CHAPTER 1
INTRODUCTION

1.1 WATER RESOURCE PROJECTS

Water is a critical natural resource. Without it, life could not exist and people could not survive. For more than 5,000 years, dams have provided people with a reliable source of the water they need to live. Dams have enabled people to collect and store water when it is plentiful and then use it during dry periods. Dams have been essential in establishing and supporting human establishment and farms, as well as providing food through irrigation of cropland. Today, dams and reservoirs also help control flood waters to protect people and property, keep rivers navigable, provide electricity from renewable energy for towns/villages and factories, and provide recreational opportunities such as fishing, water sports, etc.

Today dams improve the living conditions of the world's population that continues to grow at a rate of more than 100 million people per year. Yet, about 1.5 billion people still do not have access to a reliable source of suitable drinking water and more than two dozen countries do not have enough water to properly sustain their populations. Today more than one billion people are malnourished or starving. In many countries, increased food production is only possible through improved irrigation, which generally depends on diminishing groundwater resources. Therefore, more dams are needed now and into the foreseeable future to improve the management of existing surface water resources.

The availability of energy is essential for the socio-economic development of a region. Today energy is largely supplied by fossil fuels, but these fuels are being depleted and they contribute to air pollution and possibly to climate change. It is clear that we should look for ways to generate electricity without releasing harmful substances in the air. In many countries, hydropower is the only natural energy sources. Hydropower is clean and the production from existing projects can be increased without a harmful impact on the environment. At present, hydropower is the largest renewable source of energy. In other words, hydropower from dams is one of the key sources for providing energy for expanding development.

Dams provide domestic and individual water supply, energy, water for irrigation and industrial use, flood control and recreational opportunities, but there is a cost. Our quest to provide the growing world population with a better life means may change the natural environment if the developmental activities are not carried out in judicious and sustainable manner. People and other forms of life are inevitably affected when dams and reservoirs are built. Developers must avoid or mitigate any environmental and social damage caused by water projects. Historically, the priority was given to meeting people's immediate needs for water and energy. Today, we recognize the importance of the natural environment and the need for long-term protection against pollution.

Hydro-powers share has gradually declined. Therefore, thermal generation, which should generally be used for base load operation, is also being used to meet peaking requirements. This leads to non-optimal utilisation of economic and perishable resources. Only about 28.7% of vast hydel potential of 1,48,701 MW has been tapped so far. The region wise hydro-potential tapped and capacity yet to be developed is given below (Source CEA):

Status of Hydroelectric Potential Development

As on 30.04.2006

Region	Identified capacity as per reassessment study (MW)	Capacity developed (MW)	Capacity under construction (MW)	Capacity developed + under development (MW)	Capacity yet to be developed (MW)
Northern	53395	11070	8129	19199	34196 (64%)
Western	8928	5172	980	6152	2776 (31.1%)
Southern	16458	8964	867	9831	6627 (40.3%)
Eastern	10949	2384	1111	3495	7454 (68.1%)
North-Eastern	58971	1095	2934	4029	54942 (93.2 %
All India	148701	28685	14021	42706	105995 (71.3%)

Source: CEA

Power development in India began with the setting up of small isolated station in 1890s. The first hydroelectric station in India was a 130 KW plant installed in 1897 at Darjeeling. Prior to the attainment of independence in 1947, the growth in power sector in the country was rather slow and by 1950, the aggregate installed generation capacity of the country was only 2300 MW. The share of power generation from hydel sources has decreased every year in India after independence. This has happened basically due to construction of more no. of thermal power projects in comparison to hydel projects. It is imperative that hydel projects are much better for environment compared to thermal or nuclear projects. Many a times, hydel projects create positive impacts and lead to environmental enrichment, which may not be reflected in EIA studies.

Therefore, exploiting the vast hydro potential has been provided extra thrust in the capacity addition plans and has been accorded high priority in our power development plans.

1.1.1 Understanding the Environmental Clearance Process

Environmental clearance from Ministry of Environment & Forests is required for 32 categories of project as per EIA notification and its subsequent amendments. The rational behind listing these projects is environmental damage intensity. However, depending upon size/investment the applicability of our requirement may vary in certain cases. Similarly, certain areas are more degraded and require specific regulation for permitting setting up of any kind of developmental project. MoEF has brought out various notifications regulating setting up projects in these areas.

Ministry of Environment & Forests has grouped 32 categories of projects in five-sub group depending on the similarity of EC process work flow.

These groups are as under:

1. **Industry** (interactive EC process work flow)
2. **Mining** (interactive EC process work flow)
3. **Thermal Power** (interactive EC process work flow)

4. River Valley and Hydro Electric (interactive EC process work flow)

5. Infrastructure and Miscellaneous projects (interactive EC process work flow)

1.2 NEED FOR THE PROJECT

The state of Arunachal Pradesh is situated in the north-eastern region of the country and lies between latitude 26°28' to 29°30' North and longitude 91°31' to 97°30' East. The state shares international boundaries with China along the snow line in the north, with Bhutan in the west and Myanmar in the south-east. The state shares most of its southern boundary with Assam. The state also shares its boundaries with Nagaland for a small stretch on the southern side. The total geographical area of Arunachal Pradesh is 83743 sq km Subansiri, Siang (or, Dihang), Dibang (or, Sikang), Siyom, Kameng, Lohit and Tirap are the major rivers of the state. Arunachal Pradesh has a huge hydro-potential, which is required to be tapped to meet the power demand of the country. As per the studies for the re-assessment of the potential carried out by CEA, Arunachal Pradesh has a probable installed capacity of 66065 MW and hydroelectric potential of Arunachal Pradesh is estimated at 34920 MW at 60% load factor. Dibang river system has a probable hydropower potential of about 10152 MW from 12 identified schemes. These schemes are run of river and storage types. Thus, it is extremely important to harness the hydropower potential of Arunachal Pradesh.

Hydropower is commonly known to be a pollution (water, air and noise) free, renewable and cheap source of energy. Hydropower projects have substantial positive environment impact e.g.

- Assured supply of drinking water and water for irrigation
- Flood moderation
- Improved agricultural produce
- Pisciculture

1.3 DIBANG MULTIPURPOSE PROJECT: HISTORICAL MILIEU

Brahmaputra Board geared up investigation works of Dibang Multipurpose

Project in 2001-02 and the Pre-Feasibility Report (PFR) was prepared by them in March, 2002. As per the PFR, the project comprised of a 263 m high rock fill dam at Munli with upstream concrete face. The project was planned to generate 3000 MW hydropower from a surface powerhouse and also for flood moderation at downstream.

Brahmaputra Board continued the survey and investigation works for preparation of Detailed Project Report. During a review meeting held in office of Chairman, Central Water Commission (CWC) on 21.11.02, where representatives from Brahmaputra Board, Ministry of Water Resources and NHPC were present, it was decided that NHPC would take up the work of drilling and drifting required for preparation of Detailed Project Report.

Subsequently Dibang Multipurpose Project was transferred to NHPC by Ministry of Water Resources vide F No. 24/2(D)/2001-ER/4972-77 dt. 20.12.2002 and order was formally issued to NHPC under section 18A of the Electricity (Supply) Act vide Ministry of Power (MoP) letter no. 22/7/2001-DO (NHPC) dt. December 24th, 2002 to establish, operate and maintain the project. In the letter by Ministry of Water Resources it was also decided that Brahmaputra Board will continue to prepare Detailed Project Report with active involvement of CWC and NHPC.

Accordingly, based on the Pre-Feasibility Report, NHPC had undertaken detailed survey & investigation. Later on after the joint meeting of senior officials/experts of CWC, Brahmaputra Board and NHPC, the project data was reviewed by the above team and the present dam axis was fixed at 460 m downstream of the earlier investigated dam axis and also it was proposed to make the power house underground inside a hill on right bank of River Dibang near the dam, thereby reducing the tunnel length considerably. Subsequently further investigation activities were taken up on the new dam axis and in power house area. In the meantime the work of preparation of Detailed Project Report was also entrusted by Ministry of Water Resources to NHPC including the design of the project independently vide F No-24/4/D/2004-ER/93-97 dt. 7th Jan 2005.

Dibang Multipurpose Project (3000 MW) is being conceived on River Dibang which originates from snow covered southern flank of the Himalayas close to Tibet border at an altitude of more than 5000 M. The river emerges from the hills and enters sloping plain area near Nizamghat in Arunachal Pradesh, from where the river flows a distance of 50 Km. to meet the river Lohit. The total catchment area of Dibang up to the dam site is 11276 sq km which lies entirely in India. The Project is located in Lower Dibang Valley district of Arunachal Pradesh and its site is found to be a good combination of geological and topographical features for development of hydro-potential, with negligible R&R problems and no submergence of archaeological/other installations. However, the project area is extremely remote & inaccessible. The reservoir created behind Dam will provide flood moderation benefit in the down stream. The back water in the reservoir will travel up to a length of 43 km in Dibang river and its various tributaries - Airi Pani, Ilu Pani, Imu Pani, Ahi river, Ithun river, Emra river etc. which will facilitate promotion of navigation by connecting inaccessible upstream villages/areas. The Project after construction will be one of the biggest projects in terms of generation of power in India. The project headquarters is proposed to be at Pathar Camp on the right bank of river Dibang approximately 6 km downstream of dam site. The project has a poor connectivity from the railhead and the nearby towns (viz. Tinsukia, Dibrugarh, Pasighat, Itanagar, Tezpur etc.). The project is about 43 km from Roing which is at a distance of 110 km from Tinsukia the nearest railhead. Airport at Mohanbari (Dibrugarh) is further 45 km from Tinsukia.

Boosting up of electricity generating capacity is an urgent national need, because of the growing power demand year by year. NE region has huge hydel potential for electricity generation and also has the advantage of exporting the same to other SAARC/South Asian Countries due to its strategic location.

The salient features of the project are given in Table 1.1. Layout plan of the project is presented in Annex 1.1.

Table 1.1: Salient Features of the Project

1. LOCATION

❑ STATE	:	ARUNACHAL PRADESH
❑ DISTRICT	:	LOWER DIBANG VALLEY DISTRICT
❑ RIVER	:	DIBANG / TANGON
❑ DAM SITE	:	1.5 km U/S OF CONFLUENCE OF ASHUPANI WITH DIBANG
		LATITUDE : 28°20'07" N
		LONGITUDE : 95°46'38" E
❑ NEAREST BG RAIL HEAD	:	TINSUKIA/ DIBRUGARH
❑ NEAREST AIRPORT	:	DIBRUGARH

2. HYDROLOGY

❑ CATCHMENT AREA	:	11276 km^2.
❑ LOCATION OF CATCHMENT		
❑ LATITUDE	:	28°11' 50" N TO 29°25' 59" N
❑ LONGITUDE	:	95°14' 47" E TO 96°36' 49" E
❑ AVERAGE ANNUAL RAINFALL	:	4405 mm
❑ MAXIMUM TEMPERATURE	:	45° C
❑ MINIMUM TEMPERATURE	:	2° C

3. RESERVOIR

❑ MAXIMUM WATER LEVEL (MWL)	:	EL 548 m
❑ FULL RESERVOIR LEVEL (FRL)	:	EL 545 m
❑ MIN. DRAW DOWN LEVEL (MDDL)	:	EL 490 m

❑ GROSS STORAGE		
- AT MWL	:	3850.3 Mcum
- AT FRL	:	3748.21 Mcum
- AT MDDL	:	1983.89 Mcum
❑ AREA UNDER SUBMERGENCE AT FRL	:	40.09 km^2
❑ LENGTH OF RESERVOIR	:	43 km

4. DIVERSION TUNNEL

❑ NUMBER	:	5
❑ SIZE	:	12.0 m DIAMETER
❑ SHAPE	:	HORSESHOE
❑ LENGTH	:	1175 m TO 1325 m
❑ DIVERSION CAPACITY	:	8680 m^3/sec
❑ HEIGHT OF U/S RCC COFFER DAM (OVERFLOW PORTION)	:	25 m (Above RBL)
❑ HEIGHT OF D/S COFFER DAM	:	7 m (Above RBL)

5. CONSTRUCTION SLUICE

❑ NUMBER	:	6
❑ SIZE (W X H)	:	4 m x 5 m
❑ CREST LEVEL	:	EL 300 m

6. DAM

❑ TYPE	:	CONCRETE GRAVITY DAM
❑ TOP ELEVATION OF DAM	:	EL 550.00 m
❑ HEIGHT OF DAM ABOVE DEEPEST FOUNDATION LEVEL	:	288 m
❑ LENGTH OF DAM AT TOP	:	816.3 m

6.1 SPILLWAY

- DESIGN FLOOD : 19000 m^3/sec
- TYPE : ORIFICE TYPE
- CREST ELEVATION

LOWER LEVEL : EL 455 m

UPPER LEVEL : EL 500 m

- NUMBER & SIZE OF SPILLWAY OPENING

LOWER LEVEL

NUMBER : 7

SIZE (W x H) : 6 m x 8 m

UPPER LEVEL

NUMBER : 4

SIZE (W x H) : 9 m x 12 m

- ENERGY DISSIPATION : SKI JUMP
- LENGTH OF SPILLWAY : 154.0 m

7. HEAD RACE TUNNEL INTAKE

- INVERT LEVEL : EL 465.00 m
- NUMBER : 6
- SIZE OF GATE OPENING : 8.0 m x 9.0 m
- TRASH RACK : INCLINED TYPE

8. HEAD RACE TUNNEL

- NUMBER : 6
- SIZE : 9 m DIAMETER
- SHAPE : HORSESHOE
- LENGTH (VARYING FROM) : 300 m TO 600 m

- DESIGN DISCHARGE : 237.80 m^3/sec

9. PRESSURE SHAFT

- NUMBER : 6
- SHAPE : CIRCULAR
- DIAMETER : 7.5 m
- HEIGHT : 184.8 m

10. MIV CAVERN

- CAVERN SIZE : 15 m(W) x 23.5 m(H) x 277.8 m(L)
- MIV DIAMETER : 4.75 m

11. POWER HOUSE CAVERN

- TYPE : UNDERGROUND
- INSTALLED CAPACITY : 3,000 MW
- NUMBER OF UNITS : 12
- POWER HOUSE CAVERN SIZE : 24.5 m(W) x 54.8 m(H) x 356.8 m (L)
- TYPE OF TURBINE : FRANCIS
- NET RATED HEAD : 233 m

12. DRAFT TUBE GATE CUM TRANSFORMER CAVERN

- CAVERN SIZE :17 m (W) x 20.5 m (H) x 295.8 m (L)
- DRAFT TUBE GATE SIZE : 2 NOS. EACH OF 4.5 m x 7.1 m WITH CENTRAL PIER OF 2.0 m

13. TAIL RACE TUNNEL

- NUMBER : 6
- SIZE : 9 m DIAMETER
- SHAPE : HORSESHOE

❑ LENGTH	:	320 m TO 470 m
❑ DESIGN DISCHARGE	:	237.80 m^3/sec

14. POTHEAD YARD AND GIS

❑ SIZE AND ELEVATION	:	300 m x 100 m AT EL 310.0 m

15. ACCESS TUNNELS/ ADITS

❑ SIZE AND SHAPE	:	9.0 m / 6.5 m DIA D-SHAPED
❑ TOTAL LENGTH	:	3200 m

16. POWER GENERATED

❑ INSTALLED CAPACITY	:	3000 MW
❑ ANNUAL ENERGY GENERATION IN 90% DEPENDABLE YEAR		
WITH RULE CURVE	:	12270 MU
WITHOUT RULE CURVE	:	13194 MU
❑ ANNUAL ENERGY GENERATION IN 50% DEPENDABLE YEAR		
WITH RULE CURVE	:	13904 MU
WITHOUT RULE CURVE	:	14925 MU

17. PROJECT COST

❑ TOTAL COST (AT NOVEMBER 2005 PRICE LEVEL)		
WITH COST OF EXTERNAL ROAD	:	Rs. 14530.48 CRORES
WITHOUT COST OF EXTERNAL ROAD	:	Rs. 13854.22 CRORES
❑ COST OF GENERATION AT BUS BAR PER UNIT (INCLUDING 12% STATE SHARE AND 14% RETURN ON EQUITY		
WITH COST OF EXTERNAL ROAD		

WITH FLOOD MODERATION	:	Rs. 2.12
WITHOUT FLOOD MODERATION	:	Rs.1.97

WITHOUT COST OF EXTERNAL ROAD

WITH FLOOD MODERATION	:	Rs. 2.02
WITHOUT FLOOD MODERATION	:	Rs.1.87

1.4 ENVIRONMENTAL MANAGEMENT

Water Resources of India are contributing to the prosperity of the country a lot in general and North-Eastern India in particular through River Valley Developmental Projects.

Concern for environmental pollution is rather a recent phenomenon emerged from the ill-effects of industrial growth through the planning process which somehow overlooked the role of natural resources in developmental activities.

Over the years, the information accumulated in course of working of River Valley Projects, revealed that the River Valley Projects like all other developmental projects, have been beneficial but have some adverse impacts. These impacts must be carefully assessed and balanced for achieving sustained benefits. The objective of environmental impact assessment is to ensure that development proceeds hand-in-had with ecological preservation so as to achieve sustained growth.

The objective of considering environmental aspects as integral part of development projects is to achieve:

- Sustained development with minimum environmental degradation.
- Prevention of long-term environmental side effects by incorporating mitigative measures.

1. 5 PREFERENTIAL ASPECTS OF THE PROPOSED SITE

The present dam site is found to be a good combination of geological and topographical features for development of hydro potential, with negligible R&R problems and no submergence of archaeological / other installations. In addition, its other advantageous points are:

i. Exposed Gneissic rock at dam site
ii. Reasonable distance from Mishimi and Lohit Thrusts
iii. Devoid of any active or significant slides
iv. Topographic stability to accommodate all appurtenances
v. No submergence of mineral resources
vi. Easy availability of construction materials, like quartzite etc., and
vii. Having more storage capacity due to gentle river slope,

1.6 ENVIRONMENTAL IMPACT ASSESSMENT

EIA is a planning tool that is now generally accepted as an integral component of sound decision-making. The objective of EIA is to foresee and address potential environmental problems/concerns at an early stage of project planning and design .EIA/EMP should assist planners and government authorities in the decision making process by identifying the key impacts/issues and formulating mitigation measures. Ministry had issued sectoral guidelines some time ago.

A beginning in this direction was made in our country with the impact assessment of river valley projects in 1978-79 and the scope has subsequently been enhanced to cover other developmental sectors such as industries, thermal power projects, mining schemes etc. To facilitate collection of environmental data and preparation of management plans, guidelines have been evolved and circulated to the concerned Central and State Government Departments. EIA has now been made mandatory under the Environmental (Protection Act, 1986 for 32 categories of developmental activities involving investments of Rs. 100 crores and above. A compendium of the procedures and questionnaires entitled "Application Form and Questionnaire for

Environmental Clearance was published in September, 1999 in association with the Confederation of Indian Industry.

1.7 ENVIRONMENTAL APPRAISAL PROCEDURE

Once an application has been submitted by a project authority along with all the requisite documents specified in the EIA Notification, it is scrutinised by the technical staff of the Ministry prior to placing it before the Environmental Appraisal Committee. The Appraisal Committee, comprising of experts from various fields of environment, evaluates the project proposal and if necessary, site visits or on-the-spot assessment of various environmental aspects are also undertaken. Based on such examination, the Committees make recommendations for approval or rejection of the project, which are then processed in the Ministry for approval or rejection.

In case of site specific projects such as Mining, River Valley, Ports and Harbours etc., a two stage clearance procedure has been adopted whereby the project authorities have to obtain site clearance before applying for environmental clearance of their projects. This is to ensure avoiding areas which are ecologically fragile and environmentally sensitive.

1.8 MONITORING

After considering all the facets of a project, environmental clearance is accorded subject to implementation of the stipulated environmental safeguards. Monitoring of cleared projects is undertaken by the six regional offices of the Ministry functioning at Shillong, Bhubaneshwar, Chandigarh, Bangalore, Lucknow and Bhopal. The primary objective of such a procedure is to ensure adequacy of the suggested safeguards and also to undertake mid-course corrections required, if any. The procedure adopted for monitoring is as follows:

- Project authorities are required to report every six months on the progress of implementation of the conditions/safeguards stipulated, while according clearance to the project.
- Field visits of officers and expert teams from the Ministry and/ or its Regional Offices are undertaken from time to time to collect and

analyse performance data of development projects, so that difficulties encountered are discussed with the proponents with a view to finding solutions.

- In case of substantial deviations and poor or no response, the matter is taken up with the concerned State Government.
- Changes in scope of project are identified to check whether review of earlier decision is called for or not.

1.9 NEED FOR THE EIA STUDY

Like many other developmental activities, the proposed project, while providing planned power generation could also lead to a variety of adverse environmental impacts. However, by proper planning at the inception and design stages and by adopting appropriate mitigatory measures in the planning, design, construction and operation phases, the adverse impacts can be minimized to a large extent, where as the beneficial impacts could be maximized.

The main objective of the EIA study is to assess the positive and negative impacts likely to accrue as a result of the construction and operation of the proposed Dibang Multipurpose Project. A suitable Environmental Management Plans (EMPs) have been suggested to ameliorate the adverse impacts and enhance the positive impacts. A well-designed environmental monitoring programme covering various critical parameters in the project operation phase have also been suggested.

1.9.1 Objectives of the Study

The present study covers:

- Assessment of the existing status of water, land, biological, climatic, socioeconomic, health and cultural component of environment.
- Identification of potential impacts on various environmental components due to activities envisaged during pre-construction, construction, and operational phases of the proposed Hydroelectric Project.

- Prediction of significant impacts on the major environmental components using appropriate mathematical/simulation models.
- Preparation of environmental impact statement based on the identification, prediction and evaluation of impacts.
- Delineation of environmental management plan (EMP) outlining preventive and curative strategies for minimising adverse impacts during pre-construction, construction and operational phases of the proposed project along with the cost and time-schedule for implementation of EMP.
- Formulation of environment quality monitoring programme for construction and operational phases to be pursued by the project proponent.

1.9.2 Details of Work Plan under Each Environmental Component

1.9.2.1 Water Environment

- Study of the regional water resources with respect to their quantity and quality.
- Estimation of possible siltation in the reservoirs, and recommendations on appropriate watershed management practices (e.g. Catchment Area Treatment) for enhancing operational life of impoundage.
- Prediction of changes in water quality due to impoundage.
- Assessment of environmental impacts due to the projects at Dam site, and upstream and downstream of Dam sites through impact networks.

1.9.2.2 Land Environment

- Delineation of land use pattern in the catchment area through the analysis of remote sensing data.
- Identification of critically and severely eroded areas in the catchment.
- Identification of the borrow areas and quarries for extraction of earth and stone materials for construction.

- Identification and enumeration of land areas (Private, Government etc.) likely to be submerged.
- Identification of critical zones, viz. degraded forests, steep slopes, etc. through secondary information and remote sensing data and ground truthing.
- Prediction of loss of forest resources in submergence area.
- Delineation of plans for restoration of excavation and stone quarry areas, land disposal sites with recourse to integrated biotechnological approach.
- Delineation of afforestation and Catchment Area Treatment measures.

1.9.2.3 Biological Environment

Aquatic

- Assessment of biotic resources with special reference to zooplankton, benthos, fishes and avifauna in impact area.
- Identification of fish habitats, monitoring of resident and migratory fishes, assessment of fisheries potential in the reservoir, and requirement of fish ladder.

Terrestrial

- Collection of information on flora and fauna including rare and endangered species in the catchment and submergence areas.
- Identification of forest types and density in catchment and submergence areas, biodiversity and importance value index of the dominant vegetation in the impact region of proposed project.
- Collection of data on wildlife population (including birds), feeding areas, water holes, migratory routes etc. in catchment and submerged areas.
- Assessment of potential impacts on national parks and sanctuaries.
- Assessment of economic value of existing forests in impact area.
- Prediction of impacts on forests due to submergence, and assessment of changes in flora and fauna in the submergence and command areas.

- Prediction of impacts arising out of increase in noise levels, particulate concentration, and fugitive emissions during construction activity.

1.9.2.4 Socio-economic, Health and Cultural Environment

- Collection of baseline data on demography with special reference to occupational patterns, infrastructure resource base, and economy.
- Assessment of information relating to tourism, monuments/sites of cultural, historical, religious, archaeological or recreational importance including wildlife sanctuaries and national parks likely to be impacted by the proposed projects.
- Collection of data on riparian rights of downstream users vis-à-vis proposed water releases.
- Prediction of disruption in social life due to relocation of human settlements, submergence of bridges and roads, and assessment of rehabilitation requirements.
- Prediction of anticipated health problems due to vector borne diseases induced by water impoundage.
- Prediction of health problems related to changes in population density and distribution of immigrant construction workers
- Prediction of economic benefits to community and environment arising out of the proposed projects.
- Interaction with Non Government Organizations (NGOs), social organizations and community consultations in the areas likely to be impacted due to the proposed projects.

1.9.3 Additional Studies

Environmental Management Plan is delineated along with cost and time schedule incorporating the following plans:

- Catchment Area Treatment Plan
- Biodiversity Conservation & Management Plan
- Geo-environmental Management Plan
- Energy Conservation Plan
- Green Belt Development Plan

- Landscape and Restoration Plan
- Muck Disposal Plan
- Solid Waste Management Plan
- Fisheries Development and Management Plan
- Resettlement and Rehabilitation Plan
- Public Health Delivery Systems
- Control of Water, Air & Noise Pollution
- Disaster Management Plan
- Environmental Monitoring Programme.

1.10 OUTLINE OF THE REPORT

The contents of the study are arranged as follows:

Chapter 2 outlines the methodology adopted for the study.

Chapter 3 details pre-project environmental baseline conditions of physical aspects.

Chapter 4 details pre-project environmental baseline conditions of ecological aspects.

Chapter 5 details pre-project environmental baseline conditions of socio-cultural and economical aspects.

Chapter 6 deals the assessment of impacts as a result of the construction and operation of the proposed hydel project.