

No. 18320

**INTERNATIONAL FUND
FOR AGRICULTURAL DEVELOPMENT
and
BANGLADESH**

**Technical Assistance Agreement—*Integrated Agricultural
Development Project* (with schedules). Signed at Rome
on 9 July 1979**

Authentic text: English.

*Registered by the International Fund for Agricultural Development on
26 February 1980.*

**FONDS INTERNATIONAL
DE DÉVELOPPEMENT AGRICOLE
et
BANGLADESH**

**Accord d'assistance technique — *Projet de développement
agricole intégré* (avec annexes). Signé à Rome le 9 juillet
1979**

Texte authentique : anglais.

*Enregistré par le Fonds international de développement agricole le
26 février 1980.*

TECHNICAL ASSISTANCE AGREEMENT¹ (*INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT*) BETWEEN THE PEOPLE'S REPUBLIC OF BANGLADESH AND INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

Dated 9 July 1979

T.A. Grant No. 7-BD

INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

Rome, 9 July 1979

IF 7/4 BANGLADESH
(TA BADC)

Dear Mr. Secretary,

Ref.: Technical Assistance Grant No. 7 BD
Integrated Agricultural Development Project
in Jessore, Kushtia and Northern Faridpur
Districts of Bangladesh

1. I wish to acknowledge your letter dated 7 March 1979 in which your Government requested a technical assistance grant from IFAD for the preparation of the above Study.

2. I am pleased to inform you that IFAD accepts your Government's request for making available from its resources a technical assistance grant to study the following aspects:

- i. Technical studies to determine the groundwater potential of the Project area, location of groundwater irrigation facilities, suitable design criteria for the proposed wells and water distribution systems which would enable maximum flow of Project benefits to small farmers and share-croppers;
- ii. Socio-economic survey of the Project area;
- iii. Proposals for agricultural support services;
- iv. Estimates of Project costs and benefits; and
- v. Preparation of a detailed final Project report.

3. The technical assistance will be on the terms and conditions set forth below. Hereinafter this preparatory activity is referred to as the "Study".

4. The Food and Agriculture Organization of the United Nations (hereinafter called the Cooperating Institution) will administer this technical assistance on behalf of the Fund for the purposes of disbursement of the proceeds of the financial assistance provided hereunder and for the supervision of the carrying out of the study. If for any reason, a change of the Cooperating Institution becomes necessary, such a change will be made by agreement between the Government and the Fund in consultation with the Cooperating Institution administering this technical assistance.

¹ Came into force on 9 July 1979 by signature.

5. Except where specifically provided in this letter or requested by the Fund, the Government will furnish all information and address all communications simultaneously to the Cooperating Institution and the Fund.

6. The Study will be undertaken by a consulting firm to be selected by the Government in accordance with procedures acceptable to the Fund. The consulting firm will supply a mission composed of such experts, including local experts, as are required to carry out the terms of reference as specified in Schedule 1.

7. The Government will engage, as promptly as possible, the services of the consulting firm referred to in paragraph 6 above on terms and conditions stipulated in a contract (hereinafter called the Contract) satisfactory to the Fund.

8. The terms of reference of the consulting firm providing the mission are set forth in Schedule 1 to this letter, and these may be amended by agreement between the Government and the Fund in consultation with the Cooperating Institution.

9. The Mission is expected to commence on a date to be specified in the Contract between the Government and the firm and, except as the Government and the Fund will otherwise agree, completed within four months thereafter.

10. The Fund will pay the consulting firm for its services, rendered as provided in the Contract and the cooperating institution for the supervision of the Project. The total cost for the Fund of the technical assistance grant to be provided under this letter will not exceed the equivalent of Special Drawing Rights two hundred thousand (SDRs 200,000).

11. The Government will make available for the purposes of the Mission, free of charge, the services, facilities and equipment set forth in Schedule 2 to this letter.

12. The Government will provide suitable local counterparts to cooperate with and assist the members of the Mission in the carrying out of the Project.

13. The Government will cooperate with the Fund and with the Mission and the Cooperating Institution to ensure that the Study is carried out as promptly and as effectively as possible, and will issue to its officials, agents and representatives all such instructions as may be necessary or appropriate to achieve this objective.

14. The Government will take promptly all such steps as will be necessary to enable the Fund and the Cooperating Institution to carry out their responsibilities and functions in respect of supervising and administering the technical assistance provided under this letter smoothly and effectively. With this end in view the Government will, *inter alia*, apply to the property, Funds assets and staff of the Fund and the Cooperating Institution provisions of the Convention on the Privileges and Immunities of Specialized Agencies¹ under existing rules, afford reasonable opportunities to the representatives of each organization to visit any part of the territory of the Government for purposes related to the Study and promptly issue any visas or permits required provided that such visit will not take place in protected or prohibited area of the country.

¹ United Nations, *Treaty Series*, vol. 33, p. 261. For the final and revised texts of annexes published subsequently, see vol. 71, p. 318; vol. 79, p. 326; vol. 117, p. 386; vol. 275, p. 298; vol. 314, p. 308; vol. 323, p. 364; vol. 327, p. 326; vol. 371, p. 266; vol. 423, p. 285; vol. 559, p. 348; vol. 645, p. 340; vol. 1057, p. 320, and vol. 1060, p. 337.

15. The Government confirms that expatriate members of the Mission will have the status of experts performing a mission for the Fund, and shall be accorded the following privileges and immunities so far as is necessary for the effective exercise of their functions:

- i. Immunity from personal arrest or seizure of their personal baggage;
- ii. In respect of words spoken or written or acts done by them in the performance of their official functions, immunity from legal processes of every kind, such immunity to continue notwithstanding that the persons concerned are no longer employed on missions for the Fund;
- iii. The same facilities in respect of currency and exchange restrictions in respect of their personal baggage as is afforded to officials of foreign governments on official missions;
- iv. Inviolability of all papers and documents relating to the work on which they are engaged for the Fund, and for the purposes of their communications with the Fund and the Cooperating Institution, the right to use codes and to receive papers or correspondence by courier or in sealed bags.

The Government will exempt from any taxes, duties, fees, levies and other impositions imposed under its laws and regulations or the laws and regulations in effect in its territories or of any political subdivision or agency thereof in respect of:

- i. Any payments made to expatriate members of the Mission (including payments made to a consulting firm and its personnel) in connection with the carrying out of the Study;
- ii. Any equipment, materials and supplies brought into the territories of the Government for the purpose of carrying out the Study and which, after having been brought into such territories, will be subsequently withdrawn therefrom; and
- iii. Any property brought by the members of the Mission for their personal use or consumption or which, after having been brought into the territories of the Government, will subsequently be withdrawn therefrom upon the departure of the members of the Mission.

16. The Government and the Fund and the Cooperating Institution will exchange views with respect to the Mission's interim findings, its draft report and implementation thereof.

17. The Fund and the Cooperating Institution may use any reports prepared by the Mission for such purposes as the Fund shall reasonably determine, but shall not release such reports for public information except at the request or with the consent of the Fund and the Government.

18. The Fund's willingness to participate in financing the Study does not commit the Fund to assist in the implementation of recommendations contained in any reports of the Mission or to extend financial or further technical assistance to the Government with respect thereto.

19. The Government may at any time in writing request the Fund to terminate the Study, and the Fund may at any time whether or not any such request shall have been received, suspend or, after consultation with the Government and the Cooperating Institution, terminate the Study if any circumstances arise which interfere with or threaten to interfere with the successful carrying out

of the Study in the manner and upon the terms contemplated in this letter or with the accomplishment of the purpose thereof. In the event of any such termination or suspension the Government and the Fund and, to the extent necessary, the Cooperating Institution will consult with each other concerning the appropriate steps to be taken and any further action which it may be necessary or desirable to take with respect to the Study.

20. Any action required or permitted to be taken under this letter on behalf of the Government and of the Fund may be taken by the official designated below or any person thereunto duly authorized in writing by him.

(a) For the Government: the Secretary, External Resources Division,

(b) For the Fund: Assistant President, Project Management Department.

21. Please indicate your agreement with the foregoing by signing this letter and returning it to us.

International Fund
for Agricultural Development:

Signed by: A. SUDEARY
President

Accepted and agreed
Government of the People's Republic
of Bangladesh:

Signed by: S. RAHMAN

Authorized Representative

The Secretary
External Resources Division
Ministry of Finance
Government of the People's Republic of Bangladesh
Dacca
People's Republic of Bangladesh

SCHEDULE 1

TERMS OF REFERENCE FOR CONSULTANTS

Study for Integrated Agricultural Development
Project in Jessore, Kushtia and North Faridpur
(South-West Bangladesh)

I. PREAMBLE

The consultants will have the detailed terms of reference set out below. However, the consultants may propose minor changes in these terms of reference, having regard to the achievement of the objectives of the technical assistance, for the approval of the Government and IFAD. The consultants will be required to take note of the scope and the approach indicated in the terms of reference but may reformulate them in accordance with their best judgement to achieve the objectives of the technical assistance.

II. OBJECTIVES

a. The objective of the Study is to design a Project which is fully consistent with the Fund's Lending Policies and Criteria (L.P.C.) and ensures that the Project's benefits flow mainly to the Fund's target groups, and the Project has a positive income distribution effect as stated in para. 27 of the L.P.C. The Study will identify the target groups in stepping up food production and improving their income standards and the gaps in institutional infrastructure. The Study will formulate an appropriate programme of activities so that the benefits to the poorest rural groups including the landless are maximised.

b. The Study will assess the possibilities in developing ground water irrigation by a mix of deep, shallow and hand tubewells depending on technical feasibility and ground water conditions in selected areas of the districts of Jessore, Kushtia and North Faridpur (SW Bangladesh), keeping in view the overwhelming priority to locate the irrigation facilities in particular areas where small farmers and share croppers dominate. The preparation study should clearly determine the possibility of irrigation of an additional 100,000 acres.

c. The proposed Study will aim at integrated agricultural development of the Project area through provision of irrigation water, fertilizer, credit and other inputs and by means of appropriate institutional arrangements including special farmers' cooperatives where representation of small farmers and share-croppers are adequately ensured.

d. The technical aspects of the Study will include (i) collection of data on existing wells with respect to design, construction, testing and in particular in regard to stratigraphy, depth of water table, transmissibility, storage coefficient, quality sieve analysis of formulation sample, (ii) to establish the depth and total extension of the aquifer system, (iii) calculating existing recharge using past rainfall records, evaporation data, discharge from existing wells, river flow, flooding, and water table fluctuation records and other relevant data. If necessary, a computer model for this should be used.

e. The Study will undertake a socio-economic survey in the Project area and obtain detailed information regarding land ownership patterns, tenurial forms, cultivation practices, share-cropping arrangements, efficiency thereof, cost and returns and suggest appropriate irrigated cropping practices on a sample basis and utilising all available secondary sources of information.

f. Where technical conditions justify and socio-economic situation fulfills the criteria of maximising benefits to the small farmers and share croppers, location of ground water irrigation facilities will be determined as a part of the Study.

g. The Study will also work out the framework for an adaptive research, trial and demonstration programme relating to cropping patterns, water management practices and identification of new crop varieties which are more geared to nutrition needs of the rural poor. This shall be included as a Project component.

h. The Study will formulate suitable design criteria for the proposed wells, the most suitable spacing of the deep and shallow tubewells as well as the interference of prolonged pumping from these wells to shallow open dug-wells. Also the most suitable design criteria for the water distribution system, maintenance and operation system which enables small farmers and share croppers to adopt intensive irrigated agriculture through organised group actions instead of individual management of irrigation facilities. The Project would aim to promote cooperative ownership of the tubewells.

i. The Study will estimate the total cost and benefits of a possible Project as defined in previous paragraphs with particular reference to Integrated Agricultural Development Programme of the Project that would maximise employment as well as income of rural poor.

III. SCOPE

The proposed Study is to be based on existing and available data from previous geological, hydrogeological, geophysical, socio-economic, agricultural, hydrological and other pertinent investigations carried out both inside as well as outside the Project area. An evaluation of the quality and reliability of these data should also be done. These data will form the basis on which the ground water potential of the alluvial aquifers within the Project area will be determined. No particular or extensive field work, apart from data collecting in local Government offices, is envisaged. However, some provision is made for exploratory drilling should an acute need arise.

In order to achieve the objectives of the proposed technical assistance, it is envisaged that the scope of the feasibility study would include, but not be limited to, the following:

- a.* Considering hydrological, hydrogeological, geohydrological, topographical, agricultural and other relevant factors, define areas within the Project area where ground water can be developed and clearly mark areas which are entirely unsuitable. Distinguish in this aspect between areas suitable for deep, shallow or hand tubewell irrigation.
- b.* Present ground water quality maps with respect to its potential for irrigation use.
- c.* Using maps produced by the Soil Survey of Bangladesh indicate areas where tubewell irrigation might best be used from the soil viewpoint.
- d.* From this and other information define the ground water potential for the Project area indicating the most suitable number and spacing of each of the various types of tubewells.
- e.* Based on the findings from previous studies and reports from other parts of the country and the conditions made by the agronomist and economist working in this Study, recommendations of the most suitable cropping pattern should be given.
- f.* The Study will make use of the proposals for water management around tubewells which are being prepared by an FAO/IBRD CP mission insofar as these are relevant to the proposed Project. It will suggest a set of technical and socio-economic criteria to assist in the location of different types of wells and recommend the average area that can be irrigated around each type of well in the various areas. Due consideration should be given to the data analysed as mentioned in objectives (*b*).
- g.* Give recommendations to the usefulness and economy of lining up the distribution canals in the light of hydrogeological, soil conditions, cropping pattern and economic aspects.
- h.* Review the present design of deep and shallow tubewells in the light of hydrogeological, water needs for the crops and other relevant conditions in the Project area and recommend the most suitable design of the proposed tubewells.
- i.* Confirm that the future cropping pattern and irrigated areas can be achieved in full scale development according to the period used in the economic analysis.
- j.* Recommend the appropriate institutional framework at the farm-level to ensure effective on-farm development, equitable and efficient distribution of water resources, and operations and maintenance of proposed irrigation facilities.
- k.* Identify agricultural support services which will be available under the Government's ongoing programmes and how these will be tied into the proposed Project. Estimate requirements of inputs such as seeds, fertilizers, agro-chemicals and credit, etc., and evaluate the prevailing input delivery systems and suggest improvements. In particular, the study will review existing surveys relating to accessibility of small farmers and share-croppers to agricultural credit and Government policies aimed at ensuring access to credit by these farmers.
- l.* Study farm budgets and benefits in the light of operational experience and give an assessment of farmer repayment capacity.

- m.* Present cost estimates of the future Project, with all costs broken down, to show the foreign exchange and local currency components and the benefits of the Project with an assessment of the Project rate of return (economic and financial). The agricultural development of the Project should be included in the cost and benefit stream.
- n.* Prepare terms of reference for a further work necessary for financing this development and for the preparation of designs and tender documents so that early implementation can proceed.
- o.* The Government of Bangladesh (BADC) will help in identifying, within the framework of the envisaged Government programmes, certain critical elements of rural infrastructure, such as rural roads, village level storage facilities and certain social components such as public health, drinking water supply and education in the Project area. At the time of interim review an assessment will be made as to whether the study may provide for such components being built into the Project scope and costed separately.
- p.* The study will recommend an appropriate organisational set-up for Project implementation, covering particularly the following aspects:
 - (i) Channels of financing proposed Project activities and the institutions involved;
 - (ii) Agencies responsible for execution of physical components included in the Project;
 - (iii) Organisational set-up and inter-agency coordination;
 - (iv) Project implementation schedule;
 - (v) Monitoring and evaluation arrangements; and
 - (vi) A training programme to be included in the Project.

IV. APPROACH

The consultants will review all available studies, reports and data, carry out any necessary field trips to collect additional data that may be available in the districts themselves (i.e., water level fluctuations in other wells than the observation wells regularly monitored by BADC and WDB, statistics about crops grown on irrigated land, etc.). In particular the consultants will review the literature and report given in Appendix B. This Appendix contains a number of selected reports and the latest available reports about ground water development, hydrology, agriculture, etc. both inside and outside the Project area. However, the Appendix B-I may not cover all existing and usable literature concerning the Project area.

The consultants will carry out the study in such a way that after the basic data collection has been done a very brief and preliminary report should be written indicating the general aspects of the ground water situation and the development potential of the Project area. This report should be written and printed in Bangladesh. The report will be reviewed urgently by the Government, IFAD and the cooperating institution.

The final report should include the main social features of the Project area, such as land tenure, size of holdings, fragmentation of holdings, population and a short description of the infrastructure and social services. The supporting services which should be improved under the Project, should also be described in relation to the Project and their costs, capital and recurrent, included in the Project costs (technical assistance, extension services, workshops, building facilities, input distribution, credit facilities, agricultural research, marketing facilities, storage, etc.).

A development schedule and Project output forecast for agricultural development should also be prepared.

V. PROPOSED INDIVIDUAL CONSULTANT ASSIGNMENTS

It is anticipated that the terms of reference of the individual members of the consultants' team would cover, but not necessarily be limited to, the following:

i. *Internationally recruited staff*

a. *Senior Agricultural Economist* or equivalent—Team Leader

- Be in charge of the Project and direct and guide the rest of the team members in their work in collaboration with Government and other agencies, private companies, etc. He should be responsible for the Final Report.
- Ensure that the studies focus on developing an integrated approach to the agricultural development of the selected areas.
- Exercise an over-view on the socio-economic, institutional and organisational aspects of Project formulation and design.
- Compile, assess and evaluate the collected information.
- Make cost estimates regarding all relevant costs of the proposed Project discussing the future Project organisation.

b. *Ground Water Engineer/Hydrogeologist*

- Assisting the Team Leader in collecting, compiling and evaluating all the available information.
- Review all hydrogeological and other relevant reports.
- Review the existing well design and distribution system with special emphasis to well capacity calculating the well construction and maintenance costs, advantages or disadvantages of the lining up of distribution canals, and other improvements of the distribution system, and recommend most economic system of lining with cost estimate.
- Assist the Team Leader in making cost estimates of the proposed Project taking into account the existing situation of the existing boreholes and the boreholes to be drilled by the consultants if needed.

ii. *Locally recruited staff*

a. *Agronomist/Sociologist*

- Assessment of agricultural practices and the extension services estimating and quantifying the improvements required under the Project.
- Compile and assess all available data on present cropping patterns, land use, yields, inputs, irrigation practices and examine the improved future agricultural practices "with the Project", evaluating the "with Project" cropping patterns, inputs and yields and their phasing up to the full development period.
- Evaluate the effectiveness of the agricultural research and suggest improvements if needed with cost estimate.
- Review the input distribution system, suggest improvement, if any, and assess the required Project needs and costs.
- Estimate the irrigation water requirements of different crops according to climate, soils and irrigation efficiency.
- Using the results of different soil surveys, establish soil maps in the Project area including land classes in relation to monsoon season flooding indicating area and percentages. Establish also soil associations, areas and percentages, indicating the main characteristics and land capability classes.
- Assess the land tenure situation and the farm size in the Project area, indicating the farm size and fragmentation.

- Indicate the farm model and phasing to be established under the Project with areas, yields and inputs.
- Estimate the training required under the Project at farmers' cooperative and extensionists level, costing of the main items to be included in the Project cost.
- Analyse the effect of the ground water quality on crops and on the equipment.
- Discuss the farmers' participation in the selection of sites for tubewell irrigation as well as in the operation of the wells.

b. *Irrigation Engineer*

- Review the present water taxes and costs.
- Discuss the rules to select the tubewell areas.
- Compare estimates of the irrigation group budgets and water charges discussing the present rental system.
- Discuss the design and construction of the distribution system, the participation of farmers in earth works, estimating the amount of grant and the terms of credit required to improve the irrigation efficiency.
- Discuss the water management of the wells and prepare a time-table of the irrigation.
- Estimate the costs of improved maintenance of irrigation equipment.
- Discuss the possibility of electrification of wells in the Project area and estimate the capital and recurrent costs.
- Estimate the costs of training the farmers in the irrigation techniques.

c. *Agro-economist*

- Review the present utilisation of the rural population age groups' employment.
- Review the present marketing system and storage constraints.
- Analyse the present prices including seasonal variations for the inputs and outputs and calculate the economic and financial farm gate prices required for the evaluation of the Project.
- Study the farm budgets "without" and "with" the Project and phasing, discussing the repayment capacity of the farmers.
- Examine the cash flow of an irrigation group/association calculating the water charges.
- Review the present situation of rural credit and general credit facilities to be used by the Project specifying the conditions of farms specifying what amounts of credit are needed for short and long-term loans.
- Estimate the beneficial influence of the Project on the food production, import substitution, employment and assistance to low income groups.
- Estimate the economic and financial feasibility of the Project, calculating its rate of return showing the stream of incremental costs and benefits.
- Undertake a sensitivity analysis in relation to some basic assumptions.
- Estimate the financial implications of the Project for the Government.

d. *Hydrogeologist*

- Assist the Team Leader and the Groundwater Engineer/Hydrogeologist in all relevant tasks given to him by these two people.
- As soon as appointed, assemble all available information (reports, maps, unpublished materials, etc.) regarding the hydrogeology of the Project area as to

reduce the time to be spent on this task by the Team Leader or Groundwater Engineer.

- As soon as appointed, prepare suitable base maps to be used in the study.
- Activate the BADC District officers in the Project area for the collection of all relevant data.

e. Agricultural credit specialist

- Assist the Agro-economist and the Team Leader in evaluating the institutional framework, policies and procedures relating to input supplies, delivery systems, and agricultural credit.
- Study the channels and modes of securing the access of small farmers and sharecroppers to the agricultural credit, both under the proposed Project and under other ongoing projects and programmes.
- Study the mode of financing the credit requirements of the beneficiaries for installation of the proposed irrigation facilities, the extent of such requirements, the lending terms, interest rates and repayment period, the institutions/agencies through which financing to be provided to farmers, the arrangements for organising groups of farmers to avail of such credit and safeguards to ensure that the target groups benefit the most from such arrangement.
- Collaborate with Agro-economist on the socio-economic and institutional aspects of the studies.

It should be noted that the suggestions made above are to be considered only as a guideline and that the consultant is free to propose changes in respect of specialization of experts and areas of responsibility to achieve the objectives.

VI. SUPERVISION OF CONSULTANTS' WORK AND REPORTS

a. The Food and Agriculture Organisation of the United Nations will supervise and evaluate the work of the consultants and give them necessary directions in this regard. The consultants shall submit periodic reports as necessary on the progress of their work to BADC (Government of Bangladesh) with copies to IFAD and the cooperating institution.

b. After about a month of its work in the field, the progress of work will be reviewed jointly by the Government of Bangladesh, the cooperating institution and IFAD with a view to:

- i. Determining if the scope of the proposed studies needs to be modified/supplemented;
- ii. Taking stock of the various technical and policy issues emerging from the studies and their relevance to Project formulation;
- iii. Finalising the format in which the final report will be submitted and firming up the time-table for completion of various phases of project preparation.

c. The consultants will follow the FAO Investment Centre "guidelines" for project preparation.

d. On completion of their studies, the consultants will prepare a draft Project Preparation Report and submit to the Government of Bangladesh with copies to the cooperating institution, and IFAD will review the draft report in consultation with the Government of Bangladesh, after which consultants will prepare the final report.

VII. VETTING OF THE APPOINTMENT OF CONSULTANTS

The appointment of the consultants will be vetted by IFAD.

Appendixes

—Appendix A: Comments on Certain Technical Aspects.

—Appendix B: List of Available Technical Reports and Studies.

Appendix A

COMMENTS ON CERTAIN TECHNICAL ASPECTS

Limitations of Present Geohydrologic Data

1. In order to evaluate the groundwater potential of an aquifer system and its response to recharge and extraction, it is necessary to know, apart from other factors, the permeability and the storage coefficient of the system. Regarding permeability it is common practice to evaluate the transmissivity, i.e. the permeability multiplied with the thickness of the permeable formations, instead of only the permeability.

2. The information so far compiled by BWDE includes the calculated transmissivity values for all deep tubewells based on six to eight hour pump tests. Transmissivity values obtained through such relatively short tests are usually not as accurate as is necessary for more reliable geohydrologic calculations. They are more to be considered as indicative of the magnitude of the parameter. For more detailed and precise information the pump test should have a duration of some four to eight days depending on the hydrogeological conditions. The calculations of the transmissivity should also preferably be based on water-level changes measurements in an observation well rather than in the pumped well itself in order to avoid interference from hydraulic losses and well deficiencies which normally occurs in a pumped well. Although corrections for such losses can be made, it still is preferable to base the calculations on data from one or more observation wells.

3. In order to calculate the vertical permeability and the storage coefficient*, it is necessary to have at least two, if possible four observation wells suitably spaced around the pumped well. The spacing and spatial arrangements of these wells can be found in most modern textbooks in geohydrology, for example W. Walton: *Groundwater Resources Evaluation, 1970*. However, no information regarding these two very important geohydrological parameters are at present available for the aquifer systems within the Project area. Some information regarding these parameters for the north-western areas of Bangladesh exist, BADC/IDA *Tubewell Project 1977*, but it is presently not known if this information is of any use for the Project area.

Proposal for Aquifer Tests

4. The proposed groundwater study to be carried out by a consultant company with the aim to ascertain that enough groundwater is available within the Project area to irrigate an additional 100,000 acres must, due to limitations in time and money, be based on existing and available information. As the present data on transmissibility is based on very short pump tests, and not including the use of observation wells, it is suggested that at least nine but if possible more long-term pump tests are carried out before the consultants arrive in order to enable the consultant to make a better and more accurate evaluation of the geohydrologic conditions.

5. The aquifer tests should be carried out, at least three in every district within the Project area, using suitable existing irrigation wells and pumps. To each well should be attached at least four suitably spaced observation wells. The tests should have a duration of six to eight days depending on how quickly reliable and significant data are obtained at each test.

6. The wells to be tested should be located in different geological environments, i.e., one well where the surface layers mainly consist of clayed soils, another where the surface layers are as sandy or silty as possible and the third in the vicinity of surface water body (large pond, river, etc.), in order to establish the hydraulic connection between surface water and groundwater.

7. It is suggested that the tests are carried out by BADC in cooperation with BWDB Groundwater Circle as the latter has been responsible for previous tests.

* Which are necessary for recharge calculations and aquifer storage conditions.

8. The tests should be executed and evaluated as described in modern textbooks, for example W. Walton: *Groundwater Resources Evaluation, 1970*.

9. It is most important that these tests should be carried out as soon as possible, so that the information is available when the consultant arrives. The tests should be done in places or areas which are not likely to be flooded during the rainy season.

Saline Groundwater Contamination

10. As there may be an increasing risk that the saline groundwater may move inland if extensive groundwater development takes place, it is suggested that the consultant should also propose a suitable monitoring network of observation wells for controlling this problem.

Appendix B

LIST OF AVAILABLE TECHNICAL REPORTS, JOURNALS AND FEASIBILITY-STUDY REPORTS, IN THE LIBRARY OF GROUND WATER CIRCLE, UNDER PROCESSING AND PUBLICATION DIVISION

<i>Sl No.</i> 1	<i>Code No.</i> 2	<i>Name of Author and year</i> 3	<i>Title of Books and Volume</i> 4
24.	60.441	Erammer H. FAO Deputy project commissioner, soil survey project of Pakistan	Chapter on geology, physiography, hydrology and soils of East Pakistan
26.	60.537	Bangladesh agricultural development corporation June 1973 (Tubewell irrigation division)	Report on grain-size analysis of aquifer materials
28.	60.619	Bangladesh agricultural development corporation (Shallow tubewell division)	Static water level of shallow tubewell Month: January, 1975
29.	60.822	Bangladesh water development board, Dacca March 1976	Management guide
31.	60.875	Bangladesh agricultural development corporation (Tubewell irrigation division) June 1973	Report [on] grain-size analysis of aquifer materials
43.	60.781	Camp, dresser and McKee	Ground water data of the East Pakistan Province
62.	60.517	East Pakistan water and power de- velopment authority, Dacca January 1970	Agreement between EPWAPDA and geological survey of Pakistan for drilling of forty-five deep holes in East Pakistan
63.	60.791	March 1970	Tharurgaon tubewell project Extension (modified feasibility report)
67.	60.157	Ahmed	Groundwater potential and scope of study of water movement in unsaturated zone in East Pakistan
89.	60.1007	Flood forecasting and warning, BWDB February 1976	Annual report on flood in Bangladesh 1975
95.	60.127	Ground water circle annual report, No. I for 1969-70	Flood publication No. 1, 76 Ground water survey in East Pakistan

<i>Sl. No.</i> 1	<i>Code No.</i> 2	<i>Name of Author and Year</i> 3	<i>Title of Books and Volume</i> 4
96.	60.146	Ground water circle Dacca Quarterly report No. 1 for July to September 1970	Ground water survey in East Pakistan
105.	60.347	Ground water circle EPWAPDA, Dacca	Ground water survey in East Pakistan quarterly report No. 3
108.	60.384	Geophysical directorates October 1969	Geological and sub-soil investigation report Report No. 104 (69) Project: 37 XV - sub-station Location: Faridpur, Meherpur and Bat-tail (Kushtia)
113.	60.496	Ground water circle Dacca Quarterly report No. 4 for April to June 1973	Ground water survey in Bangladesh Sub-project under U.S. aid relief and rehabilitation grant No. I
114.	60.497	Ground water circle Dacca Quarterly report No. 1 for July to September 1972	Ground water survey in Bangladesh Sub-project under U.S. aid relief and rehabilitation grant No. I
115.	60.498	Ground water circle Dacca Quarterly report No. 2 for October to December 1972	Ground water survey in Bangladesh Sub-project under U.S. aid relief and rehabilitation grant No. I
116.	60.499	Ground water circle Dacca Quarterly report No. 3 for January to March 1973	Ground water survey in Bangladesh Sub-project under U.S. aid relief and rehabilitation grant No. I
120.	60.775	Ground water circle Bangladesh water development board	Basic principles of ground water survey and development
124.	60.937	Ground water division-I Ground Water Circle BWDB, Dacca February 1977	List of observation wells and ground water sampling stations
126.	60.1010	Ground water division-II Ground water circle, BWDB, Dacca May 1977	List of observation wells and ground water sampling stations
130.	60.099	Hydrology directorate Dacca March 1967	Daily rainfall of East Pakistan January to December 1963
131.	60.100	Hydrology directorate Dacca November 1967	EPWAPDA water supply paper—266 Daily rainfall of East Pakistan January to December 1964
132.	60.102	Hydraulic research laboratory June 1969	Materials testing report Project: 1000 tubewell project, Rangpur holes—6 and 8 to 15
143.	60.153	Hydrology directorate Dacca	Ground water survey in East Pakistan Form P.C. II
135.	60.123	Hydrology directorate Dacca March 1966	Index of gauge, discharge and silt observation stations in East Pakistan with instructions and procedures for collecting basic surface data Water supply paper—I
208.	60.	Hydrology directorate Dacca December 1971	Hydrological Year-Book of Bangladesh 1968-1969 water year volume I Rainfall and evaporation

<i>Sl. No.</i> 1	<i>Code No.</i> 2	<i>Name of Author and year</i> 3	<i>Title of Books and Volume</i> 4
209.	60.	Hydrology directorate Dacca December 1971	Hydrological Year-Book of Bangladesh 1968-1969 water year volume II, Part A
210.	60.	Hydrology directorate Dacca November 1970	Hydrological Year-Book of Bangladesh 1968-1969 water year volume III
211.	60.	Hydrology directorate Dacca November 1972	Annual report on flood in Bangladesh for 1970
212.	60	Hydrology directorate Dacca May 1972	Annual report on flood in Bangladesh for 1971
252.	60.	Hydrology directorate Dacca September 1967	Hydrological Year-Book of East Pak- istan 1965-66 water year volume IV
258.	60.	Hydrology directorate Dacca July 1973	Hydrological Year-Book of Bangladesh 1969-70 water year
260.	60.847	Hydrology directorate Dacca October 1975	Hydrological Year-Book of Bangladesh 1970-71 water-II: Part-B Water yr. level
261.	60.848	Hydrology directorate Dacca November 1973	Hydrological Year-Book of Bangladesh 1970-71 water year volume II: Part-A Water level
262.	60.849	Hydrology directorate Dacca May 1975	Hydrological Year-Book of Bangladesh 1970-71 water year volume III
263.	60.	Hydrology directorate Dacca October 1973	Hydrological Year-Book of Bangladesh 1970-71 water year volume I Rainfall and evaporation
265.	60.	Hydrology directorate Dacca March 1966	Hydrological Year-Book of East Pak- istan 1963-65 water year volume I Rainfall and evaporation
266.	60.	Hydrology directorate Dacca March 1966	Hydrological Year-Book of East Pak- istan 1964-65 water year volume II
267.	60.	Hydrology directorate Dacca March 1967	Hydrological Year-Book of East Pak- istan 1965-66 water year volume III
268.	60.	Hydrology directorate Dacca March 1968	Hydrological Year-Book of East Pak- istan 1966-67 water year volume I Rainfall and evaporation
269.	60.	Hydrology directorate Dacca March 1968	Hydrological Year-Book of East Pak- istan 1966-67 water year volume IV
270.	60.	Hydrology directorate Dacca November 1970	Hydrological Year-Book of East Pak- istan 1968-1969 water year volume I Rainfall and evaporation

<i>Sl. No.</i> 1	<i>Code No.</i> 2	<i>Name of Author and Year</i> 3	<i>Title of Books and Volume</i> 4
271.	60.	Hydrology directorate Dacca December 1971	Hydrological Year-Book of East Pakistan 1968-69 water year volume II Part A
272.	60.809	Hydrology directorate Dacca November 1970	Hydrological Year-Book of East Pakistan 1968-69 water year volume III
273.	60.876	Hydrology directorate Dacca March 1972	Bibliography of hydrological publications
274.	60.87	Hydrology directorate Dacca March 1968	Hydrological Year-Book of East Pakistan 1966-67 water year volume II
275.	60.87	Hydrology directorate Dacca March 1966	Hydrological Year-Book of East Pakistan 1964-65 water volume III
277.	60.87	Hydraulic research laboratory	Study and interpretation G.W. levels in respect of [irrigation] Amla Experimental Kushtia
279.	60.10	Hydrology directorate Dacca August 1975	Hydrological Year-Book of Bangladesh Volume III
281.	60.03	International Engineering Co. Inc. October 1964	Water balance study East Pakistan Ganges Kobadak project
284.	60.77	International Engineering Company Inc. December 1964	Master plan supplement A Climate and hydrology
287.	60.100	International Engineering Company Inc. September 1977	Special Studies Volume A and B
288.	60.1002	International Engineering Company Inc. September 1977	Special studies Volume XX C
304.	60.721	Morgan and Meclutire	Quasernary geology of the Basin East Pakistan and India
310.	60.1009	Sir. M. MacDonald and partners I, Consulting engineers December 1967	Logs of exploratory Bore-Holl tubewells fixtures and pump test data, drain size and chemical analysis data and copy of report of investigation for ground water resources for irrigation IEA in Syleet and Chittagong districts
311.	60.258	Offield W. Terry 1964	The geological survey of Pakistan Vol. XII, Part I Preliminary bibliography and index of the geology of Pakistan
315.	60.230	Parsons corporation Dacca East Pakistan	Report on ground water survey East Pakistan
343.	60.1011	Public health engineering October 1976	Rural water supply programme depth book Average depth of tubewells Union-Wise
347.	60.075	Surface water directorate Hydrology organisation EPWAPDA, Dacca	Progress report For November 1970

<i>Sl. No.</i> 1	<i>Code No.</i> 2	<i>Name of Author and year</i> 3	<i>Title of Books and Volume</i> 4
354.	60.261	UNDP, FAO 1968	Hydrological survey East Pakistan Interim report
359.	60.1016	World Bank/IBRD 1972	Bangladesh land and water resources sector study Technical report No. 20.22

A LIST OF BWDB WATER SUPPLY PAPERS ON "GROUND WATER INVESTIGATION IN BANGLADESH" PUBLISHED AS ON JUNE, 1978, BY THE GROUND WATER CIRCLE OF BANGLADESH WATER DEV. BOARD

<i>Sl. No.</i>	<i>Title date and cost of the BWDB Water Supply Paper</i>	<i>Main contents of BWDB Water Supply Paper</i>	<i>Remarks</i>
1.	EPWAPDA Water Supply Paper 220 on "Ground Water Investigation" in East Pakistan (Bangladesh) November 1964 Cost: Tk. 13.83	Lithologic and Water table data collected as of December 1963. Some well hydrographs with a short report about general hydrogeologic conditions of East Pakistan (Bangladesh)	For official use only
2.	EPWAPDA Water Supply Paper No. 316 (Vol. I and II) on "Ground Water Investigation" in East Pakistan (Bangladesh) November, 1968. Cost of Vol. I = Tk. 18.50, Vol. II = Tk. 42.70	Lithologic and water table data collected from 1964 to March, 1967. Some maps, illustrations and well-hydrographs and geologic cross-sections with a short-report	For official use only
3.	EPWAPDA Water Supply Paper No. 325 on study and interpretation of fluctuation of ground water level in Amla Experimental Farm, WAPDA Kushtia October, 1969 Cost: Tk. 7.90	Specific study on the effects on Surface Water irrigation on ground water table in Amla Farm	At present out of print
4.	EPWAPDA Water Supply Paper No. 331 on Ground Water study in the districts of Rajshahi, Pabna, Kushtia, Jessore, Khulna, Faridpur and Barisal in Bangladesh June 1970 Cost: Tk. 8.70	Study on the prospect of Ground Water Development in the districts of Rajshahi, Pabna, Kushtia, Jessore, Khulna and Barisal	Restricted for general circulation
5.	EPWAPDA Water Supply Paper No. 329 on "Ground Water Investigation" in East Pakistan (Bangladesh) August 1971 Cost: Tk. 22.00	Data of Water table collected during April 1967 to December 1969	For official use only
6.	BWDB Water Supply Paper No. 351 on "Ground Water Potential" on Northern areas of Dinajpur and Rangpur districts in Bangladesh January 1972 Cost: Tk. 10.50	Study on movement of ground water, specific yield, recharge conditions and ground water potential of the study area	For official use only

Sl. No.	Title date and cost of the BWDB Water Supply Paper	Main contents of BWDB Water Supply Paper	Remarks
11.	BWDB Water Supply Paper No. 386, report on "Preparation of Hydro-geological Map" of Bangladesh and suggested distribution of tubewells among different districts of Bangladesh December 1964 Cost: Tk. 35.00	A preliminary "hydrogeological map of Bangladesh" showing prospecting areas for drilling deep and shallow tubewells including criteria for [identification] of prospective areas and distribution of deep and shallow tubewells district-wise for the five-year plan (1973-1978).	Restricted
12.	BWDB Water Supply Paper No. 390 on "Ground Water Investigation" in Kushtia, Jessore, Faridpur, Barisal Patuakhali and Khulna Districts December 1975 Cost: Tk. 152.00	Data of Ground Water level and lithology, aquifer properties and ground water quality with some ground water contour maps results of interpretation of those data	For official use only
13.	BWDB Water Supply Paper No. 394 on "Ground Water Qualities of Bangladesh" November, 1976 Cost: Tk. 41.75	Basic data of ground water qualities analysis. Some maps showing dissolved minerals in ground water for all districts in Bangladesh based on data of ground water samples collected from 101 selected sites all over Bangladesh during the years 1973 to 1975	For official use only
17.	BWDB Water Supply Paper No. 402 on "Ground Water Investigation" in Kushtia, Jessore, Faridpur, Khulna Barisal and Patuakhali districts Dacca 1977 Cost: Tk	Data of Ground Water Level and lithology, aquifer properties and ground water quality with some ground water contour maps, of illustrations and the results of interpretation of these data	For official use only
18.	BWDB Water Supply Paper No. 403 on "Ground Water Qualities of Bangladesh" May 1978 Cost: Tk	Basic data of ground water qualities analysis. Some maps showing dissolved minerals in ground water for all districts in Bangladesh based on data of ground water samples collected from 101 selected sites all over Bangladesh during the year 1976-77	For official use only
20.	BWDB Water Supply Paper No. 405 "Report on the analysis of the detailed aquifer test" at Pahartali Thana, Rauzan, District Chittagong August 1978 Cost: Tk	An analysis of detailed aquifer test data by applying different methods and procedures and the interpretation results of analysis used for the feasibility of ground water development in the test area	For official use only

SCHEDULE 2

SERVICES, FACILITIES AND EQUIPMENT TO BE PROVIDED BY THE GOVERNMENT

The services, facilities and equipment to be provided by the Government pursuant to paragraph 11 of this Letter will be as follows:

- 1) Such office accommodation (suitably furnished and equipped) and supplies, secretarial assistance, translation and interpretation services and communication facilities as the members of the Mission will reasonably require;
- 2) Such vehicles (including the cost of maintenance and operation) and drivers and such other internal transportation facilities as may be needed by the members of the Mission for purposes related to the Project;
- 3) Such operational devices, apparatus, instruments and equipment at the disposal of the Government which may be considered by the members of the Mission to be essential for the efficient performance of their functions and duties;
- 4) Such available documents, drawings, maps, statistics and other data and information relevant to the Project;
- 5) Suitable furnished living accommodation (including utilities).