Prunus persica*	Aaru	May-June	Long lived (1-2years)	Not required	July-Aug.	40-60	2-3	Sept.-Oct.	Direct sowing, entire planting	Fruits
9	*Pyrus communis*	Naspati	June-July	Short lived(1-3 months)	Not required	July-Aug.	50-60	4-5	Sept.-Oct	Direct sowing, stump planting	Fruits
10	*Salix acmophyla*	Barun	Feb.-May	Short lived(1-3 months)	Not required	July-Aug.	30-60	3-4	Sept.-Oct.	Direct sowing, entire planting	Ornamental, Fuel wood
11	*Taxus baccata*	Thuner	Apr. – Sept.	Long lived (1-2years)	Not required	July-Aug.	40-60	3-4	Sept.-Oct.	Direct sowing, entire planting	Ornamental, Fuel wood

Table 9.1 (b) Species wise details of shrubs indicating planting techniques and their uses

SN	Botanical name	Common name	Plantation method	Plantation time	Uses
1	*Asparagus filicinus*	Jhirna	Through cuttings and transplanting whole plant	In rainy season	Ornamental and should be grown along roads, gardens and colony
2	*Berberis aristata*	Rasut	Through root cuttings and through transplanting whole plant	In rainy season	Can be grown easily along roads, eroded and landslip areas
3	*Cotoneaster integrrima*	-	Through seeds; through transporting whole plant	In any season	Can be grown easily along roads, eroded and landslip areas
4	*Prinsepia utilis*	Bhenkal	Through seeds and cuttings	In rainy season	Can be grown easily along roads, eroded and landslip areas
5	*Ribes orientale*	-	Through seeds; through transporting whole plant	In rainy season	Ornamental and should be grown along roads, gardens and colony
6	*Sorbaria tomentosa*	Barun	Through seeds; through transporting whole plant	In rainy season	Can be grown easily along roads, eroded and landslip areas
7	*Viburnum cylindricum*		Through seeds	In rainy season	Ornamental and should be grown along roads, gardens and colony
8	*Zanthoxylum armatum*	Timru	Through seeds; through transporting whole plant	In rainy season	Can be grown easily along roads, eroded and landslip areas

Table 9.1(c) species wise details of herbs indicating planting techniques and their uses

SN	Botanical Name	Common Name	Family	Habitat	Floweri-Fruiting time	Parts used for curing the disease
1	*Allium griffithianum*	Jambu	Amaryllidaceae	Wild	Aug.-Oct.	Leaves used for flavouring food
2	*Allium humile*	Ladu	Liliaceae	Cultivated as garden crop	May-June	Whole plant used medicinally
3	*Aloe vera*	Ghe-kunar	Liliaceae	Cultivated as garden crop	Throughout the year	Seeds are used as condiment and for flavouring food
4	*Artemisia gmelinii*	Kala parcha	Asteraceae	wild	Aug.-sept.	Whole plant used medicinally
5	*Bupleurum falcatum*	Brahmi	Apiaceae	Wild	April-Oct.	Plant decoction is used as tonic
6	*Mintha arvensis*	Pudina	Lamiaceae	Cultivated crop	May-June	Whole plant used medicinally
7	*Potentila fulgens*	Vajardanti	Rosaceae	Wild	June-July	Roots are medicnally
8	*Selinum wallichianum*	Berhatu	Apiaceae	Wild	July-August	Roots are medicnally
9	*Saussurea costus*	Kut	Asteraceae	Cultivated crop	May-June	Roots are medicnally
10	*Tegetus minuta*	Genda	Asteraceae	Wild	May-June	Flowers and seeds are useful source of aromatic oil

9.5 BUDGET

The overall cost of green belt development **Rs. 39.25 lakhs** (Table 9.2). The budget also includes maintenance of the executed work.

Table 9.2 Summary of cost for green belt development

S.N	Component	Cost (Rs. in lakhs)
1.	Cost of planting of sapling around Barrage site	0.88
2.	Cost of planting of sapling around power house areas	0.44
3.	Maintenance cost for 6 years-2 supervisor @150.00/day	6.48
4.	Cost of planting of sapling along reservoir periphery (including maintenance cost)	12.35
5.	Barbed wire fencing (10 km) for protection of natural Regeneration from biotic interference	8.10
6.	Celebration of World Environment Day, etc @ Rs. 1.00 lakhs	6.00
7.	Contingency	5.00
	Total	**39.25**

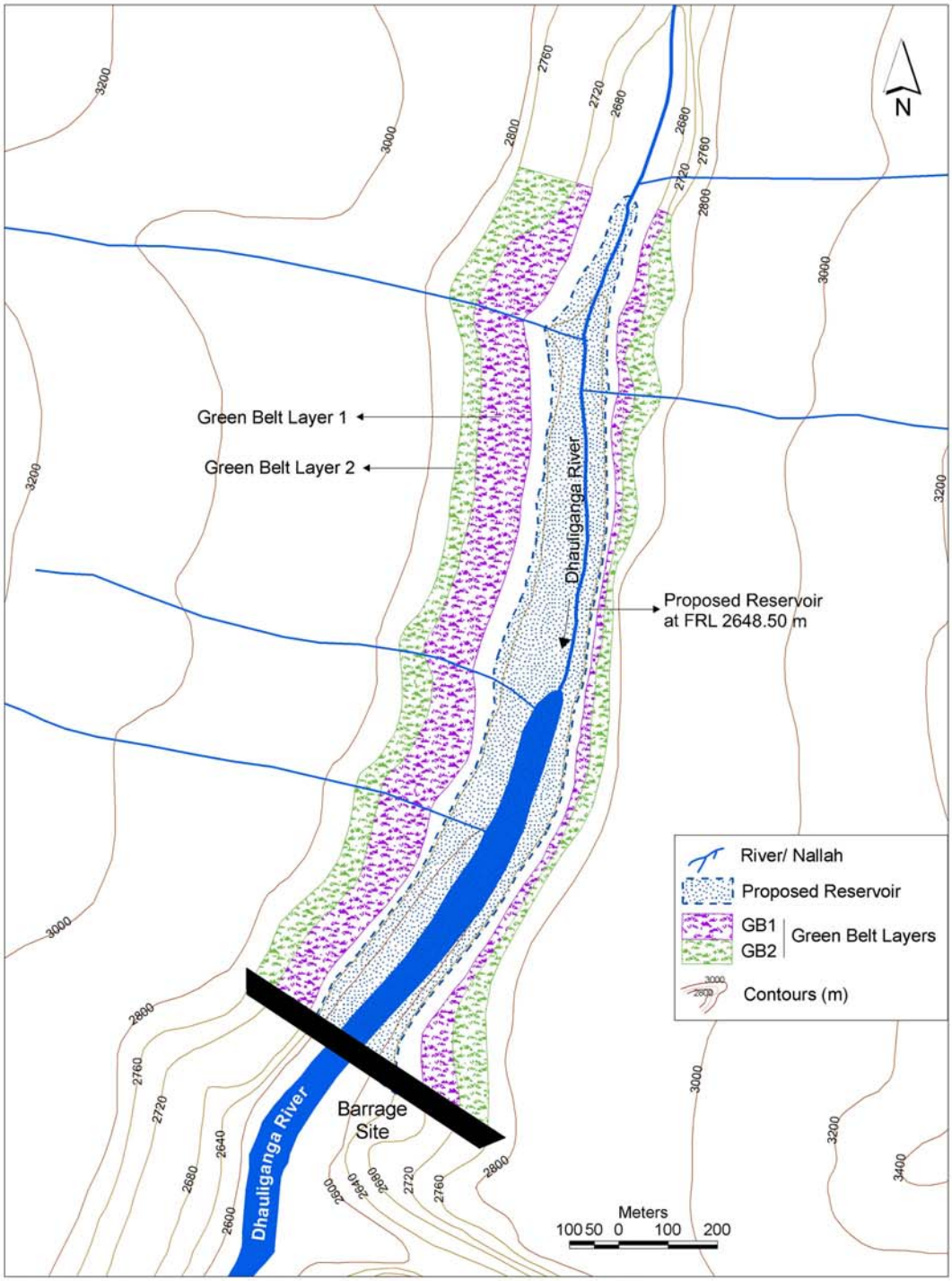

Fig.9.1 Map showing green belt area around the proposed reservoir of the Jelam Tamak H.E. project

Chapter 10

RESTORATION OF QUARRY & BORROW SITES

10
RESTORATION OF QUARRY & BORROW SITES

10.1 INTRODUCTION

Excavation related to quarry operations involves large degradation which results into the complete removal of vegetation cover and profound landform modifications. Therefore, it is important to restore quarry sites/borrow pits in a stable condition for the persistence of biological community and economic well being of the people. This could be achieved by filling the quarry / borrow pit with suitable materials and recreate species composition close to the state that existed before disturbance. For construction of different components of Jelam Tamak H.E. Project substantial excavation in rock and soil would be required. This would lead to formation of depression and craters. These areas at a later date will require proper management and restoration. Total area likely to be disturbed due to these activities is around 10.09 ha (0.31 ha area for two rock quarry and 9.78 ha for five RBM borrow areas). The proposed quarry areas are at present covered with open mixed coniferous forest. This existing landscape will be totally modified or changed due to proposed project. It is, therefore, important that after the project work and related activities are over, these disturbed areas are restored to bring them back to their similar or near to similar pre-construction condition or in improved state.

10.2 RESTORATION OF DISTURBED SITES

The quarrying for rock material and impervious soil would lead to removal of vegetation cover, top soil and leave the area barren. A total of 10.09 ha land (0.31 ha for two rock quarry areas and 9.78 ha for RBM borrow areas) would be affected due to quarry operations. After the completion of the mining activity, these areas will be restored to their normal condition. Appropriate measures would be adopted both before and after the quarrying activity at various sites in the project area. Proposed mitigation measures will also help to arrest soil erosion in the region.

10.3 DETAILS OF QUARRY & RBM BORROW SITES

Two rock quarry sites i.e. rock quarry 1 upstream of submergence area near Bhapkund and another rock quarry downstream of submergence area near THDC Colony are proposed for the

requirement of coarse and fine aggregates. For meeting soil requirement three RBM borrow sites viz., RBM Borrow Area 1 (u/s of Dronagiri bridge), RBM Borrow Area 2 (near Adit 4) and RBM Borrow Area 3 (d/s of Tamak Power house) have been identified. After excavation of the required material, these quarry sites will require restoration.

10.4 RESTORATION OF QUARRY SITES

Removal of rocks from the quarry sites for different construction works will result in the formation of depression and craters. These will be filled up by the dumping materials consisting of boulders, rock, gravel and soil from nearby sites. To achieve this, appropriate measures would be adopted at various sites in the project area so that the restoration work will be scientifically executed. Various biological, bio-engineering and engineering measures are proposed for the restoration of the quarry sites and their costs are presented in the Table 10.1.

10.5 ENGINEERING AND BIOENGINEERING MEASURES

10.5.1 Removal of Top Soil

The top soil (top 6-12 inch soil) should be removed before excavating the sand or rocks from the quarry sites. This soil contains all microbes (including earth worms) and important nutrients and organic matters which will be required at the time of restoration of these quarry sites. The estimated cost for removal of top soil and its storage for later transplantation purposes is **Rs. 10.00 lakhs**.

10.5.2 Filling of Depressions

Removal of rocks from quarry sites for different construction works will result in formation of depression and/or craters. These will be filled up by the dumping materials consisting of boulders, rock, gravel and soil from the nearby sites or unusable material from quarry sites.

After filling these craters, the top soil collected prior to quarrying will be spread as top layer. The top soil then should be covered with geo-textiles like jute or by other locally available bio-degradable material. This will protect the top soil from erosion. The estimated cost for carpeting with geo-textiles (coir, jute, other local fibers) is placed in Table 10.1.

10.5.3 Diversion of run-off

Effective drainage system will be provided to avoid the infiltration of run-off and surface waters into the ground of quarry sites.

10.5.4 Construction of Retaining Walls

Retaining walls will be constructed at the filled up depressions of quarry sites to provide necessary support particularly where there are moderately slopes. The budget kept for retaining walls and other engineering measures is around Rs. 1.5 lakh (Table 10.1).

10.5.5 Biological measures

10.5.5.1 *VAM Fungi for Soil Reclamation*

Top soil obtained from the project sites, before the start of quarrying activity would be reclaimable by using VAM fungi. The saplings of trees and shrubs should be raised using microbial inoculums like, VAM (Vesicular-arbuscular mycorrhiza), bacterial and fungal strains. The steps for raising plant saplings with mycorrhizal colony are given below.

A brief description of the procedure to be followed for the colonization of seedlings with VAM fungi and other soil microbes is given below:

1) Top soil collection from quarry sites before start of quarrying.
2) This soil which is rich in microbes should be used for the preparation of seed beds and should also be filled in polybags for raising saplings.
3) Isolation of VAM from the roots of juvenile seedlings particularly dominant tree species which are available in the region.
4) Suitable strain of VAM and other microbe can also be obtained from IARI, New Delhi, NEERI, Nagpur and/or IMTECH, Chandigarh.
5) Preparation of mother culture and their appropriate dilution.
6) Growing of plant species which will be inoculated by specific and efficient strains,
7) Mixing the soil with the VAM inoculum and filling in the polybags.
8) Planting of saplings in the polybags two days after inoculating the soil with fungal microbial strains.
9) After thirty days of inoculation these saplings can be planted at the quarry sites.

10.5.5.2 *Revegetation*

In addition to the use of VAM fungi isolated from the roots of plant species growing in these area and organic manure for enrichment of the top soil, revegetation of quarry sites would require the initial establishment of fast growing grasses like *Agrostis micrantha, Calamagrostis emodensis, Cynodon dactylon* and *Cymbopogon caesius*. These grasses spread by creeping rootstocks and will also help in binding soil. Perennial species such as *Chrysopogon gryllus, Pennisetum flavidum, Themeda anathera* will be established subsequently by seeding and planting them directly into the annual crop residue.

Along with annuals and perennials, nitrogen fixing herbaceous legumes (*Indigofera heterantha*, *Lespedeza juncea, Trifolium repens*) and non legume shrubs like *Hippophae salicifolia* will be planted at quarry sites to increase the nitrogen levels of soil. *Trifolium repens* and *Lespedeza juncea* are also desirable food plants and are less aggressive and persistent as compared to other herbaceous legumes. These legumes with dense cover will retard or prevent the invasion and establishment of native plant species. Temporary crop cover of annuals and perennials will thus help in stabilization of the quarry sites, which will take approximately 5-6 years. The planting of herb and grass species would be done (Table 10.1). Once the initial establishment of perennials is complete and quarry sites are stabilized, the sites would be ready for plantation of tree species. *Acer caesium, Aesculus indica, Juglans regia, Pyrus malus* would be first among tree species that would be planted. In open areas mixed perennial shrubs and herbs such as *Berberis aristata, Prinsepia utilis, Zanthoxylum armatum, Bupleurum falcatum, Fagopyrum dibotrys* and *Themeda anathera* will be planted which grow well on rocks and on open slopes. The cost estimates for planting trees for 1100 plants/ha is presented in Table 10.1.

10.6 COST ESTIMATES

The estimated cost for restoration of quarry sites indicating engineering, bio-engineering, biological measures and maintenance are provided in Table 10.1.

Table 10.1 Cost estimates for Restoration Quarry sites

S.No.	Item of Work	Amount (Rs. in lakhs)
	Quarry Sites	
(i)	Engineering measures	
	a) Removal of top soil (transplantation and stockpiling)	10.00
	b) Filling of crates with muck, stones, etc.	8.00
	c) Retaining walls, diversion channels	1.50
(ii)	Bio-engineering measures	
	a) Carpeting with geo-textiles (coir, jute and other local fibers)	2.00
	b) Mulching	2.00
(iii)	Biological measures	
	(a) Planting of herbs and grass species	1.60
	(b) Planting of trees and shrubs (1100 plants/ha)	3.00
	(c) Maintenance, watering, replacement, etc.	3.00
	(d) Miscellaneous (use of VAM, strains, expertise, etc.)	10.00
	Total	**41.10**

Chapter 11

BIODIVERSITY MANAGEMENT & CONSERVATION PLAN

11
BIODIVERSITY MANAGEMENT & CONSERVATION PLAN

11.1 INTRODUCTION

The catchment area and other components of Jelam Tamak H.E. Project fall in the Buffer zone of Nanda Devi Biosphere Reserve (NDBR) and is ecologically and socially very sensitive area. The region harbours relatively more unique, rare and threatened plant and animal species and inhabited predominantly by scheduled tribes of Uttarakhand having unique culture and customs.

The legal framework of biodiversity management and conservation is covered under the National Biodiversity Strategy & Action Plan (NBSAP), Biological Diversity Act (2002), Forest Act (1980), Wildlife (Protection) Act (1972) etc. For the same reason, the Government of Uttarakhand constituted State Biodiversity Board to protect and conserve the wildlife. A complete ban on the hunting and green felling has already been imposed adopting the National Forest Policy.

The tribal population of the region is closely associated with forest and forest products (herbal products, fuel wood, etc.), however, they are highly fond of environment and its conservation (The region is the birth place of world famous 'Chipko Movement'). Proposed biodiversity management and conservation plan would require an integrated approach, taking the aspiration, cooperation and participation of local people into account. Following the guidelines from above acts, the proposed biodiversity management and conservation plan focuses the issues of influence area. The biodiversity mitigation measures of project areas are included in others chapters like rehabilitation of quarrying sites and restoration of the project affected areas.

11.2 OBJECTIVES

Main objectives of biodiversity management and conservation plan of catchment area of Jelam Tamak H.E. Project are described in the following paragraphs.

(i) To maintain a sustainable approach between local bodies and biodiversity conservation,

(ii) To establish botanical gardens for the voucher specimens of threatened, newly recorded, cultivars, land races and varieties,

(iii) To protect and extract the traditional knowledge of the local people regarding biodiversity and its value,

(iv) To provide incentives for research, training and public education to increase awareness with respect to biodiversity conservation.

11.3 STUDY AREAS: CONSERVATION STATUS AND MAJOR THREATS

The details of biodiversity of the catchment and project areas are given in EIA report of the proposed Jelam Tamak H.E. Project. Catchment area of the project lies in the buffer zone of Nanda Devi Biosphere Reserve (NDBR); it is repository of threatened and rare plant and animal species, viz. snow leopard (*Panthera uncia*), brown bear (*Ursus arctos*), musk deer (*Moschus chrysogaster*), monal pheasant (*Lophophorus impejanus*) and snow partridge (*Lerwa lerwa*), and medicinal plants, e.g. *Aconitum heterophyllum*, *Podophyllum hexandrum*, *Dactylorhiza hatagirea*, *Nardostachys grandiflora*, *Taxus baccata* and *Picrorhiza kurrooa*. The entire Nanda Devi Biosphere Reserve lies within the Western Himalayas Endemic Bird Area (EBA). Thus, the area has high significance in containing the valuable biodiversity. However, in buffer zone, 17 settlements of Bhotiya tribe are interspersed as patches (<1% of the total area of buffer zone) in the matrix of natural ecosystems ranging from temperate forests to snow clad peaks. The core zones of NDBR are located at a distance of more than 10 km from the project area.

11.4 BIODIVERSITY CONSERVATION PLAN

11.4.1 Definitions

The terms and definitions used in this volume are mentioned in the Biological Diversity Act (2002). However, some of the terms used exclusively in this plan, which are relevant, are explained below:

? "Biological diversity" means the variability among living organisms from all sources and the ecological complexes of which they are a part and includes diversity within species or between species and of ecosystem.

? "Biological resources" means plants, animals and micro-organisms or parts thereof, their genetic material and by-products (excluding value added products) with actual or potential use or value but does not include human genetic material.

? "Bio-survey" means survey or collection of species, sub species, genes, components, and extract of biological resources for any purpose and includes characterization, inventorisation and bioassay.

? "Local bodies" means panchayats and municipalities.
? "Cultivar" means a variety of a plant that has originated and persisted under cultivation or was specifically bred for the purpose of cultivation.
? "Folk variety" means a cultivated variety of plant that was developed, grown and exchanged informally among farmers.
? "Land race" means primitive cultivar that was grown by ancient farmers and their successor.

11.4.2 Activities and Development Works to be Undertaken

11.4.2.1 *Forest Resource Management*

Traditionally, each village had notional territories of forests and alpine meadows. Resource uses within village common lands were decided by the concerned village communities. These lands were taken over by the government and notified as forest land in 1865. Alpine meadows and snow-clad areas were also given a legal status of forest land. However, local people were granted rights for utilisation of non-timber forest products from these forests. Rights of timber vested in the government but timber required for essential subsistence needs was provided to local people free of any cost. Extension of agriculture in government land became illicit encroachment. In addition, most of the villages in the influence area have their own panchayat lands.

The forest resource management would be a practice of joint forest management, in which 'local bodies' will protect their own forest resources and Panchayat land and they will get some incentives for it. The forest resource management or joint forest management would include the afforestation on the grazing and panchayat land. The local fodder plan species would be selected for the plantation. In addition, these areas would be protected through biofencing and firelines. An awareness programme towards the control on grazing and forest fire would be run in the area. The local bodies of influence area would be provided with tools and equipment to control the forest fire. Certain areas of forest of common utilization will be given fire lines while some of the areas will be declared as grazing land which will be fenced.

The mechanism of forest resource management includes the selection of panchayat land, plantation, fencing and construction of firelines. Directly affected villages like Jelam, Jumma, Langshaghari and Dronagiri villages will be given preference, however, it can be extended in other villages of Influence area. Forest Department would constitute Village Forest Community (VFC) in each selected village. VFC would select the panchayat land and grazing land for the plantation. All

infrastructure, transportation cost and materials like equipment, seedlings (for plantation), barbed wires, diagonal poles (for fencing) , stone masonry (fire lines and fencing) would be provided by the Forest department while VFC would help in other activities like pitting, construction of stone masonry wall, fencing and protection of the area voluntarily. However, incentives would be provided to VFC to encourage them. The project authorities would provide the budget to State Forest Department for this programme. Total financial outlay for the forest resource management would be **Rs. 45.00 lakh**. Year wise Break up is given below:-

		Years					
	Particulars	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
							(**Rs. in lakh**)
i	Awareness Programme	3.00	2.00	-	-	-	5.00
ii	Fire line (10,000 m.) @ Rs. 50/- per m.	-	2.00	1.00	1.00	1.00	5.00
iii.	Plantation of fodder plant (lump sum)	-	-	5.00	3.00	2.00	10.00
iv.	Fire control tools and Equipment	5.00	-	-		-	5.00
v.	Fencing of grazing area and other (stone masonry wall)	- -	-	10.00	5.00	5.00	20.00
	Total	**8.00**	**4.00**	**16.00**	**9.00**	**8.00**	**45.00**

11.4.2.2 ***Documentation of Threatened, Endemic and Landraces species***

Local bodies like 'Tolcha' and 'Marcha' Bhotiyas have a vast knowledge of economic and medicinal plant species growing in the catchment area. They have a traditional health care system for many diseases like fever, headache, dyspepsia, jaundice, pregnancy complications, asthma cold & cough. In order to extract this knowledge and to document the record of valuable plant species and para taxonomists, a documentation process is proposed for the Jelam Tamak H.E. Project. A research team from University or Research Institute would carry out this study for the project authorities. The copies of the reports would be submitted to all concerned departments of state Government and Government of India. The project would provide the fund for three years. Total financial outlay for Peoples Biodiversity Register would be **Rs. 20.00 lakh** only.

11.4.2.3 ***Botanical/Herbal Gardens***

As earlier stated that the catchment area is repository of a variety of medicinal and economic plant, threatened and rare species like Khirku (*Nepata discolor*), Atibisha (*Aconitum atrox*),

Biskanara (*Cirsium vesutum*), Jatasmasi (*Nardostachys grandiflora*), Bhainkal (*Principia utilis*), Sedam (*Allium humile*), Jambu (*A. stracheyi*) Pharan (*Allium humile*), Bhojpatra (*Betula utilis*), Hathajadi (*Dactyorrhiza hatagirea*), Choru (*Pleurospermum angelicoides)*, Kala Jeera (*Carum carvi*) etc. In order to conserve these species one or two botanical gardens, depending on the availability of land, are proposed in 2 ha land in the free draining area of the project. The proposed repositories would be of special interest to biodiversity conservation, scientific research, education and environmental awareness. The nurseries for the purpose of CAT plan would be used for the botanical gardens. The project authorities would bear the budget for botanical gardens whereas State Forest Department would implement this activity. State Forest Department would provide the land for this reason. Total budget the development of botanical gardens would be **Rs. 59.40 lakh**. Break up of the budget is given below :

	Particulars	Years					Total (Rs. in lakh)
		1st	2nd	3rd	4th	5th	
i	Bio-survey for seeds	3.00	-	-	-	-	3.00
ii	Fencing (Barbed wiring)	-	3.00	-	-	-	3.00
iii.	Digging of pits (45x45x45 cm) (Nos. 3000, @ Rs. 820.00)	-	19.50	-	-	-	19.60
iv	Trenching for herbs and shrubs	-	10.00	-	-	-	10.00
v.	Filling of pit (Nos 3000, @ Rs. 180.00)	-	-	5.40	-	-	5.40
vi.	Transportation Charges	-	-	1.50	-	-	1.50
vii.	Miscellaneous Including maintenance	-	-	4.00	5.00	8.00	17.00
	Total	**3.00**	**32.50**	**10.90**	**5.00**	**8.00**	**59.40**

11.4.2.4 *Removal of Invasive Species and Recovery of Susceptible Species*

Many plant species like *Rumax nepalensis*, *Chenopodium foliosum*, *Conyza* spp. have invaded the area while a few species like *Astragalus candoleana, Caragana spinisa, Ephedra gerardiana* etc. are severely stressed. Also, the construction sites like road, quarrying, excavation etc. become prone to invasive species and obnoxious weeds. The invasive species have quality to spread rapidly over an area and are one of the major threats to native biodiversity. In order to conserve the biodiversity identification of invasive and stressed species and physical removal of invasive species are proposed for Jelam Tamak H.E Project. The plantation of native stressed species is proposed in the catchment under the CAT plan. The Environment Cell of THDC India Ltd would carry out this exercise

involving the local people. The activities would be carried out in free draining and project areas. in 4th and 5th years and after completion of the project Total financial outlay for this reason would be **Rs. 10.00 lakh**.

11.4.2.5 ***Forest Protection Plan***

Project authorities are suggested to adopt the free draining catchment area for the protection with cooperation of State Forest Department. Forest protection plan essentially relies on the available infrastructure in the target area and strengthening the infrastructure facilities. Main objective of the forest protection plan are: intensive patrolling and inspection, checking of poaching and hunting activities if any, protection of critical areas under afforestation programme, fencing of certain areas, provision of fire lines, etc. Such types of activities would require man power and other infrastructure facilities viz. new inspection path, deployment of forest guards, check posts, equipment, etc. Detailed plan for the forest protection would be prepared by the state forest department on the request of Project authorities. State forest department would deploy at least two forest guards in the free draining catchment area for the construction period. All basic infrastructures like check posts and inspection paths will be provided in the free draining catchment. In order to strengthen the working capacity the forest guards must be provided with necessary equipment like camera, wireless, binoculars and other minor equipment (altimeter, spotscope, search lights, sleeping bags, health kits, etc.). In addition, an comprehensive awareness programme highlighting the importance of wildlife would be run in the area. The forest guards would consult the workers of joint forest management to strengthen the forest protection plan. The main responsibility of forest guards would be to protect the plantation, nurseries, to inform the state forest officials and project authorities on poaching, hunting and forest fire and to rescue wounded wild animals. After 5 years, if project authorities are interested, they can extend this programme. Total budget for forest protection plan would be **Rs. 66.00 lakh**. It includes salaries of forest guards, cost of equipment, check posts, tubular hut and veterinary facilities. The break up of the budget is given below:

Heads	**Total cost (Rs.in Lakhs)**
i. Salaries/wages/Contingency (for 5 years)	
(2 forest guards)	30.00
ii. Equipment (Camera, Wireless, Laptop, GPS etc)	10.00
iii). Reward programmes	2.00

iv). Fire lines	10.00
v). Check posts	3.00
vi). Construction of bridges and patrolling paths	5.00
vii) Construction of tubular huts for camping (2 No)	4.00
viii). Anti poaching activities	2.00
Total cost	**66.00**

11.4.2.6 Habitat Improvement

The habitat improvement is an integral part of wildlife management. It consists of bringing into useful association of those conditions which are required by a species to reproduce and survive. Even creation of small openings may be of great value and importance. In some cases such openings are essential for herbaceous cover and insect population on which ground living animals such as pheasants predominantly feed during the first few weeks after birth. However, control of proper cover is also important from wildlife point of view. Any change in the habitat due to the change in vegetation can affect most species, increasing the carrying capacity for some, decreasing it for others. A number of van panchayats are having reserved forests and these areas are rich in wild animals there is urgent need to undertake habitat improvement works immediately in these areas. Following works have been proposed under this activity:

i Identification of animal corridors in the free draining catchment
ii Removal of unwanted plants/obnoxious weeds from the corridors habitat,
iii Identification of critical habitats like caves and to check all human routes towards critical habitats
iv. Cutting and control burning of mature and old grass so as to give better conditions for fresh growth,
vi. Degraded wildlife habitats to be improved by regulating human and livestock use and by afforestation,
vi. Better cover and refuge points will be developed in those areas wherever required,
vii Plantation of local species such as ringal for wild animals as food and shelter,
ix. Soil and moisture conservation measures in the area and recharging of natural streams.

Out of these, treatment of catchments area would be taken up on priority basis through plantations, soil and moisture conservation structures. Total budget for habitat improvement would be **Rs. 30.00** only.

11.4.2.7 *Safeguards during Construction Phase*

During the construction phase, various adverse impacts on the wildlife are anticipated in the surrounding areas of the proposed project in terms of increased noise levels, land vibrations during

tunneling and blasting, release of air and water pollutants, etc. Mammals are the most vulnerable group affected by these negative impacts, which affect their movement, behaviour and breeding habit. To avoid and minimize the negative impacts from these activities project authorities are advised to prepare strict guidelines as follows.

(i) Strict restrictions shall be imposed on the workers at project sites to ensure that they do not harvest any species/produce from the natural forests and cause any danger or harm to the animals and birds in the wild.

(ii) The fuelwood to the labourers shall be provided from plantations meant for the purpose and/or the provision made for the supply of the free/subsidized kerosene/LPG from the depots being set up for this purpose to avoid forest degradation and destruction of animal habitats.

(iii) The interference of human population would be kept to a minimum in the adjacent forested areas and it would be ensured that the contractors do not set up labour colonies in the vicinity of forests and wilderness areas.

(iv) The project authorities will be bound by the rules and regulations of the Wildlife Protection Acts (1972), Biological Diversity Act (2002), Forest Act (1980), Environment Protection Act (1986) and guidelines of State Biodiversity Board for the preservation of habitats and protection of wild animals.

v) It will be ensured that the noise levels in no case go above 100-120 dB in the project area, particularly where human and wildlife habitats are located. One of the measures proposed to be adopted is that the blasting is to be restricted and avoided during nights, early mornings and late afternoons, which are the feeding times of most of the fauna. Blasting will be resorted to only if extremely necessary. For this strict blasting regime, i.e. controlled blasting under constant and strict surveillance should be followed. The details of noise mitigation measures are given in a separate chapter.

11.5 BIODIVERSITY MANAGEMENT COMMITTEE (BMC)

To monitor and evaluate the progress of Biodiversity Management and Conservation Plan a Biodiversity Management Committee (BMC) is proposed for Jelam Tamak H.E. Project. The BMC will follow the guidelines of management plan of Nandadevi Biosphere reserve during the implementation. The activities of BMC shall be under the direct administrative control of Conservator of Forest. The committee would comprise of following members.

i.	Conservator of Forest	Chairman
ii.	General Manager (Environment), THDC India Ltd	Member Secretary
iii.	DFO (s) (wildlife) of the concerned Division	Member(s)
iv	One nominee from National Biodiversity Authority	Member
iv.	One expert form University or renowned R & D Institution	Member
v.	Two member from proposed Forest Resource Management	Members
vi.	Representative of a well known local NGO	Member

The Chairman of the committee will have the right to assign various activities to various members for proper functioning and result-oriented tasks. BMC would submit the reports to National Biodiversity Authority, State Biodiversity Board, Environment Cell, THDC India Ltd, State Forest Department and Environment Monitoring Committee. Total budget for the committee's routine functioning would be **Rs. 15.00 lakh**.

11.6 COST ESTIMATES

The project authorities will provide the funds for Biodiversity Management Plan of Jelam Tamak H.E. Project of Uttarakhand for five years. The total estimated cost of the Biodiversity management and conservation would be **Rs. 245.40 lakh** (Two hundred forty five lakhs and forty thousand). The year-wise break up is given in (Table. 11.1).

Table 11.1 Year-wise break up of Biodiversity management & conservation plan of Jelam Tamak H.E. Project

Particulars	Years					Total (Rs. in lakh)
	1st	2nd	3rd	4th	5th	
i. Forest Resource Management	8.00	4.00	16.00	9.00	8.00	45.00
ii. Peoples Biodiversity Register	2.00	3.00	5.00	5.00	5.00	20.00
iii. Botanical gardens	3.00	32.50	10.90	5.00	8.00	59.40
iv. Removal of invasive & recovery of susceptible species	-	-	-	4.00	6.00	10.00
v. Forest Protection Plan	28 .00	12.00	10.00	8.00	8.00	66.00
vi Habitat improvement	2.00	10.0	6.00	6.00	6.00	30.00
vi. BMC expenses	3.00	3.00	3.00	3.00	3.00	15.00
Total	**46.00**	**64.50**	**50.90**	**40.00**	**44.00**	**245.40**

Chapter 12

FISHERY DEVELOPMENT & DOWNSTREAM MANAGEMENT PLAN

12
FISHERY DEVELOPMENT & DOWNSTREAM MANAGEMENT PLAN

12.1 INTRODUCTION

None of the fish species was recorded from the influence area of Jelam Tamak H.E. project during the primary surveys. Also, no other source is available, indicating the presence of fish species from the river stretch under discussion. Alaknanda river is nearest fish zone (about 50 km downstream), which harbours nearly 19 fish species (CEA Report of Vishnugad Pipalkoti H.E. project). In spite of the fact, the presence of rheophilic species like *Noemacheilus, staliczkae, Noemacheilus gracilis* and *Glyptosternum reticulatum* is expected to inhibit this head water zone (e.g. Sehgal, 1988). These species are bottom dwellers and do not take upstream or downstream migration to cope the climatic condition or for the purpose of spawning. Thus, the fishery development plan has been formulated considering the presence and composition of fish species the study area.

Downstream Management Plan would rely on the species composition in the downstream of Dhauliganga river, livelihood of the inhabitants depending on the river water for irrigation and drinking. The primary surveys indicate that no irrigated land is available in the vicinity of downstream of Dhauliganga and river water is not used for the drinking as well as irrigation purposes. Therefore, the plan is focused basically towards the sustenance of aquatic life in downstream section.

12.2 PLAN OF ACTION

12.2.1 Introduction of Fish Species

Nearly 38 ha area of reservoir could facilitate the scope of development of reservoir fishery. The absence of fish species in that area can be attributed to the adverse climatic condition like low temperature. However, there are other indigenous Himalayan species especially schizothoracines which can thrive better in stagnant water and low temperature. These species can be introduced in the reservoir for the fishery purpose. For the reason project authority would consult fishery expert,

which would explore fish species, site for the collection of seeds etc. After developing reservoir fishery, the project affected families would given fishing right in reservoir at no cost. Total budget for this purpose would be **Rs.15.00 lakhs** only. In addition project developers would provide funds to strengthen the nearby hatchery of *Schizothorax richardsonii*. Though, in the nearby area a hatchery of exotic trout is under operation at Barangna near Gopeshwar (head quarter of Chamoli district, therefore, the funds could not be provided for this hatchery as per guidelines of EAC. However, **Rs. 25.00 lakhs** would be provided to any hatchery of indigenous fish species located in nearest place for procurement of Hatching Troughs, Hatching Trays, Feeding Troughs and development of rearing facilities. Also, **Rs. 15 lakhs** would be provided for pick up van with required accessories for transportation of fish seeds from hatchery to reservoir site. Total budget allocated for fishery management plan would be **Rs. 55 lakhs** only.

12.2.2 Maintenance of Flow in Downstream

After the diversion of water about 4.5 km river stretch would suffer from the paucity of water. Though, diversity of ichthyofauna is nil or very low but the stretch is rich in algal and macro-invertebrates diversity. Thus, adequate flow would require to conserve above said aquatic life. In the downstream 4 tributaries join river Dhauliganga at 0.52 km (Dunagiri Gad on left bank), 1.7 km (unnamed nallah on left bank), 3.6 km (Jumma Gad on right bank) and 4.04 km (Bhosing Gad on left bank). These tributaries have different discharge capacity depending on the area of watershed, thus, in downstream course river discharge increases gradually. Considering 20% average discharge of lean months 2.97 cumec of water would be released from the barrage axis during non monsoon months while 5 cumec of water would be released in monsoon months (June to September). After the confluence of first Dunagiri nallah water discharge would increase to 4.14 cumec (February) to 15.51 cumec (July). Water discharge would gradually increase in downstream and before tailrace discharge it would be 4.44 cumec to 18.07 cumec in respective months (Table 12.1). In addition second scenario was also considered for environmental flow. In which 20% of average lean season discharge would be release during lean months and 5 cumecs would be release in monsoon months.

Table 12.1 Downstream discharge in Dhauliganga river between barrage and powerhouse site

Months	Discharge Release from barrage	d/s 0.52 km	d/s 1.7 km	d/s 3.6 km	d/s 4.04 km
Jun	5.78	13.95	14.21	15.70	15.99
Jul	5.27	15.51	15.84	17.70	18.07
Aug	5.34	14.89	15.20	16.94	17.28
Sep	5.00	11.92	12.14	13.41	13.66
Oct	2.97	7.15	7.29	8.05	8.19
Nov	2.97	5.39	5.47	5.92	6.00
Dec	2.97	4.64	4.69	5.00	5.06
Jan	2.97	4.25	4.29	4.52	4.56
Feb	2.97	4.14	4.18	4.40	4.44
Mar	2.97	4.31	4.36	4.60	4.65
Apr	2.97	5.29	5.36	5.79	5.87
May	2.97	8.75	8.94	9.99	10.19

The main concern of discharge is whether it would be adequate to sustain aquatic life or not. Since fish fauna is absent in the river stretch under discussion or barely some bottom dweller species so that the available water discharge seems adequate for such types of species. As far as other aquatic species like algae and macro-invertebrates are concerned, the available data can sustain these species, however, changes in species composition are anticipated.

12.2.3 Provision of Fish Pass/Ladder

Our primary surveys and various reports (WII, 2011; IIT Roorkee, 2011) have confirmed the immediate vicinity of the proposed project as fish less zone. However, considering the maximum possibilities, some rheophilic species like *Noemacheilus, staliczkae, Noemacheilus gracilis* and *Glyptosternum reticulatum* can be expected to inhabit this stretch. Due to the bottom dwelling habit of these species a fish ladder/pass does not seem feasible for them. However, some indigenous species of fishery interest are proposed to introduce in the proposed reservoir. Considering the suggestions from honorable members of EAC, Ministry of Environment & Forests, project authorities are suggested to explore the possibility of a fish pass to facilitate the easy movement of fish in the proposed reservoir and reservoir of downstream projects.

The fish pass like simple sluice, rock rump fish ways, pool and weirs, vertical slot fish pass and baffle fish ways are used in the rivers. Fish passes have been added to the barrages of river Ganga in India and barrages of Koshi, Chandra Nahar, Andhi Khola, Gandak and Kankaima in Nepal. The fish pass and ways are useful for the structure, which are generally less than 30 m in height. Moreover, fish composition is most important factor as the feasibility of fish pass depends on the types of fish. The fish pass could be feasible for the indigenous Snow trout, if they would be introduced in the reservoirs of the projects.

A fish ladder to be built in the barrage of Jelam Tamak H.E. Project should meet the following criteria

- It should be adapted to the requirements of the species concerned
- It should be of a pool type, rocky ramp type, or a vertical slot
- Flow velocities must not exceed the swimming capacity of fish
- It should provide passage for all fish sizes - large and small
- It should be provided with proper fencing, with total ban on fishing

The project authorities are suggested to explore expertise of fish passes having vast experience of designing of fish passes. No additional budget is kept for the provision of fish passes to the barrage because it is the part of the barrage structure.

No separate budget would be earmarked for the fish ladder as it would be the part of proposed barrage.

Chapter 13

RESETTLEMENT & REHABILITATION PLAN

13
RESETTLEMENT & REHABILITATION PLAN

13.1 INTRODUCTION

Resettlement and Rehabilitation Plan is a key and imperative issue in the developmental projects covering not only the compensatory measures for project affected persons but fulfill the people aspirations of affected area and peripheral/Local Area Development Plan. Government of India has its own policy for Resettlement and Rehabilitation, known as National Policy for Resettlement and Rehabilitation (NPRR, 2007). It has been issued by Ministry of Rural Development, and Department of land Resources. Taking the regional issues, culture and custom into account a few states and some project developers have also developed their Resettlement and Rehabilitation policy with better packages. THDC has in vogue an updated revised policy on Resettlement & Rehabilitation for Tehri Project effective from 09.12.1998. THDC now proposes to review and modify its R&R policy to make it in line with the NPRR 2007 and in light of the experience gained over the years.

Regarding Jelam Tamak H.E. Project the R&R policy will be implemented in close cooperation with the state authorities as may be set up as per the NPRR, 2007. This Policy will be implemented within the framework of local applicable law and aspiration of local people. Though this policy takes into account of local factor and good practices adopted in R&R along with making it in line with NPRR, 2007, any practices and policy measures required specific to any sector in future will be incorporated.

The proposed Resettlement and Rehabilitation Plan will include adequate institutional arrangements to ensure effective and timely design, planning, consultation and implementation of compensation, resettlement and rehabilitation measures**.** Adequate arrangements will be made for effective and timely supervision, internal and external monitoring and evaluation of the implementation of the R&R measures. The care will be taken that after a reasonable transition

period, the affected families improve, or at least regain their previous standard of living, earning capacity and production levels**.**

13.2 JELAM TAMAK H.E. PROJECT

Jelem Tamak H.E. Project is proposed to tap hydropower potential of Dhauliganga in between Jelam and Tamak villages in district Chamoli of Uttarakhand. The Project involves construction of a 28 m high and 65 m long barrage at altitude 2651.50 m, a horse shoe concrete lined head race tunnel of 4428.80 m length, an underground power house and 154.00 m long Trail Race Tunnel. The scheme envisages the utilization of design discharge of 58.22 m^3/s and the drop of about 205.27 m for power generation. The annual energy generation in a 90% dependable year is 501.36 GWh. Total land required for the project activities is 96.27 ha. The land is classified as land of revenue record and permanent forest land. The details of land required for the acquisition is given below:

13.3 LAND REQUIREMENT

Total requirement for the land for various activities is 96.27 ha. Of 96.27 land forest land accounts for 88.29 ha. Total forest land is divided into forest land (65.45 ha), reserve forest land (13.04 ha) and van Panchayat land (9.8 ha). In addition a total of 7.98 ha naap land belongs to Jelam, Tamak and Jumma villages would be acquired for the construction of project. Van Panchayat land to acquired belongs to Dronagiri village. The maximum land of 38.33 ha including river bed area is required for reservoir (Table 13.1).

Table 13.1 Break up of the land required for various project components of Jelam Tamak H.E. Project. The value of land is given in ha.

Particulars	Forest	Reserve Forest	Van Panchayat land	Naap Land	Total
	(ha)	(ha)	(ha)	(ha)	(ha)
Reservoir area up to EL. 2650.00	29.29		9	0.04	38.33
Balance land for barrage	2.2		0.8	-	3
Land required above intake, desanders, HRT part etc,	2.92			-	2.92
Owners 'colony	4.83			-	4.83
Rock Quarry	0.31			-	0.31
RBM	4.76	5.02			9.78
Disposal area at barrage site	7.22				7.22

Disposal area near HRT	0.85				0.85
Disposal area near Jumma		1.17		0.34	1.51
Disposal area near Power house at Tamak				0.36	0.36
Roads	9.38	0.82		-	10.2

Central workshop, fuel pump, auto repair shop	1.44			-	1.44
Area above power house complex & balance HRT		4.76		-	4.76
Explosive magazine area	0.03			-	0.03
Plant, store, etc. in barrage area	0.81			-	0.81
Plants, weir house, penstock, fabrication yard, etc in powerhouse area		1.27			1.27
Aggregate processing plant, stockpile area & river bed material.	1.41			-	1.41
Contractor's colony near Jumma nallah/Jelam/Tamak etc.				7.24	7.24
	65.45	13.04	9.8	7.98	96.27

13.4 BRIEF SOCIO-ECONOMIC PROFILE

Proposed Jelam Tamak H.E Project is located on the Dhauliganga river in Joshimath, sub division of Chamoli district in Uttarakhand. The total population of district Chamoli is 3,70,359 with a sex ratio of 1015 (Census 2001) (as per Census 2011, total population is 3,91,344 with sex ratio 1020). About 86.3% of the total population inhabits the rural areas. Total literacy rate of district is 75.4% with maximum in males (as per Census 2011 literacy rate is 83.48%). The population structure is comprised of Brahmins, Rajputs, Scheduled caste (SC) and Scheduled tribe (ST). Joshimath is one the largest tehsils of Chamoli district in term of area. It is comprised of 93 villages and 27 notified wards. Total population of tehsil is 39,919 with a sex ratio of 774. Literacy rate of Joshimath tehsil is 78.8%. About 62.7% of the total population is rural.

A total of 14 villages are located in the influence zone of Jelam Tamak H.E. Project. Total population of these villages is 2034 come from 517 households (Census, 2001). The sex ratio in these villages is 1007; is more than district, state and National averages. Age group 0-6 year accounts for 15.50% of the total population. Scheduled caste population forms a small part of the population and restricted in 5 villages only. The influence zone is dominated with Scheduled tribe population, accounting for 78.6% of the total population. Total land of these villages is 54807 ha in which forest land (6.7%) account for major share. The forest land is used for livelihood like fodder, fuel wood, pasture etc. Agriculture land accounts only for 1.3% of the total land. Total land is unirrigated.

Maize, millets, beans, potato and spices are main crop in the area. In addition, certain species like Chippi or Gandrayani (*Angelica glauca*) and Kut (*Sausssurea costus*) are cultivated mainly for local consumption. The people are engaged in various other occupations. Nearly 49% people form the workers in these villages in which 71% are main workers.

Three villages, viz. Jelam, Longsagari and Jumma are directly affected due to the various project activities, while Dunagiri revenue village is affected due to acquisition of van panchayat land. Jelam is nearest village of proposed barrage site, located on the right bank of Dhauliganga river. It comprises Jelam, Dungri, Kuthar and Sengla. Village Jelam is spread over 15,436 ha land, of which 143 ha is used for agriculture. Total population of Jelam village is 315 comes from 85 households. Jumma village is located on the right bank of Dhauliganga river. It is located on a land covering 659 ha area, in which 13 ha is used for cultivation. Total population of Jumma village is 98 belong to 27 households. The land of Jelam village has to be acquired for dumping areas and colony area is 4.83 ha as naap land. The land of Jumma village to be acquired for dumping areas, contractor and labour colony area is 3.34 ha. Total 6 households will be affected due to various project activities. Longsagari (Tamak) village is located on the right bank of Dhauliganga river and is nearest village of proposed power house. Earlier the village was located on the left bank of the river. Due to frequent land slide and flood village had to displace to the left bank. Total area of the village is 419 ha, in which 90 ha is used for cultivation. Total population of Longsagari is 67 of 20 households (Census 2001). The land of Longsagari village to be acquired for proposed power house complex is 0.36 ha as naap land. A total of 17 households are displaced. Dronagiri revenue village is located on the left bank of Dhauliganga river and comprises of four villages namely Dronagiri, Garpak, Kaga, and Ruing. Total area of these villages is 29295 ha with maximum in Dronagiri village. As per Census 2001 total population of these villages is 180, comes from 64 households. More than 98% of the total population comprises scheduled tribe population. No naap land will be acquired from the Dronagiri revenue village, however 9.8 ha van panchayat land of these villages will be affected due to various project activities.

A total of 94 families belonging to 47 households from three villages namely Jelam, Jumma and Longsagari (Tamak) are affected due to various project components of Jelam Tamak H.E. Project. Out of 47 households total 31 families of 17 households belonging to Longsagari village are displaced. Only one household is common under between category of displaced and project affected.

Total population of affected families of proposed project is 217 with a sex ratio of 1028. All population comes from Scheduled tribe families. Age group 0-6 year accounts for 9% of the total population. Longsagari village records maximum affected persons, in which 17 households are displaced and 16 are affected due to land acquisition. One household is common between these categories.

Average literacy rate in affected families is 79.2%, which is lower than district average and slightly higher than average of influence area. Nearly 46% of the total population is employed in various works; the majority is engaged in cultivation and agricultural practices. Only 11.9% of the total population is employed in government or private jobs. Only one person from Jelam village is beneficiary of pension while three families from these villages have taken small scale business.

Livestock population of affected families comprises of cows, goats, ox, and buffaloes. Cows are reared almost by all families. Cows are major source of milk in the affected villages. Vulnerable category includes old age fellows (above 50 years), BPL families, widow and physically handicapped. Old age fellows account for maximum vulnerable persons. In addition, 19 households are BPL card holders while 11 persons are widow. In addition to three families mentioned above Dunagiri revenue village is affected due to acquisition of 9.8 ha of van panchayat land. A total number of 145 families have the rights on 9.8 ha land.

13.5 PROPOSED PLAN OF ACTION

Prior to formulation of R & R plan for the project, brief outlines regarding the limitations are discussed here. Eligibility criteria, definitions of various terms and rehabilitation package proposed by THDC India Ltd in its policy are used in the proposed plan of action.

13.5.1 Cut-Off Date For R&R Package

The cut-off date for title holders shall be two years prior to the date of publication of notification under section 4 of LA act 1894. To eliminate/ minimize the possibilities of usurpation of rights by agricultural or non agricultural labourer in order to reap the advantage of various R&R benefits, 3 years of residence, in the acquired area, before the date of publication of the notification under section 4 of the LA Act, 1894 or similar section prescribed for publication of first notification indicating the intention of acquisition under any other act currently in force, will be required in order

to avail R&R package. However in such cases that are left out due to the cut off date of three years, the approach of Project Authority will be flexible and they will be reviewed on a case to case basis and genuine cases such as family transactions amongst legal heirs due to death in family/marriage etc. will be considered for R&R benefit. The intention is to eliminate/minimize those who obtain rights in property with ulterior motive of grabbing R&R benefit only. Evidence of status as a PAF is to be provided by a person in the form (a) Written legal document or (b) Reference to a record such as revenue officer certificate, electoral roll or ration card etc .The list shall be finally verified by Gram Panchayat and duly certified by Collector. Payment of compensation benefits for the assets acquired, however, will be determined as per the law of the land. Members of Scheduled tribe (ST) in possession/occupation of forest land prior to 13th day of December 2005 will however be entitled for benefits as laid down. The list compiled and recommended by Forest Department Shall be verified by Gram Panchayat and certified by District Collector.

13.5.2 Definitions

Various terms used in the Resettlement and Rehabilitation Plan are defined under this section. If certain terms are not mentioned here, they will be considered as per NPRR (2007).

13.5.2.1 *Project Affected Family (PAF)*

(i) Project Affected Family (PAF) means family whose place of residence or other properties or source of livelihood are substantially affected by the process of acquisition of land for the project or involuntary displacement for any other reason.

(ii) Any tenure holder, lessee or owner of other property, who on account of acquisition of land (including plot in the abadi or other property) in the affected area or otherwise has been involuntarily displaced from such land or other property: or

(iii) Any agriculture or non agricultural labourer, landless person (not having homestead land, agricultural land or other homestead or agricultural land), rural artisan, small trader or self employed person: who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, or date of publication of notification under section-4 of the LA act,1894 and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced for any reason.

13.5.2.2 ***Family***

i). Family means Project Affected Family consisting of such persons, his or her spouse, minor sons, unmarried daughters, minor brothers or unmarried sisters, father, other and other members residing with him and dependent on him / her for their livelihood.

ii) Any son immaterial of marital status above the age of 18 years and unmarried daughters above the age of 30 years will be considered as Separate family.

13.5.2.3 ***Project Affected Persons (PAPS)***

Project Affected Person (PAPs) means person belonging to or member of Project Affected Family (PAFs).

13.5.2.4 ***Homestead Oustees (HSOS)***

A PAF whose homestead has been acquired by the process of law and who has to be relocated shall be considered a Homestead Oustee. An unauthorized structure shall not be considered for any benefit. However in case of any such regularization by the government 3 years prior to Sec 4 notification, will be considered as a HSO. An allotee of any government scheme like Indira Awas Yojana, homestead allottee on Government lands etc. shall be considered as HSOs.

13.5.2.5 ***Vulnerable Persons***

Persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women or persons above 50 years of age who are not provided or cannot be immediately provided with alternative livelihood and who are not otherwise covered as part of family and families. Suitable annuity policies shall be taken, which will pay a pension for life to the vulnerable affected person subject to a minimum of Rs. 500.00 (Rs. five hundred) per month.

13.5.2.6 ***Affected Area***

Means area of village or locality notified by the appropriate Govt., where the appropriate Govt. is of the opinion that there is likely to be involuntarily displacement of families in plain, tribal or hilly areas; DDP blocks or areas mentioned in the schedule V or schedule VI to the constitution due to acquisition of land for the project or due to any other reason.

13.5.3 Categories of PAFS

A CATEGORY: PAFs owning agricultural land in the acquired area two years before the Sec 4 notification and whose entire land has been acquired. The list shall be prepared based on the revenue records as on the date of Section 4 notification under LA Act.

B CATEGORY: PAFs owning agricultural land in the acquired area two years before the Sec 4 notification and losing partial land and becoming **marginal farmer** (left with unirrigated land holding up to 1 ha or ½ ha irrigated land). The list shall be prepared based on the revenue records as on the date of Section 4 notification under LA Act.

C CATEGORY: PAFs owning agricultural land in the acquired area two years before the Sec 4 notification and losing partial land and becoming **small farmer** (left with un irrigated land holding up to 2 ha. or irrigated holding up to 1 ha.). The list shall be prepared based on the revenue records as on the date of Section 4 notification under LA Act

D CATEGORY: PAFs owning agricultural land in the acquired area before the Sec 4 notification and losing partial land but not covered in either category B or C. The list shall be prepared based on the revenue records as on the date of section 4 notifications under LA Act.

E CATEGORY: Agricultural laborer PAF including squatters and encroachers who normally is a resident of the affected area for a period not less than three years immediately before Sec 4 notification, who does not own land in the acquired area but who earns his/her livelihood principally by manual labor and have been deprived of his /her livelihood due to acquisition. The list should be prepared and verified by Gram Panchayat and duly certified by collector or his/ her authorized representative.

F CATEGORY: Non agricultural laborers PAF including squatters and encroachers who is not an agricultural labour PAF, but is normally residing in the affected zone for a period of not less than three years immediately before the Sec 4 notification and who does not own any land but who earns his livelihood principally by manual labour or as a rural artisan or having any client relationship with PAF community, immediately before acquisition and has been deprived of his/her such livelihood due to acquisition. The list shall be prepared based on the socio-economic survey, verification by the Gram Panchayat and duly certified by Collector or his/her authorized representative.

G CATEGORY: PAFs losing partial land in case of projects/schemes related, connecting approach roads and bridges outside the project and its associated area etc., wherein only a narrow stretch of land extending several kilometers is being acquired. The list shall be prepared based on the revenue records as on the date of Section 4 notification under LA Act. (In case of acquisition of homesteads

in such a case shall fall in Category I). In case of acquisition of major portion of their land holding (say 25% of land or more, however, in such a case shall fall in Cat A to D, subject to a minimum acquisition of one acre).

H CATEGORY: Occupiers i.e. PAFs of STs in possession of forest land since 13th December 2005. The list shall be prepared based on the socio economic survey, verification by the Gram Panchayat, State/Central Forest Department and duly certified by Collector or his/her authorized representative.

I CATEGORY: PAFs who are Homestead Oustees (HSO), residing in the area and owning house since before the Sec 4 notification under LA Act and whose house has been acquired by the process of law.

13.5.4 Rehabilitation Package

The PAFs of Category A to I will be entitled for any one of the following rehabilitation packages. If a PAF falls in more than one category of A to G, she/she will be entitled for only one of the rehabilitation package. For the Category H and I the package will vary depending upon the type of PAF as per Category A to G.

13.5.4.1 *Land For Land (LFL)*

The "Land for land" option will be applicable to PAF owning agricultural land in the affected zone, whose entire land has been acquired or has been reduced to status of marginal as a consequence of the acquisition or loss of land may be allotted agricultural land or cultivated land to the extent of actual loss of land subject to a maximum of one Ha of irrigated land or two ha of un irrigated/ cultivable wasteland preferably in the command area subject to availability of Government land in the district. Land availability for allotment for this purpose will be explored by State Government. If Government land is not available, PAFs will be facilitated for purchase of land on a "willing buyer-willing seller" basis.

The limit of purchase of land in this case will be two ha. For this purpose, the following process will be adopted. Land price for the purpose of purchase of land will be fixed after consultation with the State Government on the basis of market price of the good agriculture land in the vicinity generally within 25 Km radius but normally not exceeding the 1.3 times of the rate paid for the acquisition of good agriculture land as per LA Act. The basic land compensation amount paid (i.e. excluding solatium and interest) will be adjusted against this amount. In addition, land

development amount @ Rs. 10,000/- (Rs. Ten thousand) per acre as per entitlement (Based on price CPI as on 31.12.2006 and subject to revision from time to time) and actual land registration and stamp duty charges as per entitlement will also be paid as per entitlement to those, who actually purchase the land and submit the required papers. The PAFs who though, losing less than one acre of land, purchase land up to one acre out of the grants and compensation money they would be reimbursed the actual stamp duty and registration charges of up to one acre. In situation, where the LFL option is not feasible because of scarcity of land in the particular area, this option shall not be applicable to PAFs.

13.5.4.2 ***Rehabilitation Grant (RG)***

Only those grants are described here which are relevant to Jelam Tamak H.E. Project.

- One time RG will be paid to eligible categories. The grants will be as follow

S.No.	Category	Amount	Amount (in Rs.)
1	A	1000 days of MAW	1,05,000
2	B to F	750 days of MAW	78,750
3	I	500 days of MAW	52,500

*Minimum agricultural wage (MAW) in Uttarakhand is Rs. 104.52 (Say Rs. 105) including variable dearness allowance

- In case of rehabilitation of any rural artisan/small trader and a self employed person falling in category F who was having a shop in the affected area, a one time financial assistance of **Rs. 40,000** will also be provided in addition to RG for construction of working shed/shop.
- Keeping in view the time required for stabilizing the resettlement process, each PAF shall normally get a monthly subsistence allowance equivalent to 25 days of minimum Agriculture Wages per month for a period of one year up to, starting from the date of relocation/displacement and physically handing over of the acquired land. Payment on account of subsistence grant i.e. 12X25 day = 300 MAW shall be made in one installment separately as per option exercised by PAF and on approval of project head. This amount shall not be included in any other grants payable to PAF's, for the purpose of determining the installments.
- PAFs of category I **(homestead oustee)** and willing to resettle on their own or shift to some alternate location will be encouraged for self resettlement. In addition to the compensation a financial assistance for self-resettlement shall be provided at the rate assessed by PWD/SLAO of the basic compensation payable for the house, excluding solatium and interest, under Land

Acquisition Act subject to a minimum of Rs. 50,000/- and a maximum of Rs. 1,00,000/- in each case (Based on price CPI as on 31.12.2006 and subject to revision from time to time).

THDC shall bear the actual cost of transportation of the building materials and other movable properties including self, family members, cattle etc. belonging to the PAFs from the place of displacement to resettlement colony or the place of resettlement generally within 25 km. Of accessible roads in any transport arranged by THDC. Alternatively, a lump sum grant of **Rs. 20,000** will be paid to each HSO for self transportation/shifting. This is inclusive of transportation of man, material, a reusable goods, wood, cattle etc, if any. A fixed resettlement grant of Rs. 40,000/- will also be provided to each HSO. The implementation process has been described in para 3.4.5. This is inclusive of Rs. 15,000/- towards assistance for construction cattle shed, if any. In terms of rupees an Amount of Rs. **1,90,000** including Rs. 30,000 for construction, Rs. 20,000 for transportation and Rs. 40,000 as resettlement grant is suggested for homestead oustee.

13.5.5 Additional Benefits To ST PAFs

13.5.5.1 Each PAF of ST category shall be given preference in allotment of land for land option**.**

13.5.5.2 Each tribal PAF shall get additional financial assistance equivalent to 500 days MAW **(Rs. 52,500)** for loss of customary rights/usages of forest produce in case the acquisition has affected their such rights.

13.5.5.3 Tribal PAFs resettled out of the District/ Taluk will get 25% higher R&R benefits in monetary terms.

13.5.5.4 If any reservoir is constructed and owned by THDC as a result of its construction of any hydro electric project, the tribal PAFs of the affected area having fishing rights in the river/ ponds/dam will be given the fishing rights in the reservoir area.

13.5.5.5 In case during acquisition of any land for THDC project. It is found out by the State Government that tribal land has been alienated in violation of the laws and regulation in force on the subject, it would be treated as null and void and R&R benefits would be available only to the original tribal owner.

13.5.5.6 In case, land being acquired from ST, at least1/3 of compensation amount due shall be paid to the affected families at the outset as first installment and rest at the time of taking over possession of land.

13.5.6 Loss of Common Property

During the construction of hydro projects, should any common property resources, cremation, religious, structure/places etc or any existing facilities such as irrigation, water supply, road, electricity communication system, path etc. be adversely affected due to execution of the project, remedial measure will be taken and incorporated in the project specific RAP. The extent of such measure shall be decided in consultation with the stakeholders.

13.5.7 Relief Package

For the various categories of affected families total budget allocated for the relief package is **Rs. 4,72,89,750** only. None of the family is rendered landless in affected area. However, 31 families are homestead oustess. Though, these families are displaced but a separate resettlement colony is not proposed for them due to inadequate group. Details of budget is given in Table 13.2.

Table 13.2 Relief and rehabilitation package for project affected families and persons

S.N.	Categories	No. of families/ Persons	Rate of grant (in Rs.)	Total Amount (in Rs.)
i).	Total No of Households	47		
i)	Total No. of Families	94		
ii).	Landless Family (Category A)	0	1,05,000	-
iii).	Project Affected families Category (D)	63	78,750	49,61,250
iv).	Houseless or displaced Family (category I)	31	1,90,000	58,90,000
v).	Vulnerable person's pension*			
	Above 50 Year's	32	(@ Rs. 1000 PM)	60,00,000
	Unmarried Girl	32	(@ Rs. 1000 PM)	60,00,000
	Widows	11	(@ Rs. 1000 PM)	20,00,000
vi).	ST Family (500 days MAW)	94	52,500	49,35,000
vii).	Subsistence grant	94	2625/- pm for 1 yr	29,61,000
viii).	Loss of common resource/ Grazing land (Jelam and Long. Tamak Gram Sabha as per 2001 census)	132 @ Rs. 105 x 100 x 5 x 132)		69,30,000
ix).	Loss of common resource Van Pan. Land (Dronagiri Gram Sabha)	145 @ Rs. 105 x 100 x 5 x 145)		76,12,500
Total				**4,72,89,750**

*for the vulnerable person's pension grant, project authority would deposit a capital money of Rs. 1,40,00,000 in the Bank and pension would be paid through interest for life time. The amount would be reviewed time to time for the increament.

13.5.8 Rehabilitation Package – Option II (Negotiated Settlement)

13.5.8.1 For loss of land (Agriculture/residential/commercial), THDCIL will approach the affected community for a negotiated settlement. The unit of negotiation would be per *naali* (one fiftieth of a hectare or a land parcel of 200 sq. m). The negotiated amount would include the compensation amount, solatium (30% of the compensation amount), interest (12% from the date of award) and R&R assistance. The negotiated amount would be the prevailing market rate.

13.5.8.2 The compensation amount including solatium and interest (if payable) will be disbursed by the competent authority and balance amount will be paid by THDCIL as R&R assistance. Even if any PAF (title holder) has a landholding of less than one and half naali or is a landless, he / she will be entitled for an R&R package of at least one and half (1.5) *naali*.

Loss of Residential And/ or Commercial Structures

13.5.8.3 THDCIL will pay the replacement value of the structure based on concerned PWD's latest schedule of rates (SOR).

13.5.8.4 To mitigate the loss of income due to acquisition of shop/commercial establishment, 300 days MAW will be paid to each affected shop owners/commercial establishment located in the rural areas and 500 days of MAW to shop owners/commercial establishment located on branch road adjoining main road.

13.5.8.5 (i)All PAF's (title holder) losing agriculture land or getting displaced (whether en-mass or individually) or losing livelihood will be supported by THDCIL for restoration of income. For income restoration, the NGO contracted for RAP implementation along with the Environmental and Social Cell of THDCIL will take following steps: (i) conduct need assessment survey to identify trades; (ii) would identify master trainers for training; (iii) would establish backward and forward linkages for each of the trade selected; (iv) would arrange for training logistics. The NGO would also monitor each PAF (title holder) and would document the progress. The external agency that will be hired for mid and end term evaluation of RAP implementation will also evaluate the implementation of income restoration schemes.

(ii) PAFs whose 50% or more land has been acquired but house has not been acquired shall be given house construction assistance of Rs. 30,000/- in addition to other entitled Rehabilitation benefits.

(iii) An exgratia payment will be provided to each house hold as per self resettlement grant for house under option –I of the R&R Policy whose house has also been acquired and who have opted option- II of the policy.

13.5.8.6 LOSS OF COMMUNITY PROPERTY/RESOURCE:

Any community property that will be affected by the project will be replaced by THDCIL before the demolition or acquisition of such properties. In case of grazing land and van panchayat land, THDCIL will provide access roads to the residual van panchayat and / or grazing land. In addition each House hold in the affected habitation will be paid 100 days of MAW per year for a period of 5 years. The amount will be paid as a grant towards the loss of fuel and fodder. Cut off date for transfer of Van Panchayat land shall be reckoned from the date of stage- II clearance of the Project Eligibility for payment to each house hold shall be considered based on their names registered in the Pariwar register maintained by Gram Panchayat and subject to fulfillment of two of the following criteria.

(i) Ration card should be in running condition on cut off date.

(ii) Proof of residence in the affected village since last 2 years from the cut off date issued by District Administration

(iii) Electricity bill or any other document substantiating the claim that the person is residing in a separate house hold.

Cutoff date for determining the applicable rate of MAW shall be as below-

1st -Installment- Rate of MAW as applicable on the date possession of land

2nd -Installment- Rate of MAW as applicable just after one years of release of 1st installment.

3rd - Rate of MAW as applicable just after two years of release of 1st installment.

4th - Rate of MAW as applicable just after three years of release of 1st installment.

5th- Rate of MAW as applicable just after four years of release of 1st installment.

13.6 ENVISAGED BENEFITS

In addition to the relief and rehabilitation package for the affected families, the Project Authority will undertake a plan of infrastructural development in the area which would result in better quality of life for the entire human population of the area. Several such facilities would be

created for the benefit and use of general public. A detailed account of these proposed development activities is presented based on envisaged impacts of the Project.

13.6.1 Economic Development

The proposed Jelam-Tamak Hydro-Electric Project is located in the remotest Indo Tibat Border region of Chamoli District of Uttarakhand with virtually scarce or no basic facilities. The people have to travel to Joshimath at a distance of around 55 Km for their daily need. There is no market, telephone, bank etc. in the area. The Project would require a large number of workers, officers and other staff. As a result of increased population and with more surplus income at their command, together with enhanced requirements of food grains, vegetables, milk, clothing and other grocery items, there would be a sharp increase in the business activity and turnover of existing businessmen. This would also lead to establishment of Markets and growth of local economy. In addition to the prospering business establishments, there would be requirement of many other items for various Project activities, which again would result in upliftment of local economy and better quality of life.

13.6.2 Employment Opportunities

The proposed Resettlement & Rehabilitation Policy fair participation of local people in the jobs in the project. The Project Authority directly as well as through their contractors would ensure that local population gets good number of jobs. The jobs, however, would be determined by the qualifications and experience of the persons wanting to be employed. It will also provide an opportunity to many unskilled youth to become skilled. By gaining technical knowledge and experience, their chances of gainful employment will be greatly enhanced. Enhancing the local people's skills and opportunities for employment the project would result in uplifting the standard of living and the existing quality of life of the local inhabitants. This would go a long way in making the area economically self-sustaining.

Besides generating local employment for the skilled and un-skilled labour, the project would also provide an opportunity for the local people to compete for various small contracts related to project works, depending on their economic status and experience. The participation in this process would, however, be guided by the usual process of tendering. Project Developer would ensure as far as possible, to engage local labourer in various skilled/non-skilled jobs depending on a candidate's

qualifications and experience. There would also be sufficient opportunities for indirect income generating activities, which include provision of services to contractors, opening of small and medium sized market place/ shops, etc. Project Authority will provide various training and will run income generating schemes for local youth. These developments would be helpful in self employment of the local residents.

The Project affected youth will be trained in various Institutions in tailor made programmes to make them employable for the Project during its construction and post commissioning. The THDC shall do all necessary arrangements and take all required steps to train/capacity building for the land oustees/local people.

The THDC shall give the preference to local Tribal people (PAPs) in various categories of posts, subject to the incumbents fulfilling the job requirements as per the criteria given below:

- 100% recruitment at the level of workmen (including Technical & Ministerial) required to be done, if any, will be done first from the land oustees and in case of non-availability of suitable candidate amongst land oustees, the recruitment will be done from other residents of Uttaranchal State whose names are registered on live register of any Employment Exchange located in the State subject to individuals fulfilling the qualification and job specification for the relevant post.

13.6.3 Educational Facilities

The Project Authority would extend finances for renovation of educational institutions in the area for the children/wards of the project effected villages. These institutions shall also be open to the children of the local inhabitants in the influence area. Also sufficient grants would be provided for the maintenance and upgradation of these educational institutions which would be a great benefit for the local residents.

13.6.4 Health Related Facilities

The Project Authority would establish healthcare facilities in terms of healthcare centers/dispensary/mobile hospital for meeting the primary health requirement their employees and the Project affected villages. These centers shall also extend services to the local people. Project

Authority would provide mobile vans for emergency services in the area for shifting the patients to Govt. Hospital at Joshimath/Srinagar.

13.6.5 Sports Facilities

The Project Authority would construct and establish club/playgrounds for the project employees/ sports competitions and sports meets would be organized between the local players and project employees which would ensure the local participation. This will also provide them necessary facilities for excelling in sports of their choice. These facilities would go a long way in honing and nurturing the local talent in the field of sports and competitive games.

13.6.6 Free Electricity

100 units of free electricity to be provided to each affected house hold per month for a period of 10 years from the date of commissioning.

13.6.7 Electrification In 5 Km Radial Area Of Project

The Project authority shall carry out the electrification of the villages falling within a radius of 5 kms from the Project.

13.7 LOCAL AREA DEVELOPMENT PLAN/PERIPHERY (LADP)

The Project authority has developed a comprehensive local area/periphery development plan for benefit of the villages being affected by the Project. Social upliftment plan in hydro-electric project leads to the positive impacts of the project in the peripheral villages and population. Considering the local population as stakeholders of the project, this plan is proposed to empower the weaker sections, women, tribes and to provide the infrastructure facilities in the villages located in project influence area. As a part of National Policy on Resettlement and Rehabilitation, the social upliftment plan is proposed for the influence area of Jelam Tamak H.E. Project in Uttarakhand.

The influence zone of the Jelam-Tamak HEP is considered an abode for Bhotiya Tribes, having uniqueness in culture and customs. The area is sparsely populated. The Mishmis have traditional right on the forest produce and practice shifting cultivation and regular hunting. The forest is, therefore, under heavy anthropogenic pressure. The proposed infrastructure development has been suggested keeping in view the cultural complexity and sensitivity of the area. The

developmental activities and the involvement of Tribes might divert their focus from the exploitation of forest.

THDC India Ltd (project authority) has its own Corporate Social Responsibility (CSR) Policy towards the development and social upliftment in the project surroundings.

THDCIL shall contribute to the socio-economic development of the area contiguous to its area of operation with the district administration. The local area development plan will be prepared in consultation with VDAC/SHIST MANDAL and District Administration. THDC is carrying out the various CSR activities in the project for which an amount of approx. Rs.50 lakhs has already been spent so far. Being a CPSU THDC will continue to contribute in the CSR activities as per the Government norms.

Additionally, the required infrastructural facilities under local area development plan are described under the following headings:

13.7.1 Development of Infrastructure Facilities in Schools

In order to strengthen the infrastructure facilities in the existing schools of influence zone, Project Authority are suggested to provide the fund for the purpose. A survey of schools to record the inadequacy would be conducted in 14 villages of influence area. Schools as per need would be short listed. The budget shall include renovation of school buildings, purchasing of chairs, desks, sport materials, books etc. The Project Authority are suggested to develop three play grounds for the schools at centre places with consultation with Gram Pradhans. Development of playgrounds would subject to the availability of land. The land for the play grounds would be provided by State Government. Annual inter-schools games at primary, middle and secondary levels would be organized to encourage the sport capacity in the region. There would be provision of trophies, certificates and financial assistance to best qualified students. In addition, annual schools meet can be facilitated to boost the extra curricular activities in the region. The provision of budget is for 5 years, however, if the Project Authority are interested, it can be extended. Total budget in this head would be **Rs. 68.00 lakh** only. Break up of the budget is given below.

S.No. Heads	Year-wise breakup of budget (Rs. in lakh) 1st yr	2nd Yr	3rd Yr	4th Yr	5 Yr	Total
i. Renovation works	4.00	4.00	4.00	4.00	4.00	20.00
ii. Purchasing of goods	10.00	-	-	-	-	10.00
iii. Development of Playground	-	-	5.00	5.00	5.00	15.00
iv. Annual games	2.00	2.00	3.00	3.00	3.00	13.00
v. Extra curricular activities	2.00	2.00	2.00	2.00	2.00	10.00
Total	**18.00**	**8.00**	**14.00**	**14.00**	**14.00**	**68.00**

13.7.2 Bus Stops/ Rain Shelters

The project areas and surrounding villages are connected to the state highway (Joshimath to Malari). Transportation facilities in the area are very poor. The means of transport comprises mainly of light vehicles. People have to travel 1 to 5 km to access the highway and wait for much time. The roads are not facilitated with bus stops with rain shelter. For the convenience of the residents, rain shelters and bus stops are suggested alongside footpaths and roads. These facilities are proposed in influence areas. There are nearly 15 locations on the road which are linked to surrounding villages. Therefore, 15 rain shelter cum bus stops are proposed on the state highway. Total budget for the same would be **Rs. 15.00** lakh (@ 1.00 lakh per shelter).

13.7.3 Construction of Footpaths and Bridge Repairing

The surrounding villages are located on the slopes and villagers travel for 1 to 15 km to access the road. In most of the villages the footpaths linked to the roads are either *Kuccha*, rough or damaged. These footpaths lead to severe encumbrance to the residents, particularly during ill-health and sickness. These villages like Jumma, Tolma (Tamak), Jelam, would require *pucca* footpaths for relatively easy movement. Total length of proposed footpaths would nearly be 20 km with maximum for Dronagiri village (nearly 12 km). The estimated cost (@ Rs. 300/m^3) of footpaths for 14 affected villages would be **Rs. 30.00 lakh** only. In addition, repairing of bridge connecting Dronagiri village also proposed that would cost **Rs. 10.00 lakh**. Total budget under this head would be **Rs. 40.00 lakh** only. The task would be completed within 4 years during the construction phase.

13.7.4 Provision of Solar Green House

Agricultural practice in the surrounding village is very sparse because Dhauliganga river flows through deep gorges and formation of river terraces is low. Also, the area is semi arid and resulting in low agricultural production. In order to increase the agricultural production solar green house are proposed in the area, which are well practiced in Laddak area.

The improved greenhouse (IGH) is designed to maximize the capture of solar energy during the day, while minimizing heat loss at night so that the crops do not freeze. The greenhouse is heated by solar energy alone, and there is no supplementary heating. This is achieved using standard ideas from passive solar architecture, enabling solar heat gain, heat storage, natural ventilation, and reduced heat loss. Firstly, the greenhouse is orientated very carefully along an East-West axis, so that there is a long South-facing side. The transparent cover on the South-facing side is made from heavy duty polythene, which has extra stabilizer in it to resist the intense ultra violet (UV) light which penetrates the thin atmosphere. The polythene should last for at least five years. In particularly cold places a double layer of polythene is used. Secondly, the side and back walls of the green house have a high thermal mass, so that they (and the soil) absorb heat from the sun during the day and release it at night to keep the inside of the greenhouse at a suitable temperature. Thirdly, to minimize heat loss, the side and back walls are cavity construction, and the 100 mm wide cavity is filled with insulation of either straw or sawdust. The back of the roof is sloped at 35° to avoid blocking any direct sunlight in winter, and it is covered with thatch to minimize heat loss. In addition a cloth or tarpaulin is used to cover the polythene at night in order to reduce heat loss. Fourthly, the inner atmosphere is controlled by natural ventilation through vents in the walls and roof, to avoid excess humidity and overheating. The greenhouses are designed to be simple and robust. The walls are generally constructed of mud bricks, made locally, although in areas of high snow-fall more resilient walls of stone and rock are needed.

Another objective of the solar greenhouse is to encourage the people of region to install them. Project Authority would provide funds as well as technical input to few selected families (preferably BPL) with the help of experts. GERES, India and G.B Pant Institute of Himalayan Environment & Development (GBPIHED), Almora etc. can provide technical support. Nearly 5 solar greenhouse (one in each surrounding village) are proposed in area. Locally available construction materials like stones, mud, wooden poles would be borne by beneficiaries while other

materials like polythene, and technical support and training will be provided by project authorities. The land would also be made available by beneficiaries. Total estimated cost of solar green house would be **Rs. 5.00 lakh.** It includes cost of installation (@ Rs. 40,000 per green house), training, technical input, travel, etc. Two solar greenhouses would be installed per year.

13.7.5 Training Program/Capacity Building

Following the clause 7.13.2 of NRRP 2007, the affected persons shall be offered the necessary training facilities for development of entrepreneurship, technical and professional skills for self-employment. Training on the food processing, mushroom cultivation, computer courses, organic farming, apiculture, vermiculture, eco-tourism, poultry farming, dairy farming, knitting, sewing etc. could open new areas of self employment in the region. Project authority (THDC India Ltd.) would invite trainees among the affected families for the training on various courses. The Project authority would select 03 trainees every year for the period of 5 years. If the applicants are not available among the affected families the training programme can be extended to the affected villages and/or villages located in the 10 km radius. The applicants can obtain application form at no cost from the office of Project authority **(Enclosure-I).** Applicant would submit application form along with certificate of land acquired from the LAO (Land Acquisition Officer) of Project Authority, income certificate from DC/SDM/, certificates of educational qualification, caste certificate issued by an officer not below the rank of executive magistrate and verification certificate of the concerned Gram Pradhan. The scheme is only a welfare measure for the PAF's and does not confer any right on the PAF's for financial assistance. If the Project authority is not able to develop all infrastructural facilities for all the training programmes, it may consult concerned department of the state to facilitate training to the applicants. The Project authority would bear all expenditure including accommodation, travel etc. of the trainees and charges of the concerned department. Total financial out lay for the training programme has been kept as **Rs. 25 lakhs.**

13.7.6 Merit Scholarship Scheme

As per clause 7.13.1(c) of NPRR 2007, Project authority shall offer scholarships on merit basis and other skill development opportunities to the eligible persons from the affected families. To improve and encourage the literacy and educational standards in the project affected area and to create a pool of potential candidates, Project authority proposes to introduce a Merit Scholarship Scheme for the wards of the Project Affected Families. If the wards from the affected families are

not eligible and/or available, then Merit Scholarship Scheme would be extended to the wards of the affected villages or vicinity villages. The wards should be studying in school, college or any other educational institute recognized by State or Central Government or a reputed private institution. The students should not be receiving any other scholarship of State and Central government.

A total of 16 students every year will be selected for the scholarship on merit basis. The scholarship would be divided on the basis of standards and disciplines, viz. High/Secondary school (Class 9^{th} to 12^{th} for 4 students), Vocational training (4 students), Diploma (4 students) and Degree in Science, Engineering, Medical etc. (4 students). The scholarship will last for the tenure of course. The scholarship @ Rs.1000/-, Rs.1500/-, Rs.2000/- and Rs.2500/- per month would be provided to the students of secondary school, vocational training, diploma and degree, respectively. The Project Authority propose to run this scheme at least for 5 successive years. After completion of the scheme, Project authority reserves the right to restart or terminate this scheme. The scholarship shall be confined to one ward from each family.

The eligible students may apply for the grant of scholarship as per the FORMAT given at **Enclosure-II.** The amount of the scholarship shall be released on a half-yearly basis. The submission of application for scholarship shall not guarantee the grant of scholarship. Project authority management shall reserve the right to accept or reject any or all application without assigning any reasons. Project authority also reserves the right to reduce/ increase the number of beneficiaries or change the number of beneficiaries in different standards depending upon availability of the students. 50% scholarship shall be reserved for girl child. If girl child are not available the scheme will stand transferred for boy child. In case of type the girl child shall be given preference in Grant of Scholarship. The eligible candidate shall apply on the prescribed Form printed by Project Authority. Duly completed application form should be submitted along with attested copies of marks sheets of previous annual examinations, certificates of land/ house acquisition from LAO and two passport size photographs attested by the principal/head of the institute. Total budget for the Merit scholarship including increment has been kept as **Rs. 40.00 lakhs.**

13.7.7 Marriage Grant

Project authority would provide an amount of Rs. 10,000 to the daughter of affected family of BPL category as a marriage grant. The provision is kept for a daughter in a family, but if affected

family person would apply second time for marriage grant, Project authority can consider it. The grant would be given preferably to the affected families; however, Project Authority may extend it to the families of the influence zone. A lump sum budget for the purpose has been kept as **Rs. 5 lakhs.**

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13.7.8 Income Generation Scheme

As discussed earlier, Project authority would run various Training programmes for the youth of the project affected area. Food processing, vermin culture and mushroom cultivation are given special attention due to their easily availability in the region. After completion of training, Project Authority may provide financial assistance to the trained project affected person to enable him/her to generate his own source of income. In addition to the different vocations, this scheme will be extended to small scale business, apiculture, sewing knitting, etc. The preferences will be given to those belonging to (BPL) Scheduled Caste, Scheduled Tribe and vulnerable groups. Any family whose member has been provided employment in the company will not be considered for this scheme. The candidate would opt for any vocational training and would be paid 80% of the cost of the assets, procured for the vocation (up to a maximum of Rs. 50,000). The amount of the financial assistance would be paid by Project authority to supplier (s) of assets. The financial assistance would be a one time grant and the Project authority would not stand guarantee or surety for the loan amount arranged by the applicant. The maximum number of beneficiaries of the scheme will be about 6 for every year upto 5 years.

The applicants are required to submit their application in the enclosed prescribed FORMAT **(Enclosure-III).** It would be submitted along with certificate of land acquired from LAO (Land acquisition Officer) of Project Authority, income certificate from DC/SDM/ certificates of educational qualification, caste certificate issued by an officer not below the rank of executive magistrate and verification certificate of concerned Gram Pradhan. The scheme is only a welfare measures for the PAF's and does not confer any right on the PAF's for financial assistance. The Project Authority 's decision in implementation of the scheme will be final and the Project authority reserves the right to accept or reject any application. Total budget for the Income generation Scheme including creation of basic infrastructure would be **Rs. 50.00 lakhs.**

13.7.9 Health Related Facilities

The details of establishing a Public health delivery system has been given in the Chapter 5 of EMP report with a financial outlay of Rs. 285.50 lacs.

13.7.10 Communication Facilities

Phone, internet and television access are most important ways of empowerment and development of communities. These are primary needs for the improvement of quality of life. The Project areas are lacking of these facilities. Communication facilities include financial support to BSNL with other Project authorities in the area including ITBP etc. The cost is included in Project cost.

13.7.11 Incentive for Small Family

In addition to the R&R package, one time incentive will be granted to PAFs, if the family undergoes family planning operation within the specified period of acceptance of R&R package (Rs. 5000/- within 6 months, Rs. 4000/- within 12 months and Rs. 3000/- within 24 months). Only those PAPs who are between the age of 35 years and 50 years and have at least one child will be eligible for this incentive. The eligible persons seeking for the grant will submit application along with duly attested certificates in a prescribed format, provided by the project authority. The Project Authority can extend this programme for affected villages and influence area. Total financial outlay for the incentive will be **Rs. 5.00 lakh** only.

13.7.12 Adoption of Village

THDC may also explore adoption of village (s) in the vicinity of project area to develop them as a model village. Priority will be given to those villages, which have a majority population of under privileged like SC/ST, BPL etc. and / or are having scant infrastructure facilities. THDC may provide one time developmental assistance to provide community facilities so that socio economic upliftment of the villagers could be facilitated. The facilities could also be developed on the Provision of urban amenities in rural area (PURA) concept as detailed by GOI. The facilities could also include check dams, Decentralized Distribution Generation Scheme (DDGS), provision of smokeless chulhas, social forestry/ afforestation, provision of low cost toilets/ soak pits, rain water harvesting systems etc. Certain other welfare activities like nutritional supplement for expectant mothers, working towards 100% literacy for girl children etc. The actual need assessment could be

undertaken through a detailed survey, internally or externally through some agency, if so required. The option of the adoption of Village (S) will be kept open however, depending upon the need and requirement and will be decided in consultation with the stakeholders and Administrator for R&R/ State Govt. representatives. Total budget for the model village would be **Rs. 70.00 lakh** only.

13.7.13 Sports Facilities

The Project Authority would construct and establish club/playgrounds for the project employees/ sports competitions and sports meets would be organized between the local players and project employees which would ensure the local participation. This will also provide them necessary facilities for excelling in sports of their choice. These facilities would go a long way in honing and nurturing the local talent in the field of sports and competitive games. The Project Authority would distribute sport goods in the affected villages. Total budget for this head would be **Rs. 10.00 lakh** only.

13.7.14 Transportation Facilities

Transportation facilities the area is poor; which mainly depends on the light vehicles. Low transportation results in encumbrance to the residents. To improve the transportation facilities in the area Project Authority would provide bus services from Joshimath to Malari village. The bus would ply on the road in day time looking the convenience of people. The bus would be helpful for students, workers, women and project staff. Total financial outlay for buses would be **Rs. 50.00 lakh**. It includes salaries of bus staff, cost of Buses and running cost for 5 years. The services would be started prior to construction work. The plan is proposed for five years, however, Project Authority could extend these facilities for longer periods.

13.7.15 Community Welfare Centre(S)

Project authority will develop community welfare centres in those villages where this facility is not available. The preference will be given to project affected villages, however, Project authority can extend this facility to other villages in the vicinity. At least 7 villages are proposed (affected and surrounding villages) for this facility. All community welfare centres shall be provided with basic infrastructures. Existing community centre would be renovated, if required. Selection of villages for the construction and renovation would be carried out by project authority and monitoring community. Total financial outlay under this head would be **Rs. 35.00 lakh**.

13.7.16 Water Supply Schemes

A total of 14 villages are located in the influence zone of Jelam Tamak H.E. Project. Total population of these villages is 2034 come from 517 households (Census, 2001). The villages exploit drinking waters from nearby springs and nallah directly or taped. A few villages are not connected to the tap water facilities. The Project Authority are suggested to conduct a detailed survey on the drinking water facilities in these villages. Wherever it is required tap water facilities would be provided. Two to three common posts would be installed in each villages. During the provision of drinking water, hygienic condition will be ensured. Total financial outlay for the drinking water would be **Rs. 50.00** lakhs only.

13.6.17 MISCELLANEOUS

Miscellaneous activities include first aid facilities at labour camps, cretch for the infants of labourers, buses for labourers' transport, and small market place. The total financial budget for the miscellaneous activities would be **Rs. 150.00** lakh. The budget would be disbursed equally for 5 years, however, Project Authority can change this schedule as per requirement.

It is important to mention here that the budgetary provisions under various heads are tentative and the committee may reallocate/re-distribute the funds as per actual needs.

13.7.18 BUDGET FOR LOCAL AREA DEVELOPMENT PLAN

Total budget for the Periphery/local area development plan in the affected area of Jelam-Tamak HEP would be **Rs. 498.00 lakh**. The year wise break up of the budget is given in Table 13.3.

Table 13.3 Year-wise break up of Social upliftment plan of Jelam Tamak H.E. Project

	Year-wise break up (Rs. in lakhs)					
S.No. Heads	**1st yr**	**2nd Yr**	**3rd Yr**	**4th Yr**	**5 Yr**	**Total**
1. Development of Infrastructure Facilities in Schools	18.00	8.00	14.00	14.00	14.00	68.00
2. Bus Stops/ Rain Shelters	3.00	3.00	3.00	3.00	3.00	15.00
3. Construction of Footpaths and Bridge Repairing	5.00	5.00	10.00	10.00	10.00	40.00
4. Provision of Solar Green House	1.00	1.00	1.00	1.00	1.00	5.00
5. Training Program/Capacity Building	5.00	5.00	5.00	5.00	5.00	25.00

6. Merit Scholarship Scheme	8.00	8.00	8.00	8.00	8.00	40.00
7. Marriage Grant	1.00	1.00	1.00	1.00	1.00	5.00
8. Income Generation Scheme	10.00	10.00	10.00	10.00	10.00	50.00
9. Incentive For Adopting Small Family	1.00	1.00	1.00	1.00	1.00	5.00
11. Adoption Of Village	10.00	10.00	10.00	20.00	20.00	70.00
12. Sports Facilities	2.00	2.00	2.00	2.00	2.00	10.00
13. Transportation Facilities	10.00	10.00	10.00	10.00	10.00	50.00
14. Community Welfare Centres	5.00	5.00	5.00	10.00	10.00	35.00
15. Water Supply Scheme	10.00	10.00	10.00	10.00	10.00	50.00
16. Miscellaneous	30.00	30.00	30.00	30.00	30.00	150.00
Total	**119.00**	**109.00**	**120.00**	**135.00**	**135.00**	**618.00**

13.8 APPLICATION FOR GRANT AND GRANT DISTRIBUTION

The state govt. shall, by notification, appoint in respect of Jelam H.E. Project, an officer not below the rank of District Magistrate of the State Government to be the Administrator for Resettlement and Rehabilitation Plan. The District Magistrate from Chamoli district or his/her counterpart will be the sanctioning authority for rehabilitation grant, which shall be provided by the project authorities. Affected family/person will apply on a general prescribed format, provided by project authority at no cost, which will furnish the information on the village, details of land acquired, family status etc. The form will be submitted to the Environment and Social Cell and evaluated by Land Acquisition Officer and General Manager. After receiving the list of PAFs by District Magistrate, the option will be invited from head of affected family on stamp paper and this will be rooted through SDM concerned. While the cost of R & R is to be borne by THDC, the State Government will be closely involved during the whole process. This includes certification of list of PAFs forming of VDAC/SHIST MANDAL, formulation and implementation of RAP etc. The State Govt. will also be involved in taking over the maintenance of RCs, if any, including various infrastructures created by THDC in RCs as well as in Project Affected Villages. District Magistrate shall be the final authority to sort out the disputes between affected families and project authority.

After the submission of photocopy of land registration documents, the PAF shall be entitled to receive the land development cost & land registration cost as per the entitlement. This will be applicable only for one year from the date of deposit of money in the joint account. R&R Grants/ R&R Assistance will be released in two installments in the ratio of 60:40. However, if the total R&R

Grants/ R&R Assistance is less than **Rs. 50,000**/-, the amount will be released in one installment. Creation of Asset shall mean creation of any asset like purchase of land, construction of house, purchase of gold, silver, ornaments, other items, FDR, payment of housing loan, LIC premium, purchase of farm utilities, cattle's, investment on securities or any other item/investment to the satisfaction of HOP of THDCIL. If any PAF utilizes the R&R Grant/R&R Assistance as defined above in the name of his/her spouse or son, the same shall be treated as proper utilization of grant.

13.8.1 Release of Rehabilitation Grant (Rg)

The PAF will sign an agreement with THDCIL giving his/her acceptance of R&R options, the details of which would be as per Para 13.7.3 on signing of the agreement by the PAFs. THDCIL in consultation/information to Administrator will deposit RG amount in the bank in joint names of PAF head and his/her spouse. This grant will be used for creation of any asset for enhancing his standard of living and cannot be withdrawn without giving utilization certificate by PAFs.

13.8.2 Release of Resettlement and Other Related Grants

On finalization of the agreement, THDCIL shall deposit the first installment of various resettlement grants including that of self resettlement in the bank in joint names of PAF head and his/her spouse. Subsequent installments would be disbursed after the utilization certificate is submitted by the PAPs or will be deposited in the joint accounts as fixed deposit for a year, Premature withdrawal/withdrawal on fixed deposit may be done on producing of utilization certificates by PAFs. If utilization certificate not produced, fixed deposit will be extended for further one year.

13.8.3 Signing Of Agreement by All PAFs

Each PAF will sign an agreement with Administrator/ THDCIL in which he / she will undertake acceptance of R&R option as provided in the RAP as full and final settlement of all R&R obligations and that he/ she will not have any further claims towards R&R. All grants including those for resettlement and rehabilitation will be released only on signing of such agreement.

13.8.4 PAF Info Passbook

An info passbook giving relevant details of PAF viz. his name ,unique identification number assigned to individual PAF, address, family details as defined in para 2.1.2 , details of land and other assets acquired, compensation paid, R&R entitlements, etc. would be prepared. The unique

identification number assigned to individual PAF would be the reference for all his /her future communication. The passbook will have the photograph of the PAF and his/her spouse and will be attested both by the representative of the Revenue department and THDCIL. This passbook would also facilitate the PAF in getting the most benefits.

13.8.5 PAF Identity Card

In addition to the issue of passbook, each eligible PAF will be issued an identity card by Administrator / THDCIL to facilitate his identification and for reference and availing various facilities. The unique identification number assigned to PAF along with his photograph and family details will be printed/written on the Identity card, which would be laminated. This will be issued immediately at the start of the implementation of the R&R activities.

13.9 Diversion Of Forest Land

Total land required for the various project components is 96.27 ha, of which 88.29 ha is forest land (65.45 ha forest land, 13.04 ha reserve forest and 9.8 ha van Panchayat land). The Net Present Value of forest land to be acquired would be **Rs. 7,91,96,130** (@ 8.97 lacs per ha).

13.10 EVALUATION AND MONITORING

The corporate Social and Environment Monitoring Group (CMG) exist at Corporate Office of THDC India Ltd. headed by a General Manager (Social & Environment) and supported by a team of Sr. Manager and supporting staff. Similar cell will also be set up at Project for liaison, monitoring and making available funds to state government for implementation of R&R plan. The CMG will be primarily responsible for policy matters, providing guidance on R&R matters, assisting in approval of Rehabilitation Action Plan (RAP) of the project and coordination with the external agencies. After approval of the RAP, the same will be monitored both at the Project level and the corporate office. through Project review team (PRT), meetings, etc.

13.10.1 Internal Monitoring

The monthly report of execution of R & R plan will be sent by the Project to Corporate R & R cell, THDC India Ltd. which will be monitored by the corporate monitoring group headed by General Manager. The committee to oversee this will have the following members:

i) Executive Director/General Manager THDC India Ltd.

or his/her representative	Chairman
ii) General Manager (Project)	Member
iii) Head of S & D Cell	Member Secretary
iv) Head of Environment Cell	Member
v) Head of the Corporate Monitoring deptt.	Member
vi) A representative from Corporate Finance Deptt.	Member

13.10.2 External Monitoring

In addition to an internal committee (above), it is suggested to constitute another external committee in order to avoid any dispute between project authorities and the affected persons. The committee will include representatives of district administration, elected members, project authority, panchayat, member etc as per the provision of NRRP 2007. The committee will comprise of followings:

i. District Magistrate, Chamoli or his/her representative	Chairman
ii. Representative of Panchayat members of affected villages	Member
iii. Woman (social worker) from the affected area	Member
iv. Representative of well known NGO in the area	Member
v. General Manager THDC India Ltd. or his Representative	Member
vi. Head of the Environment S & D Cell THDC India Ltd.	Member Secy.
vii. Land Acquisition Officer of the Project	Member

The financial budget for the day to day expenditure of the committees would be **Rs. 30,00,000 (Rs. Thirty lakhs)** for five years. The expenditure includes TA and DA of participants, running cost, stationeries etc.

13.11 FINANCIAL PACKAGE FOR R & R AND LOCAL AREA DEVELOPMENT PLAN

Total budget for the Resettlement and Rehabilitation Plan and Periphery/Local Area Development Plan is **Rs. 18,92,85,900 (Rupees Eighteen crores ninety two lakhs eighty five thousand and nine hundred only).** The break up of the budget is given below:

S.No.	Head	Amount (in Rs.)
i)	Relief Package	4,72,89,750
ii)	LADP Provisions	6,18,00,000
iii)	Compensation for Land (NPV)	7,91,96,130
iv)	Evaluation & Monitoring	30,00,000
Total		**18,92,85,880 (say Rs. 19,12,85,900)**

Chapter 14

DISASTER MANAGEMENT PLAN

14
DISASTER MANAGEMENT PLAN

14.1 BARRAGE BREAK PHENOMENON

Dams and barrages play a very vital role in the economy of a country by providing essential benefits like irrigation, hydropower, flood control, drinking water, recreation, etc. However, when these fail in rare conditions, these may cause catastrophic flooding in the downstream area resulting in huge loss to human life and property, if any. This loss to life and property would vary with barrage size, extent of inundation area, size of vulnerable population at risk, the amount of warning time available and concentration of infrastructure downstream etc. The effect of such a flood disaster can be mitigated to a great extent, if the resultant magnitude of flood peak and its time of arrival at different locations downstream of the barrage can be estimated, facilitating planning of the emergency action measures. This warrants barrage break modeling, which assesses the flood hydrograph of discharge from the barrage breach and maximum water level at different locations of the river downstream of the barrage due to propagation of flood waves along with their time of occurrence.

Disaster management plan may be summarized as the partial or catastrophic failure of a barrage leading to the uncontrolled release of water. Such an event can have a major impact on the land and communities downstream of the failed structure. A barrage break may result in a flood wave up to tens of meters deep traveling along a valley at quite high speeds. The impact of such a wave on developed areas can be sufficient to completely destroy infrastructure, such as, roads, railways and bridges, and to demolish buildings. With such destructive force comes an inevitable loss of life, if advance warning and evacuation was not possible. Additional features of such extreme flooding include movement of large amounts of sediment (mud) and debris along with the risk of distributing pollutants from any sources, such as, chemical works or mines in the flood risk area.

14.2 HYDROLOGY AND BARRAGE CHARACTERISTICS OF JELAM TAMAK HE PROJECT

The Dhauliganga river in the catchment area has a length of 60 km up to the barrage site from the head water region. It is largely fed by tributaries on the left bank, however, glaciers and

snow capped mountains are widely spread on the right bank but there are few rivers originating from the right bank. Some of the prominent rivers in the catchment area are Amrit Ganga, Girthi Ganga, Jainti Gad, Chuba Gad, Kosa Gad, and Siraunch Ghar.

The total annual inflow rate in the Jelam Tamak H.E Project site during 1972-73 to 2007-2008 water years is presented in Chapter 4 in EIA volume. The discharge data was extrapolated using data sources from d/s discharge data. In most of the years, the annual inflow shows above 1000 Mcum. The maximum inflow of 2,659.59 Mcum was recorded in the year 1998-1999, while the minimum of 819.9965 Mcum was recorded in the year 1982-1983. The maximum 10 daily discharge was recorded in the middle of July (184 cumec) and end of February (3.1 cumec) respectively.

Table 14.1 Salient features of the proposed Jelam Tamak H.E. Project

Project Location	
State	Uttaranchal State
District	Chamoli
River	Dhauliganga
Vicinity	Jelam and Tamak Villages
Hydrology	
Catchment area	1666 km^2
Snow Catchment	879.00 km^2
Rain fed Catchment	787.00 km^2
Snow Line Elevation	4900 m
Standard Project Flood	1906 m^3/s
One Day PMP	14.90 cm
Reservoir	
Maximum Water Level (M.W.L.)	2649.5 m
Full Reservoir Level (F.R.L.)	2648.5 m
Minimum Draw-down Level (M.D.D.L.)	2638.8 m
Area of Reservoir at FRL	37.90 Ha
Barrage	
Latitude	30^0 37’ 35.4”N
Longitude	79^o49’39.5”E

Site	Downstream of Jelam Village
Spillway bays	6 m (H) X 8 m (W)
Under Sluice bays	6 m (H) X 8 m (W)
Piers	3 X 7.0 m and
	1 X 6.0 m
Length of barrage between abutments	83 m
Height of the barrage	28 m
Crest level : Spillway	2624.5 m
Under Sluice Sill level	2623.5 m
River Bed Level	2623.50 m
Top of barrage at bridge level	2651.50 m

Jelam Tamak H.E. Project is proposed to tap hydropower potential of Dhaulianga in the between Jelam and Tamak villages. The water of Dhauliganga river is proposed to be diverted by a water conductor system located on its right bank for power generation. Project involves a 28 m high barrage and 83 m long barrage at altitude 2623.50 m, a horse shoe concrete lined head race tunnel of 4404.58 m length, an underground power house and 308 m long trail race tunnel. The scheme envisages the utilization of design discharge of 57.58 m^3/sec and the drop of about 217.54 m for power generation. The barrage salient features of Jelam Tamak H.E. Project are given in Table 14.1.

Besides, there are three projects in downstream and one project in upstream of the Jelam Tamak HE project on Dhauliganga river. In Table 14.2 the distances from proposed Jelam Tamak HE project to various proposed HE project along the d/s and u/s were estimated. Therefore the disaster management plan is prepared keeping in view the several proposed HE project along the upstream and downstream of the Jelam Tamak HE project.

Table 14.2 Estimated distances from Jelam Tamak HE project to proposed HE project on the u/s and d/s.

Location	HE projects	Distance
U/S	Malari Jelam	~10 Km
D/S	Tamak Lata	~7.5 km
D/S	Lata Tapoban	~12.6 km
D/S	Tapoban-Vishnugarh	~24.7 km

14.3 BARRAGE (DAM) BREACH SCENARIO

The effective rainfall for design storm duration is to be applied to the unit hydrograph of a catchment and Standard Projected Flood (SPF) has been computed as 1906 m^3/s. The ordinates of SPF plots are shown in **Figure 14.1**. Therefore, in worst case scenario a discharge capacity of 1906 cumec at barrage site would be encountered. The projected flood after the barrage failure would add 1906 cumecs in storage capacity of barrage. Spillway capacity as calculated, considering FRL at El 2648.5m and corresponding to design flood of 1906 cumec, is 3175 cumec. Thus spillway capacity is much larger than the SPF. In addition to it GLOF study has also been carried out by NIH, Roorkee, which indicates that no potential lake is vulnerable to breaching as such no consideration of flood peak due to GLOF has been taken during design flood estimation. However, provisions as made in four spillway discharge capacity is considerably very high and will not create any problem even any worst situation arises from GLOF.

Considering the barrage breach as worst case scenario the disaster management plan is proposed.

14.4 DISASTER MANAGEMENT PLAN

Jelam Tamak H.E. Project proposes 28 m barrage with a small reservoir. Barrage failure is a catastrophic which is most-unlikely to occur. Moreover the dam break series will another most-unlikely scenario to occur. However, the disaster management plan has been prepared assuming that barrage from Malari-Jelam to Tapoban-Vishugarh would serially fail. However, considering worst situation emergency preparedness plan has been proposed. Dam and barrage failure poses serious threat to all people and property, located downstream from the structure. In order to save a large numbers of injuries, huge damage to property an integrated disaster management approach is essential. This approach includes disaster prevention, mitigation and preparedness. However, failure of barrage is a low risk but high impact hazard as they do not occur often but can be extremely catastrophic. However, over the recent years failure rate has fallen below 0.5%, in which most of the failures involve small.

There will be one HE project upstream and three HE project downstream of the Jelam Tamak barrage (see Table 14.2). The total distance from Malari-Jelam barrage site to Tapoban-Vishnugarh barrage site will be about ~40 km. Under the worst scenario it is assumed that downstream dams will also be affected. Subsequently all the dams would be affected downstream of barrage site of Jelam

Tamak H.E project. It hardly leaves any possibility of any rescue or evacuation. Since the time available is very short, the Disaster Management Plan should concentrate on preventive actions. Moreover, the communication systems should be coordinated in such a way that all the projects upstream and downstream of the Jelam Tamak HE project would be able to conduct the disaster management plan. The vulnerable villages in d/s to the flood arise as a result of barrage breach are Shayama, Saigari, Markura, Gadi Kharak and Panwarsu.

Surveillance and monitoring programmes are required to be implemented during design and investigation, construction, first reservoir filling, early operation period and operation & maintenance phases of the life cycle of barrage. It is desirable that all gates, electricity, public announcement system, power generator backups etc are thoroughly checked before arrival of the monsoon. As it is clear from the results that upstream water level has significant effect on the barrage break flood, the following flood conditions may be considered for different level of alertness:

i) If u/s water level reaches at top of the barrage, it may be considered as an emergency. At this point only a few minutes are available for taking any action. All the staff from the barrage site should be alerted to move to a safe place. The district administration and the corporation's head office shall be informed about the possibility of barrage failure.

ii) If u/s water level rises above the barrage top and barrage begins to fail, it may be considered as a disaster condition. At this stage, nothing can be done. Information in this regard should be given to the head office and district administration.

The following measures can be taken to avoid the loss of lives and property:

14.4.1 Preventive Measures

Once the likelihood of an emergency situation is suspected, action has to be initiated to prevent a failure. The point at which each situation reaches an emergency status shall be specified and at that stage the vigilance and surveillance shall be upgraded. At this stage a through inspection of the barrage shall be carried out to locate any visible signs of distress. The anticipated need of equipment shall be evaluated and if these are not available at the barrage site, the exact locations and availability of these equipments shall be identified. A plan shall be drawn on priority for inspection of the barrage. The barrage, its sluices and non-overflow sections will be properly illuminated.

14.4.2 Surveillance

Surveillance and monitoring programs are required to be implemented during design and investigation, construction, early operation period and operation and maintenance phases of the life cycle of the barrage. It is desirable that all gates, public announcement system, power generator backups etc are thoroughly checked before arrival of the monsoon. An effective flood forecasting system is required by establishing hourly gauge reading at suitable u/s locations with real time communicator at the top. An effective barrage safety surveillance and monitoring programme also includes rapid analysis and interpretation of instrumentation and observation data along with periodic inspection, safety reviews and evaluation.

14.4.3 Infrastructural Development

It is essential to improve, modernize and expand the existing network and rainfall and stream gauging stations in the region. Total financial allocation for the surveillance, monitoring and infrastructure development would be **Rs. 30 lakhs**.

14.4.4 Emergency Action and Preparedness Plan

An emergency is defined as a condition of serious nature which develops unexpectedly and endangers downstream property and human life and requires immediate attention. Community preparedness is key mitigation factor in the flash flood condition. It involves not only the emergency action plan and well developed communication but needs awareness programme for the people residing in downstream areas. Preparedness also involves the development of infrastructures like escape routes and refuge for people and livestock flood prone areas. The following preparedness measures are suggested for disaster management of Jelam Tamak H.E. Project Stage:

14.4.4.1 *Administrative and Procedural Aspects*

The administrative and procedural aspects of emergency action plan consists of a flowchart depicting the names, addresses and telephone numbers of the responsible and coordinating officials. In order of hierarchy, the following system will usually be appropriate. In the event of potential emergency, the observer at the site is required to report it to the Engineer-in-charge through a wireless system, if available, or by the fastest communication system available. The Engineer-in-charge shall be responsible for contacting the Civil Administration, *viz*. Deputy Commissioner, In order to oversee all the operations required to tackle the emergency situations, a centralised

command and control room would be set up by the project authorities at Tamak. The office would also remain in contact with offices of upstream projects.

Each person involved with the emergency plan would be made aware of his/her responsibilities/ duties and the importance of work assigned under the Emergency Action Plan. All the villages falling under the flood prone zone or on the margins would be connected through wireless communication system with backup of standby telephone lines. A centralized siren alert system would be installed at all the village Panchayats (downstream of Malari-Jelam to Vishnugarh barrage site) so that in the event of a warning all villagers can be alerted through sirens rather than informing everybody through messengers which is not feasible in such emergency situations. A financial allocation of **Rs.35 lakhs** has been made in the project cost for setting up of emergency control room and installation of siren/hooter alert systems at various locations.

14.4.4.2 *Communication System*

An efficient communication system and a downstream warning system are absolutely essential for the success of an emergency plan especially when time is of great essence. The difference between a high flood and barrage break situation shall be made clear to the downstream people in advance through awareness programmes. All the villages falling under the flood-prone zone or on the margins are required to be connected through wireless system backed by stand-by telephone lines. A centralized siren system is to be installed at Panchayats so that in the event of a warning.

Keeping the disaster scenario in mind, any terrestrial system such as land lines or even cellular towers, etc. are likely to be the first casualty in earthquakes or floods. The restoration of such systems is time consuming. Moreover, the maintenance of such lines becomes a great problem in emergency even for the technical personnel who are required to reach the site of fault, which may be struck by the disaster. The system, therefore, cannot be made operational soon enough. The fault repairs and restoration of communication services are usually not possible for a considerable period of time after the calamity has struck. Moreover, it is critical that the communication systems are restored at the earliest so that relief/medical teams and other personnel can be arranged at the earliest possible time. All the subsidiary help depends solely on the communication system. As this criterion is paramount, existing systems such as telephones and telex, etc. are practically of little use in case

of such events and situations. Similarly, microwave links are expected to be down due to collapse of towers, etc. Restoration of towers and alignment of equipment is again a time consuming activity.

Keeping in view the urgency of services and their dependability during emergency relevant to the disaster conditions, satellite based systems present an ideal solution. The satellite based system usually comprises following components.

i) A small dish of approximately one meter diameter
ii) Associated radio equipment
iii) A power source

The deployment of the system is not dependent on the restoration of land routes. The existing satellite based communication systems are designed in such a manner that they are able to withstand fairly high degree of demanding environmental conditions. Secondly, the restoration of the satellite based system can be undertaken by carrying maintenance personnel and equipment by helicopters at a very short notice. Even the fresh systems could be inducted in a matter of an hour or so because most of these are designed for transportability by air. The deployment takes usually less than an hour. The power requirements are not large and can be met by sources such as UPS/ batteries/ generators. Satellite phones are the other option that could prove very useful for such situations and must be considered by the project authorities.

The cost of deployment and maintenance of a telecommunication system in disaster prone areas is not as important as the availability, reliability and quick restoration of the system. The cost of both satellite bandwidth and the ground components of the satellite communication system has been decreasing rapidly like that of V-SAT (Very Small Aperture Terminal) based systems supporting a couple of voice and data channels. Some highly superior communication systems in VSAT without time delay are marketed by National agencies like HECL, HFCL and HCL Comet. There are two different types of systems with the above mentioned capabilities available in the market *viz*. SCPCA and TDMA. The estimated cost of installation of such a communication system has been given in Table 14.3.

Table 14.3 The estimated cost of setting up of a satellite communication system

Sl.No.	Product	Amount (Rs. in lakhs)
A.	Setting up of V-SAT communication system	
1.	Product Name : SCPCA (4 sites) @ Rs.25.00 lakhs per site a) Antenna 3 x 2.4 M b) RF 3 x 2 W c) Modem 3 x 1No.	100.00
2.	Generators 8 Nos. (2 KVA)	12.00
3.	UPS 4 Nos. (2 KVA)	5.00
4.	Installation and maintenance of system, maintenance and running cost of UPS, generators, etc. @ 10% of the total cost for 7 years	60.00
	Total	**177.00**

14.4.4.3 *Awareness*

A few guidelines to be generally followed by the inhabitants of flood prone areas, which form part of public awareness for disaster mitigation include:

(i) Listen to the radio for advance information and advice.

(ii) Disconnect all electrical appliances.

(iii) Move household goods and all clothing out of reach of flood water.

(iv) Move vehicles, farm animals and movable goods to the highest ground nearby.

(v) Move all dangerous pollutants and insecticides out of reach of water.

(vi) Do not enter flood waters on foot, if it can be avoided.

14.4.4.4 *Response and Recovery*

The entire rescue operation depends on the responses from the administration and project developers. All technical support and medical support must be supplied to the victims in first phase of operation. The response and Recovery plan include evacuation plan,

14.4.4.5 *Evacuation Plan*

Emergency Action Plan includes evacuation plans and procedures for implementation based on local needs. These are:

(i) Demarcation/prioritization of areas to be evacuated

(ii) Notification procedures and evacuation instructions

(iii) Safe routes, transport and traffic control

(iv) Shelter areas

(v) Functions and responsibilities of members of evacuation team

(vi) The flood prone zone in the event of barrage break of Jelam Tamak H.E. project shall be marked properly at the village locations with adequate factor of safety. As the flood wave takes sufficient time in reaching these villages, its populace shall be informed well in time through wireless and sirens etc. so that people may climb on hills or to some elevated place beyond the flood zone which has been marked.

The Evacuation Team would comprise:

i) D.M./ Nominated Officer (To peacefully relocate the people to places at higher elevation with State Administration)

ii) Engineer-in-Charge of the Project (Team Leader)

iii) S.P./Nominated Police Officer (To maintain law and order)

iv) C.M.O. of the area (To tackle morbidity of affected people)

v) Sarpanch of Affected Villages to execute the resettlement operation with the aid of state machinery and project proponents

vi) Sub-committees at village level

The entire evacuation team will be well equipped with rescue team, medical team, medicines, emergency vans, boats, helicopter, and other means of transport. The Engineer-in-Charge will be responsible for the entire operation including prompt determination of the flood situation from time to time. Once the red alert is declared the whole state machinery will come into swing and will start evacuating people in the inundation areas delineated in the inundation map. For successful execution, annually Demo exercise will be done. DM is to monitor the entire operation. Total financial outlay for the Recovery, Evacuation and rescue operation would be **Rs.35.00 lakhs**.

14.4.4.6 *Medical team*

After declaration of red alert, district administration would arrange a team of doctors within a few hours. The strength of the medical team depends on the magnitude of disaster. The team will be lashed with all possible medical facilities to cure the emergency cases, injuries and water borne diseases like diarrhoeal, etc. Total financial budget for the medical team would be **Rs. 25.00 lakhs**.

14.4.4.7 *Mitigation and Rehabilitation*

In the event of the barrage break, project authorities would provide adequate Relief fund. The package includes the cost of property lost, sustenance grant, livelihood grant, medical grant and rights and privilege grant on forest resources.

14.4.5 COST ESTIMATE

The estimated total cost of execution of disaster management plan including the equipment would be **Rs. 352.00 lakhs** and it is given in Table 14.4.

Table 14.4 Cost estimate for the disaster management plan of Jelam Tamak H.E Project

Particulars	Total cost (Rupees in lakhs)
Infrastructure development	30.00
Administrative and Procedural Aspects	35.00
Communication System	177.00
Recovery, Evacuation and rescue operation	35.00
Medical expenditure	25.00
Miscellaneous	50.00
Total	**352.00**

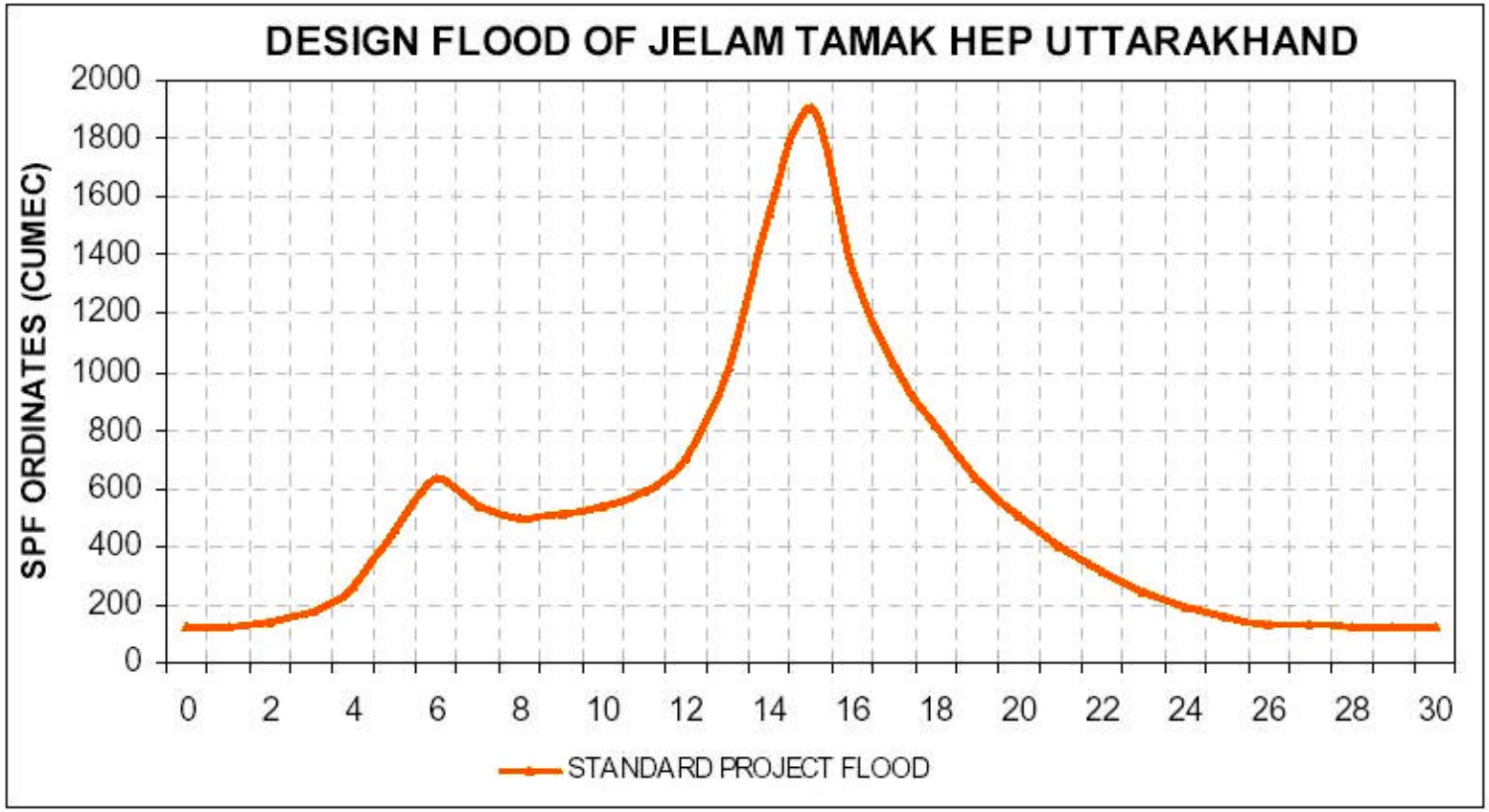

Fig. 14.1 Design flood discharge at Jelam Tamak HE Project

Chapter 15

ENVIRONMENT MANAGEMENT, IMPLEMENTATION AND MONITORING PROGRAMME

15
ENVIRONMENT MANAGEMENT, IMPLEMENTATION AND MONITORING PROGRAMME

15.1 GENERAL

A successful Environment Management Plan relies on the well planned implementation of management plans and regular monitoring of various environmental variables. It requires a proper coordination among project authorities, various committees and state and national level committees. For this reason THDC Ltd shall construct a Corporate Environment Group (CEG) for Jelam Tamak H.E. Project, headed by Chief (Environment). CEG will ensure the implementation of management plans and monitoring of various environment related parameters. CEG shall provide all necessary infrastructures and funds for the Environmental monitoring programmes. Regarding the implementation of social works like R & R plan, Health Delivery System, Energy Conservation measures, Corporate Social Responsibility Cell (CSRC) of THDC will be authorized body. In order to furnish an appropriate monitoring programmes following actions would be required.

15.2 FUNCTION OF CEG & CSRC

15.2.1 Corporate Environment Group

CEG will establish a base laboratory for the testing of water air and soil parameters. The laboratory will provide the basic infrastructure to various agencies involved in the monitoring of these parameters. The research team of the laboratory comprises Research Scientist (1), Research officer (2), Lab Assistant (2) and Field assistant (3). Corporate Environment Group will assist in the coordination among the various committees, agencies and departments having active participation in Environment Management Plan. CEG shall collect the progress report from various agencies and after a detailed analysis quarterly progress report will be submitted to state level and national level environment monitoring committees. It will be the responsibility of CEG to ensure the provision of funds to all agencies assigned with various works in specified time. A detailed plan of work and responsibility of action is given in Table 15.1.

Table 15.1 Details of the actions to be taken and implementing and responsible agencies for Jelam Tamak H.E. project

Plan	Actions	Agency	Responsibility
1. Biodiversity Management Plan	i. Forest Resource Management	State Forest Department & Local Panchayat	State Forest Department/ CEG/GM (Emt), THDC
	ii. Peoples Biodiversity Register	Research Team from a reputed institute/university	State Forest Department/ CEG/GM(Emt),THDC
	iii. Botanical Garden	State Forest Department	State Forest Department/CEG
	iv. Removal of invasive species	Research Institute	State Forest Department/CEG
	v. Forest Protection plan	State Forest Department	State Forest Department
	vi. Safeguard Measures	CEG, THDC	CEG/GM (Environment)
2. CAT Plan	i. Construction of Check dams/ Brushwood, etc	State Forest Department	State Forest Department/CEG
	ii. Terrace Benching	State Forest Department	State Forest Department/CEG
	iii. Afforestation	State Forest Department	State Forest Department/CEG
3. PHDS	i. Establishment of Hospital	Technical Division, THDC	Technical Division, THDC
	ii. Establishment of PHC	Technical Division, THDC/ State Health Department	Technical Division, THDC
	iii. Immunization/ vaccination	S & D/ State Health Department	S & D, THDC
	iv. Medical camp	S & D, THDC/ State Health Department	S & D, THDC
	v. Distribution of First aid boxes	S & D, THDC/ State Health department	S & D, THDC
	v. Safeguard measures	S & D, THDC	S & D, THDC

4. Waste Management	Construction of compost pit, Septic tanks, Community toilets, Bathrooms, sewage treatment plant	Technical Division, THDC	State Pollution Control Board
5. Energy Conservation	i. Distribution of LPG	S & D, THDC	S & D, THDC
	ii. Passive Solar House	Expert Agency like GERES	Technical Division, THDC
	iii. Distribution of improved Chullahs, solar cockers, etc.	S & D, THDC	S & D, THDC
	iv. Community Kitchen	Technical Division, THDC	Technical Division, THDC/
6. Management of Air, Water & Noise	i. Precautionary Measures	CEG, THDC	CEG
	ii. Regular Monitoring	State Pollution Control Board (SPCB)	SPCB, CEG
7. Rehabilitation of Muck	i. Construction of retaining wall	Civil Division, THDC	Civil Division, THDC
	ii. Plantation	CEG, THDC	CEG, GM (Emt), THDC
	iii. Precautionary measures	CEG, THDC	CEG, GM (Emt), THDC
8. Landscaping & Restoration	i. Rehabilitation of disturbed site	CEG, THDC	CEG, GM (Emt), THDC
9. Restoration of quarry sites	i. Rehabilitation of quarry sites	CEG, THDC	CEG, GM (Emt), THDC
10. Rim treatment & Green Belt	i. Engineering measures	Civil Division, THDC	Civil Division, THDC
	ii. Biological measures	CEG, THDC	CEG, GM (Emt), THDC
11. R & R Plan	i. Relief package for PAFs	R & R cell, THDC/ District Administration	District Magistrate/S & D, THDC
	ii. Developmental activities in project areas	R & R Cell, THDC	S & D and Monitoring Committee
	iii. Peripheral development	R & R Cell, THDC/S & D, THDC	S & D, THDC/ Monitoring Committee
12. Disaster Management Plan	i. Telecommunication	Technical Division, THDC	Technical Division, THDC

	ii. Emergency Action Plan	Technical Division, THDC/ District Administration	District Magistrate
	iii. Rescue Operation	District Administration	District Magistrate
	iv. Rehabilitation	R & R cell, THDC/ District Administration	District Magistrate
13. Environmental Monitoring	i. Implementation & Monitoring	Various agencies	Third Party Monitoring Committee

15.2.2 Corporate Social Responsibility Cell (CSRC)

Corporate Social Responsibility Cell (CSRC) of THDC under takes community development in the impacted area. The CSRC will explore the various works like health, rehabilitation drinking water supply, and peripheral development. Therefore, it will coordinate various committees like R & R cell and consult various State Government Department for an effective implementation of Environment Management Plan. It will be the responsibility of CEG to ensure the provision of funds to all agencies assigned with various works in specified time. A detailed plan of work and responsibility of action is given in Table 15.1.

15.3 ENVIRONMENTAL MONITORING

Various environmental variables like water, noise, air would require a regular monitoring to avoid deterioration of quality while others actions as mitigation measure need sound evaluation. Table 15.2 gives details of work, and agencies, which will be involved in the monitoring and evaluation.

Table 15.2 Detailed plan for the evaluation and monitoring of various environmental variables and mitigation measures

S.N.	Parameters	Time Schedule	Agency
1.	Monitoring of water quality (pH, temperature, DO, BOD, Alkalinity, Hardness, TDS, Nutrients, Sulphates, Silicates, Heavy metals, coliforms)	Quarterly	State Pollution Control Board
2.	Monitoring of Air Quality (SOx, NOx, CO, SP)	At an interval of 15 days	State Pollution Control Board
3.	Monitoring of Noise Level	Randomly	State Pollution Control Board
4.	Evaluation of Waste Management	Quarterly	State Pollution Control Board
5.	Monitoring of Afforestation	Quarterly	Representative of TPMC
6.	Transportation and Dumping of	Monthly Control Board	State Pollution Muck Muckl
7.	Distribution of relief package	All days	District Magistrate or His/her representative

8. Progress in peripheral development	Randomly Committee (R & R)	Evaluation and Monitoring
9. Water level in downstream	Randomly	State Pollution Control Board

Two committees are suggested for the evaluation and monitoring of environment in Jelam Tamak H.E. project.

15.3.1 Third Party Monitoring Committee (TPMC)

In order to implementation of various environmental plans a Multidisciplinary Third Party Monitoring Committee would be constituted, by the project authorities in consultation with State Government. This committee would include Ecologists, Environmental scientists, Conservationists and experienced Administrators so that the project leads to sustainable development with adequate protection to the Environment. This committee would also evaluate the progress of other sub committees, constituted for individual plan. TPMC comprises of following members. The committee will be final authority for evaluation and monitoring of implementation and monitoring of environmental measures and variables, respectively. It will submit its reports to Ministry of Environment & Forest, State Government and other concerned agencies.

Nominee of Project authorities and State Government	Chairman
Representative, Uttarakhand Pollution Control Board	Member Secretary
Representative (Environment), Government of Uttarakhand	Member
District Magistrate/his/her representative	Member
Executive Director, Project THDC Ltd	Member
Renowned Ecologist/ Environment Scientist	Member
Conservationist	Member(s)
Local MLA	Member
Representative of State Level NGO	Member

This committee will function during the construction and operational phases of the project

15.3.2 Project Level Coordination Committee (PLCC)

The project level coordination committee would coordinate Third Party Monitoring Commitee in various aspects. It would act as representative of TPMC. The committee would ensure the provision of Schedule of meetings between TPMC and various implementing and responsible

agencies. For some of the aspects of mitigation measures and monitoring TPMC and PLCC will be directly involved. Project Level Coordination Committee comprises of following members.

Director, S & D	Chairman
HOD (Environment), Project	Member Secretary
HOD, CSRC, THDC	Member
General Manager, Project	Member
Representative of District Administration	Members (s)
Representative, Forest Department	Member(s)
Heads of affected villages	Members(s)
Local NGO	Member

In order to strengthening of Third Party Monitoring Committee and Project Level Coordination Committee, provision of a total budget of **Rs. 100.00 lakh** is suggested. The budget includes infrastructure facilities like furniture, stationary, camera, computers, printers and Internet facilities, expenditure of routine meetings, and travel etc. The committee can also bring the experts from recognized national level institutes/ centres to evaluate and monitor the progress of the work suggested in the EMP for the amelioration of the environment due to adverse impacts of project development process on the environment/ecosystem of the region. The proposed Committee will have following members.

15.4 BUDGET

Total financial layout under this head would be **Rs. 300.00 only**. There would be provision of a separate budget for the evaluation of monitoring environment and TPMC and PLCC. Many agencies like State Pollution Control Board, State Forest Department, Research institutions, etc would be involved in this work. The break up of the budget is given in Table 15.3.

Table 15.3 Break up of the budget assigned to various agencies for evaluation and monitoring

S.N.	Agency	Budget (Rs. in lakhs)
1.	State Pollution Control Board	100.00
2.	District Administration	25.00
3.	TPMC	25.00
4.	Other research institutions	50.00
4.	Running cost of TPMC & PLCC	100.00
	Total	**300.00**

*Budget for equipment is given to the chapter 'Management of Water and Air Quality and Noise Level. Provision of the monitoring staff under CEG is not given because it will be permanent staff

Chapter 16

GOOD PRACTICE

16
GOOD PRACTICE

The activities put in the negative impacts on the environment are either avoided or minimized. In this regard, some of the impacts are mitigated through detailed management plan while other are avoided by taking the precautionary and safeguard measures into account. These measures are environmentally, socially and economically sound. Most of the measures are addressed under the various chapters of EMP Report, however, some of measures for which a detailed plan can nor be prepared are suggested as good practice in this section.

1.0 Environmental Training for the project Workers

Project authorities and contractors would prepare a training plan to their workers highlighting the importance and consequences of wildlife, forest and forest products. All employees would be required to comply with environmental protection procedures. In addition, training programme would highlight the issues of waste management, social relation, health care, use of explosive, chemicals and other equipment. There must be provision of rules and penalties.

2.0 Conservation of Biodiversity

Project authorities and contractors would take the responsibility of their workers not to damage the forest and streams, not to involve in the forest firing, poaching and hunting. A detailed guideline would be issued by the authorities to the workers. Also, all workers will be provided by identity cards by contractors or project authority. The workers should not be allowed access to forest area without permission or/and without valid reason. There should be provision of rules and penalties.

3.0 Waste Management

The project authorities would ensure the maintenance of surface water quality. The open defecation would be strictly prohibited alongside the rivers and roads. Project authority would ensure the complete ban on the use of plastic carry bags within project area

4.0 Health Aspects

Project authorities/contractors shall follow a strict quarantine procedure for their labourers coming from outside. Each labourer should passes through a proper check up to avoid any possibility of spread of communicable diseases like AIDS, hepatitis etc. In addition, the workers involved in excavation, tunneling, dumping etc. activities should be provided with breathing masks. All safety measures for the workers should be followed strictly. Each worker must be registered under the contractor or project authority with their full address.

5.0 Landscaping

All areas disturbed by the construction activities including temporary access road will be rehabilitated properly. The spoil heaps and excavated slopes will be re-profiled to prevent the soil erosion.

6.0 Social Aspects

There is always a possibility of cultural confliction between locals and migrants. To avoid any confliction due to culture, social evils, etc. suitable measures will be taken by the project authorities. There should be a clear demarcation of the project construction area. All project workers must be provided with identity cards by contractors or project authorities. The workers should not be allowed access to villages or forest area without permission or/and without valid reason. There should be provision of rules and penalties.

7.0 Storage, Handling and Emergency Response for Hazardous Chemicals, Explosives

There should be a proper management for the storage of hazardous chemicals and explosives. The storage of fuel, oil and chemicals should not be permitted within 100 m or river water. In case of an accidental spill overflow, release of fluid occurs into the stream, open surface an emergency measures should be followed by the contractors and project authorities. There will be appropriate rules and regulations and penalties towards the misuse of chemicals and explosives.

8.0 Public Relation Cell

Project authorities would open a public relation cell to short out the complains of locals towards workers, activities, etc. It would be helpful in maintaining the harmony between project authorities and locals.

9.0 Videography

Project authorities have conducted the videography of hutments along the HRT and natural springs within project component area to ensure that if there will be any damage due to construction of the project, the stakeholders could be compensated properly.

Chapter 17

CONSTRUCTION METHODOLOGY & EQUIPMENT PLANNING

17
CONSTRUCTION METHODOLOGY & EQUIPMENT PLANNING

17.1 INTRODUCTION

Jelam Tamak HE Project involves construction of 28 M high concrete barrage with underground Power House. The other components of the project are one diversion channel, 2 nos. of intake tunnels, 2 nos. of de-sanding chambers, 1 no. of Headrace tunnel, 1 no. of surge shaft of dia 12 m, 1 no. of pressure shaft and 1 no. of tail race tunnel of 308 m.

The monsoon rains occur in project area for four months from June to September every year. This invariably keeps the season out of work. In view of this, working season of 8 months starting from October to May has been considered for surface work. In a day, 15 working hours have been adopted for three shift working, i.e. 3000 hrs in a year. However for underground activities the working period has been adopted as 12 months.

The construction methodology and equipment has been formulated based on the general construction practices and machinery operation generally deployed for the respective works. The completion of Powerhouse is a critical activity of the project. Further, access to Powerhouse service bay level (EL 2432.40 m) is available through an exploratory drift, utilization of which is proposed to expedite excavation of powerhouse cavern. Diversion of river at an earliest date after the end of monsoon period will result in saving of complete one year. The construction of all other major components is proposed to be taken up after the availability of basic infrastructural facilities. The total construction period has been considered as 52 months (exclusive of 6 months as pre-construction period involving infrastructure works).

17.2 CONSTRUCTION ACTIVITIES

17.2.1 Diversion Channel

To allow adequate waterway for the river to flow during the diversion stage, some excavation along the left bank would be done. The channel width is about 40m on the average and the length

would be about 500m. The excavation of the diversion channel along the left bank would be taken up and the guide bund would be constructed concurrently using the spoil from the channel excavation. Protection to the water side slope and toe would be provided with boulder filled gabions. Thereafter the river flow would be diverted into the channel. The construction of the barrage would then be taken up in the river bed thus vacated. Total time required to excavate will be 20 days. The total quantity of excavation of RBM or mixed gravel involved to excavate the diversion channel would be about 30,000 cum. Back hoe excavators of 1.57 cum bucket capacity with 15T rear end dumpers would be deployed to carry out the excavation. Machinery required for Channel Excavation are: Excavator 1.57 cum 1 no., JCB Backhoe Loader 1 no., Dumpers 15T capacity 5 nos, Bulldozers 90 HP 2 nos. and Roller Compactor 1 T 1 no.

17.2.2 Construction of Diversion Dyke

It is proposed to divert the river along the left hand side and take up the construction of the barrage for Bay nos.1, 2 and 3 including the right wing wall. The diversion dyke for this stage would be about 4.5 meters high and shall be constructed from the excavated spoil from the channel bed excavation. The water surface slope would be provided a 500 mm thick plain cement concrete cladding. The top of the dyke would again be provided with a layer of roller compacted concrete. The body of the dyke would, however, comprise of RBM. The two ends of the dyke would be abutted with the hill slopes on the right bank. The left side of the river would be used for river diversion. The length of the 1st stage dyke would be 530m, with top width as 4.0m and side slopes of 1.5:1 to facilitate movement of construction machinery. Cut off (2m deep) is provided along the water side of the dyke to take care of seepage which would be excavated with the JCB backhoe-loader. The placement of cement concrete cladding on the water face would be done by using shutters and concrete pumps & transit mixers. This activity would be dovetailed with the placement activity and done concurrently. The first stage diversion of the river current would be done in 16 days. The second stage river diversion would be done after the one half of the barrage & abutment wall portion is constructed as envisaged to be completed in 1st working season. The gabions (3m L x 1m W x 1m H) would be placed along the pier ends and flush with pier. Behind the gabion walls, RBM dyke would be constructed as done in the 1st stage dyke. Since the volume of the dyke is reduced along the water side, the time of construction would also be reduced. It is proposed to use the same the set of equipments as used in the 1st stage for construction purpose. Total time for 2nd stage diversion arrangement - 25 days

17.2.3 Barrage

Concrete Barrage having river bed level at 2623.50m and barrage height of 28 m shall be constructed across river Dhauliganga. Construction of concrete barrage involves surface excavation of river bed up to foundation level, excavation of abutments on both sides and concreting of barrage. After the river diversion, the excavation to expose the bed of the barrage structure would then be taken up (quantity 90,000 cum). Deploying two 1.57cu.m capacity excavators with 15T dumpers, daily progress of excavation would be 2940 cum per day. Time required for excavation of barrage bed 31 days. Machinery required for excavation of Barrage Bed: Excavators 1.57 cum 2 nos., Dumpers 15T capacity 8 nos., Bulldozers 90 HP: 1 no., at disposal site 1 no., Wagon drills 2 nos, Tipper 10 T for boulder carriage 1 no., JCB Backhoe Loader 1 no, Dewatering pump sets Lot., Pile Driving Rigs, etc 2 nos. The quantity of concrete in the raft in Ist stage is estimated to be 30,000 cum. Total time for placing floor concrete 60 days. Total quantity of concrete in wing walls in the Ist stage is estimated to be 16,000 cum to be placed in 1.5 m high lifts from El 2616.40 to 2651.50. Total time of construction of barrage will be 217days. After the diversion of the river for the second stage construction is effected by the making of the dyke, the same process of excavation, base concrete laying, casting of the floor, piers, abutments, etc would be taken up. For working on the left half of the river in construction of stage two, all equipment, manpower and material would need a crossing over the river current flowing on the right side. Length of barrage between abutments would be 83 m with top elevation at 2651.50m.

17.2.4 Intake Complex including Feeder Tunnels

The intake complex would comprise of the intake structure with trash racks etc and the feeder tunnels. This complex would be constructed above the right side wing wall upstream of the barrage axis. The crest of the intake is fixed about 8.8m above the barrage floor level at El. 2632.30. The length of the intake weir would be 35 m with a height of 21.2m. Two intake ducts of 19.9 m long followed by underground feeder tunnels (17 m c/c) would off-take from the intake well structure, which would lead the water into the de-sanding chambers. The feeder tunnels would be 4.0m in diameter, D-shaped and each 135m long (average). They would meet two 200 m long underground de-sanding chambers, through 26m long inlet transitions.

17.2.4.1 *Intake Structure*

The open cut excavation for the intake structure would be started immediately and it would be completed up to El 2630.30 before the river is diverted. The excavation below that would be done after the river diversion. Muck removal would be done with the help of 15 dumpers and dozing would be done with 90HP bulldozers. The concreting of the intake floor would be taken up after all tunneling activities are over. About 3350 cum of concrete is required to be placed as floor concrete and in cutoff. Equipment planned for Intake works: Hyd. Excavators (1.57 cum - 1 nos., Dumpers (15T) - 3 nos., Dozers (90 HP) - 1 nos., Wagon drills,1 no., Rough Terrain Crane (40T) - 1 no., Concrete pumps (25 cum /hr) - 2 nos., Transit Mixers (4 cum) - 10 nos., Steel Formwork & Vibrators – Lot, Dewatering Pumps (40 kW) - 3 nos.

17.2.4.2 *Feeder Tunnels*

Two feeder tunnels merge out from the intake structure, 146m & 125m long and 3.8 m finished diameter and D-shaped. The access for constructing the feeder tunnels would be from the intake area. Tunnel Dimensions: Finished dia of the tunnel – 3.8 m. Drilling of holes for blasting would be done by two boom drilling jumbo with man basket. A 10 m long hydraulically operated and controlled traveler mounted gantry would be erected for concreting the feeder tunnel in the downstream end of the tunnel.

17.2.5 Desanding Chamber

The water from the feeder tunnels would be let into two 12 m wide, 13.6 m deep and (220+26) m long underground de-sanding chambers. The bottom & top level of the chamber would be at El. 2620.20 m and El. 2634.10 m, respectively. Three accesses to the de-sanding basins would be available for construction, viz., on the inlet side, through the feeder tunnels (4.9 m excavated dia, D-shaped), a cross adit (5m x 6m D-shaped) between the chambers reaching at El. 2620.40m and on the downstream end, through the link tunnels (4.4m excavated dia, D-shaped). The excavation and concreting activities would be dove-tailed in a definite sequence. After the pilot tunnel is excavated through the basin and slashed to the required crown profile up to El.2628.00. A working bench of about 8m width at El.2623.40 would be available for movement of equipment & machinery. Removal of the blasted muck would be done through the feeder tunnel end. The adit reaching the bottom of the chambers would also be available by then. Excavation for the de-sanding chamber would be completed in 63 days. After elevation El.2623.40 is achieved, the concreting of the overt

would be done before proceeding with the excavation activity. Concrete would be placed with the help of pumps and transit mixers. Concreting shall be done in the overt and the side walls through various ports using concrete pumps. An average of 87cu.m of concrete is required to be placed per block of 10 m length.

17.2.6 Head Race Tunnel

One head race tunnel about 4404.58 m long and having 5.2 m finished diameter, horseshoe in shape, will be constructed to carry the river water to the underground powerhouse for generation of power. The excavation of HRT would be carried out by conventional drill and blast method. Drilling of holes for blasting would be done by two boom drilling jumbo with man basket. Equipment required for HRT excavation (per face): Two boom drill jumbo with man basket , Rock bolter 1, Robojet Shotcrete Machine 1, Shotcrete machine (manual) Standby 1, Hyd. Excavator 1.0 cum capacity 1, Dumpers 10 T capacity 6, Transit Mixers 4 cum 3, Compressors 450 cfm 1.

Concreting activities would be carried out with the help of concrete pumps and transit mixers to place concrete behind collapsible steel shutters/gantries moving on pre-erected rail track. The concreting of the invert would be done concurrently with the overt. Equipment required for Concreting of HRT (for one face): Collapsible hydraulic gantry for overt concreting - 1 nos., Transit Mixers 4 cum capacity - 4 nos., Concrete pump 25 cum/hr - 1 nos., Excavator (1.0 cum) - 1 no., Dumper (10T) - 2 no.

17.2.7 Silt Flushing Tunnel

The silt-flushing duct is located at the bottom of the de-silting chamber. Two independent ducts emerge out of each of the de-silting chambers and then they merge into a single tunnel. The size of the single merged tunnel would be 2.5 m (w) x 3.0 m (h). The total length of the tunnel (including the two branches) is about 703 m with outfall at El. 2614.70 m. The excavation would be done from the outlet end. Total time for constructing silt flushing tunnel **377 days**. The equipment required for silt flushing tunnel would be as: Drill Jumbo 1 Boom, Jack Hammers, Bobcat excavator 0.5 cum**.**

17.2.8 Surge Shaft, Pressure tunnel & Valve chamber

17.2.8.1 *Surge Shaft*

The excavation work at surge shaft would commence immediately after the construction of approach road. A pilot shaft 3 m in diameter with a Raise Climber having 2.75 m working platform would be made from bottom upwards. After the pilot shaft reaches the top, the section would be widened by drilling and blasting from top to bottom and disposing off the blasted muck in the pilot, which would be removed from the bottom of the pilot shaft. There would be two approaches to the surge shaft viz., a construction adit (size 5m x 6m, D-shaped) to the surge shaft top with the adit invert meeting the surge shaft and another construction adit of the same size to the surge shaft bottom/HRT with the adit invert meeting the tunnel. Total time for excavation of surge shaft (including the pilot) will be 5.5 months. The main equipment required for the excavation of the surge shaft would be: Raise Climber with 2.75 circular platform 1 no., Hand-held stoppers 4 nos., Hand held rock drills 12 nos, Excavator (1.00 cum bucket) 1 no., Front End Loader (1.7 cum) 1 no., Winch arrangement 1 no., Rock Bolter 1 no., Tipper 10T capacity 4 nos., Wet Shot Crete machine (manual) 2 nos., Transit mixers 4 cm 4 nos., Compressors (600 cfm) 3 nos. The concrete lining of the surge shaft would be done from bottom to top by conventional shuttering process. A period of one month would be required to set up the initial reinforcements, fixing shutters at the precise location, casting of the ring beam and to start concreting operations. Equipment required for Concreting of Surge Shaft: Concrete pump (25 cum/hr) - 2 nos., Steel Shutters – Lot, Transit mixer (4 cum) - 5 nos.

17.2.8.2 *Pressure Tunnel (Between surge shaft & valve chamber)*

The 5 m (excavated) dia, 26 m long pressure tunnel would be excavated through the same adit as that for the HRT/ Surge Shaft. Equipment Required for Pressure Tunnel Excavation: Two boom drill jumbo 1 nos., Shotcrete Robojet machine 1 no., Transit Mixers 3 nos., Front End loader 1.7 cum 1 nos., Tippers 10 T capacity 5 nos., Dozers (90 HP) 1 nos., DG sets (500 kVA) 1 no.

17.2.8.3 *Valve Chamber*

A 10 m wide, 19 m high and 20 m long valve chamber would be constructed immediately after the surge shaft. There are four accesses to this chamber, two through the pressure tunnels, the third to the top (A-12) from A-5 adit and the fourth through adit A-11 to the bottom of the chamber. For constructing the valve chamber, the bottom and the top construction adits would be utilized. A pilot tunnel would be excavated through the chamber at a slope of 1:10 and then slashed to the

required width of the cavern. Equipment Required for Valve Chamber Excavation: Two boom drill jumbo 1 no., Wagon drill 2 nos., Shotcreting machine Robojet 1 no., Transit Mixers 4 cum 4 nos., Hydraulic Excavator 1.57 cum 1 no., Dumpers 15T capacity 4 nos., Hand held Rock drills 4 nos., Compressors (1000 + 600 cfm) 1 each and DG sets (500 kVA) 1 no.

17.2.9 Pressure Shaft

The excavated diameter of the 4 m finished vertical pressure shaft would be 5 m. Full face excavation of the 5 m dia shaft is proposed with 3.5 to 3.75 m working platform of the machine. Drilling for blasting would be done with two stoppers capable of drilling vertically. To deploy the Raise Climber, some preparatory excavation would be done to allow its entry into the shaft. The start up would take about **15 days**. Once the space is created and the raise climber erected, regular full face excavation of the shaft would start. Time required to excavate shaft of 190 m height will be 95 days. On completion of excavation, steel lining of the pressure shafts will be carried out. Equipment proposed are : Raise Climber - 1 nos., Stoppers - 4 nos., Dumpers (10 T) - 5 nos., Excavators (1.57 cum) - 1 nos., Diesel Compressors (400 cfm) - 2 nos.

17.2.10 Power House and Transformer Hall

The powerhouse would be built underground on the right bank of the river. The major components of the entire powerhouse complex would be :

Adits to various locations:

a. Surge Shaft 1 no., 12m diameter and 60 m high,

b. Valve Chamber, I no., 20 m (L) x 10 m (w) x 19 m (H),

c. Pressure Shaft 1 no, 4.0 m diameter and 245.10 m long,

d. Powerhouse Cavern, 1 no., 101 m (L) x 19.5 (W) x 39.70 m (H),

e. Transformer Hall, 1 no., 79 m (L) x 13.5 m (W) x 22 m (H),

f. Draft Tubes 3nos,

g. Collection Gallery, 1 no., 58.45 m (L) x 12.0 m (W) x 23.5 m (H), and

h. Tailrace Tunnel, 1 no. 7.0m (W) x 9.0 (H) - 308 m (L).

Out of the above, most of the components have been discussed individually under different paras. The Main Cavern and the Transformer Hall are detailed hereinafter.

17.2.10.1 ***Main Cavern***

The dimensions of the main cavern would be 39.70 m high x 19.5 m wide x 101 m long. The entire structure would be underground. Construction would be done in two distinct parts viz. excavation and concreting. The excavation would be started from Adit A-7 at El 2445.90 m. A pilot tunnel of the same dimensions as the adit i.e. 6 m high would be constructed from the left end to the right end. Since the final crown of the main cavern would get exposed during this cut, the rock reinforcement required for the crown as per design would be installed along with the pilot excavation. After the pilot is done up to the right end of the cavern, its widening/slashing to achieve the final profile up to El. 2445.90 would be done.

Benching activities would be taken up to continue the excavation below El. 2445.90 in three cuts each of 3.0 and 3.5 m depth. Vertical drilling with wagon drills would be done. This sequence of excavation from right to left side is adopted to facilitate the movement of loaded tippers on horizontal surface (El. 2445.90).Vertical holes about 3.5 m deep would be drilled and blasted. To achieve continuous excavation in the interest of keeping the equipment fully engaged, drilling /blasting would be done in half width of the cavern, while mucking would go on in the other half (blasted earlier) at the same time. The compressed air supply pipelines would be installed along both the longitudinal sides. To avoid excessive vibrations due to blasting cuts more than 3.5 m depth would not be taken. The muck would be removed by 1.57 cum back hoes and 15T capacity dumpers. The 7 x 7 m MAT would be completed by then up to the cavern location and access through it would be available. A cross tunnel or an extension of the MAT would be through the width of the powerhouse up to the upstream longitudinal side. Excavation would take 20 days at the general advance rate of 100m in 20 days. Total time required for pilot excavation would be 35 days. The blasted muck would be removed through the top adit for disposal. Thereafter, excavation would be through the MAT done on either side of the cavern to complete the Phase 1 excavation up to El. 2432.40 as described. The equipment required for excavation of Phase I would be: Two boom drilling Jumbo 1 no., Rock Bolter 1 no, Tippers 10 T 10 nos., Excavator 1.57 cum 1 no., Dumpers 15T capacity 3 nos., Robojet Shotcrete Machine 1 no., Transit mixers 4 cum 4 nos., Wagon Drills 2 nos. and Compressors 1000 + 450 cfm 1 each. Excavation of phase II would be done in two stages Stage I: Excavation from El. 2432.40 m (Service Bay level) up to El 2419.35, and Stage II: Below El. 2419.35. Total time required to complete Phase I excavation 294 days. Excavation of phase II

would be done in two stages, as: Stage I: Excavation from El. 2432.40 m up to El 2419.35, and Stage II: Below El. 2419.35.

At this stage of the excavation, the TRT and the Draft Tubes would be done up to the cavern and access would be available for traffic movement through them. Total time for powerhouse excavation 347 days. Equipment Required for Phase II Excavation: Hydraulic Excavator 1.57/1.00 cum 1 no, Dumpers 15T 5 nos., Wagon drills 2 nos., Jack Hammers 8 nos., Bulldozers D-8 2 nos., Robojet shotcrete machine 1 no., Transit Mixers 4 cum 3 nos.

17.2.10.2 ***Transformer Hall***

The transformer hall cavity would be 13.5 W x 22 H x 79 m long, having bottom level at El. 2431.90 and crown at El. 2454.40. The approach to the hall would be available through two adits viz., Adit A-8 at the top left side and the MAT at El. 2431.90 m at the bottom left side of the cavity. Multi-stage excavation would be adopted to achieve the final profile.

A pilot tunnel along the length of the transformer hall (cut no. 5) would be constructed of the same height as the Mat i.e. 7 m. Towards the end, the crown would get exposed. The final cut no. 6 would be made by drilling vertical holes for blasting and mucking through the MAT. The 79 m long pilot tunnel would be excavated at an average advance of 6 m /day in a period of 3 days. Equipment Required for Excavation of Transformer Hall: Two boom drill jumbo for pilot tunnel 1 no., Shotcreting Robojet 1 no., Transit Mixers 4 cum 4 nos., Hand-held rock drills 6 nos., Excavator 1.57 cum 1 no., Dumpers 15T 4 nos., Bulldozer 90 HP 1 no., Compressors 600 cfm 2 nos., DG sets 1000 kVA 1 no. Total time for excavation of Transformer Hall1 year and total time for excavation and concreting of powerhouse cavern would be 718 days.

17.2.11 Collection Gallery

The excavated dimensions of the chamber would be 12 m wide x 23.5 m high and 58.45 m long. There would be two accesses which would approach the gallery. There are two accesses to the collection gallery, from which the excavation will be taken up viz. Construction adit (size 5m x 6m) to the collection gallery from MAT at El. 2433.51 m-gate operation floor and Pilot Tunnel of TRT (size 5m x 7m). This tunnel would start at an El. 2426.80 m from TRT portal and reach the collection gallery. The excavation of the collection gallery would be started through the top adit at

El. 2433.51 m. Total time required for excavation of collection gallery would be 146 days. The equipment required for the stage wise excavation of the gallery would be as: Two boom drill jumbo 1 no., Wagon drills 2 nos., Hydraulic excavator (1.57 cum) 1 no., Rear end dumpers 10 T 6 nos., Robojet shotcrete machine 1 no., Transit mixers 4 cum 4 nos., Dozer (90 HP) 1 no., Compressor 1450 cfm 1 no. After the excavation of gallery is done, concreting would be taken up at the appropriate time. Columns would be cast first using steel shutters, concrete pumps and transit mixers. Floor concrete of 1.0m thick would then be placed in bottom of the gallery. Total time for excavation and concreting of Collection Gallery 216 days. Equipment required for concreting of Collection Gallery Steel Shutters 10m long x 2·10 m high with 5 sets, Concrete pump 25 cum/hr capacity 1 no., Transit mixers 4 cum capacity 4 nos.

17.2.12 Tail Race Tunnel

Tail race tunnels work involve portal excavation, concreting and excavation of 1 no. D shaped tail race tunnel of 7.0m (w) x 9.00m (h). The excavated dimensions would be about 9.8 high and 7.8 m wide, allowing 0.3m thickness for lining and primary supports.

A pilot tunnel 5x7 m size would be driven from the outlet side towards the collection gallery. It would then be widened and deepened to achieve the final profile of the TRT.

Total time for TRT excavation 198 days. The drilling and blasting of the bench would proceed ahead of its mucking. Mucking would be a filler activity to follow bench blasting. Equipment Required for Excavation of HRT: Two boom drill jumbo 1 no, Loader 1.57 cum 1 no., Tippers 10 t 4 nos., Wagon drill tyre mounted 1 no., Shotcrete machine (Manual) 1 no., Transit Mixers 3 nos., Diesel Compressors 400 cfm 2 nos.

The concreting of the TRT would be done in two distinct stages i.e. overt and invert. The overt would be concreted with the help of a 12 m long gantry moving on rails mounted on firm base. The concrete placed behind the gantry would be allowed to set for one full day to harden before the gantry is released and shifted to the next block. Time to complete concreting of TRT 154 days.

17.2.13 Construction of Adits

Construction adits would be constructed to access various underground structures like Desander Chambers, HRT and Powerhouse. There are four construction adits in the headworks area and HRT, and others in the powerhouse complex viz., Adit A-1, Adit no. 2, Adit no. 3 and Adit no.4.

After the access roads to the locations of the various adit portals are made available, the construction of these adits would be done. The sizes of all adits would be 5 m wide and 6 m high, D-shaped, while the Main Access Tunnel would be 7 m x 7 m high, D-shaped. Any loose deposits/ vegetation above the adit portals would be removed manually or mechanically and the tunnel face would be prepared for portal construction by blasting. Then three or four steel arches would be erected in the open, butting with the exposed tunnel face. Forepoles/ Rock bolts 3 m deep at 600 mm spacing would be installed along the tunnel periphery to hold the rock from falling in the initial blasting operations.

The excavated dimensions would be 5.5 m x 6.5 m including space required for primary support. Time required for first 100 m length 53 days. Time for subsequent 100 m reaches 38 days. Equipment required for construction of one adit: Two boom jumbo 1 no., Loader 1.7 cum 1 no., Dumpers 10 MT 5 nos., Shotcrete machine (manual) 1 no., Transit Mixer 4 cum 3 nos. and Diesel compressor 300 cfm 1 no.

Chapter 18

COMPENSATORY AFFORESTATION PLAN

18
COMPENSATORY AFFORESTATION PLAN

18.1 INTRODUCTION

Conservation is the sustainable use of natural resources, so that it is preserved for future generation as well. The need for conservation, preservation and management arises because of threats to natural ecosystems by anthropogenic activities. In view of the foreseen disturbance and degradation of natural ecosystems, a compensatory afforestation plan has been proposed for Jelam-Tamak Hydroelectric Project. The proposed compensatory plan has been prepared by the State Forest Department after conducting a detailed survey.

18.2 PROPOSED PLAN

The Forest Department of Uttarakhand is responsible for conservation and Management of forests in the state. The objective of the compensatory afforestation is to make up for the loss of forest land proposed to be utilized for construction of the proposed Jelam-Tamak Hydroelectric Project. The other objectives are to combat soil erosion, afforestation and last but not least to maintain and improve the ecological and environmental balance.

18.2.1 Impacts on Forest

The total forest land required for the project is 88.29 ha. It has been divided into Reserve forest, Civil soyam forest and Van panchayat land. The details are given in Table 18.1.

18.1 Break of the land to be acquired for Jelam Tamak H.E. Project

Type of Land	Under Ground (Ha)	Over Ground (Ha)	Total Land (Ha)
Reserve Forest	4.70	8.34	13.04

Civil Soyam	1.20	64.25	65.45
Van Panchayat	-	9.80	9.80
Sub Total Forest Land	**5.90**	**82.39**	**88.29**

18.2.2 Afforestation

The Indian Forest Conservation Act (1980) stipulates:

If non-forest land is not available, compensatory plantations are to be established on degraded forest lands, which must be twice the forest area affected or lost.

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

The entire land to be acquired for the Project including submergence area and other Project appurtenances is 88.29 ha. It is proposed to afforest double the amount of entire land being acquired for the project including private land.

Thus, a total of (88.29 x 2) 176.58 ha of land needs to be afforested. The afforestation work is to be done by the Forest Department. The total expenditure required for afforestation of 176.29 ha of area will be **Rs. 153.00 lacs** (Ref **Enclosure-I**) as per the estimate submitted by the DFO, NDBR, Joshimath. In addition to above the project proponent will pay NPV (Rs. 791 lacs) (Ref **Enclosure-II**) and cost of trees (Rs. 3.06 lacs) (Ref **Enclosure-III**) to the Forest Department, Uttarakhand.

Thus as per the Forest Department the estimated cost for Compensatory Afforestation of 176.29 ha is **Rs. 153.00 lacs**.

Chapter 19

SUMMARY OF COST ESTIMATES

19
SUMMARY OF COST ESTIMATES

Environmental Management Plan contains 15 different plans. There is also provision of rights and privileges against the loss of customary rights of collection of forest produce and traditional land use of community forest land and USF. Total amount to be spent for implementation of Environmental Management Plan is **Rs 5449.17 lakhs**. The summary of the cost estimates is given in **Table 19.1**.

Table 19.1 Summary of cost estimates for various plans suggested in EMP report of Jelam Tamak H.E. Project

S. No.	Particulars	Amount (Rs. in lakhs)
1.	Restoration of Dumping Areas	771.44
2.	Waste Management	249.00
3.	Fuel wood & Energy Conservation	50.00
4.	Public Health Delivery System	285.50
5.	Restoration of Roads & other Construction Areas	121.20
6.	Management of Air & Water Quality and Noise Level	100.00
7.	Catchment Area Treatment Plan	773.43
8.	Green Belt Development Plan	39.25
9.	Restoration of Quarry & Borrow Sites	41.10
10.	Biodiversity Management & Conservation Plan	245.40
11.	Fishery Development & Downstream Management Plan	55.00
12.	Resettlement & Rehabilitation Plan	1912.85
13.	Disaster Management Plan	352.00
14.	Environment Management, Implementation and Monitoring Programme	300.00
15.	Compensatory Afforestation Plan	153.00
	Total	**5449.17**

ANNEXURE

Annexure - I

Table for Computation of Silt Yield Index

Sub-watershed code	Erosion intensity	Area* (ha)	Weightage	Area x weight-age	Delivery ratio	Gross silt yield	Sediment yield index
Dg1	a	988.68	16	15818.88	0.85	13446	
	b	1313.38	14	18387.32	0.80	14710	
	c	329.86	14	4618.04	0.8	3694	
	d	18.88	12	226.56	0.7	159	
Total		**2650.80**				**32009**	**1207.52**
Dg2	a	144.25	18	2596.5	0.90	2337	
	b	1156.21	16	2308	0.90	2077	
	c	238.58	15	17343.15	0.8	13875	
	d	35.56	14	497.84	0.75	373	
Total		**1574.60**				**18662**	**1185.19**
Dg3	a	67.44	17	1146.48	0.9	1032	
	b	1590.67	15	23860.05	0.90	21474	
	c	930.10	15	13951.5	0.85	11859	
	d	63.80	13	829.4	0.7	581	
Total		**2652.01**				**34945**	**1317.69**

Annexure-II

THDC INDIA LIMITED
JELAM-TAMAK H.E. PROJECT
APPLICATION FORM FOR TRAINING PROGRAMME

Attested Photograph

1.	Name of the applicant (in block letters)	:	----------
2.	Fathers Name	:	----------
3	Date of birth	:	----------
4.	Qualification	:	----------
5.	Residential Address	:	----------
6.	Name of head of family From whom land acquired (PAP)	:	----------
7.	Relation of applicant With head of family (PAP)	:	----------
8.	Caste	:	Gen SC OBC ST
9.	Land details		
	a) Name of the village (S) : from where land acquired.		
	b) Area of the land acquired : (in ha.) and taken possession by THDC India Ltd		
	c) Land left (in ha)	:	----------
	d) whether the family has been declared landless by R&R Officer	:	----------
	e) Whether the family member has got employment in THDC India Ltd R&R scheme.	:	Yes No.
	f) If Yes Name of employee	:	----------
	g) whether SC/ST/OBC/Gen.	:	----------
10.	a) Present occupation of the applicant.	:	----------
	b) Annual income from the	:	----------

11. Choice of vocations for :

For which applied

(please put a tick mark

i) Food processing

ii) Mushroom cultivation

iii) Computer course

iv) Dairy farming

v) Poultry farming

vi) Organic farming

vii) Sericulture

viii) Apiculture

ix) Fish culture

x) Knitting

xi) Sewing

xii) Any other please specify

12. Certificates enclosed

i)

ii)

iii)

iv)

13. Declaration:

I here by declare that all the particulars furnished in this application are complete are true to the best of my knowledge. I shall abide by the rules and conditions mentioned in this scheme for PAFs.

Signature of the applicant

Name :

Date :

Place :

Verified that the particulars of the applicant Sh/Smt./Km. ---------- /daughter/wife of ---------- are true.

Signature of Gram Pradhan

Date : Name with stamp:

Annexure-III

THDC INDIA LIMITED
JELAM-TAMAK H.E. PROJECT
APPLICATION FORM FOR
MERIT SCHOLARSHIP SCHEME

Attested Photograph

1.	Name of the applicant (in block letters)	:	----------
2.	Fathers Name	:	----------
3	Date of birth	:	----------
4.	Qualification	:	----------
5.	Residential Address	:	----------
6.	Correspondence Address	:	----------
7.	Name of head of family From whom land acquired (PAP)	:	----------
8.	Relation of applicant With head of family (PAP)	:	----------
9.	Caste	:	Gen SC OBC ST
10.	Land details		
	a) Name of the village (S) : from where land acquired.		
	b) Area of the land acquired : (in ha.) and taken possession by THDC India Ltd		
	c) Land left (in ha)	:	----------
	d) whether the family has been declared landless by R&R Officer	:	----------
	e) Whether the family member has got employment in THDC India Ltd R&R scheme.	:	Yes No.
	f) If Yes Name of employee	:	----------
	g) whether SC/ST/OBC/Gen.	:	----------
11.	a) Present occupation of	:	----------

the applicant.

b) Annual income from the occupation. : ----------

12. Name of the school/institute/University in which applicant studies : ----------

13. Name of the class/course/diploma/degree for which scholarship is applied. : ----------

14. Tenure of the class/course/diploma/degree : ----------

15. Certificates enclosed

i)

ii)

iii)

iv)

13. Declaration:

I here by declare that all the particulars furnished in this application are complete are true to the best of my knowledge. I shall abide by the rules and conditions mentioned in this scheme for PAFs.

Signature of the applicant
Name :
Date :
Place :

Verified that the particulars of the applicant Sh/Smt./Km. ---------- /daughter/wife of ---------- are true.

Signature of Gram Pradhan
Name with stamp:
Date:

Signature of Principal
Name with Stamp
Date

Annexure-IV

Attested Photograph

THDC INDIA LIMITED
JELAM-TAMAK H.E. PROJECT
APPLICATION FORM FOR
INCOME GENERATION SCHEME

1.	Name of the applicant (in block letters)	:	----------
2.	Fathers Name	:	----------
3	Date of birth	:	----------
4.	Qualification	:	----------
5.	Residential Address	:	----------
6.	Name of head of family From whom land acquired (PAP)	:	----------
7.	Relation of applicant With head of family (PAP)	:	----------
8.	Caste	:	Gen SC OBC ST
9.	Land details		
	a) Name of the village (S) : from where land acquired.		
	b) Area of the land acquired : (in ha.) and taken possession by THDC India Ltd		
	c) Land left (in ha)	:	----------
	d) whether the family has been declared landless by R&R Officer	:	----------
	e) Whether the family member has got employment in THDC India Ltd R&R scheme.	:	Yes No.
	f) If Yes Name of employee	:	----------
	g) whether SC/ST/OBC/Gen.	:	----------
10.	a) Present occupation of the applicant.	:	----------
	b) Annual income from the	:	----------

occupation.

11. Choice of unit/assets :

For which applied financial assistance

Required (please put a tick mark :

i) Food processing

ii) Mushroom cultivation

iii) Computer course

iv) Dairy farming assets

v) Poultry farming assets

vi) Organic farming assets

vii) Sericulture assets

viii) Apiculture assets

ix) Fish culture assets

x) Knitting machines

xi) Sewing machines

xii) Business

xiii) Bakery unit

xiv) Handicraft

xv) Any other please specify

12. Certificates enclosed

i)

ii)

iii)

iv)

13. Declaration:

I here by declare that all the particulars furnished in this application are complete are true to the best of my knowledge. I shall abide by the rules and conditions mentioned in this scheme for PAFs.

Signature of the applicant

Name :

Date :

Place :

Verified that the particulars of the applicant Sh/Smt./Km. ---------- /daughter/wife of ---------- are true.

Signature of Gram Pradhan

Date :

Name with stamp:

धौली गंगा के निकट जेलम–तमक जल विद्युत परियोजना (108 मेगावाट) के निर्माण हेतु सगस्त ढाँचागत,(बाँध,विद्युत गृह,सुरंग,मलवा निस्तारण,सडक, भवन आदि) कार्यो के लिए 88.290 हेक्टेयर सिविल/आरक्षित वन भूमि हस्तान्तरण प्रस्ताव। (186)

परियोजना का नामः– जेलम – तमक (108 मेगावाट) जल विद्युत परियोजना **Enclosure – I**

क्षतिपूरक वृक्षारोपण स्थल उपयुक्तता प्रमाण–पत्र

क्षतिपूरक वृक्षारोपण हेतु चयनित अवनत वन भूमि क्षतिपूरक वृक्षारोपण हेतु उपयुक्त है।

ह0/
वन दरोगा

ह0/
वन क्षेत्राधिकारी
वन क्षेत्राधिकारी
जोशीमठ रेंज
जोशीमठ।

ह0/
प्रभागीय वनाधिकारी
जोशीमठ (चमोली)

धौली गंगा के निकट जेलम–तमक जल विद्युत परियोजना (108 मेगावाट) के निर्माण हेतु समस्त ढॉचागत, (बॉध, विद्युत गृह, सुरंग, मलवा निस्तारण, सडक, भवन आदि) कार्यो के लिए 88.290 हेक्टेयर सविल/आरक्षित वन भूमि हस्तान्तरण प्रस्ताव।

क्षतिपूरक वृक्षारोपण योजना का सारांश

परियोजना का नाम : जनपद चमोली में जेलम–तमक जल विद्युत परियोजना (108 मेगावाट क्षमता) के निर्माण कार्य हेतु 88.29 हे0 वन भूमि का टीएचडीसी इंडिया लिमिटेड को हस्तान्तरण।

वृक्षारोपण स्थल का नाम : जनपद चमोली, उत्तराखण्ड

रोपित किये जाने वाले पौधों की संख्या : 353120 (देवदार, सुरई, कैल आदि)

दुगने अवनत वन भूमि पर : 88.29 X 2 = 176.58 हे0

क्र0	चयनित क्षेत्र	क्षेत्रफल (हे0 में)	धनराशि (रू0 में)
1	जनपद चमोली, उत्तराखण्ड में क्षतिपूरक वृक्षारोपण हेतु चयनित भूमि में वृक्षारोपण	176.58	15388026.00
	कुल योग		**15388026.00**

वन दरोगा

,हे0/
वन दरोगा

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वन क्षेत्राधिकारी
वन क्षेत्राधिकारी
जोशीमठ रेंज
जोशीमठ।

,हे0/
प्रभागीय वनाधिकारी

धौली गंगा के निकट जेलम–तमक जल विद्युत परियोजना (108 मेगावाट) के निर्माण हेतु समस्त ढाँचागत, (बाँध, विद्युत गृह, सुरंग, मलवा निस्तारण, सड़क, भवन आदि) कार्यो के लिए 88.290 हैक्टेयर सविल/आरक्षित वन भूमि हस्तान्तरण प्रस्ताव।

(188)

क्षतिपूरक वृक्षारोपण योजना

परियोजना का नाम : जनपद चमोली में जेलम–तमक जल विद्युत परियोजना (108 मेगावाट क्षमता) के निर्माण कार्य हेतु 88.29 हे0 वन भूमि का टीएचडीसी इंडिया लिमिटेड को हस्तान्तरण।

वृक्षारोपण स्थल का नाम : जनपद चमोली, उत्तराखण्ड

रोपित किये जाने वाले पौधों की संख्या : 353120 (देवदार, सुरई, कैल आदि) क्षेत्रफल : 176.58

क्र0	कार्य का नाम	इकाई		इकाई दर (रु)		योग
1	2	3		4		5
1	सर्वे एवं सीमांकन	176.58	हे0	50.00	./प्र0 हे0	8829.00
2	क्षेत्र की सफाई (झाड़ी कटान आदि)	176.58	हे0	1630.00	./प्र0 हे0	287825.40
3	अग्रिम दीवाल बन्दी (फैंसिंग)	176.58	हे0	9801.00	./प्र0 हे0	1730660.58
4	मृदा एवं जल संरक्षण एवं संग्रहण हेतु कच्चे चाल–खालों			लo/रा0		
	छोटी कच्ची खाल	880.00	सं0	500.00	./–	440000.00
	गली प्लगिंग	208.00	सं0	1500.00	./–	312000.00
	आर0 आर0 ड्राई चैकडैम/स्पर	150.00	सं0	6500.00	./–	975000.00
	वानस्पतिक चैकडैम/स्पर	178.00	सं0	7700.00	./–	1370600.00
5	रेखांकन चूना सहित गड्ढा खुदान (0.30X0.30X0.45)	353120.00	सं0	3.47	./प्र0 हे0	1225326.40
6	निरीक्षण बंटिया बनाना	8310.00	क0मी0	8.00	./वर्ग मी0	66480.00
7	पौधों की कीमत (प्रथम वर्ग)	353120.00	सं0	2.75	प्र0पौ0	971080.00
8	अन्य व्यय जैसे यन्त्र, संयत्र, औजार तेज करना एवं अन्य	176.56	हे0	300.00	हे0	52968.00
9	अन्य कार्य				लo/रा0	50000.00
	योग प्रथम चरण					**7490769.38**
	द्वितीय चरण					
1	गड्ढा भरान कार्य	353120.00	सं0	0.62	प्रति	218934.40
2	पौधों की कीमत (द्वितीय वर्ष)	353120.00	सं0	0.75	प्रति	264840.00
3	पौध बुलान	353120.00	सं0	4.02	प्रति	1419542.40
4	पौधरोपण व थावलाबन्दी	353120.00	सं0	1.21	प्रति	427275.20
5	निराई गुड़ाई व मल्चिंग (दो बार)	353120.00	सं0	1.54	प्रति	543804.80
6	खाद व दवा पर व्यय	353120.00	सं0	0.62	प्रति	218934.40
7	प्रथम वर्ष में वृक्षारोपण की देख–रेख व रखरखाव पर व्यय	176.58	हे0	2100.00	हे0	370818.00
8	8.1 वृक्षारोपण क्षेत्रों के अन्तर्गत सूखे घास, फूस एवं	176.58	हे0	लo/रा0		50000.00
	8.2 सुरक्षा दीवाल/घेरबाढ के बाहर 4 मी0 की पटटी साफ करना	10.00	किमी0	290.00	./प्रति किमी0	2900.00
	8.3 वृक्षारोपण से लाभान्वित होने वाले ग्रामीणों को अग्नि सुरक्षा जागरुकता हेतु प्रशिक्षण एवं अग्नि सुरक्षा में उज्जेखनीय कार्य हेतु व्यक्तियों/समितियों को प्रात्साहन देना					

धौली गंगा के निकट जेलम–तमक जल विद्युत परियोजना (108 मेगावाट) के निर्माण हेतु समस्त डॉचागत, (बॉध, विद्युत गृह, सुरंग, मलवा निस्तारण, सड़क, भवन आदि) कार्यों के लिए 88.290 हैक्टेयर सिविल/आरक्षित वन भूमि हस्तान्तरण प्रस्ताव।

2	अन्य कार्य			
	योग – सप्तम चरण		लo/सo	50000.00
	कुल व्यय			**721004.00**
				15388026.66
			या	**15388026.00**

(रू० एक करोड़ तिरेप्पन लाख अठ्ठासी हजार छब्बीस मात्र)

ह0/

वन दरोगा

ह0/

वन क्षेत्राधिकारी
जोशीमठ।

ह0/

प्रभागीय वनाधिकारी
नन्दादेवी बायोस्फीयर रिजर्व
जोशीमठ (चमोली)

(27/B)

Enclosure – II

जनपद चमोली के अन्तर्गत जेलम–तमक (108 मेगावाट) जल विद्युत परियोजना का निर्माण कार्य 88.29 है0

प्रमाण पत्र

मा0 उच्चतम न्यायालय द्वारा पारित निर्णय के अनुसार विषयांकित विकासखण्ड जोशीमठ के अन्तर्गत जेलम–तमक (108 मेगावाट) जल विद्युत परियोजना का निर्माण कार्य 88.29 है0 हेतु एन0पी0वी0 मूल्य का निम्न प्रकार से निर्धारण किया जाता है।

याचित वन भूमि का कुल क्षेत्रफल	इको श्रेणी (Eco- class)	एन0पी0वी0की धनराशि की दर (प्रति हे0)	एन0पी0वी0 की देय धनराशि
88.29 है0	Eco-class VI Dense Forest	897000.00	79,196,130.00

(रूपये सात करोड इक्यानब्बे लाख छियानब्बे हजार एक सौ तीस मात्र)

(एस0आर0 प्रजापति)
प्रभागीय वनाधिकारी,
नन्दादेवी राष्ट्रीय पार्क जोशीमठ।

(वर्ष- 2011-12 एवं 2012-13)

FR [illegible] FR NO. [illegible] [illegible]

आदेश

उत्तराखण्ड शासन के वित्त अनुभाग–9 के शासनादेश संख्या–351 /2011 XXVII(9)–2009/स्टाम्प–80/2009 दिनांक 24.06.2011 शासन के पत्र संख्या–682 /2011 XXVII(9)/स्टाम्प–80/2009 दिनांक 01.11.2011 के क्रम में महानिरीक्षक निबन्धन, उत्तराखण्ड देहरादून के पत्र संख्या 1018/म0नि0/2011–12, दिनांक 09 मार्च, 2012 तथा स्टाम्प नियमावली (सम्पत्ति का मूल्यांकन–1997) में निहित प्राविधानों के अनुसार जनपद [illegible] स्थित सभी प्रकार की भूमि जिसमें कृषित व अकृषित तथा शहरी, अर्द्धशहरी एवं ग्रामीण [illegible] सम्मिलित है की परगनावार/किस्मवार अध्यावधिक मूल्यांकन दो वर्ष (2011–12) एवं (2012–13) के लिये निर्धारित की जाती है, जो शासनादेशानुसार 01 अप्रैल, 2012 से लागू होगी। अतः [illegible] द्विवार्षिक मूल्यांकन सूची दिनांक 01.04.2012 से प्रभावी मानी जायेगी।

क्र0सं0	तहसीलवार/क्षेत्र भूमि का विवरण	वर्ष 2011–12 एवं वर्ष 2012–13 हेतु प्रस्तावित दरें प्रति नाली अर्थात (0.020 हे0)
1	2	3
	तहसील चमोली	
	चमोली-गोपेश्वर शहरी क्षेत्र (नगरपालिका क्षेत्र)	
	1. (अ) गोपेश्वर, पपड़ियाणा व पाडुली (सम्पूर्ण क्षेत्र)	
	अ– मोटर मार्ग के दोनों ओर 10 मीटर तक	रू0 2,79,500.00
	ब– मोटर मार्ग के दोनों तरफ 11 से 50 मीटर तक	रू0 2,58,000.00
	स– मोटर मार्ग के दोनों तरफ 50 मीटर से बाहर की सम्पूर्ण भूमि	रू0 2,58,000.00
	(ब) कोठियालसैंण, रामपुरचक पाडुली, चमनाऊ, कोठियालगांव, ग्वीलों, क्षेत्रपाल, भूमल्ला, लग्गा खनुरी (सम्पूर्ण क्षेत्र)	
	अ– मोटर मार्ग के दोनों ओर 10 मीटर तक	रू0 1,56,000.00
	ब– मोटर मार्ग के दोनों तरफ 11 से 50 मीटर तक	रू0 1,44,000.00
	स– मोटर मार्ग के दोनों तरफ 50 मीटर से बाहर की सम्पूर्ण भूमि	रू0 1,44,000.00
	(स) ग्राम गंगोलगांव, सगर, चन्दकोटी	
	अ– मोटर मार्ग के दोनों ओर 10 मीटर तक	रू0 1,04,000.00
	ब– मोटर मार्ग के दोनों तरफ 11 से 50 मीटर तक	रू0 96,000.00
	(द) गोपेश्वर मण्डल तथा गोपेश्वर–देवरखडोरा मोटर मार्ग	
	अ– मोटर मार्ग के दोनों ओर 10 मीटर तक	रू0 1,04,000.00
	ब– मोटर मार्ग के दोनों तरफ 11 से 50 मीटर तक	रू0 96,000.00
	क्रमांक (स) व (द) में उल्लिखित ग्रामों की मोटर मार्ग से 50 मीटर दोनों तरफ [illegible]	
	सिंचित	[illegible]
	असिंचित	[illegible]

ग्रामीण क्षेत्र–

(अ) 1–नौरख (पीपलकोटी बाजार क्षेत्र) व अगथला

अ– मोटर मार्ग के दोनो ओर 10 मीटर तक — रू0 1,95,000.00

ब– मोटर मार्ग के दोनों तरफ 11 से 50 मीटर तक — रू0 80,000.00

स– मोटर मार्ग के 50 मीटर से बाहर — रू0 1,80,000.00

सिंचित– — रू0 52,000.00

असिंचित– — रू0 36,000.00

(ब) रौलीखाड, मायापुर गडेरा, बादुला नागबगड उर्फ फरखेत, धरगाव लग्गा उस्तोली, धोलाचक उस्तोली, कुन्तरी लग्गा फाली, कुमारतोली, नन्दप्रयाग, पुरसाडी, मैठाणा, रौपा (कुहेड), गोलिम (बाजपुर), बिरही

अ– मोटर मार्ग के दोनों ओर 10 मीटर तक — रू0 10,500.00

ब– मोटर मार्ग के दोनो तरफ 11 से 50 मीटर तक — रू0 02,000.00

स– मोटर मार्ग के 50 मीटर से बाहर सम्पूर्ण भूमि — रू0 97,750.00

(स) कांपेश्वर, पोखरी–नन्दप्रयाग, नन्दप्रयाग–मासी, नन्दप्रयाग–घाट, घाट–लुणतरा, घाट–बाजबगड, घाट–सितेल, घाट–भेंटी, बिरही–निजमूला कोटियालसैंण–सैंकोट, चमोली–मठ, छिनका, थिरपाक–काण्डई–सेभा–बैरासकुण्ड

अ मोटर मार्ग के दोनों ओर 10 मीटर तक — रू0 78,000.00

ब– मोटर मार्ग के दोनों तरफ 11 से 50 मीटर तक — रू0 72,000.00

(द) क्रमांक (ब) क्रमांक (स) में उल्लिखित ग्रामों की मोटर मार्ग से 50 मीटर बाहर की सम्पूर्ण भूमि

सिंचित — रू0 78,000.00

असिंचित — रू0 72,000.00

उपरोक्त के अतिरिक्त तहसील अन्तर्गत अन्य ग्रामों की भूमि के लिये

सिंचित– — रू0 52,000.00

असिंचित– — रू0 30,000.00

तहसील जोशीमठ

नगरपालिका क्षेत्र जोशीमठ

(अ) जोशीमठ अपर बाजार, लोअर बाजार, सिंहधार मोटर मार्ग

अ– मुख्य सड़क मार्गों के दोनो ओर 10 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए — रू0 2,60,000.00

ब– मुख्य सड़क मार्गों के दोनों ओर 11 से 50 मीटर अन्तर्गत सभी प्रकार की भूमि के लिए — रू0 2,40,000.00

(ब) ग्राम जोशीमठ अपर बाजार लोअर बाजार तथा सिंह धार मोटर मार्ग से 50 मीटर बाहर पड़ने वाली भूमि के लिए–

ग्राम जोशीमठ की सभी प्रकार की भूमि के लिए — रू0 1,50,000.00

नगर पालिका की सभी प्रकार की भूमि के लिए — रू0 90,000.00

	(य) ग्राम औली लगा जोशीमठ, औली लगा सलधुरा औली लगा परसारी, औली लगा रविग्राम की सभी प्रकार की भूमि के लिए-	रू0 2,00,000.00
	अधिसूचित क्षेत्र बदरीनाथ	
2	(अ) ग्राम बदरीनाथ एवं बामणी की सभी प्रकार की भूमि के लिए-	रू0 5,00,000.00
	(ब) ग्राम माणा की सभी प्रकार की भूमि के लिए-	रू0 1,20,000.00
	तहसील जोशीमठ के मोटर मार्ग के समीप पड़ने वाले ग्रामों के लिए-	
3	(अ) ग्राम पाखी, जलग्वाड, टगणा तल्ला, मल्ला, नौलाग्वाड, लगासी, गुलाबकोटी, हेलंग, पैनी, सलंग, बड़गांव, मेरग, परसारी, पनुली, बेला, चमतोली, पस्फ तल्ला, मल्ला तपोवन, रैणी, रैणी चक लाता, तोलमा, पगरासू, जुम्मा, जेलम, कोषा, मलारी, वाई तथा सौफ, सहमपुरी, कैलाशपुर, गुरगुटी, देवल चक गुरगुटी, फरकियाग्वाड, बाम्पा, गमशाली, अरूडी, पटुडी, लामबगड़, हनुमानचट्टी।	
	अ- मुख्य सड़क मार्गों के दोनों ओर 10 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 65,000.00
	ब- मुख्य सड़क मार्गों के दोनों ओर 11 से 50 मीटर अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 60,000.00
	(ब) तहसील जोशीमठ मोटर मार्ग के समीप पड़ने वाले ग्रामों के लिए	
	ग्राम बड़ागांव, मेरग, कुण्टी खोला, टाक विरागए, तपोवन, रैणी, रैणी चक सुनाई, रैणी चक लाता, तोलमा, पगरासू, जुम्मा, जेलम, कोषा, मलारी, कैलाशपुर, गुरगुटी, देवल चक फरकिया ग्वाड, बाम्पा, गमशाली मोटर मार्ग से 50 मीटर बाहर के ओर की सभी भूमि के लिए	रू0 15,000.00
	मोटर मार्ग से बाहर के ग्रामों के लिए-	
	यथा- क्रमांक 3 (अ) व 3 (ब) पर उल्लिखित मोटर मार्ग से 50-50 मीटर बाहर के क्षेत्र के ग्रामों के लिए-	
	सिंचित-	रू0 25,000.00
	असिंचित-	रू0 18,000.00
	पाण्डुकेश्वर (गोविन्दघाट)	
5	अ- मुख्य सड़क मार्गों के दोनों ओर 10 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 1,30,000.00
	ब- मुख्य सड़क मार्गों के दोनों ओर 11 से 50 मीटर अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 1,20,000.00
	स- मोटर मार्ग से 50 मीटर बाहर की सभी भूमि पर	रू0 72,000.00
	तहसील पौखरी	
	अविकसित शहरी क्षेत्र ग्राम	
	अ ग्राम सभोगाड़	

	कर्णप्रयाग–केदारनाथ मार्ग–	
	(अ)– मोटर मार्ग से 10 मीटर तक	रू0 1,30,000.00
	(ब)– मोटर मार्ग के 11 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 1,20,000.00
	ब– पोखरी ग्राम देवरतल्ला, पल्ला देवस्थान मयाणी व गुनियाला, विशाल	
	कर्णप्रयाग पोखरी मोटर मार्ग	
	(अ)– मोटर मार्ग से 10 मीटर तक	रू0 93,600.00
	(ब)– मोटर मार्ग के 11 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 86,400.00
2.	पोखरी–कर्णप्रयाग, पोखरी–रूद्रप्रयाग, पोखरी–गोपेश्वर, पोखरी–बीणा मोटर मार्ग के मध्य में से 50 मीटर दूरी तक स्थित ग्रामों के लिये–	रू0 72,000.00
	पोखरी–कर्णप्रयाग, पोखरी–रूद्रप्रयाग, पोखरी–गोपेश्वर, पोखरी–बीणा मोटर मार्ग के दोनों ओर 50 मीटर तक	
	सिंचित–	रू0 24,000.00
3.	असिंचित–	रू0 18,000.00
	उक्त के अतिरिक्त तहसील के अन्य ग्रामों के लिये–	
	सिंचित–	रू0 21,600.00
	असिंचित–	रू0 18,000.00
	तहसील कर्णप्रयाग	
	टाउन एरिया कर्णप्रयाग (अर्द्ध शहरी क्षेत्र)	
	(अ) कर्णप्रयाग एवं भेडगाव की सभी प्रकार की भूमि के लिए–	
1	अ– मुख्य सडक मार्गों से 10 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 3,40,600.00
	ब– मुख्य सडक मार्गों से 11 से 50 मीटर अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 3,14,400.00
	टाउन एरिया गोचर (अर्द्ध शहरी क्षेत्र)	
	(अ) ग्राम पनाई तल्ली, मल्ली, रावल नगर तल्ला, रावल नगर मल्ला, भटटनगर, धल्ली लगा भटटनगर की सभी प्रकार की भूमि के लिए–	
	अ– मुख्य सडक मार्गों से 10 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 3,26,950.00
2	ब . मुख्य सडक मार्गों से 11 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 3,01,600.00
	ग्रामीण क्षेत्र	
	(ब) ग्राम बसन्तपुर, रणसरा एवं शेल की भूमि के लिये–	
	सिंचित–	रू0 76,800.00
	असिंचित–	रू0 66,400.00
	तहसील कर्णप्रयाग मे मार्ग पर पड़ने वाले मुख्य मार्गो के	
	लाभ के लिये–	

	(अ) ग्राम कमेडा, झिरकोटी, [illegible], [illegible], [illegible], उत्तरों, [illegible], नौली तल्ली अ— मुख्य सड़क मार्ग से 0 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 1,21,200.00
3	(ब) ग्राम बगोली नौली, पिपलसैण, [illegible] [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], सोनला सिमली अ— मुख्य सड़क मार्ग 0 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रू0 1,05,000.00
	(स) क्रमांक—3 (ब) में उल्लिखित मोटर मार्ग के दोनों ओर 50—50 मीटर बाहर की भूमि के लिए—	रू0 46,200.00
4	तहसील कर्णप्रयाग के अन्तर्गत कनखुल, नैनीसैंण, बगोली—कोटी, गौचर—सिदौली, सोनला—कण्डारा—मैखुरा, सिमली—बैनीताल, सिमली—उज्जवलपुर, कर्णप्रयाग—नौटी के दोनों ओर 50—50 मीटर भूमि के लिए—	रू0 43,200.00
5	(अ) क्रमांक—3 (अ) के अतिरिक्त रा0 राजमार्ग स्थान कमेडा से सोनला तक मोटर मार्ग पर पड़ने वाली 50 मीटर बाहर की भूमि के लिए (ब) तहसील कर्णप्रयाग के अन्य ग्रामों क्रमांक—4 पर अंकित मोटर मार्गों से 50 मीटर बाहर स्थित भूमि के लिए - सिंचित— असिंचित—	 रू0 19,500.00 रू0 17,500.00
	तहसील थराली	
1	1—तहसील थराली के मोटर मार्ग पर पड़ने वाले ग्राम केवरतल्ला, पन्ती, कुलसारी, देवराडा, थराली, ग्वालदम, [illegible] मार्ग के 10 मीटर तक दोनों ओर स्थित भूमि— 2. मोटर मार्ग के 11 मीटर से 50 मीटर तक 3. उक्त क्रमांक—1 के ग्रामों से 50—50 मीटर बाहर की भूमि के लिए— सिंचित— असिंचित—	 रू0 50,000.00 रू0 48,000.00 [illegible]
2	1— तहसील के अन्तर्गत मोटर मार्गों पर पड़ने वाले [illegible] [illegible] [illegible], [illegible], [illegible] [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible] गडेरा [illegible] [illegible] [illegible] [illegible] की मोटर मार्ग के 10 मीटर तक दोनों ओर स्थित भूमि— 2— मोटर मार्ग के 11 मीटर से 50 मीटर तक 3— मोटर मार्ग के 50 मीटर सम्पूर्ण भूमि	रू0 45,500.00 रू0 [illegible]2,000.00 रू0 [illegible]0,250.00

3- तहसील के अन्तर्गत अन्य ग्रामों की भूमि- ...00.00
सिंचित- ...000.00
असिंचित-

तहसील गैरसैंण

1	तहसील गैरसैंण के अन्तर्गत कर्णप्रयाग- रानीखेत मोटर मार्ग के दोनों ओर की गैड (गैरसैंण) ...की भूमि के लिए अ- मोटर मार्ग से 10 मीटर भीतर ब- मोटर मार्ग के 11 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रु0 ...700.00 रु0 1,66,800.00
2	अर्द्धशहर के रूप में विकसित हो रहे स्थान जैसे आदिबद्री, मेहलचौरी, पाण्डुवाखाल (रगचोडा) की समस्त भूमि के लिये- अ- मोटर मार्ग से 10 मीटर भीतर ब- मोटर मार्ग के 11 से 50 मीटर के अन्तर्गत सभी प्रकार की भूमि के लिए	रु0 1,17,000.00 रु0 1,04,000.00
3	(क) कर्णप्रयाग-रानीखेत मोटर मार्ग पर पड़ने वाले क्रमांक 1 व 2 पर अंकित ग्रामों को छोड़कर समस्त ग्रामों के लिए मोटर मार्ग की भूमि के लिए अ- मोटर मार्ग से 50 मीटर तक ब- मोटर मार्ग से 50 मीटर से बाहर सभी प्रकार की भूमि के लिए	रु0 1,01,000.00 रु0 71,500.00
4.	क्रमांक-01, 02 व 03 में अंकित ग्रामों को छोड़कर तहसील की अन्य समस्त ग्रामों की भूमि के लिए सिंचित- असिंचित-	रु0 26,950.00 रु0 18,700.00

1 तहसील जोशीमठ क्षेत्रान्तर्गत क्रमांक 2 के (अ) पर श्री बद्रीनाथ धाम में 150 गुना ... नाली दरों की वृद्धि इस आशय से की गयी है, कि श्री बद्रीनाथ धाम में बाजारी ... अधिक है, तथा सर्किल रेट कम होने से राजस्व ... को देखते हुये वर्तमान में सर्किल रेट में बाजारी मूल्य को दृष्टिगत रखते हुये वृद्धि की जानी आवश्यक है। भविष्य में बद्रीनाथ धाम में मास्टर प्लान लागू किया जाना है।

2 शासनादेश दिनांक 24.06.2011 के प्रस्तर-08 के सम्बन्ध में स्पष्ट करना है कि ... लोक निर्माण विभाग द्वारा ... अन्तर्गत बहुमंजिले भवनों की बिक्री, दरों के अनुसार ... बनाया जायेगा तथा भविष्य में जो दर निर्धारित की गयी है, उन दरों को ही आधार ... होगी, वही प्रभावी होगी।

3 उ0प्र0 वित्त निगम, उ0प्र0 आवास विकास परिषद ... प्राधिकरण ... अन्य राजकीय संस्थाओं द्वारा ... परिसम्पत्तियों हेतु ... निर्धारित ... मूल्य ही बाजार ... [illegible]

(5)

जनपद अन्तर्गत उ0प्र0 वित्त निगम, उ0प्र0 आवास विकास परिषद, विकास प्राधिकरणों, सिडकुल तथा राजकीय संस्थाओं की कोई परिसम्पत्तियाँ नहीं हैं।

4. यदि कोई भूमि दो या दो से अधिक मार्गों के मध्य स्थित है तो ऐसी दशा में जिस मार्ग का मूल्य अधिक होगा उसी आधार पर भूमि का मूल्यांकन किया जायेगा तथा उसी के अनुसार स्टाम्प शुल्क देय होगा।

5. बंजर भूमि, वन भूमि व वन पंचायत की भूमि के लिये मूल्यों का निर्धारण प्रत्येक तहसील में वर्णित स्थानों की असिंचित तथा जिन शहरों के ग्रामों, स्थानों पर सब प्रकार की भूमि का मूल्य एक ही दर पर निर्धारित किया जाता है, के न्यूनतम दर के अनुसार मूल्य आंका जायेगा।

6. उप निबन्धक लेख पत्रों का पंजीकरण करने से पूर्व पटवारी द्वारा दिये गये मौके खसरे का उद्धरण के साथ–साथ इस आशय का प्रमाण पत्र भी प्रस्तुत करें कि विक्रय भूमि पर कोई भवन, वृक्ष आदि तो नहीं है। इस आशय का प्रमाण पत्र/शपथ पत्र भी पक्षकारों से प्राप्त करेंगे, जिससे किस्म जमीन का निर्धारण हो।

दिनांक -- 31 मार्च, 2012

(डा0 रंजीत कुमार सिन्हा)
जिलाधिकारी,
चमोली।

कार्यालय: जिलाधिकारी, चमोली।

संख्या–4614/पाँच–03 (2008–2009) दिनांक गोपेश्वर, 31 मार्च, 2012

प्रतिलिपि– ~~निम्नांकित~~ को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:

1. प्रमुख सचिव, उत्तराखण्ड शासन, वित्त अनुभाग–9, देहरादून।
2. आयुक्त कर, उत्तराखण्ड शासन, देहरादून।
3. महानिरीक्षक, निबन्धन, उत्तराखण्ड, देहरादून।
4. सचिव, कर एवं [illegible] उत्तराखण्ड, देहरादून।
5. जिला निबन्धक, चमोली।
6. समस्त उप जिलाधिकारी, जनपद चमोली।
7. समस्त तहसीलदार/उप निबन्धक, जनपद चमोली।
8. जिला निबन्धक, जनपद पौड़ी एवं रूद्रप्रयाग।

डा0 रंजीत कुमार सिन्हा
जिलाधिकारी
चमोली।

धौली गंगा के निकट जेलम–तमक जल विद्युत परियोजना (108 मेगावाट) के निर्माण हेतु सगरत ढॉचागत,(बॉध,विद्युत गृह,सुरंग,मलवा निस्तारण,राडक, भवन आदि) कार्यो के लिए 88.290 हेक्टेयर सिविल/आरक्षित वन भूमि हस्तान्तरण प्रस्ताव।

परियोजना का नाम :– जेलम – तमक (108 मेगावाट) जल विद्युत परियोजना

प्राकलन बावत एन0पी0वी0 की धनराशि

कार्यालय उप वन संरक्षक नन्दादेवी राष्ट्रीय पार्क, जोशीमठ

क्र0 सं0	याचित आरक्षित वन एवं सिविल वन भूमि का कुल क्षेत्रफल	ईको क्लास	एन0पी0वी0 की धनराशि की दर (रू0 प्रति हे0) मे।	एन0पी0वी0 की कुल धनराशि
1	88.29 हे0	VI	8.97 लाख प्रति हे0	रू0 7,91,96,000.00
		Dense Forest	कुल योग	रू0 7,91,96,000.00

हे0/–
अनुभाग अधिकारी

हे0/–
वन क्षेत्राधिकारी
जोशीमठ रेंज
जोशीमठ।

हे0/–
प्रभागीय वनाधिकारी
नन्दादेवी राष्ट्रीय पार्क
जोशीमठ (चमोली)

CENTRAL-EMPOWERED COMMITTEE

(CONSTITUTED BY THE HON'BLE SUPREME COURT OF INDIA
IN WRIT PETITION (CIVIL) No. 202/95 & 171/96)

IInd Floor, Chanakya Bhawan, Chanakyapuri, New Delhi 110021, Tel. 26884221,26884923, 24101926, FAX No. 24101925

File No. 1-26/CEC/SC/2008-Pt.XXIX Dated 22nd December, 2008

To

The DGF &SS
Ministry of Environment & Forests
Paryavaran Bhawan
CGO Complex, Lodhi Road
New Delhi 110003

Sub: Clarification on NPV for the minimum rate in case of Wind Energy as per the Hon'ble Supreme Court's order dated 24.4.2008.

Sir,

Please refer to FC Division letter No. 7-17/2008-FC(Pt.) dated 16.12.2008 on the above subject. Pursuant to the order of the Hon'ble Supreme Court, for the Wind Energy Projects NPV is payable at the rate of the 50% of the minimum rate of the NPV, irrespective of the eco-class in which the project lies.

Yours faithfully,

(M.K.Jiwrajka)
Member Secretary

(132)

Certified to be true copy
Assistant Registrar (Judl.)
Supreme Court of India

184026

IN THE SUPREME COURT OF INDIA

CIVIL ORIGINAL JURISDICTION

I.A. Nos. 826 IN 566 WITH 955 IN 566, 958, 985, 1001-1001A, 1013-14, 1016-1018, 1019, 1046, 1047, 1135-1136, 1164, 1180-1181, 1182-1183, 1196, 1208-1209, 1222-1223, 1224-1225, 1229, 1233 IN 1135-1136, 1248-1249, 1253, 1301-1302, 1303-1304, 1312, 1313, 1314, 1318, 1319 IN 1137, 1325, 1364, 1365-1366, 1370-1370A,1371, 1384, 1385-1386, 1387, 1434, 1435-1437, 1438, 1441 WITH 1634, 1475-1476, 1513, 1573, 1639 IN 1135-1136 IN IA 566, 1664, 1665, 1671, 1676, 1707, 1721, 1779 IN 1164 IN 566, 1785-1786 IN I.A. NO. 1441, 1980-1981, 1993, 2013, 2074-2076, 2077-2078 IN 1441 & 2098 IN 1233 IN 1135-1136, 2145-2146, 2147-2148, 2149-2150 & 2153-2154 IN I.A. 566 IN W.P.(C) NO. 202/1995

T.N. Godavarman Thirumulpad ...Petitioners

Versus

Union of India & Ors. ...Respondents

ORDER

It is an undisputed fact that the forest in this country is an important and vital component to sustain the life support system on this planet. For various reasons, our forest is being slowly depleted.

At the same time, as part of our developmental activities, some areas of the forest have to be used for non-forest purposes. The economic development shall not be at the cost of complete degradation of the forest or the environment and eco-system provided by the green area of the forest. Therefore, it was considered whether the user agency of such land which is required for developmental activities to compensate for the diversion of the forest and on the recommendations of the Central Empowered Committee (hereinafter being referred to as 'CEC'), it was decided by this Court that the user agency shall be required to make payment of net present value(NPV) of such diverted land so as to utilize this for getting back in the long run which are lost by such diversion. A scheme was submitted by Ministry of Environment and Forests(MOEF) alongwith an affidavit dated 22.3.2002. The CEC considered all relevant aspects including the scheme submitted by MOEF and filed a report on 9.8.2002. These reports were accepted by this Court. This Court in T.N. Godavarman Thirumulpad Vs. Union of India 2006(1) SCC 1 finally directed that the question as to what amount of NPV is required to be paid and to achieve these objectives, it was directed that the question is to be examined by experts. A Committee

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comprising of three experts including Mrs. Kanchan Chopra was appointed and this Court gave the following directions:-

(i). to identify and define parameters (scientific, biometric and social) on the basis of which each of the categories of values of forest land should be estimated.

(ii) To formulate a practical methodology applicable to different biogeographical zones of India for estimation of the values in monetary terms in respect of each of the above categories of forest values

(iii) To illustratively apply this methodology to obtain actual numerical values for different forest types for each biogeographical zone in the country.

(iv) To determine on the basis of established principles of public finance, who should pay the costs of restoration and/or compensation with respect to each category of values of forests.

(v) Which projects deserve to be exempted from payment of NPV

On the basis of the directions issued by this Court, a Committee consisting of Mrs. Kanchan Chopra gave a report and the same was examined by the CEC

The report contains detailed study of the relevant factors. The Forest Survey of India, has since last two decades, been undertaking forest cover mapping of the country using satellite data obtained by the NRSA, Hyderabad. The methodology of mapping involves the geo-rectification of the satellite imagery using the Survey of India toposheets followed by the digital interpretation of the same and extensive ground truthing. It was found that the forest cover maps depicts mainly three tree canopy density classes, viz., very dense, moderately dense and open. There were other classifications in the Forest of India and "Champion and Seth" have classified the forests of India into 16 major groups. The major basis of classification included the climate, the soil and the past treatment as these factors determine the vegetation type of a given locality. CEC has classified the forest taking in view the ecological role and value of the forests and for the purpose of the report, 16 major forest types have been

Based on the ecological importance of forest falling in different eco-value and canopy density classes, relative weightage factors have also been taken into consideration. By using these relative weightage factors, the equalized forest area in eco-value Class I and very dense forest corresponding to forest falling in different eco-value and density classes have been compiled. For example 17,997 sq. km. of open forest of Eco-Class IV has been calculated to be equivalent to 7,558 sq km. of very dense forest of Eco-Value Class I. Accordingly, the entire forest area of the country has been calculated and found to be equivalent to 5.2 lakh sq. km. forest area having highest ecological significance as that of forest falling in eco-value Class I with density above 70%.

The net present value per hectare of forest has been fixed based on this data. For calculating the average net percent value per hectare of forest in India, the following monetary value of goods and services provided by the forest have been considered -

(i) Value of timber and fuel wood

(ii) Value of Non Timber Forest Products (NTFP)

(iii) Value of fodder

further grouped into 6 ecological classes depending upon their ecological functions

Eco-Class I - Consisting of Tropical Wet Evergreen Forests, Tropical Semi Evergreen Forests and Tropical Moist Deciduous Forests

Eco- Class II -Consisting of Littoral and Swamp Forests

Eco-Class III -Consisting of Tropical Dry Deciduous Forests

Eco-Class IV -Consisting of Tropical Thorn Forests and Tropical Dry Evergreen Forests

Eco-Class V -Consisting of Sub-tropical Broad Leaved Hill Forests, Sub-Tropical Pine Forests and Sub Tropical Dry Evergreen Forests

Eco-Class VI -Consisting of Montane Wet Temperate Forests, Himalayan Moist Temperate Forests, Himalayan Dry Temperate Forests Sub Alpine Forest, Moist Alpine Scrub and Dry Alpine Scrub

permission from the Hon'ble Court. Such permissions may be considered on payment of an amount equal to ten times in the case of National Parks and five times in the case of Sanctuaries respectively of the NPV payable for such areas. The use of non-forest land falling within the National Parks and Wildlife Sanctuaries may be permitted on payment of an amount equal to the NPV payable for the adjoining forest area. In respect of non-forest land falling within marine National Parks / Wildlife Sanctuaries, the amount may be fixed at five times the NPV payable for the adjoining forest area;

(iii) these NPV rates may be made applicable with prospective effect except in specific cases such as Lower Subhanshri Project, mining leases of SECL, Field Firing Ranges, wherein pursuant to the orders passed by this Hon'ble Court, the approvals have been accorded on lump-sum payment / no payment towards the NPV; and

(iv) for preparation and supply of district level maps and GPS equipments to the concerned State / UT Forest Departments and the regional offices of the MoEF, the Ad-hoc CAMPA

economists and it was of the view that the social discount rate should be around 2% in India. We do not find much force in the contention advanced by the learned Counsel who appeared for the user agents. The 10% suggested by them cannot be applied to the present case because 10% is the rate linked to assumptions about the opportunity cost of capital. One cannot apply that rate for social time preference in evaluating the benefits from an environmental resource such as forests. In project evaluation, the horizon is compatible with the life of the project whereas in forest matters, the horizon spans over several generations. Therefore, the rate of 10%, as suggested by the user agency cannot be accepted.

Another contention raised by the applicant(FIMI) is that the NPV is not fixed on site specific and, therefore, the fixation of the rate is based on surmises and conjectures and the same rate cannot be applied to the large extent of area covered by the forests. This question was elaborately considered by the CEC. Considering the large extent of this country and the forest being spread over in various parts of the State, it is difficult to fix the NPV based on the specific area. It is not feasible to fix NPV in each and every individual

may be asked to provide an amount of Rs 1.0 crore to the Forest Survey of India out of the interest received by it.

Ministry of Environment and Forests also has filed its response and has accepted the recommendations made by CEC. Various user agencies have filed its objections. We heard the learned senior Counsel Mr. Nariman and other learned senior Counsel who appeared before us. The main contention raised is that the NPV value was fixed on the basis of the net flow accruing over 20 years at a 5% social discount rate. This, according to the applicants, is too low. It has been contended that the Economic and Research Department of the Asian Development Bank is of the view that a survey of the social discount rate policies of individual countries show significant variations and the developing countries apply higher social discount rate. The paper published by Asian Development Bank shows that India should have a social discount rate of 12%. It may be noted that the Expert Committee under the leadership of Mrs. Kanchan Chopra recommended 5% social discount rate but the CEC has reduced further and accepted 4% social discount rate. It may be noted that the CEC had made consultation with eminent

Enclosure – III

(1973)

प्राक्कलन वावत :– जेलम–तमक (108 मेगावाट क्षमता) जल विद्युत परियोजना के निर्माण कार्य हेतु हस्तान्तरित होने वाली 88.29 है0 वन भूमि का टीएचडी0सी को हस्तान्तरण प्रस्ताव – कार्य का नाम:– 1000 पौध वृक्षारोपण रेंज–जोशीमठ

प्रभाग–नन्दादेवी राष्ट्रीय पार्क जोशीमठ। वर्ष 2012–12

क0स0	कार्य विवरण	मात्रा	दर	धनराशि
01	रोड के किनारे पौध रोपण हेतु गढ्ढे खुदान कार्य। (0.60X0.60X0.60) सेमी0	1000 / स0	11.50	11500.00
02	गढ्ढे भरान कार्य (0.60X0.60X0.60) सेमी0।	1000 / स0	6.50	6500.00
03	ट्री गार्ड कय करना। (2.00X2.00 X1.50) सेमी0	1000 / स0	1200.00	120000.00
04	ट्री गार्ड का ढूलान कार्य करना– वाहन द्वारा	1000 / स0	ल0स0	20000.00
05	ट्री गार्ड ढुलान /वाहन में चढाना एवं उतारना	1000 / स0	50.00	50000.00
06	ट्री गार्ड का ढूलानकर फीटिंग कार्य सीमेन्ट मसाले में।	1000 / स0	60.00	60000.00
07	ट्री गार्ड पर पेन्ट कार्य मय मजदूरी सहित।	1000 / स0	50.00	50000.00
	योग:–			306500.00

(रूपये तीन लाख ~~पैसठ हजार~~)

(N.K.S. RAWAT)
FORESTER JOSHIMATH

वन क्षेत्राधिकारी
जोशीमठ रेंज
जोशीमठ।

case. The entire forest area in each of the State/UT is calculated by considering the monetary value of the services provided by it. The average NPV per hectare of the forest area in the State has also been calculated. If NPV is to be calculated on the specific area, the process would be time consuming and in most of the cases, it may be beyond the capability of the Range Forest Officers or other officials posted at the grassroot level. Moreover, the NPV is linked with the type of the forest and no useful purpose would be served by carrying out NPV calculations in each case involving the diversion of forest areas.

We are of the view that the NPV now fixed is more scientific and is based on all available data. We accept the recommendations and we make it clear that the NPV rate now fixed would hold good for a period of three years and subject to variation after three years. The following exemptions have been recommended:-

(i) public works such as schools, hospitals, children play grounds of non-commercial nature and the public welfare

projects such as community centres in rural areas which require forest land upto 2 ha;

(ii) rural infrastructure and basic services such as the construction of the overhead tanks, village roads, etc.

(iii) the minor irrigation projects upto 10 ha. of storage area, municipal water supply projects, drinking water supply pipelines;

(iv) activities necessary for the ecological management; relocation of the villages from the sactruaries and the national parks, regularization of pre-1980 eligible encroachers;

(v) housing for the rehabilitation of tribals; laying of the underground optical fibre cables;

(vi) laying of the pipelines for the underground gas transportation;

(vii) the district and rural roads;

(viii) shifting cultivation;

(ix) roads constructed by Defence in border areas;

(x) construction of the transmission lines.

The above recommendations for exemptions are accepted. If, in any case, exemption is required by nature of the peculiar circumstances of the case, the same would be decided as and when necessary on a case to case basis.

.....CJI
(K.G. BALAKRISHNAN)

.....J.
(DR. ARIJIT PASAYAT)

.....J.
(S.H. KAPADIA)

New Delhi;
March 28, 2008.

payment of NPV, the last part of that order reading *"We are of the view . . . . . (x) construction of the transmission lines"* on pages 10 to 11 shall stand substituted with the following :-

Category	CEC
i) Schools ii) Hospitals iii) Children's play ground of non commercial nature iv) Community centres in rural areas v) Over-head tanks vi) village tanks, vii) Laying of underground drinking water pipeline upto 4 diameter and viii) Electricity distribution line upto 22 KV in rural areas.	Full exemption upto 1 ha. of forest land provided : (a) no felling of trees is involved; (b) alternate forest land is not available; (c) the project is of non-commercial nature and is part of the Plan/Non-Plan Scheme of Government; and (d) the area is outside National Park/Sanctuary
Relocation of villages from the National Parks/Sanctuary to alternate forest land	Full Exemption
Collection of boulders/silts from the river bells in the forest area	Full exemption provided:- (a) area is outside National Park/Sanctuary; (b) no mining lease is approved/signed in respect of this area;

IN THE SUPREME COURT OF INDIA

CIVIL ORIGINAL JURISDICTION

I.A Nos 926 IN 566 WITH 955 IN 566, 958, 985, 1001-1001A, 1013-14, 1016-1018 1019, 1046, 1047, 1135-1136, 1164, 1180-1181, 1182-1183, 1196, 1206-1209, 1222-1223, 1224-1225, 1229, 1233 IN 1135-1136, 1248-1249, 1253, 1301-1302, 1303-1304, 1312, 1313, 1314, 1318, 1319 IN 1137, 1325, 1364, 1365-1366, 1370-1370A,1371, 1384, 1385-1386, 1387, 1434, 1435-1437, 1438, 1441 WITH 1634, 1475-1476, 1513, 1573, 1639 IN 1135-1136 IN IA 566, 1664, 1665, 1671, 1676, 1707, 1721, 1779 IN 1164 IN 566, 1785-1786 IN I.A. NO 1441, 1980-1981, 1993, 2013, 2074-2076, 2077-2078 IN 1441 & 2098 IN 1233 IN 1135-1136, 2145-2146, 2147-2148, 2149-2150 & 2153-2154 IN I.A 566 IN W.P.(C) NO. 202/1995

T.N. Godavarman Thirumulpad ...Petitioners

Versus

Union of India & Ors ...Respondents

ORDER

On 28th March, 2008, we had passed an order regarding payment of Net Present Value (NPV) accepting the recommendations made by CEC which were more or less acceptable to MoEF. In that order we had also indicated that exemptions from payment of NPV have to be granted in respect of certain categories However, it is brought to our notice that certain typographical mistakes had crept in that order as to categories to which such exemptions are to be granted Therefore, we direct that as regards exemptions from

	(c) the works including the sale of boulders/sill are carried out departmentally or through Government undertaking or through the Economic Development Committee or Joint Forest Management Committee; (d) the activity is necessary for conservation and protection of forests; and (e) the sale proceeds are used for protection/conservation of forests
Laying of underground optical fibre cable	Full exemption provided : (a) no felling of trees is involved; and (b) areas falls outside National Park/Sanctuary
Pre-1980 regularisation of encroachments and conversion of forest villages into revenue villages	Full exemption provided these are strictly in accordance with MoEF's Guidelines dated 18.9.1990.
Underground mining	50% of the NPV of the entire area