REGIONAL AGRICULTURAL DEVELOPMENT PLAN
FOR
JANAKPUR ZONE AND RAPTI MODEL FARM
IN
NEPAL

(REPORT ON FIRST AGRICULTURAL DEVELOPMENT DESIGN)

March 1972

OVERSEAS TECHNICAL COOPERATION AGENCY

Government of Japan

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MEMBERS OF THE JAPANESE AGRICULTURAL SURVEY MISSION IN NEPAL

Dr. Hitoshi Fukuda	Leader	Professor Emeritus, Tokyo University, Adviser to OTCA
Takashige Kimura	Vice-leader, Irrigation	Chief of Project Operations Div., Agricultural Cooperation Dept., OTCA
Takio Kariya	Farm Management	International Cooperation Div., Agr. and Forestry Economy Bureau, MAF
Kozo Tomita	Assignment Work	Chief of Overseas Assignment Div., Japan Overseas Cooperation Volunteers, OTCA
Mizuo Aiba	Agricultural Policy	Agricultural Cooperation Dept., OTCA
Norio Matsuzawa	Coordination	Overseas Project Dept., OTCA
Teruo Shimada	Agricultural Economy	Non-regular Staff of OTCA
Tadayuki Aoike	Agricultural Machinery	Nippon Koei Co., Ltd.
Gakuji Kimura	Land Utilization	Ditto
Masamitsu Fujioka	Irrigation	Ditto
Noboru Miyamoto	Groundwater	Ditto
Fumio Tamura	Surveying	Ditto
Toshio Eguchi	Ditto	Ditto

FOREWORD

Through its agricultural cooperation programme for Nepal, Japanese government dispatched three survey missions in the past which engaged in field works centering on reconnaissance, development planning and development design, respectively. It gives me great pleasure that the outcome of these past field works, which is compiled into this report on agricultural development design for Janakpur Zone and Rapti Model Farm, is hereby presented to HMG of Nepal.

Gradual progress and flexibility are the inherent factors of any agricultural development project, and it cannot be considered practical to draw up a detailed design covering the entire project area from the very beginning. In preparing this report, therefore, consideration was given to the steps that must be taken before achieving the desired development and to the temporal and spatial sequence of Japan's future cooperation. Accordingly, scope of development design covered by this report is limited to what could be reasonably undertaken in the near future. It is hoped that the design work contained herein will be very shortly ensued and expanded by further development design conforming to the established development policy.

It is my ardent desire that advanced farming techniques will be actively extended with the cooperation of the competent Nepalese authorities and serve as the major incentive to the country's development, and that such incentive will be fostered by Japan's cooperation, particularly by the scrupulous care exercised by Japanese experts, to the extent that it encourages farmers to make voluntary efforts for development. My personal desire, if I may be allowed to record it here, is to visit prosperous and flourishing Nepal again with my Japanese colleagues and meet our Nepalese friends.

I sincerely hope that the cooperation between HMG of Nepal and Japanese Government will bring about fruitful results in the project area to the full satisfaction of farmers.

Completion of this report calls to my mind the enthusiastic support shown towards the cooperation project by the late king of Nepal. I wish to express my deepest respect for him and my heartfelt gratitude to all the competent officials of HMG of Nepal and Japanese Government.

Hitoshi Fukuda
Leader
Japanese Agricultural Survey
Mission to Nepal

March 1972

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CHAPTER I INTRODUCTION

This report was prepared in cooperation with the competent Nepalese staffs from the results of the field survey including land surveying which was conducted by a 13 member mission headed by Dr. Hitoshi Fukuda from October to November 1971 for development of Janakpur Zone and Rapti Model Farm. It was compiled to give a concrete description of the scope and particulars of Japan's future agricultural cooperation to Nepal in accordance with the fundamental approach and plans contained in the feasibility report of the second survey mission which was already presented to HMG of Nepal.

This report does not therefore give a detailed design of the entire agricultural development project presented by the second survey mission, though it was prepared in the format of a final working design. The final design must be drawn up with prudent care after scrupluous field investigations in order to avoid any major errors that would otherwise be exposed after the project is put in execution.

The mission exerted its best during the limited survey period, but the scope of design work it covered was limited to the items described in Chapter III and these items constitute only a part of the agricultural development of Janakpur Zone requested by HMG of Nepal.

Accordingly, the mission wishes to point out that surveys for final design under Japanese cooperation have not been brought to an end by the completion of this report but should be continued in future. It is to be added however, that implementation of Japan's cooperation programmes will be commenced in the coming years according to the development design contained in this report. Cooperation programmes described herein must, of necessity, be the ones which deserve high priority order.

This report was prepared on the responsibility of the mission and compiled by the Overseas Technical Cooperation Agency for submission to HMG of Nepal and Japanese Government. The mission hopes that the development plans contained in this report will be approved as designed by the two governments for their early implementation.

CHAPTER II FUNDAMENTAL CONCEPT OF PROJECT COOPERATION

2.1 Introduction

An agricultural development project must always be mapped out with due account taken of its economic feasibility, and this is true of the present project. In a extremely backward area, however, it cannot be justified to base one's evaluation of a development project merely on the effect of investment. Like supplying water to a hot desert land, investment in such an area to a substantial degree often fails to produce effect on production. The three Japanese survey missions dispatched in the past covered a fairly large area in Nepal though their survey priods were all rather short, and exchanged views with many Nepalese people in various fields. To be brief, the findings of the past surveys are that the farmers' productivity in Tarai Plain which is considered a fairly developed area in Nepal is lower than the average of Asia, and that farmers' livelihood cannot be considered higher than the average of India.

Considered from the viewpoint of economic aspect of development investment, this indicates that agricultural development in Nepal involves virtually no danger of over-investment. What should be guarded against is not the excessive investment but the concentration of development projects in a certain district or for certain limited number of crops because such concentration is liable to isolate the project area from the surrounding areas. No spill out effect can be expected from such a project.

Agricultural productivity in Nepal is generally low. Though class formation of rich farmers is observed to a limited degree, productive means adopted by such farmers are not based on the advanced agricultural techniques but are identical to those applied by ordinary farmers.

In a project cooperation, a government-to-government agreement is concluded to delineate the scope of cooperation and specify the area and period of cooperation. In the project area selected for such cooperation (100 to 1, 000 ha in case of Japan's cooperation), capital investment is made for fairly intensive technical cooperation during the cooperation period and improvements are attained as a result, but it is often the case that such project area becomes isolated from the surrounding areas. Agro-inputs made by technical cooperation funds during the cooperation period bring about production increase, but the production often ceases to grow after termination of the cooperation period and gradually declines to the original low level.

These drawbacks were taken into due consideration in planning the cooperation programmes for agricultural development in Nepal, and surveys were made on the existing state of Nepalese agriculture to establish a policy under which diffusion of techniques over an extensive area can be assured. Efforts were also made to meet the strong desire expressed by HMG of Nepal that Japan would extend its cooperation in a manner that produces promotional effect on the entire Janakpur Zone.

At a meeting held on November 26, 1971, the Record of Discussion (R/D) (See Sec. 2. 5) was signed by the mission and HMG of Nepal after a discussion which was held in an atmosphere of friendliness. At this meeting, both the mission and the representatives of HMG of Nepal paid due recognition to the need for extensive diffusion of techniques mentioned above. As for the schedule of the cooperation programmes, however, it was agreed that a two year preparatory period would be provided prior to the five year cooperation period as previously proposed by the second survey mission.

During the said two year preparatory period, Japanese experts will be dispatched to Nepal as soon as possible to implement the cooperation programmes set forth under Item 2 of R/D. It was agreed that both sides would make arrangements for a number of items during the said period in preparation for full-scale cooperation, and that the full-scale cooperation based on R/D would be commenced by November 1973. The mission hopes that the two year preparatory period will be effectivily utilized by HMG of Nepal and Japanese government so that it will be shifted smoothly to the full-scale cooperation period at an earliest date.

2.2 Background of Survey

In April 1970, Japnese government conducted a preliminary survey in three zones of Nepal, i.e., Narayani, Janakpur and Mechi, at the request of HMG of Nepal. It was with this survey that Japan's technical cooperation to Nepal was actually set afoot.

Based on the said preliminary survey, Japanese government established the fundamental concept of regional agricultural development in Nepal in July 1970 and strongly recommended, at the same time, that Chitwan district be selected for implementing Japan's technical cooperation.

As described in the first survey report, Chitwan district is a newly settled area and is therefore considered to allow for smooth progress of extension services including the introduction of advanced farming techniques. Further, since the district is situated in Inner Tarai, new farming techniques established there can be readily diffused to the entire Inner Tarai and part of the hilly area.

At Rapti, one of the centres of the district, is found Rapti Experiment and Model Farm which has been operated by Tokyo University of Agriculture (TUA) since 1965. Through the active farm operation and extension activity conducted by TUA, this model farm now enjoys the confidence of not only the government but local farmers. It was chiefly for this reason that Chitwan district was given top priority by Japanese government as the area of technical cooperation project.

After completion of the first survey HMG of Nepal requested the dispatch of a second survey mission and technical cooperation for the development of Janakpur Zone. Acceding to this request, Japanese government sent the second survey mission which carried out a feasibility survey for about one month from October to December 1970.

The feasibility survey by the second survey mission covered Chitwan district and Janakpur Zone. Due to the limited survey period and poor road condition, however, the survey activity was concentrically out, covering Tarai Plain as well as Rapti Model Farm and its surrounding area in Chitwan district.

The regional agricultural development plan in Nepal under Japanese cooperation, which is contained in the second survey report, was prepared from the results of the said survey.

The present third survey was carried out for the purpose of putting the said regional development plan into practice. The survey was originally intended to cover the entire Janakpur Zone, and Rapti Model Farm and its surrounding area in Chitwan district, but actually covered the flowing well zone extending to the north of Janakpur city, Hardinath Extension Farm, and Rapti Model Farm and its surrounding area. Selection of these survey areas was made in consideration of the development order and road condition.

The third survey was intended for detailed design. The findings of this survey therefore provided the basis for drawing up the detailed design of the areas and projects for which cooperation programmes are expected to be implemented in the near future. Detailed description of the design is given in Chapter III and subsequent Chapters.

2.3 Fundamental Approach to Project Cooperation

To attain the maximum results within the limited cooperation period (7 years = 2 years' preparatory period + 5 years' full cooperation period) and with limited availability of experts and personnel, scrupulous and thorough reivew of "development cooperation strategy" can never be dispensed with. The mission made such review by collecting as many data as possible, by meeting many people and exchanging views with them and by conducting various field surveys during its stay in Nepal. As a result, the mission reached the conclusion that in co-operating in the development of Nepalese agriculture, the following principles should be observed.

(1) Cooperation activity should be initiated after making sufficient preparations. In particular, accommodations for Japanese experts and Nepalese technicians serving in rural districts should be provided with care so as create comfortable living environment for their long-term service.

(2) While it is desirable that the cooperation activity be carried out on the basis of the agreement between HMG of Nepal and Japanese government, cooperation should preferably be extended over as long a period as possible that may be agreed upon by the two governments.

(3) The extent of cooperation may be limited by the amount of investment funds, number of participating experts and period of cooperation. Efforts should therefore be made for establishing the project plans which would ensure the diffusion of cooperation effect over an extensive area.

(4) Increase of farmers' production is one of the pressing needs of today. In addition to technical cooperation for increased agricultural production, incessant guidance efforts should be made to stimulate the farmers' volition for accelerated production.

(5) Services of the exsiting organizations of HMG of Nepal (ADO*1 ASC*2 and ADB*3) should be fully made use of.

(6) Measures for improving the collecting and marketing system should be drawn up, with necessary advices and guidances provided to assure that agricultural production will serve for the elevation of Nepalese economy.

(7) Project cooperation should be started with items whose implementation is easy for both Japanese and Nepalese sides so that Japanese side may get acquainted with the situation in Nepal, and then pushed forward to undertake harder ones step by step.
In implementing the project, the phasing study presented in this report should be reviewed by JADB and put in practice.

(8) The present survey for detailed design does not suffice for the planned agricultral development. Surveys should be continued according to the need, and if a situation arises which calls for any changes in the development strategy, necessary action should be taken without delay after a careful study. In other words, it should be noted that giving flexibility to the project is the key to its success.

(9) Since the project is a rather elaborate and ambitious undertaking, it is very important to recruit capable personnel and staffs who can participate in the project with the spirit of mutual confidence. In this respect, HMG of Nepal and Japanese government are requested to pay due recognition to the importance of appointing project leaders whose personality is great enough to assure the essential team work.

(10) HMG of Nepal and Japanese government are also requested to understand that untiring and incessant efforts are required before the regional agricultural development yields any

substantial results. It is therefore hoped that hearty support be extended to the experts and technicians as well as farmers in the project area without putting too high an expectation on them.

*1 ADO = Agriculture Development Office

*2 ASC = Agriculture Supply Corporation

*3 ADB = Agriculture Development Bank

2.4 Plan of Project Implementation

The present project which is to be implemented under Japanese cooperation is a regional agricultural development project covering the entire Janakpur Zone, and Rapti Model Farm and its surrounding area in Chitwan district, Narayani Zone. The project is intended to accederate the progress of regional agricultural development through effective and practical extension of advanced farming techniques under a new extension system.

The extension activity under the project must cover an area of 9,769 km^2 embracing Inner Tarai and hilly area where the road condition is extremely poor. By reason of this huge area, an attempt to realize an all-out promotion of extension activity in the early part of the cooperation period can never be brought to a success. To make the extension activity truly effective, therefore, a scheme is established for maintaining close personal contact between farmers and extension workers including Japanese experts and providing farmers, through such contact, knowledges on advanced farming techniques as well as guidances and advices on farm management. Under this scheme, it is planned that the extension activity will be carried out concentrically in a model district at the outset of the cooperation period. The model district will be established in Tarai Plain because of its favourable natural, social and economic conditions and also because the plain is considered to promise high extension effect. The model district will have extension plots serving as the basis of extension activity. At each of such extension plots, local farmers will be given progressive extension service from Nepalese extension workers trained by Japanese experts. For example, they will be given direct guidance from extension workers for applying introduced techniques in crop cultivation.

The extension activity in the area surrounding the model district and other parts of Tarai Plain is planned to be carried out after the extension service within the district attains success. Results of extension services in Tarai Plain will become the basis for the extension activity to the conducted in the latter part of the cooperation period in Inner Tarai and hilly area.

Hardinath Extension Farm and Rapti Model Farm will play a significant role in the project. Hardinath Pilot Farm, established in 1969 as part of FAO's Sunkosi Irrigation Development Project, is to make a new start as an extension farm under the present project. Hardinath Farm is expected to give training to Nepalese trainees and conduct trials on improved farming techniques needed by farmers. These trails will not be the basic researches which were conducted when the farm was run by FAO, nor will they in any way resemble the basic and applied researches currently conducted at the Central Agricultural Experiment Station, HMG of Nepal. The trails will be the tests and experiments contributing directly to regional agricultural development and farmers. The farm is therefore expected to have the nature of an extension centre.

Rapti Model Farm on the other hand, is located in Inner Tarai and can therefore undertake, in a concentric and continuous way, the tests and data collection which cannot be expected of Hardinath Farm in Tarai Plain. In the latter part of the cooperation period, this farm is expected to take the leading role in the extension activity in Inner Tarai and hilly area.

The extension activity under the project will be pushed forward by the combined efforts of the three major promoters, i.e., Hardinath Extension Farm which is more or less like an extension centre, Rapti Model Farm which will be the base for extension work in Inner Tarai and hilly area, and extension plots established in respective areas.

Tarai Plain and the flowing well zone spreading in the north of Janakpur city in particular are blessed by relatively favourable socio-economic conditions and have high potentials for developing irrigation agriculture as pointed out in the second survey report. Under the current technical cooperation agreement, a 420 ha area situated to the north of Janakpur city was selected as the first stage irrigation infrastructural improvement area by reason of its excellent socio-econimic conditions. Under the project plan, this district is designated as the aforementioned model district where active extension activity is planned to be carried out.

The whole of cooperation programmes for the project is shown in Table 2.4.1.

The Record of Discussion (R/D) signed by the third survey mission and HMG of Nepal in November 1971 stipulates that a two year preparatory period will be provided prior to the five year co-operation period. During the said two year period, Japanese experts will be dispatched to Nepal as soon as possible to implement the co-operation programmes set forth under Item 2 of R/D. The agreement also stipulates that during the said period, both sides will make arrangements for the following programmes in preparation for full-scale cooperation, and that the full-scale cooperation based on R/D will be commenced prior to November 1973.

a. Establishment of Janakpur Regional Development Centre.
b. Procurement and delivery of part of aid equipment and materials.
c. Establishment of the project implementation system.

Table 2.4.1 Japan-Nepal Regional Agricultural Development Programme

- Project Centre
  - (I) Hardinath Extension Farm (40 ha)
    - Introduction and demonstration of improved farming techniques of paddy, wheat and other upland crops (Tarai Plain).
    - Trials for extension of improved farming techniques of paddy, wheat and other upland crops.
    - Training of extension officers and extension workers.
    - Multiplication of improved seeds and seedlings of various crops for extension work.
  - (II) Janakpur Extension Activities (Zone)
    - Guidance on farming techniques in the 420 ha paddy field area provided with tube wells and simple irrigation and drainage facilities.
    - Improvement of traditional farming practices, and guidances on new farming techniques acceptable for farmers at suitably established extension plots.
    - Formation of farmers' organizations for effective diffusion of farming techniques, and guidances on the activities of such organizations.
    - Guidance of agricultural development of hilly area.
  - (III) Rapti Model Farm (Zone)
    - Introduction and demonstration of improved farming techniques of paddy, wheat and upland crops (Inner Tarai and hilly area).
    - Construction of irrigation facilities and diffusion of improved farming techniques in the areas surrounding the model farm (approx. 100 ha).

2.5 Record of Discussions Concerning the Japan-Nepal Agricultural Development Project

RECORD OF DISCUSSIONS BETWEEN THE JAPANESE AGRICULTURAL SURVEY MISSION AND THE AUTHORITIES CONCERNED OF HIS MAJESTY'S GOVERNMENT OF NEPAL CONCERNING THE JAPAN-NEPAL AGRICULTURAL DEVELOPMENT PROJECT IN THE JANAKAPUR ZONE AND THE RAPTI MODEL FARM.

In pursuance of the basic agreement reached between the authorities of His Majesty's Government of Nepal and the Second Agricultural Survey Mission that visited Nepal in November - December 1970, followed by the visit of the Nepalese delegation to Japan on the invitation of the Japanese Government in July, 1971, the Third Japanese Agricultural Survey Mission headed by Dr. Hitoshi Fukuda visited Nepal in October - November 1971 to work out the details of the proposed cooperation between the Government of Japan and His Majesty's Government of Nepal for the regional agricultural development in the Janakapur Zone and the Rapti Model Farm, Nepal. The Mission conducted surveys in the proposed project area and also had a series of discussions in Kathmandu with the authorities concerned of His Majesty's Government of Nepal concerning the above cooperation. As a result of the surveys and discussions, the two parties came to the conclusion that the above cooperation should start with two years' preparatory cooperation which should be followed by five years' cooperation. During the period of the preparatory cooperation, the two Governments will make every effort to take necessary measures for the smooth implementation of the programme of agricultural development in the Janakapur Zone and the Rapti Model Farm. The gist of the present Record of Discussions including its Annexes is understood to serve as the basis of the official agreement to be concluded as soon as possible between the two Governments for the further five years' cooperation.

<u>Attached</u>

Attached hereto is the Record of Discussions between the Mission and the authorities concerned of His Majesty's Government of Nepal concerning the preparatory cooperation.

Kathmandu, November 26, 1971

Hitoshi Fukuda	R. P. Sharma
Leader of the Japanese	Joint Secretary
Agricultural Survey Mission	Ministry of Finance

1. For the purpose of increasing Nepalese farmers' income and raising their standard of living through the improvement of agricultural techniques and the extention activities, the Government of Japan and His Majesty's Government of Nepal will jointly carry out, as the preparatory cooperation, a regional agricultural development project in the Janakapur Zone and the Rapti Model Farm. (hereinafter referred to as "the Project").

2. As the first steps of the regional agricultural development cooperation which is outlined in Annex I, the following programmes will be implemented.

(1) The Hardinath Extension Farm in the Janakapur Zone:

a. Introduction of improved farming techniques including water management and introduction of improved seeds.

b. Demonstration and practical training.

c. Multiplication of improved seeds.

(2) The Rapti Model Farm:

a. Introduction and demonstration of improved farming techniques with various crops.

b. Demonstration and extension of agricultural techniques for farmers living in the vicinity of the Farm.

3. (1) The Government of Japan will necessary measures to provide at its own expense the requisite services of Japanese experts as listed in Annex II through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

(2) The Japanese experts mentioned above and their families will be granted the privileges, exemptions and benefits as listed in Annex III and the privileges, exemptions and benefits no less favor-

able than those granted to the experts under the Colombo Plan.

4. The Japan Overseas Cooperation Volunteers may participate in the Project. The schedule for such participation will be separately agreed upon by the two Governments.

5. (1) In accordance with laws and regulations in force in Japan, the Government of Japan will take necessary measures to provide at its own expense such equipment, machinery, vehicles, tools, spare parts and other materials as listed in Annex IV through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

(2) The goods referred to above will become the property of His Majesty's Government of Nepal upon being delivered c. i. f. at the Kathmandu Airport or at the Nepalese border to the Nepalese authorities concerned.

(3) The goods referred to above will be utilized exclusively for the implementation of the Project in consultation with the Japanese Project Manager mentioned in Annex II.

6. (1) The Government of Japan will take necessary measures to receive Nepalese staff engaged in the Project for technical training in Japan through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

(2) His Majesty's Government of Nepal will take necessary measures to ensure that the knowledge and experience acquired by the Nepalese staff associated with the Project as a result of the technical training in Japan under the Colombo Plan Technical Cooperation Scheme will be utilized for the successful implementation of the Project.

7. His Majesty's Government of Nepal will undertake to bear claims,

if any arises, against the Japanese experts resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions covered by the present Record of Discussions, except for those claims arising from the wilful misconduct or gross negligence of the Japanese experts.

8. His Majesty's Government of Nepal will take necessary measures to provide at its own expense:

(1) the services of Nepalese officers and other personnel as listed in Annex V,

(2) requisite land and buildings as listed in Annex VI as well as incidental facilities,

(3) supply or replacement of equipment, machinery, vehicles, tools, spare parts and other materials necessary for the implementation of the Project which are locally available other than those provided by the Government of Japan.

(4) housing accommodations for the Japanese experts and facilities for their official travels within the Kingdom of Nepal.

9. His Majesty's Government of Nepal will undertake to meet:

(1) expenses necessary for construction works of the project except such goods as listed in Annex IV,

(2) expenses necessary for the transportation of the goods as listed in Annex IV within the Kingdom of Nepal as well as for their installation, operation and maintenance,

(3) customs duties and any other charges, if any, as may be imposed in the Kingdom of Nepal in respect of the goods as listed in Annex IV,

(4) all running expenses necessary for the implementation of the project.

10. (1) Under the supervision and direction of the Janakapur Agricultural Development Board (JADB), the Japanese Project Manager and the Nepalese Project Manager will be jointly responsible for technical matters pertaining to the implementation of the Project and the Nepalese Project Manager will also be responsible for the administrative and management matters.

(2) The Japanese Senior Advisor will advise the JADB on the implementation of the Project and its related matters.

Note: Janakapur Agricultural Development Board (JADB)

1) For the successful operation of the Project, a Janakapur Agricultural Development Board comprising of the authorities concerned of His Majesty's Government of Nepal will be established in conformity with the Nepalese Development Committee Act of 2013, 1956. The Japanese Senior Advisor and Project Manager will also participate in the JADB meeting as permanent advisors and their opinions and advice will be equally treated as those of the members of the JADB.

2) The JADB will meet from time to time and will be responsible for ensuring the successful operation of the Project.

3) The JADB will be composed of members listed in Annex VII, subject to changes when necessity arises.

11. (1) For the successful implementation of the Project, there will be established Joint Committees at operational level comprising of the Japanese experts and the Nepalese officers concerned.

(2) The Joint Committees will meet regularly and will be responsible for ensuring the implementation of the Project. The Committees may receive general instructions from the JADB.

12. The two Governments will consult with each other from time to time for the successful implementation of the Project.

13. The period of the Japanese cooperation for the Project will be two years during which the two Governments will have mutual consultations for the further five years' cooperation.

Annex I

Regional Agricultural Development Programme

A. The Janakapur Zone

1. The Hardinath Extension Farm

The Hardinath Extension Farm in the Janakapur Zone plays the role of the centre to promote highly efficient extension activities and training through the close cooperation of technicians and farmers.

The functions of the Hardinath Extension Farm are:

(1) Introduction of improved farming techniques including water management and demonstration of such techniques,
(2) Trials of various farming techniques,
(3) Training for the extension staff,
(4) Multiplication of improved seeds of various crops for the distribution among farmers.

2. The Janakapur Extension Activities.

To ensure smooth extension activities a network of extension farms and extension plots should be effectively utilized for:

(1) Improvement of the agricultural infrastructure in the form of tube wells development and terminal works of water management.

(2) Improvement of the conventional farming methods by use of modern agricultural inputs such as improved seeds, fertilizers and so on,

(3) Improvement of the organization and activities of a group of farmers for the agricultural extension purpose.

The above activities may be extended in the hilly areas depending on local conditions.

B. The Rapti Model Farm

Considering the favourable conditions of climate and water resources, the Farm will be used for:

(1) Introduction and demonstration of improved farming techniques in the irrigated agriculture,

(2) Extension activities to the farmers living near to the water supply line from the Narayani River to the Farm.

Note: In order to carry out the above programme, it is tentatively estimated that the two Governments should take following measures:

Measures to be taken by the Government of Japan:

(1) Dispatch of Japanese experts;
Senior Advisor (Kathmandu)
Project Manager
Agronomist
Specialist on Farm Management
Irrigation Engineer
Specialist on Farm Machinery
Mechanical Engineer
Specialist on Tube Well Engineering
Agricultural Economist
Specialist on Agriculture Extension work
Liaison Officer (Kathmandu).

(2) Supply of agricultural goods;
Construction equipment and their spare parts,
Tube well equipment and their accessories,
Agricultural machinery and implements and their spare parts,
Pesticides, insecticides and fertilizers,

Tools

Machinery, tools for repair work,
Tools and implements for testing work,
Equipment and materials for public utilities,
Vehicles,
Teaching materials including audiovisual aids,
Other necessary equipment, tools and materials to be mutually agreed upon.

2. Measures to be taken by His Majesty's Government of Nepal:

(1) Nepalese Officers and other Personnel;
His Majesty's Government of Nepal shall provide Nepalese Project Manager and Nepalese counter parts to the Japanese Experts. Sufficient number of Technical staff and other auxiliary personnel also will be made available for the implementation of the Project.

(2) Land and Buildings;

<u>Land:</u>

a.	For office and housing accommodations (in the Janakapur Zone)	10 - 15 ha
b.	Hardinath Extension Farm	40 ha
c.	Rapti Model Farm	20 ha

<u>Buildings:</u>

a. Project office

b. Housing Accommodations for the Staff

c. Hardinath Extension Farm
   Office
   Shed for machinery and equipment
   Store-house for farming materials
   Laboratory
   Living-quarters and dormitory
   Workshop and garage

d. Rapti Model Farm

Office

Shed for machinery and equipment

Store-house for farming materials

Living-quarters

Workshop and garage

e. Kathmandu

Office.

Annex II

Japanese Experts

	Number
Senior Advisor (Kathmandu)	1
Project Manager	1
Agronomist (Rapti)	1
Specialist on Irrigation (Hardinath)	1
Specialist on Farm Machinery (Hardinath)	1

Note:

1) The experts mentioned above will be dispatched taking into account the progress of the Project.

2) The experts for the short term assignment may be dispatched when necessity arises.

Annex III

Privileges, Exemptions and Benefits

(1) Identification card:

Identification cards of the Japanese experts and their families should contain an assurance that the Nepalese authorities concerned will assist them in performing the tasks assigned to them.

(2) Income Tax:

The Japanese experts and their families are exempted from Income Tax.

(3) Customs Duty:

The Japanese experts and their families will be permitted to import for the duration of their stay free from duties and taxes, and without providing security articles for their personal use; such articles should include for each household one moter vehicle, one refrigerator, one deep-freezer, one radio, one record-player, one tape-recorder, minor electrical appliances as well as for each person one air-conditioner and one set of photographic and cine equipment.

Also, the Japanese experts and their families will be permitted to import duty free within the limits of their personal requirements, medicaments, foodstuffs, beverages and other articles of daily use.

(4) Medical Facilities:

Free local medical services and facilities to the Japanese experts and their families should be provided.

(5) Leave:

2 weeks casual leave per annum and 6 weeks' vacation leave per annum should be permitted.

Annex IV

Equipment, Machinery,

Vehicles, Tools, Spare Parts

and other materials

(1) Agricultural Machinery, implements and their spare parts.

(2) Pesticides, insecticides and fertilizers.

(3) Equipment and materials for public utilities.

(4) Vehicles.

(5) Other necessary equipment, tools and materials to be mutually agreed upon.

Annex V

Nepalese Officers and other Personnel

1)	Project Manager	1
2)	Agronomist	1
3)	Farm Manager (Rapti)	1
4)	Irrigation Engineer	1

Other technical personnel as well as auxiliary personnel will be made available by the JADB as and when necessity arises.

Annex VI

Land and Buildings

(1) Land:

For the office and housing accommodations (Janakapur)

		10 - 15 ha
Hardinath Extension Farm	about	40 ha
Rapti Model Farm	about	8 ha

(2) Buildings:

(i) Hardinath Extension Farm

Office
Shed for machinery and equipment
Store-house for farming materials
Laboratory
Dormitory
Workshop and garage

(ii) Rapti Model Farm

Office
Shed for machinery and equipment
Store-house for farming materials
Living quarters
Workshop and garage

(iii) Kathmandu

Office

Annex VII

Composition of the Janakapur Agricultural Development Board

Members of the Janakapur Agricultural Development Board:

Chairman	:	Secretary, Ministry of Food and Agriculture
Members	:	Director, Department of Agricultural Extension
"	:	Director, Department of Agricultural Education and Research
"	:	Chief Engineer of Irrigation Department
"	:	Representative of Ministry of Finance
"	:	Representative of the Economic Analysis and Planning Division, Ministry of Food and Agriculture
Members' Secretary	:	Nepalese Project Manager

Permanent Advisors

1. The Senior Advisor
2. The Japanese Project Manager

Note: An official of the Embassy of Japan or any other appropriate person designated by the Embassy of Japan may attend the meetings of the Board as an observer.

CHAPTER III JANAKPUR ZONE

3.1 General Description

As shown in Fig. 3.1.1, Janakpur Zone covers an area of 9,769 km^2. The zone can be topographically divided into the hilly area, Inner Tarai and Tarai Plain, and consists of six administrative districts as described in the second survey report. At present, there is a branch office of ADO in each of the six districts.

The major activity to be conducted in this zone in the forthcoming technical cooperation period is to provide agricultural extension services in a practical and effective way under a new extension system, and it is expected that Hardinath Extension Farm and a number of extension plots to be established at different places will play an important role in such activity.

The extension activity is planned to cover the entire zone. At the outset, however, it will be concentrically carried out in a model district near Janakpur city. This is because the model district is not only considered to yield substantially large extension effect within a relatively short time but also has favourable natural and socio-economic conditions. Under the project plan, it is envisaged that the basic pattern of extension activity will be established in this district by the input of human and material resources, i.e., Japanese experts, Nepalese counterparts and extension workers, fertilizers, agro-chemicals farming machines and implements. Extension services in other parts of the zone will be undertaken by stages based on the achievements and experience gained in the model district.

As pointed out in the second survey report, the model district has high potentials for developing irrigation agriculture. It leaves no doubt that this district will grow into one of the advanced agricultural districts in eastern Tarai Plain in future. To accelerate the pace of its development, it is planned that an irrigation infrastructural·

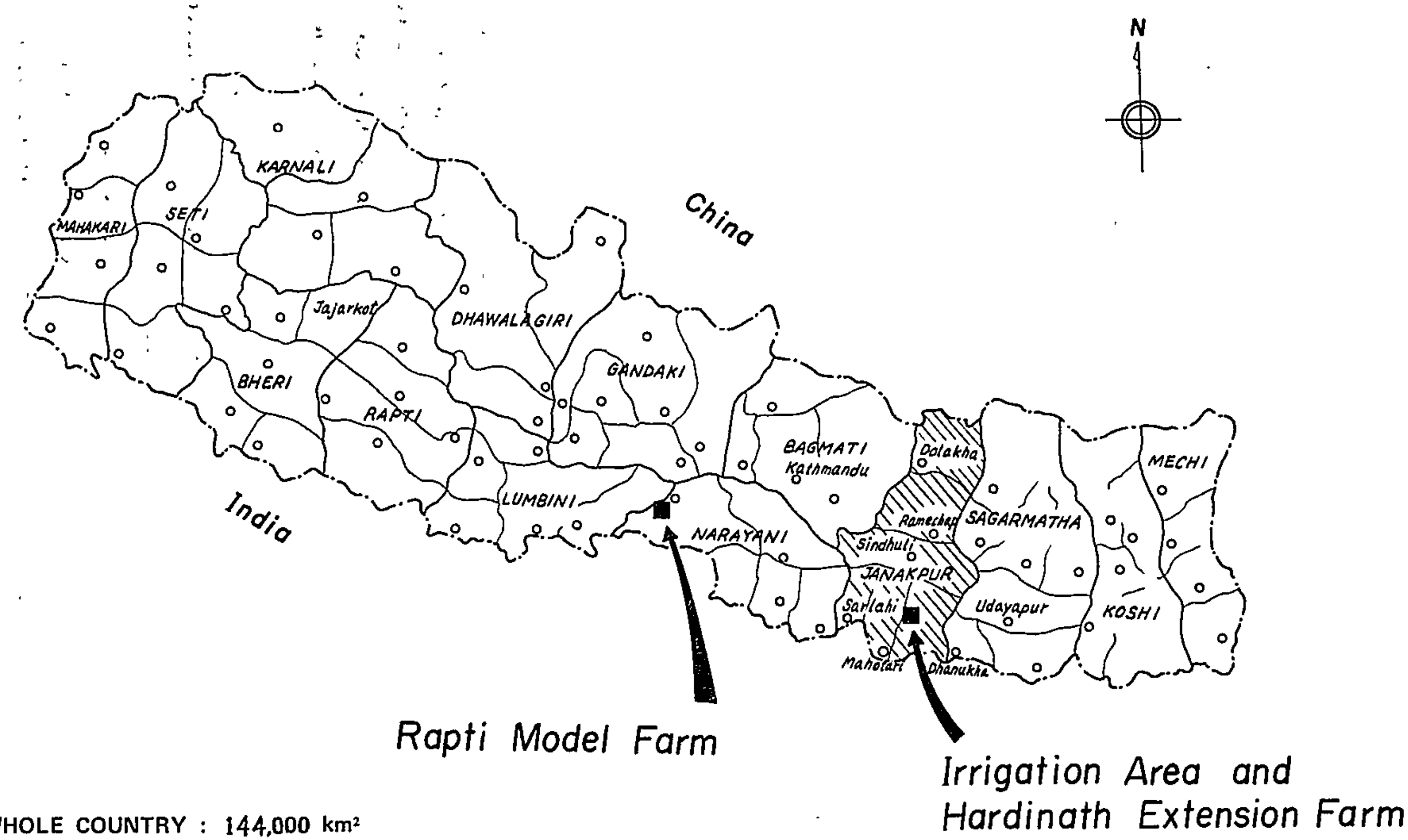
improvement plan will be pursued in this district in parallel with the progress of extension activity.

As the first step approach to this end, an area of about 420 ha extending north to south on the west side of the highway approximately 18 km to the north of Janakpur city was selected as the first stage irrigation infrastructural improvement area. Selection of this area was made by reason of the availability of groundwater and favourable socio-economic conditions. It is planned that eight tube wells will be dug in this area based on the findings of the third survey. These wells are expected to provide a yield of about 0.16 m^3/s of flowing water which can be used for paddy cultivation in the wet season and wheat cultivation in the dry season. Production of vegetables will also be encouraged in some parts of the area with irrigation water supplied from these wells.

At the initial stage of the cooperation period, the extension activity mentioned above will be prompted in this irrigation infrastructural improvement area in order to introduce improved techniques of irrigation farming such as the establishment of a new crop rotation system and application of chemical fertilizers. In extension plots, these improved farming techniques will be applied by local farmers for practical purposes with guidances provided by trained Nepalese extension workers. The extension efforts and achievements made at extension plots are expected to stimulate the farmers in the surrounding areas into development efforts.

It is to be emphasized here that the extension method to be adopted under the project is characteristic in that active and progressive guidances are planned to be offered to farmers by Nepalese extension workers trained by Japanese experts. Technical problems confronted by farmers will therefore be transmitted to Hardinath Extension Farm-cum-extension centre through pertinent Nepalese extension workers and solutions brought for them with the cooperation

Fig. 3.1.1 DISTRIBUTION OF ZONE IN NEPAL



WHOLE COUNTRY : 144,000 km²
JANAKPUR ZONE : 9,769 km²

of Japanese experts will be transmitted back to farmers through the same channel.

Extension activity in rain-fed farming areas is an urgent need in Nepal, and will therefore be pushed forward along the lines of the activities in irrigation farming areas on the basis of the trials conducted at Hardinath Extension Farm.

As stated in the second survey report and R/D, the government-run Hardinath Farm in Dhanukha district of Janakpur Zone will make a new start as an extension farm with the commencement of Japan's technical cooperation.

As already described, success of the forthcoming technical cooperation programmes hinges on three major ingredients, i.e., extension activity, operation of Hardinath Extension Farm and operation of Rapti Model Farm. These three may appear independent of each other but are actually interlocked closely with each other.

3.2 Infrastructural Improvement

3.2.1 Design Requirements

3.2.1.1 Irrigation Area and Its Location

The selected irrigation infrastructural improvement area is located on the western side of Janakpur-Mahendra Nagar Highway approximately 18 km to the north of Janakpur city. It is bordered on the west by the Dudhmati nadi, on the north by Haraiwa village, on the south by Agleswa village, and on the east by the above-mentioned highway, and has an acreage of 420 ha.

About the whole of this 420 ha land will be cultivated by the farmers in Ramdaiya village and Saphi village. The survey disclosed that the northern half will be covered by the farmers of Ramdaiya village and the southern half by the farmers of Saphi village.

As already stated, the irrigation area promises easy and econimical supply of flowing water and also enjoys favourable socio-economic conditions. Fig. 3.2.1 is the map showing this area and surrounding villages.

3.2.1.2 Water Utilization

1) Natural Features

In Janakpur Zone, clusters are found sporadically on slopes of mountains not higher than EL. 4,000 m, in basins in the hilly area and in Tarai Plain. The greater part of Churia Hill and the southern alluvial fan forms a jungle area not embracing clusters.

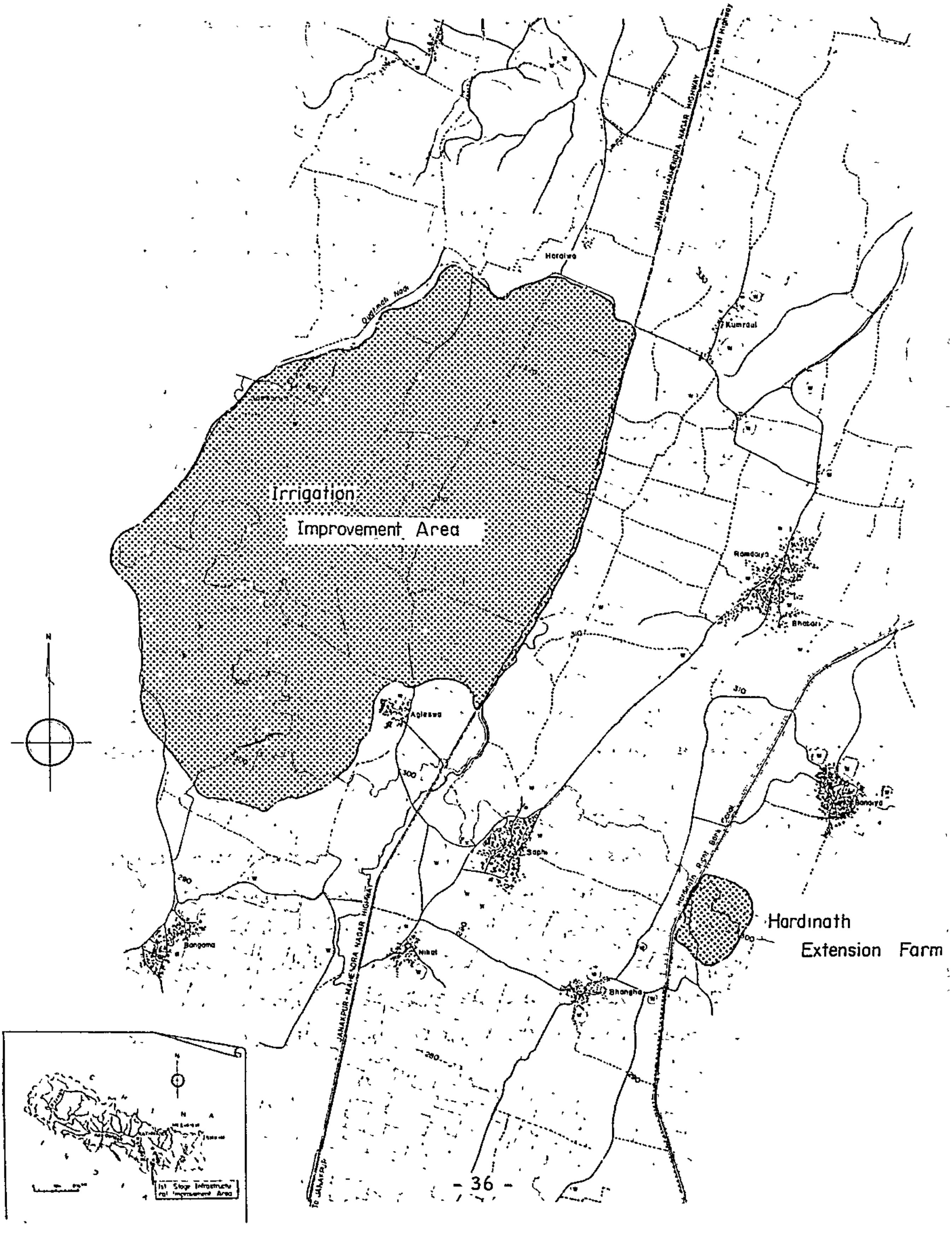
The northern hilly area is geologically composed of hard rocks of Palaeozoic era and Mesozoic era. South of the great fault running in E-W direction in the south of the Mahabharul Range, which is commonly called Main Boundary, one finds the distribution of Tertiary formations. Tarai Plain, on the other hand, is composed of uncoagulated alluvial formations.

As shown in Fig. 3.2.2, Tarai Plain is an alluvial fan. On its summit which is close to the hilly area, therefore, rivers flow underground in the dry season and no surface water can be observed. In portions lower than El. 120 m, however, spring water can be observed though small in scale. Groundwater is generally abundant.

2) Water Utilization

As described above, sources of surface water vitually dry up in the dry season. Modern canal irrigation is therefore conducted in limited areas such as Hardinath and Manusmara. Irrigation in the greater part of the zone is conducted on a small scale in the wet season with water drawn from rain water tanks, springs or storage reservoirs.

FIG. 3.2.1 1ST STAGE INFRASTRUCTURAL IMPROVEMENT AREA



In Malangwa, pumps were installed recently to pump up abundant groundwater for irrigation purpose. However, extension of this type of pumping irrigation is considered rather difficult since agricutural profit is rather small for the large maintenance and operation cost.

3) Flowing Well

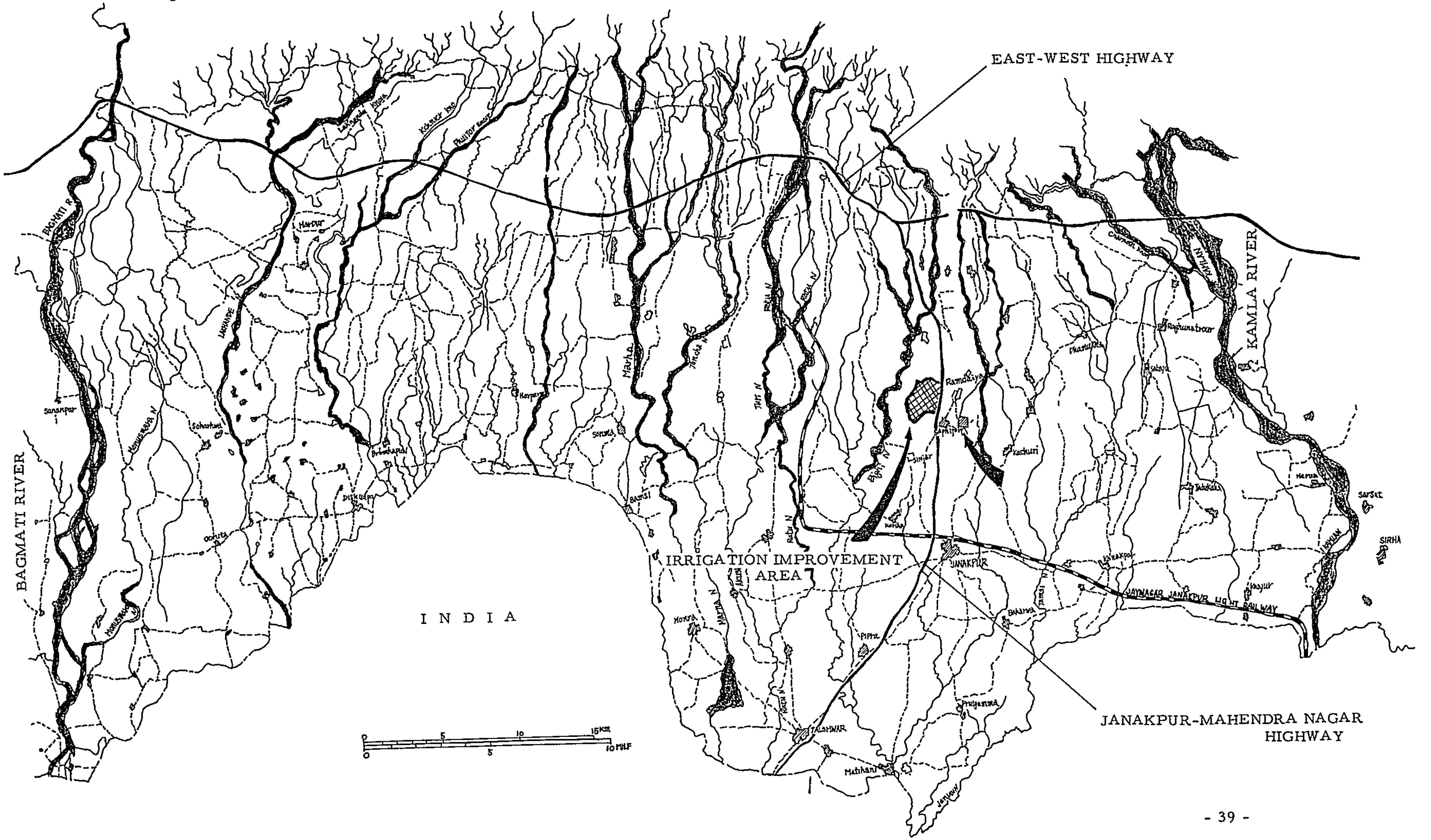
It has long been known that there extends a relatively large artesian flowing zone in the area surrounding Janakpur city. In recent years, tube wells with a diameter of about 1.5" came to be installed to obtain flowing water for irrigation purpose.

FAO's survey conducted after 1968 indicates that a fairly large yield of flowing well water can be expected in the northern half of the artesian flowing zone. In areas where surface water supply is deficient, stabilized and economic supply of water can be assured by the flowing wells.

4) Selection of Groundwater Irrigation Infrastructural Improvement Area

The groundwater irrigation infrastructural improvement area should be sought in the said artesian flowing zone even for economic reasons alone. The selected irrigation area not only has fairly well arranged fields but also is favoured with good transport conditions. Success of the irrigation scheme in this area will certainly accelerate the future development of groundwater irrigation in the whole artesian flowing zone.

Fig. 3.2.2 TARAI PLAIN OF JANAKPUR ZONE



5) Irrigation Plan

Gross water requirement in the 420 ha irrigation improvement area, as calculated on the basis of the data contained in the second survey report, is as tabulated below.

Gross Water Requirement

Unit : ℓ/s

Month	Apr	May	Jun	Jul	Aug	Sep	Oct
Per ha	0.355	0.337	1.14	0.73	0.06	0.71	0.88
Total	149	142	479	307	252	298	370

Eight tube wells are planned to be dug in the irrigation improvement area, but the yield of flowing well water is not expected to be any larger than 153 ℓ/s which is apparently insufficient for year-round irrigation of the 420 ha area.

To make maximum use of this limited availability of irrigation water, the irrigation plan was drawn up on the premise that the puddling would be carried out about two weeks later than at present, crops requiring small water supply such as pulses and forage crops would be introduced, and maximum planted area in the dry season would be held at about 200 ha.

3.2.2 Construction Works

3.2.2.1 Construction Area

A. Tube Well

1) Groundwater Condition in Construction Area

The plain extending southwards from Churia Hill presents the topography characteristic of an area where the transition from alluvial fan to Ganga fload plain takes place.

Elevation is about 200 m on the apex of the alluvial fan and about 110 m in the neighbourhood of the southern border line with India.

The apex of the alluvial fan is composed chiefly of sandy gravel layer and therefore, rivers flowing from Churis Hill become influent seepage during the dry season except for large rivers like the Kamla and no surface water can be observed. Consequently, surface water irrigation in the farmland area extending from the alluvial fan to the flood plain is made virtually impossible in the dry season when small springs found near El. 120 m are the only water sources.

From the middle (El. 120 m) to the end of the alluvial fan is found an artesian flowing zone which extends around Janakpur city. Particularly, the area shown in Fig. 3.2.3 is known to embrace a noteworthy occurrence of artesian groundwater by a survey conducted by FAO. It can therefore be reasonably expected that efficient groundwater irrigation can be conducted in this area.

It may be added that the 420 ha irrigation infrastructural improvement area is included in this area.

A comprehensive study of test wells drilled by FAO which are shown in Fig. 3.2.3 discloses that layers are stratified as shown in Fig. 3.2.4 and that dominant aquifer occurs in Layers 2 and 4. Two well logs are shown by way of example in Fig. 3.2.5. One of them is for the well of Hardinath Farm and the other is for the well currently used as the source of city water supply to Janakpur city. The aquifer of the former lies in the fine sand layer extending at a depth of about 60 m and in the sand layer containing fine gravels which is found between 80 m and 100 m from the ground surface. The aquifer of the latter is in the sand layer extending downwards from a depth of 160 m.

Coefficient of permeability of each aquifer is shown in Table 3.2.1 Height of piezometric surface above ground surface and yield of artesian flow of the wells drilled by FAO are shown in Table 3.2.2.

Table 3.2.1 Permeability of Aquifer

Test Well No.	Layer No.	Depth	Thickness of Aquifers	Artesian Yield	Draw-down	Perme-ability
		(m)	(m)	(m^3/d)	(m)	(m/d)
1	2	64 - 70	6.0	200	4.5	3.9
	2	82 - 87	5.0	800	4.5	18.7
	2	94 - 100	6.0	1400	4.5	27.3
Hardinath	Total		17.0	2400		
2	2	114-122	8.0	810	4.9	10.9
	Total		8.0	810		
3	2	64 - 68	4.0	200	1.7	15.5
	2	72 - 90	18.0	1500	1.7	25.8
	Total		22.0	1700		
4	2	61 - 69	8.0	700	8.5	5.4
	2	79 - 84	5.0	100	8.5	1.2
	2	98 - 106	8.0	900	8.5	7.0
	3	Below		300		
	Total		21.0	2000		

Table 3.2.1 Permeability of Aquifer (Cont'd)

Test Well No.	Layer No.	Depth	Thickness of Aquifers	Artesian Yield	Draw-down	Perme-ability
		(m)	(m)	(m^3/d)	(m)	(m/d)
5	2	90 - 95	5.0	230	1.4	17.3
	Total		5.0	230		
6	2	93 - 99	6.0	150	0.8	16.4
	3	134.8 - 140.3	5.5	150	0.8	17.9
	4	162 - 170	8.0	1300	0.8	106.9
Janakpur	Total		19.5	1600		
7		No artesian flow				

Table 3.2.2 Elevation of Piezometric Surface and Yield of FAO's Test Wells

Test Well No.	Depth	Elevation of Piezometric Surface	Height of Piez. Surf. above Ground Surf.	Yield of Artesian Flow in 1969	Specific Capacity	Yield of Artesian Flow in 1971
	(m)	(m)	(m)	(m^3/d)	($m^3/d/m$)	(m^3/d)
1	133	91.5	5.50	2400	533	2500
3	113	107.5	2.60	1700	1000	2030
4	176	84.5	9.50	2000	235	1300
6	175		1.80	1600	2000	700

When the potential line of artesian groundwater is prepared by plotting the values shown in Table 3.2.2 above, it becomes clear that the height of piezometric surface declines, as shown in Fig. 3.2.1, from north to south at a hydraulic gradient of 1/550. Further, comparison of measurements made after the drilling and pumping test conducted in 1969 and those made during the present survey reveals that Test Well Nos. 1 and 3 which have been well taken care of produce a yield equivalent to or larger than the initial value, whereas Well Nos. 4 and 6 for which no yield control has been made show a substantial discharge decrease.

From Fig. 3.2.6, the elevation of piezometric surface in the selected irrigation area is estimated to El. 100 m and 2.5 m above ground in Ramdaiya village and El. 98 and 6 m above ground in Agleswa village. This estimation can be justified from the fact that a well with a depth of 70 m a diameter of 1.5", which was drilled about two years ago approximately at the centre of the irrigation area and thereafter left uncontrolled, now has an elevation of piezometric surface of 4.5 m above ground surface and a yield of 2 ℓ/s.

Fig. 3.2.3 ARTESIAN ZONE IN JANAKPUR ARER

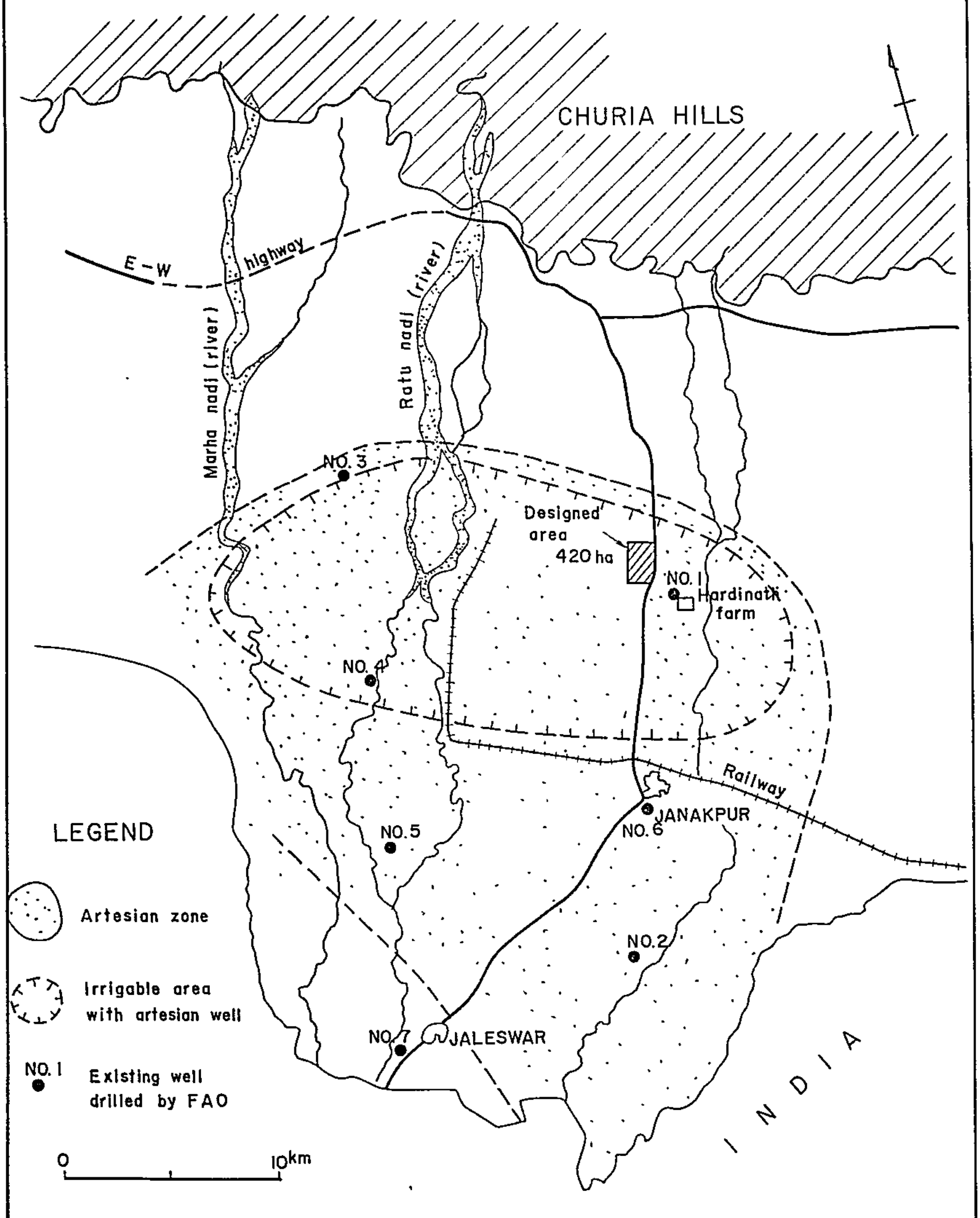


Fig 3.2.4 FENCE DIAGRAM BASED ON WELL LOG CORRELATION

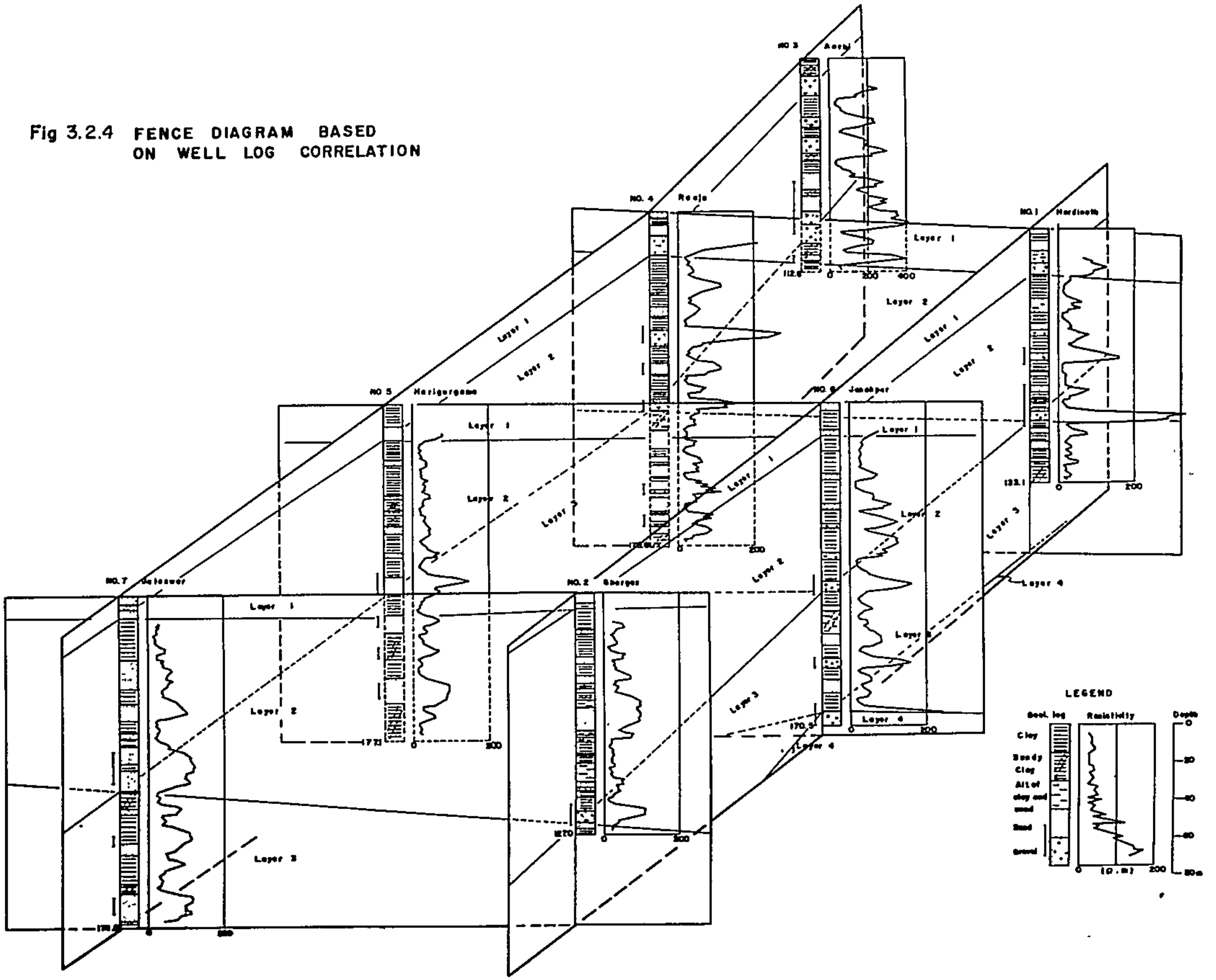
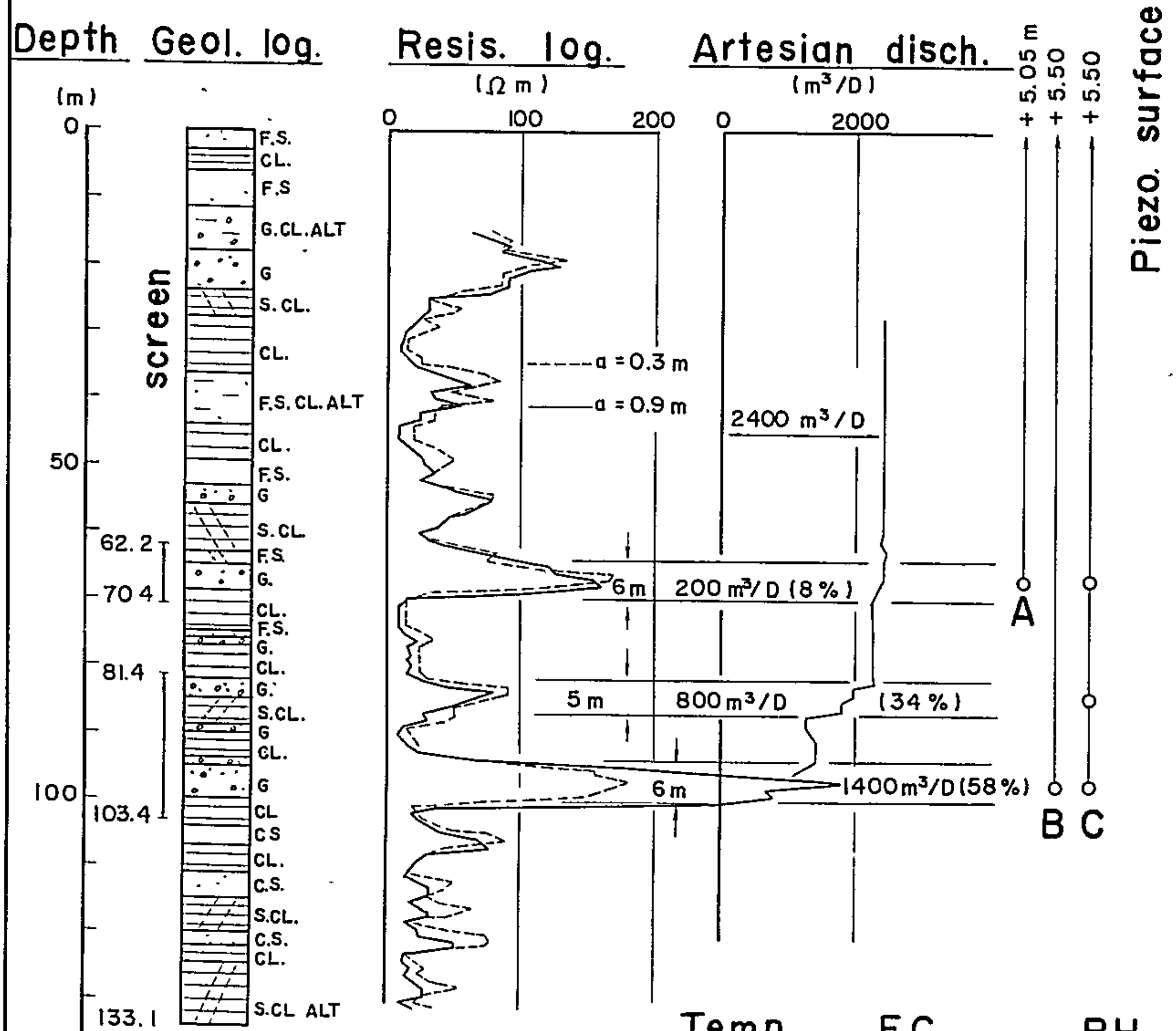


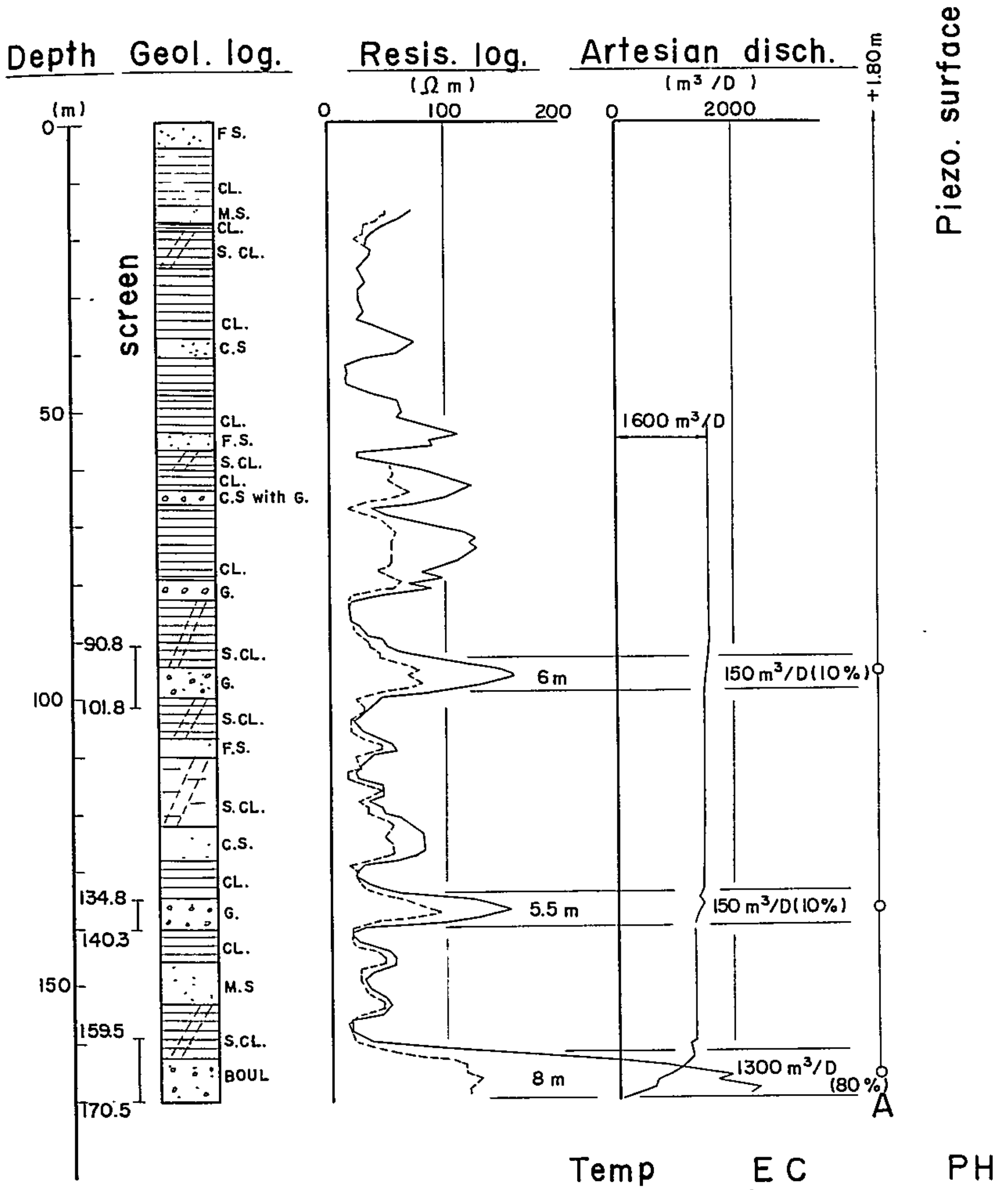
Fig. 3.2.5 (1) NO. 1 TEST WELL Hardinath



	Temp	EC	PH
A	25.5C°	215μ℧/cm	6.7
B	23.8	145	6.2
C	25.2	163	6.2

Fig. 3.2.5 (2)

NO. 6 TEST WELL Janakpur



	Temp	EC	PH
A	26.8C°	220μʊ/cm	6.9

Fig. 3.2.6 CONTOUR MAP OF PIEZOMETRIC SURFACE

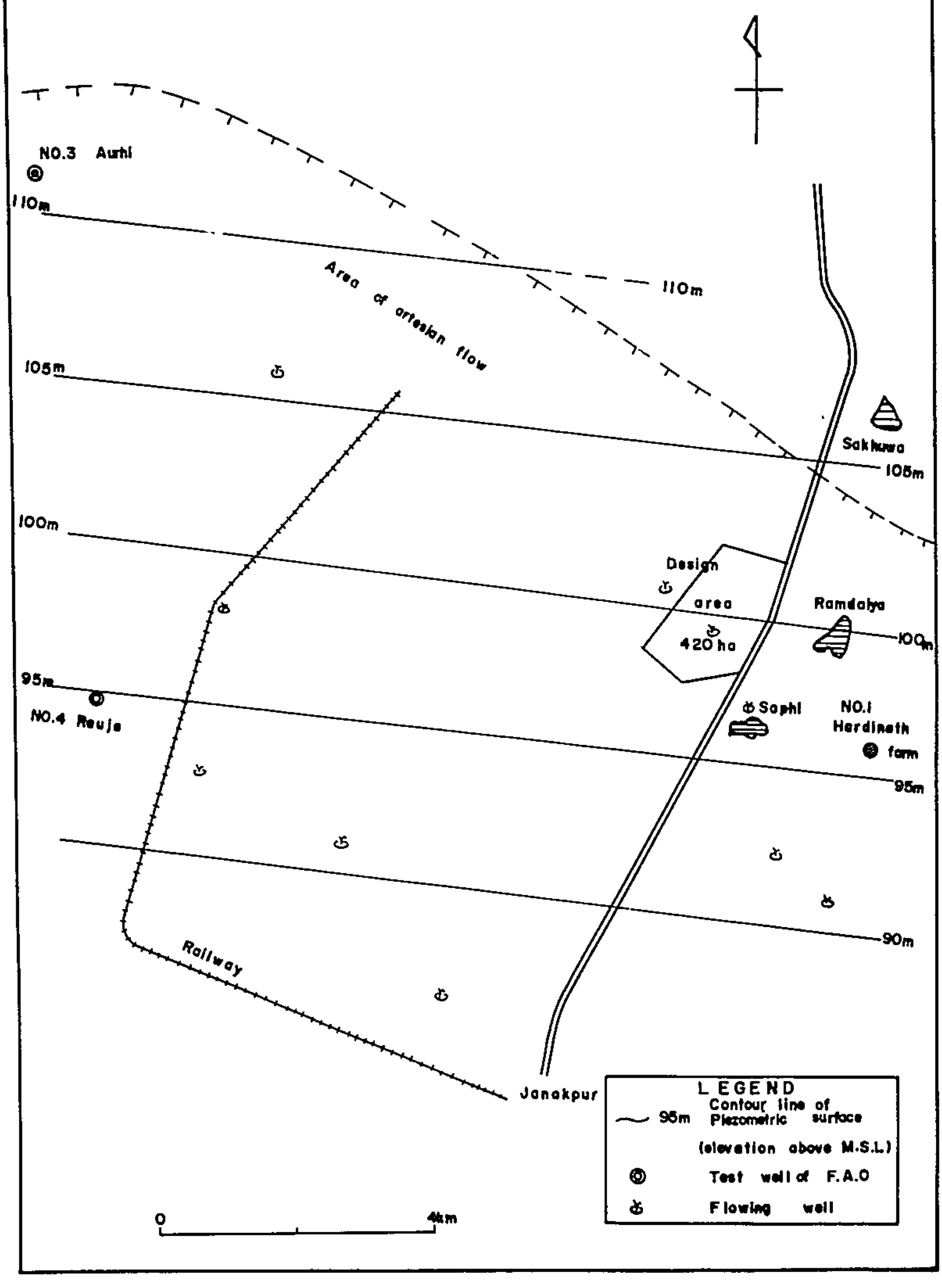


Table 3.2.3 Design Depth and Yield of Wells in Irrigation Area

Well No.	Depth	Elevation	Piezometric Surface	Drawdown	Yield /2
	(m)	(m)	(m)	(m)	(ℓ/s)
1	200	94.5	99.0	3.5	21 (26)
2	130	94.0	99.9	4.0	24 (20)
3	(200)/1	94.5	99.5	4.0	24 (20)
4	(200)/1	96.5	100.5	3.0	18 (18)
5	130	94.5	100.5	5.0	30 (30)
6	130	98.5	102.0	2.5	15 (15)
7	(200)/1	98.5	102.5	3.0	18 (15)
8	130	98.5	102.5	3.0	18 (15)

/1 Depth to be determined from the results obtained from Well No. 1.

/2 Figures in parentheses to be adopted as design values for safety's sake.

2) Estimate of Yield of Artesian Flow

Test Well No. 1 made by FAO in the compunds of Hardinath Farm is most close to the irrigation improvement area. In designing tube wells to be made in the irrigation area, therefore, data of this well were used.

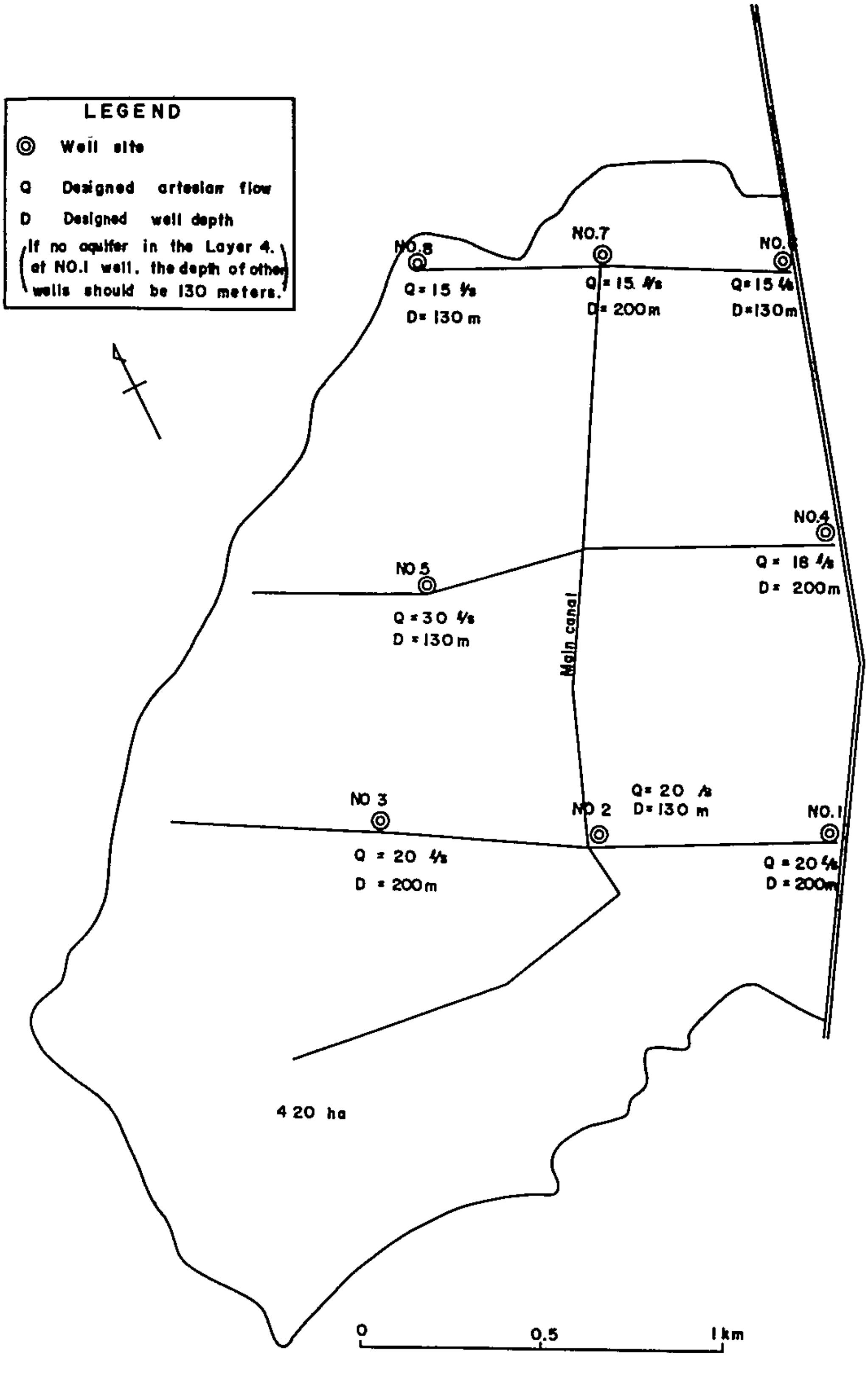
The yield of this well, 2,400 m^3/d (28 ℓ/s), produces a drawdown of 4.8 m which is the difference between the elevation of piezometric surface and pipe top. Therefore, the specific capacity is as calculated below.

$28/4.5 = 6.2\ \ell/s/m$

In order to be on the safety side, the design specific capacity is set at 6 ℓ/s per m of drawdown.

Layout of wells in the irrigation area is as shown in Fig. 3.2.7. height of piezometric surface above ground surface can be obtained from the distribution of the potential line. Trial yield calculation was made on the assumption that there is a drawdown from the said height of piezometric surface to the pipe top which is 1 m above ground surface. As for the wells to be made on the downstream end, however, consideration was given to the interference over a long time and their yield was set at values smaller than actual estimated values as shown in Table 3.2.5 below.

Fig 3. 2.7 WELL FIELD DESIGN



3) Study on Interference of Wells

Approximate radius of influence circle can be obtained from the following equation when transmissibility is given in terms of m^2/d.

$$R = 2S\sqrt{T}$$

where,

R : Radius of influence circle (m).

S : Drawdown (m).

T : Transmissibility (m^2/d).

Transmissibility obtained from the pumping test conducted on the FAO's test well in Hardinath Farm is 670 m^2/d. Therefore, the value of R is as given below.

$$R = 52S$$

Since the maximum drawdown obtained from Table 3.2.3 is 3 ~ 5 m, well sites can be arranged at minimum intervals calculated below.

$$2R = 2 \times 52 \times 5 = 520 \text{ m}$$

To avoid the interference involved in long term flowing, wells should be arranged at larger intervals than given above. The well site arrangement shown in Fig. 3.2.7 can be considered satisfactory in this respect.

4) Determination of Well Depth

Insofar as the well in Hardinath Farm is concerned, dominant aquifer in Layer 2 is the sand layer containing fine gravels which is found at a depth of about 60 m. This layer is found distributed over the entire irrigation area and promises stabilized supply of groundwater. Wells to be drilled in this aquifer should have a design depth of 130 m which includes an allowance for the sand trap.

As for the well of Janakpur city, it is known that a dominant aquifer runs at a depth of larger than 160 m in

Layer 4. To minimize the interference of wells, wells drawing groundwater from this aquifer of Layer 4 will be arranged alternately and have a design depth of 200 m including the allowance. Since the groundwater availability of this aquifer is not definitely known, a strainer is to be installed in the aquifer found at a depth of about 100 m in Layer 2 and also in the aquifer in Layer 4 when the first well in the irrigation construction area (Well No. 1) is drilled to a depth of 200 m. This will be followed by a pumping test and observation of flowing condition in order to measure the yield from the aquifer in Layer 4. If, as a result, occurrence of a dominant aquifer at a depth of larger than 160 m is confirmed, other wells will be drilled to their respective depths shown in Fig. 3.2.7, with a strainer installed in Layer 2 alone for 130 m deep wells and also at a point deeper than 160 m for 200 m deep wells. If no dominant aquifer is found in Layer 4, all the wells to be drilled after Well No. 1 will have a depth of 130 m to draw water from Layer 2 alone. Even in this case, the interference of wells can be avoided as discussed in Item (3) above.

5) Casing and Strainer

The casing will be fitted on the assumption that for the total yeild of 30 ℓ/s, groundwater rises about 90 m through the pipe. However, to provide against the possible future decrease in the yield of artesian flow, the upper 25 m section of the casing pipe will have a diameter of 12" to allow for the installation of a pump.

In case of a yield of 30 ℓ/s, the head loss in the casing pipe composed of a 80"ϕ and 65 m long section and a 12"ϕ and 25 m long section, as obtained from the William-Hazen graph, is 0.41 m.

$0.36 + 0.05 = 0.41$ m

The head loss in the casing pipe composed of a 6"ø and 65 m long section and a 12"ø and 25 m long section is as given below.

$1.65 + 0.05 = 1.70$ m

This means that the head loss increases by about 1.29 m if the diameter of the lower casing pipe is reduced to 6". Since the specific capacity is 6 ℓ/s/m, decrease of the yield of artesian flow in case of 6"ø casing pipe reaches 1.29 x 6 = 7.74 ℓ/s.

Therefore, the lower casing pipe will be designed to have a diameter of 8".

As shown in Table 3.2.1, aquifer thickness of FAO's test wells is known to be 17 m for Test Well No. 1, 19.5 m for Test Well No. 6 and 22 m for Test Well No. 3. Average of these values, i.e., 20 m, will therefore be taken as the aquifer thickness. Further, the strainer will have a length of 27.5 m per well including allowance to provide for the possible installation in a sandy gravel layer which resembles aquifer as well as for the need of adjusting the strainer position.

In order to prevent sand intruction and minimize entrance head loss, the strainer will be of a coiled wire type having a small mesh size and large inflow area ratio.

Sand discharge can be generally suppressed to a satisfactory degree by preventing the inflow of sand particles larger than the 50% grain size of aquifer sand.

From the critical tractive velocity, the strainer open area ratio can be calculated as follows.

$$Vc^2 = 8.4\, d^{\frac{11}{32}} \quad (Vc : \text{Critical tractive velocity})$$

By applying the 50% grain size, which is known to be 0.2 mm from FAO's data, to the above equation,

$$Vc = 1.51 \text{ cm/s}$$

Assuming that the discharge of 30 ℓ/s is produced from the 20 m thick aquifer, the open area ratio of a strainer having an outside diameter of 230 mm can be obtained as follows.

$$30,000/2 \times 3.14 \times 11.5 \times 2,000 \times 1.51 = 0.13$$

Therefore, an open area ratio of 13% will suffice. Opening between coiled wires should preferably be smaller than the grain size of sand. Strainers with a mesh size of 0.5 mm which are available on the market will meet the requirement.

6) Drilling Diameter and Filling Gravel

The drillying diameter of FAO's Well Nos. 1 and 6 is 10-1/2". Quantity of sand contained in flowing water and pumped up water after the casing is installed is shown in Fig. 3.2.8. Hence, the correlation between the apparent velocity and sand quantity at the surface of drilled hole is as shown in Fig. 3.2.9. Fig. 3.2.9 indicates that if a sand discharge of 100 ppm is to be allowed for the wells in the irrigation area immediately after their completion, then the apparent velocity at the surface of drilled hole must be held at a value smaller than 1.4 mm/s.

Assuming that the maximum flowing water yield is 30 ℓ/s and aquifer thickness 20 m, the radius of drilling hole r, which gives a sand quantity of 100 ppm will be as calculated below.

$$r = 30,000/2 \times 3.14 \times 2,000 \times 0.14 = 17.1 \text{ cm}$$

Accordingly, the drilling diameter should be larger than 34.2 cm. Considering the possible case where the aquifer thickness is smaller than 20 m, bits of 14-3/4" (375 mm) which are available on the market will be employed.

Fig. 3.2.8
CORRELATION BETWEEN DISCHARGE AND SAND FROM ARTESIAN WELL

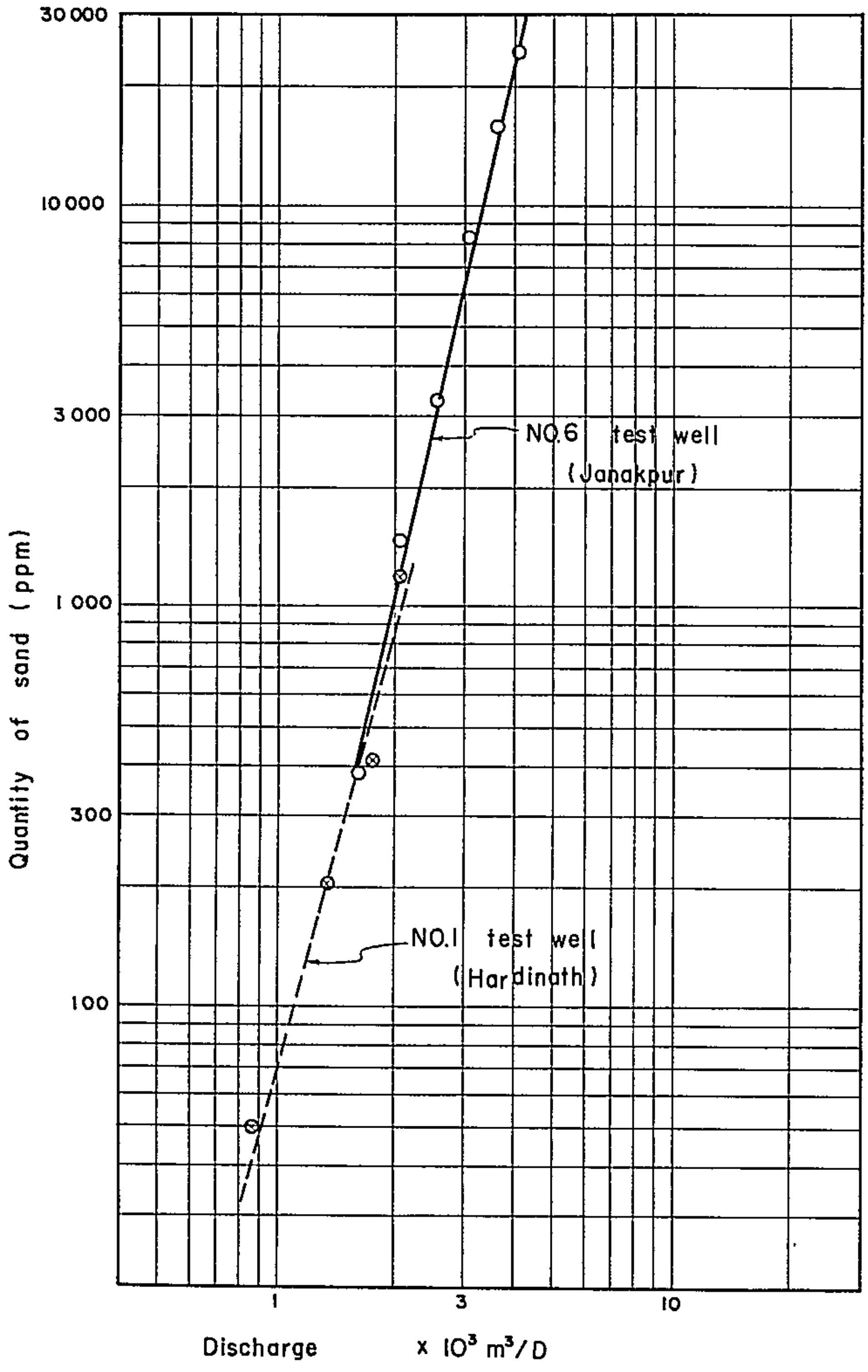
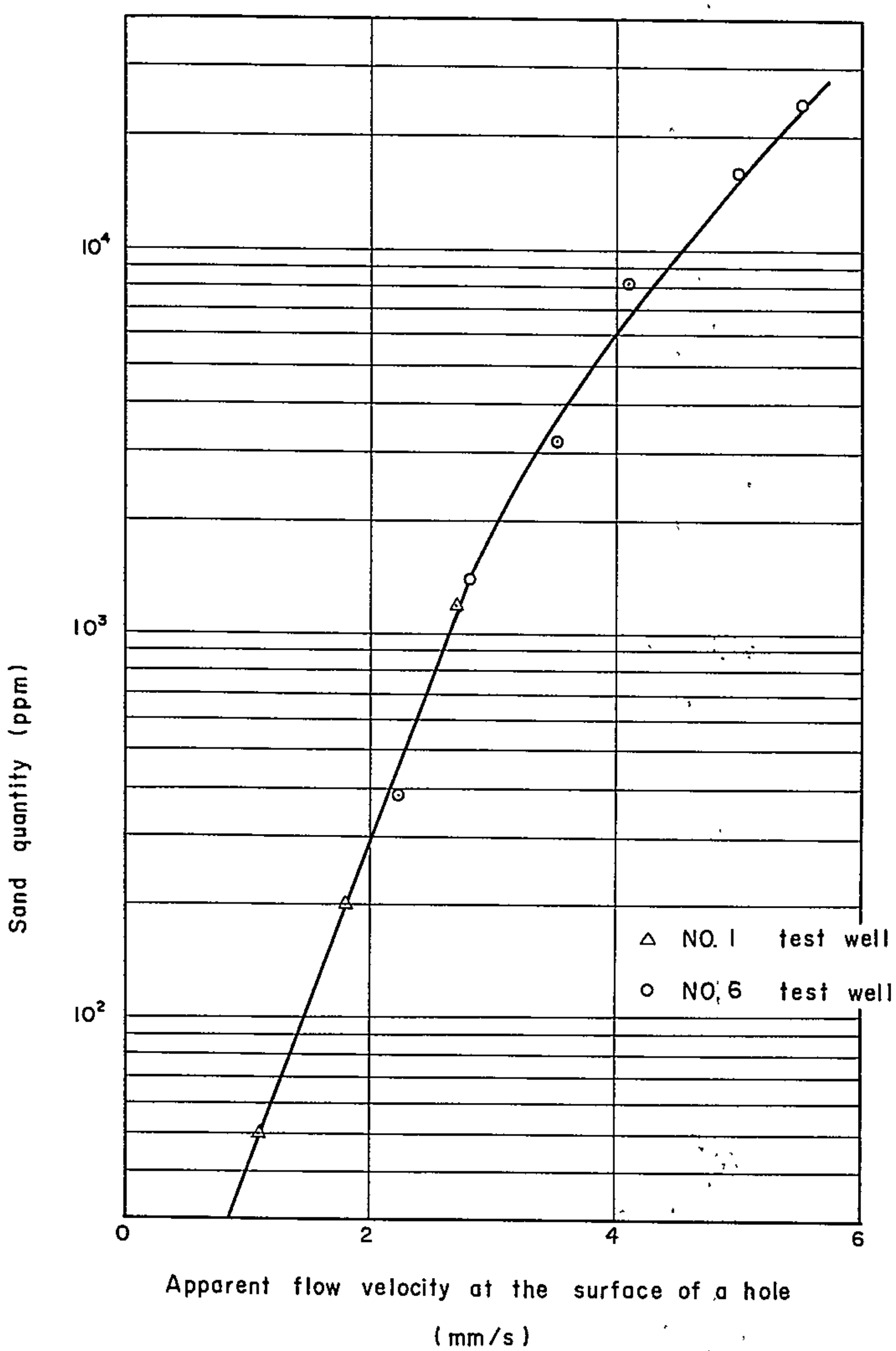


Fig. 3.2.9 CORRELATION BETWEEN APPARENT VELOCITY AND SAND AT BORED HOLE



In the above case, gravels will be filled in the annular space between the drilled hole and the casing and between the drilled hole and the strainer pipe. Further, clay will be filled in the upper 30 m section to prevent the discharge of artesian water, with a 30 cm concrete base constructed on the ground surface in a manner that it forms part of the canal structure.

Quantity of gravels required per well is as calculated below.

$$V_{130} = \pi (V_1{}^2 - V_2{}^2) \ell = 3.14 (0.223^3 - 0.108^2) (130-30)$$
$$= 3.14 (0.0497 - 0.0116) \times 100 = 12.0 \text{ m}^3$$

where,

V_{130} : Quantity of filling gravels per well with 130 m depth.

V_1 : Radius of drilled hole.

V_2 : Outside diameter of casing and strainer pipe.

ℓ : Filling length.

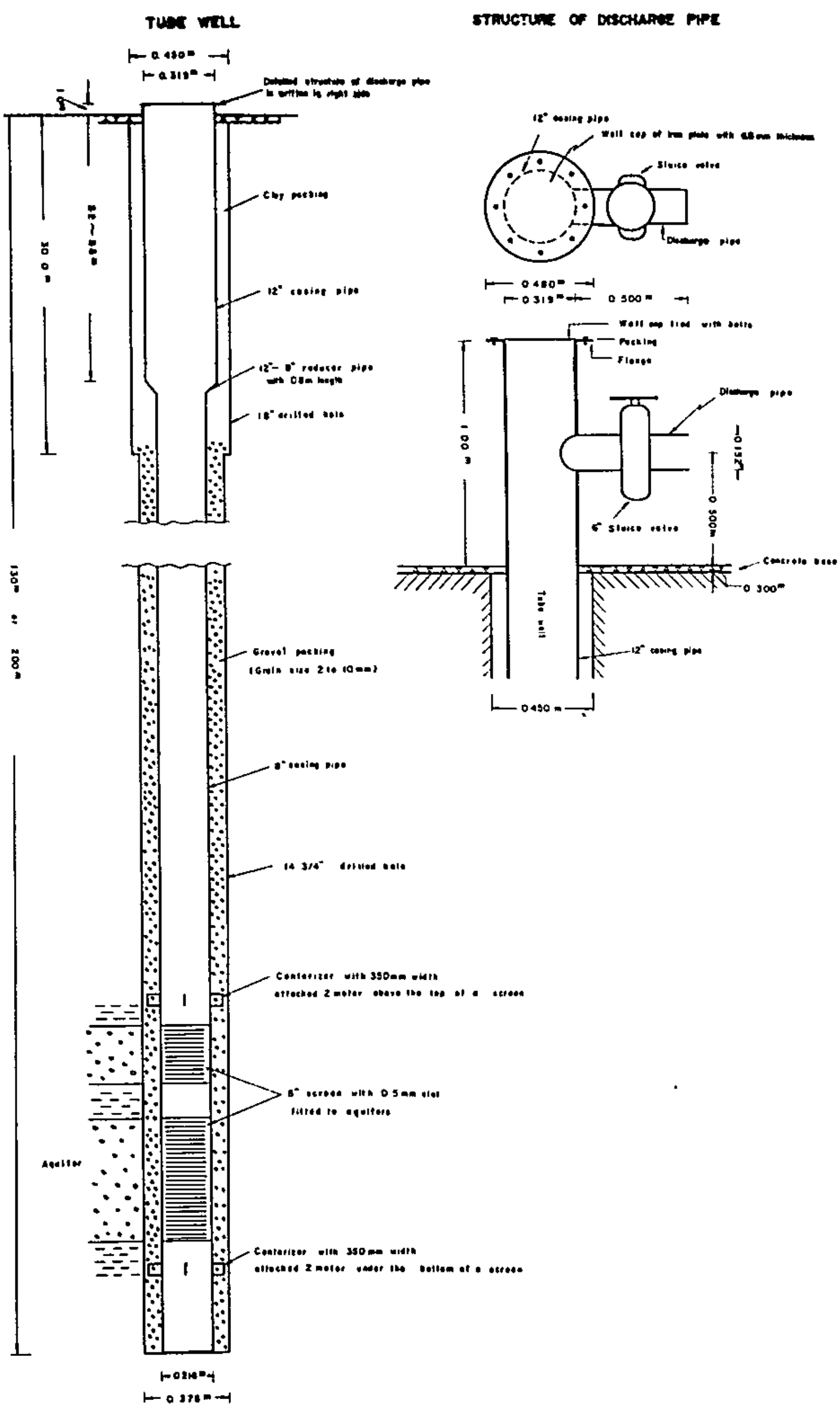
Quantity of filling gravels required per 200 m deep well is as calculated below.

$$V_{200} = 3.14 (0.0490 - 0.0116) (200 - 30) = 20.3 \text{ m}^3$$

Gravels collected from the Ratu Nadi or other rivers near the irrigation area will be sieved and those having a grain size of 2 to 10 mm will be used for filling.

The standard well design is shown in Fig. 3.2.10.

FIG 3. 2. 10 STANDARD WELL DESIGN



7) Drilling Rig and Accessories, and Construction Period

The drilling rig used in the project should be capable of drilling to a depth of more than 200 meters with 14-3/4" diameter. Supplementary equipment and materials, casings, strainers will be provided and transported by the Japanese side. Fuels and other locally available supplies will be procured in Nepal.

In the initial year of construction, equipment and materials for eight wells for irrigation and one for the dormitory will be sent. Equipment and materials delivered to the construction area will be stored in the dormitory as well as on the high land along the highway which runs near Saphi village.

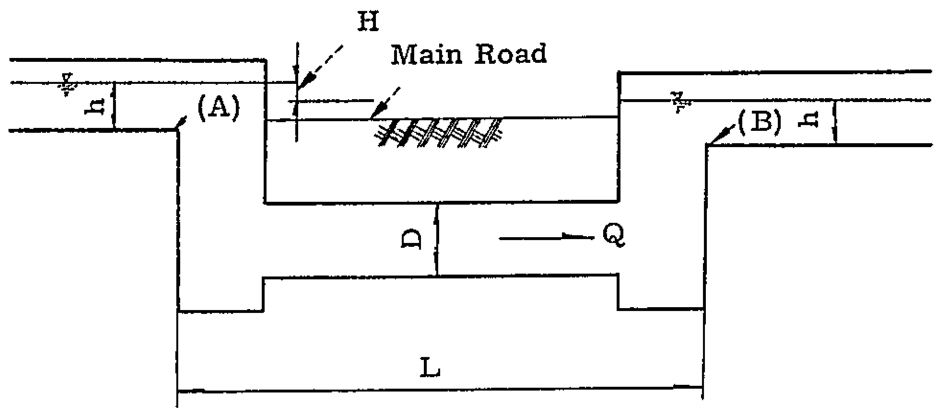
Water required for construction will be obtained from the flowing wells and storage reservoirs in the construction area.

Wells will be made in the order of well numbers shown in Fig. 3.2.7 according to the work schedule shown in Fig. 3.2.11.

8) Maintenance of Wells

According to the data of FAO's wells (See Table 3.2.2), it is known clearly that the yeild of artesian flow of the wells decreases to about half the original value if artesian water is left flowing out without control as in the case of Nos. 4 and 6. It is evident that the design yield of the wells to be newly drilled under Japanese technical cooperation will show a similar decrease if no control measures are taken. Therefore, groundwater utilization should be conformed to the plan described elsewhere in this report, with efforts directed towards controlling unnecessary water discharge.

Table 3.2.6 Basic Data of Siphons



Siphon No.	Location	Design Discharge (Q)	Siphon Diameter (D)	Flow Rate in Siphon	Siphon Length (L)	Head Loss	Canal Bottom(A) Elevation at Inlet	Canal Bottom(B) Elevation at Outlet	Water Depth
		(ℓ/s)	(mm)	(m/sec)	(m)	(cm)	(EL m)	(EL m)	H (cm)
No. 1	II-3 + 7.5	30 (Max. 45)	ϕ250	0.61	15.0	10	96.92	96.82	24
No. 2	III-5 + 10.0	20 (Max. 30)	ϕ250	0.41	15.0	10	93.45	93.35	17
No. 3	III-4 + 65.0	133 (Max. 201)	ϕ450	0.84	15.0	30	93.86	93.56	39

Fig. 3.2.11 WORKING SCHEDULE

ITEM	1973	1974											1975					
	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
Bid																			
Supply																			
Transport																			
Developing																			
Drilling in quarters																			
Drilling and pumping test in design area																			

At present, groundwater from all the existing artesian wells is allowed to flow out freely. If the new wells are left to the care of farmers without establishing a suitable maintenance plan, it could lead to the drying up of groundwater resources. For this reason, it is an imperative that in the forthcoming technical cooperation, farmers should be given a thoroughgoing training so that they may embark on rational maintenance and management of wells in time with the commencement of irrigation in prevention of the drying up of groundwater resources and for smooth operation of the irrigation plan. For this purpose, suitable arrangements including the fitting of valves to the wells should be made for easier water management.

B. Irrigation Works

1) Selection of Irrigation Area

As the first stage irrigation infrastructure improvement area in Janakpur Zone, the paddy field area of 420 ha covering parts of the Ramdaiya and Saphi villages is selected, as a result of the current survey, out of the areas proposed by the 2nd phase survey.

The selected area is an approximately rectangular area along the Janakpur-Mahendra Nagar Highway situated about 18 km to the north of Janakpur city, extending for about 1.7 km in east-west and 2.5 km in north-south.

This area has the following favourable conditions.

a) The area is located within the artesian well zone.

b) The area is provided with conditions favourable for application and extension of the improved farming techniques being practiced at the Hardinath Farm previously constructed as part of the FAO's Sun Kosi Irrigation Development Project.

c) The existing road is sufficient for transportation of the drilling machinery, excavating machinery and materials required for the construction of the irrigation facilities and drilling of the wells.

d) Unlike other many parts of Tarai Plain, the area has no unfavourable socio-economic conditions for extending the new improved facilities and improved techniques to the surrounding areas, and is favourably located for the demonstration purpose.

The area is a paddy field area bordered on the north by the road connecting Kumraul village and Haraiwa village, on the east by Janakpur-Mahendra Nagar Highway, on the west by the Dudhmati nadi which serves as the natural drainage waterway, and on the south by the village road to Agleswa village. The area slopes from north to south at a gradient of 1/500 and the elevation of land is within the range of 100m-90m above sea level.

The Hardinath Farm is located at 1.5 km east of this area.

2) Irrigation Management System

As a result of the groundwater survey, it is planned to construct eight tube wells in the area. The eight wells are expected to provide a total of 153 ℓ/s of artesian water.

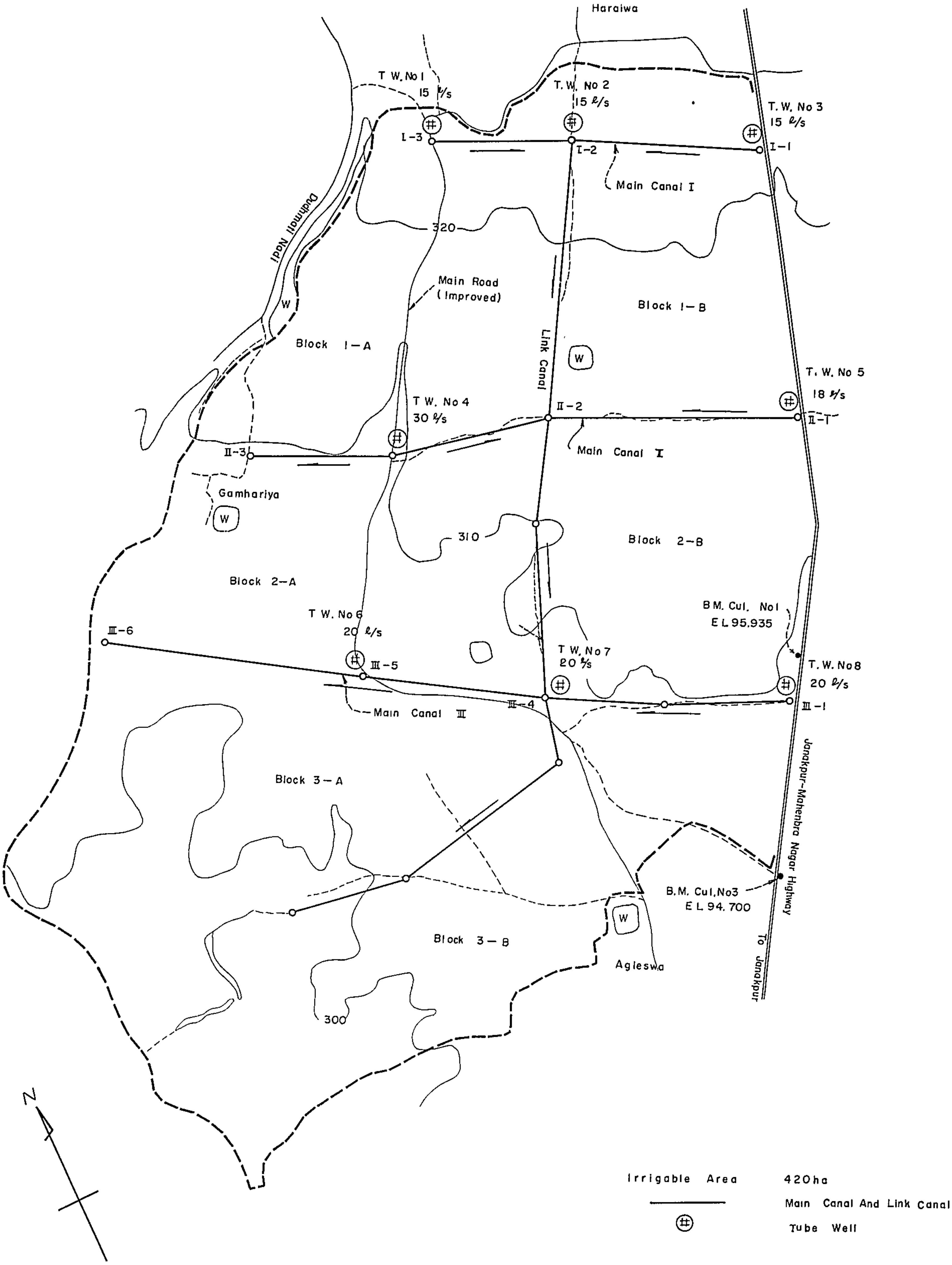


Fig. 3.2.12 Plan of Irrigable Area

The above total well yield under natural artesian pressure is not sufficient for irrigation requirements of 420 ha either for paddy or wheat. A rotational irrigation, therefore, has to be introduced to use the limited water as efficiently as possible. Accordingly, it is planned to establish an irrigation management system which serves to obtain the maximum irrigation effect with the limited water supply by resorting, for instance, to the circulating irrigation method.

Three of the eight tube wells will be drilled along the selected contour line in the northern part of the area at intervals of about 400 m, two in the central part 800 m south of the said contour line at an interval of 1 km, and three in the southernmost part of the area 800 m from the central part at intervals of about 500 m. These three groups of tube wells will be connected by No. I, II and III canals laterally. A link canal will run on the center line from north to south to connect those three main canals.

a) Irrigation Blocks and Water Distribution

The irrigation block lying between the Main Canals I and II will be called Block 1, the block between Main Canals II and III Block 2, and the block lying south of the Main Canal III Block 3. Thus, the entire area is planned to be divided into three irrigation blocks. Each block will be divided into Sub-blocks A and B by the central link canal as shown in the following table.

Block	Irrigation Area
1-A	60 ha
1-B	57
Sub-total	117 ha

2-A	68.3
2-B	60
Sub-total	128.3 ha
3-A	82.5
	92.2
Sub-total	174.7 ha
Total	420 ha

The artesian water from all the wells will be collected into the main canals with a gentle gradient of 1/3, 000. Several stop log structures will be provided on those canals to flow water in reverse direction by damming up with the stop logs, when such reverse direction supply is required.

The link canal will have a water surface gradient of 1/500 for topographical reasons, and will be provided, in principle, with drops at points where topographic condition changes. Through the link canal, therefore, a total of 45 ℓ/s of water flowing out at a rate of 15 ℓ/s from each of the three wells connected to Main Canal I will be supplied to Main Canal II. With 48 ℓ/s of water collected from the two wells, one having a flowing rate of 30 ℓ/s and the other 18 ℓ/s and both connected to Main Canal II, a total of 93 ℓ/s of irrigation water is planned to be supplied to Main Canal III.

Under this irrigation system, a maximum of 45 ℓ/s of water can be supplied to Block 1, 93 ℓ/s to Block 2 and a total of 153 ℓ/s of flowing water to Block 3.

3) Irrigation Canal

a) Design Discharge

In view of the interconnection of all wells, flowing rate of respective wells and water distribution plan, the design discharge of main canals is planned to be as tabulated below.

Table 3.2.4 Design Discharge

Name of Canal	Section	Canal Length	Design Discharge	Maximum Capacity of Canal
		(m)	(ℓ/s)	(ℓ/s)
Main Canal I	I-1 - I-2	524.6	20	30
	I-2 - I-3	397.5	20	30
Main Canal II	II-1- II-2	697.7	20	30
	II-2- II-4	869.8	30	45
Main Canal III	III-1-III-4	694.0	20	30
	III-4-III-5	522.9	50	75
	III-5-III-6	764.0	20	30
Link Canal	I-2 -II-2	792.6	45	69
	II-2 -II-4	786.3	93	141
	III-4 -A-4	1, 075.9	133	201

Notes : The maximum capacity of each canal should be designed to be 150% of the design discharge.

b) Structure and Cross Section of Canals

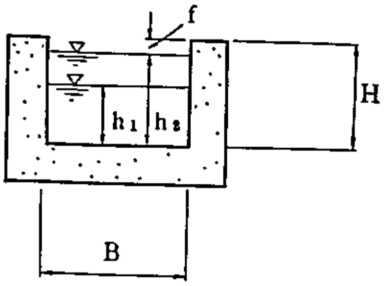
Both the main canals and the link canal will be lined with bricks. The main canals will be designed to have a mild bed gradient in order to connect all the wells to the link canals and allow the reverse flow of water in the dry season. Efforts must be made so that the canal bottom will not be extremely higher than the existing paddy field level.

The cross sections of the brick-lined canals will be rectangular. The sizes were determined by hydraulic calculation employing Manning's Formula. The result of this calculation is shown in Table 3.2.5. Codes used in this table are explained below.

Table 3. 2 5

Cross Section Data of Each Canal

Name of Canal	Section	Canal Length	Design Discharge	Maximum Discharge	Canal Bottom Gradient I	H 1 cm	H 2 cm	B cm	H cm
Main Canal I	I - 1 — I - 2	524.6 m	20 ℓ/s	30 ℓ/s	1/3,000	18	25	43	30
	I - 2 — I - 3	397.5	20	30	1/1,000	12	16	43	30
Main Canal II	II - 1 — II - 2	697.7	20	30	1/3,000	18	25	43	30
	II - 2 — II - 4	869.8	30	45	1/3,000	24	34	43	40
Main Canal III	III - 1 — III - 4	694.0	20	30	1/1,000	17	23	31	30
	III - 4 — III - 5	522.9	50	75	1/1,000	24	33	43	40
	III - 5 — III - 6	764.0	20	30	1/1,000	17	23	31	30
Link Canal A	I - 2 II - 2	792.6	45	69	1/ 500	24	34	31	40
	II' - 2 III - 4	786.3	93	141	1/ 500	29	40	43	45
	III - 4 A - 4	1,075.9	133	201	1/ 500	39	55	43	60
Total		7,125.3 m							



B : Width of canal bottom (cm)

H : Height of canal crown (cm)

h_1: Water depth at the time of design discharge (cm)

h_2: Water depth at the time of maximum discharge (cm)

f : Free board at the time of maximum discharge, being approx. 5 cm

I : Gradient of canal bottom

L : Length of canal

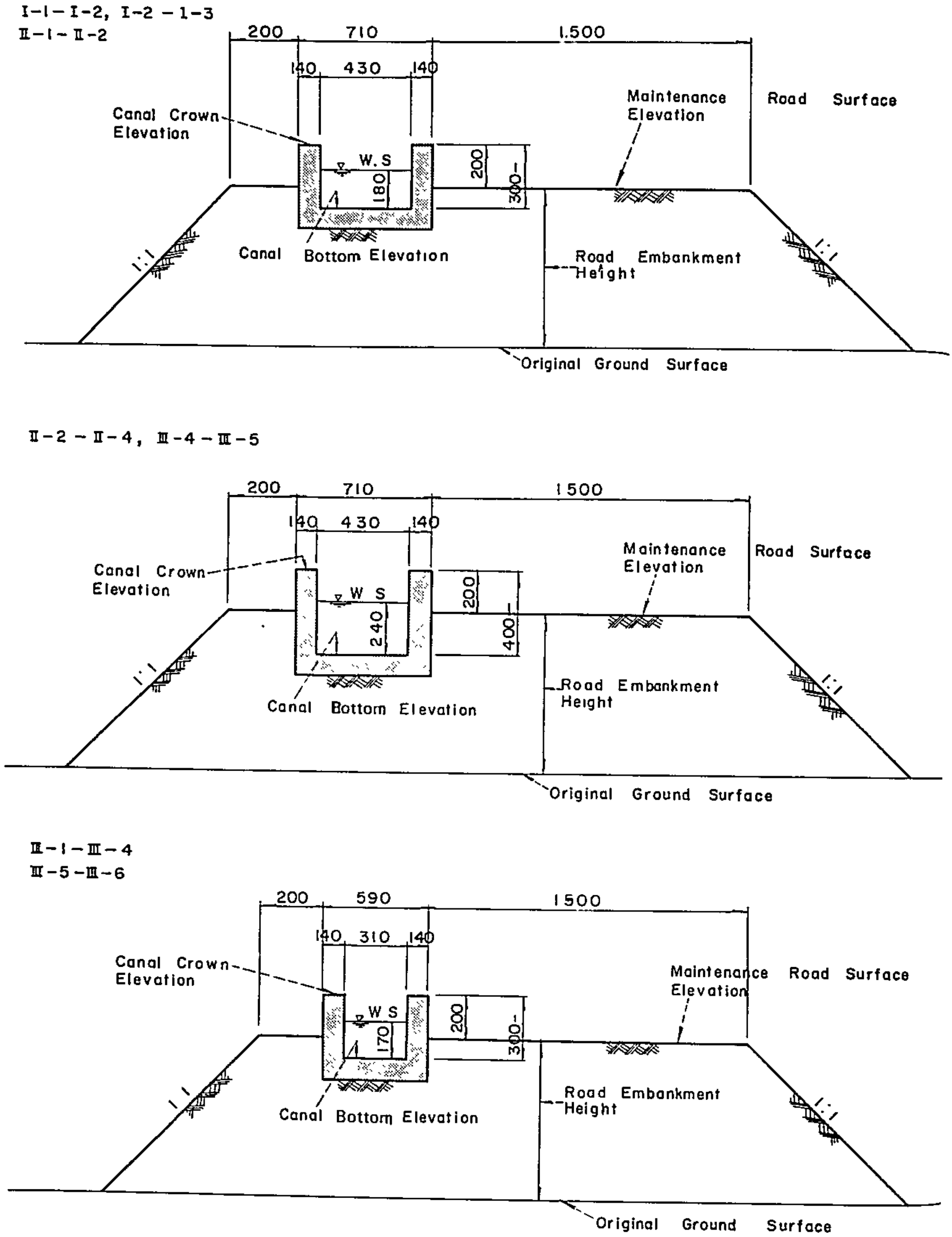


Fig. 3.2.13 Typical Cross Section of Main Canal

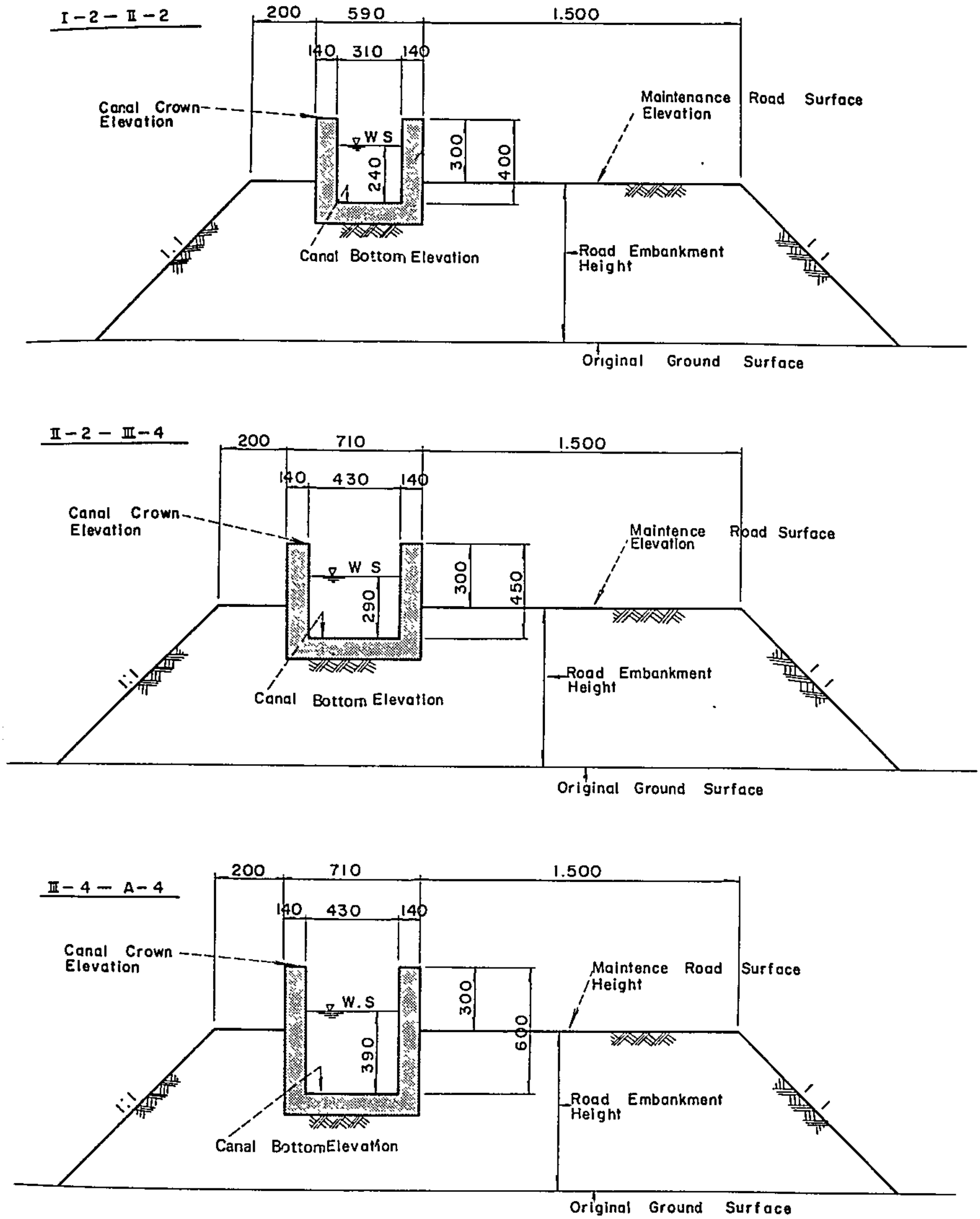


Fig. 3.2.14 Typical Cross Section of Link Canal

c) Appurtenant Structures to Canals

Appurtenant Structures to Main Canals I, II and III and link canal are as shown in Table 3.2.6.

(i) Junction Works

At each junction of the main canals and the link canal, a brick-made mortar-finished junction work of water tank type will be constructed. Road crossing will be provided with a corrugated pipe culvert beneath the maintenance road.

Junction work No. 1 :	Junction of Main Canal I with link canal
Junction work No. 2 :	Junction of Main Canal II with link canal
Junction work No. 3 :	Junction of Main Canal III with link canal

(ii) Siphon

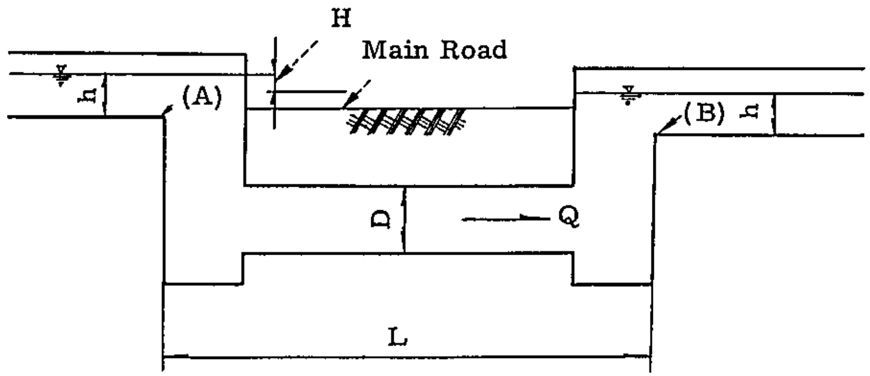
A siphon will be provided to allow the main canals and link canal to cross the main road which will be constructed by renovating the existing road. The siphon will be a corrugated pipe with its inlet and outlet parts designed to be of the water tank type brick construction finished with mortar.

Locations of the three siphons to be constructed are as shown below.

Siphon No. 1 :	Main Canal I	(II-3 + 7.5)
Siphon No. 2 :	Main Canal II	(III-5 + 10.0)
Siphon No. 3 :	Link canal	(III-4 + 65.0)

Table 3.2.6 shows the basic dimensions of respective siphons.

Table3.2.6 Basic Data of Siphons



Siphon No.	Location	Design Discharge Q	Siphon Diameter Dmm	Flow Rate in Siphon	Siphon Length Lm	Head Loss	Canal Bottom(A) Elevation at Inlet	Canal Bottom(B) Elevation at Outlet	Water Depth
No. 1	II-3 + 7.5	30 (ℓ/s) (Max. 45 l/s)	(mm) ϕ250	(m/sec) 0.61	(m) 15.0	(cm) 10	(EL m) 96.92	(EL m) 96.82	H (cm) 24
No. 2	III-5 + 10.0	20 l/s (Max. 30 l/s)	ϕ250	0.41	15.0	10	93.45	93.35	17
No. 3	III-4 + 65.0	133 l/s (Max. 201 l/s)	ϕ450	0.84	15.0	30	93.86	93.56	39

(iii) Outlet

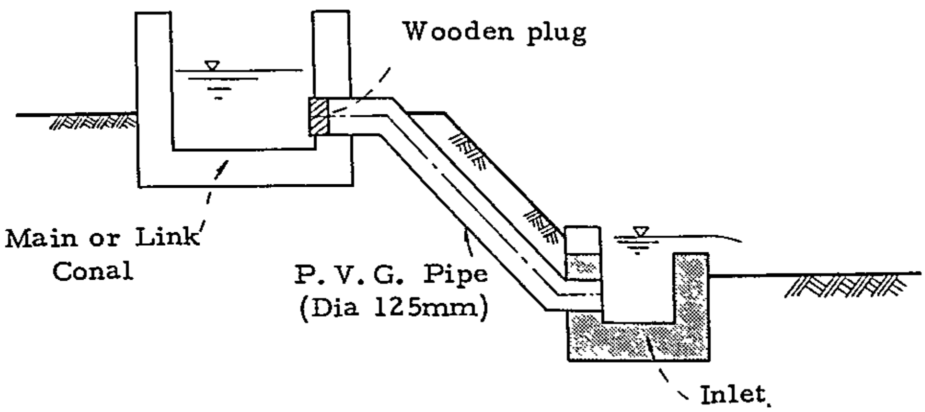
Outlets will be constructed for water distribution to paddy fields from the main canals and link canal.

The outlets will be of two types, one for diverting water to one side only and the other to both sides of the canal.

Type A : For water diversion to one side

Type B : For water diversion to both sides

As shown in the following drawing, the outlet will be so designed that water can be directly diverted from the canal through 125 mm diameter PVC pipe, with a water tank type inlet provided in the field to prevent souring effect.



To stop water supply, a wooden plug will be fitted into the pipe inlet.

The outlets will be provided at intervals of about 200 m, and water will be diverted a rate of about 30 ℓ/sec at each of them.

(iv) Culvert

Since the main canals and the maintenance road are planned to be constructed in the existing paddy fields, water from the upstream part of the area will be intercepted. To drain the water from the upstream part, it is planned that culverts will be provided beneath the main canals and the maintenance road. The culvert will be a 300 mm diameter corrugated pipe provided with a stop log at its inlet side port.

The numbers of the culverts required are broken down in Table 3.2.7.

(v) Stop Log

A wooden stop log will be provided at each end of the main canals and link canal so that water can be drained off whenever necessary.

(vi) Drop

The link canal will have several drops fitting for the gradient of the ground surface of approximately 1/350. The drop will be of the chute type having a gradient of 1/10.

4) Drainage Canal

Water supplied to paddy fields in the area from tube wells through the main canals and the link canal will have to be properly drained. During the survey conducted in October and November, 1971, the team identified some water logging around a small existing well of 1.5" diameter at about the centre of the area which was due to poor drainage and free artesian outflow. Since the topography around this well does not allow for smooth drainage and there exist no drainage canals, water stagnates in a depression making it a swamp.

The irrigation plan must therefore be accompanied by a drainage plan. Only one drainage canal along the east side of Janakpur-Mahendra Nagar Highway is now available. Natural drainage way is available on the west side, and is called Dudhmati nadi. It is therefore planned to provide drainage canals along Main Canals II and III to drain water to east and west.

Table 3.2.7 Dimensions of Appurtenant Structures of Canal

Name of Canal	Section	Canal Length	Junction Works	Siphon	Outlet Type B	Outlet Type A	Culvert	Stop Log	Drop
		(m)	(No.)	(No.)	(No.)	(No.)	(No.)	(No.)	(No.)
Main Canal I	I-1 - I-2	524.6			4		3	1	
	I-2 - I-3	397.5			2	1	2	1	
	Sub-total	922.1	-	-	6	1	5	2	
Main Canal II	II-1 - II-2	697.7				5	5	1	
	II-2 - II-4	869.8		1		6	6	1	
	Sub-total	1,567.5	-	1	-	11	11	2	
Main Canal III	III-1 -III-4	694.0				4	4	1	
	III-4 -III-6	1,286.8		1		4	4	1	
	Sub-total	1,980.8	-	1	-	8	9	2	
Link Canal	I-2 - II-2	792.6	1		4	-		-	1
	II-2 -III-4	786.3	1		3	-		-	2
	III-4 -A -4	1,075.9	1	1	1	4		1	-
	Sub-total	2,654.8	3	1	8	4	-	1	3
Total		7,125.3	3	3	14	24	25	7	3

Table 3.2.8 below shows the main features of drainage canals.

Table 3.2.8 Drainage Canals

Name of Drainage Canal	Length	Route	Remarks
1	2,280 m	Existing drainage canal along Janakpur-Mahendra Nagar Highway	Existing drainage canals are to be continuously used.
2	2,500	Existing Dudhmati Nadi	
3	1,580	East side of the area's main road	
4	1,070	North side of Main Canal II	To be newly constructed.
5	1,980	North side of Main Canal III	
6	1,200	Between III-4 and A-4 of Link Canal	
Total	10,610		

5) Road

Construction of roads is planned for water management of main canals and transportation of harvested crops.

Roads will be a main road having a length of 4.4 km and several branch roads having a total length of 7.1 km.

The main road will be constructed by improving the existing road which stems from Janakpur-Mahendra Nagar Highway at the northernmost point, crosses the western part of the area, passes through Agleswa village and then joins the above highway again. The arterial road will have an effective width of 4 m which will be metalled with gravels to ensure all-weather traffic. The proposed alignment of the main road has an enough space to accommodate the above width.

Branch roads are intended for the maintenance and operation of the main canals and the link canal and will be constructed along these canals. They will have a width of 1.5 m for bicycle and moter cycle passage and will be metalled with gravels.

The following table shows the main features of these roads.

Table 3.2.9 Features of Roads

Name of Road	Length	Route	Remarks
Main Road	4,350 m	Existing Road	Existing road to be improved
Branch Road No. 1	925	Along Main Canal I	To be newly constructed
- do - No. 2	1,570	- do - II	- do -
- do - No. 3	1,980	- do - III	- do -
- do - No. 4	2,655	Along link canal	- do -
Total length of branch roads	7,130 m		

Fig. 3.2.15 shows the typical cross section of the main road. The typical cross section of the branch road is shown on the design drawings of main canals.

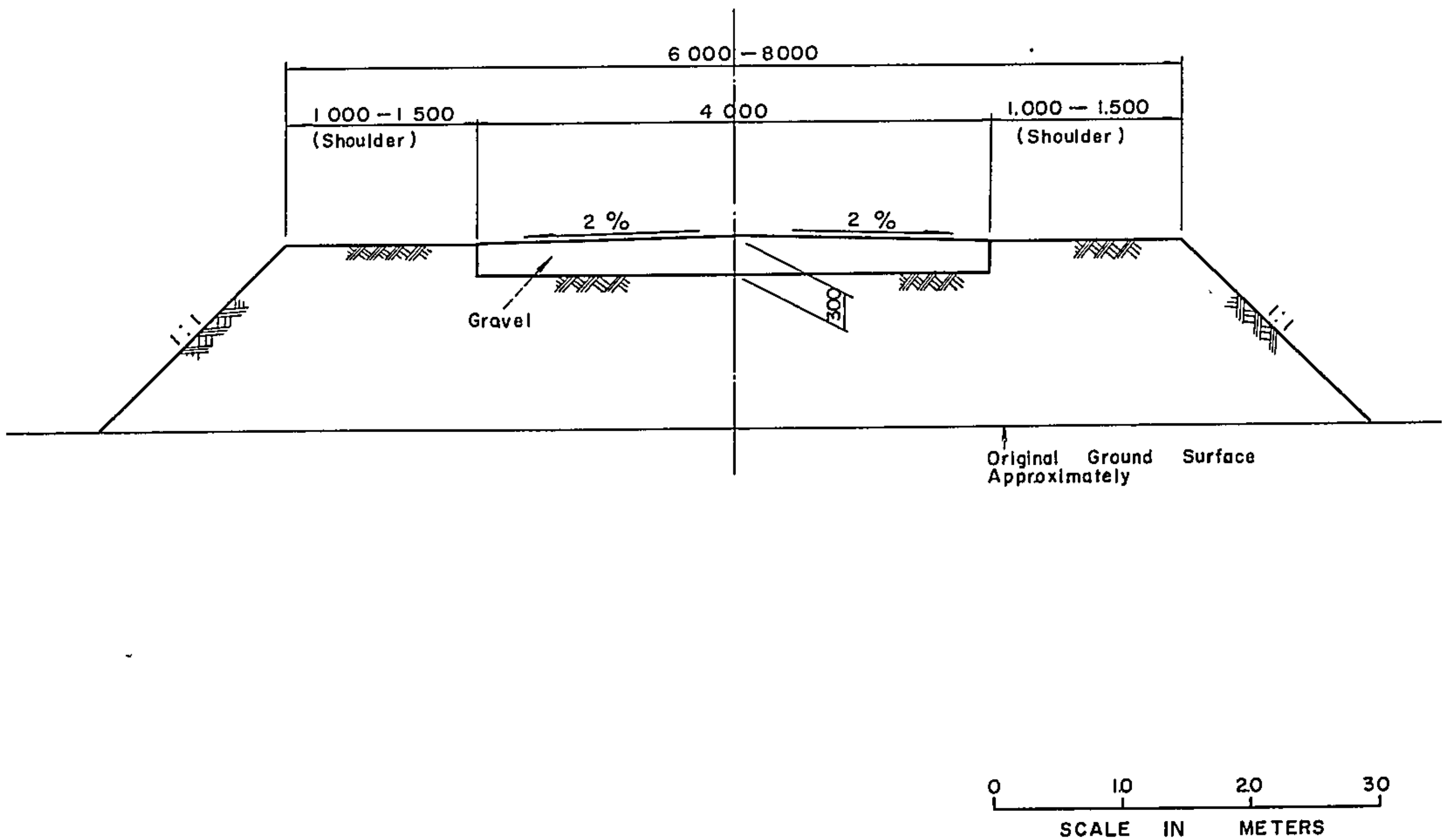


Fig. 3.2.15 Typical Cross Section of Main Road

3.2.2.2 Connecting Road

1) Route Selection

The existing road that connects the area with Hardinath Farm is the maintenance road of Hardinath Right Bank Canal and leads to Janakpur-Mahendra Nagar Highway and Janakpur. Car passage on this road is extremely difficult and becomes impossible during the wet season. Construction of a new connecting road between Hardinath Farm and the above highway was planned to ensure smooth operation of the farm throughout the year.

There are a number of existing roads which may be improved into adequate conditions to serve as a new connecting road. These include the route that passes through Nikal and Bhangha, the route that crosses Saphi and the route that leads from Kumraul to the farm via Ramdaiya. All these routes, however, cross one or more villages through which the road is frequently reducted to a very small widths, though the width is substantially large outside the village area. Since it is not possible to expand the width of roads passing through village areas, all these routes were discarded and a bee-line route is planned for the new connecting road.

At a point approximately 150 m north along the above-said highway from the starting point of Main Canal III in the southernmost part of the area, the planned route leads out from the highway at about a right angle to it, extends eastwards passing by Ramdaiya about 500 m south of it, joins the existing village road that connects Bhangha and Banaiya, and then joins the maintenance road of Hardinath Right Bank Canal. This 1.5 km long section should be newly constructed and from the point where the route joins the maintenance road of the above canal (where there is a bridge) a 1.15 km long road to the farm will be improved and used as the connecting road. Thus, the length of the connecting road is expected to total 2.65 km. This route is shown in Fig. 3.2.16.

2) Design

Since the planned connecting road plays a very important role of linking the Hardinath Farm with the Janakpur-Mahendra Nagar Highway, the entire Janakpur Agricultural Development Project will be adversely affected if free passage is impeded in the wet season.

Taking such importance into consideration this road should be constructed to have the same high standard as the Janakpur-Mahendra Nagar Highway, namely, after gravel-metalled to a thickness of 30 cm the surface will be paved with asphalt.

The road is planned to have 4.0 m of effective width and 1.0 m of shoulders on both sides, so that the total road width will be 6.0 m. A cross-grade of 2.0% will be provided from the centre line towards the shoulders. The typical cross section of the connecting road is shown in Fig. 3.2.17.

A bridge will be constructed at the starting point of the road, i.e., at the approach to the above highway, so as to connect the road with the highway across the drainage canal running along the highway. Further, culverts will be constructed at intervals of about 200 m along the 1,515 m long section because this section will be newly constructed across the existing paddy field area and this will cause the disadvantage of dividing the paddy fields blocks. Provision of these culverts will avert such disadvantage. The brick bridge crossing the Hardinath Right Bank Canal is planned to be renovated.

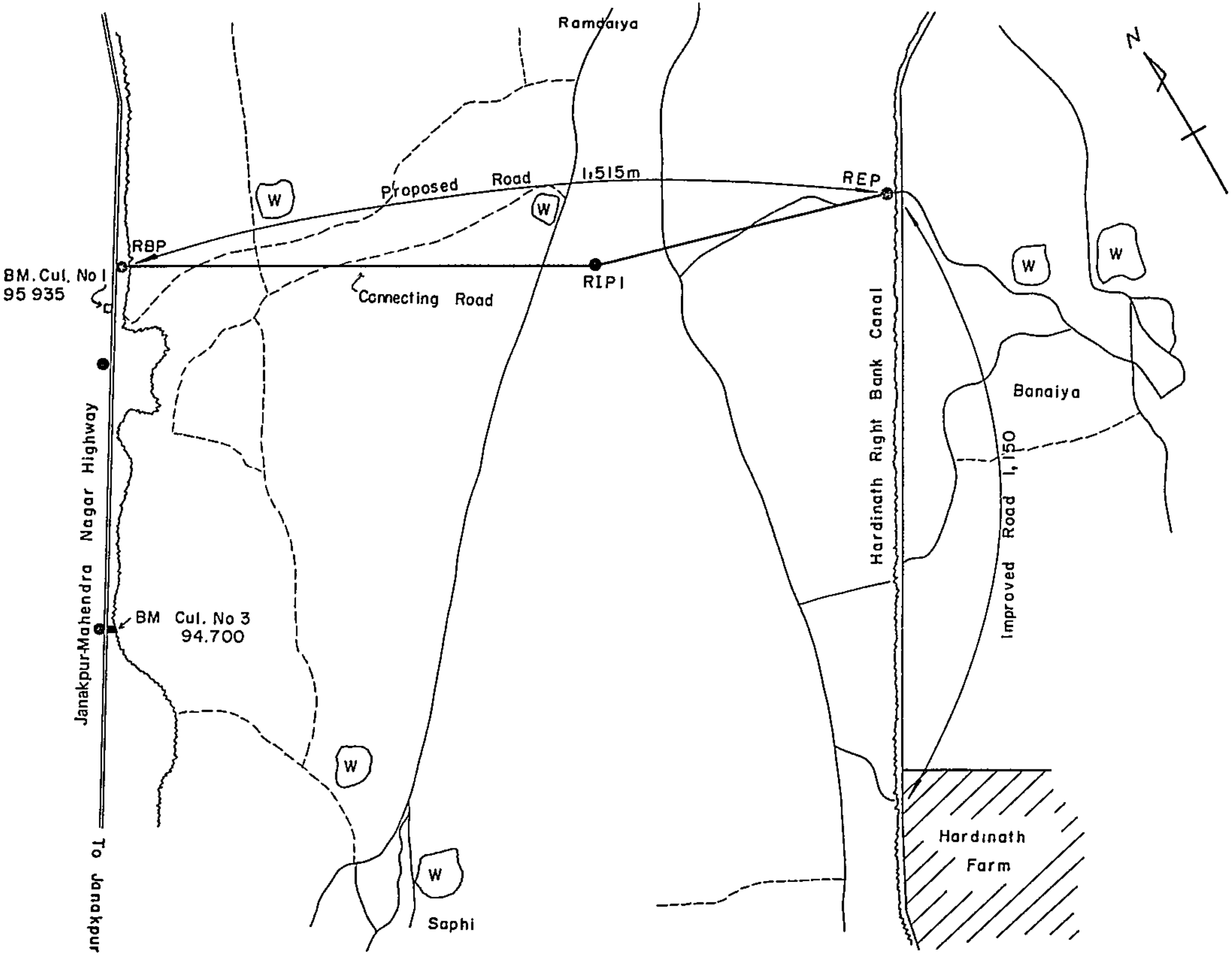


Fig 3.2.16 Plan of Connecting Road

The length and appurtenant structures of the connecting road are as described below.

1. Length of road

Length of road	Section to be newly constructed -1, 515 m
	Section to be renovated -1, 150 m
	Total -2, 665 m

2. Appurtenant structures

Bridges at two places	Width - 4.0 m, span - 6.6 m, H-type steel bridge.
Culverts at six places	Corrugated pipe with a diameter of 500 m.

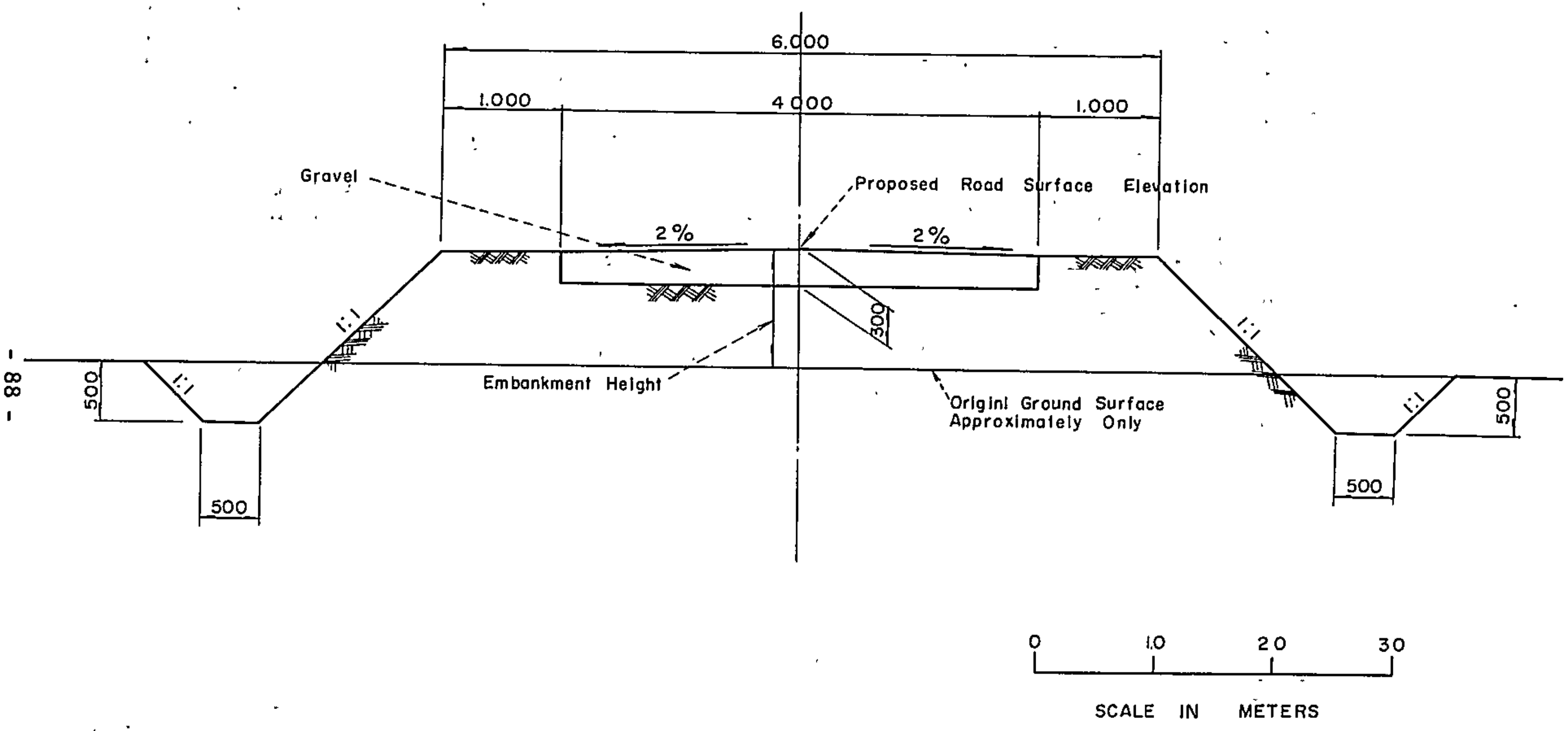


Fig. 3.2.17 Typical Cross Section of Connecting Road

3.3 Extension Activity

3.3.1 Farming Techniques

Farming techniques planned to be diffused through extension service are by no means highly advanced modern techniques. Rather, they are the techniques a step advanced from but based on the traditional farming practices and are therefore acceptable for farmers.

There can be observed no large differences in the techniques employed by ordinary farmers in the agricultural extension area. It is noted, however, that agricultural capital input varies by the economic footing of individual farmers and that introduction of modern farming techniques is affected by the availability of irrigation water. In their respective service areas, therefore, extension workers are required to encourage farmers to apply the new techniques which are most suited for their individual financial footing and the condition of their fields. Hence, the new techniques must be extended through the mutual co-operation and ingenuity of extension workers and farmers.

3.3.1.1 Cropping Pattern

1) Paddy Field Area

In the paddy field area of Tarai Plain, the following basic cropping patterns prevail by reason of the irrigation and drainage condition of fields.

a) Paddy fields favoured with good year-round irrigation and drainage condition

Pattern 1 :	Paddy --- Paddy
Pattern 2 :	Paddy --- Paddy --- Winter crop of green manure
Pattern 3 :	Paddy --- Wheat or winter crop of vegetables
Pattern 4 :	Paddy --- Winter crop of pulses, or mustard
Pattern 5 :	Summer crop of green manure crops --- Paddy

Pattern 6 : Summer crop of green manure crops --- Paddy --- Wheat or winter crop of vegetables

Pattern 7 : Summer crop of green manure crops --- Paddy --- Winter crop of pulses, or mustard

Pattern 8 : Paddy --- Autumn crop of vegetables

Pattern 9 : Paddy --- Autumn crop of vegetables --- Wheat or pulses

Patter 10 : Summer crop of vegetables --- Paddy

b) Paddy fields with good year-round supply of irrigation water and poor drainage condition.

Pattern 11 : Single cropping of paddy

Patterns 1, 5 and 10 listed in Item 1) also prevail.

c) Paddy fields cultivated by wet season supplementary irrigation and provided with good drainage condition.

Patterns 3, 5, 7 and 8 listed in Item 1) prevail.

d) Paddy fields cultivated by wet season supplementary irrigation and having poor drainage condition.

Patterns 11 and 5 prevail.

e) Rain-fed paddy fields

Pattern 11 alone prevails.

2) Upland Field Area

Upland crops are grown mostly in the rain-fed field area and partly in the paddy field area for farmers' domestic consumption and cultivation of cash crops.

a) Rain-fed upland fields

Pattern 12 : Maize --- Mustard, millet or pulses

Pattern 13 : Upland paddy --- Autumn crop of vegetables or millet or pulses

Pattern 14 : Wet season crop of vegetables --- Autumn crop of vegetables

b) Irrigable upland fields

Pattern 15 : Maize or upland paddy --- Autumn crop of vegetables, or tabacco

Pattern 16 : Maize or upland paddy --- Autumn crop of vegetables --- Winter crop of vegetables

Pattern 17 : Summer crop of green manure crops --- Tobacco or autumn crop of vegetables

Pattern 18 : Single cropping of sugar cane

Cropping patterns shown above are not the fixed but basic ones from which various variations can be devised. Combinations of cropping patterns are also devised for extension over a number of years. In such a case, adoption of a pattern involving green manure crops should be encouraged for both paddy fields and upland fields so as not to cause the decline of their soil fertility.

Crops can be classified as follows by cropping season.

Winter crop of green manure crops: Khesary, peas, and Egyptian clover.

Summer crop of green manure crops: Dhaincha, and cow peas.

Winter crop of pulses : Khesary, Chana, and peas.

Summer crop of vegetables: Water melon, egg plant, tomato, pumpkin, sponge gourd, cucumber, red pepper, melon, okra, amarantas, etc.

Wet season crop of vegetables: Taro, sweet potatoes, gourds and melons, tomato, egg plant, pumpkin, red pepper, ginger, turmeric, cow peas, and okra.

Autumn crop of vegetables: Potatoes, tomato, egg plant, red pepper, cauliflower, cabbage, raddish, leaf beet, cow peas, etc.

Winter crop of vegetables: Onion, potatoes, cauliflower, cabbage, raddish, leaf beet, etc.

3.3.1.2 Improvement of Farming Practices

In the paddy field area of Tarai Plain, paddy is the major crop in the wet season and pulses in the dry season. In the upland field area, on the other hand, mustard and tobacco constitute the main crops during the dry season, with sugar cane grown throughout the wet season. In the coming years, cultivation of wheat and vegetables in paddy fields should be augmented, with efforts also made for the introduction and extension of greem manure crops. In the upland field area, however, introduction of new crops is not considered to take place for some time to come.

Problems involved in the currently adopted farming practices will be brought to light and solved with the progress of the project. Improvement to be made for the present are as described below.

1) Paddy:

a) Ear manuring fertilization should be carried out for local varieties from the young-ear formation stage to the earing time. Standard dosage of ear manuring should be 40 kg of N and 20 kg of K_2O per ha.

Reason for the retarded progress of fertilizer application is that farmers are still subjected to yield instability resulting from deficient supply of irrigation water and damages of diseases and insect pests and therefore tend to say away from the risk involved in capital input for fertilization. However, since ear manuring period coincides with the time when the harvest prospects can be made clear, farmers can decide whether to apply fertilizers or not. Further, ear manuring produces a prominent effect for the small fertilizer requirement and can be introduced by farmers with relative ease.

Standard dosage of fertilizers by crop is as shown in Table 3.3.1.

b) Healthy seedlings should be raised by seed assortment, fertilization and thin rate seeding. In nursery beds of conventional type, thick sowing produces extremely weak and poor seedlings so that the number of effective tillers in the paddy field is largely reduced. Raising healthy seedlings is not only the key to increased yield but also can be readily practised by any farmer. Dosage of fertilization in nursery beds is as shown in Table 3.3.1, and seeding rate per ha is as given below.

Acreage of Nursery Bed	7 a - 10 a
Seeding Rate	38 kg (smaller seeds) - 50 kg (larger seeds)

Brine assortment of seeds is advisable. If farmers show resistance to this method, they should be encouraged to introduce wind selection.

Table 3.3.1 Standard Dosage of Fertilization by Crop

Crop	N	P_2O_5	K_2O	Remarks
1. Paddy				
Nursery Bed	10	10	5	g/m^2
Paddy Field (local varieties)	60	60	20	kg/ha
Paddy Field (improved varieties)	100-120	60	20	"
Additional Manuring	40	0	20	"
2. Wheat	100	60	40	"
3. Maize	80	60	40	"
4. Sugar Cane	200-250	60	30	"
5. Mustard	80	60	30	"
6. Pulses	20	60	30	"

c) Weeding is practised by some farmers and all the farmers are aware of its effect. At the initial stage, farmers should be induced to carry out manual weeding every 30 - 40 days after transplanting. When they come to recognize the need for mechanization, guidance should be given on row planting method and use of weeding wheels. It is to be noted that herbicides such as granulated PCP and 2.4.D are used for intensive farming carried out by few farmers.

d) Varieties should, in principle, be selected from among local ones. However, improvied varieties like 1R-8 1R-5, Masuri and Malinja are to be introduced for early-planting culture and T141 for cultivation in deep-mud paddy fields when farmers' fields come to be favourably conditioned for the growth of these varieties.

e) Late-planting culture will continue to be the basis of paddy cultivation in future. However, early-planting will have to be encouraged for paddy cultivation in well-irrigated fields. Though transplanting can be carried out in February in early-planting culture, transplanting in March - April period is recommendable for some time to come. As for late-planting culture, transplanting in June should be enhanced for cultivation of medium varieties in fields with favourable irrigation and drainage condition so that wheat may be introduced as succeeding crop.

It is to be noted that early-planting paddy develops bacterial leaf blight and white head due to the hot wind blowing in the ripening period and is therefore unstabilized in crop condition. In addition, if its reaping time coincides with the wet season, farm works such as reaping, drying, winnowing and transport are made difficult and shortage of farm labour arises because of the transplanting of late-planting paddy. It cannot therefore be expected that the planted area of early-planting paddy will be increased in future.

f) Disease and Insect Pest Control

Considerable damages are known to be caused by blast, bacterial leaf blight, rice borers, planthoppers, stink bugs and other diseases and pests. Efforts should therefore be directed towards chemical control of diseases and insect pests using MEP (Sumithion), Malathon, Bordeau liquid, New Sankel, and Kasumin. At the initial stage, these chemicals will have to be applied by individual farmers using shoulder-type sprayers but at a later stage when the project progresses to some degree, collective insect and disease control should be put in practice. At present, BHC, Pholidol and other chemicals which are banned in advanced countries for their harmful effect on human body constitute the majority of agro-chemicals. Throughout the project period, therefore, efforts should be exerted for replacing these harmful chemicals with harmless ones.

2) Wheat:

Wheat is a rather new crop in Janakpur Zone and its farming method is not yet fixed. Introduction of its modern farming techniques will be relatively easy as compared with other crops. Efforts should therefore made for increasing its planted area in paddy fields after paddy harvesting.

a) Suitable seeding period is from mid-November to late November. If the harvesting of the preceding crop is delayed, seeding may be carried out in early December but not later. If paddy is the preceding crop, its reaping should be completed by the end of October and suitable paddy variety should be selected.

b) Improved Indian and Mexican varieties such as S-227, C-306, Sonora 64, Lerma Roho 64 and RR21 should be cultivated since these are all high-yielding varieties and can be grown with ease.

c) Fields where wheat is grown are either irrigable or rich in soil moisture and fertilizers can be always applied. Dosage of fertilization is as shown in Table 3.3.1. Base fertilizers should be plowed in at time of fallowing work immediately before seeding time, whereas additional fertilizers are to be applied in time with inter-tillage in January.

d) Weeds growing in wheat fields vary in kind by soil moisture but most of them belong to Polygonum spp. and Chenopodium spp. Manual weeding work should be conducted once or twice. For advanced farmers, application of herbicides such as 2.4.D and granulated CAT should be encouraged.

e) Wheat is less vulnerable to diseases and pests than other crops but is occasionally afflicted with heavy occurrence of Puccina spp. for which sterilization with Seresan is required.

3) Other Crops:

Maize - Stress should be placed on the extension of improved varieties (Khumal-yellow and Rampur-yellow), fertilization (See Table 3.3.1), weeding, intertillage and molding. Intertillage, weeding and molding should be manually carried out two to three times with care.

Sugar Cane-Extension of improved varities (B034, B050, C0416), fertilization (See Table 3.3.1), weeding, intertillage and molding should be given importance. Maximum efforts should also made for introduction of irrigation farming.

Mustard - Fertilizers should be applied (See Table 3.3.1). If Boron deficiency symptom develops, 5 kg of borax diluted in 540 ℓ of water should be used per ha for foliar application.

Pulses - Since pulses are grown mostly as the succeeding crop of paddy and seeds are sown during the growing of paddy, after manuring is conducted. Granulated synthetic fertilizers (See Table 3.3.4) should therefore be applied after paddy is reaped.

Vegetables - With no studies as yet made on vegetable cultivation in Tarai Plain, nothing definite is known about improved varieties and dosage of fertilizer application. Pending the completion of trials at Hardinath Farm, therefore, local varities are to be grown with fertilizers applied according to the dosage shown in the data obtained in Kathmandu and North Bihar, India. Improvement should be effected to the seedling raising techniques. At the initial stage of the project, however, seedlings raised at Hardinath Extension Farm are to be distributed to farmers.

3.3.1.3 Introduction of Improved Farming Implements and Machinery

As discussed in the second survey report, improvement and introduction of farming equipment is a must for the development of Nepalese agriculture. Efforts are now being made by both the government and people for improving plows, bullock carts, weeding wheels, pedal rotary threshers, etc. Use of these improved equipment will raise the efficiency of farm work including plowing, transport, weeding, harvesting and winnowing. By further introducing such equipment as shoulder type dusters, small type irrigation pumps and powered thereshers, improvement can be expected in the supplementary irrigation to paddy fields, upland field irrigation, disease and pest control, and harvesting and winnowing work. It is to be noted, however, that introduction of hand tractors and tractors should be preceded by a preparatory stage for providing farmers with necessary mechanical knowledges, securing the supply of parts and establishing repairing facilities.

3.3.1.4 Utilization of Livestock

Local bullocks cannot be used for tracting improved plows due to their small size and power, nor do they provide a high transport capacity when employed for bullock carts. For this reason, improved Indian species (Harana) should be introduced as breeding stock for breeding and rearing of improved local species in respective villages.

For increased production of buffalo milk, introduced Delhi species are used for mating at the veterinary hospital. It is considered that these breeding stocks should be introduced in larger numbers for distribution to local communities so that mating may be carried out in villages as in the case of bullocks.

Livestock rearing is carried out in an extremely rough way at present. Hence, efforts for livestock breeding should be accompanied by the forage crop cultivation on farm land so that drylot feeding will be materialized. Drylot feeding will open the way for increased production of compost and stable manure and improvement of soil productivity. Techniques for increasing compost and stable manure production should be diffused among farmers without delay.

3.3.2 Agricultural Extension System and Farmers' Organizations

3.3.2.1 Agricultural Extension System

1) Existing State of Extension System

Diffusion of agricultural techniques in Nepal is carried out solely by HMG's extension system. Since the agricultural development planned under the project is to be prompted through this system, fostering of the system is a prerequisite to smooth progress of the project.

HMG's extension system in Janakpur Zone is illustrated below.

Agricultural Extension Director (HMG)
↓
Janakpur Regional Agricultural
Development Officer (RADO)
↓
Agruicultural Development Officer (ADO)
↓
Junior Technical Assistant (JTA)
↓
Farmers

The Janakpur RADO assumes the overall responsibility for agricultural development in Janakpur Zone and Sagarmatha Zone. Janakpur Zone has five ADOs who are stationed in five of the six districts of the zone. These five districts are Dhanukha, Mahotari, Sarlahi, Sindhuli and Ramechhap. Under each ADO are assigned 7 to 14 JTAs who are stationed in respective villages and engaged in the actual extension service. Table 3.3.2 shows the numbers of extension staffs, panchayats, and panchayats covered by extension service at present in Janakpur Zone.

Of a total of 367 panchayats of the zone, those which enjoy the benefit of extension activities in some way or other count only 143. It is known that JTA's training period varied considerably in the past. The training period was as long as two years at the outset, reduced to only three months some time in the past, and recently extended to one year. Since the level of training curriculum is not very high, JTA's technical knowledges are rather poor and this is impeding the smooth progress of terminal extension activities.

Table 3.3.2 - Panchayats and Extension Staffs in Janakpur Zone (November 1971)

1. Regional Agriculutral Development Office

Regional Agricultural Development Officer 1

Peon Office Assistant 1

2. ADO, JT, JTA and Panchayats

District	ADO	JT	JTA	Total	Covered
	(Extension Staff)			(Panchayat)	
1. Dhanukha	1	3	11	103	33
2. Mahotari	1	2	12	96	35
3. Sarlahi	1	2	14	44	44
4. Sindhuli	1	1	13	43	13
5. Ramechhap	1	1	7	41	18
6. Dolakha	-	1	3	40	-
Total	5	10	60	367	143

2) Improvement and Fostering of Extension System

It is planned that the fostering of the extension system will be taken up as the primary need in the project implementation.

a) Relationship between Regional Agricultural Development Office and Janakpur Agricultural Development Board and their positions in the government's extension system are a matter which is to be determined by HMG. It is hoped, however, that Janakpur RADO will be reorganized to cover Sagarmatha Zone alone and all ADOs in the zone be brought under the control of JADB.

b) It is to be understood that not all the districts will be covered by the forthcoming full-scale cooperation from the outset of the project even if all the ADOs, JTs and JTAs in the zone are assigned to the project implementation. Extension activities in all the districts will not go beyond the current level, and full-scale cooperation programmes in the districts in Tarai Plain will be put in practice in the order of Dhanukha district --- Mahotari district --- Sarlahi district. When the extension system in Inner Tarai is substantially improved, efforts will be made to diffuse its effect in Sindhuli district in Inner Tarai and then Ramechhap district in the hilly area. For Dolakha district, it is not considered possible to provide a satisfactory extension system during the cooperation period.

c) The project implementation calls for the increase in the numbers of JTAs and JTs (Junior Technicians) who provide technical training to JTAs. As shown in Table 3.3.3 (Annual Plan for Increasing JTs and JTAs), it is planned that 16 JTs and 70 JTAs will be newly appointed during the cooperation period. It is also planned that if the recruiting of new JTs involves any difficulty, JTAs who have a long and excellent service record will be appointed Acting JTs on the responsibility of JADB. It is expected that by the augmented availability of JTAs, 333 out of a total 367 panchayats will receive the benefit of extension service.

Table 3.3.3 Annual Plan for Increasing JTs and JTAs

District	Status	Present (1971)	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	Total
Dhanukha	JT	3		2						7
	JTA	11	10	10	3					34
Mahotari	JT	2			2	3				6
	JTA	12			7	10	3			32
Sarlahi	JT	2					1			3
	JTA	14					1			15
Sindhuli	JT	1					2	1	1	5
	JTA	13					6	3		22
Ramechhap	JT	1						2	2	5
	JTA	7						7	7	21
Dolakha	JT	1								1
	JTA	3							3	6
Total	JT	10	10	12	14	17	20	23	26	26
	JTA	60	70	80	90	100	110	120	130	130
Total Increase	JT	-	-	2	2	3	3	3	3	16
	JTA	-	10	10	10	10	10	10	10	70

d) Each JTA will cover three panchayats in Tarai Plain and two in Inner Tarai and hilly area, and each JT will be responsible for training about five JTAs. In order to bring extension activities to a success in the face of poor transport condition, the maximum coverage of each JTA should be limited to one to two panchayats in Tarai Plain and one in Inner Tarai and hilly area. However, since the services of a sufficient number of extension staffs required for satisfactory and wide-spread extension service cannot be expected in the cooperation period due to the limited scale and budgetary appropriation of the government's training institutes, it is planned that as many farmers as possible will be given the benefit of the extension activity through the staff increase to be realized during the project period.

e) It is considered that the maximum number of farmers with whom one extension worker can maintain close personal contact is about 15. This number could drop to one to two if the ability of JTA is poor. It is also considered that one extension worker can grasp and pay constant attention to the farm management, technical level and volition for improvement of about 100 farmers at most. The number of farmers with whom one extension worker can have personal acquaintance is believed to be about 500 including the above 15 and 100 farmers. Of these 500 farmers who will be covered by one extension worker, 15 or less will be given actual technical guidance and the remaining 485 will receive the benefit provided in the form of supply of materials and equipment for development and introduction of improved varieties. It can naturally be expected that farmers who are given intensive technical guidance will influence other farmers.

f) The extension system will be run chiefly by HMG's staffs. Direct participation of Japanese experts in the operation of the system will be minimized and their services will be limited to close technical cooperation with HMG's staffs.

3) Quality Improvement of Extension Staffs

Improvement and fostering of extension activities hinges, above all other things, on the services of JTAs. Personal contact between JTA and farmers is the start of extension activity and their mutual confidence is the only and most important key to the progress of agricultural extension.

It is through the confidence which farmers place in their JTA that they endeavour to accept and digest enlightenment and new information he provides and groups of progressive farmers attempt to apply new techniques.

To win such confidence, JTA's personality counts a great deal, but at the same time, he must understand and be understood by farmers and have deeper technical knowledges than farmers. It is to be added that the willingness, self-confidence and enthusiam towards the extension activity are also essential for winning the farmers' confidence.

Further, to assure smooth progress of agricultural development, each JTA is required to have full understanding of the agriculture and farmers in his service area and have the capability to detect and map out countermeasures for problems.

To put in other words, he is demanded to grasp and analyze the technical level, management condition and volition of the farmers he is serving and at the same time take measures for solving whatever problmes he may discover. Hence, he must have a keen power of observation and judgement as well as an excellent synthesizing ability.

For successful impelemention of the project, JTAs are expected to be active and forward looking in the performance of their duties and for this purpose, the following measures will be taken.

a) JTAs will be trained on the basic technical knowledges of agriculture and related industries and will also be given instructions and guidances on the extension method at Hardinath Extension Farm.

b) They will be given information on new techniques, equipment, materials and varieties through ADO either periodically or as occasion arises.

c) They will be given instructions and guidances on the actual extension service in their respective service areas by ADO or JT.

d) They will in principle be stationed in areas in which their own birthplace is found and their own language is spoken. Under the extension policy currently adopted by HMG, JTAs are dispatched to areas far from their native place. Since the mutual communication and understanding between JTAs and farmers is the basis of extension activities, this practice is not commendable though it may be justified by some good reason.

e) They should preferably be stationed at the same place for as long a period as possible. A JTA arriving at his new place of assignment must make a year or more of incessant efforts before he gets himself sufficently informed of the situation of his service area and establish close personal relations with farmers. If the language spoken in his service area differs from his own, he needs a longer preparatory period. Since he cannot be expected to undertake full-scale extension activity in such preparatory period, transferring him to another place after a short service period cannot be justified. Disadvantages that may arise from long-term assignment should be counterbalanced by suitable means.

f) HMG should provide a good climate for extension activities so that JTAs may discharge their duties with determined will and enthusiasm. Many JTAs are known to be living alone and apart from their families and depending on the leaders in their service area for daily meals. Unless their treatment is improved to the extent that they can at least live with their families in their service area, it will not be possible to break out of the vicious cycle of training new JTAs and letting them leave their post.

g) JTAs currently engaged in extension activities are the high school graduates who were given a certain period of training. Plans should be drawn up for recruiting agricultural college graduates for intensified extension service in future. By way of experiment for this purpose, it is planned that agricultural college graduates will be stationed as extension staffs in the irrigation infrastructural improvement area.

4) Cooperation with Related Organizations

HMG's organizations which will be cooperating in the extension activities can be grouped into two types, one specialized in technical fields and the other in economic aspect.

Technical organizations include Janakpur Agronomy Experiment Farm, Janakpur Horticulture Centre, Janakpur Fish Farm and Janakpur Cigarette Factory Farm. These organizations will cooperate in the project implementation through tests and experiments and production of seeds, seedlings and fries. Besides these organizations, Janakpur Veterinary Hospital will also participate in the project through medical treatment of domestic animals and breeding of bullocks and dairy buffaloes.

Economic organizations are expected to offer full support to the project. Major economic organizations are Agriculutre Supply Corporation (ASC) and Agriculture Development Bank (ADB).

a) Agriculture Supply Corporation

Practically all the materials and equipment required for agricultural development, such as seeds of improved varieties, fertilizers, agro-chemicals, farming implements and machinery, etc., are supplied by ASC. Hence, its structural and functional improvement should be prompted with the progress of the project.

In Janakpur Zone, ASC has its branch office located in Janakpur city but its depot is found only in one district, Sarlahi. In future, at least one depot should be established in each district and at the project centre. Under each depot should be established sales offices which are to be located in bazaar areas so that farmers may be able to easily obtain the equipment and materials they want. Excepting those which are operated directly by ASC, the sales offices will be run by local merchants on a commission basis.

For the transport of implements and materials handled by ASC, trucks procured for the project implementation will be made available. Staffs occupying themselves with the ASC's sales service will be required to have the same qualifications as those of JTA and assistance will be extended for this purpose under the project.

b) Agricultural Development Bank

ADB advances funds for purchase of fertilizers and seeds, development of livestock farming, development of minor irrigation, and small-scale agricultural product processing schemes. In Janakpur Zone, the bank has branch offices in Janakpur city, Sarlahi and Jaelswar. It is expected that the bank will have one branch office at the project centre and establish increasingly many branches in future when the project comes to cover Inner Tarai and hilly area.

3.3.2.2 Farmers' Organizations

Due to the diversity of natural conditions inherent to the country, the socio-economic condition presents a wide gap between districts. In Tarai Plain alone, farmers' conditions vary largely by their class. As described in the second survey report, therefore, introduction of improved techniques and resulting production increase is liable to lead to a wider gap between classes without bringing about direct promotional effect on the production of the zone's inhabitants.

As in other developing countries, creation or reorganization of farmers' organizations is not at all an easy task in Nepal. It is desirable that production, purchase and marketing cooperative societies will be created or reorganized in the project area at an ealy date. During the project period, however, this will actually be next to impossibility. In this section, therefore, description will centre on the producers' cooperative society and the groundwater irrigation association which are planned to be established in the irrigation infrastructural improvement area where the cooperation programmes will be enforced in the beginning of the project period.

1) Producers' Cooperative Society

With the improvement in irrigation facilities, advanced irrigation farming techniques involving rational water distribution, fertilization, application of agro-chemicals, use of improved farming implements, etc. will be introduced in the project area.

To attain the maximum results from the limited availability of irrigation water, it will become inevitable to control the planting area and transplanting time, and this is considered to bring about changes in labour force. The producers' cooperative society to be established in this area will decide on questions relating to production (such as the control of cropping system, etc.) through the discussion of its members and endeavour to attain increased production.

Since no cooperative societies for purchase and marketing are existent in this area, their functions could temporarily performed by the said producers' cooperative society.

2) Groundwater Irrigation Association

The groundwater irrigation association to be established in the project area is an organization which will maintain the quality and quantity of groundwater for irrigation on a satisfactory level over a long period and assure its rational utilization. Groundwater is a public property like surface water and its arbitrary use for private purpose is not permissible. This must be stressed from the fact that tube wells are to be dug by HMG, and will therefore be the government property to be commonly used within the 420 ha irrigation area. Maintenance and operation of the tube wells will be undertaken by the said groundwater irrigation association under the control of the government. Expenses for maintenance and operation will be borne by the beneficiary farmers as water utilization fee. Water charges to be collected from farmers are determined on the basis of the cultivated area and quantity of water supplied. The rate of water changes will be reexamined when the irrigation facilities are consolidated to a satisfactory degree. From the viewpoint of water utilization, the association resembles the producers' cooperative society but differs from it in that it functions for the control and maintenance of water and facilities rather than for agricultural production. Detailed design of the functions, structure and other particulars of the above two organizations will be studied during the next survey.

3.3.3 Domestic Water Supply Plan

Ramdaiya and Saphi are the two major villages found in the irrigation improvement area. Domestic water supply facilities are established in neither of the two villages. Domestic water is obtained from 28 shallow wells in Ramdaiya and from 21 shallow wells and two flowing wells in Saphi. Since all these wells were dug without timbering, water drawn from most of them is contaminated. Test of water quality disclosed that the contamination is very heavy. At one of the wells, the test recorded an electric conductivity of 2, 100 uv/cm, pH value of 7.2 and water temperature of 25° C.

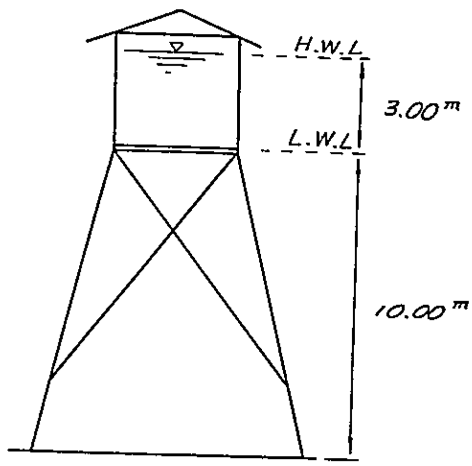
For these two villages which were covered by the third survey, the following domestic water supply plan was designed. In this design, it is planned that water from the tube well will be pumped up into an elevated tank in each village and then distributed through the distributing main to common hydrants each covering 150 persons.

1) Population Covered and Water Consumption

In either village, population in the central part is approximately 3, 000. Since the central part is already overpopulated, it is not likely that its population will increase sharply in future. Accordingly, calculation was worked out assuming that the population to be supplied is 3, 000. Consumption of domestic water per day per person, as obtained through interviews with farmers, is 30ℓ. Assuming that the maximum daily water consumption will be 1.5 times this value in future, the daily water supply was calculated to be 135, 000ℓ as shown below.

30ℓ x 3, 000 persons x 150/100 = 135, 000 ℓ/d

It was assumed that water would be required to be supplied for an average of 14 hours a day and that twice the normal supply would be required in two peak consumption periods occuring around 10.00 a.m. and 6.00 p.m. The maximum houly discharge satisfying this assumption is 19.3 m^3/h (= 5.4ℓ/s) as calculated below.



$(135/14) \times 2 = 19.3\ m^3/h$

2) Water Source

Since ample artesian groundwater supply can be expected in both Ramdaiya and Saphi, a tube well will be made in the vicinity of the storage reservoir in the northern part of the cluster of each village. The ground level and the height of piezometric surface at the proposed well sites are estimated to be as follows.

	Ground Level	Height of Piezometric Surface	Height of Piezometric Surface above Ground Surface
	(m)	(m)	(m)
Ramdaiya	98.7	100.2	+1.5
Saphi	92.8	97.5	+4.7

The casing pipe will have a diameter of 6" to provide the design pump discharge of 8.5ℓ/s, and a gravel wall type screen having an outside diameter of 6" and inside diameter of 4" will be installed in the lower aquifer to prevent the inflow of sand.

As described in Section 3.2.2.1 (Irrigation Area), the aquifer is mostly in the sandy gravel layer ranging from 82 to 100 m in depth and is estimated to have a total thickness of about 20 m. For the installation of the above-mentioned casing pipe, it is considered that a well depth of 130 m and a drilling diameter of 10-5/8" will suffice.

The well will have 6"ϕ casing pipe from the ground surface to the aquifer, and a 4"ϕ (outside dia. 6") gravel screen in the aquifer. As in the case of irrigation wells, the surface of the well will be covered with a 4" discharge pipe, with a sluice valve provided on the side to prevent free discharge of flowing water. Since the valve is to be opened to pump up well water during the pump operation, the pump and the well cap will be directly connected.

3) Pump and Elevated Tank

A self-priming pump with a total head of 20 m and a discharge rate of 0.5 m^3/min (= 8.5 ℓ/s) is planned to be used. 5 HP will be sufficient for operating this pump.

The elevated tank is planned to be a cylindrical steel plate-made tank having a capacity for an hour's peak supply, i.e., 19.3 m^3 = 20 m^3. The tank will have an inside diameter of 3 m and a height of 3 m (effective water depth - 2.83 m) and will be provided with a cover after mounted on its supporting legs. Considering the hydraulic-grade line of the distributing pipe, the supporting legs will be required to have a height of 10 m. No sterilizing equipment are planned to be installed since water quality is satisfactory.

4) Distributing Pipe

Branch points are planned to be so installed that each will cover 25 households. Assuming that each household has an average of six family members, the number of branch points in each village turns out to be 20 as calculated below.

3, 000 (persons) ÷ (25 (households) x 6 (persons)) = 20

Since the simultaneous water supply ratio is supposed to be 4.0, the number of hydrants supplying water at a same time will be 5. The hydrants are planned to have a diameter of 25 mm, and the standard water consumption from a hydrant of this diameter is 65ℓ/min (≒ 1.1 ℓ/s). Therefore, if the peak discharge is 5.4 ℓ/s, the number of hydrants from which water can be supplied simultaneously will be five as calculated below.

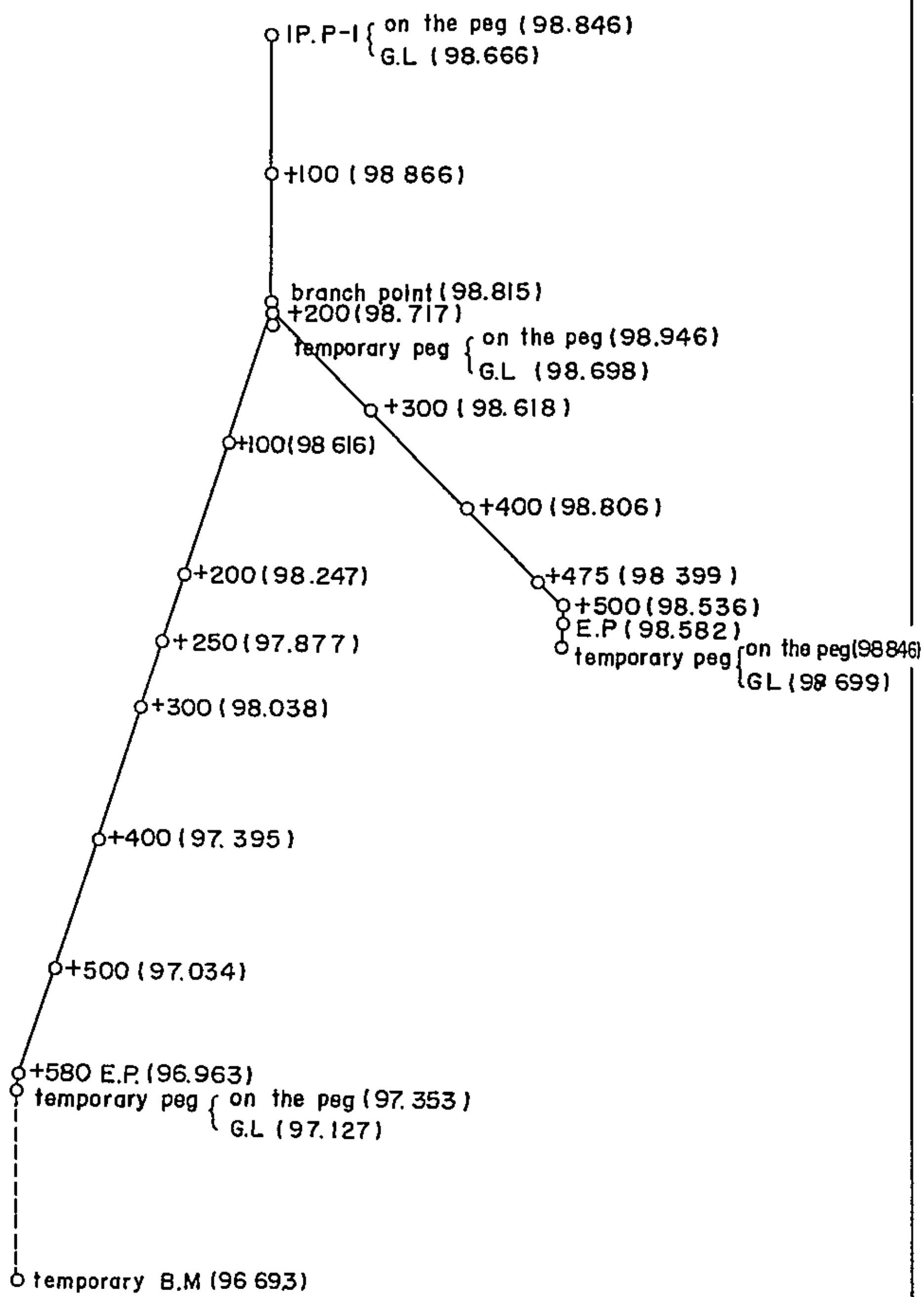
5.4/1.1 ≒ 5

The distributing branches will have a diameter of 40 mm and an average length of 100 m from the distributing main. The head loss at each branch point calculated with the hydraulic-grade line taken at I = 28o/oo is 3.1 m as shown in Table 3.3.4 below.

Table 3.3.4 Head Loss Through Distributing Pipe

Pipe and Fixtures	Diameter	Discharge	Hydraulic-Grade Line	Actual Length	Converted Length	Head Loss
	(mm)	(ℓ/s)	(o/oo)	(m)	(m)	(m)
Distributing Branch	40	1.1	28	100		
Swing Faucet	25				3	
Class B Curb Stop	25				2	
Class B Ferrule	25				2	
Falling Main	25				3	
Total	40	1.1	28	100	110	3.1

Fig. 3.3.1
GROUND ELEVATION ALONG THE PIPE LINE AT RAMDAIYA

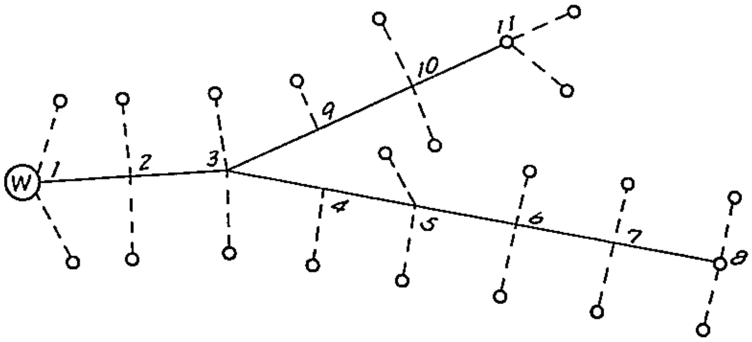


(unit ; meter)

The layout of the distributing main is as shown below.

The distributing branches are planned to be laid as shown in Fig. 3.3.2 according to the results of ground level surveying conducted in Ramdaiya which are shown in Fig. 3.3.1.

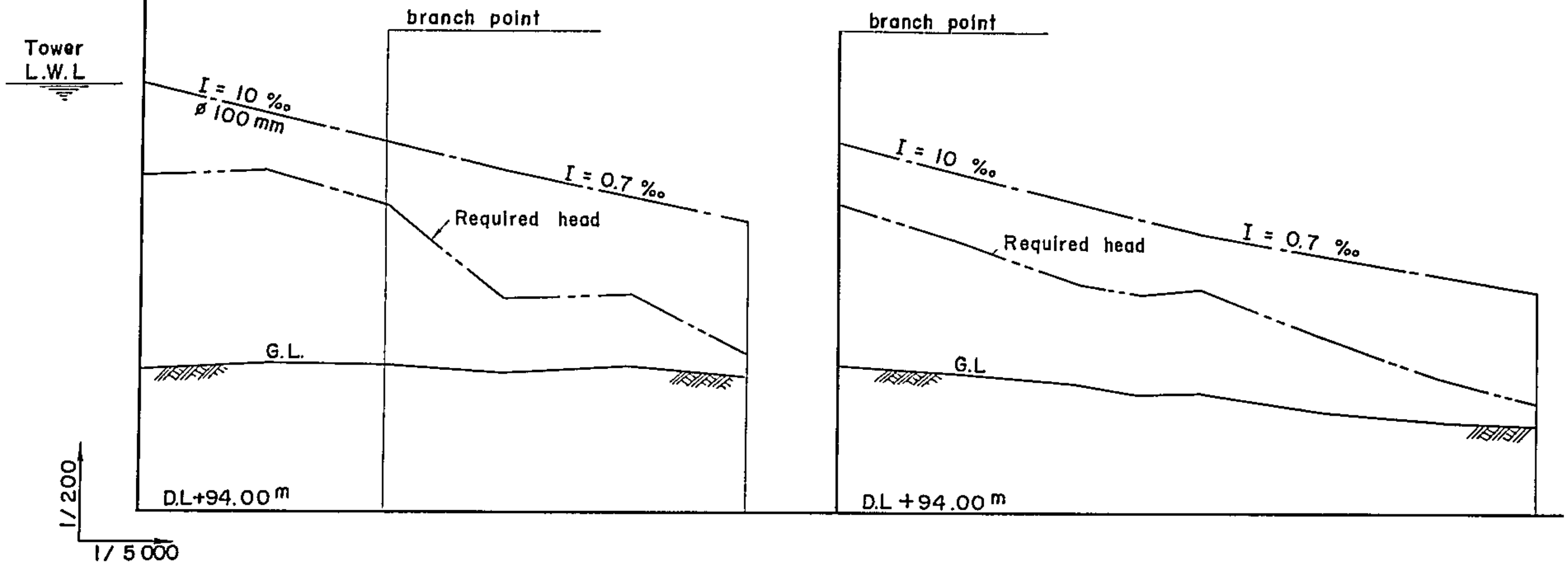
Fig. 3.3.2 Layout of Distributing Branches in Ramdaiya Village



If the distributing main is designed to have a diameter of 100 m, then the head loss calculated from Willaim-Hazen's formula will be as shown in Table 3.3.5.

From the design water head along the distributing main shown in Fig. 3.3.3, it is clear that the tank can fulfil its function if its LWL is larger than the sum of the head loss to the end of distributing pipe and the head loss incurred after the branch point through the distributing branch, i.e., 6.4 + 3.1 = 9.5 m. This further justifies the 100 mm diameter of the distributing main. The ground level at the end of the distributing main is 98.666 m. Accordingly, LWL is required to be larger than 108.2 m above sea level (≒ 98.666 + 9.5).

Fig. 3.3.3 DESIGN WATER HEAD (Ramdaiya)

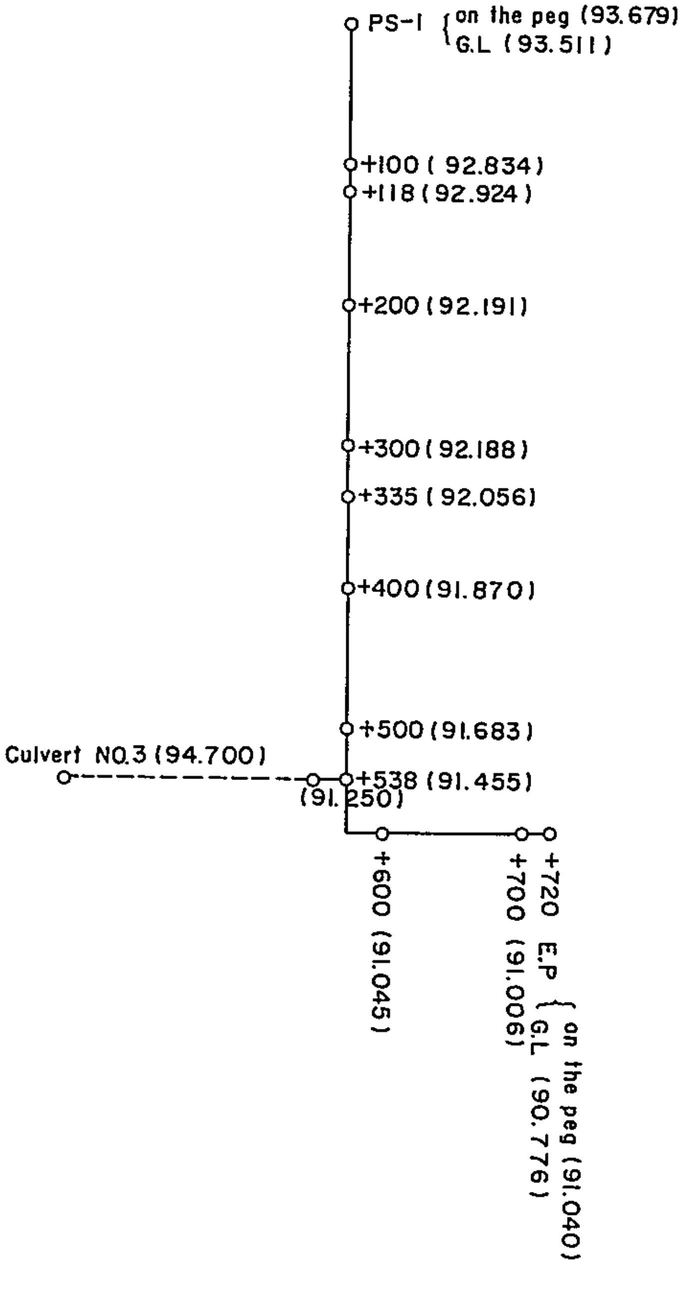


L	0	100	200	300	400	500
G.L.	98 666	98 866	98 815	98 618	98 806	98 536
W.H	105.066	105 266	104 215	101 018	100 206	99 236

L	0	100	200	250	300	400	500	580
G.L.	98 815	98 616	98 247	97 877	98 038	97 395	97 034	96 963
W.H	104 215	103 016	102 647	101 277	101 438	99 795	98 434	97 663

Fig. 3.3.4

GROUND ELEVATION ALONG THE PIPE LINE AT SAPHI



(unit ; meter)

Table 3.3.5 Head Loss through Distributing Pipe in Ramdaiya

C in W.H.'s formula = 100

	Section	6~7	7~6	6~5	5~4	4~3	11~10	10~9	9~3	3~2	2~1
Discharge	Distributing Branch (ℓ/s)	2.2	2.2	1.1	-	-	2.2	2.2	1.1	-	-
	Distributing Main (ℓ/s)	2.2	4.4	5.5	5.5	5.5	2.2	1.4	5.5	5.5	5.5
	Flow Velocity (m/s)	0.45	0.6	0.7	0.7	0.7	0.45	0.6	0.7	0.7	0.7
	Distance (m)	100	100	100	100	100	100	100	100	100	100
	Pipe Diameter (mm)	75	100	100	100	100	75	100	100	100	100
	Hydraulic-Grade Line (o/oo)	7	7	10	10	10	7	7	10	10	10
	Head Loss (m)	0.7	0.7	1.0	1.0	1.0	0.7	0.7	1.0	1.0	1.0
	Cumulative Head Loss (m)	0.7	1.4	2.4	3.4	4.4	0.7	1.4	2.4	5.4	6.4

The results of surveying conducted in Saphi village are shown in Fig. 3.3.4. Assuming that distributing branches will be laid as shown in Fig. 3.3.5 below according to the said results of surveying, the head loss calculated with the distributing main diameter taken at 100 m is as shown in Table 3.3.6.

Fig. 3.3.5 Layout of Distributing Branches in Saphi Village

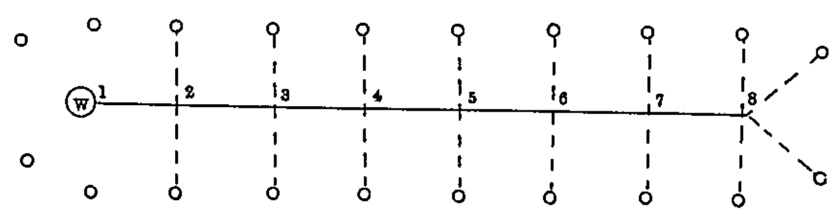
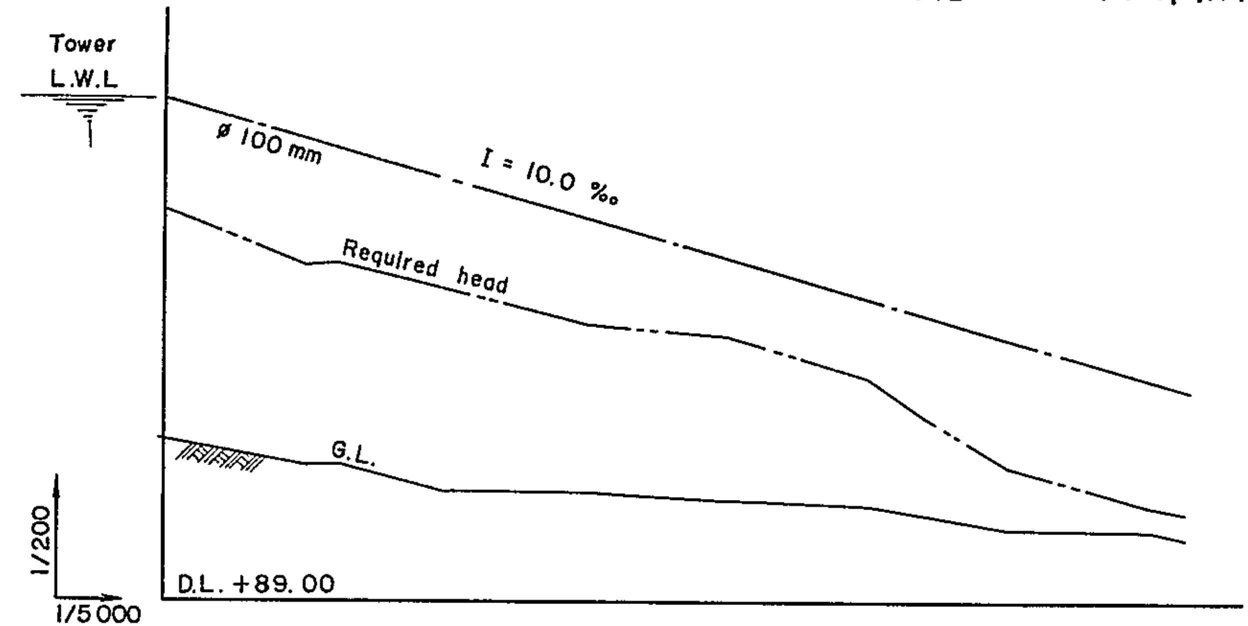


Fig. 3.3.6 DESIGN WATER HEAD (Saphi)



L	G.L	W.H
0	93 511	100 211
100	92 834	99 534
118	92 924	98 624
200	92 191	97 891
300	92 188	96 888
335	92 056	96 756
400	91.870	95 570
500	91 683	94 383
538	91 455	93 155
600	91 045	92 745
700	91 006	91 706
720	90 776	91 776

From the design water head along the distributing main shown in Fig. 3.3.6, it can be reasoned that the elevated tank can fulfil its function if its LWL is larger than the sum of the head loss to the end of the distributing main and that incurred after the branch point through the distributing branch, i.e., 6.7 + 3.1 = 9.8 m. Since the ground level at the end of the distributing main is 93.511 m, the LWL larger than 103.4 m above sea level (= 93.511 + 9.8) will be sufficient.

From the calculations worked out above, the elevated tank is planned to be set on 10 m high supporting legs and that the distributing main to be a steel pipe having a diameter of 100 mm.

Table 3.3.6 Head Loss through Distributing Pipe in Saphi Village

C in W.H.'s formula = 100

	Section	8~7	7~6	6~5	5~4	4~3	3~2	2~1
Discharge	Distributing Branch (ℓ/s)	4.4	1.1	-	-	-	-	-
Discharge	Distributing Main (ℓ/s)	4.4	5.5	5.5	5.5	5.5	5.5	5.5
	Distance (m)	100	100	100	100	100	100	100
	Flow Velocity (m/s)	0.55	0.7	0.7	0.7	0.7	0.7	0.7
	Pipe Diameter (mm)	100	100	100	100	100	100	100
	Hydraulic-Grade Line (o/oo)	6.6	10	10	10	10	10	10
	Head Loss (m)	0.7	1.0	1.0	1.0	1.0	1.0	1.0
	Cumulative Head Loss (m)	0.7	1.7	2.7	3.7	4.7	5.7	6.7

3.3.4 Transport Facilities

3.3.4.1 Light Railway Construction Plan

This plan is intended to link Janakpur Tarai Plain and East-West Highway by constructing a light railway line in the central part of Sarlahi district for passenger and cargo traffic.

The only railway now available in Janakpur Tarai plain is the 50 km long Jaynagar - Janakpur Light Railway which extends from Jaynagar in India to central Mohatari via Janakpur. For overland traffic other than by railways, there are two roads. One is East-West Highway which runs east to west in Tarai Plain passing through the northern part of Janakpur area, and the other is Janakpur - Mahendra Nagar Highway which leads out of East-West Highway into India. Both are paved roads and expected to be completed in a year or two. Apart from these main roads, villages in Janakpur Tarai Plain are connected by small roads which allow the passage of bullock carts only in the dry season.

In the Indian territory, both roads and railways are well developed along the Nepalese border. Hence, farm produce of Janakpur Trai Plain finds its outlets in India for the most part and only a small fraction is distributed to Nepalese markets.

Completion of East-West Highway is expected to further the possibility of marketing the farm produce of Janakpur Tarai Plain in Kathmandu and other places in hilly area. At present, however, the only north-south transport route connecting East-West Highway and Janakpur Tarai Plain is Janakpur - Mahendra Nagar Highway. The light railway construction plan introduced in this section is designed to cover the existing lack of transport means. It will connect rural communities in Sarlahi district with East-West Highway for northward shipment of agricultural products.

Implementation of this plan is expected to require machinery and materials amounting in value to about 79 million yen.

The following is the outline of the plan.

1) Route

The new railway will have its starting point at Karmaiya on the eastern side of Bagmati bridge and its terminal at the intake of Juddha Canal. The route will run on the ridge line and have a total length of about 16.3 km. The difference in elevation between the starting point and terminal is about 36.6 m. The average grade is 1/450 and the maximum 1/328. By reason of this grade, the railway should preferably be planned to have a total length of 19 km for safety's sake.

2) Ballast

It is considered that the ballast construction can be done with ease since the proposed route runs through an area favoured with a good drainage condition and covered with relatively compact sandy soil. Banking is to be carried out to the extent shown in the typical cross-section (See Fig. 3.3.7) in upland field and jungle areas and to a little larger height in paddy field areas. Some quantity of gravels are to be used for ballast tamping. The track gauge is 762 mm.

3) Bridge

A bridge is to be constructed at a selected point in Purnia village where the route crosses the Manusmara. This bridge can be constructed with Saul trees obtainable from the nearby jungle. The cross-section of the Manusmara at Purnia bridge site is shown in Fig. 3.3.8.

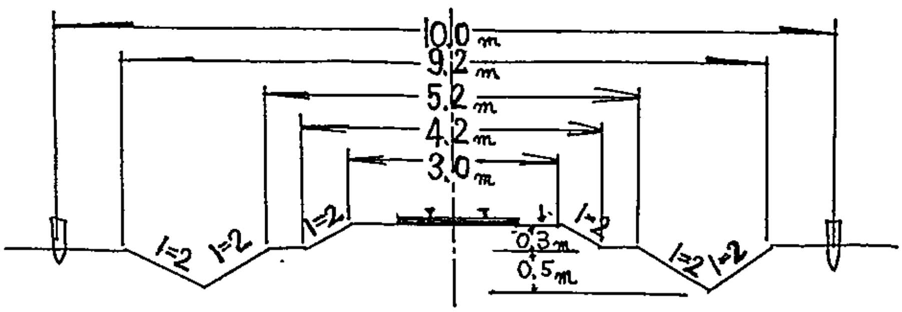


Fig. 3.3.7 Typical Cross-section of Ballast in Upland Field and Jungle Areas

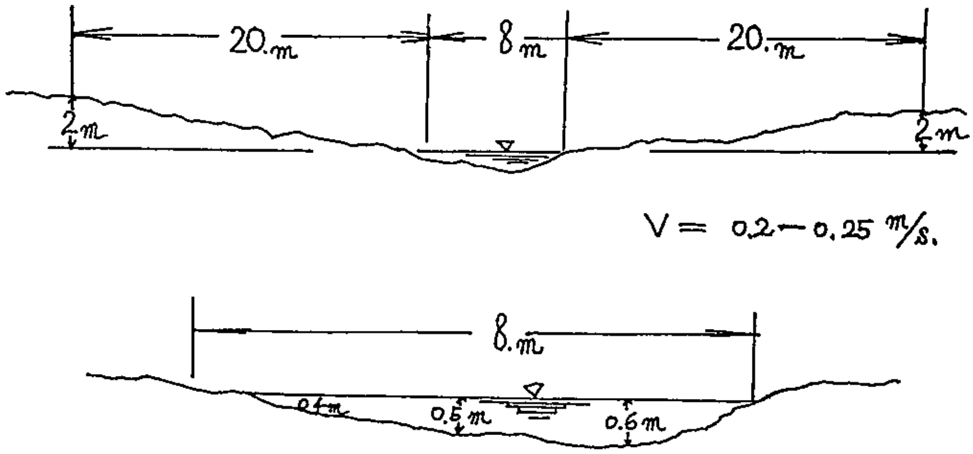


Fig. 3.3.8 Cross-section of the Manusmara at Purnia Bridge Site (Prepared by Stadia Survey)

4) Rails and Rolling Stock

5 m long rails weighing 23 kg per m and steel sleepers will be used. For traction, a diesel engine locomotive (Model UDL 106), 63 HP, is planned to be employed. Both freight cars and passenger cars will have a loading capacity of 5 tons. 10 cars, railway switches and maintenance and repairing tools are required.

5) Construction Machinery

Construction machinery for the project implementation will be used for the railway construction. Besides these, tampers, rammers, pile driving winches, belt conveyors, chain saws and generators will be required.

It was only the technical feasibility of this plan that was studied during the present survey. Though the survey disclosed that the railway can be constructed without difficulties if the route is properly selected, actual implementation of construction work should be preceded by detailed studies on social and economic aspects of the plan as well as on technical conditions and problems of the railway operation. These studies will be made in the stage of construction when the final working design is to be prepared.

3.3.4.2 Light Plane Service Plan

This plan is intended to employ a light aeroplane to accelerate the pace of the project and to offer transport service to staffs participating in the project and their families.

The traffic between Kathmandu and the project area resorts, on the one hand, to the regular flight service of Royal Nepal Airlines which connects Kathmandu with Bharatpur (near Rapti Model Farm) and Janakpur, and on the other to road transport from Kathmandu to Janakpur and Rapti. The road from Kathmandu to Rapti is partly gravel road, whereas the road from Kathmandu to Janakpur is a paved road expected to be completed in 1974.

The flight service of Royal Nepal Airlines is often suspended. Particularly in the wet season, the flight service to Rapti stops for about four months from June to September and that to Janakpur is also brought to a virtual halt. Road traffic is likewise made difficult in the wet season: the road to Rapti does not allow the passage of jeeps nor does the road to Janakpur promise safe trip since the traffic is frequently blocked up by landslides ensued from rainfalls and bridges are washed away by floods. Hence, in the wet season when the project area becomes completely isolated from the outside world, traffic of engineers and staffs between Kathmandu and the project area is extremely difficult not to mention of the transport of equipment and materials. Dispatch of liaison staffs to the project area becomes just an impossibility when the flight service of Royal Nepal Airlines is suspended.

Since no well equipped hospitals are found in or around the project area, engineers, staffs and their family members afflicted with a disease or wounded in an accident have no choice but to travel all the way to Kathmandu to receive medical treatment. Complete isolation of the project area resulting from total absence of traffic means to Kathmandu is therefore a problem which should be solved in the cause of humanity.

For this reason, R/D stipulates that a light plane service similar to the flight service which was maintained between Hardinath Farm and Kathmandu while the farm was operated by FAO should be offered to connect Kathmandu with Janakpur and Rapti.

For landing and taking off of this light plane in the project area, Bharatpur Airport will be used at Rapti, while Janakpur Airport and the airstrip of Hardinath Extension Farm and Jiri Farm (Dolakha district) will be used in Janakpur. Further, a simple airstrip will be constructed near the project centre if necessary.

The aeroplane will be a six-seater having a maximum loading capacity of about 400 kg. Approximately 40 million yen is planned to be appropriated for its purchase from the 1975 budget.

As for the maintenance, repair and operation of the light plane, a detailed study must be made before the plan is put into practice.

3.3.5 Machines, Equipment and Materials

3.3.5.1 Fundamental Policy

Excepting those described in Section 3.3.4 machines, equipment and materials required for the extension activities are not very large in size but substantially large in quantity since the extension service will cover the entire Janakpur Zone.

Machines and equipment used in the extension activities can be broadly classified into two groups, i.e., the transport equipment such as jeeps and motorbicycles and the small type farming equipment such as hoes, sickles, shoulder type sprayers and pedal rotary threashers.

In pushing forward extension activities in Tarai Plain, jeeps as primary transport means can never be dispensed with. As described already, extension activities will be developed through efficient utilization of the existing system of ADO. It is therefore planned that at least four jeeps will be made available for liaison between the project centre, Hardinath Extension Farm, Rapti Model Farm and ADO offices as well as for effective field investigation.

It is also planned that each JT and JTA will be provided with a motorbicycle or bicycle so as to facilitate their activities in their respective service areas. In Inner Tarai and hilly area where the topography does not allow for the effective use of jeeps and motorbicycles, however, the major transport means will be bicycles, horses and yaks.

In extension plots, crop cultivation is planned to be undertaken by local farmers themselves. Traditional farming practices currently adopted in the project area are rather backward and farmers do not even know how efficiently small farming implements can be used. In the operation of extension plots, therefore, hoes, sickles, pedal rotary threshers, etc. will be loaned out or offered against no payment to farmers. Extension plots will be established in Inner Tarai and hilly area in the latter part of the cooperation period. Hence, it is planned that the farming implements and transport equipment to be supplied in these areas will be of the design meeting the specific local conditions.

Chemical fertilizers, agro-chemicals and seeds are the main agricultural materials. In view of the natural supply of three elements and kinds of crops cultivated in Nepal, it is planned that ammonium sulphate will be supplied as nitrogen fertilizer, triplesuperphosphate as phosphate fertilizer and potassium chloride as potassium fertilizer. Further, three kinds of synthetic fertilizers having the three element mixing ratios of 15 : 15 : 15, 18 : 22 : 0 and 20 : 0 : 10 are specially planned to be supplied for easier fertilization by Nepalese farmers.

Agro-chemicals having an extreme toxic or residual effect on aquatic aniamls are excluded from the scope of supply.

Major seeds to be supplied will be paddy, barley, maize and vegetables.

3.3.5.2 Distribution Plan

Vehicles, farming implements and fertilizers will be supplied as detailed in Annex 1-D according to the fundamental policy described in the preceding section.

HMG of Nepal and Japanese government have agreed that the present technical cooperation will be extended over the preparatory period (April 1972 to November 1973) and the full-scale cooperation period (December 1973 to March 1979). Supply of equipment and materials for these two periods will conform to the following plan.

Preparatory Period:

a) Full-scale cooperation activity will not take place in this period. Consequently, supply of equipment and materials is not considered.

Full-Scale Cooperation Period:

a) Initial year - In addition to the fertilizers and agro-chemicals, farming implements such as hoes and sickles for 20 extension plots will supplied.

b) 2nd year - Fertilizers, agro-chemicals and small farming implements for 100 extension plots will be made available.

c) 3rd and subsequent years - In addition to the fertilizers, chemicals and farming implements mentioned above, materials and equipment suited for the extension activities in Inner Tarai and hilly area will be made available.

3.4 Hardinath Extension Farm

3.4.1 General Description

Hardinath Extension Farm performs the functions stated in the second survey report and of R/D and is expected to play a role of vital importance in the technical cooperation.

The repair shop planned to be established as one of the farms' facilities is expected to offer as much repair services as possible to the surrounding farmers.

Since the extension activities under the present technical cooperation will be carried out chiefly in Tarai Plain at the outset, establishment of an improved farming pattern is the primary task to be undertaken by the farm.

Activities of the farm will be expanded to include various trials and other works required for the development of Inner Tarai and hilly area when the extension activities eventually come to cover these areas. Due to its geographical condition, however, Hardinath Farm cannot be expected to satisfactorily conduct all the trials required for the development of Inner Tarai or hilly area. It is for this reason that Rapti Model Farm was selected together with Hardinath Farm to take part in the technical cooperation. It is to be pointed out that trials required for the development of the hilly area cannot be expected to be fully conducted at Rapti Model Farm alone. Therefore, when the extension activities come to cover Inner Tarai and hilly area in the latter part of the cooperation period, a farm of about 0.4 ha will be created where various trials will be made whenever need arises.

Staff composition for the operation of Hardinath Farm after the termination of the cooperation period will be studied during the next survey for final design. Staff composition of the farm during the preparatory period of the technical agreement is as shown below.

Post	Status	Nepalese Side	Japanese Side
Farm Manager	2nd Class Techical Office	1	
Irrigation agronomist	Specialist		1
Agronomist	2nd Class Technical Officer	1	
Specialist on Agromachinery	Specialist		1
Agro-machinery Technician	1st Class Engineer	1	
Agro-mechanic	1st Class Engineer	1	
JT		2	
Administrative Assistant		2	

The farm manager assumes overall responsibility for the operation and management of the farm. Japanese experts assist him in the discharge of his duties and provide guidances and instructions to Nepalese staffs to help achieve the purpose of the farm.

In addition to the above-listed officers and technical staffs, store keeper, jeep and truck driver, tractor operator, field foreman, guard, office boy, assistant mechanic, cow boy and farm labourer are to be employed on the responsibility of HMG.

3.4.2 Trials of Improved Farming Techniques

Improved farming techniques will be put to trials at Hardinath Extension Farm to provide practical means of agricultural extension Therefore, problems to be put to trials at this farm will be essentially those which are encountered in the arena of actual extension service.

Such problems will be discovered by farmers in their own field or other places and conveyed directly to Hardinath Farm or through the relevant extension worker. In other cases, they may be detected by Nepalese or Japanese technicians participating in the project. Considering the nature of the farm, it is desirable that trials be made on problems encountered by farmers. In the initial stage of the project, however, trials will be made chiefly on the problems discovered by the project technicians. It may be added that studies and experiments on farming techniques and varieties of maize, upland paddy and mustard as well as their seed multiplication are planned to be undertaken at Rapti Model Farm.

Activities to be made at Hardinath Farm in the immediate future are described below. It is to be noted that the kinds of problems to be put to trials will be naturally reviewed, screened and increased in the course of the farm's future management and during the survey for final design.

3.4.2.1 Introduction of Improved Farming Techniques

1) Paddy:

a) Study of ear manuring fertilization on local varieties.

While local varieties are expected to cover the greater part of paddy field area in future, irrigation facilities still remain in a rather poor condition. Under the existing condition, the fertilization technique which farmers can introduce readily will be ear manuring. Studies will therefore be made on the time and dosage of ear manuring fertilization on wet season paddy varieties in a rain-fed field and an irrigated field.

b) Study of standard dosage of fertilization on high yielding paddy varieties.

This study will be made on both dry season and wet season cropping.

c) Study and establishment of control measures against bacterial leaf blight, blast, stink bugs and stem borers.

Japanese agro-chemicals will be used.

d) Measurement for determining optimum supply of irrigation water for paddy cultivation.

e) Study of water-saving paddy culture.

2) Wheat :

a) Study of standard dosage of fertilization on high yielding wheat varieties.

b) Study of irrigation method suited for wheat cultivation.

c) Study and establishment of control measures against rust, earworms, and other diseases and insect pests.

3) Vegetables:

a) Study of best cropping season of each vegetable.

b) Study of suitable dosage of fertilization on main vegetables such as egg plant, tomato, potato, onion, cauliflower, raddish and cucumber.

4) Pulses (autumn crop):

a) Study of time and dosage of additional fertilization on various pulses.

b) Study of seeding rate of various pulses.

5) Green Manure Crops:

a) Study of cultivation method, seeding time and seeding rate of Dhaincha.

b) Study of green manure crops suited for autumn and winter cropping.

c) Study of the best time for plowing in green manure.

6) Forage Crops:

a) Study on the cultivation of forage crops.

7) Meteorological Observation:

a) Observation at Hardinath Farm.

b) Collection and analysis of observation data recorded in the past in Janakpur Zone and surrounding areas.

3.4.2.2 Introduction of Seeds and Seedlings of Improved Varieties

1) Selection of improved paddy varieties.

Selection will be made with consideration given to the following conditions.

a) High yielding varieties that can be cultivated with ease should be selected.

b) Varieties having a high commercial value and promising a large yield should be selected.

c) Varieties suited to local conditions, easy to be cultivated and promising a high yield should be selected.

2) Selection of improved wheat varieties.

Selection will be made with consideration given to the following conditions.

a) High yielding varieties that can be cultivated with ease should be selected.

b) Varieties having a high commercial value and promising a large yield should be selected.

c) Varieties having a large drought resistance should be selected.

d) Vareities capable of late seeding should be selected.

3) Selection of improved sugarcane varieties.

Selection should be made with consideration given to the following conditions.

a) High yielding varieties that be readily cultivated should be selected.

b) Varieties having a large drought resistance should be selected.

4) Selection of improved varieties of vegetables.

a) Selection will be made for egg plant, tomato, potato, onion, cauliflower, radish, water melon, cucumber, etc.

b) Apart from local varieties, Indian and Japanese varieties will be introduced.

5) Selection of varieties of bananas and pineapples.

Selection will be made chiefly from among Indian varieties for bananas and Hawaiian varieties for pineapples.

6) Selection of varieties of green manure crops.

Selection will be made by the cropping season.

7) Selection of varieties of forage crops.

3.4.2.3 Demonstration

Improved farming techniques and improved varieties will be demonstrated when reviews and tests have disclosed that they deserve to be diffused among farmers through extension activities. Hence, the techniques and varieties which are already known to be suited for extension will be demonstrated from the beginning. Farming techniques or varieties demonstrated must basically be those which can be introduced by farmers in some way or other. Modern intensive farming techniques will also be displayed as part of the demonstration to provide the goal for farmers' development efforts.

1) Demonstration of improved varieties.

Varieties that can be demonstrated at the present stage are as follows.

Paddy : IR5, IR8, IR20, IR22, IR24, Malinja, Masuri, T141, BR34, etc.

Wheat : S331, S227, C306, Lerma Loho 64, Sonora 64, RR21, etc.

Sugarcane: B034, B050, C0416, etc.

2) Demonstration of cultural techniques.

Paddy:

a) Cultivation techniques for attaining a high yield.

Cultivation techniques of high yielding varieties such as row planting, perfect fertilization, adequate irrigation and drainage control, disease and insect control, and weeding will be demonstrated.

b) Ear manuring fertilization technique.

Local varieties will be demonstrated with irregular planting, weeding, and application of ear manuring fertilizer. Irrigation water control will be demonstrated for water-saving culture and deep water culture (in which different varieties are to be grown) for comparison with non-fertilized cultivation.

c) Weeding.

Manual weeding of local varieties planted irregularly without fertilizers and with ordinary irrigation method will be demonstrated for comparison with local varieties which are left without weeding.

d) Water-saving culture

Local varieties cultivated by such techniques as application of standard dosage of fertilizers, row planting, weeding and disease and pest control will be demonstrated with irrigation water control for comparison with plot-to-plot irrigation farming.

e) Fertilization by single cropping of green manure crop.

Green manure crop will be grown as the preceding crop and no fertilizers will be applied. Weeding and other farm labour will be similar to those for water-saving culture.

Wheat:

a) Cultivation techniques for attaining a high yield.
Same as in the case of paddy.

b) Plowed ditch seeding cultivation.
Same as Item a) above except that seeds are to be shown in ditches formed by animal drawn plow.

c) Water-saving culture
Same as Item a) above except that irrigation is to be conducted at time of seeding and in the young-ear formation period. This cultivation method will be demonstrated for comparison with non-irrigated farming method.

3.4.3 Multiplication of Seeds and Seedlings of Improved Varieties

Production of seeds and seedlings aims at assuring sufficient supply of improved varieties which are known to be instrumental in the extension of agricultural techniques as a result of trials on improved farming techniques. Advanced farming techniques will be applied to the maximum extent and many fields of Hardinath Extension Farm will be used for the production of seeds and seedlings.

Seeds and seedlings to be produced at Hardinath Farm will be limited to those of paddy, wheat and Dhaincha for some time to come. Production of seeds and seedlings of crops other than these will be planned after reviewing the future improvement of farmers' farming techniques. It will be from the 1974 wet season cropping that the farm can embark on full-scale production of seeds and seedlings using necessary farming equipment and materials including fertilizers and agro-chemicals.

1) Varieties for seed and seedling production

Seeds and seedlings produced at Hardinath Farm in the coming few years will be limited to those of the following crops and varieties. Needless to say, some of the varieties listed below will be excluded from the production plan and new ones added according to the results of trials on newly introduced varieties to be conducted at the farm concurrently with the seed and seedling production.

Paddy	:	IR5, IR8, IR20, IR22, IR24, Malinja, Mauri, T141, and BR34.
Wheat	:	S331, S227, C306, Lerma Roho 64, Sonora 64, and R21.
Sugarcane	:	BO34, BO50, and CO416.
Vegetables	:	Raddish (seeds); egg plant, tomato and water melon (seeds and seedlings); onion and cauliflower (seedlings). Varieties will be determined after studies to be made in future.
Green manure crops	:	Dhaincha, Egyptian clover, and cowpea.
Fruit tree	:	Neither layering nor grafting will be carried out at the farm because of the long period required for the growth of mother plants. Instead, seedlings produced at HMG's Horticultural Farm will be transplanted in autumn for rearing and preservation at the farm. Varieties of fruit trees are mango, litchi, guava and others.

2) Annual Production Plan of Seeds and Seedlings

Of a total field area of 38 ha of the farm, 32 ha is used for crop cultivation. The area for seed and seedling production in this 32 ha field area will be made smaller by the expected formation of a trial farm and demonstration farm.

Annual production plan of seeds and seedlings is shown in Table 3.4.1. It is to be added that this plan will undergo changes in the course of future management of the farm.

Table 3.4.1 Annual Production Plan of Seeds and Seedlings

Year	(Paddy) Area (ha)	(Paddy) Unit Yield (ton/ha)	(Paddy) Production (ton)	(Wheat) Area (ha)	(Wheat) Unit Yeild (ton/ha)	(Wheat) Production (ton)	(Dhaincha) Area (ha)	(Dhaincha) Unit Yield (ton/ha)	(Dhaincha) Production (ton)
1972	30	3.0	90						
1973	30	3.0	90	20	2.5	50	2	0.5	1.0
1974	30	3.5	105	20	2.5	50	2	0.5	1.0
1975	30	4.0	120	25	3.0	75	5	0.5	2.5
1976	33	4.2	139	28	3.0	84	5	0.5	2.5
1977	33	4.4	146	28	3.5	98	5	0.5	2.5
1978	33	4.5	149	28	3.5	98	5	0.5	2.5

3.4.4 Training of Extension Workers

Extension workers will be given training to improve the level of their extension techniques and provide them with more practical and detailed agricultural knowledges for enhancing the extension activities. For this purpose, the project's own training courses will be established in addition to HMG's training plan which will be continued in future.

The fundamental approach to the training of extension workers is described in pp. 154 of the second survey report.

Of a number of training courses to be provided under the project, seminars for ADOs and short-term training courses for JTs and JTAs will be initiated in the initial stage of the project, whereas the seasonal training course for JTAs will start in May 1974. the subject matter extension worker course in May 1975, and the training course in farming machines and equipment in 1974.

1) Seminars for ADOs

Seminars for ADOs will be held twice a year, i.e., in the latter part of March and September. The period of each seminar will be six days.

ADO seminars will be attended by all ADOs in the project area as well as branch officers of ASC and ADB. The following matters will be discussed at the seminar.

a) Establishment of the policy and target of extension activities for the coming six months in each district.

b) Discussion on district-wise budgetary allocation to extension activities.

c) Establishment of district-wise plans for supplying materials and equipment and financing agricultural development.

d) Selection of agricultural techniques for crop-wise extension.

2) Short-term Training Course for JTs

This training course is given at Hardinath Farm to train JTs who will be the instructors at short-term training course of JTAs so that they will have deeper technical knowledges on the cultivation of major crops grown in the project area. The training will be given in January, April and October each year and last for six days each time. Two JTs or JTAs selected by each ADO in the project area will be dispatched to the farm to receive the training. The same trainee is required to receive the training and by finishing all the three trainings, he will be considered to have completed the course.

The training will include the following lectures and practical exercises.

Training in January :

a) Lectures on the selection of varieties, fertilization and disease and insect control in the cultivation of maize and on cultivation techniques in general.

b) Practical exercise in application of base fertilizer and seeding in maize cultivation.

c) Practical exercise in application of additional fertilizer, intertillage and weeding, irrigation, and disease and insect control in wheat cultivation.

d) Lectures on paddy field cultivation technique using green manure.

e) Lectures and practical exercise in compost production.

Training in April:

a) Lectures on the selection of varieties, fertilization, irrigation and disease and pest control in paddy cultivation and on cultivation techniques in general.

b) Practical exercise in seed selection, disinfection, nursery bed fertilization and seeding in paddy cultivation.

c) Practical exercise in transplanting of rice.

d) Practical exercise in intertillage and weeding of paddy field.

e) Practical exercise in the control of diseases and insect pests of paddy.

f) Practical exercise in the application of additional fertilizer, intertillage and weeding in maize cultivation.

Training in October:

a) Lectures on the selection of varieties, fertilization, irrigation and disease and pest control in wheat cultivation and on the cultivation techniques in general.

b) Practical exercise in the application of base fertilizer and seeding in wheat cultivation.

c) Practical exercise in the application of additional fertilizer in paddy cultivation.

d) Practical exercise in the production of paddy seeds.

e) Lectures and practical exercise in general cultivation techniques of mustard.

3) Short-term Training Course of JTAs

This training course will be given in February, May and November each year under the auspies of respective ADOs for the purpose of training JTAs on the cultivation techniques of paddy, wheat, mustard and maize. The training will be given for three days each time to all JTAs serving in the area covered by each ADO. The training will in principle be provided at the place where ADO is stationed. In Tarai Plain, however, it may be conducted at Hardinath Farm.

Lectures and practical exercises given through the training course will be as described below. Lecturers will be ADO or JT, or an expert participating in the project if occasion so demands.

Training in February:

a) Lectures on the general cultivation techniques of maize.
b) Practical exercise in the application of base fertilizer and seeding in maize cultivation.
c) Lectures on the general paddy field cultivation techniques resorting to green manure.
d) Lectures and practical exercise in the compost production techniques.
e) Lectures on the extension techniques.

Training in May:

a) Lectures on the paddy cultivation techniques in general.
b) Practical exercise in paddy seed selection and disinfection.
c) Practical exercise in the transplantation of rice.
d) Practical exercise in plowing operation using improved animal drawn plow.
e) Lectures on the extension techniques.

Training in October:

a) Lectures on the wheat cultivation techniques in general.
b) Practical exercise in the application of base fertilizer and seeding in wheat cultivation.

c) Lectures on the mustard cultivation techniques in general.

d) Practical exercise in the operation and maintenance of small type farming machines.

e) Lectures on the extension techniques.

4) Seasonal Training Course of JTAs

This course is intended to elevate the level of JTAs by training them on the cultivation techniques, irrigation and drainage control, soil conservation, plant protection and extension techniques of farming machines and equipment. The course will be given twice a year in the dry and wet seasons. The trainees and their number and privileges will conform to the description given in pp. 156 of the second survey report.

Training in the wet season

Period: May 15 to November 13.

Lectures and practical exercises:

a) Lectures on the paddy cultivation techniques in general and relevant practical exercise.

b) Lectures on the cultivation techniques of wet season vegetables in general and relevant practical exercise.

c) Lectures on the care of fruits culture in the wet season.

d) Practical exercise in the wet season cultivation of green manure crops.

e) Lectures on the wet season conservation of soil productivity and relevant practical practice.

f) Lectures on the elementary knowledges on the operation and maintenance of farming machines and equipment and relevant practical exercise.

g) Lectures on the extension techniques.

h) Introduction and explanation of the extension system and related organizations.

Training in the dry season

Period: November 15 to May 13.

Lectures and practical exercises:

a) Lectures on the wheat cultivation techniques in general and relevant practical exercise.

b) Lectures on the mustard cultivation techniques in general and relevant pracitcal exercise.

c) Lectures on the pulses cultivation techniques in general and relevant practical exercise.

d) Lectures on the dry season vegetables cultivation techniques in general and relevant practical exercise.

e) Lectures on the dry season care of fruits culture.

f) Practical exercise in the dry season cultivation techniques of green manure crops.

g) Lectures on the dry season conservation of soil productivity and relevant practical exercise.

h) Lectures on the elementary knowledges on the operation and maintenance of farming machines and equipment and relevant practical exercise.

i) Lectures on the extension techniques.

j) Introduction and explanation of the extension system and related organizations.

Method of training

a) Trainees will be considered to have completed the course when they have attended the training in both seasons. For the time being, however, trainees having received training in one season will not be given another training so that as many JTAs as possible will be given the opportunity to improve their technical level through this course.

b) In case a trainee receives training in two successive seasons, lectures and practical exercise he has completed in the first training will be excluded from the scope of the second training.

c) Trainees will make practical exercise by participating in the operation of Hardinath Farm and also by taking charge of the cultivation of various crops at designated farms for one season from the seeding stage.

5) Subject Matter Extension Worker Course

The objective of this training course is described in pp. 156 of the second survey report.

Period : One year fromMay 15 to May 13 of the following year.

Courses and Number of Trainees:

Agronomy Course - 2

Horticulture Course - 1

Agro-irrigation Course - 1

Agro-mechanic Course - 1

Lectures and Practical Exercise:

Common subjects -

a) Lectures on the extension and guidance methods and relevant practical exercise.

b) Introduction and elucidation of the extension system and related organizations.

c) Lectures on subjects related to but not included in the courses and relevant practical exercise.

Lectures on soil conservation and relvant practical exercise.

Training in specialized courses -

Agronomy Course

Lectures on the cultivation techniques in general of food crops, pulses, sugarcane and green manure crops, and relevant practical exercise.

Horitculture Course

Lectures on the cultivation techniques in general of vegetables and fruit trees and relevant practical exercise.

Agro-irrigation Course

Lectures on the irrigation techniques for cultivation of wet and dry season crops and relevant practical exercise.

Agro-mechanic Course

Lectures on the operation, maintenance and repair of farming machines and equipment to be introduced under the project, and relevant practical exercise.

Method of Training:

a) Trainees attending the subject matter extension worker course will serve as JT staffs of Hardinath Farm during the period of the course and receive training by directly participating in the operation and management of the farm.

b) JTs who have completed this course will be immediately assigned to the office of ADO and continue their training while maintaining constant contact with JTs at Hardinath Farm and those engaged in actual extension service.

6) Training Course in Farming Machines and Equipment

This course is intended to give training on the operation and maintenance of farming machines and equipment. Trainees will be the technicians of both HMG and non-governmental concerns. Courses, number of trainees and period will be as described below. No arrangements for accommodation will be made for the trainees attending this course.

a)	Small type irrigation pump course	- 5 trainees, 2 days
b)	Hand tractor course	- 4 trainees, 6 days
c)	Large type tractor course	- 2 trainees, 30 days

Time and number of the courses will be determined according to circumstances.

3.4.5 Major Facilities

The greater part of the facilities employed at Hardinath Farm when it was run by FAO will be used for the project. It is believed, however, that these facilities cannot fully meet the need for smooth progress of the farm's activities described in the foregoing pages.

Major facilities of the farm which can be put in use in time with the commencement of the technical cooperation are the farmland area of 38.38 ha in the farm's total area of 42.52 ha, roads, irrigation and drainage facilities, buildings and structures, and the runway.

Redevelopment of the farm facilities is the prerequisite to satisfactory progress of various activities to be undertaken at the farm. The redevelopment should include, for one thing, the repair of the irrigation and drainage facilities, and improvement of glass-houses and nursery beds for another. Further, lecture rooms, laboratories and trainees' dormitory will have to be remodelled for smooth progress of the training at the farm.

At present, office rooms, dormitory for the farms' employees, working yards, laboratories and other facilities are all embraced in a single block of building. Since this is considered to impede the smooth and satisfactory activities at the farm, it is planned that the said block will be suitably divided into the office section, laboratory section, working yard section and dormitory section so that each section can exhibit its functions independently to the fullest extent.

Details of the facilities redevelopment plan will be studied during the next survey for final design. As described in the second survey report, facilities so far planned to be improved are the irrigation facilities, nursery beds, barns, compost sheds, warehouses, working yards and the dormitory of Nepalese staffs. These facilities are outlined in Annex 1-D. The new layout of the dormitories, working yards and office rooms is illustrated in Fig. 3.4.1.

3.4.6 Machines, Equipment and Materials

3.4.6.1 Existing Availability

The present survey revealed that the machines and equipment that can be put in immediate use when Hardinath Farm starts functioning would be as listed below. Details of these machines and equipment are given in Annex 1-D.

1) Machines

Jeep	1 unit
Four-wheel tractor	2 units
Grain dryer	1 unit
Irrigation pump	1 unit
Hand tractor	2 units
Generator (3 KVA)	2 units
Power threasher	2 units
Air compressor	1 unit
Power mist blower	1 unit

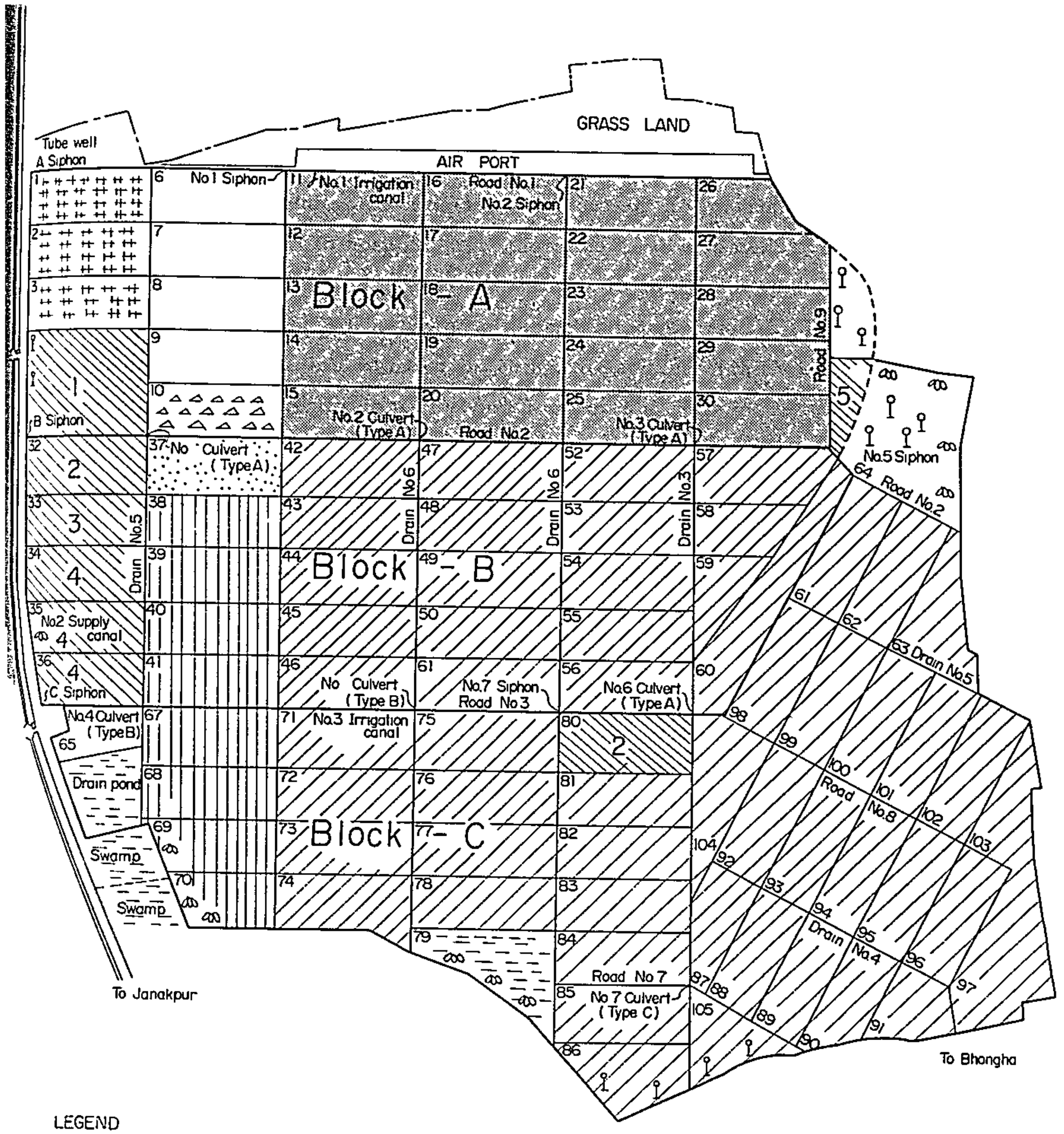
2) Equipment

Instrument and appratus for meteorological observation	1 set
Experimental equipment and appratus	Some

3) Materials

Fertilizers, agro-chemicals and seeds	Some

FIG.3.4.1 LAND USE MAP OF HARDINATH EXTENSION FARM



LEGEND

- Building site
  1. Office quarter
  2. Store and working shed
  3. Training quarter
  4. Dormitory
  5. Compost shed
- Drain pond
- Bamboo bush
- Horticultural nursery bed
- Field of banana, pine, apple and other garden crops
- Nursery bed of paddy
- Trial cultivation
- Experiment
- Demonstrational cultivation
- Seed multiplication of paddy and wheat, field of garden and industrial crops, or pasture land area.

Machines and equipment available for farm works and training at Hardinath Farm are extremely limited in both kinds and quantity, and this puts constraint on the types of machines to be introduced. Farming machinery taken by way of example, introduction of highly efficient single purpose machines of modern and large type is not desirable. It is therefore planned that machines that may not be comparable in efficiency to single purpose machines but can be employed for diversified purposes by effecting minor remodelling or improvement at the farm will be introduced.

3.4.6.2 Plan for Installation and Supply of Machines, Equipment and Materials

New machines and equipment are planned to be installed at the farm in accordance with the recommendations made by FAO when the farm is left to the care of the Nepalese government.

Major machines to be installed are 2 units of four-wheel tractors (35 ps), 4 units of hand tractors (5 - 6.5 ps), 2 units of hand tractors (6.5 - 8 ps), 1 unit of rice polishing machine, and 1 unit of combine. Besides these, transport equipment including 1 jeep, 1 2-ton truck and 3 motorbicycles as well as radio and office equipment for farm management are planned to be provided. Further, provision of agricultural materials such as fertilizers and agro-chemicals, construction materials, office supplies and audio-visual aids is also planned. Details of these machines, equipment and materials are shown in Chapter 5 (Cost Estimate) and Annex Nos. 1-B and 1-D.

Machines, equipment and materials mentioned above will be delivered to the farm over the preparatory and full-scale cooperation periods described in Chapter 2 (Fundamental Concept of the Project Cooperation) in accordance with the long-term prospect of the activities to be made during the term of technical cooperation. In the preparatory period when the farm will be operated with the existing facilities and machines, a limited quantity of farming implements and necessary spare parts will be supplied, and the full-scale installation and supply of machines, equipment and materials will be effected during the period of full-scale technical cooperation lasting for five years from November 1973 to November 1978.

3.5 Project Centre

The project manager is expected to exercise overall control over the extension activities and operation and management of Hardinath Extension Farm described in the foregoing pages as well as the operation and management of Rapti Model Farm which will be introduced later in this report. In exercising control over these matters, the project manager will follow the decisions and instructions of Janakpur Agricultural Development Board (hereafter called "JADB") and the Joint Committee. The project centre will be established to enable the project manager to discharge his duty in a satisfactory and uninterrupted manner. At the centre where the project manager will be stationed, offices and dormitories of Japanese experts will be provided together with the facilities and machines required for the implementation of the entire project.

Major facilities to be established at the centre will be as follows.

1. Office
2. Dormitory
3. Guest hourse
4. Assembly hall
5. Warehouse of farming machines
6. Warehouse of agricultural materials
7. Warehouse of construction machinery
8. Workshop
9. Pump room
10. Clinic
11. Offices of ASC and ADB

12. Powerhouse

13. Other facilities for project implementation not directly related to the activites of Hardinath Farm and Rapti Model Farm nor to the extension activities in Janakpur Zone.

The location and details of facilities of the centre are planned to be studied in the course of the forthcoming detailed survey. In this section, therefore, no detailed design is presented and only the outline of the centre is shown in Annex 1-D.

It is expected that the project centre will be provided with a great diversity of machines, equipment and materials including electrical machines and equipment, vehicles and parts, aircraft, telecommunication equipment, repairshop tools and equipment, office supplies, medical supplies, etc. To assure that the centre will fully exhibit its function, stress will be placed on machines, equipment and materials required for transportation, telecommunication and office. Annex 1-D shows the out-line of these machines, equipment and materials the greater of which will be provided during the term of the technical agreement, i.e., between November 1973 and November 1978. Facilities, machines, etc. to be supplied during the preparatory period will be limited to the minimum required for the activities stipulated in R/D. Machines, equipment, etc. which will be sent to the centre from Japan during the preparatory period will be as listed below.

1)	Prefabricated house	6 houses
2)	Jeep	2 units
3)	Telephone set	1 set
4)	Office supplies	1 lot
5)	Others	

Pending the completion of the project centre, the centre's work will be carried out at a temporary office in Janakpur city. The staff composition of the centre during the preparatory period is as shown below, and that during the period of the technical cooperation agreement will be studied during the next survey for final design.

Post	Status	Nepalese Side	Japanese Side
Project Manager	1st class technical officer	1	
Project Manager	Specialist		1
Agronomist	2nd class technical officer	1	
Irrigation Engineer	Ditto	1	
Agricultural Economist	Ditto	1	
Agricultural Extension Officer	3rd class technical Officer	1	
JT		5	
Administrative Officer	3rd class administrative officer	1	
Senior Accountant	Ditto	1	
Administrative Assistant		5	

In addition to the above-listed staffs, HMG of Nepal will secure the services of drivers, guards, office boys, etc. and the Japanese government will consider the dispatch of construction engineers if occasion demands.

CHAPTER IV RAPTI MODEL FARM

4.1 General Description

Rapti Model Farm is the former Rapti Experiment and Model Farm of Tokyo University of Agriculture and will be operated with the facilities left at this farm.

Activities at this farm will centre on the selection of modern techniques required for agricultural development of Inner Tarai as well as on pointing up and solving problems that may be encountered in the course of extension activities. The farm's efforts for technical improvement are largely impeded at present by deficient availability of irrigation water. Improvement of its irrigation facilities will therefore be one of the major tasks to be undertaken in future.

The farm is located in Chitwan district in the central part of Inner Tarai. Agricultural development conditions in the area surrounding the farm resemble those in Sindhuli district of Janakpur Zone in the eastern part of Inner Tarai. Inner Tarai presents the same soil conditions as observed in the skirts of Siwalik ranges which extend in the northern part of Janakpur Tarai.

Because of these physical conditions, Rapti Model Farm will make studies on agricultural techniques for application in Inner Tarai, lowland area of hilly area and Siwalik ranges hill area.

Development of agricultural techniques in Janakpur Tarai is planned to be forwarded chiefly at Hardinath Extension Farm. However, since the greater part of Janakpur Tarai is covered by paddy fields and development of upland crop cultivation is extremely difficult particularly in the wet season, Rapti Model Farm is expected to provide the necessary data for development of upland crop cultivation.

Development efforts at Rapti Model Farm will be directed chiefly to upland crops, and improvement of paddy cultivation techniques will be undertaken on a full scale after irrigation facilities have been sufficiently improved.

As in Chitwan district, mountain tribes of Nepal occupy the majority of inhabitants in three areas of Janakpur Zone, i.e., Inner Tarai, lowland area of hilly area and piedmont area of Siwalik ranges. Conflicts between tribes arising from the progress of extension activities are expected to present a similar pattern in Chitwan and these three areas of Janakpur Zone. Hence, data of extension activities obtained in Chitwan can be directly applied in the three areas of Janakpur Zone.

At present, spring water is drawn and stored for irrigation at this farm. Since the current availability of spring water does not suffice even for upland crop cultivation to say nothing of paddy cultivation, improvement of irrigation facilities is the prerequite to the development of modern agricultural techniques at this farm. For this reason, pump irrigation is planned to be developed with water drawn from the Narayani. Under this plan, it is envisaged that irrigation water will be supplied through a pipe to the farm, part of HMG's Ratpi Horitculture Centre and about 100 ha land extending along the pipe line.

The farm's extension activities, to be carried out with the cooperation of ADO, will cover the pump irrigation area. If requested by ADO, however, extension and guidance activities will be offered to designated farmers in other parts of Chitwan.

Improvement or augmented supply of facilities, machines, equipment, and materials is also planned. Improvement and repair will be effected to such facilities as the existing buildings, office of the tractor station offered for use at the farm, and repair shop. Farming machines and equipment and agricultural materials will be additionally supplied for use at the farm and extension plots.

Staff composition for operation and management of the farm during the two-year preparatory period is shown below. The new staf composition for the farm's management in the full-scale cooperation period will be studied during the next survey for final development design.

Post	Nepalese Staff	Japanese Staff	Status
Farm Manager	1		3rd class technical officer
Agronomist		1	Specialist
Agronomy-cum-Extension Officer		1	Cooperation volunteer
Horticulture-cum-Extension Officer		1	Ditto
Agro-Machinery Officer		1	Ditto
Agricultural Economy Officer		1	Ditto
Soil Science Officer		1	Ditto
Agro-Mechanic	1		2nd class technical officer
JTA	1		
Administrative Assistant	1		

The Nepales farm manager assumes overall responsibility for the management and operation of the farm. The members of Japan Overseas Cooperation Volunteers assist him in the actual operation of the farm and also provide guidances to Nepalese agro-mechanics and JTAs. The Japanese expert gives advices to the farm manager and Cooperation Volunteers and at the same time exerts efforts for the sound management of the farm. In addition to these staffs, field foreman, farming machine operators, drivers, warehouse keepers, guards, office boys and farm labourers are employed on the responsibility of Nepalese government.

4.2 Activities at Rapti Model Farm

Major activities to be undertaken at this farm during the term of the technical cooperation agreement are the trials of improved farming techniques, demonstration of improved farming techniques and improved varieties, multiplication of seeds and seedlings of improved varieties, production of carbonate of lime, repair of farming machines and equipment, surveys on traditional farming practices, training of JTAs and farmers, and extension of advanced farming techniques in the area surrounding the farm.

4.2.1 Trials of Improved Farming Techniques

4.2.1.1 Introduction of Improved Farming Techniques

1) Cultivation Techniques

Paddy:

a) Study of ear manuring fertilization on local paddy varieties.
b) Study and establishment of measures for the control of bacterial leaf blight, blast, stem borers, stink bugs, etc.
c) Study of water-saving cultivation.
d) Study of optimum rate of irrigation water supply.

Upland Paddy:

Farmers regard upland paddy as the third next important crop in the wet season after paddy and maize, yet no attempt is made at HMG farms to apply advanced techniques for improving its cultivation. Considering the extreme shortage of irrigation water, establishment of adequate upland paddy cultivation techniques is a pressing need in the project area. The following studies will therefore be made for the present.

a) Study of the optimum dosage and application method of fertilizers.
b) Study of seeding rate and seeding method.
c) Study of the method of intertillage and weeding.
d) Study for the prevention and eradication of diseases and insect pests.

Maize:

a) Study of the optimum dosage of fertilizer application.

b) Study of the planting density and seeding rate.

c) Study of the method of intertillage, weeding and molding.

Wheat:

Studies must be made on the cultivation techniques of newly introduced varieties, with emphasis placed on RR-21 for the present.

a) Study of the optimum dosage of fertilizer application.

b) Study of the best seeding time.

c) Study of drought resistance.

d) Study of the optimum supply rate of irrigation water.

Mustard:

Mustard is an important second crop in upland crop area. As in the case of upland paddy, however, no efforts have so far been made at HMG farms for improving its cultivation techniques through introduction of advanced agricultural techniques. The following studies will therefore be made at Rapti Model Farm.

a) Study of the optimum dosage of fertilizer application.

b) Study of the seeding rate and seeding method.

c) Study for the control of parasitic plants (Orobanche).

d) Study for the establishment of countermeasures against micro element deficiency (particularly boron and magnesium).

Potato:

a) Study of the optimum dosage of fertilizer application.

b) Study of the cropping season.

c) Study of the time of irrigation and supply rate of irrigation water.

d) Study for the control of infectious diseases.

Vegetables:

a) Study of the raising method of seedlings of winter and autumn vegetables.

b) Study of cultivation and seed growing techniques of radish.

Green Manure Crops :

Cowpea cultivation will be studied for growing as the succeeding green manure crop of maize (preceding crop: mustard).

2) Soil Conservation

a) Study of the cropping pattern.

b) Study on the production and application of compost and stable manure.

c) study on the application of lime.

d) Study of sub-soil compacting.

4.2.1.2 Introduction of Seeds and Seedlings of Improved Varieties

a) Selection of improved paddy varieties

High resistance against drought and diseases as well as large yield ratio should be taken into consideration in selecting varieties.

b) Selection of improved wheat varieties.

Drought resistance, marketability, disease resistance, and yield ratio should be taken into account in selecting varieties.

c) Selection of improved upland paddy varieties.

Selection will be made from among local and introduced varieties with consideration given to resistance against drought and diseases and yield ratio.

d) Selection of improved mustard varieties.

Selection will be made from among local and introduced varieties with account taken of resistance against diseases and insect pests. High yielding varieties having a large oil content should be selected.

e) Selection of improved vegetable varieties.

Varieties of egg plant, tomato, cauliflower, radish, water melon, cucumber and other vegetables which are most suited for cultivation in respective cropping seasons will be selected.

f) Selection of varieties of green manure crops.

Varieties suited for cultivation in different cropping seasons will be selected.

4.2.1.3 Demonstration of Improved Farming Techniques and Improved Varieties

1) Demonstration of Improved Farming Techniques

Paddy:

a) Green manure fertilization method.

Irregularly planted local varieties will be displayed with the demonstration of weeding and green manure fertilization techniques for comparison with non-fertilized farming method. Control of irrigation water will be carried out in much the same manner as applied in water-saving cultivation.

b) Weeding

Local varieties planted irregularly without fertilization will be displayed with the demonstration of manual weeding for comparison with the non-weeding farming method.

c) Water-saving cultivation of improved varieties

Water-saving cultivation of improved varieties will be demonstrated with the standard dosage of fertilization, row planting, weeding and control of diseases and insect pests.

d) Fertilization by single cropping of green manure crop.

Dhaincha will be cultivated as a preceding green manure crop with no other fertilizers applied. Care of the field will correspond to that for water-saving cultivation of improved varieties.

Maize:

Improved varieties of maize will be displayed with the demonstration of such techniques as the application of standard dosage of fertilizer, application of lime, row planting, weeding, and disease and pest control.

Wheat:

a) Cultivation techniques for attaining a high yield
High yielding varieties will be displayed with the demonstration of full application of such advanced techniques as row planting, perfect fertilization, lime application, optimum supply of irrigation water, disease and insect control, weeding, etc.

b) Sowing in plowed ditches.
Seeds will be sown in ditches formed by an animal drawn plow (conventional type plow). Other cares of the field will be the same as taken for cultivation of high yielding varieties.

Mustard:

a) Cultivation techniques for attaining a high yield.
Local varieties will be displayed with the demonstration of such advanced techniques as row planting, fertilizer application (boron as base fertilizer), lime application, weeding, and control of diseases and insect pests.

b) Application of boron.
Boron will be sprayed on leaves during the flowering period. Other cares of the fields will be same as taken for attaining a high yield rate.

Potato:

Local variety (Kathmandu) will be displayed with the demonstation of advanced techniques including row planting, perfect fertilization, irrigation, intertillage, weeding, molding, and control of diseases and insect pests.

Seeding of Radish:

Whiteneck will be displayed with the demonstration of advanced techniques including fertilization, irrigation, intertillage, weeding, disease and insect control, and boron application.

2) Demonstration of Improved Vareities

At the present stage, improved varieties that can be demonstated will be as listed below.

Paddy	:	IR5, IR20, IR22, Malinja, Masuri, etc.
Wheat	:	Lerma Roho 64, Sonora 64, NP 852, S331, RR21, etc.
Maize	:	Rampur-yellow, and Khumaltar-yellow.
Vegetables		
Sweep Potat	:	"Tamakotaka"
Water Melon	:	"Fumin," and "Shin-Yamatogo".
Cucumber	:	"Yotsuba".
Tomato	:	"Fukuji," "Super Natsu-tomato", and "Kurihara".
Radish	:	"Whiteneck," "Riso", and "Mino-Wase".
Cabbage	:	Habukakei and "Shiki".
Cauliflower	:	"Meigetsu".

4.2.2 Multiplication of Seeds and Seedlings

Paddy:

Full-scale production of paddy seeds will be started after the irrigation facilities have been sufficiently improved.

With the completion of the irrigation improvement work, seeds of the following varieties will be produced at the farm.

IR5, IR20, IR22, Malinja, Masuri, etc.

Wheat:

Seeds of Lerma Roho 64, Sonora 64, NP852, S331, RR21, etc. will be produced. Estimated annual production is about 10 tons.

Maize:

Seeds of Rampur-yellow and Khumaltar-yellow will be produced. Estimated annual production is about 6 tons.

Vegetables:

Production of seeds (water melon, cucumber, tomato and radish), seed potato (sweet potato), and seedlings (water melon, cucumber, tomato, cabbage and cauliflower) will be undertaken.

4.2.3 Agricultural Extension, Training and Investigations

4.2.3.1 Agricultural Extension

Extension activities of Rapti Model Farm will cover the pump irrigation area to which water is to be supplied from the Narayani. If requested by ADO, the farm will also provide guidances to designated farmers who take the leading part in the development of Chitwan's agriculture.

Though the extension activities are expected to be carried out directly by the farm, the farm will work in collaboration with ADO, ADB, etc. in Chitwan to enhance the effect of its activities.

Extension plots will be established in the pump irrigation area so that neighbouring farmers will be given guidances and extension service. Designated farmers will be provided with guidances and assistances intended to elevated their technical level and improve their productivity. These designated and progessive farmers are expected to act as leaders of the farmers in their neighbourhood.

4.2.3.2 Training

As will be described later, the size of the agricultural extension area to be covered by the farm is approximately the same as the coverage of one JTA in Janakpur Zone. Farmers in this extension area will be trained directly by the JTA stationed at the farm, and the said JTA will be trained through participation in the daily operation of the farm. Farmers' training will be given at the farm and extension plots.

1) Training on Cultivation Techniques:

For farmers living in the extension area, training will be given at the farm and the extension area on the cultivation techniques of major crops grown in Chitwan.

2) Training on Farming Machines and Equipment:

Diffusion of Japanese made farming machines and equipment including cultivators and small type irrigation pumps is being pushed forward by ASC. However, diffusion of these equipment is not accompanied by the necessary training on their operation and maintenance. At this farm, therefore, farmers will be given elementary to advanced training on the operation and maintenance of the machines and equipment procured on intended to be procured by them. This training will also be provided, within the limits of the farm's capacity, to farmers in other parts of Chitwan if requested by ADO.

4.2.3.3 Surveys and Investigations

The following surveys and investigations will be carried out for the purpose of collecting data and information required for trials and tests for technical development and enhancement of extension activities.

1) Analysis of soils in and around the Farm and Preparation of Soil Map

Detailed soil survey will be conducted in the pump irrigaarea for preparation of its soil map.

2) Survey on Traditional Farming Practices

Survey will be made on the traditional farming practices followed by farmers in the entire Chitwan district in cultivating various crops. Results of the survey will be consolidated and used as the basic data for introducing improved farming techniques.

3) Meteorological Observation

Meteorological observation will be made at the farm and values recorded will be compiled into the farm's meteorological data.

4.2.3.4 Production of Carbonate of Lime

As stated in the second survey report, the soil acidity in Chitwan is so high that it apparently prohibits the introduction of modern farming techniques unless some corrective measure is taken. Devastation of soil is already in progress and it is highly probable that cultivation of crops will become very difficult in a matter of few years if farmers continue to adhere to traditional farming practices. For soil conservation in Chitwan, introduction of green manure is planned, and this will necessitate the application of lime. At present, lime for fertilization is not available in Nepal. What lime available in the country is all intended for construction purposes and its cost is prohibitively high for farmers to afford.

Fortunately, however, there is a lime stone deposit along Narayanight-Hitaura road approximately 30 km from the farm. It is therefore planned that carbonate of lime will be produced from lime stone obtained from the said deposit and crushed at the farm.

For production of carbonate of lime, lime stones will be crushed manually into gravels measuring 3 to 4 cm in diameter and then processed by a pulverizing mill. The mill will have an hourly production capacity of 120 kg and require 1 HP for operation.

The production plan is thus very small in scale. In the initial stage of production, carbonate of lime will be used at Rapti model Farm, Hardinath Extension Farm and HMG Farms, and then supplied, with the lapse of time, for farmers' use. With the increase in shipment, the farm's production capacity will be required to be increased and the installation of additional and larger machines will become essential.

4.2.3.5 Repair of Farming Machines

Rapti Model Farm will undertake the repair of Japanese farming machines employed there and at HMG farms (Rapti Agricultural Station, Rampur, and Rapti Horticulture Centre, Yagyapuri). Within the limits of its capacity, the farm will offer repair service for machines provided to farmers by ASC. If farming machines used at the farm cannot be repaired at the farm, they will be sent to the repair shop of the project centre.

4.2.4 Activities during Preparatory Period

Activities described in the foregoing pages are to be made during the period of the technical cooperation agreement. Major activities planned to be undertaken during the two-year preparatory period will be as listed below.

1) Trials of Improved Farming Techniques

a) Studies on ear manuring fertilization, control of diseases and insect pests and water-saving cultivation in the cultivation of local paddy varieties.

b) Studies on fertilization, seeding rate, intertillage, weeding, and control of diseases and insect pests in the cultivation of local upland paddy varieties.

c) Studies on fertilization, seeding rate, intertillage, weeding, molding, etc. in the cultivation of local and improved varieties of maize.

d) Studies on fertilization, seeding time, optimum supply rate of irrigation water, etc. in the cultivation of an improved wheat variety (RR-21).

e) Studies for establishment of countermeasures against micro element deficiency in the cultivation of mustard.

f) Studies on the optimum dosage of fertilization and control of infectious diseases in potato cultivation.

g) Studies on the techniques of seed growing and cultivation of radish.

2) Introduction of Seeds and Seedlings of Improved Varieties

Introduction and selection of seeds and seedling of improved varieties such as paddy with a high drought resistance, high yielding wheat, high yielding upland paddy, Japanese vegetables, and green manure crops.

3) Demonstration of Improved Farming Techniques

a) Ear manuring fertilization technique for paddy cultivation.

b) Weeding technique for paddy cultivation.

c) Water-saving cultivation of paddy.

d) Paddy fertilization by single cropping of green manure crop.

e) High yielding cultivation techniques of wheat.

f) Seeding in plowed ditches for wheat cultivation.

g) Boron application for mustard cultivation.

h) High yielding cultivation techniques of potatoes.

4) Demonstration of Improved Varieties

The following varieties will be demonstrated.

a) Paddy: IR5, IR20, IR22, Malinja, and Masuri.

b) Wheat: Lerma Roho 64, Sonora 64, NP852, S331, and RR21.

c) Maize: Rampur-yellow and Khumaltar-yellow.

d) Sweet Potato: "Tamayutaka"

e) Water Melon: "Fumin," and "Shin-Yamatogo".

f) Cucumber: "Yotsuba".

g) Tomato: "Fukuju," "Super Natsu-tomato", and "Kurihara".

h) Radish: Whiteneck, "Riso," and "Mino-Ware".

i) Cabbage: "Habukakei" and "Shiki".

j) Cauliflower: "Meigetsu".

5) Multiplication of Seeds and Seedlings of Improved Varieties

Seeds of the above-mentioned improved varieties will be produced with the exception of paddy, cabbage and cauliflower, and seedlings of water melon, tomato and cabbage and cauliflower will be raised.

6) Repair of Farming Machines

Japanese farming machines employed at the farm and Rapti Horitculture Centre will be repaired.

7) Surveys and Investigations

a) Analysis of soils and preparation of soil map of the proposed pump irrigation area.

b) Survey on the traditional farming practices adopted in the entire Chitwan district for cultivating different crops.

c) Meteorological observation.

8) Agricultural Extension

Extension service and guidances will be provided to designated and progressive farmers when requested by ADO in Chitwan.

4.3 Major Facilities, Machines, Equipment and Materials

4.3.1 Facilities

The entire facilities of the former Rapti Experiment and Model Farm of Tokyo University of Agriculture and the greater part of Rapti Tractor Station facilities of HMG will be transferred to Rapti Model Farm for its operation. If it is found that these facilities do not suffice for the smooth operation of the farm, part of the facilities of the adjoining Rapti Horticulture Centre will be utilized. Existing availability of facilities is not considered to ensure satisfactory progress of the farm's activities described in the foregoing pages.

Facilities that can be put in immediate use with the commencement of technical cooperation are those of the former Rapti Experiment and Model Farm of TUA and Rapti Tractor Station of HMG. These include about 9 ha of land (of which 5.27 ha is farm land), roads, frrigation canal, buildings and grass land.

Redevelopment and improvement of facilities is indispensable for satisfactory progress of the farm's activities. In addition to the improvement of irrigation facilities which will be described later in this report, redevelopment and improvement will be effected to thatched and unthatched nursery houses for raising vegetable seedlings, framed paddy plot and netted house for experimental cultivation, working yards, etc. Redevelopment and improvement will also cover the repair shop of farming machines, machine room, garage, power house as well as the office rooms and dormitories which are needed for smooth management of the farm.

Facilities transferred from the former Rapti Tractor Station will include farming machines and equipment, part of warehouses and office rooms, and those from the former Rapti Experiment Farm of TUA will provide part of warehouses, working yards and dormitories.

As in the case of Hardinath Extension Farm, details of the facilities installation plan will be studied during the next survey for final development design. However, repair of the existing facilities will be undertaken soon after the commencement of technical cooperation. The repair work will include the painting of roofs and walls, repaning of window glasses, and setting of a new barbed wire fence.

4.3.2 Machines, Equipment and Materials

1) Existing State

Machines and equipment that can be put in use with the commencement of the farm's activities are described in the second survey report (pp. 201 - 202). Tools for repairing farming machines will be transferred from Rapti Tractor Station.

2) Improvement Plan

In order that the machines and equipment transferred from the former Rapti Experiment Farm of TAU will be put in perfect working condition, efforts will be made for quick supply of the necessary spare parts. Main machines to be introduced are four-wheel tractor (35 HP, 1 unit), hand tractor (5 - 6.5 HP, 3 units; 6.5 - 8 HP - 3units), and pulverizing mill (1 unit). Besides these, transport equipment such as jeep (1 unit), truck (2 ton, 1 unit) and motorbicyle (3 units) will be provided. For smooth management of the farm, it is also planned that radio equipment and office equipment and supplies will be provided. Further, introduction of experimental equipment and apparatus is planned.

Materials to be newly supplied will include fertilizers, agro-chemicals and other agricultural materials as well as construction materials, audio-visual aids, etc.

Introduction and supply of these machines, equipment and materials will be carried out according to the manner adopted at Hardinath Extension Farm.

4.4 Infrastructural Improvement

4.4.1 Design Requirement

1) Irrigation Area and Water Source

As no groundwater seems to be available, water source of irrigation water for Rapti Model Farm will be the Narayani river as stated in the second phase report. Distance from the Narayani river to the farm pond in Rapti Model Farm is about 2.2 km.

Irrigation area covers about 100 ha along the pipe line and includes Rapti Model Farm and the adjacent Government Farm.

2) Basic Plan

Irrigation water will be pumped up to the farm pond in Rapti Model Farm from the Narayani river. Pumping station will be constructed on the left bank of the Narayani river. Proposed discharge is 8.34 m^3/min and conveyance pipe will be a 300 mm diameter steel pipe.

Irrigation water for Rapti Model Farm and the Government Farm will be conveyed from the farm pond, and for irrigation area outside Rapti Model Farm and the adjacent Government Farm, water will be supplied through the pipe line.

4.4.2 Pump Irrigation Facilities

1) Water Requirement

Proposed major crops in the irrigation area are upland crops like upland paddy and vegetables.

Daily requirement of irrigation water can be obtained by the following formula;

$$q = \frac{d \times A}{h}$$

where, d: water requirement (7 mm/day)

A: irrigation area (100 ha)

h: pump running hour (14 hrs/day)

therefore,

$$q = \frac{7 \text{ mm/day} \times 10^{-3} \text{ m/mm} \times 100 \text{ ha} \times 10^{4} \text{ m}^2\text{/ha}}{14 \text{ hr/day} \times 60 \text{ min/hr}}$$

$$= 8.34 \text{ m}^3\text{/min}$$

Irrigation water, 8.34 m^3/min. will be pumped up from the pumping station on the left bank of the Narayani river and conveyed by a 300 mm diameter steel pipe (conveyance pipe) to the farm pond.

Irrigation water for the area outside Rapti Model Farm and Government Farm will be supplied directly from the pipe line through field valves.

2) Pumping Station

a) Pump Capacity and Total Head

The pumping station is planned to be established on the left bank of the diversion channel of the Narayani and provided with a pump capacity of Q = 8.34 m^3/min. Since the low water level of the Narayani is EL. 84.61 m, the water surface for suction is set at EL. 84.41 m. Assuming that the water surface for discharge is equivalent to the farm pond high water level of EL. 100.50 m, the actual head is set at H = 16.09 m. The total head loss through the pipe line (ϕ300 mm, L = 2.2 km) is 47.3 m and therefore, the total head turns out to be ΣH = 64.0 m.

b) Suction and Discharge Bore and Type

In view of the pump capacity (Q = 8.34 m^3/min) and total head (ΣH = 64.0 m), one unit of double suction volute pump is planned to be employed for the sake of easy maintenance and management and for accurate operation. The pump is to have an output of 170 PS and may be driven by a gas oil engine depending on the local power supply condition.

c) Location of Pumping Station

At the site of the pumping station, the existing ground surface has an elevation of 89. 17 m which is 4. 76 m higher than EL. 84.41, the design elevation of water surface for suction. To prevent the possible cavitation arising from this difference, the pump centre line is planned to have an elevation of 88.36 m and the pumping station floor 87.81 m. As the pump body is constantly above the water level, its starting should be preceded by filling of water by a vacuum pump or other means. To simplify this work, the pump suction pipe is to be fitted with a foot valve so that water can be filled in the pump before starting.

d) Pump Specifications

Pump Capacity :	Q = 8.34 m^3/min
Quantity :	1 unit
Type :	Horizontal double suction volute pump
Bore :	Suction port - 250 mm Discharge port - 200 mm
Elevation of Water Surface for Suction :	EL 84.41 m
Elevation of Water Surface for Discharge :	EL. 100.50 m
Total Head :	64.00 m
Total Output Required :	170 PS (Gas oil engine to be used)

e) Oneway Surge Tank

A study of water hammering discloses that a negative pressure of about 37 m will be developed in the return pipe, and the resultant water column separation will impair the function of the pipe. A oneway surge tank is therefore planned to be constructed on the pipe line to prevent the occurrence of any large negative pressure.

3) Pipe Line

The distance between the Narayani and the farm pond is planned to be covered by a pipe line. Since this pipe line is to be directly connected to the pump discharge pipe and its length will be as large as about 2.2 km, steel pipes will be used to prevent the possible water hammering.

With the discharge set at $Q = 8.34\ m^3/min = 0.14\ m^3/sec.$ it is planned that the pipe will have a diameter of 300 mm so that water will flow through it at a rate of 2.0 m/sec.

When frictional loss including loss through bent sections are claculated by Hagen William's formula on the basis of the pipe diameter of 300 mm and total pipe line length of 2.2 km, the total head loss turns out to be $\Sigma H = 47.3$ m.

Along the pipe line are to be installed blow-offs, air valves as well as outlets for water diversion. The outlets are planned to be of a simple type equipped with a field valve.

Since the pipe line is expected to cross both upland field area and paddy field area, it should be laid at least 60 cm beneath the ground surface.

4) Farm Pond

The farm pond will measure 60 m x 40 m at its base and 2.5 m in embankment height. It will therefore have a capacity calculated below.

$$V = 60 \times 40 \times 2.0 = 4,800\ m^3$$

The farm pond embankment will be constructed by earth banking work, with its surface covered with PVC sheet or the like and provided with a slope of 1 : 2.0.

The elevation of the farm pond bottom, as calculated from the balance between the volume of excavation work and banking work, is 98.00 m.

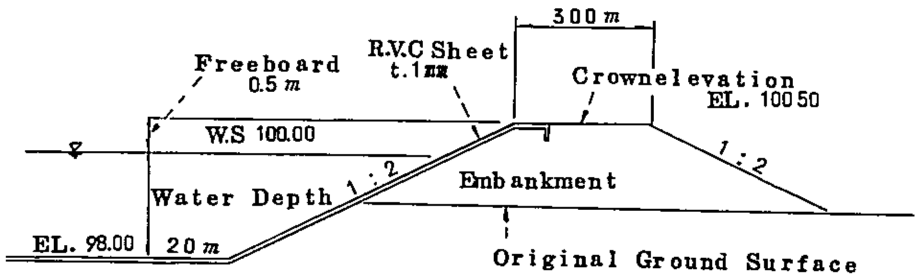


Fig. 4.4.1 Cross Section of Farm Pond Embankment

CHAPTER V COST ESTIMATE

5.1 General Description

Cost estimate of the project was made for each of the following categories of investment.

Table 5.1.1

1.	Irrigation Infrastructural Improvement	1.1	Tube well drilling works
		1.2	Irrigation works
		1.3	Related works
		1.4	Initial input for agriculture
2.	Hardinath Extension Farm	2.1	Facilities
		2.2	Machinery and materials
		2.3	Operation
3.	Extension Activities	3.1	Facilities
		3.2	Machinery and materials
		3.3	Operation
4.	Rapti Model Farm	4.1	Facilities
		4.2	Machinery and materials
		4.3	Operation
		4 4	Related irrigation works
5.	Project Centre	5.1	Facilities
		5.2	Machinery and materials
		5.3	Operation
6.	Improvement of Living Environments	6.1	Construction of demestic supply system
7.	Transport Facilities	7.1	Railways
		7.2	Airplane
		7.3	Operation

Estimation of the project cost is based on the following terms and conditions.

1) Technical cooperation project will run for seven years. The first two years starting from April 1972 and ending in November 1973 will be the preparatory period, and full-scale cooperation will be offered during the remaining five years.

2) Tube well drilling machinery, construction machinery, farming machinery and implement, steel materials, major structures and parts, cement, wires, fertilizers will be covered by the foreign currency portion, whereas local labour cost, wooden materials, bricks and fuels will be covered by HMG of Nepal in local currency.

3) All estimates are exclusive of any import duties or other taxes on machinery, equipment and materials that might be payable in Nepal and India in transit, and of any taxes that might be levied in Nepal.

4) Construction of the groundwater irrigation facilities in Janakpur Zone and of the irrigation facilitiesof Rapti Model Farm will be carried out for a period of five years from January 1974 to November 1978.

5) In this report, estimates are made only for those activities which will be undertaken during the initial stage of technical cooperation. Cost estimate for the project center and groundwater irrigation facilities, which are to be constructed in the latter part of the technical agreement, will be given in the next survey report.

5.2 Project Cost

Detailed calculation was worked out for the initial three year portion of the total. project cost which is stated in the first survey report.

Cost estimate for the said three years is shown in Table 5.2.1 and the break-down of the estimated cost for the same period is shown in Table 5.2.2.

5.3 Annual Fund Requirement

Tables 5.3.1 - 5.3.2 show the annual fund requirement as calculated on the basis of the work schedule.

A period of about one year is required for transport from Japan to Nepal of the machinery and equipment to be covered by the foreign currency portion. For this reason, costs of these machinery and equipment are carried forward to the following year. Table 5.2.2 was prepared according to this principle.

Table 5.2.1 Cost Estimate for Initial Stage (1972 - 1974)

('000 ¥)

Item	Description	Total Cost	Currency Component Foreign	Local
Infrastructural Improvement	Tube well drilling works	44,658.4	42,158.4	2,500
	Irrigation works	9,635	7,536	2,099
	Related works	0	0	0
	Initial input for agriculture	0	0	0
	Total	54,293.4	49,694.4	4,599
Hardinath Extension Farm	Facilities	11,330	8,893	2,437
	Machinery and materials	10,239	10,239	0
	Operation	3,485	0	3,485
	Total	25,054	19,132	5,922
Extension Activities	Facilities	539	99	440
	Machinery and materials	1,591	1,591	0
	Operation	750	0	750
	Total	2,880	1,690	1,190
Rapti Model Farm	Facilities	8,597	5,156	3,441
	Machinery and materials	5,611	5,611	0
	Operation	1,935	0	1,935
	Total	16,143	10,767	5,376
Project Center	Facilities	29,342.6	19,718	9,624.6
	Machinery and materials	6,104	6,104	0
	Operation	1,880	0	1,880
	Total	37,326.6	25,822	11,504.6
	Grand Total	135,697	107,105.4	28,591.6

Table 5.2.2 Detailed Break-Down of Estimated Cost

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
(I) Infrastructural Improvement							
Tube Well Drilling Works	Drilling works	set	1	44,659,400	44,559.4	42,158.4	2,500
Irrigation Works	Road	m	2,175	2,112,000	2,112	13	2,099
	Construction machinery						
	Angle dozer	no.	1	3,500,000	3,500	3,500	0
	Belt conveyor	no.	1	75,000	75	75	0
	Vehicle						
	Jeep	no.	1	1,330,000	1,330	1,330	0
	Truck	no.	1	2,618,000	2,618	2,618	0
Initial input for Agriculture	Chemical fertilizer	-	-	-	-	-	-
	Agricultural chemicals		-	-	-	-	-
	Total				34,294.4	49,694.4	4,599

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Local ('000 ¥)
(II) Hardinath Extension Farm							
Facilities	Green house	m^2	50	11,000	550	110	440
	Stable compost shed	m^2	50	11,000	550	110	440
	Indoor's nursery bed	m^2	50	10,000	1,150	145	805
	Miscellaneous		L.S.		440	60	350
	Contingency	%	10				
	Sub-Sub-Total				2,930	693	2,237
	Office (prefabricated)			8,400,000	8,400	8,200	200
	Sub-Sub-Total				8,400	8,200	200
	Sub-Total				11,330	8,893	2,437
Machinery Vehicle	Jeep	no.	1	1,330,000	1,330	1,330	0
	Truck (2 t)	no.	1	1,500,000	1,500	1,500	0
	Motor-bicycle	no.	2	150,000	150	150	0
	Bicycle	no.	4	25,000	50	50	0
	Sub-Sub-Total				3,030	3,030	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
Agricultural Machinery	Tractor (35 PS)	no.	1	1,500,000	1,500	1,500	0
	- do - (0.5 - 8 PS)	no.	2	775,000	1,550	1,550	0
	Minor implements		L.S.		900	900	0
	Spare parts		L.S.		600	600	0
	Sub-Sub-Total				4,550	4,550	0
Office Supplies	Desk	no.	3	25,000	75	75	0
	Chair	no.	3	10,000	30	30	0
	Book-shelf	no.	3	30,000	90	90	0
	Duplicator	no.	1	74,000	74	74	0
	Typewriter	no.	1	30,000	30	30	0
	Calculating machine	no.	1	34,000	34	34	0
	Miscellaneous		L.S.		50	50	0
	Sub-Sub-Total				383	383	0
Equipment for Survey and Experiment	Regrigerator	no.	1	90,000	90	90	0
	Portable pit meter	no.	1	35,000	35	35	0
	Portable Eh meter	no.	1	40,000	40	40	0
	Hand level	no.	1	10,000	10	10	0
	Transit	no.	1	150,000	150	150	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥")	Current Component Foreign ('000 ¥)	Current Component Local ('000 ¥)
	Clinometer	no.	1	5,000	5	5	0
	Soil survey equipment	set	1	22,000	22	22	0
	Tent	no.	2	9,000	18	18	0
	Generator (2 KV)	no.	1	150,000	150	150	0
	Miscellaneous	L.S.			231	231	0
	Sub-Sub-Total				741	741	0
Audio-visual Aids	Slide projector	no.	1	45,000	45	45	0
	Tape recorder	no.	1	50,000	50	50	0
	Transistor radio	no.	1	65,000	65	65	0
	Movie camera (8 mm)	no.	1	60,000	60	60	0
	Camera (35 mm)	no.	1	55,000	55	55	0
	Miscellaneous	L.S.			170	170	0
	Sub-Sub-Total				445	445	0
	Sub-Total				9,149	9,149	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Current Component Foreign ('000 ¥)	Current Component Local ('000 ¥)
Materials							
Agricultural Materials	Chemical fertilizer						
	Agricultural chemicals	L. S.			550	550	0
	Miscellaneous						
	Sub-Sub-Total				550	550	0
Office supplies and others	Paper, penciles, minor instruments, etc.				360	360	0
	Sub-Sub-Total				360	360	0
Audio-visual Aids	Film, printing paper, developing solution, etc.				180	180	0
	Sub-Sub-Total				180	180	0
	Sub-Total				1,090	1,090	0
Operation	Fuel, oil, etc.	year	3		1,152	0	1,152
	Labor	year	3		2,016	0	2,016
	Contingency	%	10				
	Sub-Total				3,485	0	3,485
	Total				25,054	19,132	5,922

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Local ('000 ¥)
(III) Extension Activities Facilities	Store (A)	m^2	25	11 00	275	50	0
	Store (B)	m^2	25	11,000	165	30	135
	Miscellaneous	L.S.			50	10	40
	Contingency	%	10		49	9	40
	Sub-Total				539	99	440
Machinery	Hand duster	no.	15	3,000	51	51	0
	Hand sprayer	no.	10	9,700	145.5	145.5	0
	Weeder	no.	15	7,000	105	105	0
	Parmers' tools	set	30	5,000	150	150	0
	Pump set	set	2	98,000	196	196	0
	Diesel engine	no.	2	64,000	128	128	0
	Gasoline engine	no.	2	60,000	60	60	0
	Miscellaneous	L.S.			150	150	0
	Sub-Sub-Total				937	937	0
Office Supplies and others	Miscellaneous	L.S.			354	354	0
	Sub-Sub-Total				354	354	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
Agricultural Materials					300	300	0
	Sub-Sub-Total				300	300	0
	Sub-Total				1,591	1,591	0
Operation	Fuel, oil, etc.		L.S.		400	0	400
	Labor		L.S.		300	0	300
	Miscellaneous				50	0	50
	Sub-Total				750	0	750
	Total				2,880	1,690	1,190
(IV) Rapti Model Farm Facilities	Power house	no.	1	600,000	600	180	420
	Green house	m^2	50	11,000	550	110	440
	Stable compost shed	m^2	50	11,000	550	110	440
	Work shop	m^2	50	11,000	550	110	440
	Outdoor's nursery bed	m^2	115	10,000	1,150	330	820
	Miscellaneous		L.S.		970	120	850

(continuous)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
	contingency	%	10		437	96	341
	Sub-Sub-Total				4,807	1,056	3.751
	Office (pre-fabricated)	no.	1	4,200,000	4,200	4,100	100
	Sub-Sub-Total				4,200	4,100	100
	Sub-Total				8,597	5,156	3,441
Machinery Vehicle	Truck (2 t)	no.	1	1,500,000	1,500	1,500	0
	Motor-bicycle	no.	2	150,000	300	300	0
	Bicycle	no.	2	25,000	50	50	0
	Sub-Sub-Total						
Agricultural Machinery	Tractor (5-6.5 PS)	no.	1	390,000	390	390	0
	-do- (6.5-8 PS)	no.	1	775,000	775	775	0
	Miscellaneous		L.S.		600	600	0
	Spare parts		L.S.		300	300	0
	Sub-Sub-Total						
Office Supplies	Desk	no.	1	25,000	25	25	0
	Chair	no.	1	10,000	10	10	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
	Book-shelf	no.	1	30,000	30	30	0
	Calculating machine	no.	1	34,000	34	34	0
	Miscellaneous		L. S.		150	150	0
	Sub-Sub-Total				249	249	0
Equipment for Survey and Experiment	Refrigerator	no.	1	90,000	90	90	0
	Soil survey equipment	set	1	22,000	22	22	0
	Tent	no.	2	9,000	9	9	0
	Sleeping bag	no.	2	6,000	6	6	0
	Hand level	no.	1	10,000	10	10	0
	Miscellaneous		L. S.		200	200	0
	Sub-Sub-Total				337	337	0
Audio-visual Aids	Slide projector	no.	1	45,000	45	45	0
	Tape recorder	no.	1	50,000	50	50	0
	Camera (35 mm)	no.	1	65,000	65	65	0
	Miscellaneous		L. S.		160	160	0
	Sub-Sub-Total				310	310	0
	Sub-Total				4,811	4,811	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
Materials							
Agricultural Materials	Chemical fertilizer	ton					0
	Agricultural chemicals	L.S.			350	350	0
	Miscellaneous						
	Sub-Sub-Total				350	350	0
Office Supplies and others	Paper, pencils, minor instruments, etc.	L.S.			250	250	0
	Sub-Sub-Total				250	250	0
Audio-visual Aids	Film, printing paper, etc.	L.S.			200	200	0
	Sub-Sub-Total				200	200	0
	Sub-Total				800	800	0
Operation	Fuel, oil, etc.	L.S.			655	0	655
	Labor	L.S.			1,754	0	1,754
	Contingency	%	10				
	Sub-Total				1,935	0	1,935
	Total				16,143	10,767	5,376

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
(V) Project Center Facilities	Power house	no.	1	600,000	600	180	420
	Clinic	no.	1	1,400,000	1,400	280	1,120
	Guest house	no.	1	2,970,000	2,970	594	2,376
	Fuel tank	no.	1	450,000	450	250	200
	Miscellaneous	L.S.			466	116	350
	Contingency	%	10		608.6	148	460.6
	Sub-Sub-Total				6,634.6	1,568	5,066.6
	Office	no.	4	4,200,000	16,800	16,400	400
	Sub-Sub-Total				16,800	16,400	400
	Sub-Total				23,434.6	17,968	5,466.6
Machinery Vehicle	Jeep	no.	2	1,330,000	2,660	2,660	0
	Motor-bicycle	no	2	150,000	300	300	0
	Bicycle	no.	2	25,000	50	50	0
	Sub-Sub-Total				3,010	3,010	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
Office Supplies	Desk	no.	4	25,000	100	100	0
	Chair	no.	4	10,000	40	40	0
	Bookshelf	no.	5	30,000	150	150	0
	Duplicator	no.	1	74,000	74	74	0
	Typewriter	no.	2	30,000	60	60	0
	Electric calculating machine	no.	1	150,000	150	150	0
	Miscellaneous	L.S.			120	120	0
	Sub-Sub-Total				694	694	0
Equipment for survey	Tent	no.	3	9,000	27	27	0
	Ground sheet	no.	2	7,000	14	14	0
	Sleeping bag	no.	6	7,000	42	42	0
	Binoculars	no.	3	20,000	60	60	0
	Miscellaneous	L.S.			307	307	0
	Sub-Sub-Total				450	450	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
Others	Generator	no.	2	80,000	160	160	0
	Water pump	no.	2	70,000	140	140	0
	Handy talking set	set	1	200,000	200	200	0
	Telephone set	set	1	600,000	600	600	0
	Miscellaneous	L.S.			800	800	0
	Sub-Sub-Total				1,750	1,750	0
	Sub-Total				7,454	7,454	0
Materials							
Office Supplies	Paper, pencils, minor instruments, etc.	L.S.			150	150	0
	Sub-Sub-Total				150	150	0
Others	Materials for survey, construction, etc.	L.S.			250	250	0
	Sub-Sub-Total				250	250	0
	Sub-Total				400	400	0

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)	Currency Component Foreign ('000 ¥)	Currency Component Local ('000 ¥)
Operation	Fuel, oil, etc.	L.S.			1,174	0	1,174
	Labor	L.S.			535	0	535
	Contingency	%	10				
	Sub-Total				1,880	0	1,880
Land	Purchasing and land arrangement	L.S.			4,158	0	4,158
	Total				37,326.6	25,822	11,504.6
	Grand Total				135,679	107,105	28,592

Table 5.3.1 Annual Requirement of Foreign Currency in Japan (1972 - 1978) ('000 ¥)

Item	1972	1973	1974	1975	1976	1977	1978	Total
Vehicle (including aeroplane)	4,340	9,048	8,510	39,190	4,660	1,330	0	-
Machinery and materials for construction	25,880	21,561	20,000	15,000	20,000	10,000	0	-
Machinery and materials for infrastructural improvement	0	42,171.4	35,000	45,000	35,000	1,000	0	-
Agricultural machinery and materials	4,197	4,555	20,000	15,000	20,000	7,000	3,500	-
Equipment for survey and experiment	881	1,247	2,250	2,130	1,500	1,500	1,000	-
Audio-visual aids	0	1,135	1,500	2,100	2,300	1,500	850	-
Machinery for communication	0	0	5,500	2,100	1,500	850	600	-
Office supplies	976	1,116	2,500	3,170	2,840	930	630	-
Total	36,272	70,833.4	95,260	123,690	87,800	24,110	6,580	444,545.4

Table 5.3.2 Annual Fund Requirement (1972 - 1974) ('000 ¥)

Fiscal Year: Japan	Fiscal Year: Nepal	Foreign Currency	Local Currency	Total
1972	1972-1973	36,272	14,019	50,291
1973	1974	70,833.4	14,572.6	85,406
Total		107,105.4	28,591.6	135,697

ANNEX

ANNEX I

CONTENT

ANNEX I
CONTENT (Cont'd)

A. BREAK DOWN OF COST ESTIMATE

A-1 Infrastructural Improvement

A-1-1 Janakpur Zone

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
LAND ARRANGEMENT									
1. Irrigation Canal									
	Main Canal I	m	922.1			45.91	42,334		
	Main Canal II	m	627.7			45.91	32,031		II-1 - II-2
	Main Canal II	m	869.8			51.98	45,212		II-2 - II-4
	Main Canal III	m	1,458.0			43.01	62,709		III-1 - III-4 III-5 - III-6
	Main Canal III	m	522.9			51.98	27,180		III-4 - III-5
	Link Canal	m	792.6			49.34	39,107		I-2 - II-2
	Link Canal	m	786.3			55.26	43,451		II-2 - III-4
	Link Canal	m	1,075.9			64.40	69,288		III-4 - A-4
	Junction Work No. 1	No.	1	4,705	4,710	909.93	910		
	Junction Work No. 2	No.	1	9,158	9,160	1,271.65	1,272		
	Junction Work No. 3	No.	1	9,141	9,140	1,279.33	1,279		
	Siphon No. 1	No.	1	23,427	23,430	907.28	907		
	Siphon No. 2	No.	1	23,374	23,370	849.87	850		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
	Siphon No. 3	No.	1	37,758	37,760	830.86	831		
	Outlet Type A	No.	24	4,826	115,820	77.09	1,850		
	Outlet Type B	No.	14	10,491	146,870	147.12	2,060		
	Culvert	No.	25	8,991	224,780	61.57	1,539		
	Drop	No.	3	57	170	8.83	26		
	Stoplog Structure	No.	7	57	400	8.83	62		
	Tube Well Structure	No.	8	-		1,667.37	13,339		
	Sub Total				595,610		386,237		
2. Drainage Canal									
	Drainage Canal	m	5,830			1.19	6,938		
	Sub Total						6,938		
3. Road									
	Main Road	m	4,350			31.80	138,330		
	Branch Road	m	7,130	To be included at Main Canal and Link Canal					
	Culvert	No.	3	8,991	26,970	61.57	185		ϕ 300
	Sub total				26,970		138,515		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
4.	Contingency	%	10		62,260		53,169		
	Total				684,840		584,859		
HARDINATH EXTENSION FARM									
1.	Connecting Road								
	Connecting road	m	1,515.0			188.87	286,138		
	Improved road	m	1,150.0			163.82	188,393		
	Bridge	No.	2	600,000	1,200,000	9,514.53	19,029		
	Culvert	No.	6	29,145	174,870	475.73	2,854		
	Sub Total				1,374,870		496,414		

A-1-2 Break Down of Cost Estimate

........Infrastructural Improvement
in Rapti Model Farm

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
LIFT IRRIGATION FACILITIES									
1. Pumping Station									
	Pump facilities	set	1	15,850,000	15,850,000				
	Housing	No.	1	160,000	160,000	36,096.00	36,096		
	Suction pit	No.	1			9,692.29	9,692		
	Sub Total				16,010,000		45,788		
2. Pipe Line System									
	Pipe line	m	2,200.0	9,405	20,691,000	11.02	24,244		
	Surge tank	No.	1			972.19	972		
	Air valve box	No.	2	46,000	92,000	118.65	237		
	Blow off	No.	1	50,043	50,040	443,54	444		
	Outlet	No.	7	57,085	399,600	64.85	454		
	Sub Total				21,232,640		26,351		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
3. Farm Pond									
	Farm Pont	No.	1	2,128,500	2,128,500	17,887.15	17,887		
	Discharge Structure	No.	1	88,000	88,000	344.78	1,979		
	Intake	No.	1	78,947	78,950	1,979.49	335		
	Spillway	No.	1	62	60	813.48	813		
	Sub-Total				2,295,510		21,014		
4. Contingency		%	10		3,953,810		9,315		
	Total				43,491,960		102,468		

A-1-3 Detailed Break Down of Cost Estimate

........Infrastructural Improvement in Janakpur Zone

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Main Canal 10 m	Brick work	m^3	1,621			141.26	228.98		I-1 - I-3 II-1 - II-2
	Cement mortar plastering	m^2	21.30			5.92	126.10		
	Banking	m^3	32.7			3.18	103.99		
	Total						459.07		
Main Canal 10 m	Brick work	m^3	1.901			141.26	268.54		II-2 - II-4 III-4 - III-5
	Cement mortar plastering	m^2	25.30			5.92	149.78		
	Banking	m^3	31.9			3.18	101.44		
	Total						519.76		
Main Canal 10 m	Brick work	m^3	1.489			141.26	210.34		III-1 - III-4 III-5 - III-6
	Cement mortar plastering	m^2	20.10			5.92	118.99		
	Banking	m^3	31.7			3.18	100.81		
	Total						430.14		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Link Canal 10 m	Brick work	m^3	1.769			141.26	249.89		I-2 - II-2
	Cement mortar plastering	m^2	24.10			5.92	142.67		
	Banking	m^3	31.7			3.18	100.81		
	Total						493.37		
Link Canal 10 m	Brick work	m^3	2.041			141.26	288.31		II-2 - III-4
	Cement mortar plastering	m^2	27.30			5.92	161.62		
	Banking	m^3	32.3			3.18	102.71		
	Total						552.64		
Link Canal 10 m	Brick work	m^3	2.461			141.26	347.64		III-4 - A-4
	Cement mortar plastering	m^2	33.30			5.92	197.14		
	Banking	m^3	31.20			3.18	99.22		
	Total						644.00		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Junction Work No. 1	Brick work	m^3	4,711			141.26	665.48		
	Cement mortar plastering	m^2	36.52			5.92	216.20		
	Stop log	m^3	0.032			882.86	28.25		
	Steel	kg	8.748	31	271				L-40 x 40 x 3
	Corrugated metal pipe	kg	36.966	120	4,435				ϕ 250 t = 1.6
	Total				4,705		909.93		
Junction Work No. 2	Brick work	m^3	6.559			141.26	926.52		
	Cement mortar plastering	m^2	53.08			5.92	314.23		
	Stop log	m^3	0.035			882.86	30.90		
	Steel	kg	9.224	31	286				L-40 x 40 x 3
	Corrugated metal pipe	kg	73.932	120	8,872				ϕ 250 t = 1.6
	Total				9,158	1,271.65			

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Junction Work No. 3	Brick work	m^3	6.640			141.26	937.97		
	Cement mortar plastering	m^2	52.89			5.92	313.11		
	Stop log	m^3	0.032			882.86	28.25		
	Steel	kg	8.675	31	269				L-40 x 40 x 3
	Corrugated metal pipe	kg	73.932	120	8,872				ϕ 250 t = 1.6
	Total				9,141		1,279.33		
Siphon No. 1	Brick work	m^3	4.742			141.26	669.85		
	Cement mortar plastering	m^2	37.72			5.92	223.30		
	Stop log	m^3	0.016			882.86	14.13		
	Steel	kg	4.466	31	138				L-40 x 40 x 3
	Corrugated metal pipe	kg	194.072	120	23,289				ϕ 250 t = 1.6
	Total				23,427		907.28		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Siphon No. 2	Brick work	m^3	4.511			141.26	637.22		
	Cement mortar plastering	m^2	34.28			5.92	202.94		
	Stop log	m^3	0.011			882.86	9.71		
	Steel	kg	2,782	31	86				L-40 x 40 x 3
	Corrugated metal pipe	kg	194.07	120	23,288				∅ 250, t = 1.6
	Total				23,374		849.87		
Siphon No. 3	Brick work	m^3	4.331			141.26	611.80		
	Cement mortar plastering	m^2	34.32			5.92	203.17		
	Stop log	m^3	0.018			882.86	15.89		
	Steel	kg	4.612	31	143				L-40 x 40 x 3
	Corrugated metal pipe	kg	313.461	120	37.615				∅ 450, t = 1.6
	Total				27.758		830.86		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Outlet Type A	Brick work	m^3	0.376			141.26	53.11		
	Cement mortar plastering	m^2	2.26			5.92	13.38		
	Stop log	m^3	0.009			882.86	7.95		
	Steel	kg	2.281	31	71				L-40 x 40 x 3
	P.V.C. Pipe	m	0.70	650	455				ϕ 125 mm
	P.V.C. pipe (bend)	No.	2	2,000	4,000				ϕ 125 mm 45°
	Cap	m^3	0.003			882.86	2.65		ϕ 125, t = 50
	Chain	m	1.0	300	300				
	Total				4,826		77.09		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Outlet Type B	Brick work	m^3	0.752			141.26	106.23		
	Cement mortar plastering	m^2	4.52			5.92	26.76		
	Stop log	m^3	0.009			882.86	7.95		
	Steel	kg	2.281	31	71				L-40 x 40 x 3
	P.V.C. Pipe	m	2.80	650	1,820				ϕ 125 mm
	P.V.C. Pipe (Bend)	No.	4	2,000	8,000				ϕ 125 mm 45°
	Cap	m^3	0.007			882.86			ϕ 125, t = 50
	Chain	m	2.0	300	600				
	Total				10,491		147.12		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Culvert (ø300) 1 unit	Brick work	m^3	0.250			141.26	35.32		
	Cement mortar plastering	m^2	3.690			5.92	21.84		
	Stop log	m^3	0.005			882.86	4.41		
	Steel	kg	1.464	31	45				L-40 x 40 x 3
	Corrugated metal pipe	kg	74.554	120	8,946				ø 300, t = 1.6
	Total				8,991		61.57		
Stop log structure 1 unit	Steel	kg	1.83	31	57				L-40 x 40 x 3
	Stop log	m^3	0.01			882.86	8.83		
	Total				57		8.83		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Tube Well 1 unit	Boulder concrete	m^3	6.844			176.57	1,208.45		
	Form	m^2	32.78			14.00	458.92		
	Total						1,667.37		
Drop 1 unit	Steel	kg	1.83	31	57				L-40 x 40 x 3
	Stop log	m^3	0.01			882.86	8.83		
	Total				57		8.83		
Drainage canal 10 m	Excavation	m^3	3.75			3.18	11.93		
	Total						11.93		
Main Road 10 m	Banking	m^3	100.0			3.18	318.00		Improved road
	Total						318.00		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Connecting Road 10 m	Banking	m^3	68.3			3.18	218.78		
	Excavation	m^3	10.0			3.18	31.80		
	Gravel	m^3	12.0			3.18	38.16		
	Asphalt pavement	m^2	40.0			40.00	1,600.00		
	Total						1,888.74		
Improved Road 10 m	Gravel	m^3	12.0			3.18	38.16		To Hardinath Farm
	Asphalt pavement	m^2	40.0			40.00	1,600.00		
	Total						1,638.16		
Culvert (ϕ500) 1 unit	Brick work	m^3	2.391			141.26	337.75		
	Cement mortar plastering	m^2	19.58			5.92	115.91		
	Stop log	m^3	0.025			882.86	22.07		
	Steel	kg	2.928	31	91				L-40 x 40 x 3
	Corrugated metal pipe	kg	242.119	120	29.054				ϕ 500 t = 1.6
	Total				29.145		475.73		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Bridge 1 unit	Excavation	m^3	25.0			3.18	79.50		
	Backfilling	m^3	15.0			3.18	47.70		
	Boulder concrete	m^3	29.5			176.57	5,208.82		Abutment
	Slab concrete	m^3	9.2			335.49	3,086.51		
	Form	m^2	78.0			14.00	1,092.00		
	Superstructure	set	1	600,000	600,000				Steel Beam etc.
	Total				600,000		9,514.53		

A-1-4 Detailed Break Down of Cost Estimate

.... Infrastructural Improvement in Rapti Model Farm

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Suction Pit									
	Excavation	m^3	500.0			3.18	1,590.00		
	Backfilling	m^3	100.0			3.18	318.00		
	Boulder concrete	m^3	17.666			176.57	3,119.29		
	Form	m^2	43.91			14.00	614.74		
	Wet masonry	m^3	5.359			140.00	750.26		
	Dry masonry	m^3	330.0			10.00	3,300.00		
	Total						9,692.29		
Pipe Line 10 m	Excavation	m^3	13.8			3.18	43.88		
	Backfilling	m^3	13.0			3.18	41.34		
	Steel Pipe ϕ 300	kg	627.0	150	94.050				with flange
	Pipe laying	m	10			2.50	25.00		
	Total				94.050		110.22		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Oneway Surge Tank	Boulder concrete	m^3	3.445			176.57	608.28		
	Form	m^2	19.94			14.00	279.16		
	Plank	m^3	0.096			882.86	84.75		
	Steel surge tank	set	1	To be included at Pump Facilities					
	Total						972.19		
Air Valve Box 1 unit	Air valve	set	1	16,000	16,000				ϕ 25 mm
	T Pipe	No.	1	30,000	30,000				ϕ300 x 25
	Brick work	m^3	0.456			141.26	64.41		
	Cement mortar plastering	m^2	6.926			5.92	41.00		
	Plank	m^3	0.015			882.86	13.24		
	Total				46.000		118.65		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Blow Off 1 unit	Blow off pipe	No.	1	30,000	30,000				ϕ 300 x 75
	Sluice valve	set	1	17,000	17,000				ϕ 75 mm
	Steel pipe	kg	17.9	170	3,043				ϕ 75, = 2 m
	Boulder concrete	m^3	0.161			176.57	28.43		
	Excavation	m^3	25.0			3.18	79.50		
	Backfilling	m^3	20.0			3.18	63.60		
	Plank	m^3	0.015			882.86	13.24		
	Brick work	m^3	1.083			141.26	152.98		
	Cement mortar plastering	m^2	15.34			5.92	90.81		
	Form	m^2	1.07			14.00	14.98		
	Total				50,043		443.54		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Outlet 1 unit	Field Valve	set	1	20,000	20,000				ϕ 75
	T Pipe	No.	1	30,000	30,000				ϕ 300 x 75
	Steel Pipe	kg	26.40	150	3,960				ϕ 75 ℓ = 3.0 m
	Steel Pipe (Bend)	No.	1	3,000	3,000				90° Bend
	Brick work	m^3	0.292			141.26	41.25		
	Cement mortar plastering	m^2	3.987			5.92	23.60		
	Steel	kg	4.026	31					
	Total				57,085		64.85		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Farm Pond	Excavation	m^3	3,181.8			3.18	10,118.12		
	Banking	m^3	1,834.6			3.18	5,834.03		
	Leveling	m^2	3,870.0			0.50	1,935.00		
	P.V.C. Sheet	m^2	3,870.0	550	2,128,500				
	Total				2,128,500		17,887.15		
Discharge structure	Sluice valve	set	1	88,000	88,000				ϕ 300
	Steel pipe	kg	-	To be included at Pipe Line					ϕ 300
	Brick work	m^3	1,404			141.26	198.33		
	Cement mortar plastering	m^2	18,129			5.92	107.32		
	Plank	m^3	0.033			882.86	29.13		
	Total				88,000		334,78		

Item	Description	Unit	Q'ty	Currency Component				Total Cost Yen	Remarks
				Foreign		Local			
				Rate Yen	Cost Yen	Rate Rs	Cost Rs		
Intake	Sluice gate	set	1	70,000	70,000				Steel ϕ 300
	Corrugated metal pipe	kg	74.557	120	8,947				ϕ 300 t = 1.6
	Brick work	m^3	11.635			141.26	1,643.56		
	Cement mortar plastering	m^2	56.745			5.92	335.93		
	Total				78,947		1,979.49		
Spill way	Brick work	m^3	4.193			141.62	592.30		
	Cement mortar plastering	m^2	33.93			5.92	200.87		
	Steel	kg	2.013	31	62				L-40 x 40 x 3
	Stop log	m^3	0.023			882.86	20.31		
	Total				62		813.48		

A-2 Break Down of Cost Estimate

.... Tube Well Drilling Works

Remarks /1 : Cost for whole period of technical cooperation

/2 : Cost for initial stage of technical cooperation

Refer to the following tables

Tube Well Drilling Machinery and Materials

	PACKING LIST	N.W. (kg)	G.W. (kg)	C.F.T.
1.	Drilling Equipment	20,000	23,000	2,000
2.	Pump	7,000	8,000	1,200
3.	Generator	9,000	11,000	1,400
4.	Casing Pipe and Tools Screen	186,000	190,000	14,000
5.	Working Tools and Comsumable, Survey Equipment	33,000	37,000	2,700
6.	Transporting Equipment	30,000	35,000	4,800
7.	Camping Equipment	7,000	10,000	500
	TOTAL	292,000	314,000	26,600

Item		Description	Unit	Q'ty	Rate	Total Cost
(I)		IMPORTED MATERIAL				/1 /2
	(A)	Drilling Equipment				14,552,000 (21,519,600)
	(B)	Pump				4,200,000 (5,890,000)
	(C)	Generator				5,325,000 (6,115,000)
	(D)	Casing Pipe and Tools				6,043,500 (13,895,190)
	(E)	Screen				4,583,500 (12,029,500)
	(F)	Survey Equipment				984,600 (996,600)
	(G)	Working Tools and Consumables				2,441,800 (5,616,900)
	(H)	Transportation Equipment				3,618,000 (7,436,000)
	(I)	Camping Equipment				410,000 (4,745,000)
			TOTAL F.O.B. JAPAN			¥42,158,400 (¥78,243,790)
(II)		LOCAL MATERIAL	TOTAL LOCAL COST			¥ 4,900,440 (¥12,569,480)
						Rs 162,486 (Rs. 416,262)
(III)		LOCAL LABOR	TOTAL LOCAL COST			¥ 295,680 (¥ 887,040)
						Rs 9,792 (Rs 29,376)

(Estimated in January 1972)

/1 : Cost for the initial stage
/2 : Cost for the whole period

Item	Description	Unit	Q'ty	Rate	Total Cost	
(A)	DRILLING EQUIPMENT					
(A)-1	Drilling Machine Complete				4,259,220	(4,809,220)
(A)-2	Mud Slush Pump Complete				2,862,650	(3,490,320)
(A)-3	Mud Mixer Complete				320,800	(320,800)
(A)-4	Derrick Complete				1,030,000	(1,030,000)
(A)-5	Drill Rod				2,585,520	(3,013,200)
(A)-6	Drill Bit				2,493,800	(6,365,200)
(A)-7	Drilling Tools				557,400	(845,440)
(A)-8	Coring Tools				225,050	(1,404,700)
(A)-9	Fishing Tools				169,320	(169,320)
(A)-10	Metal Setting Tools and Consumable				15,780	(15,780)
(A)-11	General Tools				32,460	(55,620)
		TOTAL F.O.B. JAPAN			¥14,552,000	(¥21,519,600)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(A)-1	DRILLING MACHINE COMPLETE					
(A)-1-1	Rotary Spindle, Hydraulic Feed Large Hole Drilling Machine (TONE Mod. TBM-70 or equivalent)	unit	1 (1)		3,080,000	(3,080,000)
	Spare Parts for the Above consisting of 28 items	lot	1 (1)		411,990	(411,990)
(A)-1-2	Power Unit (Mitsui-Deutz Mod. F3L912 or equivalent)	unit	1 (1)		568,000	(568,000)
	Spare Parts for the Above Consisting of 35 items	lot	1 (1)		199,230	(749,230)
		TOTAL F.O.B. JAPAN			¥4,259,220	(¥4,809,220)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-1-1	ROTARY, SPINDLE, HYDRAULIC FEED LARGE HOLE DRILLING MACHINE (TONE Mod. TBM-70 or equivalent)				
	Capacity; Hole dia. - Depth 8"-500m 12"-400m 16"-300m 20"-200m				
	Spindle; Inside dia. approx. 93mm Spindle stroke, approx. 50mm				
	Transmission; At least 6 speed forward from 50 to 500 rpm and 2 speed reverse				
	Main hoist; Drum capacity 14mm wire x 70m, Max. hoisting capacity approx. 4t				
	Beiler hoist; Drum capacity 12mm wire x 200m, Max. hoisting capacity approx. 2.6t				
	Fram; Skid type with hydraulic retractable sliding base of a sliding stroke 500 mm				
	Dimensions (mm); 1,100 x 2,500 x 1,620				
	Weight; Gross weight 2,000 kg				
	Accessories; including of spanner for drill chuck 1 pc and disassembling tools kit 1 set	unit	1 (1)		3,080,000 (3,080,000)
	(Turbine oil should be equipped)				

Item	Description		Unit	Q'ty	Rate	Total cost	
	SPARE PARTS FOR THE ABOVE						
1.	Hose ass'y	D4320-006	pc	2 (2)	3,870	7,740	(7,740)
2.	Packing	E2521-543	pc	4 (4)	20	80	(80)
3.	Scale	E2961-001	pc	1 (1)		1,260	(1,260)
4.	Washer bearing	AW-12	pc	2 (2)	70	140	(140)
5.	Packing	UPH 68.88.12	pc	4 (4)	250	1,000	(1,000)
6.	Bearing ball	7222	pc	2 (2)	7,890	15,780	(15,780)
7.	- do -	6028	pc	2 (2)	9,640	19,280	(19,280)
8.	Washer bearing	AW-28	pc	2 (2)	600	1,200	(1,200)
9.	Felt ring	Fi 28	pc	2 (2)	170	340	(340)
10.	- do -	Fi 30	pc	1 (1)		300	(300)
11.	Oil seal	SBI 35165 14	pc	1 (1)		890	(890)
12.	Chuck bushing	EO255-001	pc	6 (6)	1,150	6,900	(6,900)
13.	Chuck pease	CF 3-02-85	pc	24 (24)	2,520	60,480	(60,480)
14.	Chuck pease	D2560-014	pc	24 (24)	5,930	142,320	(142,320)
15.	Chuck bolt	EO324-001	pc	12 (12)	990	11,880	(11,880)

Item	Description		Unit	Q'ty	Rate	Total Cost	
16.	Disc .clutch	JM62045-2	pc	4 (4)	6,820	27,280	(27,280)
17.	Pressure plate ass'y	K618281-0	set	1 (1)		11,730	(11,730)
18.	Clutch wire	D3422-003	pc	3 (3)	1,970	5,910	(5,910)
19.	Vinyl pipe	8ø x 750	pc	1 (1)		80	(80)
20.	Bearing	22313	pc	1 (1)		5,300	(5,300)
21.	Oil seal	SB80105 13	pc	1 (1)		320	(320)
22.	Brake lining with rivet	E2706-031	set	2 (2)	9,450	18,900	(18,900)
23.	Pressure gauge double pointer		pc	2 (2)	17,520	35,040	(35,040)
24.	Speed meter		pc	2 (2)	9,820	19,640	(19,640)
25.	Pressure gauge	BT 3/8x100x70 kg/cm^2	pc	2 (2)	3,920	7,840	(7,830)
26.	Grease nipples		set	2 (2)	840	1,680	(1,680)
27.	V-belt		set	2 (2)	1,930	3,860	(3,860)
28.	Spanner for drill chuck		pc	2 (2)	2,410	4,820	(4,820)
			lot	1 (1)		411,990	(411,990)

Item	Description		Unit	Q'ty	Rate	Total Cost	
(A)-1-2	POWER UNIT (MITSUI-DEUTZ Mod. F3L912 or equivalent) 3 cylinders and cooled type diesel engine Total displacement; 2,825 cc Max. output; 41 PS/2,500 rpm Accessories; standard accessories including of V-pulley 1 set, V-belt 1 set, belt cover 1 set and disassembling tools kit		unit	1 (1)		568,000	(568,000)
	SPARE PARTS FOR THE ABOVE						
1.	Spare diesel engine		set	0 (1)		0	(550,000)
2.	Main bearing	9-01009-0 MIA-6	pc	2 (2)	1,500	3,000	(3,000)
3.	Thrust ring	9-01306-0 MIA-10	pc	2 (2)	1,600	3,200	(3,200)
4.	Idle pulley	8-01040-3 MIA-39	pc	1 (1)		8,800	(8,800)
5.	Cylinder	9-04002-0 MIC-1	pc	1 (1)		12,100	(12,100)
6.	Exhaust valve	8-0381A-0 MIC-9	pc	2 (2)	1,100	2,200	(2,200)
7.	Inlet valve	9-08012-0 MIC-14	pc	2 (2)	660	1,320	(1,320)
8.	Split collar	8-08020-0 MIC-16	pc	3 (3)	70	210	(210)
9.	Valve spring	8-08021-0 MIC-17	pc	3 (3)	220	660	(660)

Item	Description		Unit	Q'ty	Rate	Total Cost	
10.	Cylinder head bolt	9-08008-0 MIC-18	pc	3 (3)	660	1,980	(1,980)
11.	Valve guide	8-08308-0 MIC-8	pc	3 (3)	400	1,200	(1,200)
12.	Spring ring	8-08305-0 MIC-12	pc	6 (6)	15	90	(90)
13.	Tension bolt M12 x 15 x 55	10K M50-9	pc	6 (6)	170	1,020	(1,020)
14.	Crank pin metal	9-06001-0 M5D-12	pc	3 (3)	1,540	4,620	(4,620)
15.	Piston complete	9-07001-0 M5D-13	pc	1 (1)		12,100	(12,100)
16.	Piston ring (top)	9-07005-0 M5D-16	pc	3 (3)	550	1,650	(1,650)
17.	- do - (second, third)	9-07006-0 M5D-17	pc	6 (6)	270	1,620	(1,620)
18.	Oil scrape ring	9-07007-0 M5D-18	pc	3 (3)	500	1,500	(1,500)
19.	Lube oil filter	8-15312-3 MIF-10	pc	20 (20)	1,200	24,000	(24,000)
20.	Injection nozzle	9-19003-0 M5G-37	pc	3 (3)	2,300	6,900	(6,900)
21.	Fuel oil filter	9-201001 M5G-47	pc	20 (20)	1,430	28,600	(28,600)
22.	V-belt to blower	8-39024-3 M5H-19	pc	2 (2)	750	1,500	(1,500)
23.	V-belt to dynamo	8-44024-10 M5L-12	pc	2 (2)	650	1,300	(1,300)
24.	Packing kit	9-50005-3	pc	1 (1)		8,200	(8,200)

Item	Description		Unit	Q'ty	Rate	Total Cost	
25.	Starter	9-441002 M5K-6	pc	1 (1)		41,000	(41,000)
26.	Dynamo (12V 120W)	8-441235 M5L-15	pc	1 (1)		12,000	(12,000)
27.	Regulator	8-441081 M5L-57	pc	1 (1)		2,500	(2,500)
28.	Safety relay	5-44045-5 M5K-11	pc	1 (1)		4,600	(4,600)
29.	Starter switch	8-48301-0 M58-5	pc	1 (1)		1,000	(1,000)
30.	Packing for air cleaner	8-221128 M5N-17	pc	2 (2)	280	560	(560)
31.	Taperd roller bearing	19(0003-0310)	pc	2 (2)	2,200	4,400	(4,400)
32.	Oil seal	24(09924-195)	pc	1 (1)		200	(200)
33.	Release bearing	31(00095-015)	pc	1 (1)		1,300	(1,300)
34.	Disk plate	5(51240-031)	pc	1 (1)		3,500	(3,500)
35.	Pilor bearing	1(0000-6205)	pc	1 (1)		400	(400)
			lot	1 (1)		199,230	(749,230)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(A)-2	MUD SLUSH PUMP COMPLETE					
(A)-2-1	MUD SLUSH PUMP (TONE Mod. NAS-500 or equivalent)	unit	1 (1)		1,250,000	(1,250,000)
	SPARE PARTS FOR THE ABOVE consisting of 22 items	lot	1 (1)		845,420	(1,473,090)
(A)-2-2	POWER UNIT (MITSUI-DEUTZ Mod. F3L912 or equivalent)	unit	1 (1)		568,000	(568,000)
	SPARE PARTS FOR THE ABOVE consisting of 34 items	lot	1 (1)		199,230	(199,230)
		TOTAL F.O.B. JAPAN			¥2,862,650	(¥3,490,320)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-2-1	MUD SLUSH PUMP (TONE Mod. NAS-500 or equivalent) 2 cylinders-double acting piston pump Capacity; approx. 500 /min Max. pressure; approx. 15 kg/cm^2 Cylinder bore dia; approx. 114 mm Dimensions (mm); 740x1, 620x1, 370 Weight; approx. 900 kg Accessories; 1. Suction hose with fitting 75mmx5m 2. Return hose with fitting 75mmx5m 3. Water swivel hose with fitting 50mm x15m 4. Intermediate hose with fitting 50mmx10m 5. Disassembling tools kit including of extractor for piston, extractor for valve seat, piston nut wrench, extractor bolt for cylinder cover, extractor bolt for gudjon pin, box spanner and spanner for packing gland	unit	1		1,250,000 (1,250,000)
	SPARE PARTS FOR THE ABOVE				
1.	Rubber packing E2702-128	pc	10 (16)	870	8,700 (13,920)
2.	Cylinder liner 114ϕ	pc	10 (16)	21,000	210,000 (336,000)
3.	Retainer E2735-017	pc	2 (4)	630	1,260 (2,520)

Item	Description		Unit	Q'ty	Rate	Total Cost
4.	Piston rod with nuts	D2841-084	pc	8 (16)	6,800	55,040 (110,080)
5.	Piston ass'y	114ø	pc	8 (16)	11,000	88,320 (176,640)
6.	Piston rubber	114ø	pc	30 (48)	1,440	43,220 (69,120)
7.	Valve ball ass'y	D4046-020	pc	30 (48)	9,150	274,500 (439,200)
8.	O-ring	P-90	pc	16 (32)	60	960 (1,920)
9.	- do -	P-140	pc	4 (8)	120	480 (960)
10.	Diaphragm	D4047-001	pc	1 (2)	150	150 (300)
11.	Pressure gauge	BT3/8x100x80 kg/cm^2	pc	2 (4)	3,920	7,840 (15,680)
12.	Bushing	E0251-086	pc	2 (4)	750	1,500 (3,000)
13.	Graphite packing	5/16 SQ x 270 1	pc	2 (4)	30	60 (120)
14.	Oil level gauge ass'y	T-LG-0035	pc	2 (4)	290	580 (1,160)
15.	Oiler ass'y	E4587-001	set	1 (1)		900 (900)
16.	Packing	2521-337	pc	1 (1)		250 (250)
17.	V-belt		set	2 (4)	3,400	6,800 (13,600)
18.	V-packing		set	24 (48)	2,180	52,320 (104,640)
19.	Suction hose	75mm x 5m	pc	2 (4)	3,680	7,360 (14,720)

Item	Description		Unit	Q'ty	Rate	Total Cost
20.	Water swivel hose	50mm x 15m	pc	2 (4)	34,650	69,300 (138,600)
21.	Intermediate hose	50mm x 10m	pc	1 (2)	13,860	13,860 (27,720)
22.	Return hose	50mm x 5m	pc	1 (1)		2,040 (2,040)
			lot	1 (1)		845,420 (1,473,090)
(A)-2-2	POWER UNIT (MITSUI-DEUTZ Mod. F3C912 or equivalent) 3 cylinders air cooled type diesel engine Total displacement; 2,825 cc Max. output; 41 PS/2,500 rpm Accessories; standard accessories including of V-pulley 1 set, V-belt 1 set and belt cover		unit	1 (1)		568,000 (568,000)
	SPARE PARTS FOR THE ABOVE					
1.	Main bearing	9-01009-0 MIA-6	pc	2 (2)	1,500	3,000 (3,000)
2.	Thrust ring	9-01306-0 MIA-10	pc	2 (2)	1,600	3,200 (3,200)
3.	Idle pulley	8-01040-3 MIA-39	pc	1 (1)		8,800 (8,800)
4.	Cylinder	9-04002-0 MIC-1	pc	1 (1)		12,100 (12,100)
5.	Exhaust valve	8-0381A-0 MIC-9	pc	2 (2)	1,100	2,200 (2,200)

Item	Description		Unit	Q'ty	Rate	Total Cost	
6.	Inlet valve	9-08012-0 MIC-14	pc	2 (2)	660	1,320	(1,320)
7.	Split collar	8-08020-0 MIC-16	pc	3 (3)	70	210	(210)
8.	Valve spring	8-08021-0 MIC-17	pc	3 (3)	220	660	(660)
9.	Cylinder head bolt	9-08008-0 MIC-18	pc	3 (3)	660	1,980	(1,980)
10.	Valve guide	8-08308-0 MIC-8	pc	3 (3)	400	1,200	(1,200)
11.	Spring ring	8-08305-0 MIC-12	pc	6 (6)	15	90	(90)
12.	Tension bolt	M12x1.5x55-10K M5D-9	pc	6 (6)	170	1,020	(1,020)
13.	Crank pin metal	9-06001-0 M5D-12	pc	3 (3)	1,540	4,620	(4,620)
14.	Piston complete	9-07001-0 M5D-13	pc	1 (1)		12,100	(12,100)
15.	Piston ring (top)	9-07005-0 M5D-16	pc	3 (3)	550	1,650	(1,650)
16.	- do - (second, third)	9-07006-0 M5D-17	pc	6 (6)	270	1,620	(1,620)
17.	Oil scrape ring	9-07007-0 M5D-18	pc	3 (3)	500	1,500	(1,500)
18.	Lube oil filter	8-15312-3 MIF-10	pc	20 (20)	1,200	24,000	(24,000)
19.	Injection nozzle	9-19003-0 M5G-37	pc	3 (3)	2,300	6,900	(6,900)
20.	Fuel oil filter	9-201001 M5G-47	pc	20 (20)	1,430	28,600	(28,600)
21.	V-belt to blower	8-39024-3 M5H-19	pc	2 (2)	750	1,500	(1,500)

Item	Description		Unit	Q'ty	Rate	Total Cost
22.	V-belt to dynamo	8-44024-10 M5L-12	pc	2 (2)	650	1,300 (1,300)
23.	Packing kit	9-50005-3	pc	1 (1)		8,200 (8,200)
24.	Starter	9-441002 M5K-6	pc	1 (1)		41,000 (41,000)
25.	Dynamo (12V 120W)	8-441235 M5L-15	pc	1 (1)		12,000 (12,000)
26.	Regulator	8-441081 M5L-57	pc	1 (1)		2,500 (2,500)
27.	Safety relay	5-44045-5 M5K-11	pc	1 (1)		4,600 (4,600)
28.	Starter switch	8-48301-0 M58-5	pc	1 (1)		1,000 (1,000)
29.	Packing for air cleaner	8-221128 M5N-17	pc	2 (2)	280	560 (560)
30.	Taperd roller bearing	19 (003-0310)	pc	2 (2)	2,200	4,400 (4,400)
31.	Oil seal	24 (09924-195)	pc	1 (1)		200 (200)
32.	Release bearing	31 (00095-015)	pc	1 (1)		1,300 (1,300)
33.	Disk plate	5 (51240-031)	pc	1 (1)		3,500 (3,500)
34.	Pilot bearing	1 (0000-6205)	pc	1 (1)		400 (400)
			lot	1 (1)		199,230 (199,230)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-3-1	MUD MIXER (TONE Mod. MCE-200A or equivalent) Total capacity; 250 Mixing capacity; 200	unit	1 (1)		245,000 (245,000)
	SPARE PARTS FOR THE ABOVE				
1.	Propeller	pc	1 (1)		3,150 (3,150)
2.	Bearing ball	pc	1 (1)		250 (250)
3.	- do -	pc	1 (1)		310 (310)
4.	Mach screw	pc	1 (1)		10 (10)
5.	Bearing ball	pc	1 (1)		250 (250)
6.	Felt ring	pc	3 (3)	20	60 (60)
7.	Grease nipple	set	2 (2)	100	200 (200)
		lot	1 (1)		4,230 (4,230)
(A)-3-2	POWER UNIT (YAMMER Mod. TS-50 or equivalent) Single cylinder, water cooled diesel engine Max. output; 4 PS/2,000 rpm Accessories; standard accessories including of V-pulley 1 set, V-belt 1 set and belt cover	unit	1 (1)		58,000 (58,000)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(A)-3	MUD MIXER COMPLETE					
(A)-3-1	MUD MIXER (TONE Mod. MCE-200A or equivalent)	unit	1 (1)		245,000	(245,000)
	SPARE PARTS FOR THE ABOVE consisting of 7 items	lot	1 (1)		4,230	(4,230)
(A)-3-2	POWER UNIT (YAMMER Mod. TS-50 or equivalent)	unit	1 (1)		58,000	(58,000)
	SPARE PARTS FOR THE ABOVE consisting of 18 items	lot	1 (1)		13,570	(13,570)
		TOTAL F.O.B. JAPAN			¥320,800	(¥320,800)

Item	Description		Unit	Q'ty	Rate	Total Cost	
	SPARE PARTS FOR THE ABOVE						
1.	Suction valve	104100-11100	pc	2 (2)	370	740	(740)
2.	Exhaust valve	104100-11110	pc	2 (2)	370	740	(740)
3.	Spring, suc/exh. valve	104100-11120	pc	2 (2)	100	200	(200)
4.	Retainer, valve spring	104200-11180	pc	2 (2)	100	200	(200)
5.	Cotter valve spring	101158-11190	pc	2 (2)	60	120	(120)
6.	Piston w/ring	104100-22090	set	1 (1)		2,730	(2,730)
7.	Piston ring set	104100-22500	set	1 (1)		810	(810)
8.	Piston ring metal	104100-23100	pc	1 (1)		240	(240)
9.	Crank pin metal	104100-23340	pc	1 (1)		950	(950)
10.	Circlip, piston pin	101158-22400	pc	2 (2)	15	30	(30)
11.	Element, lub. oil strainer	104200-35150	pc	4 (4)	270	1,080	(1,080)
12.	Delivery valve	101300-51300	set	1 (1)		330	(330)
13.	Regulator neelde	171590-51420	pc	1 (1)		150	(150)
14.	Plunger with barrel	101104-51100	pc	1 (1)		1,770	(1,770)
15.	Plunger spring	101400-51160	pc	1 (1)		60	(60)

Item	Description		Unit	Q'ty	Rate	Total Cost	
16.	Washer, plunger spring	172100-51170	pc	1 (1)		40	(40)
17.	Needle valve with case	172100-53000	pc	2 (2)	1,680	3,360	(3,360)
18.	Packing needle valve spring holder	172100-53200	pc	1 (1)		20	(20)
			lot	1 (1)		13,570	(13,570)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-4	DERRICK COMPLETE				
1.	Steel structural square type 12m derrick (TONE Mod. DR12-3 or equivalent) Max. load capacity; approx. 20t Effective length of rod pull; 9m				
2.	Accessories; standard accessories including of ladders and platform 1 set, seat for derrick 1 set, guy line ass'y 1 set and Foundation bolt for derrick 1 set.	unit	1 (1)		1, 030, 000(1, 030, 000)
		TOTAL F. O. B. JAPAN			¥1, 030, 000(¥1, 030, 000)

Item	Description		Unit	Q'ty	Rate	Total Cost
(A)-5	DRILL ROD					
1.	Flush joint drill rod; tapered coarse-pitch Acme thread	85mmø x 3mℓ	pc	75 (85)	32,400	2,430,000 (2,754,000)
2.	- do -	85mmø x 1.5mℓ	pc	6 (10)	25,920	155,520 (259,200)
			TOTAL F.O.B. JAPAN			¥2,585,520 (3,013,000)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-6	DRILL BITS				
1.	Tricone bit; connectable with drill collar 3H type 14 3/4"	pc	3 (8)	308,200	924,600 (2,465,600)
2.	- do - 10 5/8"	pc	1 (3)	144,200	144,200 (432,600)
3.	Wing bit; connectable with drill collar 22 "	pc	1 (2)	154,000	154,000 (308,000)
4.	- do - 18 "	pc	1 (5)	132,000	132,000 (660,000)
5.	- do - 14 3/4"	pc	2 (8)	123,000	246,000 (984,000)
6.	- do - 10 5/8 "	pc	1 (2)	95,000	95,000 (190,000)
7.	Metal tip 6x6x8mm	pc	200(500)	90	18,000 (45,000)
8.	Drill collar; connectable with 85mm rod 2mℓ bit. size 14 3/4"	pc	2 (3)	150,000	300,000 (450,000)
9.	- do - bit. size 10 5/8"	pc	2 (3)	130,000	260,000 (390,000)
10.	Stabilizer; connectable with drill collar bit. size 14 3/4"	pc	1 (2)	112,000	112,000 (224,000)
11.	- do - bit. size 10 5/8"	pc	1 (2)	108,000	108,000 (216,000)
		TOTAL F.O.B. JAPAN			¥2,493,800(¥6,365,200)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-7	DRILLING TOOLS				
1.	Hoisting wire rope with safety clevis 14 mmφ x 60mℓ	roll	2(5)	13,600	27,200 (68,000)
2.	- do - 12 mmφ x 200 mℓ	roll	1(3)	23,760	23,760 (71,280)
3.	Head pully 470 mm x 3 wheels	pc	2(2)	140,400	280,800 (280,800)
4.	Hoisting water swivel hose 50mm x rod 85mm	pc	1(2)	51,840	51,840 (103,680)
5.	Hoisting swivel rod 85 mm	pc	1(2)	34,880	34,880 (69,760)
6.	Rod holder rod 85 mm	pc	1(2)	25,920	25,920 (51,840)
7.	Extra jaws for the above	set	2(5)	9,720	19,440 (48,600)
8.	Rod holder plate rod 85 mm	pc	1(1)		16,200 (16,200)
9.	Pipe wrench #36	pc	4(8)	5,200	20,800 (41,600)
10.	- do - #24	pc	4(8)	2,600	10,400 (20,800)
11.	- do - #18	pc	4(8)	1,820	7,280 (14,560)
12.	Drill rod wrench rod 85 mm	pc	4(6)	9,720	38,880 (58,320)
			TOTAL F.O.B. JAPAN		¥557,400(¥845,440)

Item	Description	Unit	Q'ty	Rate	Total Cost
(A)-8	CORING TOOLS				
1.	Single core tube 1 ml bit size 14 3/4"	pc	1 (2)	55,830	55,830 (111,660)
2.	Core tube read for the above, connectable with 85 mm rod	pc	1 (2)	32,400	32,400 (64,800)
3.	Tungsten carbite insert but for the above 14 3/4"	pc	2 (5)	15,600	31,200 (78,300)
4.	Sediment tube for the above 1 ml	pc	1 (2)	70,630	70,630 (141,260)
5.	Sediment tube head for the above	pc	1 (2)	34,990	34,990 (69,980)
6.	Boulder barrel 85mm x 14" x 1.5 m	set	0 (1)		0 (700,000)
7.	Wing crown for the above	pc	0 (1)		0 (130,000)
8.	TN Metal for the above	set	0 (1)		0 (40,000)
9.	Plate for the above	pc	0 (10)	420	0 (4,200)
10.	Packing for the above	pc	0 (5)	250	0 (1,250)
11.	Oil seal for the above	pc	0 (5)	350	0 (1,750)
12.	Holder for the above	pc	0 (2)	29,500	0 (59,000)
13.	Claw for the above	set	0 (2)	310	0 (1,550)

Item	Description	Unit	Q'ty	Rate	Total Cost
14.	Pins for the above	set	0 (1)		0 (200)
15.	Spring for the above	set	0 (5)	150	0 (750)
		TOTAL F.O.B. JAPAN			¥225,050 (1,404,700)

Item	Description		Unit	Q'ty	Rate	Total Cost	
(A)-9	FISHING TOOLS						
1.	Drill rod outside tap	RH 85 mm	pc	1 (1)		27,640	(27,640)
2.	Drill rod inside tap	RH 85 mm	pc	1 (1)		24,840	(24,840)
3.	Hydraulic jack	30 t	pc	2 (2)	21,600	43,200	(43,200)
4.	Knocking block	85 mm	pc	1 (1)		10,900	(10,900)
5.	Drive rammer with chin	150 kg	pc	1 (1)		37,800	(37,800)
6.	Rod band with spare bolts	85 mm	set	1 (1)		24,940	(24,940)
			TOTAL F.O.B. JAPAN			¥169,320	(¥169,320)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(A)-10	METAL SETTING TOOLS AND CONSUMABLE					
1.	Steel rule 300 mm	pc	2 (2)	240	480	(480)
2.	Caliper's inside and outside 150 mm	set	1 (1)		350	(350)
3.	Center punch 150 mm	pc	1 (1)		60	(60)
4.	Setting chiesels 1 set consisting of 5 pcs	set	1 (1)		750	(750)
5.	Smiths tong 1 set consisting of 3 pcs	set	1 (1)		710	(710)
6.	Compass 150 mm	pc	1 (1)		80	(80)
7.	Toarch lamp 1.5 1	pc	1 (1)		4,350	(4,350)
8.	Borax 1 case consisting of 500 g	case	4 (4)	250	1,000	(1,000)
9.	Brass solder 1 set consisting of 500 g	set	20 (20)	400	8,000	(8,000)
		TOTAL F.O.B. JAPAN			¥15,780	(¥15,780)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(A)-11	GENERAL TOOLS					
1.	Oil can	pc	10(20)	300	3,000	(6,000)
2.	Grease gun	pc	2 (4)	780	1,560	(3,120)
3.	Socket wrench set	set	1 (1)		3,800	(3,800)
4.	Cutting pliers	pc	10 (20)	650	6,500	(13,000)
5.	Monkey 250	pc	5 (10)	700	3,500	(7,000)
6.	- do - 150	pc	5 (10)	480	2,400	(4,800)
7.	Screw driver	pc	5 (10)	560	2,800	(5,600)
8.	Pliers	pc	5 (10)	280	1,400	(2,800)
9.	Double ended spanner	set	2 (3)	1,500	3,000	(4,500)
10.	Wire brush	pc	10 (20)	50	500	(1,000)
11.	Tool box with key and lock #A	pc	1 (1)		4,000	(4,000)
		TOTAL F.O.B. JAPAN			¥32,460	(¥55,620)

Item	Description	Unit	Q'ty	Rate	Total Cost
(B)	PUMP				
(B)-1	SUBMERSIBLE MOTOR PUMP FOR PUMPING TEST (NIPPON PLUNGER Mod. G 205/1 + Ju 210) Pumping capacity; approx. 3.5 m^3/min Total head; 30 m Accessories, including of cable 30 m, Stardelta switch 1 set, cable clip 6 pcs, check valve 1 pc, auto air valve 1 pc, band for supporting pump 2 sets, discharge pipe 150 mm x 2.75 m x 6 pcs + 150 mm x 1.25 m x 2 pcs, sunny rose with sleeve 6" x 30 m and disassembling tools kit 1 set	unit	1 (1)		1,350,000 (1,350,000)
	SPARE PARTS FOR THE ABOVE				
1.	Standard parts including of impeller 3 sets, gide vane 1 pc, wearing 2 pcs, gide bush 1 pc, balance disk 1 pc, filter 1 pc, upper and lower sleeves 1 set, sealring 2 pcs, thrust bearing 1 pc, thrust block 1 pc and nats 1 set	lot	1 (1)		150,000 (150,000)
2.	Spare pump set	set	0 (1)		0 (450,000)

Item	Description	Unit	Q'ty	Rate	Total Cost
(B)-4	ENGINE DRIVE VACUUM PUMP FOR DRILLING Spairal pump complete with gasoline engine portable type Capacity; not less than 0.65m^3/min Accessories; including bf suction hose with fitting 10 m, foot valve with fiter and nipple 1 set and delivery hose with fitting 100 m.	unit	1 (1)		180,000 (180,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		60,000 (60,000)
(B)-5	ENGINE DRIVE VACUUM PUMP FOR WELL Spairal pump complete with diesel engine Capacity; approx. 1.2 m^3/min Caliber; approx. 100 mm (MITSUBISHI Mod. EPO-1000 + MITSUBISHI Mod. SD6H or equivalent) accessories; including of suction hose with fitting 5 m, delivery hose with fitting 10 m and trailer set.	unit	1 (3)	350,000	350,000 (1,050,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		50,000 (300,000)
		TOTAL F.O.B. JAPAN			¥4,200,000 (¥5,890,000)

Item	Description	Unit	Q'ty	Rate	Total Cost
(B)-2	PORTABLE ROTARY AIR COMPRESSOR FOR AIR LIFT (HOKUETSU Mod. AMR-70 or equivalent) Capacity; 7 kg/cm^2 x 2 m^3/min Power unit; diesel engine 29 PS Weight; 740 kg with standard accessories	unit	1 (1)		800,000 (800,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		150,000 (400,000)
	ACCESSORIES FOR AIR LIFT PUMPING TEST including of steel pipe 4"ϕ x 120 m + 1/2"ϕ x 200m, sary hose 4"ϕ x 50 m, air hose 1/2"ϕ x 50 m, casing bank 4"ϕ x 2 sets + 1/2"ϕ x 2 sets, sleeve and valve 1 set	lot	1 (1)		750,000 (750,000)
(B)-3	SUBMERSIBLE MOTOR PUMP FOR QUARTERS Capacity; not less than 0.5m^3/min Total read; not less than 20 m Pump dia; approx. 100 mmϕ with standard accessories	unit	1 (1)		350,000 (350,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		50,000 (50,000)

Item	Description	Unit	Q'ty	Rate	Total Cost
(C)	GENERATOR				
(C)-1	THREE PHASE CURRENT DYNAMO PORTABLE DIESEL GENERATOR (MITSUBISHI Mod. DU75 or equivalent) Capacity; 62.5 KVA·50 KW 200 V 50 c/s with standard accessories including of captire cord 50 m, oil pump, oil cone and hosting wire set	unit	1 (1)		2,750,000 (2,750,000)
	TRAILER FOR THE ABOVE	unit	1 (1)		385,000 (385,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		300,000 (900,000)
(C)-2	SINGLE PHASE CURRENT DYNAMO PORTABLE DIESEL GENERATOR (MITSUBISHI Mod. DN or equivalent) Capacity; 2 KVA 2 KW 100 V 50 c/s with standard accessories including of captire cord 50 m	unit	1 (1)		200,000 (200,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		20,000 (60,000)
(C)-3	ELECTRIC WELDING APPARATUS Diesel engine drive type Usable in single phase current generator with standard accessories (DENYO ACD-250AC3 or equivalent) Engine, MITSUBISHI Mod. KE31 or equivalent Generating Capacity; 3 KW 100 V	unit	1 (1)		1,320,000 (1,320,000)

Item	Description	Unit	Q'ty	Rate	Total Cost
	4 WHEEL TRAILER FOR THE ABOVE	unit	1 (1)		200,000 (200,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		150,000 (300,000)
		TOTAL F.O.B. JAPAN			¥5,325,000 (¥6,115,000)

Item	Description		Unit	Q'ty	Rate	Total Cost
(D)	CASING PIPE AND TOOLS					
1.	Casing pipe of electric welded carbon steel pipe	12"ϕ x 5.5 mℓ	m	198 (484)	3,780	748,440 (1,829,520)
2.	- do -	12"ϕ x 2.75mℓ	m	44 (104.5)	3,780	166,320 (395,010)
3.	- do -	8"ϕ x 5.5 mℓ	m	880 (2,200)	2,140	1,883,200 (4,708,000)
4.	- do -	8"ϕ x 2.75 mℓ	m	99 (242)	2,140	211,860 (517,880)
5.	- do -	6"ϕ x 5.5 mℓ	m	121 (319)	1,400	169,400 (446,600)
6.	- do -	6"ϕ x 2.75 mℓ	m	11 (33)	1,400	15,400 (46,200)
7.	- do -	4"ϕ x 5.5 mℓ	m	5.5(5.5)	740	4,070 (4,070)
8.	- do -	2"ϕ x 55 mℓ	m	33 (33)	290	9,570 (9,570)
9.	Sleeve-processing charge for the above	12"ϕ	pc	52 (126)		260,000 (630,000)
10.	- do -	8"ϕ	pc	196 (488)	4,000	784,000 (1,952,000)
11.	- do -	6"ϕ	pc	20 (70)	3,000	78,000 (210,000)
12.	- do -	4"ϕ	pc	1 (1)	2,000	2,000 (2,000)
13.	- do -	2"ϕ	pc	6 (6)	1,000	6,000 (6,000)

Item	Description	Unit	Q'ty	Rate	Total Cost	
14.	Conductor pipe of electric welded carbon steel pipe 20"ø x 5.5 m	m	33 (66)		280,500	(561,000)
15.	Conductor pipe of electric welded carbon steel pipe 12"ø x 5.5 m	m	33 (33)	3,780	124,740	(124,740)
16.	Sleeve-processing charge for the above 20"ø	pc	6 (12)	6,000	36,000	(72,000)
17.	- do - 12"ø	pc	6 (6)	5,000	30,000	(30,000)
18.	Shoes for the above 20"ø	pc	3 (6)	2,000	6,000	(12,000)
19.	- do - 12"ø	pc	2 (2)	1,500	3,000	(3,000)
20.	Reducer 12"øx8"øx0.8m	pc	8 (20)	20,000	160,000	(400,000)
21.	Well cap with bolts, flange type for 12"ø casing	set	8 (20)	14,000	112,000	(280,000)
22.	- do - for 6"ø casing	set	1 (3)	7,000	7,000	(21,000)
23.	3 wheel block with casing hook; 400 mm	pc	1 (1)	17,600	17,600	(17,600)
24.	Chain block; hand type 3 t	pc	2 (2)	28,200	56,400	(56,400)
25.	Beiler for hole dia. 14 3/4"	pc	1 (2)	48,300	48,300	(96,600)
26.	- do - 10 1/2"	pc	1 (2)	26,300	26,300	(52,600)

Item	Description		Unit	Q'ty	Rate	Total Cost	
27.	Casing bans with spare bolts	20"ø	set	2 (4)	68,000	136,000	(272,000)
28.	- do -	12"ø	set	3 (4)	38,000	114,000	(152,000)
29.	- do -	8"ø	set	3 (4)	38,000	84,000	(112,000)
30.	- do -	6"ø	set	3 (4)	22,000	66,000	(88,000)
31.	Notch box; 1.1m x 1.1m x 2.2m		box	1 (1)	103,000	103,000	(103,000)
32.	Puller; wire type 1.5 t		pc	2 (2)	19,700	39,400	(39,400)
33.	Sluice valve	6"ø	pc	8 (20)	30,000	240,000	(600,000)
34.	- do -	4"ø	pc	1 (3)	15,000	15,000	(45,000)
			TOTAL F.O.B. JAPAN			¥6,043,500	(13,895,190)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(E)	SCREEN					
1.	Screen pipe (N.S.T. screen or equivalent) slit width, approx. 0.5 mm 8"ϕ x 5.5 mℓ	m	176 (440)	14,000	2,464,000	(6,160,000)
	- do - 8"ϕ x 2.75 mℓ	m	46.75 (112.75)	14,000	654,500	(1,578,500)
3.	Sleeve processing charge for the above 8"ϕ	pc	49 (121)	4,000	196,000	(484,000)
4.	Gravel screen pipe 6"ϕ3.0 mℓ	m	27 (81)	46,000	1,242,000	(3,726,000)
5.	Sleeve processing charge for the above 6"ϕ	pc	9 (27)	3,000	27,000	(81;000)
		TOTAL F.O.B. JAPAN			¥4,583,500	(¥12,029,500)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(F)	SURVEY EQUIPMENT					
1.	Electric conductivity meter (TOHODENTAN Mod. EST-3 or equivalent) Accessories including of cable; 20m	unit	1 ( )		171,600	(171,600)
2.	Current meter (TOHODENTAN. Mod. CM3S or equivalent)	unit	1 (1)		385,000	(385,000)
	Cable for the above; 200 m	lot	1 (1)		100,000	(100,000)
	Cable drum	set	1 (1)		65,000	(65,000)
3.	Electric logging meter (YOKOKAWA Mod. L-10 or equivalent)	unit	1 (1)		60,000	(60,000)
	Cable for the above; 220 m	lot	1 (1)		120,000	(120,000)
	Cable drum	set	1 (1)		50,000	(50,000)
4.	Portable conductivity meter	pc	3 (3)	3,000	9,000	(9,000)
5.	Water level meter	set	2 (2)	12,000	24,000	(36,000)
		TOTAL F.O.B. JAPAN			¥984,600	(996,600)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(G)	WORKING TOOLS AND CONSUMABLE					
	(GENERAL TOOLS)					
1.	Oxyacetylene welding appratus with accessories and spare parts	set	1 (1)		90,000	(90,000)
2.	Portable electric glinder 180	set	1 (1)		31,000	(31,000)
3.	Edge for the above	pc	6 (10)	1,500	9,000	(15,000)
4.	Electric drill kit	set	1 (1)		23,500	(23,500)
5.	Disk sander 180	set	1 (1)		25,200	(25,200)
6.	Paper for the above	pc	10 (20)	1,500	15,000	(30,000)
7.	Soldaring kit	set	1 (2)	3,000	3,000	(6,000)
8.	Hand pump for oil supplying	set	1 (1)		4,500	(4,500)
9.	Parallet vise	pc	1 (1)		7,000	(7,000)
10.	Metal cutting hand saw with 12 spare edge	set	2 (5)	4,000	8,000	(20,000)
11.	Levels 600 mm	pc	2 (4)	800	1,600	(3,200)
12.	Steel tape 10 m	pc	2 (4)	1,600	3,200	(6,400)

Item	Description	Unit	Q'ty	Rate	Total Cost	
13.	Folding rule 1 m	pc	10 (30)	100	1,000	(3,000)
14.	Cramp 150 mm	pc	20 (50)	50	1,000	(2,500)
15.	Bar	pc	5 (10)	1,000	5,000	(10,000)
16.	- do - (long type)	pc	2 (5)	2,000	4,000	(10,000)
17.	Wire clips (various type)	lot	1 (1)		100,000	(300,000)
18.	Turn backles 25 mm	pc	10 (20)	2,500	25,000	(50,000)
19.	Files (flat, grail etc.)	set	2 (5)	2,500	5,000	(12,500)
20.	Cold chisels (various type)	set	2 (5)	3,000	6,000	(15,000)
21.	Knives	pc	2 (5)	1,000	2,000	(5,000)
22.	Shino	pc	2 (5)	600	1,200	(3,000)
23.	Wire with ring	pc	30 (30)	2,000	60,000	(60,000)
24.	Spare bolts and nuts (various type)	lot	1 (1)		30,000	(50,000)
25.	Spare sleeve, valve and packing (various type)	lot	1 (1)		50,000	(100,000)
26.	Clipper 600 m	pc	2 (4)	5,000	10,000	(20,000)
27.	Hand hammer 1 kg	pc	5 (10)	700	3,500	(7,000)

Item	Description		Unit	Q'ty	Rate	Total Cost	
28.	Hand hammer	10 kg	pc	1 (2)	1,500	1,500	(3,000)
29.	- do -	15 kg	pc	1 (2)	2,500	2,500	(5,000)
30.	Spare handles for the above		pc	14 (42)	300	4,200	(12,600)
31.	Chain tong	#34	pc	4 (8)	12,000	48,000	(96,000)
32.	- do -	#33	pc	4 (8)	9,000	36,000	(72,000)
33.	Spare chain for the above	#34	pc	4 (8)	9,000	36,000	(72,000)
34.	- do -	#33	pc	4 (8)	6,000	24,000	(48,000)
35.	Screw anchor chackles (various type)		lot	1 (1)		10,000	(20,000)
	(WOOD WORKING TOOLS)						
36.	Saw (double edge and single edge)		set	2 (5)	2,000	4,000	(10,000)
37.	Axes		pc	2 (5)	1,000	2,000	(5,000)
38.	Plane for wood working		pc	2 (5)	1,200	2,400	(6,000)
39.	Steel square		pc	2 (5)	1,800	3,600	(9,000)
40.	Nomi (chisels for wood) various type		set	2 (5)	900	1,800	(4,500)
41.	Kiri (drill for wood)		pc	2 (5)	1,000	2,000	(5,000)

Item	Description	Unit	Q'ty	Rate	Total Cost	
42.	Gimune (various type)	set	2 (5)	6,000	12,000	(30,000)
43.	Hard oil stone (hard, medium and soft type)	set	2 (5)	1,500	3,000	(7,500)
44.	Electric carpenter's tools kit	set	1 (2)	65,000	65,000	(130,000)
45.	Scoop	pc	5 (10)	1,000	5,000	(10,000)
46.	- do - (acute edge)	pc	10 (20)	1,000	10,000	(20,000)
47.	Hand shovels	pc	5 (10)	500	2,500	(5,000)
48.	Picks	pc	2 (3)	1,500	3,000	(4,500)
49.	Keys	pc	10 (30)	500	5,000	(15,000)
	(CONSUMABLES)					
50.	Water-proof sheat of canvas	pc	5 (10)	18,000	90,000	(180,000)
51.	Working coat, shoes, rain coat safety cap	set	10 (30)	15,000	150,000	(450,000)
52.	Gloves	pc	70 (150)	1,000	70,000	(150,000)
53.	Nails (various type)	kg	50 (100)	60	3,000	(6,000)
54.	Annealed iron wire #8	kg	20 (50)	50	1,000	(2,500)
55.	- do - #10	kg	70 (150)	50	3,500	(7,500)

Item	Description		Unit	Q'ty	Rate	Total Cost	
56.	Annealed iron wire	#16	kg	70 (150)	60	4,200	(9,000)
57.	- do -	#21	kg	20 (50)	70	1,400	(3,500)
58.	Manila rope	12 mmø	m	200 (400)	180	36,000	(72,000)
59.	- do -	18 mmø	m	200 (400)	150	30,000	(60,000)
60.	Specific gravity meter		pc	2 (5)	2,000	4,000	(10,000)
61.	Pouch for bolts		pc	2 (5)	500	1,000	(2,500)
62.	Waste		kg	30 (60)	50	1,500	(3,000)
63.	Buckets		pc	10 (20)	800	8,000	(16,000)
64.	Welding rod	5 mmø	kg	200 (500)	300	60,000	(150,000)
65.	- do -	4 mmø	kg	100 (300)	330	33,000	(99,000)
66.	- do -	3.2 mmø	kg	100 (200)	350	35,000	(70,000)
67.	Babit metal		kg	10 (20)	1,300	13,000	(26,000)
68.	Noco-tube metal 5 mmø		kg	70 (200)	9,000	630,000	(1,800,000)
69.	Bentnite		ton	8 (20)	18,000	144,000	(360,000)
70.	Barite		ton	2 (4)	23,000	46,000	(92,000)
71.	C.M.C.		kg	100 (200)	700	70,000	(140,000)

Item	Description		Unit	Q'ty	Rate	Total Cost	
72.	Wire net	3 mm	m^2	20 (50)	600	12,000	(30,000)
73.	Wire net	7 mm	m^2	5 (10)	600	3,000	(6,000)
74.	- do -	10 mm	m^2	20 (50)	600	12,000	(30,000)
75.	Wire rope	11.2 mmø	m	100 (200)	180	18,000	(36,000)
76.	Wire rope	14 mmø	m	100 (200)	250	25,000	(50,000)
77.	Chalk and paint		lot	1 (1)		3,000	(5,000)
78.	Blackboard		pc	1 (1)		1,000	(1,000)
79.	Soap for cleaning		pc	200 (400)	200	40,000	(80,000)
80.	Soap for toilet purposes		pc	200 (400)	100	20,000	(40,000)
81.	Material for reapir (steel board, angle and rod, etc.)		lot	1 (1)		50,000	(100,000)
82.	Vinyl coard (double wire)		m	200 (400)	50	10,000	(20,000)
83.	Electric bulb (60W and 100W)		pc	20 (40)	150	3,000	(6,000)
84.	Socket and concent for the above		set	10 (20)	200	2,000	(4,000)
			TOTAL F.O.B. JAPAN			¥2,441,800	(5,616,900)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(H)	TRANSPORTATION EQUIPMENT					
(H)-1	6 TON TRUCK Diesel engine, all wheel drive type (ISUZU Mod. TS or equivalent) with standard accessories	unit	0 (1)		0	(2,618,000)
	SPARE PARTS FOR THE ABOVE	lot	0 (1)		0	(600,000)
(H)-2	3.5 TON TRUCK Diesel engine; (HINO Mod. KM300 or equivalent) with standard accessories	unit	1 (1)		1,375,000	(1,375,000)
	TRUCK CRANE FOR THE ABOVE (KYOEI Mod. V200J or equivalent) mounted on 3.5 t truck, with standard accessories (turbine oil should be equipped)	unit	1 (1)		913,000	(913,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		200,000	(600,000)
(H)-3	JEEP (TOYOTA Mod. FJ43 or equivalent) with standard accessories	unit	1 (1)		1,030,000	(1,030,000)
	SPARE PARTS FOR THE ABOVE	lot	1 (1)		100,000	(300,000)
		TOTAL F.O.B. JAPAN			¥3,618,000	(¥7,436,000)

Item	Description	Unit	Q'ty	Rate	Total Cost	
(I)	CAMPING EQUIPMENT					
	(TENT)					
1.	Tent for loading; double sheet type	unit	0 (4)	500,000	0	(2,000,000)
2.	Tent for local labors	unit	2 (3)	200,000	400,000	(600,000)
3.	Tent for field kitchen	unit	0 (3)	300,000	0	(900,000)
	(BED CLOTHES)					
4.	Bed; fold double type	pc	0 (10)	15,000	0	(150,000)
5.	Blanket	pc	0 (20)	5,000	0	(100,000)
6.	Bedcover	pc	0 (20)	8,000	0	(160,000)
7.	Mattress	pc	0 (10)	5,000	0	(50,000)
8.	Mosquito net	pc	0 (10)	10,000	0	(100,000)
9.	Pillow	pc	0 (10)	2,000	0	(20,000)
10.	Sheets	pc	0 (20)	1,500	0	(30,000)
11.	Sleeping bag	pc	0 (10)	10,000	0	(100,000)
12.	Vinyl sheet	lot	0 (1)		0	(50,000)

Item	Description	Unit	Q'ty	Rate	Total Cost	
	(COOKING TOOLS)					
13.	Oil burner	pc	0 (10)	4,000	0	(40,000)
14.	Petroleum cooking stove	pc	0 (5)	5,000	0	(25,000)
15.	Dinner set	lot	0 (1)		0	(50,000)
16.	Saucepan, pots and kettles and frying-pan	set	0 (5)	6,000	0	(30,000)
17.	Filter kit; simple type	set	0 (10)	10,000	0	(100,000)
18.	Pohyethylene backets(large middle and small type)	set	0 (10)	3,000	0	(30,000)
19.	Mosquito coil	pc	0 (500)	200	0	(100,000)
20.	Insecticide; spray type	pc	0 (200)	300	0	(60,000)
21.	First-aid kit	set	2 (10)	5,000	10,000	(50,000)
		TOTAL F.O.B. JAPAN			¥410,000	(¥4,745,000)

Item	Description	Unit	Q'ty	Rate	Total Cost
(II)	LOCAL MATERIAL				
1.	Oxygen gas (5 pcs/1 well)	pc	40 (115)	2,464	
2.	Acetylene gas (2 pcs/1 well)	pc	18 (46)	4,620	
3.	Diesel oil (1500 ℓ/1 well + 21,600ℓ/2 cars year)	ℓ	35,100 (99,300)	61.6	
4.	Gasoline (200 ℓ/1 well + 10,800 ℓ/1 car year)	ℓ	12,600 (26,200)	77	
5.	Lubricant	lot	1 (1)		
6.	Battery charging	well	9 (23)	92,400	
7.	Dilute sulphuric acid and Distilled water	lot	1 (1)		
8.	Torch lamp and battery	lot	1 (1)		
9.	Square timber	lot	1 (1)		
10.	Floor boards	lot	1 (1)		
11.	Cement (4 bags/1 well)	bag	36 (92)	770	
12.	Pipe and steel material	set	1 (1)		
		TOTAL LOCAL COST			(¥12,569,480)
					Rs 162,486(Rs. 416,262)

Item	Description	Unit	Q'ty	Rate	Total Cost
(III)	LOCAL LABOR				
1.	Labors for screening gravel	man month	12 (36)	4,620	
2.	General working labors	man month	24 (72)	6,160	
3.	Temporary labors	man month	20 (60)	4,620	
		TOTAL LOCAL COST			¥295,680 (¥887,040)
					Rs. 9,792 (Rs.29,376)

B. LIST OF MACHINERY

IMPLEMENTS AND MATERIALS

B LIST OF MACHINERY, IMPLEMENTS AND MATERIALS

B-1 Agricultural machinery, implements and materials

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Machinery	4 wheel tractor, 35 PS	no.	3	980,000	2,940
	The above attachments				
	Strake fins set	set	3	110,000	330
	Stabilizer set	set	3	10,000	30
	Rotary tilling device ass'y	set	5	265,000	1,325
	Rotary blade set	set	3	20,000	60
	Harrowing blade set	set	3	15,000	45
	Rotary cutter	no.	2	350,000	700
	Bottom plow	no.	2	180,000	360
	Disc plow	no.	3	185,000	555
	Tandem disc harrow	no.	3	200,000	600
	Broad caster	no.	2	135,000	270
	Manure spreader	no.	2	220,000	440
	Lime sower	no.	3	65,000	195
	Ridger	no.	2	120,000	240
	Grain drill	no.	2	270,000	540
	Cultipacker	no.	2	125,000	250
	Cultivator	no.	2	135,000	270
	Transport box	no.	3	80,000	240
	Hole digger	no.	2	170,000	340
	Front loader	no.	2	338,000	676
	Half trailer	no.	3	300,000	900
	Subsoiler	no.	2	110,000	220
	Front wheel weight	no.	3	15,000	30

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Machinery	Rear wheel weight	no.	3	35,000	105
	Front wheel w/rim	no.	3	20,000	60
	Rear wheel w/rim	no.	3	95,000	285
	P.T.O. ass'y	no.	3	65,000	195
	Spare parts for the above tractor		L.S.		800
	Hand tractor 5-6.5 PS	no.	6	180,000	1,080
	The above accessory				
	Paddy field wheel	no.	6	15,000	90
	Pipe wheel	no.	6	12,000	72
	Plow	no.	6	23,000	138
	Rotary plow	no.	6	23,000	138
	Spine rotary	no.	6	18,000	108
	Puddler	no.	6	5,500	33
	Ridger	no.	6	6,000	36
	Trailer	no.	6	80,000	480
	Spare parts for the above tractor		L.S.		320
	Hand tractor 6.5-8 PS	no.	5	190,000	950
	The above accessory				
	Paddy field	no.	5	15,000	75
	Pipe wheel	no.	5	15,000	75
	Rotary mower	no.	5	60,000	300
	Plow	no.	5	25,000	125
	Ride raker	no.	5	23,000	115

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Machinery	Ridger	no.	5	6,000	30
	Spine rotary	no.	5	25,000	125
	Rotary plow	no.	5	25,000	125
	Vacuum tank car	no.	5	188,500	942.5
	Lime sower	no.	5	42,000	210
	Trailer	no.	5	80,000	400
	Spare parts for the above tractor		L.S.		950
	Power duster mist	no.	4	23,000	92
	Power sprayer	no.	3	89,300	267.9
	Power bush cutter	no.	2	27,800	55.6
	Rice mill unit	no.	1	475,000	475
	Power thresher	no.	3	150,000	450
	Combine	no.	1	600,000	600
	Rice planter unit	no.	2	210,000	420
	Corn sheller	no.	2	105,000	210
	Forage cutter	no.	2	131,200	262.4
	Flour milling plant	no.	1	465,000	465
	Oil mill plant	no.	1	613,000	613
	Hammer crusher	no.	2	210,000	420
	Miscellaneous		L.S.		950
Sub-total					25,199

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Implements and Tools	Hand duster	no.	300	3,400	1,020
	Knapsack hand sprayer	no.	300	9,700	2,910
	Weeding hand duster	no.	50	2,800	140
	Hand soil injector	no.	5	6,000	30
	Pump set	no.	30	98,000	2,900
	Diesel engine	no.	20	64,000	1,280
	Gasoline engine	no.	20	30,000	600
	Root cutter	no.	5	29,000	145
	Straw rope making machine	no.	5	30,000	150
	Wheel barrow	no.	300	300	90
	Acetylene carbide disperser	no.	50	9,000	450
	Miscellaneous		L.S.		900
Sub-total					14,665
Total					39,764

B-2. Tube well drilling machinery and materials
.......for whole period of technical cooperation

Summary

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥) ('000 Rs)
Imported	Drilling equipment				21,519.6
	Pump				5,890
	Generator				6,115
	Casing pipe and tools				13,895.19
	Screen				12,029.5
	Survey equipment				996.6
	Working tools & consumable				5,616.9
	Transportation equipment				7,436
	Camping equipment				4,745
Sub-total					78,243.79
Local	Materials				12,569.48 (416.262)
	Labor				887,04 (29.376)
Sub-total					13,456.52 (445.638)
Total					91,700.31

B-3. Construction machinery and materials

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Machinery	Angle dozer	no.	1	3,500,000	3,500
	Dozer shovel	no.	1	3,800,000	3,800
	The above attachment	set	1	1,600,000	1,600
	Truck	no.	3	1,300,000	3,900
	Concrete mixer	no.	1	200,000	200
	Velt conveyor	no.	2	75,000	150
	Chain block	no.	1	50,000	50
Sub-total					13,200
Materials	For Janakpur Zone				
	Steel (L-40 x 40 x 3)	kg	202.0	31	6
	Corrugated metal pipe ϕ 250	kg	573.0	120	69
	- do - ϕ 300	kg	2,087.5	120	251
	- do - ϕ 450	kg	313.5	120	38
	- do - ϕ 500	kg	1,452.7	120	174
	P.V.C. pipe ϕ 125	m	56	650	36
	P.V.C. pipe bend 45 ϕ 125	no.	104	2,000	208
	Chain	m	52	300	16
	Superstructure	set	1	600,000	600
Sub-total					1,398
	For Rapti Model Farm				
	Steel pipe ϕ 300	kg	13,794.0	150	2,069
	- do - ϕ 75	kg	202.7	150	30
	Steel T pipe ϕ300 x 25	no.	2	30,000	60
	- do -ϕ300 x 75	no.	7	30,000	210

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Materials	Steel bend pipe 90° ϕ 75	no.	7	3,000	21
	Air valve ϕ 25	no.	2	16,000	32
	Sluice valve ϕ 75	no.	1	17,000	17
	- do - ϕ 300	no.	1	88,000	88
	Sluice gate ϕ300	no.	1	70,000	70
	Blow off pipe ϕ 300 x ϕ 75	no.	1	30,000	30
	Steel (L-40 x 40 x 3)	kg	6.0	31	-
	Field valve ϕ 75	no.	7	20,000	140
	Corrugated metal pipe ϕ 300	kg	74.6	120	9
	P.V.C. sheet (t=1.0 mm)	m^2	3,870	550	2,129
Sub-total					4,905
	Double suction volute pump	set	1		2,400
	Steel pipe (Linear)	m	1		
	- do - (40°bend)	no.	1		
	- do - ϕ200 - ϕ250 (Reducer)	no.	1		
	- do - ϕ250 - ϕ300 (Reducer)	no.	1		400
	Expansion joint ϕ 250	set	2		
	Movable flange ϕ 250	set	2		
	Bolt, nut, packing, etc.	set	1		
	Foot valve w/ strainer ϕ 250	set	1		
	Sluice valve ϕ 250	set	2		500
	Check valve ϕ 250	set	1		

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Materials	Gasoline engine 170 PS	set	1		4,000
	Generator 3 KVA	set	1		500
	Underwater pump ø 65	set	1		50
	Oil tank 3.5 m^3	set	1		500
	Steel oneway surge tank	set	1		1,000
	Check valve ø300	set	1		
	Sluice valve ø300	set	1		
	- do - ø100	set	1		
	Pilot valve w/float	set	1		
	Pipe, etc.	set	1		
Sub-total					9,350
Total					28,853

B-4. Materials for better farm management

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥)
Chemical Fertilizer	Ammonium sulphate	ton	280	7,700	2,156
	Superphosphate	ton	210	11,400	2,394
	Muriate of Potash	ton	28	22,000	616
	Synthetic fertilizer (15:15:15)	ton	140	26,200	3,668
	- do - (18:22:0)	ton	230	23,100	5,313
	- do - (20:0:10)	ton	560	20,000	11,200
Sub-total					25,347
Agricultural Chemicals	Pesticides Insecticides Weedicides	L.S.			3,500
Sub-total					3,500
Improved Seeds	Paddy Wheat Maize Others	L.S.			700
Sub-total					700
Total					29,547

B-5 Others

B-5-1. Machinery and Material for Domestic Water Supply

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥) ('000 Rs)
1	Supply Pump Complete Self priming pump with engine Pump : capacity 0.5 m^3/ min. head 20 m, caliber 65 mm Engine : output 37 KW/3,600 rpm	unit	2	130,000	260
2	Water Tank Complete Steel tank : capacity 20 m^3 Steel tower for tank:H=10m Standard accessories including of steel pipe and valve	unit	2	2,400,000	4,800
3	Supply Pipe Valve for Main Line				
	Steel Pipe :100mm ø	m	1,800	600	1,188
	Sluice valve:100mm ø	pc	2	27,300	54.6
		lot	1		1,242.6
4	Supply Pipe and Valve for Branch Line				
	Steel pipe : 40 mm ø	m	400	190	76
	Steel valve : 40 mm ø	pc	40	7,500	300
		lot			376
5	Faucets				
	Steel pipe : 25mm ø	m	120	130	15.6
	Swing faucets 25mm ø	pc	120	4,800	576
	J.W.W. A type hydrants	pc	80	3,300	264
	- do - (branch type)	pc	80	4,000	320
		lot			1,173.6
	Total(F.O.B. Japan)				7,854.2

(continued)

Item	Description	Unit	Q'ty	Rate (¥)	Total Cost ('000 ¥) ('000 Rs)
6	Local Material				
	Cement	bag	200	770	154 (51)
7	Personel				
	Craftman	man-month	6	3,240	55.46 (18.36)
	Labor	man-month	20	11,620	92.4 (30.6)
	Total (Local Currency)				301.84 (99.96)

B-5-2. Unit Cost for Construction

Item	Unit Cost (Rs)				Remarks
	Ft. unit		M. unit		
Excavation	1,000 cf	90.00	c.m.	3.18	
Banking Back-filling	1,000 cf	90.00	c.m.	3.18	
Brick work	100 cf	400.00	c.m.	141.26	
Cement mortar plastering	100 sf	55.00	s.m.	5.92	1/2"
Boulder concrete	100 cf	500.00	c.m.	176.57	
Cement mortar	100 cf	600.00	c.m.	211.89	
Reinforced concrete	100 cf	950.00	c.m.	335.49	
Form	100 sf	130.00	s.m.	14.00	
Steel bar			ton	2,200.00	
Wooden board	1 cf	25.00	c.m.	882.86	

C. SPECIFICATION

C SPECIFICATION

C-1 Agricultural Machinery, Implements and Tools

Item	Specification	Remarks
4 wheel tractor 35 PS	Radiator cooling 4 cycle diesel, 35 PS/2,500 rpm, hydraulic 3 point linkage, position, draft control. W/glow plug and decompressor, road clearance 480 mm up. Tire 5.5-16-4, 12.4-28-6	Ishikawajima, Kubota, Mitsubishi
Canopy	Removal iron support w/canvas	- do -
Front wheel w/rim	W/tire, air tube, rim 5.50-16-4	- do -
Rear wheel w/rim	W/tire, air tube, rim 12.4-28-6	- do -
Front wheel weight	15 kg-4 pieces cast or steel	- do -
Rear wheel weight	35 kg-6 pieces cast or steel	- do -
Strake fins set	Strake width 35 cm, 7 fins	- do -
Rotary tilling device	P.T.O. drive, rotary blade 40, tilling width 160 cm up.	- do -
Rotary cutter	P.T.O. drive, 2 knives, cutting width 130 cm, MRC 130	- do -, Star
Bottom plow	14"-2 general purpose, MGP 142	- do -, Star
Bottom plow	18"-1 general purpose, TB 18-1	- do -, Sugano
Disc plow	26"-2 MOP 242 AG	- do -, Star
Tandem disc harrow	18"-20 TL 1820	- do -, Sugano
Broad caster	250 l, w/canvas attachment, BC 105-250	- do -, Takakita
Manure spreader	500 kg, working with 400 cm, MMS 5	- do -, Star

(continued)

Item	Specification	Remarks
Lime sower	5' working width 140 cm, DH 140 KB	Ishikawajima, Kubota, Mitsubishi, Derika
Ridger	3' FV 3	- do -, Sugano
Grain drill	7' fertilizer 100 l, w/maker MGD 7 A	- do -, Star
Cultipacker	8' 600 kg, CP 101	
Hand tractor 5-6.5 PS	Radiator cooling 4 cycle diesel 5 PS/2,200 rpm, w/center drive rotary ass'y, tilling width 48 cm up, 14 blades, tire 5.00-12	Mitsubishi, Kubota, Izeki Ishikawajima
Steel paddy field wheel	Set	- do -
Steel pipe wheel	Set	- do -
Plow	Reversible, plowing width 18 cm,depth 15 cm	- do - Matsuyama, Takakita
Rotary plow	Ass'y	- do -
Spine rotary	W/blades and bolts, nuts ass'y	- do -
Puddler	Leveller	- do -
Ridger	Ogawa type 5	- do -, Ogawa
Trailer	500 kg, w/brake	- do -
Knapsack hand sprayer	12 l, w/hose, nozzle, C 12	Kyoritsu, Maruyama
Hand duster	T-7 A	- do -

(continued)

Item	Specification	Remarks
Power duster mist blower	Air cooling gasoline, DM-9 w/mist and dust pipe, dust long hose 40 cm and reel	Kyoritsu, Maruyama
Weeding hand duster	7 l, T-8 GS	- do -
Power sprayer	W/vinyl hose 13 mm-60 m, HPE 41 A Swath nozzle, BS 2 N-15	- do -
Hand soil injecter	HB-4B	- do -
Power bush cutter	Air cooling 2 cycle gasoline ass'y 5.9 kg, RM-25 A	- do -
Rice milling unit	Centrifugal type huller, KY-71, w/polisher, elevator, cyclone hooper cooling diesel 10 PS/ 1,500 rpm, approx. 500 kg/hr on cleaned paddy 330 kg (without engine)	Kokuyo, Mitsubishi, Satake
Cultivator	3-3, S	Ishikawajima, Kubota, Sugano
Hole digger	Auger 30 cm P.T.O. drive, hydraulic control, L 109	Takakita
Front loader	Hydraulic control, w/backet, manure fork, TFL 350, 45 BS, 45 MS	Sanyokiki
Half trailer	2 ton synchronized blake	Derika
Subsoiler	2 wings, PW-2	Sugano
P.T.O. ass'y	5" flat belt 10 cm w/lacing, wax	Kubota, Ishikawajima
Hand tractor 6.5-8 PS	Radiator cooling 4 cycle diesel, 6.5 PS/2,200 rpm, w/center drive rotary tilling ass'y, tilling width 51 cm up, 16 blades, innerbrake, tire 6.00-12	Mitsubishi, Kubota, Izeki, Ishikawajima

(continued)

Item	Specification	Remarks
Paddy field steel wheel	Set	Mitsubishi, Kubota, Izeki, Ishikawajima
Steel pipe wheel	Set	- do -
Rotary mower	W/V-belt and pully	- do -
Plow	Reversible, plowing width 20 cm depth 15 cm	- do - Matsuyama, Takakita
Ride raker	Width 180 cm, riding puddler	- do -
Ridger	Ogawa type 5	- do -, Ogawa
Spine rotary	W/blades and bolts, nuts	- do -
Rotary plow	Set	- do -
Vacuum tank car	500 l, w/hose, engine, HVC-500 A	- do -, Star
Lime sower	135 l, wheel drive, HLS-90 B	- do -, Star
Trailer	500 kg, w/blake	
Rice milling unit	Centrifugal type huller, KY-71, w/polisher, elevator, cyclone, hopper cooling diesel 10 PS/1,500 rpm, approx. 500 kg/hr on cleaned paddy 330 kg (without engine)	Kokuyo, Mitsubishi, Satake
Power thresher	Threshing pulley diameter 540 mm, radiator cooling diesel 5 PS/2,200 rpm, flat belt 20 m, w/lacing, wax	Izeki, Ishikawajima, Kubota, Mitsubishi
Combine	Power thresher type, 2 row riding type w/accessory gasoline 10 PS/1,500 rpm	- do -
Rice planter unit	W/seeder, rising implements, seeding boxes, engine	- do -

(continued)

Item	Specification	Remarks
Pump	2.5" self priming. Suction hose 6 m. w/strainer, vinyl hose 10 m, hooper cooling diesel 5 PS/2,200 rpm w/V-blet	Izeki, Ishikawajima, Kubota, Mitsubishi
Diesel engine	Diesel, radiator cooling 4 cycle, 5 PS/2,200 rpm	- do -
Gasoline engine	Gasoline, air cooling 4 cycle, 5 PS/2,000 rpm	- do -
Corn sheller	700-1,000 kg/hr, hooper cooling diesel 5 pieces, CS-2 A, w/flat belt 10 m and lacing, wax	- do -, Star
Root cutter	RC-30	Star
Forage cutter	Charging width 175 mm, hooper cooling diesel 5 PS/2,200 rpm, FC18	- do -, Star
Straw rope making machine	KD 1	Hokokukikai
Wheel barrow	One wheel car, w/tire	
Acetylene carbide bomb	A 2 B	Fujisawa neji
Hammer crusher	No. 1 lime stone, 120 kg/hr	Sogo sangyo
Flour milling plant (small)	Roll 8"-10" 129 mesh, milling capacity 50 kg/hr, R-3	Nakashima
Oil mill plant (small)	50 kg/hr, mustard seed scorcher S, 1 PS, geared motor, oil expeller, new type 52, w/accessory, 1/2 PS geared motor, steel hose	Handa oil
Animal plow	Reversible, GEM-3	Matsuyama

C-2. Construction Machinery

Item	Specification	Remarks
Angle dozer	5 ton class, 55 PS diesel	Komatsu, D30A
Dozer shovel	0.6 m^3 class, 55 PS diesel with push board (angle)and back hoe	Komatsu, D30S
Truck	6 ton class, 130 PS gasoline	Toyota, FA115
Concrete mixer	0.2 m^3 capacity, 5 PS, gasoline	Matsuoka, TD-8
Velt conveyor	Portable type. 7 m long, 35 cm wide 3 PS gasoline	Koyo, KE-5
Chain block	1.0 ton	Nihon Chain Block
Steel Pipe	ϕ 300 mm t = 69 mm linear 40 m with flange	Shin -Nitetsu
Corrugated metal pipe ϕ 250	flange type with bolts and nuts, t = 1.6 mm	- do -
" ϕ 300	- do -	- do -
" ϕ 450	- do -	- do -
" ϕ 500	- do -	- do -
P.V.C. Pipe ϕ 25	VP, t = 7.0 mm	
Superstructure	for bridge, Span 6.6 m width 4.0 m, main steel beam, 2-H-446 x 199 x 8 x 12 x 7,000 steel beam, 3-L-250 x 90 x 9 x 13 x 2,800 slab plate (570x4) 33 m^2 guard rail, Base plate, etc. total weight of steel 3.6 ton	Shin-Nitetsu: Standard Bridge
Air valve	ϕ 25 mm	Maezawa
Sluice valve ϕ300	Hand-operated valve	- do -
" " ϕ250	- do -	- do -
" " ϕ100	- do -	- do -

(continued)

Item	Specification	Remarks
Sluice valve ϕ 75	Hand-operated valve	Maezawa
Field valve ϕ 75	Hand-operated valve	Type sprinkler KK
Sluice gate ϕ300	Spindle	Daido-Kiko DKSF-300
P.V.C. sheet	t = 1.0 mm	Seibu-Gomu SP-mat
Double suction valute pump	Suction bore 250 mm discharge bore 200 mm Total head 64 m, capacity 8.34 m^3/min Engine power 170 SP Attachment; channel steel base, gauge cock with stand, friction clutch and tool, etc. Spare parts : ball bearing, linear ring, packing, etc.	Torishima, CDM, Type
Suction and discharge pipe	Steel, ϕ 250 mm t = 6.9 mm	- do -
Expansion joint of pipe		- do -
Movable flange of pipe		- do -
Foot valve	With strainer	- do -
Sluice valve	Hand operated valve	- do -
Check valve		- do -
Gasoline engine	Output 170 PS, 6 cylinder 1,500 rpm, radiator cooling system starter (motor) Attachment; controllers, bonnet radiator, flywheel, hand operation clutch, oil tank, oil gauge tools, etc.	- do -

(continued)

Item	Specification	Remarks
	Spare parts; springs, rings packings, etc.	
Generator	Output 3 KVA 60 Hz - 1,800 rpm, 110 V	Torishima, CDM, Type
Underwater pump	ø 65 mm, capacity 250 ℓ/min Motor Power 1.5 kW	- do -
Oil tank	Capacity 3 5 m^3	- do -
Oneway surge tank	Steel surge tank (capacity 1.0 m^3) Check valve (ø 300), hand operated sluice valve (ø 300 & ø 100), Pilot valve with float (ø 100) and pipes	- do -
Frame of doors and windows	Steel door 2.0 m x 1.7 m Almi-sash windows 1.2 m x 1.6 m, Flash door 2.0 m x 0.75 m	Fuji Sash KK

C-3 Specifications of Well Drilling Work

(1) Purpose of Well Drilling Work

The well drilling work specified herein is planned to be carried out for drilling wells to secure the source of water for irrigation and domestic use in accordance with the technical cooperation agreement concluded between His Majesty's Government of Nepal and the Government of Japan. The scope of the drilling work includes the training of Nepalese personnel wishing to acquire the well drilling techniques.

(2) Engineers

The well drilling work shall be conducted by one hydrogeologist and two to three drilling experts. The hydrogeologist shall supervise the drilling experts in the performance of drilling work under the direction of the project manager assigned for the current technical cooperation. In carrying out the drilling work, he shall also make prudent consultantion with other Japanese experts and competent officials of Nepalese government. The drilling experts shall closely follow the instructions of the hydrogeologist, and shall pay scrupulous attention to the maintenance and handling of the well drilling machinery and equipment.

(3) Labourers

Labourers shall be employed by HMG of Nepal.

(4) Supply of Machinery and Equipment

The well drilling machinery and equipment procured in Japan and transported to Nepal shall be delivered without uncrating at the stock yard in the project area. These machinery and equipment shall be uncrated and assorted by the drilling experts for use in the drilling work for storage near the construction site and for safekeeping the warehouse. The place for storing the machinery and equipment shall be designated by the project manager.

Request for the supply of locally available materials such as wood, fuels, lubricants, gas*, cement, pipes, steel plate and cells or for battery charging and repair of minor faults shall be made to the project manager or the person designated by him.

In case of the need arises for obtaining clay, gravels or water at site for the purpose of the well drilling work, such materials shall be obtained at places determined by prior arrangements with the competent officials of Nepalese government.

Gravel sieve, tool kits and the like which are required for the execution of work shall be fabricated by the drilling experts using the equipment and materials provided.

* Acetylene gas and oxygen gas can be obtained at Birganj and the most of other materials at Janakpur.

(5) Stock of Machinery and Equipment

Upon completion of each dry season work, the drilling experts responsible for the well drilling work shall put all machinery and equipment in good working condition, prepare a list showing their condition and stock places, and store them at places designated by the project manager. This practice shall be followed upon completion of the whole well drilling work.

(6) Selection of Well Sites

The well sites shall be determined by the project manager after consultation with the hydrogeologist and irrigation engineer.

In the initial year, the drilling work shall be carried out in the district described in Section 3.2.2.1 of this report as well as at the place selected to secure the source of drinking water for the dormitory of Japanese experts. The sequence of drilling work shall be instructed by the project manager. In the irrigation improvement area, drilling work shall be carried out in the order of well numbers shown in Fig. 3.2.7 in Section 3.2.2.1 of this report, commencing with the well at the southeastern corner and proceding towards west, unless circumstances call for the change in this sequence.

(7) Drilling Method

Drilling of wells for irrigation water supply shall be carried out according to the sequence outlined below.

a. Drilling shall be conducted with the drilling diameter maintained at 22" to a depth considered adequate by the hydrogeologist to locate the clayey layer. Then, a conductor pipe having a diameter of 22" shall be installed at the said depth.

b. Drilling shall be continued to the design depth with a drilling diameter of 14-3/4". During this drilling work, the specific weight of mud water shall be constantly maintained at a value larger than 1.2 in prevention of the outflow of artesian water.

c. The hydrogeologist shall detect the aquifer by means of electrical logging, well long and core sample.

d. After drilling to a depth of 30 m with an 18" diameter bit, a 14-3/4" diameter bit shall be employed for re-drilling to the bottom, and the settled slime shall be taken out.

e. A casing having a diameter of 12" shall be installed to a depth of 22 - 25 m from the drilling surface, which shall be connected to another casing and screens of 8" diameter extending further downwards. The screen shall be fitted in the aquifers, centering guide shall be provided on top and bottom of the screen.

Drilling of wells for drinking water supply shall be conducted as described below following the approximately same sequence. (Instruction given under Items a, b and c are identical to those given for well for irrigation water supply)

a. Drilling shall be conducted to a depth considered to be adequate by the hydrogeologist with the drilling diameter of 14-3/4" to locate the clayey layer. A conductor pipe of 12" diameter shall be installed at the said depth.

b. Drilling shall be continued to a depth of 130 m with a drilling diameter of 10-8/5". If the drilling is intended to secure the water source for the dormitory, the depth may be altered by the judgement of the hydrogeologist according to the location of the dormitory. The specific weight of mud water shall be maintained as instructed for the wells for irrigation water supply.

c. The aquifer shall be detected as instructed for the wells for irrigation water supply.

d. Omitted.

e. A casing pipe of 6" diameter connected with 4" ϕ gravel screens shall be installed in the drilled hole. Gravel screens shall be fitted at the aquifers.

f. Gravels shall be filled in the annular space as in the case of irrigation water.

g. Same as for wells for irrigation water.

h. Ditto.

i. Ditto.

j. Gravels sieved by the instructions of the hydrogeologist at the site shall be filled around the casing, which shall be ensued by the filling of clay and concrete placing. The completed well shall conform in its finish to the standard well shown in the drawing in Section 2.2.2.1 of this report.

k. The well shall be fitted, on its drilling surface, with a cover and discharge pipe as illustrated in the above-mentioned drawing.

l. Mud water shall be pumped up by means of an airlift pump or submergible motor pump for the development of the well with the swapping method applied if necessary.

m. After the development pumping test shall be conducted. Well water shall be pumped up for more than 48 hours. Water level recovery until the outflow of artesian water is noted. In addition to this continuous pumping test, step drowdown pumping test shall be conducted, and observation of electrical conductivity and temperature of well water shall be simultaneously carried out. Further, in 24 hours or more after completion of pumping test, elevation of piezometric surface artesian yield shall be measured.

All the data including the yield, present elevation of piezometric surface, water quality and temperature, result of pumping test, and well log shall be submitted to the project manager with the comments of the hydrogeologist upon completion of each well.

(8) Depth of Wells for Irrigation Water Supply

In order to minimize the mutual interference of wells, 130 m deep wells and 200 deep wells shall be alternately arranged as described in Section 3.2.2.1 of this report, with strainers fitted down to a depth of 130 m for the former and to the section deeper than 150 m beneath the ground surface for the latter.

However, if the drilling of the first well fails to locate a aquifer deeper than 150 m or results in sudden decline of the artesian yield of 200 m deep wells, then all the wells planned to be drilled in the initial year in the irrigation improvement area shall have a depth of 130 m.

In spite of this drilling method and the principles described in the preceding item, the first well drilled for irrigation water supply shall have two screens, one fitted in the aquifer in Layer 2 stretching at a depth of about 100 m and another in the aquifer which is considered to extend at a position deeper than 150 m in Layer 4, and a current meter shall be installed between the two screens with the well put in free flowing condition in order to measure the artesian yield from the lower screen. If the measured value is larger than the design yield shown in Section 3.2.2.1 of this report (i.e., the water yield in parentheses), than 130 m deep wells and 200 deep wells shall be arranged alternately as originally designed, but the depth of all wells to be subsequently drilled shall be altered to 130 m if the first well does not produce the design yield.

(9) Dormitory

The dormitory shall be provided by the project manager. However, if the location of the dormitory is too far from the construction site in the second and subsequent years for easy communication, camps may be installed at the construction site.

(10) Transportation

One each of jeep and a crane truck shall be made available at all times for transport of machinery and equipment and procurement of various materials. Further, one truck shall be made available if necessary.

D. OTHERS

D-1 Project Centre Facilities

1) Office (total building area: 430 m^2)

Room	Number	Size (m x m)
Conference Room	1	5 x 10
Manager's Office	1	5 x 8
Accountant's Office	1	5 x 4
Engineers' Office	4	5 x 8
Administrator's Office	1	5 x 8
Office Room	1	5 x 8
Workshop	1	5 x 4
Communication Room	1	5 x 2
Warehouse	1	5 x 8
Toilet Room	2	2 x 2.5

2) Dormitory

(1) Type A for Japanese Staffs with Family (total building area: 113 m^2)

Room	Number	Size (m x m)
Bedroom	1	5 x 4
Living Room	1	5 x 6
Dining Room	1	5 x 3
Kitchen	1	5 x 2
Storeroom	1	5 x 2
Bathroom with Toilet	1	4 x 2

(2) Type B for Japanese Bachelor Staffs (total buildinga area : 93 m^2)

Room	Number	Size (m x m)
Bedroom	1	5 x 4
Living Room	1	5 x 6

Room	Number	Size (m x m)
Dining Room	1	5 x 3
Kitchen	1	5 x 2
Storeroom	1	5 x 2
Bathroom with Toilet	1	4 x 2

(3) Type C for Japanese Project Manager (total building area: 161 m^2)

Room	Number	Size (m x m)
Bedroom	3	5 x 4
Living Room	1	5 x 8
Dining Room	1	5 x 4
Kitchen	1	5 x 2
Storeroom	1	5 x 3
Bathroom with Toilet	2	4 x 2

(4) Type D for Japanese Engineers on Short-terms Service and Members of Japan overseas cooperation volunteers (total building area: 465 m^2)

Room	Number	Size (m x m)
Bedroom	18	5 x 3
Shower Room with Toilet	18	5 x 1
Dining Room	1	5 x 6
Kitchen	1	5 x 5
Storeroom	1	5 x 5
Bathroom	1	5 x 5

(5) Type E for Nepalese Project Manager (total building area: 122 m^2)

Room	Number	Size (m x m)
Bedroom	1	5 x 4
Living Room	2	5 x 6
Dining Room	1	4 x 3
Kitchen	1	4 x 3
Storeroom	1	5 x 2
Bathroom with Toilet	1	4 x 2

(6) Type F for Nepalese Staffs with Family (total building area: 70 m^2/houses; 700 m^2 for 10 houses)

Room	Number	Size (m x m)
Bedroom	1	5 x 4
Living room	1	5 x 4
Dining Kitchen	1	4 x 3
Storeroom	1	5 x 2
Shower Room with Toilet	1	4 x 2

(7) Type G - Dormitory for Nepalese Bachelor Staffs (total building area: 55 m^2/apartment, 1,650 for 30 apartments)

Room	Number	Size (m x m)
Bedroom	1	5 x 4
Living room	1	5 x 3
Kitchen	1	5 x 3
Shower Room with Toilet	1	5 x 1

3) Guest House (total building area: 266 m^2)

Room	Number	Size (m x m)
Bedroom (A)	6	5 x 3
Bedroom (B)	2	5 x 4
Shower Room with Toilet	6	5 x 1
Bathroom with Toilet	2	4 x 2
Kitchen	1	5 x 2

Room	Number	Size (m x m)
Dining Room	1	5 x 6
Assembly Hall	1	10 x 5

4) Hall (total building area: 320 m^2)

Room	Number	Size (m x m)
Hall	1	20 x 14
Anteroom	1	5 x 4
Toilet	1	5 x 4

5) Warehouse of Farming Machinery and Implements (total building area: 270 m^2)

6) Warehouse of Agricultural Materials (total building area: 270 m^2)

7) Warehouse of Construction Machinery and Equipment (total building area: 270 m^2)

8) Workshop (total building area: 1, 170 m^2)

Room	Number	Size (m x m)
Machine Parts Storehouse	1	30 x 9
Garage (A)	1	30 x 9
Garage (B)	1	30 x 9
Repair Shop	1	30 x 9
Car Washing Yard	1	5 x 9
Fuel Tank	1	5 x 9

9) Pump Room (total building area: 50 m^2)

10) Clinic (total building area: 195 m^2)

Room	Number	Size (m x m)
Consultation and Treatment Room	1	5 x 8
Ward	2	5 x 4
Medical Office	1	5 x 4
Nurses' Room	1	5 x 4
Dispensary	1	5 x 4

Room	Number	Size (m x m)
Examination Room	1	5 x 4
Kitchen	1	5 x 3
Toilet	1	5 x 1
Bathroom with Toilet	2	4 x 2

11) Office of ASC and ADB (total building area: 145 m^2)

Room	Number	Size (m x m)
Office of ASC's Manager	1	5 x 4
Office of ASC's Accountant	1	5 x 4
Office of ASC's Administrator	1	5 x 4
Office of ADB's Manager	1	5 x 4
Office of ADB's Accountant	1	5 x 4
Office of ADB's Administrator	1	5 x 4
Office for ADB's Banking Service	1	5 x 4
Toilet	1	5 x 1

12) Generator Room (total building area : 50 m^2)

D-2- 1 Tools and Equipments for Hardinath Extension Farm

Item	Unit	Q'ty	Rate	Remarks
Engine service				
Compression gauge	no.	1		Iyasaka anzen 0 - 20 kg/cm^2
Diesel compression gauge	no.	1		- do -, 0 - 70 kg/cm^2
Nozzle tester	no.	1		- do -, 0 - 500 kg/cm^2
Ames cylinder gauge	no.	1		- do -
Valve lapper and compound	set	1		- do -
Valve lifter	no.	1		- do -, universal
Sound scope	no.	1		- do -
Thickness gauge	no.	1		- do -
Valve seat cutter set	set	1		- do -
Air service				
Air compressor set	set	1		- do -, w/accessory
Tire remover set	set	1		- do -
Hot patch set	set	1		- do -
Tire gauge	no.	3		- do -
Air gun	no.	1		- do -
Engine cleaner	no.	1		- do -
Hand air infractor	no.	1		- do -, w/gauge and tank
Lifting service				
Garage jack	no.	1		- do -, 10 ton
Chain block	no.	1		
Steel wire rope	no.	5		- do -, w/eye hook
Oil jack	no.	4		- do -

(continued)

Item	Unit	Q'ty	Rate	Remarks
Electric service				
Universal circuit tester	no.	1		Iyasaka anzen
Megger	no.	1		- do -, 500 V 100 M
Timing light	no.	1		- do -
Battery charger set	set	1		- do -
Lubrication and washing service				
Oil and fuel service set	set	1		- do -
Car washer	no.	1		- do -, W/2 PS motor
Welding and metal working service				
Engine welder set	set	1		- do -
Gas welder set	set	1		- do -, inch size
Welding rod set	set	1		- do -
Torch lamp	no.	1		- do -, 1 1
Metal working set	set	1		- do -
Portable electric tools	set	1		- do -
Portable carpenter's electric tools	set	1		- do -
Measuring tool set	set	1		- do -
Hand tool set	set	1		- do -

D-2- 2 Tools and Equipments for Rapti Model Farm

Item	Unit	Q'ty	Rate	Remarks
Engine service				
Compression gauge	no.	1		Iyasaka anzen 0-20 kg/cm^2
Diesel compression gauge	no.	1		- do -, 0-20 kg/cm^2
Nozzle tester	no.	1		- do -, 0-500 kg/cm^2
Valve lapper and compound	no.	1		- do -, set
Sound scope	no.	1		- do -
Thickness gauge	no.	2		- do -
Valve set cutter	no.	1		- do -, set
Valve lifter	no.	1		- do -, universal type 0.82 kg
Air service				
Air compressor set	set	1		- do -, w/accessory, 3 PS motor
Tire remover set	set	1		- do -
Tire gauge	no.	2		- do -, bar type, 10 kg/cm^2
Engine cleaner	no.	1		- do -
Hot patch set	no.	1		- do -
Lifting service				
3 ton chain block	no.	1		- do -
Oil jack	no.	2		- do -
Electric service				
Universal circuit tester	no.	1		- do -
Portable generator ass'y	set	1		- do -
Battery charger set	set	1		- do -
Lubrication service				
Oil and fuel service set	set	1		- do -

(continued)

Item	Unit	Q'ty	Rate	Remarks
Metal working service set	set	1		Iyasaka anzen
Portable electric tool set	set	1		- do -
Portable carpenter's electric set	set	1		- do -, Makita
Measuring set	set	1		- do -
Hand tool set	set	1		- do -

D-3 List of Vehicles, Agricultural Tools and Materials for Extension Activities

1) Initial stage (1972 - 1974)

Item		Required Number			
		1972	1973	1974	Total
Agricultural Implements and Tools	Hand duster	0	0	15	15
	Hand sprayer	0	0	10	10
	Weeder (hand-operated)	0	0	15	15
	Farmers' tools (set)	0	0	30	30
	Pump set	0	0	2	2
	Diesel engine	0	0	2	2
	Gasoline engine	0	0	2	2
	Miscellaneous	0	0	L. S.	L. S.
Office Supplies	Miscellaneous	0	0	L. S.	L. S.
Materials					
Agricultural Materials	Chemical fertilizer	0	0	L. S.	L. S.
	Agricultural chemicals	0	0	L. S.	L. S.

2) Latter stage (1975 - 1978)

Major items are as follows :

Vehicle : Jeep, motor-bicycle, bicycle

Agricultural Implements and Tools: Hand duster, hand sprayer, weeder, pedal thresher, diesel engine, gasoline engine, pump set, farmers' tools, etc.

Materials: Chemical fertilizer, agricultural chemicals, improved seeds, other agricultural materials, etc.

D-4. List of Facilities for Hardinath Extension Farm

1) Initial stage (1972 - 1974)

Facilities to be constructed within initial stage are as follows :

1.1 Office

1.2 Green house

1.3 Stable compost shed

1.4 Indoor's nursery bed

1.5 Miscellaneous

2) Latter stage (1975 - 1978)

Facilities to be constructed during latter stage are as follows :

2.1 Irrigation facilities

2.1.1 Partial improvement of irrigation and drainage canals

2.1.2 Creation of a new drain pond and partial improvement of existing drain pond

2.2 Outdoor's nursery bed

2.3 Horticultural control room

2.4 Stock house-cum-staple manure shed

2.5 Ware house

2.6 Working yard

2.7 Paved road

2.8 Dormitory for trainee

2.9 Water supply facilities

2.10 Miscellaneous

D-5. List of Machinery, Equipments and Tools for Hardinath Extension Farm

1) Initial stage (1972 - 1974)

Item		Required Number			
		1972	1973	1974	Total
Machinery Vehicle	Jeep	0	1	0	1
	Truck (2 t)	0	0	1	1
	Motor-bicycle	0	0	1	1
	Bicycle	0	1	1	2
Agricultural Machinery	Tractor (35PS)/1	0	1	0	1
	- do. - (5-6.5 PS)	0	0	1	1
	- do - (6.5-8 PS)	0	1	1	2
	Pump set	0	0	1	1
	Diesel engine	0	0	1	1
	Gasoline engine	0	0	1	1
	Straw rope making machine	0	0	1	1
	Miscellaneous & spare parts	L.S.	L.S.	L.S.	L.S.
Office Supplies	Desk (steel-made)	0	1	2	3
	Chair (- do -)	0	1	2	3
	Book shelf (- do -)	0	1	2	3
	Duplicator	0	0	1	1
	Typewriter (handy)	0	1	0	1
	Calculating machine (hand-operated)	0	1	0	1
	Miscellaneous	L.S.	L.S.	L.S.	L.S.
Equipment for Survey and Experiment	Refrigerator	0	0	1	1
	Portable pH meter	0	0	1	1
	Portable EH meter	0	0	1	1
	Hand level	0	0	1	1
	Transit	0	0	1	1
	Clinometer	0	0	1	1

/1 : with attachments

Item		1972	1973	1974	Total
		Required Number			
	Soil survey equipment	0	0	1	1
	Tent	0	0	2	2
	Generator (2 KW)	0	0	1	1
	Miscellaneous	L. S.	L. S.	L. S.	L. S.
Audio-visual Aids	Slide projector	0	0	1	1
	Tape recorder	0	1	0	1
	Transistor radio	0	1	0	1
	Movie (8 mm)	0	1	0	1
	Camera (35 mm)	0	1	0	1
	Miscellaneous	L. S.	L. S.	L. S.	L. S.
Materials					
Agricultural Materials	Chemical fertilizers	0	L. S.	L. S.	L. S.
	Agricultural chemicals	0			
	Miscellaneous	L. S.	L. S.	L. S.	L. S.
Office Supplies	Paper, pencils, minor instruments, etc.	L. S.	L. S.	L. S.	L. S.
Audio-visual	Film, printing paper, developing solution etc.	L. S.	L. S.	L. S.	L. S.

2) Latter stage (1975 - 1978)

Major items are as follows :

Machinery : Agricultural machinery .... tractor (6.5-8 PS), rice mill, power dust mist, power sprayer, rice planter unit, power thresher, corn sheller, forage cutter, hammer crusher, combine, tractor (35 PS), tractor (5-6.5 PS), etc.

Office supplies .... desk (steel-made), chair, book-shelf, electric calculating machine, typewriter, tape write, duplicator, mimeograph, etc.

Equipment for survey and experiment ....
Refrigerator, freezer, equipment for physical, chemical and botanical experiment, equipment for topographic survey, soil survey, water survey and agricultural survey, etc.

Audio-visual aids.................. motion picture camera (16 mm), movie camera (8 mm), camera (35 mm), photo-developing and printing appratus, video apparatus, tape recorder, transistor radio, etc.

Others .... generator, water pump, transformer.

Materials : Agricultural materials.............. chemical fertilizers, agricultural chemicals, improved seeds, other materials, etc.

Office supplies .... paper, pencil, ink, etc.

Audio-visual aids .... film, developing solution, printing paper, recording tape, dry battery, etc.

Materials for survey and experiment ....
chemicals, polyethylene-made bottles, flask, materials for drawing, etc.

D-6. List of Machinery and Materials for Project Center

1) Initial stage (1972 - 1974)

Item		Required Number			
		1972	1973	1974	Total
Machinery Vehicle	Jeep	0	2	0	2
	Motor-bicycle	0	1	1	2
	Bicycle	0	2	0	2
Office supplies	Desk (steel-made)	0	2	2	4
	Chair (- do -)	0	2	2	4
	Book shelf (- do -)	0	2	3	5
	Duplicator	0	1	0	1
	Typewriter	0	1	1	2
	Electric calculating machine	0	0	1	1
	Calculating machine (hand-operated)	0	1	1	2
	Miscellaneous	L. S.	L. S.	L. S.	L. S.
Equipment for Survey	Tent	0	1	2	3
	Ground sheet	0	1	1	2
	Sleeping bag	0	3	3	6
	Cooking set	0	3	2	5
	Biniculars	0	1	2	3
	Filter press	0	1	2	3
	Rope	0	L. S.	L. S.	L. S.
	Planimeter	0	1	1	2
	Curvimeter	0	1	1	2
	Clinimeter	0	1	1	2
	Miscellaneous	L. S.	L. S.	L. S.	L. S.
Others	Generator	0	1	1	2
	Water pump	0	1	1	2
	Telephone set	0	1	1	2
	Lightning set	0	1	1	2

Item	Required Number			
	1972	1973	1974	Total
Implements and tools for repair shop (set)	0	1	1	2
Miscellaneous	L.S.	L.S.	L.S.	L.S.

2) Latter stage (1975 - 1978)

Major items are as follows:

Machinery: Vehicle .... jeep, station wagon, motor-bicycle, bicycle

Aeroplane.......... light aeroplane

Office supplies .... desk, chair, book-shelf, money safe, suplicator, typewriter, electric calculating machine, locker (steel-made), miscellaneous, etc.

Others .... wireless appratus, telephone set, speaker, implements and tools for repair shop, video set, generator, water pump, transformer, medical appratus, alarm appratus; freezer, refrigerator, air conditioner, cooking set, sleeping set for Guest house, etc.

Materials : Materials for construction .... cement, wire, prefabricated house, service tools, etc.

Office supplies .... paper, pencil, miscellaneous, etc.

Others

D-7 Major Machinery and Implements Available at Hardinath Farm

Item	Description	Unit	Q'ty	Remarks
Vehicle				
	Land cruiser Toyota, FJ-40, No. 1986	no.	1	C
Agricultural machinery				
	Thresher, pedal	no.	1	C
	Duster and mist blower, DM-9	no.	1	D
	Tractor, hand, Yammer, YC42B	no.	1	C
	Thresher, power, AF-2	no.	1	C
	Tractor, tiller, "CECOCO", LK-2	no.	1	C
	Tractor, MF-35	no.	2	C
	Sprayer, "CECOCO"	no.	1	D
	Duster cum mist blower, DM-9	no.	2	B
	Thresher, power CN	no.	1	B
	Hand duster, knapsack, HD	no.	1	C
	Grain dryer, MDR-23D	no.	1	B
	Water pump, "KUBOTA"	no.	1	B
Others				
	Air compressor, "BTC" CTE-222DA	no.	1	B
	Diesel generator, Yammer, 3 KVA	no.	2	C
	Microscope "BELOGICAL"	no.	1	B

(continued)

<u>Note</u>:

A : Brand new

B : Used and quite in good order

C : Usable but to be repaired or renewed soon

D : Not serviciable or not to be repaired