

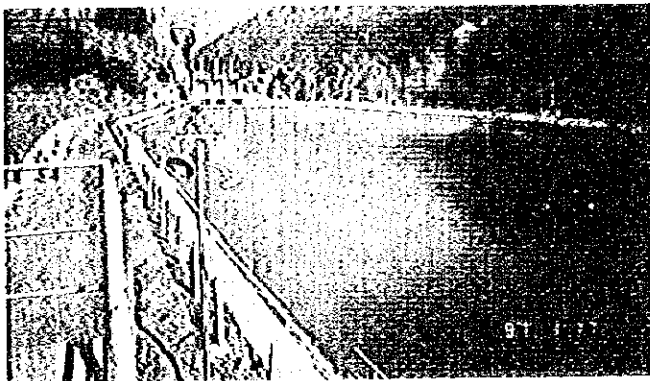
*Field Photos*

15.14

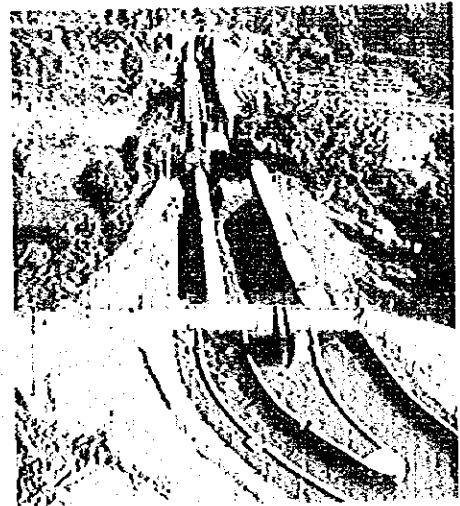
I. TRISHULI - DEVIGHAT HYDROPOWER PROJECT. (1/1)



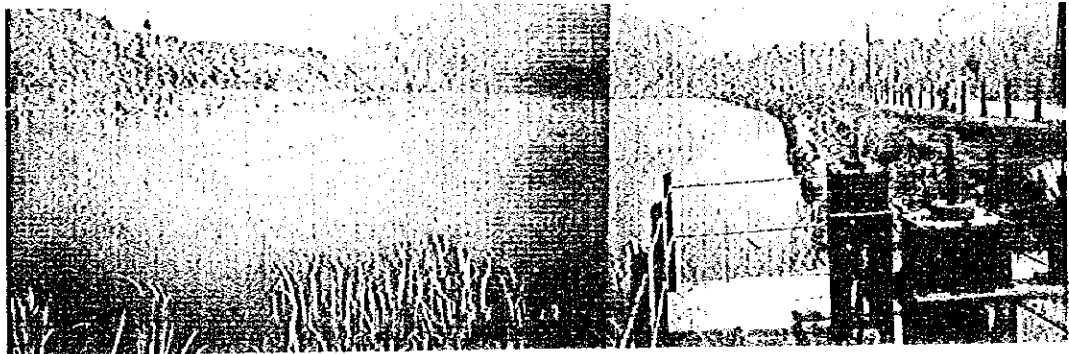
Intake Facility



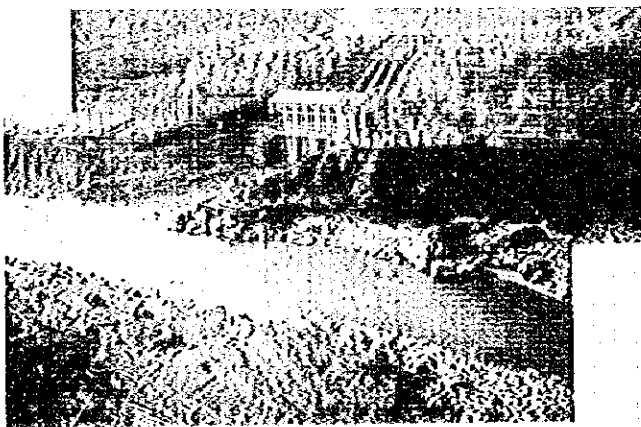
Desilting Basin



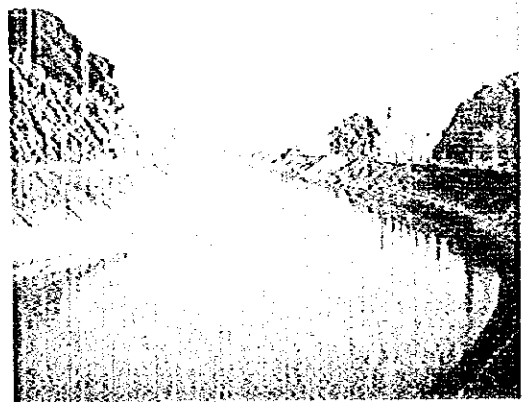
Aqueduct No. 2



Balancing Reservoir



Devighat Power Station

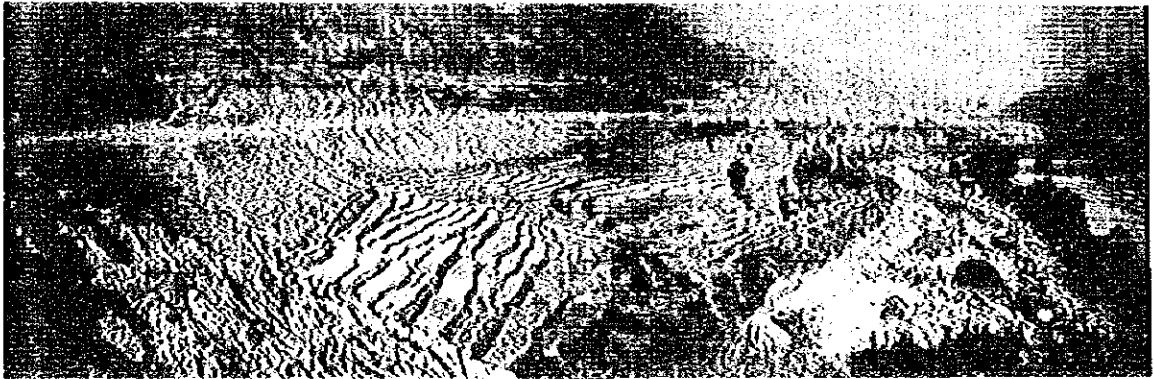
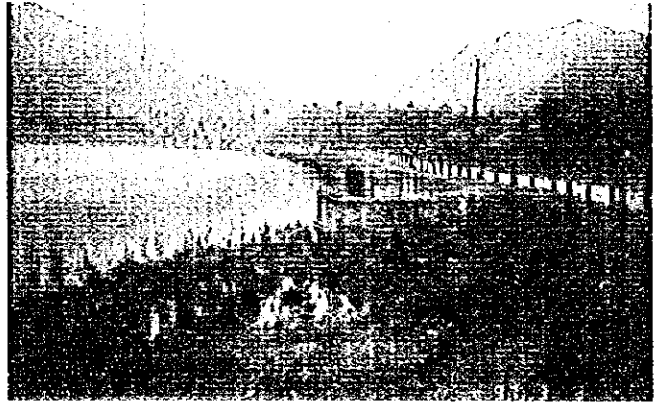


Headrace Canal

1566

## 2. PROPOSED MAIN CANAL ALIGNMENT. (1/3)

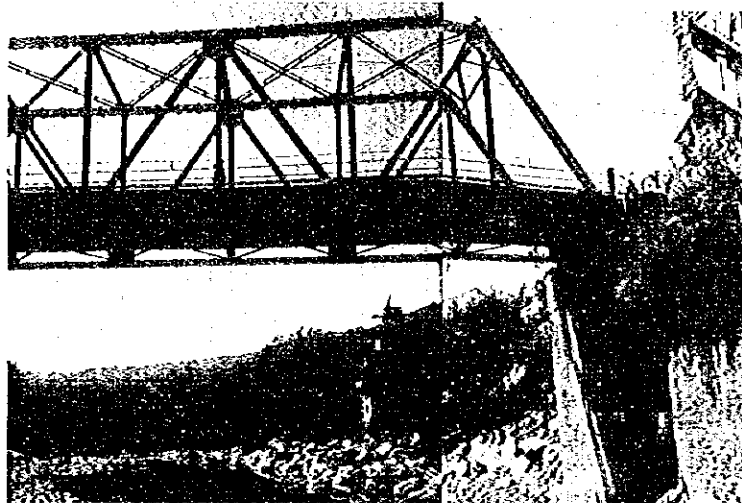
Proposed Intake Site  
at Balancing Reservoir  
(Sta. 0+000)



Along the R/B of Trishuli River (Sta. 0+800)

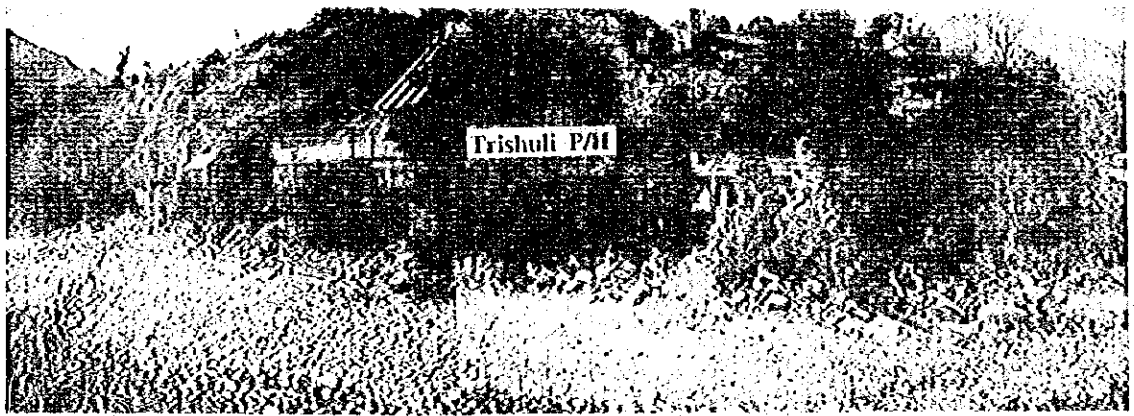


Alignment of the Proposed Water Bridge (Sta. 1+650)

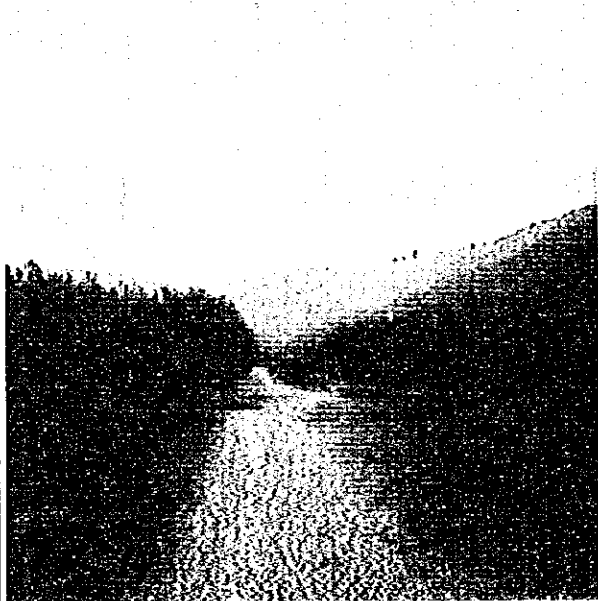


Across the Trishuli Bridge (Sta. 1+730)

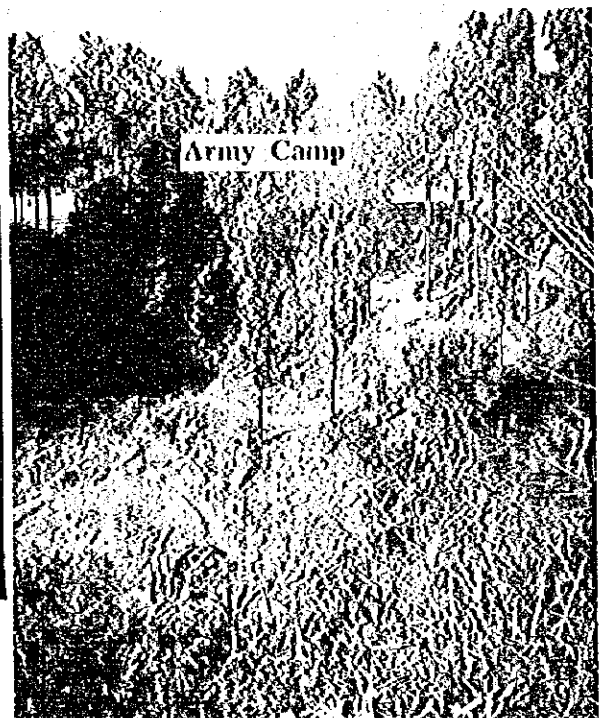
**2. PROPOSED MAIN CANAL ALIGNMENT. (2/3)**



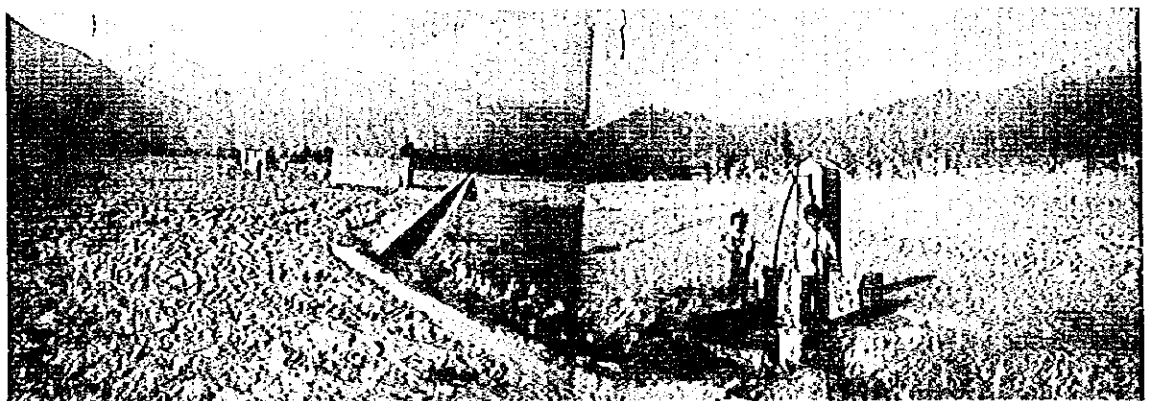
**Across the Trishuli River (Sta. 2+100)**



**Horticulture Farm (Sta. 2+500)**



**Location for Proposed Aqueduct to Army Camp  
(Sta. 3+930)**



**Along the Existing Canal of Battar Lift Irrigation Project  
(Sta. 4+850)**

**2. PROPOSED MAIN CANAL ALIGNMENT. (3/3)**



**Across the Road to District Irrigation Office (Sta. 4+900)**



**Proposed Site for the Control Tank (Sta. 5+800)**

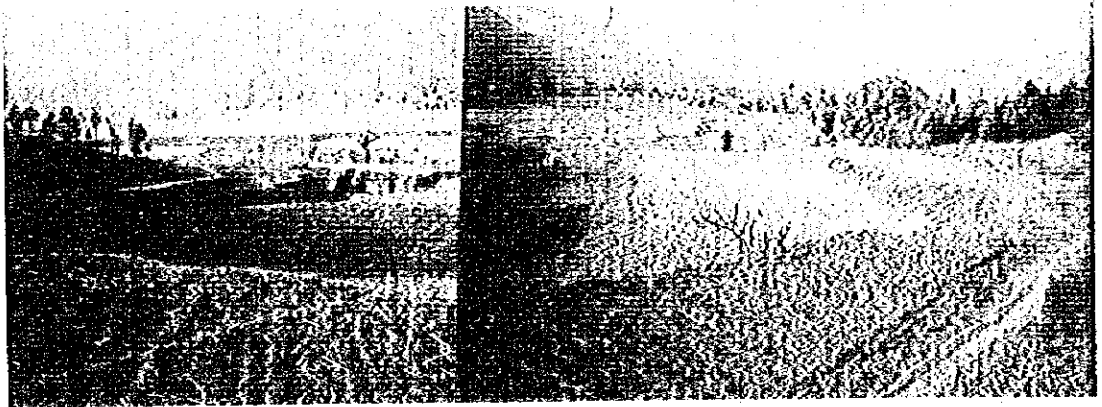


**View of the Block D Area (Inarpati) from Proposed Control Tank**

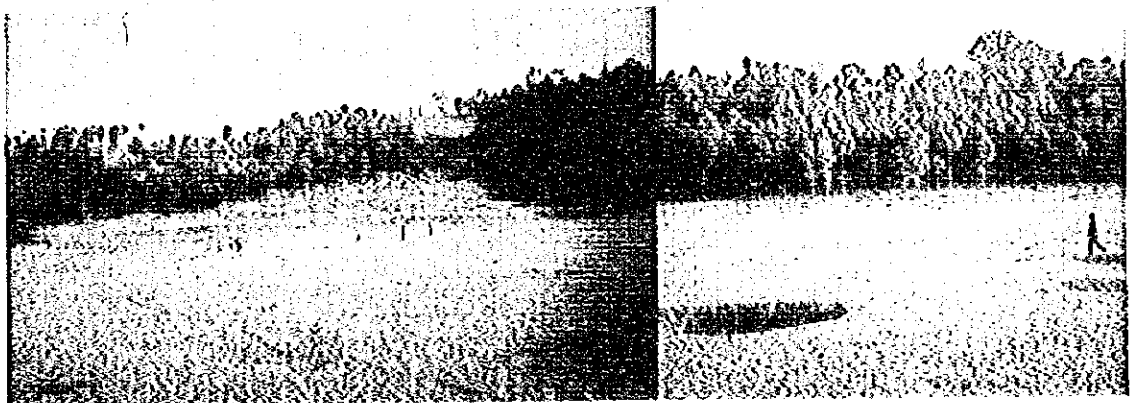
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Proposed Site for P/II No.1 (at Ghadigaon)



Proposed Site for P/II No.2 (at Chwadi)



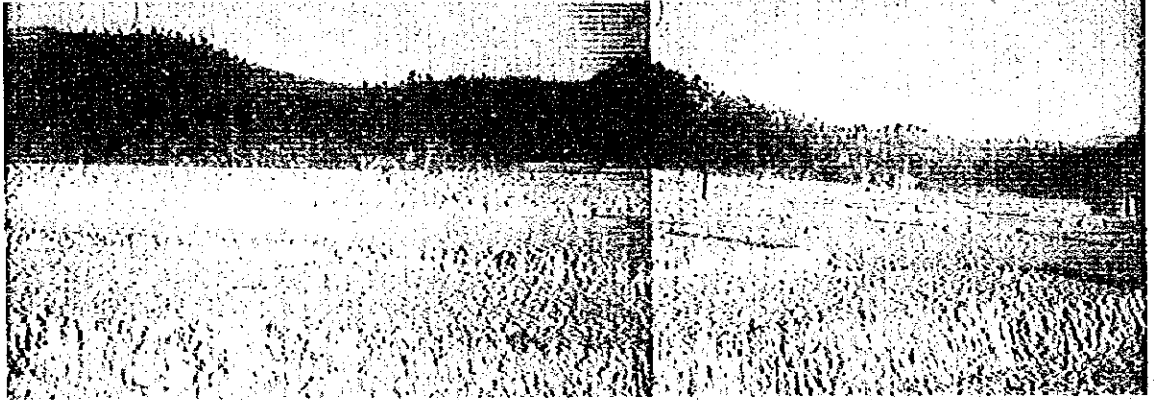
Proposed Pipe Alignment to Tallo Pipaltar (Block G) at Lambagaicha



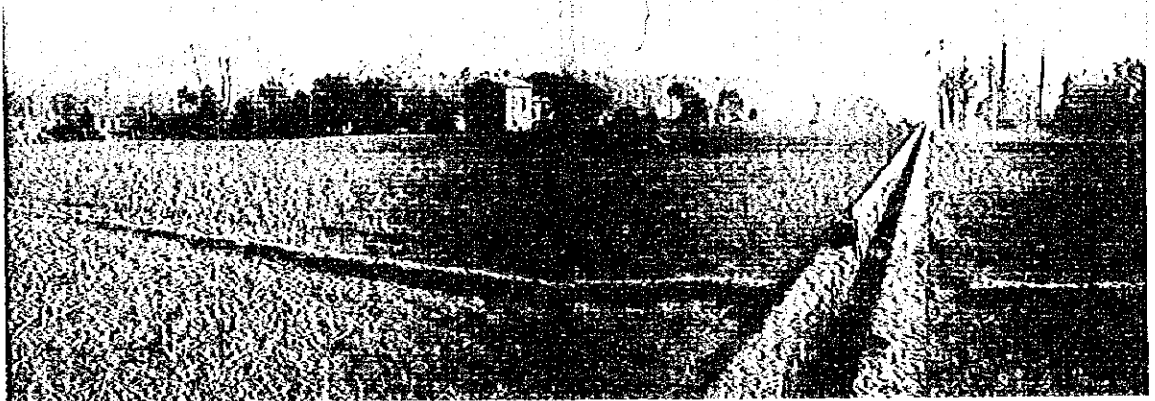
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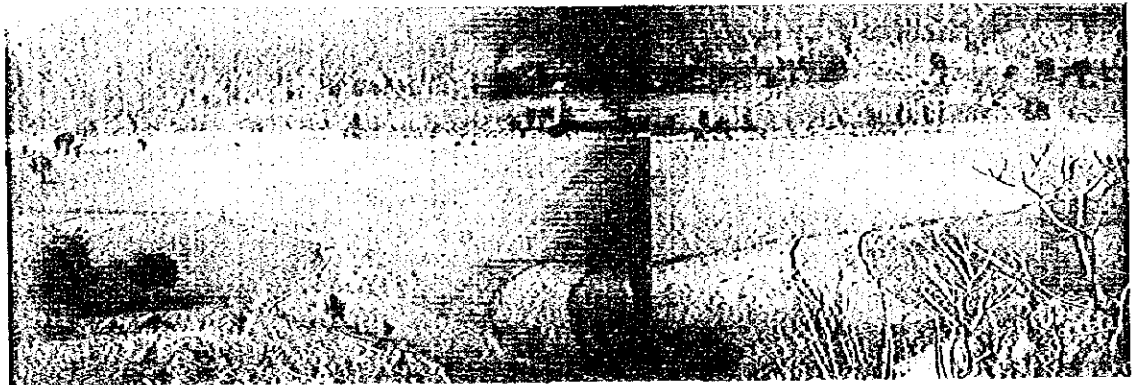
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**Block E (Maharanidhi)**



**Block H (Devighat)**



**Block K (Pipaltar) : Lift Area by P/I No.2**



**Block I (Pokhari Phant)**

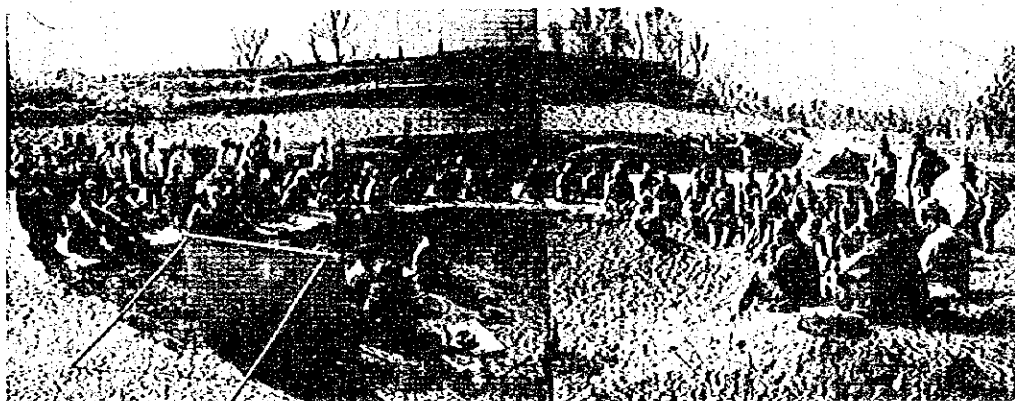
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## **ATTACHMENTS**

1. Scope of Work and Minutes of Meeting on S/W
2. Minutes of Meeting on Inception Report
3. Minutes of Meeting on Draft Final Report

## **SEPARATE VOLUMES**

- Volume II      Appendices  
Volume III     Drawings

## ABBREVIATIONS

|         |   |
|---------|---|
| ADB/N   | Agricultural Development Bank/Nepal           |
| AIC     | Agriculture Inputs Corporation                |
| AO      | Agricultural Officer                          |
| APP     | Agricultural Perspective Plan                 |
| ASC     | Agricultural Services Center                  |
| BCT     | Block Control Tank                            |
| C-CODER | Center for Community Development and Research |
| CCG     | Central Coordinating Group                    |
| CCT     | Central Control Tank                          |
| CDO     | Chief District Office                         |
| CDR     | Central Development Region                    |
| CHF     | Cost, Insurance and Freight                   |
| DADO    | District Agricultural Development Office      |
| DANIDA  | Danish International Development Assistance   |
| DDC     | District Development Committee                |
| DDWSO   | District Drinking Water and Sanitation Office |
| DEO     | District Education Office                     |
| DFO     | District Forest Office                        |
| DHM     | Department of Hydrology and Meteorology       |
| DHO     | District Health Office                        |
| DIO     | District Irrigation Office                    |
| DLSO    | District Livestock Services Office            |
| DOA     | Department of Agriculture                     |
| DOF     | Department of Forest                          |
| DOI     | Department of Irrigation                      |
| DOR     | Department of Road                            |
| DPTC    | Des Disaster Prevention Technical Center      |
| DSC     | Department of Soil Conservation               |
| DSCO    | District Soil Conservation Office             |
| DSP     | District Superintending Police                |
| EIA     | Environmental Impact Assessments              |
| EIRR    | Economic Internal Rate of Return              |
| FLAG    | Field Level Acting Group                      |
| FMIS    | Farmer Managed Irrigation System              |
| FW      | Future With Project                           |
| FW/O    | Future Without Project                        |
| IBP     | Intensive Banking Program                     |
| IDA     | International Development Association         |
| IEE     | Initial Environmental Examination             |
| IIMI    | International Irrigation Management Institute |
| ILC     | Irrigation Line of Credit                     |
| ISP     | Irrigation Sector Project                     |
| LBIS    | Left Bank Irrigation System                   |
| LDO     | Local Development Office                      |
| MOA     | Ministry of Agriculture                       |
| MOLD    | Ministry of Local Development                 |
| MOPE    | Ministry of Population and Environment        |

|      |   |
|------|---|
| MOWR | Ministry of Water Resources             |
| NARC | Nepal Agricultural Research Council     |
| NBBL | Nepal Bangladesh Bank Ltd.              |
| NBL  | Nepal Bank Ltd.                         |
| NEA  | Nepal Electricity Authority             |
| NPC  | National Planning Commission            |
| NPV  | Net Present Value                       |
| PD   | Project Director                        |
| PHC  | Primary Health Center                   |
| PMC  | Project Management Committee            |
| PRA  | Participatory Rural Appraisal           |
| RDP  | Rapti Development Project               |
| SCF  | Standard Conversion Factor              |
| SFDP | Small Farmer Development Program        |
| SWR  | Shadow Wage Rate                        |
| TA   | Technical Assistant                     |
| THP  | Trishuli Hydropower Project             |
| TIP  | Trishuli Irrigation Project             |
| VDC  | Village Development Committee           |
| WECS | Water and Energy Commission Secretariat |
| WUA  | Water Users Association                 |

### **CONVERSION FACTORS**

|        | <u>Form Metric System</u> |                | <u>To Metric System</u> |                         |
|--------|---------------------------|----------------|-------------------------|-------------------------|
| Length | 1 cm                      | = 0.394 inch   | 1 inch                  | = 2.54 cm               |
|        | 1 m                       | = 3.28 ft      | 1 ft                    | = 30.48 cm              |
|        | 1 km                      | = 0.621 mile   | 1 mile                  | = 1.609 km              |
| Area   | 1 m <sup>2</sup>          | = 10.76 sq.ft  | 1 sq.ft                 | = 0.0929 m <sup>2</sup> |
|        | 1 ha                      | = 2.471 acres  | 1 acre                  | = 0.4047 ha             |
|        | 1 ha                      | = 0.051 Ropani | 1 Ropani                | = 19.65 ha              |
|        | 1 ha                      | = 1.515 Bigha  | 1 Bigha                 | = 0.66 ha               |

### **EXCHANGE RATE**

US \$ 1 = Rs. 56.70 (March 1997)



**CHAPTER 1**

## CHAPTER 1 INTRODUCTION

Based on the agreement and Scope of Work (S/W), signed between His Majesty's Government of Nepal and Government of Japan on July 15, 1996, the JICA Feasibility Study Team was dispatched by the Japan International Cooperation Agency (JICA) and commenced execution of the Field Survey from December 4, 1996 to March 22, 1997.

At commencement of the Field Survey, the Study Team submitted 20 copies of the Inception Report to the Department of Irrigation (DOI), Ministry of Water Resources on December 5, 1996 and the contents of the Inception Report were accepted by DOI.

The JICA Study Team submitted the Progress Report of the Feasibility Study on the Trishuli Irrigation Project in twenty (20) copies with two (2) sets of Topographical Maps on March 19, 1997 to the Department of Irrigation, Ministry of Water Resources.

This Main Report comprises the Final Feasibility Study Report, and compiles the findings of field survey and related home office works.

### 1.1 Objectives and Scope of the Study

The objective of the Study is to carry out a Feasibility Study on the Trishuli Irrigation Project (TIP) under which diverted irrigation water from the headrace canal of the Trishuli Hydropower Project (THP) is to be utilized to irrigate about 760 ha of farmland in hill tracts on both banks of the Trishuli River in the Nuwakot district approx. 70 km northwest of Kathmandu.

The scope of the Study is divided into two stages:

Stage 1, to be conducted between early December 1996 and the end of March 1997 in the field, and comprise data collection in the related study fields, site reconnaissance for the selection of main canal alignment, delimitation of the Study area, execution of Participatory Rural Appraisal (PRA) and various Farmers' Meetings which were scheduled between the middle of December 1996 and the end of February 1997.

Stage 2, to embody the findings and conclusions in the Feasibility Study Report between middle April and June 1997 in Japan.

Based on the findings of field survey, the following development plans were formulated to establish the optimum content for the envisioned Project:

| <u>Development plan</u> | <u>Plan content</u>  |
|-------------------------|--|
| 1) General plan:        | Farm management plan, irrigation plan, agricultural support plan, farmer support |

- |    |   |   |
|----|---|---|
|    |   | plan, farmer organization plan,<br>marketing · distribution plan  |
| 2) | Major facilities plan:                      | Desilting plan, canal plan, pumping<br>plan, other facilities plan  |
| 3) | Facility operation and<br>maintenance plan: | Major facility O&M plan, terminal<br>facilities O&M plan  |
| 4) | Environmental conservation<br>plan:         | Mitigating countermeasures for social<br>and natural environments, IEE plan,<br>environmental monitoring plan |
| 5) | Project implementation plan:                | Project scale, project costing, project<br>implementation period  |
| 6) | Project evaluation:                         | Benefit calculation, overall project<br>evaluation  |

## 1.2 Study Area

The Study area encompasses a benefit area of about 760 ha of river terraces on both banks of the Trishuli River in Bidur municipality of the Nuwakot district about 70 km northwest of Kathmandu. The said benefit area comprises 630 ha (Zone A) between the Trishuli and Tadi Rivers, and 130 ha (Zone B) on the Trishuli River right bank.

The Study area also includes about 6 km of new irrigation canal alignment from the intake point at the downstream of the NEA balancing reservoir for the Trishuli and Devighat Power Stations to the benefit area.

| <u>Name of area</u>            | <u>Command area (ha)</u> |
|--------------------------------|--------------------------|
| Zone A (L/B of Trishuli river) |                          |
| 1) Gravity area                | 447.2                    |
| 2) Lift area                   | 182.0                    |
| Sub-total                      | 629.2                    |
| Zone B (R/B of Trishuli river) |                          |
| Pokharephant                   | 128.0                    |
| Total for Zone A + B           | 757.7 (760 ha)           |

## 1.3 Related Government Agencies

Several government agencies are involved in the implementation and fulfillment of the objectives of the Trisuli Irrigation Project (TIP). The Ministry of Water Resources

is responsible for overall policy for irrigation development in Nepal. The Department of Irrigation (DOI) is responsible for implementation and O&M activities.

During the implementation of the Project, the Ministry of Agriculture and its Department of Agriculture through the District Agricultural Development Office are responsible for agriculture improvement programs in the Project area.

The Ministry of Forestry is responsible for granting permission to use forest area for project implementation. The District Soil Conservation Office of the Department of Soil Conservation under the Ministry of Forest has a natural hazard prevention and soil conservation demonstration center within the TIP area. The activities of DSCO have impact on the performance of irrigated agriculture in TIP.

The Ministry of Land Administration is to provide information on the number of beneficiaries, and demarcation of land area for acquisition during the time of project implementation.

Part of the canal alignment falls within the compound of Nepal Royal Army Barrack at Maithali, Bidur Municipality. Accordingly, the Ministry of Defense through Army Headquarters must grant permission to construct the irrigation canal within the barrack boundary.

The Ministry of Population and Environment is concerned with environment protection, pollution control, monitoring and environment impact assessment. The TIP has to follow the standard set by the Ministry regarding environmental matters.

The Chief District Officer (CDO) of Nuwakot under the Ministry of Home is responsible for maintenance of law and order and to ensure that implementation of the irrigation project takes place without hindrances. Flow of materials and manpower required for the construction work of the project would be ensured. Each district has to fix the rate for minimum wages for different skilled and unskilled workers. The committee under the chairmanship of CDO decides the rate for wages and rate for quantity of work. The land acquisition and payment of compensation would be done through the CDO office.

The TIP has direct relation with Nepal Electricity Authority (NEA) for two distinctive irrigation related activities. Water required for irrigation is to be shared from the balancing reservoir of the Trisuli hydropower station at Trisuli. Part of the command area is proposed to be irrigated by pumps which require electricity supply.

The other three local agencies are also directly related with TIP. They are; a) Nuwakot District Development Committee for the mobilization of the beneficiary support to the project and registration of Water Users associations in the Local Development Officers Office, and b) part of the command area fall under Bidur Municipality and part of Khadgabhanjyang VDC.

Support services are to be provided by ADB/N and other banking agencies to TIP. The Agriculture Inputs Corporation at the district level has to make seed and fertilizer available to the farmers of TIP.

#### **1.4 Progress of the Study**

The first group of the Study Team arrived in Kathmandu on December 4, 1996. In the meetings held between the Department of Irrigation (DOI) and the Study Team on December 8 and 9, 1996, details of activities undertaken were discussed between the two parties and agreed upon (refer to Attachment M/M of the Inception Report).

The Study Team in collaboration with counterpart personnel, proceeded with the field investigations. The site surveys were made in the Study Area during the period from December 11, 1996 to March 6, 1997.

The Central Coordinating Group (CCG) meeting, Field Level Acting Group (FLAG) meetings and Sub-Project Area-wise and Block-wise Farmers' Meetings were held in Kathmandu and the target area, respectively (refer to Appendixes 3, 4, 5 and 6).

The basic approach, progress of works, the major findings, and conclusions and recommendations are mentioned in this Final Report.

Under Stage 1 of the Study, field survey of schemes targeted for formulation of the irrigation development plan was done from mid April to mid June, the results of which are contained in this Feasibility Study Report compiled by the Team after its return to Japan.

**CHAPTER 2**



## CHAPTER 2 PROJECT BACKGROUND

### 2.1 Basic Data on Nepal

Nepal is a country with an estimated population of about 21.1 million (1995/96), a total area of 147,181 km<sup>2</sup>, and located between 80°00' to 88°15' east longitude and 26°15' to 30°30' north latitude. Topographically and climatically, the country is classified into three ecological zones, i.e. the Mountain Area, the Hill Area and the Terai Area. The unique topographical and meteorological conditions prevailing in each area greatly influence the regional economic activities therein. Respectively, the Mountain Area, the Hill Area and the Terai Area account for 35%, 42% and 23% of total land area of the country. Cultivated area comprises 18% (2,642,000 ha) of the nation's land area. On a zone-wise basis, cultivated area comprises 1.5% of Mountain Area, 7.2% of Hill Area and 9.3% of Terai Area. The Project area is located in Nuwakot district, adjacent to Kathmandu. Ecologically, it is a central hill district.

The Nepalese economy is agronomy based, with the agricultural sector contributing 40% to the GDP and accounting for 80% of the economically active population. A government policy of economic liberalization has been in progress since 1990. Nevertheless, disparities in levels of economic development between urban and rural areas is evident, with the country in transition from a traditional to a modern economic system. Under the 8th National Plan (1991/92~1996/97), rectification of regionally skewed levels of economic development is a major goal.

#### (1) Social Indicators

Social indicators for Nepal are given in Table 2.1-1

**Table 2.1-1 Social Indicators**

| Social Indicators  | Year                 | Unit            | Nepal      | CDR       | Nuw |
|--|----------------------|-----------------|------------|-----------|-----|
| Population   | 1981/82              | no.             | 15,022,839 | 4,909,357 | 2   |
|  | 1991/92              | no.             | 18,491,097 | 6,183,955 | 2   |
|  | 2001/02              | no.             | 23,832,105 | 8,054,661 | 3   |
| - Male   | 1981/92              | no.             | 7,695,336  | 2,538,615 | 1   |
|  | 1991/92              | no.             | 9,220,974  | 3,147,894 | 1   |
| - Female   | 1981/82              | no.             | 7,327,503  | 2,370,742 |     |
|  | 1991/92              | no.             | 9,270,123  | 3,036,061 | 1   |
| - Sex Ratio  | 1981/82              |                 | 1.05       | 1.07      |     |
|  | 1991/92              |                 | 0.99       | 1.04      |     |
| - Urban Population   | 1981/82              | %               | 6.4        | 9.6       |     |
|  | 1991/92              | %               | 9.2        | 14.9      |     |
| - Economically Active Population Rate (10 years and above) | 1991/92              | %               | 56.99      | 53.55     |     |
| Agriculture  | 1991/92              | %               | 81.1       | 74.39     |     |
| Non-agriculture  | 1991/92              | %               | 18.9       | 25.61     |     |
| - Population Growth Rate                                   | 1981/82 -<br>1991/92 | %               | 2.1        | 2.3       |     |
| Households   | 1981/82              | no.             | 2,585,154  | 854,545   |     |
|  | 1991/92              | no.             | 3,328,721  | 1,115,428 |     |
| - Household Size   | 1981/82              | no.             | 5.8        | 5.7       |     |
|  | 1991/92              | no.             | 5.6        | 5.5       |     |
| Area   | 1991/92              | km <sup>2</sup> | 147,181    | 27,410    |     |
| - Density  | 1981/82              | km <sup>2</sup> | 102.1      | 179.1     |     |
|  | 1991/92              | km <sup>2</sup> | 125.6      | 225.6     |     |
| Enrollment Ratio   |                      |                 |            |           |     |
| - Primary School (Grade 1-5)                               | 1991/92              | %               | 105.7      | 94        |     |
| Male   | 1991/92              | %               | 126.4      | 112.3     |     |
| Female   | 1991/92              | %               | 82.9       | 73        |     |
| - Lower Secondary School (Grade 6-8)                       | 1991/92              | %               | 40.2       | 37.5      |     |
| Male   | 1991/92              | %               | 52.1       | 47.5      |     |
| Female   | 1991/92              | %               | 26.9       | 25.8      |     |
| - Secondary School (Grade 9-10)                            | 1991/92              | %               | 32.4       | 31.7      |     |
| Male   | 1991/92              | %               | 44.3       | 41.6      |     |
| Female   | 1991/92              | %               | 19.5       | 20.4      |     |
| Literacy Rate (6 years and above)                          | 1991/92              | %               | 39.6       | 38.6      |     |
| - Male   | 1991/92              | %               | 54.5       | 52        |     |
| - Female   | 1991/92              | %               | 25         | 24.6      |     |
| Life Expectancy at Birth                                   | 1991/92              | Years           | 54.26      | -         | -   |
| - Male   | 1991/92              | Years           | 55         | -         | -   |
| - Female   | 1991/92              | Years           | 53.5       | -         | -   |
| Infant Mortality Rate (per 1,000 births)                   | 1991/92              | %               | 97         | -         | -   |
| - Male   | 1991/92              | %               | 94         | -         | -   |
| - Female   | 1991/92              | %               | 101        | -         | -   |
| Crude Death Rate   | 1991/92              | %               | 13.3       | -         | -   |
| - Male   | 1991/92              | %               | 12.9       | -         | -   |
| - Female   | 1991/92              | %               | 13.6       | -         | -   |
| Poverty Incidence  | 1994/95              | %               | 49         | -         | -   |

Note : CDR indicates Central Development Region.

Source: 1) "Nepal Fertility, Family Planning and Health Survey of 1991/92", Ministry of Health.

2) "Educational Statistics Report, 1991", Ministry of Education.

## (2) Macro-economic Indicators

Macro-economic indicators for Nepal are given in Table 2.1-2.

**Table 2.1-2 Macro-economic Indicators**

| Indicator  | 1991/92 | 1992/93 | 1993/94 | 1994/95* | 1995/96** |
|--|---------|---------|---------|----------|-----------|
| Real GDP (at 1984/85 Prices)                     | 4.6     | 3.3     | 7.9     | 2.9      | 6.1       |
| Growth Rate (%)                                  |         |         |         |          |           |
| - Agriculture                                    | -1.1    | -0.6    | 7.6     | -0.3     | 5.4       |
| - Non-agriculture                                | 9.8     | 6.5     | 8.1     | 5.3      | 6.7       |
| Nominal GDP Growth Rate (%)                      | 24.8    | 14.0    | 15.9    | 9.7      | 13.9      |
| - Agriculture                                    | 17.7    | 7.6     | 15.0    | 6.0      | 12.7      |
| - Non-agriculture                                | 31.3    | 19.3    | 16.6    | 12.4     | 14.8      |
| Agricultural Production (%)                      | -2.4    | -4.7    | 13.3    | -4.0     | 10.0      |
| - Cereal Crops                                   | -6.2    | -7.9    | 16.8    | -7.9     | 13.4      |
| - Cash Crops                                     | 8.7     | 3.4     | 5.3     | 5.8      | 2.6       |
| Inflation Rate (%)                               | 21.0    | 8.9     | 8.9     | 7.6      | 6.8       |
| Exports (%)                                      | 85.5    | 26.0    | 11.7    | -7.2     | 6.7***    |
| - India  | -6.6    | 11.8    | 48.5    | 39.9     | 18.7***   |
| Imports (%)                                      | 37.5    | 22.7    | 31.5    | 27.1     | 19.5***   |
| - India  | 53.6    | 11.5    | 35.8    | 22.0     | 27.3***   |
| Trade Balance Deficit (%)                        | 15.1    | 20.3    | 47.1    | 47.6     | 25.0***   |
| - India  | 69.7    | 11.5    | 33.9    | 19.1     | 29.1***   |
| Government Receipts (Revenue and Foreign Grants) | 17.5    | 25.0    | 16.0    | 29.8     | -         |
| - % to Nominal GDP                               | 10.5    | 11.5    | 11.5    | 13.6     | -         |
| Government Expenditure                           | 12.2    | 17.0    | 1.4     | 16.3     | -         |
| - % to Nominal GDP                               | 18.2    | 18.7    | 17.5    | 18.6     | -         |
| Government Deficit                               | 5.7     | 6.2     | -2.8    | -9.3     | -         |
| - % to Nominal GDP                               | 7.8     | 7.2     | 6.1     | 5.0      | -         |

Note: 1) \* Revised estimates.

2) \*\* Tentative estimates.

3) \*\*\* Provisional for the first nine months.

Source: "Economic Survey, Fiscal Year 1995-96", Ministry of Finance, July 1996.

The national economy and the agricultural sector are described below.

### 1) GDP Growth Rate and Inflation Rate

Real GDP growth rate (1984/85 constant prices) in 1994/95 was constrained to 2.9% as a result of slumping production in the agricultural sector (0.3% decrease over the previous year). Of particular impact in this regard was a 7.9% decrease over the previous year in cereal production. However, growth rates in the agricultural and non-agricultural sectors are forecast at 5.4% and 6.7%, respectively, in 1995/96 for an average overall growth rate for that period of 6.1%. For the five year period 1991/92~1995/96, real GDP exhibited an average growth rate of 5.0% p.a., reflecting the per capita growth rate for the same period of 10.4%. (see Appendix 2.1-1).

In 1991/92, inflation was at a high level of 21.0%. Subsequent to this, the inflation rate tapered off and stabilized with a 6.8% rate forecast for 1995/96.

## 2) Industrial Structure

Sector wise contributions to the GDP in 1991/92 were 45.0% for agriculture, fisheries and forestry, 11.4% for trade, restaurants and hotels, 10.2% for construction, 9.1% for finance and real estate, 8.8% for manufacturing and 15.5% for other miscellaneous sectors. In 1995/96, these shares of the GDP were, respectively, 40.2%, 12.3%, 10.8%, 9.8%, and 17.6%, reflecting slumping activity in the agricultural sector on the one hand, and conversely growth in the trade, restaurant and hotel sector and the transport, communications and storages sector. Nevertheless, the agricultural sector remains the mainstay of the industrial structure of the country. (see Appendix 2.1-1).

Although the agricultural sector is a major source of labor employment, the Agricultural Perspective Plan (APP) cites the following as factors in slumping production performance in the sector in recent years: ① lack of a coherent agricultural development policy, ② lack of chemical fertilizer use, ③ inappropriate water management, ④ insufficient economic infrastructure, and ⑤ insufficient level of agricultural technology.

## 3) National Budget

Nepal suffers from chronic national budget deficit, relying on assistance from abroad as an important funding source. Revenue as a percentage of GDP rose from 10.5% in 1991/92 to 13.6% in 1994/95; however, this level still remains lower than other Southwest Asian countries (Sri Lanka: 20.8%; India: 15.3%). This is considered attributable to the fact that: ① poverty incidence nation-wide is around 49%, reaching 63% in the Hill and Mountains, and ② the rural population accounts for 90.8% of the total population of the country. As has been the case up to this time, the government continues to rely on the mainstay agricultural sector as a tax revenue source.

In 1994/95, the agricultural sector was the recipient of 16.4% (Rs 6,417.9 million) of total government expenditure. Breakdown of this amount was 42.1% for agriculture, 41.3% for irrigation, 12.3% for forestry and 4.3% for survey and land reform. In contrast to 42.9% for other sectors, the agricultural sector accounts for 90.4% of development expenditure. The rate of development expenditure in the sector has shown a steady increase since 1991/92. (see Appendix 2.1-2)

## 4) Trade Balance

For the five year period 1991/92 to 1995/96, the country's trade balance has shown an excess of imports over exports. Commerce with Nepal's largest trading partner, India, accounts for 39.5% of the total value of import excess. (see Table 2.1.1-3) Although trade in agricultural products exhibits an increase subsequent to 1993/94, there is concern about a worsening balance of payments in this regard.

Agricultural products exported to neighboring India comprise pulses, jute goods, cardamom, rice bran oil, rosin, etc., and accounted for 51.6% of export value to that country from Nepal in 1995/96. On the other hand, agricultural products imported from India (fruits and vegetables, livestock products, etc.) comprise 8.6% of the total import value from that country. (see Appendix 2.1-4~5) The above serves to highlight the dependency that Nepal's trading activity has on the Indian economy.

With regards to trade in agricultural products with other trading partners, export value of nigerseed and lentils grew rapidly in 1995/96, at respective rates of 4.9 fold and 6.8 fold over the previous year. In contrast, rice import value grew by 5.5 fold over the previous year, reflecting the chronic shortage in domestically produced food. (see Appendix 2.1-6~7)

#### 5) Foreign Aid

The structure of Nepal's national budget is characterized by a dependency on foreign assistance. In 1994/95, the agricultural sector was the target of 28.1% of the total assistance received from foreign donors. This represents a 2.8 fold increase compared with 1990/91. Breakdown of this within the sector is 54.4% for irrigation and 37.6% for agriculture. In both cases loans as opposed to grant-aid account for the majority of this assistance. (see Appendix 2.1-8) The agricultural sector accounts for 59.7% of total national development expenditure, within which the greatest amount is targeted at irrigation development (73.8%).

## 2.2 National Development Plan

### 2.2.1 Introduction

Following adoption in 1990 of a national policy to promote a free market economy, the Nepalese government has taken bold initiatives to promote growth and restructure of the economy by enhancing the role of non-governmental organizations (NGOs) and the private sector in development. These policy initiatives are aimed at freeing the economy from excessive government controls of the past and turning it to a liberal and competitive market economy. Accordingly, steps already taken towards the creation of a necessary policy environment include full convertibility of Nepalese currency on current accounts, delicensing of industrial quotas, removal of fertilizer price subsidies and allowing the private sector to undertake importation and distribution of the same, privatization of some public enterprises, and, above all, creation of a competitive environment for investment in various sectors of the economy. Reduction of widespread poverty is the central concern of the Government.

Along these strategic lines, the Government formulated its 8th National Plan (1991/92~1996/97), with principal targets of 1) sustainable economic growth, 2) alleviation of poverty, and 3) rectification of regional imbalances in development. Under the said plan, priority is accorded 1) agricultural intensification and diversification, 2) energy development, 3) development of rural infrastructure, 4) employment generation and human resources development, 5) control of population growth, 6) industrial development and tourism promotion, 7) export promotion and

diversification, 8) macro-economic stabilization, 9) reforms in development administration and 10) strengthening of monitoring and evaluation.

The 8th National plan targets an overall GDP growth rate of 5.1% (3.7% for the agricultural sector and 6.1% for the non-agricultural sector). Sector-wise allocation of government budget is 25.7% for the agriculture · irrigation · forestry sector, which is second in overall budget behind the social welfare sector for which allocation is 31.5% of the total. In terms of fixed capital investment, that for the agriculture · irrigation · forestry sector is 25.8% of the total (24.5% under the 7th National Plan), relying 64.1% on investment from the private sector and 35.9% on investment from the public sector.

### 2.2.2 Agricultural Policy

#### 1) 8th National Plan

Agricultural intensification and diversification is the highest priority issue under the 8th National Plan. Main policy targets in this regard are:

- (a) To increase agricultural production based on geographical specialization;
- (b) To increase agricultural production and productivity to meet the growing domestic food demand;
- (c) To increase production and productivity of raw materials, necessary for the expansion of agro-based industries;
- (d) To increase productive employment opportunities for small and marginal farmers; and
- (e) To maintain a balance between agricultural development and environmental protection.

Targets for production growth in the agricultural sector are 5.4% for food grains, 9.1% for cash crops, 5.4% for horticultural crops, 3.8% for livestock commodities and 10.7% for others.

#### 2) Agricultural Perspective Plan: APP

The Agricultural Perspective Plan (APP) was formulated with assistance from the ADB, and proposes strategy and orientation for agricultural development in the country over the next 25 years (1995/96~2014/15). The plan emphasizes year round irrigation, use of chemical fertilizers, research and extension activities for agricultural technology development, road infrastructure and energy development, etc. Targeted economic growth rate under the plan is 5% p.a.

Specifically, the main objectives of the APP are:

- (a) To accelerate the growth rate in the agriculture sector through increased factor (land, capital, labor) productivity;
- (b) To alleviate poverty and improve living standards through accelerated growth and expanded employment opportunities in the agricultural sector;
- (c) To shift from subsistence based farming to commercial agriculture through diversification and realization of comparative advantage;
- (d) To invigorate the overall national economy through agricultural development; and
- (e) To identify immediate, short-term and long-term strategies for implementation, and to provide guidelines for future year-wise planning.

To achieve the above, the following agricultural development strategy is set out:

- (a) A technology-based green revolution in agriculture as the initial engine of accelerated growth;
- (b) Accelerated agricultural growth as a demand pull for the production of high value commodities in agriculture, as well as for non-agricultural commodities, with consequent large multiplier effects on other sectors of the economy;
- (c) Broad ranged generation of employment opportunities;
- (d) Public policy and investment focus on human resources and socio-economic institutional infrastructure development;
- (e) Introduction of a package approach to development, with attention to regional differences and recognition of complementarity and priorities between public and private investment; and
- (f) Regionally balanced strategies which ensure the participation of women.

As can be seen from the above, the APP envisions increased crop demand pull through development of cultivation technology for high value crops, and specialization and commercialization of agricultural products. This will accelerate agricultural production, which in turn will be a catalyst for overall economic growth, generating employment opportunities in both the agricultural and non-agricultural sectors. Technological development is to be achieved through investment in research and extension promoting fertilizer use and improved water control. Specialization and commercialization of agricultural products is to be made possible by investment in roads and other market infrastructure. The strategy of the hills and mountain package will be centered on high value commodities. However this priority must deal concurrently with issues of agricultural road infrastructure, improved water control, immediate direction for research and

extension for improved technology for high value commodities, as well as monitoring of rapidly changing needs for the support of successful private sector development.

Agricultural GDP growth rates by region are forecast as per below.

**Table 2.2-1 Agricultural GDP Growth Rates by Region**

| Period                        | (unit: %) |          |       |         |
|-------------------------------|-----------|----------|-------|---------|
|                               | Hill      | Mountain | Terai | Average |
| 1991/92~1994/95 (base period) | 2.57      | 2.58     | 3.4   | 2.96    |
| 1995/96~1999/00               | 4.21      | 3.68     | 4.78  | 4.45    |
| 2000/01~2004/05               | 4.99      | 4.44     | 4.82  | 4.87    |
| 2005/06~2009/10               | 5.07      | 4.79     | 4.71  | 4.88    |
| 2010/11~2014/15               | 4.9       | 4.94     | 4.61  | 4.76    |

source: "Nepal Agricultural Perspective Plan (Final Report)", NPC & ADB, June 1995

### 2.2.3 Irrigation Policy

#### 1) 8th National Plan

Targets for irrigation development under the 8th National Plan include the following:

- (a) To increase agricultural production using appropriate irrigation technologies suited to varying geo-physical and climatic conditions with careful attention to environmental impact
- (b) To increase food production and agricultural productivity by improving the management of existing irrigation systems
- (c) To provide maximum irrigation facilities by implementing financially, technically and environmentally sustainable and cost effective projects with farmers' participation

#### 2) Agricultural Perspective Plan: APP

In the area of irrigated agricultural development, the APP calls for the establishment of year round irrigation systems for the introduction of high yield varieties and increase in cropping intensity.

Targets for irrigated area by region under the APP are as follows.



**Table 2.2-2 Target Year Round Irrigated Area by Region**

(unit: 1000 ha)

| Year                   | Hill · Mountain | Terai | Average |
|------------------------|-----------------|-------|---------|
| 1994/995 (base period) | 136             | 323   | 459     |
| 1999/00                | 157             | 481   | 638     |
| 2004/05                | 190             | 649   | 839     |
| 2009/10                | 217             | 790   | 1,007   |
| 2014/15                | 237             | 889   | 1,126   |

source: "Nepal Agricultural Perspective Plan (Final Report)", NPC & ADB, June 1995

In addition to year-round irrigation in pursuing irrigated agricultural development, the APP also calls for concurrent upgrading of all weather farm road and electrification infrastructure, and strengthening of distribution activities including fertilizer distribution. In the area of agricultural research, top priority is given the development of the optimum farm management structure to achieve a high cropping intensity under year-round irrigation. The APP also stresses the participation of women, including appropriate training, in water management organizations.

#### 2.2.4 Environmental Policy

Main environmental policies of the HMG comprise the National Conservation Strategies (1988), the Nepal Environmental Policy Action Plan (1993) and the Eighth Development Plan (1992~1997).

The National Conservation Strategies were formulated in 1988 as a result of the government's conclusion that environmental measures under the 7th National Development Plan (1985~1990) up to that time had been largely ineffective. The subsequent 8th National Development Plan set out policy for conservation of the environment and natural resources, as well as a concept for the Earth Summit (UNCED: United Nations Conference on Environment and Development) held in 1992. The action plan "Agenda 21" adopted at the foregoing summit, and the Nepal Environmental Policy Action Plan (setting out government environmental policy under the 8th National Development Plan) were incorporated in government policy in 1993.

The National Conservation, which was endorsed by the Government in 1988, stresses the integration of conservation and development with the following four objectives:

- satisfy material, spiritual, and cultural needs of the people of Nepal for both present and future generations.
- ensure sustainable use of land, water and other renewable resources.

- preserve biological diversity, maintain and improve quality and yields of crops and livestock, and maintain varieties of wild species of both plant and animal.
- maintain the ecosystem by ensuring soil regeneration, nutrient recycling and the protection and cleansing of air and water.

The Eighth Plan recognizes the importance of sustainable development and the need for integrating environmental concerns with development activities. Main policy features of the Plan include:

- 1) incorporation of preventative and mitigatory measures from the planning stage of development projects;
- 2) development of a comprehensive legal framework to integrate consistently environmental concerns into the development process;
- 3) a series of studies on the pollution of air, water, noise and land, and the development of appropriate standards and guidelines based on these studies;
- 4) greater participation by people in the management of natural resources and in the implementation of environment programs;
- 5) environmental education and public awareness actions;
- 6) the provision of economic incentives for industries to voluntarily adopt pollution mitigation measures;
- 7) preservation and promotion of Nepal's natural and cultural heritage; and
- 8) the establishment of environmental units in all related ministries.

The Nepal Environmental Policy Action Plan was prepared under the auspices of National Planning Commission in 1993 to review current environment related government policies, formulate new policy where needed and suggest an action agenda to address environmental problems. The actions needed to improve water resource management in the irrigation sector are follows:

- encourage the conservation of water through the implementation of irrigation fees related to the amount of water consumed.
- where possible, turn over the management of irrigation systems to local users' groups.
- use the users' groups as a basis for channeling information about the need for conservation and better management of ecological resources.

### 2.3 National Policy and TIP

The Eighth Five Year Plan emphasizes a policy of poverty alleviation, environment and resource conservation, employment generation and increased food production to ensure food security to the people.

The development planning document estimates 50% of Nepal's population as below the abject poverty line. Hence poverty alleviation is made as major national policy of the government. The other related issue of poverty is employment generation. Besides these major policies, the government has also established policy to increase agriculture production to ensure food security to the people. The sustainability of development depends on environment protection and resource conservation.

The TIP addressed these major national policies during project preparation. One of the major reasons for the population to remain poor and fall under the poverty line is due to inaccessibility of resources and opportunity to break the poverty circle. People below the poverty line are estimated to be 80% in the TIP area; accordingly TIP addresses the poverty question through natural resources management like the development of irrigation facilities for increasing agriculture production. Irrigation development is considered to be an entry point for the implementation of the poverty program within the TIP area.

TIP has the potential of generating more employment to the farmers of the area. Through the irrigation development, a substantial amount of employment would be generated in the agricultural sector and indirect employment would be generated in the agro-processing industry and marketing services. The transport and service sectors would also generate more employment.

TIP proposes to design an irrigation system taking into consideration environmental protection and natural resource conservation, and in this regard an environmentally friendly irrigation system is proposed by avoiding the alignment through forest area and land slide zones. The canal main line will be of pipes which have been proven to be environmentally friendly.

TIP has accordingly incorporated those features which are addressed in the national policy on poverty alleviation, employment generation food security and environment protection.

TIP has been formulated based on a participatory approach enlisting the participation of the farmers in design, operation and maintenance of the system as prescribed by the Irrigation Policy of Nepal. It also attempts to bring functional participation of both farmers and agency staff in irrigation management by constituting the project management committee consisting of farmers representatives and agency staff.

## 2.4 Related Administrative Organizations

The primary agency concerned with TIP is the Ministry of Water Resources. The various agencies concerned with the Project and their respective roles are indicated in Table 2.4-1. Organization charts of the Ministry of Water Resources, the Department of Irrigation of the central government, and the Regional Irrigation Directorates of the Department of Irrigation are shown in Tables 2.4-2~4. Table 2.4-5 shows the administrative structure for Nuwakot district, within which the Project area lies.

**Table 2.4-1 Related Government Agencies and Their Relation with Trishuli Irrigation Project (TIP)**

| No. | Name of Agency   | Functions   | Relation with TIP  |
|-----|--|---|--|
| 1.  | Ministry of Water Resources (MWR)                              | Overall water related policy formulation and supervise implementation of policy                           | Approval for the implementation of TIP   |
| 2.  | Department of Irrigation (DOI)                                 | Irrigation program implementation, construction, O&M, promotion of participatory irrigation management    | Implementation of TIP, coordination with other agencies for the implementation of TIP  |
| 3.  | Ministry of Agriculture (MOA)                                  | Formulation of overall agriculture policy and supervision of its implementation                           |  |
| 4.  | Department of Agriculture (DOA)                                | Implementation of agriculture development programs through District Agriculture Development Office (DADO) | Responsible for the implementation of agriculture improvement programs in TIP  |
| 5.  | Ministry of Forestry and Department of Soil Conservation (DSC) | Forest conservation, protection and utilization   | Grant permission for the use of forest area for the project implementation. DSC through district office undertakes soil conservation activities in the project area  |
| 6.  | Ministry of Land Administration                                | Land resource management, survey, record keeping  | Through the district office, land records of the TIP area are to be provided, and list of beneficiary land holders, land ownership record, land demarcation for acquisition and compensation prepared  |
| 7.  | Ministry of Defense  | National defense, management of army barracks located in different parts of Nepal                         | TIP canal alignment passes through the barrack in Maithali, Nuwakot district. Approval of Ministry is required for the construction of canal through the barrack compound  |
| 8.  | Ministry of Population and Environment                         | Concerned with population issues and environment protection   | TIP has to follow the standard set by the Ministry regarding environmental matters   |
| 9.  | Chief District officer (CDO)                                   | Law and order maintenance in the district to provide support to development activities in the district    | Law and order maintenance during project implementation, to ensure the flow of materials and manpower for the implementation of the project, fixing of minimum wages to the workers and acquisition for project and compensation distribution by CDO office. |
| 10. | Nepal Electricity Authority (NEA)                              | Electricity generation and supply to the consumers  | Agreement for the provision of intake for TIP from Trishuli Hydropower Project at Trishuli and to provide electricity to operate lift pumps in TIP command area.   |
| 11. | District Development Committee (DDC)                           | To undertake activities for overall development of the district   | Mobilize beneficiary support to TIP, to register WUAs at DDC with I DO   |
| 12. | BiJur Municipality   | The municipality is to look after all development activities within municipality area                     | To provide support to the project, larger part of municipality area fall within TIP command, social and political support to be provided.  |
| 13. | Khadgabhanjyang VDC  | Overall development of the village area   | To provide social and political support  |
| 14. | Agriculture Development Bank and Other banks                   | To provide credit for agriculture related activities, to give priority sector loan by other banks.        | Agriculture production loans are to be made available by these banks.  |

**Table 2.4.2 Ministry of Water Resources Organization Chart**

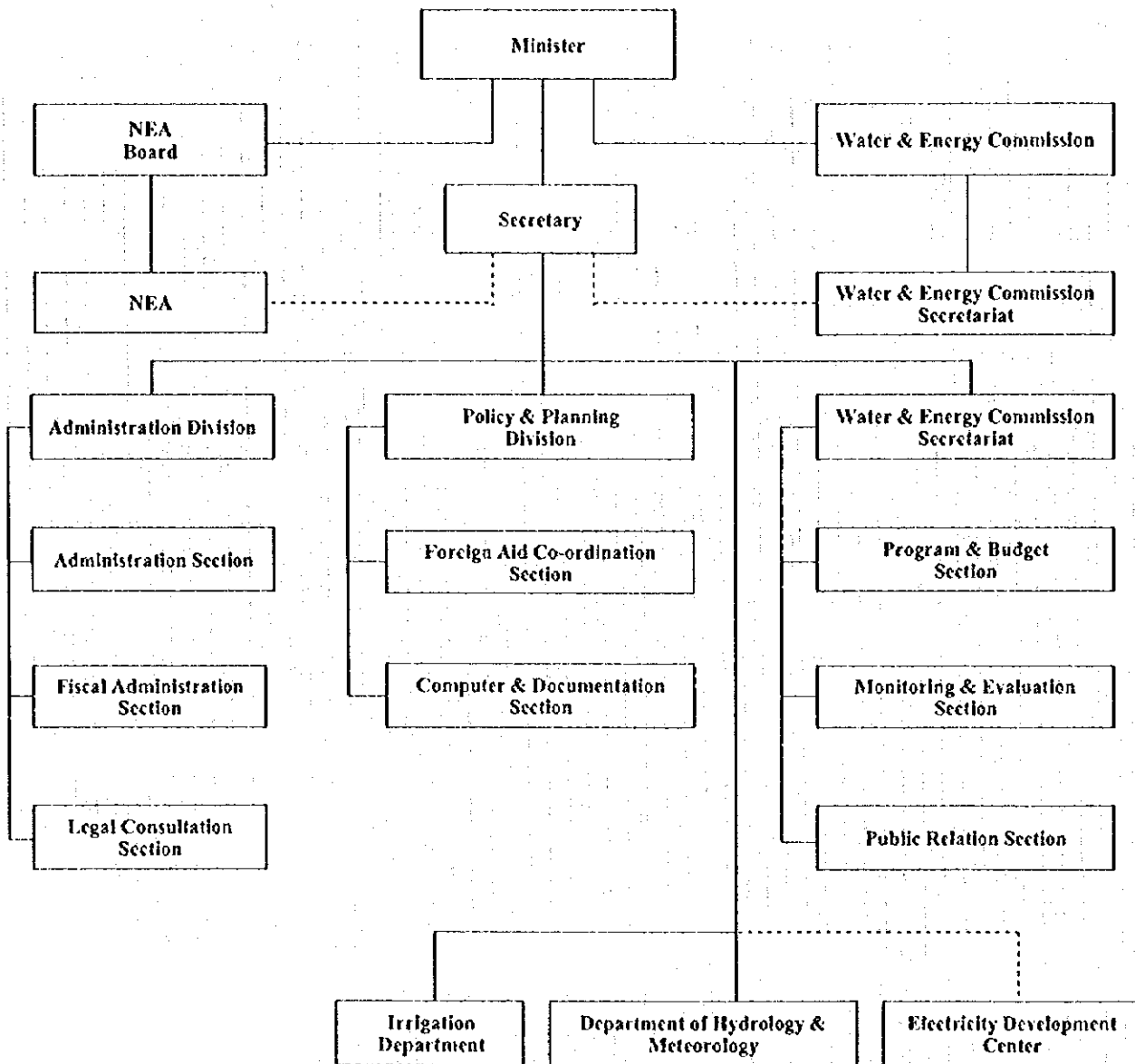


Table 2.4-3 Organization Chart of Irrigation Department

DIRECTOR GENERAL  
(DG-1)

| PLANNING DESIGN & EVALUATION DIVISION, DDG   | SURFACE IRRIGATION DIVISION DDG-1  | GROUND WATER DIVISION DDG-1   | IRRIGATION MANAGEMENT, DDG-1  | FLOOD CONTROL, ENVIRONMENT & MECHANICAL DIVISION, DDG-1   | Administration Section   |
|--|--|---|---|---|--|
| Design, Quality Control & Feasibility Study Section  | Major Irrigation Section   | Groundwater Irrigation & Resource Evaluation  | System Management Section   | Flood Control Section   | Chief Adminis. Officer -1<br>Administration Officer -6<br>Office Assistant -20                   |
| Supdt. En. -1<br>Chief water spec. -1<br>Divisional En. -2<br>Geologist -1<br>Senior Agr. En. -1<br>Engineer -2<br>Agronomist -1<br>Sociologist -1<br>Draftman -2<br>Tracer -2 | Divisional Engineer -1<br>Assistant Engineer -2<br>Overseer -1                         | Senior Geologist -1<br>Hydrologist -1<br>Assistant Engineer -1<br>Hydrogeologist -1       | Divisional Engineer -2<br>Div. Agr. Engineer -1<br>Assistant Engineer -1<br>Agr. Engineer -2<br>Agronomist -1<br>Sociologist -1 | Divisional Engineer -1<br>Assistant Engineer -1<br>Overseer -1<br>Draftman -1<br>Computer Operator -2                           | Librarian -1<br>Telephone Operator -1<br>Artist -1<br>Typist -6<br>Other -15<br>Peon & Other -25 |
| Design & Monitoring Evaluation Section   | Medium & Small Irrigation Section  | Groundwater Management & Information Section  | Research & Technology Development Section   | Environment Section   | Account Section  |
| S.M.E. Officer -1<br>Div. Agronomist -1<br>Div. Agr. Engineer -1<br>Divisional En. -1<br>Sociologist -1<br>Agronomist -1<br>Computer Operator -1                               | Divisional Engineer -1<br>Assistant Engineer -2<br>Overseer -1                         | Senior Geologist -1<br>Hydrogeologist -2<br>Computer Operator -2                          | Agr. Engineer -1<br>Assistant Engineer -1<br>Agronomist -1<br>Sociologist -1<br>Computer Operator -2                            | Environmental Specialist -1<br>Geologist -1<br>Divisional Engineer -1<br>Assistant Engineer -1<br>Water Conservation Officer -1 | Chief Account -1<br>Account Officer -6<br>Accountant -15   |
| Management Information System Section  | Major Irrigation Section   | Groundwater Irrigation Section  | Management Development & Training Section   | Mechanical Management Section   | Law Section  |
| Senior Stationer -1<br>Stationer -1<br>Assistant Engineer -1<br>Computer Operator -1   | Divisional Engineer -1<br>Assistant Engineer -1<br>Draftman -1<br>Computer Operator -1 | Divisional Engineer -1<br>Geologist -1<br>Mechanical Engineer -1<br>Assistant Engineer -1 | Agr. Engineer -2<br>Assistant Engineer -1<br>Agronomist -1<br>Sociologist -1  | Divisional Mech. Engineer -1<br>Mechanical Engineer -1<br>Mechanics -1  | Senior Law Officer -1<br>Law Officer -1  |
|  | Water Quality Control Section, Chemical Lab. Unit Division                             | Chemist -1<br>Lab. Technician -1<br>Assistant Chemist -2<br>Lab. Boy -1                   |   | Mechanical Workshops<br>Divisional Mech. Engineer -1<br>Mechanical Engineer -1<br>Mechanics -2                                  |  |

Table 2.4-4

**Organization Chart of Regional Irrigation Directorate of Department of Irrigation**

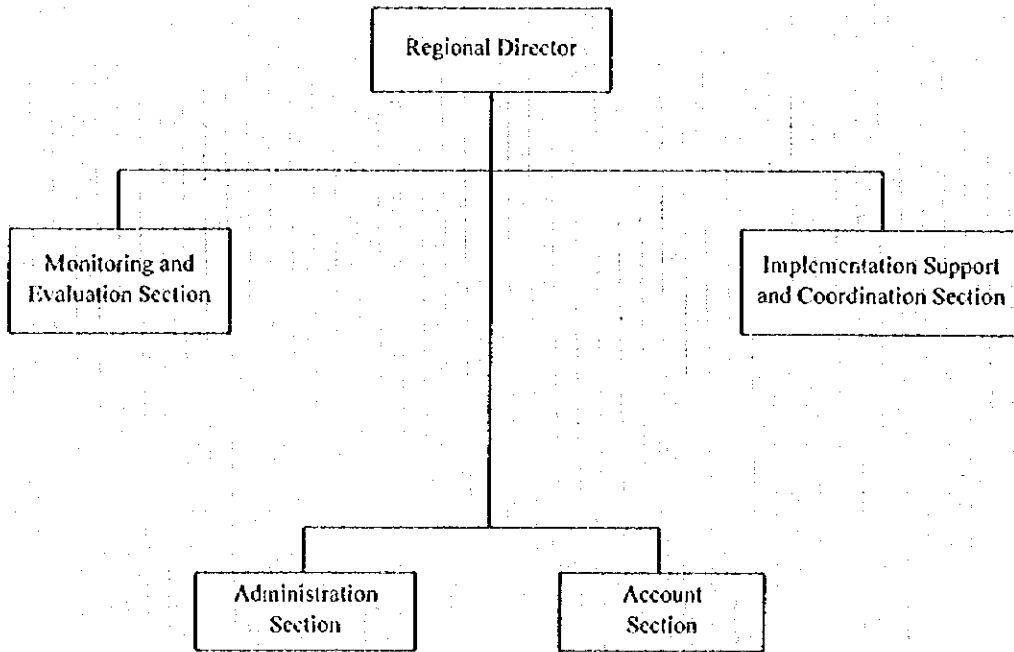
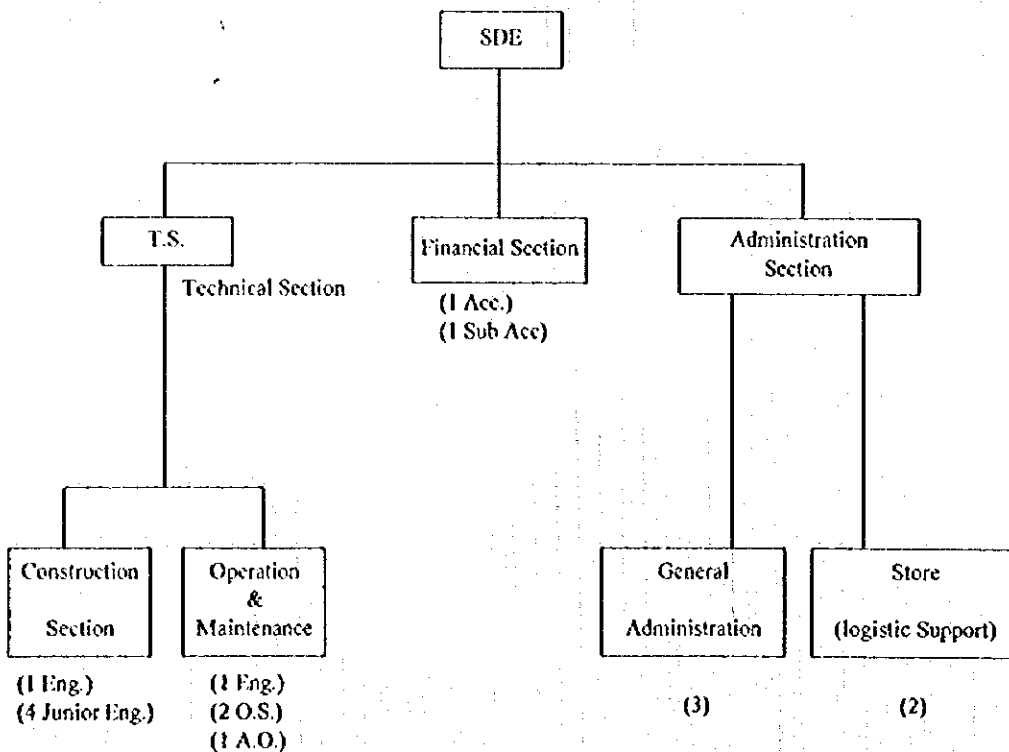


Table 2.4-5

**District Irrigation Office Nuwakot**





**CHAPTER 3**

## CHAPTER 3 EXPERIENCE AND LESSONS FROM SIMILAR PROJECTS IN THE HILLS

Numerous development projects have been carried out to date in the Hill and Mountain areas of Nepal with a basic objective of rectifying skewed levels of socio-economic development. In order to effectively apply the lessons learned from these to the subject Project, the replicability of factors leading to the success of these previous projects was examined. Previous projects selected in this regard for study were chosen on the basis of the following 2 criteria which are essential to the success of TIP; i.e. ① participatory management in irrigation development and ② agricultural diversification.

### 3.1 Participatory Irrigation Management in the Hills

Nepal has accumulated a number of experiences for the promotion of participatory irrigation management and methods to strengthen the farmers' organization. The lessons learnt in these different projects are of direct relevance for strengthening farmers capacity and promotion of participatory irrigation management in Trishuli Irrigation Project (TIP). Following are some brief case studies on the experiences of participatory irrigation management in Nepal.

#### (1) Andhi Khola Project

This is multipurpose project combining hydropower generation of 5 MW and irrigation development of 300 ha by utilizing tailrace water of hydropower generation. One of the principles introduced in this project was to distribute water share among the beneficiaries of the project benefit area. Water is not allocated on the basis of land but water allocation was made on the basis of share to the individual beneficiaries. The large landholders are requested to sell a certain amount of land to the project so that extra land could be made available to the landless people of the project benefit area. The project benefit area is defined within a 3 km radius.

Social preparation to the farmers and officials initiated about two years before the physical construction of the irrigation systems. Two social organizers were hired by the project to help in WUA formation. Membership was mobilized from among the beneficiaries of the project benefit area. These members are registered in the water users association. The members have to pay an annual membership fee which would be used for the management of the WUA. The executive committee is formed on the basis of the membership of the WUA. The farmers were to make the decisions regarding the activities of irrigation development and management.

Representative farmers were taken from Andhi Khola to Chherlung and Argeli irrigation systems of Palpa District where the irrigation system is managed on the basis of water share. Water share is a unit of water proportional to investment or area irrigated within the command area. Later on the farmers were taken to Sukhamajeri, Hariyana, India for observation in order to facilitate understanding of the principles of water share to all and income generation by the landless population by selling water

from their share to the farmers who would like to buy water from them. Water is viewed separate from land and it is recognized that water is a resource to be shared by all. Besides these observation tours and the farmer to farmer training program, several other training programs were organized for the farmers of the project area. The lessons learned in this project are that the social preparation directed at the farmers should have enough time lead so that they are fully made aware of their roles and responsibilities.

## (2) CARE/Nepal and ADB/N Irrigation Program.

The Agricultural Development Bank of Nepal (ADB/N) provides loans to small farmers for different economically productive activities. In this program for irrigation development, CARE/Nepal provided technical assistance to ADB/N so that the farmer organization plays an important role in technology selection, cost estimate and implementation of the project. The farmers get a 50% subsidy from CARE/Nepal and 50% contributions from the farmers themselves. Out of the contribution of 50% from the farmers, ADB/N provides loans to them. A 35% loan would be taken by the farmers and 15% worth of resources would be mobilized from among the beneficiaries in the form of cash and labour. These programs are implemented through the Small Farmers Development Program via the group loan system. The small farmers groups identify a project, and the groups engage in discussion with the group organizer of SFDP near the project area. In undertaking such a project, several small farmers groups must reach an agreement for the irrigation project. The group organizer plays a very important role in bringing these groups together and making them agree to pay the contribution for the construction of the irrigation system. Once the project is approved for implementation, CARE/Nepal engineers then start survey of the irrigation system along with the farmers groups. Extensive interaction takes place between the farmers groups and the engineering group. The farmers have to bear 50% contribution through direct contribution and loan from ADB/N, and farmers are accordingly very particular about the cost aspect. They will constantly check whether the cost can be reduced in order to reduce loan burden. Once the proposal is agreed to by the beneficiary groups and ADB/N-CARE/Nepal, a construction supervision group from among the farmers is formed between the time of detail design and construction. ADB/N-CARE/Nepal has introduced a program to field an agriculture extension person in the project site to educate the farmers in new methods of agriculture practices, improved seeds and inputs. As soon as the irrigation system construction is completed, new agriculture practices can be introduced by the farmers and they can begin to garner income from the new agricultural practices.

The approach in this project is to help the farmers help themselves. The project creates community assets, rather than government property in the community.

## (3) The International Irrigation Management Institute (IIMI) and Water and Energy Commission Secretariat (WECS) Action Research on Farmer - Managed Irrigation Systems

Appropriate assistance to farmer-managed irrigation systems has been a major concern in Nepal. Action research in order to identify appropriate methodology to

assist the farmer managed irrigation systems was initiated by the IIMI-WECS program. The action research took place in the Indrawati Watershed area of Sindhupalchowk district. Important results of the action research are:

- a) Farmer participation is possible in project identification, cost estimate, cost saving and project implementation.
- b) Farmers are oriented toward a participatory management style. In order to increase farmer capability, two notable experiments were undertaken. A farmer to farmer training program was conducted in order to make farmers aware of better irrigation management systems. A farmer consultancy program was also introduced. Farmers from better managed systems were invited to the system where improvement or rehabilitation is taking place in order to provide advice to the farmers of the latter.
- c) Greater transparency and accountability made the farmer organization quite active.
- d) The farmers believe only when they see the changes themselves. A farmer to farmer (F-F) training program was organized in order to enable the project farmers visit a better managed irrigation system and hold discussion with the farmers who have experience in better system management. Upon return from the better managed irrigation system, they start introducing some of the features by themselves which they have seen working in the other system. It is found that the farmer to farmer training program is a quite useful and effective program.

#### (4) Dhaulagiri Irrigation Development Project, Dhaulagiri Zone

This irrigation project extends to four districts of Dhaulagiri Zone of Western Nepal. Implementation supervision is done by the International Labour Organization (ILO). The objectives of this project were to: a) increase food production in hill regions b) generate employment within the project area, c) provide skill training to men and women within the project area and d) form a farmer organization to undertake better agriculture practices and income generating activities. The central objective of this project was to introduce programs for poverty alleviation within the project area.

ILO technical staff collaborated with the Regional Directorate of Irrigation, Western Region. The Western Regional Directorate and District Irrigation Offices have very limited manpower with the skill of social mobilization of the farmer groups within the project area.

ILO contracted out the responsibility of social mobilization to two NGO Groups of the region. They were assigned the responsibility of awareness creation among the beneficiary groups and organize different types of training programs directed at these beneficiary groups to assist the farmers in forming their own organization. One social organizer for each irrigation system was assigned. The cost for the NGO services was paid by the ILO. In this project, several groups of farmers were organized for income generating activities within the umbrella of the water users' associations. This project is different from other irrigation implementation programs in that it focuses on

employment and income generating activities as well as formation of different groups for such income related activities. This project has taken irrigation as an entry point for poverty alleviation within project area. Hence, the lesson of this project is that the physical construction of an irrigation system is to be complemented by specific programs aiming at income generation, poverty alleviation and information to the beneficiaries about better alternatives.

(5) Mechi Hill Irrigation Project

This project covers the hill districts of Mechi Zone of eastern Nepal. The objective of this project is to increase food production. However, the implementation of the project is through a participatory approach. It attempts to incorporate the beneficiary participation during project identification, design of the system, implementation of the project and O&M responsibility of the farmers after physical implementation of the project. This project adopted several features from the Action Research Project in Indrawati Basin of Sindhupalchowk district. This project attempts to strike a balance between physical infrastructure development and socio-economic capacity development of the beneficiaries.

(6) Irrigation Line of Credit (ILC)

(7) Irrigation Sector Program (ISP)

These projects are implemented through the loans by the World Bank and Asian Development Bank. Both these projects established the farmers as the central point for the implementation of the program. The Irrigation Sector Program extends over 20 districts in the Eastern and Central Regions of Nepal. Efforts are made to enlist farmer participation at different stages of project implementation. The number of social organizers required is enormous. The existing social organizers located in the District Irrigation Office alone could not provide the necessary services for the promotion of the farmer organizations. Hence, farmer social organizers were employed in many systems under the sector program. Oftentimes, one would notice the emphasis on the physical infrastructure development. Such emphasis has been necessary by the budgetary system and evaluation procedure of His Majesty's Government of Nepal. The project progress evaluation is done on the basis of the amount of the project money spent and only physical infrastructure would help spend money quickly. The time required for social preparation of the farmers is very short. No flexibility is provided in this exercise. DOI employed Association Organizers (AO) are placed in charge of the social preparation exercise. This exercise became a routine administrative exercise. No NGO is employed in this exercise under the sector program.

**Table 3.1-1 Experiences in Similar Hill Irrigation Projects in Nepal**

| No | Name of the Project                       | Location   | Irrigation Area                 | Objectives  | Donor Agency   | Project Duration    |
|----|---|--|---------------------------------|---|--|---------------------|
| 1. | Andhi Khola Project                       | Galong Bhanjyang, Syonja District                              | 300 ha                          | (a) to distribute the benefit of water resources to all<br>(b) to provide access of resources to poor people  | United Mission to Nepal (UMN)                          | 1984 - 1995         |
| 2. | CARE/Nepal-ADB/N Irrigation Project       | 24 Districts   | 1,250 ha (24 systems)           | (a) to help increase the living standard of the poorest farmers<br>(b) help build community awareness, cooperation and self-reliance  | CARE/Nepal mobilized from other                        | I Phase 1984 - 1986 |
| 3. | HIMI-WECS Action Reserch Project          | Infrawati Basin, Suidhupalchawh district                       | 974 ha (19 systems)             | (a) development of criteria of selection of system for assistance<br>(b) promotion of farmer participation in physical improvment and management                              | FIRD Foundation  | 1987 - 1990         |
| 4. | Dhaulagiri Irrigation Development Project | Baylung, Mygdi, Parbat and Mustang                             | 2,196 ha (46 systems)           | (a) employment generation<br>(b) skill development<br>(c) focus on poverty alleviation  | Denmark through International Labor Organization (ILO) | 1989 - 1996         |
| 5. | Hechi Hill Irrigation Project             | Hlam, Taplegunj and Paunchthar of Hechi Zone                   | 2,465 ha (22 systems completed) | (a) increase food grain production<br>(b) rehabilitation of farmers Systems<br>(c) help increase the farm income of HHs   | Netherlands government grant                           | 1988 - 1996         |
| 6. | Irrigation Line of Credit (ILC)           | 34 districts of western, mid-western and far western districts | 15,000 ha                       | (a) increase food grain production<br>(b) rehabilitation of systems through participation<br>(c) turnover of systems<br>(d) agriculture support<br>(e) environment protection | IDA/World Bank loan                                    | 1988 - 1996         |
| 7. | Irrigation Sector Project (ISP)           | 35 districts of central and eastern regions                    | 63,438 ha identified            | -rehabilitation<br>-participatory approach<br>-turnover<br>-increase of foodgrain production  | ADB loan   | 1989 - 1996         |

| No | Name of the Agency   | Social Mobilization   | Group Formation                            | Type of Training Program  | Duration of Social Mobilization before Construction   | Replicability Features  |
|----|--|---|--|---|---|---|
| 1. | UMN  | Project social organization helped form WUA and educate the farmers about project   | two tier WUA formation                     | -Farmer to farmer training both within Nepal and India, agriculture extension training  | About 2 and half year before project implement  | (a) F-F training<br>(b) Awareness session activity<br>(c) poverty alleviation focused program                       |
| 2. | ADB/N and CARE/Nepal   | Group organizer employed by ADB for Small Farmers Development Program (SFDP)        | Small farms group formation WUA formation  | -Training on agriculture extension<br>-Training on water management   | Group organizer are fielded in all SFDP before identification of project  | -Group organizer<br>-Focus on poorest small farmers   |
| 3. | Water and Energy Commission Secretariat, Nepal (WECS)            | One social mobilizer hired by HIMI for 19 systems, farmer consultants were employed | WUA  | Farmer to farmer training program for all systems   | 3-6 months before physical improvement of the system  | (a) consultation with farmer for design<br>(b) F-F training program<br>(c) WUA before physical improvement          |
| 4. | ILO and DOI (District Irrigation Offices)                        | NGOs hired for social mobilization work   | -Women's group<br>-Income generating group | On the spot training on:<br>-skill development to women<br>-agriculture improvement training<br>-manson skill development training<br>-income generation related training<br>-water management training | - 6-8 months of before the physical improvement work<br>-awareness creation though meeting and training program | -NGO employment for social mobilization<br>-training program through NGOs<br>-focus on poverty alleviation activity |
| 5. | Ministry of Local Development and DOI                            | NGO mobilization for group mobilization work  | Formation of users committee               | -training on repair, maintenance  |   | - NGO as change agent<br>-farmer to farmer training program   |
| 6. | DOI, Regional Irrigation Directorate, District Irrigation Office | Government employed Association Organizer (AOS)                                     | only WUA                                   | Construction skill, repair and maintenance, strengthening of WUA activities   | 6-8 months before project implementation  | Process of consultation with farmers  |
| 7. | DOI, Regional Irrigation Directorate, DIO                        | AOS and farmer social organizer   | only WUA                                   | Management skill development of WUA office management   | Before the physical implementation takes place  | - process of consultation with farmers<br>- introduction of farmer social organizer                                 |

Table 5.2.4-2 Number of Poor Households and Their Land Holding Size

| Integration Block | Municipality/VDC | Ward No. | Settlement Name    | No. of Households (H.H) |                     | No. of Poor Households* (H.H) | No. of Poor HH (%) | Landless |           |       | Marginal (<0.2ha) |       |           | Small (0.2-0.5ha) |           |      | Medium (0.5-1.0ha) |       |           | Large (>1.0ha) |           |      |           |
|-------------------|------------------|----------|--------------------|-------------------------|---------------------|-------------------------------|--------------------|----------|-----------|-------|-------------------|-------|-----------|-------------------|-----------|------|--------------------|-------|-----------|----------------|-----------|------|-----------|
|                   |                  |          |                    | No. of Households       | No. of HH responded |                               |                    | No.      | Poor HH % | No.   | Poor HH %         | No.   | Poor HH % | No.               | Poor HH % | No.  | Poor HH %          | No.   | Poor HH % | No.            | Poor HH % | No.  | Poor HH % |
|                   |                  |          |                    |                         |                     |                               |                    |          |           |       |                   |       |           |                   |           |      |                    |       |           |                |           |      |           |
| A                 | Cerkhuar Bidur   | 3        | Cerkhuar           | 15                      | 15                  | 14                            | 93.3               | 1        | 100.0     | 2     | 2                 | 100.0 | 3         | 3                 | 100.0     | 7    | 6                  | 85.7  | 2         | 2              | 100.0     |      |           |
|                   |                  | 1        | Simbar             | 20                      | 20                  | 11                            | 55.0               | 0        | 0         | 1     | 100.0             | 11    | 7         | 63.6              | 3         | 2    | 66.7               | 5     | 1         | 20.0           |           |      |           |
|                   |                  | 35       | Sub-Total          | 35                      | 25                  | 71.4                          |                    |          |           |       |                   | 14    | 10        | 71.4              | 10        | 8    | 80.0               | 7     | 3         | 42.9           |           |      |           |
| B                 | Bidur            | 1        | Dhang              | 10                      | 10                  | 7                             | 70.0               | 2        | 100.0     | 7     | 5                 | 71.4  | 1         | 1                 | 100.0     | 0    | 0                  | 0     | 0         | 0              |           |      |           |
|                   |                  | 3        | Bidar (upland)     | 10                      | 10                  | 8                             | 80.0               | 3        | 2         | 66.7  | 2                 | 2     | 100.0     | 3                 | 2         | 66.7 | 1                  | 1     | 100.0     |                |           |      |           |
|                   |                  | 42       | Sub-Total          | 42                      | 26                  | 72.2                          |                    |          |           |       |                   | 11    | 7         | 63.6              | 14        | 11   | 78.6               | 5     | 2         | 40.0           |           |      |           |
| C                 | Bidur            | 62       | Sub-Total          | 62                      | 41                  | 72.2                          |                    |          |           |       |                   | 15    | 10        | 66.7              | 15        | 12   | 80.0               | 6     | 3         | 50.0           |           |      |           |
|                   |                  | 3        | Batar (upland)     | 52                      | 37                  | 21                            | 56.8               | 9        | 4         | 44.4  | 9                 | 5     | 55.6      | 14                | 9         | 64.3 | 4                  | 2     | 50.0      |                |           |      |           |
|                   |                  | 155      | Sub-Total          | 155                     | 131                 | 84.5                          | 35                 | 31       | 88.6      | 38    | 27                | 71.1  | 54        | 49                | 90.7      | 17   | 17                 | 100.0 | 11        | 7              | 63.6      |      |           |
| D                 | Bidur            | 4        | Batar Purano Bajar | 36                      | 36                  | 31                            | 86.1               | 7        | 6         | 85.7  | 13                | 11    | 84.6      | 11                | 9         | 81.8 | 4                  | 4     | 100.0     |                |           |      |           |
|                   |                  | 4        | Sangam Chok Batar  | 18                      | 18                  | 11                            | 61.1               | 6        | 5         | 83.3  | 0                 | 0     | 0         | 3                 | 1         | 33.3 | 6                  | 3     | 50.0      |                |           |      |           |
|                   |                  | 18       | Sub-Total          | 18                      | 18                  | 100.0                         | 0                  | 0        | 0         | 1     | 1                 | 100.0 | 11        | 10                | 90.9      | 3    | 3                  | 100.0 | 3         | 2              | 66.7      |      |           |
| E                 | Bidur            | 18       | Dhigau Marandhi    | 17                      | 13                  | 76.5                          |                    |          |           |       |                   | 4     | 5         | 71.4              | 4         | 3    | 75.0               | 0     | 0         | 0              |           |      |           |
|                   |                  | 6        | Mahanadhi          | 107                     | 103                 | 96                            | 93.2               | 1        | 1         | 100.0 | 11                | 10    | 90.9      | 46                | 44        | 95.7 | 39                 | 36    | 92.3      | 6              | 5         | 83.3 |           |
|                   |                  | 125      | Sub-Total          | 125                     | 109                 | 90.8                          | 2                  | 2        | 100.0     | 16    | 14                | 87.5  | 50        | 49                | 92.5      | 43   | 39                 | 90.7  | 6         | 5              | 83.3      |      |           |
| F-G               | Bidur            | 178      | Palo Pipalar       | 159                     | 141                 | 88.7                          |                    |          |           |       |                   | 15    | 15        | 100.0             | 18        | 15   | 83.3               | 64    | 60        | 93.8           |           |      |           |
|                   |                  | 7        | Devghat            | 135                     | 103                 | 80                            | 77.7               | 3        | 2         | 66.7  | 24                | 22    | 91.7      | 34                | 29        | 85.3 | 30                 | 21    | 70.0      |                |           |      |           |
|                   |                  | 313      | Sub-Total          | 313                     | 244                 | 78.0                          | 6                  | 5        | 83.3      | 48    | 44                | 91.7  | 98        | 89                | 90.8      | 94   | 84                 | 89.4  | 27        | 21             | 77.8      |      |           |
| H                 | Bidur            | 185      | Majhar             | 133                     | 111                 | 82.9                          |                    |          |           |       |                   | 18    | 15        | 83.3              | 32        | 26   | 81.3               | 48    | 45        | 93.8           |           |      |           |
|                   |                  | 5        | Devghat            | 16                      | 15                  | 100.0                         | 3                  | 3        | 100.0     | 2     | 2                 | 100.0 | 4         | 4                 | 100.0     | 4    | 4                  | 100.0 |           |                |           |      |           |
|                   |                  | 201      | Sub-Total          | 201                     | 166                 | 82.6                          | 9                  | 8        | 88.9      | 20    | 18                | 90.0  | 36        | 30                | 83.3      | 52   | 49                 | 94.2  | 52        | 49             | 94.2      |      |           |
| I                 | Bidur            | 16       | Pipalar Tholgaun   | 35                      | 32                  | 90.6                          |                    |          |           |       |                   | 4     | 2         | 50.0              | 15        | 15   | 100.0              | 10    | 10        | 100.0          |           |      |           |
|                   |                  | 5        | Pipalar Majhgaun   | 51                      | 47                  | 92.2                          | 3                  | 3        | 100.0     | 6     | 4                 | 66.7  | 19        | 19                | 100.0     | 14   | 14                 | 100.0 |           |                |           |      |           |
|                   |                  | 72       | Sub-Total          | 72                      | 65                  | 90.3                          | 6                  | 4        | 66.7      | 25    | 23                | 92.0  | 27        | 26                | 96.3      | 24   | 23                 | 95.8  | 6         | 4              | 66.7      |      |           |
| J                 | Bidur            | 89       | Phurkep Devghat    | 87                      | 73                  | 83.9                          |                    |          |           |       |                   | 7     | 4         | 57.1              | 7         | 4    | 57.1               | 25    | 23        | 92.0           |           |      |           |
|                   |                  | 5        | Majhgaun           | 15                      | 15                  | 100.0                         | 0                  | 0        | 0         | 8     | 7                 | 87.5  | 34        | 31                | 91.2      | 32   | 25                 | 78.1  | 12        | 9              | 75.0      |      |           |
|                   |                  | 104      | Sub-Total          | 104                     | 88                  | 84.7                          | 0                  | 0        | 0         | 15    | 14                | 93.3  | 48        | 44                | 91.7      | 57   | 52                 | 91.2  | 44        | 38             | 86.4      |      |           |
| K                 | Bidur            | 32       | Chobatar Dhodeni   | 32                      | 30                  | 93.8                          |                    |          |           |       |                   | 3     | 3         | 100.0             | 9         | 8    | 88.9               | 14    | 13        | 92.9           |           |      |           |
|                   |                  | 7        | Shirkhali          | 91                      | 66                  | 72.5                          | 0                  | 0        | 0         | 12    | 11                | 91.7  | 16        | 13                | 81.3      | 37   | 23                 | 62.2  | 26        | 19             | 73.1      |      |           |
|                   |                  | 223      | Sub-Total          | 223                     | 186                 | 83.4                          | 0                  | 0        | 0         | 25    | 22                | 88.0  | 43        | 35                | 81.3      | 91   | 67                 | 73.6  | 45        | 35             | 77.8      |      |           |
| L                 | Khudga Bhanjyan  | 229      | Sub-Total          | 229                     | 225                 | 98.2                          |                    |          |           |       |                   | 45    | 39        | 86.9              | 390       | 332  | 85.1               | 154   | 105       | 68.2           |           |      |           |
|                   |                  | 5        | Phurkep Devghat    | 89                      | 87                  | 97.8                          |                    |          |           |       |                   |       | 7         | 4                 | 57.1      | 7    | 4                  | 57.1  | 25        | 23             | 92.0      |      |           |
|                   |                  | 1405     | Sub-Total          | 1405                    | 1291                | 91.9                          | 75                 | 61       | 81.3      | 215   | 178               | 82.8  | 457       | 397               | 86.9      | 332  | 332                | 100.0 | 154       | 105            | 68.2      |      |           |

Remarks \* Poverty Line: 3,945 Rs. per capita per annum.  
No. of poor households out of households responding.

## (8) Replication of Lessons to TIP

Some of the lessons have relevance to TIP.

### 1) Andhi Kholra Project:

Effort is made in this project to address the poverty question by land redistribution and water share allocation to the members of the project area. The land redistribution approach to address poverty issue will not be replicable in TIP.

### 2) CARE/Nepal and ADB/N Program:

The lesson on the role of the group organizer to facilitate the WUA formation is replicable in TIP. The employment of agriculture extension personnel in the project area for training in new agriculture practices to the farmers is a good lesson from this project.

### 3) HIMI-WECS Action Research Project.

The lessons drawn from this project are that:

- farmer participation in design process, introduction of a farmer to farmer training program to increase the knowledge base of the farmers for the improvement of the system; and
- formation of WUAs before construction of the project

are effective measures.

These lessons can be replicated in TIP.

### 4) Dhaulagiri Irrigation Development Project.

This project attempts to address the poverty alleviation program by providing skill development training to the beneficiaries within the project area. Groups were formed to get them engaged in income generating activities. These activities are undertaken by employing NGOs.

The issue of poverty alleviation, skill training, group formation and employment of NGOs as catalyst are relevant to TIP. Some of these features can be replicated during the implementation of TIP.

### 5) Mechi Hill Irrigation Project.

F-F training program and employment of NGOs to mobilize the farmers are the replicable features.

### 6) ILC and 7 ISP



These projects attempt to introduce the participatory approach in project identification, project implementation and increased role of the farmers in O&M. The WUAs assisted by Association Organizers (AOs) of DOI have not been effective. The AOs of DOI are overstretched, resulting inability to give the required attention in helping to form WUAs. ISP came out with the idea of recruiting farmer association organizers from among the farmer communities.

The lesson for TIP is that AOs of DOI have only limited capacity to respond to the needs of the farmer organizations.

General lessons:

Specific efforts are made in social preparation of the beneficiary groups in the Andhi Khola Project, CARE-Nepal -ADB/N Project Dhaulagiri Project and HMI-WECs Action Research Project.

NGOs are employed in many projects as catalysts.

### **3.2 Agricultural Diversification in the Hills**

#### **(1) Vegetables, Fruits and Cash Crops (VFC)**

The VFC program component of the Rapti Development Project (RDP) was launched in 1988 as Phase I and in 1992 as Phase II for 8 years to increase farm household income and well being through increased productivity and improved management of local resources. The VFC program activities concentrated in increasing farm productivity, strengthening local groups and private enterprises, and market development and linkages. The project strategy for enhancing farm productivity was to support the gradual development of local capacity and responsibility for managing scarce resources.

Focus under the project was given to the following:

- (i) Increased income of farm households
- (ii) Increased production and productivity
- (iii) Increased employment

In order to achieve the above, the program combined the following components:

- (i) Increasing agricultural production per unit of land and per unit of labour;
- (ii) Arrangement for funding supply of agricultural inputs;
- (iii) Marketing management for marketing the products of small farmers;
- (iv) Development of farmer organizations for both production and marketing activities; and
- (v) Provision of both technical and market information and linkages with them

The final evaluation of the Rapti Development Project in February 1995 indicated the following.

- (i) Rural poor in the VFC program sites have improved their skills to cultivate labour intensive vegetables for income raising and self-employment.
- (ii) The VFC program has successfully encouraged small farmer participation in cash cropping and marketing;
- (iii) The VFC program has benefited farmer producers, traders, women and the unemployed.

**Table 3.2-1 Performance of Off-season Vegetable Production and Marketing in Kapurkot Region**

| Particulars               | Performances in Kapurkot Area for the Year |        |        |
|---------------------------|--|--------|--------|
|                           | 1994                                       | 1995   | 1996   |
| VDCs Covered (No.)        | 5  | 9      | 12     |
| No. of Groups             | 30   | 99     | 136    |
| Men (No.)                 | 18   | 50     | 73     |
| Women (No.)               | 12   | 49     | 63     |
| Participant Farmers (No.) | 450  | 1,500  | 1,900  |
| Beneficiaries (No.)       | 2,700                                      | 9,000  | 11,400 |
| Production Area (ha.)     | 19   | 55     | 60     |
| Vegetable Production (MT) | 225  | 2,500  | 3,000  |
| Cash Sale (Rs.'000)       | 1,800                                      | 10,699 | 21,000 |

Source: No-Frills Monitoring Survey 1994, 1995 & 1996.

- (iv) The specialized and commercial production of high value crops required the services of a specialist in vegetables, apples, vegetable seeds, citrus, etc.; and
- (v) The production of high quality, disease free and true-to-the variety plants is of utmost necessity. Therefore, private nursery gardens and orchards needed regular supervision in order to strengthen and upgrade the capacities of local farmers.

The VFC program yielded the conclusion that off-season vegetables grown in the hill during the monsoon have a higher potential of profitability than any other crops grown in the hill. An economic analysis of farm level data shows that production and marketing of off-season vegetables provides much higher returns than cereal food grains.

- (2) Integrated Hill Development Project (IHDP) and Lamosangu-Jiri Road Development Project (LJRD)

The Swiss Development Cooperation (SDC) has assisted rural development in an area of the central hills of Nepal for about 20 years. It was intended to help people develop self-propelling activities to improve their socio-economic condition. The projects contributed to increases in local food production and to more and diversified food consumption.

The Impact Monitoring Project (IMP) reported foodgrains and potato production increased by 40% over 15 years. The report further estimated the main factors contributing to the increase in grain production.

- (i) Extended application of chemical fertilizer and irrigation: 30%;
- (ii) Increase in cropping intensity: 30%;
- (iii) Extension of net cultivated area: 10%; and
- (iv) Extension of improved cereal varieties and potatoes: 30%.

The report also indicated increase in daily caloric intake from 2,030 Kcal per person in 1975 to 2,200 Kcal in 1990.

IHDP adopted a "Leader Farmer" approach to agricultural extension and identified these as "Tukis". IHDP reports that the "Integrated Progressive Farmer Training" has trained many progressive farmers to identify as Tukis. The impact of the Tuki program has received recognition and the potential for Tuki activities has been a focus of attention.

### (3) Options for Sustainable Mountain Agriculture

Pakhribas and Lumle Agricultural Centres (PAC/LAC) located in the Western and Eastern parts of Nepal were found to be relatively more effective in technology generation and diffusion. A large number of reports (e.g. technical reports, annual progress reports and other documents) published by PAC/LAC were reviewed and the reviewers (PAC/ICI MOD staff) of these reports have presented more than 35 options for sustainable mountain agriculture. They are grouped into six major categories; (i) crop production, (ii) cropping system, (iii) horticultural crop production, (iv) livestock production, (v) forestry, and (vi) utilization of local resources and farmers traditional knowledge.

The review report indicated the following:

- 1) These option and farming techniques were found suitable for the hill.
- 2) The options documented have a potential for wider replication.

The most relevant options indicated in the report for designing the agricultural development plan are as follows:

- (i) Year Round Production of Radish in the Mid-Hills

Many years of research on radishes at PAC have enabled the identification of different varieties of radish that can be grown throughout the year. Farmers can get good market prices by growing off-season radishes.

**Table 3.2-2 Radish Varieties Suitable for Cultivation during Different Months of the Year**

| Months of Sowing           | Varieties                                |
|----------------------------|--|
| Mid-January to Mid-June    | Tokinashi, Dae Hyeng Bom                 |
| Mid-June to Mid-July       | Bhedetar Local, Tokinashi, 40 Days       |
| Mid-August to Mid-November | Mino Early, Pyuthane Red, and White Neck |

Source: PAC 1991

Note: Radishes have a comparative advantage as an off-season crop.

Radishes are a common vegetable crop grown by Nepalese farmers. Radishes can be eaten cooked or fresh. Hill farmers also use radishes in various processed form such as dried vegetables (Sinki) and dried and processed leaf vegetables (Gundruk).

**(ii) Year Round Production of Cabbage in the Mid-hills**

The mid-hills provide a "niche" or comparative advantage for growing cabbage throughout the year. Cabbage varieties suitable for cultivation during different months of the year are given in Table 3.2-3.

**Table 3.2-3 Cabbage Varieties Suitable for Cultivation during Different Months of the Year**

| Months of Sowing            | Varieties                                 |
|-----------------------------|---|
| Mid-January to Mid February | Green Stone, K K Cross, Copenhagen Market |
| Mid-February to Mid-March   | Green Stone, K K Cross, Drum Head         |
| Mid-March to Mid-April      | Pride of India, K K Cross                 |
| Mid-May to Mid-June         | Pride of India, K K Cross                 |
| Mid-August to Mid-October   | Copenhagen Market, Drum Head              |

Source: PAC 1991

**(iii) Off-season Production of Vegetables**

The successful production of off-season vegetables depends upon the farmers socio-economic conditions and their ability to spend cash to buy quality seeds, polyethylene sheets, fertilizers, etc.

Off-season vegetable production is expected to fetch a good market price as it will require external inputs for commercial production. Farmers can earn a

considerable amount of cash by selling off-season vegetables provided access to market and market linkages is developed.

**(iv) Diversified Cropping systems; Mixtures of Cereals and Vegetables**

Cultivation of cereals and vegetables under an integrated system disturbed the existing cropping pattern. In the initial phase it was difficult for farmers to adopt a particular technology and special efforts were made to promote the same. Keeping this in mind, the PAC introduced vegetable cultivation along with cereals in the existing cropping pattern. Farmers have increased income from the sale of vegetables in markets.

**(4) Lessons Learned**

Several lessons have already been drawn from the crop diversification programs launched, i.e. (i) the Swiss funded Vegetable Program at the Dhading and Daman areas, (ii) the ODA (British) funded Vegetable Program in Dhankuta, (iii) the GTZ (German) funded Gorkha Project, (iv) the USAID funded Rapti Project and (v) the JICA funded horticultural projects. Some of the lessons learned can be replicated in the Project area. The main lessons learned are as follows;

**(i) Needs Assessment with the Beneficiaries' Participation**

Making rural people realize their problems, potentials and possible solutions is the first and most important step in attracting them to crop diversification.

**(ii) Participatory Planning Approach**

Involving beneficiaries all through the planning cycle created the sense of partnership in implementing the program plans, the sense of belonging, and clear understanding of roles and responsibilities.

**(iii) Local Capacity Building for (i) reaching the beneficiaries, (ii) rapid transfer of technology and (iii) cost effectiveness**

Emphasis on local capacity building has been the prime focus of these interventions with the development of local resource centers, local human resources, local training centres, local trainers, field model demonstrations, and farmer organizations. Farmer group formation and group savings have assisted cash-poor farmers.

**(iv) Series of Training Sessions to Impart Skills**

A series of training sessions and on-the-spot guidance at the appropriate stage and at the appropriate place with field demonstrations was very effective to impart skills to farmers.

(v) Sustainable Increase in Family Income and Family Self-employment

Increased production and productivity of high value crops increased income at the farm household level, and the adoption of labour intensive vegetable and cash crops increased family self-employment.

(vi) Emphasis on Food Security and Income

Focusing on the geographical potential of each location for profitability and comparative advantage, the programs also helped for making more food available to the rural people, besides increasing their income and enabling them to purchase food items from outside.

(vii) Access to markets

The programs were supportive in linking the products with the market so that the small producers would be benefited.

The hill agricultural development projects referred to are summarized as follows:

| Projects/Donor Agency  | Lessons and Experience Referred   |
|--|---|
| (1) VFC Project for Rapti Development, USAID funded (1988 to 1996)               | <ol style="list-style-type: none"><li>(1) The project has been working to alleviate rural poverty by providing technical assistance in the production and marketing of high value crops in Rapti zone.</li><li>(2) One of the bases of the VFC project's successes are the production and marketing groups of farmers</li><li>(3) Small hill farmers with scarce land and subsistence living have shifted to high value crops to harness the comparative advantage and profitability of their locations.</li></ol>  |
| (2) IHDP/LJRD Project, funded by Swiss Development Cooperation (SDC) (1975-1990) | <ol style="list-style-type: none"><li>(1) The project has assisted rural development in hills of Nepal for 20 years to improve their socio-economic condition and contributed to increase in local food production and diversified food consumption.</li><li>(2) The project has successfully identified, developed and utilized local human resources (Tuki) for technology transfer.</li><li>(3) A time series reports on project impacts and general development trends indicated specific impact area and the search for overall impacts, was limited.</li></ol>  |
| (3) Pakhribas Agricultural Centre (PAC), funded by ODA (U.K.)                    | <ol style="list-style-type: none"><li>(1) The PAC/IC/MOD project has documented 35 options for sustainable mountain agriculture grouped into six major categories (i) crop production; (ii) cropping systems; (iii) horticultural crop production; (iv) livestock production, (v) forestry, (vi) utilization of local resources and farmers traditional knowledge.</li><li>(2) Even for the promotion and dissemination of these successful options, the project found need to develop a Cadre rather than using the general Cadre.</li><li>(3) To increase cropping intensification and diversification, the project recommends development of some approach/method to maintain the organic matter supply for sustainable crop production.</li></ol> |