ASIAN DEVELOPMENT BANK

TECHNICAL ASSISTANCE

TO THE

KINGDOM OF NEPAL

FOR THE

COMMUNITY GROUNDWATER IRRIGATION

SECTOR PROJECT

June 1996
CURRENCY EQUIVALENTS
(as of 31 May 1996)

<table>
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The Nepalese rupee is pegged to the Indian rupee (Rs) at the rate of NRs1.60 = Rs1.00. The Nepalese rupee is fully convertible on the trade account. For the purpose of calculations in this Report, the rate of $1.00 = NRs55.25 has been used, which was the rate generally prevailing during the Fact-finding Mission.

ABBREVIATIONS

AIC - Agricultural Inputs Corporation
A DBN - Agricultural Development Bank of Nepal
APP - Agriculture Perspective Plan
DOA - Department of Agriculture
DOI - Department of Irrigation
DTW - Deep Tubewell
DWSS - Department of Water Supply and Sewerage
GID - Groundwater Irrigation Division
GWRDP - Groundwater Resources Development Project
JICA - Japan International Cooperation Agency
IFAD - International Fund for Agriculture Development
NARC - Nepal Agricultural Research Council
NEA - Nepal Electricity Authority
NGO - Nongovernmental Organization
PRA - Participatory Rural Appraisal
STW - Shallow Tubewell
TAAC - Technical Assistance Advisory Committee
TASF - Technical Assistance Special Fund
WTP - Willingness to Pay
WUG - Water User Group

NOTES

(i) The fiscal year (FY) of the Government ends on 15 July.
(ii) In this Report, "$" refers to US dollars.
I. INTRODUCTION

1. The Government of Nepal requested the Bank to provide project preparatory technical assistance (TA) during the Country Programming Mission in 1996, to formulate a community groundwater irrigation project. A Bank Fact-Finding Mission visited Nepal from 17 to 29 March 1996 and held discussions with representatives of the Government, including the National Planning Commission, the Nepal Rastra Bank, Agricultural Development Bank, Grameen Bank-Nepal Biratnagar, as well as external agencies such as the United States Agency for International Development, Japan International Cooperation Agency (JICA), and the World Bank. It also held discussions with nongovernment organizations (NGOs) and prospective beneficiaries. The Mission confirmed the need for the TA and reached an understanding with the Government on the scope, cost estimates, financing plan, terms of reference, and implementation arrangements for the TA.

II. BACKGROUND AND RATIONALE

2. Groundwater irrigation has been used in the Terai for a long time. Assessments of the groundwater resources confirm the large potential to expand its use for irrigation. The Government has recently endorsed the Agriculture Perspective Plan (APP) which was prepared with assistance from the Bank as a guideline for agricultural development. The APP specifies that groundwater irrigation will be the focus of the irrigation strategy in the Terai. There is also scope for improving the existing surface schemes; however, only a small portion of these schemes will provide the year-round water control that is essential to the rapid increase in agricultural production specified in the APP.

3. The construction costs per unit command area of shallow tubewells (STWs) and deep tubewells (DTWs) are lower than those of surface irrigation schemes and the management is easier because the operations and water users groups are smaller. The total groundwater irrigation area is expected to increase from 107,000 hectares (ha) in 1991/92 to 612,000 ha at the end of the APP in 2015. The APP estimated that 726,000 ha have a high potential to benefit from STWs and another 305,000 ha have a marginal potential. An additional 190,000 ha have the potential to benefit from DTWs. The APP calls for an average of 24,000 ha a year to be added to the groundwater irrigated area (STWs: 22,000 ha, DTW: 2,000 ha). Ninety percent of the total investment requirement in the APP would be allocated for STWs.

4. Of the two agencies responsible for groundwater irrigation, the Agricultural Development Bank of Nepal (ADB) specializes in manually drilled STWs, while the Department of Irrigation (DOI) handles DTWs and rig-drilled STWs. Other relevant agencies are the Department of Agriculture (DOA), the Nepal Agricultural Research Council (NARC), the

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1 The TA first appeared in the ADB Business Opportunities in March 1996.
2 The Terai is the flat subtropical area in the southern part of Nepal.
6 TA 1854-NEP: Agriculture Perspective Plan, for $600,000, approved on 15 March 1993.
7 Shallow tubewells are characterized by a surface mounted pump. Their application is limited to areas with a static water table level within 7 meters (m) from the surface (maximum suction depth). Drilling depths, however, usually vary between 10 m and 80 m depending on local hydrogeologic conditions.
8 Deep tubewells are characterized by deep set pumps. Based on economic considerations, the static groundwater table should not be below 10 m and drilling depths should generally not exceed 150 m.
Agricultural Inputs Corporation (AIC), the Grameen Bank-Nepal Biratnagar, the Department of Water Supply and Sewerage (DWSS), and the Nepal Electricity Authority (NEA). Recently, there has been a rapid growth of both national and international NGOs in Nepal, some of which have been involved in groundwater irrigation development.

5. The present water resources legislation is general and a regulatory system for groundwater resources does not exist. However, the groundwater table is monitored. The development effort envisaged in the APP will require the monitoring of groundwater use and administration of water rights at the local and national levels. Consequently, the Government has commenced to revise the existing water resources legislation.

6. The Bank has financed credit programs for STWs through ADBN under several loan projects. The World Bank, JICA, International Fund for Agricultural Development (IFAD), and several other aid agencies have also financed groundwater development projects. The Grameen Bank-Nepal Biratnagar, formed in 1992, is implementing a group based groundwater irrigation program in the Eastern Development Region.

7. Under the Bank-assisted projects, the role of ADBN has been limited to a technical assessment of proposed subprojects and an evaluation of the borrowers capability to repay. Following the Government’s current groundwater irrigation policy, the subprojects receive a subsidy (40 percent for individually owned wells and 75 percent for group wells). Important aspects of the Bank-financed projects implemented by ADBN are that (i) the subprojects are based on demand, (ii) the subproject evaluation and approval relies on minimal, but effective inputs, and (iii) the construction is undertaken by private contractors and beneficiaries. However, to improve cost recovery, groundwater irrigation projects need to be made more effective and increase cash income faster than the current operations.

8. The lessons learned from completed, Bank-financed groundwater irrigation projects in Nepal pertain mainly to the social and institutional aspects and to the issues of sustainability, servicing, and maintenance. These projects have already demonstrated that DOI has the technical capability to undertake groundwater irrigation development. On the other hand, they generally only benefitted farmers with larger landholdings since the selection criteria applied by ADBN and the collateral requirements for subloans resulted in the exclusion of most smaller landholders. Under the proposed community approach, the issues of land fragmentation and small landholders as the target clientele can be addressed and resource poor farmers and tenants will be able to participate. In addition, extension services, infrastructure, and support from the private sector can be targeted better at the selected communities, which will improve the production systems faster and permit cost recovery. Water user groups for groundwater irrigation have already been used under the Irrigation Line of Credit Project financed by the World Bank. In addition, lessons can be learned from the Bank’s experience with surface irrigation systems and drinking water supplies. Elsewhere, the possibility of more efficient operations and cost

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1 Loan No. 1112-NEP (SF): Sixth Agricultural Credit, for $35.0 million, approved on 31 October 1991 and five earlier loans to ADBN.
recovery through the effective preparation of subprojects and support from the private sector has already been demonstrated.

9. The APP identified four requirements for the development of groundwater irrigation. First, a road network is generally necessary to provide access to drill tubewells, as well as to high-intensity agricultural inputs and marketing. Second, development cannot proceed without the farmers receiving training in the operation of pumpsets and the availability of service facilities. Third, a credit system and an investment subsidy are required. Fourth, farming systems need to be developed and information on them needs to be disseminated to the farmers so they can use tubewells effectively. The development of tubewells will also benefit from rural electrification because it will lower costs of investment and of operation and maintenance.

10. The proposed expansion of groundwater development needs to be supported by the sector policies in the APP such as (i) improving access for small landholders to groundwater irrigation and appropriate farming systems technology, (ii) organizing communities to ensure their participation in the design and implementation of projects, (iii) improving cost recovery, (iv) increasing the involvement of the private sector, (v) improving access to services such as marketing information, extension, credit, and farm inputs, (vi) improving infrastructure, and (vii) establishing effective monitoring systems and regulations, as necessary.

11. The role of Government would increasingly be limited to facilitation, coordination, and quality control, while the private sector would increasingly become involved in implementation. The areas targeted for involvement by the private sector would include drilling, provision and installation of pump sets, and operation and maintenance. The opportunity exists to improve the choice of technology for drilling operations, pump sets, maintenance, and farming systems as well as water distribution systems. NGOs could have an important role in organizing the communities and in training.

12. DOI’s extensive experience with the completed first phase of the Irrigation Line of Credit Project financed by the World Bank and other completed and ongoing projects related to groundwater irrigation, and ADBN’s technical approaches under the Bank-financed projects, provide a suitable framework for intensified groundwater irrigation development. The TA will build on these experiences by encouraging participation of both the communities and the private sector through a process approach. The TA will assist in designing a project to support the changes necessary during the interim period before a self-reliant, private sector emerges. While individual ownership of tubewells will continue, a group approach will be explored to improve access to credit and services for small landholders. The Government has given high priority to the development of groundwater irrigation and has requested TA from the Bank to prepare a community groundwater irrigation sector project, covering an aggregate area of about 20,000 ha over six years, and suitable for financing as a sector loan.

III. THE PROPOSED TECHNICAL ASSISTANCE

A. Objectives

13. The TA is designed to prepare a Community Groundwater Irrigation Sector Project in the Terai covering eleven districts in the Central Development Region and the Eastern

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1 Loan No. 1125-BAN (SF): Northeast Minor Irrigation Project, for $73.0 million, approved on 21 November 1991.
Development Region. The TA will determine the general scope of the project, its cost, operation and maintenance procedures, and implementation arrangements as well as the measures required to ensure that the project is socially and environmentally sound.

B. Scope

14. Using a process approach through workshops and intensive field investigations, the scope of the TA will include a review of the existing groundwater irrigation projects to determine the: (i) selection criteria for target areas and individual subprojects; (ii) social strategies for community groundwater irrigation development as well as the extent of beneficiary participation and their willingness to pay for different groundwater development options; (iii) institutional development needs at the village, district, regional, and central levels; (iv) support requirement for private drilling operations, pump operators, and contractors; and (v) most economic and appropriate technologies for specific environments and markets that will allow for full cost recovery. The TA will also review and make recommendations concerning the groundwater resources strategy and the administration of water rights at both the local level and the national level.

15. Based on the information obtained, the TA will propose: (i) a cost-effective approach for increasing groundwater irrigation coverage through a mix of subprojects and technologies; (ii) an investment program including a prioritized longlist of potential project sites; (iii) six sample projects at already identified sites; (iv) a program of policy changes including the issues of groundwater irrigation subsidies, institutional development, and capacity building; and (v) an effective monitoring and evaluation system. It is envisaged that, eventually, an accelerated, sustainable tubewell program led by the private sector will develop, which the Government will support through the activities of its line agencies. The terms of reference for the consultants are in Appendix 1.

C. Cost Estimates and Financing Plan

16. The total cost of the TA is estimated at $755,000 equivalent comprising $384,100 in foreign exchange costs and $370,900 in local currency cost. The TA will be financed by the Bank on a grant basis, and cover the entire foreign exchange cost as well as $215,900 equivalent of the local currency cost, for a total of $600,000. The remaining local currency cost of $155,000 will be financed by the Government from its own resources. The detailed cost estimates are in Appendix 2. The Government has been informed that approval of the TA does not commit the Bank to finance an ensuing project.

D. Implementation Arrangements

17. The TA will be carried out over six months, and will be completed by the end of March 1997. It will require about 42 person-months of consulting services (14 person-months - international and 28 person-months - domestic). Expertise will be required in institutional and community development, financial and economic analysis, irrigation engineering and irrigated agriculture, marketing and credit, hydrogeology, drilling technology and pumps, and environmental and legal aspects. The selection of an international consulting firm, which will liaise with a domestic firm, will follow the simplified technical proposal procedure.

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1 The World Bank is currently preparing the second phase of the Irrigation Line of Credit project, which will target the Western Development and the Far Western Development Region.

2 An expert in community and institutional development will be the team leader.
18. DOI will be the Executing Agency for the TA. It will coordinate the day to day implementation of the TA with DOA through the already established coordination committee of the two departments. The Government will appoint a Project Manager for overall management and coordination of the TA. A Technical Assistance Advisory Committee (TAAC) will be established under the chairmanship of the Director General of DOI to review the progress of the TA in the first, third, and fifth months and assist in its implementation. The members of the TAAC will include representatives from the Ministry of Finance, the Central Bank, DOA, ADBN, Grameen Bank-Nepal Biratnagar, NARC, DWSS, and NEA. The Government will assign two senior staff from DOI and one senior staff each from DOA and from ADBN as well as six officers at the proposed sites to work with the consultants under the TA.

19. The TA will be carried out in five stages in accordance with the terms of reference in Appendix 1. Stage 1 (about six weeks) will involve an evaluation of completed groundwater irrigation projects and a survey of the status of groundwater irrigation in the area to be covered by a future investment project. Under Stage 2 (about one week including preparation and reporting), a workshop will be held to review the findings of Stage 1, to discuss policy aspects and institutional concerns, and to propose the strategies and the details of the intensive field investigations to be carried out under Stage 3 (about eight weeks), which will prepare five STW sample subprojects and one DTW sample subproject. Under Stage 4 (about one week), a second workshop and midterm review will be conducted to review findings of the field investigations and to discuss the approaches, scope, and implementation arrangements for the investment project to be prepared during Stage 5 (about eight weeks).

20. The field investigations to be undertaken at the six already identified sites will lay the foundation for sample subprojects to be financed under a future investment project. A local NGO will be engaged by the consulting firm to assist in the field investigations, the participatory rural appraisal (PRA) process, and policy studies.

21. The consultants will be engaged in accordance with the Bank’s Guidelines on the Use of Consultants and arrangements satisfactory to the Bank. The equipment will be procured by the consultants in accordance with arrangements acceptable to the Bank. The equipment will be retained by DOI upon completion of the TA. The consultants will prepare brief monthly progress reports. The main reports will consist of an inception report at the end of Stage 1, a midterm report at the end of stage 3, a draft final report after five months, and a final report. Tripartite meetings will be held one week after receipt by the Bank of the inception, midterm, and draft final reports.

IV. THE PRESIDENT’S DECISION

22. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance, on a grant basis, to His Majesty’s Government of Nepal in an amount not exceeding the equivalent of $600,000 for the purpose of the Community Groundwater Irrigation Sector Project, and hereby reports such action to the Board.
TERMS OF REFERENCE FOR CONSULTING SERVICES

1. **Community and Institutional Development** (Community development specialist-international, 6 person-months (pm); Sociologist-domestic, 6 pm).

The primary tasks of the two consultants are detailed below for each stage of TA implementation.

**Stage 1** (about six weeks)

(i) Review: (a) a representative sample of completed subprojects financed under the Bank-assisted Sixth Agricultural Credit Project (Loan No. 1112-NEP) and earlier Bank loans to the Agricultural Development Bank of Nepal (ADBN), and projects implemented by the Department of Irrigation (DOI) and other local institutions to identify lessons learned in subproject design, cost estimation, affordability, and delivery standards, (b) approaches and experiences of related projects concerning surface irrigation, drinking water supply and rural infrastructure development in order to determine lessons learned about community involvement and farmer participation in planning and design; and (c) the project preparation and implementation performance under ongoing and completed projects funded by the World Bank, Japan International Cooperation Agency, United Nations Development Program, Grameen Bank-Nepal Biratnagar, nongovernment organizations (NGOs), and bilateral aid agencies.

(ii) Review the manner in which water user groups (WUGs) have been established, their involvement in initiating demands for groundwater irrigation, the extent of community involvement in the planning, design, implementation and management processes (especially the sustainability of maintenance), and the effectiveness of WUGs in dealing with Government agencies.

(iii) Review the adequacy of existing procedures for the identification and selection of groundwater irrigation subprojects involving (a) request from beneficiaries, (b) identification, (c) feasibility study, and (d) final selection. Specifically, review the application of existing criteria for selection of groundwater irrigation subprojects and for priority ranking of target areas. The criteria should cover marketing potential, technical, and socioeconomic aspects. Recommend a comprehensive set of practical criteria for use under a future investment project.

(iv) Review the availability and capacities of the private sector, including NGOs, to participate in subproject activities e.g. farmer mobilization, training, assistance to operation and maintenance.

(Reference in text: page 4, para. 15)
Appendix 1, page 2

(v) Review the extent to which DOI's Groundwater Irrigation Division (GID) and the Department of Agriculture (DOA) have adjusted their role from that of being implementors to one of facilitator. Examine the quality of training programs undertaken to reorient engineering and extension staff to community based development. Assess the quality of new staff recruited by the organizations to obtain a better blend among engineers, technicians, community development specialists, and sociologists. Evaluate the willingness of DOI and DOA senior management to adapt to their new roles, and develop a time-bound plan to accelerate the changes in skill mix in GID and DOA for implementation under a future investment project.

(vi) Assess how social mobilization can be better achieved in the design and management of subprojects. Evaluate and recommend any specific roles that women can play in catalyzing the involvement of communities. Detail, specifically, the beneficiary consultation processes, beneficiary participation in design and implementation and the working relationships between the communities and facilitators such as the village and district development communities and ADBN, DOI, DOA, Grameen Bank-Nepal Biratnagar and NGOs. Develop proposals for better preparation of communities for playing the lead role in establishing subprojects. Assess any adverse social effects and provide for their mitigation in the project design and costs.

(vii) Examine, in cooperation with the irrigation engineer and groundwater legislation specialist, the need to strengthen the groundwater resource management system, analyze all elements of the system and formulate an institutional strengthening component for implementation under a future investment project.

Stage 2 (about one week, including preparation and reporting)

(i) Upon completion of these evaluations, conduct a workshop with management and staff of concerned Government line agencies and financial institutions and representatives of other relevant agencies including other financial institutions, the private sector, NGOs and aid agencies. Review the findings and results of the policy dialogue and determine ways in which the lessons learned can be incorporated effectively in the design of the field investigations to be undertaken under stage 3 of the TA. Prepare specific proposals to address weaknesses and deficiencies in systems, procedures (including selection and prioritization of subprojects), financial management, design and service standards, community liaison and skill development.

(ii) Define approaches, incorporating the lessons learned, and detailed and varied investigation packages for implementation at the field investigation sites.
Appendix 1, page 3

Stage 3 (about eight weeks)

(i) Contract an NGO to assist in the detailed site investigations and the participatory planning processes of subprojects, and implement these, carefully monitor activities, continue the policy dialogue and the general evaluations.

Stage 4 (about one week)

(i) Conduct a workshop with representatives of stakeholders and concerned Government and private sector institutions to draw conclusions from the field investigations carried out under stage 3, the general evaluations and the policy dialogue, and determine approaches, scope and implementation arrangements for the design of a future investment project.

Stage 5 (about eight weeks)

(i) Propose: (a) a cost-effective approach for increasing groundwater irrigation coverage through a mix of subprojects, consisting of five subprojects for shallow tubewells (STW) and one subproject for deep tubewell (DTW), and technologies in rural communities, which are well adapted to the local marketing, infrastructure, agricultural, hydrogeologic and socioeconomic conditions, (b) a program of investment in groundwater irrigation subprojects in the Central Development Region and the Eastern Development Region with indicative unit costs, and analyzed in economic, financial, technical, environmental and social terms, (c) a program of sector and institutional changes to be financed and undertaken in phases in conjunction with an ensuing investment project, and (d) a meaningful monitoring and evaluation component.

(ii) Undertake a comprehensive social analysis of the investment project in accordance with the Bank’s Handbook for Incorporation of Social Dimensions in Projects and the Bank’s policy on indigenous people’s, if applicable. Assess impacts on women and children and the specific design and other considerations these impacts should cause. Evaluate the impact of the project on beneficiary vocations and income, especially in the context of poverty reduction, and evaluate impacts on the social equilibrium.

2. Financial and Economic Analysis (Economists/Financial Analysts - international, 4 pm; and domestic, 4 pm)

(i) Examine the existing subsidy schemes and their economical and financial implications with respect to accelerated groundwater irrigation development. Assess the alternatives, such as reducing or eliminating the subsidy, and changing the subsidy on investment to one on operation and maintenance, and propose a gradual phasing out of subsidies in line with the Bank’s Guidelines on Subsidies.
(ii) Examine the rationale for public investment in private irrigation and
determine the financial implications of investment in sustainable
groundwater irrigation development.

(iii) Determine the economic and financial advantages and disadvantages,
including international prices and production costs, of different single
crops and farming systems options, the off-season production potential,
and the credit requirements.

(iv) Determine the economic advantages and disadvantages of alternative
options of groundwater irrigation investments, including the tradeoff
between construction quality and initial high investment costs.

(v) Calculate farm budgets using the FARMOD\(^1\) computer program for a
range of alternative crop-production packages focusing on crops that have
high marketing potential.

(vi) Estimate the financial and economic costs of the investment project,
including those to be incurred by beneficiaries through the contribution of
labor and cash, separately in foreign and local terms following the relevant
Bank Guidelines (Bank’s Guidelines for Economic Analysis of Projects, and
Economics Office Staff Paper No. 31, Economic Analysis of Environmental
Impacts of Development Projects). The categories to be covered should
include groundwater irrigations systems, training, implementation
assistance and service charge on a possible Bank loan. The costs should
include an estimate of duties and taxes. Establish a financing plan. Use
the computer programs COSTAB\(^2\) and FARMOD.

(vii) Carry out an economic analysis of representative subprojects in each
region using a set of different design models and investment levels and
assess the financial costs and returns of alternative groundwater
development options. Establish the willingness to pay (WTP) for
groundwater irrigation projects and quantify the benefits. Determine the
factors affecting WTP. Identify those groundwater development options
that are within the WTP of communities. Calculate economic internal rates
of return and demonstrate clearly the assumptions used and the
methodology employed. Assess the Government’s policies for cost
recovery in the sector and comment on their adequacy consistent with
affordability considerations. Estimate the financial subsidies involved, if
any, and comment on the appropriateness of their targeting. Analyze the
fiscal impact of the investment project.

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1. Farm Income Model Table.
2. Cost Estimates Table.
(viii) Assess affordability for the beneficiaries and analyze the financial viability of the community-based groundwater irrigation subprojects. Evaluate the impact on household incomes and examine the extent to which current cost recovery arrangements can be improved. Evaluate the extent of poverty mitigation.

3. Irrigation and Agriculture (Agronomist-international, 1 pm; and Irrigation Engineer-domestic, 3 pm)

   (i) Review water distribution technologies including the acceptance and feasibility of sprinkler and drip irrigation as well as complex systems.

   (ii) Analyze existing cropping systems and potential for improved cropping systems. Based on a review and analysis of farmer's perception and needs design optimal cropping systems.

   (iii) Review agricultural research and extension needs and recommend an appropriate research and extension program to support optimized cropping systems and modern appropriate irrigation technologies.

   (iv) Review the status of existing groundwater irrigation projects and determine the scope and procedures for rehabilitation.

   (v) Assess the opportunity for application of integrated pest management in proposed improved farming systems.

4. Marketing and Credit (Agricultural Economists-international, 1 pm; and domestic, 5 pm)

   (i) Conduct a detailed marketing study to assess the marketing potential of high value crops and prioritize these by area keeping in mind the off season production potential of groundwater irrigated crops.

   (ii) Critically review the operations and disbursement procedures of the ADBN’s groundwater irrigation program.

   (iii) Examine the credit programs of the Grameen Bank and determine their applicability in groundwater irrigation development under a future investment project.

   (iv) Assess the credit disbursement procedures used by NGOs and relevant experiences in other countries for possible adoption under the Project.

   (v) Assess absorptive capacity of ADBN, DOI, Grameen Bank-Nepal Biratnagar and NGOs, under various project approaches of beneficiaries involvement and disbursement channels.

5. Hydrogeology (Hydrogeologists-international 1 pm; and domestic, 3 pm)

   (i) Conduct a comprehensive review of the existing groundwater use situation in the Central Development Region and Eastern Development Region in
cooperation with the Government, and assess in detail the surface and groundwater irrigation coverage achieved and the scope for further development in groundwater irrigation in each of the districts in these regions.

(ii) Review hydrologic data needs and monitoring program.

(iii) Assess the seasonal and long-term effects of intensified groundwater use at the six prioritized sites and throughout the Project area on the groundwater table level and provide the data necessary for further evaluation of environmental aspects.

6. **Drilling Technology and Pumps** (Drilling Engineer-international, 1 pm; Drilling Engineer-domestic, 2 pm; and Electrical Engineer-domestic, 1 pm)

   (i) Review technical standards for drilling and groundwater source development, including training and equipment needs as well as investment needs for improved operation and maintenance.

   (ii) Review status and potential concerning source of energy, type of pumps and design of optimized integrated pumping and distribution systems.

7. **Environment** (Consultant-domestic, 2 pm)

   (i) Assess the environmental implications of the proposed groundwater irrigation subprojects, including effects of changes in groundwater table, soil salination and use of pesticides. Conduct a summary initial environmental examination (SIEE) and, if required, an environmental impact assessment of the components requiring such an assessment as identified by the SIEE, in standard Bank format available in the Environmental Assessment Requirements and Environmental Review Procedures of the Asian Development Bank; establish the costs of environmental protection works and include them in the costs of an investment project.

   (ii) Assess the implications of the proposed groundwater irrigation subprojects in the light of the Bank's policy on involuntary resettlement and prepare, if appropriate, a resettlement plan pursuant to this policy.

8. **Groundwater Legislation and Regulation** (Consultant-domestic, 2 pm)

   Review water resources legislation and regulations applicable to an investment project and make appropriate recommendations for deliberation by the Government to facilitate implementation of such project, including those concerning a regulatory system for groundwater resources, taking into account the need to administer and monitor water rights at the local and national levels. The recommendations may also include draft contracts to be entered into by parties participating in an investment project.
## COST ESTIMATES AND FINANCING PLAN

($)

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(Reference in text: page 4, para. 16)