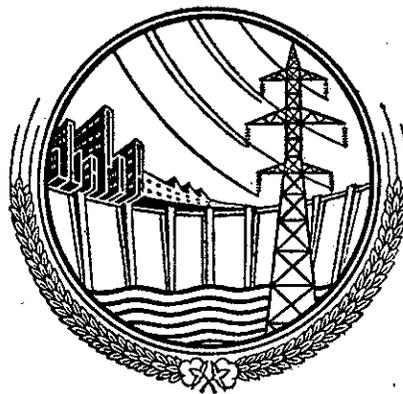


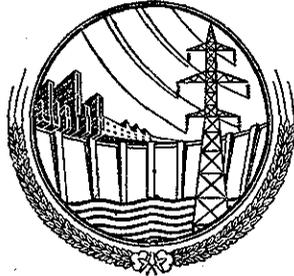
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# ANNUAL REPORT

1959-60

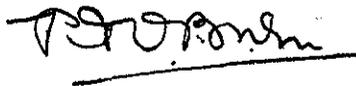


**WEST PAKISTAN  
WATER AND POWER DEVELOPMENT  
AUTHORITY**



This report has been prepared for submission to the Government of West Pakistan under Section 21(i) of the West Pakistan Water and Power Development Authority Act, 1958. Included in it also are reports on projects under the Indus Basin Settlement Plan which the Authority is to execute on behalf of the Government of Pakistan. They have been included in this annual review to give a complete picture of the activities of the Authority.

The Authority availing of this occasion wishes to place on record its appreciation of the services of all its consultants and staff who during the year under review have helped the Authority in making a substantial progress towards the fulfilment of its statutory responsibilities. The Authority is also deeply appreciative of the close co-operation and help given to it by the various departments and agencies of the Central and the West Pakistan Governments. Without this co-operation and active assistance the Authority would not have been able to achieve all that has been recorded in this report.

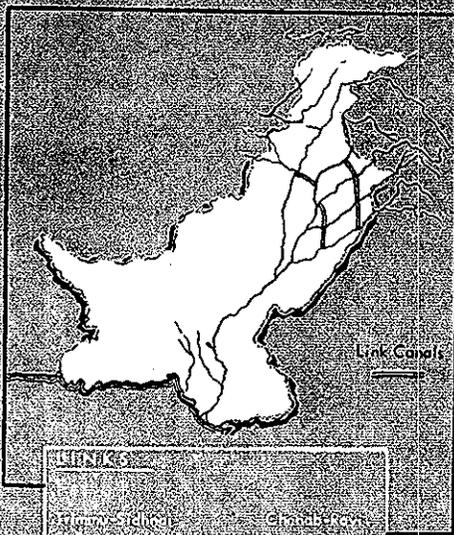


Secretary

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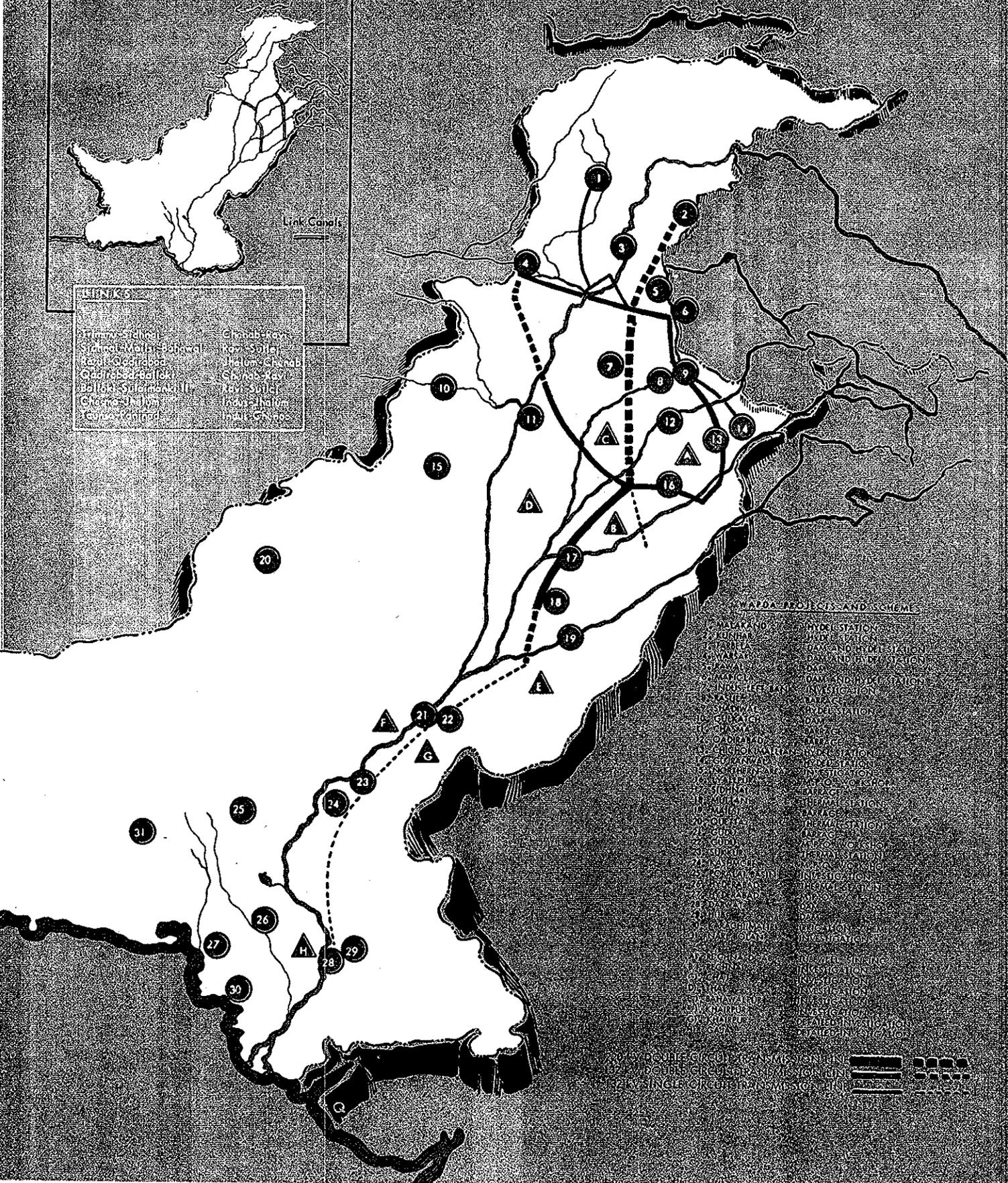
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Link Canal

**LINKS**

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**WAPODA PROJECT AND SCHEME**

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## ANNUAL REPORT

The first annual report of the West Pakistan Water and Power Development Authority, relating to the period ending June, 1959, dealt mainly with the laying of foundations and collection of materials to raise the structure of this organisation. The year now under report from 1st July, 1959, to 30th June, 1960, was taken up with the actual raising of the structure, successful commissioning of some projects, the gathering of momentum on old and new projects transferred to the Authority for execution, starting work on new projects, collection of data for the preparation of a master plan for the unified and multipurpose development of West Pakistan's water and power resources and in the process becoming acutely conscious of the actual dimensions of the task ahead of the Authority. Also, during the same period, the Authority further reviewed and defined procedure for its operations and formulated delegations of powers to match its own semi-autonomous nature. On all this we shall report in the proper sequence. To make this report as self-contained as possible we shall, where necessary, repeat the relevant background information.

### **Budget**

The scope and tempo of the Authority's activities changed greatly during the year. Some idea of this may be had from a comparison between the Authority's first and second annual budgets. The revised financial statement for projects under execution, excluding Electricity Operations, for 1958-59, shows a total expenditure of Rs. 42 million; for the year under report the total expenditure for projects, excluding Electricity Operations, was Rs. 285 million. The revenue of the Electricity Operations Department during 1959-60 was about Rs. 74.7 million. After meeting the operating and establishment costs providing for depreciation, setting aside Rs. 15.2 million as payment of 4% interest to the Government on the value of the assets (assumed at Rs. 380 million) of the Electricity Department of the Government transferred to the Authority, the revenue surplus is estimated at Rs. 9.9 million. It is not possible to compare these figures with the 1958-59 period as the Authority took over the Electricity Department only on 1st April, 1959. However, figures for the three month period, April to June, 1959, are available. During this period the revenue was Rs. 16.36 million; Rs. 3.8 million were set aside as interest payable to the Government and the revenue surplus was Rs. 535,000.

More details of the expenditure on projects and of Electricity Operations Department budget are given in the financial statements in the Appendix.

### **New Projects**

Since the last report the number of "projects" in hand increased from 16 to 22—the new "projects" being the Mangla Resettlement Organization, the Link Canals, the Tarbela Dam (these three are part of the proposed work under the Indus Basin Settlement Plan), the Karachi Irrigation Project, the Sukkur-Gudu Drainage and Reclamation, the Gomal Zam Project, Wapda Printing Press and Wapda Housing. In actual fact, the activities of the Authority have expanded much more than is indicated by the increase in the number of "projects". Not only have operations within the projects become more intensified, a number of the so called projects are more in the

nature of programmes consisting of several individual schemes and sub-projects as yet at too preliminary a stage of development to rate a separate project director or a separate ledger in our Central Accounts, but important enough nevertheless, to claim particular mention which we do in a separate chapter in the Appendix to this report.

### **Progress**

Increase in financial expenditure cannot by itself be taken as an indication of the progress made by the Authority. We shall report here briefly, and in detail in the Appendix, that there has been proportionate physical progress as well. A number of our projects went into commission during 1959-60. The biggest of these projects to come into operation was the Multan natural gas power station. With the almost simultaneous commissioning of the 220 kV Multan-Lyallpur transmission line and the Warsak hydel station in May, the Authority lifted controls on power consumption which had been in force for over two decades. Several more sections of the 650 mile network of the primary grid, such as the Warsak-Wah section were completed, enabling the Electricity Operations Department to give new connections to over 31,000 domestic, 1,900 industrial and 860 agricultural (tubewell) consumers. All this resulted in raising the maximum demand on the West Pakistan grid from 103,000 kw to 131,000 kw and the sale of over 600 million units as compared to the sale of 120 million units in the last quarter of the previous year. Also during the same period about 300 villages were electrified, involving the running of over 450 miles of high tension and 200 miles of low tension lines, and adding nearly 10,000 kVa transformer capacity to the system. The Shadiwal hydel project was taken a stage further to completion and is now expected to be in commission in early 1961.

Last year's report covered only 15 days' work on the Rawal dam project. This year we report the completion of the main dam up to the spillway gate level, the formation of a lake covering one square mile and maintaining a regular supply of drinking water to Rawalpindi city. At Gudu, work has progressed with the building of another 25 piers up to the crest level—the number of piers so completed and reported last year was 21. On the canals 75 per cent of the work on the Begari-Sind Feeder was completed. In the salinity control project in the Rechna doab another 569 tubewells were drilled and the rate of progress reached 30 wells a month; this rate is expected to increase still further to 100 wells a month to complete the project by mid-1961. The Machinery Pool Organisation now has 74% of the equipment in use; when it was formed only 50% of the equipment was usable.

Even more satisfying than the physical progress has been the achievement on the organisational front, particularly for the execution of the works included in the Indus Basin Settlement Plan. During the year under review we began moving into position for the actual construction job under the proposed Plan. This programme is estimated to cost about a billion dollars and will be financed out of a Fund to be set up with contributions from the United States, United Kingdom, Canada, West Germany, Australia, New Zealand and India, and with loans from the International Bank for Reconstruction and Development which will also be the Administrator of the Fund. Since

the nomination of the Authority by the Government of Pakistan as the sole agency to execute these works on its behalf, the Authority has gone ahead with detailed investigation of the individual projects and with the execution of the preliminary works. Consultants have been engaged for the various projects, a new directorate has been set up at headquarters under the Chief Engineer (Water) to co-ordinate the activities of the project directors engaged on the Indus Basin Settlement Plan works.

To help maintain a close liaison between the headquarters and the various projects, especially the replacement works, the Authority is planning a high frequency radio network. This is to provide radio telephone and radio teleprinter connections between Wapda headquarters at Lahore and the project centres at Mangla, Tarbela, Balloki, Lyallpur, Rasul, Qadirabad, Trimmu, Sidhnai, Taunsa, Mailsi, Karachi, Naran, Campbellpur, Kohat, Peshawar, Tank, Dhok Pattan, Hafizabad, Shahkot, Bela, Gudu, Darwat, Sibi, Sukkur and Hyderabad. The network is being designed by the Telecommunications Section of the office of Wapda's Chief Engineer (Power Development). The system when established will make it possible for the project centres to have V.H.F. radio communication with mobile construction crews and with headquarters. Specifications and tenders for the radio network have been drafted but the scheme, until the close of the year under report, was still under clearance with the Posts and Telegraphs Department of the Government of Pakistan.

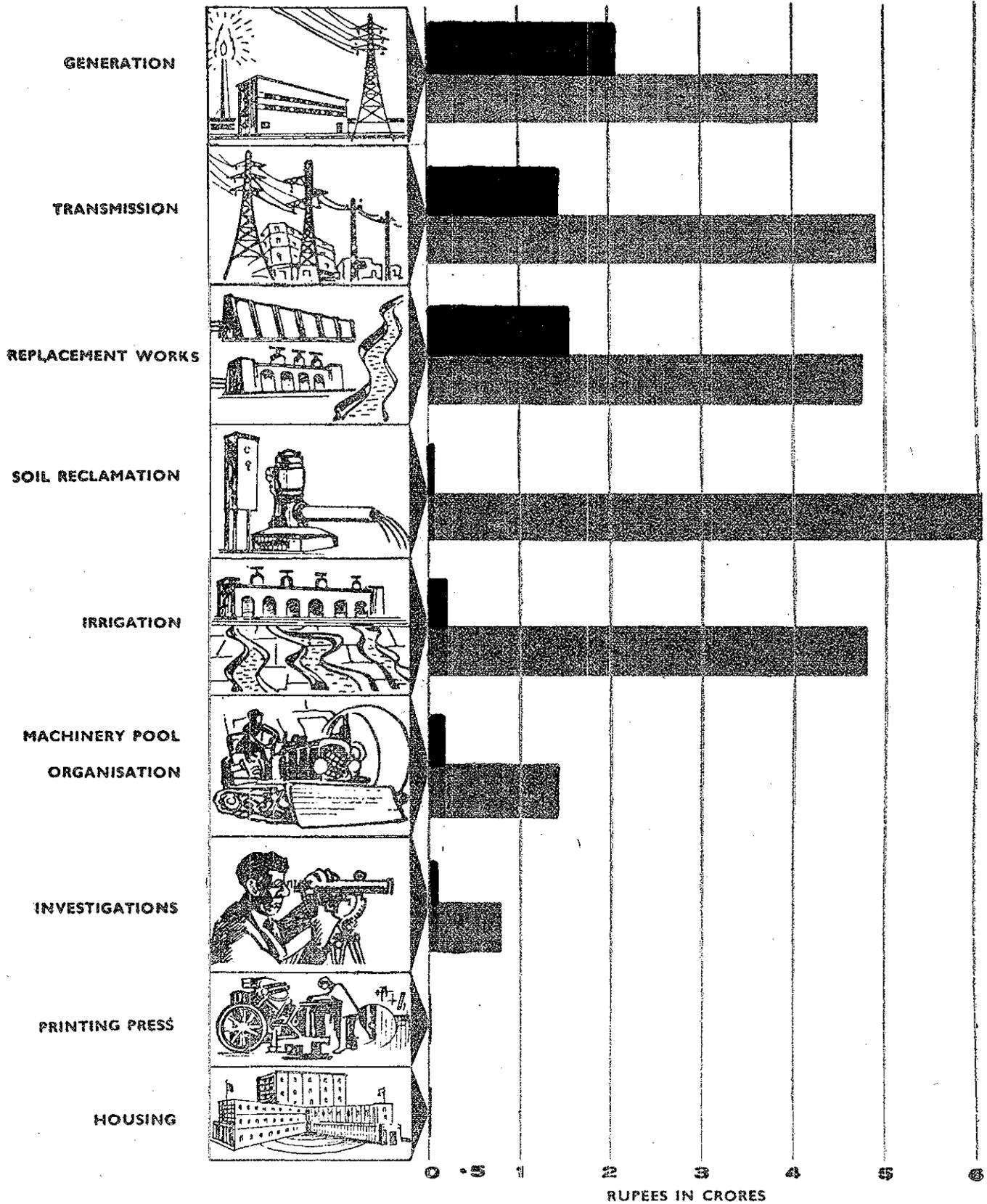
Meanwhile, progress was accorded on providing the West Pakistan grid with a telecommunications and control system. This system uses the power lines themselves as carriers for the purpose of communications between the various grid stations and the central control. A carrier link was established between Warsak and Wah and interlinked with the carrier link between Warsak and Dargai. Work is now in hand to provide a direct High Frequency Radio link between Shalimar and Warsak. When complete this control system will help greatly in the quick location of faults on the grid and in grid operations generally.

### **Wapda Charter**

The progress outlined above has been towards the fulfilment of Wapda's responsibilities as laid down in the West Pakistan Water and Power Development Authority Act. According to the Wapda Act, the Authority is to develop West Pakistan's water and power resources on a unified and multipurpose basis. The Authority's functions cover.

- i) the development of irrigation, and water supply and drainage; and recreational use of water resources;
- ii) the generation, transmission and distribution of power; and the construction, maintenance and operation of power houses and grids;
- iii) flood control and watershed management
- iv) the prevention of waterlogging and reclamation of waterlogged and salted lands
- v) inland navigation and

### EXPENDITURE ON PROJECTS UNDER EXECUTION



1958-59

1959-60

- vi) the prevention of any ill effects on public health resulting from the operations of the Authority.

### **Planning and Investigations**

And what these responsibilities mean to the national economy is underlined in Pakistan's Second Five Year Plan. The largest sector in the Second Plan is that dealing with the development of water and power resources. Agricultural and industrial progress is dependent mainly on the successful implementation of schemes for irrigation, soil reclamation and generation, transmission and distribution of electricity. What the Authority has been doing in these fields is shown in the expenditure chart on page iv.

Along with construction jobs and operational activities we have speeded up, as the expenditure chart indicates, investigations and surveys connected with the preparation of a master plan for our future projects. The formulation of this comprehensive guide, by its very nature, is a long term assignment. Work on it has been slow in gathering momentum because of the absence of basic hydrological, meteorological, topographical and geological data.

To collect this basic data on a systematic basis the necessary surveys have begun and are well in hand. Land is being classified for its capabilities and ground water is being assessed for its yield and quality. Sedimentation records are being collected and availability of construction materials is being investigated. To assess the availability of surface flows in point of time and place hydrological data is being processed along with site investigations of likely future storage sites. It is hoped that an appraisal report of the available land and water resources on which the master plan will be built will be available by about the middle of 1961-62 fiscal year.

The ends for which the master plan is to serve as a means are already known. The main objective is increased agricultural production to meet the ever increasing food and fibre requirements of the population. Considerable work has been done already on co-relating the land and water resources as currently known to these needs, for which tentative projections have been made right up to the end of the century.

Assuming a growth rate of 1.8 per cent we estimate that the population in West Pakistan in 1960 will be about 39 million. At present one acre of land under food crops is producing barely enough to feed one person for one year. Keeping this in mind and taking into consideration the food elements obtained from livestock, about 8 million new crop acres are required to remove the existing food deficiency. In 1965, this figure will rise to over 12 million acres and by 2000 A.D. it will have increased to 48 million acres. Production of cash crops and raising of livestock for the growing population will need still more acreage to be brought under cultivation.

With over 50 million acres of culturable virgin land still being available our land resources are more than sufficient to meet our land requirements upon the turn of the century. The water resources position as now known is however not as happy. The current estimate of water availability, both surface flows and utilizable ground

water, that it is not likely to be equate for the water requirements of these additional 50 million acres of land. In addition to these agricultural uses there will also be in the years to come increasingly large demands for municipal and industrial water. But these estimates are still to be defined and indications are that in the ground water which we have just about started exploiting we may yet have a potential which, utilized in conjunction with the surface water, may go a long way in meeting the deficit now apparent in the future water budget.

Wapda's investigations and future planning is being made against the background of this situation. In the decades to come the greatest natural resource may turn out to be human skill and ingenuity. Already scientific knowledge is on the threshold of discoveries which can literally change the geography of the world. Artificial rain making, within limits, is an established fact. Commercially successful conversion processes have been developed to separate salt from sea water at a cost of 25 annas per thousand gallons. With improvement in techniques this cost should come down considerably enabling sea water to be used for agricultural purposes. The reduction of seepage losses in the canals which account for almost 40% of the water withdrawals from the rivers can be another source for augmenting our utilizable water resources. Again, the direct precipitation that our lands receive is not put to optimum use at present for lack of an adequate programme of soil and water conservation or watershed management. Water and land resources are interdependent and the use of each in such a manner as will contribute to the usefulness of the other can appreciably enhance the productivity of both. These are matters to which we will address ourselves in due course. In the meantime we are going ahead with the preparation of the master plan in a manner which will make in the foreseeable future the best possible use of the available land and water resources through techniques already known and proved.

During the year under report we also made a preliminary appraisal of the power resource potential. It is our intention to develop this potential according to the demand for power from time to time. For this purpose a power market survey was completed during the year with the power market divided roughly into two categories: the zone served by the grid covering Peshawar, Dera Ismail Khan, Rawalpindi, Sargodha, Lahore, Multan and Bahawalpur divisions and the other comprising the remaining areas of West Pakistan (excluding Karachi) served by the isolated stations in the Sukkur, Hyderabad and Quetta areas. In the grid zone the Authority is operating 7 hydel stations (including Warsak which was informally handed over to Wapda when partially commissioned) and 6 thermal stations, two of them run on diesel. The total installed capacity in the grid zone, with the completion of Warsak and Multan will be about 416,000 kw. After providing for a reserve capacity of 64,000 kw, the net available capacity in summer will be 337,000 kw and in winter about 212,000 kw. The Upper Sind region is served by 8 thermal stations (including one privately owned station at Sukkur) and the Lower Sind and Quetta region by 6 thermal stations each (the Quetta station is also privately owned). Their total installed capacity is about 15,000 kw; the effective capacity being 11,000 kw.

The power market survey of the grid zone indicates that the power consumption is just over 20 units (kwh) per capita. Worked out for the whole of West Pakistan (excluding Karachi) this figure would be very much lower. How low this figure is becomes evident when it is compared with per capita consumption in other countries: India, 38; Turkey, 92; Japan, 870; U. K., 2,083 ; U. S. A., 4,159 ; and Canada, 5,640.

After taking into account the pent-up demand and the future requirements as reflected in the Second Five Year Development Plan, it is estimated that the demand by the end of 1962 will be of the order of 338,000 kw and by the end of 1965 it will rise to 507,000 kw. This will absorb nearly all of the new generation which will be provided by the Multan, Warsak, Shadiwal and Gujranwala stations. This indicates that about 115,000 kw of new generating capacity will be required to meet the peak in December, 1962, and 283,000 kw in December, 1965. These figures are arrived at after taking one machine of 65,000 kw at Multan which is the largest unit in the system as reserve. The anticipated demand and the new generation required from 1962 to 1968 are given below:—

Date	Anticipated Demand	New Generation required
December		
1962	338,000	115,000
1963	389,000	165,000
1964	445,000	221,000
1965	507,000	283,000
1966	558,000	343,000
1967	614,000	399,000
1968	675,000	460,000

The Authority has in hand several other schemes to fill the power gaps between demand and supply. The first of these is a plan to expand the Multan natural gas power station by 130,000 kw, and for this project an offer of financial assistance has been received from a West German consortium of firms through a West German bank. The next major gap will be in 1965 and the Authority is at present investigating the Kunhar hydel scheme to meet this gap. In 1968, power will be available from Mangla.

In the Sind and Quetta regions the present shortage is to be met by installing thermal stations at Sukkur (30,000 kw), Hyderabad (20,000 kw) and Quetta (15,000 kw). The progress on the Hyderabad and Sukkur projects is described in the Appendix. Installation of the Quetta thermal station for which preliminary work is in progress will begin when DLF accepts our application for a loan to meet the foreign exchange cost of the project.

### **New Power Tariff**

Shortly after taking over the Electricity Department the Authority began, with the help of an expert on tariffs from the Electricity de France, a study of the different tariff rates in force in different areas of the grid zone—a legacy from the pre-integration

days when the Punjab and the Frontier Governments had their own schedules of electricity rates—with a view to unifying and rationalising them.

The new tariff rates which take into account the additional capital outlays on the Warsak and Multan power stations, the primary grid and the secondary transmission and distribution network were announced by the Authority on the last day of the period covered by this report and became effective from the 1st of July, 1960. The main features of the new tariffs are: substantial reductions for agriculturists in the central zone using power for tubewell or lift irrigation; a decrease of 3 pies per unit on the average for small and cottage industries in the central zone; a 5 to 13 per cent increase for the big industries in the central zone and higher increases for such industries in the northern zone; abolition of rental for the first 100 feet of service lines in the northern zone and a small reduction for domestic consumers in the northern zone with no change in the rate of domestic supply in the central zone. The new rates were notified under Section 25 of the Wapda Act.

### **Organisation**

The organisational pattern of the Authority continued to be tribasic: **Administration and Co-ordination, Water and Power**. There was, however, considerable overall expansion. To the administrative and co-ordinating wing were added divisions for Internal Audit, and Finance and Budget Co-ordination. The control of the Purchase Directorate was transferred to the Chief Engineer (Water). Added also to the Water wing were new sections to deal with the works to be constructed under the proposed Indus Basin Settlement Plan and for planning and investigations in connection with the preparation of the master plan. The Water wing continues to be responsible for the planning, investigation and execution of all new water development schemes, reporting on the progress made on projects already underway, co-ordinating and scrutinizing proposals of project directors and dealing with establishment cases of the staff of the rank of executive engineers and above. The Power wing is responsible for the generation, transmission and distribution of electricity. Its functions are bifurcated into operational and development branches, the latter discharging in respect of power schemes more or less the same functions as the Water wing in respect of water schemes. The Authority also has a Resident Representative in Karachi for liaison with Central Government offices there, for opening of letters of credit, for physical imports after orders have been placed by the project directors on the head office and for arranging the clearing and forwarding of imported goods, and agents in London, New York and Paris to handle enquiries, arrange for shipments, of goods purchased abroad and for other miscellaneous functions connected with the work of the Authority overseas.

### **Accommodation**

Wapda's head office is still at the Pipals, the 36 suite hostel of the former West Pakistan MPAs'. The fact that Wapda headquarters had outgrown this accommodation was commented upon in the report submitted last year. With the expansion of our activities, with the opening of more divisions and appointment of more consultants and staff at headquarters it was necessary to hire several more private buildings in Lahore, many of them in Gulberg. Telephone connections in Gulberg being difficult to obtain

during the year under report some of the offices remained without adequate telephone facilities for several months. The absence of a building where all main offices of the Authority can be accommodated has continued to cause delays and create difficulties in the proper co-ordination of our activities. A scheme has now been prepared for the construction of **Wapda House** to accommodate all personnel connected with the head office. The scheme will be taken in hand for execution as soon as the Government of West Pakistan decides to transfer to the Authority a suitable plot of land in some central locality.

The Authority is faced also with the problem of finding residential accommodation for its increasing staff, both foreign and Pakistani. During the year under review it was decided to build 36 flats near the crossing of the Gulberg and Race Course roads. These flats will be in a four storeyed building on a plot of 12 kanals only and will be ready for occupation by about the middle of 1961.

### **Wapda Publications**

There is a great demand from within the country and from abroad for information about Wapda's activities. This demand has increased since the announcement that Wapda is to implement the construction programme under the Indus Basin Settlement Plan. As a statutory body accountable to the Government and the taxpayer we have to satisfy this demand for information about our plans and activities and to meet it our Public Relations Division has undertaken a publications programme.

Wapda's monthly journal, **Indus**, started publication in February, 1960. The cost of producing the first five issues of **Indus** was about Rs. 30,000 and the income from advertisements and sales of the same issues was about Rs. 33,500.

Simultaneously with the present report the Public Relations Division is producing **Wapda Miscellany, 1960**. Its cost is estimated at Rs. 20,000 and the income from advertisements and sales at Rs. 25,000.

In addition to **Indus** and **Wapda Miscellany** several other brochures, both in Urdu and English were produced. Among them was "DLF Loans and Wapda", produced on the occasion of the visit to Pakistan of the Managing Director of the U. S. Development Loan Fund. The United States Government later made a request for 1500 copies of this brochure and these were distributed by the United States Information Service.

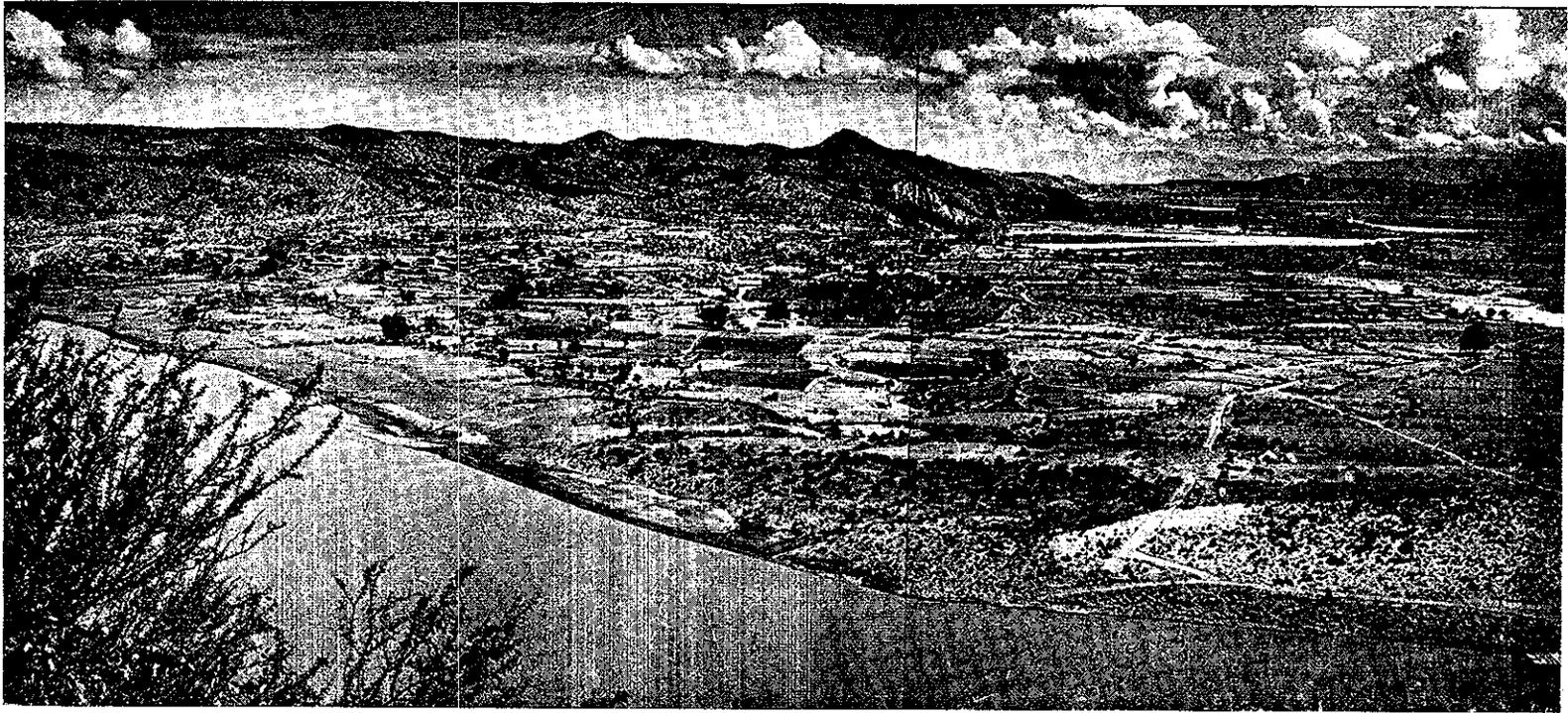
### **Wapda Act**

There have been no further amendments in the Wapda Act. During the period covered in the previous report the Wapda Act was amended to enable the Authority to function as the Central Government's agent for any projects assigned to it; to take over the Electricity Department of the West Pakistan Government; and to make the staff of the Electricity and Irrigation Departments transferable to the Authority.

### **The Authority**

There was also no change in the personnel of the Authority; Mr. Ghulam Faruque continued as Chairman; Mr. Ghulam Ishaq and Mr. A. M. Sial as Members; and Mr. S. M. Raza as Financial Adviser.

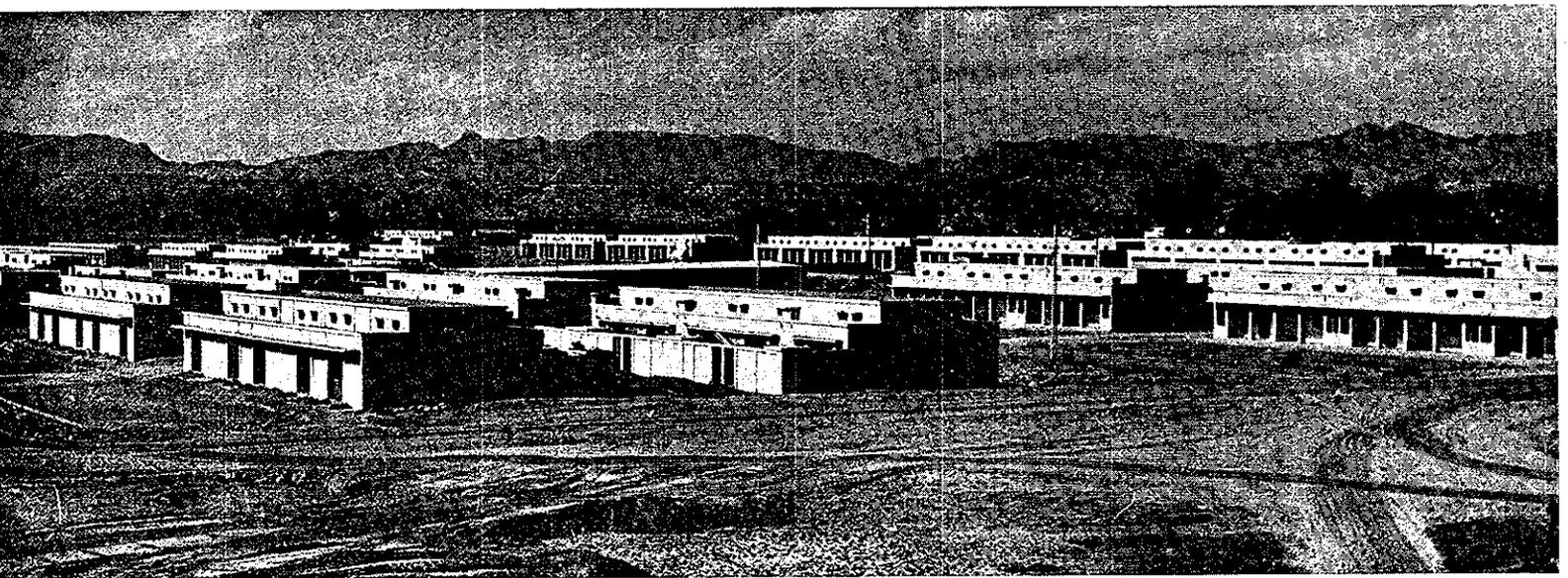
## MANGLA AND TARBELA DAM PROJECTS



▲ A view of the area which will be submerged on the completion of the Mangla dam.

▼ A view of Tarbela dam site overlooking the proposed dam axis. The construction colony shows at the right.



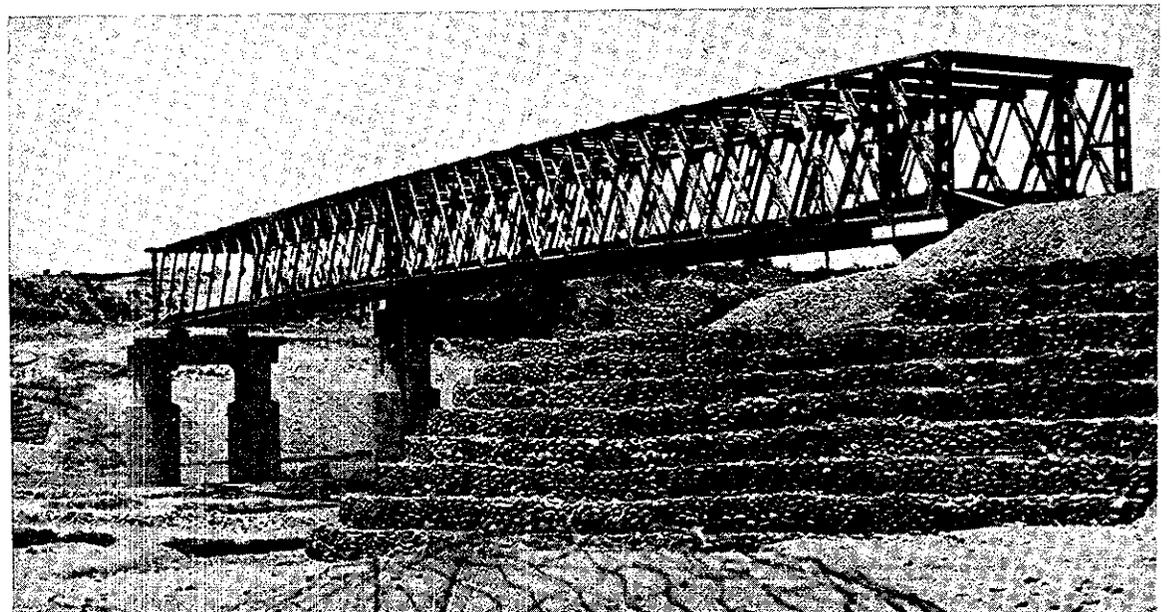


A view of the construction colony at Mangla. ^



< Preliminary investigations in progress at Tarbela dam site:  
Drilling for rock specimen.

>  
Two spans of the Mangla  
access bridge.



## MANGLA DAM PROJECT

1. **NAME OF PROJECT** .. Mangla Dam Project.
2. **NATURE OF REPORT** .. Annual.
3. **PERIOD COVERED** .. Is July, 1959 to 30th June, 1960.

4. **DATE AND DETAILS OF SANCTION**

Project was sanctioned by the Government of Pakistan.

- i) Vide letter No. WD-7(I)/54-I dated 10-8-55 from Ministry of Industries Government of Pakistan, Karachi.
- ii) Vide letter No. A & B (428)/55 dated 9-4-55, from Ministry of Industries, Government of Pakistan, Karachi.
- iii) Vide letter No. A & B-9(456)/56-II, dated 10-8-57, from Ministry of Industries, Government of Pakistan, Karachi.
- iv) Vide letter No. 200(38) W-II/58, dated 10-2-58, from Ministry of Industries, Government of Pakistan.

5. **PURPOSE AND COST OF PROJECT**

The Mangla Dam, a multi-purpose project, is designed to control and conserve the flood waters of the Jhelum, for use mainly as replacement irrigation supplies for the area now served by the three eastern rivers. In addition, the project provides for hydro-electric power development on a large scale — the installed capacity in the first stage will be 300,000 kilowatts out of a total power potential of 900,000 kilowatts to be developed gradually, as and when needed. The dam will be located across the Jhelum about one mile upstream of the Upper Jhelum Canal regulator. It will be an earth embankment with a maximum height (measured from river bed level) of 370 feet and a crest length of approximately 11,000 feet. The reservoir so created will have a gross storage capacity of 5.3 million acre feet and will cover an area of about 100 square miles.

The dam will be flanked by a power station on the left and a spillway structure on the right. The spillway will be of the submerged orifice type with a discharging capacity of 1.2 million cusecs.

The approximate estimated cost of the project with no provision for future raising will be Rs. 149 crores if Mirpur Dyke is found feasible or Rs. 169 crores if the Jari Dam is to be built. The corresponding costs with provision for future raising will be Rs. 159 crores and Rs. 182 crores respectively. The proposed future raising will be of the order of 50 feet which will increase the gross storage capacity to 8.5 million acre feet.

## 6. PROGRESS

Surveys and investigations for fine aggregates at Campbellpur, Dina Nullah and Suketar Nullah were completed.

A large field grouting test on alluvium has been completed while rock grouting tests continue. Field permeability tests have also been carried out. Large scale drilling for design purposes was also taken in hand in the spillway area.

In order to ascertain the behaviour of the rock during tunnelling operations a trial adit 7 feet wide and 7 feet high in section and 600 feet in length was excavated.

Along with the field investigations usual tests were carried out in the Soils and Concrete Laboratories. The Soil Laboratory is now fully equipped to undertake soil tests of any description.

Hydraulic model studies to determine the most suitable type of spillway structure are being conducted at St. Anthony Falls Hydraulic Research Station, USA. Model studies are also in progress at Lahore and at Nandipur for the diversion and power tunnel arrangements.

### Preparatory works

The embankment for Hastedpur-Mangla rail link is nearing completion while the laying of track and the construction of bridges and culverts are in progress. Satisfactory progress has been made on the construction of skeleton residential accommodation and essential services such as water supply, electricity, sewerage and approach roads to the supervisory staff camp at Baral and the labour camp near Thil.

The most important work in hand is the construction of the access bridge over the Jhelum at Mangla. This bridge, estimated to cost about Rs. 55 lakhs, is 650 feet long with a 26 feet wide carriageway and is capable of carrying a maximum single load of 220 tons. Work on the bridge was started on the 1st of October, 1959. The pier foundations comprise 97 reinforced concrete bored piles. Each pile is about 45 feet deep and the surrounding alluvium has been grouted with cement and clay slurry. The massive reinforced cement concrete piers and abutments were completed by April, 1960. The left bank approach embankment was completed in the short space of a month to enable the erection and launching of the steel superstructure of the two smaller spans from the left end. The right bank approach to the bridge is through a 75 feet deep cut. The two smaller spans have been assembled and launched in position. In spite of unfavourable monsoon weather, good progress is being maintained on the erection and launching of the main span from the right bank. It is hoped to complete the bridge by the middle of February, 1961.

## **7. COMPARISON WITH PROGRESS DURING PREVIOUS YEAR**

The interim report and preliminary designs prepared by the Consultants, Messrs Binnie, Deacon and Gourley, during the last report period were examined by a Board of Consultants who later visited the site also. Based on their recommendations, a series of model studies and site investigations directed towards reducing the cost and improving the safety of the Project were carried out.

Contract drawings for the spillway, dam, tunnels and other ancillary works have been started and it may now be possible to issue the tender documents during February, 1961.

## **8. BUDGET**

The total budget allocation of the project was Rs. 270 lakhs and the total actual expenditure after adjustment of all debits is likely to be of the same order.

## MANGLA DAM RESETTLEMENT ORGANIZATION

1. **NAME OF PROJECT** .. Mangla Dam Project Resettlement Organization, Mirpur.
2. **NATURE OF REPORT** .. Annual.
3. **PERIOD** .. August, 1959 to 30th June, 1960
4. **DATE AND DETAILS OF SANCTION**
  - (a) Ministry of Economic Affairs conveying approval of Economic Council. Letter No. WD-7(1)/54-1, of 10-8-55 from Ministry of Industries, Government of Pakistan, Karachi.
  - (b) Central Ministry/Provincial Government conveying detailed sanction.
    - (i) Letter No. A & B (428)/55 of 9-4-55 from Ministry of Industries, Government of Pakistan, Karachi.
    - (ii) Letter No. A & B-9 (456)/56-2, dated 10-8-58 from Ministry of Industries, Government of Pakistan, Karachi.

### 5. PURPOSE AND COST OF PROJECT

The Resettlement Organization, headed by a Chief Engineer, was set up in August, 1959 with the immediate object of resettling a large population facing displacement due to the planned creation of the Mangla Reservoir. The reservoir to be created by the construction of the Mangla Dam will submerge the whole of the existing town of Mirpur, the township of Dhudial and more than 200 villages.

The objectives set before the Resettlement Organization are:—

- (i) To rehabilitate the urban population in a new town to be constructed just outside the reservoir.
- (ii) To rehabilitate the artisan class of the affected villages in a number of hamlets and townships to be built around the periphery of the reservoir.
- (iii) To rehabilitate the agriculturist class of the affected population on lands to be procured in West Pakistan.

The Resettlement Organization, therefore, consists, mainly of two sections:—

- (i) Engineering Section.
- (ii) Revenue Section.

The Engineering Section is engaged in the planning and construction of a new town, a road around the periphery of the reservoir besides a number of internal roads, a number of small townships and hamlets in the Azad Kashmir territory, and the con-

struction of village abadis in West Pakistan. Construction of small earthen dams to store up water in the nullahs for construction as well as drinking purposes, also forms part of the engineering activities. This section is also busy with the evaluation of built up property within the reservoir for the purpose of compensating the property holders.

The main functions of the Revenue Section are:

(a) To acquire the land which is going to be submerged by the reservoir and that required for connected works outside the reservoir. The necessary staff for this purpose has been employed by the Azad Kashmir Government in their territory under a senior officer called the Commissioner, Mangla Dam Affairs. In West Pakistan territory, similar staff has been appointed by the West Pakistan Government. As the cost of both these staffs is met by Wapda vigilant financial control has to be exercised by the Resettlement Organization.

(b) To select suitable lands in West Pakistan for the resettlement of the affected land owners, and to develop such lands, where necessary, before allotment to the settlers.

(c) To resettle the affected families on land so procured in accordance with the policy laid down by the Pakistan Government in consultation with the Azad Kashmir Government.

The total estimated cost of the entire scheme (Stage I upto R. L. 1210) including expenditure in foreign currency of Rs. 200 lakhs is Rs. 2,395.93 lakhs as per the following details:—

1. Cost of land .. .. .	Rs.	888.15 lakhs
2. Cost of built up property .. .. .	"	539.23 "
3. Compensation for trees .. .. .	"	61.04 "
4. Compensation for shrines and miscellaneous rights .. .. .	"	7.71 "
5. Compulsory acquisition allowance at 15% of item 1, 2 & 3 .. .. .	"	223.26 "
6. Periphery roads including bridges & Culverts etc. .. .. .	"	130.00 "
7. Construction of 6 hamlets & New Mirpur Town .. .. .	"	267.30 "
8. Rehabilitation of non-agriculturist classes by providing Cottage Industries .. .. .	"	10.00 "
9. Resettlement .. .. .	"	130.39 "
10. Contingencies and unforeseen expenditure .. .. .	"	112.85 "
11. (i) Establishment of Chief Engineer, Resettlement and Commissioner, Mangla Dam Affairs .. .. .	"	84.00 "
(ii) Temporary accommodation, transport, office furniture, stationery, etc. .. .. .	"	42.00 "
Total .. .. .	"	<u>2495.93 "</u>

## 12. Credit

Cost of material, built up property and trees, by auction .. .. .	100.00
Net cost ..	2395.93
(Million) ..	50.335 dollars

Expenditure in foreign currency Rs. 200 lakhs out of Rs. 2395.93 lakhs.

(Million) .. 4.201 dollars

The work is to be executed in two stages, and the additional cost for the second stage (R. L. 1262) will be Rs. 527 lakhs.

## 6. PROGRESS UPTO JUNE 1960

### I. ENGINEERING SECTION

#### (i) Construction of New Town

To resettle the population residing in the town of Mirpur (to be submerged in the reservoir) a new town is being planned at Balagala, about 3 miles from the existing town and situated between Mirpur and Mangla. A detailed survey of the site has been carried out and the work of town planning is nearing completion. The existing town is a small one, pretty-old fashioned, the people living mostly in old houses devoid of basic facilities, such as sanitation, good water supply, proper streets, electricity and public parks. Generally the town is unhygienic.

The new town being a district headquarters, is being planned on modern lines. Amenities such as electricity, chlorinated water supply and underground sewerage system will be provided. As the town will be connected with the main power grid at Dina (West Pakistan) it will help to encourage the establishment of small scale industries which will be a good source of employment for the affected population. The town is bound to flourish commercially and industrially as it is proposed to be connected by rail with the West Pakistan railway network through Mangla.

After the reservoir is full, fishing industry is likely to grow rapidly and add substantially to the national food production. Air conditioned house boats like those on the Dal Lake in Srinagar will attract tourists and provide employment for the local population. Timber industries will develop, rapidly as all the timber floating down the Jhelum and Poonch rivers will now be intercepted by the Dam. There will be several beautiful islands in the reservoir where tourist resorts can be developed. The formation of the reservoir will give a great fillip to the development of forests, sericulture, sheep breeding etc. on the adjoining hill slopes.

#### (ii) Construction of hamlets and small townships

A number of hamlets and small townships around the periphery of the reservoir will be constructed to house the non-migrating population of the affected villages.

One such hamlet is already under construction near Mangla where about a thousand families will be accommodated.

### **(iii) Construction of road along the periphery of the reservoir**

With the construction of the Mangla Dam and the creation of a reservoir the existing town of Mirpur and a greater part of the existing lines of main communication in the area will be submerged under water, including the Mirpur-Kotli road to a length of about 12 miles. Since the existing Mirpur town has to be shifted outside the reservoir to rehabilitate and resettle the displaced population, the necessity of constructing new roads, running outside the reservoir and connecting those small towns and important villages which would otherwise be cut off from the district headquarters due to the creation of the reservoir is obvious. With a view to fulfilling the above necessity, the work of road construction has already been taken in hand. The Mangla-Mirpur Road, connecting Mangla with the new Mirpur is currently under construction. Apart from providing communication, this road will greatly facilitate the construction of the main dykes which incidentally all lie in this area. When complete, it will reduce the distance between Jhelum and Mirpur by 5 miles and that between Muzaffarabad and Mirpur by 20 miles. The construction of the road is therefore of vital importance for linking West Pakistan with Azad Kashmir and the two wings of the Azad Kashmir territory between which not a single all weather road now exists. The periphery roads will also afford an excellent view of the reservoir and as such will be a source of attraction to the tourists. Survey work on the periphery roads is in progress.

### **(iv) Small earthen dams**

As there is an acute shortage of water in this area, various economical devices are being explored not only to meet the requirements of the new town but also of the hamlets and townships. In this region there are no apparent sources of water available within easy means. Therefore attempts were made to install tubewells through various firms etc. As there was no immediate possibility of sinking tubewells for the town, it was proposed to collect rain water by constructing, in suitable spots, earthen dams, across nullahs and ravines. One such site at Balagala and another at Akalgarh (where a township will be constructed) were selected and necessary investigations were completed. This stored water will not only be useful during the construction of the town and townships but will also be useful for the domestic needs of the people.

### **(v) Demarcation of the reservoir**

The entire boundary of the reservoir has been demarcated at RL 1270 by pucca burjies (demarcation pillars).

### **(vi) Temporary colony**

Since Mirpur was established as the headquarters of the Chief Engineer, Mangla Resettlement, and his organization, the question of housing the staff both for office and residential purposes became very important. Hence temporary structures of cheap

and economical specifications such as sun-dried brick walling and tin roofs had to be constructed. In addition to this a large number of shouldaris and tents had also to be pitched both for residential and office accommodation. The existing approach road to the colony in Mirpur was in a very bad state of repair. To avoid excessive wear and tear, and damage to the large number of vehicles using this road, surfacing had to be done for a length of about 4,000 feet.

### (vii) Transport and machinery

With the opening of Resettlement Organization and during the first shipping period (July to December '59) the following machinery was imported against the foreign exchange allocation of Rs. 15 lakhs allotted to this Organization.

<i>Vehicles and Machinery</i>	<i>Number</i>
T. D.—25 Dozers .. .. .	2
Diesel road rollers .. .. .	3
Willys Jeeps .. .. .	8
Land Rovers .. .. .	5
Volkswagon buses .. .. .	4
Electric welding sets .. .. .	2
Trucks .. .. .	14

In the next shipping period (January to June 1960) orders for the supply of the following vehicles and machinery have been placed against a foreign exchange of Rs. 22 lakhs.

	<i>Number</i>
Diesel road rollers .. .. .	2
Brick moulding machine .. .. .	2
Motor grader .. .. .	1
Willys Jeeps & pick ups .. .. .	16
Trucks .. .. .	32

The heavy vehicles are meant for transportation of villagers to the new places of resettlement and the materials for construction.

### (viii) Assessment of built-up property

Since the volume of engineering work increased considerably, the necessity of creating one more division at the end of January, 1960, arose for the assessment of built-up property. This was created to expedite the evaluation of built-up property. In the initial stages assessment of built-up property was being done by detailed measurements. This method was not only time consuming but uneconomical as well. Therefore, the plinth area basis was adopted as the new method of evaluation of the built-up property. For this purpose a committee of Executive Engineers and Sub-Divisional Officers was constituted with an equal number of representatives of both Wapda and Azad Kashmir Government. This was done to avoid dissatisfaction among the public. Subsequently, in actual practice, it was found that so far as buildings with boulder in mud and katcha masonry were concerned (which, of course, constitute the

largest number) this mode of plinth area basis proved very useful, but for pucca buildings, since variety of items are involved, detailed measurements are being continued.

The total number of houses required to be assessed are 30,900. Out of this 10,616 houses were assessed upto the end of June, 1960. Thus about 34 per cent of the total work has been completed. The entire work of assessment is expected to be completed within the financial year 1960-61.

#### **ix) Rehabilitation in West Pakistan**

At the end of April, 1960 another division was created in Multan district with Jahanian as its headquarters. The object of creating this division was to construct speedily village abadis including provision of such basic amenities as water supply in the acquired land for the rehabilitation of displaced agriculturist classes affected by the construction of Mangla Dam. Transitory huts were also constructed to meet the immediate requirements of the displaced persons. These huts were proposed to be given free of cost to the affected people so that in due course they could build houses of their own. About 55 chaks were acquired to accommodate such persons. All these activities were in full swing but they had to be suspended due to nonacceptance of this land by the affected population though the top revenue officers of the Azad Jammu and Kashmir Government had inspected the same in detail and considered it as very good land and had accepted the same. This division has, therefore, been shifted to Mirpur for works to be undertaken around Mirpur.

## **II. REVENUE SECTION**

The main functions of this section have already been stated. The progress made under each head is reviewed below:

### **i) Procurement of land for resettlement**

This year discussions and deliberations gave place to decisions and their implementation. By curtailing to the reducible minimum the intervals between proposals, decisions and actions, considerable success was achieved in the procurement of land in West Pakistan for resettlement of persons to be displaced, a problem which earlier seemed to be an acute one and had defied solution. In October, 1959, the West Pakistan Government transferred to Wapda 90,000 acres of state owned land for this purpose. As desired by the West Pakistan Government, inspecting teams headed by experienced Revenue Officers were sent to the colony districts of the Punjab area for the selection of developed and irrigated land. Out of an area of 21,478 acres selected by these parties in Montgomery, Lyallpur, Multan and Sargodha districts, the West Pakistan Government agreed, in another meeting held with the Governor, to transfer to us 10,117 acres in Multan district. Physical possession of 7,926 acres had been taken over by the end of the period covered by this report.

An area measuring 2,171 (698 acres in Sheikhpura and 1,473 acres in Gujranwala district) had already been transferred to the Mangla Resettlement Organization in December, 1958. The land in Gujranwala district is affected by *thur* and its reclama-

tion has been taken in had this year with the help of one tubewell. More tubewells are necessary and the organization is waiting for the tubewells which are going to be installed shortly in this area under the general programme for water-logging and salinity control by Wapda. After this, full reclamation operations will begin and be completed in about 3 years. The land cannot, therefore, be allotted to the displaced families from the project area at present.

The Chief Engineer, Resettlement, himself headed a party of senior officers for the selection of land on Ghulam Mohammad Barrage in Sind. An area measuring 46,000 acres in a compact block lying on both sides of Mirpur Sakro-Gharo Road was found suitable considering that it could form a separate colony which could be conveniently split up into small estates preserving the social, cultural and tribal homogeneity of the settlers. Unfortunately the Government could not see its way to transfer this area as it was later intimated that it had already been allocated either for various other schemes or for auction. Government has, however, only recently allocated to us 9,280 acres on G. M. Barrage in the non-perennial zone and has also promised further allocations in the same tract. A representative of Azad Kashmir Government will shortly go round that area to judge its suitability and declare acceptance, as is required by a Council Order of 1957 of Azad Kashmir Government.

At the suggestion of the West Pakistan Government, Chief Engineer Resettlement, accompanied by the Revenue Secretary, West Pakistan, and his own Revenue Officers visited Dera Ghazi Khan and Muzaffargarh districts in March, 1960 and found that certain lands under Government rakhs in Dera Ghazi Khan district were of good quality and could be made use of after proper development. They are shortly to get an assured supply of water from Taunsa Barrage. A party of Revenue Officers has been deputed for the preliminary reconnaissance and collection of data of the available area. All this was for Azad Kashmir people for whom land is required in sufficiently large compact blocks.

For the affected persons of West Pakistan, the Government has consented to make available 4,000 acres of land comprised in scattered patches lying in various colony districts of the Punjab area and Mangla Resettlement officers are busy selecting them in Sargodha and Multan districts.

More recently, the West Pakistan Government has offered to Wapda all the land leased out under Grow-More-Food scheme in the colony districts of the Punjab area. This has widened the scope for selection of land for the resettlement of the displaced families. An inspection team representing the West Pakistan Government, Azad Jammu & Kashmir Government and Wapda is to select good land out of the area offered. This team will be headed by a senior officer of the West Pakistan Government to ensure cooperation of the revenue staff of the various districts and to expedite the inspection and selection work.

## **ii) Acquisition of land**

The Resettlement Organization entrusted with the task of the remeasurement of the affected area and with the reconstruction of records thereof has prepared the

records of 59 villages. The Assessment Committee evaluated 21,509 acres of land, 3,13,036 trees and 5,230 building sites. Two Revenue Assistants were appointed to sit on the Assessment Committee, as representatives of Wapda to watch its interests. Revenue Officers assisted by qanungos and patwaris were also posted in the Assessment Section for checking the records prepared by the staff of the Azad Kashmir Government. This measure was taken to remove the oft-repeated complaints by the Collector that the records sent to him were incomplete and full of mistakes. The system of double check now introduced has ensured completeness and correctness of the acquisition papers. To cope with the increased work in Azad Kashmir, one more Collector was appointed in January, 1960. The total area to be acquired for the construction of the reservoir upto 1270 feet level is 88,400 acres, out of which about one fifth lies in West Pakistan and the rest in Azad Kashmir. The area required to be acquired for first stage (R. L. 1210) is 67,800 acres. Upto the end of the year under report, 7,492 acres had actually been acquired in Azad Kashmir territory and 1109 acres in West Pakistan. Steps have been taken to speed up the work and to remove bottle-necks in the way of the staff put on the job.

For the effective supervision of work in West Pakistan, the Resettlement Officer was relieved from the work of Azad Kashmir territory and put solely in charge of the acquisition work there. A separate whole time Collector was also appointed for the West Pakistan zone. With these measures the speed of work in Jhelum and Rawalpindi districts is expected to improve.

For the rehabilitation of the displaced persons, the Resettlement organisation is now in a position to act at a moment's notice as and when it is asked to go ahead with evacuation.

### **iii) General**

This report may also record the fact that employees of the Resettlement Organization had to work all the year round under very difficult conditions. Some of them had to live without a proper shelter against the biting cold and scorching heat. In the field work they had to deal very delicately with people naturally reluctant to leave their homes and lands. All this constituted a heavy strain on their tolerance and patience but it is very gratifying to record that they stood these tests well and with a sympathetic but firm approach to these human problems they have emerged from these trials with a better appreciation by the affected population of the work of Wapda's Mangla Resettlement Organisation.

## TARBELA DAM PROJECT

- 1. **NAME OF PROJECT** .. Tarbela Dam Project.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. July 1959 to 30th June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** Not available.
- 5. **PURPOSE AND COST OF PROJECT**

The Tarbela Dam is one of the projects to be built under the proposed Indus Basin Settlement Plan. Wapda has begun investigations and other preliminary work in anticipation of the Indus Waters Treaty. The Tarbela Dam will be on the Indus. Three possible dam sites, Kirpalian, Kiara and Bara are being investigated. So far Bara axis is the most promising one. It is situated six miles downstream of Tarbela village. Reconnaissance of Tarbela Project extending over a period of eighteen months was made during 1953-54 under the Dams Investigation Circle of the Government of Pakistan. Tipton & Hill were the consultants. A brief feasibility report was submitted to the Pakistan Government in October, 1954. In 1959, Wapda was asked to go ahead with the project as part of the replacement plan. The Tarbela Dam Organisation came into being on 1st August, 1959.

Although a definite project plan has not yet been prepared and therefore a good cost estimate is not yet available, preliminary estimates based on information collected so far indicate a cost of about Rs. 1,650 million, out of which Rs. 1150 million are estimated to be in foreign currency.

The plan for the Tarbela Dam is that it should be an earth and rock fill embankment, 375 feet high, impounding 6 million acre feet of water, developing 4 million acres of land and providing 1.1 million kw. (installed) power. A benefit of Rs. 200 million per year is expected in the form of national income from increased food production and industrial development.

### 6. PROGRESS

The project is still in the initial stages of investigations. Extensive work on surface and sub-surface exploration, hydrologic studies, and preliminary design studies are in progress. Sub-surface investigations include core and percussion drilling, seismic surveys, permeability tests, test pits and auger holes. Surface work includes geological mapping, topographic mapping, establishing permanent triangulation points, and soils mapping. Classification of cores and detailed laboratory testing of soils accompanies the above activities.

Drilling is being done by Messrs Indus Valley Construction Company, a combine of Pakistanis and a Yugoslav firm. The total core drilling to determine the general condition foundation area upto the end of June, 1960 was 8,690 feet out of which



## LINK CANALS

- 1. **NAME OF PROJECT** .. Indus Basin Project-Link Canals.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. July 1, 1959 to June 30, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Under sanction.
- 5. **PURPOSE AND COST OF PROJECT**

The link canals described below are to be constructed as part of the Indus Basin Settlement Plan after the signing of the Indus Waters Treaty. The other works under the Settlement Plan include two large storage dams and five barrages. The purpose of the link canals is to replace the flows of the Beas, Ravi, and Sutlej rivers, which will go to India under the treaty, by flows to be transferred from the Chenab, Jhelum, and Indus rivers, which are to remain with Pakistan.

A total of seven new links are to be constructed, as follows:

Link	From	To
Trimmu-Sidhnai	Chenab river	Ravi river
Sidhnai-Mailsi-Bahawal	Ravi river	Sutlej river and Bahawal canal.
Rasul-Qadirabad	Jhelum river	Chenab river.
Qadirabad-Balloki	Chenab river	Ravi river.
Balloki-Suleimanki II	B.S. No. I Ravi	Sutlej river.
Chasma-Jhelum	Indus river	Jhelum river.
Taunsa-Panjnad	Indus river	Chenab river.

The remodelling of the existing link canals and several smaller canals and canal systems is also included in the link canals work. Remodelling is to be done on the Marala-Ravi, the Bamberwala-Ravi-Bedian-Dipalpur, and Balloki-Suleimanki I links; and the Sidhnai canals, Dipalpur canal, Fordwah canal system, and the Mailsi and Pakpattan canal systems.

The cost of the link canals as estimated by Tipton and Kalmbach, Inc., consultants on the link canals work, is Rs. 1,342.9 million. The cost of the new link canals constitutes the major portion of the total cost. The estimated cost of the new link canals is Rs. 1,242.7 million or 92.5 per cent of the total cost of which some 51 per cent is estimated to be the local currency requirement and 49 per cent the foreign currency requirement.

## 6. PROGRESS

Tipton and Kalmbach, Inc., Engineers of Denver, Colorado, U.S.A., were engaged as consultants for the link canals work under an agreement signed on February 25, 1960. Work was immediately begun with the establishment of an office in Lahore by the consultants.

A nucleus of the staff required to carry out the planning, design and technical supervision of the construction of the works was created. At the same time, the preparation of large scale, accurate maps of the areas to be traversed by the link was initiated.

Hunting Surveys Ltd., were retained for aerial photography along the routes of the link canals and to prepare detailed planimetric and topographic maps.

Concurrently with the creation of an engineering organization in Pakistan and the initiation of aerial mapping, the consultants also undertook an independent review of earlier estimates of the cost of the link canals which had been prepared by the Pakistan Water Delegation. A group of engineers from the Denver office of the consultants came to Pakistan in early February, 1960, for this purpose. They spent several months in visiting the sites of the work and in gathering and compiling the data necessary for preparation of the estimates of cost. As a part of this task, it was necessary to develop preliminary designs for the several link canals and their appurtenant works to form a basis for estimating the quantities of work involved.

A summary of the consultant's estimates of cost of the link canals and their appurtenant works, together with the data and criteria upon which they were based, are contained in a report entitled "Preliminary Review of Estimates of Cost of Link Canals" which was submitted on June 17, 1960.

**New Construction:** Up to the end of the reporting period, no new construction work had been undertaken.

**Remodelling:** Work was initiated on the remodelling of the Marala-Ravi and Bambanwala-Ravi Bedian-Dipalpur links in the winter of 1958-59. Work was continued during the winter of 1959-60. Remodelling work on the main links can only be done during the winter when the links are out of service. This work is under the control of the West Pakistan Irrigation Department.

**Financing:** The link canals, together with the other works which form the Indus Basin Project, will be financed by the Indus Basin Development Fund.

## 7. EXPENDITURE

The total expenditure on the link canals till June, 1960 was Rs. 42,74,000 of which Rs. 27,79,000 was in local currency and the equivalent of Rs. 14,95,000 was in foreign exchange. These figures do not include costs incurred in connection with the remodelling work, figures for which are available with the Irrigation Department of West Pakistan.

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## CONSTRUCTION OF FIVE BARRAGES

1. **NAME OF PROJECT** ... Construction of Barrages under Indus Basin Settlement Plan.
2. **NATURE OF REPORT** ... Annual.
3. **PERIOD COVERED** ... 1st July, 1959 to 30th June, 1960.
4. **DATE AND DETAILS OF SANCTION** ... Scheme sanctioned by the Planning Commission.
5. **PURPOSE AND COST OF PROJECT**

The cost of the project as anticipated at the present is about Rs. 41 crore. It provides for the construction of five barrages as follows:

- a) at Mailsi on river Sutlej;
- b) near Abdul Hakim railway station on river Ravi;
- c) at Qadirabad on river Chenab;
- d) at Rasul on river Jhelum; and
- e) at Chashma on river Indus.

The purpose of the project is to construct barrages to facilitate the transfer of water from three western rivers to eastern rivers in replacement of water allocated to India under the proposed Indus Waters Treaty.

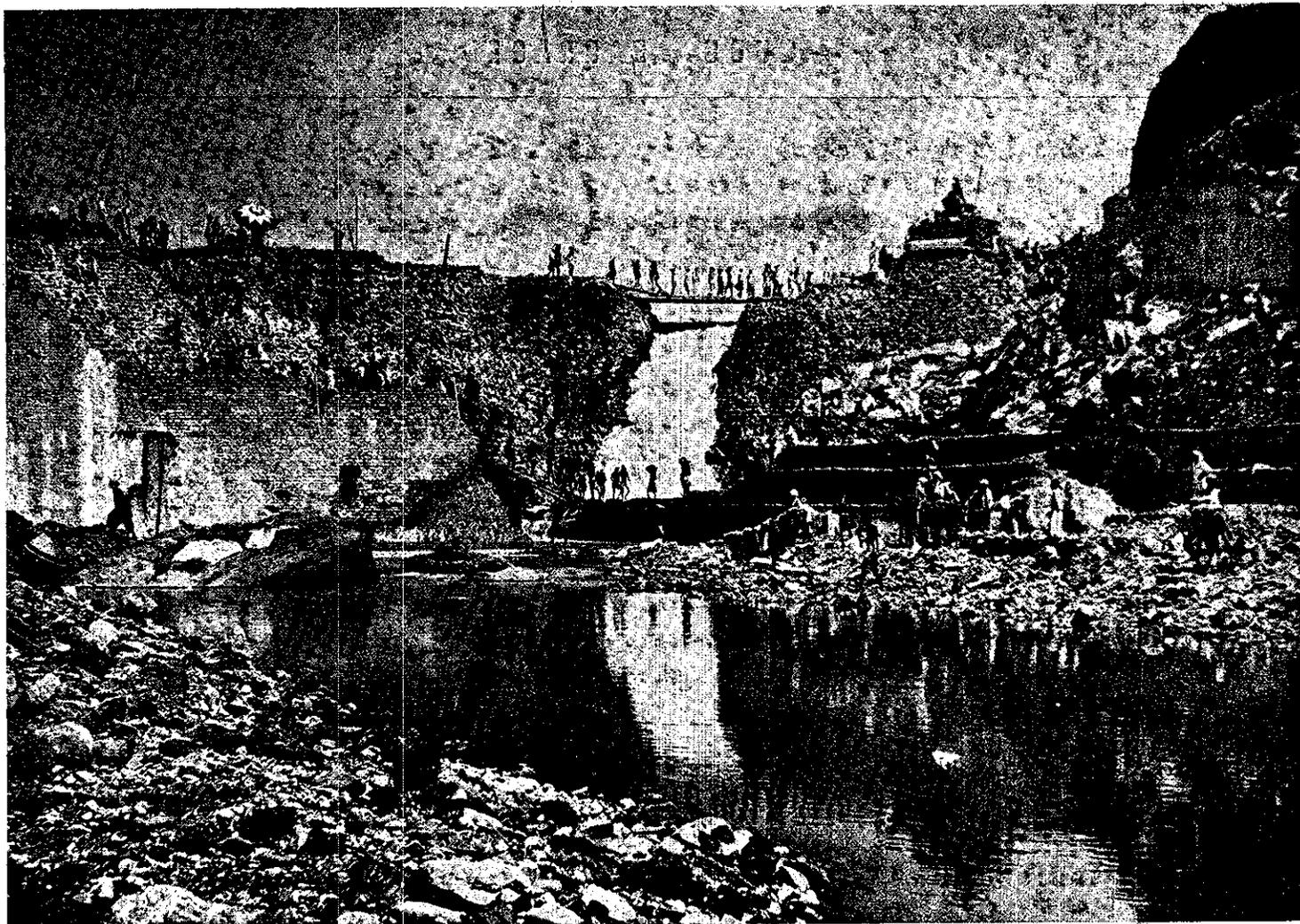
### 6. **PROGRESS**

A combined office for Links and Barrages was opened during February, 1960, for collection of information in regard to the designs of barrages. Messrs. Coode and Partners were appointed as consultants for barrages and they also opened an office in Lahore in January, 1960.

During the early part of the year, sites for Mailsi, Sidhnai and Qadirabad barrages were tentatively agreed upon. The contract for site investigations were let out and work completed. The aerial photography of the barrage sites was also let out and completed.

Expenditure on the barrages' project up to the end of June, 1960 was Rs. 675 million.

# RAWAL DAM

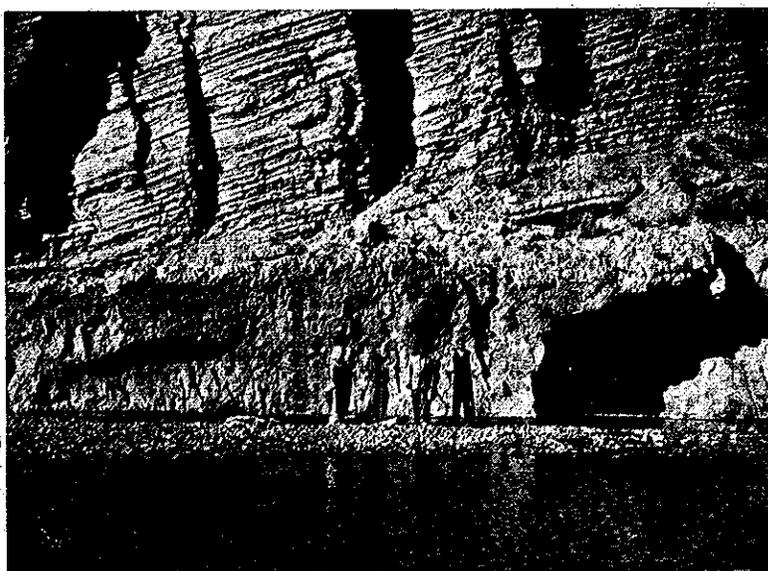


▲ Construction work in progress on the Rawal dam.



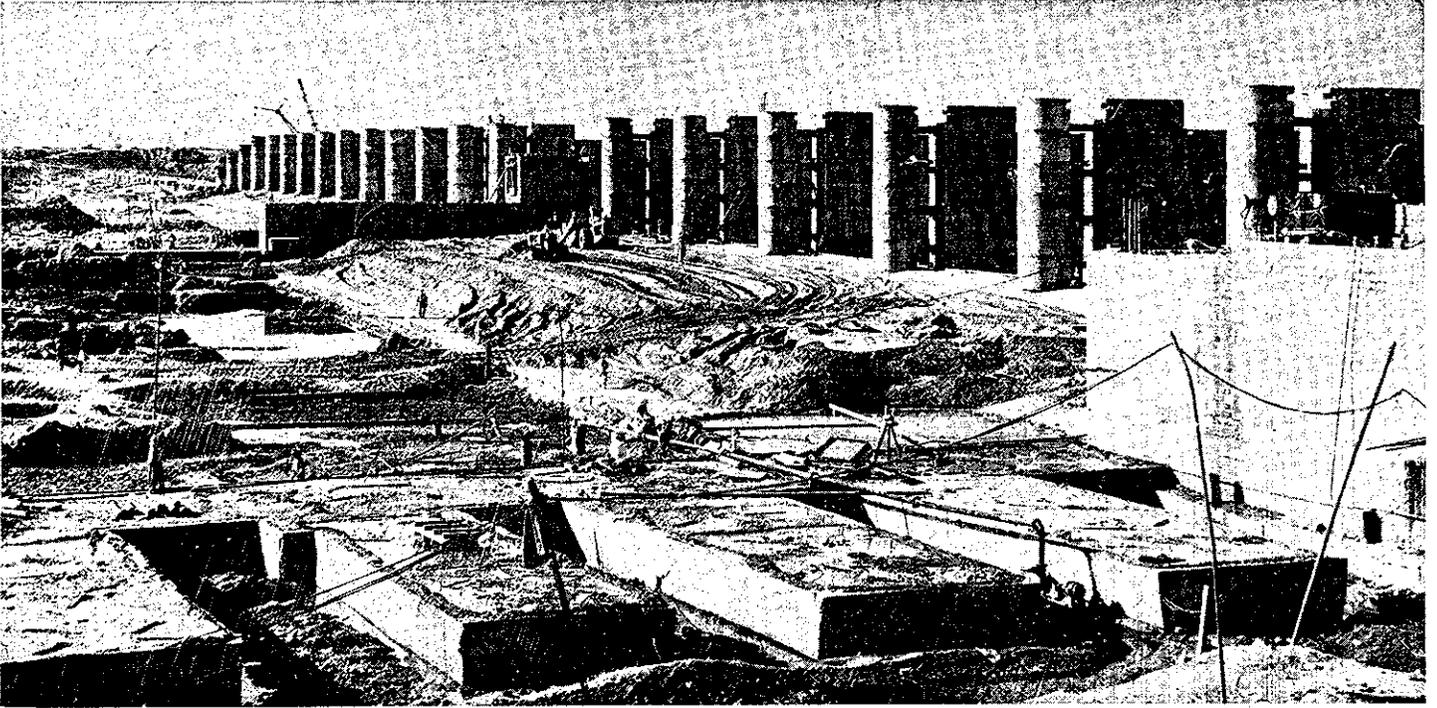
Drilling in the Kunhar Valley project area

## GENERAL INVESTIGATIONS



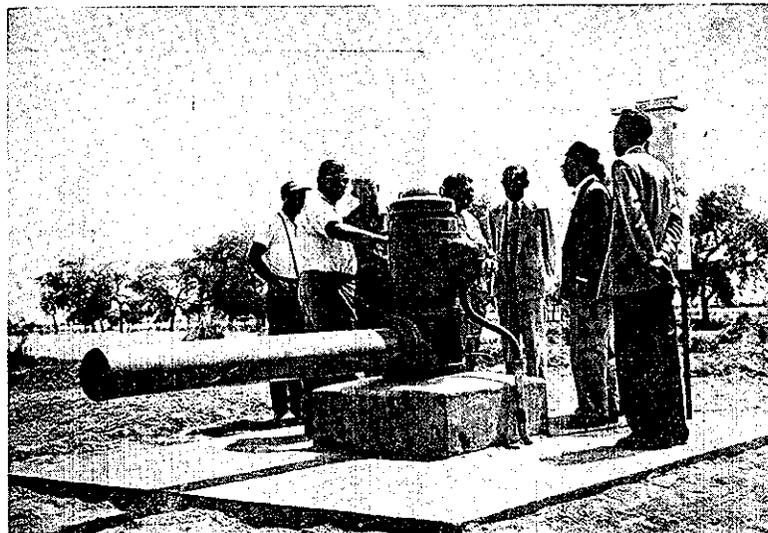
Sheikh Haider zam average station

## GUDU BARRAGE



▲ A view of construction work on the piers of the Gudu barrage near the right divide wall.

## SALINITY CONTROL AND RECLAMATION PROJECT ▼



Journalists from Peshawar visiting tubewells in the Sukheke area.

## GUDU BARRAGE PROJECT

- 1. **NAME OF PROJECT** .. Gudu Barrage.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. 1st July 1959 to 30th June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Government of Pakistan Ministry of Industries, letter No. WD-20/121/52/1873, dated 15-4-1956 and Government of Sind PWD Resolution No. 9090-G, dated 23-8-1954.

### 5. PURPOSE AND COST OF PROJECT

The Gudu Barrage Project is estimated to cost Rs. 37.05 crores. The project provides for the construction of a barrage on river Indus at the northern most boundary of Sind. This barrage with 65 spans of 60 feet each, two fish ladders, and a lock channel for navigation, will give assured water supply to the Sind and Baluchistan areas to the north of Sukkur and Rohri. This area is at present being irrigated by inundation canals that are dependent on excess water in the river which is an uncertain factor. The barrage will feed two main canals on the right bank, the Desert feeder canal with a discharge capacity of 13,245 cusecs and the Begari Sind feeder with a discharge capacity of 14,780 cusecs. On the left bank there will be only one canal called the Ghotki feeder with a discharge of 8,500 cusecs. The existing irrigated area is only 9,44,797 acres, which also suffers from the vagaries of the river. It is expected that after full development 24,70,821 acres, including dubari but excluding forests, will be irrigated.

#### Short Description of Canal System

**The Desert Feeder:** It will supply water to the existing Desert canal system, and to Pat feeder, a new canal about 120 miles in length which is expected to bring about 5 lakh acres of virgin soil under cultivation. The discharge of Desert feeder on full development of the area to be served by the Pat feeder will be 13,245 cusecs.

**The Begari Sind Feeder:** It will provide water supplies, to the existing Begari, Uner, Sind, Rajeb and Chitti canals systems. The length of the feeder will be 88 miles which will be excavated anew and its discharge will be 14,780 cusecs.

The Ghotki feeder is a new link, 9 miles in length, and will link up the existing left bank canal system. The discharge of this feeder will be 8,500 cusecs. With the completion of the project, the annual cultivation in the affected area will increase by nearly 100% on full development.

## 6. PROGRESS

### Barrage Head Works

#### Excavation

The quantity of excavation done on the barrage during the period under review is 304.68 lakh cft and this is as scheduled.

#### Piling

(i) All three lines: upstream, middle and downstream have been completed upto span No. 46.

(ii) Divide wall upstream side: (a) Deep 75 % completed, (b) Shallow 90 % completed.

(iii) Right Bank Regulators (a) Downstream piles, Begari Sind feeder completed, (b) Common abutment boxed piling completed, (c) Down stream Desert feeder piling in progress.

#### Well Sinking

Well sinking has been completed upto pier No. 53 of the barrage and all the wells of the right bank regulator and the understream flank wall have been sunk.

Colgrouting of pier wells completed upto pier No. 49. Also three wells of pier No. 50 and first stage colgrouting of wells of piers No. 51 and 52 is being done. Final colgrouting was held up as the middle pile line had not yet been completed upto this point.

#### Concreting

There has been a short supply of aggregate from the quarries. However, this has been overcome to some extent, by engaging departmental dumpers to supplement the supply. Progress achieved under various sub-heads is as follows:

1. Pavement. (a) Upstream pavement has been completed in the Right Pocket and upto span No. 19.  
(b) Downstream pavement completed upto span No. 46.
2. Upstream Glacis completed upto span No. 19.
2. Downstream Glacis completed upto span No. 46.
3. Upstream Right Divide wall raised upto R. L. 228.0 in 3300 ft. length beyond the pier portion. Pier portion of Right Divide Walls upstream completed upto R. L. 254.0. Fish Ladder completed upto R. L. 242.0 in 150 feet length.,
4. Right Abutment downstream raised upto R. L. 250.
5. Piers Nos. 1 to 20 completed upto R. L. 268.0 and Nos. 21 to 46 upto crest level.

### Flexible Protection

Desired progress could not be achieved as most of the stone had to be diverted to the guide banks and the river training works. However, works completed are as follows:

<b>Stone apron</b>	<b>Main Barrage</b> Upstream apron completed from spans 1 to 24. Downstream apron completed from spans 1 to 31.
<b>Filter blocks</b>	Downstream completed from spans 1 to 32. Settling Blocks Downstreams from completed spans 1 to 30.

**Training Works:** The apron and the pitching work on guide bank noses has progressed very well and the essential part is complete. The portion of work done upto end of June, 60 is detailed below:

#### Right guide banks:

- (1) Earthwork has been done in a length of 1550 feet from R. L. 235.0 to R. L. 252.0.
- (2) Stone apron is complete in the length of 1900 feet.
- (3) Stone pitching completed in 1700 feet length.

#### Left guide bank:

- (1) Earthwork in a length of 400 feet has been done from R. L. 235 to R. L. 262.
- (2) Stone apron river side and mole head has been done in a length of 2750 feet.
- (3) Stone pitching has been done in a length of 1780 feet.

**Gates and Gearing:** During the period under report, negotiations with Messrs Dinglerwerke to send out a team of erectors from Germany to the barrage site, were completed. This team is expected to arrive shortly and start the erection of the gates and gearing. Two scouring sluice gates have arrived at site from the shipyard, Karachi, who have the contract for fabricating the gates.

**Road and Service Bridge:** Messrs Italaomer of Italy have been awarded the contract for quarrying out the work of the pre-stressed R.C.C. work of the road and service bridge of the Gudu Barrage. Their representatives have arrived at site, and are busy in making all preliminary arrangements, pending the arrival of the equipment and tools that are on way, and are expected to be in the country very shortly.

### CANALS

#### a) Right bank

The designs of main canals and all the channels on Begari Sind feeder and Desert system are complete and field work for preparation of earthwork estimates is in progress and earthwork estimates for those where field work has been done are under preparation.

The designs of the main canal Pat feeder is also complete and its detailed earthwork estimate has been prepared. The design work of the channels is in progress.

### **b) Left Bank**

On the Left Bank the design of the main canal and all the channels except those on the river side of the bunds are completed ; the work for preparation of earthwork estimates is in progress.

### **Masonry Work**

**Right bank Begari Sind feeder:** The work on two fall regulators 45.5 and 151 has been let out. The designs for Uner cross regulator, Begari cross regulator have been prepared and plans have been sent to the Irrigation Research Institute, Lahore, for carrying out model experiments. Work on four bridges is in progress; on three of them nearly 70 to 80 % work is completed.

Data is being sent to the Railway department for design of the road-cum-rail bridge. Experiments on silt ejectors are not yet complete at Nandipur. The experiments so far carried out indicated low efficiency of the ejectors at higher discharges when the silt charge is naturally more.

On Desert canal the plans for re-modelling and construction of cross-regulator at three sites have been prepared and are under check.

On the Left Bank apart from other small regulators and bridges the plan for Kaziwah cross-regulator on the main canal has been prepared and is under check in the central designs division.

### **Spillways**

Alternative alignments in the head reach are ordered to be investigated to avoid disturbing the existing irrigation system as far as possible. This work is being started now. Levelling of Reni River is complete.

**Excavation by manual labour:** During the year 1959-60 very substantial work has been done by manual labour. The quantities done through this agency during the year are 209.920 million cft. on the right bank and 24.680 million cft. on the left bank.

**Machinery in operation on the Canals:** Two Page Draglines and one Marion Machine have been in operation on the right bank, on the excavation of the Begari Sind feeder and Desert feeder. The two Page Draglines could not work throughout the year on the canals, as these had to be shifted in November to the headworks to work on the river training. The quantities done by these machines are

(1) Page D/L 127.526 M. CFT.

(2) Marion 1.52.621 M. CFT.

Marion No. II was under erection, and was put into commission in June, 1960 on the excavation of the Begari Sind feeder and Marion I was shifted from Begari Sind feeder to Pat feeder in May 1960, as it had completed the work assigned to it.

### QUANTITATIVE PROGRESS

Head-works	Total estimated quantity.	Upto 30-6-59.	From 1-7-59 to 30-6-1960.	Total upto 30-6-60.
1. Exavation ..	985.0 lakhs cft.	509 lakhs cft.	295.68	804.68
2. Well-Sinking ..	13503 rft.	5076 rft.	2387.5	7463. 5
3. Piling ..	19516 nos.	7029 nos.	4525	11544
4. Concreting ..	13469 cft.	2463 cft.	3018.13	5481.13
5. Stone in apron ..	62.61 lakhs cft.	11.17 lakhs cft.	1.3949	12.5649
<b>6. Training Work ..</b>	(Guide Bank)			
a) Earthwork ..	769 lakhs cft.	nil.	368.20	368.20
b) Stone in apron ..	152 lakhs cft.	nil.	5649.1	5649.1
c) Stone in pitching	42.0 lakhs cft.	nil.	596	596
<b>Canals</b>				
A—Begari Sind feeder..	8842 lakhs cft.	3996 cft.	2877 lakhs cft.	6873.971 lakhs cft.
B—Desert feeder ..	1020 lakhs cft.			
Past feeder				
I—Excavation ..	4000 lakhs cft.	163 lakhs cft.	204.39	369.39
C—Ghotki feeder ..	1340 lakhs cft.			

## SALINITY CONTROL AND RECLAMATION PROJECT

- 1. **NAME OF PROJECT** .. Salinity Control and Reclamation Project No. 1.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. 1st July, 1959 to 30th June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Project was sanctioned by the Government of West Pakistan, Irrigation, Communications and Works Department vide their Memorandum No. 4/20-RGWD/S.O.III(i)/59 dated 6-8th April, 1959, and subsequently approved by the Economic Committee of the Cabinet at its meeting held on 16th February, 1960 (Planning Commission Memo No. 21(3) D.A./P.C./60, dated 12th March, 1960.

### 5. PURPOSE AND COST OF PROJECT

The cost of the project as approved is estimated at Rs. 7,27,00,000. It provides for the installation of 1,888 tubewells in Rechna doab and 159 in Chaj doab totalling 2,047, and covers nine reclamation scheme areas: Harse Sheikh, Beranwala, Zafarwal, Hafizabad, Shadman, Sangla Hill, Shahkot, Khangah Dogran and Lallian with a total area of about 1.4 million acres. The tubewells will be operated by electric power for which necessary transmission and distribution facilities will be provided under the Secondary Transmission and Distribution Project. The purpose of the project is to bring about a gradual decline in the water table to reclaim waterlogged areas and at the same time to provide adequate irrigation supplies with tubewell cum canal waters to achieve a duty of 1 cusec per 150 acres against the existing abnormally high duty of 1 cusec per 350 acres. The additional irrigation supplies will achieve not only the desired objective of reclaiming salted lands by leaching down the salts but will also result directly in increasing crop production.

On completion of this proposed programme, it is estimated that food production will rise by 0.7 million tons during the third year of the operation of the project and by 0.8 million tons during its fifth year of operation. Farm incomes, expressed in terms of cost benefit ratios, are expected to improve from the present level of 1:1:48 in 1959 to 1:2:48 in 1979. Because of the progressive deterioration of the lands, the same ratio without salinity control operations, would probably have decreased to 1:0:26 in 1979. These results, however, are conditional on the optimum utilization of the additional water supplies alongwith the intensive use of fertilisers and improved cultural practices and scientific rotation of crops.

## 6. PROGRESS

Construction work on the project was started by the Irrigation Department in September, 1958. After 70 tubewells had been installed the project was transferred to Wapda on the 1st of March, 1959.

**Foreign Exchange:** To meet the foreign currency requirements on the installation and electrification of the tubewells, a loan of 15.2 million dollars has been obtained from the U. S. Development Loan Fund for which an agreement was executed by Wapda on 18th February, 1959.

**Consultants Report:** Under the provisions of the agreement with DLF, Messrs Tipton & Kalmbach, Inc. Engineers, of Denver U.S.A. were appointed as consultants for this project and a contract with them was signed on 5th March, 1959. The project was reviewed by Tipton & Kalmbach, Inc, and it was fully endorsed by them as a technically and financially feasible and sound project.

**Physical Progress:** The project is scheduled to be completed by mid 1961. One thousand tubewells are being installed through contract and the balance through Wapda's own forces, partly with the help of equipment supplied by Australia under the Colombo Plan.

**Contract Work:** Tenders were invited for the construction of tubewells and installation of equipment on the 24th July, 1959, and a contract was awarded to Messrs Harold T. Smith International S.A. on 7th August, 1959, for constructing 600 tubewells at an estimated cost of Rs. 2,47,00,000. For the construction of another 400 tubewells tenders were received on 20th October, 1959, and Harold T. Smith International S.A. were again the lowest bidders. They were awarded the second contract of Rs. 1,54,00,000 on 14th November, 1960. Soon after the award of contracts the contractor placed orders for the construction plant and equipment, tubewell casings, pumps and motors. A large construction camp was set up by the contractor at Sukheke complete with workshop, machine shop, offices and residential quarters, and according to schedule the work of installing tubewells was taken in hand from January, 1960. Upto the end of June 1960, 375 tubewells had been drilled, cased and shrouded; of them 291 developed and tested; and pumps and motors installed on 120. By the close of the period under review the Harold T. Smith rate of progress had reached 100 tubewells per month, which is likely to be maintained when the operations are resumed in October, 1960, after the monsoons.

**Departmental Work:** Since the taking over of the project by Wapda 100 tubewells had been drilled making a total of 170 upto the end of June, 1959. The rate of installation of tubewells by Wapda forces, however, could not be maintained as the equipment received on transfer from the Irrigation Department was incomplete. Considerable efforts were needed to improvise the missing accessories without which the drilling machines could not be put into operation. Another difficulty was the lack of field transport and ancillary equipment such as tractors, welding machines, testing rigs, heavy trucks. On appointment under the DLF agreement, Messrs Tipton & Kalmbach, consultants, assumed the technical supervision of the departmental work

and as a first step evolved an organizational set up and initiated a training programme for drillers and welders. Lists of essential construction equipment were also drawn up and procurement was taken in hand. By the end of June, 1960, all the essential construction equipment had been procured and the progress of work was gradually stepped upto schedule. During the year under review 194 tubewells were drilled, cased and shrouded, making a total of 364. Apart from lack of adequate construction equipment progress was retarded due to heavy rains during 1959 which interfered with the field movement upto November, 1959. By the close of the year, however, the monthly progress had reached a level of just over 30 wells per month. Eight hundred pumps and motors (pumping sets) for wells drilled by Wapda forces, have been arranged. Out of these 400 pumps were procured locally and motors are being supplied by Australia under the Colombo Plan. The actual supply of these motors has just started. For the balance 400 pumps and motors, tenders have been invited and a supply order will be placed shortly.

**Pump Houses and Quarters:** The construction of pump houses and operators' quarters for all the tubewells is being done by Wapda forces and 165 pump houses and 36 operators' quarters were completed by the end of June, 1960.

## **7. COMPARISON WITH PROGRESS DURING PREVIOUS YEAR**

When the project came over to Wapda on 1st March, 1958, 70 tubewells had been installed. In the remaining 4 months of the previous reporting period another 100 wells were drilled. During 1959-60 the total number of wells drilled, cased and shrouded were 569 (by Wapda forces and contractors). Of these 291 (contractors) were developed and tested, and 120 of them were fitted with pumps and motors.

## **8. BUDGET**

The expenditure on the project upto the end of June, 1960, amounts to Rs. 316.08 lakhs as against Rs. 27.33 lakhs upto 30th June, 1959.

In the utilization of DLF funds letters of commitment were received for all requests made, amounting to 8.15 million dollars. Against these letters of credit were established for the amount of 6.67 million dollars.

## GENERAL INVESTIGATIONS OF WATER AND POWER RESOURCES OF WEST PAKISTAN

- 1. **NAME OF PROJECT** .. General Investigation of Water and Power Resources of West Pakistan.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. 1st July 1959 to 30th June 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Sanction awaited.
- 5. **TOTAL COST AND EXPENDITURE UPTO 30th JUNE, 1960** Total estimated cost is Rs. 186 million (Rs. 117.1 million in Pakistan currency and Rs. 68.9 millions in foreign currency) out of which Rs. 18.1 million has been spent up to June 30, 1960. Rs. 101.5 million will be spent within the 2nd Five Year Plan and Rs. 66.4 million beyond June 1965. Financing will be done from loans and grants to be obtained from within and outside the country.

### 6. PURPOSE OF PROJECT

The West Pakistan Water and Power Development Authority Act of 1958 provides for the unified and coordinated development of the water and power resources of West Pakistan. The purpose of this project is the carrying out of investigations throughout West Pakistan so as to develop the water and power potential in the most efficient way, this being the most important sector of the economy of Pakistan.

In this respect extensive surveys are to be carried out regarding rainfall, run off, stream-flows, groundwater supplies, analyses of soils, possible sites for dams, power plants, weirs, waterlogged and salinity affected areas and a host of other related problems so as to exploit fully the water potential for irrigation, power production and navigation.

These general investigations will be carried out in two phases.

**Phase I:** Investigations are broadly regional in character and are directed towards completion by the end of 1962 of a comprehensive plan for the conservation and development of irrigation water and power resources of West Pakistan.

**Phase II:** Investigations will cover specific projects in greater detail and will lead to firm plans, cost estimates and economic analyses, for implementation of selected projects within the framework of the Master Plan.

To direct and coordinate the investigations Wapda has engaged a well known firm of consultants Messrs Harza Engineering Company International. The consultants will provide a team of experts who will work with Pakistani engineers. Other consultants will also be employed for specific jobs.

## 7. PROGRESS

**a) Preparation of Master Plan:** This is a comprehensive plan for West Pakistan to assess the water and power resources both present and those capable of developing in future. Our general consultants Messrs Harza Engineering Company International collected the data to process it at their Chicago office.

**b) Inland Navigation Survey:** No investigations were carried out during the period of this report.

**c) Hydrologic Survey: Surface Water Branch:** At the end of 1959, each major Wapda project under investigation had its own hydrology section or division. Wapda created Central Hydrologic Section on February 1, 1960. This is being operated as a joint function of Wapda and Harza. It is intended, however, with additional training and experience, that Wapda will eventually take it over.

The work consists of collection, evaluation and analysis of river discharge and sediment data. Also construction and measurement facilities are to be provided. Rain gauging and snow surveys are also on the programme.

During the period of this report the Hydrologic Section has been sending field parties to various projects of Wapda under investigation for current-meter measurement of river discharges, collection of sediment data, construction of gauging stations and for other related information which was processed in the head office.

**d) Porali Basin:** This assignment has been given to Messrs Lewis Lane and Company Ltd., of Canada.

**e) Nari Bolan Scheme:** This scheme is for the development of the area between Jhatpat and Sibi. Sir Murdoch Macdonald and Partners, were given the contract and they have been collecting data and doing investigations during the period of this report.

**f) Indus River Main Development:** No work done.

**g) Swat River Development:** No work done during the period.

**h) Kurram River Development:** No work done during the period.

**i) Chitral River Development:** No work done during the period.

**j) Gomal River: Progress:** To complete this job investigations are being carried out by Wapda in consultation with Messrs Energoprojekt of Yugoslavia. The consulting engineers have already submitted a preliminary report and are going ahead with detailed investigations.

Among other smaller items an approach road to the dam site at Gulkatch and the construction of a picquet at Murtaza are in hand. Ground survey of a two mile stretch

of the Murtaza-Khajuri Katch (Adam Kok) road has also been completed. A tentative alignment of the proposed main canal from Murtaza weir site to R. D. 70,000 has also been completed. A site plan for the erection of a Bailey bridge at Murtaza has been prepared.

**k) Kunhar Valley Project: Progress:** For the preparation of the feasibility report on the project Chase T. Main Incorporated of USA have been appointed as consulting engineers. They have already made preliminary site studies and submitted an interim report.

Field work on the collection of hydrological data and the preparation of topographical and geological maps is in progress. The Cementation Company and Indus Valley Construction Company are busy drilling at Suki Kinari and Potandes dam sites.

**l) Baluchistan River:** No work done as yet.

**m) Other Left Bank Tributaries:** No work done as yet.

**GENERAL INVESTIGATIONS OF WATER AND POWER RESOURCES OF WEST PAKISTAN**

- 1. NAME OF PROJECT** .. General Investigations of Water and Power Resources of West Pakistan.
- 2. SUB-PROJECT** .. Drainage and Reclamation Project Preparation.
- 3. PERIOD COVERED** .. 1st July, 1959 to 30th June, 1960
- 4. DATE AND DETAILS OF SANCTION** .. Sanction awaited.

**5. PURPOSE AND SCOPE OF PROJECT**

To prepare schemes and their reports covering specific projects selected in accordance with the objective of orderly and continuous reclamation of lands under the overall unified plan of water resources development, an agreement was entered into by the Authority with Messrs Tipton & Kalmbach, Inc., Denver USA, on 19th December, 1959. The programme of work under this agreement provides for the completion of the report covering the first project to be undertaken (after completion of Salinity Control and Reclamation Project No. 1) before the end of 1960 so that the Authority, could undertake active construction on this project by September, 1961.

**6. PROGRESS**

The work on project preparation started from February, 1960, after the arrival of the Project Engineer. Upto June 1960, an area comprising 2.27 million acres in Chaj Doab was selected for the next project keeping in view the needs for reclamation, and all basic data for this area was collected from various agencies and analysed. This included compilation of groundwater records, analysis of aquifer tests, studies of cropping patterns, estimating the consumptive use requirements and analysis of safe groundwater yield. Sufficient progress was achieved during the period to ensure the submission of the project report by the due date.

The total expenditure, which is on the basis of a cost plus fee, incurred upto 30th of June, amounts to Rs. .32 million.

## GENERAL INVESTIGATIONS OF WATER AND POWER RESOURCES OF WEST PAKISTAN

- 1. **NAME OF PROJECT** .. General Investigations of Water and Power Resources of West Pakistan.
- 2. **SUB-PROJECT** .. Salinity Control and Waterlogging (Sukkur Gudu Barrage Drainage) and Reclamation Project.
- 3. **PERIOD COVERED** .. 1st July, 1959 to 30th June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Sanction awaited.
- 5. **PURPOSE AND SCOPE OF PROJECT**

The agricultural productivity in the irrigated areas of the Lower Indus Plan has been declining on account of waterlogging and salinity because no remedial measures have been undertaken there. Therefore it was considered essential that investigations should be started immediately to determine the extent of waterlogging and salinity and to evaluate the prevailing conditions so that reclamation measures could be taken in hand. The present project, provides for a survey of the soils, determination of the groundwater conditions, study of water use and water application methods, cropping patterns and determination of the feasibility of reclamation measures either by the use of tubewells or by a system of open drains. A drilling programme has also been incorporated to evaluate the groundwater and sub-surface conditions. The work under the project has been divided into three phases extending over a period of 4 years. The work on the first phase was initiated through Messrs Hunting Technical Services, Limited, London, with whom an agreement was signed on 27th of August, 1959. This original agreement provided for investigations in the irrigated areas of the Sukkur and Gudu Barrages excluding the areas commanded by the Rohri and Nara Canals. Subsequently, the scope of the work entrusted to Messrs Hunting Technical Services Ltd., was extended by amending the original agreement on the 8th of March, 1960. As a result of this amendment the entire area within the command of the Ghulam Muhammad Barrage was also included in the Phase I investigations.

The first phase investigations are scheduled for completion before June, 1961, and as part of the Phase I programme. Provision has also been made for detailed investigations in Khairpur and Gaja areas for which feasibility reports have to be submitted by the consultants for undertaking reclamation measures there. The estimated cost of the investigations programme for all the three phases is Rs. 21.6 million. For Phase I it is Rs. 8.4 million.

### 6. **PROGRESS**

The work on the Phase I was actually started in the field by late December 1959.

By 30th of June, the following progress was achieved in the various fields:

1) **Soil Studies:** A regional type of soil survey over 3000 square miles on the right bank of Sukkur Barrage covering Rice, Dadu and Northwest canals and 700 square miles of G. M. Barrage was completed. Detailed surveys in Khairpur (600,000 acres) and Gaja areas (120,000 acres) were also made. A soil reconnaissance of G. M. Barrage was also carried out.

2) **Engineering Studies:** A drainage layout in Khairpur area with several proposals for outfall locations was studied. In the field, setting out and levelling of 145 miles of main drains and 190 miles of branch and sub-drains was completed. The setting out and levelling of the line of the outfall drain with alternatives was undertaken on the Sukkur Right Bank. Drainage layout for G. M. Barrage was also reviewed in the light of the requirements for sub-surface drainage. A report on the reconnaissance study of Ghulam Muhammad Barrage was submitted by the consultants.

3) **Drilling:** Out of 50 exploratory holes 19 had been drilled with an average depth of 600 feet each. Seven tubewells out of 30 had been established for carrying out aquifer tests.

## **7. EXPENDITURE**

To meet the foreign exchange expenditure on Phase I of the project an allocation of Rs. 3.3 million was obtained from the second U. K. credit. Rs. 1.7 million had been utilised from internal resources. The expenditure upto 30th June, 1960 amounted to Rs. 3.17 million.

## WEST PAKISTAN GROUND WATER SURVEY PROJECT

- 1. **NAME OF PROJECT** .. West Pakistan Ground Water Survey Project No. 035
- 2. **NATURE OF REPORT** .. Annual
- 3. **PERIOD COVERED** .. 1st July, 1959 to 30th June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. The Project was sanctioned by the Government of West Pakistan, Irrigation, Communication and Works Department on 19th January, 1957.

### 5. PURPOSE AND COST OF PROJECT

Water and Soils Investigation Division previously known as Ground Water Development Organization was set up in cooperation with I.C.A. in 1954 for ground water investigations and soil surveys in the areas of Rechna, Chaj and Thal doabs and selected parts of former Bahawalpur and Khairpur states. These investigations form the basis of development schemes for the utilisation of ground water for irrigation or anti-waterlogging and salinity control purposes. The cost of the Project for investigations in the above areas is Rs. 3,22,38,000.

### 6. PROGRESS

The progress of the various categories of investigations e.g., test drilling, resistivity survey, pumping tests, water level measurements, soil surveys, water sampling etc., for the period ending 30-6-60 is shown as under:—

1) Rechna Doab	..	..	..	..	90 per cent.
2) Chaj Doab	..	..	..	..	95 —do—
3) Thal Doab	..	..	..	..	65 —do—
4) Bahawalpur Area	..	..	..	..	80 —do—
5) Khairpur Area	..	..	..	..	50 —do—

### 7. BENEFITS

No direct benefits arise from these investigations. Indirect benefits will, however, accrue on completion of development schemes based on the data of these investigations. "Salinity Control and Reclamation Project (No. 1)" is one such scheme and is already underway in a part of Rechna Doab. It provides for installation of over 2000 tubewells for depressing the water table and reclaiming the waterlogged and saline lands.

### 8. BUDGET

Actual expenditure during the period under report was Rs. 48,71,918.

## RAWAL DAM

- |  |  |
|--|--|
| <b>1. NAME OF PROJECT</b>              | .. Rawal Dam.  |
| <b>2. NATURE OF REPORT</b>             | .. Annual.   |
| <b>3. PERIOD COVERED</b>               | .. July 1, 1959 to 30th June, 1960.  |
| <b>4. DATE AND DETAILS OF SANCTION</b> | Wapda Chief Engineer, Water, letter No. WPEI/1 RD-6/59/3583-84, dated 27th June, 1960. |

### 5. PURPOSE AND COST OF PROJECT

Situated on Kurang river, about 9 miles from Rawalpindi, the Rawal dam is to be 80 feet high and 820 feet long. It will have a storage capacity of about 32,000 acre feet and after the installation of 10 feet high steel gates on the top of the dam the storage capacity will go up to 47,500 acre feet and under certain conditions up to 53,000 acre feet. It will irrigate 10,000 acres near Rawalpindi and will also make available daily 22 million gallons of drinking water which will meet the requirements of the federal capital, the Rawalpindi municipal committee, the Cantonment board and the North Western Railway.

The estimated cost of the dam has more than doubled from the original estimate of Rs. 6.3 million. It has now gone up to about Rs. 16 million. The reasons for this increase are; greater effective capacity of the reservoir, higher compensation rate for the land acquired for the lake and the provision of a modern plant for filtration of the drinking water. As compared to the original plan of 36,000 acre feet reservoir capacity the latest effective capacity now will be 47,500 acre feet. The compensation for the land now works out to Rs. 4 million as against Rs. 250,000 estimated originally. The filtration plant will cost Rs. 3 million for which there was no provision in the first instance.

### 6. PROGRESS

The construction on Rawal dam was taken in hand in June, 1959. It is scheduled to be completed by the end of 1960. The progress to date is that the main dam has been completed to the crest of sluice channel head regulator. The diversion channel has been closed and water has started heading up. As a result of monsoon showers in the catchment area of the Kurang, a one square mile lake has already been formed behind the dam. About a mile of the road to Murree was submerged but before this happened a diversion road constructed for the purpose was opened to traffic. All the bridges are complete. Earth work and the soling of approach road are complete. Metalling and black topping will be done in due course.

In most cases compensation to displaced persons has been decided and paid.

In respect of the main dam 80 per cent of work, that is, 1.2 million cubic feet of masonry and 900,000 cubic feet of excavation work was completed during the period

under review. The entire work involved 1.43 million cubic feet of masonry and 1.225 million cubic feet of excavation of foundation.

The saddle embankment has almost been completed but owing to a revision in the design the amount of work has increased. The 11.3 million cubic feet of earth work done during 1959-60 represents 74% of the entire work.

The designs of the irrigation channels were received in June, 1960. Work on the right channel has started and on the left channel it will start shortly.

By the end of June, 1960, about Rs. 7.4 million had been spent on the project.

## KARACHI IRRIGATION PROJECT

- 1. **NAME OF PROJECT** .. Karachi Irrigation Project (Hub and Malir Dams)
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. 1st July, 1959 to 30th June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Central Government, Ministry of Works, Irrigation and Power, Karachi, letter no. 11(50)WII/59, dated the 26th September, 1959. Approved by Economic Council on 10-7-1959.

### 5. PURPOSE AND COST OF PROJECT (HUB DAM PROJECT)

The project is for a reservoir impounded by an earthen dam 146 feet at the deepest section and 22,900 feet long, to be constructed just below the confluence of Shorin Nala with the parent river, a distance of about 35 miles north east of Karachi. The lake will have a storage capacity of about 7,73,000 acre feet of water, submerging 20,360 acres of barren land.

The project will take three years to complete. It aims at providing irrigation for 84,000 acres of cropped area yielding annually 15 million maunds of fodder, 3 million maunds of fresh vegetables, 85 million maunds of fruits and about 4 million maunds of sugar cane. This yield will not only ease the existing acute shortage of these essential commodities in the Karachi area but will also meet the future requirements of Karachi and its surrounding area. The proposed cultivation of fodder promises to ensure an adequate supply of dairy products and meat for Karachi.

An additional advantage will be the creation of a green belt around Karachi and this will also have an improving effect on its climate.

There are also possibilities of cheap production of hydro-electric power (from two 30 feet falls on the main canal), to the tune of 11 million kwh annually. This aspect is likely to be taken up later on, as the preliminary considerations have shown that it will be a financial asset to the project as a whole.

The project is estimated to cost Rs. 88.6 million out of which Rs. 49 million will be in foreign exchange. This cost excludes the hydro-electric power generation proposals, the implementation of which will cost an additional Rs. 2.5 million. The sanctioned expenditure for detailed survey and design of Karachi Irrigation Project is Rs. 2.2 million out of which Rs. 635,013 have been spent.

### 6. PROGRESS

The detailed designs, drawings and estimates are expected to be completed before the scheduled date, that is, 30-6-61. Preparatory work, however, has been completed.

Investigations regarding this project were originally conducted by the Karachi Irrigation Survey Scheme and a preliminary report by the then Chief Engineer, the late Mr A. F. Qureshi was submitted in April, 1958.

Investigations were however continued and during the period intervening 31st June and 14th October, 1959, (when the organisation was transferred to Wapda by Central Government), some rectangulation survey of the commanded area according to the proposals presented in the Late Mr. A. F. Qureshi's report, was carried out along with some subsoil explorations work and collection of data regarding river flows and rainfall. On being transferred to Wapda, the preparation of an engineering report was entrusted to Associated Consulting Engineers Ltd.

On careful examination and preliminary field investigations undertaken by the consultants drastic changes had to be made in previous proposals. The dam site was shifted about 7 miles upstream and as such fresh reconnaissance surveys and investigations had to be carried out.

**Preparatory works:** A preliminary survey of about 20 miles was carried out and 6 possible dam sites were inspected and the best alternative chosen. About 2,500 acres at the dam site were topographically surveyed and a map prepared. An area of about 30 square miles was surveyed for the purposes of the reservoir and the area to be submerged was marked.

**Canal Surveys:** About half of the work regarding the detailed survey of the head reach of the main canal including the auxiliary reservoir and a survey of about 70 miles length of the canal was completed. Twenty-two miles were surveyed and the alignment of the road fixed and necessary related works indicated. A distance of about 40 miles was traversed in order to carry a double checked bench mark from Karachi to the dam site.

Two square miles were covered in order to fix the spillway position and to prepare the preliminary design.

**Hydrology:** Work on the collection and analysis of data, water quality studies, silt and sedimentation studies, reservoir balance studies and flood routing studies was completed during the period under consideration.

**Borings and geology:** Out of a total of 52 bores planned to be executed, 35 bores were completed and the data so collected was analysed. In addition, mapping studies were done and a report compiled regarding geological sections.

**Soil studies:** Out of a total of 60, 52 trial pits were excavated and preliminary testing of the collected samples was done. The soil survey of the commanded area was completed.

**Designs and plan:** Preliminary layouts, preliminary selection of the type of dam and tentative heights, final decision regarding the type of the and spillway and the preparation of designs and plans were completed.

## **MALIR DAM PROJECT**

Investigations regarding this project were also conducted by the Karachi Irrigation Survey Scheme side by side to the investigations of the Hub Dam Project. The preliminary report by Mr. A. F. Qureshi also included proposals for constructing a dam across Malir river.

For the present these proposals have been dropped, as most of the lands which are likely to fall under the command of the reservoir are already under cultivation on open tubewells. However, the collection of hydrological data continues and the scheme is likely to be taken up for details when the work on the Hub Dam has been executed.

## DARWAT DAM

1. **NAME OF PROJECT** .. Darwat Dam.
2. **NATURE OF REPORT** .. Annual.
3. **PERIOD COVERED** .. 1st July, 1959 to 30th June, 1960.
4. **DATE AND DETAILS OF SANCTION** .. Wapda letter No.W/P & I/I-DD-I/59/2397, dated the 7th May, 1960.
5. **PURPOSE AND COST OF PROJECT**

The dam which is proposed to be constructed across Barran river at a distance of about 70 miles from Karachi, will, in addition to flood control provide water for irrigating at least 50,000 acres of barren lands. The cost of the project is estimated at Rs. 1.24 lakhs.

### 6. **PROGRESS**

A fair amount of data has been collected spread over the past eight years. This scheme was transferred to Wapda by the Government of West Pakistan in October, 1959. Previously it was being investigated by the West Pakistan Irrigation Department. So far a sum of Rs. 22,362 has been spent.

## PORALI BASIN DEVELOPMENT

This investigation scheme has been drawn up to examine the possibilities of converting barren lands of Lasbela district into fertile tracts.

The aim is to collect hydrological and other necessary data spread over about 4,000 square miles of of Porali Basin for optimum utilization of the land and water resources.

This will involve preparation of reports for various structures that can be constructed across the four rivers of the basin namely Porali, Kud, Kantra, and Windor.

A preliminary survey suggests that great chance of success exists.

The consultations have been entrusted to a Canadian firm, Messrs Lewis Lane and Company Ltd., who have started field work at various sites in the area and are also trying to collaborate and analyse the data so far collected. The expenditure sanctioned stands at Rs. 2.17 million out of which Rs. 2.205 has been spent.

## SHADIWAL HYDEL PROJECT

- |  |   |
|--|---|
| <b>1. NAME OF PROJECT</b>              | .. Shadiwal Hydel Project.  |
| <b>2. NATURE OF REPORT</b>             | .. Annual.  |
| <b>3. PERIOD COVERED</b>               | .. 1st July 1959 to 30th June, 1960.  |
| <b>4. DATE AND DETAILS OF SANCTION</b> | Government of Pakistan, Ministry of Industries, Karachi, letter No.WD-19 (114)53/286 dated 13-2-1955. |

### **5. PURPOSE AND COST OF PROJECT**

The Shadiwal hydel station which is to have an installed capacity of 13,500 kilowatts is being built on the Upper Jhelum canal 7 miles from Gujrat. Originally designed mainly to supply power for running the tubewells of the reclamation project in the Chaj and Rechna doabs, it will now be connected with the power grid. The project is estimated to cost Rs. 38 million.

### **6. PROGRESS**

The year under review saw the completion of most of the major civil works such as the power house, the headrace, the spillway and the silt ejector. These targets were achieved by introducing day-and-night shifts. The position now is that both the turbo-generators having a capacity of 6,750 kilowatts each are expected to be in operation by the end of 1960.

The power house has been completed in all respects except for the painting and the finishing of the floor. The backfill around the power house required the dumping of 400,000 cubic feet of filter, 2 million cubic feet of sand and 6 million cubic feet of earth fill. This work was completed during the last year. Work on the spillway and silt ejector was behind schedule at the end of June, 1959 for want of detailed drawings, and about 65 per cent (spillway) and 100 per cent (silt ejector) of work was required to be done in a period of about six months. This schedule was fulfilled.

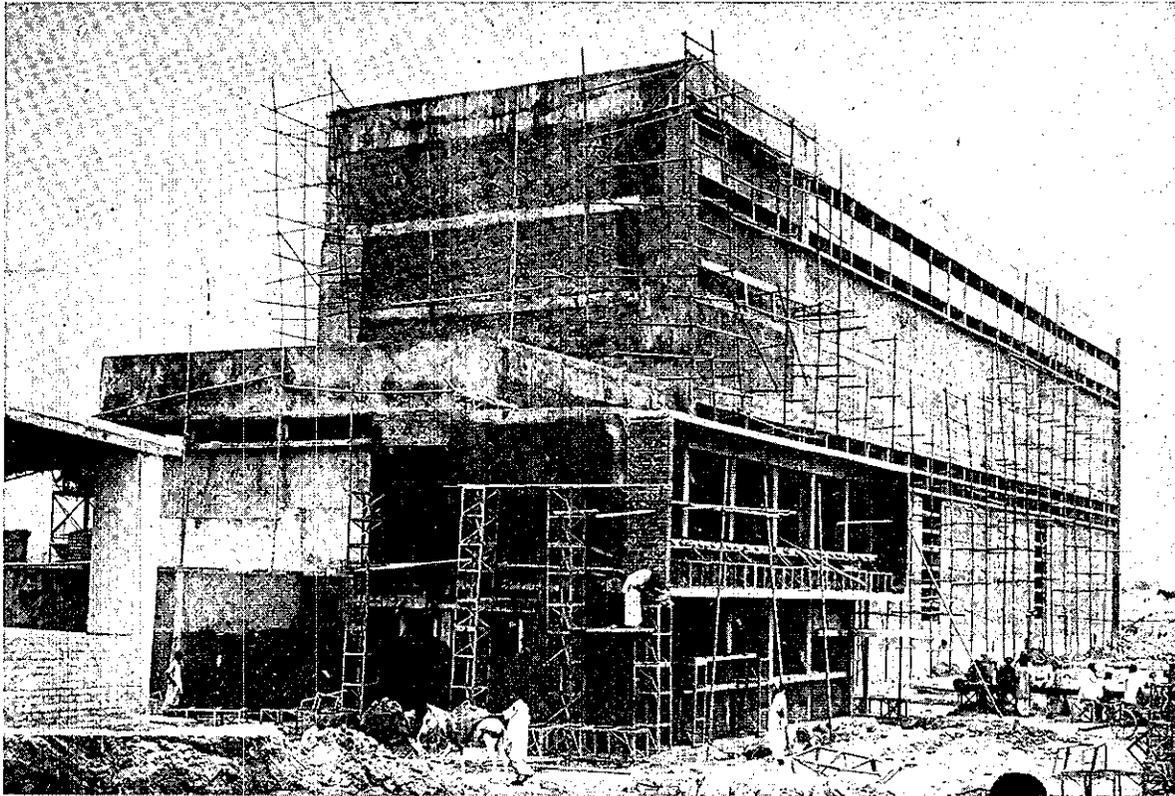
During the year 20 per cent of the lining of the headrace was done to complete the work. In addition the concrete lining adjoining the power house was also completed. Good progress was maintained on the excavation and pitching of the tail race. It is expected to be complete well before the scheduled opening of the power house.

Progress on the erection of turbines and generators is ahead of schedule. The work on turbines is complete up to 80 and 70 per cent of Unit No. 1 and Unit No. 2 respectively and on generators up to 75 and 10 per cent respectively. The power house crane has been fully completed. The control block, switch station and cable duct were started and completed during the last year. All transformers have been installed and their drying out is in progress.

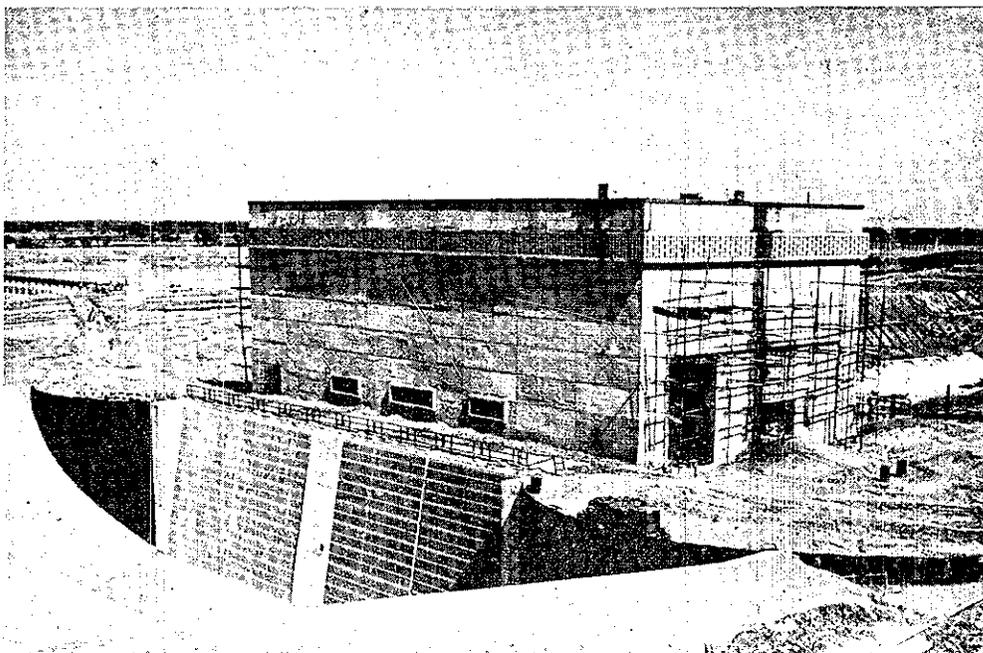
Five miles of 132 kV transmission line connecting the power station with the main grid at Gujrat was completed in a period of two months.

Total expenditure till 30th June, 1960 was Rs. 17.9 million with the approximate cost of equipment, received from Canada, under the Colombo Plan, as 2.8 million dollars.

# SHADIWAL HYDEL PROJECT

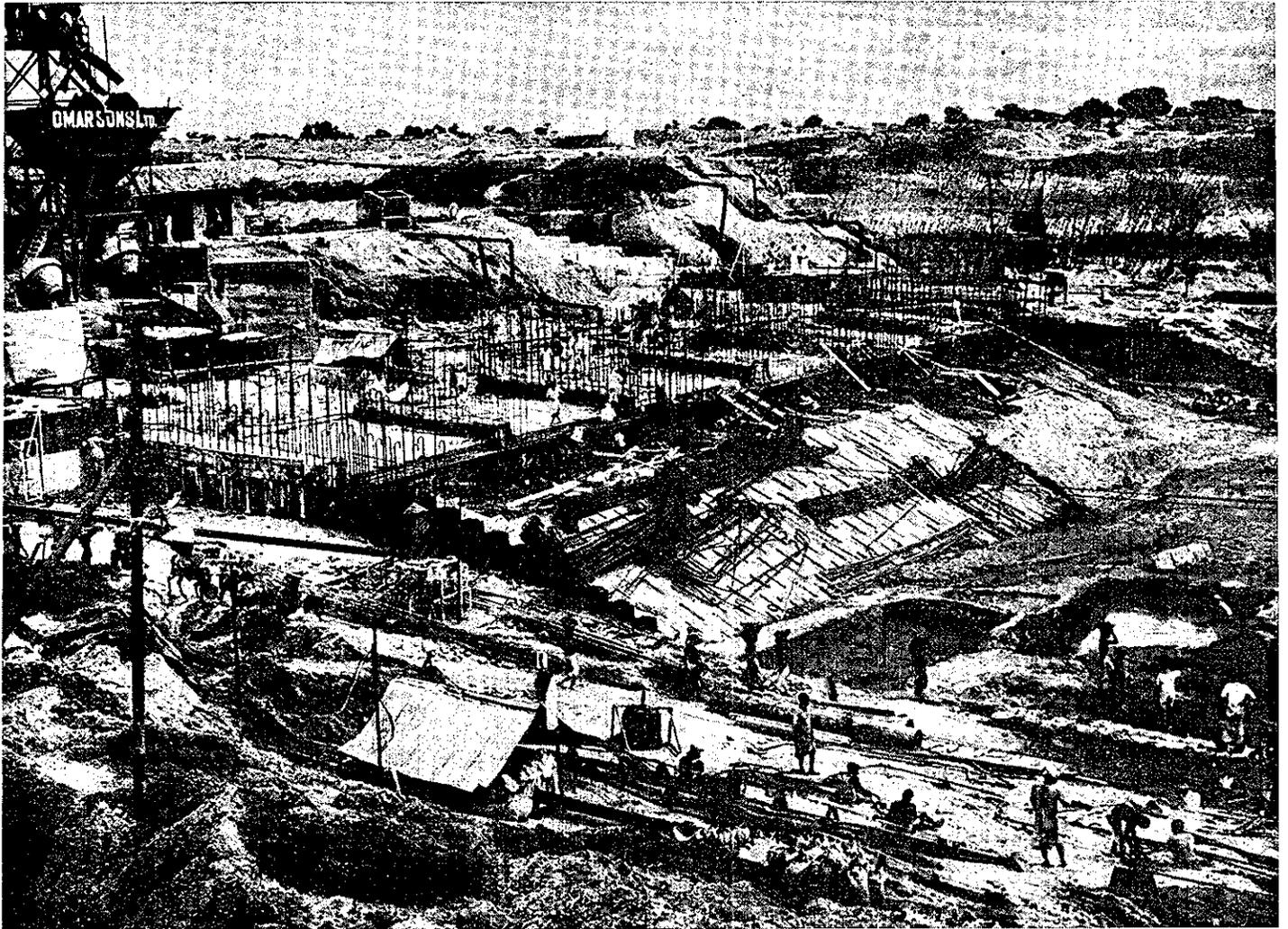


Power house and control Block viewed from south-west.



Power house viewed from north-west, 30th June, 1960.

## GUJRANWALA HYDEL PROJECT



▲ Preliminary construction work in progress for concreting the power house bed.

## GUJRANWALA HYDEL PROJECT

- |  |   |
|--|---|
| <b>1. NAME OF PROJECT</b>              | .. Gujranwala Hydel Project.  |
| <b>2. NATURE OF REPORT</b>             | .. Annual.  |
| <b>3. PERIOD COVERED</b>               | .. July 1, 1959 to June 30, 1960.   |
| <b>4. DATE AND DETAILS OF SANCTION</b> | Government of Pakistan, Ministry of Industries, Karachi, letter No.WD-19 (III)53 dated 12-2-1955. |

### 5. PURPOSE AND COST OF PROJECT

The Gujranwala hydel station is designed to generate 13,800 kilowatts of power and through the power grid provide electricity for the tubewells of the reclamation project in the Rechna and Chaj doabs. The project is situated on the Upper Chenab canal, near Nandipur about 9 miles from Gujranwala. The project is estimated to cost Rs. 39 million.

### 6. PROGRESS

The project is complete in as far as the civil works are concerned. This has been achieved despite heavy odds like the unusually heavy monsoons of 1959. Rain flooded the power house pit and the pumping system was completely buried under the sand. All works completed or under execution were also buried and work came to a standstill. In spite of this set back the work was finished in time.

During the period under review the first stage of concreting the power house was completed, although there are some finishing touches to be given. The work on the second stage is fairly ahead of schedule, and the arrival of an erection group from Yugoslavia is awaited. The first stage of the masonry work relating to the power house is over. The second is slightly behind schedule. The control blocks and the switchyard have been completed.

Earthwork and concreting of the spillway channel was completed far ahead of the programme. It was decided to change the design of the regulator and the amended drawings have been received and work on it has been started.

In respect of the tail race the gap between the scheduled and actual work was markedly reduced during the past year. About 107 million cubic feet of earthwork has been done out of the 108.5 million cubic feet scheduled for the period. The shortfall was owing to power breakdowns. The total work is estimated at 126.5 million cubic feet. The second stage of the earthwork of tailrace involving work to the tune of 8.9 million cubic feet has not commenced. It will be taken up during the closure of the Upper Chenab canal in December. The first stage of the earthwork (10.5 million cubic feet) and lining of the headrace channel was completed much before schedule. The second stage of earthwork (2.5 million cubic feet) which is ahead of schedule and the second stage of lining will be completed during the closure of the canal in December.

The expenditure up to the end of June 1960 was about Rs. 23.5 million.

## NATURAL GAS POWER STATION MULTAN

- 1. **NAME OF PROJECT** .. Natural Gas Power Station, Multan.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. July 1, 1959 to June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** Ministry of Industries letter No. 8-120 (1)/54 dated 10-1-1956 and No. I-III (3)/55 dated 10-8-1957.

### 5. PURPOSE AND COST OF PROJECT

This power station has been constructed to perform the following main functions:

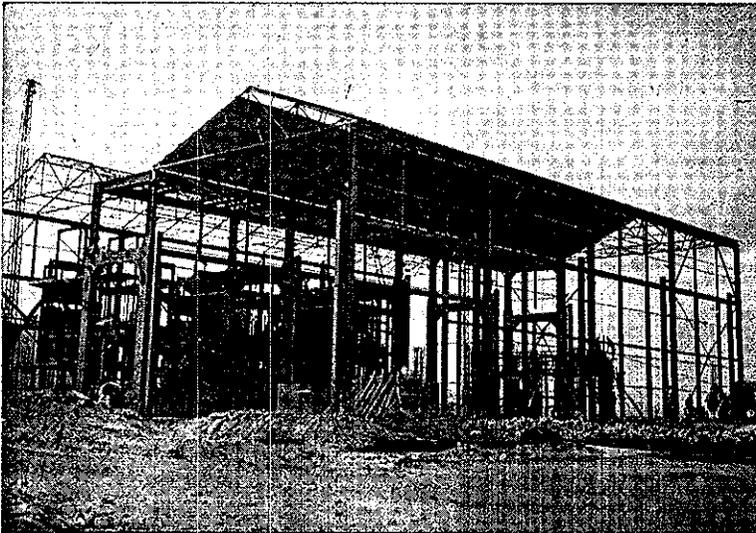
(i) It will help meet the rising demand for power in the Punjab and N.W.F.P. areas. It will also firm up the hydel power generated in the northern region. The existing grid is mostly fed by hydel stations where a serious shortage of power occurs in winter during a low water discharge in the rivers. This seasonal power fluctuation is an inherent characteristic of hydel supply. In order to firm up and to utilise both hydel and thermal power in an efficient, economical and co-ordinated manner a thermal power station is necessary. Since the existing stations are far too inadequate to perform this function the power station at Multan will adequately fulfil this vital requirement.

(ii) The districts of Dera Ghazi Khan, Muzaffargarh and Multan and Thal and Bahawalpur are without any important source of power. The non-availability of a regular and continuous supply is mainly to blame for the industrial and economic backwardness of these areas. This station will make cheap power available for the industrial and agricultural development of these parts. Large lift irrigation schemes are under consideration for Dera Ghazi Khan and Muzaffargarh which will be given power from this station. Utilisation of natural gas from Sui for the generation of power will eliminate the use of imported fuel in the existing thermal station resulting in large savings of foreign exchange. Ample power will also be available for tubewells to fight the menace of waterlogging. The total cost of project is estimated to be Rs. 108 million.

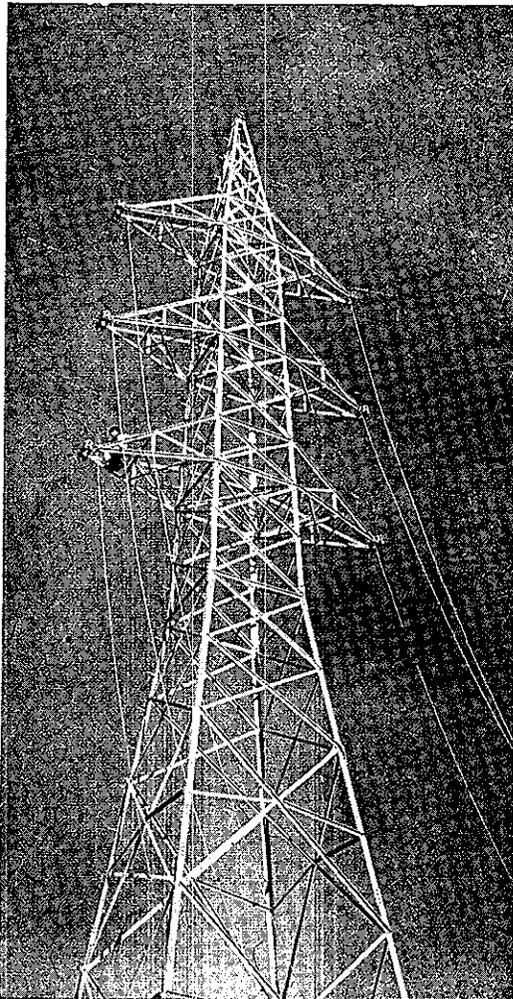
### 6. PROGRESS

All the work connected with the power house has been completed. The first machine of 65, 000 kw was commissioned on 22nd February, 1960, and the second one was put on commercial loading in the 3rd week of May. During the same period, however, the first unit developed a technical fault and it has been out of service since then. Suitable arrangements have been made for its repairs. The other unit is working satisfactorily and along with the 5,700 kw gas turbine is pooling power into the Grid. The expenditure up to date is Rs. 92.5 million.

# HYDERABAD THERMAL STATION



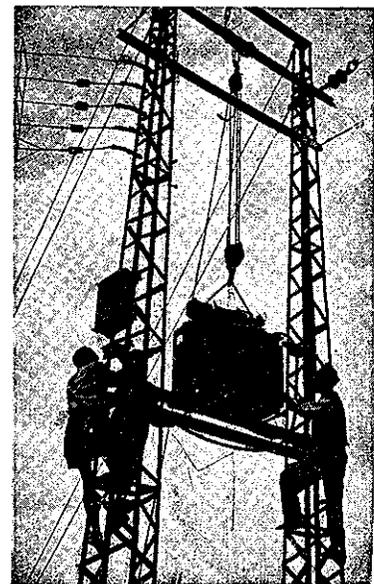
Civil works in progress on the Hyderabad thermal station.



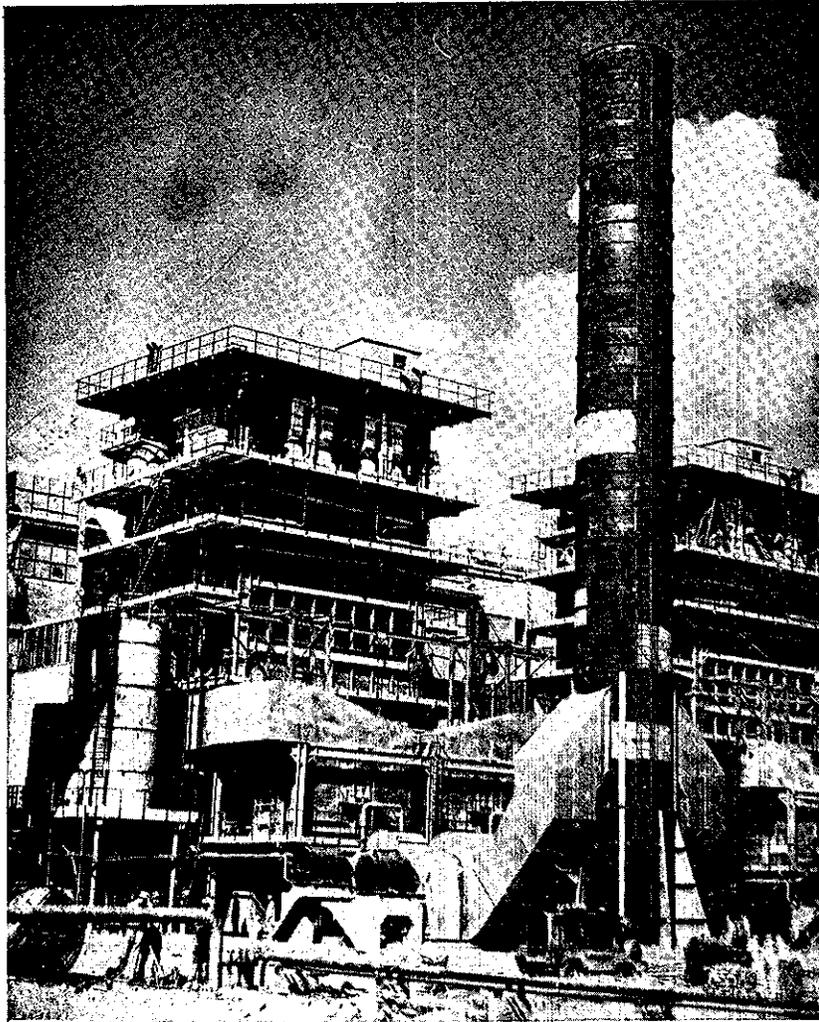
Stringing in the progress of Wapda's 132 kV transmission lines.

## < WEST PAKISTAN HIGH TENSION GRID

### SECONDARY TRANSMISSION AND DISTRIBUTION SCHEME

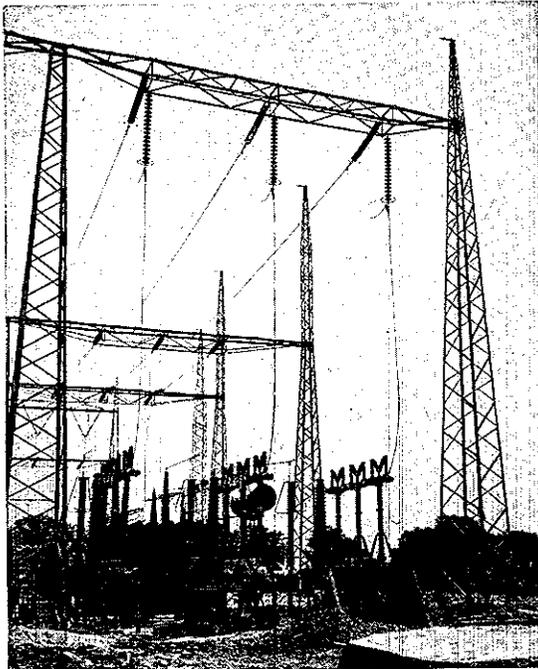


v  
Transformers being put into position under the Secondary Transmission and Distribution Scheme.

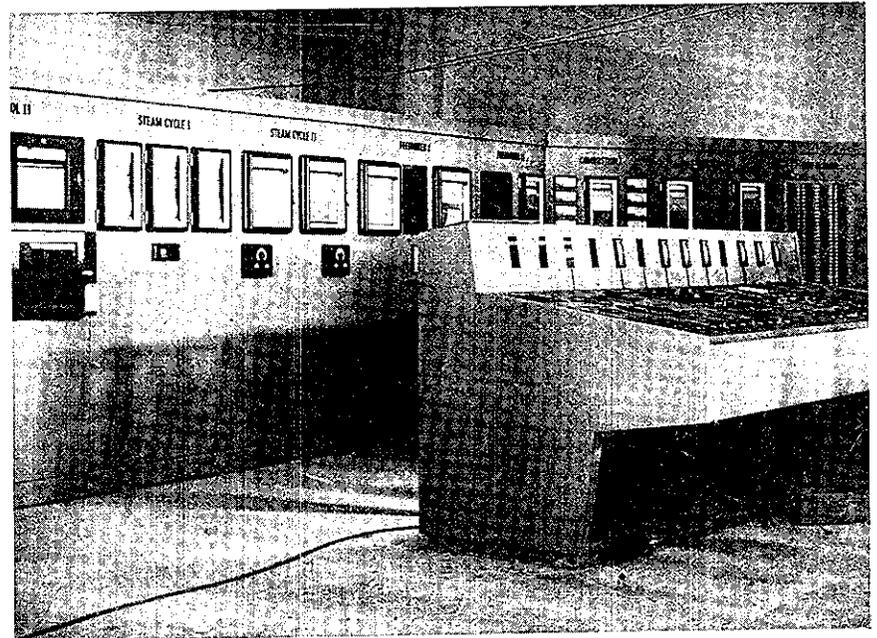


## MULTAN POWER STATION

< A view of the Multan Power house boilers.



Multan power station switchyard which transmits power to Lyallpur through 220 kV line.



Control room of the Multan power station.

## 220 KV MULTAN-LYALLPUR TRANSMISSION SYSTEM

- 1. **NAME OF PROJECT** .. Multan-Lyallpur 220 kv transmission line.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. July 1, 1951 to June 30, 1960.
- 4. **DATE AND DETAILS OF SANCTION**
  - (1) Approved by the Economic Committee of the Cabinet on 3rd August, 1957.
  - (2) Ministry of Industries letter No. I-III-6(46)/56, dated 5th October, 1957.

### 5. PURPOSE AND COST OF PROJECT

The project is estimated to cost Rs. 26 million. This line is being erected to link the Multan thermal station with the existing grid. A detailed system study was carried out in England to lay down a general pattern of future development of the transmission line. As a result a 220 kV link between Multan-Lyallpur was considered essential for the interflow of power for firming up the hydel generation. Similary during the high water periods it would be possible to utilise the surplus hydel power in the southern region. This line would also increase the reliability of supply by making available to the grid an alternative source of power in the case of failure of a major hydel station in the north.

### 6. PROGRESS

The line was energised on 22nd February, 1960. At the Lyallpur grid station 2 x 60 MVA and 2 x 30 MVA power transformers have been installed. This station was commissioned on 3rd March, 1960. The housing colony is 96% complete. The minor works are now in hand to complete the project. Now power from Multan is being supplied to the existing 132 kV grid throughout this line. The progress on the whole is satisfactory and 95% of the work is complete. The total expenditure to date is Rs. 22.6 million.

## WEST PAKISTAN HIGH TENSION GRID

- 1. **NAME OF PROJECT** .. West Pakistan High Tension Grid.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. July 1, 1959, to June 30, 1960.
- 4. **DATE AND DETAILS OF SANCTION**
  - (a) Ministry of Finance letter No. 3 (10)/R & S/58, dated 19-8-58 Central Government conveying Warsak-Kharian Line only.
  - (b) Government of West Pakistan Irrigation, Communication & Works letter No. 7/1/PE/58 dated 22-4-59, for West Pakistan High Tension Grid.

### 5. PURPOSE AND COST OF PROJECT

This is a transmission scheme and the capacities of various lines and sub-stations have been based on the requirements of power at various primary load centres upto 1975. These capacities have been established by the system study in England and Japan, in collaboration with a U. N. expert, Mr. Sven Sviden.

On completion the primary grid will permit the use of power generated at the various hydel and thermal power stations (under construction and in operation) in the most economical manner. It will be possible to utilise hydro electric capacity to its maximum in summer, when ample water is available in the rivers, and thermal capacity to the best advantage in winter. The grid will make available abundant and reliable power supply in large areas of West Pakistan and will also provide adequate transformer and line capacity to meet the prospective loads at the various load centres, thus helping in industrial and agricultural development. Besides, the transmission grid will establish a primary network to which it will be possible to connect the future generating stations without much additional cost. The total estimated cost is Rs. 121 million.

### 6. PROGRESS

The general progress of work is according to schedule. Nearly 99 per cent of the material required for the lines have been shipped and most of it received at site. The entire survey work and 58 per cent of the excavation for all the lines has been completed. 36 % concreting, 24 % erection and 2 % stringing has also been done.

The Warsak-Wah section has been completed in all respects and a temporary inter-connection has been made with the Wah grid station so that power from Warsak

can be utilised on the grid. On the Wah-Kharian section excavation has been completed on 520 foundations (88 per cent) and concreting in 450 foundations (76 per cent). Besides erection of 221 towers, stringing of 147 spans has also been done. This line is scheduled to be completed by September, 1960. On the Warsak-Daudkhel-Lyallpur and Montgomery-Lahore sections 1,175 foundations have been excavated, 721 concreted, 491 towers have been erected and stringing completed of 30 spans.

Sites for Daudkhel, Sargodha, Peshawar and Wah sub-stations have been selected and proceedings for acquisition of the land are in progress.

The total expenditure to date is Rs. 25.57 million.

## SECONDARY TRANSMISSION AND DISTRIBUTION SCHEME

- 1. **NAME OF PROJECT** .. Secondary Transmission and Distribution Scheme.
- 2. **NATURE OF REPORT** .. Annual.
- 3. **PERIOD COVERED** .. July 1, 1959 to June, 1960.
- 4. **DATE AND DETAILS OF SANCTION** Secretary to Government of West Pakistan, Irrigation Communication & Works Department letter No. 7/1/PE/59 dated 24-4-1959.

### 5. PURPOSE AND COST OF PROJECT

This scheme is for the distribution of the power received at the primary load centre, being established with the High Tension Grid, to the ultimate consumers in each centre through a net-work of transmission lines and sub-stations. In other words the primary grid will be linked with the existing distribution facilities within the areas of inadequate supply. Extension of the power system to new areas where there is an existing or a potential demand for power will also be carried out. This project covers a very large area of good agricultural land of the Punjab and Bahawalpur areas which is seriously affected by salinity and waterlogging. In the first instance power will be made available to about 2000 tubewells under the reclamation programme.

This project is an integral part of the overall programme for the production of more power to meet the growing demand in the grid zone. It is an essential link between the generating stations and the ultimate consumers. The cost of the project is estimated at Rs. 206 million and provides for over 4000 miles of transmission lines, including about 200 miles of 132 kV, 650 miles of 66 kV, 700 miles of 33 kV, 2000 miles of 11 kV and 500 miles of 400 volt lines; and 45 new distribution centres.

### 6. PROGRESS

A detailed construction programme for the implementation of the project has been finalised by the consultants and Wapda. Orders have been placed for some power transformers. Tenders for the erection of lines in the south of Multan and Bahawalpur areas are under issue. 30% of the sub-station sites have been selected and acquisition of land is in progress. With the completion of this scheme it will be possible to meet the immediate demand of consumers and an adequate transmission and distributions system will have been laid to cater for the prospective demand. It will be possible to cater the maximum demand of 380,000 kw in 1963 against the present 100,000 kw. The project is still in its initial stage and the total up-to-date expenditure stands at Rs. 14.1 million.

## HYDERABAD THERMAL STATION

1. **NAME OF PROJECT** .. Lower Sind (Hyderabad) Thermal Scheme.
2. **NATURE OF REPORT** .. Annual.
3. **PERIOD COVERED** .. July 1, 1959 to June 30, 1960.
4. **DATE AND DETAILS OF SANCTION** .. Approved by the Planning Commission vide letter No. 21 (2)DA(PC)/59, dated January 29, 1960.  
Secretary to Government of West Pakistan, Irrigation Communication & Works Department, Lahore, vide letter No. 1106/DEV-SIII/67, dated 6-1-1956.

### 5. PURPOSE AND COST OF PROJECT

Large areas of Lower Sind have remained under developed so far. Absence of power has been one of the reasons for this general backwardness. A load survey of Lower Sind was carried out in 1951 and this fully justified the setting up of a central station at Hyderabad.

The completion of this project will eliminate the present expensive, unreliable and inefficient diesel power stations in the towns of Hyderabad, Tando Jam, Tando Allah Yar, Mirpur Khas, Nawabshah, Tando Mohammad Khan, Tando Adam and Shahdadpur, because these stations will receive their supply from the Grid. In addition, 12 new towns lying within a radius of 75 miles of Hyderabad will be supplied energy through a network of transmission and distribution lines. Availability of abundant and cheap power will provide impetus to industrial and agricultural development in the area raising its productivity and the standard of living of the people. The present maximum demand of 8 towns that are being supplied by small diesel stations is 4550 kw. This demand has been restricted and controlled since 1952 and is anticipated to rise up to 13,000 kw within 2 years of implementation of the scheme. The 12 new towns proposed to be connected with the Grid are expected to give rise to a demand of 2,000 kw. Moreover, a new cement factory in addition to the present one and another textile mill are being set up in Hyderabad. This will mean an additional industrial load of 5,000 kw. A pumping load of approximately 3,000 kw is also required by the Irrigation Department near Hyderabad. Thus the station will be loaded up immediately after commissioning. The cost of the project is estimated at Rs. 44.3 million.

### 6. PROGRESS

Construction work is in full swing and progressing according to schedule. Major work connected with boiler No. 1 is complete. A preliminary hydraulic testing of boiler No. 2 has also been done. Foundations for gas turbine and two steam turbines are complete. Erection of steam turbine No. 1 and gas turbine is in progress. Cooling tower is complete and work is now progressing on the water channel. Half of the work on switchyard has been completed. The railway authorities have started the construction of the siding. Total up-to-date expenditure stands at Rs. 12.4 million.

## SUKKUR THERMAL POWER SCHEME

- |  |  |
|--|--|
| <b>1. NAME OF PROJECT</b>              | .. Upper Sind (Sukkur) Thermal Power Scheme.   |
| <b>2. NATURE OF REPORT</b>             | .. Annual.   |
| <b>3. PERIOD COVERED</b>               | .. July 1, 1959, to June 30, 1960.   |
| <b>4. DATE AND DETAILS OF SANCTION</b> | Approved by the Economic Committee of the Cabinet in May, 1960. Intimation received vide Government of Pakistan, Planning Commission's letter No. 21(2)/DA/PC/59, dated 31-5-1960. |

### **5. PURPOSE AND COST OF PROJECT**

The project is still in its preliminary stages and has been designed to supply power to towns around Sukkur. In the Upper Sind area, proposed to be supplied from this station, power is available from local generation in 13 small towns. Their present simultaneous demand is estimated at 5,600 kw. 28 new towns falling within the radius of 70 miles around Sukkur have small scale industries such as flour mills, oil expellers and rice husking mills. These towns will give rise to a demand of 2,100 kw. Among these 28 towns are Dadu, Garhi Yasin, Jacobabad, Gambat, Khairpur, Sukkur, Tharu Shah, Rohri, Shikarpur, and Ratto Dero. This scheme of distribution of power is tentative at the moment and is subject to changes on the advice of the consultants. Besides large areas in the vicinity of Khairpur and Sukkur are faced with the menace of waterlogging. Some pumping schemes to lower the water level in this area are also under consideration. Cheap power available from this central station will save foreign exchange annually to the tune of Rs. 40 lakhs now being spent on imported fuels used in small, inefficient and uneconomical diesel power stations in the area. Moreover there is a lift irrigation scheme along Nara Canal for which 2400 kw of power is required in stages. The overall maximum demand by the end of 1962 is estimated to be 12,000 kw which is expected to rise to 18,400 kw at the end of fifth year of operation. The total cost of the project, including the cost of transmission and distribution lines within 70 miles radius around Sukkur, is estimated at Rs. 53 million.

### **6. PROGRESS**

No substantial progress could be achieved during the period under report as the feasibility report for the Canadian Government is under preparation. In the meantime a tentative site for the power house has been selected and proceedings for its acquisition are in progress. The total expenditure to date is Rs. 1,25,000.

## QUETTA THERMAL SCHEME

- 1. **NAME OF PROJECT** .. Quetta Thermal Station
- 2. **NATURE OF REPORT** .. Annual
- 3. **PERIOD COVERED** .. July 1, 1959 to June 30, 1960.
- 4. **DATE AND DETAILS OF SANCTION** .. Not yet approved.

### 5. PURPOSE AND COST OF PROJECT

The Baluchistan region is very backward in industrial and power development. So far only a few isolated towns have been electrified and power facilities are still confined to Quetta, Chaman, Fort Sandeman, Mach, Sibi and Kalat. Even these towns are served by small and uneconomical diesel sets. The Quetta station too has an old, almost obsolete plant that suffers from frequent breakdowns. The Government of Pakistan has recently embarked upon an industrial development programme for the Quetta division and authorised a number of enterprises. The requirement of the existing and authorised industries is estimated to 7,000 kw. In addition, the Irrigation Department has launched a tubewell drilling scheme about 10 to 12 miles north-west of Quetta. Under this scheme more than 1250 tubewells are to be sunk by the summer 1965. Besides, coal and chromite mines need about 4,000 kw of power for mechanisation.

Keeping in view the present and future demands of the area it has been decided to set up a 15,000 kw steam station by 1963. Power thus generated will be fed into a network of 66 kV transmission line extending up to Quetta, the coal mines, the irrigation pumping station and other industrial and domestic load centres, within a radius of 50 miles of the station. A load survey in the area was recently carried out by the consultants and a maximum demand of 14,702 kw has been estimated by the summer 1963. The total cost of the project is estimated at Rs. 37.3 million.

### 6. PROGRESS

Site investigation is still in progress. The Irrigation Department could not carry out drilling operations beyond 266 feet for lack of proper equipment. This work has now been entrusted to Messrs Harold T. Smith who have received the machinery and equipment at the site and have started work. A loan application is still under consideration with DLF. A team of Wapda and Harza Engineering Company International visited the site to ascertain the correct position in respect of water availability. The total up-to-date expenditure is Rs. 1 Lakh.

## MACHINERY POOL ORGANIZATION

- |  |  |
|--|--|
| <b>1. NAME OF PROJECT</b>              | .. Machinery Pool Organization   |
| <b>2. NATURE OF REPORT</b>             | .. Annual  |
| <b>3. PERIOD COVERED</b>               | .. 1st July, 1959 to 30th June, 1960.  |
| <b>4. DATE AND DETAILS OF SANCTION</b> | .. The Organization was set up by the Government of West Pakistan to centralize in one body the control of the machinery lying with the Irrigation Department and Wapda. |

### **5. PURPOSE OF PROJECT**

Machinery Pool Organization, generally known as MPO, is a semi-autonomous body governed by the Machinery Pool Board (with Chairman, Wapda, as its Chairman; and Chief Engineer, Water, Wapda, and Chief Engineer, Irrigation Department, West Pakistan, as its Members). The MPO staff is headed by a General Manager who works under the direction of the Board.

MPO was set up in April, 1959, to undertake the unified and co-ordinated use of all heavy earthmoving and construction equipment in West Pakistan, improve efficiency and out-put of individual pieces of equipment so as to bring them up to or near the internationally accepted standards, organize and standardize the field maintenance practice of various machines, carry out detailed inventories of all construction equipment in hand, eliminate divergent and non-standard makes of similar types of equipment, write off those pieces of machinery which are beyond economic repairs, arrange adequate replacement and spare parts of the equipment in hand. For new purchases MPO was to standardize the makes and models keeping in view the performance of such makes by international standards, assess the overall workload of Wapda and Irrigation Department's projects and then recommend and process new purchases of all construction equipment.

For assembling, repairing and overhauling of major and ancillary equipment so standardized, MPO was to reorganize, develop and suitably equip 4 Equipment Repair Workshops at Kashmore, Sukkur, Lyallpur and Jamshoro, instead of numerous small, scattered and ill-equipped workshops all over the country. It was also to chalk out repair programmes according to the workload and then expand the workshop facilities at these 4 centres accordingly. Another task was to reorganize warehousing, indenting and stockpiling of spares at 4 depots near the workshops and develop a programme of manufacture of standard replacement parts in these 4 workshops at a later stage.

All these activities were to be organized on commercial lines and for this purpose MPO was to introduce commercial and cost accounting and manage the Pool on a self-liquidating basis.

## 6. PROGRESS

Machinery Pool Organization started operations in the first week of June, 1959. Messrs Morrison-Knudsen (Pakistan) Limited were appointed as consultants. The staff of MPO and M-K immediately joined together in all areas and Pakistani engineers were soon working overtime to learn new methods and practices in the field of heavy earthmoving equipment. MPO is now organized into the following different wings:

### Equipment Control Wing

Immediately after the inception of MPO detailed inventories of equipment already in hand were taken up and completed. According to the MPO inventories the existing equipment with the Irrigation Department and Wapda is valued at Rs. 300 million. After the completion of this job each piece of equipment was carefully examined from the repair and rehabilitation point of view and survey reports of those machines which are beyond economic repairs were prepared. These inventories revealed that the approximate value of the equipment which cannot be reclaimed economically and will have to be written off is about Rs. 100 million

A central Equipment Control Wing has been established at MPO's Headquarters in Lahore. It keeps track of all equipment and controls its distribution in different projects of Wapda and Irrigation Department. Equipment control cards are introduced which give a brief history of each piece of equipment, that is, when purchased, total hours so far worked, when major overhauls were carried out and its present condition. Any new equipment purchased is immediately taken over on the equipment control records. Lists of equipment which is to be rented out by MPO are under preparation and will be published shortly and circulated to Wapda and Irrigation Department so that the existing equipment with the Pool is put to the maximum use and fresh imports are reduced.

### Procurement Wing

There are 4 central equipment repair workshops established by MPO and with each of these a warehouse has been attached. These warehouses are central depots and have been completely reorganized and master-card systems introduced in them. Spare parts worth about Rs. 40 million have been taken over by MPO from the Irrigation Department and have been shifted and properly stored in these warehouses. Each warehouse is headed by a Warehouse Officer, and at MPO's Headquarters at Lahore a central master card for all spares and replacement parts has been set up. This master card gives at a glance the stock position, indenting, shipping status, etc. of each individual replacement item of the entire construction equipment. All further purchases of spares are screened with the help of this master card at Lahore before processing so that the mistakes committed in the past are not repeated and wrong types of spares or those spares which are already in stock are not ordered. Maximum and minimum limits of each individual replacement item have been fixed in respect

of standard equipment and as soon as the minimum limit of a particular item is reached fresh indents are placed, and before this item is exhausted stocks are already in the MPO warehouses. Thus MPO is now in a position to ensure a regular supply of genuine replacement parts for all standard construction and ancillary equipment.

Only in rare cases are parts airlifted and that also only in the organizational stage. It is hoped that such occasions will not arise when MPO is fully equipped.

### **Equipment Repair Wing**

This wing consists of 4 equipment repair shops at Lyallpur, Kashmore, Jamshoro and Sukkur. West Pakistan has been divided and demarcated into 4 sectors and each sector has one equipment repair workshop which caters for all repair, overhaul, maintenance and operation problems of the equipment in its jurisdiction.

The above 4 workshops which were taken over by MPO from the Irrigation Department have been completely reorganized, renovated and equipped for all major and minor repairs to all standard equipment.

Field maintenance practice which hitherto was lost sight of by the Irrigation Department is also being standardized and standard maintenance and history cards are being introduced for each piece of equipment. Mobile service units and workshops are already on the high seas and on arrival will be deployed immediately.

### **Finance and Accounting Wing**

Commercial accounting and cost accounting have already been introduced and MPO will be functioning on a self-liquidating basis, thus pulling its own weight. The ultimate objective of MPO is to use the entire construction equipment on the internationally accepted rental basis. Billing for the rentals and repair works so far carried out for the Irrigation Department, Wapda and other various agencies is in full swing and MPO have carried out operations costing about Rs. 30 million.

## **TRAINING**

With each of the M-K's personnel a suitable Pakistani has been posted as a counterpart and Emkayans are showing keen interest in imparting suitable training to their Pakistani colleagues. Six Pakistani technicians were sent to the United States by M-K for specialised training in heavy machinery. They are due back in the middle of December, 1960, after the completion of a six months course. The batch consists of mechanical and technical workers from Jamshoro, Sukkur, Lyallpur, Mangla and Gudu workshops of MPO.

The idea of this training is to enable Pakistani staff to run the Pool independently and replace the imported personnel gradually. According to an M-K report the trainees are doing very well in the United States and their trainers are satisfied with the performance of the trainees.

## **G. M. BARRAGE CHANNELS**

The Ghulam Muhammad Barrage was completed in 1956, but irrigation channels and drainage works for combating the waterlogging menace were still lagging behind schedule. The West Pakistan Government decided to hand over all the remaining earthwork excavations to MPO so that work was speeded up and completed according to schedule.

The effective control of machines and men was given to MPO in March, 1960, and within four months MPO has been able to complete about 42 miles of drains; some of the work being executed by the military forces. These works were carried out to save the fertile land in between Tando Muhammad Khan and Mirpur Bathoro from the growing menace of waterlogging. These drains flow out into the sea.

## **WARSAK EQUIPMENT**

Heavy construction equipment, including draglines, shovels, batching plants, screening and crushing plants and cable ways, and rock drills, worth about Rs. 15 million became surplus with the near completion of the Warsak multipurpose project. This equipment has been taken over by MPO and after being overhauled and renovated at Warsak is being rented out to various Wapda and Irrigation Department projects. Canadian engineers are carrying out the necessary repairs before handing over the equipment to MPO.

## **24 PER CENT IMPROVEMENT**

Detailed inventories by MPO at the time of its inception revealed that about 50% of the equipment in hand was out of order. Now about 74% of this equipment is in use as a result of MPO operations. The present figures show that out of 416 tractors 251 are in operation, while out of 178 draglines only 25 are under repairs.

## **GENERAL**

Being new to the use of heavy construction equipment the tendency in the past has been to purchase more and more equipment without laying due stress on keeping the equipment running for most of the time which is the main objective of introducing mechanization in civil engineering projects. The problem was further aggravated by the fact that no proper records had been maintained nor was the operation examined from the commercial angle. However, MPO has already helped to speed up the construction tempo and hopes to increase this further. It is also imparting training to Pakistani engineers and technicians not only in the correct use of construction equipment but also in the correct economics of mechanization. In this way MPO will also help in saving millions of rupees in foreign exchange.

### ELECTRICITY OPERATIONS DEPARTMENT

The Electricity Department was transferred by the West Pakistan Government to Wapda on the 1st of April, 1959. When the previous annual report was written the Electricity Operations Department, as it came to be called in Wapda to distinguish it from the Power Development Department, was still in the process of being taken over. Hence no account of its activities was included in the previous annual report.

Soon after it was taken over by Wapda the Electricity Operations Department was entrusted with the task of increasing the generating capacity, of extending the transmission and the distribution system to carry the increased load, and to improve the service to the general public. A result of these measures would be an increase in the revenues which would help in paying back a 4% return to the Government on the assets of the Department transferred to Wapda. The value of these assets is now assumed at Rs. 38 crores.

As this is the first report on Electricity Operations by Wapda to the Government it is necessary to describe the whole system which can be divided into two main zones: the one covered by the grid and the other by isolated stations.

#### GRID ZONE POWER PLANTS

The grid zone covers the Peshawar, Dera Ismail Khan, Rawalpindi, Sargodha, Lahore, Multan, and Bahawalpur divisions. The power stations connected to the grid are listed below with their installed capacities shown against each:—

Malakand	..	..	..	..	..	20,000 kw.
Dargai	..	..	..	..	..	20,000 kw.
Rasul	..	..	..	..	..	22,000 kw.
Renala	..	..	..	..	..	1,125 kw.
Chichoki Mallian	..	..	..	..	..	12,000 kw.
Kurram Garhi	..	..	..	..	..	4,000 kw.
Warsak	..	..	..	..	..	160,000 kw. (not yet fully developed)
<b>Steam:</b>						
Shahdara	..	..	..	..	..	8,000 kw.
Lyallpur	..	..	..	..	..	14,000 kw.
Montgomery	..	..	..	..	..	8,500 kw.
Multan	..	..	..	..	..	135,000 kw. (not yet fully developed)
<b>Diesel:</b>						
Lyallpur	..	..	..	..	..	10,000 kw.
Burewala	..	..	..	..	..	1,600 kw.

## ISOLATED STATIONS

The isolated stations are mostly in the southern region and all of them are thermal. These in turn are grouped as the Upper Sind Thermal, Lower Sind Thermal, and Quetta Thermal schemes. The stations working in these areas, at present, are:

### Upper Sind

Jacobabad	..	..	..	..	..	640 kw.
Kambar	..	..	..	..	..	100 kw.
Khairpur	..	..	..	..	..	270 kw.
Tharushah	..	..	..	..	..	140 kw.
Dadu	..	..	..	..	..	300 kw.
Garhi Yasin	..	..	..	..	..	165 kw.
Kot Dijji	..	..	..	..	..	70 kw.

### Lower Sind

Hyderabad	..	..	..	..	..	5,000 kw.
Tando Mohammad Khan	..	..	..	..	..	165 kw.
Nawabshah	..	..	..	..	..	700 kw.
Mirpurkhas	..	..	..	..	..	1,000 kw.
Jamshoro	..	..	..	..	..	700 kw.
Tando Adam	..	..	..	..	..	300 kw.

### Quetta and Kalat Region

Chaman, Mach, Fort Sandeman and Sibi	..	..	..	..	..	400 kw.
Kalat	..	..	..	..	..	60 kw.

## PRIVATE COMPANIES

The above list does not show the total installed capacity available in the two zones. Some privately owned stations are operating in both zones, such as Sukkur (1,800 kw) and Quetta (2,800 kw) in the southern region, and the Rawalpindi and Multan electric supply companies in the grid zone.

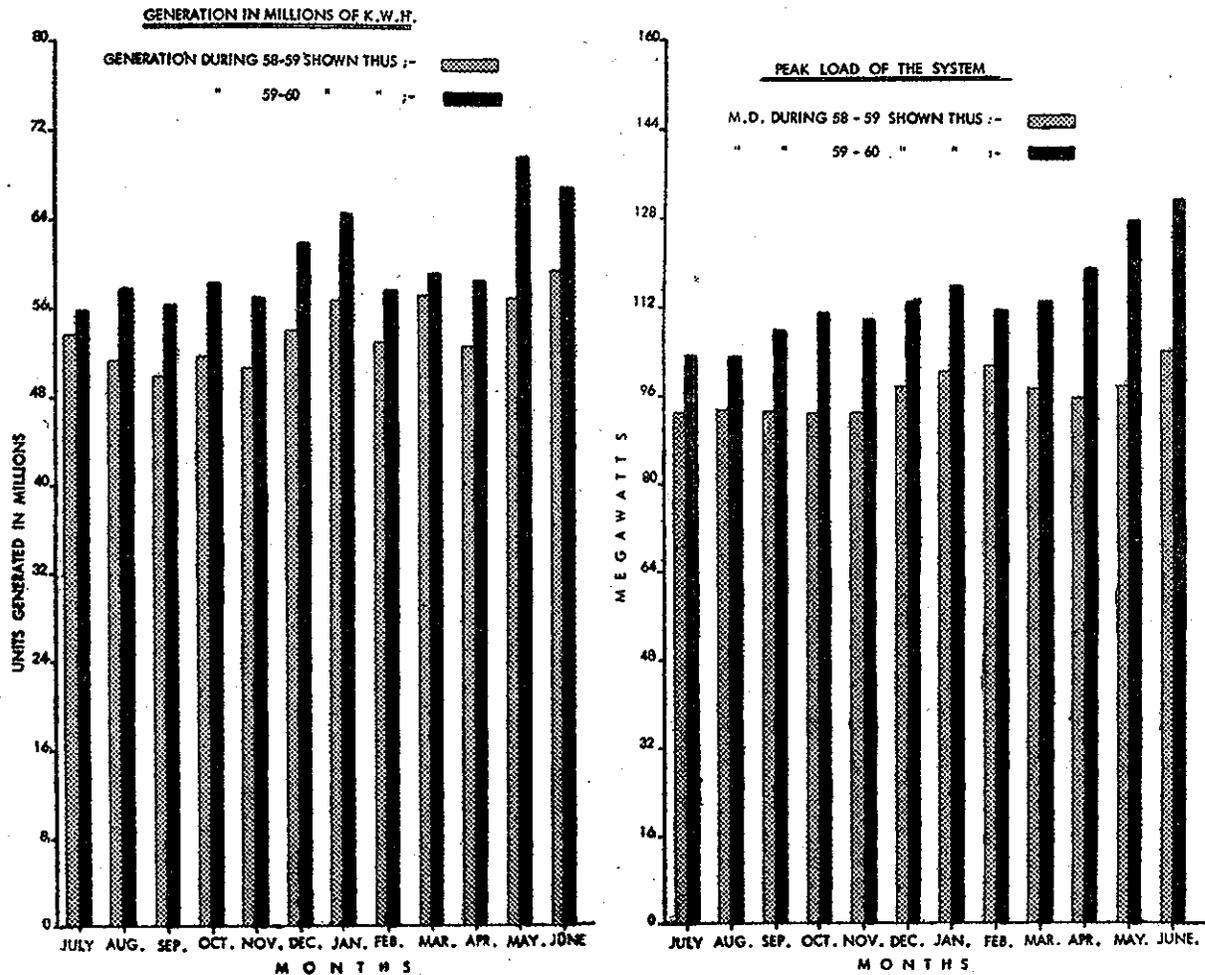
## NEW STATIONS

Towards the end of the year under report the Multan natural gas power station (135,000 kw.) and the Warsak hydel station (160,000 kw.) were brought into operation partially. With power available from these sources the purchase of electricity from the power stations of PIDC's fertiliser factory at Daudkhel, (7,000 kw) and the Pakistan Ordnance Factory at Wah (5,000 kw) was discontinued. Thermal stations like Shahdara and Lyallpur were closed down resulting in saving a good deal of foreign exchange spent on fuel. The commissioning of Multan and Warsak also made it possible to begin overhauling and repairing the machinery at the small hydel stations like Rasul, Malakand and Dargai which had been working continuously for the last several years.

## TRANSMISSION

To consume the power from Warsak and Multan it was necessary to speed up the installation of the transmission and distribution system to carry the power to the consumers. Consequently, a 220 kV link between Multan and Lyallpur and a 132 kV link (double circuit) between Warsak and Wah were established. Sub-stations of the

required capacities were installed at the various load centres. As a result it was possible to meet the power demand upto 131,000 kw. The units generated in the grid zone rose from 644 million in 1958-59 to 723 million in 1959-60. How the power demand and the generation developed in the grid zone is shown in the charts below.



Including the Multan-Lyallpur 220 kV link the primary section of the West Pakistan grid will extend over 650 miles. This network which interconnects the hydel, steam and diesel power stations in the grid zone is at present passing through a period of transition. As already stated the increase in the generating capacity during the period under review came with the partial commissioning of the Multan and Warsak stations. These two stations, the biggest in the country, are situated at the extreme ends of the grid. The transmission lines interconnecting these stations with the grid are still being installed. So far their main connection has been through a single circuit 132 kV line meant originally for the transmission of power from the Dargai station to the central zone. Not only is the capacity of this line limited but it also extends to only 300 miles.

This situation makes the grid system vulnerable. Even temporary faults often cause general failures in large areas. And this position is not likely to improve until the 132 kV circuits of the primary grid, linking Warsak and Multan, are completed. Two of these circuits are to be completed by the end of 1960 and the situation will

improve. The grid, however, will be fully stable only on the completion of the two other circuits between Warsak and Lyallpur via Daudkhel towards the middle of 1961, and with the completion of the grid stations towards the end of 1961.

Along with the installation of the primary grid Wapda is working on the construction of secondary transmission and distribution facilities in the grid zone. Under this scheme over 4000 miles of transmission lines of 132, 66 and 33 kV capacities will be installed. This will also mean the construction of 45 new distribution centres to take power from the main load centres. In addition, there will be 2000 miles of distribution lines of 11 kV and 500 miles of 400 volt lines. Progress on this scheme is reported in the relevant chapter in this Appendix.

Besides the Multan-Lyallpur 220 kV link and the Warsak-Wah 132 kV link, a number of 66 kV and 33 kV lines were laid during the year to cope with the increased load. These were:

**Liaqatabad.** Liaqatabad in the Thal was being served by a diesel station. The town has now been connected to the grid system by taking a 33 kV line from Mianwali. The diesel station, which was uneconomical, has been closed down.

**Kohat.** Kohat has now been connected to the grid system with a 66 kV line.

**Murree.** Murree has been experiencing an unstable and unsatisfactory supply for the last few years. It could not be linked to the grid on account of unstable generation conditions on the system. The grid has now been extended by means of 33 kV lines to Murree via Dunga Gali. Another link with Murree on 33 kV line was also established from Rawalpindi grid station. These links have stabilised the supply position and also resulted in the closing down of the uneconomical local diesel station.

**Mangla.** A 10,000 kw sub-station has been established at Mangla to provide the power needed for the initial stages of construction. Later the capacity at Mangla will be increased to 40,000 kw as the tempo of work develops over the next few years.

**Augmentation and Renovation Works.** The additional power could not be injected into the existing system in big towns like Lahore and Lyallpur unless the local distribution systems were augmented and renovated. Sub-station capacities were required to be increased besides the laying of new 11 kV mains and sub-mains. With this object in view extensive work on the augmentation and renovation was undertaken in Lahore, Lyallpur, Gujranwala, Sialkot, Sargodha, Vehari and Montgomery. The elimination of local faults depends on this work. In Lahore, for instance, this system is 30 to 40 years-old without much renovation.

**Village Electrification.** The very slow extension of electric supply facilities to the villages has been the result of a chronic shortage of power and an inadequate transmission network. The power position is now better and a village electrification programme is being prepared by Wapda. A start was made during the year under review and 300 villages were electrified. The Wapda plan is to cover 1000 villages a year.

## DETECTION BRANCH

In the past there was a considerable gap between the electricity generated and the electricity for which revenue was collected. The percentage of energy unaccounted for was so high that a study of the problem was made and it was found that the theft of energy was one of the main causes. To tackle this problem the Detection Branch was set up. This branch began its activities in June, 1959, and organised raids on those small and big industrial consumers who were suspected of stealing energy directly or indirectly by tampering with meters. So far about 30,000 consumers have been checked and about Rs. 1.2 million recovered from them. Also, as a result of improved checking the monthly revenue of the department has increased by Rs. 750,000 which is a recurring permanent gain.

The activities of the Detection Branch are being increased so as to cover more areas within the grid zone. With this the revenue of the Electricity Department is expected to increase further.

## STORES ORGANISATION

Great difficulties were experienced in the procurement of stores before the Department was taken over by Wapda as all requirements were indented through D.G.S. & D., Karachi. This resulted in long delays. All purchases are now being made by Wapda itself and a directorate within the Department has been created for this purpose. The stores are being procured at a much more rapid rate which makes it possible for the works to be executed at a much quicker pace.

## NEW CONSUMERS

During the year under report about 34,000 new connections were given of which 1900 were industrial and 865 for tubewells. The new connections involved extensions of the existing system and consequently 990 miles of 11 kV lines, 245 miles of 400 volt lines and a large number of sub-stations with an aggregated transformer capacity of about 24,725 kVa were installed.

## REVENUE ACCOUNTS

For the quarter ending before the period of this annual report, that is, from 1st April, 1959 to 30th June, 1959, the Department sold nearly 120 million units as detailed below:—

Domestic Consumers	..	..	..	..	1,63,34,996
Seasonal Industries	..	..	..	..	37,37,305
Other Industries	..	..	..	..	7,70,49,806
Bulk Consumers	..	..	..	..	65,67,720
Government Agricultural Tubewells			..	..	1,29,57,279
Non-Government Agricultural Tubewells			..	..	24,73,437
Public Lighting	..	..	..	..	8,12,223
			Total	..	11,99,32,766

For the same quarter, the revenue of the department was Rs. 1,36,82,024. Of this Rs. 1,35,16,449 came from the sale of energy and the rest from commissions re-

ceived from the Government for collections of outstanding bills made on its behalf, interest on deposits and miscellaneous receipts.

The total revenue expenditure was Rs. 1,31,46,817; the revenue surplus being Rs. 5,35,207. The main items of expenditure were: cost of generation, transmission and distribution amounting to Rs. 60,54,463; interest payable to Government at the rate of 4% on Rs. 58 crores, amounting to Rs. 38 lakhs; depreciation at the rate of 2% amounting to Rs. 19 lakhs, the rest being expenditure incurred on establishment, head office administration, consultants' fees and bank charges.

1959-60. For the year under report, the total number of units sold were over 603 million as detailed below:

Domestic consumers .. .. .	9,82,92,300
Seasonal Industries .. .. .	2,12,20,544
Other Industries .. .. .	36,90,23,606
Bulk Consumers .. .. .	4,23,55,919
Government Agricultural Tubewells .. .. .	5,47,86,862
Non-Government Agricultural tubewells .. .. .	1,23,92,814
Public lighting .. .. .	52,40,548
Total .. .. .	60,33,12,593

The financial statement for 1959-60 shows a revenue of Rs. 7,46,69,838. Of this Rs. 7,41,74,511 came from the sale of energy; Rs. 3,22,124 from interest on deposits; Rs. 68,005 as commission receivable for collections of outstanding bills made on behalf of the Government; Rs. 1,05,075 on account of expenses recovered on deposit works and Rs. 523 for miscellaneous receipts.

On the expenditure side the cost of operations came to Rs. 3,15,04,645; establishment expenses Rs. 75,06,584, consultants' fees Rs. 60,795; interest payable to Government at the rate of 4% on assumed Government assets of Rs. 38 crores, Rs. 1,52,00,000; provision on account of depreciation Rs. 1,00,16,133 and miscellaneous expenses Rs. 48,48,200. This leaves a revenue surplus of Rs. 99,33,48.

## NEW TARIFF

On the last day of the period covered by this annual report the Department's new power tariff was announced through a notification by the Authority under Section 25 of the Wapda Act. The new tariff comes into force from the 1st of July 1960. Work on formulating a new tariff began shortly after the Department was taken over by the Authority. This was considered necessary because different tariff rates were in force in different areas of the grid zone, this being a legacy from the days before West Pakistan was unified. To make the power tariffs followed by the Punjab and Frontier Governments uniform and rational, Wapda engaged the services of Mr. A. F. Bordrionnet, an expert on electricity tariffs from France. He worked on this for six months and then submitted a report to the Authority. The Authority adopted the new schedule of tariff after making modifications where this was considered necessary. Some features of the tariff have already been outlined earlier in this annual report.

### REVENUE AND EXPENDITURE ACCOUNT STATEMENT OF THE ELECTRICITY OPERATIONS DEPARTMENT.

During the year ending on the 30th of June, 1960, the income of the Department was as follows:

<b>Sale of Energy:</b>	Rs	Rs
As per Billing section figure .. ..	7,45,95,728	
Less Government duty billed .. ..	4,22,217	7,41,73,511
<b>Miscellaneous Receipts:</b>		
(Receipts having relation with contra items have been deducted from contra account) .. ..		523
<b>Expenses Recovered on Deposit Works</b>		1,05,075
<b>Commission Receivable:</b>		
(5% commission on 13,60,093 which is the amount of collection on behalf of Government)		68,005
<b>Interest on Deposits:</b>		
(Bank interest allowed on Fixed Deposits and Current Account Balances) .. ..		3,22,724
		<u>7,46,69,838</u>

During the same period the expenditure account of the Department was as follows:—

<b>Cost of Operations:</b>		
Cost of Generation .. ..	1,81,18,607	
Cost of Transmission .. ..	59,95,995	
Cost of Distribution .. ..	41,19,320	
Works Expenditure paid for the Department ..		
by Chief Accountant, Wapda .. ..	15,81,684	
Cost of Power-Wah .. ..	16,89,039	3,15,04,645
<b>Establishment Expenses</b>		
(This is divided in the ratio of 60% to Revenue and 40% to Capital) .. ..		75,06,584
<b>Consultants Fees</b>		
Proportion of fees charged to Chief Accountant Wapda .. ..	47,050	
Auditors fees charged for year-end work June 30th 1959 .. ..	13,745	60,795

<b>Interest Payable to Government:</b>	Rs	Rs
(4% on assumed Government assets Rs. 38 crores)		1,52,00,000
<b>Provision for Depreciation:</b>		
(2½% on assumed Government assets) (As per Authority's orders dated.....)	95,00,000	
(2½% on period paid Capitalized expenditure (58,89,998) .. .. .)	1,47,250	
(1¼% on Current year's Capitalized expenditure (6,15,10,620) .. .. .)	7,68,883	1,04,16,133
	<hr/>	
<b>Miscellaneous Expenses:</b>		48,200
<b>Revenue Surplus:</b>		
(Subject to further adjustments) .. .. .		99,33,481
		<hr/>
<b>Total</b> .. .. .		<b>7,46,69,838</b>
		<hr/>

**BALANCE SHEET****ELECTRICITY OPERATIONS BRANCH**

Balance Sheet as at June 30, 1960 (Subject to adjustments)

<b>ASSETS</b>		<b>LIABILITIES</b>	
Cash	1,48,94,781	Sundry Creditors and Deposits	10,53,69,106
Stock	6,38,89,555	Amount payable to Government	5,67,69,937
Advances and Accounts receivable	1,62,25,765	Depreciation	1,15,99,118
Capitalized Expenditure	6,26,19,201	Consumer Bills receivable on Government Account (Contra)	53,43,620
House Building and Imprest Advance	1,16,867	Working Suspense	51,47,928
Inter-divisional Settlement Control Account	3,16,08,608	Revenue Surplus (1-4-59 to 30-5-60)	1,04,68,688
Bills receivable on Government Account (Contra)	53,43,620		
	<u>19,46,98,397</u>		<u>19,46,98,397</u>

**FINANCIAL STATEMENT FOR THE YEAR ENDING 30TH JUNE, 1960.**  
**On 1st July, 1959.**

	Rs.	Rs.
a. The Authority had on hand and on deposit with various banks .. .. .	2,74,81,354	
b. Various parties owed to the Authority in respect of advance payments made to them for purchase of cement and other materials and on account of advances to clearing agents and consultants and security deposits .. .. .	38,05,545	
c. Small loans due from the staff to the Authority were .. .. .	38,400	
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	3,13,25,299	

Deducted from this amount are the following amounts which were due from the Authority to various parties as on 1st July, 1959:

a. Electricity Operations Branch ..	6,18,990	
b. Sundry creditors for supplies and services .. .. .	7,86,466	14,05,456
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Balance being the amount at the disposal of the Authority as on 1st July, 1959. .. .. .		2,99,19,843
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**During the year 1959-60 the Authority received:—**

a. Loan from the Government of West Pakistan ..	15,69,17,500	
b. Funds from the Government of Pakistan for Project Expenses .. .. .	9,34,05,237	
c. Loans from the Development Loan Fund of America .. .. .	4,21,39,437	29,24,62,174
	<hr/>	<hr/>
		32,23,82,017

**As on 30th June, 1960.**

a. The Authority had on hand and on deposit with various banks .. .. .	3,09,30,012	
b. As on that date various parties also owed the Authority in respect of advances made by it to them for the purchase of material, services, security deposits, small loans, etc. .. ..	35,41,510	
c. The Electricity Operations Branch also owed the Authority as on that date .. .. .	70,93,716	
d. The Authority did not accept the debits received from the P.I.D.C. for disbursements made by the Corporation upto 30-6-59 and reversed during the year 1959-60 the debits to the extent of .. ..	1,12,355	
Total .. .. .	<u>4,16,77,593</u>	
As on 30th June, 1960 the Authority also owed to sundry creditors for supplies and services .. .. .	12,60,059	4,04,17,534
The balance being the expenditure during the year .. .. .		<u>28,19,64,483</u>
From this amount the Authority has .. .. .		
a. Bought land and buildings during the year .. .. .	12,00,000	
b. Bought vehicles during the year .. .. .	1,93,646	
c. Purchased furniture, office equipment and fittings, library books and office and residential machinery during the year .. .. .	4,11,314	
d. Repaid D.L.F. Loan .. .. .	19,20,000	37,24,960
		<u>27,82,39,523</u>
During the year 1959-60 the material supplied by I.C.A. to Multan-Lyallpur Transmission Line, Lyallpur has been valued at .. .. .	69,86,735	
Depreciation provided on the amounts during the year was		
Land and Buildings .. .. .	60,000	
Vehicles .. .. .	47,922	
Furniture, equipment, fittings, library, and machines .. .. .	48,036	1,55,958
Unallocated project expenditure brought forward from last year .. .. .	77,935	<u>72,20,628</u>
The total being the expenditure on the Projects during the year 1959-60 as per list attached .. .. .		<u>28,54,60,151</u>

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**REVISED FINANCIAL STATEMENT FOR THE PERIOD  
1ST APRIL, 1958 TO 30TH JUNE, 1959.**

From 1st April, 1958 to 30th June, 1959 the Authority received from:—

	Rs.
a. The Government of West Pakistan, Loan amounting to .. .. .	5,24,19,700
b. The Government of Pakistan, for Project expenditure .. .. .	23,50,000
c. P.I.D.C. out of the funds previously advanced to the Corporation by Government .. .. .	57,75,000
A total of .. .. .	<u>6,05,44,700</u>
On 30th June, 1959 the Authority had on hand and on deposit with various banks a sum of .. .. .	<u>2,74,81,354</u>
The balance being the amount disbursed during the period was .. .. .	3,30,63,346
As on 30th June, 1959 the Authority also owed to sundry creditors for supplies and services .. .. .	<u>7,86,466</u>
The total expenditure being .. .. .	<u>3,38,49,812</u>
From this sum the Authority has:	
a. Bought office equipment, furniture and vehicles, the book value of which on 30th June, 1959 was ..	3,45,642
b. Made advance payments for the purchase of cement and other materials, and to clearing agents and consultants, and has given to banks and public authorities as security deposits .. .. .	38,05,545
c. Given advances for library and made small loans to staff .. .. .	<u>38,400</u>
Deducting from the disbursements these payments which total .. .. .	<u>41,89,587</u>
Leave a balance of .. .. .	<u>2,96,60,225</u>
From 1st January, 1959 to 30th June, 1959 P.I.D.C. out of the funds previously advanced to the Corporation by Government met commitments previously made against the projects which have now been transferred to the Authority, by spending .. .. .	71,24,403
Sums advanced by the Electricity Operation Branch to construction divisions after certain adjustments were ..	6,18,990
Materials supplied by I.C.A. to Multan-Lyallpur Transmission Line have been valued at .. .. .	<u>46,00,686</u>
Thus the total expenditure on projects was .. .. .	<u><u>4,20,04,304</u></u>

This sum was spent on the following Projects:

Natural Gas Power Station, Multan .. ..	2,02,29,654
Multan-Lyallpur Transmission Line .. ..	50,69,978
Warsak Kharian Transmission Line .. ..	73,12,418
Thermal Power Station, Hyderabad .. ..	1,42,598
Secondary Transmission Lines .. ..	8,00,241
Extension of Distribution Facilities .. ..	2,07,591
Thermal Power Station, Sukkur .. ..	8,496
Hydroelectric Power Station, Gujranwala .. ..	21,13,092
Hydroelectric Power Station, Shadiwal .. ..	10,91,474
Hydroelectric Power Station, Chichoki Mallian .. ..	1,97,605
Rawal Dam .. ..	68,910
Dams Investigation .. ..	6,633
Machinery Pool Organization .. ..	13,22,490
Gudu Barrage .. ..	12,89,363
Mangla Dam .. ..	15,50,765
Salinity Control and Reclamation .. ..	5,15,061
Unallocated Projects Expenditure (to be allocated in 1959-60) .. ..	77,935
	4,20,04,304

1. The Authority has not received from the Government figures for various projects of assets and liabilities on the dates when the projects were taken over from various Government departments.

2. Transactions of the Electricity Operation Branch are shown in a separate statement.

3. The Authority took-over the construction of Gudu Barrage from 1st November, 1958, but payments up to 30th June, 1959, were made by the Treasury direct to the suppliers, contractors and staff. The Authority has been advised that the expenditure on works during the period was Rs. 2,13,41,302.

4. Till December, 1958, the Government had advanced to P.I.D.C. sums aggregating Rs. 7,42,04,239 for the construction of Projects which were subsequently transferred to the Authority. Upto 31st December, 1958, P.I.D.C. had incurred an expenditure amounting to Rs. 5,94,82,591. During the half-year to 30th June, 1959, the Corporation paid the Authority Rs. 57,75,000 and paid to suppliers and others Rs. 71,24,403 for commitments entered into prior to the take over by the Authority. Out of the balance of Rs. 18,22,245 it is understood that Corporation has made certain other payments for which full information has not been received by the projects concerned.

5. Expenditure by the Canadian Government under the Colombo Plan on the Hydroelectric Power Station at Shadiwal is not included in the amount of Rs. 10,91,474 as the information is not yet available.

**Details of Expenditure on Projets During the Year  
1959-1960.**

	Rs.	Rs.
1. Natural Gas Power Station, Multan .. ..		1,91,46,623
2. Multan—Lyallpur Transmission Line .. ..		2,92,05,001
3. Warsak Kharian Transmission Line .. ..		70,95,319
4. Thermal Power Station, Hyderabad .. ..		78,28,243
5. Thermal Power Station, Sukkur .. ..		9,118
6. Secondary Transmission Lines .. ..		84,62,889
7. Extension of Distribution Facilities .. ..		26,79,147
8. Hydroelectric Power Station, Gujranwala .. ..		1,13,99,171
9. Hydroelectric Power Station, Shadiwal .. ..		47,56,006
10. Hydroelectric Power Station, Chichoki Mallian .. ..		7,53,265
11. Rawal Dam .. ..		77,58,880
12. Gulkatch Dam .. ..		16,19,942
13. Machinery Pool Organisation .. ..		3,08,30,572
14. Gudu Barrage .. ..		3,67,54,358
15. Mangla Dam .. ..		2,29,15,633
16. Resettlement Organisation .. ..		1,65,78,747
17. Link Canals .. ..		21,64,975
18. Tarbela Dam .. ..		64,18,365
19. Karachi Irrigation .. ..		6,54,063
20. Salinity Control and Reclamation .. ..		5,75,13,506
21. Sukkur-Gudu Drainage and Reclamation .. ..		30,54,734
22. Investigation and Survey:—		
a. General Investigation including Dams Inv:	54,07,966	
b. Water and Soil Investigation .. ..	7,95,002	
c. Reclamation Project preparation .. ..	6,24,148	68,27,116
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23. Wapda Printing Press .. ..		4,03,484
24. Wapda Housing .. ..		6,30,994
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		28,54,60,151
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