

c. インタリムレポート

インタリムレポートは調査開始後14ヶ月以内に作成し、Part B の調査結果を記載する。

d. ドラフトレポート

ドラフトレポートはメインレポート及びサポーティングレポートとして作成するとともに、併せて収集主要資料を今後の調査及び計画変更に役立つよう編集した資料集を作成する。

ドラフトレポートは調査開始後19ヶ月以内に作成するものとし、詳細検討を行った代替案を含め、十分な資料をつけ、全ての調査分析結果を記載するものとする。

e. ファイナルレポート

ファイナルレポートはネパール水資源省電気局のコメントを充分検討し作成する。

留 意 事 項

a. ネパール政府は現時点までに調査対象地域の水資源開発について国際機関又は二国間援助等により種々の調査と計画を実施しており、調査団は本件調査に関連するものについては充分なレビューを行い、これら種々の調査との重複をさげなければならない。特に Part A の調査においては基本的に既存調査報告書及び資料に基づくデスクスタディーであり、この結果はその後の Part B 及び Part C の内容を大きく影響するものであり、この点を充分留意しなければならない。

b. Part A の調査のうちの h の項目である基本計画策定にあたって必要とされる地形測量、地形図作成、河川測量及び地質調査等の詳細現地調査の計画作成にあたっては、いたずらに全ての資料を作成することは厳に慎しみ、基本計画策定の基本目的において必要とされる精度と照らし合わせ、必要最少限かつ効果的効率的なものとしなければならない。特に水資源省電気局のカウンターパートの能力、保有機材状況、地元測量会社等の状況を検討するとともに、ランドサットの導入により、より効果的効率的に計画策定ができるならば、その導入についても考慮する必要がある。

5. 要 員 計 画

4.17 本格調査において必要とされる要員についての概略計画は次のとおり。なおこの要員計画には Part B 調査の項目 a で実施される測量等の現地調査については検討を Part A の結果を待つこととする。

4.18 本格調査にあたっては、4年間にわたる Water and Power Resources Development Project の成果としてかなりの調査資料が現地に保存されていること、又、計画の策定にあたって

は十分にネパール政府と意見交換をすることが必要なこと等を勘案し、作業はできるかぎり現地で実施することが望ましい。

	58 年 度												59 年 度											
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1. Team Leader																								
2. Coteam Leader, (Water Resources Planning Engineer)																								
3. Engineering Hydroglist (senior)																								
4. "																								
Power Engineer																								
Dam Engineer																								
Agricultural Engineer																								
Irrigation Engineer																								
River Engineer																								
Structurer Engineer																								
"																								
Geolojist																								
Survey Specialest																								
Land use Analist																								
Development Planner/ economest (senior)																								
Financial Analyst																								
Technical writer																								

V 実施体制及び便宜供与

1. 実施体制

実施機関

- 5.1 本調査の実施機関は Electricity Department Ministry of Water Resources (水資源省電気局) である。水資源省は、電気局の他に Irrigation Meteorology & Hydrology Department 及び Water Supply & Sewerage Department を有し、ネパールの水資源の開発にかかる全てについて責任を有する。電気局はこのうち水力発電内主要計画の立案、実施、評価全般を受け持つ。(詳細、組織図等付録4を参照されたし。)なお本件においては、主要 Sector 水力発電及びかんがいであるが、電気局は本件調査の実施機関として他部局との調整等全てについて責任を負う。

国際河川

- 5.2 調査対象のコシ河は、下流部でガンジス河に合流する国際河川として特徴づけられる。ネパール政府とインド政府との間にこの河川の開発に関して1966年12月19日付で締結した Hanuman Nagar の Barrage のプロジェクトにかかる協定の中でとり決めている。協定名は " Revised Agreement between His Majesty's Government of Nepal and The Government of India on The Kosi Project " である。この協定の中でネパール政府のコシ河開発に関し 4. Use of water and power (i) で次のように述べられており、ネパール政府のコシ河開発の権利が明確化している。

Use of water and power.— (i) HMG shall have every right to withdraw for irrigation and for any other purpose in Nepal water from the Kosi river and from the Sun-Kosi river or within the Kosi basin from any other tributaries of the Kosi river as may be required from time to time. The Union shall have the right to regulate all the balance of supplies in the Kosi river at the barrage site thus available from time to time and to generate power in the Eastern Canal.

2. 便宜供与

5.3 ネパール側便宜供与

ネパール政府よりの便宜供与は詳細は Scope of works に示すとおりであるが概略次のとおり。

- 1) カウンターパートの供与
- 2) 第三者よりのクレイムの免責
- 3) 資料及び情報、事務室、車輛(1台)及びヘリコプターの提供
- 4) 免税処置、資料の国外持出し許可、調査のための立入許可及び安全確保

日本側の負担

5.4 日本側の調査にかかる負担は、詳細は Scope of works に示すとおりであるが概略次のとおり。

1. 調査団のリクリュート及び航空賃と日当・宿泊料等の負担
2. 技術移転
3. 地形図の作成（必要な場合実施する。）
4. 車輜及び調査用重機材の確保
5. ヘリコプターの燃料の費用負担

VI ネパール政府との協議事項

- 6.1 事前調査団は、主に本件調査実施機関である水資源省電気局と、ネパール政府の本件調査に対する優先性、考え方、及び要望事項とその内容、既存調査と既存資料の有無とその概要、又、便宜供与事故等について協議を重ね、協議内容は十分に Scope of Work に反映させた。協議のうち特記すべきことは、1/10,000 地形図の作成と便宜供与としてのヘリコプターの確保である。

1/10,000 地形図の作成

- 6.2 ネパール政府は、本件調査において Sun Kosi 河沿に縮尺 1/10,000 の地形図の作成を強く要請した。

これに対し日本側は下記の理由により、ネパール側要請が必要ないことを強張し、要請を断った。

- 1) 本件調査は Master Plan の作成であり、既存地形図 (1/63,360)、航空写真 (1/50,000) に加え、補助測量、河川測量等と実施すれば充分である。
- 2) もし Sun kosi 河沿に縮尺 1/10,000 の地形図を作成する場合、ばう大な費用がかかる。

なお、代替案の比較検討にあたり、優先プロジェクトにかかるダム地点及び貯水池の地形図が基本調査 (Part A Study) の結果によりこれを作成することを説明した。

ヘリコプターの確保

- 6.3 本件調査において検討対象となるダム計画地点のうち、ほとんどの地点についてそのアクセスは極めて困難が予想される。このため日本側としては Part B Study の現地調査に長期にわたりヘリコプターの確保が必要である旨述べ、次の理由によりネパール側に提供を依頼した。

1. ネパール国内においては、政府所有のヘリコプター以外適切なものを求めることは難しい。
2. それ以外の方法で長期にわたり確保する場合、ばう大な費用とともにその安全性について信頼が持たない。

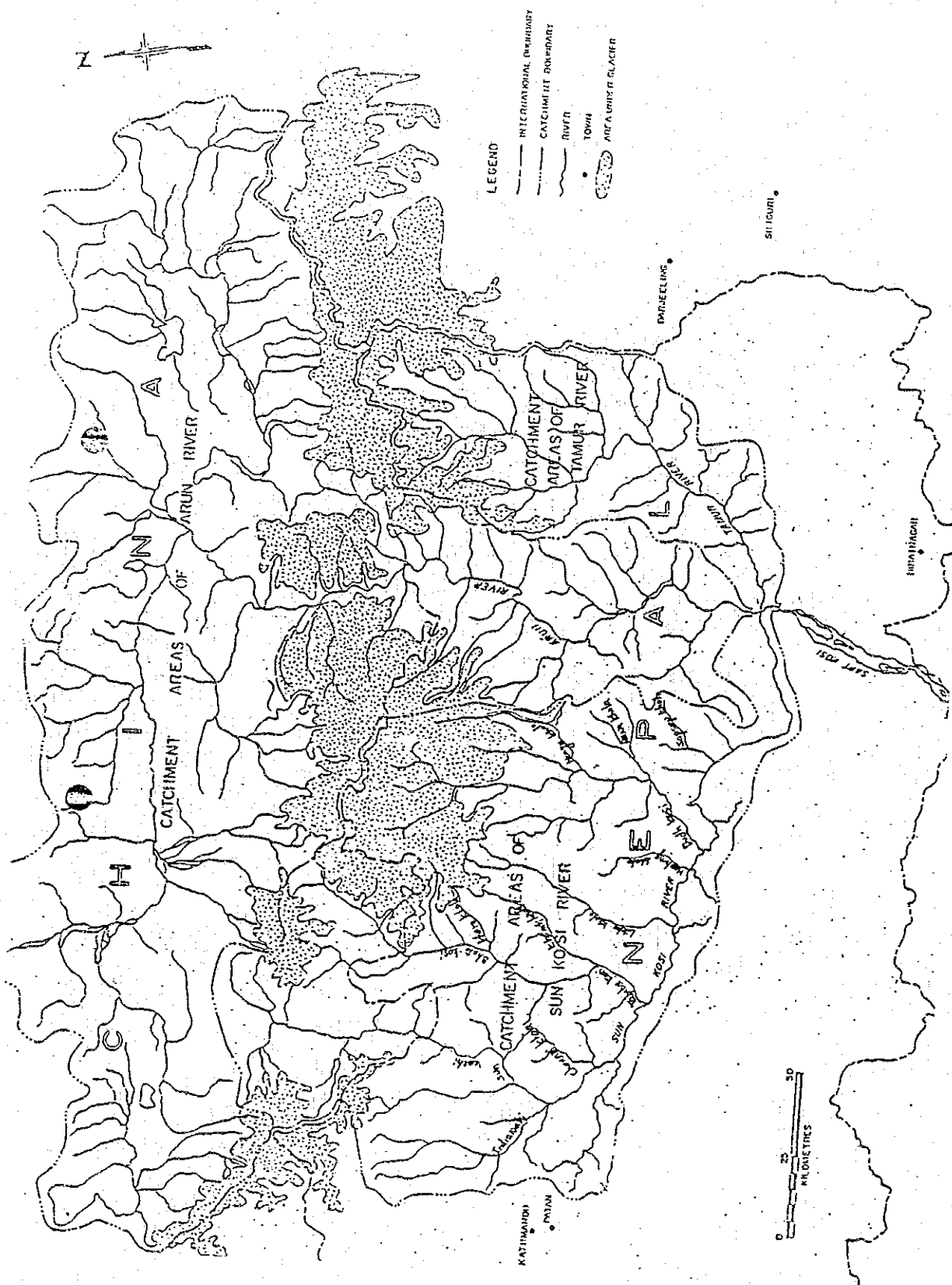
ネパール政府は同提供依頼に対し、政府所有ヘリコプターの提供可能なるも、同ヘリコプターが他官庁所有のため、その借用料について日本側の負担を要請した。

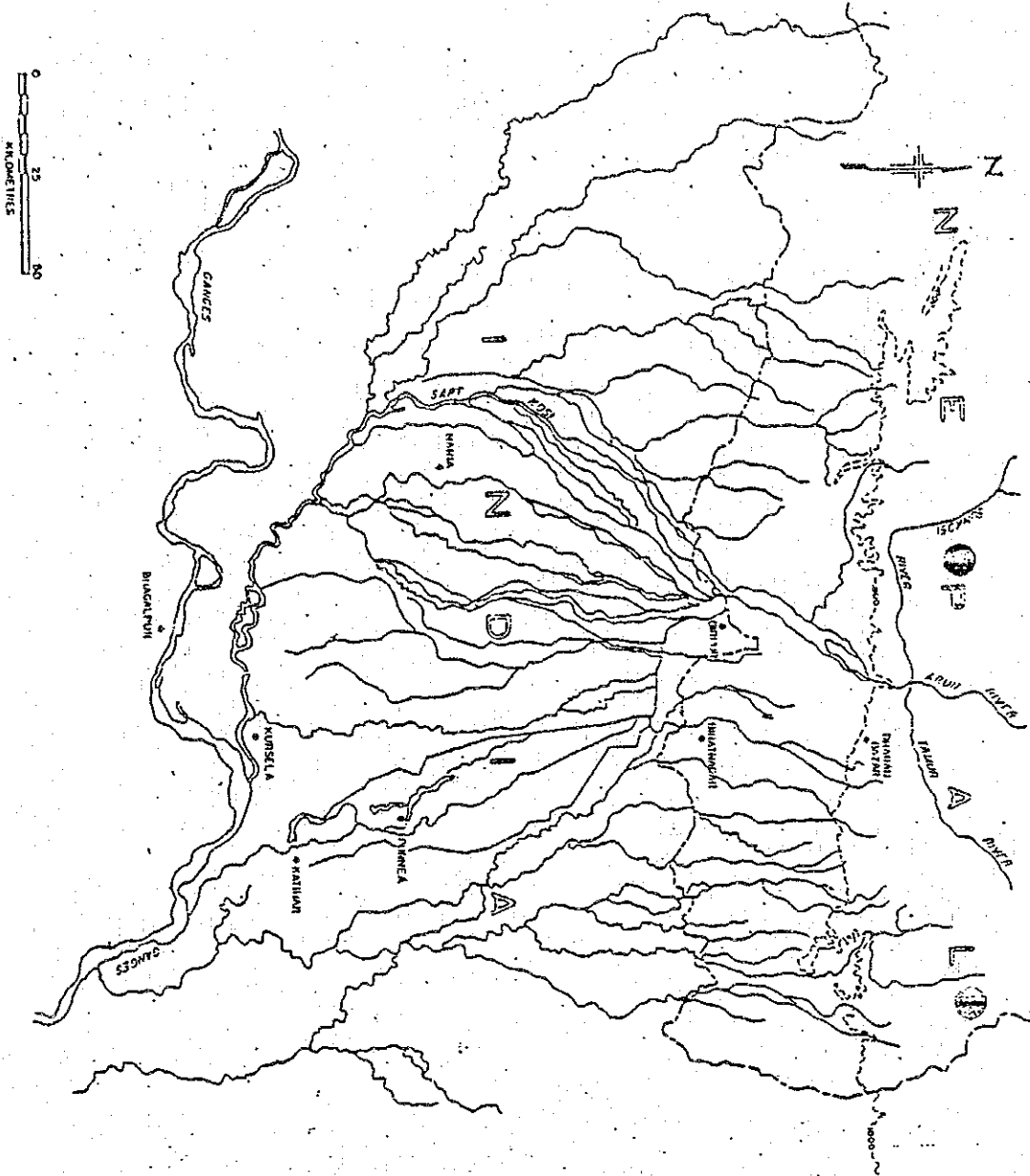
日本側はヘリコプターの借用料については、これが実質的にはネパール政府内の予算移転であり、これに応ずることは難しい旨述べ、実質的支払の伴うヘリコプターの燃料についてこれを負担することとした。

付 録

1. 調査関連図

1-1





LEGEND

--- INTERNATIONAL BOUNDARY

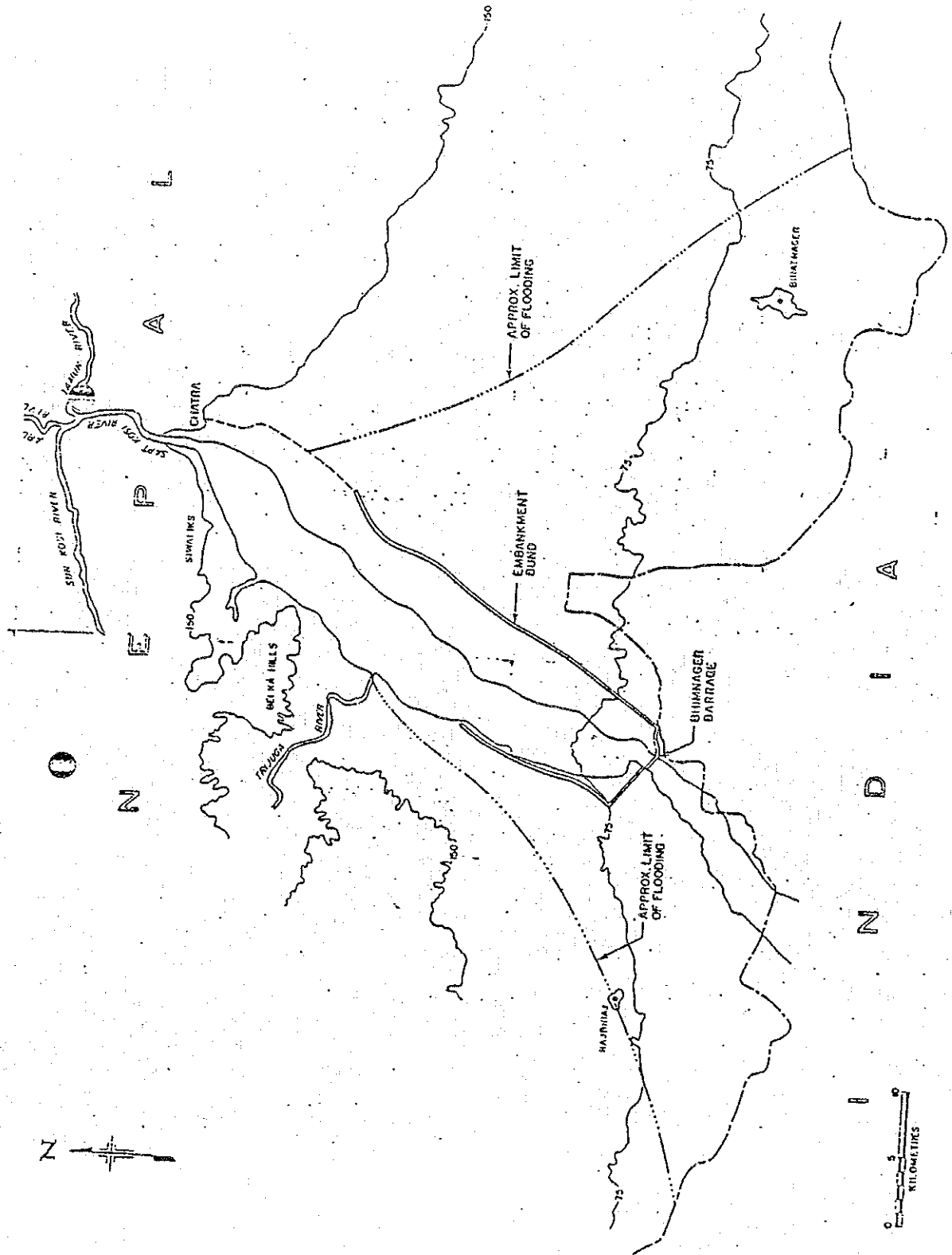
— RIVER

--- CONTOUR

• TOWN

1-2

1-8



2. 事前調査団の編成及び日程

事前調査団 I

1) 編 成

谷 本 修 志	河川計画	建設省河川局防災課災害対策調査室長
村 山 正 純	発電計画	資源エネルギー庁公益事業部水力課
橋 本 正	農業開発 計 画	農林水産省近畿農政局建設部設計課農業土木専門官
三 好 皓 一	業務調整	国際協力事業団社会開発協力部開発調査第二課

但 昭和 57 年 9 月 30 日から総括として参加予定の国際協力事業団社会開発協力部長 飯
島昭美は業務の都合により派遣を中止した。

2) 日 程

Sep. 22 (Wed)	Tokyo - Bangkok
23 (Thu)	Bangkok - Kathmandu
	Embassy of Japan Ministry of Water Resources (MWR)
24 (Fri)	Mission, IBRD
	UNDP
	National Planning Commission Nepal Rastra Bank
25 (Sat)	Internal Meeting
26 (Sun)	MWR
	UNDP
27 (Mon)	MWR
	UNDP
	Dept. of Soil Conservation & Watershed Management.
	Nepal Rastra Bank Embassy of Japan
28 (Tue)	Kathamendu - Biratnagar - Chatra
29 (Wed)	Reconnaissance on Supt Kosi River and Barrage
30 (Thu)	Reconnaissance on Mulghat Hydropower Project Site
Oct. 1 (Fri)	Chatra - Biratnagar - Kathmandu
2 (Sat)	Internal Meeting
	Preparation of the Preliminary Survey Report.
3 (Sun)	Reconnaissance on Sun Kosi power station
4 (Mon)	MWR
	Dept. of Soil Conservation and Watershed Management
	Geodestic Survey Branch Central Bureau of Statistic
	Department of Road
5 (Tue)	MWR
	Water and Power Resources Development Project
6 (Ned)	MWR

7 (Thu)	MWR Embassy of Japan
8 (Fri)	Embassy of Japan Kathmandu - Bangkok
9 (Sat)	Bangkok - Tokyo

事前調査団Ⅱ

1) 編 成

飯 島 昭 美	総 括	国際協力事業団社会開発協力部長
谷 本 修 志	河 川 計 画	建設省河川局防災課災害対策調査室長
村 山 正 純	発 電 計 画	資源エネルギー庁公益事業部水力課
橋 本 正	農業開発計画	農林水産省近畿農政局建設部設計課農業土木専門官
三 好 皓 一	業 務 調 整	国際協力事業団社会開発協力部開発調査第二課

2) 日 程

Jan. 26 (Wed.)	Tokyo - Bangkok
27 (Thu.)	Bangkok - Kathmandu
28 (Fri.)	Embassy of Japan JICA Kathmandu Office Electric Department, MOWR Meeting with Secretary MOWR
29 (Sat.)	Internal Meeting
30 (Sun.)	ED., MOWR Ministry of Finance
31 (Mon.)	Water & Energy Commission
Feb. 1 (Tue.)	ED. MOWR Signature for Scope of Works Embassy of Japan JICA Kathmandu Office
2 (Wed.)	Kathmandu - Bangkok
3 (Thu.)	Bangkok - Tokyo

3. 調査関連者リスト

Ministry of Water Resources

Mr. Madhusudan Dhakal

Secretary

Mr. S. J. Rana

Joint Secretary

Electricity Department

Mr. H. M. Shrestha

Chief Engineer

Mr. B. M. Shingh

Deputy Chief Engineer

Mr. R. C. Chaudhari

Chief,

Investigation/Feasibility Study
Division

Dr. M. R. Tuladhar

Senior Electric Engineer.

Mr. G. N. Mishra

Civil Engineer

Irrigation, Meteorology and Hydrology Department

Mr. C. D. Bhatta

Director General

Department of Drinking Water and Sewerage

Mr. D. B. Rayamajhi

Chief Engineer

Regional Office in Biratnagar

Mr. Binod Aryal

Executive Engineer

Water and Energy Commission

Mr. B. K. Pradhan

Executive Secretary

Dr. Hari Man Shrestha

Executive Director

Nepal Electricity Corporation

Head Office

Mr. L. M. Dixit

General Manager

Mr. Gyan Kaji Shakya

Electric Engineer

Sun Kosi Power Station

Mr. Mrigendra Prasad Pradhan	Electric Engineer
Mr. D. B. Kaji	Mechanical Engineer

Water and Power Resources Development Project

Naya Baneshwar Kathmandu.	Tel. 13091, 16599
Mr. Jack S. Baker	Project Manager
Mr. P. Hendes	Deputy Project Director
Dr. Marshall Gysi	Water Resources Planning Engineer

National Planning Commission

Mr. P. P. Shah	
Mr. Sharma Keshavrat	Deputy Director, Central Bureau of Statistics

Ministry of Forestry

Department of Soil Conservation and Watershed Management	
Babar Mahal, Kathmandu.	Tel. 15928
Mr. M. D. Joshi	Director General

Geodetic Survey Branch

Dilli Bazar	Tel. 14292
Mr. S. B. Manandhar	Assistant Director
Mr. N. Shrestha	Levelling Division

Department of Road

Mr. U. P. Shrestha	Design Engineer, Planning Section.
--------------------	------------------------------------

World Bank, Resident Mission

R. N. A. C. Building Kathmandu	Tel. 14792, 14793
Mr. Kedar Mathema	Programme Officer

United Nation Development Program

Mr. P. Subba

Planning Officer

Embassy of Japan

Panipokhari Kathmandu

Tel. 12730, 13264

Mr. Toshisada Komori

Counsellor

Mr. Hideo Morikawa

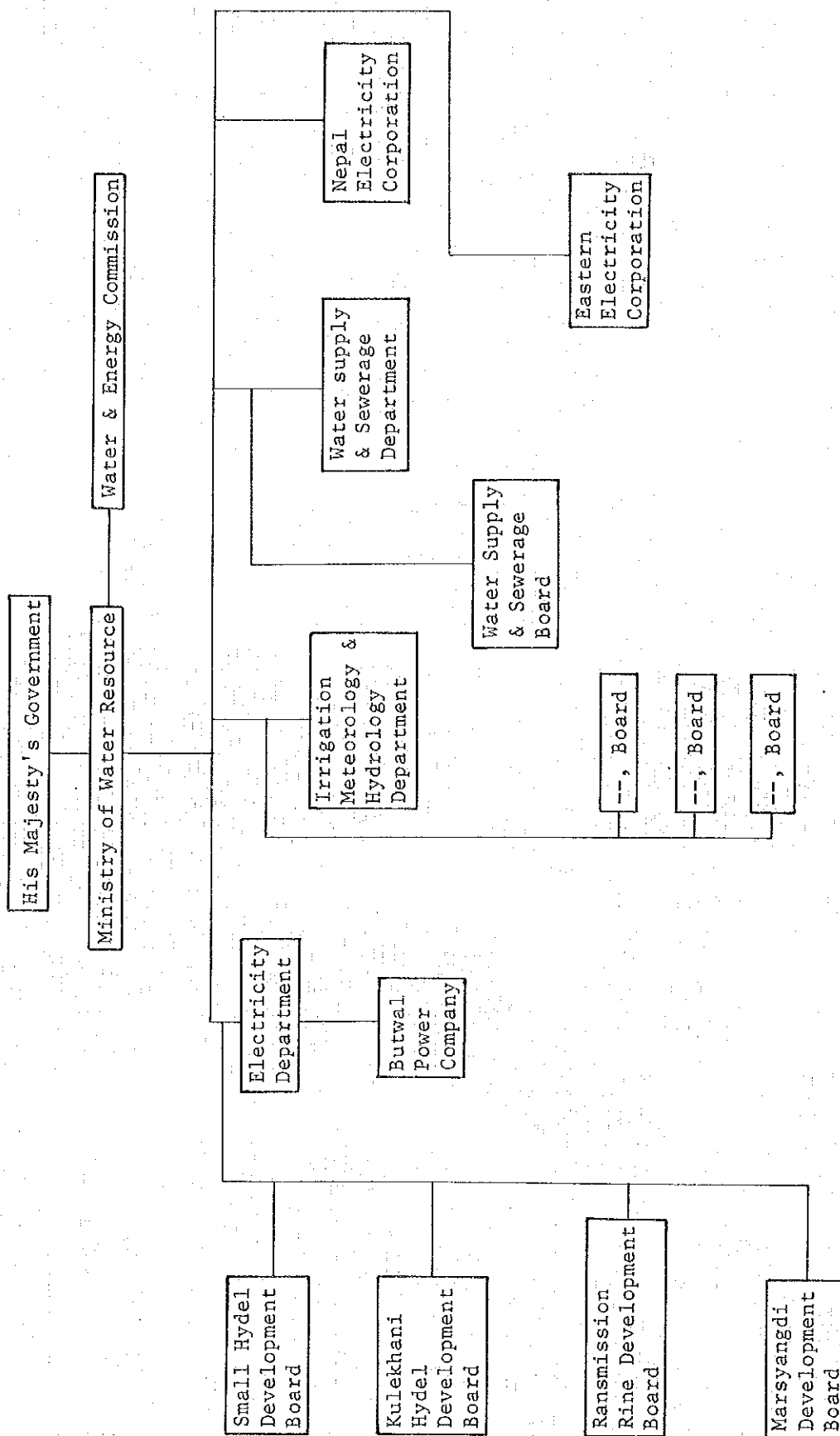
Second Secretary

JICA Kathmandu Office

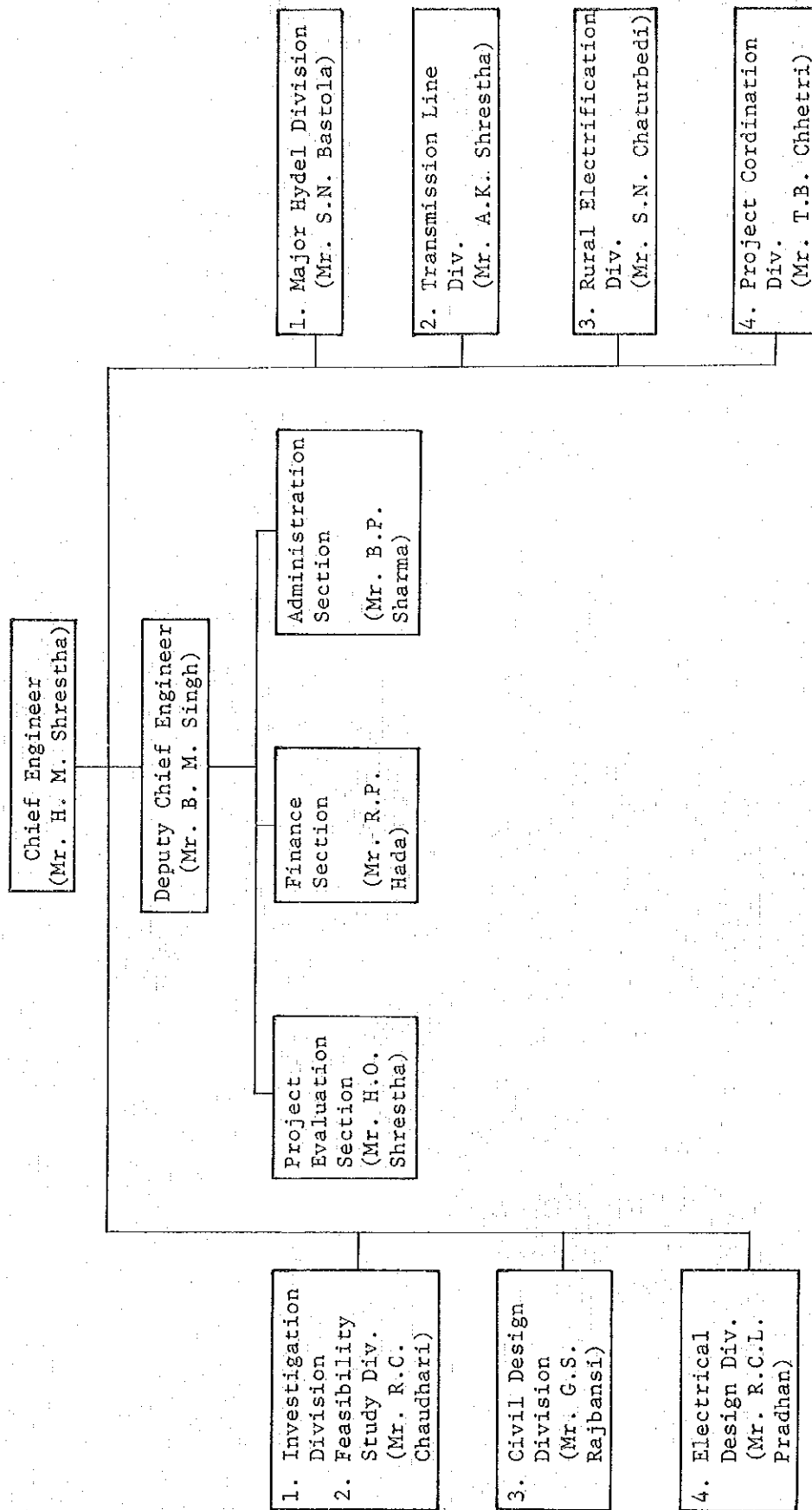
Mr. Hiroaki Nakagawa

4 . 水資源省関連組織図

4 - 1 ORGANIZATION OF MINISTRY OF WATER RESOURCES



4 - 2 ORGANIZATION OF ELECTRICITY DEPARTMENT



- Ministry of Water Resources (MWR), which covers policy matters for the water and power sectors. Its staff includes the Chief Electrical Inspector;
- Water and Emergy Commission (WEC), with its Secretarist and advisers, which provided advice on water and power policy and on technical matters;
- Electricity Department (ED) on MWR, which among other things constructs or monitors the constuction of major power projects;
- Nepal Electricity Corporation (NEC), which is responsible for the operation of power facilities in the Central and Western Regions;
- Eastern Electricity Corporation (EEC), which is responsihble for power supply in the Eastern Region;
- Several Development Boards including the Small Hydel Development Board, Transmission Line Development Board, Kulekhani Development Board and Marsy-angdi Development Board.

Cabinet had decided that the EEC should now be merged with the NEC. Also we understand that the Butwal Power Company is to be revived as the constructing body for a new station at Butwal.

5. नेपाल政府要請書及びTerms of Reference

The generation expansion program presently adopted by HMG/N will meet the internal demand of the country till 1993/94 by hydro energy alone. By that time, annual increments in peak demand are expected to reach 40 - 45 MW and in energy to exceed 160 Gwh. It means that larger plants than those currently planned will be needed. In average a period of ten years would be necessary from the decision to proceed through investigation, engineering, financing and ultimately construction, then by working backwards from the year 1993/94 the date mentioned above, (beyond which the system will likely be incapable to meet the demand) the decision on the project to come after Sapt Gandaki must be made by 1983/84 at the latest.

To satisfy the domestic demand for power and energy and to export hydro energy in the decade beyond 1990 the inventory of the resources available to meet the projected demand should be increased by further basin studies.

So that the probable project sites could be compared and a least cost investment plan could be adopted for future expansions. To achieve this objective HMG/N is very keen to undertake the Kosi Basin Study with the cooperation and assistance of the Government of Japan.



MINISTRY OF FOREIGN AFFAIRS

His Majesty's Government of Nepal
Kathmandu

SEA/72-2/1621

The Ministry of Foreign Affairs, His Majesty's Government of Nepal presents its compliments to the Embassy of Japan in Kathmandu and has the honour to request the Embassy to kindly communicate the request of His Majesty's Government to the Government of Japan to provide cooperation and assistance in order to conduct a comprehensive study of the Kosi river basin.

The Ministry of Foreign Affairs has further the honour to forward herewith a paper on the Kosi Basin Study prepared by the Department of Electricity, His Majesty's Government, and request the Embassy to transmit the contents of the paper to the competent authorities in Japan for their favourable consideration.

The Ministry of Foreign Affairs, His Majesty's Government avails itself of this opportunity to renew to the Embassy of Japan the assurances of its highest consideration.

December 30, 1981.

The Embassy of Japan
KATHMANDU.



KOSI BASIN STUDY

There are three main river system in Nepal: Karnali, Gandaki and Kosi. The former two river basins have been studied to a considerable extent, but the investigation and study of Kosi river basins are yet to be commenced.

To enhance the development of water resources potential of the country a comprehensive basin study should be carried out in the Kosi river basin as early as possible.

The water resources development potential of the Kosi river system in the Eastern Development Region has not been examined in a comprehensive manner. The hydroelectric potential alone may be as high as 10,000 megawatts. A preliminary reconnaissance is underway to identify the water resource development potential. The lower portion of the Kosi river in the Terai is being developed for irrigation purposes, primarily in India. An irrigation diversion barrage and offtake canals have been constructed at the Nepal-India boundary, Irrigation canals have also been constructed in Nepal upstream but these are beyond the influence of the barrage. River training and high sedimentation rates are perennial problems in the reach of the Kosi river in the Terai.

There is a need to prepare a master plan for water resource development in the Kosi river basin similar to that recently completed for the Sapt Gandaki river basin. The necessary studies should not only include hydroelectric assessment but should take into account multiple use and other single use potentials. The rapid siltation and flood threat of the Kosi river in the Terai dictates that the studies include watershed management and flood damage reduction measures on a priority basis as they have international importance. In addition at least one of the priority development sites should be studied to feasibility level. The cost of an adequate basin study will likely be in the order of 4-5 million 1982 US dollars.

24/9/1982

KOSI BASIN WATER RESOURCE STUDY

1. PROJECT DESCRIPTION: The Kosi basin is the largest in Nepal. It drains a large segment of the Tibetan plateau and provides a series of widely differing tributaries with very different hydrological and morphological profiles and terminates in Nepal's largest river of great importance to Nepal and India. No comprehensive study has been made for any water resource sector. The proposed study would encompass all aspects of water resource development including basin master planning and long term catchment control studies.

To date the Kosi River Basin has been subjected to only limited study. Reconnaissance level work has been completed at a limited number of upper basin sites and feasibility studies are available for the Kosi High Dam site located at the outlet of the basin on to the Terai, the Mulghat site on the lower Tamur River and for the Kurule site on the Sun Kosi River. A basin study is required to place these and other potential projects in a basin context and to provide for a national phased development plan for the basin as a whole.

2. OBJECTIVES: The basin terminates at its Southern end at the proposed site of what could be Nepal's largest and most significant dam. It is vital that an appreciation of this dam in the context of basin development be provided as soon as possible. At a different scale HMG/N is keen to develop attractive power projects for the national domestic expansion plans, and a prefeasibility study of those schemes already identified, (which would come within the term of the main study) is needed to justify or eliminate their present position in the future expansion planning.

Based on the study, and given criteria to be provided by the Ministry of Water Resources, two electric projects, one suitable for meeting domestic electrical energy demand, and another for export of energy should be selected and studied to the feasibility level and for some projects to pre-feasibility level.

3. ACCESS PROBLEMS: Access will be a major problem. Some potential site could be approached by Dharan-Dhankuta and Sun Kosi-Jiri roads and for other helicopter should be used.
4. MAPPING: Aerial photography, at a scale of 1:50,000, exists for basin, but ground control for study mapping would have to be keyed into available sites that are identifiable on the present photos. One of the outputs required from the study would be 1:10,000, scale map of the river basin.
5. MAJOR STUDY COMPONENTS:
 - (a) Review of existing studies and reports
 - (b) Development of topographic map to a suitable scale
 - (c) Site identification studies
 - (d) Geotechnical investigations and exploration
 - (e) Sedimentation and hydrologic studies
 - (f) Environmental and watershed management studies
 - (g) Socio economic impact surveys of potentially affected population in area
 - (h) Access requirement
 - (i) Conceptual designs and layouts for dam structures, spillways and power-house and related structures for all potential sites, studies to determine preliminary cost.
 - (j) Sizing and number of generating stations at sites to be included in master plan.
 - (k) Studies and evaluation of power, irrigation, flood control, navigational aspects and other benefits to be derived from basin development

- (1) System simulation and other studies required to support recommended basin development program
- (m) Detailed feasibility study of one priority site for meeting Nepal's domestic electrical energy requirements for period 1993 onward and another for export of energy. Study should be suitable for submission to Nepal's financing agencies as an application for financing and include:
 - . Mapping at structures at a scale of $\frac{1}{2000}$
 - . Seismic survey and drilling
 - . Detailed site survey plus search for materials
 - . Analysis of faults (Earthquake Engg/Seismic studies)
 - . Staging of construction.

6. STUDY SCHEDULE: The study schedule would take place over the 1982/83 and 1983/84 fiscal years. Depending on the likelihood of identified sites appearing to be of immediate interest for Nepal's national water resources development planning, some more pre-feasibility work will be necessary in the second year of the program (1983/84) and possibly extended into 1984/85.

DRAFT

(For internal discussions only)

TERMS OF REFERENCE FOR THE PREPARATION OF
WATER RESOURCES DEVELOPMENT MASTER PLAN
OF THE SAPTA KOSI BASIN AND FEASIBILITY
STUDY OF TWO PROMISING PROJECTS

1. INTRODUCTION
2. DESCRIPTION OF THE BASIN
3. STUDY OBJECTIVES
4. DESCRIPTION OF WORK
5. STUDY SCHEDULE
6. SCOPE OF WORK

KATHMANDU,
7 October 1982

1 INTRODUCTION

In commensurate with the policies of HMG/Nepal to develop water resources of the country Sapta Kosi River Basin Master Plan study is included in the Sixth Five-Year Plan.

A Master Plan for the basin should take into account the basin's natural features and attributes such as topography, climate, hydrology, geology, environment and the need for protection of the catchment against erosion. The proposed Master Plan Study is intended to investigate the possible sequences of development of the Sapt Kosi Basin with a view to identifying and defining the program, of development that will best meet the short, medium and long term needs of Nepal. The Master Plan will thus be a guide to the logical sequential development of the water resources potential of the basin. The study will also define the priority sites for feasibility studies with the framework of the identified sequence of development, in such a way to best meet Nepal's future needs.

At present only a total 12450 Kw of hydro power have been developed in Sapta Kosi Basin inside Nepal: 10050 Kw at the Sun Kosi Power Station at the upper reaches of Sun Kosi river and 2400 Kw at the Panauti Power Station at Rosi River.

2. DESCRIPTION OF THE BASIN

2.1 General

The Sapta Kosi Basin is the largest river basin in Nepal. Located in the eastern quarter of Nepal, it drains a large segment of the Tibetan Plateau and comprises a series of widely differing tributaries with very different hydrological and morphological profiles terminating in Nepal's largest river of great importance to Nepal and its neighbours. The main river of the Sapta Kosi basin, the Sun Kosi is about 334 Km long, of which about 98 Km are situated in Tibet. Near Kodari, at the north boundary of Nepal the riverbed elevation is 1650 m and at its confluence with the Arun the elevation is 125 m resulting in a drop of 1525 m, over a river length of 250 Km. Preliminary studies have revealed that the theoretical power potential on the basis of average flow of the Sapta Kosi Basin is in the order of 22,350 Mw, with 84% of this potential concentrated in its major rivers, the Sun Kosi, Dudh Kosi, Dudh Kosi, the Tama Kosi, the Indrawati, the Arun and the Tamur. In addition to the basin's power potential a rational development program would take into consideration irrigation, flood control, navigation, fisheries and other possible benefits. Any diversion of water from the Sun Kosi basin into Terai plain could result in significant agriculture benefits basins. Regulation, flood control and sediment control associated with basin development will result in large irrigation benefits in the areas commanded by the Chatra Irrigation and the East and West Kosi Irrigation canals at downstream reaches.

2.2 Geology and Hydrology

The basin is formed mostly of Cambrian or pre-Cambrian rocks of the Mahabharat series and the lithologies are arenaceous and argillaceous metasediments. The three main tributaries (Arun, Sun Kosi, Tamur) have deeply incised "V" - shaped valleys through these formations.

The hydrographic characteristics of the Kosi and its tributaries are given in table 1.

TABLE 1

Main Rivers of Kosi Basin	Catchment area Km ²	Length Km	Mean gradient	Extreme heights within the basin in metres	
				Maximum	Minimum
Indrawati	1185	62	0.0063	6400	627
Tamba-Kosi *	2586	100	0.033	7185	464
	(4110)				
Dudh-Kosi	4110	122	0.036	8845	329
Balephi-Khola	675	53	0.087	6977	692
Likhu-Khola	950	69	0.052	6959	408
Rosi-Khola	570	51	0.020	2760	543
Arun **	6350	173	0.028	5000	60
Tamur	5818	149	0.039	5900	60
KOSI TOTAL	22244 ***			8845	60

* () includes the catchment area and length in Tibet as well.

** Excludes the catchment area and length in Tibet.

*** Catchment in Nepal only

The basin has a high mountainous structure with elevations varying between 8848 m and less than 125 m.

3.0 STUDY OBJECTIVES

The objective of this study is to prepare a Water Resources Development Master Plan of the Sapta Kosi River Basin taking into account its hydro-electric, irrigation, flood control, navigation (in land and international) and other potentials. Based on this study, and criteria to be provided by the Ministry of Water Resources two projects, one suitable for meeting domestic needs and another oriented towards export of energy including other benefits should be selected for the feasibility level.

4.0 STUDY COMPONENTS

The work will comprise the following study components:

- (a) Review of existing studies and reports;
- (b) Development of topographic mapping to: 1:10,000 scale;
- (c) Site identification studies and preparation of the Master Plan of the river basin;
- (d) Geotechnical investigations and explorations; including seismic surveys and drilling at preferred sites, regional and site seismicity and reservoir rim watertightness for selected schemes;
- (e) Erosion control and protection and sedimentation;
- (f) Hydrologic studies;

- (g) Flood control
- (h) Environmental and Socio Economic impact surveys of potentially affected area;
- (i) Potential for navigation in the Sapt Kosi river both in land and international;
- (j) Irrigation and Agricultural Studies
- (k) Access requirements;
- (l) Conceptual designs and layouts for dam structures, spillways and powerhouse and related structures for all potential sites with a view to regulate as fully as possible the available water resources;
- (m) Interbasin water transfer schemes;
- (n) Preliminary sizing and number of generating stations at sites to be included in Master Plan;
- (o) Preliminary economic cost benefit analysis of the various development options;
- (p) System simulation and other studies required to support recommended basin development program;
- (q) Detailed feasibility studies of two priority sites, one for meeting Nepal's domestic requirements including irrigation and flood control; another one oriented towards export of energy including other benefits. These studies should be suitable for submission to Nepal's major aid donors as an application for financing and should include:

- o Topographical mapping for the selected sites and along main rivers and tributaries at a scale of 1:10 000 with 5m contours;
- o Seismic survey to determine cover thickness to sound rock plus verification by drilling;
- o Detailed site survey (including vertical control) to a 1:2000 scale with 5m contours;
- o Search for construction materials;
- o Determination of active and inactive faults and effects in the dam design (Seismic studies);
- o Staging of construction;
- o Detailed cost estimates.

5.0 STUDY SCHEDULE

The study will consist of two parts: preparation of Master Plan and feasibility of two promising projects. The preparation of Master Plan is schedule to be completed by April 1984 and feasibility studies will be completed by April 1986.

6.0 SCOPE OF WORK

The study components in Section 4 are described hereafter:

(a) Review of Existing Studies and Reports:

No comprehensive study has been made as yet on the Sapt Kosi Basin. To date the Sapt Kosi River Basin has been subjected to only limited study. Reconnaissance work has been completed at a limited number of upper basin sites and feasibility studies have been conducted for:

- o the Barakschetra high dam site located at the outlet of the basin onto the Terai, by the Central Water Commission of the Government of India in 1950 and updated in 1981;
- o the Mulghat site on the Lower Tamur River in 1982;
- o the Kurule site on the Sun Kosi River with diversion of Sun Kosi Water in Kamala River in 1969.

These studies should be reviewed to determine their adequacy and consistency with the work to be undertaken in this basin study.

- (b) Development of topographic mapping to 1:10,000 scale at 5 m contour intervals along the main river and the main tributaries.

Aerial photography at a scale of 1:50,000 exists for the basin, but ground control for study mapping must be referenced to surveyed sites that can be identified on the available photographs. For the consumptive use side of water of Sapta Kosi, the following studies are available:

- o Sun Kosi-Morang Irrigation Project
- o Kosi West and East Canal Projects
- o Rajbiraj Pump Canal Project
- o Trijuga/Chandra Canal Development Project
- o Kamala Irrigation Project Report
- o Bagmati Irrigation Project

(c) Site identification studies and preparation of the Master Plan of the river basin:

Based on existing mapping and river profiles, a list of all potential sites should be prepared discarding those considered as unfeasible for obvious adverse reasons. The most promising sites will thus be selected for in situ survey with access by helicopter, as required. Schemes which have annual storage will be referred to as storage schemes while schemes with daily or weekly storage will be referred to as run-of-river schemes. For each site preliminary power and energy characteristics will be assessed, along with the potential for integrated use of water resources such as irrigation, flood control navigation, etc.

(d) Geotechnical investigations and explorations:

Each of the most promising sites among those retained for in situ reconnaissance will be the object of a walkover survey to assess the varying depth of overburden, to define the situ geology and its main geological features (systems of rock outcrops, rock structure, nature of riverbed and depth of alluvium), to search for construction materials and to plan for site development (access, camps, construction plants, etc). Representative rock sample should be tested for strength. Seismic surveys with complementary drilling should be carried out at preferred sites. Particular attention should be devoted to the seismicity given the importance of this factor in Nepal. The adequacy of the existing seismic network and the map of recorded events available at the Ministry of Mines should be examined, and their influence on the design of project

structures should be assessed.

The reservoirs associated with the preferred schemes should be investigated for low lying saddles and for ground and rock watertightness.

(e) Erosion control and protection and sedimentation:

An in-depth investigation of the erosion and sedimentation processes taking place within the Sapta Kosi Basin should be conducted, identifying areas having severe erosion, landslides and dangerous torrents. Erosion problems in the Hills and mountain regions of Nepal are the results of many factors, the most important of which are:

- o uncontrolled removal of forests
- o undesirable agricultural methods
- o natural over-steepening of valleys

Due cognizance of past documentation on the subject as developed by the Department of Water and Soil Conservation of the Ministry of Forestry, by UNDP and by the Land Resource Mapping Project should be taken. Based on information contained in the available documentation, namely, the rates of erosion and sedimentation, special consideration should be given to the erosion/sedimentation phenomena to ensure that schemes are designed to cope with sediment load in the rivers. In river development work, areas most prone to erosion effects should be identified appropriate means of protection

for the toes of slopes subject to undermining by rivers should be suggested. Control structures should be planned and designed to safely pass major floods. It is found that the Sapt - Kosi River system carries a heavy load of sediment and estimation of bed load is a problem. Therefore, in this study specific attention has to be paid to establish the bed load factor by observation rather than estimation in order to correctly determine the lives of potential reservoirs.

(f) Hydrological studies

Hydrological studies ^{1/} have been conducted for the entire territory of Nepal. Whenever available hydro-meteorological data have been used to derive synthetic long term flows, to identify defined low flow periods and to estimate flood peaks and volumes. The derived data are deemed satisfactory for this Master Plan study as they provide a representative and consistent base for project design and for the sizing of structures and equipment. The above mentioned synthetic data should therefore be used for the study.

In addition hydrological measurements accumulated since 1975 are available at the Department of Irrigation, Hydrology and Meteorology (DIHM). These measurements require due processing and this task should be included in this study component. The hydrological data base for the basin study will thus be considerably improved.

1/ Hydrological Studies of Nepal by HMG/N - Water Energy Commission, WECS, 1982 .

While the referred hydrological data are adequate for the study, the final basin study report should include recommendations for necessary improvements of the hydrological information in the basin. For this purpose and to obtain a better insight into the hydro-meteorological recommendations will cover: the definition of measurement and observation systems; the location of related instrumentation; the duration and methodology of the measurements and observations; all to permit confirming the used synthetic data, such as meteorological, run-off, floods, low flows and sediment.

(g) Flood Control Studies:

Storage projects identified in the Master Plan study will provide among other benefits flood-control benefits as well. The preliminary estimate of such benefits accurable at downstream reaches from each storage project should also be made.

(h) Environmental and Socio-economic impact surveys of potentially affected population in Project area:

The effects on local populations, flora and fauna of the various schemes should be investigated. In particular the socio-cultural impact on the local populations of storage schemes necessitating resettlement of people and relocation existing facilities including access roads should be assessed. Costs of such resettlement should be determined for inclusion in the economic evaluations.

Therefore it should be ensured throughout this study that precautionary measures can be taken during implementation of future projects to protect the environment in its multiple aspects, namely, the fauna and socio-cultural factors.

(i) Navigation:

A study of the potential for navigation inland and international should be carried out.

The Sapt Kosi River, meets the Ganga River at Monghyr, in Bihar. Navigation facilities exist up to Patna in the main Ganges. In this study a navigation link should be investigated on the basis of published information, between the Sapt Kosi and the Ganga Rivers, as forming part of the waterway system connecting Calcutta to Patna. A conceptual design compatible with the study should be carried out and related cost estimates prepared for due consideration in the economic analysis of the Sapt Kosi Basin Master Plan Study.

(j) Irrigation and Agricultural Studies:

Irrigation benefits resulting from basin development should and the surplus of regulated flow over Nepal's consumptive need is also to be assessed. One benefit of particular importance will be additional Terai agricultural benefits resulting from improved river regulation and sediment control, as the major constraints on irrigation benefits in the Chatra Canal command and the much larger East and West Kosi Canal commands are sedimentation problems

and insufficient dry season flows for extensive pre-monsoon irrigation. A basin development programme incorporating diversion schemes would bring the latter type of irrigation benefits to irrigation schemes currently limited in scope by and dependent upon low dry season flows in rivers such as the Kamala and Trijuga. Due attention is required to be paid to examine the possibility of incorporation of scheme in the Master Plan diverting Sun Kosi water to Kamala Basin which will provide irrigation water to Terai area enclosed between Bagmati and Sapt Kosi Rivers.

(k) Access Requirements:

Based on the existing road network and on the schemes selected for study, layouts should be chosen for necessary access roads to each individual site and an implementation schedule provided. Where feasible upgrading of existing roads should be allowed for. Road categories should be compatible with economic, safe and functional construction operations, aiming also at access during the subsequent life of the projects.

It should be borne in mind that the study of a road system in this Master Plan is mainly for general technical feasibility and estimating purposes.

(l) Conceptual Designs:

Following a preliminary selection of the sites to be surveyed an inspection should be made of each site to determine the general arrangement of the structures, dams, spillways, headworks, powerhouse and ancillaries.

Structures should be located taking into account the observed and otherwise known geotechnical features and with due consideration of their sizing and intended performance.

Site areas requiring specific investigations should be designated and recommendations formulated. In locating the project components, the approach should be such that foundations will be sound, that related potential problems will be economically solved and that desired performance will be assured in all operating conditions. A catalog of potential problems associated with locations of structures from the geotechnical, hydraulic and protection viewpoints should thereafter be prepared.

(m) Interbasin Water transfer schemes:

The Sapta Kosi Basin has an extensive and diversified potential. Long term planning studies are underway by other HMG/N agencies to cover all of Nepal's water resources and for preservation of the natural resources. For this reason, it should be ensured that the basin study will adequately take into account contemplated inter-basin water transfer and other schemes for the development of irrigation projects in the Terai, and in general for integrated watershed management.

- (n) Preliminary sizing and number of generating stations at sites to be included in the Master Plan:

To be considered for each site, in run-of-river or storage schemes, is a full range of development alternatives reflecting the possibilities afforded by topographical, geotechnical and environmental conditions, staging requirements as may be achieved in reservoir and head development and generation capacity (dam construction, powerhouse and headworks extensions).

From the vast range of alternatives the best sequences of development should be selected to permit arriving at a recommendation with respect to a basin development program, as called for in items (o) and (p) hereafter.

- (o) Economic cost benefit analysis of the various development options:

The study should include

- a preliminary cost benefit analysis of all promising projects, in order to eliminate uneconomic projects;
- a comparative analysis of alternative basin development programs;
- the selection of the development program that best satisfies Nepal's needs in accordance with HMG/N guidelines.

The study should further include the recommendations for the management of the Sapta Kosi watershed.

Cost estimates must make proper allowance for watershed projects (access roads, agriculture/irrigation and slope protection) in planning or implementation stages by HMG/N.

The construction cost estimates for each contemplated site should be based on calculated schedules of quantities of materials and equipment at present day unit cost rates. To these construction and equipment costs should be added the costs of land acquisition and resettlement, engineering and administrative costs. In addition, a proper project contingency should be added to the estimated project costs. Each project cost will therefore include:

- Civil construction costs;
- Power plant costs;
- Transmission Costs;
- Irrigation System Development Costs;
- Acquisition of land and Resettlement Costs;
- Engineering Costs;
- Government administration Costs; and
- Project Contingency

Cost estimating for all basin schemes should be carried out at this stage on a basis of relativity rather than of project cost accuracy. Sites should be investigated and costed using a consistent approach with uniformity of allowances for unknown factors, such as:

- Degree of certainty of site investigations (hydrologic records, aerial mapping, volumes of materials in borrow areas, etc);
- Validity of assumptions made in preparing preliminary layouts, quantities and estimates (tunnel supports, foundation stripping for dams);
- Changes in item quantities which may occur during detail design studies;
- Geological conditions encountered during construction and varying from initial assumptions at basin study level;
- Trends of bidding climate during basin development reflecting world wide economic conditions.
- System Simulation and other Studies Required to Support the Recommended Basin Development Program:

The Sapta Kosi Basin study should include a methodology for the system simulation and for other studies required to support the recommended basin development program. Reference should be made to the Computer program intended to be used, its capacity and the results format.

(g) Detailed feasibility studies of priority sites

General requirements are specified in Section 4 of these Terms of Reference for the Sapta Kosi Basin Study. Terms of Reference for the detailed feasibility studies of the priority sites will be issued at the time set in the study schedule hereafter forming part of these Terms of Reference.

Upon completion of the above study components, recommendations will be determined/submitted in the Basin Study Report for future work within the basin with regard to:

- Topographic surveys and mapping;
- Hydrology;
- Geotechnical investigations;
- Sedimentation;
- Environmental requirements;
- Flood mitigation;
- Erosion control and protection;
- Navigation;
- Fisheries and
- Land acquisition and re-settlement of populations.

6 . Scope of Work

MINUTES OF MEETING
FOR
THE SCOPE OF WORK
FOR
THE MASTER PLAN STUDY
ON
THE KOSI RIVER WATER RESOURCES DEVELOPMENT
AGREED BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
ELECTRICITY DEPARTMENT
MINISTRY OF WATER RESOURCES
HIS MAJESTY'S GOVERNMENT OF NEPAL

飯島 昭彦

Terumi Iijima
Leader
Preliminary Survey Team
Japan International Cooperation
Agency

H. M. Shrestha

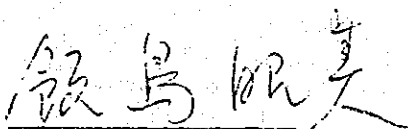
H. M. Shrestha
Chief Engineer
Electricity Department
Ministry of Water Resources

February 1, 1983
Kathmandu

MEMORANDUM OF UNDERSTANDING
BETWEEN
ELECTRICITY DEPARTMENT, MINISTRY OF WATER RESOURCES
HIS MAJESTY'S GOVERNMENT OF NEPAL
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

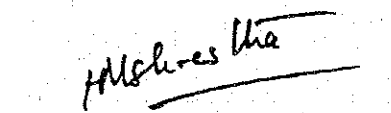
This is to understand that the Minutes of Meeting for the scope of Work for The Master Plan Study on The Kosi River Water Resources Development signed on February 1, 1983 between the parties hereto and attached herewith is subject to the approval of His Majesty's Government of Nepal and such approval with any change there upon shall be communicated to the Japan International Cooperation Agency as soon as possible by Electricity Department, HMG of Nepal.

Dated this First day, February 1983.


Terumi Iijima

Team Leader

Japan International Cooperation Agency


Harsha Man Shrestha

Chief Engineer

Electricity Department

MINUTES OF MEETING
FOR
THE SCOPE OF WORK FOR THE MASTER PLAN STUDY
ON
THE KOSI RIVER WATER RESOURCES DEVELOPMENT

In response to the request of His Majesty's Government of Nepal for technical cooperation in conducting a master plan study on the Kosi River Water Resources Development, The Japan International Cooperation Agency sent a contact mission to Nepal from September 23 to October 8, 1982. The mission carried out a series of discussions on the proposed study with the officials of Electricity Department (ED), Ministry of Water Resources and other Nepalese Government agencies concerned, collected necessary information and data and carried out a field survey during their stay in Nepal.

Based on the findings of the contact mission, the preliminary survey team headed by Mr. Iijima has visited Nepal from January 27 to February 2, 1983 and held a series of discussions on the scope of work for the Master Plan Study on the Kosi River Water Resources Development with the officials of ED, the Ministry of Water Resources and other Nepalese Government agencies concerned during their stay in Nepal. The final meeting between the preliminary survey team and ED, Ministry of Water Resources was held on February, 1, 1983. (A List of Participants in the final meeting is attached as Appendix 1.)

As a result of the discussions, the Scope of Work was finalized as attached herewith.

THE SCOPE OF WORK

1. INTRODUCTION

In response to the request of His Majesty's Government of Nepal, the Government of Japan agreed to extend a technical cooperation (the Cooperation) for the Master Plan Study on the Kosi River Water Resources Development (the Study) in accordance with laws and regulation in force in Japan, and entrusted the Cooperation to the Japan International Cooperation Agency (JICA), the responsible organization for implementation of the technical cooperation programme of the Government of Japan.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to prepare a comprehensive water resources development plan for the Kosi River taking into consideration its hydro-electric generation, irrigation, flood control, navigation and other potentials including inter-basin development schemes.

III. THE STUDY AREA

The Study Area will cover the area of the Kosi River basin and Terai plain between Bagmati and Kankai Rivers in Nepal.

IV. SCOPE OF THE STUDY

The Japanese Study Team will conduct the Study in consultation with ED and in close cooperation with the counterpart personnel. The Study will include the following:

General:

- a. Review and evaluate all data and previous studies directly relevant to the Study and draw a program for further studies.
- b. Examine the existing and on-going development programs directly relevant to the Study.
- c. Examine and evaluate alternative schemes to seek the best sequences of the water resources development of the Kosi River with a view to identifying and defining the program of development that will meet the short, medium and long term needs of Nepal.

Particular:

Part A - Basic Study

- a. Review and evaluate the previous studies mainly concentrating on the following:

Hydro-electric Oriented:

- i. Barahkshetra High Dam Project
- ii. Mulghat Hydro-Power Project
- iii. Kurule Project in Sunkosi river

Irrigation Oriented:

- i. Sunsari-Morang Irrigation Project
- ii. Kosi West Canal Project
- iii. Rajbiraj Pump Canal Project
- iv. Trijuga/Chandra Canal Development Project
- v. Kamala Irrigation Project
- vi. Bagmati Irrigation Project
- vii. Kankai Irrigation Project
- viii. Sunkosi-Terai Irrigation Project

- b. Collect , process,if necessary, and evaluate the existing hydro-logical data and information including the review of the previous studies conducted by Water and Energy Commission. This Study will include the assessment of the existing observation system and recommendation of the future hydrological activities.
- c. Collect and evaluate the existing geological data and information.
- d. Collect and evaluate the topographical information, mainly the existing maps for the study.
- e. Examine the development strategy in the field of the water resources development covering hydro-electric generation, irrigation, flood control, navigation and so on, together with analysis of their future demand and needs.
- f. Conduct the site identification study on the Kosi River and assess the power potential along with potential for integrated use of its water resources such as irrigation, flood control, navigation, etc. based on the results of the above items a. to e.
- g. Conduct the project identification study for discarding those projects considered as unfeasible for . obviously adverse reasons.
- h. Prepare the pr-gram for the detailed field investigation including topographic survey and mapping, river survey and surface/subsurface geological survey, for the further detailed analysis use.

Part B - Field Investigation and Project Analysis

- a. Conduct the detailed field investigation in accordance with the program prepared in the Part A of the study.
- b. Assess the sites identified in the Part A of the Study for the power generation in run-of-river or storage schemes and formulate the power generation schemes including multi-purpose schemes.
- c. Examine the agricultural situation, determine the irrigable areas and identify major rehabilitation works for existing systems and new construction works for irrigation.
- d. Examine the land use condition and define a future land use plan.
- e. Examine flood damage in the Kosi River basin and examine and evaluate flood schemes.
- f. Conduct an erosion control and protection study for the effective use of water resources.
- g. Conduct a study of the potential for navigation both inland and international.
- h. Examine access requirement to the sites identified and evaluate them.
- i. Conduct a socio-economic impact study.
- j. Conduct the overall water supply and demand balance in the Study Area including inter-basin development schemes.
- k. Identify the alternative schemes for the Kosi River Water Resources Development covering hydro-power generation, irrigation, flood control, navigation and so on.

Part C - Master Plan

- a. Compare the identified alternative development schemes based on the results of the Part A and B studies considering technological and financial aspects.
- b. Examine and clarify cost and benefit of the alternative schemes of development together with adequate information and supporting data.
- c. Conduct economic evaluation of the alternative schemes and formulate the comprehensive master plan for Kosi River Water Resources Development, including fundamental dimensions and technical description to facilitate further studies.
- d. Examine and formulate the implementation arrangement by suitable technology and method taking into account local condition and availability of construction materials and equipment.
- e. Prepare the terms of reference on identified priority projects for further studies.

Part D - Transfer of Technology

- a. Transfer technological knowledge to Nepalese counterpart personnel through the Study.
- b. Conduct seminars on the water resources development using the Study as the subject matter.

V. THE STUDY SCHEDULE

The Study will be executed in accordance with the Study Schedule attached herewith.

VI. REPORTS

The Japanese Study Team will prepare the following Reports:

a. Inception Report (30 copies)

Inception report will be prepared at the commencement of the field survey, covering method of approach, proposed plan of operation etc.

b. Progress Report (30 copies)

Progress report will be prepared within three(3) months after the commencement of the Study covering the results of the Part A of the Study.

c. Interim Report (30 copies)

Interim report will be prepared within fourteen (14) months after the commencement of the Study covering the results of the Part B of the Study.

d. Draft Final Report

Main Report	30 copies
Supporting Report	10 copies
Compiled Data and Information	1 copy

Draft final report will be prepared within nineteen (19) months after the commencement of the Study.

The report will cover all studies and analysis with enough supporting data, including the alternative development schemes analysed in detail. ED shall give its comments within forty five (45) days after receipt of the draft final report.

e. Final Report

Main Report	50 copies
Supporting Report	50 copies
Compiled Data and Information	2 copies

Final report will be finalized within forty five (45) days after receipt of comments from ED on the draft final report.

VII. UNDERTAKINGS OF HIS MAJESTY'S GOVERNMENT OF NEPAL

1. His Majesty's Government of Nepal shall provide the necessary counterpart consisting of study coordinator, engineers and other personnel necessary for the Study.
2. His Majesty's Government of Nepal will bear claims, if any arises, against the members of the Japanese Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties agreed upon by the two Governments; except such claims arise from gross negligence or willful misconduct on the part of members of the Japanese Study Team.
3. His Majesty's Government of Nepal shall, at its own expense, provide the following:
 - a. Available relevant data, information and materials necessary for the execution of the Study.
 - b. Suitable office space with necessary office furniture for the Study.
 - c. A helicopter with a pilot.
 - d. One vehicle with driver.

4. His Majesty's Government of Nepal shall make necessary arrangement:
 - a. To exempt the Japanese Study Team from taxes and duties on machineries, equipment and any other materials, and personal effects brought into Nepal for the purpose of the Study.
 - b. To allow for the Japanese Study Team to take back to Japan the data, maps, aerial photographs and materials connected with the Study subject to the approval by His Majesty's Government of Nepal in order to prepare the reports.
 - c. To secure the necessary entry permits for the Japanese Study Team to conduct field survey in private properties and other areas if any.
 - d. To inform the members of the Japanese Study Team of any existing risk in the Study Area and take any measure deemed necessary to secure the safety of the members of the Japanese Study Team.

VIII. UNDERTAKINGS OF THE GOVERNMENT OF JAPAN

JICA shall take the following necessary measures to conduct the Cooperation:

1. To organize and dispatch Japanese consultants as the Japanese Study Team to conduct the Study.
2. To bear travelling expenses and fares between Japan and Nepal and also within Nepal for the members of the Japanese Study Team.
3. To bear the cost of accommodation and living expenses for the members of the Japanese Study Team during their visits to Nepal.

4. To bear the cost of fuel for the helicopter.
5. To perform technological transfer to Nepalese counterpart personnel in course of the Study.
6. To conduct a topographic mapping of the potential dam, reservoir and powerhouse sites with scale of 1/10,000 if necessary according to the results of the Part A Study.
7. To provide appropriate number of vehicles for the execution of the Study.
8. To provide a copy machine and other necessary equipment such as micro-computer, drafting instrument and electric typewriter for use in the Study.
9. To send to ED the reports prepared according to section VI of The Scope of Work.

THE STUDY SCEDHULE

[illegible]

APPENDIX 1

LIST OF PARTICIPANTS

Japanese Team

1. Mr. Terumi Iijima, (Team Leader) Director, Social Development Cooperation Department, JICA.
2. Mr. Tadasi Tanimoto, (River Planning) Director, Disaster Prevention Research Sub-Division, River Bureau, MOC
3. Mr. Masazumi Murayawa, (Electricity Generation Planning), Hydroelectric Power Division, Natural Resources and Energy Agency, MITI
4. Mr. Tadashi Hashimoto, (Agricultural Development Planning) Design Division, Kinki Regional Agricultural Administration Office MOAFF
5. Mr. Koichi Miyoshi, (Coordinator) Social Development Cooperation Department (JICA).

HLB

APPENDIX 1 (Contt.)

Nepalese Team

- | | |
|---------------------------------|--|
| 1. Mr. Harsha Man Shrestha, | (Team Leader) Chief Engineer,
Electricity Department. |
| 2. Mr. Badri Man Singh, | Deputy Chief Engineer,
Electricity Department |
| 3. Mr. Gauri Shanker Rajbanshi, | Superintending Engineer
Electricity Department |
| 4. Mr. Kam Chandra Chaudhari, | " " |
| 5. Mr. Surya Bhakta Upadhyay | " " Irrigation
Department |
| 6. Mr. Vijaya Shanker Shrestha, | Senior Engineer, Electricity
Department |
| 7. Dr. Manik Ratna Tuladhar, | " " " |
| 8. Mr. Kiran Shanker | Senior Hydrologist, Irrigation
Department |

HS

7 . 海外援助状況

表 7 - 1

AID COMMITMENTS
(In Million Rupees)

	<u>1975/76</u>	<u>1976/77</u>	<u>1977/78</u>	<u>1978/79</u>	<u>1979/80</u>	<u>1980/81</u> a/
<u>AID GROUP</u>						
Austria	-	-	-	-	7.5	-
Canada	9.2	53.0	28.6	-	56.7	32.8
France	-	-	-	-	-	125.0
Federal Republic of Germany	108.4	159.4	72.1	394.0	50.1	93.0
Japan	132.5	40.2	17.1	234.7	183.7	307.4
Switzerland	17.3	-	31.3	-	37.8	219.3
United Kingdom	-	346.7	4.7	361.3	295.5	-
United States	96.8	8.4	40.8	96.6	112.9	1,060.8
ADB	306.6	560.0	221.1	300.0	370.6	462.8
IDA	425.0	300.0	263.2	519.6	339.0	938.4
UN Group	<u>79.7</u>	<u>210.0</u>	<u>99.8</u>	<u>36.7</u>	<u>143.3</u>	<u>328.4</u>
<u>Sub-Total</u>	<u>1,175.5</u>	<u>1,686.5</u>	<u>780.7</u>	<u>1,942.9</u>	<u>1,597.1</u>	<u>3,567.3</u>
<u>NON-AID GROUP</u>						
India	-	3.0	646.2	4.9	2.6	1.2
China	-	168.0	-	b/	-	-
Other	<u>240.3</u>	<u>53.8</u>	<u>98.8</u>	<u>469.5</u>	<u>311.9</u>	<u>230.3</u>
<u>Sub-Total</u>	<u>240.3</u>	<u>224.8</u>	<u>745.0</u>	<u>474.4</u>	<u>314.5</u>	<u>239.5</u>
<u>TOTAL COMMITMENTS</u>	<u>1,415.8</u>	<u>1,911.3</u>	<u>1,525.7</u>	<u>2,417.3</u>	<u>1,911.6</u>	<u>3,806.0</u>

a/ First nine months.

b/ Establishment of a Paper Mill and a Sugar Mill committed.

Source: Ministry of Finance.

表 7-2

AID DISBURSEMENTS a/
(In Million Rupees)

	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81 Budget Estimates
<u>AID GROUP</u>							
Australia	-	-	-	-	-	-	-
Canada	-	0.5	2.0	6.7	9.5	61.0	10.2
France	-	-	-	-	-	-	-
Federal Republic of Germany	4.5	43.2	17.8	19.9	27.6	66.9	85.7
Japan	9.8	11.0	18.3	1.2	74.4	138.1	86.0
Switzerland	2.0	5.9	19.7	3.9	34.0	37.4	71.8
United Kingdom	25.2	30.8	35.4	73.9	114.4	184.4	176.5
United States	30.3	84.7	42.8	66.6	54.7	32.4	132.7
ADB	51.4	88.1	64.1	80.1	88.9	102.3	288.8
IDA	20.6	34.8	74.2	165.6	203.2	273.8	487.8
UN GFund	20.4	42.7	45.7	92.0	121.3	87.5	160.6
Sub-Total	164.2	341.7	320.0	509.9	728.0	983.8	1,500.1
<u>NON-AID GROUP</u>							
India	113.0	103.9	117.6	117.8	121.4	182.9	171.6
China	54.9	49.4	105.9	76.2	40.3	35.9	56.5
Kuwait	-	-	4.0	56.1	35.6	57.1	145.0
CPEC Fund	-	-	-	52.0	16.6	-	2.0
Other	9.9	10.6	9.4	46.4	47.5	80.8	173.1
Sub-Total	177.8	163.9	236.9	348.5	261.4	356.7	548.2
<u>TOTAL DISBURSEMENTS</u>	<u>342.0</u>	<u>505.6</u>	<u>556.9</u>	<u>858.4</u>	<u>989.4</u>	<u>1,340.5</u>	<u>2,048.3</u>
<u>Memorandum Items:</u>							
Grant Aid	262.8	359.7	392.6	466.6	599.3	805.6	1,049.3
Loan Aid	59.2	145.9	164.3	381.8	390.1	534.9	999.0
Multilateral Aid	92.4	174.9	186.0	391.7	450.6
Bilateral Aid	249.6	330.7	370.9	456.7	538.8

a/ Not including technical assistance and fellowships.

Source: Ministry of Finance.

表 7 - 3 EXTERNAL ASSISTANCE TO POWER SECTOR

Source	Name of Project	Description of Project	Year of Agreement	Amount of Aid (US\$ million)	Terms
<u>Bilateral</u>					
Austria	Namche Small Hydel Plant	Construction of power plant at Solukhumbu (500 kW).	1980	0.63	Grant
China	Sunkosi Hydro-Power	Construction of hydropower of 10.5 MW from Sunkosi River.	1967	8.33	Grant
India	Trisuli Hydro-Power	Construction of hydropower of 18 MW from Trisuli River.	1958	16.22	Grant
	Trisuli Desilting	Construction of a desilting basin in the Trisuli Project.	1972	0.64	Grant
	Devighat Hydro-Electric	Construction of 14.4 MW of power from Trisuli River.	1978	38.67	Grant
Japan	Kulekhani Hydro-Power	Cofinancing for construction of Kulekhani hydropower of 60 MW.	1976	10.00	2.75% interest 30 years with 10-year grace period.
	Kulekhani Hydro-Power	Supplementary loan.	1978	5.00	2.75% interest 30 years with 10-year grace period.
	Kathmandu Transmission Line	Rehabilitation and expansion of transmission line in Kathmandu Valley.	1980	6.58	Grant

Source	Name of Project	Description of Project	Year of Agreement	Amount of Aid (US\$ million)	Terms
Kuwait	Kulekhani Hydro-Power	Co-financing for construction of Kulekhani hydropower.	1976	18.23	2.5% interest 32 years with 7-year grace period.
	Kulekhani Hydro-Power	Supplementary loan.	1979	7.40	- do -
Switzerland	Salleri Small Hydel	Construction of mini hydropower of 80 kW in Solukhumbu District.	1977	0.14	Grant
United Kingdom	Hetauda Diesel Plant	Diesel plants of 10 MW.	1978	3.97	Grant
West Germany	Marsyangdi Hydro-Power	Cofinancing for Marsyangdi Hydro-Power Project of 70 MW.	1975	10.83	Grant
	Marsyangdi Hydro-Power	" "	1976	10.83	Grant
	Marsyangdi Hydro-Power	" "	1978	26.25	Grant
Yugoslavia	Doti Small Hydel	Construction of mini hydropower of 300 kW.	1975	0.75	Grant

Source	Name of Project	Description of Project	Year of Agreement	Amount of Aid (US\$ million)	Terms
<u>Multilateral</u>					
Asian Development Bank	Gandak-Hetauda Transmission	Construction of a 132 kV transmission line	1972	2.70	2% interest, 25 years including 5-year grace period.
	Gandak-Hetauda Transmission	Supplementary loan.	1975	2.50	1% service charge, 40 years, including 10-year grace period.
	Second Power	Construction of transmission line from Bharatpur to Pokhara including sub-station.	1976	3.80	1% service charge, 40 years, including 10-year grace period.
International Development Association	Third Power	Construction of the Hetauda-Biratnagar transmission lines and improvement of Biratnagar Distribution System	1979	18.60	1% service charge, 40 years including 10 year grace period.
	Kulekhandi Hydro Power	Cofinancing for construction of Kulekhandi Hydropower Project	1976	26.0	3/4 of 1% service charge 50 years including 10-year grace period.
	Kulekhandi Hydro Power	Supplementary loan.	1979	14.80	-do-

Source	Name of Project	Description of Project	Year of Agreement	Amount of Aid (US\$ million)	Terms
UNDP	Kulekhani Hydro Power	Cofinancing for Kulekhani Hydropower Project.	1976	3.80	Grant
	Kulekhani	Supplementary financing	1979	1.00	Grant
	Kulekhani	Supplementary financing	1980	2.10	Grant
OPEC Fund for International Development	Third Power	Cofinancing with the Bank Third Power Project.	1979	1.30	3/4 of 1% service charge 20 years including 5 years grace period.

8 . ネパール基本情報

Area
140,796 km²

Population
14.00 million (mid-1980)
Rate of growth: 2.3% (1975-80)^{a/}

Density
99 persons/km

Social Indicators

Life expectancy at birth (year)	45 (1977)
Pipe water in urban area (%)	83 (1978/79)
Pipe water in rural area (%)	7 (1978/79)
Primary school enrollment (%)	77 (1978)
Adult literacy ratio (%)	19 (1976/77)
Calories intake per day per capita (Cal)	2002 (1977)
Protein intake per day per capita (Gram)	47.7 (1977)
Persons per physician	38650 (1976)

	<u>1975/76</u>	<u>1976/77</u>	<u>1977/78</u>	<u>1978/79</u>	<u>1979/80</u>
<u>Gross Domestic Product (GDP)</u>					
GDP at current market prices (NRs Mn)	17394	17280	19598	21634	25055
GDP at 74/75 constant prices (NRs Mn)	17300	17822	18087	18765	18510
Growth rate (%)	4.4	3.0	1.5	3.8	-1.4
Per capita GNP (US\$) ^{b/}		110(1977)	120(1978)	130(1979)	...
<u>GDP (at market prices) by Industry (%)</u>	100.0				
Agriculture, forestry & fishery	66.8				
Mining & manufacturing	9.8				
Construction	1.1				
Electricity & water supply	0.2				
Transportation & communications	4.6				
Commerce	4.8				
Other services	12.7				

Savings Ratio

Domestic savings as % of GDP	4.8 (1974/75)	8.2 (1979/80)
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^{a/} Recent revised estimate.

^{b/} World Bank estimates, using 1977-79 as base period.

	1976	1977	1978	1979	1980
<u>Production Indexes</u> ^{a/}					
Agriculture (1969/71 = 100)	115	110	109	112	100
Growth rate (%)	3.6	-4.3	-0.9	2.8	-10.7
<u>Manufacturing</u> ^{b/}					
Electricity (1971 = 100)	222.0	240.7	271.2	300.0	...
Growth rate (%)	14.9	8.4	12.7	10.6	...
<u>Price Indexes</u>					
	1975/76	1976/77	1977/78	1978/79	1979/80
<u>Consumer (Kathmandu)</u>					
(1972/73 = 100)	141.1	141.5	155.9	161.1	180.8
Annual increase (%)	5.3	0.3	10.2	3.3	12.2
<u>Money and Credit (NRs Mn.)</u> ^{a/}					
Money supply	1452.5	1852.9	2167.6	2491.7	2832.3
Annual change (%)	8.6	27.6	17.0	15.0	13.0
<u>Commercial Bank</u>					
Time & Savings deposits	1005.7	1330.0	1711.7	1932.2	2386.1
Loans to private sector	693.6	824.7	1037.6	1299.9	1855.1
	1976/77	1977/78	1978/79	1979/80	1980/81
(Actual)	(Actual)	(Actual)	(Actual)	(Actual)	(Budget)
<u>Government Finance (NRs Mn.)</u>					
Current revenue	1302.2	1559.3	1811.9	1857.1	2414.3 ^{c/}
Current expenditure	784.1	815.0	1041.7	1135.6	1454.2
Current surplus/deficit (-)	518.1	744.3	770.2	721.5	960.1
Capital expenditure	1498.3	1808.0	1978.8	2403.8	3413.9
Overall surplus/deficit (-)	-980.2	-1063.7	-1208.6	-1682.3	-2453.8
<u>Financing</u>					
Domestic borrowings, net	300.0	240.0	200.0	180.0	250.0
Foreign borrowings & grants	556.9	848.4	989.4	1363.8	2048.4
Use of cash balances	123.3	-24.7	19.2	138.5	155.4

^{a/} Revised.

^{b/} Data are not available.

^{c/} Includes new revenue proposals.

	1975/76	1976/77	1977/78 ^{a/}	1978/79 ^{a/}	1979/80
Balance of Payments (US\$ Mn.)					
Exports (f.o.b.)	96.8	94.0	87.8	108.6	95.1
Imports (f.o.b.)	-154.8	-167.1	-209.6 ^{c/}	-242.7 ^{c/}	-294.3 ^{c/}
Trade balance	-58.0	-73.1	-120.9	-134.1	-199.2
Services (net)	22.7	39.4	47.6	64.9	91.6
Transfers (net)	47.1	49.4	49.0	72.5	99.2
Current balance	11.8	15.7	24.3	3.3	-8.4
Capital flows (net)	16.8	9.1	25.2	45.3	10.9
Official	11.7	17.2	24.3	35.7	48.1
Miscellaneous	5.1	-8.1	0.9	9.6	-37.2
Net error & omissions					
Overall balance	28.6	24.8	0.9	48.6	2.5
Trading Export Commodities (%)	1975/76	1976/77	1977/78	1978/79	1979/80
Food	67.8	51.5	38.7	37.6	26.9
Crude materials	19.1	32.4	42.2	37.9	39.9
Manufactured goods	10.8	13.0	16.9	21.7	30.3
Trading Import Commodities (%)					
Minerals, fuels & lubricants	10.7	12.4	10.1	8.1	11.5
Manufactured goods	27.5	40.2	41.3	47.1	40.0
Machinery & transport equipment	20.9	18.7	19.6	19.9	21.4
Food	14.7	12.4	13.1	10.1	8.0
Chemicals & drugs	9.6	11.2	10.3	10.3	10.3
Crude materials	4.5	1.8	2.1	2.1	1.9
Terms of Trade^{b/}					
Exchange Rate (NRs/\$)	1976 12.50	1977 12.50	1978 12.00	1979 12.00	1980 12.00
International Reserves					
Total (end of year, \$ Mn.)	134.9	147.8	153.6	170.4	195.9
Ratio to merchandise imports (Months)	10.5	10.6	8.8	8.5	8.0
External Public Debt (\$ Mn.)					
Outstanding (including undischarged, end year)	236.5	301.2	381.6	363.5	
Outstanding (disbursed only, end year)	44.3	72.7	87.7	125.8	
Service payments (during year)	1.7	2.2	2.7	3.2	
Debt service ratio (%)	1.0	1.4	1.4	1.4	

^{a/} Revised.

^{b/} Data are not available.

^{c/} c.i.f.

^{d/} June 1980.

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