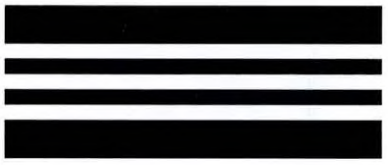

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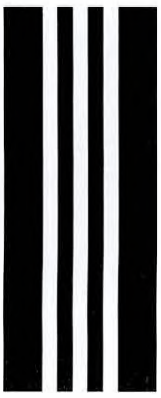

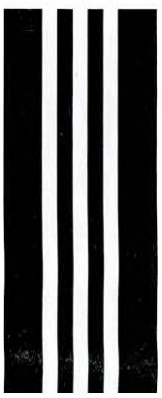

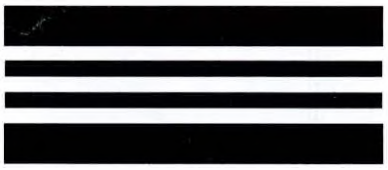

REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

DEPARTMENT OF WATER DEVELOPMENT

ANNUAL REPORT OF THE DEPARTMENT OF WATER DEVELOPMENT FOR THE YEAR 1970

BY

C. A. C. KONTEATIS

Director of the Department of Water Development

NICOSIA - CYPRUS

OCTOBER 1971

REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

A N N U A L R E P O R T

OF THE

DEPARTMENT OF WATER DEVELOPMENT

FOR THE YEAR

1970

By

C.A.C. KONTEATIS
Director
of the Department of Water Development

CONVERSION TABLE

One Meter	=	3.281 feet
One Kilometer	=	3281 feet or 0.621 Statute mile
One Millimeter	=	0.039 Inches
One Square Kilometer	=	0.386 Square Statute mile
One hectar	=	10000 Square meters (7.5 Donums)
One cubic meter per second	=	35.315 cubic feet per second
One Liter	=	0.224 gallon

ABBREVIATIONS USED

mm	=	Millimeter
MCM	=	Million cubic meter
m^3/s	=	cubic meter per second
m^3/h	=	cubic meter per hour
ha	=	hectar

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Infiltration gallery in the gravel deposits of Vasilikos river.

Measuring the Water velocity and flow with a current meter
at the outlet of Kephalovrysos Spring at Kythrea.

I. GENERAL

1.1 Introduction

The Department of Water Development is one of the Departments of the Ministry of Agriculture and Natural Resources and is responsible for the Government's overall policy water resources, planning, design and construction including all engineering hydrological and geological aspects of all types of water development projects on the Island. It also contributes towards the management of water resources and water development projects together with other interested Ministries and Departments. Such water development projects include domestic water supplies, irrigation and drainage projects, flood protection works, protection works against pollution of water resources, groundwater recharge works and other relevant works. Soil Conservation and agricultural problems involved in the economic use of water are responsibilities of the Department of Agriculture. The Government institutional set up for water resources conservation and development and the role of the Department of Water Development is shown on page 12.

1.2 Departmental Organization

The Departmental organization is shown on page 13 and is made up of:-

1.2.1 Division of Water Resources

This Division groups together all services required for the collection study and interpretation of hydrological and hydrogeological data both for ground and surface water, drilling works, control of groundwater extraction and engineering geology problems as connected with the planning and execution of water works projects.

1.2.2 Division of Planning

This Division deals with the preparation of reconnaissance and feasibility studies prior to the detailed design of such projects. The works for planning include field investigations for hydraulic structures, laboratory testing for these structures, water use studies, hydrological evaluations, evaluation of benefits, techno-economic studies, as well as, engineering geology problems.

1.2.3 Division of Design

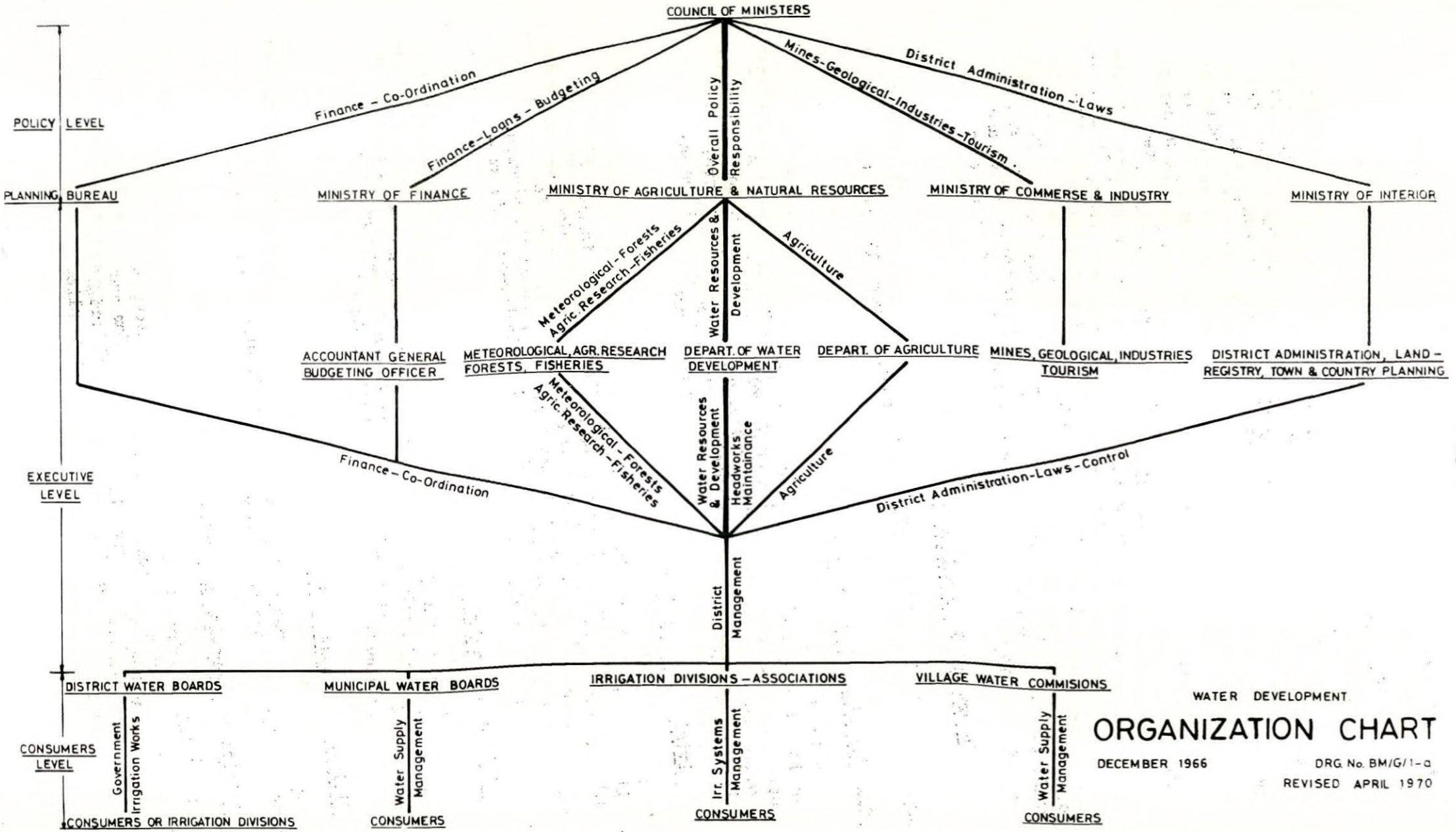
This Division deals with the detailed design and specification work required for major projects after they have been approved as feasible. In this Division the drawing and topographic functions of the Department are incorporated.

1.2.4 Division of Construction

This Division is responsible for all construction work whether carried out by direct labour or by contract.

1.2.5 Division of Operation and Maintenance

This Division assists in the operation and maintenance of the major projects such as dams and town water supplies. For every major project there is a Project Water Board in the case of Irrigation or a Town Water Board in the case of town domestic water supplies, to which we are a member.



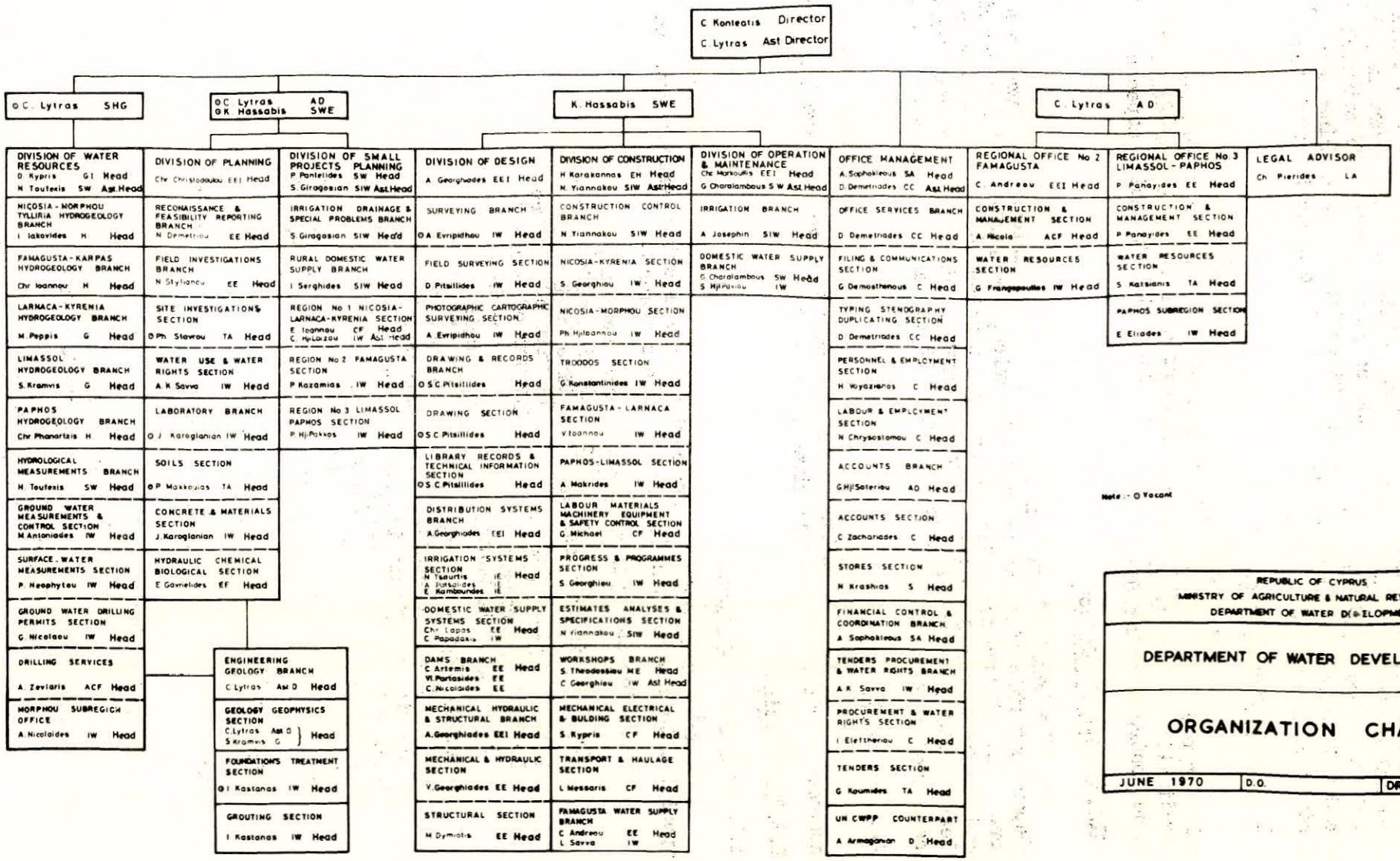
WATER DEVELOPMENT

ORGANIZATION CHART

DECEMBER 1966

DRG. No. BM/G/1-a

REVISED APRIL 1970



Note :- O Vacant

REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE & NATURAL RESOURCES
DEPARTMENT OF WATER DEVELOPMENT

DEPARTMENT OF WATER DEVELOPMENT

ORGANIZATION CHART

JUNE 1970	D.O.	DRG. No. BM/G/1/2

1.2.6 Division of Small Projects Planning

This Division deals with the planning and designing of small irrigation and domestic water supply projects which are of a rather routine nature and do not need elabcrate planning and design procedures.

1.2.7 Regional Offices

There is one regional office in Famagusta and one regional office in Limassol with sub-regional office in Paphos, Also there is a sub-regional office in Morphou. In these regional offices the mainwork carried out is hydrological measurements, collection of engineering data, operation and maintenance of projects and control of construction work from the administrative point of view.

1.2.8 Office Management

This office is responsible for the office services, accounts, labour, personnel and stores. At the same time a financial control and coordination branch is included which deals with financial aspects including the control of expenditure.

1.2.9 Legal Advisor

The Legal Advisor gives advice on the various legal problems of the Department which include water legislation, contractors, and water right problems. At the same time he drafts new water legislation whenever required for approval by the Attorney General. He also deals with important legal matters of the Ministry of Agriculture and Natural Resources whenever requested to do so.

1.3 Staff

A list of the Senior Technical Staff is given on page 39. The numbers of staff by post are given on page 41.

1.3.1 Appointments

1.3.1.1 On Monthly Basis

During the period under review the following persons have been appointed to the posts shown against their names:-

Mr. Nicolas Stylianou, Executive Engineer, Class II with effect from 16.11.70
Mr. Vlassis Partassides, Executive Engineer, Class II with effect from 16.11.70
Mr. Panayiotis Hji Pakkos Inspector of Works from 1. 1.70
Mr. George Frangopoulos - do -
Mr. Panayiotis Photiou Technical Assistant, with effect from 1.6.70
Mr. Georghios Hji Ioannou, with effect from 1.6.70
Mr. Andreas Kourtellas, with effect from 1.6.70
Mr. Michael Michaelides, with effect from 1.10.70
Mr. Andreas K. Sofocleous, with effect from 1.10.70
Mr. Antonios Papageorghiou, with effect from 1.10.70
Mr. Vassos Ch. Zenios, with effect from 1.10.70
Miss Georghia Christodoulou, Draughtsman 15.10.70
Miss Aphrodite Rodosthenous, Draughtsman 15.10.70
Mr. Alexandrou Avgousti, Foreman, 2nd Grade with effect from 1.11.70
Mr. Georghios Iordanou, Foreman, 2nd Grade with effect from 1.11.70
Mr. Nicolas Kyriacou, Foreman, 2nd Grade with effect from 1.11.70

1.3.1.2 On a daily basis

Mr. Charalambos Palantzis, was appointed Executive Engineer with effect from 7.12.70.

Mr. I Photiades, was appointed Irrigation Engineer, with effect from 28.9.70.

1.3.1.3 On Contract

Mr. Antonakis Ioannides, was appointed Legal Advisor, with effect from 19.8.70, in the place of Mr. Charilaos Pierides.

1.3.1.4 Promotions, Secondments

Quite a number of Officers were promoted or seconded to the posts appearing opposite their names:-

1.3.1.4.1 Promotions

Mr. Chr. Christodoulou,	was promoted from Executive Engineer Class II to Class I, with effect from 1.7.70 .
Mr. Chr. Marcoullis,	was promoted from Executive Engineer Class II to Class I, with effect from 1.7.70.
Mr. Costas Andreou,	was promoted from Executive Engineer Class II to Class I with effect from 1.7.70.
Mr. Andreas Georghiades,	was promoted from Executive Engineer Class II to Class I with effect from 1.7.70.
Mr. George Charalambous,	was promoted from Senior Inspector of Works to Superintendent with effect from 15.1.70.
Mr. Costas Papadakis,	was promoted from Inspector of Works to Senior Inspector of Works with effect from 15.1.70.
Mr. Jacovos Kastanas,	was promoted from Technical Assistant to Inspector of Works with effect from 15.1.70.
Mr. Georghios Orphanides,	was promoted from Foreman 2nd to Foreman 1st Grade with effect from 1.10.70.
Mr. Chrysostomos Soteri,	-do-
Mr. Anastasis Nicola,	-do-
Mr, Lambros Nicolaou,	-do-
Mr. Modestos Themistocleous,	-do-
Mr. Costas Mavropetrou,	-do-
Mr. Efstathios Panayi,	was promoted from Foreman 2nd to Foreman 1st (Unestablished) with effect from 1.10.70.
Mr. Demos Zoppos,	-do-
Mr. Antonios Zackeos	-do-

1.3.1.4.2 Secondments

Mr. Costas Georghiou,	from Inspector to Senior Inspector of Works with effect from 15.1.70.
Mr. Phivos Hji Ioannou,	from Technical Assistant to the permanent post of Inspector of Works with effect from 1.1.1970
Mr. Liassis Savva,	-do-
Mr. Andreas K. Nikolaides,	from Technical Assistant to Inspector of Works (Temporary) with effect from 15.1.70.

1.3.2 Resignations, terminations of engagements, transfers, retirements

1.3.2.1 Resignations

The following officers resigned from the Department during the year.

Mr. Charilaos Pierides our Legal Advisor resigned from his post as from the 1st September 1970 to take the post of temporary judge in the Nicosia Courts. Mr. Pierides' work in the Department was very useful both in giving legal advice and in affecting certain modifications in our water laws, so that he will be very much missed.

Mr. Theocharis Thrassou Executive Engineer resigned as from the 1st February 1970 to take up private practice.

Mr. V. Georghiades Executive Engineer resigned as from the 15th December 1970 to take up work with a Building Contractor in Nicosia.

1.3.2.2 Termination of Engagement

Mr. B. Milinusic FAO Senior Irrigation Engineer who served as an Expert attached to the Department since 1st January 1963 was appointed by FAO as an Irrigation Expert in Algeria and had to leave the Island on the 5th March 1970. He thus worked with the Department continuously for over seven years until it was not possible to retain him any longer.

The services that Mr. Branko Milinusic has rendered to the Department of Water Development during his long stay in Cyprus are numerous and fruitful It is very difficult to enumerate all the work that Mr. Milinusic has done for the Water Development Department for he has contributed in almost every aspect of water development work, but more particularly we owe him gratitude for his invaluable contribution in -

construction works on major dams. In this direction he actively helped the Department in the execution of more than 10 major dams, 7 of which were internationally contracted. He helped a lot in the preparation of the contract documents, the necessary agreements and in some cases he gave advice in arbitration proceedings with contractors.

Very important contribution was offered by Mr. Branko Milinusic in Irrigation Engineering and he has given his advice and help in the design and construction of irrigation schemes for at least six major projects. He also produced many reports about irrigation schemes which still have to be constructed such as for the Arkaka-Magounda irrigation schemes including land consolidation and on irrigation and drainage scheme for the reclamation of the Akrotiri salt lake. He has also carried out a pilot irrigation scheme at Athalassa Research Institute for the purpose of carrying out research on irrigation systems.

Mr. Branko Milinusic has written some 20 important reports on the various subjects he dealt with, which will remain as a valuable reference for us in the years to come.

Mr. S. Hsu U.N.D.P. Dams Expert worked with the Department from the 10th March 1963 to the 1st July 1970.

During his service with us he gave valuable advice in the design and construction of 13 major earth and rockfill dams of a total capacity of 26 million cu.m. of water which have increased the previously available storage capacity to more than 2½ times. Furthermore he helped for the design and construction of many other smaller dams and groundwater recharge projects as well as for the maintenance of these dams. He has also helped us in drawing up agreements with Consultants on the design of dams and in checking and controlling their work.

Mr. Hsu's contribution to the training of our young Engineers has also been very helpful.

We tried to retain his services as much as we could and we have managed to have him with us longer than any other expert.

Mr. A.H. Goosen U.N.D.P. Associate Expert from Belgium left also in 1970 after having worked with us for about 2 years.

1.3.2.3 Transfers

Mr. D.J. Demetriades Chief Clerk of the Department was transfered to the Public Service Commission as from the 1st September 1970.

Mr. Christodoulos Ioannides Accounting Officer of the Department was transfered to the Department of Agriculture as from the 1st June 1970.

1.3.2.4 Retirements

No member of the staff retired during the year.

1.3.2.5 Deaths

We are very sorry to record the death of Sir Colin Raeburn on the 27th October 1970 in Nicosia at the age of 76.

The late Sir Colin Raeburn Kt, C.B.E., D.Sc., F.G.S., M.I.M.M., C. Eng. was the first Director of the Department appointed when the Department was established in 1939. He served continously until 1949 when he retired and settled in Cyprus. Sir Colin Raeburn was an important personality and greatly influenced the policies and actions of the Government. He possessed considerable knowledge and experience in hydrogeology, and his appointment was an indication of the importance on which the Government at the time attached on water development. During his time a start was made of the groundwater resources development and numerous small village water supply and irrigation schemes were executed.

1.3.3. Scholarships - Fellowships - Congresses - Duty abroad

During 1970 a number of Officers were granted scholarships, others were sent on short courses of attended Congresses and/or Symposiums. All the Officers who had participated derived the maximum of benefit.

1.3.3.1 Scholarships - Fellowships

The Officers thus concerned are the following:-

Mr. Pantelis Alexandrou Technical Assistant was granted a scholarship by the Israeli Government in Hydrometeorology, which lasted from the 2nd December 1969 to the 7th June 1970.

Mr. Petros Maccoullas, Technical Assistant was granted a scholarship in Soil Testing, under the U.K. Programme of Technical Assistance which lasted from the 28th August, 1969 to the 18th June, 1970.

Mr. Savvas Theodossiou, Mechanical Engineer, was granted an one-year scholarship, starting from the 1st October 1970 by Carreras Ltd., tenable in Glasgow of the United Kingdom, for a postgraduate course, with a view to obtaining an M.Sc. in Salt-water Desalination.

Mr. Christos Marcoullis, Executive Engineer, Class I, proceeded to Utah University of the U.S.A. at the end of September 1970 on a year's scholarship, with a view to obtaining an M.Sc. in Water Resources Management.

Mr. A.P. Georghiades, Executive Engineer, Class I, who had been granted an one-year scholarship in Materials and Construction Management, tenable in Birmingham of the U.K., returned to Cyprus having got the M.Sc. degree, and resumed duties on the 21st September 1970.

Mr. Daedalus Kypris, Geologist, Class I, attended an International Post-graduate course in Management of Water Resources, tenable in Israel, between the 29.4.70 - 29.7.70.

Mr. I. Iacovides, Hydrologist, attended a course for the use of Radioisotopes in Hydrology, tenable in Vienna between the 7.10.69 - 25.1.70.

1.3.3.2 Congresses - Symposiums

Mr. C. Lytras, Assistant Director, attended the Congress of the International Association of Engineering Geology held in France between the 8th to the 11th September, 1970.

Mr. Christos Phanartzis, Hydrologist, attended a Symposium on Hydrometry in Koblenz Germany between the 13th to the 19th September 1970.

Mr. Nicos Toufexis , Superintendent of Works attended the same Symposium.

1.3.3.3 Duty abroad

Mr. Chr. Artemis, Executive Engineer, Class II, was seconded for duty in Italy with Pietrangeli ed Humphreys, S,P.A. Consulting Engineers, with the object of helping in the design of Lefkara Dam.

1.4 Foreign Technical Assistance

As already mentioned both Mr. Milinusic and Mr. Hsu left the Island, so that we had no more foreign experts attached to the Department. However, other foreign technical assistance continued as follows:-

1.4.1 U.N. Water Resources and Utilization Special Fund Project (CWPP).

This Project was completed in 1970 except for the Paphos Feasibility Study which will continue in 1971. Interim reports were issued which will be approved by the Government before published on their final form. A brief Summary of the Studies prepared by the FAO experts in co-operation with the experts of the Government, is given below:-

1.4.1.1 Plan of Operation

According to the Plan of Operation the objectives of the C.W.P.P. were the following:

1.4.1.1.1 Reconnaissance survey and establishment of an inventory of the Island's Water Resources both surface and underground.

1.4.1.1.2 Estimation of the future water requirements for domestic use, industry and agriculture.

1.4.1.1.3 Proposals for development projects, for all major watersheds, together with cost estimates and benefits to be derived from them.

1.4.1.1.4 A detailed feasibility study for the Paphos Area which was undertaken by a specialized sub-contractor.

1.4.1.1.5 Using the results of the overall Survey and of the detailed feasibility study for Paphos to draw up a comprehensive water resources development plan (Master Plan) including not only specific investment schemes but also measures introducing modern water control legislation and establishing one institutional structure to execute water management.

1.4.1.1.2 Methodology

The Island was initially divided into seven regions as follows:

Paphos, Limassol, Larnaca, Morphou-Tylliria, Polis, Kyrenia-Karpasia, East and South East Mesaoria.

The Technical staff has been divided into teams according to specialization as follows:

Hydrologists
Civil Engineers and Geologists
Irrigation and water use engineers
Agriculturists
Economists

The work of each of the above teams was connected with the other, but in spite of this, the work has initially progressed independently in order to gain time. At last comprehensive studies have been prepared for development schemes in single regions and for schemes with transportation of water from one region to another.

During the course of the studies it became clear that two such schemes in addition to Paphos i.e. Tylliria-Morphou and Limassol-Akrotiri were of particular interest from the financial point of view, so they were proposed for detailed feasibility study.

1.4.1.3 Potential Resources and Present Level of Utilization

The Island's physical conditions were briefly analysed as well as the probable population projections and the general economy with special attention to Agriculture.

The contribution of Agrioulture to the gross domestic product is 21.3% and the percentage of the active population employed is 37.5% of the total. These figures indicate that Agriculture is by far the dominant sector of Cyprus economy.

The importance of irrigation in Agriculture can be easily seen from the production value of the irrigated plantations which is 54.0% of the total Agricultural production, while the area covered by them is only 13% of the total area cropped.

The total amount of the Island's water crop was estimated 960 MCM out of which 350 MCM is ground water. For the moment only 400 MCM are used irrigating 43,000 ha.

Land suitability surveys have been carried out in the potential development areas and land suitability maps have been prepared at a scale 1:25,000 for an area of 170,000 ha.

Several surveys covering land tenure aspects and production structures were carried out, in certain groups of villages in the potential development areas, during which a lot of usuful data regarding production and income were gathered.

1.4.1.4 Prospects for Water Development

The potential development areas were identified to be:

Limassol-Larnaca-Famagusta
Morphou-Tylliria
Paphos and Polis

The possibility of extending upland irrigation is not dealt with since it does not present any interest from the economic point of view. Nevertheless account of these extensions, has been taken, estimating the water resources that could be developed in every region.

The regions :

East Mesaoria
Kyrenia
Karpasia Peninsula

are not included in the potential development areas because the results of all studies carried out for them were not promising. These results can be summurized as follows:-

The main problem of East Mesaoria is the great inter-annual fluctuation of Pedieos and Yialias flows as well as the many water rights which makes the control of water very difficult.

A good possibility of development is the construction of small dams on the southern foot-hills of Kyrenia range, similar to those already constructed at Mia-Milia and Kanli-Key, having a total capacity of the order of 1.0 MCM.

Attention has also been paid to the problem of the numerous brackish aquifers of South-Eastern Mesaoria, the high salinity of which makes any development uneconomic. The development of the surface water in the regions of Kyrenia and Karpasia was found to be completely uneconomic while the development of the limestone aquifer could be proved economic. The last is being studied now by the Water Development Department with British Technical Assistance.

In view of the expected touristic development of the above regions no extension of the irrigated areas is proposed. For some isolated touristic areas with no groundwater, certain desalination plants can be installed. These plants can have capacities ranging from 10 to 300 cubic meters per day.

1.4.1.4.1 The Limassol-Larnaca-Famagusta development scheme.

The water resources of Limassol region are in average 140 MCM out of which 40-50 MCM are used now irrigating 3750 ha.

In this area there are seven dams constructed until now out of which two are classified as major (Yermasoyia and Polemidhia).

The most important plantations in the area are those of Phassouri and Zakaki covering 1700 ha which are irrigated mainly from the Akrotiri aquifer into the eastern part of which sea intrusion has been observed.

The land to be irrigated from the Kouris Irrigation Project has been divided into six parts the total area of which is 6400ha. The average annual water requirements of this area are 37 MCM.

Four alternative schemes have been examined and analysed for which the internal rate of return has been found to be:10.5%-14.5% while the capital investment needed is £7.6 - £10.6 million and the estimated cost of water is 15-22 mils per cubic meter.

1.4.1.4.2 The Limassol-Larnaca-Famagusta Scheme

The purpose of the project is 1st to supply water for the irrigation of 13500 ha of first class land in Larnaca area and 2nd to save the Famagusta plantations.

Twenty alternative schemes have been examined and analysed based on the most probable combinations of local use and transport of water together with the construction of a desalination plant.

The capital investment needed for the above alternative schemes is £17.2-£25.5 million while the internal rate of return and the cost of water were found to be 12.6%-17.1% and 25.2-38.2 mils per cubic meter respectively.

1.4.1.4.3 The Tylliria-Morhou Scheme

The purpose of the scheme is to transport water from the Tylliria and the Morphou gulf rivers to Morphou area.

The Tylliria region water resources were estimated to be in average 95-110 MCM per annum out of which only 20-60 MCM can be used economically within Tylliria region.

Thirty two alternative schemes have been examined and analysed for which the internal rate of return has been found to be 13.5%-25.3% while the capital investment needed is £5.75-£14.36 million and the estimated cost of water is 13.7-49.5 mils per cubic meter.

1.4.1.4.4 Paphos Feasibility Study

This study has been undertaken by a sub-contractor employed by FAO. Inspite of this, certain technical and economic data, found during the C.W.P.P. studies, are mentioned below.

The water resources of the Paphos region are estimated to be in average 230 MCM per annum out of which 60 MCM is ground water.

The water used at present is in average 28.5 MCM per annum. The irrigable land that can be developed is found to be 22,000 ha.

Six alternative schemes have been examined and analysed. Internal rate of return has been calculated only for one alternative and found to be 16.5. The capital investment needed is £8.6-£11.6 and the estimated cost of water is 17.0-29.5 mils per cubic meter.

1.4.1.4.5 Polis development scheme

This is a local scheme the main purpose of which is to irrigate the small coastal plains of Polis region having a total irrigable area of 3800 ha.

The main proposed project in the area is the Sarama dam on the Stavros-tis-Psokas river.

Two alternative schemes have been examined and analysed for which the internal rate of return has been calculated and found to be 14.1%-20.9% while the capital investment needed is £2.0-£2.7 million and the estimated cost of water is 22-24 mils per cubic meter.

1.4.1.4.6 Conclusions

The total quantity of water that can be developed in the Island with the above schemes is 133-202 MCM per annum while the total quantity of water not used at present is 560 MCM per annum. This development can be achieved in two alternative ways as follows:

All Agricultural needs to be covered by the total quantity of water to be developed. All town water supply needs to be covered by desalination of sea water.

The town water supply needs for Nicosia, Limassol Larnaca and Famagusta to be covered by 68-86 MCM per annum and consequently the water available for agricultural purposes will be decreased.

The total capital investment for the proposed single and complex schemes ranges between £20 and £54 million. It was considered very difficult to make recommendations for priorities based on pure economic criteria since there were not found big differences between the economic parameters of the various schemes.

1.4.1.5 Legal and Institutional Aspects

The organizational and legal problems, which the Government faces on the application of its water policy, were examined, in detail.

An institutional body is proposed to execute water management in the Island named "Water Authority". All advantages and disadvantages together with the legal status, the administrative organization and functions of this Authority were examined and analysed.

1.4.2 British Technical Assistance

Technical Assistance continued to be given by the Ministry of Overseas Development during 1970 on the following projects:

1.4.2.1 Services of Hydrogeologist Dr. Dixey

Dr. Dixey had two trips to Cyprus during the year in connection mainly with the programme of drilling and hydrogeological investigations on the Kyrenia limestone. Also he spent sometime in giving advice for the drilling and extraction of water from the Khirokitia-Vassilikos aquifers in connection with Famagusta Water Supply.

Drilling was carried out with four rigs on the Kyrenia limestone at sites near Kantara, Trimeni, Ayios Amvrosios, Bellapais and Lapithos. Drilling on the limestone was done by percussion rigs and some of the holes went up to 10000 ft depth starting with 12 in. diameter. Some of these holes take up to 6 months to be completed and test pumped and require considerable time to be completed. It is estimated that drilling should continue in 1971 and possibly 1972 before enough water is pumped to satisfy the domestic and touristic requirements in the northern coastal part of Kyrenia.

1.4.2.2. Akrotiri Feasibility Study

An agreement was reached during the year with the Ministry of Overseas Development so that through British Technical Assistance the Feasibility Study would be made for the development of water resources in the Akrotiri region.

This study was undertaken by Messrs. Howard Humphreys and Sons in co-operation with Sir Murdoch MacDonald and Partners and Hunting Technical Services Ltd. It was initiated early in September and is scheduled to be completed in 18 months from the time of commencement.

The Plan of Operation for the study provides:

1.4.2.2.1 Review all existing geological data for the proposed damsite on the Kouris River, recommend a programme of drilling to determine the foundation conditions at the site and follow the progress of the work, recommending any changes that may become necessary. Make recommendations for any special investigations such as geophysical surveys, grouting tests etc.

1.4.2.2.2 Prepare preliminary outline designs, suitable for estimating purposes, for a dam at the above site.

1.4.2.2.3 Prepare preliminary designs, and layout for the main conveyor from the reservoir on the Kouris River to the irrigable area.

1.4.2.2.4 Prepare preliminary designs and layout for the irrigation distribution system, taking account of the Yermasoyia-Polemidhia dams and allowing for domestic water supply requirements.

1.4.2.2.5 Make recommendations for the integration of the ground and surface water supplies in area, including proposals for aquifer management.

1.4.2.2.6 Review preliminary design and layout for the irrigation and drainage system in the Akrotiri lake.

1.4.2.2.7 Prepare preliminary designs and layout for the irrigation and drainage system of the Akrotiri lake border marshes.

1.4.2.2.8 Draw up a revised water budget for the area.

1.4.2.2.9 Carry out an economic analysis of the project and prepare a comprehensive bankable report.

The Government of Cyprus is also providing the necessary counterpart personnel, equipment, field investigations and laboratory tests, transport and other facilities.

1.5 Cyprus National Inter-Departmental/Departmental Committee

1.5.1 International Hydrological Decade

This Committee was set up on 19th August, 1964 for U.N.E.S.C.O.'s Hydrological Decade (1965-1974) and is composed of the following persons:-

Chairman — Mr. C.A.C. Konteatis, Director, Water Development Department.

Secretary — Mr. N. Chr. Toufexis, Asst. Head of Water Resources Division.

Members — Mr. Y. HjiStavrinou, Director, Geological Survey Department.

Mr. A. Papasolomontos, Director, Agricultural Department.

Dr. Th. Christou, Director, Agricultural Research Institute.

Mr. G. Seraphim, Director, Forest Department.

Mr. Cl. Philaniotis, Asst. Meteorologist, Meteorological Office.

The main activities during the year were the hydrometeorological observations taken in the Representative basins of Limnitis and Vasilikos rivers, as well as the evaporation observations taken at Athalassa. The results are reported to the Secretary, Co-ordinating Council for the I.H.D. Paris.

The Secretary, Mr. N. Chr. Toufexis and Hydrologist, Mr. Chr. Phanartzis participated to the Symposium on hydrometry convened by Unesco and organized in co-operation with the World Meteorological Organization (WMO), by Unesco, the National Committee for the International Hydrological Decade of the Federal Republic of Germany and the International Association of Scientific Hydrology (IASH), taken place in Koblenz, in the Federal Republic of Germany, from 13 to 19 September 1970. This Symposium was held within the framework of the International Hydrological Decade. About 530 participants from fifty countries assembled in the Rhein-Mosel-Halle in Koblenz to hear the presentation of eighty-eight papers.

The Symposium focused in particular on problems concerning the modern development of surface-water measurement. The first papers were devoted to classical procedures, which are being permanently improved. The measurement of water stages may be regarded as the basic hydrological measurement giving the most important data. Authors reported on possibilities of improving the accuracy of measurements, on techniques in arid areas and on mobile stations.

Thirty-nine papers dealt with problems of the measurement of discharge. The classical method of measuring the velocity in a cross-section was covered from the point of view of recent technical developments, calibration, errors, accuracy and instruments. The influence of aquatic weed and ice was also discussed. Tracer methods have become more and more important: chemical tracers have been used as well as fluorescent and radioactive ones. Further papers reported on new

developments in measuring structures, particularly weirs. The influence of backwater, sediment transport and flow transition were dealt with.

Various authors reported on special techniques for discharge measurement by air-bubbles, magnetic induction, ultrasonic techniques and discharge siphons.

Position fixing is important on lakes and large rivers, and new instruments for this purpose were described. A few papers dealt with depth measuring and measurement of temperatures. The measurement of solid-matter transport found particular interest. New devices have been constructed and new instruments have been tried out, but the authors did not leave any doubt that a satisfactory solution has not yet been reached. The discussion on this subject was particularly interesting since many participants could report on their own experiences. It became evident that this field still needs considerable development.

New techniques are increasingly used by hydrologists. This was evidenced by many papers on radiohydrometry and on recording and teletransmission of data, and by the new devices, new apparatus and new techniques which were presented. Much discussion was held about this part of the Symposium since recording of data is one of the most expensive activities of national hydrological authorities.

The last group of papers was devoted to the evaluation of measuring values. Some papers dealt with possible errors, while others described the use of computers and curve readers and reported on analog-digital conversion of data and the necessary technical conditions for using data for automatic calculation.

The necessity of holding such a Symposium was evidenced by the interest of the participants. It became quite obvious that hydrometry is still in a stage of vivid development and that hydrologist still have to devote much of their time to obtaining data for their research and practical work. The technical progress is still far from reaching a level which permits automatization from the stage of observation of data to its processing and evaluation. Existing procedures are not yet sufficiently reliable and need much research.

There was a general feeling that this review of the whole field of surface-water hydrometry should be followed by a similar one in several years time in order to study the progress which has been made.

The proceedings of the Symposium will be printed and are expected to be available in summer 1971.

1.5.2 International Commission on large dams

The Cyprus National Committee on Large Dams (CNCOLD) was elected as a full member of the International Commission on Large Dams in 1969. It is at present composed of the following members:-

Chairman	Mr. C.A.C. Konteatis, Director, Water Development Department.
Secretary	Mr. C.C. Artemis, Executive Engineer, Division of Design.

DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT	1000 m³	YEAR
1	Kouklia	Earth	6.1	4545	1900
2	Lymbia	Masonry	5.2	18	1945
3	Lythrodhonta	Masonry	10.7	32	1945
4	Kalochorio (Kl.)	Masonry	9.1	82	1947
5	Akrounda	Masonry	6.7	23	1947
6	Galini	Masonry	11	23	1947
7	Petra	Masonry	9.1	32	1948
8	Petra	Masonry	9.1	23	1951
9	Lythrodhonta	Masonry	10.4	32	1952
10	Kafizes	Masonry	23.5	115	1953
11	Ayios Loucas	Earth	3.4	455	1955
12	Gypsos	Earth	3.4	100	1955
13	Kandou	Masonry	14	35	1956
14	Perapedhi	Gravity	21.6	55	1956
15	Pyrgos	Gravity	22.3	280	1957
16	Trimiklini	Gravity	33.2	340	1958

Total Storage Capacity 6,190 $m^3 \times 10^3$

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000 m³	YEAR
36	Ay Yeorghios	Earth	6.1	90	1962
37	Fsta Antiflood	Earth	7.6	165	1963
38	Ay Nicolaos	Earth	1.8	1,365	1964
39	Paralimni Lake	Earth	0.9	1,365	1964
40	Fresh Water Lake	Earth	3	4545	1964
41	Makrasyka	Earth	7.9	195	1966
42	Akhna (Mesana)	Earth	3.7	90	1967
43	Morphou spreading grounds	Earth	4.6	130	1969
44	Ormidhia	Earth	5.5	100	1968
45	Vrysoules	Earth	6.7	140	1969
46	Protopapas	Earth	5.9	90	1970

Total Storage Capacity 8,275 $m^3 \times 10^3$

N B Total Storage Capacity to date 47,700 $m^3 \times 10^3$

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000 m³	YEAR
47	Sotira	Earth	7.6	45	1962
48	Panayia (F)	Earth	7	45	1962
49	Paralimni (4$)	Earth	4.6	115	1963
50	Ayia Napa (7)	Earth	8.2	55	1963
51	Fsta Recharge	Earth	4.9	50	1963
52	Phrenaros (6)	Earth	5.5	115	1964
53	Dherynia	Earth	6.1	23	1964
54	Phrenaros (3)	Earth	6.7	45	1966
55	Avgorou (7)	Earth	3	68	1966
56	Kontea (2)	Earth	5.5	82	1966
57	Xylophagou (4)	Earth	6.7	86	1966
58	Sotira (4)	Earth	4.6	32	1966
59	Lysi	Earth	6.7	77	1967
60	Ay Yeorgios (9)	Earth	3	68	1967
61	Ay Epiktitos (6)	Earth	6.1	34	1968
62	Akanthou (6)	Earth	6.1	45	1968
63	Akhna (3)	Earth	4.3	40	1968
64	Xylotymbou (5)	Earth	5.5	50	1969

Total Storage Capacity 1,075 $m^3 \times 10^3$

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT	1000 m³	YEAR
17	Prodhromos	Earth	10.4	115	1962
18	Morphou	Earth	15.5	2,045	1962
19	Letka	Gravity	34.4	365	1962
20	Geunyeli	Earth	18	1,050	1962
21	Athalassa	Earth	18.3	790	1962
22	Kanli Keyu	Earth	19.8	1,100	1963
23	Argaka	Rockfill	41.1	1,150	1964
24	Mia Milea	Earth	21.6	340	1964
25	Ovgos	Earth	15.8	850	1964
26	Tremithios	Earth	22.6	1,615	1964
27	Agros	Earth	26.2	100	1964
28	Liopetri	Earth	18.3	340	1964
29	Polemidhia	Earth	44.8	3850	1965
30	Ayia Marina	Rockfill	32.9	310	1965
31	Kalopanayiotis	Earth	39.3	395	1966
32	Mavrokolymbos	Earth	46.6	2,180	1966
33	Pomos	Earth Rock	38.4	850	1966
34	Yermasoyia	Earth	49.4	13600	1968
35	Syngrasis	Earth	7.3	1,115	1968

Total Storage Capacity 32,160 $m^3 \times 10^3$

HT refers to height in meters from foundation

YEAR is the year of completion

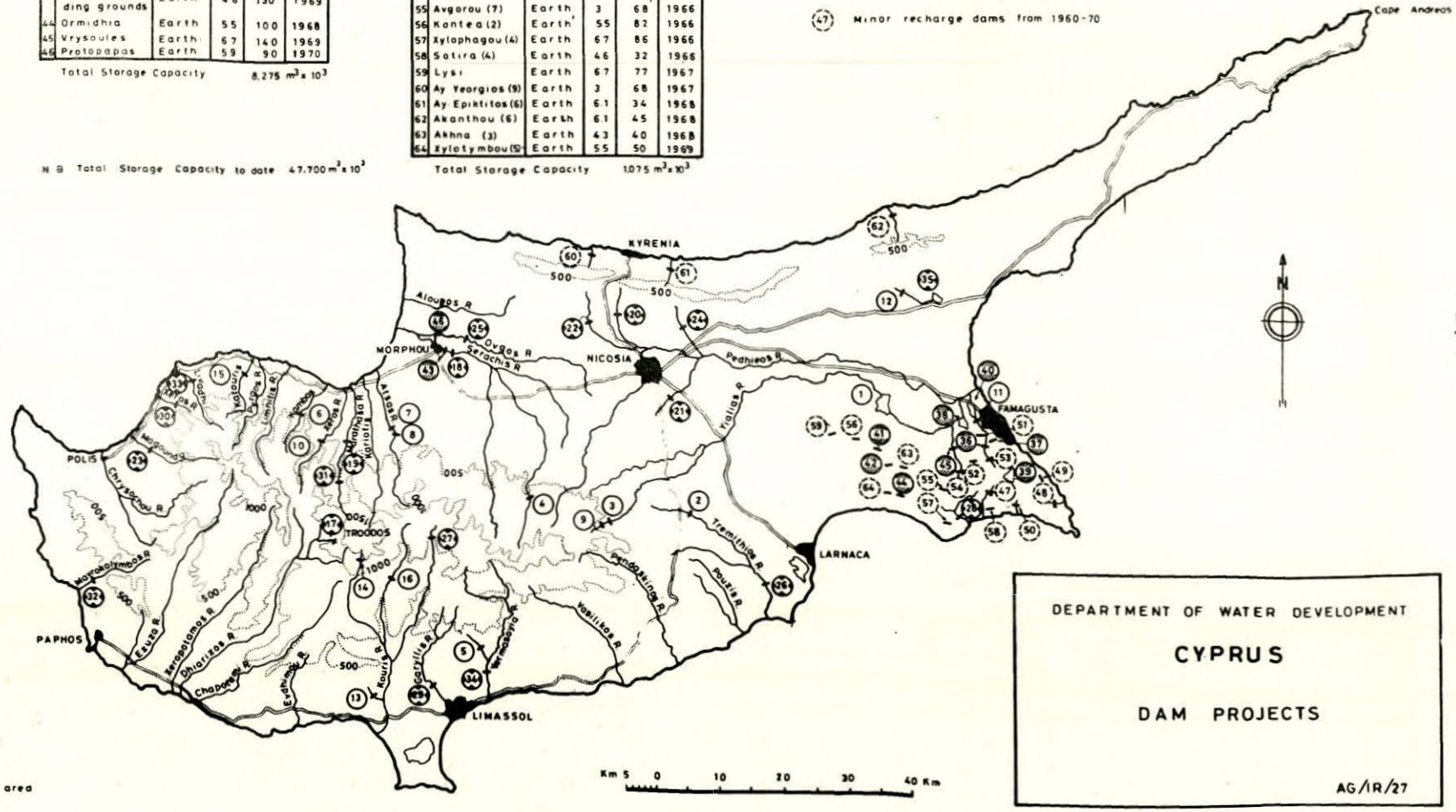
Phrenaros (6) means six small dams in Phrenaros area

(1) Dams constructed up to 1960

(17-4) Major dam projects from 1960-70

(36) Major recharge dams from 1960-70

(47) Minor recharge dams from 1960-70



DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

DAM PROJECTS

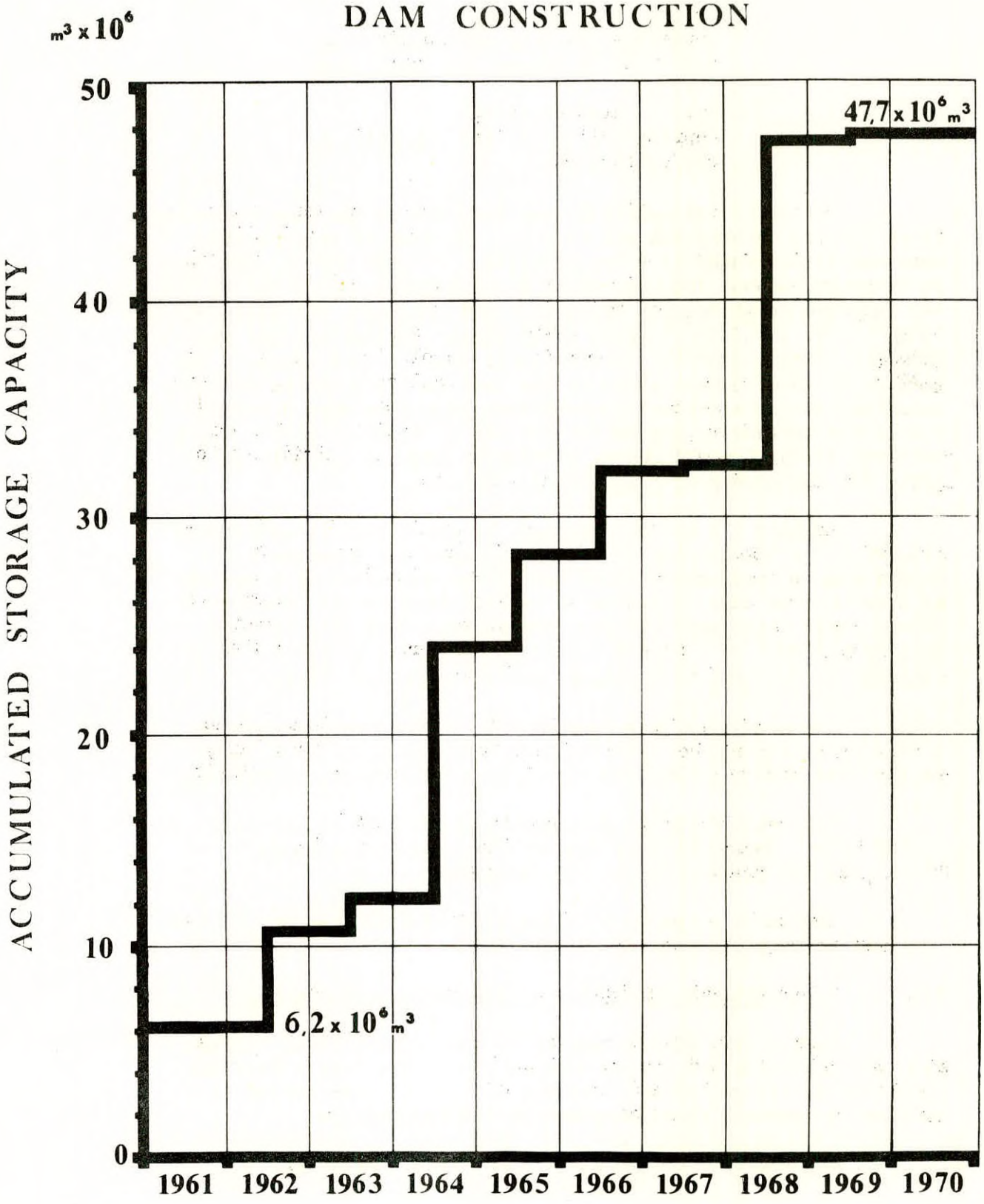
AG/IR/27

International Commission on Large Dams
WORLD REGISTER OF DAMS
NATIONAL COMMITTEE OF CYPRUS
Information on Dams supplied to National Committee by
Director, Department of Water Development
Including Dams in Existence, under Construction or Proposed
1961

	(1) FILE NO.	(2) NAME OF DAM	(3) YEAR OF COMPLETION	(4) LOCATION RIVER	(5) NEAREST CITY	(6) STATE COUNTY OR EQUIVALENT	(7) TYPE	(8) HEIGHT ABOVE LOWEST FOUNDATION	(9) HEIGHT FOUNDATION TO CUT-OFF	(10) HEIGHT ABOVE GROUND LEVEL	(11) LENGTH OF CREST	(12) VOLUME CONTENT OF DAM	(13) CAPACITY OF RESERVOIR	(14) PURPOSE	(15) INSTALLED POWER CAPACITY	(16) OWNER	(17) ENGINEERING BY	(18) CONSTRUCTION BY	(19) REMARKS	
			-: Delete units which are not being used :-					FEET	FEET	FEET	FEET	CUBIC YARDS	CUBIC FEET x 10⁶		KW					
1		YERMASOYIA	1968	YERMASOYIA	LIMASSOL	LIMASSOL DISTRICT	E	162	51	110	965	650,000	480	I		GOVERNMENT	ENERGOPROJECT OF YUGOSLAVIA	CYBARCO OF CYPRUS		1
2		KALOPANAYIOTIS	1966	MARATHASA	NICOSIA	NICOSIA DISTRICT	E	129	44	85	450	200,000	14	I		GOVERNMENT	HOWARD HUMPHREYS & SONS OF U.K.	DEPARTMENT OF WATER DEVELOPMENT		2
3		MAVROKOLYMBOS	1966	MAVROKO-LYMBOS	KTIMA	PAPHOS DISTRICT	E	153		133	600	350,000	77	I		GOVERNMENT	ENERGOPROJECT OF YUGOSLAVIA	CYBARCO OF CYPRUS		3
4		POMOS	1966	LIVADHI	KTIMA	PAPHOS DISTRICT	ER	126		106	560	200,000	30	I		POMOS IRRIGATION DIVISION	ENERGOPROJECT OF YUGOSLAVIA	MEDITERRANEAN CONSTRUCTORS GREECE G.P ZACHARIADES CYPRUS		4
5		AYIA MARINA	1965	XEROS TYLLIRIAS	KTIMA	PAPHOS DISTRICT	R	108		100	380	80,000	11	I		AYIA MARINA IRRIGATION DIVISION	ENERGOPROJECT OF YUGOSLAVIA	MEDITERRANEAN CONSTRUCTORS GREECE G.P ZACHARIADES CYPRUS		5
6		POLEMIDHIA	1965	GARYLLIS	LIMASSOL	LIMASSOL DISTRICT	E	147		124	650	281,000	138	I		GOVERNMENT	ENERGOPROJECT OF YUGOSLAVIA	MOWLEM & RIDGWAY OF U.K.		6
7		AGROS	1964	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	E	86		66	570	80,000	3.5	I		AGROS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		7
8		ARGAKA	1964	MAGOUNDA	KTIMA	PAPHOS DISTRICT	R	135		100	560	180,000	40	I		GOVERNMENT	HOWARD HUMPHREYS & SONS OF U.K.	MOWLEM & RIDGWAY OF U.K.		8
9		LIOPETRI	1964	POTAMOS	FAMAGUSTA	FAMAGUSTA DISTRICT	E	60		48	1,800	65,000	12			LIOPETRI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	GROUND WATER RECHARGE	9
10		MIA MILIA	1964	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	71		50	415	70,000	12	I		MIA MILIA IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		10
11		OVGOS	1964	SERAKHIS	NICOSIA	NICOSIA DISTRICT	E	52		46	2,400	170,000	30	I		MORPHOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		11
12		KITI	1964	TREMITHIOS	LARNACA	LARNACA DISTRICT	E	74		52	3248	230000	57	I		GOVERNMENT	IL NUOVO CASTORO OF ITALY	DEPARTMENT OF WATER DEVELOPMENT		12
13		KANLI KEUY	1963	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	65		40	700	62,000	39	I		KANLI KEUY IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		13
14		ATHALASSA	1962	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	60		42	1,370	135,000	28	F,I		GOVERNMENT	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		14
15		GEUNYELI	1962	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	59		53	655	66,000	37	I		GEUNYELI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		15
16		LEFKA	1962	MARATHASA	NICOSIA	NICOSIA DISTRICT	G	113		89	490	15,000	13	I		LEFKA IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		16
17		MORPHOU	1962	SERAKHIS	NICOSIA	NICOSIA DISTRICT	E	51		39	4500	197,000	61	I		MORPHOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	ALSO GROUND WATER RECHARGE	17
18		PRODHROMOS	1962	DHIARIZOS	LIMASSOL	LIMASSOL DISTRICT	E	34		20	1400	96,000	4	I		PRODHROMOS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	RECTANGULAR RESERVOIR	18
19		TRIMIKLINI	1958	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	G	109		95	250	8,000	12	I		TRIMIKLINI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		19
20		PYRGOS	1957	KATOURIS	NICOSIA	NICOSIA DISTRICT	G	73		67	215	10,000	10	I		PYRGOS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		20
21		KANDOU	1956	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	G	46		43	175	4,000	1.2	I		KANDOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	MASONRY	21
22		PERAPEDHI	1956	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	G	71		64	215	6,000	2	I		PERAPEDHI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		22
23		KAFIZES	1953	XEROS MORPHOU	NICOSIA	NICOSIA DISTRICT	G	77		54	90	9,000	4	I		LEFKA IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	MASONRY	23

DEPARTMENT OF WATER DEVELOPMENT

DAM CONSTRUCTION



Members

Mr. K.C. Hasabis,
Senior Water Engineer.

Mr. Y. Zambarloukos,
Representative of the Association
of Civil Engineers and Architects.

Mr. G. Paraskevaides,
Representative of the Association
of Contractors.

Two committee meetings were held during the year under review. One in January and one in June. Matters of organization were mainly discussed at these meetings. A third meeting was held in December between the Chairman and the secretaries of the CNCOLD, the National Committee for Irrigation and Drainage, the National Committee of the International Water Supply Association and the National Committee of the International Hydrological Decade. The possibilities of coordination of the technical activities of these organizations by a central coordinating committee were discussed and it was decided to pursue this matter by drawing up of a draft constitution which would enable interested private individuals to apply for membership of the central committee.

Towards the end of the year the committee, in collaboration with the Association of Civil Engineers and Architects of Cyprus started preparatory work for the organization of a lecture on Planning for Dams in Cyprus to be delivered by the Chairman of CNCOLD early next year. It has been decided that this lecture will be followed by a second one to be delivered by the retiring chairman of the British National Committee Mr. H.H. Dixon.

The committee is supporting Mr. Dixon's candidature as a Vice President of the International Commission on Large Dams, at the 39th Executive Meeting to be held in Dubrovnic, Yugoslavia.

The tenth Congress on Large Dams was held in Montreal in May 1970 Unfortunately, due to financial limitations, CNCOLD was not represented at the Congress.

The table on page 28 gives important data of our 23 Large Dams as compiled for the use of ICOLD.

1.5.3 International Commission on Irrigation and Drainage

Cyprus is a member country to the International Commission on Irrigation and Drainage since 1954. The Cyprus National Committee on Irrigation and Drainage of the ICID was formed in 1964 and at present it is composed of the following:-

Chairman — Mr. C.A.C. Konteatis, Director, Water Development Department.

Secretary — Mr. N. Tsiourtis, Topographer Irrigation Engineer W.D.D.

Members — Director, Department of Forestry
Director, Department of Agriculture
Director, Agricultural Research Institute

1. It has continued to keep correspondence with the Central Office of the I.C.I.D.

2. All publications such as bulletins and Annual reports which were received from I.C.I.D. or any member country of the I.C.I.D. were circulated to all members.

3. An invitation from the French National Committee has been received to participate at the 8th European meeting on Irrigation and Drainage. The Cyprus Government approved the appeal made by the Committee for granting permission for representation and financial support.

   To this effect Mr. N. Tsiourtis (secretary of the C.N.C.I.D.) is to represent the Cyprus Committee. The congress is to take place at Aix-En Provence 14th-19th June, 1971.

4. On October the 30th 1970 a meeting was held to discuss the proposed constitution of the Cyprus National Committee prepared by the Secretary.

   The constitution was modified and a second Draft has been prepared and sent to the members for comments. The purpose of the constitution is to set up the framework within which the committee shall act to accomplish its main objectives.

During the year 1970 the main activities of the I.C.I.D. were the following:

- The 21st Meeting of the Executive Council of the I.C.I.D. was held in Ankara between 2 6-27 June 1970. Cyprus was not represented.
- A publication "Irrigation and Drainage in the World" has been released by the I.C.I.D. Cyprus has participated with a report.

1.5.4 International Water Supply Association

The Department of Water Development was an associate member of the I.W.S.A. until 1969. Late in 1969 a National Committee was established made up of :

Mr. C.A.C. Konteatis,
Director, W.D.D. as Chairman.

Mr. G. Charalambous,
Superintendent of Works of the W.D.D.
as Secretary.

and the representatives of the Ministry of Interior and Water Boards of Nicosia, Limassol, Famagusta and Larnaca as members.

The National Committee applied to the I.W.S.A. for corporate membership. The application was approved and Cyprus is a corporate member since early 1970.

1.5.5 Meetings of the Director with the Staff

Several meetings were held during the year under the Chairmanship of the Director with the Heads of the Various Divisions as well as with other members of the staff to discuss various aspects of works and personal matters. Interdepartmental meetings with the Departments of Agriculture, Forests, A.R.I. the Geological Department, Meteorological Office, Fisheries Department and the District Administration were also held during the year.

1.6 Water Resources

During the year the rainfall was about 373 mm i.e. about 75% of the normal annual precipitation. 1970 was definitely a dry year and one of the least precipitations recorded since 1916. The insufficient rainfall resulted to a very low runoff in the rivers many of which did not have any flow to reach the sea. The effect on ground water recharge was also adverse and furthermore the contribution of rainfall to irrigated crops was very low. The production of cereals such as wheat and barley was very poor.

Because of the low rainfall occurence the Government entered into contract in March 1970, with the Weather Engineering Corporation of America a firm specializing in rain augmentation which undertook cloud seeding operations for 10 operational days. 5 of such cloud seeding operations were undertaken in April and as there were no more clouds during that month to be seeded rain clouding was abandoned and restarted early in October when another 5 seedings were completed. Detailed records of the rainfall that occurred on the operational days were collected by the Meteorological Office. These records show that in the 2 seeding periods about 2 million cu.m. of recoverable water was added to the various ground water reservoirs. However, it is not possible to determine what fraction if any of this rainfall could be justifiably attributed to the cloud seeding operations. In order that a reliable evaluation should be made it would be necessary that continuous cloud seeding operations should be carried out for several number of years with simultaneous complete meteorological observations. Such a long term project would facilitate a statistical evaluation of the cloud seeding results and would help to differentiate when a particular seeding had increased or decreased precipitations. These cloud seeding operations, by the Government, can be considered as an emergency measure taken to help in relieving the dry weather effects. At the same time the Government is interested for the future, in establishing properly the necessary stations and have the required procedures for a proper operation of cloud seeding and control.

During the year an evaporation retarding experiment was carried out on the Prodhromos reservoir suing a fatty alcohol made of hexateganol and octodeganol blended with a dispersing agent in such proportions as to ensure rapid spreading on the water surface and at the same time prolong continuity. The chemical is bio-degradable and is harmless to all forms of life. By the daily application of the retardant on the water surface which was done in July and August the reduction of evaporation achieved was about 30%. It was concluded from this experiment, as well as from the previous one carried out last year in Yermasoyia dam reservoir that the cost of water saved in this way was of the order of 5 mils per cu.m. Although relatively experimental results were obtained for this short period, the effectiveness of the chemicals when carried out on larger periods of time on smaller or larger surfaces, requires further investigation. It is contemplated that such experiments will continue in the future.

Regarding the general ground water situation of Cyprus during the year, this deteriorated far more than any previous one. We have to observe again with regret that both illegal drilling in the region of Famagusta, Larnaca and uncontrolled extraction in these areas as well as in Morphou and Akrotiri was intensified through the year. With regard to the progress of the application of the Special Measures Law for drilling, extraction and utilization of water in the areas of Famagusta-Larnaca, Morphou and Akrotiri. This was entirely unsatisfactory. With regard to Famagusta and Larnaca during the year 1968, 364 water meters were installed on private boreholes, in the year 1969, 105 and in the year 1970 only 8, until finally the law was withdrawn by the Government from these areas.

In the Morphou region 199 water meters were installed in 1968, 198 in 1969 and 118 in 1970.

Finally in Akrotiri Limassol, 322 water meters were installed in 1968, 33 in 1969 and 20 in 1970.

It can be seen from the above figures that the situation deteriorated over the years, and the failure to apply the law is quite obvious. Thousands of water meters have still to be installed in these areas and it is not possible that this could be done with the present rate of enforcement. Together with the inability to install water meters, the application of efficient systems of irrigation cannot be considered satisfactory either. Furthermore, the extraction rate increases at the expense of water table drop over the years, and numerous illegal boreholes spring up in various parts of the island, more particular in the districts of Famagusta and Larnaca. There can be no doubt that with this rate of pumping and the inability to control the extraction of water, the water storage in these aquifers cannot last for long. Already in many parts of Famagusta and Larnaca pumping is achieved only from the annual recharge, whereas all important coastal aquifers have been sea intruded.

During the year, we carried out several investigations and drilling of boreholes in certain aquifers or parts of aquifers from where it is possible to extract more water. These investigations were done mainly in Kyrenia where the limestone aquifer has possibilities for further development. Also investigations were carried out for the future development of the coastal aquifer of Paphos, the west coastal aquifer of Akrotiri and the coastal aquifer of Pendayia at the west of Morphou. More water can be tapped from these places but this is only of local importance and it is not enough to be expected to solve the major problems of ground water deficiency in the main parts of the important aquifers of the Island.

1.7 Planning and Design of Projects

During 1970 the main planning work was the continuation of the C.W.P.P.'s activities. This Project was finally completed in September and a description of the work is given in para. 1.4 Foreign Technical Assistance.

Important field investigations and Laboratory tests were carried out in connection with this project and in particular at several damsites in Paphos. Investigations where also started on the big damsite at Kourris and that of Ovgos in the Morphou region. There is an extension of the C.W.P.P. work during 1971 in connection with the Phase 'B' Feasibility Study for Paphos.

Important investigations were also carried out for the Lefkara dam which constitutes the 2nd Phase of the Water Supply Scheme of Famagusta. This phase which includes the construction of a 65 meters high rockfill dam, of a storage capacity of about 15 million cu.m., a 21 inch steel conveyor pipeline to Khirokitia and the necessary treatment works at Khirokitia from where the necessary storage and conveyor system to Famagusta is already available having been constructed during the 1st Phase of the Project. The design of the Lefkara dam and connected treatment works at Khirokitia have been produced during the year by Consulting Engineers Howard Humphreys & Sons of Reading U.K. This project is scheduled to start its construction in 1971.

The field investigations and laboratory branch carried out during the year important investigations and tests for several independent agencies such as:

The Nicosia municipality for its sewage scheme.

The Cyprus Antiquities Department for the foundation investigations of the Ayia Sophia Mosque Nicosia, where certain restoration works will be carried out by the U.N. Technical Assistance.

For the Famagusta Grain Commission, investigations were carried out for a new Silo.

For the Famagusta Municipality, investigations were carried out for their sewage scheme.

For the new Limassol Harbour, investigations were carried out to determine the suitability of the proposed quary to be used by the contractors.

1.8 Construction of Projects

During the year an amount of about £740,000 was spent on the construction of several domestic water supply and irrigation projects all over the Island. These projects include:

1.8.1 60 village water supply schemes for house to house connections, supply of additional water and expansion of distribution systems and storage. Some of the more interesting schemes carried out were the regional water supply scheme from the Vasilia borehole supplying water to 9 villages in the region as far as Livera to the west. The Messaoria dry villages, Regional Scheme supplying water to 13 Messaoria villages from Asha to Pyrga. The Morphou additional water supply scheme valued at £117,000 and the Vatili Strongylos combined scheme.

1.8.2 51 small irrigation schemes which include lining of canals in the Morphou region, small recharge dams in the district of Famagusta and Kyrenia pumping schemes and other small irrigation schemes all over the Island.

1.8.3 12 Major irrigation projects which include the extension of the Yermasoyia dam spillway, the raising of the Morphou Dam to provide additional head on the spillway part lining of the Athalassa dam spillway and the extension of the distribution systems of the Kiti, Mavrokolymbos and Pomos Dams. Also an important extension to the grouting curtain of the Polemidhia dam was undertaken directly by the Department at the cost of about £20,000 thus raising the total grouting extension works on this dam to about £31,000. It is hoped that this grouting will now reduce the leakage to an allowable limit.

1.8.4 Two town water supply projects were under construction during the year. An additional supply for Nicosia by using 2 boreholes at Tseri and the completion of the 1st Phase of Famagusta water supply. On the latter project an amount of about £206,000 were spent both on Government control works and on works handed over to the Water Board of Famagusta, the latter being the storage tank at Phrenaros and the conveyor pipeline from Phrenaros to the Stavros reservoir at Famagusta. One other important part of this scheme completed during the year, was the Vassilikos river deep gravel cutting and the infiltration works carried out in this cutting in order to collect additional water for the supply to the Khirokitia reservoir.

Because of the great interest and effort made by the W.D.D. staff on the Famagusta water supply project the Government decided to give benuses to those who were distinguished on this job. The total cost up to date for the 1st Phase of Famagusta Water Supply reached £1,146,000.

1.8.5 It is with regret that I have to record that important works which were not only in the 1970 budget but also in the 1969 budget were not executed because of administrative formalities beyond the responsibility of this Department. Some of these important projects were:

The Yermasoyia dam distribution system about which the Government was unable to take a decision.

The Paleckori dam about which there were difficulties with the loan formalities.

The Massari dam about which the Morphou beneficiaries downstream objected to its construction.

The Argaka-Magounda dam distribution system difficulties of which were the water rights claimed by the downstream beneficiaries.

The Mavrokolymbos dam distribution system which has not been completed because of the lengthy formalities required for land consolidation which has been decided to be introduced to the area.

1.8.6 The average number of labourers employed by the Department during 1970 was 1029 as compared with 1438 in 1969. 37.2% were classed as regulars whilst approximately 43% were skilled employees, 14.80% semi-skilled and 42.20% unskillded. 3.9% of the labourers employed were Turks.

The approximate monthly average of labourers engaged was as follows:

January	1045
February	1001
March	1023
April	958
May	960
June	978
July	1030
August	1029
September	1125
October	1175
November	1083
December	942
Average	1029

1.9 Operation and Maintenance of Projects

The Department of Water Development is advising the District Administration on the operation and Maintenance of irrigation and water supply schemes. In the case of certain major irrigation and domestic water supply schemes which are in the hands of the Government the operation and maintenance is done, for Town Water Supplies by the Department of Water Development and for Major Irrigation works by a Project Committee mad up

of the District Officer as the chairman, an Engineer of the Department of Water Development, an Agricultural Officer of the Department of Agriculture and Representatives of the Water Users as members.

1.9.1 Major Irrigation Works

There were 10 such Government Projects under supervision during the year. The total amount of water sold gave an income of £22,940 and the total expenses for operation and maintenance was £11,177, that is to say there was a net income to the Government of £11,763. The amount of income cannot be considered satisfactory and this is attributed to many problems which were not possible to resolve as yet.

1.9.1.1 The Argaka-Magounda dam was again without a distribution system and the beneficiaries continued to claim their water rights. The quantity of water utilized was only about 8% of the capacity of the dam.

1.9.1.2 For Ayia Marina Dam, the distribution of water is being improved every year. The total distribution system has now been completed and the farmers show more and more interest to buy water.

1.9.1.3 Pomos Dam. Extensive works on improving the distribution system continued last year which will be completed in 1971. The land levelling works have also been completed. Here as with Ayia Marina the interest in buying water has increased and with the completion of the land levelling and distribution system it is anticipated that the water from this dam will soon be fully utilized.

1.9.1.4 Mavrokolymbos Dam. Here the plans for land consolidation still handicap the completion of the distribution system. However a significant quantity of water was sold during the year to the farmers of Kissonerga, Emba and Khlorakas for the irrigation of vegetables and bananas.

1.9.1.5 Polemidhia Dam. This is the largest Government dam in operation, and during the year the income was £10,132 through the sale of 0.75 million cu.meters of water. The water was utilized in the Zakaki region for supplementing the ground water supply to the farms for irrigating the existing citrus and vines.

Extensive grouting works were carried out during the year at a cost of about £20,000 to enable the water tightness of this dam.

1.9.1.6 Kiti dam. Certain extentions to the distribution system were carried out during the year. The water available in the dam was only 113,000 cu.m. out of which 85,000 was sold, the rest being lost as seepage evaporation and conveyance losses. The main crop irrigated was potatoes and some citrus.

1.9.1.7 Kalopanayiotis Dam. This is the dam where the highest water efficiency and hose basin irrigation is used throughout. The main crops are apples, pears, peaches and plums. At this dam, the Fisheries Department operate a small pilot trout unit situated just downstream of the dam and which has proved quite successfull.

1.9.2 Town Water Supplies

There are only 2 water supplies under the control of the Department, the Greater Nicosia Water Supply and the Famagusta additional Water Supply.

1.9.2.1 Greater Nicosia Water Supply

Through this scheme about 13,000 cu.m. per day of water were made available and the total income during the year from the sale of this water was about £166,000. During the year there was a shortage of water in Nicosia due to the insufficiency of the sources and due to the very poor rainfall. Planning is going ahead for the provision of adequate water supply in the near future.

1.9.2.2 Famagusta Additional Supply

Pumping from the boreholes at Khirokitia to the Stavros reservoirs started on the 10th February and about 864,000 cu.m. of water were supplied giving a revenue of about £43,000. It is anticipated to start the construction of phase II for the Famagusta water supply in 1971 and which will include the Lefkara dam, the conveyor pipeline to Khirokitia reservoir and the necessary treatment works at Khirokitia.

1.10 Finance and Expenditure

As it can be seen on page 42the total expenditure during the year reached £1,339.788. £257,624 out of this amount represents administration costs. The largest item of expenditure was the Irrigation Drainage and Dams, the expenditure of which reached £428,672.

The monthly statement of Development Expenditure for the Department during the year 1970 is shown on page 43.

From this statement it will be observed that the monthly expenditure for the year is uneven, especially during the first part of the year. This is attributed to the time which the various formalities take for the applications of loans to go through the various stages to the Loan Commissioners, the process thereafter and more particularly the delay which is invariably observed in cases where the beneficiaries have arrears for previous loans which makes the decision of the Loan Commissioners very difficult indeed.

It is hoped that with the assistance of the various Government Departments and particulary District Officers, the starting of the schemes earlier in each year will ensure as far as possible the completion of the schemes which are budgeted for that year.

In Table 3 on page 44 shows the expenditure of various budgetary items since the establishment of the Department in 1939. On this Table an effort is made to show the relationship of expenditure between items which can be considered as over-head and administration costs as compared with actual works expenditure. From this Table we can see that the maximum expenditure in the history of the Department was realized during the year 1969 and reached £2,073 ,692 whilst the minimum during 1939 was £19,752. The percentage of overheads to works expenditure vary over the years from 6.6 in 1950 to 56.8 in 1939.

With the present organization, the amount of investigation, planning, design and supervision required, it appears from the last few years that this percentage should be of the order of 20%. A case was presented to the Government about the possibility of charging some of these overheads, especially items which are included in the Development Estimates to the actual works, and the Government is still considering the matter.

We also included in this Report detailed statements of expenditure for Major Irrigation Works, Minor Irrigation Works and Village Water Supplies which were carried out during the year 1970.

These statements appear under Page No. 47-55.

As a result of the exceptional high rainfall during the year 1969, we had heavy floods, which caused damages to various Irrigation Works and Village Water Supplies in several places in the Island. The Government has made available the sum of £38,330 for their restoration and in 1969 the sum of £29,499 was spent. During 1970 the sum of £4,783 was spent and the balance of £4,048 will be spent during 1971. Some of the interested communities contributed in cash or free labour towards this effort.

List of Senior Technical Staff

Name	Post	Qualifications
Christos A. Konteatis	Director	B.Sc. (Civil Eng.) University of London, F.I.C.E., F.I.W.E.
Constantinos Lytras	Assistant Director	Dipl. (Natural Science) University of Athens, M.Sc. (Geology) University of London, D.I.C.
Kyprianos C. Hassabis	Senior Water Engineer	B.Sc. (Civil Eng) University of London, M.E.,N.S.T.C., M.I.C.E., M.A.S.C.E.
Haralambos Karakannas	Engineer Hydrologist	M.A.S.C.E., F.I.P.H.E., F.R.S.H., (London).
Christodoulos Christodoulou	Executive Enginner Class I	Dipl. (Civil Eng.) National Technical University of Athens
Christos Marcoullis	Executive Engineer Class I	Dipl. (Civil Eng.) National Technical University of Athens
Andreas P. Georghiades	Executive Engineer Class I	Dipl. Tech. (Civil Eng.) University of London,M.Sc. University of Birmingham, M.I.C.E.
Costakis Andreou	Executive Engineer Class I	Dipl. (Civil Eng.) University of Dresden
Charis Lapas	Executive Engineer Class II	B.Sc. (Civil Eng.) University of Glasgow
Polyvios G. Panayides	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London, M.Sc. (Civil Eng.) University of Houston.
Christodoulos Artemis	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London, A.C.G.I., M.Sc.(Soil Mechanics) D.I.C., Assoc.Memb. I.C.E.
Eleftherios Gavrielides	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London.
Vasilios G. Georghiades	Executive Engineer Class II	Dipl. (Civil Eng.) National Technical University of Athens.
Markos Dhymiotis	Executive Engineer Class II	Dipl. (Civil Eng.) National Technical University of Athens.
Neophytos Demetriou	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London.
Theocharis Thrassou	Executive Engineer Class II	Dipl. (Civil Eng.) University of Moscow, M.Sc. (Hydrotechnical Construction) University of Moscow.
Vlasis Partassides	Executive Engineer Class II	Dipl. (Civil Eng.) University of Moscow, M.Sc. (Civil and Industrial Eng.) University of Moscow.

Name	Post	Qualifications
Costakis Nicolaides	Executive Engineer Class II	Dipl.(Civil Eng.) University of Moscow, M.Sc. (Civil and Industrial Eng.) University of Moscow.
Nicos Stylianou	Executive Engineer Class II	Dipl. (Civil Eng.) The Polytechnic. London, M.Sc. (Foundation Eng.) University of Birmigham, Assoc. Memb. I.C.E.
Charalambos P. Palantzis	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London, Assoc.Memb.I.C.E.
Savvas Theodosiou	Mechanical Engineer Class II	B.Sc. (Mechanical Eng.) University of Manchester.
Dedalos Kypris	Geologist Class I	Dipl. (Natural Science) University of Athens, D.I.C. Applied Geophysics.
Michalakis Peppis	Geologist Class II	B.Sc. (Geology) American University of Beirut, M.Sc. (Geology) American University of Beirut.
Sotiris C. Kramvis	Geologist Class II	B.Sc. (Geology) University of Birmingham, M.Sc. (Geophysics) University of Birmingham.
Christos Phanartzis	HHydrologist Class II	B.Sc. (Hydrology) University of Arizana, A.M.A.G.U.
Iacovos Iacovides	Hydrologist Class II	B.Sc. (Hydrology) University of Arizona.
Christos Ioannou	Hydrologist Class II	Dipl. (Natural Science) University of Salonica, Dipl. (Hydrology) University of London.
Nicos Tsiourtis	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Institute of Technology, M.A.E.A.I.
Demosthenis M. Patsalides	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Institute of Technology, M.A.E.A.I., Assoc.Memb. I.C.E.
Elias Kambourides	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Institute of Technology, M.A.E.A.I.
Panos Pantelides	Superintendent of Works	
Nicos Toufexis	Superintendent of Works	

TECHNICAL STAFF OF W.D.D. ON 31.12.70

	MONTHLY AND DAILY PAID TECHNICAL STAFF	D	AD	SWE	SH	EH	EE	ME	Geo	H	TIE	LA	ADM	SW	SIW	IW	CF	EDR	ACF	TA	DR	F	Total Nos
1	Permanent staff	1	1	2	1	1	9		2					3	5	14	3		4	24		39	109
2	Temporary staff						9	1	1	2	3	1	1		1	7	1	1	8	91	5	15	147
	TOTAL NUMBERS	1	1	2	1	1	18	1	3	2	3	1	1	3	6	21	4	1	12	115	5	54	256
	DISTRIBUTION OF STAFF																						
3	UNSFP Mineral & Ground Water Surveys (on loan)								1														
4	Divisions i Water Resources				1				2	2				1		3			1	3		1	5
	ii Planning						2													23		4	37
	iii Design						7 +1				3					3				9		1	15
	iv Construction					1									1	2		1		32	5	2	54
	v Small Projects Planning														2	6	3		8	1		40	61
	vi Operation & Maintenance													1	2	3	1		1	5			13
5	Administration (Head Office)	1	1	1										1	1	1			1	3		2	9
6	Regional Offices (Limassol, Famagusta, Paphos & Morphou)						2					1											4
7	Turkish Officers absent from duty						1									3			1	29		2	37
8	On scholarship						1	1												9		2	12
9	Vacancies			1			4						1							‡1			7
	TOTAL NUMBERS	1	1	2	1	1	18	1	3	2	3	1	1	3	6	21	4	1	12	115	5	54	256

REFERENCE

- D Director
- AD Assistant Director
- SWE Senior Water Engineer
- SH Senior Hydrogeologist
- EH Engineer Hydrologist
- EE Executive Engineer
- ME Mechanical Engineer
- Geo Geologist
- H Hydrologist
- TIE Topographer/Irrigation Engineer monthly & daily paid
- LA Legal Adviser (on contract)
- ADM Administrative Officer
- SW Superintendent of Works
- SIW Senior Inspector of Works
- IW Inspector of Works
- CF Chief Foreman
- EDR Engineering Draughtsman
- ACF Assistant Chief Foreman
- TA Technical Assistant monthly & daily paid
- DR Draughtsman
- F Foreman
- \+ Posts held by daily paid staff
- ‡ Vacancy in daily paid post

DRG No. BM/G/14

Table 1 - 1970 Expenditure - Water Development Department

Details	Government funds £	Contribution by Beneficiaries £	Total £
1. Administration	257,624	-	257,624
2. Irrigation, Drainage & Dams	353,890	74,782	428,672
3. Town Water Supplies	95,258	85,380	180,638
4. Village Water Supplies	107,656	118,030	225,686
5. Drilling and Prospecting	46,033	-	46,033
6. Hydr.Obs.Res. & Weirs	42,393	-	42,393
7. Workshops (Maintenance)	17,724	-	17,724
8. Purchase of machinery tools and equipment	4,103	-	4,103
9. Consultants' Fees	12,266	-	12,266
10. Govt. Water Supplies	4,060	-	4,060
11. Major Projects Investigations and Surveys	22,780	-	22,780
12. Greater Nicosia Scheme	84,424	-	84,424
13. Water Supply - Special Measures Law	-	-	-
14. Flood Damages	4,783	1,430	6,213
15. Erection of Buildings	1,569	-	1,569
16. Stores	5,603	-	5,603
Includes Ordinary and Development Expenditure	1,060,166	279,622	1,339,788
Breakdown of Administration			
1. Personal Emoluments	143,672	-	143,672
2. Casual Assistance	12,830	-	12,830
3. Technical Assistance	40,673	-	40,673
4. Travelling	20,997	-	20,997
5. M'ce & Oper. of M. Transport	19,872	-	19,872
6. Office Expenses	3,120	-	3,120
7. Leave Pay to R.E.	16,460	-	16,460
TOTAL	257,624	-	257,624

Table 2 - Monthly Statement of Development Expenditure for the year 1970

1970 Approved	£1,663,857
Add. S/Warrants 15, 34, 49, 60 and 73/70	£ 110,210
Total	£1,774,067

Month	Monthly £	Expenditure up-to-date £	Balance £	% to-date expended
January	10,433	10,433	1,763,634	0.6%
February	36,667	47,100	1,726,967	2.5%
March	48,463	95,563	1,678,504	5.2%
April	102,981	198,544	1,575,523	11.2%
May	72,314	270,858	1,503,209	15.3%
June	44,123	314,981	1,459,086	17.6%
July	39,007	353,988	1,420,079	19.9%
August	89,315	443,303	1,330,764	24.9%
September	52,720	496,023	1,278,044	27.8%
October	121,692	617,715	1,156,352	34.7%
November	106,133	723,848	1,050,219	40.6%
December	148,130	871,978	902,089	49 %

Summary

Approved amount	£1,774,067 (100%)
Less Actual Expenditure	£ 871,978 (49%)
Unspent Balance	£ 902,089 (51%)

Table 3 - Statement of Expenditure as from 1939

Ser. No.	Details	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
1.	Administration	4,716	5,652	4,322	4,111	5,157	8,586	9,245	15,974	15,974	19,033
2.	W/Shops & M'ce of Plant	467	587	500	398	254	284	414	-	350	-
3.	Purchase of Machinery, tools etc.	1,970	224	199	-	184	105	196	-	420	-
4.	Hydrological Observations										
5.	Consultants' Fees										
6.	Major Project investigations										
	Sub-total "A"	£ 7,153	6,463	5,021	4,509	5,595	8,975	9,855	15,974	15,848	19,033
7.	Drilling of water	680	952	527	486	642	2,700	3,180	660	360	25,171
8.	Water Meters for Wells & Boreholes										
9,	Town Water Supplies	1,169	925	908	1,043	1,169	1,827	2,448			
10.	Village Water Supplies	8,980	1,613	5,560	4,956	6,887	5,730	3,413	19,000	31,871	42,190
11.	Small Irrigation Projects	2,770	7,979	10,252	35,809	74,134	116,334	100,470	166,493	177,144	120,278
12.	Major Irrigation Projects										
	Sub-total "B"	£12,599	19,469	17,247	42,294	82,832	126,591	109,511	186,153	209,375	187,639
	Grand total	£19,752	25,932	22,268	46,803	88,427	135,566	119,366	202,127	225,223	206,672
	% of A to B	56.8	33.2	29.1	10.6	6.7	7.0	8.9	8.5	7.5	10.1

Ser. No.	Details	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
1.	Administration	18,156	19,146	26,270	29,991	38,050	52,950	54,350	61,699	80,790	95,256
2.	W/Shops & M'ce of Plant	-	-	39,111	10,826	14,150	13,000	13,500	15,688	25,960	20,995
3.	Purchase of Machinery, tools etc.	-	-	3,339	2,840	17,000	10,050	10,800	91,989	16,700	15,950
4.	Hydrological Observations	-	-	-	1,066	1,000	1,500	3,500	19,626	13,000	4,450
5.	Consultants' Fees										
6.	Major Projects Investigations										
	Sub-Total "A"	£ 18,156	19,146	68,720	44,723	70,200	77,500	82,150	189,000	136,450	136,651
7.	Drilling of Water	27,349	30,666	26,719	24,712	41,100	48,600	58,350	78,641	75,750	45,824
8.	Water Meters for Wells & B/Hs										
9.	Town Water Supplies	-	-	155,116	119,481	235,000	303,900	93,200	152,476	417,600	648,350
10.	Village Water Supplies	53,410	106,370	100,137	214,732	256,000	255,000	196,850	280,955	215,600	87,225
11.	Small Irrigation Projects	111,352	150,980	172,154	166,493	154,500	116,900	150,850	116,100	168,600	81,075
12.	Major Irrigation Projects	-	-	-	15,000	15,000	20 ,000	30,000	35,000	35,000	50,000
	Sub-Total "B"	£192,111	288,016	454,126	540,418	701,600	744,400	529,250	663,172	927,550	912,474
	Grand Total	£210,267	307,162	522,846	585,141	771,800	821,900	611,400	852,172	1,064,000	1,049,125
	% of A to B	9.4	6.6	15.1	8.2	10.0	10.4	15.5	28.4	14.7	14.9

Ser. No.	Details	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1.	Administration	81677	64255	70527	81983	151580	130164	135410	145389	183927	228902	248058	257624
2.	W/Shops & M'ce of Plant & Stores	20441	28979	30238	31789	14000	16150	15500	14147	14848	25594	38268	24896
3.	Purchase of Machinery tools etc.,	960	–	–	31712	120000	46030	16875	10973	12927	5918	16910	4103
4.	Hydrological Observations	7090	6059	10640	40520	40500	43223	28200	18863	20538	19768	22365	42393
5.	Consultant's Fees	–	–	–		–	39378	45065	51297	32040	14676	5021	12266
6.	Major Projects Investigations	–	–	–	–	–	10202	15290	7733	20880	34801	25083	22780
	Sub-total "A"	£110168	99293	111405	186004	326080	285147	256340	248402	285160	329659	355705	364062
7.	Drilling of water	45084	48837	83608	82151	63700	47588	40200	24253	35029	49095	22938	46033
8.	Water Meters for wells & B/Hs	–	–	–	–	–	–	–	983	2672	86	116	–
9.	Town water supplies	113853	220370	88282	97724	70900	197871	178010	138390	68782	171190	937325	265062
10.	Village Water Supplies	113493	137825	602436	602537	486600	507679	404600	108926	130340	232253	251805	229746
11.	Small Irrigation Projects	68274	49288	141712	253817	383052	400046	95002	113636	221169	174065	237594	151386
12.	Major Irrigation Projects	50000	50000	120000	150000	414948	369420	691349	689010	941131	493045	263209	283499
	Sub-total "B"	£390704	506320	1036037	1204229	1418600	1522604	1409160	1075198	1399123	1119734	1717987	975726
	Grand Total	£500872	605613	1147442	1390233	1744680	1807751	1665500	1323600	1684283	1449393	2073692	1339788
	% of A to B	28.2	19.6	10.7	15.4	22.9	18.7	18.1	23.1	20.3	20.3	17.2	37.3

STATEMENT OF EXPENDITURE FOR THE YEAR 1970

MAJOR IRRIGATION WORKS (2D-10 Govt. Share)

CONTRIBUTORY SCHEMES

Scheme	Government	Estimated Cost			Actual Expenditure		
		Government Dedaggered £	Village £	Total £	Government £	Village £	Total £
Dams							
Morphou "Serrakhis" P. House	91,708	91,000	46,354	138,062	86,667	43,333	130,000
Morphou "Serrakhis" Spr.Grounds	743,618	14,276,000	163,233	906,851	728,675	159,953	888,628
Morphou "Raising of Dam"	1,984,141	2,300,000	661,380	2,645,521	1,970,790	656,930	2,627,720
Morphou "Recharge" Protopapas	1,824,499	1,824,000	1,213,815	3,038,314	64,322	41,621	105,943
Morphou "Serrakhis Compens"	880,616	565,000	293,874	1,174,490	40,987	13,663	54,650
Ovgos "Saline Water"	169,935	113,000	56,644	226,579	0,937	0,313	1,250
Ovgos "Compensation"	3,936,380) P.L480+253,733(	300,000	1,396,704	5,586,817	10,792) P.L480+3,083(	4,625	18,500
Syrianokhori" Kokkinogi"	13,850,000	13,850,000	13,850,000	27,700,000	12,873,546	12,873,546	25,747,092
Syrianokhori "Pumping"	10,867,034	11,533,000	5,434,018	16,301,052	7,303,733	3,651,867	10,955,600
Lefkara Dam	-	3,900,000	-	3,900,000	1,564,440	-	1,564,440
Geunyoli Dam	-	978,000	-	978,000	942,080	-	942.080
Yermasoyia Dam	-	20,924,000	-	20,924,000	3,560,337	-	3,560,337
Yermasoyia-Spillway	-	5,800,000	-	5,800,000	4,611,527	-	4,611,527
Yermasoyia-Hydraulic Mod.	-	1,200,000	-	1,200,000	852,730	-	852,730
Polemidhia Grouting	-	15,698,000	-	15,698,000	15,246,398	-	15,246,398
Polemidhia Promisory Notes	-	133,400,000	-	133,400,000	133,400,000	-	133,400,000
Kalopanayiotis	-	8,420,000	-	8,420,000	690,709	-	690,709
Athalassa Spillway	-	1,900,000	-	1,900,000	1,470,066	-	1,470,066
Ovgos Dam	-	926,000	-	926,000	924,039	-	924,039
Kiti Dam	-	809,000	-	809,000	808,380	-	808,380
Agros	-	5,145,000	-	5,145,000	-	-	-
Pomos Dam	-	294,000	-	294,000	205,000	-	205,000
Mavrokolymbos	-	8,275,000	-	8,275,000	-	-	-
Distribution							
Kalopanayiotis	-	1,381,000	-	1,381,000	-	-	-
Kiti		750,000	-	750,000	605,147	-	605,147
	34,347,931	254,652,000	23,116,022	267,517,686	187,961,302	17,445,851	205,410,236

MAJOR IRRIGATION WORKS (2D-10 Govt. Share) cont.

Scheme	Government £	Estimated Cost			Actual Expenditure		
		Government Dedaggered £	Village £	Total £	Government £	Village £	Total £
B/F	34,347,931	254,652,000	23,116,022	267,517,686	187,961,302	17,445,851	205,410,236
Kiti -Pervolia	-	17,585,000	-	17,585,000	3,813,154	-	3,813,154
Yermasoyia Outlet pipe	-	2,605,000	-	2,605,000	663,909	-	663,909
Mavrokolymbos	-	52,320,000	-	52,320,000	13,107,494	-	13,107,494
Pomos Phase II	-	10,670,000	-	10,670,000	10,669,905	-	10,669,905
Pomos Phase III	-	53,530,000	-	53,530,000	37,561,566	-	37,561,566
Mia Milea	-	9,225,000	-	9,225,000	-	-	-
Polemidhia	-	4,324,000	-	4,324,000	4,120,798	-	4,120,798
	P.L.480: 253,733				P.L480 : 3,083		
Total	£ 34,347,931	404,911,000	23,116,022	417,776,686	257,898,128	17,445,851	275,347,062

STATEMENT OF EXPENDITURE FOR THE YEAR 1970

MINOR IRRIGATION WORKS (2D-11 Minor Irrig. Works) — CONTRIBUTORY SCHEMES

Schemes	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
Ay.Georghios Kyrenia M'ce of Dam	5,523	2,761	8,284	4,253	2,127	6,380
Astromeritis	62,959	62 958	125,917	8,306	8,306	16,612
Arsos Limassol	1,362,776	683,387	2,046,163	1,317,714	659,156	1,976,870
Agros "Dhikhalorotsos"	637,031	500,524	1,137,555	600,103	471,510	1,071,613
Argaki	329,618	329,619	659,237	257,233	257,233	514,466
Agros "Kaoukaris"	400,000	200,000	600,000	394,174	197,088	591,262
Anglissides	2,483,475	1,241,237	3,724,712	2,321,987	1,160,995	3,482,982
Akrounda M'ce of Dam	20,000	10,000	30,000	11,667	5,833	17,500
Ay.Therapon L'ssol Antiflood	1,565,824	205,787	1,771,611	92,668	12,160	104,828
Ay.Pavlos "Dhimma-tou-Khoriou"	333,000	167,000	500,000	310,864	155,432	466,296
Akhyritou-Vrysoulles	1,061,584	531,289	1,592,873	16,082	8,041	24,123
Amargetis "Ziripilli" Antiflood	106,070	35,356	141,426	40,429	13,477	53,906
Ay.Theodhoros Larnaca	305,296	153,648	458,944	87,942	43,971	131,913
Ay.Loucas M'ce of Dam	67,000	33,000	100,000	45,303	22,652	67,955
Akhna (1968)	953,079	477,539	1,430,618	84,413	42,207	126,620
Akaki No.I	5,275,000	5,275,000	10,550,000	5,237,234	5,237,234	10,474,468
Akaki No. II	1,040,000	520,000	1,560,000	934,412	467,206	1,401,618
Ay. Demetrios "Kaloyiros" L'ssol	2,100,000	1,050,000	3,150,000	1,827,877	913,939	2,741,816
Avgorou	1,047,893	523,944	1,571,837	11,027	5,513	16,540
Arakapas-"Perasmatis-Koutsis"	400,000	200,000	600,000	333,330	166,664	499,994
Ay.Epiktitos M'ce of Dam	20,000	10,000	30,000	19,333	9,667	29,000
Agros M'ce of Dam	24,000	12,000	36,000	18,021	9,011	27,032
Elia (Kyrenia) Recharge	2,000,000	1,000,000	3,000,000	1,005,613	502,807	1,508,420
Ergates Antiflood	300,000	300,000	600,000	298,222	298,221	596,443
Dhierona "Mylos"	820,000	410,000	1,230,000	586,533	293,267	879,800
Dhierona "Kamaroudhia"	174,570	87,285	261,855	122,197	61,099	183,296
Famagusta-Dherenia	5,119,000) 3,843,313)	2,559,500) 1,922,657)	7,678,500) 5,765,970)	5,199,537	2,599,769	7,799,306
Galini (Old scheme)	273,393	136,697	410,090	263,963	131,982	395,945
Galini (New scheme)	12,666,000	6,334,000	19,000,000	11,999,260	5,999,629	17,998,889
Cypsos M'ce of Dam	93,000	47,000	140,000	85,457	42,728	128,185
Galata "Esso" Phase II	472,573	237,288	709,861	460,203	230,103	690,306
Galataria "Fleva"	940,000	470,000	1,410,000	668,488	334,243	1,002,731
C/F	46,301,977	25,729,476	72,031,453	34,663,845	20,363,270	55,027,115

MINOR IRRIGATION WORKS (2D-11 Minor Irrig. Works) cont.

Schemes	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
B/F	46,301,977	25,729,476	72,031,453	34,663,845	20,363,270	55,027,115
Kakopetria	495,537	247,769	743,306	492,592	246,296	738,888
K. Amiandos "P. Phylagra"	541,109	499,485	1,040,594	502,413	463,765	966,178
K. Amiandos "K. Phylagra"	500,621	250,810	751,431	286,423	143,211	429,634
Kalopanayiotis "Troullinos"	82,703	0,853	83,556)	0,033	0,017	0,050)
Kalopanayiotis "Ay. Kyriakos"	653,000	627,000	1,280,000)	518,898	498,547	1,017,445)
Kyra Antiflood	700,000	700,000	1,400,000	3,500	3,500	7,000
Kissonerga "Appis"	1,880,000	940,000	2,820,000	1,361,134	680,567	2,041,701
Kapillio "Antiflood"	533,876	43,656	577,532	532,572	43,680	576,252
Kyperounda "Kholetria" Dheisis"	3,400,000	1,700,000	5,100,000	2,854,491	1,427,245	4,281,736
Kyra (New scheme)	8,750,000	8,750,000	17,500,000	3,901,636	3,901,635	7,803,271
Kyra (Old scheme)	244,737	192,294	437,031	17,806	13,990	31,796
Kouka	340,000	170,000	510,000	238,393	119,197	357,590
Kilinia "Morris"	360,000	180,000	540,000	165,296	82,648	247,944
Kilinia "Arghaki-tou-Zisimiou"	420,000	210,000	630,000	249,365	124,683	374,048
Katokopia	237,212	238,210	475,422	78,486	78,485	156,971
Kythrea-River Training	320,000	80,000	400,000	305,881	76,470	382,351
Konia	520,000	260,000	780,000	343,701	171,851	515,552
Lefka M'ce of Dam	20,000	10,000	30,000	16,667	8,333	25,000
Lefkoniko Antiflood	180,000	90,000	270,000	179,841	89,921	269,762
Lythrodontas M'ce of Dam	120,000	60,000	180,000	115,622	57,811	173,433
Milikouri	27,466	14,233	41,699	2,667	1,333	4,000
Moutoullas	792,262	396,130	1,188,392	784,527	392,263	1,176,790
Maroni (Old scheme)	1,611,995	805,998	2,417,993	1,433,611	716,806	2,150,417
Maroni (New scheme)	6,933,000	3,467,000	10,400,000	4,973,894	2,486,947	7,460,841
Mandria "Koutsi"	440,000	220,000	660,000	317,351	158,675	476,026
Morphou "Serrakhis" M'ce of Dam	60,000	30,000	90,000	52,110	26,055	78,165
Morphou "Teratsia"	24,000,000	24,000,000	48,000,000	10,123,360	10,123,359	20,246,719
Ovgos-Morphou	2,226,768	2,225,770	4,452,538	2,185,608	2,185,608	4,371,216
Potami	1,883,899	942,949	2,826,848	1,044,707	522,354	1,567,061
Psomolophou	1,008,424	504,212	1,512,636	148,369	74,185	222,554
Philia	403,079	202,538	605,617	334,118	167,058	501,176
Ptastio-Morphou	4,770,841	4,770,838	9,541,679	4,747,240	4,747,240	9,494,480
C/F	£110,758,506	78,559,221	189,317,727	72,976,157	50,197,005	123,173,162

MINOR IRRIGATION WORKS (2D-11 Minor Irrig. Works) cont.

Schemes	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
B/F	110,758,506	78,559,221	189,317,727	72,976,157	50,197,005	123,173,162
Pyrgos Tyllirias	763,214	382,608	1,145,822	528,573	264,286	792,859
Potamiau	426,905	213,952	640,857	332,757	166,378	499,135
Pelendria "Pervoloudhia"	70,893	47,264	118,157	3,660	2,440	6,100
Prodromos	2,249,476	1,124,737	3,374,213	1,872,361	936,180	2,808,541
Phiti	860,000	430,000	1,290,000	761,472	380,736	1,142,208
Peristerona)		165,906			65,951	
Astromeritis)	249,364	83,454	498,724	98,928	32,976	197,855
Palekythro	680,000	170,000	850,000	678,189	169,547	847,736
Pano & Kato Dhikomo	2,000,000	1,000,000	3,000,000	1,925,009	962,505	2,887,514
Palekhori "Millouri"	620,000	310,000	930,000	605,942	302,971	908,913
Prodromos M'ce of Dam	267,000	133,000	400,000	193,423	96,712	290,135
P. & K. Pyrgos "Katouris" M'ce of Dam	140,000	70,000	210,000	134,410	67,204	201,614
Syrianokhori "Antiflood"	273,000	137,000	410,000	273,000	137,000	410,000
Syrianokhori	232,794	232,794	465,588	22,978	22,979	45,957
Trimikliñi M'ce of Dam	1,333,000	667,000	2,000,000	1,230,247	615,123	1,845,370
Tripimeni	648,290	324,645	972,935	637,483	318,741	956,224
Tris Elies "Diplomata"	1,960,000	980,000	2,940,000	1,438,711	719,355	2,158,066
Tymbou Antiflood	435,187	217,593	652,780	371,562	185,781	557,343
Xylotymbou	1,783,230	891,126	2,674,356	275,781	137,890	413,671
Yenagra Antiflood	540,000	60,000	600,000	37,676)	4,186)	41,862)
				434,418)	48,269)	482,687(
Ziyi-Tokhni	3,559,126	1,779,063	5,338,189	3,004,163	1,502,081	4,506,244
Total	£129,849,985	87,979,363	217,829,348	87,836,900	57,336,296	145,173,196

STATEMENT OF EXPENDITURE FOR THE YEAR 1970

Village Water Supplies (2D-20 V.W.S.)

CONTRIBUTORY SCHEMES

Scheme	Estimated Cost			Actual Expenditre		
	Government £	Village £	Total £	Government £	Village £	Total £
Aphania	179,949	257,517	437,466	162,756	232,569	395,325
Ashia	1,188,217	1,537,793	2,726,010	456,195	590,363	1,046,558
Ayia Anna	1,200,000	400,000	1,600,000	565,600	188,534	754,134
Aredhiou	3,867,000	2,833,000	6,700,000	3,426,474	2,509,897	5,936,371
Alethriko	2,925,000	1,475,000	4,400,000	2,836,158	1,430,022	4,266,180
Aradhippou	2,250,000	3,150,000	5,400,000	1,747,766	2,446,539	4,194,305
Anoyira	2,000,000	3,400,000	5,400,000	1,582,886	2,695,182	4,278,068
Alaminos	400,000	800,000	1,200,000	358,676	717,351	1,076,027
Ay. Amvrosios)		826,000			783,669	
Hardjia)	1,102,000	276,000	2,204,000	1,044,892	261,223	2,089,784
Petra-tou-Dhigeni)	20,365	-		19,850	-	
Knodhara (	44,085	-		42,972	-	
Pyrga)	-	40,655			39,627	
Angastina (	-	68,648			66,913	
Marathovounos (		151,710			147,874	
Chatos) Dry	61,018	-		59,478	-	
Mousoulita) Villages	762,744	22,044	1,525,487	743,462	21,486	1,486,925
Kourou Monasteri (	15,255	-		14,869	-	
Mora)	53,393	-		52,043	-	
Ashia (	-	172,913			168,542	
Aphania)	-	55,911			54,496	
Yeragra (	-	52,553			51,224	
Ornithi)	4,193	-		4,089	-	
Dherinia	950,000	950,000	1,900,000	821,670	821,671	1,643,341
Dhiorios	322,189	321,189	643,378	311,348	311,348	622,696
Exo Metochi	607,323	607,319	1,214,642	210,007	210,007	420,014
Emba	3,200,000	4,900,000	8,100,000	3,197,844	4,897,962	8,095,806
Galataria	410,000	410,000	820,000	397,215	397,215	794,430
Komi-Kebir	2,379,798	3,023,374	5,403,172	1,952,472	2,479,927	4,432,399
Kissonerga Antiflood	1,667,000	833,000	2,500,000	1,659,798	829,898	2,489,696
K. Pyrgos Phase II	39,669	73,488	113,157	29,992	56,366	86,358
Kalopanayiotis	2,415,855	2,415,852	4,831,707	98,284	98,284	196,568
C/F	£ 28,065,053	29,053,966	57,119,019	21,796,796	22,508,189	44,304,985

Village Water Supplies (2D-20 V.W.S) con't:

Schemes	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
B/F	£28,065,053	29,053,966	57,119,019	21,796,796	22,508,189	44,304,985
Kalochorio Klirou	2,425,291	2,425,286	4,850,577	0,625	0,625	1,250
Kathikas)		390,108			378,695	
Phiti (Papaloucas		238,066			231,102	
Polemi) Regional	1,031,484	185,651	2,062,969	1,001,310	179,735	2,002,620
Lassa (Scheme		105,227			102,634	
Ay. Demetrianos (		99,230			96,326	
Psathi)		13,203			12,818	
Kalokhorio Limassol	1,230,654	1,230,653	2,461,307	630,142	630,143	1,260,285
Karakoumi	3,532,000	2,868,000	6,400,000	27,600)	22,400)	50,000)
				3,361,347)	2,728,048)	6,089,395)
Korphi	3,200,000	1,600,000	4,800,000	2,196,996	1,098,498	3,295,494
Lymbia	409,720	633,728	1,043,448	257,819	399,381	657,200
Marathovounos	255,063	287,151	542,214	98,569	165,125	263,694
Morphou	36,989,186	56,324,603	93,313,789	27,460,421	41,814,101	9,274,522
Mathikoloni	1,300,000	1,300,000	2,600,000	429,862	429,864	859,726
Mathiatis	3,705,445	1,235,147	4,940,592	1,612,702	537,568	2,150,270
Nikitari	990,856	1,238,966	2,229,822	59,851	74,798	134,649
Neo Khorio	177,951	177,949	355,900	151,979	151,978	303,957
Nata	205,000	205,000	410,000	3,250	3,250	6,500
Ora	875,000	875,000	1,750,000	717,403	717,404	1,434,807
Pano Kividhes	504,894	626,140	1,131,034	479,438	594,572	1,074,010
Phrenaros	69,457	69,456	138,913	24,793	24,792	49,585
Palekythro	126,708	126,706	253,414	55,117	55,117	110,234
Potamos-Yermasoyias	6,000,000	28,000,000	34,000,000	2,191,823	10,226,434	12,418,257
Pyrgos Limassol	400,000	400,000	800,000	392,192	392,193	784,385
Phasoula	1,750,000	3,550,000	5,300,000	1,520,590	3,087,256	4,607,846
Paleomylos	1,000,000	1,000,000	2,000,000	976,653	976,652	1,953,305
Petra	1,300,000	1,300,000	2,600,000	311,441	311,442	622,883
Agridhaki)		122,802			110,330	
Sysklipos (		146,527			132,354	
Ay. Ermolaos (	945,626	130,104	1,517,074	879,517	120,570	1,400,896
Ay. Marina) Part II		73,663			67,768	
Asomatos (		98,352			90,357	
C/F	£ 96,489,388	136,130,684	232,620,072	66,122,598	87,673,757	153,796,355

Schemes		Estimated Cost			Actual Expenditure		
		Government £	Village £	Total £	Government £	Village £	Total £
B/F		96,489,388	136,130,684	232,620,072	66,122,598	87,673,757	153,796,355
Vasilia	Part I		287,581			239,177	
Agridhaki			143,174			93,026	
Sysklypos			172,902			111,595	
Ay. Ermolaos			153,002			127,607	
Ay. Marina		1,702,560	85,950	2,758,436	1,473,916	71,765	2,296,481
Asomatos			114,602			95,687	
Panagra			13,715			11,942	
Orga			42,475			35,883	
Livera			42,475			35,883	
Agridhaki	Part III		161,996			74,887	
Sysklipos			194,397			89,865	
Ay. Ermolaos		994,123	172,464	1,619,979	550,074	91,497	857,791
Ay. Marina		96,999				51,468	
Agridhaki	Part IV	778,017	778,016	1,556,033	543,848	468,883	1,012,731
Sysklipos	Part V		20,718			1,726	
Ay. Ermolaos		88,292	18,750	138,119	9,761	1,935	14,510
Ay. Marina			10,359			1,088	
Sysklipos	Part VI	204,838	204,836	409,674	209,392	142,277	351,669
Ay. Ermolaos	Part VII	206,961	236,685	443,646	170,879	195,421	366,300
Ay. Marina	Part VIII	1,108,744	369,582	1,478,326	173,896	57,965	231,861
Asomatos	Part IX	1,079,163	539,581	1,618,744	379,395	189,696	569,091
Vasilia	Part X	470,097	470,094	940,191	352,074	352,073	704,147
Panagra	Part XI		35,399			17,136	
Orga		760,473	109,046	1,013,964	359,998	51,433	480,000
Livera			109,046			51,433	
Panagra	Part XII	184,937	61,647	246,584	66,188	22,062	88,250
Orga	Part XIII		96,579			3,539	
Livera		583,472	96,579	776,630	21,232	3,539	28,310
Orga	Part XIV	224,274	74,759	299,033	102,044	34,015	136,059
Livera	Part XV	1,038,785	346,261	1,385,046	125,474	41,826	167,300
Trakhoni		314,278	314,274	628,552	157,377	157,378	314,755
Voni		193,523	193,520	387,043	53,146	53,147	106,293
	C/F	£106,421,925	141,898,147	248,320,072	70,871,292	90,650,611	161,521,903

Village Water Supplies (2D–20 V.W.S.) cont.

Schemes	Estimated Cost			Actual Expenditure		
	Governmentt £	Village £	Total £	Government £	Village £	Total £
B/F	£106,421,925	141,898,147	248,320,072	70,871,292	90,650,611	161,521,903
Tripimeni	550,000	550,000	1,100,000	546,658	546,659	1,093,317
Tembria)		2,610,000			2,414,240	
Sina-Oros (Reg. scheme	7,250,000	1,160,000	14,500,000	6,706,223	1,072,996	13,412,446
Evrykhou) Part I		3,480,000			3,218,987	
Tembria)		483,000			104,562	
Evrykhou (Part II	1,150,000	667,000	2,300,000	248,957	144,395	497,914
Evrykhou	1,250,000	1,250,000	2,500,000	589,673	589,673	1,179,346
Meloushia)	1,908,000	-		544,948	-	
Tremethousha(		2,385,000			1,362,368	
Arsos) Reg.scheme	19,879,000	2,348,000	40,250,000	11,901,474	1,341,674	22,993,569
Vatyli (		12,312,000			7,033,732	
Strongylos)		1,418,000			809,373	
Zoopiyi		2,342,315			2,340,977	
Louvaras	8,369,125	1,840,248	12,551,688	8,360,633	1,839,339	12,540,949
Louvaras	2,910,153	1,455,577	4,365,730	2,737,068	1,368,533	4,105,601
Vitsadha	1,250,000	1,850,000	3,100,000	1,017,524	1,505,472	2,522,996
Yerovasa-Trozena	150,000	150,000	300,000	131,038	131,038	262,076
Yerakies	1,250,000	1,450,000	2,700,000	1,193,979	1,384,809	2,578,788
Xeri	681,000	681,000	1,362,000	171,000	171,000	342,000
Total	£153,019,203	180,330,287	333,349,490	105,020,467	118,030,438	223,050,905

1.11 Publications of the Water Development Department during 1970

Library Reg. No.	Title	Author	Date
4494 4495 4496 4497	Hotel and Catering Insitute Nicosia. Foundation Investigation at Proposed site. Report No. F/10	Kypris D & Artemis C.	January 1970
4486 4487 4488	Akaki River-Kambi Tributary Kambi Dam. Final Engineering Geology and Foundations Report. Report No. F/11.	Xenophontos C & Artemis C.C.	January 1970
4491 4492 4493	Kyperounda Irrigation Division, Proposed Earth Reservoir. Foundation and Materials Investigations. Report No. F/12	Artemis C.C.	January 1970
4469 4624	Dam Design and Construction Progress Report No. 22.	Hsu S.W.	January 1970
4563 4564	Review of Artificial Ground Water Recharge in the Lapathos Aquifer Famagusta Report No. H/9.	Ioannou Chr.	January 1970
4731 4735	Construction Manual Report No. S/8.	Karakannas H.P.	January 1970
4516 4517 4518	Hydrological Year-Book of Cyprus 1967-1968. Report No. H/7	Toufexis N. Chr., Phanartzis Chr.& Iacovides J.	February 1970
5070	Cloud Seeding Problems and Implications. Report No. L/4	Konteatis C.A.C.	March 1970
4633	Estimation of Floods in Cyprus. Report No. H/10.	Hsu S.W.	March 1970
4626	Dam Design and Construction. Progress Report No. 23	Hsu S.W	May 1970
5069	Feasibility Study for Pooling of Mechanical Equipment & Workshops. Report No. L/5.	Konteatis C.A.C	June 1970
5068	The Problems of Conservation and Development of the Water Resources of Cyprus No. L/6	Konteatis C.A.C.	June 1970
4649 4650	Lefkara Dam Project. Material Investigations Report Report No. F/13.	Goossens A.H.	June 1970
4654 4673	Dhiarizos Xeropotamos Rivers. Diversion Schemes. Site Investigations Report. Report No. F/14.	Stylianou N.P.	June 1970
4651 4652	Dam Engineering. Final Report.	Hsu S.W.	June 1970
4653 4602	Elea (Karavas) Irrigation Scheme Completion Report. Report No. C/3.	Georghiou S.	June 1970

Library Reg. No.	Title	Author	Date
4658 4659	Palekhori Dam Project. Distribution System. Preliminary Report. Report No. I/1.	Tsiourtis N.	July 1970
4707 4708	Asprokremmos Dam Project. Additional Site Investigations. Report No. F/15.	Stylianou N.P.	July 1970
4671	Design Division-Drawing Office Branch. Work done during 1969.	Pitsillides S.C.	August 1970
4705 4706	Nicosia Water Supply. Morphou-Syrianokhori Pipeline. Bill of Quantities, Cost Estimates and Working Drawings. Report No. D/4.	Tsiourtis N.	August 1970
4736 4737	Kiti Dam-Distribution System. Pervolia Extensions. Report No. D/5	Tsiourtis N.	September 1970
4786 4787	An Investigation into a Ground Water Supply for Famagusta in the Tremithios-Vasilikos Area, Larnaca District. Report No. H/6.	Dixey F.	September 1970
4796	Famagusta Sewerage Scheme Site Investigations Report. Report No. F/16.	Stylianou N.P.	October 1970
4957	Cyprus. Water Resources Institutions. 1. Report. Report No. L/1	Konteatis C.A.C.	November 1970
4958	Cyprus. Water Resources Institutions. 2 Annexes. Report No. L/2	Konteatis C.A.C.	November 1970
4889 4930	Polemidhia Dam Grouting. Extension of Grout Curtain. Report No. F/17.	Kastanas I.	November 1970
4789 4790	Famagusta Water Supply. Lefkara Dam. Contract Dl. 39/70/30	W.D.D.	December 1970
4852 4853	Ayios Pavlos (Limassol). Yiannidji Irrigation Scheme. Completion Report. Report No. C/4	Macrides A.	December 1970
4855	Kholetria Irrigation Scheme. Completion Report. Report No. C/5.	Macrides A.	December 1970
4854	Asomatos (LL) Water Supply. House-to-House Scheme. Completion Report. Report No. C/6.	Macrides A.	December 1970
4856	Pelendria. Pervoloudhia Irrigation. Completion Report. Report No. C/7.	Macrides A.	December 1970
4857	Pelendria. Koundouridhes Irrigation. Completion Report. Report No. C/8	Macrides A.	December 1970
4860	Agridhia. Kaouras Irrigation. Completion Report. Report No. C/11	Macrides A.	December 1970

Library Reg. No.	Title	Author	Date
4861	Agridhia Irrigation. Vrysi tou Khoriou Loc. Completion Report. Report No. C/12.	Macrides A.	December 1970
4862	Agridhia Irrigation. Pano Enetikos Locality. Completion Report. Report No. C/13.	Macrides A.	December 1970
4863	Phlamoudhi Water Supply. House-to-House Scheme. Completion Report. Report No. C/14.	Hji Pakkos P.	December 1970
4864	Famagusta Recharge. Vrysoulles Earth Dam. Completion Report. Report No. C/15.	Hji Pakkos P.	December 1970
4865	Angastina Water Supply. House-to-House Scheme. Completion Report. Report No. C/18.	Ioannou Vrahimis	December 1970
4866	Patriki Water Supply. House-to-House Scheme. Completion Report. Report No. C/17.	Ioannou Vrahimis	December 1970
4867	Palekhori (Orinis) Water Supply. House-to-House Scheme. Completion Report. Report No. C/19.	Constantinides G. A.	December 1970
4868	Pendayia Water Supply. House-to-House Scheme. Completion Report. Report No. C/20.	Constantinides G. A.	December 1970
4869 4870	Motidhes (Karavas) Irrigation Scheme. Completion Report. Report No. C/21.	Georghiou S.	December 1970

Measuring weir equipped with automatic Water Level recorder on Tremithios river at Ayia Anna village

Taking sample of Water from Peristerona river for chemical and Suspended Sediment Analysis

II. DIVISION OF WATER RESOURCES

By

D. Kypris
Head of Division

2.1 Introduction

The Division of Water Resources groups together all services required for the collection of hydrological and hydrogeological data regarding ground and surface water, drilling works, control of ground-water, extraction and engineering geology problems as connected with the planning and execution of water works projects.

2.1.2 For reasons of better control on the collection of hydrogeological data and thorough hydrogeological studies, Cyprus has been divided into eleven hydrogeological regions based on both hydrogeological and administrative criteria (See map 1.).

2.1.3 Mr. D.C. Kypris, Geologist Class I, was the Head of the Division. Mr. N. Toufexis, was the Assistant Head. Mr. J. Jacovides, Hydrologist, was the Head of Nicosia-Morphou-Tillyria Hydrogeological Branch, Mr. M. Peppis, Geologist, was the Head of Larnaca-Kynenia Hydrogeological Branch, Mr. Chr. Phanartzis, Hydrologist, was the Head of Paphos Hydrogeological Branch, Mr. Chr. Ioannou, Hydrogeologist, was the Head of Famagusta-Karpas Hydrogeological Branch, Mr. S. Kramvis, Geologist was the Head of Limassol Hydrogeological Branch, but as Mr. Kramvis has been temporarily attached to the Department of Geological Survey , Mr. J. Jacovides was given additional duties and he acted as Head of the Limassol Hydrogeological Branch. Mr. C. Xenophontos, Geologist, of the Geological Survey Department has been attached to this Department and he acted as Head of the Engineering Geology Branch. Mr. Xenophontos offered his services until 18/8/1970 when he left for Canada for further studies in Engineering Geology.

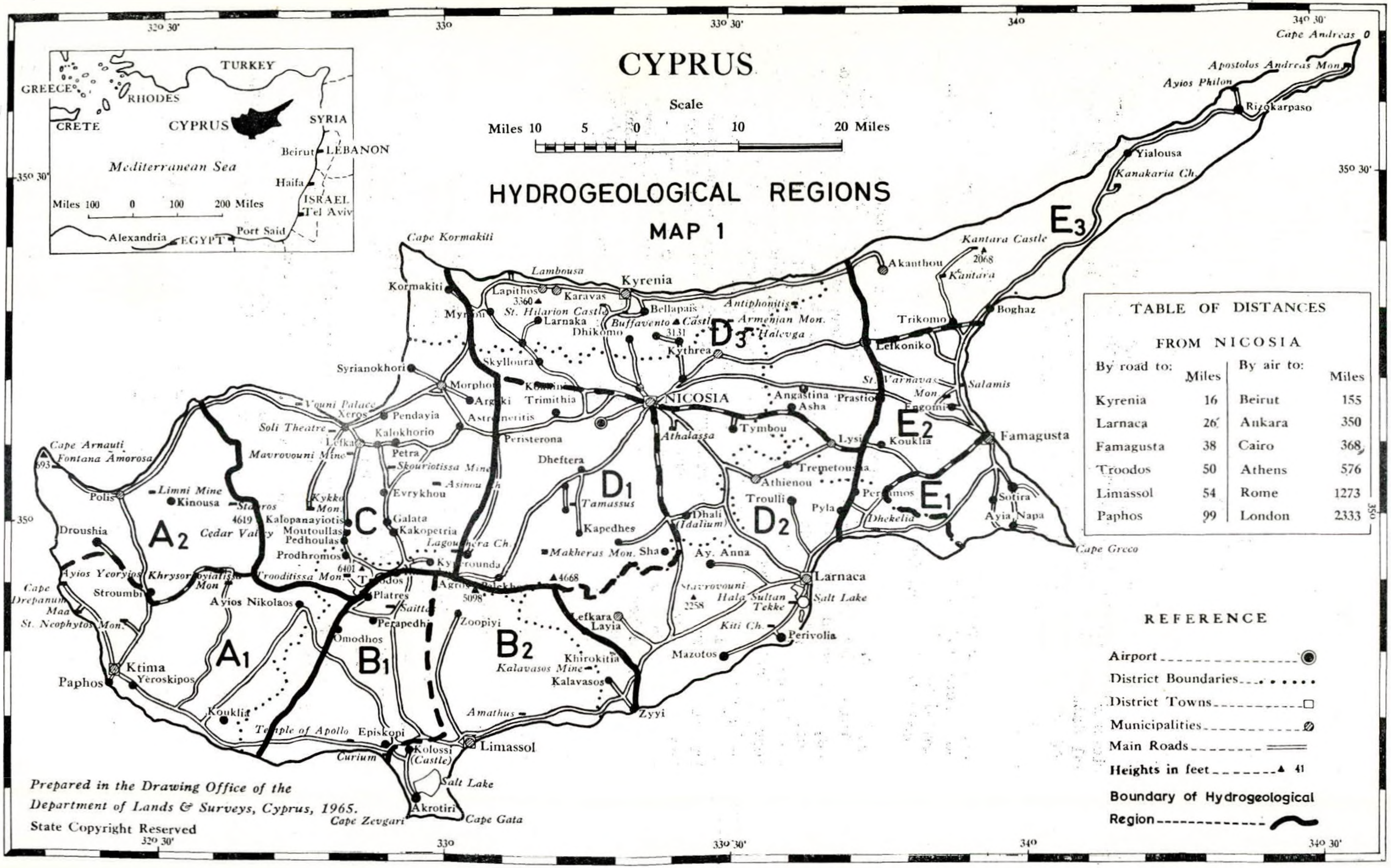
2.2 Prospecting Drilling

2.2.1 General

The programme of Prospecting Drilling was carried out with a crew of 10 drilling rigs. The rigs included two heavy duty Ruston Bucyrus 60 R.L. and eight Ruston Bucyrus 22W. Two additional Bucyrus 22W remained on loan with the Geological Survey Department. Three more rigs are still in the hands of the Turks.

During the year, 43 boreholes were drilled for water with an aggregate (penetrated depth) of 3140 m with an average depth per borehole of 73 m. Table on page 65 shows the results of our drilling operations at each village and District. Table 2 is a summary of table 1 and table 3 shows in general the drilling activities of the Department since 1946.

A total of 10 boreholes were subjected to lengthy pumping tests ranging from 3.5 hours to 68 hours continuous duration. The total volume of water pumped was 22.400 m^3 over a total pumping time of 484 hours and 30 minutes.


CYPRUS
HYDROGEOLOGICAL REGIONS
MAP 1
Scale
Miles 10 5 0 10 20 Miles
TURKEY
GREECE
RHODES
CRETE
CYPRUS
SYRIA
Beirut
LEBANON
Mediterranean Sea
Haifa
ISRAEL
Tel Aviv
Port Said
Alexandria
EGYPT
Miles 100 0 100 200 Miles
A1
A2
B1
B2
C
D1
D2
D3
E1
E2
E3
NICOSIA
Kyrenia
Famagusta
Larnaca
Limassol
Paphos
Ktima
Morphou
Lefka
Polis
Troodos
Platres
Cape Kormakiti
Cape Arnauti
Cape Andreas
Cape Greco
Cape Gata
Cape Zevgari
Salt Lake
Akrotiri
TABLE OF DISTANCES
FROM NICOSIA
By road to: Miles
Kyrenia 16
Larnaca 26
Famagusta 38
Troodos 50
Limassol 54
Paphos 99
By air to: Miles
Beirut 155
Ankara 350
Cairo 368
Athens 576
Rome 1273
London 2333
REFERENCE
Airport
District Boundaries
District Towns
Municipalities
Main Roads
Heights in feet 41
Boundary of Hydrogeological Region
Prepared in the Drawing Office of the
Department of Lands & Surveys, Cyprus, 1965.
State Copyright Reserved

2.2.2 Drilling Costs

During the year the total expenditure for the drilling was £31.646. The average cost of drilling was £746 per borehole or £10 per m of drilling. These costs include wages of drilling crews for drilling, casing and testing the various boreholes. Costs also include long pumping tests with electrosubmersible pumps as well as maintenance of drilling equipment.

Table 1.

2.2.3 Boreholes Drilled for Water in 1970

District	Locality	Number Drilled	Number successful	Percentage successful	Hours Pumped	Total output in m^3	Average Yield m^3/d
Nicosia	Ay. Ioannis (M)	1	1	100.0	67	1 177	421
	Episcopio	1	-	-	-	-	-
	Kato Moni	1	-	-	-	-	-
	Loutros	1	-	-	-	-	-
	Margo	2	-	-	-	-	-
	Nissou	4	2	50.0	45	1 080	576
	Pendayia	3	3	100.0	24)	2 678	2 678
					28)	1 421	1 218
	Pera	1	-	-	-	-	-
	Strovolos	1	-	-	-	-	-
Famagusta	Kantara	2	1	50.0	24)	115	115
					29)	137	113
	Trypimeni	1	Incomplete		35	31	218
	Vitsadha	1	1	100.0	49	6 120	3 000
Kyrenia	Bellapais	1	Incomplete	-	-	-	-
Larnaca	Ay. Theodhoros	2	1	50.0	48	3 506	1 753
	Kalavasos	4	4	100.0	48	2 499	1 249
	Kato Drys	2	-	-	-	-	-
	Khirokitia	2	2	100.0	-	-	-
	Larnaca	1	-	-	-	-	-
	Mari	3	-	-	-	-	-
	Psematismenos	1	1	100.0	51)	1 432	674
					68)	2 164	763
	Pyla	2	-	-	-	-	-
	Skarinou	1	1	100.0	-	-	-
Limassol	Arakapas	1	-	-	-	-	-
	Asomatos	1	1	100.0	-	-	-
	Eptagonia	1	1	100.0	-	-	-
	Paramitha	1	-	-	-	-	-
	Zakaki	1	1	100.0	-	-	-

Table 2.

2.2.4 Boreholes Drilled in 1970 - Summary

Purpose	No.	Aggregate depth m	Percentage Successful	Total Tested Yield Gallons	Hours Pumped
Irrigation	6	400	34.0	9 721	168 hours
Domestic W.S.	18	1 400	50.0	9 864	212 hours
Prospecting	15	1 170	48.0	2 783	104 hours 30 min.
Total for water	39				
Observation	4	195			
Technical and Geological	-				
Total	43	3 165			

Table 3.

2.2.5 Drilling Activities 1946 - 1970

Purpose	1946 1962	1963	1964	1965	1966	1967	1968	1969 c	1970
Boreholes at Full Cost	2,161	12	11	2	8	11	6	30	4
For Government	901	190	86	215	83	44	62	45	39
For W.D.D.	854	11	14	16	7	-	2	2	-
TOTAL	3,916	213	111	233	98	55	70	77	43
Aggregate Depth Drilled (m)	209,000	12,300	6,850	8,350	5,150	4,580	5,620	5,250	3,140
Average Depth (m)	53	57	63	36	53	83	80	68	73

2.3 Boreholes of special Hydrogeological interest drilled in 1970

2.3.1 B/H 10/70. Drilled near Psematismenos village. Total depth 190 m. This borehole went through Pakhna formation with interchanging layers of marls and sandstones and occasionally gypsum which when met below 167 m. it was aquiferous.

2.3.2 B/H 15/70. Drilled near and east of Kantara castle. It was sited on marls near a steeply dipping limestone bed which was met at 63 m. from the surface and proved to be aquiferous.

2.3.3 B/H 19/70. Drilled in Tripimeni area. It went through 238 m. and is still in limestone. This B/H will be completed in 1971. The water table is 135 m. from the surface.

2.3.4 B/H 34/70. Drilled in the Asomatos village area. It went through gravels being old river and beach deposits of a thickness of 87 m directly into Lapithos chalks. The total depth is 100 m. and the water table 3.6 m below surface.

2.3.5 B/H 35/70. Drilled near a fault zone in Lapithos formation near Skarinou village. The first 131 m. of rock was marly and impervious. At about the depth of 152 m where slightly crushed rock was met water came at the surface giving a free artesian flow which was increasing as the borehole was going deeper in the chalky layers, until a free flow of about 12 m^3/h when upto the depth of 207 m. was reached. The depth of the borehole is 213 m. finished in marly chalk (during 1971). It is worthwhile to note that after a pumping test of several days at an average rate of 60 m^3/h the free artesian flow was increased to about 22m^3/h.

2.3.6 B/H 40/70. Drilled near Ay. Ioannis Maloundas. Two main aquifers were met. The first one up to the depth of 38 m. which may be partly fanglomerate and partly coarse facies in Myrtou Marl. It can be classified as fine gravel. The second aquifer met at the depth of 228 m. is definitely a coarse facies within the Myrtou Marl, ranging from fine to coarse sand. The quality of the water is very good in both aquifers. To be completed during 1971.

2.4 Surface Hydrology Works

2.4.1 Meteorological Notes

The rainfall and climatological records of 160 observing stations of the Cyprus Government Meteorological office have been analysed by the Division of Water Resources and the results of the principal features of the weather during the hydrological year-1st October, 1969 to 30th September, 1970 - are given hereunder:-

(a) The average rainfall over the whole island was 373 mm which is 74.14% of normal (503 mm) this being the mean since 1916-1950. See isohyetal map on page 70.

(b) October, March, May, July and August were the months with above average rainfall. Precipitation during the other months was much below normal.

(c) The highest daily rainfall of the year was 73.1 mm which occurred at Anatoliko Monastery (near Akhelia) on 18th April 1970.

(d) The first snowfall on the Troodos range occurred in mid-December, 1969 and the last on 4th May, 1970.

(e) Temperatures were about normal during October and November, 1969 while during the period December 1969 through to April 1970 temperatures were above normal. Late spring and summer periods were characterized by temperatures around normal except for the last week of September when a cold spell occurred and temperatures dropped considerably.

The extreme maximum and minimum temperatures recorded during the Hydrological year under consideration at various Meteorological Stations are quoted below:

Station	Extreme maximum temperature and date	Extreme minimum temperature and date
Nicosia	41.1°C (on 11th August)	1.1°C (on 28th January)
Limassol	36.1°C (on 12th and 16th August)	3.9°C (on 27th January)
Larnaca	40.5°C (on 12th August)	3.3°C (on 27th January) and 19th February)
Famagusta	37.2°C (on 12th August)	1.1°C (on 15th January)
Paphos	35.6°C (on 21st May)	5.3°C (on 26th January)
Kyrenia	37.8°C (on 2nd August)	5.0°C (on 28th January)
Panayia Bridge Forest Station Between Platanistasa & Kato Moni	38.3°C (on 11th August)	-1.1°C (on 28th January)
Korphou	40.6°C (on 11th August)	0.0°C (on 28th January
Halefga Forest Station	36.1°C (on 11th August)	0.0°C (on 27th January and 18th and 19th February)
Saittas Nursery Garden	40.0°C (on 12th August)	-1.7°C (on 19th February)

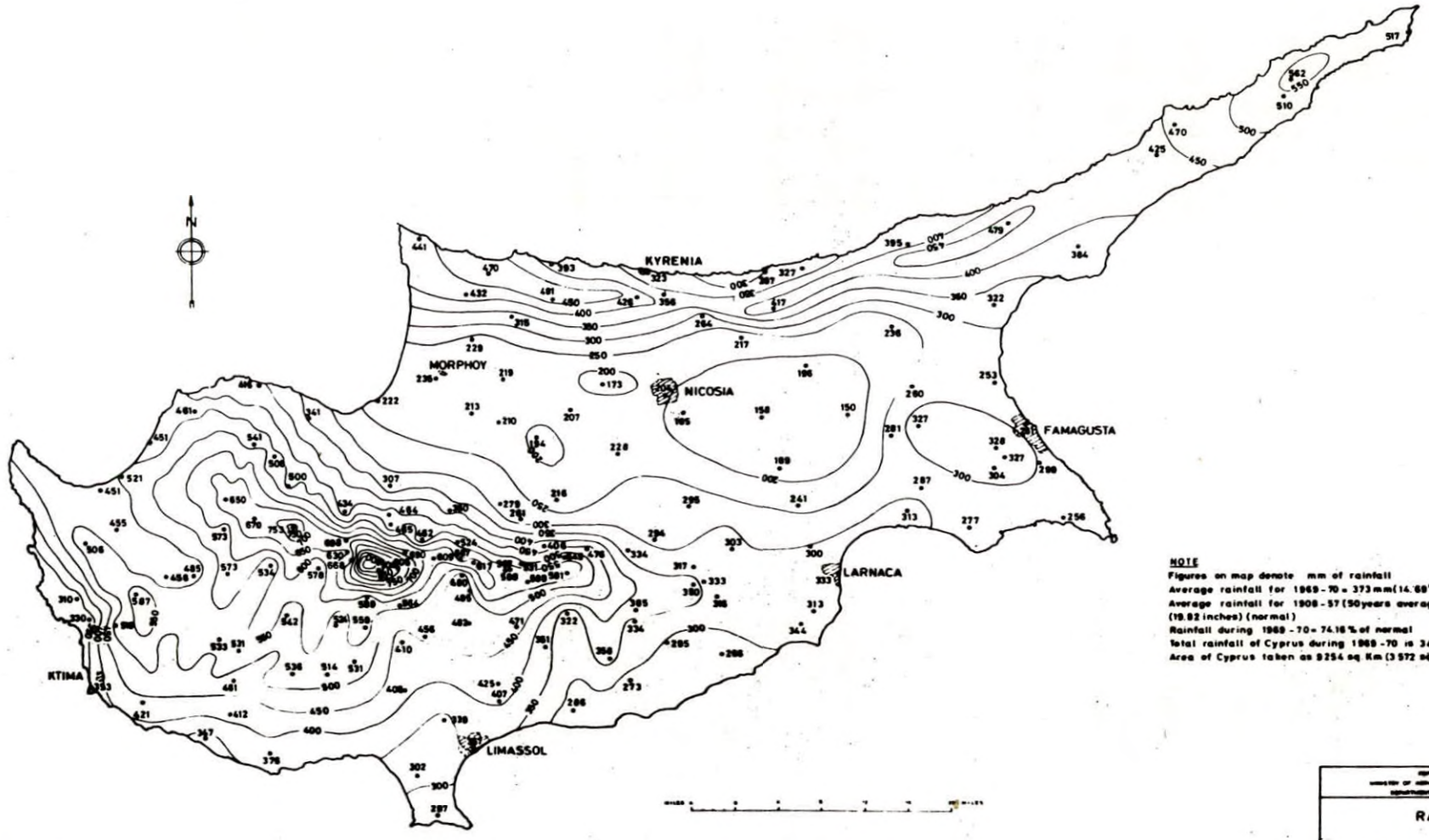
Station	Extreme maximum temperature and date	Extreme minimum temperature and date
Pano Amiandos	32.2°C (on 12th August)	-3.3°C (on 19th February)
Prodromos Forestry College	35.2°C (on 12th August)	-3.5°C (on 19th February)
Stavros tis Psokas Forest Station	37.8°C (on 11th August)	-1.1°C (on 26th December)
Kornos Forest Station	41.1°C (on 12th August)	2.8°C (on 27th January)
Platania (Kakopetria) Forest Station	35.0°C (on 12th August)	-3.3°C (on 26th January)
Phassouri	36.1°C (on 12th August)	0.6°C (on 27th January)

2.4.2 Flood Discharges

No remarkable flash flows were reported during the year due to the low rainfall intensities experienced over the island. The highest floods reported were 160 cubic meters per second in Vathis river at Athalassa and 170 cubic meters per second in Alikos river at Ayios Sozomenos on 29th December, 1969.

The table on next page summarises some of the highest floods and rainfall measured in the catchment or in adjacent catchments on the day of the flood or on the previous day.

Floods of less importance have been ignored.



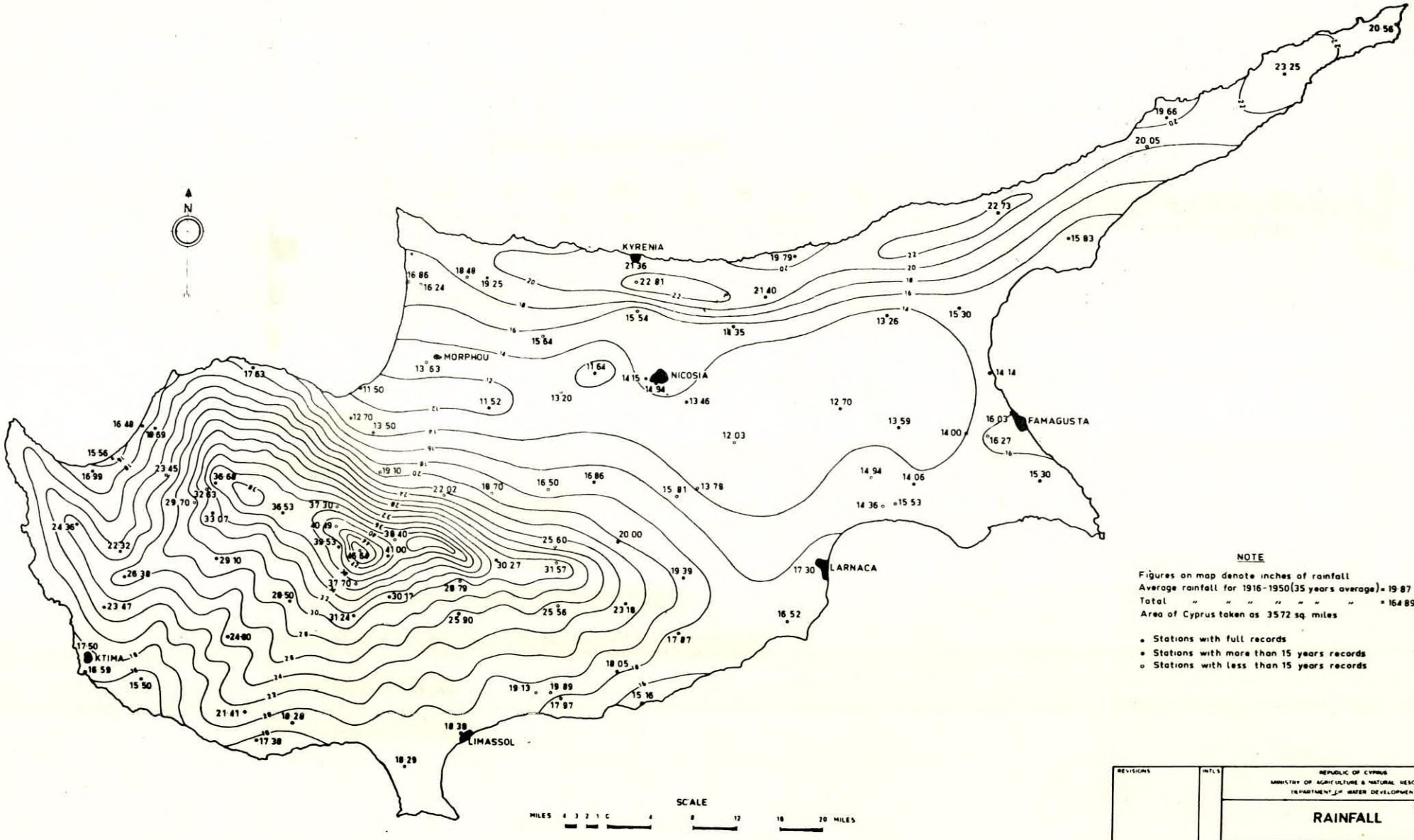
NOTE
Figures on map denote mm of rainfall
Average rainfall for 1969 - 70 = 373 mm (14.68")
Average rainfall for 1908 - 57 (50 years average) = 503 mm (19.82 inches) (normal)
Rainfall during 1969 - 70 = 74.16 % of normal
Total rainfall of Cyprus during 1969 - 70 is $345 \times 10^8 m^3$ ($121.9 \times 10^{12} ft^3$)
Area of Cyprus taken as 9254 sq. Km (3 572 sq. miles)

REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE & NATURAL RESOURCES
DEPARTMENT OF WATER DEVELOPMENT

RAINFALL

ISOHYETAL MAP OF CYPRUS BASED ON RAINFALL FROM 1st Oct 1969 - 30th Sep 1970

FEBRUARY 1971		DRG No.
SURVEYED BY		TRACED BY
DESIGNED BY		CHECKED BY
DRAWN BY		APPROVED BY



NOTE

Figures on map denote inches of rainfall
Average rainfall for 1916-1950(35 years average) = 19.87 inches
Total " " " " " " = 164.89×10^9 ft^3
Area of Cyprus taken as 3572 sq. miles

- Stations with full records
- Stations with more than 15 years records
- Stations with less than 15 years records

REVISIONS	INITLS

REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE & NATURAL RESOURCES
DEPARTMENT OF WATER DEVELOPMENT

RAINFALL

ISOHYETAL MAP OF CYPRUS BASED ON RAINFALL FROM 1916 TO 1950 (35 YEARS AVERAGE)

DRG No

SURVEYED BY	TRACED BY
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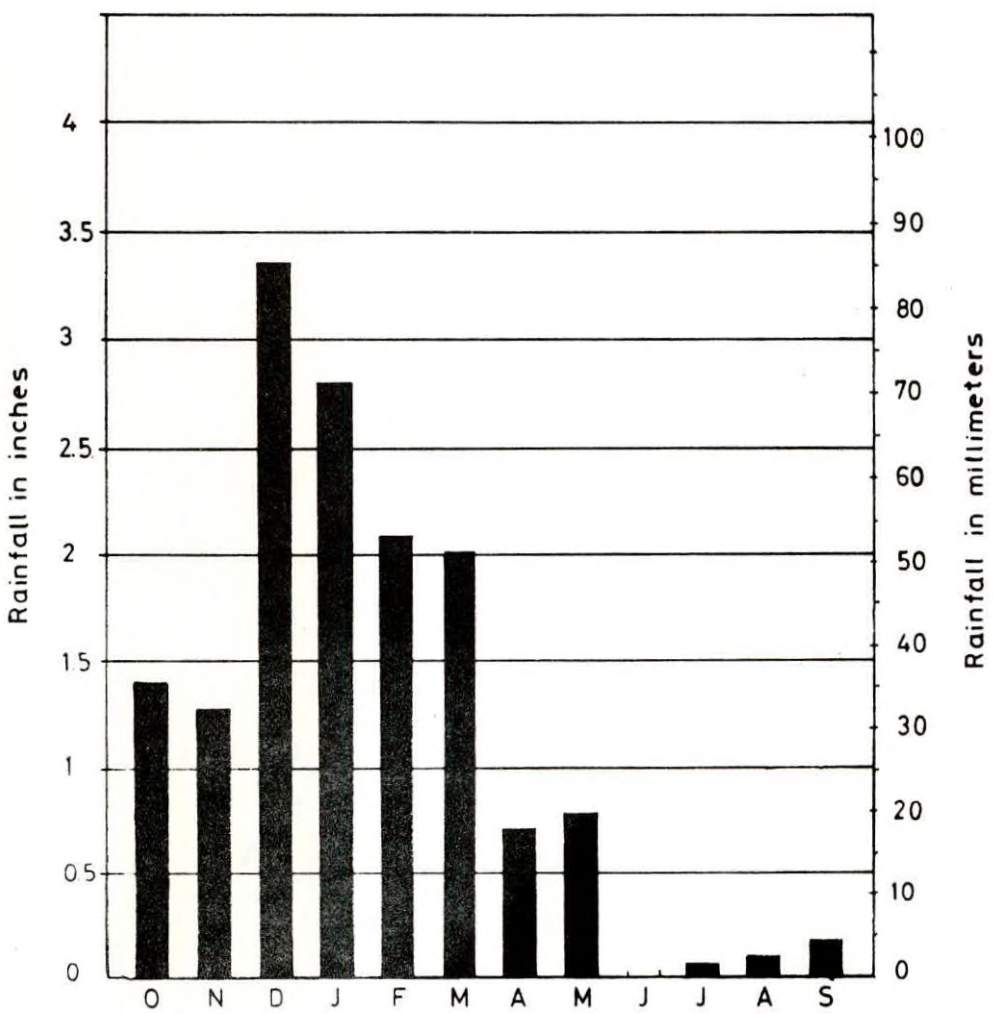
INCIDENCE OF RAINFALL

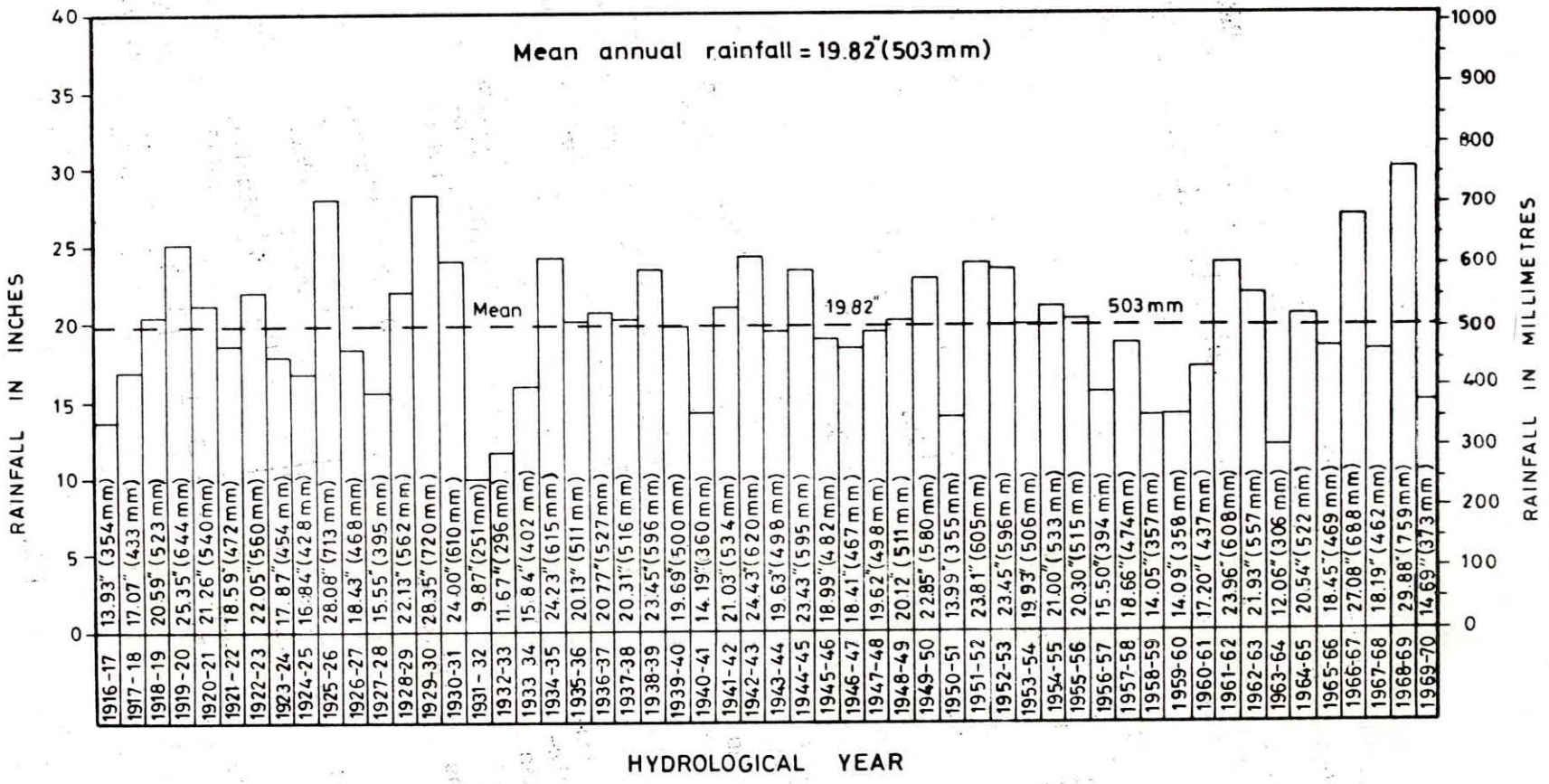
The incidence of rainfall per month as worked out from selected rainfall stations during the hydrological year 1969-1970 is given as under:-

Month	Rainfall in inches	Rainfall in millimeters	Percentage %
October	1.40	36	9.65
November	1.27	32	8 58
December	3.35	85	22.79
January	2.79	71	19.04
February	2.06	52	13 94
March	2.01	51	13.67
April	0.70	18	4.83
May	0.78	20	5.36
June	0.00	0	0.00
July	0.06	1.5	0.40
August	0.10	2.5	0.67
September	0.17	4	1.07
Totals	14.69	373	100.00

GRAPHICAL PRESENTATION
OF INCIDENCE OF RAINFALL



ANNUAL AVERAGE RAINFALL OF CYPRUS
FROM 1916 - 1970



Gauging Station No.	River & Area (km^2)	Location	Peak Flow		Rainfall		
			m^3/s	date	mm	Place	date
1-1-7-95	Khapotami 110.9	Kouklia	5.8	10. 3.70	39.4	Omodhos	9. 3.70
1-2-4-95	Dhiarizos 130.0	Philousa	3.1	18.12.69	36.8	Kaminaria	17.12.69
1-2-7-90	Dhiarizos 263.7	Kouklia	7.9	10. 3.70	22.9	Kaminaria	9. 3.70
			3.6	18.12.69	36.8	Kaminaria	17.12.69
1-3-8-60	Xeros	Phinikas	10.5	10. 3.70	19.5	Kykko Monastery	9. 3.70
1-4-4-50	Ezusa 81.3	Kannavia	13.5	14. 1.70	40.3	Kannaviou	14. 1.70
					29.2	Ayia F.S.	14. 1.70
1-4-9-80	Ezusa 211.3	Akhelia	18.0	14. 1.70	40.3	Kannaviou	14. 1.70
					29.2	Ayia F.S.	14. 1.70
1-8-2-80	Avgas	Toxeftra (Akamas)	2.3	22. 3.70	17.0	Drousha	21. 3.70
2-2-3-95	Khrysokhou 67.3	Skoulli	1.10	14. 1.70	15.7	Dhrinia	14. 1.70
2-2-6-90	Stavros-tis-Psokas 93.0	Evretou	5.6	14. 1.70	22.0	Stavros-tis-Psokas	14. 1.70
2-7-2-75	Pyrgos 38.6	Phileyia	1.40	23. 3.70	31.0	Stavros-tis-Psokas	21. 3.70
					14.5		22. 3.70
2-8-3-10	Limnitis 48.7	Limnitis Sawmill	1.75	23. 3.70	28.5	Limnitis Sawmill	21. 3.70
					5.5		22. 3.70
3-2-2-90	Maratlasa 56.9	Upstream of Lefka Dam	2.8	21. 1.70	32.3	Kalopa-nayiotis Dam	21. 1.70
					26.7	Pedhoulas Dam	21. 1.70
3-3-1-70	Ay.Nico-laos 16.1	Kakopetria	1.20	17.12.69	45.0	Platania F.S.	17.12.69
3-3-3-95	Karyotis 63.2	Evrykhou	2.6	21. 1.70	32.5	Platania F.S.	21. 1.70
			2.6	22. 3.70	20.8	Platania F S.	21. 3.70
3-3-5-95	Karyotis 94.0	Pendayia	1.35	21. 1.70	32.5	Platania F.S.	21. 1.70
					30.1	Galata N.G.	21. 1.70
3-5-4-40	Elea 81.6	Vizakia	3.8	21. 1.70	33.0	Kapoura F.S.	21. 1.70
			3.3	2.11.69	67.3	Kapoura F.S.	1.11.69

Gauging Station No.	River & Area (km^2)	Location	Peak Flow		Rainfall		
			m^3/s	Date	mm	Place	Date
3-7-1-50	Peristerona 78.5	Panayia F.S.	2.6	1.11.69	55.4	Alona	1.11.69
			2.6	26.11.69	25.4	Polystipos	25.12.69
3-7-3-90	Akaki 92.5	Malounda	2.9	26.12.69	27.7	Palekhori	25.12.69
			2.7	15. 1.70	25.4	Ghourri	14. 1.70
					19.7	Palekhori	14. 1.70
3-7-7-85	Skylloura 76.1	Ayios Vasilios	3.2	21. 1.70	65.3	Sysklipos	21. 1.70
3-8-6-50	Aloupos 78.2	Aloupos Chiftlic	1.50	21. 1.70	16.8	Asomatos	21. 1.70
					14.0	Dhiorios F.S.	21. 1.70
6-1-1-80	Ayios Onoufrios 14.5	Kambia	7.6	3. 9.70	22.8	Konia F.S.	3. 9.70
6-1-1-85	Pedhieos 29.5	Kambia	2.2	3. 9.70	30.5	Makheras Monasteri	3. 9.70
					26.9	Mandra-tou Kambiou F.S.	3. 9.70
6-1-5-50	Vathys 30.3	Athalassa	160	30.12.69	26.7	Perakhorio (Nisou)	30.12.69
			14.5	20.10.69	11.4	A.R. Institute	19.10.69
			14.0	14. 1.70	15.4	Nicosia	14. 1.70
					13.5	Perakho-rio (Nisou)	14. 1.70
6-5-2-95	Alykos 80.4	Ayios Sozomenos	170	30.12.69	26.7	Perakho-rio (Nisou)	30.12.69
6-5-3-15	Yialias 93.3	Nisou	50	30.12.69	26.7	Perakho-rio (Nisou)	30.12.69
			19.5	20.10.69	26.7	Lythrodon-das	19.10.69
6-5-3-95	Yialias 213.7	Pyroi	177	30.12.69	26.7	Perakho-rio (Nisou)	30.12.69
8-2-2-90	Aradhippou 20.5	Panayia Yematousa	2.3	6. 5.70	22.3	Araphippou	5. 5.70
					24.1	Avdellero	6. 5.70
8-4-3-40	Tremithios 90.1	Ayia Anna	4.2	30.12.69	36.1	Psevdhas	30.12.69
8-5-1-90	Pouzis 58.8	Mazotos	4.8	30.12.69	14.7	Kornos F.S	30.12.69
8-6-3-50	Xeropota-mos 28.9	Alaminos	1.55	7.10.69	5.3	Ay. Varva-ra Monas-teri	7.10.69

Gauging Station No.	River & Area (km^2)	Location	Peak Flow		Rainfall		
			m^3/s	Date	mm	Place	Date
8-7-3-60	Mylou 31.8	Kornos	4.3	19.10.69	12.2	Mathiatis	19.10.69
			3.4	25.12 69	14.7	Kornos	24.12.69
					5.1	Kornos	25.12.69
8-7-4-80	Syrgatis 131.1	Skarinou	4.2	10. 3.70	56.6	Pano Lefkara	9. 3.70
					25.0	Kionia F.S.	9. 3.70
8-8-2-50	Maroni 30.3	Vavla	1.35	9. 3.70	56.6	Pano Lefkara	9. 3.70
					25.0	Kionia F.S.	9. 3.70
8-8-3-30	Maroni 53.6	Khirokitia	1.70	9. 3.70	56.6	Pano Lefkara	9. 3.70
					25.0	Kionia F.S.	9. 3.70
8-9-7-50	Vasilikos 135.7	Kalavasos	2.0	9. 3.70	46.5	Kellaki	9. 3.70
					25.0	Kionia F.S.	9. 3.70
8-9-7-95	Vasilikos	Vasiliko	1.45	9. 3.70	46.5	Kellaki	9. 3.70
						Kionia F.S.	9. 3.70
9-2-3-85	Yermasoyia 109.8	Phinikaria	6.2	16.12.69	53.1	Kalokhorio	16.12.69
					35.6	Arakapas	16.12.69
			5.6	10. 3.70	50.8	Kalokhorio	9. 3.70
					46.2	Arakapas	9. 3.70
9-6-7-75	Zyghos 124.1	Khalassa	23	14.10.69	25.4	Agros	14.10.69
					21.6	Ay. Theodoros	14.10.69
			10.0				
			8.0	14. 1.70	17.8	Ay. Theodoros	14. 1.70
					17.3	Kapilio	14. 1.70
9-6-9-05	Kryos & Kourris 169.9	Khalassa	5.4	16.12.69	35.8	Kilani	16.12.69
					41.4	Platres	16.12.69
			4.1	10. 3.70	69.9	Ay. Theraspon	9. 3.70
					34.3	Kilani	9. 3.70
9-8-1-95	Evdhimou 35.4	Evdhimou	3.4	10. 3.70	50.8	Pakhna	9. 3.70

2.4.3 Automatic Water Level Recorders in operation

At the end of the hydrological year the following automatic water level recorders were in operation.

Gauging Station No.	Stream	Location	Co-ordinates
1-1-3-95	Khapotami	Kissousa	VD 805513
1-1-7-95	Khapotami	Kouklia	VD 627383
1-2-4-95	Dhiarizos	Philousa	VD 754575
1-2-7-90	Dhiarizos	Kouklia	VD 601411
1-3-8-60	Xeros	Phinikas	VD 615470
1-4-4-50	Ezouza	Kannaviou	VD 610633
1-4-9-80	Ezouza	Akhelia	VD 524444
1-6-2-80	Mavrokolymbos	Potima	VD 446567
1-8-2-80	Avgas	Toxeftra(Akamas)	VD 394644
2-2-3-95	Khrysokhou	Skoulli	VD 497709
2-2-6-90	Stavros-tis-Psokas	Evretou	VD 520705
2-3-8-95	Yialia	Kato Yialia	VD 549848
2-7-2-75	Pyrgos	Phileyia	VD 717857
2-8-3-10	Limnitis	Limnitis Sawmill	VD 737822
2-8-3-15	Limnitis	Limnitis Sawmill	VD 739830
2-9-4-90	Kambos	Potamos-tou-Kambou	VD 826892
3-1-3-95	Xeros	Karavostasi	VD 852889
3-2-1-85	Marathasa	U/S Kalopanayiotis Dam	VD 842733
3-2-1-95	Marathasa	Kalopanayiotis Dam	VD 841739
3-2-2-90	Marathasa	U/S Lefka Dam	VD 852795
3-2-4-95	Marathasa	Karavostasi	VD 863895
3-3-1-70	Ayios Nicolaos	Kakopetria	VD 900707
3-3-2-60	Platania	Kakopetria	VD 927698
3-3-3-95	Karyotis	Evrykhou	VD 906773
3-3-5-95	Karyotis	Pendayia	VD 883902
3-4-2-90	Atsas	Evrykhou	VD 931810
3-5-3-90	Asinou	Nikitari	VD 997820
3-5-4-40	Pilea	Vyzakia	WD 018806
3-7-1-50	Peristerona	Panayia F.S.	WD 075754
3-7-3-90	Akaki	Malounda	WD 163783
3-7-5-70	Merika	Paleometokho	WD 175874
3-7-5-85	Kokkinitrimithia	Kokkinitrimithia	WD 150906
3-7-7-85	Skylloura	Ayios Vasilios	WD 156969
3-7-8-60	Ovgos	Kyra	WD 050964
3-7-8-65	Ovgos	Ovgos Dam	WD 034973
3-7-8-90	Ovgos	Morphou	VD 973974
3-7-9-50	Serakhis	Morphou Dam	WD 007948
3-8-6-50	Aloupos	Aloupos Chiftlik	VE 980018
4-2-3-70	Panagra	Nicosia-Kyrenia Rd.	WE 077119
4-4-2-50	Boghazi	Kyrenia Rd. Forest	WE 296077
4-5-5-90	Alakati	Platymatis	WE 455105
4-7-1-75	Yerokolymbos	Boghaz (Akanthou)	WE 636142
5-2-3-50	Melini	Ayia Trias	XE 125337
5-3-4-85	Laris	Rizokarpaso	XE 218405
5-9-4-90	Kharangas	Boghaz (Famagusta)	WE 883100
6-1-1-80	Ayios Onoufrios	Kambia	WD 225735
6-1-1-85	Pedhieos	Kambia	WD 224741
6-1-4-50	Pedhieos	Mia Milia	WD 376958
6-1-5-50	Vathis	Athalassa	WD 345867
6-5-2-95	Alikos	Ayios Sozomenos	WD 413808

Gauging Station No.	Stream	Location	Co-ordinates
6-5-3-15	Yialias	Nisou	WD 359756
6-5-3-95	Yialias	Pyroi	WD 446824
7-1-7-50	Kolopannes	Kalopsidha	WD 746842
7-1-2-80	Ayios Yeorghios	Akhna P.S.	WD 750814
7-1-3-80	Avgorou	Avgorou	WD 765800
7-1-4-50	Phrenaros	Phrenaros	WD 804800
7-1-6-80	Ayios Loucas	Ayios Loucas Lake	WD 827871
7-1-6-85	Ayios Loucas Lake	Ayios Loucas Lake	WD 834865
7-2-3-50	Liopetri	U/S Liopetri Dam	WD 806732
7-2-7-05	Paralimni Lake out-Flow	Paralimni	WD 892801
8-2-1-90	Aradhippou	Nicosia-Larnaca Road	WD 517683
8-2-2-90	Aradhippou	Panayia Yeratousa	WD 516689
8-4-3-40	Tremithos	Ayia Anna	WD 442668
8-4-5-30	Tremithos	Larnaca-Limassol Road	WD 490615
8-4-5-40	Tremithos	Kiti Dam	WD 510590
8-5-1-90	Bouzis	Mazotos	WD 472518
8-6-3-50	Xeropotamos	Alaminos	WD 398519
8-7-3-60	Mylou	Kornos	WD 332613
8-7-4-80	Syrgatis	Skarinou Station	WD 343535
8-8-2-50	Maroni	Vavla	WD 261558
8-8-3-30	Maroni	Khirokitia Station	WD 317503
8-9-5-95	Vasilikos	Kalavasos Mine	WD 256503
8-9-7-50	Vasilikos	Kalavasos	WD 257472
8-9-7-95	Vasilikos	Vasiliko	WD 292425
9-2-3-85	Yermasoyia	Phinikaria	WD 093475
9-2-4-90	Akrounda	D/S Akrounda Dam	WD 070477
9-2-5-95	Yermasoyia	Yermasoyia P.S.	WD 081397
9-4-3-80	Garyllis	U/S Polemidhia Dam	VD 977450
9-4-3-90	Garyllis (Mersina Tr.)	U/S Polemidhia Dam	VD 990435
9-4-4-50	Garyllis	Polemidhia	WD 009396
9-6-4-95	Kourris	Khalassa	VD 920470
9-6-7-75	Zyghos	Khalassa	VD 941471
9-6-9-05	Kouris & Kryos	Khalassa	VD 921466
9-8-1-95	Evdhimou	Evdhimou	VD 780397
4-3-3-32	Kephalovriso Spr.	Karavas	WE 174098
6-1-7-15	Kephalovryso Spr.	Kythrea	WE 445030

2.4.4 Stream Discharges

The discharges which could be measured during the year at the gauging stations described in previous paragraph are as follows:

Gauging Station No.	Catchment	Rainfall during 1969-70 10^6 m^3	Discharge during 1969-70 10^6 m^3	Maximum Discharge in a day 10^6 m^3	Peak discharge m^3/s
1-1-3-95	Khapotami-Kissoussa	20.4	1.99	36	0.42
1-1-7-95	Khapotami-Kouklia	55.6	2.0	80	5.8
1-2-4-95	Dhiarizos-Philousa	80.4	9.8	155	3.1
1-2-7-90	Dhiarizos-Kouklia	145.7	13.0	345	7.9
1-3-8-60	Xeros-Phinikas	111.9	6.2	320	10.5
1-4-4-50	Ezouza-Kanaviou	46.1	3.1	95	13.5
1-4-9-80	Ezouza-Akhelia	108.7	2.9	199	18.0
1-6-2-80	Mavrokolymbos-Potima	20.3	0.89	48	0.56
1-8-2-80	Avgas-Toxeftra	10.5	0.73	62	2.3
2-2-3-95	Khrysokhou-Skoulli	32.6	2.9	57	1.10
2-2-6-90	Stavros-tis-Psokas-Evretou	46.1	3.3	95	5.6
2-3-8-95	Yialia-Kato Yialia	11.6	0.7	25	0.70
2-7-2-75	Pyrgos-Phileyia	23.0	3.4	117	1.40
2-8-3-15	Limnitis-Saw mill	28.7	4.2	130	1.75
2-9-4-90	Kambos-Potamos-tou Kambou	22.5	-	-	-
3-1-3-95	Xeros-Karavostasi	38.1	-	-	-
3-2-1-85	Marathasa-upstream of Kalopanayiotis Dam	14.2	3.7	38	0.81
3-2-2-90	Marathasa-upstream of Lefka Dam	28.1	5.7	68	2.8
3-2-4-95	Marathasa-Karavostasi	36.0	1.7	41	0.47
3-3-1-70	Ayios Nicolaos-Kakopetria	12.3	8.6	62	1.20
3-3-2-60	Platania-Kakopetria	6.8	1.5	15	0.44
3-3-3-95	Karyotis-Evrykhou	37.3	7.3	112	2.6
3-3-5-95	Karyotis-Pendayia	46.4	1.3	82	1.35
3-4-2-90	Atsas-Evrykhou	12.6	0.57	18	0.26
3-5-3-90	Asinou-Nikitari	5.8	0.14	1	0.022
3-5-4-40	Elea-Vizakia	32.3	2.9	216	3.8
3-7-1-50	Peristerona-Panayia F.S.	36.7	5.9	160	2.6
3-7-3-90	Akaki-Malounda	36.5	3.8	147	2.9
3-7-5-85	Kokkinitrimithia-Kokkinitrimithia	6.2	-	-	-
3-7-7-85	Skylloura-Ayios Vasilios	29.7	0.75	117	3.2
3-7-8-60	Ovgos-Kyra	60.8	0.71	164	7.3
3-7-8-65	Ovgos-Ovgos Dam Spill.	62.6	-	-	-
3-7-8-90	Ovgos-Morphou	63.3	-	-	-
3-7-9-50	Serakhis-Morphou Dam Spillway	134.9	-	-	-
4-4-2-50	Boghazi-Kyrenia Road Forest	2.3	0.22	3	0.063
3-8-6-50	Aloupos-Aloupos Chiftlic	23.9	0.40	29	1.5
5-2-3-50	Melini-Ayia Trias	1.2	0.15	5	0.47
5-3-4-85	Laris-Rizokarpaso	2.0	0.048	4	0.42
5-9-4-90	Kharangas-Boghaz(Famagusta)	9.8	0.040	11	0.38
6-1-1-80	Ayios Onoufrios-Kambia	6.9	0.93	42	7.6

Gauging Station No.	Catchment	Rainfall during 1969-70 10^6 m^3	Discharge during 1969-70 10^6 m^3	Maximum Discharge in a day 10^6 m^3	Peak Discharge m^3/s
6-1-1-85	Pedhieos-Kambia	13.6	1.10	48	2.2
6-1-5-50	Vathis-Athalassa	6.3	0.98	750	160
6-5-2-95	Alikos-Ayios Sozomenos	22.2	1.73	735	170
6-5-3-15	Yialias-Nisou	32.2	0.96	295	50
6-5-3-95	Yialias-Pyroi	64.0	1.58	770	175
7-1-2-80	Ayios Yeorghios-Akhna	8.1	-	-	-
7-1-3-80	Avgorou-Avgorou	6.6	-	-	-
7-1-4-50	Phrenaros-Phrenaros	3.7	-	-	-
7-2-3-50	Liopetri-Liopetri	3.2	0.001	-1	0.74
7-2-7-05	Paralimni Lake outflow	6.5	0.006	5	0.49
8-2-1-90	Aradhippou-Nicosia Larnaca Road	9.1	0.008	5	0.54
8-2-2-90	Aradhippou-Panayia Yematousa	5.2	0.052	9	2.3
8-4-3-40	Tremithos-Ayia Anna	27.0	0.103	32	4.2
8-4-5-40	Tremithos-Kiti Dam Spillway	45.9	-	-	-
8-5-1-90	Pouzis-Mazotos	18.1	0.038	24	4.8
8-6-3-50	Xeropotamos-Alaminos	9.0	0.049	13	1.55
8-7-3-60	Mylou-Kornos	10.9	0.30	32	4.3
8-7-4-80	Syrgatis-Skarinou St.	50.7	0.32	60	4.2
8-8-2-50	Maroni-Vavla	12.7	0.78	68	1.35
8-8-3-30	Maroni-Khirokitia St.	20.7	0.50	73	1.70
8-9-5-95	Vasilikos-Kalavassos Mine	40.0	2.18	55	-
8-9-7-50	Vasilikos-Kalavasso	49.7	1.90	58	2.0
8-9-7-95	Vasilikos-Vasiliko	53.1	0.55	76	1.45
9-2-3-85	Yermasoyia-Phinikaria	51.1	7.1	275	6.2
9-2-4-90	Akrounda-downstream of Akrounda-Dam	12.7	0.66	40	0.47
9-2-5-95	Yermasoyia-Yermasoyia P.S.	81.5	-	-	-
9-4-3-80	Garyllis-upstream of Polemidhia Dam	28.0	1.17	26	-
9-4-3-90	Garyllis(Mersina Tr.) upstream of Polemidhia Dam	1.6	-	-	-
9-6-4-95	Kouris-Khalassa	58.5	10.5	182	-
9-6-7-75	Zyghos-Khalassa	61.9	7.5	138	23
9-6-9-05	Kouris & Kryos-Khalassa	96.3	13.1	260	5.4
9-8-1-95	Evdhimou-Evdhimou	16.0	0.65	40	3.4

2.4.5 Spring Discharges

The majority of the observed springs are gauged on a routine basis at different frequencies, while a small number of springs are gauged only for a temporary period after the request of another interested Departmental Division.

During the Hydrological year 2,672 spring discharges were gauged averaging 223 gaugings every month; the output of 212 springs is being gauged regularly, 190 of these every month and 22 every two months; in addition 82 springs were gauged for a certain period during the year.

As a result of the low precipitation during the current hydrological year all over Cyprus, most springs experienced a continuous decrease of flow almost all the year round.

On the Troodos mountains all springs had a continuous decrease of flow upto the winter months, a slight increase in early spring time and then a steady decrease upto the end of the Hydrological year.

On the Kyrenia range all springs had the same behaviour as on Troodos mountains but their flow was still quite high due to the high precipitation of the previous Hydrological year.

In the central Mesaoria Plain, the flow of chain of wells experienced a continuous and rapid decrease of flow, some of which went dry.

2.4.6 Chemical Analyses

During the year 5696 samples of water were sent to the Government Analyst for partial chemical analyses. Of these 1933 samples were taken from springs, wells or boreholes which are used or proposed as water supplies sources. The remaining 3763 samples derived from springs, observation boreholes and from other miscellaneous sources. In addition 4 samples taken from boreholes and rivers were sent to the Analyst of the Agricultural Department for full analyses including boron.

Also 3219 samples of water taken from observation boreholes in the Hydrological survey areas were analysed by the Water Resources Division for Chloride content.

2.4.7 Bacteriological Analyses

Water Supply	No. of samples	No. of unsatisfactory samples
Nicosia	41	1
Famagusta	208	48
Limassol	142	22
Larnaca	94	4
Paphos	-	-
Kyrenia	20	-
T o t a l s	505	75

The unsatisfactory samples at Limassol, Famagusta and Larnaca were usually of unchlorinated water. All chlorinated samples at main reservoirs were satisfactory.

2.4.8 Suspended Sediment Analyses

In view of the future construction of large dams in Cyprus and the problem arising from reservoir sedimentation a sediment sampling programme was initiated. Though not very intensive the programme provided for sampling during routine visits to the flow gauging stations, and additional sampling during floods in as many rivers as possible.

During the year approximately 100 samples of rivers water were taken for suspended sediment analysis.

2.4.9 New stream gauging sites

During the year under review 3 new stream gauging stations were completed and automatic water level recorders were installed.

1. Xeros River at Lazaridhes: Construction of a broad crested weir, V shaped (slope 1:10) 26 ft. wide.

2. Akrounda River upstream of Yermasoyia Dam: Construction of a broad crested weir under the bridge of Yermasoyia-Akrounda road.

3. Zavos River at Khandria: Improvements on the existing irrigation weir, by alteration of the lower section of the weir by a V shaped structure, to serve as an irrigation intake, and flow gauging station at the same time.

2.4.10 Repairs and improvements to the existing flow gauging stations

1. Kouris & Kryos River near Khalassa

Repairs to the apron and sill of the station which suffered extensive damages by the floods.

2. Garyllis River upstream of Polemidhia Dam: Construction of a broad crested weir V shaped (slope 1:10), 30 ft wide; the natural river bed was used before.

3. Yermasoyia River upstream of Yermasoyia Dam: Alterations to the lower section of the weir, by replacing the existing 3 m notch with a V shaped structure (slope 1:10) 28 m wide.

2.4.11 Cost of Hydrological Observations & Research

	Approved Estimated Cost	Actual Expenditure
a) Hydrological Observations & Research	£ 38 820	£ 37 695
b) Construction & Maintenance of Measuring Weirs	£ 5 000	£ 4 699
T o t a l	£ 43 820	£ 42 394

2.5 Groundwater Hydrological Works

Hydrological Surveys of the ground water bearing systems were carried out on small scale by this Department before 1960. Since then they were rapidly amounting in scale until the most important known aquifer systems were brought in a few years time under Hydrological Observation.

The last addition to the Hydrological Survey areas was made during 1969, with Ay. Amvrosios-Kalogrea-Akanthou aquifers.

Through the Hydrological Surveys all wells boreholes, springs and chain-of-wells have been registered and plotted on maps. A dense network of observation boreholes, has also been leveled. Through these observation boreholes/wells the water level is being measured twice a year, at the end of the dry season (November), when it is expected to be at lowest and at the end of the wet season (March) when it is expected to be at highest level.

Out of a large portion of the above network of wells and boreholes, water samples are obtained twice a year (November and March) for chemical analysis to evaluate the trends of any quality change of the water in each aquifer.

The areas covered by Hydrological Surveys are shown on map. No. 2.

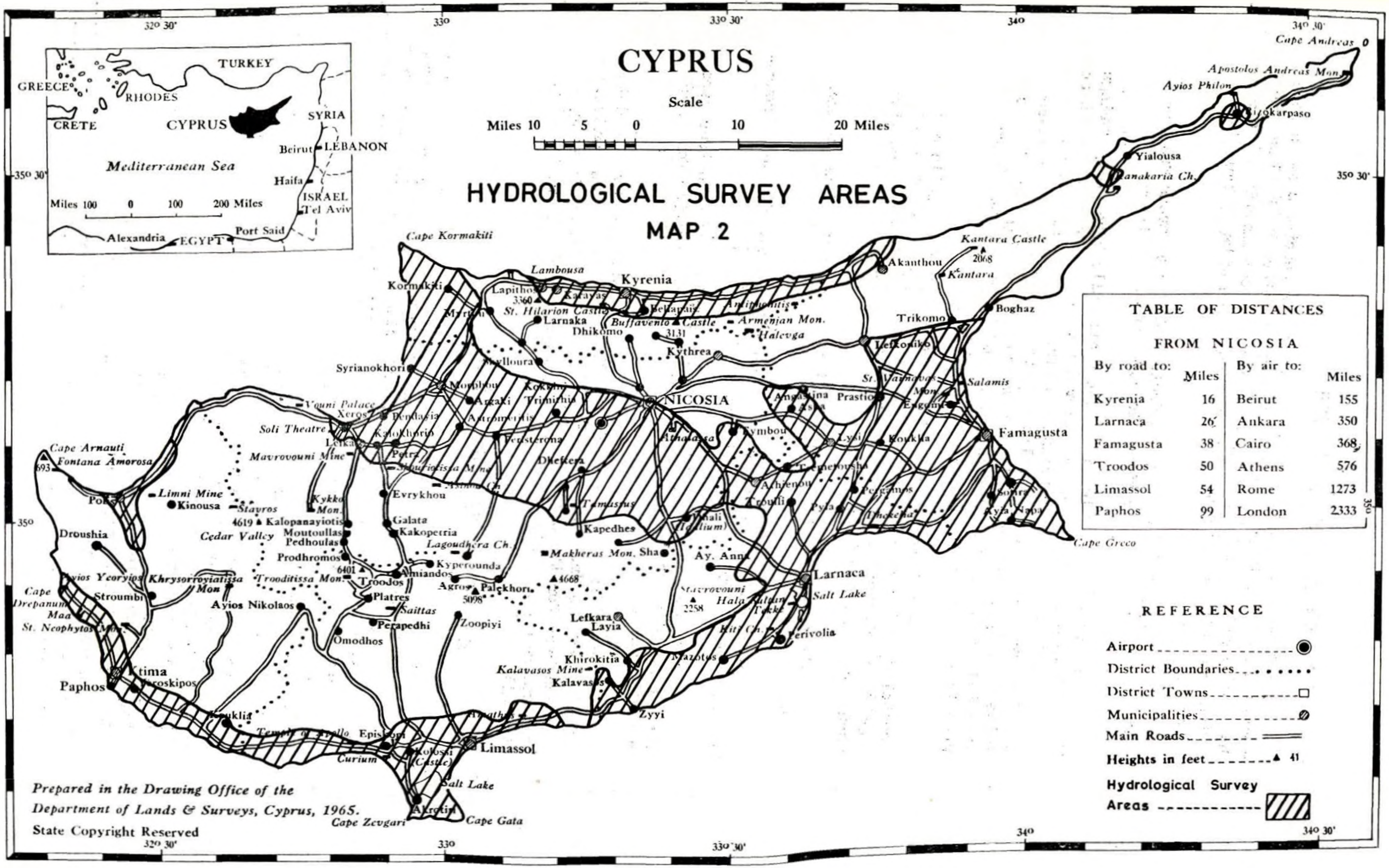
Analytically the observation network was distributed throughout the Island during 1970 as shown in table No. 4.

From the above observations, groundwater table contour maps and isosalinity maps have been prepared for each aquifer for March and November 1970.

The annual questionnaire was also carried out for the determination of the Groundwater extraction for the year under review. The accuracy for the extraction was greatly improved this year, by the water-meter readings, in the areas where such meters have been installed.

2.5.2 Groundwater Observation Network

Hydrological Area	Water levels from wells / boreholes	Water samples from wells / boreholes
1. Western Mesaoria	628	306
2. Central Mesaoria	818	252
3. S.E. Mesaoria (F'sta)	737	283
4. S.E. Mesaoria (L'ca)	435	245
5. Kyrenia Region	327	80
6. Akrotiri - Phassouri	290	131
7. Yermasoyia-Moni-Pyrgos	160	50
8. Zygi-Maroni-Kalavasos-Ayios Theodoros	164	79
9. S.W. Paphos	355	115
10. Polis Khrysochou Region	111	64
11. Lapathos-Ay. Andronikos-Rizokarpaso-Akanthou	251	82
T o t a l	4276	1687


CYPRUS
Scale
Miles 10 5 0 10 20 Miles
HYDROLOGICAL SURVEY AREAS
MAP 2
TURKEY
GREECE
RHODES
CRETE
CYPRUS
SYRIA
Beirut
LEBANON
Mediterranean Sea
Haifa
ISRAEL
Tel Aviv
Miles 100 0 100 200 Miles
Port Said
Alexandria
EGYPT
Cape Andreas
Apostolos Andreas Mon.
Ayios Philon
Rizokarpaso
Yialousa
Kantara Castle
2068
Kantara
Akanthou
Boghaz
Trikomo
Cape Kormakiti
Kormakiti
Lambousa
Kyrenia
Lapithos
3360
St. Hilarion Castle
Karavas
Bellapais
Buffavento Castle
3131
Armenian Mon.
Halevga
Larnaka
Dhikomo
Kythrea
Myrtou
Syrianokhori
Skylloura
Morphou
Argaki
Kokkini Trimithia
NICOSIA
Vouni Palace
Xeros
Soli Theatre
Lefka
Kalokhorio
Astromeritis
Peristerona
Mavrovouni Mine
Petra
Cape Arnauti
Fontana Amorosa
693
Limni Mine
Kinousa
Polis
Stavros
Kykko Mon.
Evrykhou
Dheftera
Tamassus
Kapedhes
4619 Kalopanayiotis
Moutoullas
Pedhoulas
Galata
Kakopetria
Cedar Valley
Droushia
Prodhromos
Lagoudhera Ch.
Kyperounda
Makheras Mon.
6401
Amiandos
Troodos
Trooditissa Mon.
Khrysorroyiatissa Mon.
Ayios Yeoryios
Stroumbi
Cape Drepanum
Maa
St. Neophytos Mon.
Ayios Nikolaos
Platres
Saittas
Pelendri
Agros
5098
Palekhori
4668
Zoopiyi
Omodhos
Ay. Anna
Stavrovouni
2258
Hala Sultan Tekke
Larnaca
Salt Lake
Perivolia
Lefkara
Layia
Khirokitia
Kalavasos Mine
Kalavasos
Mazotos
Zyyi
Ktima
Yeroskipos
Paphos
Kouklia
Temple of Apollo
Episkopi
Curium
Kolossi Castle
Limassol
Amathus
Salt Lake
Akrotiri
Cape Zevgari
Cape Gata
Salamis
St. Barnabas Mon.
Engomi
Famagusta
Lefkoniko
Prastio
Angastina
Assia
Kouklia
Lysi
Athienou
Troulli
Pergamos
Pyla
Dhekelia
Sotira
Ayia Napa
Cape Greco
Dhali (Idalium)
Athalassa
Tymbou
Yenagra
TABLE OF DISTANCES
FROM NICOSIA
By road to: Miles
Kyrenia 16
Larnaca 26
Famagusta 38
Troodos 50
Limassol 54
Paphos 99
By air to: Miles
Beirut 155
Ankara 350
Cairo 368
Athens 576
Rome 1273
London 2333
REFERENCE
Airport
District Boundaries
District Towns
Municipalities
Main Roads
Heights in feet 41
Hydrological Survey Areas
Prepared in the Drawing Office of the Department of Lands & Surveys, Cyprus, 1965.
State Copyright Reserved
32° 30'
33°
33° 30'
34°
34° 30'
35° 30'
35°

In general the ground water extraction, due to an exceptionally dry year, has been considerably increased in all the regions of the Island with the result that the water table in all the aquifers of the Island dropped considerably until November 1970. See table No.5.

2.5.3 Selected observation boreholes where the general groundwater situation is shown

Ser. No.	Hydr. No.	Village	Water level a.m.s.l. in meters				Water level increase (+)or or decrease (-)	
			1969		1970			
			March	Novem.	March	Novem.	March 69-70	Novem. 69-70
168/50	309	Morphou	+27.25	+22.32	+24.85	DRY	- 2.40	-24.85
44/62	1695	"	-	+17.07	+18.22	+ 6.79	-	-10.28
150/54	15	Syrianochori	+ 0.56	+ 0.51	+ 0.97	- 0.18	+ 0.41	- 0.69
1/55	61	"	- 1.58	- 1.91	- 0.59	- 2.88	+ 0.99	- 0.97
113/56	76	"	- 2.33	- 2.53	- 1.52	- 3.31	+ 0.81	- 0.78
209/56	117	"	- 2.36	- 3.23	- 1.78	- 4.46	+ 0.58	- 1.23
15/62	875	K.Varosha	- 5.64	- 4.77	- 5.09	- 5.37	+ 0.55	- 0.60
18/62	228	Ay.Memnon	- 2.18	- 1.05	- 0.71	- 2.13	+ 1.47	- 1.08
27/62	285	Ay.Loucas	- 3.41	- 3.25	- 2.51	- 3.73	+ 0.90	- 0.48
50/53	558	Dherynia	-	+ 0.24	- 0.94	- 0.52	-	- 0.76
56/56	192	Liopetri	+ 3.68	+ 3.04	+ 3.22	- 2.58	- 0.46	- 0.46
49/54	134	Makrasyka	-	+36.92	+36.21	+36.08	-	- 0.84
20/63	1516	Paralimni	+20.37	+21.17	+21.24	+20.31	+ 0.87	- 0.86
22/63	1518	"	+ 6.91	+ 6.10	+ 6.08	+ 5.83	- 0.83	- 0.27
51/51	774	Phrenaros	-	+10.25	+ 9.10	+ 8.39	-	- 1.86
76/56	972	"	-	- 0.40	- 0.49	- 2.49	-	- 2.09
79/56	975	"	-	+ 8.25	+ 8.24	+ 7.56	-	- 0.69
246/57	D438	Xylophagou	+15.35	+15.25	- 0.72	-	-16.07	-
70/51	D 66	Ormidhia	+46.93	+47.38	- 1.31	DRY	-48.24	-48.24
12/63	806	Cherkes Chiftlic	+ 1.50	+ 1.05	+ 1.38	+ 0.93	- 0.12	- 0.12
88/54	24	Kolossi	+ 3.67	+ 3.25	+ 4.41	+ 0.68	+ 0.74	- 2.57
51/63	813	Limassol	+ 2.38	+ 2.09	+ 2.03	+ 1.25	- 0.35	- 0.74
13/63	807	Zakaki	+ 0.71	+ 0.08	+ 0.51	-	- 0.20	-
107/61	17	Yermasoyia	+18.94	+17.67	+14.03	+ 1.18	- 4.91	-16.49

2.5.4 Control and Conservation of Groundwater

2.5.4.1 Water Conservation Areas (Wells Law cap. 351)

An area is declared as a Water Conservation Area when its water resources are being overexploited or the pumping trends are such that will affect the quantity or quality of the water of that area.

On map No. 3 it is shown the areas which have been declared as "Water Conservation Areas" under the Well's Law cap. 351.

Applications for well permits falling within a water conservation area are being sent by the District Officers to the Water Development Department for technical advice and recommendation. These recommendations which are based on the knowledge of the existing water situation of each aquifer, the development in the area and the existence of other wells or boreholes, chains-of-wells and springs as well as any other Government water-works, are mandatory to the District Officer.

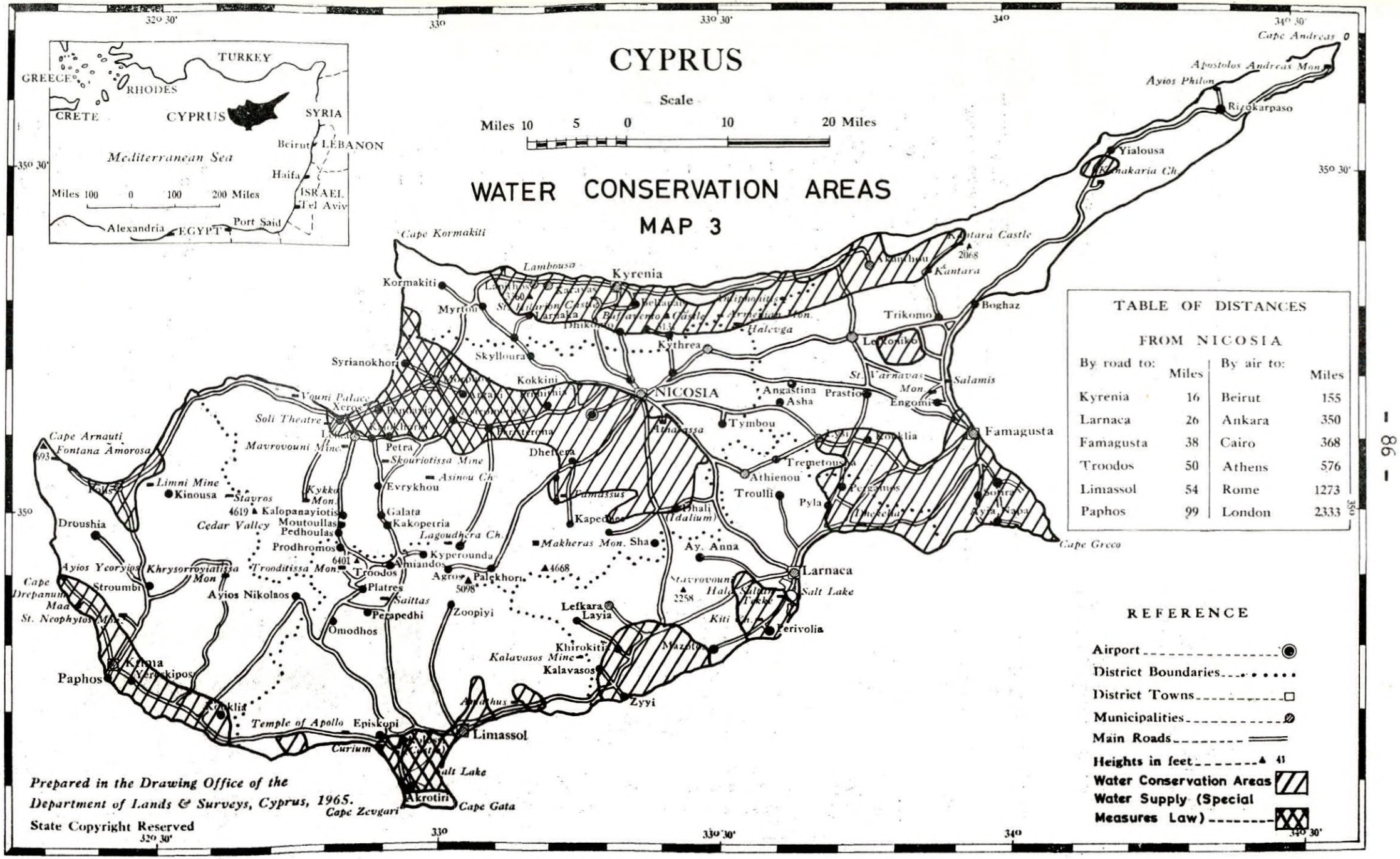


TABLE OF DISTANCES FROM NICOSIA

By road to:	Miles	By air to:	Miles
Kyrenia	16	Beirut	155
Larnaca	26	Ankara	350
Famagusta	38	Cairo	368
Troodos	50	Athens	576
Limassol	54	Rome	1273
Paphos	99	London	2333

2.5.4.2 Water Supply (special measures) Law. 32/64

The major aquifers of South-Eastern Mesaoria, Western-Mesaoria and Akrotiri aquifer, which were declared as water conservation areas in the past, have been covered by the water supply (Special Measures) Law since 1965, whose purpose is to further and more efficiently protect and control the water resources. The provisions of the water supply (Special Measures) Law 32/64 have been withdrawn from the area of South-Eastern Mesaoria on the 23/4/70. (See map No. 3).

(i) The District Officer, with the concurrence of the Director of Water Development can withdraw any permit for any well or can apply any modifications on the extraction of water as required.

(ii) On the permits which are renewed yearly, conditions are imposed regarding the quanity of water to be extracted, the method of extraction, the area to be irrigated, the measurement of extracted water, the conveyance of water and the utilization of water.

2.5.5 Drilling permits

According to the law as stated above, the Director of the Water Development Department has to give his concurrence so that the District Officer may issue a well permit, when the application falls within a Water Conservation or Special Measures Law area.

Such applications have been examined by the Division of Water Resources and our views expressed to the District Officer. A number of other applications not falling within the above referred areas have also been examined.

Analytically the number of applications during 1970 received for permits of drilling and enlarging existing boreholes are as follows:

(a)	Water Supply (Special Measures)	1.124
(b)	Water Conservation areas	2.062
(c)	Non-Conservation areas	786
	T o t a l	3.972

2.5.6 Water meters

The implementation of the Water Supply (Special Measures) Law started by reconsidering the conditions of the operation of wells and boreholes and the installation of Water Meters.

Analytically the following Water-Meters have been installed

R e g i o n	Water meters installed in 1 9 6 8	Water meters installed in 1 9 6 9	Water meters installed in 1 9 7 0	Total
Western Mesaoria	181	217	112	510
South-Eastern Mesaoria	365	103	7	475
Akrotiri Peninsula	322	33	20	375
T o t a l	868	353	139	1360

2.6 Special Hydrological Studies

2.6.1 Cloud - seeding in Cyprus

During the year experiments have been carried out by the Weather Engineering Corporation of America for initiating or augmenting precipitation by artificial means. This company entered in contract with the Ministry of Agriculture and Natural Resources in March 1970 to carry out cloud seeding with aeroplanes for 10 operational days, when conditions were suitable, against the payment of £25,000. Experiments were carried as follows:-

On the 3rd, 5th, 18th, 20th and 27th of April,
29th September, 5th, 11th, 12th and 13th of October.

Detailed records of the rainfall occured on the operational days, were collected by the Meteorological office.

The total volume of water that precipitated over the island during the operational days in April, when mainly the rainfall occurred, was according to the report prepared by the company, about 100 million cubic meters out of which about the 1/6 is attributed to the natural rainfall.

However there are other opinions on the matter, especially the percentage of the artificial to natural rainfall that occured. This was not possible to evaluate on statistical basis due to the short period during which the experiments have been carried out and the figures given by the company have been mainly derived after calculations based on theory, by computers, with parameters such as temperature of the clouds, convection currents in the clouds etc.

2.6.2 Radioisotope techniques

The application radioisotope techniques started this year in the study of special hydrological problems. So two samples of water were collected and sent to the Institute of Geological Science of London, which was offered to carry out Tritium Analysis free of charge. The results proved extremely interesting especially for the sample collected from "Kephalovrysos spring" in Kythrea village, where it was found out that its content in Tritium units were practically zero. This is very interesting because it indicates that the sample analysed entered the spring reservoir at least before 1952. More samples will also be analysed from the various springs and boreholes on the Kyrenia range collected early in 1971.

2.6.3 Evaporation control experiment

The evaporation control experiment which was carried out last year in Yermasoyia reservoir, has been repeated this year in Prodromos reservoir, which is at a much higher elevation than Yermasoyia reservoir.

The purpose was again to test the effect of monolayers of fatty alcohols in reducing evaporation under somewhat different conditions than last year.

The experiment was carried out in the same way as last year and for 35 days in July-August, during which 80 kg. of Alfol WV10 was used.

The conclusion is that with the use of monolayers, it was possible to save about 30% of the water expected to be lost by evaporation.

2.6.4 Hydrogeological Investigations of the Kyrenia Range Limestone

The Special hydrogeological investigations on the Kyrenia Range continued throughout the year in consultation with Dr. F.Dixey, Consultant, Ministry of Overseas Development. The investigations started towards the end of 1969 and the objectives are to examine and evaluate the water resources of the Kyrenia Range from Vasilia to Kantara.

Mr. M. Peppis, Geologist acted as the Counterpart of Dr. Dixey and was responsbile for the drilling, test pumping and the geological work on the range.

During the year a number of boreholes previously drilled in the limestone but not tested due to the deep water table and the lack of suitable equipment, have been enlarged in diameter up to 10" and tested.

The test was carried out with an electrosubmersible pump received at the beginning of the year and capable of yielding about 25 m^3/h of water from a depth of 300 m.

The boreholes that have been enlarged are the following:

B/H 76/66 in Karmi village. This B/H besides the enlargement has also been treated with explosives but unfortunately no increase in the yield of the B/H has been observed, which was of the order of 5 m^3/h.

B/H 53/68 in Lapithos village. The test carried out after the enlargement of this B/H proved that it was highly successful. With a pumping rate of 50 m^3/h the drawdown was only 5 cm.

B/H 22/67 in Halefka area. This B/H will be tested during 1971.

B/H 6/68 in Antiphonitis area. Tested to yield 20m^3/h.

B/H 44/67 in Halefka area. This B/H yielded 16 m^3/h.

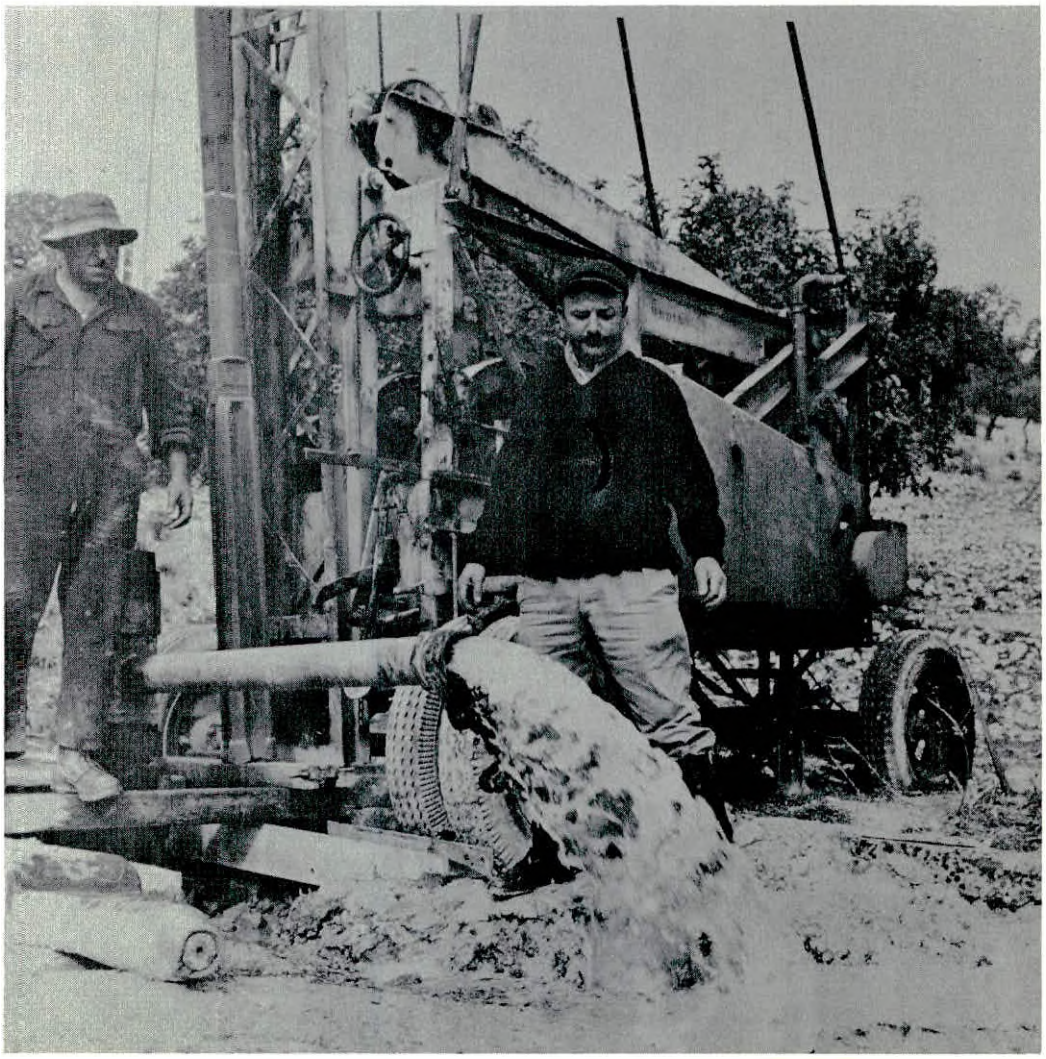
B/H B.9 in Halefka area. The enlargement was not completed in 1970 and will continue during 1971.

Also two new boreholes were drilled in the area of Kantara for Kantara-Ardana water supply. One of the boreholes reached a depth of 97 m. in limestone and yielded during a test 5 m^3/h. The other borehole was unsuccessful.

A second rig operated in the area to the north of Trypimeni village. The borehole 19/70 not yet completed reached a depth of 290 m and is at an elevation of 485 m above sea level. Water was struck at various depths and the yield during a preliminary test with a deep electrosubmersible pump was 22 m^3/h. This borehole may prove capable of higher yield.

The drilling of a borehole 48/69 in the area of Phterykha village which commenced in 1969 was completed during this year and the final depth was 330 m. The borehole was tested and is capable of yielding 11 m^3/h. enough to satisfy the domestic needs of Elea and Phterykha villages.

Profile — Levelling of Lefkara pipeline



Artesian Borehole at Skarinou

III. DIVISION OF PLANNING

By

C.C Artemis

Executive Engineer

3.1 General Investigations

These include:

(a) Material Investigations
(b) Preparation of a detailed geologic maps of dam and reservoir sites.
(c) Foundation investigations
(d) Laboratory testing
(e) Interpretation of results for design
(f) Reports

Schemes investigated in 1970 were as follows:

Investigations of Damsites and Reservoirs

3.1.1 Asprokremmos Dam Additional Investigations for the C.W.P.P.

Investigations additional to those carried out in 1968 at Asprokremmos proposed damsite were started in 1969 and were completed by January 28th, 1970.

(a) Three percussion and/or diamond rotary boreholes were drilled. Falling or constant head (Gravity, open ended) permeability tests were carried out in the percussion holes and the usual pressure tests in the rotary drill holes. The total depth drilled was 415 ft.

After the completion of the above mentioned works a second stage of investigations was undertaken. The programme for the second stage included the drilling of four boreholes using an overburden rig in order to find the depth to bedrock for locating the spillway stilling basin.

(b) In addition to the above five additional geophysical traverses were carried out.

(c) Grading tests were performed in the laboratory on bulk samples recovered from the boreholes. Wet sieve analysis and where applicable hydrometer tests were adopted.

3.1.2 Pitargou Dam Investigations for the C.W.P.P.

Four inclined and one vertical borehole were drilled using a percussion rig and a coredrill. Permeability tests were carried out in all boreholes. The total depth drilled was 1095 ft.

3.1.3 Lefkara Dam Additional Investigations

(a) One inclined and one vertical borehole of a total depth of 72 metres were drilled at the request of the consultants. Permeability tests were carried out in one of the boreholes.

(b) Two trenches were excavated, one at the location of the lip of the flip-bucket and the other at the position of the tunnel outlet portal.

The results of these investigations were considered satisfactory and did not necessitate any major changes in the design of the proposed works.

3.1.4 Kourris Dam Investigations

Detailed foundation investigations were carried out at the request of Howard Humphreys & Sons, Consulting Engineers.

(a) Thirteen boreholes of a total depth of 789 metres were drilled.

(b) Water pressure tests were carried out in all boreholes on 3 metre stages.

(c) Casagrande Piezometers and perforated pipes were fitted in some of the boreholes for the purpose of ground water measurements.

(d) Crushing strength and permeability tests were carried out on cores recovered from the boreholes.

(e) Three tunnel entrances were excavated and samples taken and tested in the laboratory.

(f) Four test pits were excavated in the riverbed upstream of the proposed dam axis and representative samples of gravels were taken and tested in the laboratory.

(g) One percussion hole and 8 observation boreholes were drilled with an over burden machine and a pumping test was then carried out.

3.1.5 Night Storage Reservoirs

(a) Six test pits were excavated at the two night storage reservoirs downstream of the main Kourris dam. These pits were excavated down to bedrock and the total depth exeavated is 100 ft.

(b) Representative samplss of the material excavated were taken and tested in the laboratory.

Note: The results of the investigations at Kourris dam and night storage reservoirs were handed over to Howard Humphreys & Sons, Consulting Engineers for this Project.

A Geophysical investigation was also carried out at the site and a detailed geological map was prepared by the Water Development Department and the Geological Survey Department.

It is expected to complete the work at Kourris in mid January 1971.

3.1.6 Famagusta Water Supply - Khirokitia Project

Two boreholes of a total depth of 227 ft. were drilled at the Khirokitia site using an over burden rig.

3.1.7 Famagusta Water Supply - Vassilikos River

Four boreholes totalling 176 ft. in depth were drilled.

3.1.8 Ovgos Existing reservoir, Ovgos Proposed Dam and Reservoir

12 hand auger holes were drilled and samples taken and tested. Total depth of auger holes reached was 90 ft.

3.1.9 Massari Dam

Core materials investigations:

(a) 6 auger holes were drilled
(b) Representative samples of the proposed core material were taken and tested in the laboratory.

3.1.10 Investigations for other Departments

Requests by other Government Departments and private firms for site investigations were continuously received throughout the year, many of them, however, had to be turned down because of the lack of extra equipment and personnel to cope with the additional volume of work. Investigations actually undertaken and carried out during the year under review were as follows:

3.1.10.1 Nicosia Municipality - Sewerage Scheme

After a request from the Municipality of Nicosia, the Field Investigations Branch undertook and completed the site investigations for the Nicosia sewerage scheme.

(a) Four boreholes were drilled and insitu permeability tests were carried out.

(b) Thirty nine investigation holes of a total depth of 760 ft. were drilled.

(c) Undisturbed and disturbed samples were taken and tested in the Soils Laboratory.

(d) Standard Penetration Tests were performed where applicable.

(e) Twenty five of the boreholes were fitted with perforated pipes for future water table measurements.

(f) All samples obtained during drilling were examined and described in the Laboratory.

(g) Liquid and plastic limits tests were carried out on all cohesive samples for classification purposes and triaxial tests to assess the shear strength of the soil were performed.

(h) A report on the investigations was prepared.

3.1.10.2 Ayia Sophia Mosque - Foundations

The investigations were carried out after a request from the Department of Antiquities to study the foundation problems of the Mosque.

(a) Seven boreholes of a total depth of 466 ft. were drilled.

(b) Undisturbed and disturbed samples were taken and tested in the Soils Laboratory.

(c) Undrained triaxial tests and Atterberg limits tests were carried out on the samples.

(d) Perforated pipes were fitted in some of the boreholes for the purpose of water table measurements.

3.1.10.3 Famagusta Grain Commission

(a) Two boreholes of a total depth of 51 ft. were drilled.

(b) Perforated pipes were installed in the boreholes for water table measurements.

3.1.10.4 Famagusta Municipality - Sewerage Scheme

Two boreholes of a total depth of 17 metres were drilled.

3.1.10.5 Quarry Investigations for Limassol Harbour

Coredrill No. WDD354 was hired to Pomgrad Consulting Engineers and Contractors, Contractors for Limassol Harbour for this investigation.

Four boreholes with core recovery of a total depth of 325 ft. were drilled.

3.1.11 Field Investigation Equipment

Table 1 shows the equipment for field investigations available during 1970.

3.2 Grouting section

3.2.1 Polemidhia Dam - Extension of Grout curtain

The grouting on the extension of the grout curtain continued and the main work was completed on the 3rd October, 1970. These grouting works were carried out by our Department.

In all 149 boreholes were drilled with a total footage of 21,663 as follows:

Extension zone IV	-	19 holes	- 2,921 ft.
" " V	-	105 holes	- 14,704 ft.
" " VI	-	15 holes	- 2,370 ft.
Piezometers		6 holes	- 1,055 ft.
Control Holes		4 holes	- 613 ft.

Out of these 17,997 ft. were drilled with overburden rigs and 3,666 ft. with a core drill.

The total quantity of dry materials injected were 1,728,000 kgms out of which 1,040,000 kgms were cement, 334,000 kgms clay, 340,000 kgms sand and 14,000 kgms bentonite.

The consumption in the various zones was as follows:

Zone IV = 38,000 kgms
" V =1,642,000 kgms
" VI = 48,000 kgms

The grout takes in kgms per metre for the various zones were as follows:

Zone IV		=	48 kgms/metre
" V	- Primaries	=	1,310 "
"	- Secondaries	=	747 "
"	- Tertiaries	=	136 "
Zone VI		=	128 "

The total expenditure for the executed grouting works on the extension of the grout curtain was £31,000 including the test grouting.

The aim of these grouting works was to decrease as much as possible the leakages from the dam which were excessive, especially at full reservoir. The grout takes and water testing results show that there was a good effect of the grouting. Now what is left is to wait until the reservoir is full, record the leakages in conjuction with the various heads and compare with previous years' measurements.

If they show a satisfactory decrease then no other grouting will be required.

On the other hand if the leakages appear to be high then additional grouting may be required by improving the already completed curtain.

3.2.2 Yermasoyia Dam Tunnel - Drainage holes

After the completion of the dam and the filling of the reservoir, there was water seepage through different parts of the tunnel.

Messrs. Sandeman, Kennard and partners recommended to drill some drainage holes, for pressure relief, prior to any additional grouting works. This work was undertaken and executed by our Department.

About 55 holes have been drilled over a distance of 180 ft. downstream from the gate. Most of these holes were drilled in threes at each of 15 sections located at intervals of 10 ft. and about 2 ft. away from the construction joints of the tunnel. Other holes were drilled in places where there was evidence of water seepage when water was stored in the Dam.

3.2.3 Grouting Equipment

The equipment shown in table 2 was available during 1970 for use in connection with grouting works.

3.3 Laboratory Branch

The troubles reported in the 1969 annual report with the high capacity triaxial machine have now been overcome and the machine is now available for special and routine tests.

The soils laboratory has been mainly involved in testing of disturbed and undisturbed samples in connection with site investigations undertaken by the Field Investigations branch. Practically no construction control tests have been carried out during the year under review since no major construction projects were under way. As a result a certain decrease in the volume of work carried out as compared to previous years has been observed.

A certain amount of new equipment has been acquired during the year and this, together with the return of Mr. P. Kakkoulas T.A after a year's training at G. Wimpey's Soils laboratory in England promise both an increased range of testing facilities available as well as a higher standard of work.

The volume of work carried out by the concrete laboratory has also shown a drop for the same reasons as in the case of the soils laboratory. The bulk of the year's work was in connection with the Famagusta Water Supply Project and also in connection with tenders for the supply to the department of concrete aggregates. A large number of tests were also carried out for private firms.

Tables 3 and 4 show the testing facilities available in the soils and concrete laboratories during 1970 and tables 5 and 6 show the number and type of tests carried out during the year.

Table 1 - W.D.D. Field Investigation Equipment
A. Drilling Rigs

Drill rig Number	Type	Make	Year Acquired
WDD294	Overburden	Atlas	1963
WDD354	Coredrill	Craelius	1963
WDD423	Wagon Drill	Atlas	1965
WDD455	Overburden	Atlas	1966
WDD460	Coredrill	Boyles	1966
WDD477	Overburden	Atlas	1967
WDD497	Coredrill	Craelius	1968

B. Other Equipment for use on site

Serial Number	Apparatus	Year Acquired
1	Vane shear test apparatus	1970
2	Portable powerhead auger	1970
3	Plate bearing test apparatus	1970
4	Clean-out auger with sludge barrel	1970
5	Stationary piston sampler	1970
6	Thinwall samplers (Shelby tubes) (3 No.)	1970
7	Light percussion drill with accessories	1970
8	U4 sampling tubes (24 No.)	1970

Table 2 - W.D.D. Grouting Machinery in 1970

1. One "Moyno" Grout pump (Pneumatic)
   Capacity = 50 gal./min.
   Pumping
   Pressure = 200 psi

2. One "Craelius" Grout pump
   Reciprocating with Diesel Engine
   Capacity = 11 gal./min.
   Pumping
   Pressure = 1000 psi

3. Two Z-M-300 High Speed Mixers (Pneumatic)
   Capacity = 66 Imp. gallons

4. Two ZA-600 Grout Agitators (Pneumatic)
   Capacity = 132 Imp. gallons

Notes: The Geological Survey Department has a grout pump similar to Item No. 2, which may be borrowed whenever required.

Also we are awaiting approval to purchase a new colloidal Grout mixer.

Table 3 - Soils Laboratory Equipment

Serial Number	Apparatus	Year Acquired
1	2 No. Liquid Limit apparatus	Prior to 1967
2	Normal and rapid moisture content determination apparatus	"
3	Standard and modified proctor apparatus	"
4	Sand replacement apparatus	"
5	Sieve analysis hydrometer and pipette apparatus	"
6	Permeameters falling and constant head for horizontal and vertical permeability	"
7	Unconfined compression apparatus	"
8	Triaxial apparatus ($1\frac{1}{2}$ inch diameter specimens)	"
9	Small shear box machine (6 cm x 6 cm specimes)	"
10	1 No. Consolidation apparatus	"
11	1 No. 17 inch diameter by 10 inch high constant head permeameter	1967
12	1 No. Extruder for different diameter specimens	1967
13	1 No. High capacity triaxial machine for up to 4 inch dia. soil and rock specimens	1968
14	1 No. Norwegian Porepressure apparatus	1968
15	1 No. Torsion dial balance	1969
16	2 No. Proctor penetrometer sets	1969
17	Universal Hydraulic extruder	1970
18	Large shear box machine (12" x 12" samples)	1970

Table 4 - Concrete Laboratory Equipment

Serial No.	Apparatus	Year received
1	Aggregate crushing test apparatus (local)	1960
2	Balance capacity 700 lbs (local)	1961
3	Compacting factor apparatus for concrete (local)	1961
4	Ovens for drying sand and aggregates	1965
5	Concrete Testing machine Hand operated 100 ton capacity	1957
6	Sieve shaker	1964
7	Vicat Neddle for cement test	1966
8	Concrete testing machine electrically operated 150 ton capacity	1966
9	Laboratory concrete mixer	1968
10	Distillation apparatus	1969
11	Sample Splitter for aggregates	1969

Table 5 - Tests carried out in W.D.D. soils laboratory in 1970

TESTS	Ovgos Prop. Dam	Yermasoyia Dam	Massari Prop. Dam	Akrotiri	Kourris	Asprokremos	Pitargou	Margo	Nicosia Sewerage Scheme	Famagusta Sewerage Scheme	Ayia Sophia Foundation Investigation	L/ca Water Board	P.W.D.	Ioannou & Paraskevaides	Cyparco	Energoinvest	Miscellaneous	Total of each Kind of test
Atterberg Limits	8		27		6			4	107		27	1	86		11	6		283
Moisture content	98		34	12	2			5	3		8	1	125			16		304
Standard Proctor	7		14		8			4										33
Sand Replacement		5														10		15
Hydrometers	8	57	26	42	10	8	1	4		9			85	5	2	6		263
Permeabilities	6		14	12	8			4										44
Under. Triaxial tests	15		9		3				75		64							166
Shear box tests																11		11
Consolidation	3		2															5
Silt content																	131	131
Specific gravity	8	57	26	42	10	8	1	4		9			85	5	2	6		263
Insitu density		53		12												6	4	75
Wet analysis		2		17											1	5		25
Consol. Undrain. Triaxial tests	4																	4
Modified A.A.S.H.O. tests															9			9
Total	157	174	152	137	47	16	2	25	185	18	99	2	381	10	25	66	135	1631

Table 6 - Tests carried out in the W.D.D. concrete Laboratory in 1970

TESTS	Phrenaros Reservoir	F.W.S. (General)	Tenders for concrete aggregate	Tenders for different small works	Miscellaneous	Tests for Private Firms	Kokkinotrimithia channel control	Total of each Kind of test
Sieve Analysis	154	18	28	137	36	53	8	434
Silt content	86	14	17	94	22	19	12	264
Organic impurities	86	14	17	94	22	19	12	264
Water absorption	15	5	14	21	12	7	4	78
Specific gravity	15	5	14	21	12	7	4	78
Aggregate crushing test	8	3	11	6	7	4	4	43
Core crushing strength						18		18
Acid test		10			4			14
False set test			8		2	4		14
Salinity tests				35	17	12		64
Fineness Modulus			10					10
Cubes prepared & crushed	510	28	48	18	53	530	56	1243
Slump test	127	8	6	4	9		12	166
Total	1001	105	173	430	196	673	112	2690

IV. DIVISION OF DESIGN

By

K.C. Hassabis
Head of Division

The Design Division includes:

(a) the Design Branch which deals with the detailed design work of major projects undertaken by the Department

(b) the Topography Branch which carries out all the surveying work of the Department

(c) the Drawing office Branch which does most of the drawing work of the Department.

4.1 Design Branch

The Design Branch is manned with qualified Civil and Irrigation Engineers and one Senior Inspector of Works. During the year design works was done on Dams, Irrigation Works, Water Supply Schemes and other miscellaneous works. Short notes on the most important works dealt with during the year are given below.

4.1.1 Famagusta Water Supply Project - 1st Phase

The first phase of the project comprising the Main Pipeline from Khirokitia to Phrenaros, the Reservoir at Khirokitia and the Pumping Schemes were completed and were put into operation during 1970, except for the Vassilikos Pumping Scheme, which due to a change in the original scheme, was to be put into operation in the early part of 1971.

4.1.1.1 Vassilikos Pumping Scheme

The change mentioned above referred to a change in the location of the sources and of the main pumping station.

4.1.1.2 Vassilikos River Cutting

The main source of water from this area now comes from an infiltration gallery across the Vassilikos river gravels, constructed as follows:

A cutting was made in the river bed, about 500 ft. long and approximately 58 ft. deep reaching at its bottom the impervious clay layer. The bottom of the trench was about 10 ft. wide.

Concrete perforated collector pipes 3' - 0" dia. were placed in the bottom of the trench and were surrounded by thick graded filter layers.

These pipes lead into a collecting well constructed of 5' - 0" dia. concrete pipes. In addition 4 rows-each row being 24 ft. in length of 10" dia. steel bridge slotted collector pipes were placed radially from the collector well into the graded gravel filters of the cutting.

A ventilation and inspection well 3' - 0" ft. in diameter constructed of prefabricated concrete pipes was also constructed midway between the collecting well and the end of the pipeline.

A concrete slab on the downstream slope of the cutting from the clay layer at 63.50 ft. AMSL up to elevation 85.00 ft. AMSL., i.e. upto about 27 ft. below river bed forms an impervious layer.

The cutting was then backfilled. The cutting is located just upstream of the bridge of the main Limassol Nicosia Road.

Provisions were made for pumping up to 200 cu.m. per hour from the cutting during the winter and spring months.

Three electrically driven submersible pumps will be installed in the well, of which one will act as standby.

4.1.1.2.1 The details of the pumps are

Manufacturer & Type : Pleuger, Q81 - 4a + V8 - 55 (4 stages)
Motor : 30 H.P. (Speed 2900 rpm)
Q = 22 500 gphr (100 m^3/hr)
H =162 ft. (49.50 m)

Suction: 62.00 ft. AMSL
Cost : £689 = each i.e. Total cost : £2 067.

An 80 KVA Power supply will be provided at a cost of £1 179.-

4.1.1.2.2 Data on Vassilikos River Cutting

Length of Cutting at surface	: 500 ft.		
" " " at Bottom	: 250 ft.		
Average Depth of	48 ft.		
Reduced level of Existing River bed	:	112.00 ft.	A.M.S.L.
Reduced level of Invert of 3' - 0" perforated concrete pipe R.H. side end (looking downstream)	=	64.25 ft.	A.M.S.L.
Ditto - L.H. side end	:	66.25 ft	"
Ditto at entry to main well	:	63.50 ft.	"
Reduced level of Invert of collecting well	:	58.25 ft.	"
Reduced level of Pump suction in collecting well	:	62.00 ft.	"
Reduced level of top of slab cover to collecting well	:	120.59 ft.	"
Reduced level of top of slab cover to Inspection well	:	120.59 ft.	"
Reduced level of top of impervious concrete slab in river cutting	:	85.00 ft.	"
Length of concrete collector pipes			
R.H.S.	:	155 ft.	
L.H.S.	:	70 ft.	
Total	:	225 ft.	

4.1.1.3 Boreholes

In addition two boreholes in the same area will be utilized mainly in emergency. The details of the two boreholes and pumping installations are given below:

4.1.1.3.1 Borehole 68/69

Yield : 20.000 gphr (91 m^3/hr.)
Suction : 54.12 ft. A.M.S.L.
Ground
Elevation: 147.30 ft. A.M.S.L.

Pump : Electrosubmersible

Type : Pleuger Q81 - 3a + V8 - 45 (3 stages)
Motor : 27 HP
Q = 20 000 gphr (91 m^3/hr)
H = 152 ft. (46.30 m)

Cost of Pump : £ 690.
Cost of Electricity Supply : (40 KVA) : £ 422.

4.1.1.3.2 Borehole 71/69

Yield : 14 000 gphr (63.7 m^3/hr)
Suction : 60.00 ft. AMSL
Ground
Elevation: 134.86 ft.

Pump : Electrosubmersible
Type : Pleuger - P82 - 3 + V6 - 73 (3 stages)
Motor: 20 HP

Q = 14 000 gphr (63.7 m^3/hr)
H = 170 ft.
Cost of Pump = £689.-
Cost of Electricity Supply : Included in the cost given for Supply to Collecting Well.

4.1.1.4 Vassilikos Main Pumping Station

The water from the Collecting Well or the nearby boreholes will be pumped to the main pumping station first into a 100 000 gallon circular tank whose floor is at elevation 206.50 ft. A.M.S.L. and from there through centrifugal booster pumps it will be pumped to the Khirokitia Reservoir. There will be three booster pumps one of which will act as stand-by.

4.1.1.4.1 Details of Pumps

Suppliers : Heinrich Ritz, W. Germany (Agents:Silvestrou and Kitromilides).

Manufacturers "K.S.B" W.G.

Type : WKL - 100 - 7 stages (Electrically driven)

Motor : Slipring B3 - P22

Motor Output : 75 KW (abt. 100 A.P.) at 1450 rpm.

Nominal Power requirement : 62 KW

Pump Duty : Q = 22 500 gphr (100m^3/hr)
H = 535 ft. (163.00 m)
Efficiency : 73%

Cost of Pumps:

3 No @ £1626 = £4 878

Cost of Electricity Supply : (155 KVA):£1244.-

4.1.2 Famagusta Water Supply Project: 2nd Phase

The 2nd phase of the new Fanagusta Water Supply project includes the Lefkara Dam, the Khirokitia Water Treatment Works and the Raw water pipeline connecting the dam to the Treatment Works.

The cost of this phase is estimated to be £2 055 000 = including an allowance of £75 000 for Engineering Services.

The design and supervision of construction of the Lefkara Dam and of the Treatment Works has been undertaken by Messrs. Howard Humphreys and Sons, Consulting Engineers.

The design of the pipeline has been done by this Department.

4.1.2.1 Lefkara Dam

The design of this Dam was done in Rome by Messrs. Pietrangeli ed Humphreys, an associated firm of Howard Humphreys and Sons, and was completed in November 1970. An Engineer from this Department worked with the Consultants in Rome for two months on the preparation of the designs of the Dam.

Tenders for the construction of the Dam were invited on the 18th December 1971. It is expected that construction work will commence in May or June 1971 and will be completed by the end of 1973.

The dam will be of the Rockfill type with an impervious clay core, about 70 m. high, with a total fill volume of about 800 000 m^3.

The storage capacity of the dam is about 13.85 Million m^3. The mean annual inflow is estimated at 8.2 x $10^6 m^3$, from a catchment area of 36.30 km^2. It is estimated that about 5.3x$10^6 m^3$ of water will be made available annually from the Dam for the Famagusta Water Supply.

The cost of the Dam has been estimated at £1 238 000.-

4.1.2.2 Lefkara - Khirokitia Raw Water Main

This will be a 22" O/D steel pipeline having a total length of 50 000 ft. with a maximum design capacity of 13 cusecs (370 l/sec), and will convey the raw water from the dam to the Treatment Works.

The design was done by the Department.

Construction will start in 1971 and it will be completed by March 1973.

The cost of the pipeline has been estimated at £442 000.

4.1.2.3 Khirokitia Treatment Works

The design of these works has been undertaken by Consulting Engineers - Messrs, Howard Humphreys and Sons.

Tenders for the provision of the treatment plant were invited and closed on the 14th November 1970. Award will be made early in 1971, following which the detailed design of the works will be carried out and be completed by September 1971.

Construction works will commence towards the end of 1971 and will be completed in the Spring of 1973.

The first stage of the treatment works will have an output capacity 20 300 m^3/day ($5.35 \times 10^6 m^3$ annually), and they will include:

(i) 6 upward flow hopper bottom type sedimentation tanks, with a specified rise rate of water at 1.83 m/hr.

(ii) four rapid gravity sand filters specified to produce up to 7.3 $m^3/m^2/hr$.

(iii) control house and ancillary equipment.
The cost of the treatment works has been estimated to be £300 000.-

4.1.3 Palekhori Dam

Detailed design work, modifications on detail drawings, and preparation of Tender Documents were done during the year.

4.1.4 Massari Dam

Work was done on the preparation of specifications and other contract documents, and on the detail drawings.

4.1.5 Athalassa Dam Spillway

The spillway of Athalassa dam which had been constructed as an earth channel suffered considerable erosion after the heavy rains towards the end of 1969. It was therefore necessary to take some remedial measures to prevent further cutting back of the channel. Two alternative designs were prepared. The first alternative consisted of a conventional concrete lined spillway at an estimated cost of £12,500. The second alternative design consisted of widening the existing earth channel and building up of the embankments where necessary including regrading of the channel floor at an estimated cost of £1,900.

The first design would have been a permanent solution whereas the second design was only a temporary measure which was expected to retard the erosion of the channel but to suffer a considerable amount of damage if it was called upon to discharge any significant flows.

In view of the considerable difference in cost between the two alternatives as well as in view of the high cost of the permanent solution compared the original cost of the dam structure (£22,200), the Planning Bureau decided to adopt the temporary design. This design has now been constructed and has been extended to include a concrete protection weir at the crest of the spillway.

4.1.6 Design of W.D.D. Hydraulics Laboratory

A design was prepared of an industrial type shed to house the Hydraulics Laboratory of the department which will be used for Hydraulic Model Tests of Yermasoyia Dam Spillway and Lefkara Dam, as well as other hydraulic tests which will be required in the future. The Laboratory measures 42 ft. x 44 ft. and is to be constructed of galvanized steel pipes with A.C. sheet cladding. Welded truss construction has been adopted.

4.1.7 Palekhori Distribution System

Preliminary design studies on the distribution system have been completed by June 1970. No detail studies were carried out because land consolidation is to be implemented in the area.

4.1.8 Palekhori Diversion Scheme

This is to divert water from the Maroulena Main tributary to the Kambi Dam in case the flow in Kambi tributary is not enough to satisfy the project demand. Detail designs and Working Drawings have been completed.

4.1.9 Kalopanayiotis Distribution System

Design work has been carried out on possible extension of the distribution system to cover an additional area of 77 don. The design work included the design of new pipelines and the preparation of working drawings. The work has been completed.

4.1.10 Kiti Distribution System

(a) Extensions to Pervolia

Design work on the extensions to Pervolia has been completed early in the year. This scheme provided the installation of 14 200 ft. of prefabricated canals at a cost of £16 000 .-

(b) Stage III

Design work on this stage of the distribution system has started late in 1970 and was completed by the end of the same year.

Detail designs were carried out and detail working drawings have been prepared.

For this stage a total of 24 235 ft. of channels are to be constructed at a cost £27 000.-

4.1.11 Pomos Distribution System

Re-design work has been made on the Pomos distribution system. This included the realignment of pipelines and cost estimating.

4.1.12 Yermasoyia Distribution System

More design work has been carried out on Yermasoyia distribution system. Various alternative proposals have been studied concerning the conveyance of water either west or east of Limassol Town.

4.1.13 Lefkara Dam Distribution System

Detail design work has been carried out and working drawings have been completed.

4.2 Drawing Branch

The drawing branch was headed by Mr. S.C. Pitsillides. The staff of this Branch numbered 29 i.e. 22 daily paid Technical Assistants, 5 draughtsmen scale 8, 2 Foremen scale 5 & 7, one hourly paid employee and the Head of the Branch also on daily wages.

4.2.1 Drawing Section

For the first six months of the year, in addition to normal Departmental work, the Drawing Branch was engaged in the execution of all drawing work needed for the Cyprus Water Planning Project as well as the work needed for the Sub-Contractors T. Ingledow and Associates to whom 2 daily paid Technical Assistants were loaned.

Work done for the Department can be listed as follows giving also the time spent in each category of drawings and maps.

	Time spent in hours	Man months
a. Existing & Proposed Dams	7,065	43.4
b. Irrigation Distribution Systems for Dams	1,215	7.5
c. Routine Irrigation Schemes	3,560	21.8
d. Domestic Water Supplies	5,830	35.8
e. Recharge Schemes	270	1.6
f. Antiflood Schemes	50	0.3
g. River Training Works	100	0.6
h. Hydrological	290	1.8
i. Hydraulic Tables	50	0.3
j. Programmes & Organization	1,108	6.8
k. Completion Plans	2,185	13.4
l. Completion Reports	75	0.5
m. Akrotiri Project	440	2.7
n. Reports	2,595	15.9
o. General	365	2.2
p. Odd Jobs	145	0.9

			Time spent in hours	Man months
q.	Auxiliary Services:			
	i. Library		920	5.7
	ii. Plan Registry		175	1.0
	iii. Plan Reproduction		380	2.3
	iv. Registry work		330	2.0
	v. Drawing Materials Store		150	0.9
r.	Training of staff		183	1.1
s.	Leave etc.,:			
	i. Leave paid	934)		
	ii. Leave without pay	461)		
	iii. Sick leave	472)	2,172	13.4
	iv. Maternity leave	165)		
	v. D.C.	140)		
	Totals		29,653	181.9

For the work required by the Cyprus Water Planning Project 10 Technical Assistants daily paid were engaged and for the work required by the Sub-Contractors 2 Technical Assistants daily paid were engaged up to 4th April, 1970. The work done for the C.W.P.P. can be listed as follows:

			Time spent in hours	Man months
a.	Dam reconnaissance		2,149	13.2
b.	Irrigation Distribution System for Dams		1,158	7.1
c.	Land Use Maps		469	2.9
d.	Hydrology Section		175	1.0
e.	Engineering Section		211	1.3
f.	Economics Section		348	2.1
g.	General		1,219	7.5
h.	Work for Contractors T. Ingledow		995	6.1
i.	Watershed Surveys		2,527	15.7
j.	Regions		2,574	15.8
k.	Odd Jobs		413	2.5
l.	Reports		426	3.8
m.	Training of Staff		50	0.3
n.	Leave etc.:			
	i. Leave paid	150)		
	ii. Leave without pay	160)	1,565	9.6
	iii. Sick Leave	323)		
	iv. D.C.	118)		
	Totals		14,479	88.9

13.4
9.6
23.0

8.5%

The total work carried out by the Drawing Branch is :-

Work for Department :-29,653 hours (182 man months)
Work for C.W.P.P. :-14,479 " (89 " ")

Grand Total :-44,132 hours (271 man months).

The above time spent on various jobs does not include any time spent by the Head of the Drawing Branch, the 2 Foremen and one hourly paid employee of the working photo process lab. Also the work of the Store man (t.a.) of drawing instruments and surveying instruments is not included.

During 1970 a new team was set up to deal solely with completion plans for all works carried out by the Department. Completion plans are being prepared for both major and minor works and form part of completion reports prepared for each completed scheme.

Training of staff is given to recruits to the Drawing Branch who undergo basic training in Engineering lettering, drawing and in work, map reading scaling etc. This is necessarily non-productive training After the initial training recruits continue to be trained by doing actual work and producing. Since 1963 when the Drawing Office was established 60 employees have received training of whom 23 have left the Department to work elsewhere e.g. with CYTA or other Departments of the Government or have emigrated.

4.2.2 Library & Technical Information Section

During 1970 61 new books at a total cost of approx. £164 were purchased by the Department and subscription was continued on 12 Technical Periodicals at a total cost of £47. In addition 39 reports were prepared by Officers of the Department and numerous other books and periodicals were received free of charge.

The Library continued to issue regular reports of material received and of articles from Periodicals of special interest.

4.2.3 Reproduction Section

Plan reproduction continued during 1970 with the automatic continuous process dyeline paper printing machine with the old machine as stand-by. Some 3,400 orders were issued to the Reproduction Section and 40,000 prints were made of various sizes and of all types. This is 5,000 prints over and above the 1969 reproduction and this was due to the printing of the C.W.P.P. Draft Final Reports.

4.2.4 Photo Process Laboratory.

An extension of the Drawing Office building was completed in March 1970. The Photo Process Camera and auxiliary equipments were installed and work started in April 1970 on reproduction enlargements and reductions of drawings and maps. The Photo Process Camera is a big advantage to the Drawing Office and the Department as a whole in as much as great saving of time in effected through enlargement and reduction by this process. Some work has been done for other Departments too.

During 1970 (i.e. from April to December) 300 jobs of various types were carried out on the photo process camera.

4.3 Topography Branch

This branch was headed by Mr. Andreas Evripidhou, Inspector of Works and has carried out all the Survey Work required by the Design and Planning Divisions of the Department of Water Development and the Cyprus Water Planning Project.

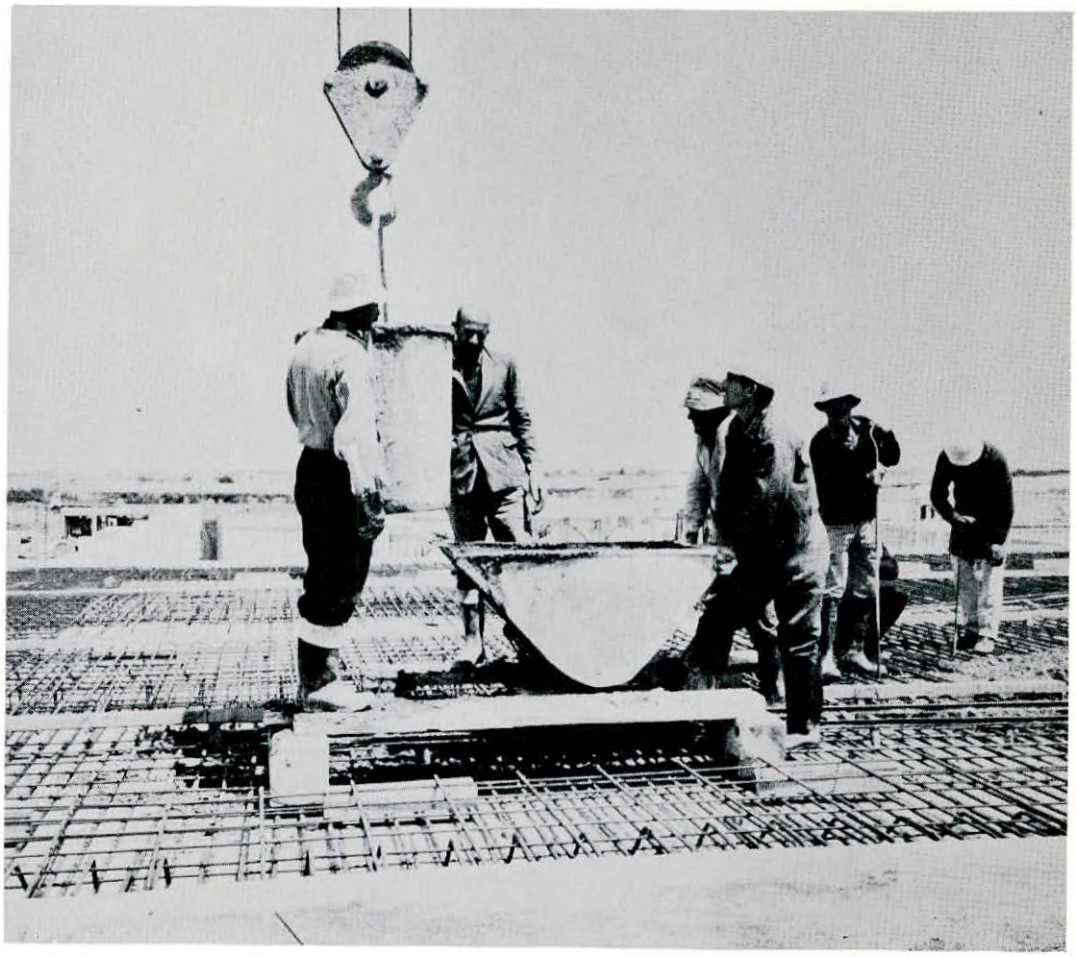
These Surveys consisted mainly of contour surveys, profile-levelling and cross-sectioning for Dam Reservoirs, Irrigation Distribution System and major pipelines for domestic water supply. Another task of this branch was to take observations of permanent monuments established at the sites of constructed Dams for the detection of vertical or horizontal movements of the structures or the neighbouring slopes.

4.3.1 The staff of this branch during the year was as follows:

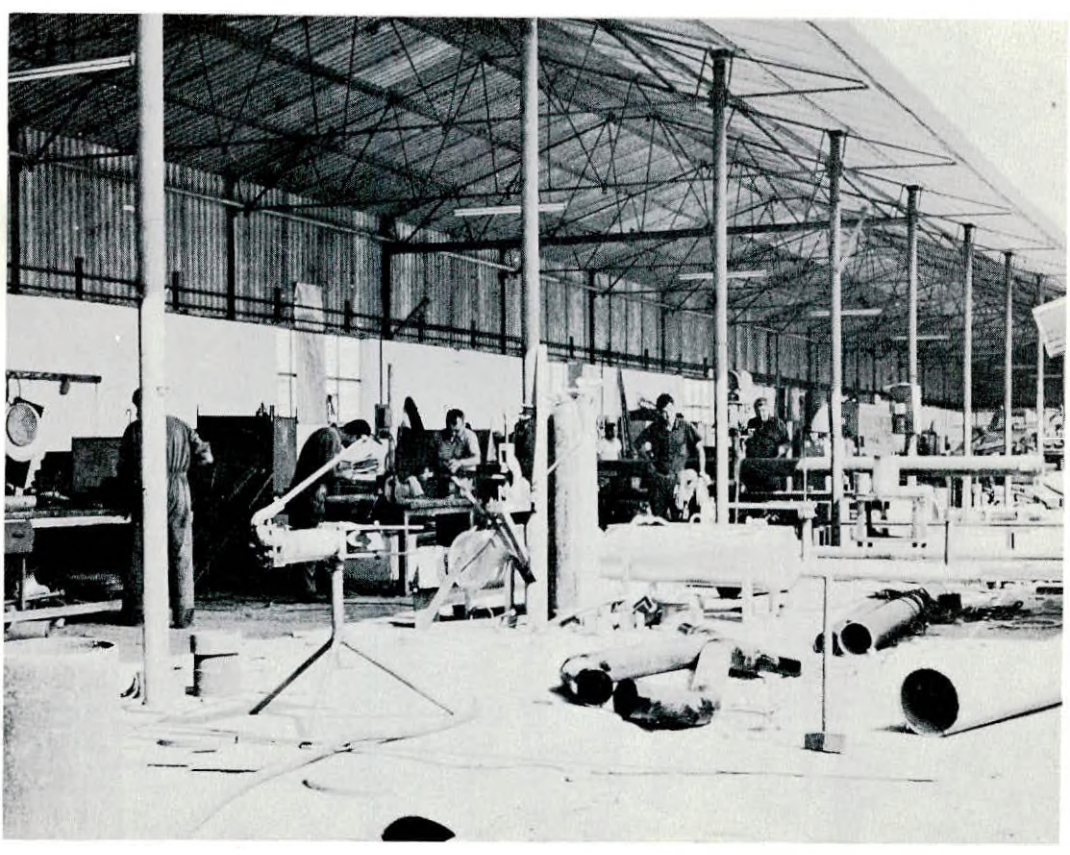
post	No	Remarks
Inspector of works	2	One 1/C of branch
Technical Assistants	6	Monthly paid
Technical Assistants	7	Daily paid
Rod-men "	6	Hourly paid

This branch has dealt with the following projects:

Project	Type	Remarks
Souskiou Diversion	Contour Survey	for the C.W.P.P.
Khandria Reservoir	-do-	Departmental
Morphou dam	Cross-Sectioning	Departmental-Sedimentation
Athalassa Spillway	Contouring-C. Sectioning	Departmental
Vyzakia Reservoir	Contour Survey	for the C.W.P.P.
Dhiarizos canal	Contour-Survey	for the C.W.P.P.
Pitargou Reservoir	-do-	for the C.W.P.P. raising
Lefkara Reservoir	-do-	Departmental-borrow areas
Kiti Pervolia	Profile-levelling	Departmental
Lythrodhonta Dam	Contour Survey	Departmental-completion
Dhromolaxia	Profile-levelling	Departmental-drainage
Lefkara pipeline	Profile-levelling	Departmental
Lefkara Dam	Contour Survey	-do-
Xeros pipeline	Profile-levelling	Departmental D.W.S.
Asprokremmos D-Site	Plotting	for the C.W.P.P.
Nikoklia D-Site	Contour Survey	for the C.W.P.P.
Lefkara Dam	Levelling	Departmental Top Water level location
Galini Dam	Contour Survey	Departmental-Completion
Kalokhorio Klirou	-do-	-do-
Mia Milea	-do-	Departmental
Lefkara Reservoir	-do-	-do-
Polemidhia Reservoir	-do-	Departmental-Sedimentation
Kourris Dam	-do-	for the C.W.P.P.
Petra Dam	-do-	Departmental-Completion
Palekhori	Profile-levelling	Departmental Distr.System
Yermasoyia Dam	Contour Survey	Departmental-Sedimentation
Kalopanayiotis Dam	-do-	-do-
Lefkara Dam	-do-	Departmental B.P. Tanks
Yermasoyia Dam	Cross Sectioning	for the C.W.P.P. Sedimentation
Polemidhia Dam	Cross Sectioning	Departmental-Sedimentation
Kapsala Reservoir	Contour Survey	for the C.W.P.P.
Akrotiri Lake	-do-	-do-
Kambi Dam	Levelling	Departmental Top water level
Pendayia pipeline	Profile-levelling	Departmental D.W. Supply



Casting of R.C.C. slab of the Phrenaros reservoir
(Famagusta — Khirokitia Project)



General view of part of the Departmental Mechanical Workshop

V. DIVISION OF CONSTRUCTION

By

H.P. Karakannas
Head of Division

5.1 This Division embraces all the constructional activities of the Department, in the field of Domestic Water Supply and Irrigation projects, all civil engineering departmental contracts, the use of constructional plant and the Departmental Workshop.

The permanent staff of the Construction Division during 1970 consisted of :

1 No. Engineer Hydrologist - Head
1 No. Mechanical Engineer
2 Nos. Senior Inspectors of Works
7 Nos. Inspectors of Works
3 Nos. Chief Foremen
9 Nos. Assistant Chief Foremen
1 No. Technical Assistant
88 Nos. Monthly paid & weekly paid Foremen
386 Nos. weekly paid regular artisans

498 Nos. Total

In addition to the above permanent staff other Executive Engineers and Technical staff were working with this Division on specific scheme.

The Construction programme for 1970 included 60 Domestic Water Supply Scheme of an estimated cost of £543,563.- 51 Minor Irrigation Schemes of an estimated cost of £275,057.- 10 Major Irrigation Schemes of an estimated cost of £194,386.- and the Nicosia Town - XERI Emergency Water Supply Scheme of an estimated cost of £25,000.-. In total the construction programme included 122 schemes of an estimated cost of £1 038,006.- as shown hereunder :

Ser. No.	No. of schemes	Nature of Scheme	Estimated cost £
1	60	Domestic Water Supply Schemes	543,563
2	51	Small Irrigation Schemes	275,057
3	10	Major Irrigation Schemes	194,386
4	1	Nicosia Emergency Scheme from Tseri	25,000
	122	T o t a l	1,038,006

Over and above the above projects the Division has carried out minor works on a number of Village Domestic Water Supplies and Irrigation Schemes from funds deposited by the Village Water Commissions or by the Irrigation Committees. On these minor works the expenditure reached the amount of £24,592.

The Construction Division has also taken active part in the new Water Supply Scheme for Famagusta Town, as regards labour and supervision, Civil Engineering machinery and contracts. It has also undertaken part of the Major Irrigation projects, such as the Yermasoyia Dam outlet pipeline, the Phinikaria road, Lefkara preliminary works & construction of access road, etc.

The overall expenditure on all schemes incurred during 1970 reached the amount of £512,598. This amount was spent on carry over and new schemes. Out of this amount £223,050.- were spent on 48 Domestic Water Supply Schemes, £145,173 on 44 Small Irrigation Schemes, £114,763 on 10 Major Irrigation Schemes, £5.020 on the Nicosia Town - Emergency Water Supply Scheme from Tseri area, and £24,592 on repairs, maintenance and minor works on 128 Water Supply and Irrigation Schemes.

In detail the expenditure incurred for the construction of all the above schemes is shown hereunder:

1.	Domestic Water Supply Schemes	£223,050
2.	Small Irrigation Schemes	£145,173
3.	Major Irrigation Schemes	£114,763
4.	Nicosia Emergency Water Supply Scheme	£ 5,020
5.	Minor Works & Maintenance to Domestic Water Supply & Irrigation Schemes from Village Deposits	£ 24,592
	Total	£512,598

5.1.1 Labour Force

For the execution of a scheme, the labour force consists of the regular employees of the Department and casual employees recruited from the area where the work is executed. During 1970 the number of regular employees engaged by the Department for the construction of all schemes was 386 and an average of 1000 casual workers were employed through the Labour Exchange. In total during 1970 an amount of £431,868 was spent on wages for the regular and casual employees engaged by the Department for all its constructional activities.

5.1.2 Constructional Plant

As usually Government machinery is used primarily for the construction of the projects approved in the Department's budget. As, however the number of Departmental heavy machinery is quite limited, it was necessary to hire machinery from private owners through tenders. In total during 1970 machinery was hired for 26,295 working hours at an expenditure of £22,174. Also machinery was hired for the excavation of 283,889 feet of trenches for the laying of pipes at a cost of £3,882.

5.1.3 Materials

As it is the usual practice for all schemes constructed by the Department the materials such as pipes & pipe fitting, steel, etc. are requisitions through the Government Central Stores. Building materials, however, such as sand, gravel, aggregate, etc, were purchased through tenders. During 1970 the Division awarded 75 tenders for the purchase of 40,984 cubic meters of such building materials at a cost of £20,277,. The needs of the Division in cement were purchased through a Government contract from the two local cement factories. During 1970 3,954 tons of cement were used for the construction of the projects, valued at £27,678.

During 1970 a total length of 236,680 meters of pipes of all types were laid by the Division for Domestic Water Supply and Irrigation Schemes.

Tables showing in detail the pipes and other materials used by the Division during 1970 are given hereunder:

(a) Galvanized mild steel pipes laid during 1970

Nominal diameter in inches	4"	3"	2½"	2"	1½"	1 1/4"	1"	3/4"	½"	Total length laid in meters
Length of pipes laid in meters	45,238	27,061	8,195	33,634	8,482	18,720	10,591	646	21,146	173,713

(b) Steel Victaulic pipes laid during 1970

Nominal size in inches	10"	8"	6"	Total length of pipes laid in meters
Length of pipes laid in meters	131	1,600	694	2,425

(c) Asbestos cement pressure pipes

Nominal size in inches	18"	15"	12"	10"	8"	6"	4"	3"	Total length of pipes laid in meters
Length of pipes laid in meters	2,932	440	4,388	5,176	15,440	16,190	10,414	5,562	60,542

(d) Materials and machinery used during 1970

Ser. No.	Description	Quantity	Expenditure
1	Cement	3,954 tons	£27,678
2 3 4	Gravel Sand Aggregate	40,984 m^3	£20,277
5	Heavy Machinery	26,296 working hours	£22,174
6	Excavation of trenches	88,716 running meters	£ 3,882
	T o t al		£74,011

5.1.4 Domestic Water Supply Schemes

The construction programme for 1970 included 60 schemes of an estimated cost of £543,563.- out of these schemes 27 were completed during the year, 21 were put in hand but could not be completed by the end of the year and were carried over for completion in 1971, and 12 schemes could not be put in hand for various administrative and other difficulties.

The expenditure incurred on these 60 Domestic Water Supply Schemes reached the amount of £223,050.-

The 60 Domestic Water Supply Schemes which were included in the construction programme of 1970 are classified as:-

a) Schemes completed during 1970.
b) Schemes put in hand during 1970, but not completed and carried over for completion in 1971, and
c) Schemes not put in hand in 1970, and carried over for construction in 1971.

5.1.5 Domestic Water Supply Schemes Completed during 1970

As it is mentioned above 27 water supply schemes of an estimated cost of £233,691 were completed during 1970. Ten of these schemes were put in hand in 1969 or even before, and the remaining 17 schemes were put in hand during 1970. By the completion of these 27 schemes a population of 23,252 persons is served, and in all cases where a new distribution system was executed, the house-to-house service was implemented. The consumption of water was controlled through metering and in all 4,600 water meters of ½ inch in diameter were installed. For these 27 schemes 26 reinforced cement concrete circular storage tanks of a total capacity of 633,000 gallons, or 2,870 M^3, were constructed, and 4 new pumping plants with their pump-houses were installed.

The 27 Domestic Water Supply Schemes that were completed during 1970 are shown in the list that follows:-

Domestic Water Supply Schemes completed during 1970

Ser. No.	Village	Population 1960 census	Estimated cost £	Type of scheme	Nature of work
	Nicosia District				
1	Aredhiou	355	6,700	Pumping	≠ H
2	Terakies	520	2,700	Gravity	+ H
	Kyrenia District				
3	Dhiorios	670	1,533	Pumping	+
4	Vasilia Regional scheme (i) Vasilia, (ii) Agridhaki, (iii) Sisclipos, (iv) Ay.Ermolaos, (v) Asomatos, (vi) Panagra, (vii) Orga, (viii) Liveras, (ix) Ay.Marina (Skyl.)	3,531	72,000	Pumping	≠ H
5	Karakoumi	206	6,622	Pumping	≠ H
	C/F	5,282	89,555		

Ser. No.	Village	Population 1960 census	Estimated cost £	Type of scheme	Nature of work
	B/F	5,282	89,555		
	Famagusta District				
6	Eastern Mesaoria			Gravity)	
—	Dry Villages	-	20,000	&)	+
				Pumping)	
— 7	Asha	2,209	19,500	"	+H
— 8	Aphania	811	6,680	"	+H
— 9	Komi Kebir	952	12,600	"	+H
— 10	Marathovounos	2,020	9,900	Gravity)	
				&)	
				Pumping)	+H
11	Dherynia	2,741	1,900	Pumping	+
12	Trypimeni	456	1,100	Gravity	+H
— 13	Vitsadha	402	3,100	Pumping	+H
	Limassol District				
— 14	Pano Kividhes	456	8,080	Gravity	⁂H
15	Zoopiyi)	265	7,616	Gravity	+H
— 16	Louvaras)	328	11,284	"	+H
—17	Anoyira	620	5,400	"	+H
18	Paleomylos	200	2,000	"	+H
19	Pyrgos	702	800	"	+
—20	Phasoula	435	5,300	"	+H
21	Yerovasa-Trozena	106	300	"	+
	Larnaca District				
22	Ayia Anna	182	1,600	Pumping	+H
23	Alaminos	564	1,200	Gravity	+H
24	Alethriko	308	5,106	Pumping)	
				&)	
				Gravity)	+H
25	Ora	335	1,750	Gravity	+H
	Paphos District				
26	Galataria	288	820	Gravity	+
27	Papaloucas Scheme)				
	(i) Phiti)	342			
	(ii) Lasa)	279			
	(iii) Ay.Demetrianos)	234	10,000	Gravity	+
	(iv) Kathikas)	763			
—	(v) Polemi)	880			
	(vi) Psathi)	65			
—28	Emba	1,027	8,100	Gravity	+H
	T o t a l s	23,252	233,691		

LEGEND

⁂ means new scheme
\+ means improvements to an existing scheme
H means a house-to-house service

Some of the most important Water Supply Schemes that were completed during 1970, are the Vasilia Regional Scheme, the Eastern Mesaoria Dry Villages Regional Scheme, Komi Kebir, Pano Kividhes, Zoopiyi-Louvaras, & Alethriko. A short description for each scheme separately is given hereunder:

5.1.5.1 Vasilia Regional Scheme

This combined Water Supply Scheme has as a source of supply borehole No. B.35 which was drilled by the Team of German Experts in 1964, and is situated about a mile South-West of Vasilia, and serves nine villages of the area, namely:

1) Vasilia
2) Agridhaki
3) Sisklipos
4) Ayios Ermolaos
5) Ayia Marina (Skyllouras)
6) Asomatos
7) Panagra
8) Orga
9) Liveras

The scheme estimated at £72,000 was put in hand very late in 1968 and was completed by the end of 1970. Most of these 9 villages had existing schemes which were old and inadequate. The share of water supply before the implementation of the new scheme hardly reached 5 gallons per day per capita in Summer, and some of the villages experienced great hardship in obtaining their water supply, during the dry season. In all nine villages a house-to-house service has been implemented and 850 water meters were installed for all houses. By the completion of the scheme each consumer in these villages enjoys a satisfactory piped supply of excellent quality. All the old sources of supply for these villages which were small springs are used in conjunction with the source of supply. So, water is pumped from borehole, B.35 as much as is needed, and in some cases especially after the high rainfall over the area during the past five years, it was observed that during the winter season certain villages did not make use of the water of the new borehole. The new scheme included the pumping of the water from borehole B.35 by an electrosubmersible pump at the rate of 12,000 gallons per hour into a 30,000 gallons capacity circular tank near the borehole. From this balancing tank the water flows by gravity to four villages, namely, Vasilia, Panagra, Orga & Liveras. For the other five villages, Agridhaki, Sisklipos, Ayios Ermolaos, Ayia Marina & Asomatos, - water is pumped at the rate of 5,000 gallons per hour by means of a high-pressure centrifugal pump into a high level storage tank from where water flows by gravity to all five villages. The difference in height between the borehole & this second high level storage tank which commands the five villages is 800 ft. 160,000 ft. or 30 miles, of conveyor pipelines were laid between the borehole & the nine villages. They are of galvanized iron, and ranging in diameter between $1\frac{1}{2}$ inch and 4 inches.

In all nine villages, additional or new storage tanks were constructed, and in all cases new house-to-house distribution systems were executed.

5.1.5.2 Eastern Mesaoria Dry Villages Water Supply Scheme

By the implementation of this combined Water Supply Scheme for the 13 dry villages in the Eastern Mesaoria, estimated at £20,000 the existing Water Supply of all the villages has been supplemented considerably.

Before the completion of this scheme the 13 Dry Villages, Asha, Aphania, Marathovounos, Pyrga etc., were deriving their Water Supply from Kephalovrysos spring, (5% of the total quantity) which as a result of the prevailing drought and the increase of population of the villages gave a share of less than 8 gallons per day per capita to the villages population.

The new scheme included the installation of an electrosubmersible pump of output 7,000 gallons per hour on borehole B.18a, the construction of a 100,000 gallons capacity R.C.C. storage tank near the borehole, and the laying of 18,000 ft. of 4"Ø galvanized iron conveyor pipeline between the new balancing tank and the distribution tank at Petra-tou-Dhigheni from where water is distributed by existing pipelines to the 13 villages.

By the completion of this scheme the share of water per capita to each person increased to over 20 gallons and thus it was possible to implement a house-to-house service in each village.

5.1.5.3 Asha Water Supply Scheme

Before the completion of this scheme Asha had an inadequate supply from Kephalovrysos spring through street fountains. After the provision of supplementary water from the new borehole B.18a, it was made possible to execute a new distribution for Asha. The new scheme estimated at £19,500.- included the construction of a new storage tank of 100,000 gallons capacity and the execution of a new house-to-house distribution system. More than 800 water meters of ½ inch in diameter were installed in each house, and now all houses enjoy a satisfactory metered supply.

5.1.5.4 Aphania Water Supply Scheme

As in the case of Asha this village also had an inadequate supply from Kephalovrysos spring through street fountains, before the provision of additional water from borehole B.18a.

The new scheme estimated at £6,680 included the construction of a new 30,000 gallons capacity storage tank and the execution of a house-to-house service scheme.

By the completion of this scheme each house in Aphania, Greek and Turkish, enjoys a satisfactory metered supply. 250 water meters were installed for the Greek and Turkish houses.

5.1.5.5 Marathovounos Water Supply Scheme

The scheme for Marathovounos estimated at £9,900 included the construction of a 60,000 gallons capacity storage tank and the implementation of a new house-to-house service. 600 water meters were installed for each house and now this village has a satisfactory up-to-date house-to-house service.

5.1.5.6 Komi-Kebir Water Supply Scheme

This village also had an old scheme with street fountains. The new scheme estimated at £12,600 included the construction of a 30,000 gallons capacity R.C.C. storage tank and the implementation of a new house-to-house service distribution system. 400 water meters were installed for each house and now all Greek and Turkish houses enjoy a satisfactory piped supply.

5.1.5.7 Pano Kividhes Water Supply Scheme

This scheme estimated at £8,080 included the laying of a new main pipeline to the site of the new village, the construction of a 10,000 gallons capacity storage tank and the execution of a house-to-house service for the newly built village. 110 water meters were installed for all the new houses, and now this new village has a satisfactory piped supply for each house.

5.1.5.8 Zoopiyi-Louvaras Water Supply Scheme

This combined scheme estimated at £18,900 included the conveying of 18,000 gallons of water from Arkolahania spring, at Mesapotamos-Troodos, to the two villages, through a 60,000 feet of 2" ϕ galvanized iron main, the construction of a new storage tank for Louvaras, and the execution of a house-to-house distribution system for both villages. 160 water meters were installed for the two villages which now have a satisfactory piped supply.

Before the implementation of this scheme Louvaras had no piped water at all, whilst Zoopiyi had a supply of less than 5 gallons per day per capita.

5.1.5.9 Alethriko Water Supply Scheme

This scheme estimated at £5,106.- included the construction of a 10,000 gallons capacity R.C.C. storage tank and the execution of a house-to-house service distribution scheme. The new scheme also included the conveying of supplementary water from the borehole of Softadhes & Anaphotia. The old supply of the village from a spring was inadequate and gave a share of less than 5 gallons per day per capita to the population.

80 water meters were installed in this vallage and now each house enjoys a satisfactory piped supply..

5.2 Domestic Water Supply Schemes put in hand in 1970 but not Completed and carried over for completion in 1971

As it has been mentioned above out of the 60 schemes included in the programme of works for 1970, 21 schemes were put in hand but could not be completed by the end of the year, as some of them were put in hand late in the year, or as some are major schemes and the period for completing the work is longer. Other combined major schemes such as, Vatyli-Strongylos etc, Polemidhia-Ypsonas, etc, were split into two phases. The amount approved in the Development Estimates for these 21 schemes was £260,827.-, out of which an amount of £149,341.- was spent during 1970, and the balance of £111,486.- was revoted for 1971 for the completion of these schemes. It is expected that all these schemes will be completed during 1971. A list showing these schemes is given on the next page:

Domestic Water Supply Schemes put in hand during 1970 but not completed and carried over for completion in 1971

Ser. No.	Village	Amount approved for 1970 £	Amount carried over for 1971 £
	Nicosia District		
1	Morphou	93,313	24,039
2	Petra	4,100	1,977
3	Sina Oros) combined	2,320)	
4	Tembria) scheme	6,186)	4,210
5	Evrykhou)	10,794)	
6	Tseri	1,362	1,020
	Kyrenia District		
7	Ayios Amvrosios)	2,204	114
8	Kharcha)		
	Famagusta District		
9	Vatyli) combined	24,624)	12,383
10	Strongylos) scheme	4,252)	
	Limassol District		
11	Mathikoloni	2,600	1,740
12	Polemidhia Kato)	19,075)	32,786
13	Ypsonas)	21,013)	
14	Potamos-tis-Yermasoyias	34,000	21,581
15	Korphi	4,800	1,504
	Larnaca District		
16	Arsos) combined	4,696)	
17	Tremetousha) scheme	4,770)	4,873
18	Meloushia)	1,908)	
19	Aradhippou	5,400	1,206
	Paphos District		
20	Nata	410	403
21	Statos	13,000	3,650
	T o t a l s	£260,827	£111,486

5.3 Domestic Water Supply Schemes approved for execution in 1970 but not put in hand during the year and carried over for construction in 1971

Out of the 60 Domestic Water Supply Schemes that were included in the 1970 Constuction Programme, 12 schemes could not be put in hand for various administrative difficulties, and were carried over for construction in 1971.

The estimated cost of these 12 schemes is £49,045.- and a list showing each scheme separately is given on the next page:

Domestic Water Supply Schemes approved for execution in 1970 but not put in hand during the year and carried over for execution in 1971

Ser. No.	Village	Amount approved for 1970 £	Remarks
	Nicosia District		
1	Kalokhorio (Klirou)	4,850	Pending removal of administrative difficulties.
2	Nikitari	2,095	Pending acquisition of spring.
3	Alona		Pending decision on utilization of water from the Chrome Gallery
4	Platanistasa		
5	Lagoudhera	24,500	
6	Sarandi		
7	Polystipos		
8	Kakopetria-Palea	3,200	Administrative formalities not completed
9	Malounda	1,600	" " "
10	Pedhoulas	4,500	" " "
	Paphos District		
11	Ayia Pipeline		
	(i) Kallepia		
	(ii) Letymbou	6,000	" " "
	(iii) Pitarkou		
	(iv) Kritou-Marottou		
12	Kritou-Terra	2,300	" " "
	T o t a l	£49,045	

5.4 Small Irrigation Schemes

The construction programme for 1970 included 51 Small Irrigation Schemes of an estimated cost of 275,057. Out of these 52 schemes 37 schemes of an estimated cost of £142,660.- were completed during 1970, 7 schemes of an estimated cost of £105,940.- were put in hand but were not completed by the end of the year and were carried over for completion in 1971, and 7 schemes of an estimated cost of £26,457.- could not be put in hand for various administrative and other difficulties and were carried over for execution in 1971.

The Small Irrigation Schemes undertaken for construction by this Division are classified in four categories, as under:

5.4.1 Lining of canals in Western Mesaoria

This project was inaugurated in 1966, and its chief aim was to replace all earthern channels between the boreholes and the citrus plantations with reinforced cement concrete channels. By the implementation of this project, an economy of about 20 per cent in water is effected, and the allocation of funds each year for the completion of the whole project is considered of vital importance for the Morphou area aquifer which is depleting continuously. The construction programme for 1970 included 9 such schemes of an estimated cost of £102,153.-.

Out of these 9 schemes, 5 schemes of an estimated cost of £26,103 were completed during 1970, two schemes of an estimated cost of £65,500 were put in hand during the year but could not be completed by the end of 1970 and were carried over for completion in 1971, and two schemes estimated at £10,550.- could not be put in hand during 1970 and were carried over for execution in 1971.

5.4.2 Recharge schemes

The construction programme for 1970 included two such schemes of an estimated cost of £22,000.- of the two schemes for Famagusta - Dherynia was put in hand in 1969 and was completed during 1970. The other scheme for Elea chiftlik in the Kyrenia District was approved in the Development Estimates of 1969 but could not be put in hand in 1969 pending the acquisition of the land and was put in hand during 1970. This scheme was not completed during 1970 and was carried over for completion in 1971.

5.4.3 Pumping schemes

The construction programme for 1970 included 7 pumping schemes of an estimated cost of £49,900. Out of these schemes, 4 of an estimated cost of £29,200 were completed during 1970, one scheme estimated at £10,400 was put in hand during 1970 but could not be completed by the end of the year and was carried over for completion in 1971, and two schemes of an estimated cost of £10,300 could not be put in hand during 1970 because of administrative difficulties and were carried over for execution in 1971.

5.4.4 Minor Irrigation Schemes

The programme of construction for 1970 included 33 Minor Irrigation Schemes of an estimated cost of £94,997.- Out of these schemes, 27 of an estimated cost of £62,350 were completed during 1970, 3 schemes were put in hand but could not be completed by the end of the year and were carried over for completion in 1971, and 3 schemes could not be put in hand because of administrative difficulties and were carried over for execution in 1971.

5.5 Small Irrigation Schemes completed during 1970

As it is mentioned above 37 such schemes of an estimated cost of £142,660 were completed during 1970. 19 of these schemes were put in hand in 1969 and a considerable amount was spent on these schemes during 1969. A list showing all 37 schemes completed during 1970 is given hereunder:

(a) Lining of canals in Western Mesaoria - Schemes completed during 1970

Ser. No.	Name of scheme	Estimated cost of scheme £	Amount approved for 1970 £	R.C. canals constructed in feet	Remarks
1	Akaki-1968 scheme	5,550	5,550	12.653'	Work put in hand in 1970
2	Akaki-1969 scheme	5,000	5,000		
3	Akaki-1970 scheme	1,560	1,560	1,810'	
4.	Morphou-Ovgos-1969 scheme	5,000	4,452	6.073	Work put in hand in 1969
5	Prastio	15,000	9,541	17,028	Work put in hand in 1969
	T o t a l s	32,110	26,103	37.564'	

(b) Recharge Schemes completed during 1970

Ser. No.	Name of scheme	Estimated cost £	Amount approved for 1970 £	Remarks
1	Famagusta-Dherynia	19,000	5,765	Work put in hand in 1969

(c) Pumping schemes completed during 1970

Ser. No.	Name of scheme	Estimated cost £	Amount approved for 1970 £	Area of land irrigated	
				Perennial	Seasonal
1	Potami	10,000	2,826	250	-
2	Anglissidhes	6,400	3,724	-	62
3	Maroni-Phase I	4,300	2,417	100	50
4	Ziyi-Tokhni	8,500	5,338	113	64
	Totals	29,200	14,305	463	176

(d) Minor Irrigation Schemes completed during 1970

Ser. No.	Name of Scheme	Estimated cost £	Amount approved for 1970 £	Nature of Work	Area of land irrigated in donums	
					Perennial	Seasonal
1	Galata-(Esso)	4,000	709	Distr. pipes	104	-
2	Kalopanayiotis(Troullinos)	3,300	1,103	Distr. pipes	24	-
3	Moutoullas-Katouris	4,500	1,188	Repairs & distr.	34	32
4	Psomolophou	6,000	1,512	R.C. canals	210	706
5	Pyrgos-Tyllirias	10,000	1,145	Distr. pipes	350	680
6	Dhikomo	3,000	3,000	pipe distr.	65	125
7	Palekythro	850	850	Irrigation gates	-	1,300
8	Palekhori-Millouri	930	930	Repairs & extensions	25	-
9	Agros-Dihalorotsos	1,200	1,137	R.C. canals	20	-
10	Agros-Kaoukaris	600	600	pipe distr.	6	-
11	Arsos	3,200	2,046	St. tank & distr.	71	59
12	Ayios Pavlos-Dhimma	500	500	Distribution pipes	50	50
13	Dhierona-Kamaroudhia	300	262	Repairs & improvements	220	-
14	Kato Amiandos-Kato Phylagra	2,600	751	R.C. channels & distr. pipes	29½	5½
15	Kato Amiandos-Pano Phylagra	1,700	1,040	St. tank & distribution pipes	26	10
16	Potamiou	2,300	640	Diversion & distribution	27	-
17	Prodhromos	4,350	3,374	St. tank & distribution pipes	68	8
18.	Ayios Demetrios	3,150	3,150	St. tank & distr. pipes	151	34
19.	Dhierona-Mylos	1,230	1,230	Channels & pipes	60	-
20	Kouka	510	510	Distribution pipes	3½	8
21	Mandria (Limassol)	660	660	Distribution pipes	5	-
22	Galataria	1,410	1,410	Distribution pipes	44	88
23	Kilinia-Morris	540	540	Distribution pipes	6	10
24	Kilinia-Argaki tou Zisimou	630	630	Distribution pipes	4	18
25	Kissonerga	2,820	2,820	Distribution pipes	24	37
26	Konia	780	780	Repairs & improvement	6	9
27	Phiti	1,290	1,290	Repairs & distr. pipes	9	19
	T o t a l	62,350	33,807		1642	3,198½

5.6 Small Irrigation Schemes put in hand during 1970 but not completed during the year and carried over for completion in 1971

As it has already been mentioned above 7 schemes were put in hand during 1970 but could not be completed during the year and were carried over for completion in 1971. For these 7 schemes of an estimated cost of £105,940 an amount of £61,459 was spent during 1970. A list showing all 7 schemes is given hereunder:

(a) Lining of canals in Western Mesaoria

Ser. No.	Name of scheme	Estimated cost £	Amount revoted for 1971 £	Remarks
1	Morphou-Teratsia	48,000	27,753	
2	Kyra	17,500	9,697	
	Totals	65,500	37,450	

(b) Recharge Schemes

Ser. No.	Name of Schemes	Estimated cost £	Amount revoted for 1971 £	Remarks
3	Elea - Kyrenia	3,000	1,491	

(c) Pumping Schemes

Ser. No.	Name of Schemes	Estimated cost £	Amount revoted for 1971 £	Remarks
4	Maroni	10,400	2,939	

(d) Minor Irrigation Schemes

Ser. No.	Name of Schemes	Estimated cost £	Amount revoted for 1971 £	Remarks
5	Galini	19,000	1,001	
6	Kyperounda-Dheisis	5,100	818	
7	Tris Elies-Diplomata	2,940	782	
	Total	27,040	2,601	

5.7 Small Irrigation Works approved for execution in 1970 but not put in hand during 1970 and carried over for execution in 1971

As it has been mentioned above 7 schemes of an estimated cost of £26,457 could not be put in hand during 1970 for various difficulties and were carried over for execution in 1971. A list showing these 7 schemes as well as the reasons for which it was not possible to put them in hand is given hereunder:

Small Irrigation works approved for execution in 1970 but not put in hand and carried over for execution in 1971

Ser. No.		Estimated cost £	Nature of Work	Remarks
1	Peristerona(1968 scheme)	5,550)		) Villagers re-
2	Peristerona(1969 scheme)	5,000)	Lining of canals	) quested change (of scheme
3	Kato Koutraphas	7,000	Pumping scheme	New scheme from new borehole prepared.
4	Massari	3,300	Pumping scheme	Scheme not approved by village.
5	Trimiklini	907	Minor Irr. Works	Pending revision of scheme
6	Gaidhouras	1,100	" " "	" "
7	Kato Akourdhalia	3,600	" " "	Scheme not approved by village
		26,457		

5.8 Major Irrigation Works

The construction programme for 1970 included 10 Major Irrigation Schemes of an estimated cost of £194,386.- Considerable work was carried out on these Major Irrigation Schemes and an amount of £114,763 was spent during the year. A list showing these schemes is given hereunder:

Major Irrigation Works

Ser. No.	Scheme	Amount approved for 1970 £	Actual Expenditure during 1970 £
1	Morphou-Serrakhis Spreading Grounds)	906	888
2	Morphou-Serrakhis Rasing of Dam)	2,645	2,627
3	Syrianokhori-Kokkinoyi channels	27,700	25,747
4	Syrianokhori-Pumping Scheme	16,301	10,955
5	Yermasoyia Spillway	5,800	4,611
6	Yermasoyia outlet pipe	2,605	664
7	Kiti-Perivolia Distr. System	17,585	3,813
8	Mavrokolymbos distr. system	52,320	13,107
9	Pomos distr. system-Phase II&III	64,200	48,231
10	Polemidhia distr. system	4,324	4,120
	T o t a l	194,386	114,763

The total mechanical equipment as on 31.12.70 is shown below:

Mechanical Equipment	No
Ruston Bucyrus Drilling Rigs 22 W	10
Ruston Bucyrus Drilling Rigs 60 RL	2
Caterpillar D8	3
Caterpillar Traxcavators 955	2
Allis Chalmers Traxvavator	1
Ruston Bucyrus Excavator RB 10	1
Ruston Bucyrus Excavator Rb 19	2
Excavator Smith 3/4 cu yd	2
Mobile Plant	
Small Core Drill	1
Core Drill 200 ft. Depth	2
Grouting Drill Pneumatic 150 ft.	1
Wagon Drill	1
Overburden	3
Concrete grouting machine	2
Compressors	12
Diesel Alternator	8
Electrosubmersible test pump	7
Turbine deep-well test pumping units	2
Pleuger deep-well test pumping units	2
Centrifugal pumping units	4
Portable Works Pumps	32
Sheepfoot Rollers	16
Vibrating soil compactors	3
Vibrating rollers	3
Vibrators	27
Concrete mixers	55
Cranes	1
Hoists	3
Lorry mounted portable 3 ton borehole pump cranes	3
Thornycroft Tractive unit low loader	1
Dumpers	3
5 ton Diesel Lorry (Austin)	1
Bedford R.L. Lorry	2
Land Rovers	21
Austing Gibsy	1
Toyota land cruiser	6
Toyota station wagon	8
Cortina station wagon	1
Pumps for test pipes	12
Rubber tyred compaction rollers	2
Sludge pump pneumatic	6
Cutting Machine for pipes	5
All concrete vibrators	12
Small drilling rig	1
Workshop Plant	
Drilling Machine	4
Planning timber machine	1
Bandsaw timber	1
Bar bender	1
Bar cutter	2
Lathe	1
Pench shaper	1

Mechanical Equipment	No.
Electric welders	7
Forges	1
Compressor Air (Tecalemit)	2
Grinding Machine	3
Hack - saw Electrical	2
Wood-cutting machine	2
Plate bending machine	1
Spark plug testing machine	1
Battery charging unit	1
Hydraulic press 190 ton capacity	1
Band saw grinding machine	1
pipe slotting machine	1
Hydraulic pipe bending machine	1
Tractor track service tool	1
soltering iron heater	2
Cast iron, Aluminium of Bronze casting force	1
Tube vulcanizing machine	1
Type extracting equipment	1
Paint spraying equipment	1
Letter printing machine	1

5.11 Famagusta Water Supply Project-Special Construction Report

by

C. Andréou
Resident Engineer

5.11.1 Main Conveyor Pipeline

5.11.1.1 Excavation - pipelaying - testing

The works for the trenching, laying and testing were completed during 1969.

5.11.1.2 Construction of Valve Chambers

During 1969,152 valve chambers were constructed, The construction of the valve chambers continued during 1970 and was finally completed at the end of February.

5.11.2 Pumping Schemes

5.11.2.1 Khirokitia Pumping Scheme

The works for this scheme were completed during 1969, and the installations were put into operation during the same year.

5.11.2.2 Psematismenos Pumping Scheme

The pipelaying-trenching and testing of the pipeline was completed during 1969. During 1970 the pump, the valves and watermeter were installed. This project was put into operation on the 12th June 1970.

5.11.2.3 Vasilikos Pumping Scheme

The boreholes which were drilled in the Vasilikos River near the Mari village were not used.

It was decided to construct a cutting across the Vasilikos River-gravels and to place perforated cement pipes as collectors, of 3'-0" diameter which will collect the water into a collecting wall.

The cutting has a length of 500 ft. and a depth of 58 ft.

During the year under review the excavation, the laying of the pipes and the placing of the filter, were completed.

Also the construction of the collecting wall and of the inspection and ventilation well, put in hand.

During the same year the excavation and the pipelaying of this scheme was completed.

The remaining fifteen valve chambers for the pipeline of this scheme were constructed during 1970.

5.11.2.4 Khirokitia New Boreholes

In addition to the Khirokitia Pumping Scheme two additional boreholes No. 4/69 and 11/69 were drilled to the west of Khirokitia Reservoir and connected to the Chlorination House.

The works started on the 18th May and were completed in August 1970. A total length of 3604 ft. of steel pipes of 4" and 6" diameter were laid.

Twelve valve chambers were constructed.

A small reservoir of capacity of 2000 gallons was constructed, which will serve the chlorination house.

5.11.3 Reservoirs

5.11.3.1 Khirokitia Reservoir

The Khirokitia Reservoir was nearly completed during 1969. The second phase of the roof - slab was cast on the 8th January 1970.

All joints of the walls were filled with gutta-terna.

During 1970 all the valve chambers near the reservoir were constructed. After the reservoir was filled with water and checked if there was any leakage, all filters were placed and the walls were backfilled.

The Reservoir was put into operation on the 6th April 1970.

5.11.3.2 Chlorination House

The excavation of the Chlorination House was completed during 1969. The chlorination house consists of three parts. The pool, the channel and the stilling basin.

The bottom part is constructed from reinforced concrete and the upper part is of masonry. This was cast on the 11th February 1970, and the roof slab on the 24th March 1970.

The bottom part is covered with porcelain. The masonry walls and the roof were plastered in three phases, and were covered with putty to get a smooth surface and painted with oil paints.

Commissioning date of chlorination house was the 11th June 1970.

5.11.3.3 Break Pressure Tank

During 1970 the automatic valve in the chamber of the Break Pressure Tank, was placed and the roof slab of the same was cast.

Also the fencing of the acquisitioned area was completed.

5.11.4 Famagusta Water Board Schemes

The Department of Water Development undertook the execution of the following schemes on behalf of the Famagusta Water-Board.

1. To lay and test the pipes from Phrenaros Reservoir to Stavros Reservoir Famagusta.
2. To construct the Phrenaros Reservoir.

5.11.5 Pipe-laying and testing

The trenching was awarded by contract to Messrs. Yiakoumettis and Soteriou of Famagusta, while the Departmental Staff was responsible for the supervision of the work the checking of the levels, and the laying and the testing of the pipes.

The length of the Phrenaros-Famagusta Pipeline is 30752 ft (9380 m).

Asbestos - Cement pipes were used for the pipeline as follows:

Chainage ft From	To	Length ft	Diameter	Class	Wall thickness mm	Origin
0	11 000	11 000	600 mm	(12kg/cm^2)	32	Sigwart Egypt
11 000	20 000	9 000	500 mm	(12kg/cm^2)	27	Eternit Lebanon
20 000	30 752	10 752	500 mm	(18kg/cm^2)	38	" "
		30 752				

The pipelaying started on the 2nd January 1970 and was completed on the 30th August 1970.

The testing of the pipes started on the 12th March 1970 and it was completed on the 3rd September 1970.

For this pipeline 26 tests were carried out as follows:

Diameter and class	No of successful tests	No of unsuccessful tests	Total	Pipes Broken
600 mm "12"	4	9	13	9
500 mm "12"	3	5	8	5
500 mm "18"	3	2	5	2
T o t a l	10	16	26	16

5.11.5.2 Valve Chambers

The construction of the valve chambers started in March 1970 and was completed in November 1970.

A total number of 35 Valve-chambers was constructed.

5.11.6 Phrenaros Reservoir

The excavation of the Reservoir was completed during 1969.

During 1970 the whole work of the Phrenaros Reservoir was completed as follows:

5.11.6.1 Casting of the walls

The walls were cast in three lifts. The casting started late in December 1969 and it was completed on the 16th June 1970.

5.11.6.2 Columns, Beams, Floor-Slabs, Roof-Slabs

The casting of the columns, of the main beams, of the floor-slabs and of the roof-slabs, started simultaneously.

The total number of the columns cast was 44.

For the construction of the floor slabs the following materials were used:

A 6" thick layer of sand gravel drain filter layer.
A 4" thick layer of lean concrete, and 8" thick slab of reinforced concrete. The floor slab was separated in seventy two parts. P.V.C. water stops were used at joints of the slabs and the vertical joints of the walls.

For the drainage of the bottom of the Reservoir 4" diameter perforated asbestos cement pipes were placed as collectors and 6" diameter perforated pipes as main drains.

The casting of the roof slab commenced on the 31st March 1970 and was completed on the 4th June 1970.

Before the casting of each part of the slab, the main beam on which the slab is placed, was cast. Six main beams were cast.

The roof-slab was divided into eight parts.

After the completion of the test the walls were back-filled and the Reservoir was put into operation on the 15th October 1970.

During the year under review all valve chambers near the Reservoir were completed.

5.11.6.3 Guardhouse and Chlorination House

The erection of the Guardhouse and Chlorination-house, started on the 25th August 1970.

During 1970 the house was erected and the roof-slab was cast.

This work will be completed early in 1970.

Famagusta Water Supply Project - Summary of Expenditure

Year	Government Works		Famagusta Water Board Works		Total	
	Partial	Cumulative	Partial	Cumulative	Partial	Cumulative
	£	£	£	£	£	£
1968	100 055	100 055	-	-	100 055	100 055
1969	837 738	937 793	26 482	26 482	864 220	964 275
1970	95 258	1 033 051	194 016	220 498	289 274	1 253 549

5.12 Pomos and Kiti Distribution systems-Special Construction Report

by

N. Tsiourtis
Topographer/Irrigation Engineer

Construction works

5.12.1 Pomos Distribution System (completion of stage II & Stage III.) Work on this part of the project was started on May 31st and by the end of 1970 a total of 77000 ft. of 4" pipe G-I have been laid.

To complete stage II and stage III of the system a total of 94000 ft. of 4" G-I pipes at a cost of £64000 are to be installed. The project is expected to be completed by June 1971.

5.12.2 Kiti Distribution System (Extensions to Pervolia)

This stage of the scheme provides the installation of 14200ft. of prefabricated reinforced polycentric channel at a cost of £ 16000.

Work on the construction has started by the begining of November and only a small part has been completed in 1970. It is expected that this stage is to be completed by June 1971.

VI. MAINTENACE AND OPERATION DIVISION

by

K.C. Hassabis
Head of Division

The Division includes two branches

i. Maintenance and Operation of Major Irrigation Projects

ii. Maintenance and Operation of Domestic (Town) Water Supplies.

6.1 Maintenance of Major Irrigation Projects

The projects with which the Division is concerned are all the Government Projects, i.e. Dams and related Distribution Systems, and all the Contributory Dams which are operated by Irrigation Divisions.

The work of the Division may be divided into three functions:

6.1.1 (a) The regular inspection of the Works

This is normally done by the Engineers of the Department, each assigned with the Inspection of a number of dams. They have to inspect regularly each project and report on any problem that requires special attention or necessitates repairs.

6.1.2 (b) The taking of regular observations and records on the behaviour and condition of the various structures

These observations and records are taken by a special team of the Topography Branch and by Technical officers assigned to each of the most important dams.

The results are plotted and reviewed as necessary.

6.1.3 (c) The Actual Maintenance Work

The various projects are divided into two categories.

6.1.3.1 (i) Government Projects : These have been built and are being maintained and operated entirely by Government.

6.1.3.2 (ii) Contributory Projects

These projects belong to Irrigation Divisions who contribute a part of the construction cost the remainder of the cost being borne by Government. Maintenance of such projects is normally done by the Irrigation Division under the supervision and advice of the Technical Staff of the Department.
In cases of Major maintenance works, the Department undertakes the work and contributes part of the cost.

Short notes on the most important maintenance works carried out during the year are given below, while a summary table giving the expenses incurred during the year are given below:

6.1.4 Summary of Expenditure on Maintenance for last three years

		1968	1969	1970
1.	Dams - Govt.	£ 858	£3 638	£3 014
2.	Distribution-Govt.			£2 314
3.	Sub-Total	£ 858	£3 638	£5 328
4.	Government Share on Contributory Scheme	£ 780	£1 910	£1 943
5.	Sub-Total (3)+(4)	£1 638	£5 548	£7 271
	Contribution-Village	£ 560	£1 123	£ 971
6.	T o t a l	£2 198	£6 671	£8 242

6.1.5 Maintenance of Government Projects

Summary of Expenditure for last three years

	1968	1969	1970
Dams Distribution systems	£ 858	£3 638	£3 014 £2 314
Total	£ 858	£3 638*	£5 328

* Note: An additional amount of £3 944 from a Special "Flood Damages" Vote was spent in 1969 for the repair of flood damages on Polemidhia Distribution System.

6.1.5.1 Argaka-Magounda Project

Expenditure £148.-

The tunnel gate, which was not in an operating condition for several years was repaired. Also routine maintenance was done such as painting of metal work, cleaning of tunnel from silt, removing vegetation growth from embankment etc.,.

6.1.5.2 Athalassa Dam

Expenditure £36.-

The expenditure indicated above was incurred for the repair of the water level indicator and other minor maintenance works.

In December 1969 large floods occurred in the catchment area of the Dam, and there was considerable overflow through the unlined spillway channel of the dam causing serious erosion.

When building the dam the spillway was left unlined for the time being, due to the infrequency of floods in the area with a view to lining the spillway at a later stage.

After the occurrence of the above floods a design was prepared for a permanent lining of the spillway. However the expenditure involved was not approved and an alternative temporary arrangement was implemented at a cost of £1 650.- (This amount is not included under maintenance). This involved the construction of a short concrete apron at the entrance of the spillway and the widening and regrading of the channel.

6.1.5.3 Ayia Marina Dam Project

Expenditre: £203. i.e. Dam: £134.-, Distribution:£69.-

The guardhouse was repaired, the lower tunnel was plastered, and general painting of metal work, and painting of 96 sluice valve manhole covers was done.

6.1.5.4 Kalopanayiotis Dam Project

Expenditure: £689 i.e. Dam: £661, Distribution System:£28.-

The work done included:

Repairing of the Lefka pipeline, and cleaning of the Lefka line intake weir, painting of all metal work, treatment of bridge timber, replacement of the steel wire of the tunnel gate position indicator, investigations for possible additional grouting works, purchase of spare parts for water meters etc.

6.1.5.5 Kiti Dam Project

Expenditure: £920.- i.e. Dam:£540.- Distribution System:£380

The work done included:

Painting of metal work structures;

Replacement of part of rip-rap at the end of spillway channel;

Repair of water meters;

Cleaning of canals, and filling of canal joints with gutta-terna.

Cleaning of silt at the end of tunnel.

6.1.5.6 Mavrokolymbos Dam Project

Expenditre:£277 i.e. Dam: NIL Distribution System:£277.-

The work done included:

Cleaning of canal, and filling of canal joints with gutta-terna;

Repair of a length of 30 ft. of canal

6.1.5.7 Polemidhia Dam Project

Expenditure:£1835.- i.e. Dam:£430, Distribution System:£1405

The work done included:

Painting of tunnel gate;

Purchase of a number of 21" dia. A.C. pipes, and 21" dia. Gibault joints for stock purposes, and purchase of spare parts for water meters;

Cleaning and repair of water meters.

6.1.5.7.1 Additional Grouting Works

In order to reduce the considerable amount of leakages occurring mainly from the left hand abutment, extensive additional grouting works were carried out by the Department extending the grout curtain on the left abutment. These works were done from funds specially provided for this purpose. Grouting works were completed in September 1970, but since no water was collected in the dam until the end of the year, no conclusion can be drawn as yet on the effect of these works until the water level in the dam is high enough to make the comparison with the leakages observed in previous years possible.

6.1.5.8 Pomos Dam Project

Expenditure:£191.- i.e. Dam:£36, Distribution System:£155

The work done included:

Repair and painting of guardhouse;

Painting of 53 manhole covers and 18 manhole trushrucks;

Repair of 13 No. Sluice Valves and replacement of 2 No. Sluice Valves;

Installation of water level indicators in 8 No. outlet boxes.

6.1.5.9 Syngrassi Dam Project

Expenditure: £729 i.e.

Dam maintenance £542.-

Operation of Ayios Pappos recharge £187.-

The work done included:

Concrete works at the inlet channel to pump well and pump house.

6.1.5.10 Yermasoyia Dam

Expenditure : £300.-

The spillway radial gates were painted.

The tunnel gate rubber sealing ring was replaced and the gate and steel transition lining were painted from funds available as balance from the construction of the Dam.

6.1.6 Maintenance of Contributory Projects

The total expenditre on these projects for the last three years is shown below, while the break-down of expenditure for each project during 1970 is given at the end of this section.

	1968	1969	1970
Government £	780	1 910	1 943
Contribution £	560	1 123	971
T o t a l £	1 370	3 033*	2 914

* Note: During 1969 an additional amount of £650 was spent from a Special Government Flood Damages Vote to repair flood damages at Trimiklini Dam.

The Work done during the year is indicated in the remarks column of the table indicating the expenditure incurred on these works during 1970.

Maintenance of Dam Projects-Summary table of expenditure

1. Government Projects

No.	Project	Expenditure			Remarks
		Dam £	Distr. £	Total £	
1.	Argaka	148	-	148	Repairs of main-gate general painting maintenance
2.	Athalassa	36	-	36	Water level indicator and minor maintenance works
3.	Ayia Marina	134	69	203	Repairs of guardhouse and general painting & maintenance-plastering of lower tunnel
4.	Kalopanayiotis	661	28	689	Part repair of Lefka pipeline and inlet weir. General cleaning and painting. Repair of Irrigation meters
5.	Kiti	540	380	920	General painting of metal work and repair of spillway bucket rip-rap. Cleaning of canals and repair of joints
6.	Mavrokolymbos	-	277	277	Painting of manhole covers, repairing of joints and of 30ft of canals cleaning of canals
7.	Polemidhia	430	1405	1835	Painting of tunnel gate purchase of spare parts for water meters and gibault joints and general maintenance of distribution system
8.	Pomos	36	155	191	Repair of guard house. Painting of all manholes and sluice valves and general maintenance
9.	Syngrasi	729	-	729	Modification to intake and repair to pumphouse
10.	Yermasoyia	300	-	300	Painting of Radial Gates
	T o t a l	3014	2314	5328	

Maintenance of Dams - Expenditure

2. Contributory Dams

No.	Project	Expenditure			Remarks
		Govt.	Contr.	Total	
		£	£	£	
1.	Agros	18	9	27	Construction of a culvert
2.	Akrounda	12	6	18	Repair of main gate
3.	Ayios Loucas	45	23	68	Repair of embankment and rip-rap
4.	Famagusta Area Recharge Dams	-	-	-	
5.	Galini	-	-	-	
6.	Guenyeli	-	-	-	
7.	Gypsos	85	43	128	Modification of outlet System
8.	Kandou	-	-	-	
9.	Kanli	-	-	-	
10.	Kalo-Khorio(Klirou)	-	-	-	
11.	Kyrenia Area Recharge Dams	24	12	36	Repairs to embankment
12.	Lefka-Kafizes	20	10	30	Repair of main pipeline
13.	Lefka-Marathasa	17	8	25	Repairs to outlet system
14.	Lythrodonda(2 dams)	116	58	174	Installing of protective grille and 8" dia. perforated outlet system.
15.	Mia Milia	-	-	-	
16.	Morphou Serrakhis	47	23	70	Repair and painting of outlet system. Raising of 100 ft. of the rural Argaki-Morphou road
17.	Ovgos	-	-	-	
18.	Pera-Pedhi	-	-	-	
19.	Petra (2 dams)	-	-	-	
20.	Prodromos	193	97	290	Repair of curbing
21.	Pyrgos	135	67	202	Repair of right abutment of the dam, seepage collection tank, outlet and distribution system
22.	River Training (General)	-	-	-	
23.	Trimiklini	1231	615	1846	Replacing of 1400 ft of 8" dia outlet main destroyed by floods in 1968-69
	T o t a l	1943	971	2914	

6.2 Management and Operation of Government - Dam Projects

6.2.1 Management

Each Government Dam Project is managed by a Dam Management Committee appointed by the Council of Ministers. This Committee is composed of the District Officer, of the district in which the project located, as Chairman, and of representatives of the Department of Agriculture, of the Department of Water Development and of the Beneficiaries as members.

The committee has the overall responsibility for the management of the project, decides on policy and other matters on the basis of regulations prepared by Government and approved by the House of Representatives, prepares the Budget, appoints the necessary personnel for the actual operation of the project i.e. the distribution of water, the collection of fees etc.

The day to-day administration is done by the staff of the District Officer.

6.2.2 Water Charges

The unit water charges for the water sold from Government projects referred to as water rates are fixed by the Council of Ministers and incorporated in the Regulations for the Project.

These charges are usually a fraction of the actual unit cost of the water, so that all projects are actually subsidized by Government.

In fixing the water rates the main considerations are the following: The unit cost of water for the particular project concerned, the weighted average unit cost of water for the Government projects, the type of crop irrigated and the expected returns as related to the amount of water consumed, the desire to encourage the implementation of improved irrigation systems so as to increase irrigation efficiency and thus save water and also to discourage uneconomic use of water for the irrigation of crops with low eash returns.

The water rates in force in 1970 are shown in the following table:

Water Rates for Government Dam Projects - 1970

Project	Mils per cubic meter						
	Over-flow	Vege-tables	Vines	Deci-duous	Citrus	Others	Flat
1 Argaka-Magounda	5	-	-	-	-	-	10
2 Ayia Marina	5	-	-	-	-	-	10
3 Kalopanayiotis	-	-	-	-	-	-	13
4 Kiti	3	-	-	-	-	-	10
5 Mavrokolymbos	5	10	15	15	15	15	-
6 Polemidhia	3	7	15	15	15	10	-
7 Pomos	5	-	-	-	-	-	10

6.2.3 Water Utilization

The year under review, 1970, was one of the dry years on record, and the quantity of water collected in the various dams was low, especially in those where utilization is high.

Thus the water available for irrigation from the various Government dams amounted to $6.16 \times 10^6 m^3$ (excluding Yermasoyia Dam) as compared to $9.8 \times 10^6 m^3$ for 1969.

The amount of water sold for irrigation in 1970 was 1.961×10^6 i.e. 32% the quantity of water available.

The gross income from the sale of water in 1970 was £22 594 as compared to £21 241 for 1969 i.e. there was a slight increase of about 6% over the previous year. The following table gives comparative figures for income and expenditure for the last three years.

			1968	1969	1970
1	Gross Income	£	15 363	21 241	22 594
2	Operation expenses	£	3 507	5 911	5 849
3	Maintenance expenses	£	858	7 582	5 328
4	Total Expenses	£	4 365	13 439	11 177
5	Net Income	£	10 998	7 748	11 417

Although there was some increase in the utilization of the available water for irrigation due to the extension of the Distribution Systems in Mavrokolymbos, Pomos and Kiti (these systems are not yet completed), and the extensive use of the water by the farmers, the level of utilization is still very low. It is expected that with the completion of the distribution systems, there will be a substantial increase in the utilization of the available water and thus these expensive projects will become a positive asset to the economy of the island, and justify their construction.

Detailed information regarding the operation of each project, is given below.

At the end of this section a table is given where all the relevant data for 1970 are summarized.

6.2.3.1 Argaka Magounda Dam

No distribution system has yet been constructed because of the question of water rights which was settled only at the end of 1970. It is anticipated that in 1971 works will start on the construction of the distribution system which will command an area of 2300 don.

The conveyance and distribution of water from the dam to the fields is at present made through earth canals which result in high losses of water. Surface methods of irrigation are used in the project area.

At the beginning of the irrigation season the dam was full with a total quantity of 1.150 x $10^6 m^3$ available for irrigation. Out of this quantity only 91.6 x 10^6 m^3 (or 7.9%) of water was used for irrigation while the rest was allowed to flow back to the riverbed at the end of the irrigation season, through the outlet tunnel.

The water has been used for irrigation of early vegetables, normal vegetables and late vegetables.

The management of the dam is undertaken by a Government committee which appointed a water guard to distribute the irrigation water and to collect the charges. The water guard was paid on daily wages whose total expense in 1970 amounted to £262. On the same year the gross income from water sales was £916.

Routine maintenance works were carried out on the dam, such as general painting of metal works and repairs to the concrete works.

The Table below shows the Gross income, total expenses, amount of water sold and other data for the last three year.

	Year	1968	1969	1970
1	Amount of Water Sold m^3	38 x 10^3	57.7 x 10^3	91.6 x 10^3
2	Gross Income £	380	577	916
3	Operation Expenses £	123	250	262
4	Maint. Exp. £	-	85	148
5	Total Expens. £	123	335	410
6	Net Income £	257	242	506
7	Area Irrigated don.	N.A.	N.A.	N.A.

The above table shows that the water consumption has been increasing since the first year of operation.

Nevertheless the quantity of water used is only 7.9% of the capacity of the dam.

6.2.3.2 Ayia Marina Dam

Here the distribution system delivering water to every plot through closed conduits has been completed. Water application within the farms in the project area is mainly made by surface methods.

The irrigation season lasted twelve months commencing on January the 1st and terminating on the 31st of December 1970. At the beginning of the irrigation season the dam was full with a total quantity of 300 m^3 of water, inflow occuring also later in October-November and December. During the same year a total quantity of 270 000 m^3 of water has been delivered to the farms

for irrigation of vegetables (early Normal and Late) Citrus, Deciduous trees, Bananas and cereals (Supplementary irrigation).

The distribution of water to the farms was supervised by one water guard who was also responsible for the collection of the charges. The income from the sales of the water amounted to £2703, while the operation expenses were £535.

Routine maintenance works were carried out such as repairs of guardhouse, general painting of the metal works and plastering of the tunnel. The cost of Maintenance works was £203.

The Table below shows the incomes and expenses as well other items for the last three years of operation .

	Year	1968	1969	1970
1	Amount of water sold m^3	220×10^3	279×10^3	270×10^3
2	Gross Income £	2493	2351	2703
3	Operation Expenses £	837	780	535
4	Maintenance Exp. £	-	153	203
5	Total Expenses £	837	933	738
6	Net Income	1656	1418	1965
7	Area Irrigated don.	N.A.	300	300

Comparing the quantity of water used in 1970, to the total capacity of the dam it is seen that the water of this project is utilized fully.

At present the possibility of diverting water from another area to help filling the dam every year is under consideration.

6.2.3.3 Kalopanayiotis Dam

Here the distribution system delivering water through closed pressure conduits to each farm outlet has been completed. All farms are equiped with a farm network for improved methods of water application. The water is applied to the plants mainly by Hose-Basin.

At present the main distribution system commands an area of 340 don. all of which have been levelled. This area has been planted with deciduous trees.

During the year 1970 the whole area has been irrigated from the Dam. In addition to this, an area of 95 donums possessing water rigths was irrigated from the river flow, which was fed from leakages from the dam.

The quantity water used during the year 1970 was limited due to the fact that:

(a) The plantations are young;
(b) The water conveyance and application efficiencies are very high;
(c) The extent of the net irrigated area as compared to the gross area is very limited.

It is estimated that the net irrigable area is less than 250 donum thus reducing by more than 30% our original estimates on water requirements.

The year 1970 was one of the driest hydrological years in 51 years of records and some difficulties were faced concerning the availability of water for irrigation of the area. Nevertheless it must be mentioned that about 100 000 m^3 of water was used by the Fisheries Department for trouts breeding purposes.

The quantity of water sold was at 48 000 m^3, with a gross income of £626.

Maintenance expenses totalling £486 were incurred mainly for the repair of the Lefka pipeline, inlet weir general cleaning and painting of metal works and repairs of irrigation meters.

The table below shows the amount of water sold and related data for the last three years.

	Year	1968	1969	1970
1	Amount of water sold m^3	8.9×10^3	27×10^3	48×10^3
2	Gross Income £	116	352	626
3	Operation Expenses £	-	160	544
4	Maintenance Expenses £	-	-	586
5	Total Expenses £	116	160	1130
6	Net Income £	116	192	-504
7	Area Irrigated	110	250	340

It is seen that the water use (amount of water sold every year) is increasing continuously.

6.2.3.4 Kiti Dam

The Kiti distribution system has not yet been completed. Only stages I and II and some extensions to Pervolia have been completed commanding an area of 1325 dons, Stage III is planned for construction in 1971 and stage IV later on. The complete scheme is to provide water at the head of each plot through open canals provided with flow control devices for quantitative measurement of water.

At the beginning of the 1970 irrigation season the water available at the dam was 113 000 m^3 out of which 85 200 has been sold, the rest being lost as seepage, evaporation and conveyance losses, i.e. 75% of the water available at the dam was actually used at the field.

The irrigation season lasted only 3 months from March to May. Due to this reason the amount of water used with respect to the water impounded was the highest on record. Relative data for other years can be seen in the Table below.

Potatoes were the main crop to be irrigated from the dam with supplementary irrigation to citrus. A total area of 200 donums of potatoes and 40 donums of citrus (supplementary) has been irrigated from the dam in the year 1970.

The Water Commissioners for the operation and management of the dam appointed a water guard for water distribution and for collection of charges. Operation & Maintenance expenses during the year 1970 exceed the gross income because of the amount paid as rent to the Evcaf lands submerged in the reservoir. The maintenance expenses were for the general painting of metal works repairs of spillway bucket rip-rap, cleaning of canals and repairs of joints.

Below in tabular for the amount of water sold and relative income and expenses for the last three years are presented.

	Year	1968	1969	1970
1	Amount of water sold m^3	80 x 10^3	243 x 10^3	85 x 10^3
2	Gross Income £	800	2425	852
3	Operation Expenses £	260	920	1347
4	Maintenance Expenses £	509	2100	920
5	Total Expenses £	769	3070	2267
6	Net Income £	31	-645	-1415
7	Area Irrigated	N.A.	780	240

Thus the expenditure during the year 1970 has exceeded the income by £1415. The operation expenses included an amount of £825 paid to Evcaf as rent for the land which is below the Normal Water Level of the Dam.

6.2.3.5 Mavrokolymbos Dam

Here it is planned to implement land consolidation. Therefore any works related to the completion of the distribution system (laying of tertiary pipelines) have to be postponed until the land consolidation plans are finalized. By the end of 1969 the following parts of the distribution system were completed.

(a) Main conveyor (canals upto Kissonerga and pipeline up to Khlorakas)
(b) Secondary branches in Kissonerga and Potima

No secondaries were laid in the Khloraka area

The 1970 irrigation season lasted for 12 months with irrigation of early, normal and late vegetables citrus, and Bananas. During 1970 an amount of 400 x 10^3 m^3 of water was sold to farmers from Kissonerga, Emba and Khloraka while an amount equal to 463243 m^3 has been given to the Potima Chiftlik as water rights.

At the beginning of the irrigation season the dam was full to spillway crest. Although the quantities of water sold are much higher than those in previous year there is a large margin for further increase, provided the distribution system is completed.

The following Table gives the relevant data for the last three years of the operation of the dam.

	Year	1968	1969	1970
1	Amount sold	-	-	400 x 10^3
2	Gross Income £	-	665	4125
3	Operat. Expenses £	-	203	764
4	Maintenance Expenses £	-	227	277
5	Total Expenses £	-	430	1041
6	Net Income £	-	235	3084
7	Area Irrig.	-	N.A.	N.A.

During 1970 the Committee appointed 2 water guards for distributing the water and collecting the charges. The operation expenses, around £764, were paid mainly as wages to the two water guards. Because of difficulties faced with regard to the operation of the distribution system (long distances from water source) the Committee has decided that Walkie-Talkies should be purchased for used, by the water-guards. This will help in co-ordinating the operation of the three functional parts of the distribution system thus saving a large quantity of water and time.

Maintenance works were confined mainly, on the distribution system such as painting of manhole covers, repair of the main canal joints, cleaning of canals and general repairs of the canal where needed. The expenses for maintenance amounted to £277.-

6.2.3.6 Polemidhia Dam

Here the distribution system has been completed in 1968 commanding an area of about 2500 don. Further extension of the distribution system to deliver water to another 950 don. is to be carried out in connection with the Yermasoyia distribution system. The extension of the distribution system seems imperative since the supply of water supplied from the dam is used at present for supplementary irrigation only.

By the end of 1970 additional grouting works which have started in 1969 have been completed. A total of 149 boreholes were drilled with a total footage of 21 663 ft. all situated on the left side of the reservoir (looking downstream). The quantity of dry material injected was amounted to 172 800 kgms at a cost of £31 000. It is expected that the seepage losses which were considerable shall now be reduced considerable.

By the beginning of the irrigation season 1st January 1971 the amount of water in the dam was only 489 x 10^3 m^3 with inflow occuring continuously. The total quantity available for irrigation for the 1970 irrigation season is estimated around 1199 x 10^3 m^3.

This quantity has been taken from the dam either for irrigation or was lost as evaporation and seepages. The different quantities of water as consumed or lost are shown below:

Water sold	74 x 353 m^3
Water rights	105 000 m^3
Losses (seepage+ Evaporation)	267 000 m^3
Water left in dams	80 000 m^3
Total	1199 000 m^3

The water was used for supplementary irrigation of the citrus and vines plantations and of some vegetables in the Zakaki area.

The balance of the water required for the irrigation of the area served from the dam was extracted from the local aquifer.

The operation expenses amounted to £1992 and were paid in wages to the Inspector in Charge, to the foreman-guard, to the night guard and to the water guard.

Maintenance works were carried out such as painting of tunnel gate, purchase of A.C. pipe, Gibault joints, spare parts for water meters etc., at a total cost of £1835.

The following table shows the gross income and expenses for the last three years.

	Year		1968	1969	1970
1	Water sold	m^3	0.658×10^6	1.2704×10^6	744×10^6
2	Gross Income	£	9771	12687	10132
3	Operation Expenses	£	1737	2555	1992
4	Maintenance expenses	£	-	4312	1835
5	Total expenses	£	1737	6867	3827
6	Net Income	£	8034	5320	6305
7	Area Irrigated		N.A	2000	2000

6.2.3.7 Pomos Dam

Stage I of the distribution system, main canals and main pipes, have been completed in 1967. In 1970 work has started for the completion of the distribution system which provides the installation of outlets to every farm head. Water measurement is made at the head of every main branch by a measuring weir.

The system commands an area of 2500 donums, out of which 2 300 were levelled. Land levelling works were completed in 1970. No farm networks have so far been installed in any of the farms commanded by the distribution system. Surface methods of irrigation are used which sometimes result in soil erosion especially in the newly formed terraces.

At the beginning of the irrigation season, 12th January, 1970, the dam was full with a total quantity $860 \times 10^3 m^3$ of water. Out of this quantity only 475×10^3 m^3 (or 55%) has been used for irrigation. Overflow had continued till May the 18th 1970. This water has been used for the irrigation of the following crops.

		Normal	Total
Cucumber	260 don.	80 don.	340
Tomatoes	140 "	100 "	240
Melons	150 "	80 "	230
Citrus	10 "	10 "	10
Cereals	151 " (supplementary)		151
Others	88 "	30 "	118
Total	799 don.	300 "	1089

The Committee has appointed two water guards for the distribution of water and to collect the charges. The operation expenses amounted to £405.

Maintenance expenses amounted to £191 and were incurred for repairs of the guard-house, painting of all metal-works (man-hole covers sluice valves) and general maintenance of dam and canals.

Following is a table indicating the relevant data for the last three years.

	Year		1968	1969	1970
1	Amount of water sold	m^3	$180x10^3$	$304x10^3$	$475x10^3$
2	Gross Income	£	1801	2184	3284
3	Operation Expenses	£	548	620	405
4	Maintenance expenses	£	349	285	191
5	Total Expenses	£	897	905	596
6	Net Income	£	904	1279	2649
7	Area Irrigated		N.A	960	1089

- Data on the Operation of Government Dam Projects for the year 1970

Ser. No.	Project	Capacity $m^3 \times 10^6$	Stored water $m^3 \times 10^6$	Water used $m^3 \times 10^6$	Command Area don.	Irrigated Area don.	Gross Income £	Expenditure			Net Income	Remarks
								Operation £	Maintenance £	Totals £		
1	2	3	4	5	6	7	8	9	10	11	12	
1	Argaka-Magounda	1.150	1.150	0.090	3 300	N.A.	916	262	148	410	506	No distribution system
2	Ayia-Marina	0.300	0.300	0.270	1 500	340	2 703	535	203	738	+1965	Distribution system completed
3	Kalopanayiotis	0.358	0.358	0.048	340	340	626	544	689	1 233	- 607	-do-
4	Kiti	1.610	0.113	0.085	6 200	240	852	1 347	920	2 267	-1415	Distribution system partly completed
5	Mavrokolymbos	2.180	2.180	0.400	4 750	N.A.	4 125	764	277	1 041	+3084	-do-
6	Polemidhia	3.430	1.199	0.744	2 912	2 483	10 132	1 892	1835	3 827	+6305	Distribution system completed
7	Pomos	0.860	0.860	0.324	2 500	799	3 240	405	191	596	+2644	Distribution system partly completed
	Sub-total		6.160	1.961	10 502	N.A.	22 594	5 849	4 263	20 112	12482	
8	Yermasoyia	13.500	-	-	-	-	-	-	300	300	-300	Distribution system not construct.
9	Syngrassi	415	-	-	-	-	-	-	729	729	-729	Recharge scheme
10	Athalassa		-	-	-	-	-	-	36	36	- 36	Anti-flood scheme
	T o t a l						22 594	5 849	5 328	11 177	11417	

6.3 Domestic Water Supply Branch Management of Domestic Water Supplies under the Provisions of Law Cap. 350

During the year under review, the activities of this Branch have continued on an increased scale soon after the operation of the pumping stations at Khirokitia and the delivery of water to Famagusta Town.

The main characteristic of the year 1970 was that rainfall followed generally the drought pattern and shortage of water was experienced in urban and rural areas including Nicosia Town and Suburbs.

The application submitted by the National Committee Cyprus for "Corporate" membership to the International Water Supply Association was approved early in the year at an annual fee of £40.-. This fee is shared up among the four existing Water Boards and this Department.

Details of the Branch activities are given below

6.3.1 Administration of Greater Nicosia Scheme

Amalgamation of this scheme with that of the Nicosia Water Board is still on paper. It is expected that a Committee will be set up to deal with this matter.

6.3.1.1 Water Supply to Nicosia Suburbs

As it is known, the responsibility for the water supply of these communities lies with this Department as Administrator of the Greater Nicosia Scheme. Though its sources could safely produce over 13,000 cu. meters daily, being capable to meet maximum consumption of 10,300 cu.m. recorded for its "area of supply" yet, restrictions were imposed due to insufficient supply in the Nicosia Water Board's area.

During the year 1970, the distribution system of Greater Nicosia Scheme was extended by 33,150 ft. of 6" ϕ and 4" ϕ asbestos cement pipes, resulted from new parcellations, and 489 new house-connections were made. By 31.12.1970 the total under of the consumers reached the figure of 9,584.

A statement showing expenditure and revenue of the Greater Nicosia Scheme for the year 1970 is given on page 163.

6.3.2 Nicosia Town and Suburbs Water Supply

As aforementioned, due to the dry weather prevailed and the even increasing demand in water, shortage was observed and restrictions to the supply were imposed from 1.8.1970 - 17.10.1971, Water was provided to the whole area supply every other day, having separated the various zones in two sets, supplying one set every day. The proceedure followed worked in a satisfactory way especially with the houses having storage facilities. Particulars of the supply during restrictions are given on page 164.

The total amount of water conveyed from the various sources was 7,503.234 cu. meters and was distributed as follows, less 338.170 cu. meters being quantity of unaccounted water:

Greater Nicosia Scheme	"area of supply"	2,511.506 c.m.
Nicosia Water Board	"area of supply"	3,995.924 c.m.
Nicosia Water Commission	(Town within walls)	657.634 c.m.

The water quality and hygiene have been kept within potability's standards. Blending method is used where the water of some sources (Laxia, Makedonitissa, Dhali) is defined to be "fairly saline and/or hard". Efforts are made that the NaCl and $CaCo_3$ contents in water delivered for consumption are below 400 p.p.m. Chlorination is applied at the rate of 0.5 p.p.m. at the various service reservoirs. Similarly, regular chemical and bacteriological analyses are made by the Government Laboratory to the staff of which we express, on this occasion, our sincere thanks and appreciation.

The highest consumption was 26,995 cu. meters daily or 5,940.000 gallons, equal to appr. 50 gallons per capita on an estimated population of 120.000.

The proposal of extending the boundaries of Nicosia Water Board, so that the town within walls may also be included, is in progress. In the meantime, Messrs. MacLaren International Corporation have been entrusted with the preparation of a feasibility study for a water supply scheme to the "walled city". The construction of such scheme will be co-ordinated with the execution of sewerage works which are scheduled to start next year.

The shortage of water has pushed efforts towards the supplementation of supply. Parallel to the execution of a small scheme which provides water from Tseri at the region of 1,500 c.m. daily area, consultants from abroad were invited for the preparation of new scheme from Pendayia to operate in conbination with existing installations of Morphou Bay Scheme. If that would prove feasible, a better utilization of the existing main pipeline could be achieved through new boosting stations, doubling its conveyance capacity.

6.3.3 Water supply to Government Residences and Institutions

Separate sources and distribution system serve the purpose. This applies to water supplied to all Government Residences and Institutions for irrigation at Government expenses.

Having carried out some minor improvements of one of the existing sources (borehole P3) water supply continued uninterrupted all over the year.

6.3.4 Technical advice to Water Boards

Regular meeting of the four existing Water Boards were attended by this Branch and on several occasions individual technical advice was offerred. Usually every Water Board meet once in a month, but other activities, especially in the case of Nicosia, render our approach rather continuous.

Facts about each existing Water Boards, as well as description of their water position are outlined below:

6.3.4.1 Nicosia Water Board

Existing sources should be supplemented immediately to a large extent. Additional supplies should provide substitution of all present sources not considered reliable either because of quantity or quality. The town is expanding rapidly and the consumption of water is expected to rise by 1,000 c.m. every year. Likewise the distribution system requires major improvements.

(a) The total quantity of water supplied was 2,975,030 c.m.

(b) The total quantity of water consumed registered by area meters was 4,653,558

(c) The total maximum summer consumption per day (including Nicosia Water Commission) was 16,695 c.m. on 19.6.70

(d) The total number of consumers on 31.12.70 was 11,572.

(e) (i) Extension of distribution system

170 ft. of 6" ϕ A.C. Pipes
13, 472 ft. of 4" ϕ A.C. Pipes

Re-laying of distribution system (Arch. Makarios III and Ayios Andreas Aven. and Limassol Road).

1,680 ft. of 12" ϕ A.C. Pipes
485 ft. of 6" ϕ A.C. Pipes
3,354 ft. of 4" ϕ A.C. Pipes

(ii) Total length of distribution system (Including extensions of 1970)

12,100 ft. of 12" ϕ A.C. Pipes
25,000 ft. of 10" ϕ A.C. Pipes
12,930 ft. of 8" ϕ A.C. Pipes
80,756 ft. of 6" ϕ A.C. Pipes
589,334 ft. of 4" ϕ A.C. Pipes

(f) (i) The total number of hydrants installed in 1970 was 18.

(ii) The total number of hydrants installed up to 31.12.70 was 806.

6.3.4.2 Limassol Water Board

Although the two boreholes drilled in Kourris river and from which a quantity of 320,000 gallons daily can be provided, they have not so far been put in operation yet, the supply of water was regular all over the year and the maximum consumption reached the figure of 15,656 cu.m. Nevertheless, for the purpose of "planning ahead" another scheme to provide an additional quantity of 1.5 m.g.d. is under study. This scheme will comprise of boreholes to be drilled in "Amathos" river downstream the Yermasoyia Dam. The implementation of the "policy" over the ownership of these boreholes, whereas both Ministry of Agriculture and Natural Resources and Limassol Water Board claim to have rights, has created a dispute between the parties concerned and designing of the scheme has been postponed.

(a) Total quantity of water supplied from our sources ... . 3,973.774 c.m.

(b) Total quantity of water consumed as registered by Area Meters and supplied direct from boreholes 2 and 7 ..... 4,097.168 c.m.

(c) Maximum daily consumption in summer on 18.8.70 ..... 15.014 c.m.

on 22.9.70 ..... 15.356 c.m.

(d) Total number of consumers as at 31.12.70 ..... 16.447 c.m.

(i) Extension of distribution system:

pipelines laid during 1970 . . .

60.911	'/4"
3.329	'/6"
390	'/8"
64.630	'

(ii) Total length of distribution system

669.554	'/4"
92.881	'/6"
29.117	'/8"
27.000	'/10"
817.552	'

(f) Number of hydrants:

(i) installed in 1970	68
(ii) Total installed	873

6.3.4.3 Famagusta Water Board

Pumping from the boreholes at Khirokitia and delivery of Stavros Reservoirs started on 10th February 1970. During the year, an amount of 863,603 c.m. of water was supplied valued to £43,180.150. Despite of this supplementation the town's requirements could not be faced at full and restrictions were imposed during summer. During restriction period, water was provided for 16-18 hours daily. Work on the construction of the Lefkara Dam, which will form the main source of supply, is expected to start next year.

(a) Total quantity of water supplied from all sources, was 1,988.578 c.m.

(b) Total quantity of water consumed as registered by area meters, 1,874.726 c.m.

(c) Total maximum summer consumption per day in c.m. 6,636.

(d) Total number of consumers by 31.12.1970, 9,930.

(e) (i) Extension of distribution system in ft. run and size of pipes, 28, 158 ft. 5,785 ft. ϕ 6" and 22,373 ft. ϕ 4".

(ii) Total length of distribution system (including extensions for 1970)

106.76 miles.

(f) (i) Number of hydrants installed in 1970, 31.

(ii) Total number of hydrants installled within water supply area, 687.

6.3.4.4 Larnaca Water Board

Due to the poor rainfall, it was found necessary that the "standby" borehole at Anglissidhes should be put in operation in order to suffice this town's requirements. The water level of the boreholes situated in Trimithos River had dropped considerably and their yield diminished. Evidently the aquifer in the area cannot afford more than one year drought. If no good replenish of this aquifer takes place in winter, definitely Larnaca will have to face shortage of water unless new sources are found. The use of the connection made with the Famagusta main Conveyor is not advisable at this stage, considering the fact that all present available water from Khirokitia is needed by Famagusta.

(a) Water supplied from all sources

1,597.304 c.m.

(b) Water consumed as registered

by area meters

1,539.550 c.m.

(c) Maximum Summer consumption 5,180 c.m. per day.

(d) Total number of consumers at 31.12.70, 4,100.

(e) (i) Extensions of Distribution system in feet. and size of pipes

560	f.r.	of 3"	dia
10,480	"	" 4"	"
9,570	"	" 6"	"
6,760	"	" 8"	"

(ii) The total length of our distribution system is not available.

(f) (i) Hydrants installed during 1970: 40

(ii) Total number of hydrants installed within water supply area: 149

Greater Nicosia Scheme (including Morphou Bay Scheme)
Revenue and expenditure account for 1970

	Expenditure		Revenue	
(a)	Pumping charges	£ 17,901.605	(a) Sale of water	£ 148,908.322
(b)	Maintenance Charges	£ 3,520.849	(b) Connection fees	£ 952.000
(c)	Collection fees	£ 17,871.740	(c) Usage of pipelines	£ 3,205.020
(d)	Morphou Rising Expenses	£ 28,326.009	(d) Other revenue	£ 13,145.441
	Total	£ 67,620.203	Total	£ 166,210.783
(e)	Administration	£ 4,000.000		
(f)	Amortization	£ 96,511.000		
	(£1,656.000 x 5% interest over 40 years)			
	Grand Total	£168,131.203		

Note: An approximate amount of £20,000 being value of water supplied to Turks could not be collected due to abnormal situation. This brings the total amount owned by the Turks (calculated at minimum per month) since 1964 to approx. £160,000.-

Particulars of Water Supply during restrictions (period 1.8.70 - 17.10.1970).

(a) Whole "area of supply" consists of 17 No. zones, separated into two sets:

Set No 1.		Set No 2.	
No of zone	No of consumers	No of zone	No of consumers
9	2,738	7	1,318
11	1,135	8	988
14	490	10	337
15	1,057	12	360
16	302	13	730
17 (Parisinos)	129	3	2,531
1	1,281	4	1,986
2	1,770	6	2,298
5	1,706		
Totals	10,608		10,548

(b) Maximum consumption of water: 22.274 cu. meters | 19,804 cu. meters

VII. DIVISION OF SMALL PROJECTS PLANNING

by

P. Pantelides
Head of Division

7.1 Introduction

This Division is dealing with the design and Planning of all contributory village water supply and irrigation projects, which are normally financed by Government through the Development Programme. Local Authorities concerned with these projects are the Village Water Commissions for water supplies, and the Village Irrigation Divisions and/or Private Water Associations for Irrigations Schemes. The section is dealing also with all correspondemes and problems emanating from implementation and operation of projects and technoeconomic matters prior to finance, and all questions arising from priorities. Because of constantly increasing matters of procedure, more time has to be devoted to correspondence and discussions by the Head of the Division than should be necessary. A simplified procedure will, no doubt, help to carry out more productive work such as the solution of local water supply problems, the improvement of design standards, and to plan further ahead of critical time limits.

There has been no change in th e staff employed in this Division during the year under review: Two Senior Inspectors of Works are in charge of Water Supply and irrigation projects respectively and there are four technical teams consisting of one inspector and one Technical Assistant operating for four combined districts in the island.

In the design stages there is a close co-operation between the Division and the Water Resources in the field of exploratory and prospective works such as boreholes, flow records and measurements, and hydrogeological data all drawings are being prepared by the Department's Drawing Office from drafts and data supplied from this Division and there is always the need of co-ordinating all the services concerned by the Head of the Division.

7.2 Village Water Supply

Because of low rainfall, 1970 has been a very difficult year for water supplies throughout the island. The output of practically all sources has dropped considerably, and this Division had to co-operate with District Officers to administer emergency water works and/or supplies to several villages.

Another significant factor affecting village water supply design and planning from 1970 is the uprating of consumption at 130 lit/head/day in accordance with the rising living standards and rural development in general. Under these new conditions village which were considered to possess an adequate water supply at 90 lit/head/day as heretofore, are new classified as having a water supply below the required standards; the position emerging out of the forestated readjustment of optimum consumption rate during the hot period of the year, is delineated in

the following Table:

Table I

Satisfactory Pipe Supply Based: Population 1970 Consumption 130/lit/head/d		Unsatisfactory Pipe Supply, Population 1970 Consumption less than 130 lit/head/day	
House to house	Public Fount.	House to house	Public Fount.
262	70	136	147

Note : Total No. of villages excluding suburbs = 615

- No village without pipe supply

In 107 villages as listed in the above table i.e. 17% of the total number of village , water is supplied at a rate less than 90 lit/Head/day and in 65 out of these the rate is under 45 litres. In these latter category the rate has dropped to near extinction in 1970 because of the general source depletion. A list of the critical villages with rates below 40 litres is given on Table III.

A list of Village Water Supply Scheme which were prepared and were ready for construction at the end of the year is given in Table IV and are summarised herebelow:

Table II

No.	District	No. of villages	Total Estimated cost
1	Nicosia-Kyrenia	48	£ 398,500
2	Famagusta	9	£ 96,000
3	Limassol	17	£ 129,500
4	Paphos	33	£ 104,000
5	Larnaca	12	£ 157,000
	T o t a l	119	£ 885,000

Note: The above Table included schemes approved for implementation in 1971 and included in the Development Budget at £357,000

The Village Water Supply situation based on the 1960 population figures and at a supply rate of 90 lit/head/day during the hot summer months is delineated on Table V. In view of the increase in population 1960-1970 and the need of upgrading the supply rate, the data given in this Table are considered to be obsolete and not depicting the actual conditions as at present.

Description of some important Water Supply Schemes.

The more notable project which was in the cource of preparation during the year is the Lefkara Regional Water Supply Project postulating water diversion from the Khirokitia Reservoir of the Famagusta Water Supply Project. For the high villages (Lefkara Pano, Lefkara Kato, Kato Pygi, Vavla and Layia) the water will be pumped to a high level, balancing reservoir from where it will be distributed to each separate village by gravity pipeline. A separate pumping arrangement for Khirokitia is envisaged and the lower villages of Tokhni to be supplied by gravity direct from the Khirokitia Reservoir. The villages of Ay. Theodoros, Alaminos and Skarinou will be supplied from one of the boreholes which serve the Famagusta Project. The total cost of the combined village Project is estimated to be of the order of £100,000.

7.3 Minor Irrigation Schemes

The Division prepared a list of Schemes for inclusion in the 1971 Development Estimates, but only 22 schemes were approved at a total cost of £114,515, and these were scheduled for implementation in 1971.

By the end of 1970 a number of schemes were ready for implementation as on Table XI.

7.3.2 Interdepartmental Committee

This Committee was set up towards the end of 1969 by the D.G. Ministry of Agriculture and Natural Resources with a view to co-ordinating the activities of technical services in the planning stages of small Irrigation Project, and for evaluating technoeconomic data. Schemes which are usually refered to this Committee concern the Improvements of old existing Irrigation Schemes, New Irrigation Pumping Schemes and Minor Storage Schemes. Schemes submitted to District Agricultural Officers prior to examination by the Committee appear on Table VII, and schemes recommended or not recommended by the Committee on Tables VIII and IX respectively.

7.3.4 Recharge Works

During 1970 the following recharge works were submitted to the District Officers for inclusion in the 1971 Development Estimates.

1. Famagusta - Dherinia (Supplementary Works)
2. Ay. Yeoryios K/nia
3. Thermia
4. Kazaphani
5. Vasilia
6. Ay. Epiktitos
7. Karakoumi

7.3.5 River Training, Antiflood Works & Land Drainage

A small scheme of Land Drainage at Koma-tou-Yialou at £ 1 200 was sent to the Famagusta District Officer.

7.3.6 Western Messaoria Control Pumping Schemes

The object of this project is to safeguard against water dipletion in the Western Plain. . Citrus growers who buy water from private boreholes apply for the formation of Irrigation Divisions whereby they are issued with permits to construct their own boreholes, and distribution works in accordance with designs prepared by this Division. Some 17 such schemes were prepared in a preliminary form and submitted through the District Officer during 1970. The schemes as prepared, postulate complete pipe distribution for the delivery of water at optimum rates at farm level. The implemantation of this project, however, with Government funds and subsidies is still a matter of consideration because of several financial and technoeconomic factors involved.

7.3.7 Description of some Recharge Schemes prepared in 1970

Famagusta-Dherinia Recharge Works (Estimated Cost £36,000)

The scheme as prepared provides for the installation of a new pumping unit on the southern and of the Ayios Loucas Lake and a pumping main 3850 meters long, capable to deliver at the rate of 4,500 - 11,000 cubic meter of water daily to the "Sphagion" and "Kokkines" localities for recharge and irrigation purposes. A second pipeline 2,500 meter long will connect the Ayios Loucas Lake with citrus gardens in the Ay. Loucas quarter for surface irrigation. All these new localities where water from the lakes will be distributed for combined recharge and irrigation were indicated from hydrogeological data completed in 1969.

With these supplementary works the main distribution network from the lakes throughout the whole area of the Division will have been completed. The secondary distribution for recharge through wells and surface irrigation will be implemented by the farmers with portable pipes.

VILLAGE WATER SUPPLY - Villages with a present Water Supply at 0-10 gls/capita /day (45 litres/H/d)

Village	Population 1970	Exist. supply gls/c./d	Estimated cost £	General Remarks regarding the design of the scheme
1. Alona	580	8		)Chromium Mines
2. Platanistasa	600	6		(Phase 'A' is
3. Lagoudhera	290	8	30,000	)included in 2nd (5 year plan
4. Sarandi	180	9		)£49,000 Phase 'B'
5. Polystypos	430	10		)under preparation
6. Ay.Marina(X)	590	10	10,000	)Chromium Mines
7. Xyliatos	150	10		)Phase 'C' - No)scheme ready
8. Analiondas	170	-		)The existing water
9. Argates	750		10,000	)is unsuitable.New
10. Episkopio	270			)borehole.No scheme
11. Kambia	280			)ready
12. Ayios Sozomenos	210	10	10,000	Borehole on Yialias river No scheme ready-Turkish village
13. Ayios Theodoros(S)	230	5	10,000	Two springs. Scheme ready
14. Kalyvakia	230	5	10,000	Spring or borehole Turkish Village
15. Klirou	1140	8	10,000	Borehole. No scheme ready
16. Lymbia	1530	3		)From boreholes near
17. Sha	360	9		)Nisou village
18. Mosphiloti	410	10	70,000	)under preparation.
19. Pseydas	400	5		)Phase 'A' is included
20. Pyrga	370	10		)in 2nd 5year plan.
21. Kornos	960	8		)The amount referred)to is for Phase 'B')only.
22. Mitsero	800	0	10,000	Borehole. No scheme ready
23. Potami	390	8	26,000	)From borehole
24. Vizakia	480	5		)Potami.Scheme)submitted
25. Elea (K)	90	6	10,000	)From borehole
26. Phterykha	120	8		)near Phterykha.)No scheme submitted
27. Lapithos	3570	7	80,000	From borehole by the village. Scheme to be prepared.
28. Temblos	250	6	10,000	Borehole-No scheme ready. Turkish village.
		C/F	296,000	

Village	Population 1970	Exist. supply gls/c./d.	Estimated cost £	General Remarks regarding the design of the scheme
		B/F	296,000	
29. Erimi	690	10	10,000	From borehole near village. Scheme under preparation
30. Pileri	120	4	10,000	Turkish village
31. Palodhia	180	10	20,000	From borehole
32. Paramytha	260	10		No scheme ready
33. Spitali	230	10		
34. Akoursos	200	10	10,000	Springs near village No. scheme ready
35. Akheritou	1170	10	22,000	From borehole within S.B. Area scheme under preparation
36. Aloa	20	0		From well in vicinity of Aloa village. No scheme ready
37. Maratha	210	10	12,000	
38. Sandalaris	70	0		
39. Ay. Efstathios	100	0		
40. Avgalida	80	10	15,000	From borehole in conjuction with the scheme for Komi-Kebir etc. (Ayios Photios B (4) Phase 'B' No scheme ready-Turkish Village
41. Livadhia	210	0		
42. Sinda	830	0	20,000	From borehole-Turkish village
43. Galatia	1270	0	15,000	From borehole-Turkish village
44. Trikomo	2370	10		From borehole near Trypimeni village. No scheme ready
45. Boghaz	2170	8		
46. Monarga	100	10		
47. Galatia	190	10		
48. Gouphes	350	10		
49. Artemi	150	10		
50. Ayios Iakovos	440	10		Turkish village Phase 'A' for Greek villages. Phase 'B' for Turkish villages with house supply
51. Melounda	330	10	60,000	
52. Topsou koyiou				
53. Alaminos	530	8		From Khirokitia Resr. Phase 'A' for £30,000 included in 2nd 5 year plan Phase 'B'
54. Ay. Theodoros	1080	8		
55. Skarinou	240	10		
56. Tokhni	810	10		
57. P. Lefkara	1190	10	80,000	
58. K. Lefkara	240	10		
59. K. Drys	160	10		
60. Vavla	100	10		
61. Layia	60	10		
62. Mennoyia	110	10	8,000	From borehole near Anglisidhes village. Scheme not ready. Turkish village
63. Aplanda	40	10		
		C/F	578,000	

Village	Population 1970	Exist. supply gls/c./d.	Estimated cost £	General Remarks regarding the design of the scheme
		B/F	578,000	
64. Kivisili	260	10	6,000	From borehole near Alethriko village, scheme ready. Turkish village
65. Melousha	280	10	10,000	Included in Vatyli, Strongylos etc. regional scheme Turkish village
		Total	594,000	

Village Domestic Water Supply ready for construction at the end of 1970 (including schemes approved for execution in 1971)

NICOSIA & KYRENIA DISTRICTS

Ser. No.	Village	Nature of scheme	Estimated cost £
1.	Alona, Lagoudhera, Sarandi, Platanistassa, Polystypos	Additional supply	49,000
2.	Kakopetria	Additional supply	19,000
3.	Sina Oros, Tembria, Evrykhou	Additional supply and house to house	37,300
4.	Kalogrea	" "	17,300
5.	Gourri	Additional storage & house to house	3,500
6.	Pyroi	House to house	2,100
7.	Apliki	" "	1,975
8.	Sarandi	Improvement and house to house	2,500
9.	Varisha	House to house	2,600
10.	Vroishia	Improvement and house to house	2,700
11.	Pharmakas	" " "	2,300
12.	Ay.Marina(Xyl.)	Improvement and house to house	7,825
13.	Kaliana	" " "	4,100
14.	Pygenia	Additional Supply & house to house	27,200
15.	Pakhyammos	Additional storage & house to house	3,940
16.	Peristeronari	House to house	1,600
17.	Xyliatos	" "	2,000
18.	Katydhata	Additional Storage & house to house	4,100
19.	Vyzakia, Potami	Additional supply & house to house	26,000
20.	Kannavia	Improvement & house to house	3,300
21.	Karavostasi	Improvements	3,200
22.	Modidhes	New scheme & house to house	3,000
23.	Kondemenos	Replacement of the main pipline & improvements	15,250
24.	Akaki	Improvements	1,350
25.	Kormakitis	"	1,200
		C/F	204,340

Ser. No.	Village	Nature of scheme	Estimated cost £
		B/F	204,340
26.	Nisou	Extensions	850
27.	Mitsero	New small spring	2,800
28.	Kalon Khorio (Kapouti)	Add. supply & house to house	32,000
29.	Kambi Pharmaka	Additional supply & house to house	4,900
30.	Evrykhou	Additional storage	3,000
31.	Nikitas	Additional supply & house to house	8,000
32.	Paleometokho	Additional supply & house to house	17,500
33.	Ay. Amvrosios	Improvement & Additional storage	5,500
34.	Ay. Theodhoros (Soleas)	Additional supply & house to house	9,575
35.	Linou	Improvements	2,200
36.	Dhali	Additional storage & improvements	25,000
37.	Bella Bais	Extensions	2,300
38.	Skylloura	Improvements	1,000
39.	Ay. Amvrosios	Additional storage & improvements	12,100
40.	Ay. Sozomenos	Improvements	500
41.	Morphou	Extensions	1,800
42.	Evrykhou	Additional storage	3,000
43.	Mia Milea	Supply of Electricity & Installation	1,840
44.	Kourdhali	Additional storage & house to house	1,800
45.	Alithinou	" "	2,400
46.	Korakou	Replacement of the main pipelines additional storage & house to house	13,300
47.	Ay.Marina(Sk.)	Extentions	1,000
48.	Astromerites	"	1,700
		Total	398.405

FAMAGUSTA DISTRICT

Ser. No.	Village	Nature of scheme	Estimated cost £
1.	Vatili) Strongylos)	Additional supply house to house	58,600
2.	Ay. Andronikos	House to house	7,200
3.	Vitsadha	Additional storage	1,200
4.	Yialousa	Improvements	2,300
5.	Kridhia	Additional storage and house to house	4,464
6.	Kondea	House to house	9,000
7.	Rizokarpaso	Improvements	720
8.	Rizokarpaso	Conveying water to "Khelonew" locality	7,800
9.	Malounda	Improvements to the spring - additional storage and house to house	4,800
		Total	£96,084

LIMASSOL DISTRICT

Ser. No.	Village	Nature of scheme	Estimated cost £
1.	Pano Polemidhia) Kato Polemidhia) Ypsonas)	Additional supply and improvements	60,800
2.	Kolossi	Additional supply	8,000
3.	Pendakomo	Additional supply and house to house	17,800
4.	Phinikaria	Additional storage and house to house	2,000
5.	Alassa	Improvements	1,100
6.	Prastio(Evdhimou)	Additional supply and house to house	4,900
7.	Ay. Demetrios	Additional supply and house to house	4,900
8.	Apsiou	Improvements	300
9.	Ay. Amvrosios	Additional supply and house to house	4,100
10.	Yerosa	Additional storage and house to house	2,400
11.	Pareklishia	Additional storage	1,500
12.	Phini	Additional supply and house to house	6,300
13.	Ay. Konstantinos	House to house	1,600
14.	Trakhoni	Additional storage and house to house	7,500
15.	P. Kividhes	New scheme for the residing village	3,800
16.	Kilani	Improvements to the spring	1,000
17.	Pissouri	Additional storage	1,300
		Total	129,300

LARNACA DISTRICT

	Ser. No.	Village	Nature of scheme	Estimated cost £
A	1.	Arsos) Tremetousha) Melusha)	Additional supply & house to house	19,730
	2.	Athienou	Additional storage & improvements	18,000
	3.	Melini	Additional supply and storage & house to house	4,400
	4.	P. Lefkara)		
	5.	K. Lefkara)		
	6.	Kato Drys)		
	7.	Vavla)	Additional supply	
	8.	Layia)	Additional storage	
	9.	Tokhni)	& house to house	114,580
	10.	Skarinou)		
	11.	Ay. Theodhoros		
	12.	Alaminos)		
			Total	156,710

PAPHOS DISTRICT

Ser. No.	Village	Nature of scheme	Estimated cost £
1.	Kolokedhara	Improvements	800
2.	Pano Panayia	"	850
3.	Episkopi	Replacement of the existing now pipeline, additional storage and house to house	6,500
4.	Peristerona	Additional storage & house to house	3,200
5.	Pano Arodhes	" "	5,500
6.	Kedhares	" "	3,700
7.	Skoulli	" "	2,100
8.	Trakhypedhoula	" "	2,700
9.	Dhymou	" "	5,500
10.	Lemona	" "	2,700
11.	K. Akourdhalia	" "	1,500
12.	Mesa Khorio	" "	3,000
13.	Simou	" "	4,600
14.	Asproyia	" "	2,600
15.	Akhelia	" "	2,100
16.	Koloni	Pumping scheme & house to house	5,400
17.	Ay. Nicolaos	House to house	3,200
18.	Ay. Ioannis	" "	2,900
19.	Fledhio	Additional fountain & Improvements	300
20.	Magounda	House to house	700
21.	Akoursou	Improvements & house to house	2,200
22.	Aradhiou	" "	1,500
23.	Kilinia	Improvements	500
24.	Loukrounou	House to house	350
25.	Pretori	Improvements	720
26.	Stavrokonnou	Additional supply	1,000
27.	Kannaviou	Additional storage & house to house	2,500
28.	Paleambela	Improvements	1,440
29.	Ktima	Additional storage & improvements	13,000
30.	Dhrynia	Additional storage & house to house	1,800
31.	Kholetria	New scheme for the residing village	12,700
32.	Psathi	Additional storage & house to house	1,900
33.	Kouklia	New pumping scheme	4,600
		Total	104,060

DEPARTMENT OF WATER DEVELOPMENT - NUMBER AND PERCENTAGE OF VILLAGES WITH PIPED SUPPLY 1970 (Based on 1960 population and supply rate at 90 lit/Head/Day)

District	Satisfactory piped supply								Unsatisfactory piped supply								No piped supply				Total number of villages	Total
	Villages with house to house				Villages with fountains				Villages with house to house				Villages with fountains				Number of villages					Population
	No	%	Pop.	%	No	%	Pop.	%	No	%	Pop.	%	No	%	Pop.	%	No	%	Pop.	%		
Nicosia	111	62.36	136,690	86.05	55	30.90	17,893	11.26	-	-	-	-	12	6.74	4,272	2,69					178	158,855
Kyrenia	33	70.21	21,590	78.46	6	12.77	1,039	3.78	1	2.13	3,496	12.70	7	14.89	1,392	5.06					47	27,517
Famagusta	70	71.43	67,849	85,22	13	13.27	4,387	5.51	2	2.04	1,360	1.71	13	13.26	6,019	7.56					98	79,615
Limassol	81	71.05	52,571	82.51	27	23.69	5,621	8.82	3	2.63	4,088	6.42	3	2.63	1,433	2.25					114	63,713
Paphos	55	41.67	28,397	57.86	77	58.33	20,679	42.14	-	-	-	-	-	-	-	-					132	49,076
Larnaca	32	54.24	26,886	69.23	8	13.56	2,269	5.84	4	6.78	4,654	11.98	15	25.42	5,027	12.95					59	38,836
Total	382	60.83	333,983	79.97	185	29.46	51,888	12.43	10	1.59	13,598	3.26	51	8.12	18,143	4.34					628	417,612

LIST OF SMALL IRRIGATION SCHEMES (Ready for construction at the end of 1970 and not included in the 1971 Development Estimates)

NICOSIA - KYRENIA DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation Perm.	Irrigation Seas.	Remarks
1.	105/1963	Pera Politiko	Division	Pedieos River	Diversion Groyne & Intake channel for flood irrig.	4,800	1/5	-	450	Revised 1970
2.	36/42	Ergates	Associat.	Kourtouji	Regrating & Lining of tunnel & general improvements	7,700	48%	93	266	190 don.winter Revised 1970
3.	127/40/103	Lagoudhera	Associat.	Affita	Irrigat.tank & Distri.channels & pipes	850	44%	10	3	Revised 1970
4.	42/1948	Apliki	Associat.	Kalogyros Tourkou	Tank & Pipes	2,900		31	9	Revised 1970
5.	72/1963	Pendayia	Associat.	Kalokerinon neron	Lining of canals	9,900		143	465	Revised 1970
6.	41/39	Katokopia	Associat.	Ktirka	-do-	9,200	50%	300	-	Revised 1970
7.	57/41/II	Dhali	Division	Near village	-do-	19,000		535	317	
8.	127/40/98/IV	Kalopanayiotis	Division	-	Distribution Works	9,720	1/3	133	-	
9.	39/44	Vyzakia	Division	-	Lining of canals	11,200	1/3	-	140	
10.	63/52	Meniko-Akaki	Division	Afxenti-Riatikon	-do-	21,500	1/4	-	500	4000 springs

LIST OF SMALL IRRIGATION SCHEMES
LIMASSOL DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation perm.	Irrigation Seas.	Benefit/ cost Ratio	Remarks
		Kyperounda									
1.	127/40/49/54	(i) Kardama Solomidhes	Associat.	K.Solo-midhes	Excavation of spring & distr. works	2,700	50%	14½	13½		Revised 1969
2.	127/40/36	(ii) Frakti-Postani	Associat.	Frakti	-do-	1,750	-	7	8		Revised 1970
3.	127/40/49/55	(iii)Livad-hi tis Mes-sis	Associat.	Livadhin	Irrig.Tank & Dis-tripution Pipes	1,650	44%	22	18		Revised 1970
4.	127/40/49/48	(iv)Appis	Associat.	Appis	Distribution Pipes	800		12	-		Revised 1970
5.	127/40/49/II	(v) Dkiala	Division	Dkiala	Irr.Tank & Distr. Pipes	900	⅓	12	-		
6.	127/40/49/47	(vi)Khalos-pitia	Associat.	Khalos-pitia	-do-	1,800	-	15	-		Revised 1970
7.	40/49/II	(vii)Vas-siliko	Associat.	Vassili-ko	Distribution pipes	620	40%	9	5		Revised 1970
8.	127/40/134/2	Pelendria		Sarakinos	-do-	630	⅓	17	-		Revised 1970
9.	61/42	Silikou	Division	Lavrania	Lining of channels & general impro-vements	3,460	⅓	73	-		Revised 1970

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL (Cont) DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation Perm.	Irrigation Seas.	Benefit/ cost Ratio	Remarks
10.	127/40/23	Omodhos	Division	Pighadi	Irr.Tank & Distr. Pipes	1,350	1/3	7	8		Revised 1970
11.	127/40/52/III	Ay.Ioannis (Agrou)	Division	Angoulos	Distribution channels	1,160	1/3	12	-		Revised 1970
12.	-do-	-do-	Associat.	Kephalo-vrysos	Distribution works	1,700	42%	16	9		Revised 1970
13.	42/43/III	Phini	Division	Dhimma-tou-My-lou	-do-	11,300	1/3	371	-		Revised 1969
14.	-do-	-do-	-do-	Ambelaki	Irr.Tank & Distr. works	500	1/3	28	-		Revised 1969
15.	127/40/165/2	Tris Elies	Division	Drakondas	Extension Distr. works	7,200	1/3	180	-		Revised 1969
16.	43/42/II	Kilani	Division	Asomatos Skotini Ay.Mav-rieti	Distribution works	8,650	1/3	150	-		Revised 1970
17.	127/40/59/II	Louvaras	-	Tsoukalas	Irrig.Tank & Distr. Pipes	800		6	4		Revised 1970
18.	127/40/22	Dhymes		Hji Pe-lendrou	Distribution works	1,300		16	-		Revised 1970
19.	45/44/2	Pyrgos	Division	Alavrov-rysi	-do-	5,700	1/4	-	80		Revised 1970
20.	45/44/2	Pyrgos	Division	Dimma tis Rigenas	Distribution works	4,600	1/4	-	300		Revised 1970
21.	127/40/99	Agros	Division	Pano Taliou	-do-	1,560	1/3	11	8		Revised 1969
22.	91/45	Moniatis	Division	-	-do-	5,300	1/3	134	16		Revised 1969

LIST OF SMALL IRRIGATION SCHEMES
PAPHOS DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation perm.	Irrigation Seas.	Benefit/ cost Ration	Remarks
1.	65/62	Khoulou	Division	Kartavi-nes	Pumping scheme	4,000	1/3	30	18		Revised 1970

LIST OF SMALL IRRIGATION SCHEMES SUBMITTED TO DISTRICT AGRICULTURAL OFFICERS FOR STUDY

Ser. No.	Village	Nature of proposed works	R e m a r k s
A.	NICOSIA KYRENIA DISTRICT		
1.	Evrykhou Irr. Division	Distribution works	Exist. Irr. works
2.	Tembria-Korakou Irr. Division "Esso Dhymma"	-do-	-do-
3.	Kaliana-Tembria Irr. Div. "Neron-tis-Tsappas"	-do-	-do-
4.	Korakou Irr. Div. "Esso Dhimma"	-do-	-do-
5.	Phlasou Irr. Div. "Ayios Epiphanitis"	-do-	-do-
6.	Philia Massari (Soil conservation Division)	Pumping Scheme	New scheme
7.	Yerolakkos "Ovgos" Irr. Association.	Pumping Scheme	New scheme from existing B.H.
8.	Peristeronari Irrig. Division.	Lining of canals	
9.	Ayia Marina (Xyliatos) "Ay. Kyriakos"	Lining of channels	New works
10.	Kato Pyrgos	Distribution works	Existing Irr. works
11.	Phylia (Paleoklisha)	Distribution works	
12.	Nikitari (Pano Dhexameni)	Distribution works	
13.	Askas "Pano Ambelia"	Distribution works	
14.	Lapithos "Kephalovrysos" Irrig . Association	Distribution works	
15.	Exometokhi-Irr. Association	Distribution works	Existing Irr. works
16.	Ergates Irrig. Association "Kourtoujis"	Lining of canals	
17.	Katokopia, P. & K. Zodhia Arghaki "Naos"	Construction of Intake channel	Existing works
18.	Vasilia (Paleokastro) Irrig. Association	Distribution works	
19.	Palekythro (Kephalovrysos) Irr. Association	Lining of canals	
20.	Ayios Amvrosios Mouthouna Irrig. Association	Distribution works	
21.	Ay. Amvrosios Sterodja Irrig. Association .		

Ser. No.	Village	Nature of Proposed works	R e m a r k s
B.	LIMASSOL DISTRICT		
1.	Yerasa Irrig.Divis.	Distribution works	Existing works
2.	Mandria Irr.Division	Distribution works	-do-
3.	Saittas Moniatis Irrig. Division.	Distribution works	-do-
4.	Trimiklini Irr. Division.	Distribution pipes	-do-
C.	PAPHOS DISTRICT		
1.	Philousa(Ambelidja) Irrig. Division	Distribution works	Existing works
2.	Kritou-Marottou Vrysi tou khoriou Irrig.Division	-do-	-do-
3.	Mesana "Piyi Pighoulia"	-do-	-do-

Ser. No.	Village	Nature of proposed works	R e m a r k s
D.	FAMAGUSTA DISTRICT		
1.	Kouklia - Kondea	Pumping schemes from Kouklia Reservoir	New scheme
E.	LARNACA DISTRICT		
1.	Psematismenos	Pumping scheme	

List of schemes approved by the Inter-Departmental Committee in 1970

1. Ayia Marina (Kyliatos) "Ay. Kyriakos"
2. Yerasa
3. Pera (Or.)
4. Trimiklini Dam Distribution Works
5. Pano Akourdalia
6. Klirou "Laoura"
7. K. Pyrgos (Tyllirias) Distribution Works
8. Yerolakkos (Ovgos)
9. K. Pyrgos (Tyllirias) Pumping Scheme
10. Liopetri pumping scheme (Dam)
11. Athienou (Athanassis)
12. Athienou (Marmarika)
13. Khoulou (Kartavines)
14. Pera Politiko
15. Xyliatos (Ay. Kyriakos)
16. Kalopanayiotis Distr. Works
17. Vyzakia
18. Psomolophou Distr. Works
19. Akaki "Kamena"
20. Ay. Yeoryios (Soleas)
21. Pelendria (Nikomitis)
22. Lourvaras (Kato Pervolia)
23. Ayios Ioannis (Agrou)
24. This Elies (Milarka)
25. Kyperounda "Piyi Dhymon"
26. Kyperounda "Klima"
27. Marathovounos-Pyrga "Neokhorritika Merradhes"
28. Saittas-Moniatis
29. Phlasou Evrykhou "Koussouliotis"
30. Evrykhou
31. Kaliana - Tembria "Neron tis Tsappas"

List of schemes not approved by the Inter Departmental Committee

1. Exometokhi Pumping Scheme
2. Angastina Pumping Scheme
3. Mesa Khorio (Piyi Livadhi) Irrigation Works
4. Pano Panayia "Vrysi" Irrigation Works
5. Dhali Irrigation Division
6. Dhali "Hji Stavrinos" Irrigation Association
7. Philousa Kelokedharou "Ambelidja"
8. Dhymes "Hji Pelendros"
9. Philia - Massari Soil Conser. Division.

VIII REGIONAL OFFICES

by N. Chr. Toufexis,
Superintendent of Works

8.1 Limassol Regional Office

8.1.1 General

By the end of the year the staff of the Regional office was composed of one Executive Engineer, (Mr. P.G. Panayides) as head of the Limassol and Paphos Regions, 2 Technical Assistants, 8 daily paid Technical Assistants and one typist.

8.1.2 Hydrological and Meteorological Stations in operation

The following flow gauging and Meteorological Stations were in operation during the year, under weekly or monthly visits for observations, measurements and maintenance :

(a) 13 stream gauging stations with automatic water level recorders
(b) 1 borehole with automatic water level recorder
(c) 3 Rainfall stations

8.1.3 Spring Discharges

Most of the springs, are gauged on a routine basis while the rest are gauged only for a temporary period after the request of another Departmental Division.

During the year, 950 spring and stream discharges were gauged volumetrically or by current meter.

8.1.4 Chemical Analysis

A total number of 965 water samples were taken during the year, from springs, boreholes/wells and rivers and sent to the Government Analyst for Ionic and Partial analysis. 7 samples were also taken from rivers for full analysis.

In addition to the above, 652 water samples were taken from observation wells/boreholes and were analysed in the regional office for chloride content.

8.1.5 Ground Water Levels

A total number of 535 water level measurements were taken from wells/boreholes in early spring and Autumn. Water level measurements were also taken from 98 selected boreholes, within the above hydrological areas, at weekly or monthly intervals.

8.1.6 Questioning

The annual questionaire was carried out in the hydrogeological areas during the Summer months, for the determination of the groundwater extracted, the area irrigated and the kind of crops planted.

8.1.7 Water meters

During the year under review, 20 water meters were installed on an equal number of boreholes in Akrotiri area, raising the total number of water meters to 384.

8.1.8 Well sinking permits

The investigation of applications of well sinking permits was assigned to the Regional Office. During the year, 41 applications were investigated and reports submitted to the District Officer, Limassol.

8.1.9 Maintenance of Dams

Routine maintenance and inspection of major dams in Limassol and Paphos Regions and their distribution system was carried out by the Regional Officer. A report was always forwarded to the Head of the Maintenance Division, after every inspection trip. Special observations and measurements, were also taken from the above dams.

8.2 Paphos Sub-Regional Office

8.2.1 General

By the end of the year the staff of the sub-region was composed of one Inspector of Works (Mr. E. Eliades) as the head of the sub-region, 2 Technical Assistants, 5 daily paid Technical Assistants, 2 Regular Employees, one typist and one draughtswoman. All the above personnel was engaged on the collection of hydrological and hydrogeological data in Paphos Region.

8.2.2 Hydrological and Meteorological Stations in operation

The following flow gauging and Meteorological stations were in operation during the year, under weekly or monthly visits for observations, measurements and maintenance:

(a) 11 stream gauging stations with automatic water level recorders
(b) 1 borehole with automatic water level recorder
(c) 7 rainfall stations

8.2.3 Spring Discharges

Most of the springs measured in Paphos Region are gauged on a routine basis while others are gauged only for a temporary period after the request of another Departmental Division.

During 1970, 789 spring discharges were measured, being the output of 5 springs measured every two weeks, 26 springs measured every three weeks and 19 springs measured every month.

8.2.4 Chemical Analyses

During the year, 607 samples of water were taken for analysis from springs, rivers and observation wells or boreholes. Out of these, 218 taken from springs and rivers were submitted to the Government Analyst for partial and ionic analysis and 54 taken from rivers and submitted to the Departmental Laboratory for Silt content analysis. The remaining 345 samples of water taken from observation wells or boreholes were analysed by this Office for Chloride content.

8.2.5 Ground Water Levels

The South Western Paphos and Polis Hydrogeological areas are covered by three networks each of different observation frequency, raising the total number of water levels to 3271 as follows:

Hydrological area	No of wells /B/Hs observed	Frequency	Total measurements
South Western Paphos	75	Every two weeks	1817
South Western Paphos	28	Every two months	336
South Western Paphos	280	Every six months	560
Polis(Khrysokhou)	14	Every two weeks	364
"	97	Every six months	194
			3271

8.2.6 Questioning

The annual questionnaire was carried out on 1508 wells boreholes and springs in both South Western Paphos and Polis Hydrogeological Areas to determine the groundwater extracted from the aquifer, the kind of crops planted and the extent of land irrigated.

8.2.7 Plotting and Levelling

A Hydrogeological Survey was carried out in Dhiarizos gravels extending South Western Paphos Hydr. area northwards, as far as Kapsala Dam-site, in addition to the plotting of 30 wells or boreholes sunk during 1970.

The settlement marks at Mavrokolymbos Dam were being levelled monthly while those at Pomos, Ayia Marina and Argaka Dams were being levelled every other month.

8.2.8 Water meters

The readings of 26 water meters installed on boreholes pumping water from Dhiarizos (lower) catchment were taken monthly, to assist the Hydrologists to estimate the water extracted from the gravel-areas of South Western Paphos.

8.2.9 Well Sinking and Citrus Plantation Permits

During 1970, 143 applications for well sinking permits were examined and reports submitted to the District Officer Paphos, while 21 applications for citrus plantation permits were examined and reports submitted to the sub-committee for citrus plantations, Paphos.

8.3 Famagusta Regional Office

8.3.1 General

By the end of the year the staff of the regional office was composed of one Executive Engineer, (Mr. C. Andreou,) as the head of Office, one Inspector of Works (Mr. G. Frangopoullos), 3 Technical Assistants, 2 daily paid Technical Assistants, 2 casual employees, and one typist. The above personnel was engaged on the collection of hydrological and hydrogeological data in the Famagusta Region.

8.3.2 Hydrological and Meteorological Stations in Operation

The following flow gauging and Meteorological stations were in operation during the year under weekly or monthly visits for observations, measurements and maintenance:

(a) 10 stream gauging stations with automatic water level recorders.

(b) 3 Rainfall stations.

8.3.3 Spring Discharges

In Famagusta Region there were 7 springs under routine observations, 84 gaugings were taken from these springs. 15 small streams in the Karpass peninsula were also under regular observations, i.e. weekly flow measurements and sampling.

8.3.4 Chemical Analysis

During the year under review, 305 samples were taken from streams and submitted to Government Analyst for Ionic and Boron analysis, 57 samples from observation boreholes and springs were also submitted to Government Analyst for Ionic Analysis. In addition, 800 samples were taken from boreholes/wells within the hydrogeological areas and analysed in the Famagusta Regional Office for Chloride content.

8.3.5 Water Levels

Within the hydrogeological survey areas 2000 water levels were taken in early spring and autumn and 1428 water levels were taken from 119 observation boreholes at monthly intervals.

8.3.6 Questioning

The questionnaire on 17,000 wells/boreholes in the area was carried out during the summer months for the determination of the groundwater extracted, the area irrigated and the kind of crops planted.

8.3.7 Water meters

During the year, 8 water meters were sold to an equal number of owners of wells/boreholes, raising the total number of water meters sold in the region to 475. These water meters were visited at monthly intervals for the determination of the water pumped from each relevant borehole/well.

8.3.8 Plotting of new boreholes

A total number of 400 new legal and illegal boreholes were plotted on map and all necessary details entered into the appropriate Register.

8.3.9 Well Permits

The water supply (Special Measures) law was revoked in Famagusta area at the end of April of the year under review. By that time 300 applications for well sinking permits were investigated and reports submitted to the District Officer Famagusta/Larnaca. An additional number of 600 applications of well sinking permits in Water Conservation Areas and 20 applications out of Water Conservation areas were investigated and followed the same procedure as above.

8.3.10 Bacteriological Analysis

Water samples for Bacteriological Analysis from Famagusta Water Supply sources, and Lapathos boreholes were also taken and submitted to the Pathological Laboratory. The total number of water samples received during the year was 266.

8.4 Morphou Sub-Regional Office

8.4.1 General

By the end of the year the staff of the sub-regional office was composed of one Inspector of Works (Mr. A. Nicolaides), as the head of the office, one monthly paid Technical Assistant, 7 daily paid Technical Assistants, and one casual employee. The above personnel was engaged on the collection of hydrological and hydrogeological data in the Morphou sub-region.

8.4.2 Hydrological and Meteorological Stations in operation

The following flow gauging and Meteorological stations were in operation during the year, under weekly or monthly visits for observations, measurements and maintenance:

(a) 20 flow gauging stations with automatic water level recorders
(b) 3 rainfall stations.

8.4.3 Spring Discharges

Most of the springs in the area were measured on a routine basis, a small number was gauged for a short period after the request of another Departmental Division. During the year, 1100 springs discharges were gauged; 80 springs were gauged once a month and 20 for a short period.

8.4.4 Chemical Analysis

Samples of water were taken at various frequencies in Morphou Regional Area. Throughout the year 2,000 samples of water were taken from boreholes/wells springs and rivers at weekly, monthly and annual intervals and submitted to the Government Analyst for Ionic and Boron Analysis.

8.4.5 Water Levels

An area of 160 sq. miles is covered by hydrogeological surveys in the Morphou Region, whithin which, Water Levels were taken at various frequencies. During the year, 4000 water levels were taken from boreholes/wells within the hydrogeological areas, along riverbeds, in the vicinity of dams at weekly, monthly and six months intervals.

8.4.6 Questioning

The routine questionaire was carried out during the Summer months on 880 boreholes/wells in use, for the determination of the groundwater extracted, the area irrigated and kind of crops planted.

8.4.7 Water meters

During the year, 118 water meters were installed on an equal number of boreholes; the total number of water meters in Morphou Region reached to 520. All these water meters were visited at various intervals for checking purposes and for the determination of the exact quantity of water pumped from each relevant borehole.

8.4.8 Well sinking permits

A total number of 600 applications for well sinking permits and 364 cases for citrus plantations were investigated and reports were submitted to the District Officer Nicosia.