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WATER RESOURCES SURVEY PROJECT

(CONTINUATION OF CONSOLIDATED WATER RESOURCES
DEVELOPMENT PROJECT NO. 492-11-120-233)

19p.

REPORT OF PROGRESS

N.C. 43

FOR THE PERIOD

OCTOBER 1, 1969 THROUGH JUNE 30, 1970

PREPARED BY:

UNITED STATES BUREAU OF RECLAMATION

FOR:

BUREAU OF PUBLIC WORKS
GOVERNMENT OF THE PHILIPPINES

AND

THE UNITED STATES
AGENCY FOR INTERNATIONAL DEVELOPMENT

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Section I

PROJECT HISTORY

The history of the original Water Resources Survey Project is given in considerable detail in the report for the six month period January 1, 1967 to June 30, 1967, Report No. 43. Additional historical information is given under Section II of this report.

Section II

PROJECT DESCRIPTION

The agreement of November 2, 1962 between the Agency for International Development and the United States Bureau of Reclamation established the initial project which was called the "Water Resources Survey Project". This Agreement sets forth the general purpose and scope of the Water Resources Survey Project as initially conceived. The Water Resources Survey Project continued throughout FY 1967 to function more or less along the original concept, with continuing emphasis on planning of the surface water resources for seven river basin areas.

In FY 1963, the Water Resources Survey Project was combined into the Water Resources Development Project which included (1) the Agricultural Productivity-Irrigation Project and (2) the Water Resources Survey Project. After combining both functions into the Water Resource Development Project, BuKec and USAID broadened its objectives to give more attention to the collection and quality of basic data, particularly streamflow records. Also, in connection with Shallow Well Pump Irrigation Research and Demonstration Project

(Activity No. 492-15-120-241), the BuRec Team working with the newly created Division of Water Resources of the GOP - Bureau of Public Works, and other organizations of the Philippine Government as well as certain Divisions of USAID began an intensive investigation of the possibilities of a more practical approach to groundwater development by the design and construction of more efficient shallow irrigation wells.

In addition to advising the Philippine Government, principally through the Bureau of Public Works on matters relating to water resources investigations and planning, effort was also directed toward the training of Filipino engineers and other technical personnel in techniques of basic data collection and project planning for water resource development. Work was also continued on the investigation of selected projects in the seven river basin areas.

On May 3, 1969, a new and revised Project Agreement between the GOP and USAID provided for an enlarged 4-man Bureau of Reclamation team consisting of M. G. Barclay, Project Engineer; John H. Steele, Hydrologist; Vernon W. Lawrence, Soil Scientist. As of the date of this report, the Ground Water Engineer has not been recruited. Mr. Barclay commenced his second tour as Project Engineer July 5, 1969. Mr. Lawrence and Mr. Steele arrived in Manila December 15, 1969 and January 3, 1970, respectively to begin 2-year assignments.

The goals and objectives of the BuRec team as set forth in the Project Agreement are as follows:

1. To evolve a fresh and viable national approach to sound planning and development of the country's land and water resources;
2. To establish programs for the collection, compilation and publication of basic data with which to support logical planning;
3. To actively plan and implement important development projects based on internationally accepted principles and procedures;

4. To establish within the GOP the capability to secure the optimum national permanent benefits from the most judicious application of limited resources available for these developments;
5. To accomplish productive work in all phases of water resources planning and development, and using the productive work as a vehicle for providing on the job training to qualified personnel in order to enhance and upgrade the GOP's capability to continue those vital and complex works without external technical or dollar assistance.

Section III

PROJECT INVESTIGATIONS

A detailed discussion of the engineering and other phases of the work carried out under the Water Resource Development Project to April 15, 1969 is contained in Progress Report No. 46. Discussion of work carried out under the revised Project Agreement between the GOP and AID, dated May 3, 1969 is contained in Progress Report No. 47, covering the period from July 1, 1969 to September 1969. Progress of the work, October 1969 - July 1, 1970 is discussed under appropriate headings below:

Organization

The Water Resources Division was established in 1969 as one of ten divisions under the Bureau of Public Works. This Division is composed of the following Branches:

1. Project Investigations and Design Branch
2. Economics and Land Resources Branch
3. Surface and Ground Water Branch
4. Water Resources Laboratory Branch
5. Water Rights Branch

It will be noted that the Water Resources Division includes in its five Branches the functions that normally would come under the Bureau of Reclamation and the Geological Survey in the States. Except for the Project Investigations and Design Branch, which deals mainly with specific water development projects, the functions of the other Branches are on an Islands wide basis.

The Project Investigations and Design Branch as its name implies has the prime responsibility for investigating and reporting on potential water resource development projects. As of January 1, 1970, the Branch had not been organized and consequently, there was some confusion and uncertainty regarding specific assignments within the Branch. In view of this situation, the Team prepared and submitted to the Director of the Bureau of Public Works a proposed organization chart for the Branch consisting of the following seven sections:

1. Lands Section
2. Hydrology Section
3. Plan Formulation and Economics Section
4. Drainage and Groundwater Section
5. Geology Section
6. Engineering Plans and Estimates Section
7. Reports and Programs Section.

Detailed job sheets were prepared and included in the submittal for the Branch Chief and the Chief of each Section. The purpose in proposing this type of organization was to develop in the Branch a strong, viable group with all the essential skills for the efficient and effective investigation of potential water resources projects. The proposed organization of the Branch has not been officially adopted. However, unofficially, five of the seven sections have been established with designated section chiefs and the planning activities within these five sections are moving forward. The Lands Section and the Drainage and Groundwater Section are the two sections that have not been established.

Planning Activities

Project planning activities of the Branch up to the present time have been largely confined to the Balog-Balog Project in the Tarlac Province. The completion of the feasibility report is scheduled for December 31, 1970. The Team members have acted as consultants to the Branch and Section Chiefs in the performance of the various phases of the planning work. A detailed outline of the basic data and studies required in the evolution of a feasibility report was prepared and furnished the Branch and Section Chiefs as an aid in visualizing the overall scope of project planning. Also suggested appendices outlines for three of the sections were prepared and furnished the Section Chiefs for their guidance in preparing appendices.

A major roadblock in the Balog-Balog Project investigations is the lack of land classification data and the dim prospects of making a land classification in the near future. The Balog-Balog project area has irregular topography and fine to coarse textured soils which would lead to some rather serious problems. A land classification, semi-detailed in scope, is essential for determining the anticipated future "With Project" cropping pattern, water requirements, drainage requirements, and engineering designs, and in determining yields and production and marketing costs needed for economic evaluation of the project.

The Lands Section has not been established in the Project Investigations and Designs Branch. However, the Bureau of Public Works is in the process of establishing a Land Resources unit as a separate Branch under the Water Resources Division. Arrangements are being made to expand the existing BPW water quality laboratory and make it a central soil and water quality laboratory capable of performing all soil and water analysis necessary to support water resources planning activities. A list of new lab equipment required to supplement the existing equipment was ordered by USAID, using funds obligated under the Project Agreement for Water Resources Development for Fiscal Year 1969 (492-11-120-233), following assurance by the BPW Director that the laboratory would be properly operated and maintained. In line with the assurance, refurbishing of the existing laboratory equipment was started the latter part of June and arrangements have been made with the National Institute of Science and Technology to train the laboratory chemists in the operation and maintenance of certain specific specialized pieces of equipment.

There appears to be a serious lack of adequate data on crop yields and production costs data for both rice and sugar cane crops under present conditions, with and without irrigation. A crop census was conducted in 1965 using high school graduates with little or no experience in such matters, to collect the data. This, and the fact that individual farmers keep no records of their farming activities casts serious doubt as to the accuracy of the census data and its suitability for use in project analysis. The Branch personnel have been encouraged to find and check other potential sources of agricultural data as a means of checking the census results. Only minor progress has been made in this area.

Section IV

UPPER PAMPANGA PROJECT

In July 1969, the National Irrigation Administration

consummated a loan agreement with the International Bank for Reconstruction and Development for a loan of \$34 million to be utilized in constructing the multipurpose Upper Pampanga River Project, the total cost of which will be about 75 million dollars including local currency. The National Irrigation Administration has also executed a contract with Engineering Consultants Incorporated (ECI) of Denver, Colorado, to provide consulting services in connection with design and construction management, particularly with respect to the Pantabangan Dam.

Surveying and Mapping

Under the current agreement between GOP and AID, the BuRec Team is providing technical guidance in the mapping and classification of project lands. In this connection, the Project Engineer has had frequent conferences with project officials and advised them on procedures for developing a base map of the project area of sufficient accuracy for location of the engineering works and for showing the project land classification. The work has gone forward, however, it is not entirely in accordance with recommendations of the Project Engineer.

Early in January 1970, representatives of the Bureau of Reclamation met with officials of the Upper Pampanga River Project, at which time detailed discussions were held regarding the requirements for rectified photographs enlarged to appropriate scale which would provide the mapping base for land classification work. Later, specifications as to accuracy and scale of photographs for land classification mapping were provided to the Upper Pampanga River Project Manager. None of these requirements were met and Mr. Lawrence, as an expedient measure, was forced to use glossy unrectified contact prints of a nominal scale of 1:15,000 which vary from 1:14,000 to 1:16,000 in actual scale. As explained later, field measurements were made to determine the scale of individual contact prints. As a whole, the method by which the limited mapping base has been provided has not

been very satisfactory. There is no certainty that the required mapping base photo-enlargements of the proper scale will be supplied.

Land Classification

Vernon Lawrence, USBR Soil Scientist, is the Team's technical advisor on soils studies, land classification, and land use practices as they relate to irrigation development in the Philippines. His primary assignment was to make a land classification of the authorized Upper Pampanga River Project which is a pre-requisite to the release of construction funds by the World Bank. Also, he was to develop within the Bureau of Public Works the capability to perform all phases of land classification in connection with the orderly investigation and development of the country's land and water resources.

Five soil or agronomy graduates, experienced in soil surveying were detailed from the Bureau of Soils to the National Irrigation Administration to learn the fundamentals of USBR land classification and make the necessary field studies. In addition to these men, the NIA also assigned five of their agriculturist employees as land classification trainees.

Fieldwork was started on the classification of UPRP lands early in February, 1970. A set of aerial photos rectified to a scale of 1:3,000 was ordered but we were advised at the time that there would be a 3 months delay due to the lack of printing paper. To expedite the work, aerial photos, nominal scale 1:15,000 were obtained from the University of the Philippines for temporary field use until the more suitable photos could be obtained. As the work was about 70 percent complete before the 1:3,000 scale prints were available, it was decided to complete the job using the contact prints because a change over at that stage of the work was impractical.

Although the 1:15,000 scale photos are unsatisfactory because they were glossy prints, printed on outdated paper and were unrectified, the scale of each photo was checked by field measurements and a corrective factor was applied to the scaled

distances.

By June 30, the field work of reconnaissance grade on about 110,000 hectares had been completed with about 30,000 hectares left to be covered. The work remaining in addition to the 30,000 hectares includes matching photos and making field checks for accuracy and completeness.

About 20 master site pits were hand dug to a depth of 150 centimeters for soil characterization, sampling for complete chemical and physical analysis, and for obtaining undisturbed samples for bulk density and moisture analysis. The pits represented all the principal soil series of the project area as well as the significant subclasses mapped in the reconnaissance classification.

Construction of the field soil laboratory, after much delay, was started about the middle of June and is scheduled for completion about September 25, 1970. Laboratory equipment was ordered through Engineering Consultants Incorporated of Denver, Colorado and is scheduled for delivery in September. In the interim, the UPRP office has arranged to have soil testing work performed by several local soils laboratories in order to complete the project lands appendix early in 1971. Laboratory instructions furnished in the Chief Engineer's letter of May 1, 1970 will be followed as closely as possible in making the soil laboratory analyses.

Eight of the original 10 trainees remain on the job and have demonstrated their capability of becoming competent land classifiers.

Section V

BASIC DATA PROGRAMS

Stream-gaging

In the past 20 years, USAID had contributed large

sums of money, equipment, and technical assistance to the GOP in an effort to develop a sound stream-gaging program which would provide data required for the administration and development of the country's water resources. This program is a function of the Surface and Ground Water Branch of the Water Resources Division in the Bureau of Public Works. In our recent review of the program, it was apparent that there has been a steady deterioration in the quality of the streamflow records over the past several years. This deterioration is attributed to successive decreases in the annual funds allocated for stream-gaging work, failure to make appropriate adjustments in the stream-gaging program to fit the available funds, and the lack of a consistent and sustained training program for personnel in the operation and maintenance of gaging stations and stream-gaging techniques. The amount programmed for stream-gaging work in 1968 was about 65% of that budgeted in 1965. There have been further reductions of about 25 percent per year in 1969 and 1970. The most serious cut in funds has been for travel and supplies. In FY 1969, the travel budget was P133,000. This was decreased to P33,500 in 1970. Funds for supplies was decreased from P212,313 in 1969 to P99,000 in 1970. The cut in funds for FY 1970 seriously restricted the field work with the result that no stream-discharge measurements or gaging station maintenance was done during the January - June 1970 period.

The stream-gaging program in the Philippines has steadily expanded since 1959, until at the present time the gaging station network includes a total of about 428 stations which is greatly in excess of the present operational capability of the Surface Water Branch.

In view of the adverse fund situation, we suggested to the Bureau Director and Division Chief that a realistic appraisal of the stream-gaging program be made with the view to reducing the stations to the number that can be effectively maintained and operated with available funds and personnel to obtain good quality records. Also, that a formal review of the program be made annually to maintain a balanced program. This approach was adopted and is in the process of being carried out. The reduced program for FY 1971 will

include a total of about 30 first priority stations, including 62 river basin base and administrative stations and 17 stations that are required for the investigation of selected high priority water resources projects. Other stations will continue to be operated as funds and logistic support will permit.

A program is also underway to calibrate all the current meters of the Branch using equipment that has been installed for that purpose at the University of the Philippines. The meters have not been calibrated since 1965. The calibrating equipment was broken in the process of rating the first current meter and the program has been delayed pending repair of the equipment.

Surveying and Mapping

During the past 5 years, the Bureau of Reclamation has managed a mapping program financed by USAID. This mapping program has been carried on under a contract with Aero Service Corporation. Works accomplished consists of topographic maps of 10 reservoir sites in the Central Luzon Basin and the compilation of photo-mosaic maps of flood plain areas in seven river basins throughout the Philippines. As a final action under this mapping contract, a topographic map of the Balintongan reservoir site in the Central Luzon Basin was completed in first draft form, the first part of June 1970. This reservoir constitutes one element of the plan of development for the Central Luzon Basin.

Another surveying and mapping program that is just being initiated is the establishment of horizontal control for the Balog-Balog Project Area. This control is to be used for rectification and enlargement of scale of aerial photographs which will be used for land classification surveys of the area. The control will also be used in connection with engineering studies of the project area, as well as providing a base for compilation of a project map. Although the need for such surveys have been explained in considerable detail, actual accomplishment of the work had not progressed much by the close of this reporting period.

Section VI

GROUND WATER PROGRAM

General

Ground water development in the Philippines in the past has been very sporadic. The pressing need for additional irrigation and municipal water supplies has directed attention to the potential development of the ground water resource. USAID has been instrumental in promoting a ground water program and has contributed extensive funds for ground water investigations. Three drilling machines have been purchased for test boring and mapping of aquifers and seven groundwater geologists and drillers have been sent to the states for training. Ground water geologists have been made available to the Bureau of Public Works to assist in the training of personnel and direct the ground water program.

The BuKec Team has monitored operations of the Ground Water Branch of the Bureau of Public Works and has made appropriate suggestions for adjustments in the program so that the work would be directed to areas where the need is most urgent.

Reverse Circulation Rotary Drill Rig

Well drilling here in the Philippines has been restricted largely by the drilling equipment at hand. In order that better well designs can be made, it is desirable that different and improved well drilling techniques be introduced to the country. In the States, the reverse circulation drilling machine has met with marked success where geologic and aquifer conditions are favorable. It has been proposed that a reverse circulation rig be purchased with funds from the NIA.

equipment loan. BuKec has assembled data concerning this type of rig and prepared a draft of specifications. The problem remaining is arriving at a suitable arrangement with the BPW for operating the rig in an efficient and effective manner. This requires funds and logistic support which apparently is not now available to the BPW. A good program of work as well as full logistic support before the order for the rig is actually placed should be assured.

Baloc Shallow Well Project

The "Shallow Well Project" is being carried out as a joint effort by the Philippine Government and USAID. The principal purpose of the project is to test out different concepts of well design and construction in an effort to determine and demonstrate the most effective type of shallow wells for sustained irrigation. A second function of the project is to furnish a year round water supply for use in demonstrating efficient water management practices, and the effectiveness of a sustained ground water supply in the growing of diversified crops, particularly during the dry season.

The original program agreement covering this project was executed on October 29, 1968 and is entitled "Shallow Well Pump Irrigation - Research and Demonstration". The RCPCC was designated as the implementing agency while the Groundwater Branch of the Bureau of Public Works was designated as having important responsibility in doing exploratory drilling in the project area, and to render other forms of technical assistance as required. The area in which the project is situated is owned and managed by Mrs. Magdalena Sangalang. She executed an agreement in December 1968 with the RCPCC which established the responsibilities of the land owner as well as other parties.

The Ground Water Branch of the Bureau of Public Works moved drilling equipment on to the job late in January 1969 and continued exploratory work into March. In this

period, six (6) test borings were made. Findings indicated that wells less than 200 ft. could probably be developed which would yield substantial amounts of water with properly constructed wells.

On the basis of these investigations, it was decided to proceed with the construction of production wells. It has been the opinion of some that the cause for poor performance of many of the wells that have been constructed here in the Philippines is due to (1) type of well design and method of construction and (2) failure to use appropriate materials, particularly a good type of commercial well screen. Since such screens are not manufactured in the Philippines, "full flow" shutter screens of 12 and 10 inch diameter were purchased from sources in the U.S. Blank pipe or casing of good quality in the form of "spiral welded pipe" was purchased from a local manufacturer.

Although the "Project Agreement" indicates that the Bureau of Public Works would do the test drilling and the construction of production wells to the extent of its capability, it was soon determined that the drilling equipment of the BPW was not suitable for drilling the large diameter production wells that were contemplated. It was decided therefore that bids would be requested from well drilling contractors. On Sept. 29, 1969, invitations were issued for proposals from qualified well drilling contractors, for the drilling of production wells as described in the tender. Bid proposals were opened on Oct. 10, 1969. The invitation proposed the construction of three (3) "type 1" wells and two (2) "type 2" wells.

As specified in the bid invitation, "type 1" wells would have a depth of 140 ft. or more while "type 2" wells would be less than 100 ft. possibly about 70 ft. as a maximum. All wells would be packed with a gravel envelope surrounding the casing and well screen. Proposals were received from five (5) bidders. The minimum bid price was P22,550 and the maximum was P153,000, with the low bid submitted by the J.B. Hoover Co., Inc. Following an investigation of the firm's capability to perform the work, the award was made to the Hoover Company on March 5, 1970.

The Hoover Company elected to drill the wells by means of a standard percussion rig, using "dummy" or temporary casing to hold the hole open. The permanent casing and well screens to be installed are of 10 and 12 diameter. In order to provide space for the gravel pack, the company elected to start with a 24 inch "dummy" casing and carry it downward as far as possible with equipment at hand. The second string of "dummy" casing would be 22 inches and so on as required.

The Hoover Company was mobilized and on the job by the close of March 31, 1970, except the full supply of "dummy" casing was not at the site. It was indicated that steel sheet stock used in fabricating the pipe was not available. Well No. 1 about 1,300 meters northeast of the Sangalang Compound was spudded in on April 1, 1970 and drilling was continued sporadically to a depth of about 165 ft. about the first of June. The well was back-filled with gravel and a 5 ft. concrete plug was placed on top so that the bottom setting of permanent casing and screen was made at 140 ft. Screens were set opposite the water bearing horizons. Thirty ft. of 10 inch screen was set in the 100-130 ft. section of the well and 30 ft. of 12 inch screen was set in the pump chamber section between 40 to 70 ft.

Well development by surging with a plunger and by means of pumping was carried out on June 25 and 26. Pumping tests were performed on June 29 by use of a turbine pump driven by a diesel engine. The well was initially pumped at a rate of 600 gallons per minute and the drawdown stabilized at about 17 ft. By increasing the pump speed, the well discharge was increased to 300 gallons per minute. At this rate, the stabilized drawdown increased to about 29.5 ft. The final pumping rate was set at 900 gallons per minute and the corresponding drawdown was about 36 ft. All tests showed very good well performance and indicated that good producing wells can be obtained at relatively shallow depths (less than 200 ft.) if properly constructed, and provided good aquifers are present.

Care should be exercised in selecting the pump capacity so that the discharge will not cause excessive

drawdown of the water table nor exceed the recharge of the aquifer on a seasonal basis. With these restrictions in mind, it is recommended that the pump capacity should not be more than 750 gallons per minute when the water table is at or near its maximum elevation. ~~As the water table is lowered during the period of maximum elevation,~~ As the water table is lowered during the period of maximum pumping, the pumping rate may be expected to decrease to about 700 gallons per minute due to increased head. To accomplish this, it is recommended that the bowl setting should be at 60 ft. below the top of the permanent casing.

In addition to drilling the well just described, the Hoover Company moved another rig in and started drilling a "type 2" well the first part of June. By the close of the month, it was 92 ft. deep, the terminus depth of the well. When completed, the "type 2" well is to be used primarily for testing propeller and centrifugal pumps to determine the effectiveness and efficiency of such installations on a year round basis.

In accordance with the wishes of the landowner, the location of two well sites were changed from those originally selected. In order to examine the geologic conditions at the new sites, the Ground Water Branch of the BPW moved a drill rig back to the job site in May. During the latter part of May and June, one test bore 200 ft. was drilled at the site of the second "type 2" well located about 200 meters north of the Sangalang Compound. A second test boring site about 300 meters southwest of the Sangalang Compound was selected for testing the aquifer for a "type 2" well. In order to test the aquifer to a depth that would also give information applicable to a deeper "type 1" well, the test boring was scheduled to be drilled to a depth of 200 ft. However, by the close of June, the boring had been drilled to a depth of 165 ft. at which time trouble was experienced with the equipment and work was suspended.

In the recent test boring operations which have been done by the Groundwater Branch of the BPW, drilling and sampling has been done by the standard percussion method with

casing being driven so that good samples can be taken. Personnel of the BPW have been instructed and encouraged to do better work in test drilling. Results which have been attained are good and believed to be more reliable than in the past. The cooperation and willingness of the BPW personnel to improve their work has been encouraging. Mr. Avelino S. Rivera, in-charge of field operations of the Ground Water Branch, as well as other personnel including Messrs. Orjalo and Ocampo have been most helpful in monitoring the work of the contractor and also directing the test boring operations. Mr. J. C. Payne, a technician of USAID who resides at Cabanatuan has rendered invaluable assistance in helping to keep the job progressing.

As Mr. Rivera gains more experience in constructing this type of well, it is believed that he will be a decided asset to the Philippines in its future groundwater development.

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