



NVE
NORWEGIAN
WATER RESOURCES AND
ENERGY ADMINISTRATION

MELAMCHI WATER SUPPLY PROJECT, NEPAL

Report from fact-finding mission



Location for water treatment plant (foreground) and hydro power station (background)

NORGES VASSDRAGS-
OG ENERGIDIREKTORAT
BIBLIOTEKET

Report to:
Ministry of Housing and Physical Planning, Nepal
NORAD

April 1998

MELAMCHI WATER SUPPLY PROJECT, NEPAL

REPORT FROM FACT FINDING MISSION

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
BPC	Butwal Power Company
EIA	Environmental Impact Assessment
HMGN	His Majesty's Government of Nepal
JICA	Japanese International Co-operation Agency
kV	kilovolt
MHPP	Ministry of Housing and Physical Planning
MoU	Memorandum of Understanding
MW	Megawatt
MWR	Ministry of Water Resources
NORAD	Norwegian Agency for Development Cooperation
NVE	Norwegian Water Resources and Energy Administration
NWSC	Nepal Water Supply Corporation
PD	Project Document
TA	Technical Assistance
TBM	Tunnel Boring Machine
TOR	Terms of Reference

1. INTRODUCTION

In the annual consultations 27-28 January 1998 between His Majesty's Government of Nepal (HMGN) and Norway, Norway was requested to take a leading role in the Melamchi Water Diversion Scheme. Norway confirmed a positive interest in the project, but made a commitment dependent on certain conditions. It was agreed to allocate country programme funds "for preparation of additional project documentation needed for further decision making on the project, documentation both in respect of the project in general, and for the Melamchi Diversion Scheme in particular. Further, the documentation should define the role of the private sector involvement related to the hydropower component". The parties agreed that this project documentation would be prepared by a consultant proposed by Norway and approved by HMGN. HMGN further requested Norway to appoint technical advisors to draw up the Terms of Reference (TOR) for such a task.

NVE was, by letter dated 17.03.98, appointed to prepare this TOR, collect information and prepare a budget for preparation of the documentation mentioned above, hereinafter called the "fact-finding mission". The Terms of Reference for the fact-finding mission is set out in Appendix I.

A visit was made to the Asian Development Bank in Manila and to Nepal 20.3-3.4.98 to receive information and viewpoints and to collect documents/reports concerning the project. Institutions and persons met are listed in Appendix II. Consultations have been held with the Norwegian embassy in New Delhi and NORAD in Oslo.

The Government of Norway have stressed the following important issues that HMGN has to address before final commitment from Norway:

- Evidence satisfactory to it that the water supply system in Kathmandu is placed under outside management and that necessary steps are taken with a view to improve the distribution system and the sewerage system in the Kathmandu Valley.
- Evidence satisfactory to it that the hydropower project will be developed as a commercial power development project. Implicit that HMGN will issue the required license to the developer, and that satisfactory access to water for the Melamchi Water Supply Project as a whole has been secured.
- Evidence satisfactory to it that assistance from the ADB and other donors will be provided in accordance with the principles indicated above.
- Environmental aspects related to the whole Melamchi Water Supply Project would also have to be taken into account.

Furthermore, in order to secure a smooth development of the diversion scheme:

- HMGN will ensure that local know-how and experience is further developed through the utilization of existing national capacity in the hydropower sector, i.e. Butwal Power Company and sister organizations, in the tunneling works and the development of the power plant.

2. DESCRIPTION OF THE PROJECT

The purpose of the Melamchi Water Supply Project is to provide new water supply to Kathmandu Valley and to establish efficient operation and management of the water supply all the way to the end users. A secondary purpose is production of electricity, in that the available hydraulic head will be utilized in a hydropower plant before the water is delivered to the treatment plant.

The Melamchi Water Supply Project consists of the following components, as described in the Feasibility Study of 1996 (Reference no. 3, Appendix IV) :

I. The Melamchi Diversion Scheme (see fig. 1):

- Headworks on the Melamchi River, approx. 35 km North-East of Kathmandu with a head race tunnel of length 28 km to Sundarijal, near Kathmandu.
- Hydropower plant, maximum static head 340 m, output 15 MW at 3.6 m³/s, with a 132 kV transmission line
- Facility for supplying raw water from the tailrace to water treatment plant
- Access roads and ropeways necessary for construction and maintenance of the facilities

The low flow capacity of the Melamchi River is expected to cover the needs up to year 2012 (170,000m³/d), from which time two other rivers (Yangri and Larke) may be connected to the system (see figure 1).

The main data for the Diversion Scheme is set out in Appendix III.

II. Water treatment plant and bulk distribution system:

- Water treatment plant (initial capacity 170,000 m³/s) to be constructed close by the hydropower plant
- trunk mains to connect to strategic points in the distribution system.

ADB is expected to be the financing agency for the bulk distribution system. Assistance from JICA has been requested for the water treatment plant, but response has not yet been received.

III. Improved distribution system

- Restructuring of Nepal Water Supply Corporation, operation and management contracted to private operator(s).
- Rehabilitation/improvement of water distribution and sewerage system.

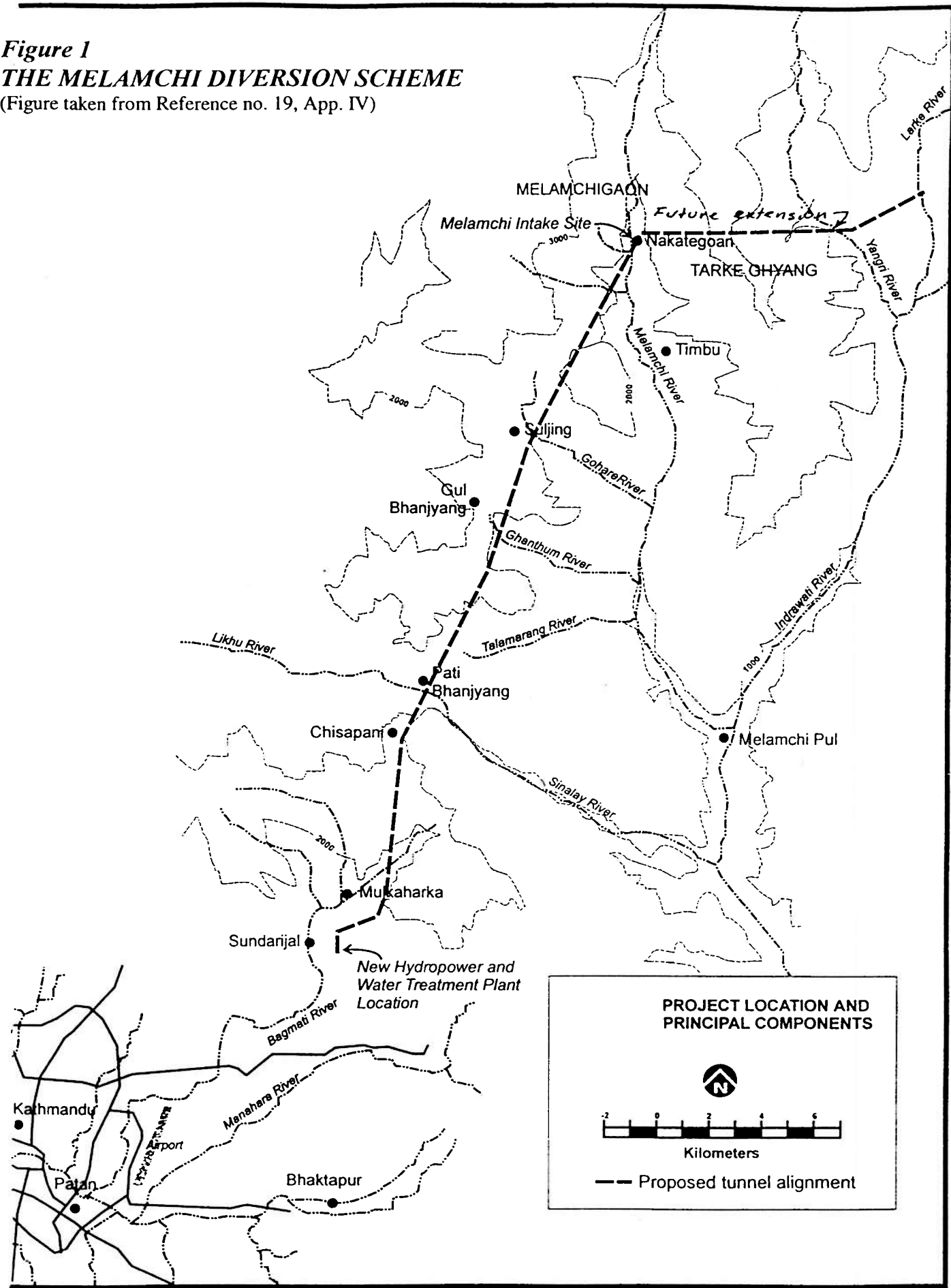
The World Bank is expected to be the main financing agency for the distribution system.

HMGN has requested the ADB to take a lead role in packaging the project and coordinating the financial arrangements. ADB will provide a Technical Assistance loan of about USD 5 million to prepare the project, conduct project management, and to investigate artificial recharge of the groundwater in Kathmandu Valley. ADB would also provide a USD 800,000 technical assistance grant to assist HMGN with urban water supply sector policy reforms.

The Ministry of Housing and Physical Planning (MHPP) will be Executing Agency for the project and in charge of project management and coordination.

A list of the documents received during the fact-finding mission is set out in Appendix IV.

Figure 1
THE MELAMCHI DIVERSION SCHEME
(Figure taken from Reference no. 19, App. IV)



3. MAIN FINDINGS, UNRESOLVED ISSUES, ASSESSMENTS

3.1 Results of discussions, main findings

Overall situation, the road towards finalizing the Project Document

It follows below that there are some unresolved issues and things to study further. But these (at least it seems now) can be resolved as part of the preparation of the Project Document. When a draft PD is ready, HMGN will invite for a donor's meeting where i.a. the document is reviewed. It seems now that such a meeting can be held in July this year. ADB (Mr. McIntosh) concurs with such a meeting and it is assumed that it then still will be time to make adjustments to the TA programme (if necessary). The intention is furthermore that the donors should firm up commitments towards the financing of the project. The PD will then be finalised based on adjustments agreed at the meeting and commitments received.

Project management and coordination

ADB and MHPP have worked out the enclosed chart for management and coordination of the overall project (Appendix V). It will be seen that the day to day management and coordination will be done by the TA team, under leadership from MHPP as the executing agency. Here there will be a Project Management Unit and the Project Director. The project will be headed by a board. The board has not yet been approved, but the proposal is as follows: Secretary MHPP (Chairperson), representatives of Ministry of Finance, National Planning Commission, Melamchi Water Ltd., Department of Water Supply (in MHPP), Mayor of Kathmandu Metropolis, Ministry of Water Resources and project Director.

Privatization of BPC

From the Ministry of Finance it was informed that the decision to privatize BPC has been taken and the following status was given: All fact-finding has been completed and the legalities are clear. Engagement of evaluator (from Britain) to evaluate the business and assets is in progress. This work is expected to be completed in April. Then follows approval by the Cabinet, the announcement, tendering, evaluation of bids and contract negotiations with 2 or 3 bidders. The Ministry's expatriate advisor working with this case hoped that everything would be completed by August or September. It was informed that several companies both in Britain and in Norway already had expressed their interest. The proposal was to let the investor have 65% of the shares, while the Government would keep 20%, the public would get 10%, and 5% would be retained as incentive for the employees (through trustfund to contribute to the salaries).

License and PPA for the Melamchi Diversion Scheme

The Ministry of Water Resources (MWR) informed that the Melamchi Diversion Scheme will need a license from the MWR both for extraction of water for water supply and for power production. According to the law, water supply (drinking water) has priority over power production. There will be no problem to get license for Melamchi. The combined use water supply/power is positive. As far as the hydro power components is concerned, there should be no problem to get a PPA with NEA (NEA is under MWR). Since it is a relatively small project (15 MW) it will be easy to fit in and its closeness to the load center is positive as well.

Possible conflict Melamchi/Indrawati?

An English translation of the license given for the Indrawati project which had been received from the developers of this project, was reviewed and confirmed in meeting with the MWR. The license is given with the condition that the mean monthly flows in the dry season of Yangri and Larke can be diverted to Melamchi from years 2013 and 2018 respectively. The dates and the flows as stated in the license are the same as in the Feasibility Report of 1996. The possibility of needing these supplementary flows at earlier dates was considered highly unlikely by the Project Director. This i.a.

due to delays already incurred and problem of financing these expansions so shortly after completion of the current project. It was also stated that in case the pilot project for groundwater recharge in Kathmandu valley is successful, this source would be used in the lean season - since the infrastructure already is there. In that case the supplementary flows from Yangri and Larke would not be needed. Based on the above, there would be no conflict between these two schemes. However, in the case the dry season flow of Melamchi River has been significantly overestimated or the water demand forecast underestimated, there may be a problem for a few years. Likewise, if the power producer for economic reasons should want to include the Yangri and the Larke from the very beginning, the compensation that would be due the developers of Indrawati up to the years 2013 and 2018 would be detrimental for this solution.

Butwal Power Company Ltd.

The BPC chairman stated that BPC already had made a commitment as BOOT operator for the hydropower component. Himal Hydro would take on the tunnel and headworks (all civil works) and BPC Hydroconsult the engineering. He had not thought about how to settle on the price for the tunnel and headworks when these partly will be financed as grant. BPC Hydroconsult is a department in BPC while Himal Hydro is a separate company. He stressed, however, that BPC, Himal Hydro and BPC Hydroconsult would like to come in as one entity. Outside support would be needed to both Himal Hydro and BPC Hydroconsult. BPC could not give information as to whether the hydrological measurements in Melamchi Khola have continued after completion of the Feasibility Study in 1996. However, information on this would be forthcoming.

Nepal Water Supply Corp. (NWSC), Management Contract

The water supply situation for the population served by NWSC is very poor indeed. Due to insufficient capacity of the sources being used, water is being served on a rotational basis. The NWSC manager said that several hundred employees are engaged in systematically opening and closing valves to accomplish this rotational supply. Most people get water only 1-2 hours per day. The situation is not quite as bad as it sounds, because most people have a tank at ground water level (of capacity around 1000 l) which will be more or less filled during this period. The water is subsequently pumped to a tank on the roof, from where it gravitates to the supply points. The leakage percentage is about 40%, which is very high when one considers that there is no pressure most of the time. Less than 40% of the demand is met during the dry period when the leakage is taken into consideration (Ref. 24, App. IV). During the wet period the corresponding figure is 60-70% . The demand increases by about 5% per year.

Another problem is low collection rate (but how to blame the customers when they get such bad service).

The World Bank and others have been engaged in projects with NWSC for a long time. Presently, a 33 million dollar "Urban Water Supply and Sanitation Rehabilitation Project" is being carried out. The components include (Ref. 23):

- Management support
- Rehabilitation of 14 wells and 23 well complexes
- Construction of 6 new wells
- Sewer rehabilitation and extension (1 treatment plant, 30 km trunk sewer, replacement of 7 km sewer, rehabilitation of 55 km old combined sewer, construction of 2500 house connection)
- Rehabilitation of surface water sources and networks (2 surface water schemes, 10 reservoirs, 100 km distribution lines, 12,000 house connections)
- Supply of 40,000 water meters and spare parts
- Supply of equipment, tools, and spare parts
- Consultancy services and misc.

The decision to privatize the operation of the NWSC has been taken by the Government. The World Bank has engaged a Consultant to work out the modalities for this operation, which is expected to be

ready in about one year. It was informed that both a leasing arrangement and a straight management contract is being considered. Duration was said to be 7-8 years. Payments to the operator are expected (at least partly) to be incentive based (payment by fulfilment of targets). The arrangement shall be approved by MHPP beforehand. It was stated (by Mr. Poshan Nepal) that comments from NVE would be welcome.

The NWSC manager stated concern that the support through the management contract would not be sustainable. He felt that the main problem was lack of water and when Melamchi came on stream, he would be able to straighten out the situation without such support. He stated that already NWSC is earning revenue that covers operation and maintenance. He also expressed concern over higher tariffs that would be the result of costly foreign experts.

The Country Director of the World Bank expressed that WB involvement in the management contract and further investment projects would be contingent on HMGN's approval of the prerequisites (restructuring/reduction in staff, tariff increases etc) and that some actions along these lines have been demonstrated. The decisions to be taken by HMGN would come up in 3-4 months time. The present NWSC project may be reduced further (from USD 33 mill) due to NWSC's inability to perform.

The impression after all this is that some rather heavy measures are needed to straighten out the water supply situation in Kathmandu valley. The size of the system itself (around 1 million people served) indicates that a large scale approach is needed. A management contract executed by foreign professionals seems therefore to be the appropriate solution. The challenge will be to find a contract solution that will encourage the contractor to involve the local personnel as much as possible in important tasks, thereby making the project as sustainable as possible.

3.2 Unresolved issues, need for clarifications, special checks to be carried out

Roles and Responsibilities for the Melamchi Diversion Scheme

A major issue is how to organise the Melamchi scheme with ownership, roles and responsibilities. The public/private partnership of Melamchi Water Ltd. proposed in the Feasibility report of 1996 (ref. no. 5, App. IV) and set out in agreement between 12 stakeholders - had failed. The reason for this was failure to obtain financing with this configuration. ADB has certain viewpoints, see Appendix VII. For purpose of discussion a note was prepared and discussed with Mr. Poshan Nepal. A version revised according to the discussion follows as Appendix VIII. This model should be looked upon as one alternative to be compared with other possibilities. Various solutions will be looked into and consulted with the involved parties. Possible financial arrangements will be an important part of the assessments in this connection. MHPP will thereafter select a solution for presentation in the PD.

Financing of remaining components

With reference to the MoU between HMGN and ADB of December 1997, wherein financial assistance from ADB for the bulk transmission system and the World Bank for the distribution system was indicated, only the water treatment plant remains. The Japanese government has been requested formally for this, but no response has as of yet been received. Therefore it is too early to request other donors. HMGN is also thinking about private financing. This would, in case it is carried further, be consulted with the involved parties (donors).

Financing of sewerage systems

A sewerage system is presently under construction with Government financing. Total cost is the equivalent of USD 6 mill. This consists of interceptor, diversion tunnel and treatment plant (oxidation channel). MHPP is currently preparing a Master Plan for the greater Kathmandu area. The plan is expected to be ready by the end of 1999. Projects will then be defined on basis of the Master Plan and prepared for financing.

Other issues.

The following tasks should be carried out in parallel with the preparation of the PD. If relevant, the results will be mentioned in the document.

- Engagement of an engineering geologist to assess the work of the Feasibility Study and in particular assess whether additional geological field tests should be carried out before implementation. The Feasibility Study recommends against this on the grounds that it would not be worth while due to very shifting conditions (better to take the risk and solve as you go), whereas ADB has included a field programme (core drillings etc) as part of the TA programme.
- Design of a formalized set-up for public participation and information system in the decision-making process.
- A rough comparative study of using tunnel boring machine (TBM) instead of conventional blasting for the head race tunnel. This may mean shorter construction time, but more importantly, perhaps 50 m extra head for the power production. MHPP and NVE are in full agreement with the principle of using technology available locally, but feel that the alternatives should be known. A brief study will also be made of the consequences of increasing the cross-sectional area of the tunnel based on conventional blasting. The results of this work may lead to a more detailed study by the main Consultant after commissioning.
- Outline of licensing conditions for the hydropower plant
- Outline of legal document between the Power Producer and HMGN/MHPP
- Check possible problem with air pockets in head race tunnel
- Special review of the hydrology
- What to do with Melamchi Water Ltd. (now they only work with the access roads)

With reference to the country programme discussions with Norway last December, MHPP would like to retain advisory services by NVE in the planning and implementation phases. The services would be within the functions of NVE in water and energy, and would be defined as the project moves along. The types of services that can be foreseen will be described in the PD and a lump sum will be set aside in the budget of the PD.

4. PLAN FOR PREPARATION OF PROJECT DOCUMENT

NVE will carry out a general review of the documents listed in Appendix IV. Special attention will be paid to the Feasibility Study of 1996 and reports on EIA and social matters. Comments of importance in the decision-making for the project and comments that concerns further studies, will be included in the PD. The tasks listed in Section 3.2 above will carried out and, if relevant, mentioned in the PD.

It was agreed that the PD should follow the following outline:

Outline of Project Document

EXECUTIVE SUMMARY

INTRODUCTION

1. ***BACKGROUND***
2. ***PROJECT RATIONALE***
3. ***OBJECTIVES***
Development objectives (goals)
Immediate objectives (purposes)

OVERALL PROJECT (4 COMPONENTS):

4. ***PROJECT DESCRIPTION (4 components)***
Brief description, mode of execution, parties involved, status at present
5. ***MANAGEMENT AND COORDINATION***
Overall system (TA + MHPP), show chart
6. ***COSTS***
7. ***TIME SCHEDULE***

MELAMCHI DIVERSION SCHEME (Component no.1)

8. ***SUMMARY***
9. ***BACKGROUND, RESPONSE TO CONDITIONALITIES***
10. ***OVERVIEW OF SCHEME***
Project design. Studies and reports. Overview of activities and components, Implementing agency, roles and responsibilities of involved parties. (Write-up about the involved parties in Appendix)
11. ***PROJECT EXECUTION***
Presentation of each activity/component with methodology (without details), timing, milestones etc
12. ***PROCEDURES***
Procurement, contracting, payments, cost control, auditing, public participation and information to the public
13. ***PROJECT IMPACTS***
Impact on the natural environment
Impact on socio-economic conditions, incl. gender impact
Further studies
Mitigation measures
14. ***TIME SCHEDULE***
15. ***BUDGET***
16. ***ECONOMIC ASPECTS***
17. ***PROPOSED FINANCING ARRANGEMENTS***
18. ***OPERATION AND MAINTENANCE ARRANGEMENTS***
19. ***ASSESSMENT OF PROJECT RISKS***
(Geology, hydrology, cost estimate in general)

APPENDICES:

1. *Write-up about involved parties in the Melamchi Diversion*
2. *Outline of license for Melamchi Diversion*
3. *Outline of legal document between HMGN and the Power Producer*

The schedule for the work described in Section 3.2 and preparation of the PD is planned as follows:

Submittal of fact finding report:	23 April
Submittal of draft contract NVE/MHPP:	24 April
Contract signed:	30 April
Approval by NORAD:	8 May
Start of work:	8 May
Review of documents, specialist work (Section 3.2), completed on:	29 May
Drafting of PD in (Norway and Nepal), completed on:	12 June
Donors meeting:	Week 28 (6 –12 July)
Completion of Final PD:	Week 29 (13-19 July)

Proposed personnel, time estimate

Team leader: Mr. Terje Gimming

The team leader will review the most important documents, communicate and coordinate with the rest of the team, and discuss the various professional issues. Organizing of contracts, roles and responsibilities of the various parties will be a main task. He will draft most of the Project Document. Estimated input 250 hours (incl. 2 visits to Nepal)

Hydropower engineer: Mr. Alf Adeler

The Hydropower engineer will review the Feasibility Study Report of 1996 and comment on technical issues and the cost estimate. He will conduct the comparative study on tunnel boring machine, look into the consequences of increasing the cross-sectional area of the tunnel, and he check potential problem of air pockets in the tunnel. Estimated input 50 hours.

Hydrologist: Mr Egil Skofteland:

The Hydrologist will review the hydrological analysis in the 1996 Feasibility Study and comment, particularly with respect to the time duration of the observation series and possible inaccuracy of the design data and consequences on the project's economic viability. Estimated input 15 hours.

Economist: Mr. Rolv Bjelland

The economist will review the economic analysis of the 1996 Feasibility Study and the Financial Analysis Report of 1998. A key issue will be whether the diversion scheme is economically viable, i.e. that the cost of the raw water as delivered is "reasonable", at the same time as a certain (calculated) portion of the headworks and tunnel cost is charged to the power project. A sensitivity test will be carried out on the most important parameters (construction cost, availability of water, power price etc). Estimated time input 25 hours.

Engineering geologist (subcontracted to NVE): Professor Einar Broch, The Norwegian University of Science and Technology

The engineering geologist will review the 1996 Feasibility Study and assess the investigations carried out, the extent of rock support, the cost estimate, and in particular whether additional geological field tests should be carried out before implementation (see Section 3.2 above). Estimated time input 30 hours.

Environmental expert (natural environment): Ms. Anne Kronen Helgestad

The environmental expert will review the 1996 Feasibility Study and earlier and subsequent reports, e.g. Ballofet and Associates, January 1998 "Environmental Impact Assessment". Comments will be made regarding sufficiency of data and information and need for further studies. Estimated time input 30 hours.

Acquatic life/fisheries expert: Mr. Jan Henning L'abee-Lund

The fisheries expert will review the chapters on aquatic life and fisheries of the 1996 Feasibility Study and earlier and subsequent reports, e.g. Ballofet and Associates, January 1998 "Environmental Impact Assessment". Comments will be made regarding sufficiency of data and information, and possible need for further studies. Need for minimum release will be commented upon. Estimated time input 30 hours.

Licensing expert: Mr. Knut Gakkestad

The licensing expert will (in cooperation with the legal expert) prepare an outline of the proposed licensing conditions for the Melamchi diversion (water supply and power production). He will also cooperate with MHPP in developing a system for public information and participation in the decisionmaking process. Estimated time input 70 hours (incl. visit to Nepal).

Social Scientist (subcontracted to NVE): Dr. Desmond McNeill, Centre for Development and the Environment, University of Oslo

The social scientist will review the 1996 Feasibility Study and earlier and subsequent reports, e.g. Ballofet and Associates, January 1998 "Environmental Impact Assessment". Comments will be made regarding sufficiency of data and information, and possible need for further studies. Estimated time input 20 hours.

Legal expert (subcontracted to NVE): Mr. Kjell Haagenen

The legal expert will, in cooperation with the licensing expert and the team leader prepare an outline of agreement between the Power Producer and the owner of the water supply scheme. Estimated time input 20 hours.

Budget

Fee, NVE personnel 470 hours at NOK 475/hour	223,250
Fee, social scientist, 20 hours at NOK 600/hour	12,000
Fee, engineering geologist, 40 hours at NOK 700/hour	28,000
Fee, legal expert, 20 hours at NOK 760/hour	15,200
Air tickets, 3 round trips Norway-Nepal at NOK 25,000	75,000
Per diem expenses 40 days at NOK 1300/day	52,000
Copying, local transport	<u>10,000</u>
Sum	415,450
Approx. 10% contingencies	<u>39,550</u>
TOTAL	<u>455,000</u>

Terms of Reference

The Terms of Reference shall specify the review and preparation of comments to the project documentation (see Appendix IV), issues to be clarified as described in Section 3.2 and a Project Document according to outline presented herein - with modifications resulting from a Donors Meeting. The proposed Terms of Reference is set out in Appendix VI.

Appendices:

- I. TOR for fact-finding mission
- II. Persons and institutions met
- III. Main data for the diversion scheme
- IV. References - Reports and documents received
- V. Chart showing organization and management of the overall project
- VI. TOR for PD
- VII. Note by Arthur McIntosh of ADB dated 23.03.98
- VIII. Note on roles and responsibilities dated 30.03.98
- IX. Photos

*Appendix I***MELAMCHI WATER SUPPLY PROJECT, NEPAL****TERMS OF REFERENCE****FOR****ASSISTANCE REGARDING PROJECT PREPARATIONS****1. BACKGROUND**

The Melamchi Water Supply Project ("the Project") comprises the following three components:

- A) Upstream water supply comprising the intake, tunnel and a 15 MW hydropower plant (referred to as "the Melamchi Diversion Scheme").
- B) Water treatment and bulk distribution.
- C) Local water distribution.

The Norwegian Government is considering part funding of component A.

In annual consultations 27-28 January 1998 between His Majesty's Government of Nepal (HMG/N) and Norway, Norway was requested to take a leading role in the Melamchi Diversion Scheme. Norway confirmed a positive interest in the project, but made a commitment dependent on certain conditions. It was agreed to allocate country programme funds for "preparation of additional project documentation needed for further decision making on the project, documentation both in respect of the project in general, and for Melamchi Diversion Scheme in particular. Further, the documentation should also define the role of the private sector involvement related to the hydropower component". The parties agreed that the project documentation would be prepared by a consultant proposed by Norway and approved by HMG/N (Herein referred to as phase 2). In order to get this work started as soon as possible, HMG/N further requested Norway to appoint technical advisors to draw up the Terms of Reference (ToR) for such a task (herein referred to as phase 1).

The present assignment is limited to phase 1. The appointment for phase 2 would be subject to the approval of HMG/N.

The Government of Norway have stressed the following important issues that His Majesty's Government of Nepal (HMG/N) will have to address prior to a final commitment from Norway:

- Evidence satisfactory to it that the water supply system in Kathmandu is placed under independent outside management and that necessary steps are taken with a view to improve the distribution system and the sewerage system in the Kathmandu valley.
- Evidence satisfactory to it that the hydropower project will be developed as a commercial power development project. Implicit that HMG/N will issue the required license to the developer, and that satisfactorily access to water for the Melamchi Water Supply Project as a whole has been secured.
- Evidence satisfactory to it that assistance from the Asian Development Bank (ADB) and

other donors will be provided in accordance with the principles indicated above.

The environmental aspects related to the whole Melamchi Water Supply Project would also have to be taken into account.

Furthermore, in order to secure a smooth development of the upstream water supply component:

- HMG/N will ensure that local know-how and experience is further developed through the utilization of existing national capacity in the hydropower sector, i. e. Butwal Power Company (BPC) and sister organizations, in the tunneling works and the development of the power plant.

The Asian Development Bank (ADB) and HMG/N have signed a Memorandum of Understanding (MoU) on 9 December 1998, which inter alia includes a component of technical assistance for project management. The approach to this assignment shall be discussed and coordinated with ADB in order to secure a smooth implementation and to prevent any duplication of work.

2. OBJECTIVES

The technical advisor shall initially, through a problem identification mission, obtain and co-ordinate information about the project and receive viewpoints from involved parties regarding proposed organisational and contractual arrangements for the project and to specify possible needs for further information and clarifications.

The technical advisor shall further, based on the above findings, assist MHPP in preparing the ToR for the preparation of the project documentation required for NORAD's formal consideration of its financial assistance to the Project.

3. SCOPE OF WORK

Problem identification mission

The technical advisor will review available documentation in Norway before he visits ADB in Manila and obtain copies of feasibility study reports and other important project documents. The project components will be reviewed, with particular attention to organisational matters with roles and responsibilities, costs and economy. Impact studies on social conditions and natural environment will be reviewed together with ADB staff with a view to assess whether additional studies will be needed prior to project implementation. Programmes and anticipated effects of mitigation measures will also be reviewed.

The technical advisor will then proceed to Kathmandu. He will relate to MHPP and its Project Director as client. MHPP will be responsible for organising field visits, meetings etc. There will be field visits to get an impression of important features of the Melamchi Diversion Scheme, water treatment plant, new trunk mains and of the distribution system of Nepal Water Supply Corporation (NWSC). If possible, the Sewerage System of Kathmandu should also be paid a brief visit. Meetings will be held with concerned authorities, including (in addition to MHPP)

Ministry of Water Resources (MWR), NWSC, Butwal Power Company (BPC), and the World Bank Resident Mission. The meetings should be problem oriented, focusing on current problems and possible ways and means of solving them.

Within two weeks (10 working days) of returning to Norway via the Norwegian Embassy in New Delhi a report will be submitted to MHPP, with copies to the Embassy and NORAD, outlining the main findings of the mission, especially on issues assessed as critical for the project, and with a plan for follow up work. The draft ToR for the preparation of a project document shall be submitted along with the report.

Oslo, 17 March 1998

Øistein Glømmi

Appendix II

PERSONS AND INSTITUTIONS MET

(In the order the meetings occurred)

<u>Name, title</u>	<u>Institution</u>
Mr. Odd Hoftun, Consultant	
Mr. Morten Høyum, Commercial Counsellor	The Norwegian Embassy, Manila
Mr. Arthur C. McIntosh, Senior Project Engineer	Asian Development Bank
Mr. Poshan Nath Nepal, Special Secretary	Ministry of Housing & Physical Planning
Mr. Khagendsa Basnyat, Secretary	Ministry of Housing & Physical Planning
Mr. Balaram Pradhan, Consultant	
Mr. Salit Kumar Basnet, Senior Divisional Engineer	Melamchi Water Limited (Guide on field trips)
Mr. Madhap P. Ghimire, Joint Secretary	Ministry of Finance
Mr. Douglas G. Clarke, Resident Advisor (Privatization project)	Ministry of Finance
Mr. Arun Kumar Ranjitkar, General Manager,	Nepal Water Supply Corporation
Mr. Madan Shankar Shrestha, Manager (WB project)	Nepal Water Supply Corporation
Mr. Rathneswar Lal Kayastha, Joint Secretary	Ministry of Water Resources
Mr. Y. L. Vaidya, Special Secretary	Ministry of Water Resources
Mr. Angira Acharya, Senior Divisional Engineer	Ministry of Water Resources
Mr. Kishor Babu Aryal, Deputy Director General	Electricity Development Center, Ministry of Water Resources
Mr. Kari Om Shrestha, Chairman	Butwal Power Company Ltd
Pushpa Nath Sharma, Acting General Manager	Butwal Power Company Ltd
Mr. Hans M. Rothenbuhler, Country Director Nepal	World Bank

Appendix III

MAIN DATA FOR THE MELAMCHI DIVERSION SCHEME

(as presented in the 1996 Bankable Feasibility Study. Reference no. 3, App. IV)

Project Name Melamchi Diversion Scheme

Hydrology (At Intake)

Catchment area	130.3 km ²
Average precipitation	2875 mm
Average flow	10.7 m ³ /s
Firm flow (90% exceedance)	2.30 m ³ /s
Design flood	550 m ³ /s

Headworks

Diversion weir crest elevation	1715 m
Diversion capacity	
- as designed	7 m ³ /s
- with 3 rd settling basin (not included at this time)	10 m ³ /s

Settling Basins

Type	Serpent sediment sluicing system
No.	2
Effective length	115 m each
Width	6 m each

Waterways

Headrace tunnel	
Cross-section	7.5 m ²
Length	27.7 km

Inclined Shaft	
Inclination	45°
Cross-section	3.3 m ²
Length	250 m

Unlined pressure tunnel	
Cross-section	3.6 m ²
Length	200 m

Steel lined pressure tunnel	
Length	550
Diameter	1500 mm
Lining thickness	18 mm

Total tunnel length	28.7 km
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Steel lined buried penstock	
Length	275 m
Diameter	1500 mm
Lining thickness	18 mm

Total waterway length	28.975 Km
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Surge Shaft	
Type	Orifice
Cross-section	4 - 13 m ²
Overall height	137 m

Adits

Length	970 m
Cross-section	7.5 m ²

Powerhouse

Plinth area	612 m ²
Francis turbines	
Rated capacity	2*7.5 MW
Running speed	1000 rpm
Maximum static head	340 m
Design head (net, full load)	255 m
Maximum discharge	3.6 m ³ /s
Generators	2*9.4 MV \bar{A}
Transformers:	
Main, 132 kV	1*20 MVA
Construction site supply, 33 kV	1*4 MVA

Power and energy output

Power	
Installed capacity	15 MW
Energy	
Firm	42 GWh
Secondary	19 GWh

Transmission Line

Mahankal to Bhaktapur	
Voltage	132 kV
Length	9 km
Conductor	ACSR 50 mm ²
Mahankal to construction sites	
Voltage	33 kV
Length	40 km
Conductor	ACSR "RABBIT" 25 mm ²

Access roads

Maximum grade	12 %
Loading	HS 20-44
Width	4.5 m
Length	
Melamchi Pul - Timbu	20.2 km
Chisapani - Patibhanjyang (Upgrading)	5.4 km
Mulkharka - Nagmati Adit	0.5 km
Sundarijal - Bagmati Adit	1.5 km
Shivapuri Catchment Road (Upgrading)	37.5 km

Ropeways

Capacity	550 kg/hr
Length	
Timbu - Headworks	6 km
Chanaute - Gohare Adit	4.1 km

Project Cost Summary

Table S.1 Project cost estimate

Item	Description	Amount US\$	Local Comp.
1.	HEADWORKS		
	Civil works	3,313,093	65%
	Mechanical	454,850	20%
	Subtotal	3,767,943	
2.	HEADRACE TUNNEL		
	Tunnel excavation	14,801,424	65%
	Rock support	11,731,929	65%
	Other	2,072,400	65%
	Subtotal	28,605,753	
3.	PENSTOCK, SURGE SHAFT & DISCHARGE CHANNEL		
	Civil works	1,866,978	65%
	Mechanical	1,876,738	20%
	Subtotal	3,743,716	
4.	SITE ACCESS		
	Roads	3,440,165	90%
	Ropeways	596,600	65%
	Subtotal	4,036,766	
5.	CONSTRUCTION POWER	522,445	30%
	Subtotal	40,676,623	
	Eng and Management (12%)	4,881,195	80%
	TOTAL CONSTRUCTION COST	45,557,818	
6.	ENVIRONMENTAL MITIGATION	1,294,800	80%
	TOTAL PROJECT COST	46,852,618	66%
	CONTRACT TAX	2,140,875	100%
	TOTAL COST (Incl. Contract tax)	48,993,492	68%

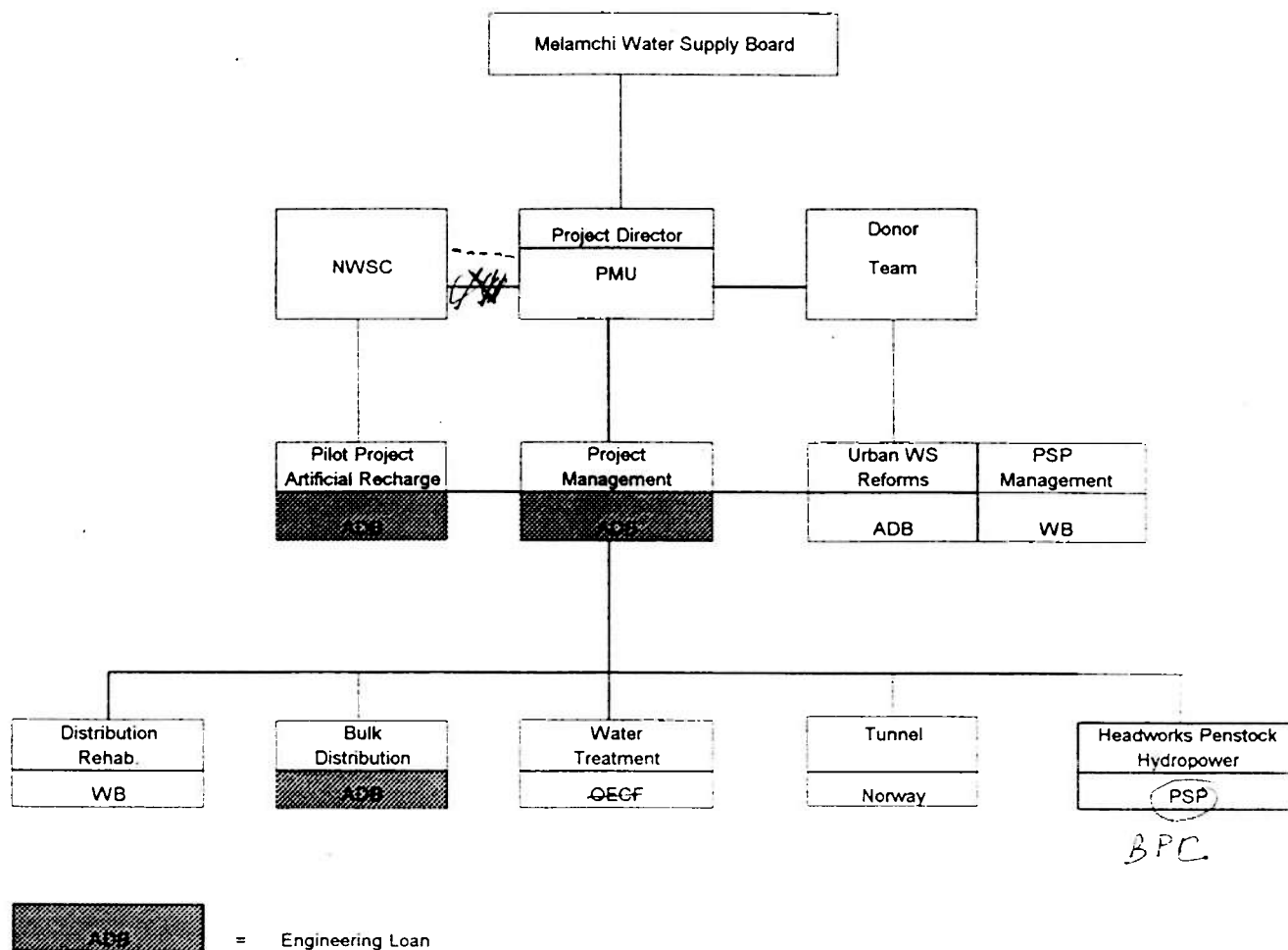
Appendix IV

REFERENCES - REPORTS AND DOCUMENTS RECEIVED

(Arranged according to date)

1. Stanley Associates: Environmental Impact Study. Final report, main volume. June 1990
2. Snowy Mountains Engineering Corp.: Greater Kathmandu Water Supply Project. Draft Final report. Summary Report June 1992
3. BPC Hydroconsult et al.: Technical Assistance to Melamchi Diversion Scheme. Bankable Feasibility Study. Main Volume February 1996
4. Ditto, Volume 2, Geotechnical Appendices
5. Ditto, Volume 3 (EIA).
6. Agreement between (12) stakeholders regarding formation of a public limited company for the purpose of implementing and operating the Melamchi Diversion Scheme. 28 May 1996.
7. World Bank: Water resources Strategy Formulation programme, Phase I. Draft report on Economic, Financial and Private sector Study. December 1996
8. Spotlight Magazine article: Drinking Water Supply. Not a Drop to Drink, 28 March 1997
9. Butwal Power Company Limited. Annual Report. April 1997
10. World Bank: Urban Water Supply and Sanitation Rehabilitation Project. Aide Memoire. May 1997
11. SILT Consultants Ltd. Urban Water Supply and Sanitation Rehabilitation Project. Draft Final Report on Consumer Survey. August 1997
12. ADB: Second Water Utilities Data Book. October 1997
13. Odd Hoftun: Kathmandu Water Supply Scheme. November 1997
14. Nepal South Asia Centre (NESAC): Nepal Human Development Report. December 1997
15. Dr. Willem K. Boemer, Euroconsult: Melamchi Water Supply Project (Hydrogeology). December 1997
16. Memorandum of Understanding ADB/HMGN. December 1997
17. Morten Høyum: Draft report from ADB's Fact Finding Mission to Nepal. 5-10 December 1997 (In Norwegian). 10 December 1997
18. KPMG: Financial Analysis report. Fact Finding Mission. January 1998
19. Ballofet and Associates: Environmental Impact Assessment. January 1998
20. ADB, Environment Division: Review of EIA Reports
21. ADB: Technical Assistance for Urban Water Supply Reforms. March 1998
22. Spotlight Magazine, article: Drinking Water Supply. Crisis of Commitment, 20 March 1998
23. Nepal Water Supply Corporation. Urban Water Supply and Sanitation Rehabilitation Project. Overview and Status, 20 March 1998
24. Nepal Water Supply Corporation: Water Demand and Expansion Plan. Undated
25. Nepal Water Supply Corporation: Map of Water System. Proposed Rehabilitation Under Package 3. Undated

MELAMCHI WATER SUPPLY PROJECT



Appendix VI

TERMS OF REFERENCE

MELAMCHI WATER SUPPLY PROJECT

CLARIFICATION OF PROJECT ARRANGEMENTS AND PREPARATION OF PROJECT DOCUMENT

1. BACKGROUND

In the annual consultations 27-28 January 1998 between His Majesty's Government of Nepal (HMGN) and Norway, Norway was requested to take a leading role in the Melamchi Water Diversion Scheme. Norway confirmed a positive interest in the project, but made a commitment dependent on certain conditions. It was agreed to allocate country programme funds "for preparation of additional project documentation needed for further decision making on the project, documentation both in respect of the project in general, and for the Melamchi Diversion Scheme in particular. Further, the documentation should also define the role of the private sector involvement related to the hydropower component". The parties agreed that this project documentation would be prepared by a consultant proposed by Norway and approved by HMGN. HMGN further requested Norway to appoint technical advisors to draw up the Terms of Reference (TOR) for such a task.

NVE was appointed for this task. The report, hereinafter called "The fact-finding mission report", serves as basis for these Terms of Reference.

The Government of Norway have stressed the following important issues that HMGN has to address before final commitment from Norway:

- Evidence satisfactory to it that the water supply system in Kathmandu is placed under outside management and that necessary steps are taken with a view to improve the distribution system and the sewerage system in the Kathmandu Valley.
- Evidence satisfactory to it that the hydropower project will be developed as a commercial power development project. Implicit that HMGN will issue the required license to the developer, and that satisfactory access to water for the Melamchi Water Supply Project as a whole has been secured.
- Evidence satisfactory to it that assistance from the ADB and other donors will be provided in accordance with the principles indicated above.
- Environmental aspects related to the whole Melamchi Water Supply Project would also have to be taken into account.

Furthermore, in order to secure a smooth development of the diversion scheme:

- HMGN will ensure that local know-how and experience is further developed through the utilization of existing national capacity in the hydropower sector, i.e. Butwal Power Company and sister organizations, in the tunneling works and the development of the power plant.

The purpose of the Melamchi Water Supply Project is to provide new water supply to Kathmandu Valley and to establish efficient operation and management of the water supply all the way to the end users. A secondary purpose is production of electricity, in that the available hydraulic head will be utilized in a hydropower plant before the water is delivered to the treatment plant.

The Melamchi Water Supply Project consists of the following components:

I. The Melamchi Diversion Scheme:

- Headworks on the Melamchi River, approx. 35 km North-East of Kathmandu with a head race tunnel of length 28 km to Sundarijal, near Kathmandu.
- Hydropower plant, maximum static head 340 m, output 15 MW at 3.6 m³/s, with a 132 kV transmission line
- Facility for supplying raw water from the tailrace to water treatment plant
- Access roads and ropeways necessary for construction and maintenance of the facilities

The low flow capacity of the Melamchi River is expected to cover the needs up to year 2012 (170,000m³/d), from which time two other rivers (Yangri and Larke) may be connected to the system.

II. Water treatment plant and bulk distribution system:

- Water treatment plant (initial capacity 170,000 m³/s) to be constructed close by the hydropower plant
- trunk mains to connect to strategic points in the distribution system.

ADB is expected to be the financing agency for the bulk distribution system. Assistance from JICA has been requested for the water treatment plant, but response has not yet been received.

III. Improved distribution system

- Restructuring of Nepal Water Supply Corporation, operation and management contracted to private operator(s).
- Rehabilitation/improvement of water distribution and sewerage system.

The World Bank is expected to be the main financing agency for the distribution system.

HMGN has requested the ADB to take a lead role in packaging the project and coordinating the financial arrangements. ADB will provide a Technical Assistance loan of about USD 5 million to prepare the project, conduct project management, and to investigate artificial recharge of the groundwater in Kathmandu Valley. ADB would also provide a USD 800,000 technical assistance grant to assist HMGN with urban water supply sector policy reforms.

The Ministry of Housing and Physical Planning (MHPP) will be Executing Agency for the project and in charge of project management and coordination.

A list of the documents received is appended to the fact-finding mission report.

2. OBJECTIVES

The objectives are

- a) to clarify issues identified as important to address before implementation of the project,
- b) to arrive at an arrangement for the planning and implementation of the project with clear division of roles and responsibilities among the involved parties, allowing professional and fair decision-making for all contracts and agreements, and
- c) to produce a Project Document with the necessary documentation for final decision to support the Melamchi Diversion Scheme by HMGN and NORAD.

3. MODE OF WORK

The Project Document will be Client's (MHPP's) document, and NVE will seek to produce the document on basis on the agreed outline (enclosed) by working closely with the MHPP. Thus, a major portion will be produced in Kathmandu in day to day contact with MHPP. On issues where several solutions are possible (like, roles and responsibilities and how to organize in contracts and

agreements), alternative solutions will be discussed with the involved parties before a decision is taken by MHPP.

4. SCOPE OF WORK

Review of project documentation, specific issues

NVE will carry out a general review of the documents collected and listed in Appendix IV of the fact finding mission report. Special attention will be paid to the Feasibility Study of 1996 and reports on EIA and social matters. Comments on specific issues of importance in the decision-making for the project and comments that concerns further studies, will be included in the PD. The following work shall be carried out:

The team leader will review the most important documents, communicate and coordinate with the rest of the team, and discuss the various professional issues. Organizing of contracts, roles and responsibilities of the various parties will be a main task. He will draft most of the Project Document.

The Hydropower engineer will review the Feasibility Study Report of 1996 and comment on technical issues and the cost estimate. He will conduct a comparative study on tunnel boring machine, look into the consequences of increasing the cross-sectional area of the tunnel, and he will look into potential problems of air pockets in the tunnel.

The Hydrologist will review the hydrological analysis in the 1996 Feasibility Study and comment, particularly with respect to the time duration of the observation series and possible inaccuracy of the design data and consequences on the project's economic viability.

The economist will review the economic analysis of the 1996 Feasibility Study and the Financial Analysis Report of 1998. A key issue will be whether the diversion scheme is economically viable, i.e. that the cost of the raw water as delivered is "reasonable", at the same time as a certain (calculated) portion of the headworks and tunnel cost is charged to the power project. A sensitivity test will be carried out on the most important parameters (construction cost, availability of water, power price etc).

The engineering geologist will review the work of the 1996 Feasibility Study^{and} assess the investigations carried out, the extent of rock support, the cost estimate, and in particular whether additional geological field tests should be carried out before implementation.

The environmental expert will review the 1996 Feasibility Study and earlier and subsequent reports, e.g. Ballofet and Associates, January 1998 "Environmental Impact Assessment". Comments will be made regarding sufficiency of data and information and need for further studies.

The fisheries expert will review the chapters on aquatic life and fisheries of the 1996 Feasibility Study and earlier and subsequent reports, e.g. Ballofet and Associates, January 1998 "Environmental Impact Assessment". Comments will be made regarding sufficiency of data and information, and possible need for further studies. Need for minimum release will be commented upon.

The licensing expert will (in cooperation with the legal expert) prepare an outline of the proposed licensing conditions for the Melamchi diversion (water supply and power production). He will also cooperate with MHPP in developing a system for public information and participation in the decisionmaking process.

The social scientist will review the 1996 Feasibility Study and earlier and subsequent reports, e.g. Ballofet and Associates, January 1998 "Environmental Impact Assessment". Comments will be made regarding sufficiency of data and information, and possible need for further studies.

The legal expert will, in cooperation with the licensing expert and the team leader prepare an outline of agreement between the Power Producer and the owner of the water supply scheme.

Preparation of Project Document

The PD shall be prepared in accordance with the enclosed outline, although minor alterations may be expected. MHPP will prepare draft for Appendix I to the PD (write-up about involved parties in the Melamchi Diversion Scheme). A draft document shall be prepared for the donors meeting planned for week no. 28, with the final document revised during the following week according to modifications agreed at the meeting.

5. TIME SCHEDULE

The schedule for the work is planned as follows:

Start of work:	8 May
Review of documents, specialist work, completed on:	29 May
Drafting of PD in (Norway and Nepal), completed on:	12 June
Donors meeting:	Week 28 (6 –12 July)
Completion of Final PD:	Week 29 (13-19 July)

23.4.98

Enclosure: Outline of Project Document

Outline of Project Document

EXECUTIVE SUMMARY

INTRODUCTION

1. ***BACKGROUND***
2. ***PROJECT RATIONALE***
3. ***OBJECTIVES***
 - Development objectives (goals)*
 - Immediate objectives (purposes)*

OVERALL PROJECT (4 COMPONENTS):

4. ***PROJECT DESCRIPTION (4 components)***
 - Brief description, mode of execution, parties involved, status at present*
5. ***MANAGEMENT AND COORDINATION***
 - Overall system (TA + MPPH), show chart*
6. ***COSTS***
7. ***TIME SCHEDULE***

MELAMCHI DIVERSION SCHEME (Component no.1)

8. ***SUMMARY***
9. ***BACKGROUND, RESPONSE TO CONDITIONALITIES***
10. ***OVERVIEW OF SCHEME***
 - Project design. Studies and reports. Overview of activities and components, Implementing agency, roles and responsibilities of involved parties. (Write-up about the involved parties in Appendix)*
11. ***PROJECT EXECUTION***
 - Presentation of each activity/component with methodology (without details), timing, milestones etc*
12. ***PROCEDURES***
 - Procurement, contracting, payments, cost control, auditing, public participation and information to the public*
13. ***PROJECT IMPACTS***
 - Impact on the natural environment*
 - Impact on socio-economic conditions, incl. gender impact*
 - Further studies*
 - Mitigation measures*
14. ***TIME SCHEDULE***
15. ***BUDGET***
16. ***ECONOMIC ASPECTS***
17. ***PROPOSED FINANCING ARRANGEMENTS***
18. ***OPERATION AND MAINTENANCE ARRANGEMENTS***
19. ***ASSESSMENT OF PROJECT RISKS***
 - (Geology, hydrology, cost estimate in general)*

APPENDICES:

1. *Write-up about involved parties in the Melamchi Diversion*
2. *Outline of license for Melamchi Diversion*
3. *Outline of legal document between HMGN and the Power Producer*

Appendix VII

MELAMCHI WATER SUPPLY PROJECT

Main Points for NORAD Consideration

1. ADB does not support BOT arrangement for the headworks or any other arrangement whereby water is sold in bulk to the water utility. Such arrangements will also not help in getting OECF and World Bank on board for cofinancing.
2. We should not forget that this is a water supply project. Any delays caused by the hydropower plant and PSP arrangements for that should not be allowed to impact on the water supply project.
3. The tunnel is on the critical path so it will be helpful if NORAD indicate as soon as possible a schedule for the tunnel from funding through to construction - so that the Government and other donors can consider their options. At the moment, ADB understands that a project document may be completed by June 1998 and NORAD financial commitment given by December 1998.
4. The proposal for one consultant funded by NORAD to carry out investigations, design and contract documents for the headworks/tunnel/penstock/hydropower plant makes sense. The client would be HMGN and the executing agency should be Ministry of Housing and Physical Planning - since this is a water supply project.
5. From the operational point of view the private sector party (for the hydropower) should be represented on the management of operations but not have any "ownership" of headworks and tunnel.
6. These points and others should be discussed at a donors meeting in Kathmandu in May of this year.

ACM

25/3/98

(Mr. Arthur C. McIntosh,
Asian Development Bank)

NOTE

(for discussion)

MELAMCHI DIVERSION SCHEME, ROLES AND RESPONSIBILITIES

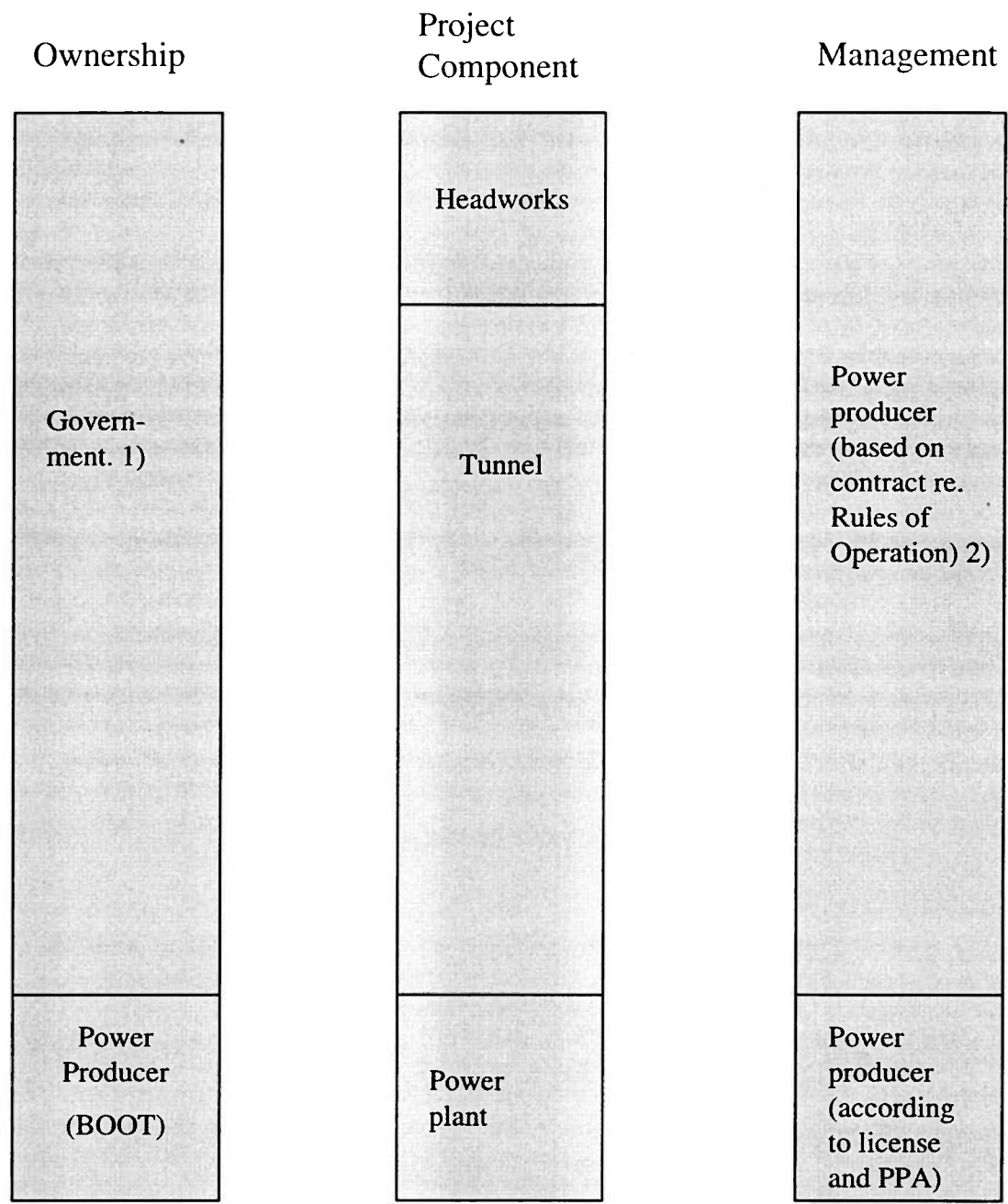
1. The reason for the project is water supply - the main objective is to transfer raw water from the source to the treatment plant. The responsibility for water supply lies on the public administration or in the end on the government. This means that the government must have the final control of the Melamchi diversion system.
2. At the same time the Power Producer who is investing his money, needs to know that his investment is protected. Both the Power Producer and financial institutions involved will look for ways of reducing the risks. If the risks are considered higher, the loans will be more costly and the project less profitable. It is considered unthinkable that a private investor will engage in a hydropower project without having direct control with the operation of the whole scheme (intake, tunnel system etc).
3. Power Producers operate according to a license given by a competent authority – the Ministry of Water Resources in this case. As part of a license there will normally be “Rules of Operation”. These may vary from system to system according to the local situation and the needs in each case. It is felt that such a contractual relationship may be designed to provide the solution in this case.
4. Private operators in water supply has become common world-wide. There are different modes of operation, but common is that they operate within contractual “Rules of Operation”. In Kathmandu it has already been decided that both the bulk transmission and distribution to the consumers will be done through private operator(s).
5. A solution for the Melamchi diversion that may be discussed, is illustrated in the enclosed figure. The Power Producer has the direct daily management and control while the Government has the ownership and the required control through a “Rules of Operation” contract. (The contract should include provision that will allow the govt. to take over in case of mismanagement).
6. Regarding Planning and design: The needs of both water supply and power production needs to be taken into account from day one. This means that there should be one Consultant for the whole scheme. The tunnel is on the critical path of the time schedule. This means that the planning must start early. The intention is that Himal Hydro shall construct the civil works based on a negotiated contract. This means that the Consultant should be independent of BPC/Himal Hydro (satisfy FIDIC requirements).

MPPH should therefore (as the Client) as soon as possible commission an independent Consultant for the project. Ideally, the contract should be financed together with the tunnel and headworks.

BPC Hydropower should be divested from BPC (to satisfy FIDIC requirements) and participate in Joint Venture with Consultant mentioned above. If this is not possible to achieve in time, then BPC Hydroconsult may participate as sub-consultant to the (main) Consultant.

MELAMCHI DIVERSION SYSTEM
MANAGEMENT AND OWNERSHIP

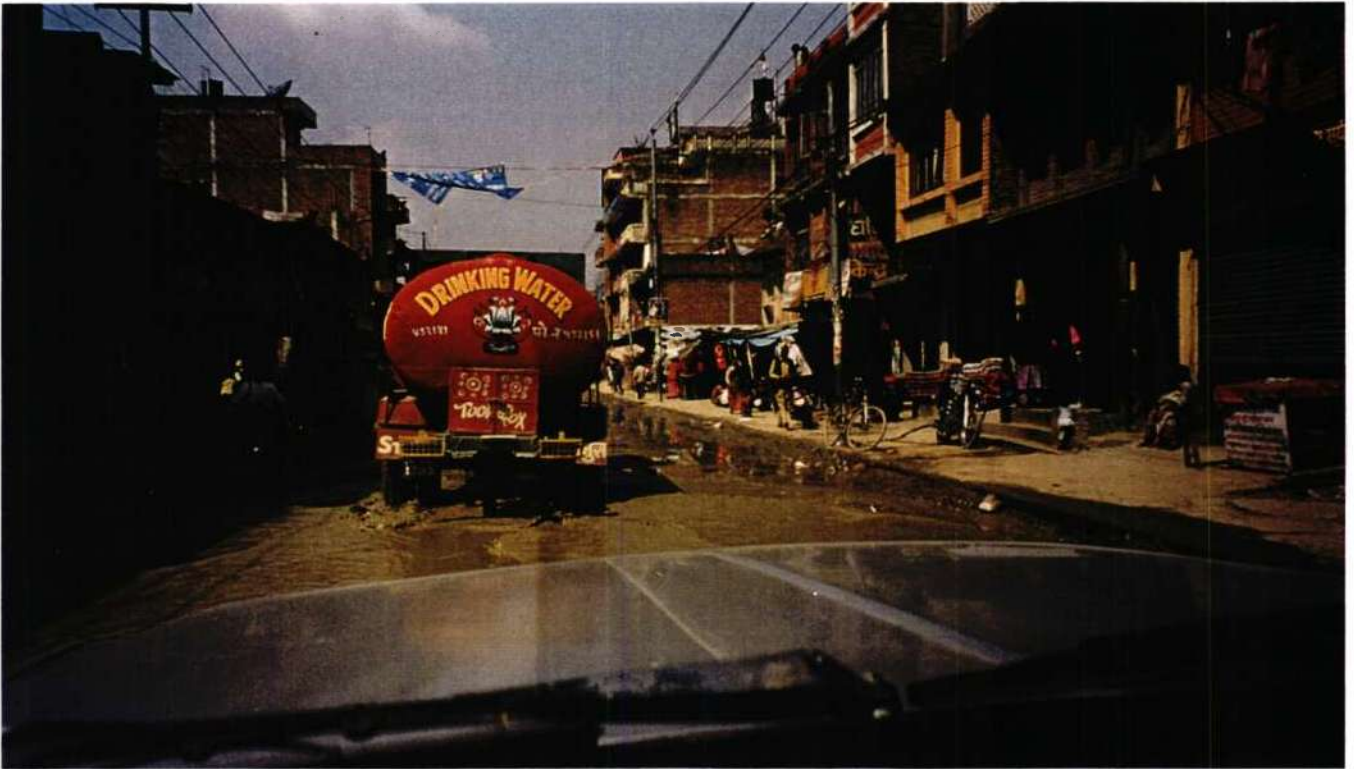
(For discussion purposes only)



To treatment plant

- Notes:
- 1) The Power Producer shall contribute to the cost of tunnel and headworks according to negotiations. Payment may be an annual fee or a percentage of the construction cost, depending on financing arrangements.
 - 2) The "Rules of Operation" should take care of the interests of both the water supply company and the power producer, but should ensure the needs of the water supply in case of conflict.

PHOTOS



Water truck in a street of Kathmandu while the street is flooded due to leakage in the water main



Woman washing her clothes in Bagmati River. The water is almost black due to sewage and stinks heavily



Confluence of the Melamchi River (left) and Indrawati River (right). The fisherman is fishing for the Asla, a good "cold water fish"



Melamchi River and valley, approximately 25 km downstream of the intake