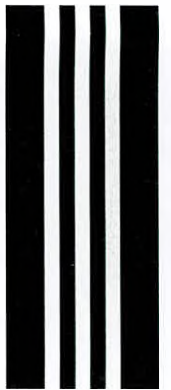
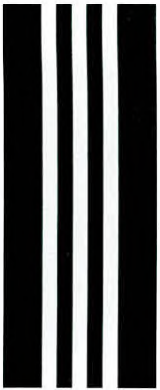


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REPUBLIC OF CYPRUS

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MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

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ANNUAL REPORT  
OF THE  
DEPARTMENT  
OF  
WATER DEVELOPMENT  
FOR THE YEAR  
1968

BY

C. A. C. KONTEATIS

*Director of the Department of Water Development*



REPUBLIC OF CYPRUS  
MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

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A N N U A L R E P O R T  
OF THE  
DEPARTMENT OF WATER DEVELOPMENT  
FOR THE YEAR  
1968

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

*MA*



## I

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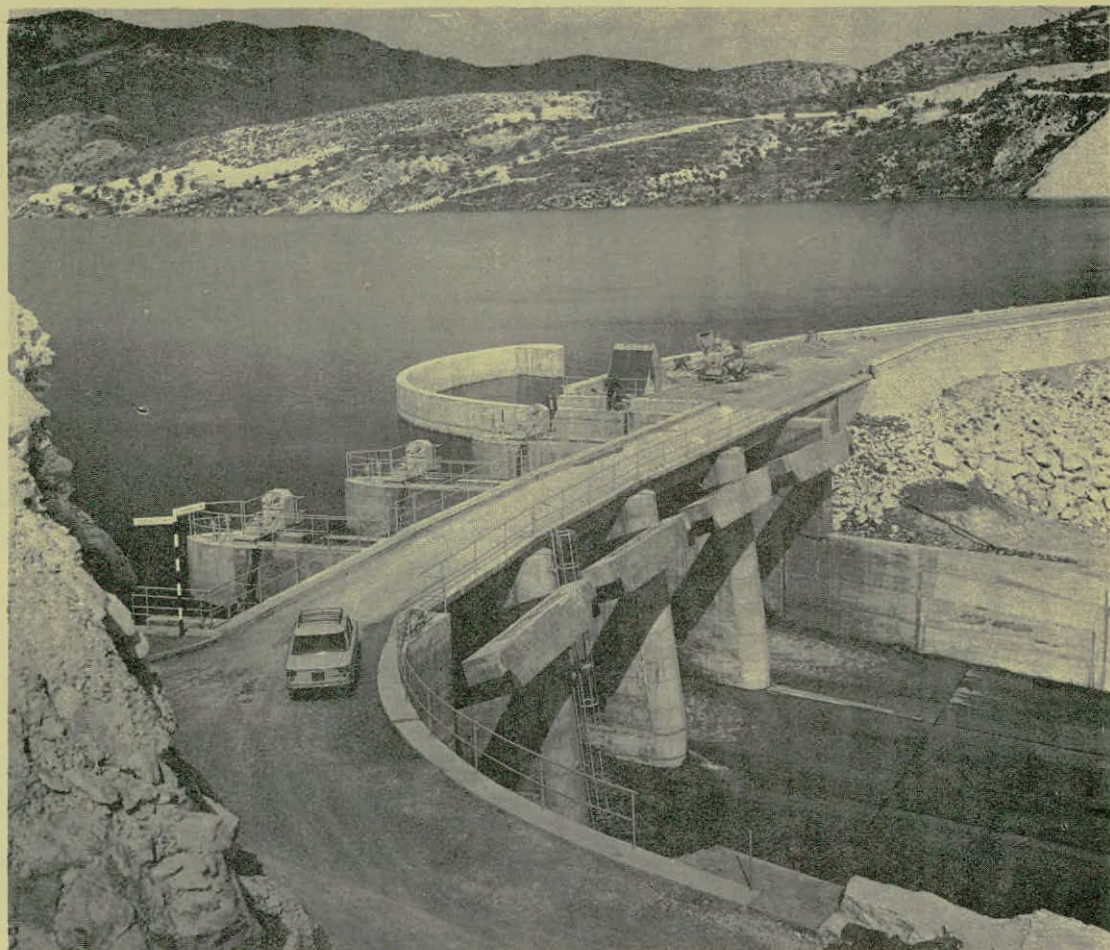
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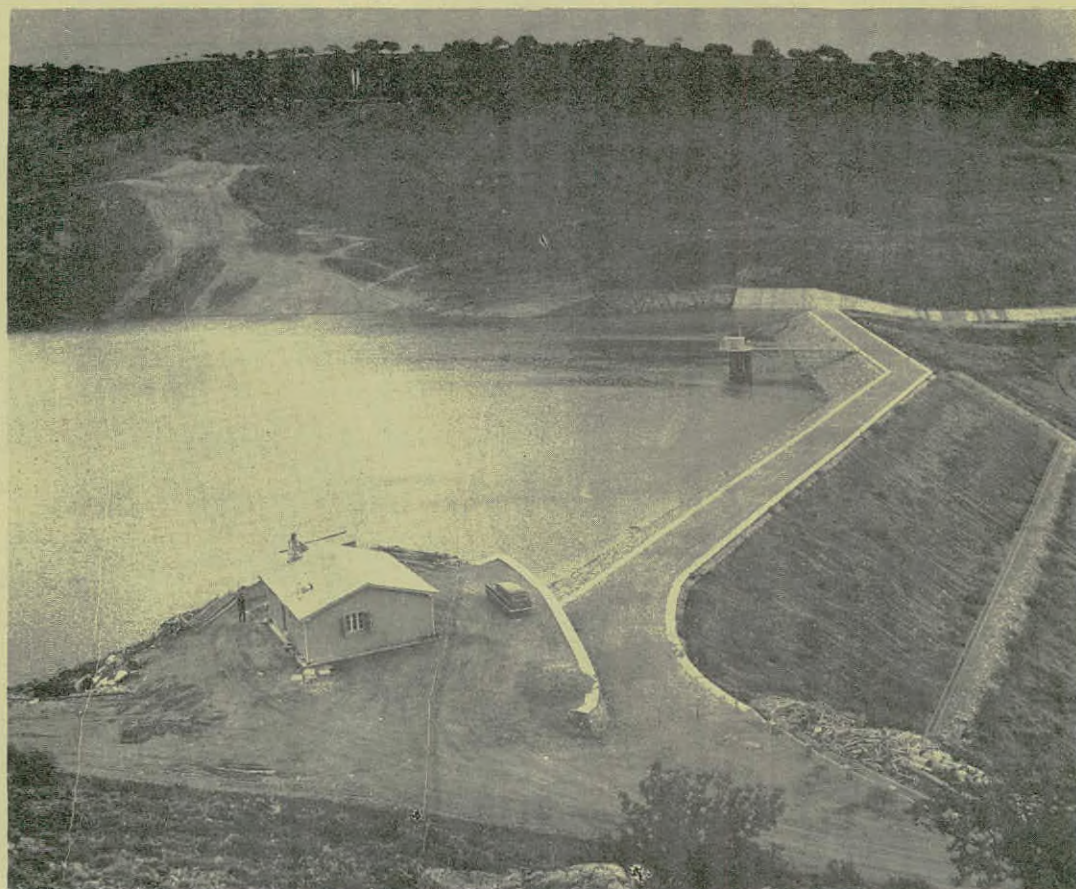
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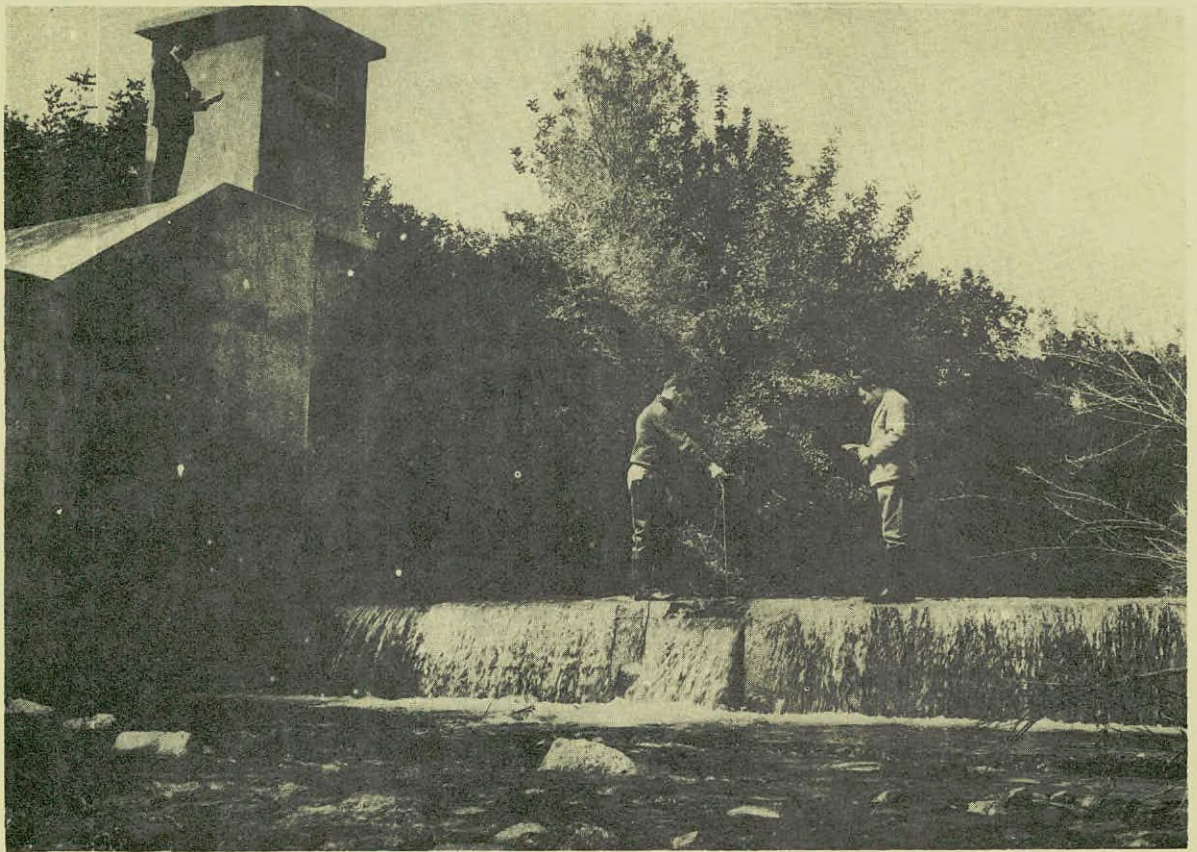
YEPMASOYIA DAM.

VIEW OF SPILLWAY

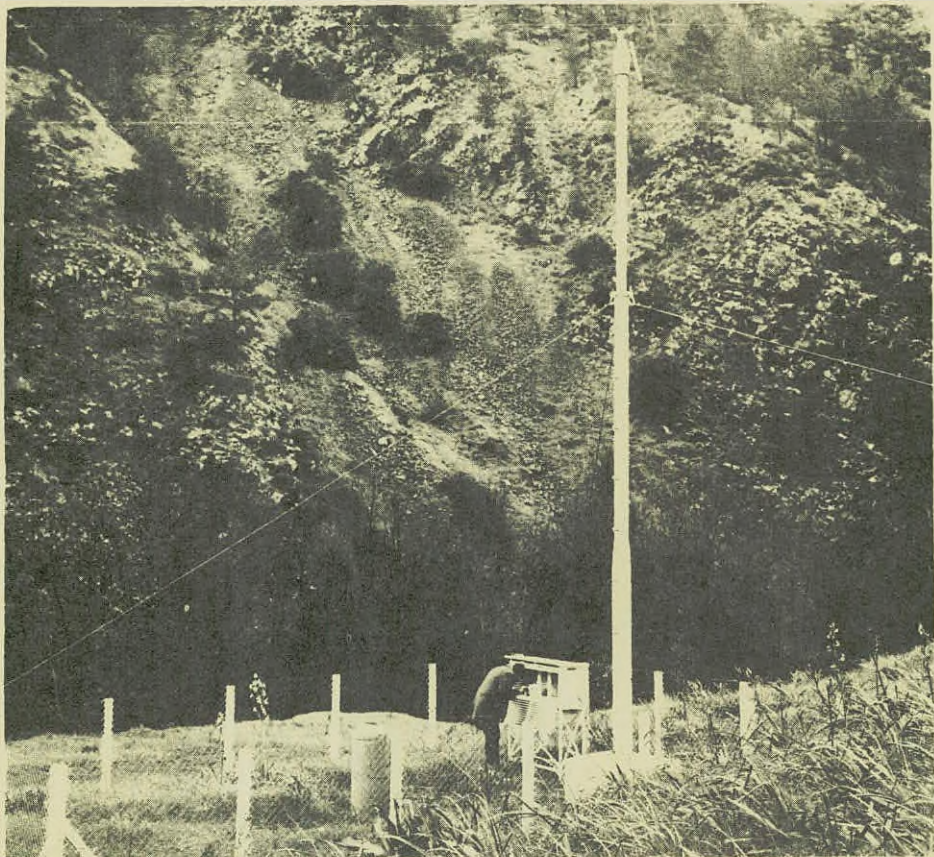


MAVROKOLYMBOS DAM



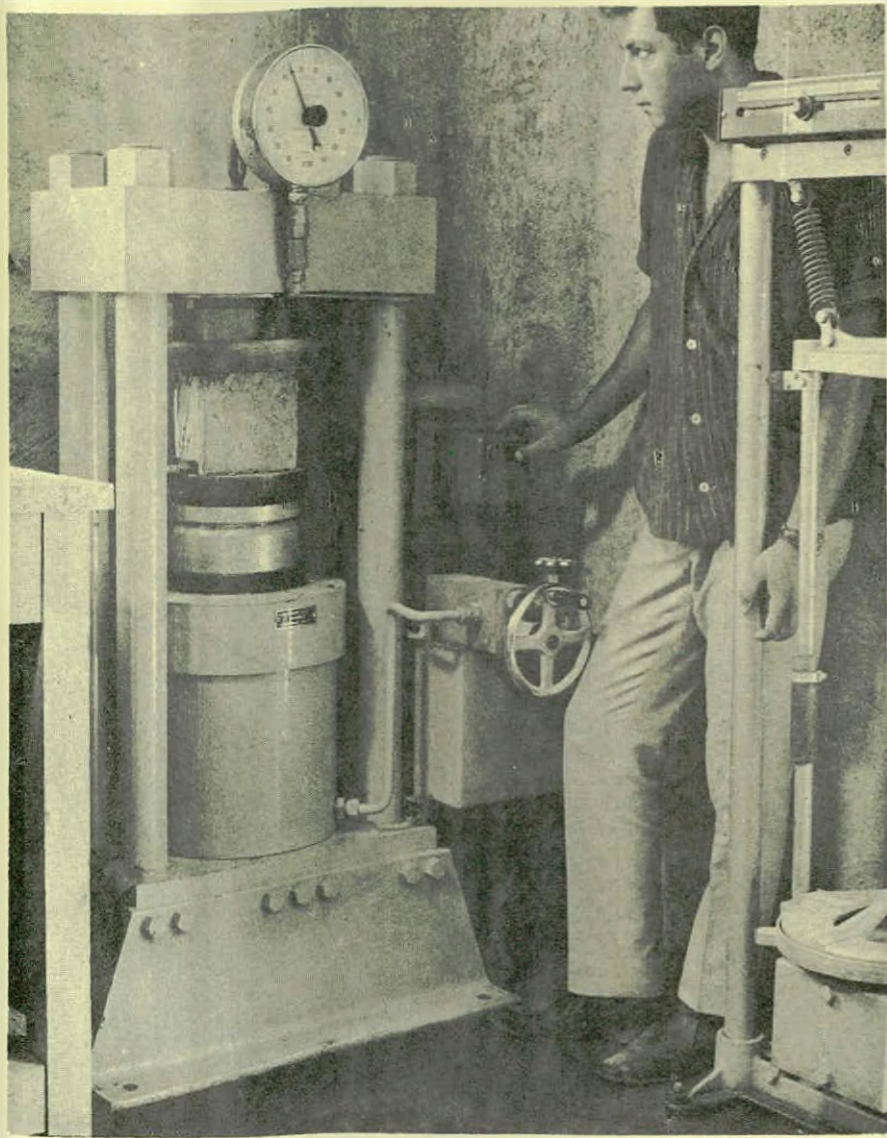


USE OF CURRENT METER AT KHIROKITIA MEASURING  
WEIR FOR CALIBRATION PURPOSE



HYDROMETEOROLOGICAL  
OBSERVATIONS AT LIMNITIS





STRENGTH TEST FOR 6 INCH CONCRETE CUBES  
AT THE DEPARTMENTAL CONCRETE LABORATORY

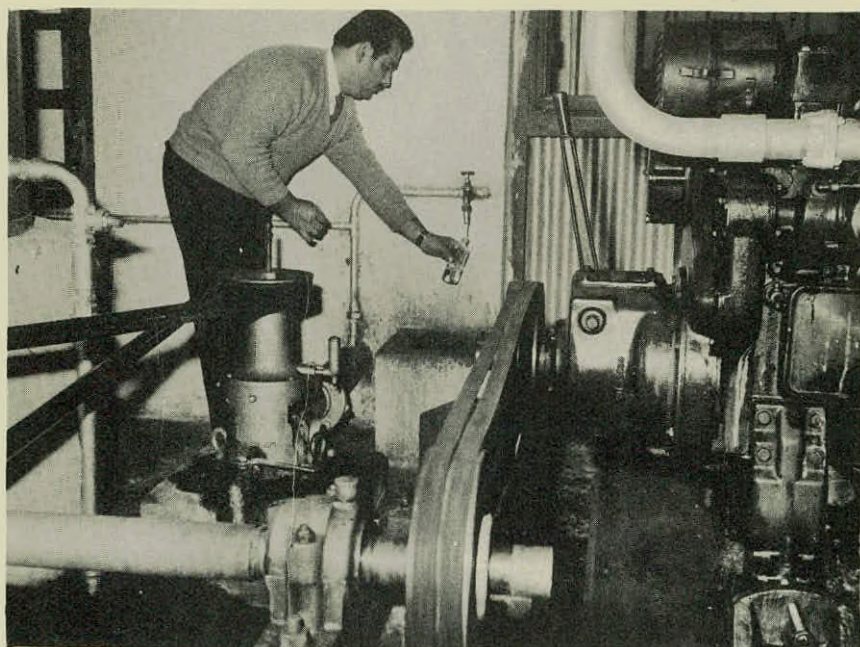


GENERAL VIEW OF YERMASOYIA DAM



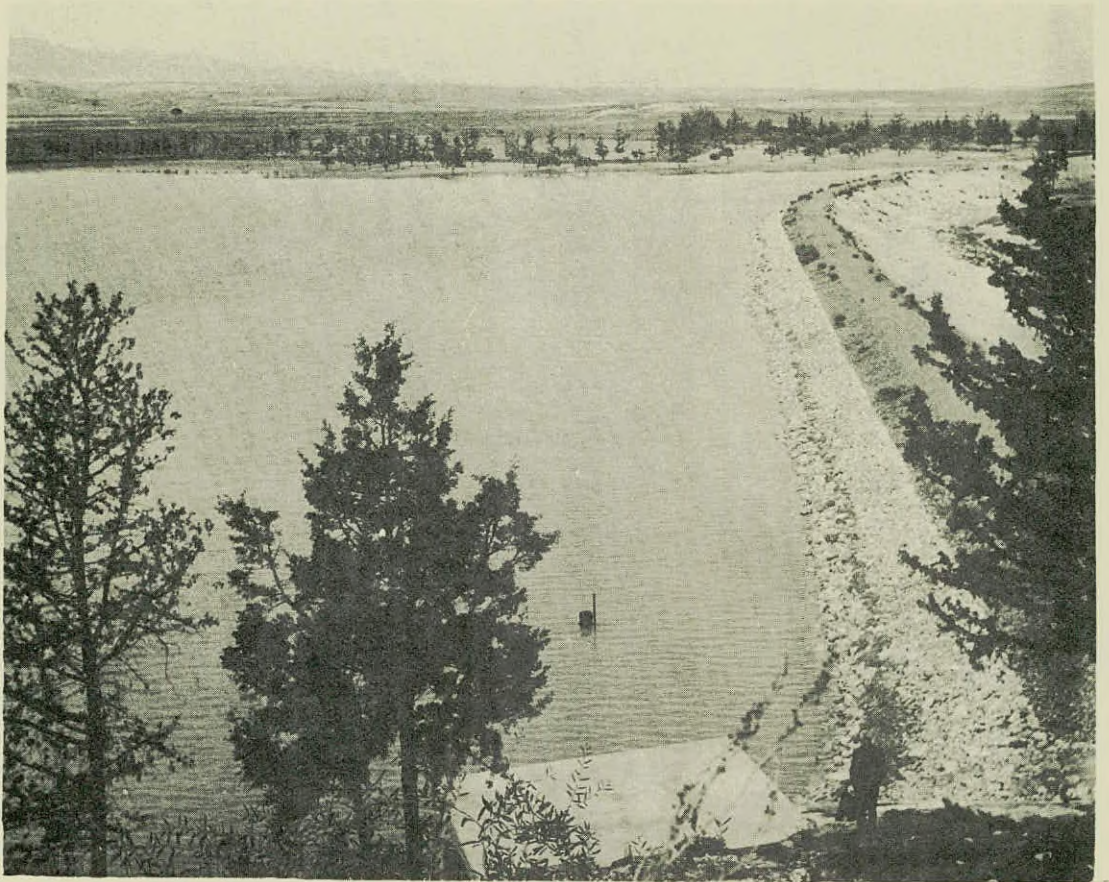


FAMAGUSTA WATER SUPPLY  
KHIROKITIA-PHRENAROS PIPELINE  
LAYING OF 650 m.m. dia A.C. PIPELINE



TAKING WATER SAMPLE FOR CHEMICAL  
& BACTERIOLOGICAL ANALYSIS





SYNGRASI DAM



GENERAL VIEW OF POLEMIDHIA DAM



## I. 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 over-all policy, water resources, planning, design and construction 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, ground water recharge works and other relevant works. The general Governmental organization and the role of the Department of Water Development is shown on Appendix I. Regarding this over-all organization, we are now in co-operation with the United Nations Special Fund Project (C.W.P.P.) considering the possibility for improving this organization especially for the management of the water resources and projects in which a lot of other departments are involved. A basis for this study will be the already submitted report by F.A.O. on Cyprus Water Legislation dated October, 1962.

## II. DEPARTMENTAL ORGANIZATION

The Departmental organization is shown on Appendix I.a and is made up of:-

### 1. Division of Water Resources

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

### 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, as connected with foundations.



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.

4. Division of Construction

This Division deals with all construction work whether carried out by direct labour or through contract.

5. Division of Operation and Maintenance

This Division gives the services required for the operation and maintenance of the major projects such as dams and town water supplies. For every project there is a District Water Board for Irrigation or a Town Water Board for domestic water supplies, to which we are a Member.

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 not need elaborate planning and design procedures.

7. Regional Offices

Two regional offices have been established: one regional office in Famagusta and one regional office in Limassol with a sub-regional office in Paphos. Also, a sub-regional office in Morphou has been established. In these regional offices the main work carried out is hydrological measurements, collection of data operation and maintenance of projects and control of construction work from the administrative point of view.

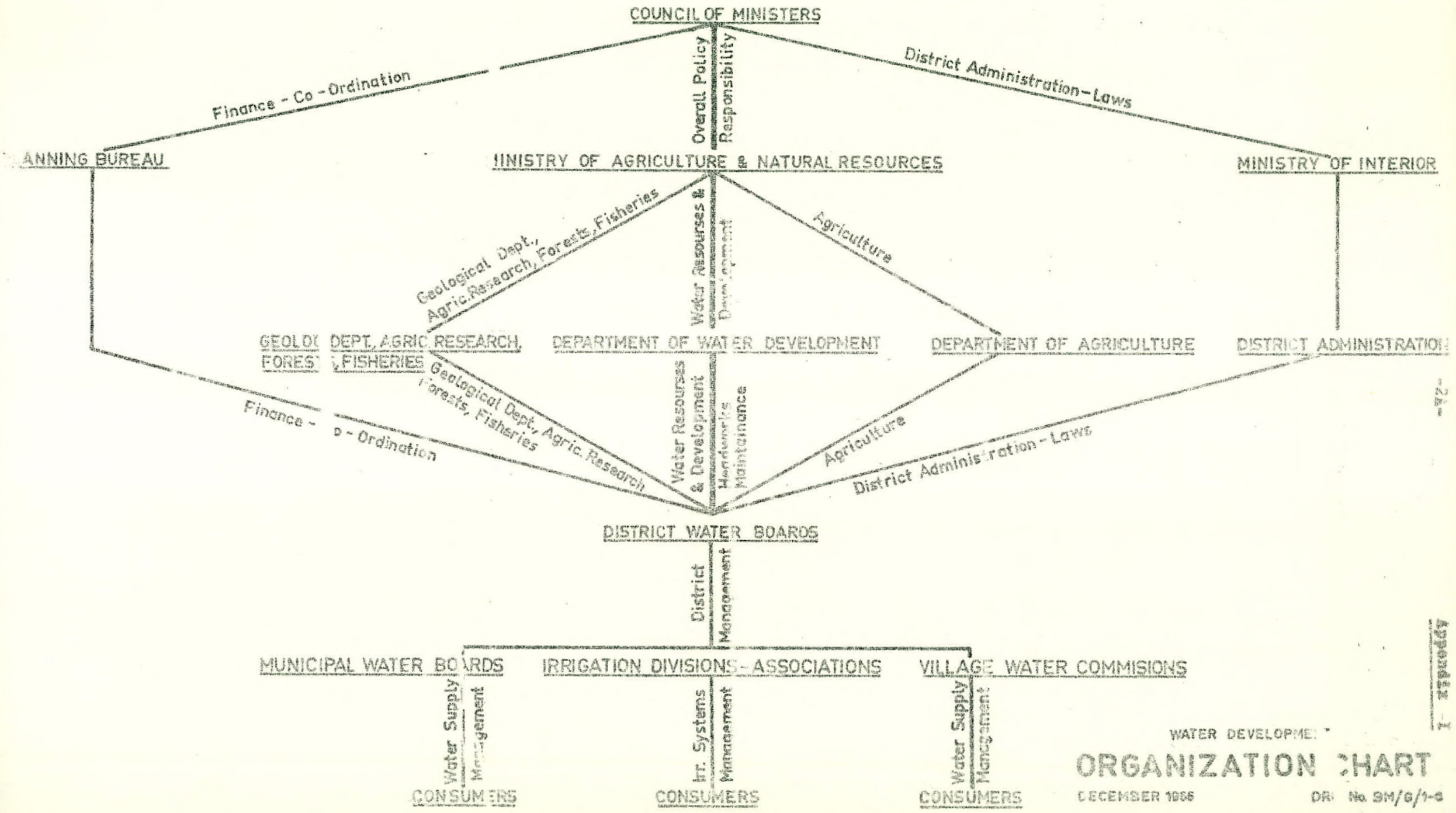
8. Office Management

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

9. Legal Advisor

The Legal Advisor deals with the various legal problems of the Department which include water legislation contractors, and water right problems and at the same time prepares new legislation as required. He also deals with important legal matters of the Ministry as a whole.





WATER DEVELOPMENT  
**ORGANIZATION CHART**  
 DECEMBER 1966  
 DR. No. 9M/6/1-6

Appendix 1



										C. Konteatis Director Vacant Ast. Director	
<b>DIVISION OF WATER RESOURCES</b> Head C. Lytras G N. Toufaxis SW Ast. Head	<b>DIVISION OF PLANNING</b> N. Ioannides EE Head Chr. Christodoulou EE Ast. Head	<b>DIVISION OF DESIGN</b> K. Hassabis EE Head Chr. Markoulis EE Ast. Head	<b>DIVISION OF CONSTRUCTION</b> H. Karakannas EH Head A. Karoglou SW Ast. Head	<b>DIVISION OF SMALL PROJECTS PLANNING</b> P. Pantelides SW Head S. Giragossian SIW Ast. Head	<b>DIVISION OF OPERATION &amp; MAINTENANCE</b> K. Hassabis EE Head G. Charalambous SIW Ast. Head	<b>OFFICE MANAGEMENT</b> Head Ast. Head Vacant	<b>REGIONAL OFFICE No 2 FAMAGUSTA</b> head Vacant	<b>REGIONAL OFFICE No 3 LIMASSOL - PAPHOS</b> Head C. Andreou EE	<b>LEGAL ADVISER</b> Ch. Pierides LA	<b>FOREIGN EXPERTS &amp; STAFF</b>	
Surface Water Resources Branch Chr. Phanartzis H Head	Applied Hydrology Branch Chr. Christodoulou EE Head	Surveying Branch A. Evripidou IW Head	Construction Control Branch N. Yiannakou SIW Head	Irrigation Drainage & Special Problems Branch S. Giragossian SIW Head	Irrigation Branch A. Josephin SIW Head	Office Services Branch D. Demetriades CC Head	Construction & Management Section head Vacant	Construction & Management Section Ph. Hjiomou IW Head	B. Millinac FAO S.W. Hsu UNDP T. L. Hsu Rep. of China V. Janzar SWE DW D B.S. Sivan SWE DW D Th. Meijer (Assoc.) FAO		
Surface Water Measurements Section P. Neophytou IW head	Flood Hydrology Section Chr. Christodoulou EE Head	Field Surveying Section D. Pitallides IW Head	Region No 1 Nicosia - Larnaca - Kyrenia Section G. Konstantinides IW Head	Rural Domestic Water Supply Branch I. Serghides SIW Head	Domestic Water Supply Branch G. Charalambous SIW Head	Filing & Communications Section G. Demosthenous C. Head	Water Resources Section G. Frangopoulos IW Head	Water Resources Section L. Sava IW head			
Sedimentation Measurements Section D. Neophytou IW Head	Water Use & Water Rights Section A. K. Sava TA head	Photographic Cartographic Surveying Section A. Evripidou IW head	Region No 2 Famagusta Section P. HjiPakkas IW head	Region No 1 Nicosia Larnaca - Kyrenia Section P. Kozamias IW Head		Typing Stenography Duplicating Section D. Demetriades CC head		Paphos Subregion Section G. E. Eliades TA Head			
Ground Water Resources Branch I. Iakovides H Head	Field Investigations Branch A. Georgiou EE Head	Drawing & Records Branch S. C. Pitallides D Head	Region No 3 Limassol Paphos Section A. Makrides IW Head	Region No 2 Famagusta Section E. Ioannou CF head		Personnel & Employment Section G. Tantas C. Head					
Ground Water Measurements & Control Section M. Antoniadis IW head	Laboratory Branch A. Georgiou EE Head	Drawing Section S. C. Pitallides D Head	Labour Materials Machinery Equipment & Safety Control Section G. Michael CF Head	Region No 3 Limassol Paphos Section V. Ioannou IW Head		Labour & Employment Section N. Chrysostomou C Head					
Ground Water Drilling Permits Section F. Butler D Head	Soils Section J. Karoglou TA Head	Library Records & Technical Information Section S. C. Pitallides D Head	Progress & Programmes Section S. Georgiou IW head			Accounts Branch G. Antoniou AD Head					
Drilling Branch M. Pappis G Head	Concrete & Materials Section J. Karoglou TA Head	Distribution Systems Branch K. Hassabis EE head	Estimates Analyses & Specifications Section C. Georgiou IW Head			Accounts Section C. Zachariades C Head					
Morphou Sub-region Office S. HjiPavlou IW head	Hydraulic Chemical Biological Section J. Karoglou TA head	Irrigation Systems Section P. Neophytides IE Head	Tenders & Procurement Section S. Georgiou IW head			Stores Section N. Krasias S Head					
Engineering Geology Branch D. Kypris G Head		Domestic Water Supply Systems Section S. C. Papadakis IW head	Workshops Branch A. Karoglou SW S. Bayados ME head			Financial Control & Coordination Branch A. Sophokleous SA head					
Geology Geophysics Section D. Kypris G C. Lytras G head		Mechanical Hydraulic & Structural Branch K. Hassabis EE Head	Mechanical Electrical & Building Section S. Kypris CF head			UNCWPP Counterpart Office Services A. Armaganian D					
Foundation's Treatment Section N. Ioannides EE Head		Mechanical Hydraulic Section A. Tymvios EE Head	Transport & Haulage Section L. Messaris CF head								
Grouting G. I. Kastanas TA Head		Structural Section A. Georgiades EE Head									
		Dams Branch Chr. Markoulis Head									

Note: \* On loan to the UN Ground Water and Mineral Project  
\* On loan to the UN Cyprus Water Planning Project  
O Vacant

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

**DEPARTMENT OF WATER DEVELOPMENT**

**ORGANIZATION CHART**

DECEMBER 1967    00    DRG. No. 8M/G/1



### III. STAFF

1. Mr. J. Mouskos ex-Director-General of the Ministry of Agriculture and Natural Resources has been engaged on contract for special administrative and financial duties, for one year as from 16.9.1968.

2. Mr. N. Tsiourtis has been appointed Topographer/Engineer as from 15.3.1968 and Mr. E. Kambouridhes as Topographer/Irrigation/Engineer on 11.11.1968.

3. The following were appointed Executive Engineers during the year: Mr. Ch. Lapas in June, Messrs. E. Gavrielides, Th. Thrassou and V. Georghiades in August and Mr. M. Dymiotis in November.

4. Mr. Chr. Ioannou was appointed Hydrogeologist in September 1968.

5. Mr. Vl. Jancar, Senior Water Engineer on contract from Czechoslovakia completed his contract in June and left Cyprus.

6. Mr. B.S. Sivan, Senior Water Engineer, on contract from India, completed his contract in August and left Cyprus.

7. Mr. A. Karoglanian, Superintendent of Works was granted leave of absence as from 1st August 1968 prior to retirement having joined the United Nations as a drilling expert in Korea.

8. Mr. S. Bayada, Mechanical Engineer, who was attached to the United Nations Groundwater and Mineral Resources Special Fund Project took over charge of the Workshop of the Department as from 1st July, 1968.

9. Mr. J. Kastanas, Inspector of Works who had been awarded a scholarship sponsored by the British Government for training in grouting techniques returned to Cyprus and resumed duty in July.

### IV SEMINARS, CONFERENCES, VISITS ABROAD.

#### (i) Mr. C.A.C. Konteatis

Mr. Konteatis as a Co-Manager of the C.F.P.P together with Mr. Cavassilas Project Manager and Mr. Andronikou of the Planning Bureau, Mr. Chimonides of the Agricultural



Department paid a visit to Morocco which was sponsored by F.A.O. During this visit it was possible to see the work of F.A.O. Project for the Water Resources Master Plan of the Sebou Valley. At the same time it was possible to see and visit some of the Irrigation Works already carried out in the country. Many citrus gardens were also visited during the same trip.

Immediately after Morocco the team excluding Mr. Andronikou visited Southern France as guests of the French Government. The visit was in the Bass due Rhone and the region of the Canal De-Provence. Many Dams, Irrigation Canals and Distribution Systems were visited. The whole trip for Morocco and Southern France was held between the 4th and 17th February.

(ii) C.H. Phanardjis, Hydrologist

Mr. Phanardjis, Hydrologist, participated in the World Meteorological W.M.O. Regional Training Seminar for Hydrological Forecasting which was held in Bratislava Czechoslovakia from the 10th to 25th October.

(iii) J. Iacovides, Hydrologist.

Mr. Iacovides, Hydrologist, paid a visit to F.A.O. Rome, where he worked with Mr. Tomas of F.A.O. on the formulation of a programme for the Morphou Hydrological Mathematical Model. This visit which was sponsored by F.A.O. lasted from the 9th September to the 12th October.

(iv) Mr. Y. Kastannas, Inspector of Works.

Mr. Kastannas, Inspector of Works, who was awarded a scholarship from the British Government on Grouting Techniques in the United Kingdom completed his training and returned to Cyprus resuming his normal duties on the 22nd July. The duration of Mr. Kastannas' course was between the 16th November, 1967 to the 27th July, 1968.

V Foreign Experts and Technical Assistance

Apart from the United Nations Special Fund Project, C.W.P.P. about which more is written later, we received other Foreign Technical Assistance as follows:-

1) Mr. S. Hsu our U.N.D.P. expert on Dams has continued for the whole year his work with us both in the Planning, Design and Supervision of Dams. Apart from his normal duties in the Department, Mr. Hsu, has helped the C.W.P.P. on general Planning such as Damsite Investigations and costing problems.



2) Mr. B. Millinusic Senior Irrigation Expert.

Mr. Millinusic our F.A.O. Senior Irrigation Expert continued also throughout the year his work which mainly included supervision of Major Construction work such as Yermasoyia Dam and Planning and Design of Irrigation systems.

3) Mr. T.L. Hsu, Senior Engineer Geologist.

Mr. Hsu, Senior Engineer Geologist of the Republic of China has continued his work throughout the year with us as offered by the Republic of China according to Bilateral Agreement. He has helped in General Engineering and Geological problems for dam site investigations and more generally has largely contributed in the work of the C.W.P.P.

4) Mr. A.H. Goossens.

Mr. Goossens from Belgium has come to Cyprus on the 10th November 1968 as an Associate Expert through the U.N.P.P. He has been working under the supervision of Mr. S. Hsu and has been dealing mainly on investigation problems mainly for Damsites.

5) United Nations Special Fund Project for Ground Water and Mineral Resources.

The G.W.M.R.P. continued its work throughout the year under Project Manager, Dr. Tornqvist and Co-Manager Mr. Y. Hji Stavrinou, Director of the Geological Department.

We have continued our contribution to this Project with one Geologist, one Mechanical Engineer for part of the year, one Chief Drilling Foreman and a number of Technical Assistants, Draughtsmen, Foremen and drilling equipment. At the same time a lot of hydrological measurements and observations on a great number of wells and boreholes had been collected by our Department as a contribution to the G.W.M.R.P. special studies for the hydrogeology of the various aquifers.

6) British Technical Assistance.

British Technical Assistance was continued throughout the year for 3 main works:-

a) Famagusta Water Supply:

For this Project, Howard and Humphreys of U.K. have been appointed to advise on problems relating to the pumping installations, the pipeline, the storage reservoirs, the dams and the filtration works required.

This work has been planned, designed and contracted by the Department of water Development and we seek advice



of Howard and Humphreys whenever required according to an agreement drawn up, by the Ministry of Overseas Development and ourselves. During the year Mr. Dixon, Director of the Company visited Cyprus in July for general problems including the dams and pipeline. Also Dr. Newberry consultant of the Firm and Specialist in Engineering Geology came in August and investigated the dam site at Lefkara and other possible dam sites in the rivers of Pentaskinos, Maroni, Vasilikos. From the same company and for the same work Mr. Wins and Mr. Faithful, visited the island.

b) Vasilikos Khirokitia Aquifer Investigations

This aquifer is made up of the Lapithos-Pakhna Formations as well as alluvial river deposits mainly in Vasilikos valley. The investigations were continued under the supervision of Dr. Dixey. These investigations are in connection with the Fama-gusta Water Supply and good quality water has been found both in the river gravels at Vasilikos and in the Pakhna sandstone near Khirokitia. It is hoped to supply water at a million gallons a day from this aquifer.

c) Special Foundation Problems

This work which has been done by Sundeman and Kennard of London include:-

The supervision of the Yermasoyia Dam alluvial and abutment grouting.

Investigations of the landslides of the Mamonia slopes of the Mavrokolymbos Dam reservoir.

Investigations of the extension of the grouting curtain in the sandstone abutment of the Polemidhia Dam.

Investigations on the terrace and rock landslides above the Kalopanayiotis Dam

Investigations for the proposed Damsite at Sklydros, Palechori.

The investigations for these works have been done by Mr. M.F. Kennard, Director of the Firm and Dr. Morgenstern of the Imperial College, Consultant on landslide problems.

7) EnergoProjekt.

This Consultant from Yugoslavia continued throughout the year consulting and supervising work for the construction of Yermasoyia Dam which was completed by the end of the year. Up to 5 engineers have been working on the dam under Resident Engineer Mr. Huibner. Dr. Anagnosti, Chief Supervisor from Beograd came in October to supervise the work.



A specialist Expert on the Mechanical Equipment Mr. Tricic came to supervise the installation of the radial gates.

#### VI Water Resources & Utilization Special Fund Project

This project continued its work throughout the year. All experts have been appointed and now include the Project Manager, Project Deputy Manager, Senior Engineer, Senior Hydrologist, Assistant Hydrologist Expert, Irrigation Expert, Economist Expert and two Associates.

At the same time the Government contributes a counterpart for each of the experts plus a great number of Technical and Clerical staff.

Work was continued mainly on the collection of data such as hydrological, agricultural, and economic.

Surveys and hydrological work as well as detailed damsite exploration have been carried out all over the island.

Regarding the hydrological work a computerizing programme has been fully developed and all computations have been done on the Bank of Cyprus computer. The soil surveys undertaken by the Department of Agriculture have been under way throughout the year and the detailed work in Paphos to a scale of 1/10,000 has been completed. This area covers 280,000 donums. Similar work is being done for Morphou, Limassol and Larnaca.

Special Farm Management and Land Tenure studies have been undertaken, and Dr. Christodoulou of F.A.O. came to Cyprus for special advice on this subject.

During the year the sub-contractors for the Paphos District have been appointed by F.A.O. after a selection of 3 consultants who they had originally selected for this purpose. The Sub-contractor finally selected by F.A.O. was T. Ingledow & Associates Ltd. of Canada. The Team Leader of the Sub-contractor arrived in Cyprus on the 15th November, 1968. During December the consultant Hydrologist, Civil Engineer, and Soil Scientist of the Company also arrived.

This sub-contractor is detailed to carry out the feasibility of the 4 rivers of Paphos Khapotami to Ezuza to such an accuracy as required by the work.

Co-operation with the C.W.M.P. which is now nearing completion has continued throughout the year on ground water hydrology.



Due to the considerable amount of work required to carry out the C.W.P.P., a proposal for an amendment to the plan of operation has been prepared providing for more experts and consultants, increase in the equipment vote and more votes for computer studies.

It provides for an extension of the Project by 4 months until April, 1970.

#### VII. COMMITTEE MEETINGS.

##### a) Hydrological Decade Committee.

This Committee which was established for U.N.E.S.C.O.'s Hydrological Decade and which is made up of the Director of the Department of Water Development as Chairman, and the Directors of the Geological Department, of the Forest Department of the Agricultural Department, of the Agricultural Research Institute and the Chief Meteorological Officer as Members, met during the year and discussed the progress of the work undertaken in connection with our contribution to the Hydrological Decade.

Throughout the year close observations were taken in the Limnitis basin which included detailed climatological and stream flow measurements. For the flow of this river which was measured with a usual broad crested weir, fitted with an automatic water level recorder, a Wellington measuring device has also been added with the object of enabling a silt free flow and establishing a unique stage discharge relationship.

A precise automatic water level recorder has been fitted to record slight water level fluctuation in the float well connected with the flow in the weir.

The climatological records include a wind velocity anemograph which records at 10 meters above the ground. Also, one weekly thermograph and one weekly rain recorder have been added.

The results are reported to U.N.E.S.C.O. Headquarters in Paris.

##### b) International Commission on Large Dams

On the 3rd September, 1968, a meeting was held in the office of the Director of the Water Development Department, during which it was decided that a National Committee would be established and an application to be submitted for membership to the International Commission of Large Dams. During this meeting it was decided that the National Committee should be made up of: -

The Director of Water Development as Chairman and the following members.



The Senior Water Engineer Head of the Division of Planning of the Water Development Department, the Senior Water Engineer Head of the Division of Design of the Water Development, a representative of the Association of Civil Engineers and Architects, and a representative of the Association of Contractors.

The names of the persons elected are:-

- Mr. C.A.C. Konteatis, Director of the Water Development,  
Chairman,
- Mr. K. Hassabis, Head of the Division of Design.
- Mr. N. Ioannides, Head of the Division of Planning.
- Mr. Y. Zambarloukos, Representative of the Association of  
Civil Engineers and Architects; and
- Mr. G. Paraskevaides, Representative of the Association  
of Contractors.

Following that meeting an application was sent to the Secretary-General of the International Commission for membership to the I.C.O.L.D. The Secretary-General answered back saying that he found all documents in order and that he was quite sure that Cyprus would be elected as a new member country at the 37th Executive Committee Meeting which would be held in Warsaw Poland, in September, 1969. It is hoped that Cyprus will participate in this Executive Committee Meeting. As it is known this Organization is made up of members of independent Government countries which have a sufficiently enough number of large dams.

The objects of the Commission are:-

- a) To inter-change information among its several National Committees
- b) To hold Executive Public or other meetings at intervals.
- c) To organize and co-ordinate studies and experiments.
- d) To publish proceedings, reports and documents.

To support our membership a list (Appendix II ) of the large dams as defined by the I.C.O.L.D. has been sent to the Secretary as well as a list (Appendix III ) showing the maximum spillway discharge of these dams.

C) Inter-Departmental Co-ordination Committee.

This Committee which is made up of the Director of Water Development Department as Chairman, and of the Directors of the Departments of Agriculture, Forests and Geological Surveys as members, and whose task is to co-ordinate work in connection with the Planning of major irrigation Projects met during the year several times to discuss several major projects. The major projects discussed during the year were:-



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

(1) FILE NO.	(2) NAME OF DAM	(3) YEAR OF COMPLETION	(4) LOCATION			(7) TYPE	(8) ELEVATION			(11) LENGTH OF DAM	(12) VOLUME OF DAM	(13) CAPACITY OF RESERVOIR	(14) PURPOSE	(15) INSTALLER POWER CAPACITY	(16) OWNER	(17) ENGINEERING BY	(18) CONSTRUCTION BY	(19) REMARKS	
			NEVER	NEAREST CITY	STATE COUNTY OR EQUIVALENT		ABOVE LOWEST FOUNDATION	FOUNDATION TO CUT-OFF	ABOVE GROUND LEVEL										FEET
Delete units which are not being used																			
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	35	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	
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	3,248	230,000	57	I		GOVERNMENT	IL NUOVO CASTORO OF ITALY	DEPARTMENT OF WATER DEVELOPMENT	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	4,500	197,000	61	I		MORPHOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	ALSO GROUND WATER RECHARGE	
18	PRODHROMOS	1962	DHIARIZOS	LIMASSOL	LIMASSOL DISTRICT	E	34		20	1,400	96,000	4	I		PRODHROMOS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	RECTANGULAR RESERVOIR	
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	12	I		KANDOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	MASONRY	
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	



Maximum Discharge Capacity of the Spillways  
Under Maximum Height of Reservoir.

<u>Dam</u>	<u>Type of Spillway</u>	<u>Maximum Discharge</u> <u>cu. ft. / sec.</u>
Yermasoyia	G.S.	30,000
Polemidthia	F.S.	20,000
Mavrokolymbos	F.S.	12,000
Morphou	F.S.	24,000
Tremithios-Kiti	F.S.	22,000
Argaka-Makounda	F.S.	9,800
Kenli-Keyu	F.S.	1,400
Geunyeli	F.S.	6,100
Pomos	F.S.	11,000
Athalassa	F.S.	1,400
Kalopanayiotis	F.S.	7,200
Liopetri	F.S.	3,200
Lefka	F.S.	2,100
Mia Milea	F.S.	850
Trimiklini	F.S.	3,200
Ayia Marina	F.S.	5,700
Pyrgos	F.S.	4,200
Kafizes	F.S.	1,900
Pera Pedhi	F.S.	3,800
Prodromos	O.P.	100
Agros	F.S.	220
Kandou	F.S.	2,100
Ovgos	F.S.	17,400

## Note:

G.S. :- Gated Spillway

F.S. :- Free Spillway

O.P. :- Overflow Pipe



- (i) Palechori proposed dam;
- (ii) Massari proposed dam;
- (iii) Karavas proposed dam;
- (iv) Argaka-Makounda Dam proposed Distribution System and
- (v) Yermasoyia Dam proposed Distribution System.

### VIII. LEGISLATION

During the year, important legislation amendments were enacted for the Government Water Works Law, Cap. 341 for the Irrigation Division Law, Cap. 342, and for the Irrigation Associations (Private Water Law) Cap. 115. These modifications to the legislation started much earlier as a result of the report of the F.A.O., Legislation Experts Professor Kranc and Dr. Carbonera of the Proposed Water Code for the Island. Early discussions and work had been done by a Committee under the Chairmanship of the District Officer of Limassol Mr. Benjamin, but the work was put in its final form and properly drawn up during the year by our Legal Advisor Mr. Pierides.

The most important provisions of the modified legislation are:-

For the Government Water Works Law:-

- (1) The establishment of District Water Committees for the management of major water works in each District.
- (2) conditions can be imposed on the use of water.
- (3) the Government can impose water rates on Irrigation Divisions or private persons, who are directly or indirectly benefitted by water works. This provision enables the charging of well owners who are benefitted indirectly by the ground water recharge or otherwise.

For the Irrigation Divisions Law:-

- (1) Irrigation Division can buy water from a Government Project.
- (2) Two or more Irrigation Divisions can be joined into a larger one.
- (3) Irrigation Divisions can acquire land required for their works.
- (4) Irrigation Divisions can charge their members with water rates.
- (5) Irrigation Divisions can charge proprietors outside the Irrigation Division's boundaries who are indirectly benefitted by works such as recharging work carried out for the Irrigation Division.

As regards the Irrigation Association's Law, the modifications aim at enabling the Committee to acquire loans and mortgage



their property. Also to come to an agreement with the Government or Irrigation Divisions or other Organizations or persons for the purchase of land or other property required for the works of the Association.

#### IX. WATER RESOURCES

Detailed report regarding the Hydrological and Hydrogeological aspects to our work appears at a later chapter which has been prepared by Mr. C. Lytras, the Assistant Director.

During the year the 3 main aquifers of the Island, that of the Western Messaoria, that of the Eastern Messaoria and that of the Akrotiri Peninsula, which have been declared as Critical Areas under the Water Supply (Special Measures) Law, have been in close observation and control. In these three areas a great number of water meters have been installed on each borehole with the view of measuring the extraction of water and thereby controlling the use of water for irrigation or water supply. There are, however, considerable difficulties in convincing the people to accept willingly the application of these special measures, but it is considered that at least in the Western Messaoria and Akrotiri where a better understanding has been shown, that the progress of the application of the law is satisfactory. In Famagusta, however, as had been anticipated, because of the severity of the problem and because of the ~~reduction~~ of the ~~income that~~ occur in the area, the people have been very reluctant to accept willingly the application of the Special Measures Law and the reduction of pumping. One important result of the Special Measures Law especially in the Western Messaoria region where a lot of water is being wasted through inefficient systems of irrigation, was the initiation of more efficient irrigation systems such as hose basin and sprinkler systems. However, the illegal drilling in the Eastern Messaoria and in particular in the south-eastern part of the Island has continued with the same rate as previously in spite of the repeated efforts and convictions by the Court. The ground water situation in this area has definitely deteriorated during the year and the hopes of significant remedial measures are very remote. The dry year has also contributed to the worsening of the ground water situation.

In the meantime during the year the work on the hydrological investigation in the Larnaca region and in particular on the Pakhna and Lapithos Formations as well as the alluvial deposits of the Vassilikos river valley has continued under the



advice of our expert Dr. Dixey who was provided to us through the British Technical Assistance by the Ministry of Overseas Development. The result of this investigation which included a lot of work on drilling and geophysical explorations proved to be very promising and we have concluded by the results of the year that the one million gallons per day of water supply promised to Famagusta as First Phase will materialize.

The diversion of water from this region to Famagusta for the domestic water supply will be a major achievement and we hope to carry it out in 1969.

During the year we carried out ground water exploration work in the coastal area of Paphos between the ~~Khapotaxi~~ and the town of Ktima in connection with the study carried out by the U.N. Project. This work will be completed in 1969. Our routine work on the measurements of the rivers of the island and the building of additional weirs to enable more rivers to be gauged has continued at the same pattern as usual. During the year more work has been carried out by the U.N. Project through the use of a hydrological model for the evaluation of the surface water resources of the island.

#### X. PLANNING AND DESIGN OF PROJECTS

The details of the planning work are outlined by the Report of Mr. N. Ioannides, Senior Water Engineer, in charge of the Division of Planning and that of the Design work are outlined by the report of Mr. Hassapis, Senior Water Engineer in charge of the Division of Design.

Our Planning Work during the year was mainly for the C.W.P.P., in connection with the Master Plan preparations for the whole island and the feasibility studies for the Paphos watersheds. Detailed investigations for the foundation conditions of several Dam Sites on the main Paphos rivers have been carried out. Two sets of core and over-burden drilling rigs were constantly working in the region.

At the same time detailed investigation works were carried out for the construction of a Dam at Lefkara and another at Khirokitia, in connection with the Water Supply Scheme of Famagusta. Also investigations were carried out to determine the suitability of the dam sites for small dams proposed for Arachippou and Neon ~~Khorio~~ (Kythreas). During the year we also carried out foundation investigations for



other Departments such as the Grain Commission for building silos at Limassol, Paphos and Famagusta.

Regarding our Paphos Projects for the feasibility studies we received special advice from three French consultants, Messrs. Barbier, Barges and Mr. L'heritch. As regards our Famagusta Water Supply Dam sites, we received special advice from Mr. Dixon and Dr. Newbery of Howard and Humphreys through the British Technical Assistance.

Regarding the following up observations for Special Engineering Geological problems on certain dams such as Yermasoyia, Mavrokolymbos, Polemidhia and Kalopanayiotis, we received special advice from Dr. Mergestern and Mr. Kennard through the British Technical Assistance.

Detailed design work during the year has been mainly done on the Famagusta Water Supply Project, the first phase of which included a 64 km. long asbestos-cement pressure pipeline of up to 640 mm diameter. Storage reservoirs at Khirokitia and at Phrenaros are also provided. The design of filtration works at Khirokitia was also under close study. During the year the design work was completed for the proposed Palekhori Dam at Sklydros site. However, this site was eventually dropped down because of adverse geological conditions and unsatisfactory foundation investigations. The detailed design of the proposed Massari recharge dam and spreading grounds have also been completed.

Detailed work for a number of distribution system for major dams have also been completed during the year. The Surveying teams and the drawing office staff were very busy throughout the year both for Departmental work and for the C.W.P.P., Planning Work. About 20 Surveyors and 20 Draughtsmen, the latter all girls have been participating in the work.

#### XI CONSTRUCTION OF PROJECTS.

Mr. Karakannas in charge of the Division of Construction writes in detail in his report regarding the activities of the Department in Construction Works. During the year, 34 village water supply works were completed at a total expenditure of about £142,000. Also during the year 75 irrigation schemes were completed throughout the island which included lining of canals pumping schemes recharge works diversion intakes and other smaller irrigation works. The total expenditure of these minor irrigation works was of the order of £112,000.



Major Projects were also undertaken during the year, the most important of which was the Yermasoyia Dam under construction by CYBARCO Contractor. At Mavrokolymbos Dam work was carried out at the right abutment of the reservoir for the stabilization of this abutment from land slides and for the protection of the inlet structure of the dam.

At Kalopanayiotis Dam a cut-off weir was built down stream of the dam to collect the leakages from the dam and divert them into the irrigation pipeline.

At Pomos Dam the concrete lining of the spillway was extended down the river bed in order to avoid erosion of the earth spillway which was endangering the downstream toe of the Dam.

The average number of labourers employed in the Department during 1968 was 1173 as compared with 1199 in 1967. 26.81% were classed as regulars whilst approximately 48.65% were skilled employees, 10.38% semi-skilled and 40.97% unskilled. 3.60% of the labourers employed were Turks.

The approximate monthly average of labourers engaged was as follows:-

January	1274
February	1145
March	1020
April	939
May	991
June	1039
July	1244
August	1322
September	1271
October	1262
November	1353
December	1219
average:	<u>1173</u>

## XII OPERATION AND MAINTENANCE OF THE PROJECTS

The difficulties in the management of the big Irrigation Projects, such as Argaka-Makounda, Pomos, Ayia Marina, and the Polemidhia Dams have continued throughout the year. As pointed out in the previous Annual Reports the Governmental organization set up for the management of Major Irrigation Projects is not the best one. There are too many Ministries and Departments involved in this management and it is very difficult to get things going easily.



In the case of the Argaga-Magounda Dam, the water right claims of the villagers are still pending and the villagers refuse to buy water from the Dam. In the case of the Pomos and Ayia Marina Dams, the villagers want to buy water from the dams at a rate per cu. meter instead of having to contribute a percentage of the total cost as is usually done for small projects. The Government is still considering what is the best course to take for these dams. In the case of Polemidhia Dam it was found very difficult to find people to buy the water at the prescribed rate of 15 mils per cu. m. which many people consider to be very high.

Maintenance work was carried out in many of the major and minor dams and their distribution system in order to maintain the safety and efficient functioning of the structures.

The most successful operation of dams last year was that of Kalopanayiotis from which all beneficiaries bought the water willingly at the prescribed rate of 13 mils per cu.m. Efficient irrigation systems using the hose-basin irrigation has been widely applied in all the area whilst terracing of the sloping land has been carried out throughout.

Our intension still is that proposals are to be submitted to the Government by the end of the C.W.P.P. studies early in 1970, regarding modifications and improvements to the organization together with the necessary legislation to enable a more efficient management of the major irrigation projects in particular.

## XII FINANCE AND EXPENDITURES

As it can be seen on page 17 the total expenditure of the Department during the year reached £1,449,393 out of which £228,902 represents administration costs. The largest item of expenditure was the irrigation works including major projects, the expenditure of which reached £667,110.

The monthly statement of development expenditure for the Department during the year 1968 is shown on page 18.

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 gratifying that the Ministry and the Planning Bureau have supported the various efforts made by this Department in November, 1968, for the Loan Commissioners to accept and consider the applications for loans towards the end of 1968 in anticipation of the approval of the 1969 Budget.

It is hoped that with the assistance of the various Government Departments and particularly 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.

The table on pages 19-21 shows the expenditures 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 in 1964 and reached £1,807,751 whilst the minimum in 1941 was £22,268. The percentage of overheads to works expenditures 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.



1968 Expenditure--Water Development

Department

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	Details	Govt. Funds £	Contribution by Beneficiaries	Total £
1.	Administration	228,902	-	228,902
2.	Irrigation Drainage and Dams.	586,168	80,942	667,110
3.	Town Water Supplies	101,168	4,415	105,583
4.	Village Water Supplies	119,472	112,781	232,253
5.	Drilling & Prospecting	49,095	-	49,095
6.	Hydr. Observ. Res.& Weirs	19,768	-	19,768
7.	Workshops (Maintenance)	16,689	-	16,689
8.	Purchase of machinery, tools and equipment	5,918	-	5,918
9.	Consultants' Fees	14,676	-	14,676
10.	Govt. Water Supplies	1,900	-	1,900
11.	Major Projects Investi- gations and Surveys	34,801	-	34,801
12.	Greater Nicosia Scheme	63,707	-	63,707
13.	Water Supply-Special Measures Law	86	-	86
14.	Erection of Buildings	2,827	-	2,827
15.	Stores	6,078	-	6,078
	Includes Ordinary & Develop. Expenditure	£1,251,255	198,138	1,449,393

Breakdown of Administration

1.	Personal Emoluments	128,847	-	128,847
2.	Casual Assistance	10,424	-	10,424
3.	Technical Assistance	40,191	-	40,191
4.	Travelling	19,289	-	19,289
5.	M'ce & Oper. of M.Transport	17,917	-	17,917
6.	Office Expenses	1,406	-	1,406
7.	Leave Pay to Reg. Employees.	10,828	-	10,828
	Total	228,902	-	228,902



Monthly Statement of Development  
Expenditure for 1968

1968 Approved	£2,295,123
Add. S/Warrants Nos. 9, 76 and 81/68.	<u>10,534</u>
Total.	<u><u>2,305,657</u></u>

Month	Monthly	Expenditure Up-to-date	Balance	% to date expended
January	43,950	43,950	2,261,707	1. 9%
February	42,527	86,477	2,219,180	3. 7%
March	69,624	156,101	2,149,556	6. 7%
April	124,050	280,151	2,025,506	12. 1%
May	109,150	389,301	1,916,356	16. 9%
June	38,999	428,300	1,877,357	18. 6%
July	30,345	458,645	1,847,012	19. 9%
August	57,651	516,296	1,789,361	22. 3%
September	84,166	600,462	1,705,195	26. .
October	105,588	706,050	1,599,607	30. 6%
November	147,438	853,488	1,452,169	37. 5%
December	242,762	1,096,250	1,209,407	47. 6%

Summary.

Approved Amount	£2,305,657	(100%)
Less Actual Expend.	£1,096,250	(47. 6%)
Unspent Balance:	<u>£1,209,407</u>	(52. 4%)



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 & B/HS.										
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	74,154	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 & Maint 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 and B/Hs										
9.	Town Water Supplies	--	--	155,116	119,431	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
1.	Administration	81,677	64,255	70,527	81,983	151,580	130,164	135,410	145,389	183,927	228,902
2.	W/Shops & M'ce of Plant and Stores	20,441	28,979	30,238	31,789	14,000	16,150	15,500	14,147	14,848	25,594
3.	Purchase of Machinery tools etc	960	-	-	31,712	120,000	46,030	16,875	10,973	12,927	5,918
4.	Hydrological Observations	7,090	6,059	10,640	40,520	40,500	43,223	28,200	18,863	20,538	19,768
5.	Consultants' Fees	-	-	-	-	-	39,378	45,065	51,297	32,040	14,676
6.	Major Projects Investigations	-	-	-	-	-	10,202	15,290	7,733	20,880	34,801
Sub-total "A"		110,168	99,293	111,405	186,004	326,080	285,147	256,340	248,402	285,160	329,659
7.	Drilling of water	45,084	48,837	83,608	82,151	63,700	47,588	40,200	24,253	35,029	49,095
8.	Water Meters for wells & B/Hs	-	-	-	-	-	-	-	983	2,672	86
9.	Town water Supplies	113,853	220,370	88,282	97,724	70,900	197,871	178,010	138,390	68,782	171,190
10.	Village Water Supplies	113,493	137,825	602,436	602,537	486,600	507,679	404,600	108,926	130,340	232,253
11.	Small Irrigation Projects	68,274	49,288	141,712	253,817	383,052	400,046	95,002	113,636	221,169	174,065
12.	Major Irrigation Projects	50,000	50,000	120,000	150,000	414,948	369,420	691,348	689,010	941,131	493,045
Sub-total "B"		390,704	506,320	1,036,037	1,204,229	1,418,600	1,522,604	1,409,160	1,075,198	1,399,123	1,119,734
Grand Total		500,872	605,613	1,147,442	1,390,233	1,744,680	1,807,751	1,665,500	1,323,600	1,684,283	1,449,393
% of A to B		28.2	19.6	10.7	15.4	22.9	18.7	18.1	23.1	20.3	20.3



XIII.

PUBLICATIONS

Reports of Water Development Department during 1968

<u>Library Reg.No.</u>	<u>Title</u>	<u>Author</u>
4004	Report No.17. (Preliminary study) Land Reclamation of the salt lake of Akrotiri.	MILINUSIC, B.M.
4005	Karavas Irrigation Project (Preliminary Report)	CHRISTODOULOU, C.A.
4090	Surveying standards. Instructions Manual No.2	EVRIPIDOU A.
4104	Small Projects Planning Instructions (Manual No. 5/4)	KONTEATIS C.A.C.
4111	Report No.18 Cost Estimating Data for Dams Constructed by Contractors in Cyprus from 1963 to 1968	MILINUSIC, B.M.
4121	Hydrological Section Annual Report 1966-67 Vol.I, Vol.II.	TOUFEXIS CHR.N.
4129	Famagusta Water Supply Khirokitia Project	W.D.D. DESIGN DIVISION.
4131	Foundation Investigations for Cyprus Grain Commission at Ypsonas Grain Silo site.	GEORGHIOU A.
4132	Foundation Investigations for Cyprus Grain Commission at Kato Paphos Grain Silo Site	GEORGHIOU A.
4144	Reconnaissance Geological Report on Kapsala Dam Site	XENOPHONTOS C.
4164	Syngراسi Dam Construction Completion Report.	GEORGHIADES A.
4165	Xeropotamos River. Asprokremmos Dam. Foundation Investigations	XENOPHONTOS C.
4171	Cyprus Spring & Stream Discharge 1966-67 Report No.1	TOUFEXIS CHR. N.
4176	Massari Dam. Design Report	GEORGHIADES A.
4194	Furrow Irrigation. Design Data and Test Results	MEIJER TH.
F/4	Ezuza River Morokambos Dam Foundation Investigations.	XENOPHONTOS C.
4226	Reconnaissance Geological Investigations of Kalavassos Dam-Site and Reservoir Areas	XENOPHONTOS C.
4294	Irrigated Land Use Instructions Manual S/3	S.C.PITSILLIDES
4291	Estimation of Floods in Cyprus	HSU W.S.
4292	Dam Projects for Famagusta Water Supply Preliminary Scheme.	HSU W.S.
4293	Selection of Reservoir Capacity	HSU W.S.



DIVISION OF WATER RESOURCES

Prepared by:

C.S. Lytras, Asst. Director, Head of Division

Introduction

Following the Department's re-organization which was effected from the beginning of the year under review, the Division of Water Resources grouped 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 work projects.

Mr. N. Toufexis, Assistant Head of the Division acted also as Head of the Surface Water Resources Branch since Mr. Chr. Phanartzis, Hydrologist, has been attached to the Cyprus Water Planning Project. Mr. M. Peppis, Geologist, was the Head of the Drilling Branch and Mr. J. Jacovides, Hydrologist, headed the Ground Water Resources Branch. Mr. C. Xenophontos, Geologist of the Geological Survey Department has been attached with this Department since February in dealing with engineering geology problems and acted as Head of the Engineering Geology Branch. Mr. Chr. Ioannou Hydrogeologist has been appointed on temporary basis in October 1968 and he has been working on the study of the hydrogeology in South Eastern Mesacoria.

A. Prospecting Drilling

There has been a remarkable addition of a heavy duty Bucyrus (60 R.L) to the Department's drilling rigs. This rig was purchased in March, this year. The present holding is: Two heavy duty Bucyrus (60 R.L) and 10 Bucyrus 22W. The Bucyrus 60 R.L., are very efficient in drilling on the limestone and for drilling to depths from 1000-2000 feet. The Bucyrus 22W are used for standard drilling. Three other Bucyrus 22W rigs still remain in the hands of the Turks. One of these unfortunately the only one of its kind, was adopted for rotary drilling.

Throughout the year two Bucyrus Drilling Rigs were made available to the United Nations Special Fund Project for Ground-Water and Mineral Survey for the drilling operations carried out by the Project.



Sixty seven boreholes were drilled for water with an aggregate footage of 14,578 feet with an average depth of 267.5 feet. A summary of the results of boreholes drilled at every village and District is shown on pages 25 - 26. Another three boreholes were drilled as technical or observation making a total of seventy.

A total of 26 boreholes were subjected to lengthy durability and potential test pumpings ranging from 6 hours to 243 hours continuous duration. The volume of water pumped was 35,735,600 gallons over a total pumping time of 2,852 hours. Most of the tests were carried out by means of an electrosubmersible pump of 7½" ø with a specific capacity of 25,000 gph from 100 feet to 15,000 gph from 450 feet.

The average cost of departmental drilling in 1968 was £500 per borehole or \$1.6 per foot of drilling. These expenses include wages, fuel, cost of drilling casing, laying of drilling casing as well as a short preliminary pumping test of boreholes with promise of a fair yield of water. They also include wages of fitters and blacksmiths and the cost of workshop maintenance of drilling tools and equipment.



Boreholes Drilled for Water in 1968

Summary of Results

District	Locality	Number drilled	Number successful	Percentage successful	Hours pumped	Total output gallons	Average Yield G.P.D.	
N'sia	Ayios Sezo- menos	3	1	33.3	121	667.073	132.312	
	Alona	1						
	Tsakistra	2	1	50.0				
	Exo-Metochi		4	3	75.0	48	193.750	96.876
						74.5	424.034	136.968
					24	296.344	296.344	
	Karavostassi	1	1	100.0	24	132.500	132.500	
	Kato Pyrgos	1	1	100.0	164	1,253.360	183.408	
	Kambos	1	1	100.0				
	Laxia		2	2	100.0	8	44.000	
						120.5	2,157.960	430.512
	Morphou	2	2	100.0	8.5	42.500		
						88	2,050.000	559.080
	Massari	2	2	100.0	65	713.867	263.208	
	Politiko	1	-	-				
Potamia	8	3	37.5					
Potamos tou Kambou	1	-	-					
Vyzakia	1	1	100.0	6	21.000			
Kyrenia	Ayia Irini	1	1	100.0	8	32.800		
	Halevga	1	1	100.0	72.5	102.501	340.248	
	Lapithos	1	to	be completed		in 1968.		
	Phterykha	1						



Boreholes Drilled for Water in 1968

Summary of Results

District	Locality	Number drilled	Number successful	Percentage successful	Hours pumped	Total output gallons	Average Yield G.P.D.
Larnaca	Alethriko	1	1	100.0	97	1.566.240	287.516
	Athienou	4	2	50.0	97	1.331.692	329.496
					142	2.329.250	393.696
					24	114.533	114.533
	Kalo Khorio	1	1	100.0	24	114.533	114.533
	Khirokitia	4	3	75.0	192	2.919.000	364.872
					135	2.650.000	471.120
					99	1.224.150	296.660
	Klavdhia	1	-	-	-	-	-
	Maroni	1	1	100.0	139	2.681.000	462.912
Tokhni	1	1	100.0	-	-	-	
Vasilikos	2	2	100.0	8	48.000	-	
				243	4.378.860	432.430	
				-	-	-	
Limassol	Episkopi	1	-	-	-	-	-
	Kolossi	1	1	100.0	118	129.400	26.316
	Pendakomo	1	-	-	-	-	-
F'ista	Kantara	1	-	-	-	-	-
	Marathovounos	3	1	33.3	-	-	-
	Paralimni	4	-	-	-	-	-
	Phrenaros	1	1	100.0	-	-	-
Paphos	Sotira	1	1	100.0	81	198.000	58.680
	Amargeti	2	1	50.0	-	-	-
	Kato Polemidhia	1	1	100.0	65	709.000	261.792
	Pelemi	1	-	-	-	-	-
	Stroumbi	1	-	-	-	-	-



B. Some notes on certain prospecting boreholes of special hydrogeological interest.

Prospecting drilling was carried out this year for new aquifers in the various geological formations and useful information about new aquifers, as well as, a more detailed knowledge of the already known aquifers was obtained.

A few selected boreholes of interesting results are described below:-

One of the most high yielding kind of aquifers is that made of river gravel deposits. Drilling in such aquifers was carried out through 1968 and the drilled boreholes gave excellent yields.

In siting a borehole in a river bed the object is to locate the thickest zone of saturated gravels for maximum yield.

The most interesting boreholes drilled in this type of sediments are:-

Borehole Serial No. 18/68 (Grid. Ref. N.68,185 E.41,145)

This borehole was drilled in the village boundaries of Kato Pyrgos in the alluvial gravels of Katouris River. It penetrated 140 feet of gravel and sand, 43 feet of which were saturated. A pumping test with an electrosubmersible pump was carried out for 164 hours continuously. For 117 hours the output was 12,000 gph. For the last 47 hours the output was increased to 23,680 gph. The maximum drawdown was 9 feet. This is considered to be an excellent borehole and will be used for a regional irrigation scheme.

Borehole Serial No. 27/68 (Grid. Ref. N.64,634 E.55,449) was drilled in the Xeros river valley near Karavostasi.

Although this borehole has not been tested for maximum yield it is considered to be very successful because it penetrated 175 feet of gravel of which 150 feet were saturated. A preliminary test with a piston pump gave 5,500 gph with a drawdown of 11 inches. The water is of excellent quality. This borehole will also be used for an irrigation scheme.

Most of the successful drilling of this year was carried out in the aquifers of the Pohna Formation. Two main aquifers were exploited in the Pahnna, the calcareous sandstone and gypsum.

Drilling in the gypsum was particularly successful in the areas of Exometochi and Athienou.



Very interesting results were obtained from drilling in the area to the East of Exometochi village in the Mesaoria. The object of drilling was to get information on the gypsum aquifer in the area.

Borehole Serial No. 48/68 (Grid. Ref. N.72,966. E.20,601).

The gypsum beds were struck at the depth of 117 feet from the surface, below light yellow marls. The gypsum went down to 347 feet being alternated with thin beds of grey marl. On a preliminary test with a small electrosubmersible pump the borehole yielded 8100 gph for 24 hours with a maximum drawdown of 15 feet. The quality of the water, however, is very poor being very high in NaCl. It can only be used for special crops that can endure saline water.

In the area east of Athienou village the gypsum deposits were proved to be very good yielders of ground water.

Borehole Serial No. 31/68 (Grid. Ref.No. 56964. E.22407).

The highly pervious gypsum beds were met at a depth of 12 feet and went down to 85 feet allowing a saturated thickness of 55 feet.

A step-drawdown test was carried out for a total of 97 hours yielding a total quantity of 1,332,000 gallons. The maximum hourly output was about 25,000 gallons with a corresponding drawdown of 25 feet.

The NaCl content was 550 p.p.m. and the total hardness 1,500 p.p.m.

The discovering of the gypsum aquifers is very important indeed particularly as this was made in areas where ground-water is so scarce and extensive lands can be exploited for agricultural purposes either for vegetables or farming.

Prospecting in the gypsum aquifers should extend especially on either side (northern and southern) of the Eastern Mesaoria plain.

A very successful borehole was drilled in the area of Alethrico village, Larnaca District, in the chalks of the Lapithos Formation. This borehole was drilled for the Larnaca Water Board as a standby for Larnaca Water Supply. The depth of the borehole is 585 feet. It was tested for 115 hours continuously with a yield of 15,000-20,000 gph with a maximum drawdown of 18 feet. The water is of excellent quality:- NaCl content 264 p.p.m. Total Hardness 430 p.p.m.



The programme of drilling of this year included the drilling of boreholes in the Limestone of Kyrenia Range. One borehole drilled to a depth of 735 feet struck water at the depth of 180 feet. It was tested for 72 hours and yielded 1,500 gp.h. This borehole may be used for Kalogrea Water Supply. The borehole is located near the Antifonites Monastery. Another two boreholes were drilled in the Limestone.

Borehole Ser. No. 22/67 (Grid. Ref. N. 82900 E 21200)

This borehole commenced in the previous year and it was completed in February 1968. The site is about 2 miles east of Halefka Station near the Halefka-Hartja road it was drilled to a final depth of 982 having penetrated 943 feet of limestone. The water was met at 756 feet.

Borehole Ser. No. 44/67 (Grid. Ref. N. 82350 E. 19700)

The site of this borehole is at a distance of about 1 mile east of Halefka Station. It was driven down to a total depth of 920 feet penetrating fissured limestones. The water level was at 646 feet.

Both boreholes are to be tested soon with a special deep electrosubmersible pump. Drilling on the Limestone of the Kyrenia Range is always very expensive, because of the great depths involved, the nature of the rocks and construction of access roads to the selected sites. Still these boreholes are of great importance because they supply drinking water to most of the villages in the area. They are also very important for the tourist development of many areas on the Northern coastal plain.

Drilling on the Kyrenia Range continues with a borehole to the west of Lapithos. This borehole will be completed in 1969 and is to be used for Lapithos Water Supply.

The boreholes drilled on the Kyrenia Range will also give the necessary hydrogeological data to be used in a general study of the water resources and their proper management to be undertaken shortly.



NUMBER AND FOOTAGE OF BOREHOLES

NUMBER OF BOREHOLES DRILLED

1946 - 1968

Purpose	1946- 1961	1962	1963	1964	1965	1966	1967	1968
Boreholes at Full cost.	2,139	22	12	11	2	8	11	6
For Government	694	207	190	86	215	83	44	62
For W.D.	836	18	11	14	16	7	-	2
TOTAL	3,169	247	213	111	233	98	55	70
Aggregate Footage Drilled	635,323	51,292	40,301	22,825	27,506	16,980	15,008	18,498
Average Depth	442	208	189	206	118	173	273	264



Boreholes Drilled in 1968

Purpose	No.	Footage Drilled	Percentage successful	Total Tested Yield Gallons	Hours Pumped
Irrigation	6	1,452	80.0	4,050,000	260
Domestic W.S.	4	1,866	50.0	2,370,000	322
Prospecting	57	14,578	54.5	28,415,613	2,270
Total for water	67				
Observation	2	482			
Technical and Geological	1	120			
Total	70	184,98			



C. Drilling in the Tremithios-Vasilikos area for  
Famagusta Town Water Supply.

Hydrogeological investigations for the Famagusta Water Supply continued through out the year with the drilling and testing of a number of boreholes. After the results obtained from the boreholes drilled in 1967 and from other supplementary hydrogeological investigations, drilling was concentrated in the aquifers of Vassilikos River and Khirokitia Area.

Two boreholes were drilled in the alluvial gravels of the Vassilikos River in line and on either side of borehole 39/67. These two boreholes are registered as 16/68 and 19/68. They met 55 feet of gravel. Borehole 19/68 was tested at the end of the dry season, in November for 243 hours with an output of 16,000-22,000 g.p.h, yielding a total of 4,380,000 gallons.

Drilling in the Pakhna Formation was concentrated in the area of Khirokitia to the South of the main Limassol-Nicosia road.

Two boreholes were drilled 50 feet apart. One will be used for production and the other as a standby. These are boreholes 5/68 (Grid. Ref. No. 26660 E.025100) and 40/68 (Grid. Ref. No. 26680 E.02510). Borehole 5/68 was drilled down to 250 feet in the calcareous sandstone aquifer and was tested for 135 hours continuously. For 69 hours it was yielding 15,000 gph and for the last 64 hours 25,000 gph. It yielded a total quantity of 2,650,000 gallons. The maximum drawdown was 35 feet.

Borehole 40/68 was drilled to a depth of 376 feet thus penetrating more thickness of the Pakhna sandstone. The aquiferous sandstone was found alternated with beds of grey marl and sandy marl. This borehole was tested for 192 hours with 15,000-18,000 g.p.h. and yielded a total of 2,900,000 gallons.

The drilling programme and hydrological investigation will continue in 1969 so as to establish the optimum exploitation and management of the operation of a system of aquifers comprising of the solid rocks aquifers (Pakhna sandstone) and the alluvial gravel deposits of the Vasilikos River.

In addition to the drilling for the Famagusta scheme several boreholes were drilled for regional irrigation projects. Most of these holes were located in areas where groundwater was expected to be unsuitable for drinking purposes because of the high sulfate content but quite suitable for irrigation.



Borehole Ser.No. 24/68 (Grid Ref. N. 21630 E.03180) was drilled near the village of Maroni and met great success in a virtually unexploited area.

This borehole was intended to penetrate gypsum deposits below Pliocene Marls. The gypsum aquifer was met at 254 feet and continued down to the depth of 430 feet. The water level rose to 45 feet below ground level a pumping test for 139 hours was carried out with an hourly output of 25,000 gallons, this being the maximum capacity of the pump used. The maximum drawdown was only 9 feet. An irrigation project is now being studied to develop a considerable extent of land.

#### D. Surface Hydrology Work

##### 1. Meteorological Notes.

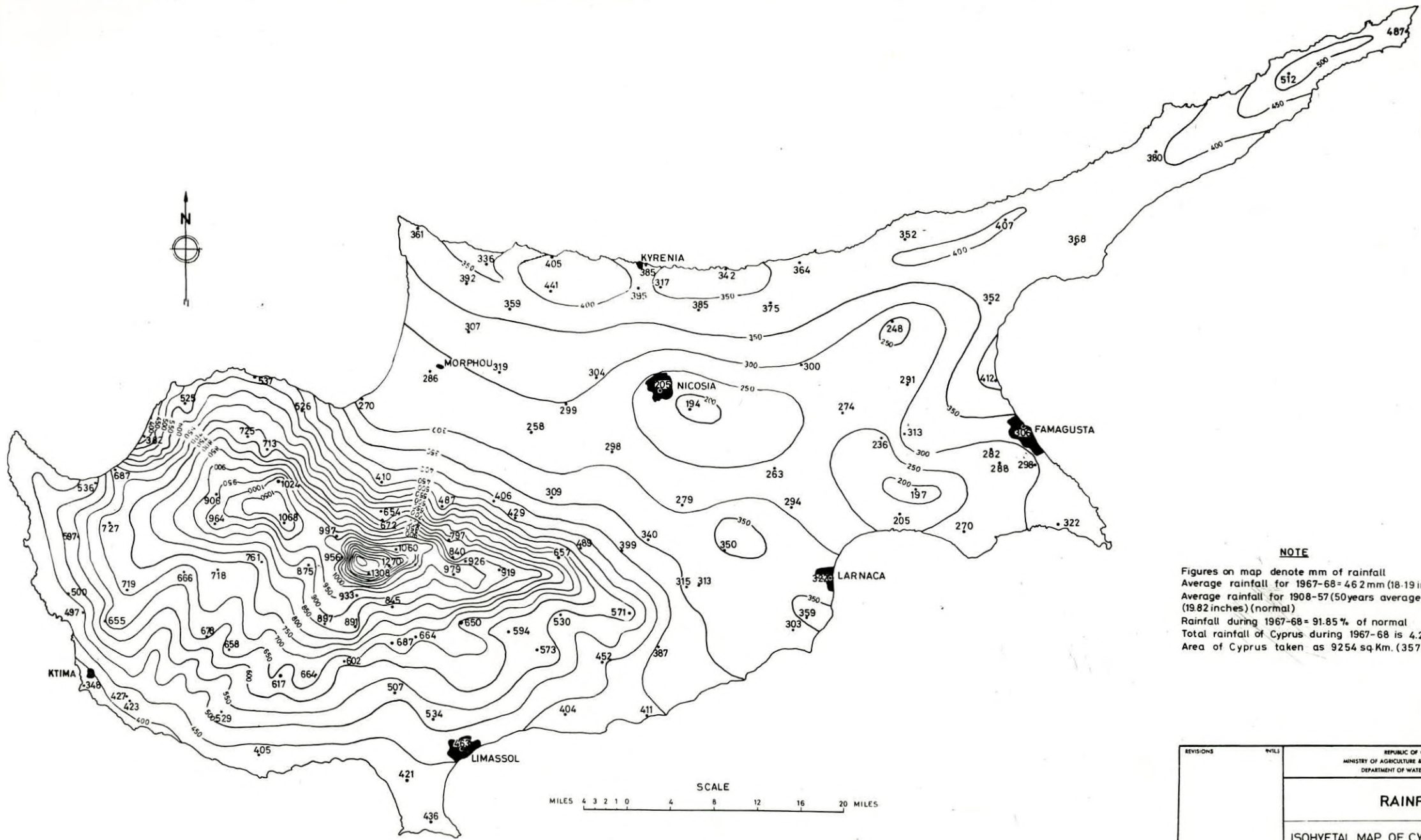
The rainfall and climatological records of 157 observing stations of the Cyprus Government Meteorological Office have been analysed by the Surface Water Resources Branch and the results on the principal features of the weather during the hydrological year - 1st October, 1967 to 30th September, 1968 - are given hereunder:-

- (a) The average rainfall over the whole island was 462 mm which is 91.85% of normal (503 mm) this being the mean since 1908 - 1957.
- (b) October, November, December, January, August and September were the months with the above average rainfall. Precipitation during the other months was below normal.
- (c) The area in the south eastern Mesaoria had relatively less rainfall than any other part of the island.
- (d) The highest daily rainfall in the year was 127 mm which occurred at Pano Amiandos on the 12th January.
- (e) Snowfall started at the high altitudes of Troodos mountains during the second fortnight of November, 1967 and continued till February, 1968. The snow depth was approx. 2 meters at Olympus peak. The snow cover persisted till the beginning of April 1968.
- (f) Temperatures were below normal in October and November 1968, below normal during Winter and Summer months, and above normal in spring months.
- (g) **On next page** are given the highest (maximum) and lowest (minimum) Temperatures recorded during the year at the existing Meteorological stations:-



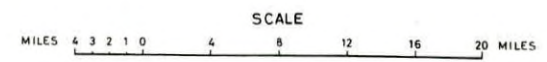
<u>Place</u>	<u>Highest Temperature and Date</u>	<u>Lowest Temperature and Date</u>
Nicosia	41.1 C <sup>o</sup> (on 13th August)	- 1.7 C <sup>o</sup> (on 24th December)
Limassol	36.7 C <sup>o</sup> (on 17th July)	-0.6 C <sup>o</sup> (on 23rd December)
Larnaca	36.7 C <sup>o</sup> (on 4th June and 16th July)	- 0.00 C <sup>o</sup> (23rd December)
Famagusta	36.7 C <sup>o</sup> (on 13, 16 & 18th July)	- 1.1 C <sup>o</sup> (on 24th December and 30th January)
Paphos	36.1 C <sup>o</sup> (on 10th July)	2.2 C <sup>o</sup> (on 15th January)
Kyrenia	37.2 C <sup>o</sup> (on 11th July)	0.6 C <sup>o</sup> (on 15th January)
Akradhes Forest Station	37.8 C <sup>o</sup> (on 12th July)	- 1.7 C <sup>o</sup> (on 30th 31st January)
Karpas Peninsula		1st- 3rd February)
Panayia Bridge Forest Station	38.3 C <sup>o</sup> (15th July)	- 4.4 C <sup>o</sup> (23rd December)
Between Platanistassa and Kato Moni.		
Morphou Govt. Farm	40.6 C <sup>o</sup> (on 10th, 12th July)	- 1.1 C <sup>o</sup> (23rd 24th Dec. & 15th March)
Halevka Forest Station	36.7 C <sup>o</sup> (on 15th July)	- 3.3 C <sup>o</sup> (on 15th January)
Saittas	36.1 C <sup>o</sup> (on 16th July)	- 5.0 (on 23rd December)
Pano Amiandos	31.1 C <sup>o</sup> (on 18th July)	- 13.3 C <sup>o</sup> (on 16th January)
Prodromos Forestry College	31.7 C <sup>o</sup> (on 16th, 18th July and 13th August)	- 8.3 C <sup>o</sup> (on 23rd December)
Stavros tis Psokas Forest Station	36.1 C <sup>o</sup> (on 15th July & 10th August)	- 3.9 C <sup>o</sup> (on 23rd December)
Kornos Forest Station	39.3 C <sup>o</sup> (on 14th August)	- 3.9 C <sup>o</sup> (23rd Dec. & 14th Jan.)
Platania (Kakopetria) Forest Station	33.3 C <sup>o</sup> (on 13th August)	- 7.8 C <sup>o</sup> (on 23rd, 24th Dec.)
Phassouri	36.1 C <sup>o</sup> (on 11th July)	- 2.8 (on 23rd December)





**NOTE**

Figures on map denote mm of rainfall  
 Average rainfall for 1967-68 = 462 mm (18.19 inches)  
 Average rainfall for 1908-57 (50 years average) = 503 mm (19.82 inches) (normal)  
 Rainfall during 1967-68 = 91.85% of normal  
 Total rainfall of Cyprus during 1967-68 is  $4.28 \times 10^9 \text{ m}^3 (150.97 \times 10^9 \text{ ft}^3)$   
 Area of Cyprus taken as 9254 sq.Km. (3572 sq.miles)



REVISIONS		NO. 13	
REPUBLIC OF CYPRUS MINISTRY OF AGRICULTURE & NATURAL RESOURCES DEPARTMENT OF WATER DEVELOPMENT			
<b>RAINFALL</b>			
<b>ISOHYETAL MAP OF CYPRUS BASED ON          RAINFALL FROM 1st OCT. 1967 - 30th SEP 1968</b>			
JANUARY 1969		D. G.	
REVISED BY	DESIGNED BY	TRACED BY	DRG. No.
DRAWN BY		CHECKED BY	
		APPROVED BY	

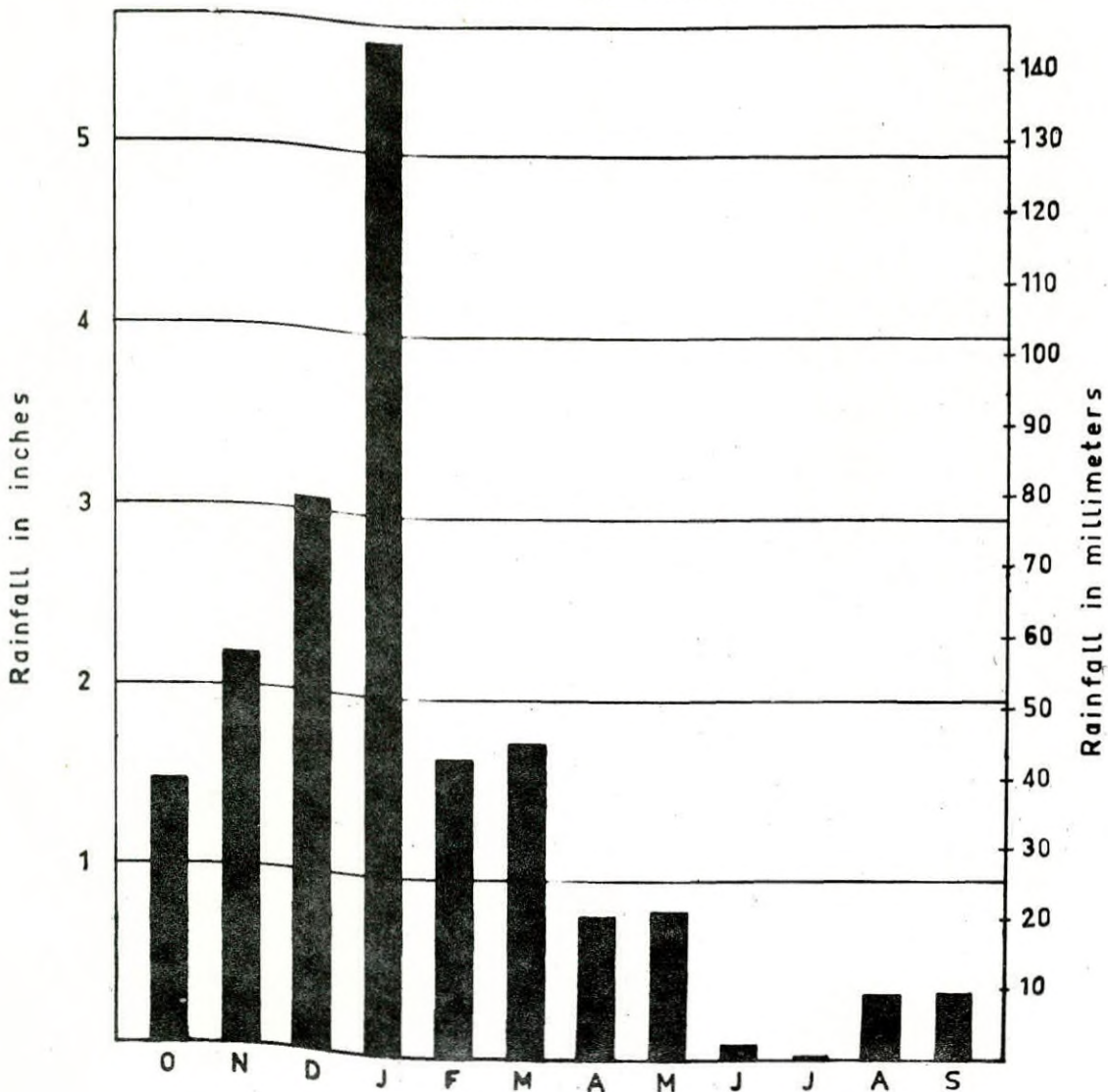


## INCIDENCE OF RAINFALL

The incidence of rainfall per month as worked out from selected Rainfall stations during the hydrological year 1967-1968 is given as under:-

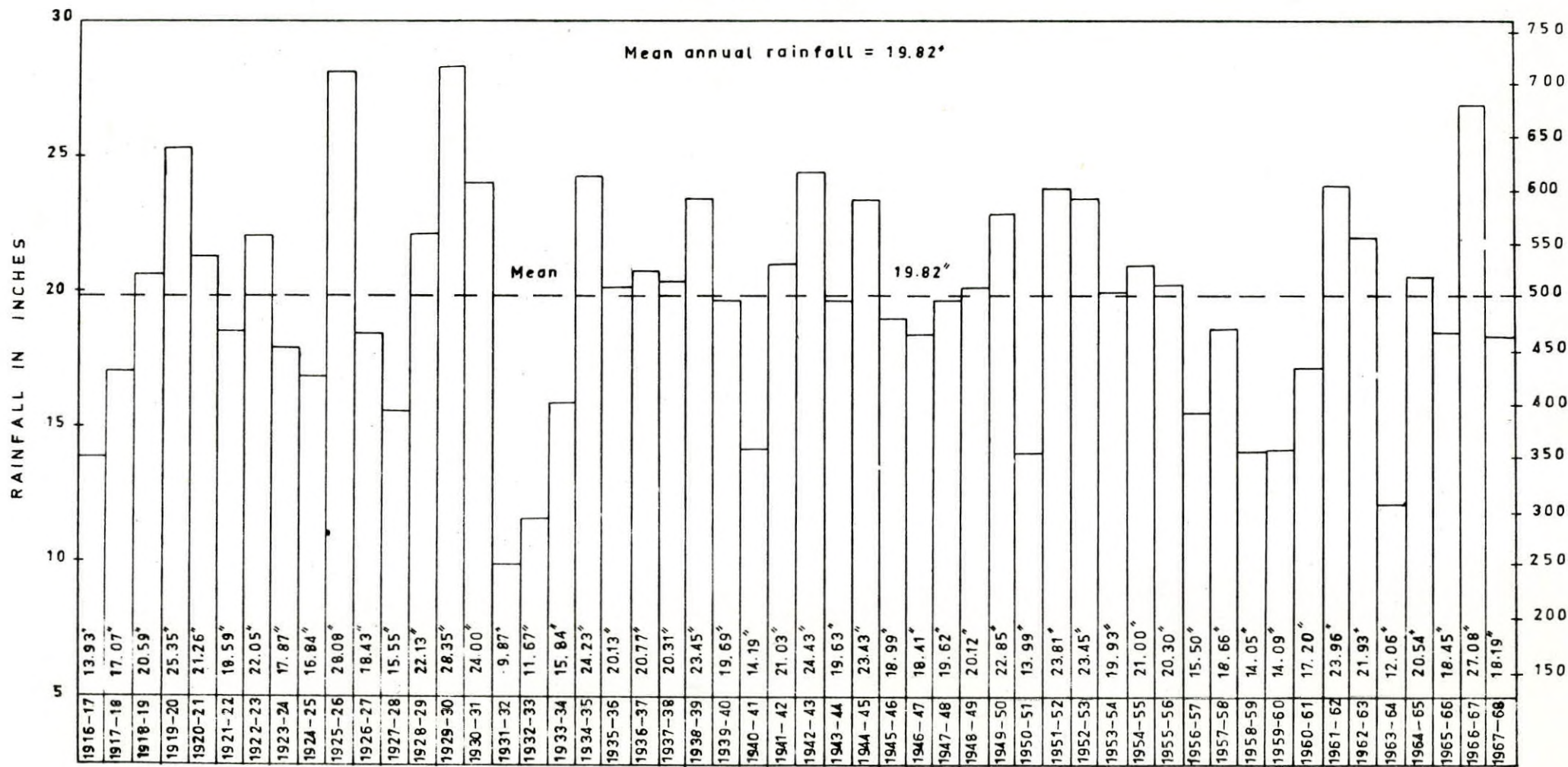
Month	Rainfall		Percentage %
	in inches	in millimeters	
October	1.47	37.34	8.08
November	2.19	55.63	12.04
December	3.05	77.47	16.77
January	5.60	142.21	30.79
February	1.68	42.67	9.24
March	1.77	44.96	9.73
April	0.80	20.32	4.40
May	0.82	20.83	4.51
June	0.09	2.29	0.49
July	0.01	0.25	0.05
August	0.35	8.89	1.92
September	<u>0.36</u>	<u>9.14</u>	<u>1.98</u>
Totals	<u>18.19</u>	<u>462.00</u>	<u>100 %</u>

GRAPHICAL PRESENTATION  
OF INCIDENCE OF RAINFALL





# ANNUAL AVERAGE RAINFALL OF CYPRUS FROM 1916 - 1968



RAINFALL IN MILLIMETRES



The only serious floods reported during the hydrological year 1967-1968 occurred in Merikas river, tributary of Serakhis. The highest flood flows recorded at the Massari gauging station was 4,700 cusecs on 24th October 1967, and 3,700 cusecs on 1st November, 1967.

The following table summarizes some of the larger floods and rainfall measured in the catchment or in adjacent catchment on the day of the flood or on the previous days. Floods of less importance have been ignored.

No.	River	Location	Cusecs	Date	Inches	Place	Date
1A	Pedheos	Kambia	362	28. 1.68	1.10	Makhera Mon.	26. 1.68
1B	Ay. Onoutrios	Kambia	424	20. 5.68	1.32	Mandra tou Kambion	20. 5.68
2A	Vialias	Nissou	530	1.11.67	1.70	Lytthrotho-nda	1.11.67
4	Ovgos and Serakhis	Morphou	547	25.10.67	1.50	Mentiko	24.10.67
			424	2.11.67	1.00	Philia	1.11.67
			494	28. 1.68	2.59	Palekhori	26. 1.68
14	Periste-roma	Panayia	740	28. 1.68	2.59	"	27. 1.68
17	Kouris	Erini	1500	28. 1.68	1.85	Ay. Theodo-ros	27. 1.68
					2.30	"	27. 1.68
23	Akaki	Malounda	740	28. 1.68	2.30	Pano Amla-ndos	27. 1.68
29	Syrgatis	Skarinou	279	3.11.67	1.24	P. Lefkara	3.11.67
			353	28. 1.68	1.44	"	27. 1.68
30	Dhiarizos	Kouklia	1483	28. 1.68	1.60	Kyliko Monst.	26. 1.68
					0.92	"	28. 1.68
					1.10	"	27. 1.68
33B	Karyiotis	Evrkyhou	272	27. 1.68	1.90	Platania	26. 1.68
			353	4. 3.68	1.10	"	3. 3.68
37	Atsas	Evrkyhou	576	26.10.68	0.50	Platania	27. 1.68
					2.33	E. St. Evrkyhou	26.10.67



No.	River	Location	Peak flow		Rainfall		Date		
			Cusecs	Date	Inches	Place			
38	Serakhis	Massari	4700	24.10.67	1.50	Meniko E.S.	24.10.67		
			3700	1.11.67	1.00	Philia E.S.	1.11.67		
			1380	28. 1.68	2.59	Palekhor	26. 1.68		
					2.30	"	27. 1.68		
44	Ezuza	Akhelia	2080	22. 5.68	1.00	Ay.Epiphaniou	22. 5.68		
			780	13. 1.68	2.12	Ayia.F.St.	12. 1.68		
45	Khapotami	Kouklia	459	28. 1.68	0.28	" "	13. 1.68		
					1.70	Omodhos	26. 1.68		
52	Kouris	Khalassa	671	3.11.67	1.55	"	27. 1.68		
					1.50	Troodos	2.11.67		
					1.00	"	3.11.67		
					1.54	P.Amiandos	2.11.67		
					636	28. 1.68	2.44	Troodos	26. 1.68
							1.20	"	27. 1.68
53	Kouris & Kryos	Khalassa	848	3.11.67	2.33	P.Amiandos	2.11.67		
					1.50	Troodos	2.11.67		
					1.00	"	3.11.67		
					1.54	P.Amiandos	2.11.67		
					777	28. 1.68	2.44	Troodos	26. 1.68
							1.20	"	27. 1.68
54	Zygos	Khalassa	706	28. 1.68	2.33	P.Amiandos	27. 1.68		
					1.52	Ay.Theodoros	26. 1.68		
56	Vathys	Athalassa	632	18.10.67	1.85	"	27. 1.68		
					1.10	Dheftera P.S.	18.10.67		
57	Elea	Vizakia	547	18.10.67	2.60	Kapoura F.St.	18.10.67		
59	Khapotami	Kissousa	441	5.10.67	0.47	Platres	3.10.67		
					0.23	"	4.10.67		
					0.58	"	5.10.67		
					0.87	"	13. 5.68		
60	Mylou	Kornos	855	3.11.67	0.97	Kornos	3.11.67		
					456	28. 1.68	1.50	"	26. 1.68
					0.80	"	27. 1.68		
67	Dhiarizos	Philousa	918	28. 1.68	1.60	Kykko Mon.	26. 1.68		
					1.65	" "	27. 1.68		
					367	13. 5.68	1.00	" "	13. 5.68
68	Serakhis	Morphou Dam Spillway	1024	28. 1.68	2.59	Palekhor	26. 1.68		
					2.30	"	27. 1.68		
70	Aradhippou	Yematousa	2507	1.11.67	1.78	Avdellero	1.11.67		
71	Aradhippou	N'a-L'ca main road	477	1.11.67	1.78	Avdellero	1.11.67		



3. Water Level Recorders

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

Recorder No.	Catchment	Location	Type of installation
1A	Pedhieos	Near Kambia	Water level recorder on 40 ft. measuring weir.
1B	Ay. Onoufrios	Near Kambia	Water level recorder on 20 ft. measuring weir.
2A	Yialias	Nicosia-Nissou Bridge	Water level Recorder on Bridge
2B	Yialias	Nicosia-Pyroi Bridge	Water level recorder on Bridge
2C	Alikos	Near Ayios Sozomenos	Water level recorder on 40 ft. measuring weir.
3	Ovgos	Morphou-Pnasi Monastery bridge	Water level recorder on 35 ft. bridge.
4	Ovgos and Serakhis	Syrianokheri	Water level recorder on 40 ft. measuring weir.
5	Xeros(N'sia)	Nicosia Xeros bridge	Water level recorder on 71 ft. bridge.
6A	Marathasa	Nicosia-Xeros main road	Water level recorder on 50 ft. measuring weir.
6B	Marathasa	Upstream of Lefka dam	Water level recorder on 23' - 9" bridge.
6C	Marathasa	Upstream of Kalopanayiotis Dam	Water level recorder on 16' - 5" Measuring weir.
8	Avgorou	Near Avgorou	Water level recorder on 40 ft. measuring weir.
9	Paralimni	Near Paralimni lake out-flow	Water level on the recharge channel.
10	Pyrgos	Phyleyia	Water level recorder on 30 ft. measuring weir.
11	Limnitis	Limnitis Saw Mill	Water level recorder on 30 ft. measuring weir.
11 A	Lminitis	Limnitis Saw Mill	Water level recorder on Wallingford flume.
13	Kourris (Trimiklini)	Limasol Troodos bridge	Water level-recorder on 18 ft. measuring weir.
14	Peristerona Nicosia)	Near Panayia Forest Station	Water level recorder on 20 ft. measuring weir.
15	Premithios	On the spillway of Kiti dam	Water level recorder on 212 ft. dam's spillway.
16	Yermasoyia	Near Yermasoyia Police Station	Water level recorder on 80 ft. measuring weir.
17A	Kourris(Erimi)	Erimi bridge	Water level recorder on 66 ft. bridge.



Recorder No.	Catchment	Location	Type of installation
17B	Kourris (Erimi)	Erimi Bridge	Water level recorder on 55' - 6" bridge.
18	Kalopannes	Near Kalopsidha	Water level recorder on 25 ft. measuring weir.
19	Akhna	Near Akhna Police station	Water level recorder on 40 ft. measuring weir.
20	Phrenaros	Near Asprovouniotissa Church	Water level recorder on 40 ft. measuring weir.
22	Liopetri	Near Liopetri	Water level recorder on 40 ft. measuring weir.
23	Akaki	Near Malounda	Water level recorder on 40 ft. measuring weir.
24	Skylloura	Near Ayios Vasilios	Water level recorder on 60 ft. measuring weir
27	Khrysokhou	Near Skoulli	Water level recorder on 40 ft. measuring weir.
28	StavrosStis-Psokas	Near Evretou	Water level recorder on 25 ft. measuring weir.
29	Syrgatis	Skarinou Station	Water level recorder on 70 ft. measuring weir.
30	Dhiarizos	Kouklia(P'os) main bridge	Water level recorder on 40 ft. bridge.
32	Alakati	Platimatis locality near Ay. Amvrosios (Kyrenia)	Water level recorder on 22 ft. measuring weir.
33A	Karyotis	Near Pendayia-Xeros main road bridge	Water level recorder on 60 ft. measuring weir.
33B	Karyotis	Near Evrykhon	Water level recorder on 15 ft. measuring weir.
34	Tremithios	Near Ayia Anna	Water level recorder on 40 ft. measuring weir.
35	Elea	Ghazivera-Pendayia main road bridge	Water level recorder on bridge.
36A	Ayios Loucas (Akhyritou outlet tunnel)	Near Ay. Loucas (Famagusta)	Water level recorder on Ayios Loucas lake.
36B	Ay. Loucas	Near Ay. Loucas (Famagusta)	Water level recorder on Ay. Loucas lake at outlet.
37	Atsas	Upstream of Petra dam	Water level recorder on 25 ft. measuring weir.
38A	Serrakhis	Massari main bridge.	Water level recorder on 58' - 6" bridge.
38B	Serrakhis	Massari main bridge.	Water level recorder on 39' - 6" bridge.
39	Livadhi	Paleambela - locality	Water level recorder on 70 ft. measuring weir.



Recorder No.	Catchment	Location	Type of installation
40	Xeros	Ayia Marina (Skylloura)	Water level recorder on bridge
41	Yialia (Polis)	Kato Yialiamain road bridge	Water level recorder on 14'-10" measuring weir.
43	Mavrokolymbos	Potima Chiflik	Water level recorder on 40 ft. measuring weir.
44	Ezuza	Akhelia	Water level recorder on 85 ft. measuring weir.
45	Khapotami	Near Kouklia	Water level recorder on 50 ft. measuring weir.
46	Garyllis	Near the Armenian Cemetery at Kato Polemidhia	Water level recorder on 66 ft. measuring weir.
47	Vasilikos	Near Kalavastos	Water level recorder on 75 ft. measuring weir.
47A	Vasilikos	Near Kalavastos Mines	Water level recorder on existing 66 ft. irrigation weir.
48	Maroni	Near Khirokitia	Water level recorder on 40 ft. measuring weir.
48A	Maroni	Vavla-Kato Dhrys main road bridge.	Water level recorder on bridge
49	Kambos	Potamos tou Kambou	Water level recorder on 45 ft. measuring weir.
50	Pouzis	Near Mazotos	Water level recorder on 45 ft. measuring weir
51	Mavravis	Alaminos main bridge	Water level recorder on bridge
52	Kourris	Khalassa-Lophos road bridge.	Water level recorder on bridge.
53	Kourris & Kryos	Near Khalassa	Water level recorder on 101 ft. measuring weir.
54	Zygos	Mia Kremmos locality	Water level recorder on 75 ft. measuring weir.
55	Elea-Asinou	Near Nikitari	Water level recorder on 25 ft. measuring weir.
56	Vathys	Near Athalassa	Water level recorder on 33'-6" measuring weir.
57	Elea-Vizakia	Near Vizakia	Water level recorder on 29' - 6" measuring weir.
58	Aloupos	Aloupos Chiftlik	Water level recorder on 55 ft. measuring weir
59	Khapotami	Near Kissousa	Water level recorder on 20 ft. measuring weir.
60	Syrgatis-Mylou	Near Kornos	Water level recorder on 30 ft. measuring weir
61	Ezuza	Near Kannaviou	Water level recorder on 45 ft. measuring weir.
62	Xeros	Near Peyia	Water level recorder on 40 ft. measuring weir
63	Melini	Near Ayia Trias (Yialousa)	Water level recorder on 22 ft. measuring weir.



Recorder No.	Catchment	Location	Type of installation.
64	Karyotis Ayios Nicolaos	Near Ayios Nicolaos Monastery Kakopetria	Water level recorder on 20ft. measuring weir.
65	Karyotis-Platania	Near Kakopetria	Water level recorder on 20ft. measuring weir.
66	Evdhimou	Near Evdhimou	Water level recorder on 40ft. measuring weir.
67	Dhiarizos	Near Philousa	Water level recorder on 60ft. measuring weir.
68	Serrakhis	On Morphou Dam	Water level recorder on 250 ft. dam's spillway.
70	Aradhippou	Near Panayia Yematousa	Water level recorder on 16 ft. measuring weir.
71	Aradhippou	On Nicosia-Larnaca old road bridge	Water level recorder on 27'-9" measuring weir.
72	Akrounda	Downstream of Akrounda dam	Water level recorder on 16ft. measuring weir.
73	Panagra	On Panagra-Kyrenia old road bridge	Water level recorder on 27ft. measuring weir.
74	Boghazi(K'nia)	On Kyrenia road Forest	Water level recorder on 28ft. measuring weir.

All water level recorders used on the above stations are of the float operated type except on stations No. 2A, 2B and 14, on which Pneumatic recorders have been installed.

4 Measured discharges 1967-1968

The discharges which could be measured during the year at the Gauging stations of the previous paragraph are as follows:-

Recorder No.	Catchment	Rainfall during 1967-68 $10^6$ cu.ft.	Discharge during 1967-68 $10^6$ cu.ft.	Maximum discharge in a day $10^6$ cu.ft.	Peak Discharge cusecs
1A	Pedhieos-Kambia	603.9	126.2	14.04	359
1B	Ay.Onoufrios-Kambia	311.1	52.7	5.95	208
2A	Yialias-Nisou	1324.3	81.9	9.61	900
2C	Alikos-Ayios Sozomenos	893.5	24.8	3.81	1020
3	Ovgos-Morphou	2683.2	121.8	20.50	495
4.	Ovgos & Ser-rakhis.	8633.4	95.4	18.92	424
5.	Xeros-Karavostassi	2096.3	134.2	8.24	100
6A	Marathasa-Xeros	1985.8	107.0	4.27	78
6C	Marathasa-Up-stream of Kalopanayiotis dam	863.1	346.1	10.00	233
8	Avgorou	203.4	-	-	-



No.	Catchment	Rainfall during 1967-68 10 <sup>6</sup> cu.ft.	Discharge during 1967-68 10 <sup>6</sup> cu.ft.	Maximum discharge in a day 10 <sup>6</sup> cu.ft.	Peak discharge cusecs.
9	Paralimni	270.2	0.23	0.14	13
10	Pyrgos	1114.9	353.2	12.09	191
11	Limnitis	1593.4	561.5	29.29	440
14	Peristerona-Panayia Forest Station	2041.9	573.1	43.94	740
15	Tremithios-Kiti dam	1902.4	-	-	-
16	Yermasoyia-Yermasoyia Police Station	3986.4	264.9	7.63	141
17	Kouris-Erimi	9701.4	1108.9	70.18	1500
18	Kolopannes	-	0.80	0.36	9.2
19	Akhna	324.9	-	-	-
20	Phrenaros	119.4	-	-	-
22	Liopetri	111.9	0.03	0.01	0.17
23	Akaki-Malounda	1944.4	491.9	44.39	1060
24	Skyloura-Ay.Vasilios	1012.8	38.2	3.05	85
27	Khrysokhou-Skoulli	1754.8	229.5	9.15	159
28	Stavros-tis-Psokas (Evretou)	2671.6	519.1	14.65	275
29	Syrgatis-Skarinou	2201.9	83.0	7.93	353
30	Dhiarizos-Kouklia	7257.9	1327.8	29.29	1480
32	Alakati-Ay.Amvrosios	163.2	2.5	0.54	53
33A	Karyiotis-Pendayia	2406.7	300.2	12.50	320
33B	Karyiotis-Evrykhon	1929.2	678.0	13.10	272
34	Tremithios Ay. Anna	1112.4	41.7	2.62	187
35	Elea-Ghaziveran	2758.9	0.07	0.01	0.2
36A	Ay.Loukas-Akhyritou outlet tunnel	-	-	-	-
36B	Ay.Loukas Lake	-	-	-	-
37	Atsas-Upstream of Petra Dam	598.2	91.8	3.36	576
38	Serakhis-Massari	5401.1	395.5	69.19	4700
41	Yialia-Near Kato Yialia	467.6	31.8	0.41	31
43	Mavrokolymbos	914.6	38.8	1.25	42
44	Ezuza-Akhelia	552.3	709.8	36.61	777
45	Khapotami-Kouklia	1913.0	353.2	15.56	460
46	Garyllis-Kato Polemidhia	1872.4	2.1	0.40	23
47	Vasilikos-Kalavassos	2499.2	229.5	11.59	247
48	Maroni-Khirokitia	1033.0	42.7	1.77	34
49	Kambos (Potamos-tou-Kambou)	1269.9	28.1	1.98	42
50	Pouzis-Mazotos	726.8	0.85	0.37	65



No.	Catchment	Rainfall during 1967-68 10 <sup>6</sup> cu.ft.	Discharge during 1967-68 10 cu.ft.	Maximum discharge in a day 10 <sup>6</sup> cu.ft.	Peak discharge cusecs.
51	Mavravis-Alaminos	374.7	9.2	0.76	102
52	Kouris-Khalassa	3174.1	861.7	28.99	671
53	Kouris and Kryos-Khalassa	5021.4	1077.1	39.67	848
54	Zygos-Khalassa	3573.2	593.3	28.83	706
55	Asinou-Nikitari	311.8	15.9	0.43	5
56	Vathys-Athalassa	275.4	6.0	3.45	657
57	Elea-Vizakia	1682.1	257.8	10.07	547
58	Aloupos-Morphou	1031.9	69.9	3.12	58
59	Khapotami, Kissousa	1178.8	211.9	8.54	440
60	Mylou-Kornos	452.7	55.4	5.80	855
61	Ezuza-Kannaviou	2376.0	360.2	10.07	187
62	Xeros-Peyia	308.6	14.1	0.40	49
63	Molini-Ay. Trias	61.4	4.1	0.67	105
64	Ay. Nicolaos-Kakopetria	629.3	448.5	3.51	46
65	Platania-Kakopetria	382.8	111.9	1.16	24
66	Evdhimou	500.1	27.2	0.17	12
67	Dhiarizos-Philousa	4358.2	1112.4	30.51	918
68	Serakhis-Morphou dam	5693.1	81.2	38.14	1024
70	Aradhippou-Yematousa	238.7	13.1	5.19	2500
71	Aradhippou-N'a-L'a old road bridge	416.7	5.3	2.74	477
72	Yermasoyia-Akrounda	610.6	26.5	1.40	44
73	Panagra	561.5	7.1	0.73	25

5. Spring discharges

During the Hydrological year, 2539 spring discharges were measured, averaging to 211 measurements every month. The output of 252 springs is now being measured regularly, 156 of these at every month, 27 every two months, 30 every three months, 13 every four months, 26 every six months and 294 on miscellaneous periods.

The above normal rainfall and snow of last year maintained the high rate of flow of springs nearly throughout the year.

On the Troodos mountains the combined flow of springs used for the water supply of Troodos was 37,000 gallons per day in October, 1967, and it is the highest yield for this month of the year for the last three years.

On the northern slopes of the Kyrenia Range the Kephalevrysos Karavas has proved to be the most constant spring in the island having very little fluctuations in its rate of flow.



During the greater part of the year it was yielding 632,000 gallons per day.

On the Southern slopes of the Kyrenia range, the Kephlovryos Kythrea has shown a steady decline. its yield at the beginning of the hydrological year (October, 1967) was 2,943,000 gallons per day, while at the end (September 1968) was 2,050,000 gallons per day. This rate of flow is lower than last year and below normal.

In Central Mesaoria plain the flow of the chain of wells has followed the same behaviour which was observed in most springs of the Kyrenia and Troodos mountains.

6. Chemical Analyses

During the year 7,700 samples of water were sent to the Government analyst for partial chemical analyses. Of these 1,707 samples were taken from spring wells or boreholes which are used or proposed as water supply sources. The remaining 6,593 samples derived from springs, observations boreholes and from other miscellaneous sources. In addition 27 samples were sent to the agricultural analyst.

Bacteriological analyses

The total number of samples taken and the number of unsatisfactory ones are as follows:-

<u>Water Supply</u>	<u>Number of samples</u>	<u>Number of unsatisfactory samples</u>
Nicosia	749	140
Famagusta	201	13
Limassol	93	11
Larnaca	41	3
Paphos	38	2
Kyrenia	24	2
Total	<u>1,146</u>	<u>171</u>

At Nicosia most of the unsatisfactory samples came from private boreholes which supply water to Nicosia Water Board. All chlorinated samples at all reservoirs were satisfactory.

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

New Measuring Sites

By the end of the year the following measuring weirs were completed and automatic water level recorders were installed:-

- a. Laris River near Rizokarpaso A V shaped structure 25 ft. long 2' - 6" high with 90° notch for low flows.



- b. Kharangas River near Boghaz (Famagusta). Stabilization of the river bed by a V shaped structure 30 ft. long 1 ft. high under the main bridge on Famagusta - Yialousa main road.
- c. Yerokolymbos River near Boghaz (Akanthou). Stabilization of the river bed by constructing a broad crested weir 17' - 8" with a notch 6' - 7" for low flows.
- d. Merikas River near Paleometokho Installation of an automatic water level recorder using the natural river bed under the bridge on Kokkini-Tremithia-Paleometokho main road.
- e. Ovgos River near Kyra. Installation of an automatic water level recorder on the existing saline water diversion weir upstream of Ovgos Dam.
- f. Marathasa River on Kalopanayiotis Dam. Installation of an automatic water level recorder on Kalopanayiotis Dam spillway.
- g. Yermasoyia River upstream of Yermasoyia Dam. Installation of an automatic water level recorder on the 28 m existing Phinikaria irrigation weir by reducing the lower section of the weir by 18 m, with a notch 30 m x 0.30 m for low flows.
- h. (i) Garyllis River (Main Tributary upstream of Polemidhia Dam)  
Installation of an automatic water level recorder using the natural river bed under the bridge on Limassol - Limnatis main road.  
(ii) Garyllis River (Mersina Tributary) Upstream of Polemidhia Dam.  
Stabilization of the riverbed by constructing 9 ft. broad crested weir with a 2' x 1' notch for low flows under the bridge on Limassol-Limnatis main road.
- i. Avgas River at Toxeftra locality near Peyia construction of Walnut Gulch Flume.

7. Repairs and Improvements to the existing measuring sites.

- a. Kokkini Trimithia River near Kokkini Trimithia.  
Repairs to the earth bank which was eroded by the big flood of October 1966.
- b. Platania River near Kakopetria.  
Construction of a gabion weir upstream of the station to regulate an even flow all over the measuring weir.
- c. Ezuza River near Akhelia.  
Installation of an iron foot bridge for the measurement of high flows with current meter.



d. Khrysokhou River near Skoulli.

Alteration of the lower section of the weir by reducing the lower section by 10 m and a notch 1m x 0.30m for low flows.

e. Serakhis River near Massari.

Due to the construction works carried out by the Public Works Department on Katokopia-Massari bridge the automatic water level recorder was installed about 300 m downstream of the bridge using the natural river bed.

8. Costs of Hydrological Surveys and Construction of Measuring weir

	Approved Estimated Cost	Actual Expenditure
Hydrological observations and Research. (Surface and Ground Water Resources Branches)	£12,000	£10,837
Construction and Maintenance of Measuring weir.	<u>£ 9 000</u>	<u>£ 8 931</u>
Totals	<u>£21,000</u>	<u>£19,768</u>

E. Ground Hydrology Work

1. Hydrological Surveys.

During the year under review, the Hydrological Surveys have progressed to a point where all the important aquifers of the island have been fully covered in the sense that all wells, boreholes and springs have been plotted and observation networks have been established and levelled.

During 1968 the existing area under the Hydrological Surveys have been extended to cover the area from Ayios Ioannis to Agrokipia, Kato Moni, Ayii Trimitias, Paleometochos, Meniko, Orounda, Nikitari, Vyzakia, Koutraphas and Petra. The whole new area being called as the "Extension of Western Mesaoria".

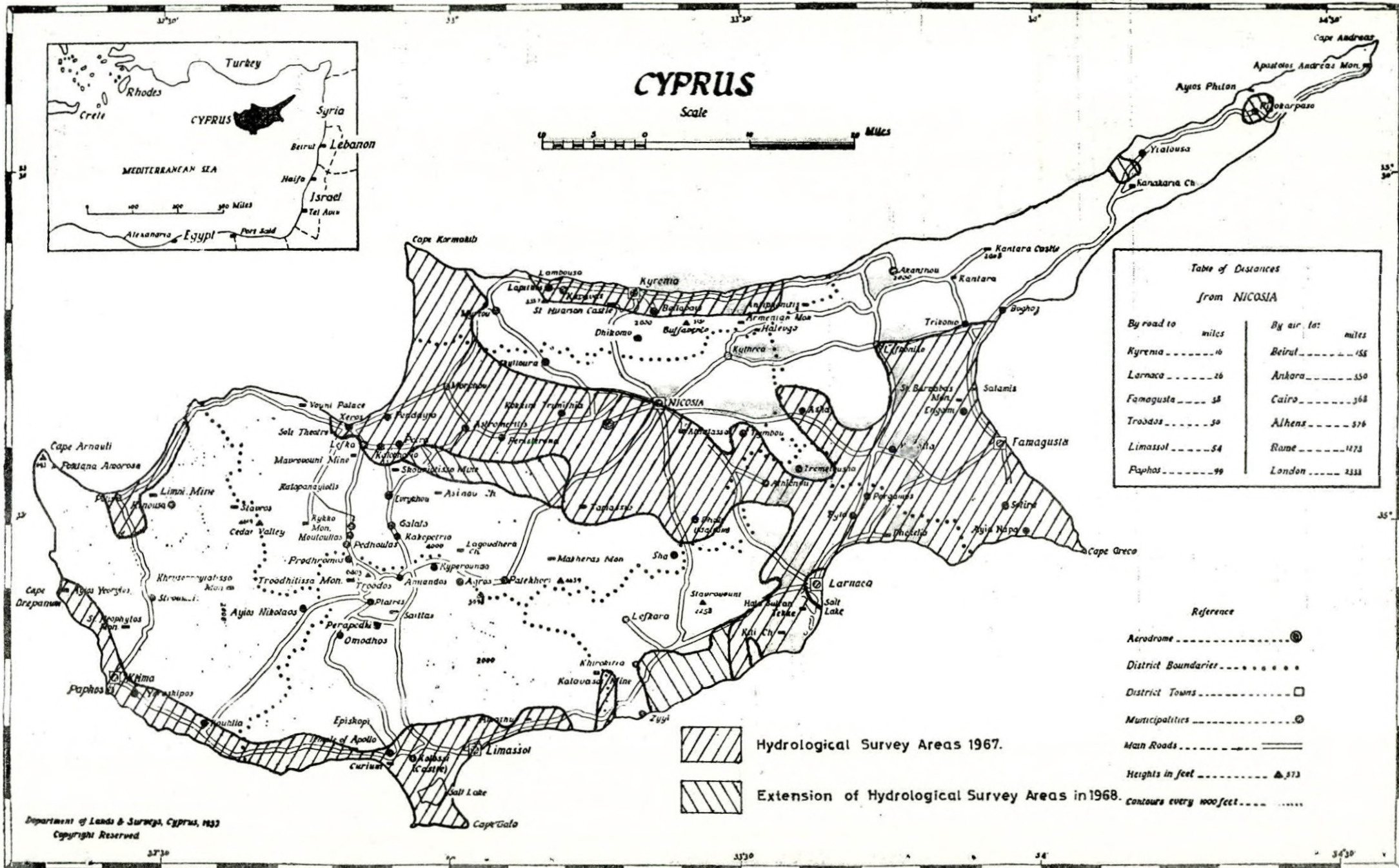
To the Southern parts of the island the surveys were extended to cover the important aquifers of Psamatismenos, Chirokitia, Maroni Skarinou, Ayios Theodoros and Alaminos. The new area being called as the "Tremithios - Vasilikos Hydrological area".

In addition to the above the area of Ayios Andronikos and Rizokarpasso were completed, as well as the area of Mesoyia and Konia village in the S.W. Paphos area.

Appendix No. VII shows the areas covered by the Hydrological Surveys.

The Hydrological Survey areas are covered by a dense network of selected observation wells in which the water level is being measured twice each year, during the dry season (November and





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the wet season (March) so that the maximum and minimum fluctuation of the water-table is determined.

In addition to the above a network of wells and boreholes exists from which water samples are taken twice each year for determining the quality of the water in the dry and wet season and determining the trends of quality of the water resources of each aquifer.

Analytically the observation networks are distributed as follows: -

Hydrological Area	Water levels from Wells/Boreholes	Water samples from Wells/Boreholes
Western Mesaoria	516	210
Central Mesaoria	554	140
S.E. Mesaoria (F'gusta)	560	210
S.E. Mesaoria (L'ca)	460	210
Kyrenia Region	260	90
Akrotiri-Phassouri	230	90
Yermasoyia-Moni-Pyrgos	150	50
Zygi-Maroni	110	30
S.W. Paphos	240	80
Polis Khrysochou Region	100	60
Total	3180	1170

From the above measurements Ground water elevation Contour maps as well as Isosalinity Contour maps have been prepared for each aquifer for March 1968 and November 1968.

The annual questionnaire was also carried out for determining the land use that is, the extent of land irrigated and the type of crops.

From this information along with the questioning on the number of hours that each well was put in operation and the scattered pumping tests carried out in each area the total extraction of ground water from each well and borehole in each area was estimated.

All the above information on water levels, quality of water and extraction of ground water provide the basis on which water-balance studies, assessment of recharge works, water policy and any other study made, is based on.

It is anticipated that by next year the scheduled programme of the extension of the Hydrological Surveys will be completed and that a new, more definite and firm observation network will be established based on the knowledge gained through the previous studies in each area so that the number of observation wells will be more scattered allowing thus more measurements to be made through the year.



Also, through the experience gained from the annual questionnaire for determining the extraction of ground-water a list of 'Typical Farms' will be prepared which will be observed through the year so that the water requirements needed for each area for any kind of crop will be determined and applied to cover the whole area in the vicinity. This in conjunction with the irrigation efficiencies given by the Department of Agriculture will help in determining the annual extraction in a rather reliable manner, until the water-meters are installed in most of the areas that are being covered by the Hydrological Surveys.

2. Control and Conservation of Ground Water

a. Water Conservation Areas (Wells Law Cap. 351)

Appendix VIII shows the areas which have been declared as "Water Conservation Areas" under the Well's 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.

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 recommendations. These recommendations which are based on the general knowledge of the existing water situation of each area, the development in the area and the existence of other wells, chain-of-wells and springs as well as any other Government water-works, are mandatory to the District Officers.

During the year under review a total of 1150 applications were investigated either on the spot or through the available records produced by the Hydrological Surveys and dealt with.

Analytically the number of applications received from each District not including the areas under the Water Supply (Special Measures) Law are as follows:-

Paphos District	122
Famagusta "	107
Nicosia "	583
Larnaca "	57
Limassol "	76
Kyrenia "	<u>201</u>
Total	<u>1146</u> applications



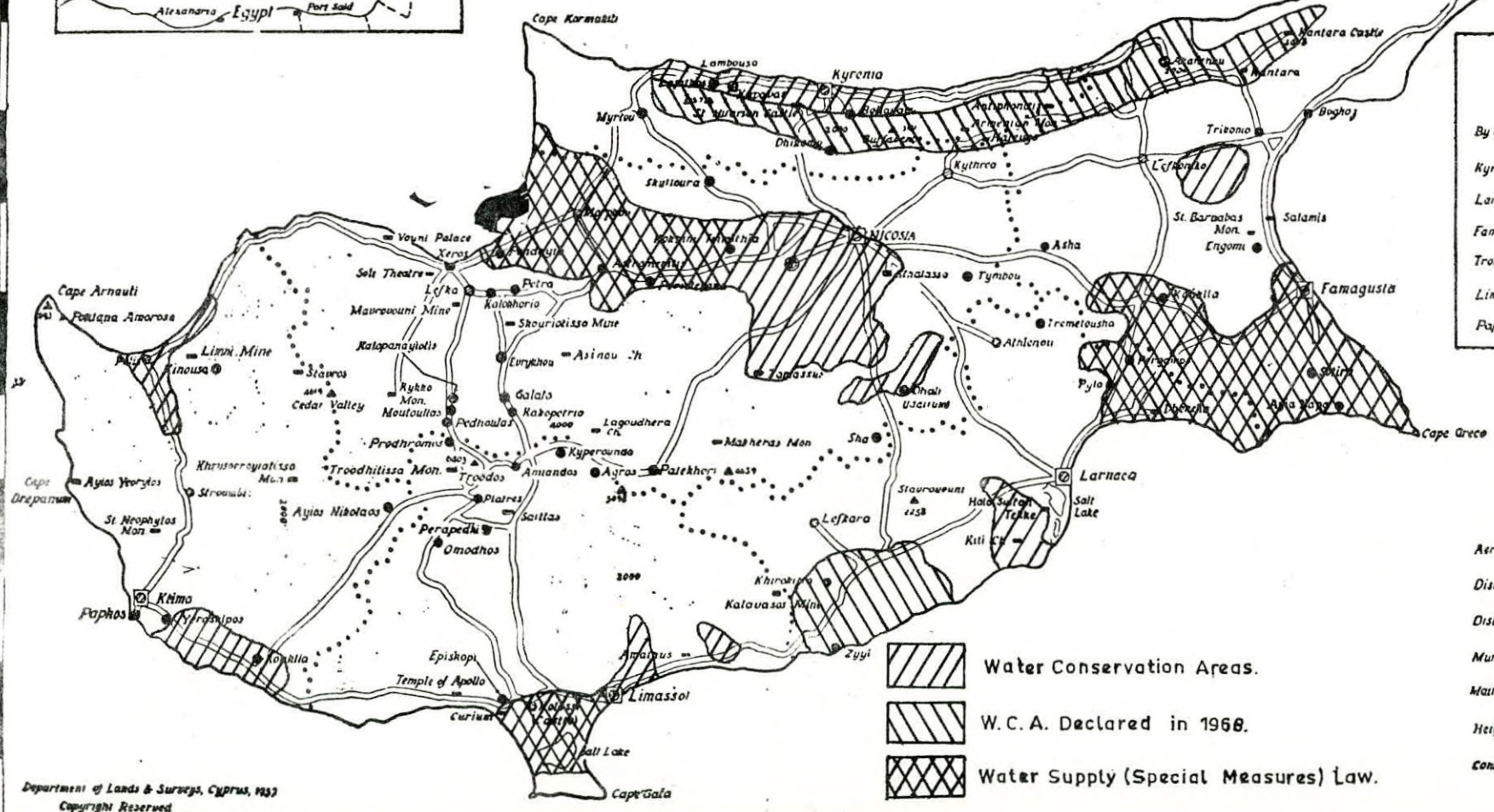
# CYPRUS

Scale



Table of Distances  
from NICOSIA

By road to	miles	By air to:	miles
Kyrenia	10	Beirut	155
Larnaca	26	Ankara	350
Famagusta	38	Cairo	368
Troodos	50	Athens	576
Limassol	54	Rome	1273
Paphos	99	London	2333



Reference

Aerodrome	⊕
District Boundaries	.....
District Towns	□
Municipalities	⊙
Main Roads	==
Heights in feet	▲ 573
Contours every 100 feet	.....

- Water Conservation Areas.
- W.C.A. Declared in 1968.
- Water Supply (Special Measures) Law.

Department of Lands & Surveys, Cyprus, 1953  
Copyright Reserved



b. Water Supply (Special Measures) Law, 32/64

The most important aquifers of South-Eastern Mesaoria Western-Mesaoria, and Limassol, see Appendix which were declared as a Water Conservation Areas in the past, have now been covered by the Water Supply (Special Measures) Law, whose purpose is to further protect and control the water resources in a more efficient manner.

The main provisions of this Law are:-

- (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 put regarding the quantity 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. 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.

(i)	South-Eastern Messaoria	No. 364
(ii)	Western Messaoria	No. 149
(iii)	Akrotiri Peninsula	No. 318

These water meters are read every month and recorded.

F. Engineering Geology Work

During the year under review problems of General and Engineering Geology have been dealt with by Mr. C. Xenophontos, Geologist, seconded to this Department from the Geological Survey. As the tempo of development increased and as the projects undertaken by this Department became larger and more



complicated, so the demand for a fuller understanding of the parameters affecting these projects, obtained the importance it merits. This is all the more important in the case of dam construction where the geological factor has a direct bearing on the stability, operation and cost of such a structure. Many of the dam failures in the world have been due to weak foundations or other geologic reasons, whilst in other cases large sums have been spent in remedial works arising out of an inadequate knowledge of the geologic parameters.

The factors that affect the selection of any one site or type of dam are many and varied but to the engineering geologist, topography materials available, geology and foundation conditions are all important.

Out of necessity therefore, the work is carried out in stages with the end result of selecting a site or number of sites in a river valley which merit further and more detailed investigations. Once topographic maps of the proposed dam-site and reservoir areas are available, these are geologically mapped and the geologic history, lithology, structure - with any pertinent geologic problems - are incorporated in a preliminary report together with maps and recommendations for further more detailed sub-surface investigations. In the year under review two such reports have been prepared entitled:-

- a:- Preliminary Geologic Investigations at Kapsala proposed Dam-Site and Reservoir Areas.
- b:- Preliminary Geologic Investigations at Kalavassos proposed Dam-Site and Reservoir Areas.

In addition to the above, further subsurface investigations in the form of boreholes, exploratory adits and trenches were carried out at Asprokremmos and Morokambos Dam-sites in the Paphos Region. The aim of these investigations has been the further elucidation of geologic problems associated with the foundations of the proposed structures and not apparent at surface. The condition of the rock at depth, its strength, permeability, the extent and attitude of faults in the vicinity of the proposed dam-axis and depth of over-burden were some of the answers sought for in this stage of the investigations.



All boreholes drilled were geologically logged as were all adits and trenches. Staged field permeability tests for all boreholes were carried out and presented on geologic cross-sections along the proposed dam-axes. Thus, all available geologic information was collected and presented in two detailed foundation reports as given below:-

a:- Foundation Investigations, Asprokremmos Dam.

b:- Foundation Investigations, Morokambos Dam.

As a sideline to the geologic studies associated with the proposed dam-sites, the Engineering Geology Branch dealt with three particular problems that cropped up at three of the existing dams i.e. Polemidhia, Kalopanayiotis and Mavrokolymbos.

1. Polemidhia Dam.

The problem in this case has been one of excessive leakage through the left abutment.

It was found that leakage increased noticeably when the water reached a certain level in the reservoir and appeared ~~in~~ numerous springs on the slopes downstream of the dam. A highly disturbed and fractured calcarenite and marly chalk unit forms the left abutment and it is through this that leakage takes place. It is thought that leakage may be reduced, if not completely stopped, by grouting but first the lateral and vertical extent of the disturbed unit had to be defined so as to choose the most economic line of grouting. Three new boreholes were drilled to well within undisturbed rock and the information obtained from these plus that obtained from existing boreholes in the area was utilised to construct two geologic cross-sections. Thus the most suitable line for grouting was chosen along which some test-grouting has already been carried out.

2. Kalopanayiotis Dam.

A problem of a completely different nature has been met within this case. Shortly after the completion of the dam, it was suspected that the hill-side on the left abutment was moving. From field investigations it became apparent that if such a movement occurred then it must have taken place along Shear planes which here slope towards the reservoir.



A marker observation network was established and measurements of the amount of movement taken fortnightly. These measurements were made from control points established outside the affected area and on ground considered to be stable. Concurrently with these, measurements of rainfall and reservoir water-level were taken and all data presented graphically. By this method the interaction between these factors could be established and tentative proposals put forward that would minimise the danger to the stability of the dam. It now seems probable that a combination of both rainfall and high reservoir water-level is conducive to movement whilst this approaches stability when one of these factors is missing. Thus the problem may finally be reduced to one of operation policy by which the dam is kept empty during the rainy season and filled when no more rain is expected. Observations however, are still continuing.

3. Mavrokolymbos Dam.

Sliding occurred on the right bank of the reservoir which might have endangered the capacity and the outlet works of the dam if not its stability. The rock in this case is composed of highly contorted and fractured red and grey shales of the Mamonia Complex. These are as a rule very unstable disintegrating easily with repeated wetting and drying.

A piezometric and monument network was established and observations of both taken prior to, during and after impounding this year. Both gravity and ground water-level have been found to affect the amount of movement and a large part of this slope was graded to a gradient of 1 : 5. The piezometric readings have shown that this highly fractured material has its own draining mechanism, a condition that is favourable to stability. It is thought that movements will still continue, but that the condition is far better than originally anticipated.



In the field of General Geology, investigations were carried out as and when necessary and the findings incorporated in a number of smaller reports and memoranda. The most important of these has been a study of increasing the salt production, Larnaca Salt Lake. A report entitled 'Methods of increasing salt production, Larnaca Salt Lake' was prepared.



DIVISION OF PLANNING

Prepared by: N. Ioannides,  
Head of Division.

Introduction:

The Division of Planning has dealt in 1968 in the following aspects:-

General planning of the Department's major projects in:-

- (A) Collection of water use data.
- (B) General Investigations.
- (C) Foundation and Engineering Geology problems.
- (D) Laboratory.
- (E) Field control during construction.

A. Collection of water use data for watershed planning.

The collection of water use data for watershed planning consists of plotting of intakes, wells, boreholes, springs etc., as well as the land irrigated and type of crops of the existing various irrigation schemes from surface and ground water resources within the catchment area of the selected rivers.

During 1968 the work was continued at full speed by the employment of three officers on hourly basis of the Water Development Department. Later in May 1968 these officers were assisted by another three new officers of the Agricultural Department who were appointed for this purpose on daily basis.

The necessary information connected with the collection of water use data were taken by investigation on the spot, by consulting with the Committees of the relative Irrigation Divisions and Associations, the private persons concerned, and the village authorities. During the investigation certain difficulties arose due to the reluctance of the parties concerned to give correct information and the existence of Turkish villages within the catchment areas under study.

During 1968 the necessary investigations were continued and completed on the following rivers :-

- a. Lower Serakhis river catchment (Morphou area)
- b. Vasilikos river catchment.
- c. Kambos river catchment.
- d. Katouris river catchment.
- e. Elia river catchment.
- f. Trimithios river catchment.
- g. Pedhieos river catchment.



At the end of the year the investigations were proceeding on the 'Idalias' river catchment area where the work on the upper catchment area was completed.

Up to 1967 50% of the selected area of Cyprus was covered. In 1968 28% was finished and it is proposed that the 22% remaining will be completely finished by the first six months of 1969.

Drawing number NU/IR/39 shows the programme of the work. See Appendix IX.

B. General Investigations.

These include:-

- a. Material investigations.
- b. Detailed geologic map of dam and reservoir sites.
- c. Foundation investigations
- d. Laboratory testing.
- e. Interpretation of results for design.
- f. Report.

Schemes investigated in 1968 were as follows:-

1. Asprokremos Dam investigations for the C.W.P.P.

- a. Material investigations were carried out and the following materials were found within a reasonable distance from the proposed dam site.
  - (i) Core material
  - (ii) Filter material
  - (iii) Rip-Rap
  - (iv) Random fill
  - (v) Concrete material.
- b. Detailed geologic maps of the dam and reservoir sites were prepared.
- c. After a study of the geologic maps prepared 17 boreholes were drilled and pressure tests were carried out in all of them. Three trenches and three tunnel entrances were also excavated.
- d. Samples of materials as well as samples from the cores recovered from the boreholes were tested.
- e. Report for foundation investigations was prepared and report for material findings will be completed in 1969.








2. Morokambos Dam investigations for the C.W.P.P.

- a. Material investigations were carried out and the following material were found within a reasonable distance from the proposed dam site.
  - (i) Core material
  - (ii) Filter material
  - (iii) Rip-Rap
  - (iv) Random fill
  - (v) Concrete material





**LEGEND**

- Hydrological Area Boundary 
- Hydrological Area Number 
- Spring or Chain of Wells 
- Stream Gauging Station 
- Collection of water use data completed before 1968 (1200 sq. miles appr.) 
- Collection of water use data completed during 1968 (690 sq. miles appr.) 
- Collection of water use data to be completed in 1969 (540 sq. miles appr.) 



- b. Detailed geologic maps of the dam and reservoir sites were prepared.
- c. For foundation investigations 14 Boreholes were drilled and pressure tests were carried out in all of them. Two tunnel entrances and 4 trenches were also excavated.
- d. Samples of material as well as samples from the cores recovered from the boreholes were tested.
- e. Report for the foundation investigations was prepared, and the report for material will be completed in 1969.
- f. It should be mentioned that at the initiation of the investigations programme for Asprokremmos and Morokambos dam sites the services of a French Consulting Team of Messrs. Barbier, Barge and L' Heriteau were utilized, when they paid a visit in Cyprus during the early part of 1968.

3. Aradhippou Dam Investigations.

- a. Material investigations were started in 1967 and were completed in 1968.
- b. Samples of materials were tested.
- c. Detailed geologic maps of the reservoir and dam sites were prepared.
- d. Foundation investigations were started in 1967 and finished by the end of March, 1968. Eight boreholes were drilled and pressure tests were carried out in all of them. Two trenches and two test pits were dug along the dam centreline.
- e. Report for the material and foundation investigations were prepared.

4. Tengelis Dam Investigations.

- a. Preliminary material investigations were carried out and samples were tested.
- b. Preliminary foundation investigations were carried out. Six boreholes were drilled and pressure tests were in all of them.



5. Khirokitia Dam Investigations.

- a. Material investigations were carried out and the following materials were found within a reasonable distance from the proposed damsite.
  - (i) Core material
  - (ii) Filter material
  - (iii) Rip--Rap
  - (iv) Random fill
  - (v) Concrete material.
- b. Samples of material were tested
- c. Detailed geologic maps of the dam and reservoir sites were prepared.
- d. After a study of the geologic maps prepared 8 boreholes were drilled and 3 trenches were excavated, pressure tests were carried out in all boreholes drilled.
- e. Report for material and foundations investigations will be completed in 1969, since it is possible that some further investigations might be necessary.

6. Kapsala Dam Investigations for the C.W.P.P.

- a. Material investigations were started and will be completed in 1969.
- b. Samples of material were tested.
- c. Detailed geologic maps of the reservoir and damsite were prepared.
- d. Two tunnel entrances were excavated and seven boreholes were drilled. Pressure tests were carried out in all boreholes drilled.  
Further investigations will continue in 1969.

7. Lefkara Dam Investigations.

- a. An access road of 14.000 ft. total length was constructed.
- b. Detailed geologic maps of reservoir and damsite were prepared.
- c. Two tunnel entrances and one trench were excavated.  
Further investigations will be carried out in 1969.



8. Investigations for other Departments.

After a request of the Grain Commission Manager our Department has undertaken and carried out foundation investigations for three grain Silo Sites at Ypsonas, Kato Paphos and Famagusta.

Detailed reports about the findings and the suitability of the sites for large grain silo were prepared.

C. Foundations and Engineering Geology Problems

1. Kalopanayiotis Dam

Readings continued to be taken for the Kalopanayiotis crack. From their interpretation is shown that:-

- a. The movement of the abutment seems to have continued but much more slower than before and indications are that it is being stabilized.
- b. Remedial works were carried out in conjunction with these movement such as surface drainage, which seem to have been quite successful.
- c. Further movements in 1969 is expected to be very little.

2. Mavrokolymbos Dam

The stabilization works for the reservoir sides have continued and finished in 1968, whilst the piezometers in the abutments have been observed.

It is expected that the reservoir which started filling in 1968 will be full in 1969.

Then further studies will continue for the stability or this rather complex problem.

3. Grouting Works at Yermasoyia Dam (Contact stage grouting)

After the completion of the main grouting works regarding the construction of the grouting curtain along the foundations of the dam by the end of November, 1967, an additional contact stage grouting on the left abutment was recommended by the grouting consultants. The execution of this work was commenced on the 12th December, 1967, and was entirely finished by the 15th March, 1968.



The main purpose of the contact stage grouting was to consolidate the rock adjacent to the core and also to create a better contact between rock and clay on the steep part of the left abutment.

All of the grouting works were carried out by the Sub-contractor "Cementation Co., London" under the joint supervision of the consulting engineers "Energoprojekt Beograd" and the Department of Water Development.

4. Grouting Works at Mavrokolymbos

a. Tunnel Fan Grouting

The Fan grouting is composed of two rings with different patterns of holes. The first ring is situated on the chainage 0' + 227' and consists of 12 holes and the second on 0' + 237' and consists of 13 holes. Maximum depth of the holes was 20 feet.

As it was programmed the work was commenced in the middle of June 1968 and it has been entirely finished by the middle of July 1968. In addition to the fan grouting, a number of test holes were drilled and grouted on different weak spots in the downstream part of the tunnel.

b. Tunnel-Contact grouting.

From the water testing results obtained while executing the fan grouting and from seepage through the concrete lining before impounding any water, it was evident that the contact between the rock and the concrete lining was not filled with any mortar.

It was then decided to execute a contact grouting throughout most of the concrete lining with 5 holes on every 8 ft. section. Work commenced in November and continued till the end of the year, when the grouting was stopped due to heavy rain and the flooding of the reservoir. The tunnel was grouted up to 35 ft., D./S of the gate starting from the inlet. All mentioned works were carried out by W.D.D., staff and machinery.



5. Grouting Works at Polemidhia Dam

Three exploratory holes were drilled and water tested on the east abutment so as to form a better opinion on the best route for executing the extension of grout curtain. Due to the bad geological condition, it was found necessary to carry out a test grouting on the proposed extension of grout curtain to enable us to decide on the final way of treatment and prepare the cost estimate.

The test grouting was carried out in descending order in 5 ft., stages on seven holes 5 ft., apart. According to these results, a final report regarding the remaining grouting works, will be ready early in 1969.

All mentioned works were carried out by W.D.D. staff and machinery.

6. Grouting Works at Kalopanayiotis Dam

No grouting work was done on this dam in 1968.

Piezometers were sunk on different spots, on the dam structure and on the D/S part, to check the water elevations compared with the water level in the reservoir.

An estimate of £950 for treating the tunnel was submitted and approved.

D. Laboratory

In 1968 the W.D.D. laboratory was enriched by a new triaxial machine that would take samples up to 4 inches diameter.

Also a Pore Pressure equipment has been acquired to be used in conjunction with this triaxial machine.

It is expected that this new machine will enable the Department to carry out triaxial tests on both soils and solid rocks and to determine thus their strength parameters.

From the enclosed table we can see that a total of 8.405 tests were carried out in the Department's laboratory in 1968.



E. Field Control During Construction

During construction of the different projects control tests were made to evaluate the efficiency and quality of the material used. The personnel were posted permanently to the sites and they checked the works constantly.

From the tables above can be seen that out of 8,405 tests, about 5,000 i.e. 59.5% were made for construction.



DIVISION OF DESIGN

Prepared by: K.C. Hassabis,  
Head of Division.

A. Design Work

The work of the Design Branch during 1968 was concerned as usual with the preparation of designs for Major Water Development Projects, i.e. Dams and related Distribution Systems, Water Supply Schemes etc.

The branch was served by three Civil Engineers and one Inspector of Works for most of the year. Later in the year, in August 1968, three additional Civil Engineers were recruited and were attached to the Design Branch. In addition the branch had the benefit of the services of two U.N. Experts and of one U.N. Associate Expert.

During 1968 design work was done on the following Projects:-

1. Famagusta Water Supply Project:-

This project is designed to supply eventually Famagusta with a maximum quantity of 4,0 Million Gallons per day, and Larnaca with 1.0 Million gallons per day. Water will be drawn initially from boreholes in the Vassilikos, Psematismenos and Khirokitia areas and later from Dams on Pendaskynos and other Rivers in the area. Water will be collected near Khirokitia where the Treatment Plant and a collecting reservoir will be located and then be conveyed to Phrenaros by a trunk main comprising of Asbestos cement pipes of 500-600 and 650 mm. dia and having a total length of 63,600 meters. At Phrenaros a Service Reservoir of 454,000 m<sup>3</sup> capacity will be constructed and from there water will be conveyed to Famagusta Town through a Main having a length of 9,200 meters.

2. Palekhorri Dam Project:-

During the first months of 1968, design work on an earth rockfill dam at Sklidros near Apliki Village was completed. However, thorough geological investigations revealed that there was some risk involved in constructing a dam at this location and as a result a new location for a concrete dam was selected on the Kambi river. The capacity of the reservoir at the new site will be the same and it will be combined with a diversion from the Sklidros tributary to ensure that the **reservoir** will fill every year. Detail designs for the concrete gravity Dam will be ready early in 1969.



3. Massari Recharge Works Project--

Detailed design work for the Massari earthfill dam was carried out in 1968.

4. Mavrokolymbos Dam-Distribution System--

The Design of the main conveyor from Kissonerga to Khlorakas and of the subsidiaries in Lemba and Khlorakas were completed.

5. Yermasoyia Dam Distribution System--

The design of this system was completed in 1968. However, due to some problems relating to the disposal of the water from the dam some work will be necessary in 1969.

6. Kiti Distribution System--

Design work was done for extensions of this system.

7. Argaka-Makounda Distribution System--

Design on this project was done during the year.

8. Extension of Pomos Dam Spillway--

The design and construction of this project were done in 1968.

9. Diversion of Saline Water Ovgos Dam--

A project for diverting the incoming saline water before entering the Ovgos Dam was Designed and executed in 1968.

10. Mia Milia Dam - Conveyor Pipeline--

A main conveyor pipeline from the dam to the area to be irrigated was designed, in order to minimise losses of water.

B. Drawing Office Work

The Drawing Office Branch was headed by Mr. S.C. Pitsillides. The staff of this Branch numbered 24 of whom 2 were on loan to the Geological Survey Department and one on loan to the Town Planning Department. All Staff were female except those on loan to the Geological Department and all of them including the Officer in Charge were on daily wages.

During 1968 the Head of the Drawing Branch prepared the Departmental Manual No. S/3 "IRRIGATED LAND USE SURVEYS". This Manual includes detailed instructions for the collecting and recording of all information on Irrigated Land Use.



1. Drawing Work.

In addition to the normal Departmental work the Drawing Branch was engaged in the execution of all drawing work needed for the CWPP.

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

(i) Existing and proposed Dams.

Subject.

- |                          |                                     |
|--------------------------|-------------------------------------|
| 1. Agros                 | 12. Polemidhia                      |
| 2. Argaka-Makounda       | 13. Pomos                           |
| 3. Ayia Marina           | 14. Prodhromos                      |
| 4. Kalopanayiotis        | 15. Syngrassi                       |
| 5. Kambi                 | 16. Tremithios (Kiti)               |
| 6. Kouklia               | 17. Yermasoyia                      |
| 7. Massari               | 18. Treatise on Dams                |
| 8. Mavrokolymbos         | 19. Dams in Cyprus                  |
| 9. Ormidhia              | 20. Progress of Dam Projects        |
| 10. Ovgos                | 21. Standard form of Dams for ICOLD |
| 11. Palekhoris Sklidhros |                                     |

Total time spent 4167 hours.

(ii) Irrigation Distribution Systems for Dams.

- |                         |   |
|-------------------------|---|
| 1. Argaka-Makounda      | 8. Polemidhia                                 |
| 2. Ayia Marina          | 9. Pomos                                      |
| 3. Kalopanayiotis       | 10. Tremithios (Kiti)                         |
| 4. Mavrokolymbos        | 11. Yermasoyia                                |
| 5. Mia Milia            | 12. Yermasoyia Polemidhia (combined Project). |
| 6. Morphou (Teratsias)  |   |
| 7. Palekhoris Sklidhros |   |

Total time spent 3260 hours.

(iii) Routine Irrigation Schemes.

- |                            |                      |
|----------------------------|----------------------|
| 1. Akaki Menico            | 13. Eastern Mesaoria |
| 2. Akaki                   | 14. Elea (Karavas)   |
| 3. Akhelia Chiflik         | 15. Galata           |
| 4. Angastina               | 16. Galini           |
| 5. Anglisidhes             | 17. Cypsou           |
| 6. Arakapas                | 18. Kalavastos       |
| 7. Argaki                  | 19. Kakopetria       |
| 8. Astromeritis            | 20. Katokopia        |
| 9. Ayios Georghios (K)     | 21. Fhirokitia       |
| 10. Ayios Theodoros (L'ca) | 22. Khoulou          |
| 11. Dhierona               | 23. Kilinia          |
| 12. Dhrinia                | 24. Kissonerga       |



- |   |                              |
|---|------------------------------|
| 25. Klirou  | 48. Philia                   |
| 26. Kouka   | 49. Phyti                    |
| 27. Kouklia Chiftlik (P)                                  | 50. Platanistasa Court Case  |
| 28. Koutraphas Angolemi Nikitas<br>Prastio P. & K. Zodhia | 51. Polis Prodromi           |
| 29. Kyperounda  | 52. Potami                   |
| 30. Lakatamia   | 53. Prastio (Morphou)        |
| 31. Mandria   | 54. Prastio-Nikitas          |
| 32. Massari   | 55. Psematismenos            |
| 33. Mazodos   | 56. Psevdas                  |
| 34. Miliou  | 57. Psomolophou              |
| 35. Morphou   | 58. Pyrgos (Tyl.)            |
| 36. Morphou- Ovgos  | 59. Statos                   |
| 37. Motidhes  | 60. Syrianokhori             |
| 38. Nikitas   | 61. Tembria Korakcu Evrykhou |
| 39. Nissou  | 62. Trimiklini               |
| 40. Palekhori   | 63. Trypimeni                |
| 41. Palekythron   | 64. Vasilia                  |
| 42. Panayia (P)   | 65. Voroklini                |
| 43. Peristerona   | 66. Vyzakia                  |
| 44. Peristerona Astromeritis<br>Orounda Dispute           | 67. Xyliatos                 |
| 45. Peristerona Kato Moni Rd<br>Channel                   | 68. Yerolakkos               |
| 46. Peristerona Orounda                                   | 69. Zodhia Kato              |
| 47. Petra   | 70. Zodhia Pano              |
|   | 71. Zodhia Pano & Kato       |
|   | 72. Zygi                     |

Total time spent 3697 hours.

(iv) Domestic Water Supply Schemes.

- |                      |   |
|----------------------|---|
| 1. Famagusta         | 19. Laxia   |
| 2. Larnaca           | 20. Mammari   |
| 3. Morphou           | 21. Mathikoloni   |
| 4. Nicosia           | 22. Melousha Tremethousa, Arsos,<br>Vatili, Strongylos. |
| 5. Akhelia           | 23. Mia Milia   |
| 6. Alethriko         | 24. Ora   |
| 7. Apsiou            | 25. Pakhyamos   |
| 8. Aradippou         | 26. Paramytha   |
| 9. Astromeritis      | 27. Pedhoulas   |
| 10. Ayia Irini       | 28. Peristeronari                                       |
| 11. Ayios Andronikos | 29. Piyenia   |
| 12. Dhali            | 30. Potami  |
| 13. Dhrymou          | 31. Potamos tis Yermasoyias                             |
| 14. Kakopetria       | 32. Psevdhas  |
| 15. Karavostasi      | 33. Spinneys (Kyrenia)                                  |
| 16. Katydhata        | 34. Skoulli   |
| 17. Kellaki          | 35. Trachypedhoula                                      |
| 18. Kelokedhara      |   |



36. Thermia
37. Vatili
38. Xyliatos

39. Yenagra
40. Zoopiyyi-Louvaras

Total time spent 4961 hours.

(v) Recharge Schemes.

1. Akhna
2. Famagusta
3. Lapathos
4. Ormidhia
5. Yialousa
6. Xylotymbou
7. Maroni
8. Elea (Karavas)

Total time spent 343 hours.

(vi) Antiflood Schemes

1. Kythrea Antiflood
2. Kato Zodhia Komitis Antiflood Works
3. Karavostasi Antiflood

Total time spent 75 hours.

(vii) River Training Schemes

1. Kelokedhara Land Reclamation Project
2. Pedhieos River Peak Flow at Strovolos Bridge.
3. Pedhieos River Training
4. Pedhieos Canalization (At Presid. Palace)
5. Pedhieos River Canalization Stage I

Total time spent 236 hours.

(viii) Hydrological

1. Measuring Weirs, Eleousa, Boghaz (F) Akanthou & Garyllis (Mersina)
2. Annual Rainfall
3. Runoff Relation
4. Loss of Capacity Curves
5. Rainfall for Different Returns Periods P.W.D. Station
6. Flood Estimate Curves of Cyprus (Hsu)
7. Rainfall Chart
8. Hydrolog. Section Annual Report 1965-66
9. Boghaz (K) Gauging Station
10. Evaporation (Nicosia)
11. Akaki River
12. Kapedhes Gauging Station Catchment

Total time spent 208 hours



(ix) General

1. Film Strip W.D.D. Works (P.I.O.)
2. Cyprus Soil Map Reduction Admin. Mapsize.
3. Leakage and other Observations for Dams.
4. Drain Spacing Graphs
5. Morphou Watersheds
6. Akrotiri Shore Embankment
7. Monthly Returns
8. Area-Capacity Curves (Addition of Zero Gauge)

Total time spent 639 hours.

(x) Hydraulic Tables.

1. Discharge Graphs for Prefab. Canals
2. Parshall Flume

Total time spent 85 hours.

(xi) Standard Drawings

1. Prefabricated Channel Support Section
2. R.C.C. Tunnels

Total time spent 58 hours

(xii) Reports

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1. Report No. 16 (Milinusic) | 6. Annual Report                  |
| 2. Report No.17 (Milinusic)  | 7. Irrigated Land Use Manual      |
| 3. Report No.18 (Milinusic)  | 8. Preliminary Estimating Data    |
| 4. Report No.19 (Milinusic)  | 9. Small Projects Planning Manual |
| 5. Report by S.W. Hsu        |                                   |

Total time spent 636 hours.

(xiii) Programmes and Organization

1. Construction Programme 1968
2. Major Project Irrig. Programme 1968
4. Division of Water **Resources** Programme 1968
5. Minor Project Programme 1968
6. Water Development Flow Chart
7. Organization Chart
8. Mapping Requirements for 1969-70

Total time spent 309 hours

(xiv) Old Jobs

- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1. W.D.D. L'ca Office Poster  |                                     |
| 2. Nomogram Sutherland        | 4. Geologic Log Form                |
| 3. Staff Leave Sheet for 1968 | 5. Albums for Various Personalities |

Total time spent 73 hours



(xv) Auxiliary Services

- |                            |                   |
|----------------------------|-------------------|
| 1. Drawing Materials Store | 3. Library        |
| 2. Plan Registry           | 4. Registry Works |

Total time spent 1836 hours

(xvi) Jobs for Other Departments

1. Grain Commission Foundation Investigation for Ypsonas, Pallcuriotissa, Paphos, Kaimakli, Famagusta, Larnaca.
2. Department of Fisheries: Akanthou Mandraki and Vasilia Fishing Shelters.
3. Agricultural Reservoir Institute Graphs
4. Town Planning, Statos Village Relocation.

Total time spent 171 hours

(xvii) Initial Training for New Staff 996 hours

b. For the work required by the CWPP ten Technical Assistants (Daily Paid) were engaged throughout the year. The work done can be listed as follows.

(i) Dam Reconnaissance.

Subject

Akapnou	Krystalla
Aradhippou	Lambroudhori
Asprokremmos	Lania
Atsas	Lefkara
Ayias	Limnitis
Ayios Mamas	Lymbia
Ayios Theodoros (Tyl.)	Morokambos
Ayios Therapon	Palaeomylos
Delikipos	Potamos tou Kambou
Dhipotamos	Pouzis
Dhoros	Psevdhas
Evdhimou	Pyrgos
Farkonias	Symboulas
Kalavastos	Vasilikos
Kapsala	Vavla
Karavas	Vyzakia
Katouris	Xeropotamos
Khalassa	Xyliatos
Khirokitia	Dam Recon. Programme
Kourris	

Total time spent 4413 hours



(ii) Existing Irrigation and Land Use Maps

Reduction to scale 1:25,000 of the watersheds of

- |               |                          |
|---------------|--------------------------|
| a) Atsas R.   | Pendaskinos R.           |
| Dhiarizos R.  | Potamos-tou-Kambou R.    |
| Ezusa R.      | Pouzis R.                |
| Garyllis R.   | Serrakhis R.             |
| Karyotis R.   | Tremithis R.             |
| Katouris R.   | Vasilikos R.             |
| Khapotami R.  | Xeropotamos R.           |
| Khrysokhou R. | Yermasoyia R.            |
| Kourris R.    | b) Famagusta area        |
| Marathasa R.  | c) Addition of Boreholes |
| Maroni R.     |                          |

Total time spent 3,416 hours

(iii) Land Use Section

- a) Land Suitability Map
- b) Growing Periods for the Main Annual Crops in Cyprus
- c) Land Levelling Curves Agriculture
- d) Irrigation Requirements
- e) Area to be Soil Surveyed
- f) Net Requirements Curves
- g) Reconnaissance Irrigation Land Use Map of Cyprus
- h) Drawings for "Techniques and Economics of Irrigation in Cyprus".

Total time spent 293 hours.

(iv) Hydrology Section

- a) Stream Discharge Graphs
- b) Isohyetal Map
- c) Hydrological Surveys
- d) Runoff Graphs
- e) Hydrological Data Requirements Report
- f) Potential Evaporation Curves
- g) Infiltration Graphs of Athalassa Test
- h) Spring Discharge Graphs
- i) Probability Diagrams for Annual Flows
- j) Soil Moisture, Dhiarizos Basin, Mamonia, Philousa and Rizokarpaso Areas

Total time spent 756 hours.



(v) Engineering Section

- a) Volume Charts Earth, Rock and Earth Rock Dams.
- b) Dam Reservoir Capacity Constants
- c) Spillway Discharge Curves
- d) Diagrammatic Model of Water Allocation
- e) Working Programme Engineering Section

Total time spent 164 hours.

(vi) Economics Section

- a) Crop Economy Graph
- b) Domestic Water Supply Projections

Total time spent 74 hours

(vii) General

- a) General Work Programme Forms
- b) Morphou Area Irrigation
- c) All Projects Map
- d) Planning Activities
- e) CWPP Flow Chart
- f) Computation of Sheet Plan Corner Coordinates U.T.M. Grid.
- g) Akrotiri-Limassol Area Development
- h) Tylliria-Morphou Area Development
- i) Snow Area North Troodos

Total time spent 1314 hours.

(viii) Watershed Surveys

- a) Karyotis River
- b) Serrakhis River
- c) Kourris Garyllis River
- d) Tremithios River
- e) Pouzis River
- f) Pendaskinos River
- g) Vasilikos River
- h) Potamos tou Kambou River
- i) Maroni River

Total time spent 2487 hours

(ix) River Profiles

- a) Khrysokhou River Profile
- b) Pendaskinos River Profile
- c) Maroni River Profile
- d) Vasilikos River Profile
- e) River Profiles Regions 2 & 3

Total time spent 290 hours

(x) Work for Regions

- a) Region 1 :
  - (i) Geological map
  - (ii) Potential Irrigation Areas
  - (iii) Feasibility Study Programme



- b) Regions 2 & 3
  - (i) Land with 10% Slope or less
  - (ii) Pyrgos, Katouris and Limnitis Rivers Land for Irrigation.
- c) Regions 4 & 5
  - (i) Details table of Dams
- d) Regions 8 & 9
  - (i) Land Suitability
- e) Regions Map

Total time spent 183 hours

(xi) Old Jobs

- |                                    |   |
|------------------------------------|---|
| a) New maps 1:25,000               | e) Letter Head CWPP                             |
| b) Placard C.W.P.P.                | f) Door Labels                                  |
| c) Project Files                   | g) Drawing Materials 1968 List of Requirements. |
| d) Tender for Photo Process Camera | h) Plan of CWPP Offices                         |

(xii) Training of Staff

Notes

- (i) The above time spent on various jobs does not include any time spent by the Officer in Charge of the Drawing Branch.
- (ii) Initial training means the basic training that the recruits to the Drawing office undergo i.e. lettering, ink work, scaling and map reading. This is necessarily non-productive training. After the initial training recruits continue to be trained by doing actual work and producing. This process of training while producing in fact never ends due to the big variety of jobs undertaken by the Drawing Office.

2. Library and Technical Information Section

During 1968 30 new books were bought by the Department and subscription was continued on 12 Technical Periodicals. In addition numerous other books, reports and periodicals were received free of charge. The Library is indebted to Mr. S.W. Hsu U.N. Dam Expert for the supply free of charge of the Journals of all the Divisions of the American Society of Civil Engineers.

The Library continued to issue monthly or bimonthly reports of material received and of articles from periodicals of interest to the Technical Staff.

3. Reproductions Section

Plan reproduction continued during 1968 with the automatic continuous process dyeline paper printing machine with the old "Still" printing machine as stand-by. Some 3,300 orders



were issued to the Reproductions Section and 32,000 prints were made of various sizes and of all types. The automatic machine underwent a general overhaul during 1968, at a cost of £98 for spare parts and £17 for repairs wages. The ammonia tank was replaced and the old one has been serviced and kept as spare. The two Foremen manning the machine worked exceptionally hard during 1968 when demand increased due to the full operation of the CWPP.

C. Topography Branch

This Branch was headed by Mr. A. Evripidou Inspector of Works and has carried out all the Survey Work required by the Design and Planning Divisions of the Department and the Cyprus Water Planning Project. These assignments consisted mainly of Contour Surveys, Cross-Sectioning, Profile-levelling for Dam Reservoirs and Irrigation Distribution Systems and control observations for horizontal and vertical movements of constructed Dams.

A major Survey assignment this Branch has dealt with this year was that of Famagusta Water Supply Project which comprises about 90 km of Profile - levelling, establishing control Bench Marks Settin out, Plotting and conducting contour-surveys at the sites of the proposed permanent structures.

The daily paid Technical Assistants recruited in 1967 have now been trained and their performance and assistance was most satisfactory and contributed very much to the efficiency of this Branch.

The staff during this year was as follows:-

Post	No.	Remarks
Inspector of Works	3	One I.W. in charge of Branch
T/A monthly paid	3	
T/A daily paid	11	Most of them appointed in 1967

The Projects that this Branch dealt with this year were:-



Ser. No.	Project	Type of Survey	Remarks
1.	Sklidros Distr. System	Contour Survey	Commenced in 1967, completed 1968.
2.	Larnaca W.S.	Completion Plans (Plotting)	--do--
3.	Famagusta W.S.	Profile Levelling	Final Route
4.	Mavrokolymbos Dam	Movement observations.	
5.	Pomos Dam-Spillway Area	Contouring and Cross-Sectioning	
6.	Pyrgos R. Dam-site	Contour Survey	For the CWPP
7.	Yermasoyia Distr. System	Profile levelling	Main Conveyor Pipeline
8.	Kapsala Dam-site(P)	Contour Survey	For the CWPP
9.	Limnitis R. Dam-site	--do--	--do--
10.	Trimiklini Dam	Completion Survey	
11.	Perapedhi Dam	--do--	
12.	Kandou Dam	--do--	
13.	Athalassa Dam	--do--	
14.	Kaphizes Dam	--do--	
15.	Kiti-Pervolia Distr. System	Profile levelling	For the CWPP
16.	Lefkara Dam	Contour Survey	"
17.	Vasilikos Dam	--do--	"
18.	Dhipotamos Dam	--do--	"
19.	Dhelikipos Dam	--do--	"
20.	Khirokitia Dam	Raising of existing Contour Survey	"
21.	Kambos Dam	Contour Survey	"
22.	Pouzis R. Dam-site	--do--	"
23.	Ayios Theodoros (2 Dam-sites)	--do--	"
24.	Mia Milea Distr. System	Profile levelling	
25.	Lymbia Dam	Contour Survey	For the CWPP
26.	Vyzakia Dam	Contour Survey	"
27.	Katouris R. Dam	--do--	"
28.	Morphou Dam	Cross-Sectioning	Sedimentation Purpose
29.	Ovgos Dam	Contour Survey	--do--
30.	Agros Dam	--do--	Determination of new capacity.
31.	Cyprus Grain Commission	Site Topography	For construction purposes.
32.	"Panayia Tis Agapis" (Vavla) Dam	Contour Survey	Continued in 1969



CONSTRUCTION DIVISION

Prepared by: H.P. Karakannas,  
Head of Division.

The Construction Division of the Department of Water Development was established in January, 1968, after the implementation of the major interdepartmental re-organization of the Department.

This Division embraces all the constructional activities in the field of Domestic Water Supplies, Irrigation Works, the contract administration in the case of the Major Projects undertaken by contractors, all Departmental contracts, the use of heavy earth moving machinery and the Departmental Workshop.

The permanent force of the Division during 1968 consisted of:-

- 1 No. Engineer -- Hydrologist (Head).
- 1 No. Mechanical Engineer
- 1 No. Senior Inspector of Works
- 6 Nos. Inspectors of Works
- 2 Nos. Chief Foremen
- 7 Nos. Assistant Chief Foremen
- 80 Nos. Foremen Monthly paid and weekly paid.
- 348 Nos. Regular artisans.

446 = Total

In addition to the above permanent force of the Division, a daily force of about 1000 casual artisans and labourers were employed for the execution of the year's programme of works. On labour force alone an expenditure of £407,598. -- has been incurred during the year on constructional works.

In 1968, an amount of £274,098 including carry over schemes and deposits was made available for village domestic Water supply schemes, and £263,246 for Minor Irrigation Schemes, in total an amount of £537,344 for 126 schemes.

A. Domestic Water Supply Schemes

The programme of works for 1968 included 51 water supply schemes out of which 34 were completed during 1968, 15 schemes were put in hand but not completed by the end of the year and were carried over for completion in 1969, and only two small schemes, namely Ayia Anna in the Larnaca District and Arminou in the Paphos District could not be put in hand during the year. These two small schemes were rejected by the householders in the first instance for certain economic and other village personal



objections, but later both schemes were revised and approved by the householders and it is expected that they will be completed during 1969.

Of the 34 water supply schemes which were completed during 1968 a population of 34,303 persons have been served and 163,504 miles of pipes varying in diameter from ½ inch to 12 inches have been laid. 26 reinforced cement concrete tanks of a total capacity of 792,000 gallons, and 12 pump-houses have been constructed. A house-to-house distribution system has been provided to 29 villages and 6,600 house connections have been installed. Practically in all villages the water meter of ½ inch in diameter has been used for the past few years and it has proved to be functioning at a highly satisfactory standard. The 34 water supply schemes which were completed during 1968 are given in the table hereunder :-

Water Supply Schemes Completed During 1968

Ser. No.	V i l l a g e	Population 1960 Census	Estimated Cost £	Type of Scheme	Nature of Work
<u>Nicosia &amp; Kyrenia District</u>					
<u>Carry Over Schemes</u>					
1.	Ayios Epiphanius	310	4,069	Gravity	* H.
2.	Kythrea	2,955	8,964	Gravity & Pumping	* H.
3.	Krysiliou	69	2,500	Pumping	* H.
4.	Kato Moni	253	1,855	"	* H.
5.	Klirou	1,008	3,400	"	+ H.
6.	i) Karmi )	653	7,565	"	* H.
	ii) Trimithi )	301			
	iii) Ayios Yeorghios )	822			
7.	Kharcha	600	1,413	"	* H.
8.	Mathiatis	409	3,645	"	* H.
9.	Nikitari	450	1,200	"	+ H.
10.	Potamos tou Kambou	461	11,820	"	* H.
		8,291	46,431	--	--



Water Supply Schemes Completed During 1968

Ser. No.	Village	Population 1960 Census	Estimated Cost £	Type of scheme	Nature of Work
<u>Famagusta District</u>					
<u>Carry over Schemes</u>					
1.	Ephtakomi	971	1,244	Pumping	+
2.	i) Styllos )	538			
	ii) Engomi )	667			
	iii) Limnia )	1,201	11,070	Pumping	+
	iv) Ayios Serghios )	1,790			
	v) Salamis )	-			
<u>New Schemes</u>					
3.	Ayios Nicolaos	309	2,000	Pumping	+ H.
4.	Gypsos Regional Scheme (Gypsos-Milia-Piyi-Peristerona)	3,934	4,820	Pumping	+
5.	Kalopsidha	975	3,400	Pumping	+
		10,385	22,534		
<u>Limassol District</u>					
<u>Carry over Schemes</u>					
1.	Ayios Ioannis (Agrou)	875	2,656	Gravity	* H.
2.	Episkopi	1,987	4,400	Pumping	+ H.
3.	Kalokhorio	549	3,679	Gravity	* H.
4.	Kato Mylos	192	2,426	Gravity	+
<u>New Schemes</u>					
5.	Ayios Theodoros	604	800	Gravity	+
6.	Kilani	1,034	1,000	Gravity	+ H.
7.	Moniatis	356	500	"	+ H.
8.	Mouttayiaka	239	1,900	Pumping	+ H.
9.	Prodhromos	484	1,000	Gravity	+ H.
		6,320	18,361		
<u>Larnaca District</u>					
<u>Carry over Schemes</u>					
1.	Pyla	961	5,605	Pumping	+ H.
2.	i) Voroklini )	695			
	ii) Livadhia (x) )	1,329	15,580	Pumping	* H.
<u>New Schemes</u>					
3.	Dhromolaxia	594	4,588	Pumping	* H.
4.	Livadhia (x)	-	8,900	Pumping	+ H.
5.	Meneou	170	3,400	Pumping	* H.
6.	Pano Lefkara	1,771	550	Gravity	+
		5,520	38,623		



Ser. No.	Village	1960 Population census	Estimated Cost £	Type of Scheme	Nature of Work
<u>Paphos District</u>					
<u>Carry over Schemes</u>					
1.	Polemi	880	5,463	Pumping	* H.
2.	Polis ) Prodhromi )	1,645 518	3,027	Gravity	+
<u>New Schemes</u>					
3.	Nikoklia	139	2,600	Pumping	* H.
4.	Yioulou	605	4,900	Gravity	* H.
		3,787	15,990		

SUMMARY OF THE WATER SUPPLY SCHEMES  
COMPLETED DURING 1968

District	Population served	Amount approved £
Nicosia & Kyrenia	8,291	£ 46,431
Famagusta	10,385	£ 22,534
Limassol	6,320	£ 18,361
Larnaca	5,520	£ 38,623
Paphos	3,787	£ 15,990
TOTALS :	£ 34,303	£141,939
<u>LEGEND</u> * = New Scheme. + = Improvements to existing scheme H = House-to-house.		

Two of the most important Water Supply Schemes which were completed during 1968 are the schemes for Kythrea Town and the Regional Scheme for Karmi, Trimithi and Ayios Yeorghios Village in the Kyrenia District.

1. Kythrea: This small Town, though deriving its Water Supply from the Kephlovryso spring, which is considered to be the largest spring in the island, was facing an acute shortage of water especially in the summer season. The old scheme with street fountains was implemented about 40 years ago and the distribution pipes became rusty and unserviceable. Also a number of householders had made unauthorized connections onto the old distribution pipes,



thus worsening the situation.

A new modern scheme of a total cost of £23,500 was put in hand late in 1967 and completed during 1968. This new scheme involved the laying of distribution mains in all inhabited areas, the construction of four reinforced cement concrete storage tanks of a total capacity of 60,000 gallons and the installation of a pumping plant near Kephlovryso spring for pumping water to a high tank which serves about 40 houses, which could not be served by gravity from the spring.

The whole Municipal Area was divided into four supply areas in order to reduce water pressure in the lower quarters and also protect the distribution pipes and the house-connections. More than 800 water meters have been installed and each house now enjoys a satisfactory meter controlled water supply.

## 2. Karmi-Trimithi-Ayios Yeorghios Regional Scheme

The three villages with a total population of 1776 persons (as per the 1960 census) were facing great hardships in obtaining their water supply before the implementation of the new combined scheme. Each village depended on a small spring whose yield diminished considerably during the past years giving a share of about 3-5 gallons per day per capital to the village population through street fountains.

The new source of supply is a successful borehole No.B.26 situated in the Eastern outskirts of Karmi, and drilled by the German Water Mission. The water is pumped by means of an automatically operated electrosubmersible turbine pump at the rate of 6,000 gallons per hour into a 30,000 gallons capacity reinforced cement concrete circular tank form where it is distributed to the three villages. Karmi and Trimithi villages have been divided into two supply areas each, as a result of the hilly ground and the great difference in the elevation.

In all three villages a house-to-house service has been implemented and 550 water meters have been installed in all houses.

The 15 Water Supply Schemes which were put in hand during 1968, and were carried over for completion in 1969, could not be completed by the end of 1968 for the following reasons:-

- a) Were approved for execution in 1968 late in the year,
- b) Were large schemes and split into phases;
- c) Were put in hand late in the year pending the completion of the Administrative formalities, and



- d) work was completed but services undertaken by other Authorities such as the Supply of Electricity could not be completed in the year.

The 15 carry over schemes are shown in the list hereunder:-

WATER SUPPLY SCHEMES PUT IN HAND IN 1968 and  
CARRIED OVER FOR COMPLETION IN 1967

Ser. No.	v i l l a g e	Estimated Cost £	Amount Revoted for 1969 £
<u>Nicosia &amp; Kyrenia District</u>			
1.	Ayia Kebir	9,700	8,416
2.	i) Dhikomo Kato	19,000	7,838
	ii) Dhikomo Pano		
3.	Kalokhoria (Klirou)	10,100	5,080
4.	Lythrodontas	10,500	2,172
5.	Pendayia	14,550	3,710
6.	Kato Pyrgos	3,100	2,376
7.	Lower Kythrea villages )		
	i) Neochorio		
	ii) Trakhoni		
	iii) Palekythro	40,000	17,664
	iv) Voni		
	v) Exometochi		
8.	i) Ayios Epiktitos )	12,700	5,000
	ii) Klepini		
9.	i) Bellapais )	22,000	6,480
	ii) Kazaphani		
10.	Vassilia Regional Scheme )		
	i) Vassilia		
	ii) Agridhaki		
	iii) Sysklipos		
	iv) Ayios Ermolaos		
	v) Ayia Marina(Skyl.)	36,000	33,229
	vi) Asomatos		
	vii) Panagra		
	viii) Orga		
	ix) Liveras		
<u>Famagusta District</u>			
11.	Eastern Messaoria Dry Villages	20,000	5,195
12.	Phlamoudhi	8,000	1,523
<u>Limassol District</u>			
13.	Pano Kividhes	4,480	1,920
14.	Asomatos	6,400	2,148
<u>Larnaca District</u>			
15.	Kornos	700	470
		217,230	103,221



LENGTH OF PIPES LAID IN 1968  
Galvanized Mild Steel Pipes.

Size Nominal Diameter	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	TOTAL
Length in miles	25.218	2.112	8.012	11.074	12.222	19.030	6.444	16.290	16.470	116.872 miles

Asbestos Cement Pressure Pipes

Size Nominal Diameter	2"	3"	4"	6"	8"	10"	12"	TOTAL
Length in Miles	3.167	23.513	12.498	5.684	0.152	1.118		46.632 miles

MATERIALS AND MACHINERY USED DURING  
1968 THROUGH CONTRACT

LABOUR FORCE USED DURING  
1968

Description	Quantity	Expenditure	Regular artisans Skilled	Casual artisans skilled	Casual labourers unskilled	Total No.	Expenditure on wages Total in 1968.
Cement	8,000 tons	£56,000.--	Average	per	day		
Gravel	5,296 cu.m.						
Sand	5,310 cu.m.	£10,545 --					
Aggregate							
Heavy Machinery	16,178 working hours	18,263.--	348	300	585	1,233	
Excavation of trenches.	148,533 feet	3,069.--					£ 407,598
TOTAL		£87,877					



Irrigation Schemes

The programme of works for 1968 included 75 Irrigation Schemes out of which 21 were carry - over schemes from 1967.

Out of the 75 schemes 33 were completed during 1968, 26 were put in hand but were not completed by the end of 1968 and were carried over for completion in 1969, and 16 schemes could not be put in hand during the year for various Administrative and other difficulties.

The sixteen Irrigation Schemes that could not be put in hand for administrative and other difficulties, such as arrears with the Loan Commissioners for previous loans, acquisition of land and rejection of schemes by the beneficiaries are given in the table hereunder:-

IRRIGATION SCHEMES NOT PUT IN HAND DURING 1968 AND  
CARRIED OVER FOR 1969

Ser. No.	Name of Scheme	Description of work	Estimated cost £
A.	<u>CARRY OVER SCHEMES</u> <u>FROM 1967</u>		
1.	Lyssi (F)	Minor Recharge Works	400
2.	Pyrgos (L'ssol)	Pumping scheme	4,300
3.	Ayios Theodoros (L'ca)	Pumping scheme	7,250
4.	Milikouri (N)	Sub-surface weir and conveyor	424
5.	Kato Amianōs	Intake and distribution works	3,925
	(i) Appis Kardaki - £1,325		
	(ii) Kato Phylagra - £2,600		
B.	<u>NEW SCHEMES</u>		
	<u>Lining of canals in Western Messaoria</u>		
6.	Akaki	Lining of canals	5,550
7.	Peristerona	Lining of canals	5,550
			<hr/> 27,399 <hr/> <hr/>



Ser. No.	Name of Scheme	Description of Work	Estimated Cost £
	<u>Pumping Schemes</u>		27,399
8.	Kato Koutraphas	Pumping scheme	7,000
	<u>Recharge Works</u>		
9.	Xylymbou (L'ca)	Recharge Work	5,500
10.	Elca of Karavas	" "	3,000
	<u>Minor Irrigation Works</u>		
11.	Pyrgos (Tyllirias)	Extension of distr. System.	10,000
12.	Pharmakas-Dexameni-tou Kaminiou	Distribution pipes	340
13.	Karavas-(Platani)	Lining of distrib. canals	750
14.	Kato Amiandos-Pelen-dria (Pano Phylagra)	Storage tank and distribution works.	1,700
15.	Ayios Pavlos (L'ssol) (Dhimma-tou-Khoriou)	Distribution Pipes	500
16.	Kato Akourdalia	Construction of diversion weir & distribution system.	3,600
		TOTAL:	£ 99,789

The Irrigation Schemes approved for execution during 1968 can be classified as under:-

1. Lining of Canals in Western Messaoria

This project was inaugurated in 1966 and since then an appreciable amount of money is approved in the Development Estimates each year for the lining of the earth channels used for the distribution of water pumped from deep boreholes. The implementation of this project is effecting an economy of more than 20 per cent of the water pumped and distributed for irrigating the citrus plantations by the old earth channels, and is considered of high importance for the whole underground aquifer which has been depleting continuously during the past years.

For 1968 the programme of the Construction Division in the above field of works included 16 schemes, 6 of which were carry over schemes from 1967. The total amount approved for 1968 was £ 104,825. - as shown on next page:-



a)	For the completion of six schemes carried over from 1967	£ 29,825
b)	For nine new Schemes each estimated @ £5,550 (approved under Sub-Head 19-- Minor Irrigation Schemes )	£ 50,000
c)	For Morphou (approved under sub-head 10 -- Major Irrigation Major Works)	£ 25,000
	Total :-	£ 104,825

Out of the sixteen schemes for the Lining of Canals in the Western Messaoria, 11 Schemes were completed by the end of the year.

Three schemes were put in hand during 1968 but could not be completed by the end of the year and were carried over for completion in 1969, and two schemes namely Akaki and Peristerona could not be put in hand in 1968 as both villages were in arrears with the Loan Commissioners and their loans were not issued.

Four of the completed schemes were put in hand in 1967 and all of them were completed in the early months of 1968 as the portion of the work carried over for 1968 was very small. For the remaining 7 schemes a total length of 72,560 running feet of Irrigation channels were completed. A list of the schemes completed in 1968 is shown hereunder:-

SCHEMES COMPLETED IN 1968  
LINING OF CANALS IN WESTERN MESSACRIA

Ser. No.	Name of Scheme	Amount Approved for 1968 £	R.C.Channels completed in feet	Prefabricated channels complet. in feet	Total R.C. & Prefabricated channels in feet.
1.	Argaki	2,470	Work put in hand	in 1967	
2.	Prastio	305			
3.	Zodia K.	1,684			
4.	Zodia P.	1,755			
5.	Orounda-Kato Moni road (Ma- outsios)	8,400	-	8,200	8,200
6.	Morphou	25,000	18,030	9,220	27,250
	C/F	39,634	18,030	17,420	35,450



Ser. No.	Name of Scheme	Amount Approved for 1968 £	R.C.Channels completed in feet	Prefab-ricated channels completed in feet.	R.C. & Pre-fabricated channels in feet.
	B/F	39,634	18,030	17,420	35,450
7.	Astromeritis	5,550	6,950	260	7,210
8.	Arghaki	5,550	6,700	1,650	8,350
9.	Prastio	5,550	5,800	-	5,800
10.	Zodhia Kato	5,550	-	7,900	7,900
11.	Zodhia Pano	5,550	3,400	4,450	7,850
	TOTALS	67,384	40,880	31,680	72,560

The three schemes that were put in hand during 1968 but could not be completed by the end of the year and were carried over for completion in 1969 are shown in the list hereunder:-

Ser. No.	Name of Scheme	Amount Approved for 1968 £	Amount carried over for 1969 £
1.	Katokopia	5,550	1,632
2.	Morphou-"Ovgos"	5,550	2,330
3.	Peristerona-Astromeritis	15,191	4,720
	TOTAL	26,291	8,682

## 2. Recharge Schemes

The construction programme for 1968 included ten Recharge Schemes of a total estimated cost of £58,212.- Two of these schemes, namely Ayia Napa and Ormidhia were carried over from 1967. In the case of Ayia Napa the work was put in hand during 1967 and was completed by the end of March, 1968.

Four of the ten approved schemes were completed during 1968, another three schemes were put in hand but could not be completed by the end of the year and were carried over for completion in 1969, and three schemes could not be put in hand for Administrative difficulties, such as land acquisition. These three schemes are shown in the list of "SCHEMES NOT PUT IN HAND DURING 1968 AND CARRIED OVER FOR 1969".



- a) Lapathos Recharge Scheme:-- One of the most important of the Recharge Schemes completed during 1968, is the Lapathos Recharge Scheme. It is worth mentioning that this scheme is the unique in its kind executed in the whole island. This scheme of an estimated cost of £11,250.-- involves the installation of a pumping plant at the Syngrassis reservoir and the laying of a pumping main of 12" - 6" in diameter and 16,530 feet in length from the reservoir to the Lapathos aquifer. Water is pumped at a rate of 25,000 gallons per hour from the Syngrassis reservoir into twelve wells at Lapathos and during the year a quantity of about 20 million gallons of water was recharged satisfactorily into the Lapathos depleting aquifer.
- b) Ormidhia Recharge Scheme: This is another important scheme, estimated at £12,000.-- and carried over from the 1967 Estimates, that was completed in 1968. By the completion of the scheme a quantity of 33 million gallons of water is stored in an earth dam for recharging the poor and also depleting aquifer of Ormidhia.
- c) Akhna Recharge Scheme: This scheme, estimated at £5,000 was also completed during the year. This scheme involved the construction of three small earth dams of a total of 9 million gallons of water.

The Recharge Schemes completed during 1968 are shown in the following table:-

RECHARGE SCHEMES COMPLETED DURING 1968

Ser.	Name of Scheme	Estimated Cost £	Remarks
1.	Ayia Napa	2,062	The work was put in hand in 1967 & completed in 1968.
2.	Ormidhia	12,000	Construction of an earth dam of total storage capacity of 33 million gallons.
3.	Akhna	5,000	Construction of three earth dams of a total storage capacity of 9 million gallons.
4.	Lapathos	11,250	Installation of a pumping plant of capacity 25,000 gallons per hour, and laying of 16,530 ft. of pumping main of 12-6 inch in diam.
	TOTAL:	£ 30,312	



The four Recharge Schemes which were put in hand during 1968, but could not be completed by the end of the year as they were put in hand late pending the completion of the Administrative formalities are shown in the table hereunder:-

RECHARGE SCHEMES PUT IN HAND IN 1968  
BUT NOT COMPLETED AND CARRIED OVER FOR COMPLETION IN 1969

Ser. No.	Name of Scheme	Estimated Cost £	Amount carried over for 1969 £
1.	Ayios Epiktitos	4,000	1,230
2.	Akanthou	7,000	1,560
3.	Vrysoulles near Ayios Nicolaos	8,000	5,000
	TOTALS:-	19,000	7,790

3. Pumping Schemes:-

The Construction programme for 1968 included six Pumping schemes of a total estimated cost of £42,550.- None of these schemes was completed by the end of the year, and only three schemes were put in hand but could not be completed by the end of 1968 as they were put in hand late pending the completion of the Administrative formalities, and were carried over for completion in 1969. The other three schemes, namely Pyrgos (L'ssol), Ayios Theodoros (L'ca) and Kato Koutraphas (N'sia) could not be put in hand during 1968 as a number of Administrative obstacles could not be settled. All these three schemes are shown in the list of "SCHEMES NOT PUT IN HAND DURING 1968 AND CARRIED OVER FOR 1969" and were carried over for execution in 1969.

The three schemes that were put in hand during 1968 but could not be completed by the end of the year and were carried over for completion in 1969 are shown in the table below:

Pumping Schemes Put In Hand During 1968  
But Not Completed and Carried Over For 1969

Ser. No.	Name of Scheme	Estimated Cost £	Amount carried over for 1969 £
1.	Potami	10,000	3,856
2.	Kyra	10,600	4,620
3.	Khirokitia	3,400	1,480
	TOTALS:-	24,000	9,956



4. Minor Irrigation Works:

The Construction Programme in this field of works included 41 schemes of a total estimated cost of £112,198. Ten of these schemes were carried over from 1967. Out of the 41 schemes 16 schemes of an estimated cost of £31,220.-- were completed during the year, 17 schemes of an estimated cost of £59,739.-- were put in hand but could not be completed by the end of the year and were carried over for completion in 1969 and 8 schemes of an estimated cost of £21,239.-- could not be put in hand for various Administrative difficulties and other difficulties. The 8 schemes which could not be put in hand are shown in the list above of "schemes not put in hand during 1968 and carried over for 1969".

Most of these Minor Irrigation Schemes are situated in the hilly areas of the island and especially in the Limassol and Nicosia Districts. The work executed in this type of schemes involved the laying of steel pipes or the construction of reinforced cement concrete channels to convey the water of springs to the fields for irrigation.

The 16 schemes that were completed during 1968 are shown in the list hereunder:-

Minor Irrigation Schemes Completed  
During 1968

Ser. No.	Name of Scheme	Nature of work	Approved amount for 1968 £	Area Irrigated in donums	
				Perennial	Seasonal
A.	<u>CARRY OVER SCHEMES FROM 1967</u> <u>Limassol District</u>				
1.	Ayios Theodoros		1,540	131½	62
2.	Pelendria	concrete tank & distribution works	1,220	44	29
	<u>Paphos District</u>				
3.	Kelokedhara	Extension of distr. system	2,985	210	40
4.	Kholi	Distribution System	460	25	22
		C/F	6,205	410½	153



Ser. No.	Name of scheme	Nature of work	Approved amount for 1968 £	Area Irrigated in donums	
				Perennial	Seasonal
B.	<u>NEW SCHEMES</u> <u>Nicosia &amp; Kyrenia District</u>	B/F.	6,205	410½	153
5.	Kaliana	Lining of the conveyor channels	800	107	43
6.	Korakou	" " "	4,800	587	63
7.	Katydhata	" " "	2,600	470	230
8.	Phlassou	" " "	2,000	909	91
9.	Ergates	Diversion Groyne & Intake channel	2,000	300	-
10.	Xyliatos	Extension of conveyor system	780	-	87½
11.	Kato Koutraphas <u>Limassol District</u>	Lining of channels	1,650	-	160
12.	Lemythou	Conveyor & Distr. pipes	1,200	52	8
13.	Potamitissa	Irrig. tank & Distr. pipes & channels	2,340	36	4
14.	Yerasa  <u>Larnaca District</u>	Extension & completion of Distr. System.	3,100	59	-
15.	Ayii Vavatsinias (i) Kaloyiannos (ii) Deploma (iii) Kephalo-vryso <u>Paphos District</u>	Distribution Works	3,085	10 10 6	- - 9
16.	Tala	Repairs	660	-	-
TOTAL:			31,220	2,956½	848½

The 17 schemes that were put in hand during the year but could not be completed by the end of 1968 and were carried over for completion in 1969 are shown in the following table:



Minor Irrigation Schemes Put in Hand During 1968 But Not  
Completed and Carried Over For Completion in 1969

Ser. No.	Name of scheme	Amount Approved for 1968 £	Amount carried over for 1969 £
A.	<u>CARRY OVER SCHEMES FROM 1967</u>		
	<u>Nicosia &amp; Kyrenia District</u>		
1.	Galata	10,680	558
	<u>Famagusta District</u>		
2.	Gypsos	1,749	1,306
	<u>Limassol District</u>		
3.	Arakapas	4,000	1,082
4.	Trimiklini	840	840
	<u>NEW SCHEMES</u>		
	<u>Nicosia &amp; Kyrenia District</u>		
5.	Kakopetria	12,000	7,721
6.	Sina-Oros-Galata	3,500	3,072
7.	Tembria	5,200	1,173
8.	Evrykhon	3,600	344
9.	Petra	4,000	563
	<u>Limassol District</u>		
10.	Agros	1,830	975
11.	Agrihia	3,140	1,903
12.	Pelendria	2,250	1,445
13.	Kalokhorio	1,150	528
14.	Ayios Ioannis (Agrou)	2,040	244
15.	Kato Amiandos (Kardama-Avgoustides)	1,100	190
	<u>Paphos District</u>		
16.	Panayia	2,380	676
17.	Kholetria	1,120	143
	TOTAL:--	60,579	22,763



5. Distribution System of Major Dams

During 1968 important work was also executed in the above field of works. An amount of £47,598 was approved for the distribution of the water of Kalopanayiotis and Kiti Dams and work carried out during the year is described in brief below:

- a) Kalopanayiotis Dam Distribution System: For this project the amount approved in the Development Estimates was £17,598 and during the year some 14,400 feet of 4 inch in diameter and 9,760 feet of 3 inch in diameter galvanized mild steel pipes were laid from the dam to newly developed areas for irrigation.
- b) Kiti Dam Distribution System: For this project the approved amount for the second phase of the Distribution System was £30,000. During 1968 a length of 25,220 feet of prefabricated channels of various sizes were laid.

6. Materials and Machinery hired

As it was stated above during the year a length of 163.504 miles of pipes of various sizes were laid mostly for Water Supply Works. In addition to these pipes the following materials were used through tenders:-

- a. Cement - 8,000 tons
- b. Gravel - 5,296 cub. meters.
- c. Sand - 5,310 cub. meters.
- d. Aggregate - 7,856 cub. meters.

The expenditure on the above materials excluding the cost of the pipes is about £66,545.-

For the execution of the works undertaken by the Construction Division private machinery had to be hired in addition to the Departmental Government machinery for the completion of the works.

Heavy earth moving equipment and trenching was hired through 48 tenders, awarded by the Tender Board of the Government. In total machinery of 16,178 working hours was hired at an expenditure of £18,213.

Also a length of 148,553 feet of trenches were excavated by hired machinery at a cost of £3,069.



C. Major Projects

The activities in this field during 1968 were concentrated on the construction of the Yermasoyia Dam and remedial works at Mavrokolymbos, Kalopanayiotis and Pomos Dams.

This Division had to deal with the Civil Engineering organization such as administration of the contract, use of plant and labour as regards the Yermasoyia Dam, in conjunction with the Consultants, Messrs. Energoproject of Yugoslavia.

All structural work was carried out by Messrs. Cybarco Co. Ltd., to whom the construction of the dam was entrusted at the tendered price of £612.000. All remedial works to the other three Dams were carried out by this Division. Hereunder is an outline of the work executed during the year:-

1. Yermasoyia Dam

Work on the construction of this Dam continued uninterruptedly all through 1968, and the Dam was ready to accept the big floods filled it in less than two days. This is most significant and extremely noticeable because, had the Dam not been there, a major disaster would have occurred to very valuable developed areas in the lower Yermasoyia River Valley, including possible losses of human lives.

An outline of the execution work on the construction of this Dam is given by the Executive Engineer, Mr. C. Andreou hereunder:-

a. General Construction

The Yermasoyia Dam which is the biggest Dam in Cyprus is situated 2 miles south of Yermasoyia Village. It consists of an earth embankment of 111 feet high, an overflow spillway of a maximum capacity of 30,000 cusecs and a circular diversion tunnel of 12 feet diameter and 740 feet long. The construction of this multi-purpose project started in January 1966 by Cybarco Co., and was completed late in 1968. The maximum storage capacity of the reservoir is 3,080 M.G. and is expected to be of paramount significance for agricultural and other developments. As a result of the heavy rains at the end of December 1968 the reservoir was filled within a very short period and overspilling started on the 29th December 1968.



b. Cut-Off Trench Excavation in Abutments.

The last part of the excavation under this heading was completed late in January 1968 by means of traxcavators and compressors. In rare cases and after the Resident Engineer's approval the contractor was allowed to use limited quantities of explosives.

c. Embankment

The filling of the embankment continued during the winter and was completed by the end of June 1968. During this period the following quantities were placed:

		<u>Total</u>
Clay core	20,935 cu. yards	135,298
First Filter Zone	10,457	52,135
2nd Filter zone	15,525	62,752
Random fill	-	257,185
River Cobble Gravel	10,865	108,864
Weightening zone	4,153	28,347
Finishing top layer.	1,460	1,460
		<u>645,981 cu.yards.</u>

d. Rubble Curb Walls

The construction of the Rubble Curb Walls started on the 13th March, 1968 on the upstream side of the embankment; the downstream side was put in hand on the 9th April.

This wall was constructed in dry and mortar masonry at 20 feet length construction joints, all over the length of the Dam crest.

The following quantities of rubble were used:-

Dry masonry 797 cubic yards.

Masonry in mortar 1.285 cubic yards.

e. Rip-Rap

The Rip-Rap protective zone which started in 1967 was completed by the end of September, 1968. The total quantity of Rip-Rap used amounts to 29514 sq. yards.

f. Spillway

Most of the spillway excavation was performed in 1966 and 1967. During 1968 the works were concentrated at the right side entrance of the spillway and were completed late in October. The excavation done during the period amounts to 41.238 cubic yards raising so the total spillway excavation to 249,887 cubic yards.



The casting of the concrete weir and piers as well as the side entrance retaining walls was continued during the year and completed in August, 1968; the access bridge over the spillway weir was also completed in August.

The total quantities of concrete used for the spillway structures are as follows:-

	<u>1968</u>	<u>Total</u>
Mass Concrete	1561cu. yds	5398
Reinforced Concrete	1044cu. yds	7207

The amount of 428,857 lbs of reinforcement was used for these structures according to the designs.

g. Grouting

The Grouting works were completed during 1967 according to the designs. Late in 1967 the Resident Engineers decided and order the drilling of some holes on the left abutment which later were grouted to perform a better conduct between the rock and clay core.

This kind of work was completed in February 1968. Soon after and on the Engineer's request the contractors drilled 4 control holes to determine the effectiveness of the grouting works which proved to be satisfactory according to the specifications.

h. Hydromechanical Equipment

The works connected with the erection of the radial gates commenced on the 6th March, 1968.

The design as well as the manufacture of the equipment was undertaken by Messrs. A.C. Kouppas Co., Greece. During the erection the Supplier was represented by a technician of his Company who was fully responsible for the technical aspects of the works. The works were fully completed in October 1968 and when the Dam was overspilled in January 1969 the whole system was checked and tested in the presence of a Departmental Committee and representatives of the manufacturers and consultants.

i. W.D.D. Works By Direct Labour

The construction of the diversion road to Phinikaria was completed in 1967 except a small part near the shaft which was interfering with contractors activities in this area. This part was completed in November, 1968.

During the year there were installed 2 electrocoustic monometers and 2 total pressure capsules according to the designs.



The following tests were carried out during the construction year 1968:-

Core Cutters	342
Rapid control	45
Proctor tests	52
Liquid Limit	18
Specific Gravity	3
Permeability	9
Hydrometers	19
Sieve Analysis	22
Water Replacement	15
Concrete Cubes	420

## 2. Mavrokolymbos Dam

This Dam is built in the Mavrokolymbos river, and was completed by Messrs. Cybarco Co. Ltd., at the end of 1966. During the period of maintenance the Contractor carried certain outstanding works and repairs.

As a result of the abnormally high rainfall during the winter season of 1967, over the catchment area of this Dam, landslides of the soils in the reservoir occurred, that it was found necessary to carry out certain remedial works in certain zones of the reservoir before it was filled and put into service.

Mr. Kennard and Dr. Morgenstern of London, in consultation with Messrs. Energoprojekt of Yugoslavia (consultants for the designing and construction of this Dam) had investigated and studied the landslides, and put up a report for primary remedial works.

An allotment of £17,000 was issued for this purpose, and the remedial works both on the left and right abutments, (zones 1 and 8) were carried out. These remedial works consisted mainly in regarding and lowering the inclination of the reservoir sliding area to a gradient of 1:5.

A quantity of 30,000 cu. yards, of river and sea aggregate was deposited at the foot of zone 1, to provide support to the sliding soils.

After the completion of these primary minor remedial works, the Dam was closed and on the 30th of January, 1969, it was completely filled up with water. In spite of the high rainfall over the catchment area during the winter of 1968 the high rate of the saturation of the soils no more slides were observed except very minor insignificant slides, at one place at the head of the reservoir and this was attributed to the high



rainfall than to the filling of the dam.

3. Kalopanayiotis Dam

This Dam was put into service during the year, and water was supplied to all new land that was developed and planted.

A collecting weir downstream of the dam was built, at the cost of £ 5,000. By this weir, water that was issuing in the river bed was collected for irrigation.

4. Pomos Dam

This Dam was put into service during the year, and new land that was developed and planted was irrigated. The spillway was extended at a cost of £ 15,000.

By this extension erosion by the overflow through the spillway is now prevented, and the Dam is in complete safety.

D. Workshop

The workshop of the Department forms part of the Construction Division. It is equipped with all facilities for carrying out all constructional works, that include earth moving equipment, transport, carpentry, plumbing fittings, the slotting and perforation of drilling casing, and for grinding and electro-welding of drilling bits. All installation and maintenance of pumping units for village water supplies and irrigation is carried out through the workshop.

A group of 72 regular artisans specialized in each of the activities of the workshop form the force of the personnel of this branch of the Construction Division. During 1968 no purchases for heavy equipment were effected, except some minor machinery, such as a lathe, one planning machine, one radial drill, all of which are necessary for the fitters shop-plant and maintenance bay.

The maintenance to the fleet of heavy earth moving equipment and other minor machinery, including the land rovers, was carried by the team of artisans of the workshop, and the total expenditure was in the region of £ 33,888. This amount includes replacements of fittings and other accessories. The total operational hours of the equipment and the mileage



covered by the land rovers is given hereunder:

- (a) Heavy earth moving equipment 100,000 hours
- (b) Motor vehicles 700,000 miles

The following machinery was condemned, during the year, by the Committee set up for this purposes:-

- 2 Nos. Bulldozers
- 1 International 45 HP
- 1 Allis Chalmers 65 HP
- 2 Nos. Traxcavators
- 1 case "Case" 100 HP
- 1 D4 Caterpillar 60 HP
- 2 Trench Digging Machines
- 1 Brayloader
- 3 Compressors 250 cu. feet.
- 4 concrete Mixers 10/7, 5/3½

TOTAL 18

The activity of the workshop was extended to:

- (a) 53 new pumping installations for Domestic supplies £ 8,913.--
- (b) 159 repairs to pumping domestic supplies £ 4,765.--
- (c) Various castings and making of fittings £16,206.--
- (d) Various carpentry works £ 7,428.--
- (e) Various masonry works 450.--

£37,762.--  
 =====

The total mechanical equipment as on 31.12.67., is shown below:-

Mechanical Equipment  
 (as on 31.12.68)

<u>Mobile Plant:</u>	<u>No.</u>
Ruston Bucyrus Drilling rigs 22W	10
Ruston Bucyrus Drilling rigs 60RL	1
Caterpillar D8	3
Caterpillar Traxcavators 955	3
Allis Chalmers Traxcavator	1
Allis Chalmers Bulldozer	1
Ruston Bucyrus Excavator RB10	1
Ruston Bucyrus Excavator RB19	1
Excavator Smith 3/4 Cu. yd.	2



<u>Mobile Plant:</u>	<u>No.</u>
Core Drill 200 ft. depth	1
Grouting drill Pneumatic 150 ft.	1
Wagon Drill	1
Overburden	3
Concrete Grouting machine	2
Compressors	12
Diesel alternator	6
Electrosubmersible test pumps	10
Turbine deep-well test pumping units	2
Plunger deep-well test pumping units	2
Centrifugal pumping units	4
Portable works pumps	22
Sheepfoots roller	16
Vibrating soil compactors	3
Vibrating rollers	3
Vibrators	28
Concrete mixers	40
Cranes	1
Hoists	3
Lorry mounted portable 3 ton borehole pump cranes	4
Thornycroft Tractive unit low loader	1
Dumpers	1
5 ton diesel lorry (Austin)	1
Bedford R.L. Lorry	1
Land Rovers	23
Toyota Land Grouser	6
Toyota Station wagon	8
Cortina Station Wagon	1
Pump for test pipes	8
Rubber typed Compaction Rollers	2
Sludge Pump Pneumatic.	6.



MAINTENANCE AND OPERATION DIVISION

Prepared by: K. Hassabis,  
Head of Division.

This Division is divided into two Branches

- (a) Maintenance of Major Irrigation Projects and
- (b) Maintenance and Operations of Domestic (Town) Water Supplies.

Mr. G. Haralambous Assistant Head of the Division headed the Domestic Water Supplies Branch and Mr. A. Josephin was the Head of the Maintenance of Major Irrigation Branch.

A. Maintenance of Major Irrigation Projects Branch

The task of maintenance and operation of the Dam Projects assumed special importance with the completion and commissioning of several such projects.

The proper maintenance of the Dams and associated Distribution Systems is the responsibility of the Department. A special section has been created for this particular purpose.

Maintenance of such works may be divided in the following functions: (a) The regular inspection of the works (b) The keeping of regular observations and records of the behaviour and condition of the various structures and (c) The actual work of maintenance.

Although the work of regular and routine maintenance may be easily defined and foreseen, experience has shown that many problems may arise at any time requiring immediate action, and that for this purpose an adequate provision must be made in order to enable prompt action as required.

During 1968 most of the work performed apart from inspection and the records of observations was one of routine maintenance only.

In the case of Polemidhia Dam the extension of the Irrigation period until late in the year did not allow the emptying of the dam and the execution of the foreseen maintenance work.

The heavy rains and large floods which occurred towards the end of 1968, created many maintenance problems which were to be tackled during 1969.

A summary of the expenditure incurred and the work performed during 1968 is shown on page 98. Additional maintenance



work done on Dams not yet handed over to the Maintenance Division but carried out of construction funds is not shown on the Table.

A serious problem concerning the maintenance of the new extensive pipeline distribution systems and especially the metering equipment, and involving the creation of gangs of skilled labourers to tackle emergencies quickly is receiving special attention, in view of the financial and organisation problems involved.

Maintenance of Dam Projects  
Expenditure in 1968.

A. Government Dams & Special Cases.

Dam	Expenditure	Work Performed
Kiti	£ 509	Minor Repairs of Tersefanou Purphouse, Spillway Bridge Cleaning of Canals etc. Programmed Major Works to reduce leakage postponed for further study.
Pomos	£ 349	General Routine Maintenance and cleaning of Canals.

B. Contributory Dam Projects.

Dam	Expenditure	Governnt. Contribution	Work Performed
Lefka (Marathasa)	£300	£300	Installation of New Gate
Lythrodontas Upper Dam	£ 20	NIL	Maintenance work in Tunnel Gate
Ovgos Dam	£ 57	£ 38	Modification to intake of Saline Water ; Diversion Pipeline.
Pera-Pedhi	£ 36.500	£ 24.500	Repair of Gate axle and greasing of equipment
Prodromos	£202	£134.670	Repair of 400 ft. of Curbins.
Trimiklini	£ 94.500	£ 63	Temporary work only on Tunnel Gate opening of Gate
Petra Atsas (a) Lower Dam (b) Upper Dam	£ 70	NIL	General Repairs to Gate & cleaning of blocked outlet. Maintenance & greasing of tunnel gate.



The operation and management of each project is done by a Dam Management Committee established under the Law, under the Chairmanship of the respective District Officer, and including representatives of the Water Development and Agricultural Departments, and also representatives of the beneficiaries.

At this stage it cannot be said that the water made available by the construction of the Dam Projects is utilized satisfactorily or fully, and thus the benefits from these projects are rather disappointing.

In some cases the farmers for whose benefits these schemes have been constructed are either reluctant to cooperate fully with Government in order to achieve the maximum benefits from the projects, or regard the charges levied on the sale of water, which are heavily subsidized by Government, as being rather high and thus are not willing to utilize such water.

Concerted efforts are being made to overcome these problems and it is to be hoped that the aims of such expensive but highly beneficial projects will be achieved with time.

The amount of water collected in each dam and utilized during the Irrigation Season of 1968, and the income realised is shown in the table on page 100.

This table does not show the water collected in the dams at the end of 1968, and which was to be utilized in 1969.



Operation of Dam Projects

Dam	Capacity Million M <sup>3</sup>	Quantity in Dam at beg- gining of Irrigation Season M m <sup>3</sup>	Area Irrigated Donums	Quantity of water sold M m <sup>3</sup>	Income £	Operation Expenses	Mainte- nance espenses	Remarks
1. Argaka	1.150	1.150	--	0.038	£380	£123.582 mils	--	No Distribution System of Canals only.
2. Ayia Marina	0.300	0.250	--	0.220	2,493,548	£837.695	--	Irrigation Period 16/2-9/11/68.
3. Kalopanayic- tis	0.390	0.390	110	0.008963	£116.519 mils	--	--	Distribution system incomplete. Only 110 dons. irrigated.
4. Kiti	1.610	0.173	Not Available	0.080	£800	£259.892	£ 509	Distribution System Incomplete Stage I only complete.
5. Mavro- kolymbos	2.180	--	--	--	--	--	--	
6. Polemidhia	3.400	1.810	--	0.6578	9,771.520 mils	£1,737	--	Irrigation Period 3/6/68--12/11/68 Distr. system incomplete.
7. Pomos	0.860	0.860	--	0.180	1,801.560	547.870	£ 349	Irrigation period 29/2-9/11/68 Distr. system incomplete
8. Yermasoyia	13.600	--	--	--	--	--	--	Impoundment at end of 1968 only.
9. Syngrassi	1.150	--	--	--	--	--	--	For Recharge Mainly.



B. Domestic Water Supply Branch  
Management of Domestic Supplies  
under the Provision of Law Cap. 350

This Law governs the water supply to "Municipal and other Areas" and provides the establishment of Water Boards exist in Nicosia, Limassol, Famagusta and Larnaca. The Water Development Department is an official member of these Boards. It is noted that the administration of the water supply of Paphos and Kyrenia (the other two main towns in Cyprus) is, so far, in the hands of the respective Municipalities.

The activities of this Section of the Water Development Department have been extended during the year under review, in addition to its substantial task comprised of:-

- (a) Administration of the "Greater Nicosia Scheme".
- (b) Water Supply to Nicosia's suburbs.
- (c) Water Supply to Govt. Residences & Institutions.
- (d) Technical Advice to Water Boards,

it has been entrusted with the dealing of division of plots all over the Island, in an advisory capacity to the Appropriate Authority, as far as water supply is concerned.

a. Administration of Greater Nicosia Scheme:

The same regulations, like those existed for the "Nicosia Water Board's area of supply" have been adopted in the administration of the Greater Nicosia Scheme. Parallel to the efforts made towards the amalgamation of the existing three Authorities of the Nicosia and its suburbs water supply, supplementary works were carried out increasing its capacity to 3.0 m.g.d. This scheme can now be placed on a "self-sufficient" standard, capable in meeting its own water requirements twice as much.

b. Greater Nicosia Scheme:

- (i) Water supply to Nicosia's Suburbs.

It has been stated on previous occasions that the area of Ayios Dhometios, Engomi, Orta Keuy, Trakhonas, Eylonja and the greater part of Kaimakli, Strovolos, Pallouriotissa and Omorphita form the "Area of Supply" of the Greater Nicosia Scheme. Though administratively separated from the other two Authorities yet, the water supply of this area is closely connected with that of the whole Nicosia town with regard to availability, delivery and consumption of water. In this respect, more details are given in paras 8-11 under the heading "Nicosia town and suburbs water supply".



With a view to making use of the "Morphou Bay Scheme" the sources of which lie in the area of Syrianokhori from where pumping is undesirable due to the depletion of the underground water level, new sources have been developed. These consist of three high yielding boreholes in Pendayia with a feeder line connected with Morphou installations which pump the water to Engomi Reservoir. With the implementation of these works the "Morphou Bay Scheme" has been brought to its original designed capacity of 2.0 m.g.d. and has caused at the same time the abolition of the "emergency scheme" near the Morphou Dam.

During 1968, the distribution system of the Greater Nicosia Scheme was extended by 44,710 ft. of asbestos pipes, resulting mainly from the division of plots into building sites, and 369 new house connections were made. By 31.12.1968, the total number of consumers within the "area of supply" of the Greater Nicosia Scheme reached the figure of 8,553.

A statement showing expenditure and revenue of the Greater Nicosia Scheme for the year 1968, is given on Appendix.

(ii) Nicosia town and suburbs water supply:

Though restrictions were not imposed, it cannot be said that the demand in summer months was satisfactory. A few high-levelled areas could not enjoy a regular supply due to under-capacitated installations. All existing sources were put into commission at maximum. The newly developed sources at Pendayia incorporated with "Morphou Bay Scheme", have, during 1968, contributed towards the supplementation of the supply.

The total amount of water conveyed from the various sources reached the figure of 6,895,491 c.m. and was distributed as follows:-

Greater Nicosia Scheme "area of supply"	2,313,014 c.m.
Nicosia Water Board	" " 3,940,788 c.m.
Nicosia Water Commission (Town within walls).	641,689 c.m.

The highest daily consumption was 26,010 c.m. or 5,722,200 gallons which equals to 50.5 gallons per head against of a population of 110,000 residing in the three areas as above.

It was stated that the sources of Greater Nicosia Scheme can suffice twice as much the requirements of its own "area of supply" but considering the fact that water supply of the Nicosia and its suburbs should be faced commonly, it is indispensable to have it supplemented. A new scheme should be planned immediately, acquiring the following features:-



Pressurized system to Nicosia within the walls;  
Relief of existing sources at K/Trimithia, Laxia  
and Dhikomo.

Re-alignment of existing boundary of "area of supply".

Such scheme should be designed in a way to suit  
existing installations, providing, however, improvements to  
storage and trunk mains capacity.

c. Government Residences and Institutions:

Water for domestic use is either supplied from  
Greater Nicosia Scheme or the Nicosia Water Board depended on  
each other's location, but the irrigation needs are wholly met  
by Government owned wells and boreholes. During 1968 a regular  
and uninterrupted supply was maintained. Other than routine  
maintenance to existing installations no major improvements were  
carried out.

d. Technical Advice to Water Boards

(i) Limassol:

A regular and uninterrupted supply to this town was  
maintained. Existing sources could safely yield 3.5 m.g.d.  
against an averaged summer consumption of 3.0 m.g.d. Late in  
the year the main pipeline conveying water from the mountain  
springs was washed away at several points because of the flooding  
of Kourris river.

The maximum consumption reached the figure of 3.22  
m.g.d. on the 8.7.1968.

In view, however, that the two boreholes drilled for  
the so called "Kourris Scheme" were not successful and the  
expressed desire for the planning of a scheme to cover this  
town's needs on a long term basis, it is very likely that the  
Yermasoyia Dam will have to be used as source of supply.

(ii) Famagusta:

Restrictions on the supply were again imposed, the  
existing sources being incapable in meeting this town's summer  
consumption.

All events, the new scheme designed for Famagusta  
has started with the laying of the main conveyor. It will be  
executed in stages, utilizing a few boreholes, in the first stage  
with a production of one m.g.d. This quantity together with that  
available from existing sources at Phrenaros would balance the  
anticipated summer requirements.



(iii) Larnaca:

Existing sources in Trimitos river could suffice maximum demand and continuous supply was possible. The borehole situated near Alethrico the water of which is saline was pumped periodically at small quantities in order that the NaCl content of the mixture to be always within permissible limits. Recently, it has been observed that the perforated casing of some of the shallow boreholes in Trimitos area have been blocked. It is recommended that gravel-packing of these boreholes is carried out given that the aquifer in the area is of great value, liable to immediate replenishment.

Though arrangements have been made that Larnaca installations may also be fed from the main conveyor being laid for Famagusta water supply, yet for the purpose of keeping up capacity of existing sources a new borehole was sunk near Anglissidhes and is ready for utilization.

Facts about Water Boards of Nicosia, Limassol, Famagusta and Larnaca are given here below under respective headings.

Facts about Nicosia Water Board

a) The total quantity of water supplied from all sources (Water Board and Water Commission) during 1968 was 4,142,724 c.m.

b) The total quantity of water consumed was as under:-

Area No.1	389.784 c.m.
" " 2	542.170 "
" " 3	469.935 "
" " 4	728.735 "
" " 5	1,177.103 "
" " 6	633.061 "
	<hr/>
	3,940.788 c.m.

Nicosia Water Commission.	641.689 "
Total:	<hr/>
	4,582.477 c.m.

c) The total maximum summer consumption was 15.650 c.m. (Including N.W.C.) on the 5th July, 1968.

d) The total number of consumer as at 31st December, 1968, was 10.989.

e) (I) Extension of Distribution System:-

- 1.873 ft. of 6" A.C. pipes
- 14.792 ft. of 4" A.C. pipes

(II) Re-laying of Distribution System:- (D. Severis Av.)

- 1.020 ft. of 6" Ø A.C. pipes
- 1.530 ft. of 4" Ø A.C. pipes

(III) Total length of Distribution System:-

- 12.100 ft. of 12" Ø A.C. pipes
- 25.000 ft. of 10" Ø A.C. pipes
- 12.930 ft. of 8" Ø A.C. Pipes
- 77.973 ft. of 6" Ø A.C. pipes
- 549.096 ft. of 6" Ø A.C. pipes

f) (I) Number of fire hydrants installed in 1968: 13.

(II) Total number of fire hydrants installed within the Board's Area of Supply: 752.



Facts about Limassol Water Board

- a) Total quantity of water supplied from all sources 3,901,909 c.m.
- b) Total quantity of water consumed, as registered by Area Meters and supplied direct from bhs
 

2 and 7	...	...	...	...	3,648,875 c.m.
			overflow	...	4,499 c.m.
				Total :-	3,753,374 c.m.
- c) Maximum daily consumption in summer on 8.7.1968. 14,673 c.m.
- d) Total number of consumers as at 31.12.68. 14,900 No.
- e) (i) Extension of Distribution system: pipelines laid during 1968.
 

27,621' / 4"
2,274' / 6"
29,895' feet
- (ii) Total length of distribution system
 

557,278' / 4"
82,059' / 6"
23,736' / 8"
27,000' / 10"
690,073' feet
- f) Number of hydrants:
  - (i) installed in 1968 : 32
  - (ii) Total installed : 708

Facts about Famagusta Water Board.

- a) Total quantity of water supplied from all sources, was 1,752,757 cu. m.
- b) Total quantity of water consumed as registered by area meters, 1,605,363 cu. m.
- c) Total maximum summer consumption per day in cu. m. 5,642.
- d) Total number of consumers by 31.12.68, 9,370 No.
- e) (i) Extension of distribution system in ft. run and size of pipes, 23,673 ft. (4.5 miles): 20,605 ft.  $\phi$  4" and 3,068 ft.  $\phi$  6".
  - (ii) Total length of distribution system (Including extensions for 1968) 96.5 miles.
- f) (i) Number of hydrants installed in 1968, 43.No.
  - (ii) Total number of hydrants installed within water supply area. 620 No.



Facts about Larnaca Water Board.

- a) Total quantity of water pumped during the year from all sources = 1,536,525 cu. m.
- b) The maximum summer consumption per day in C.M. was 5,313 c.m.
- c) Total number of consumers by 31.12.68 was 3,900. Turkish consumers of approximately 800 not included in the above figure.
- d) The distribution system was extended by 12,360' as follows :-

4,900	of	pipes	of	6"
5,450	"	"	"	4"
2,010	"	"	"	3"
<hr/>				
12,360	"			
<hr/>				

- e) 37 new hydrants were installed within the "water supply area" in 1968.



REVENUE AND EXPENDITURE ACCOUNT  
OF GREATER NICOSIA SCHEME FOR THE YEAR 1968.

<u>EXPENDITURE</u>	<u>REVENUE</u>
(a) Pumping charges                    £15,397.211	(a) Sale of water                    £108,280.282
(b) Purchase of water                4,137.200	(b) Connection Fees                682.000
(c) Maintenance charges            3,407.620	(c) Usage of pipe lines            18,650.159
(d) Collection Fees                    16,344.342	(d) Other revenues including sale of stores                                18,893.426
Total :-	£146,505.867
(e) Administration                    4,000.000	Profit for the year                65,626.494
(f) Amortisation                        37,590.000	
Grand Total:-	
£80,876.373	

Notes : (a) 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 Turks since 1964 to approx. £120,000.



SMALL PROJECTS PLANNING DIVISION

Prepared by: P. Pantelides,  
Head of Division.

Introduction.

The Small Projects Division in its present form was inaugurated in 1968 as a result of a general inter-departmental re-organization aiming at higher efficiency, by the consolidation of, and co-ordination between services within the Department.

All schemes and reports are mainly requested and addressed to District Officers. New schemes and all correspondence dealing with matters of policy are invariably referred to the Director of the Department for approval and all other routine business is dealt with by the Head of the Division. A close co-operation is always maintained with all other departmental services, particularly with the construction service on matters of costing and field lay-out, and the Drawing Office for the preparation of the drawings from drafts and field data.

Annual budgetary proposals are drafted by the Head of the Division in consultation with District Officers and approved by the Director before submission to the Planning Bureau at the appropriate time during the Financial Year.

Although it was hoped that with the new inter-departmental re-shuffling as forementioned, there might be a certain measure of relief from pressure of work, this has not materialised entirely to our expectations during the year. It is hoped that with systematic training of new staff and perhaps with further simplification of matters of procedure a greater output of work will be achieved. In the writer's opinion, however, an important factor in the field of activities pursued by the Department and this Division in particular depends on personal interest and enthusiasm of individual technical officers and the team-spirit of all the staff engaged in the work.

The Division Schedule covers the Planning and Design of all small projects which can be classified for planning purposes into :

- a. The Conventional Gravity Irrigation Schemes,
- b. Recharge Schemes,
- c. Pumping Schemes,
- d. River Training and Antiflood Work's,
- e. Some Special Schemes,

as distinct from others, because of their magnitude and/or complexity and



Under this heading we can classify the smaller mountain schemes typical of Pitsillia, the larger stream diversion schemes on the lower valleys, and spate-flow diversion schemes on the plains. These are all gravity works and consists mainly of the intake structure at the source of supply, and a system of distribution to the fields.

Even after 30 years of continued construction of such schemes, the demand continues unabated, but we have now reached a stage where the demand is more limited to the consolidation and general improvements to old-existing works, particularly in places where there exist perennial sources, rather than for altogether new schemes. Such improvement works may consist, essentially, of consolidation of the intake structure or devices, the construction of tanks for night storage, and of water-tight distribution canals or pipes to avoid the loss of water.

A. Irrigation Schemes

In the following chapters we shall give a brief and as far as possible inclusive account of our activities during 1968.

Additionally, we deal with investigations and reports on several problems appertaining to functional and administrative matters of Rural Irrigation Divisions and/or Associations, and Rural Water Supply Authorities.

F. Rural Domestic Water Supply Schemes.

Undoubtedly the underlying principle of these works is "Water Conservation", a need which becomes more and more acutely felt by the Cypriot farmer, in trying to keep up with a rising agricultural economy.

During the earlier life of the Water Development Department particularly during the years of British Administration, the policy was to carry out as many of these schemes as possible with a limited budget, and more as a token of Government appreciation of village loyalty rather than for any definite plan of agricultural economy. The result was that most of these schemes were left incomplete or inefficient; works were limited to basic structures at the intake and invariably the greater part of the distribution networks were left in their more or less primitive state in earth channels.

Efficiency in those schemes was below 50%, with the surface method of irrigation as generally applied, whereas with completely water-tight intake and distribution systems irrigation systems irrigation efficiency at 65% could be effected.



Such increase in efficiency could result to greater production either by bringing more land under irrigation with the extra water which is saved, or to conservation, where the source of supply suffers from depletion.

Sooner or later and after completion of our current programme of "consolidation" the need will be forced upon our farmer - if the present rate of development is continued - to convert to other more efficient methods of irrigation. One such method is the sprinkler, whereby efficiencies in collective systems could rise to as much as 80%. This method is now applied by individual farmers in specific areas like "Kokkinochoria" in the Famagusta District, where the continued depletion of the sources has compelled the farmers to adopt strict measures of economy. The method could, however, be extended to collective schemes particularly on the mountains with perennial sources where use could be made of residual pressure in existing pipe distribution systems and other favourable conditions for reduced capital outlay. There is no indication, however, of immediate and widespread application of sprinklers in collective irrigation schemes in Cyprus and to expand further as this subject is beyond the object of this report.

The cost of general improvements and "consolidation" of the small schemes which still form the backbone of agriculture in Cyprus varies from £1,000 for the very small to £10,000 for the larger schemes. For overall completion of this project we can envisage a programme of works extending over 5 to 10 years from now at a total cost of the order of £1,000,000.

1. Small schemes Ready for Construction at the End of 1968

A list of assorted small irrigation schemes which were sent to District Officers and are ready for construction at the end of 1968 appears on pages 111, 112, 113, 114, 115, 116. The estimated cost of these schemes is £142,690 as follows:

Nicosia	District	£ 59,050
Limassol	"	£ 64,920
Paphos	"	£ 18,720
	Total:	<u>£142,690</u>

The above table does not include the schemes which were submitted in 1968 and have been included for implimentation in the 1969 Development Estimates; they are mostly mountain schemes whose number has been selectively reduced from a longer list, by the elimination of older schemes which needed drastic revision, and by adding new schemes prepared in 1968.



List of Small Irrigation Schemes  
Nicosia District

(Ready for Construction at the  
end of 1968)

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated cost £	Village contribution %	
<u>A. Old Schemes Revised in 1968</u>								
1.	105/1963	Pera-Politiko	Division	Pediaeos River	Diversion Groyne and Intake channel for flood Irrigation.	£ 4,800	1/5	450 don. Seasonal (cost Revised from £4,600 Nov. 1965).
2.	36/42	Ergates	Assoc.	Kourdouji	Regrading & Lining the ex-filtration Tunnel and General Improvements	£ 7,700	48%	190 don. Winter 266 don. Spring 93 don. Permanent
3.	127/40/103	Lagoudera	Assoc.	Affita	Irrig. Tank & Distribution Channel & Pipes	600	44%	(cost revised in 1968) 10 don Perennial 3 don. Seasonal)
4.	42/1948	Apliki	Assoc.	Kalogyros Tourkou	Tank & Pipes	£ 2,250	List wanted	31 don. Permanent 9 don. Seasonal
5.	72/1963	Pendayia	Assoc.	Kalokerinos Works	Lining of channels	£ 8,000		143 don. Permanent 465 don. Seasonal (Revised Oct. 1968)
<u>New Schemes Submitted in 1968</u>								
6.		Kalopaniyiotis	Div.	Pano Troullinos	Excavation of springs & Distribution Pipes	£ 3,300	1/3	
7.	127/40/41	Palekhoris	Div.	Milouri	Repairs & Extensions of Distribution System.	£ 930		
8.	103/44/II	Xyliatos		Ay. Kyriakos	Concrete conveyor channel	£ 600	1/5	(10 don. seasonal)
						C/F		£28,180



List of Small Irrigation Schemes  
Nicosia District

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Remarks
9	33/43/9	Klirou	Association	"Laoura"	B/F Lining of channels	£28,180 £ 4,700	40%	25 don. Permanent
10		Katoko- pia	Assoc.	Ktirka	Lining of canals	£ 6,320		
11	57/41/II	Dhali	Division	Round the village	Lining of canals	£19,000		535 don. Permanent
12		Paleky- thro	Division	Pediaeos River	Construction of Irrig. Gate.	£850	1/5	317 don. Seasonal
					Total	£ 59,050 =====		End March 1969



Schemes Ready For Construction At The End Of 1968

Limassol District

A. Older Schemes that need to be revised

No.	W.D.D. Reference	Village	Division or Association	Name of Division or Assoc. (Locality)	Description of Schemes	Total Estimated Cost	Village contribution	Remarks	Date
1.	(127/40/II)	<u>Kyperounda</u> (i) Deisis	Division	Deisis	Pipe Distribution System	£ 3,730	1/3	49 don. P., 57 don. S.	
	(127/40/36)	(ii) Frakti (Postani)	Assoc.	Frakti	Excavation of Spring & Distr. Works	£ 1,200		7 don. P., 8 don. S.	
	(63/65)	(iii) Livadhinitis-Messis		Livadhin	Irrigation Tank & Distr. Pipes	£ 1,250		22 don. P., 18 don. S.	
	127/40/49/22	(iv) Klima		Klima	Irrigation Tank & Distr. Pipes	£ 1,000		10 don. P., 5 don. S.	
	127/40/49/48	(v) Appis		Appis	Distribution System	£ 600		12 don. P.,	
	127/40/49/34	(vi) Thymon		Thymon	Distribution Pipes	£ 1,350		20 don. P.	
	127/40/49/II	(vii) Kalia	Division	Kalia	Irr. Tank & Distribution Pipes	£ 900	1/3	12 don. P.	
	(127/40/49/7)	(viii) Khalospitia		Khalospitia	Irrigation Tank & Distribution Pipes	£ 1,200		15 don. P.	
2.	(127/40/134/2)	<u>Pelendria</u>	Assoc.	Nikomitis	Irrigation Distribution Works	£ 600	252	15 don. P.	
3.	(61/42)	Sylikou	Division	Lavrania	Lining of Channels & General Improvements	£ 2,570	1/3	73 don. P.	
4.	(127/40/23)	Omodos	Division	Pigadi	Irrigation Tank & Distribution Pipes	£ 900	1/3	7 don. P., 8 don. S.	
					C/F	£ 15,300			



Schemes Ready For Construction At The End Of 1968

Limassol District

No.	W.D.D. Reference	Village	Division or Association	Name of Division or Assoc. (Locality)	Description of Schemes	Total Estimated Cost	Village contribution	Remarks	Date
5	(127/40/54)	Athrakos	Division	Mavrosykiotis	B/F Irrigation Tank & Distr. Pipes	£15,300 £ 960	1/3	59 don. P.,	
6	(28/42)	Lemythou	Division		Conveyor & Distribution Pipes.	£ 1,200	1/3	52 don. P., 8 don. S.	
7	(127/40/52/II)	Ay. Ioannis (Agrou)	Division	Angoulos Dhipotamia	Distribution Channels	£ 900	1/3	12 don. P.	
8	(42/43/2)	Phini	Division	Dimma-tou Milou	Distribution Works	£ 9,300	1/3	371 don. Permanent.	
9	(127/40/165/2)	Tris Elies	Division	Ambelaki	Development of Spring & Distribution Works	£ 4,000	1/3	28 don. P., 14 don. S.	
		(i) Milarga	Division		Extension Distribution Works.	£ 2,800	1/3	50 don. P.,	
		(ii) Drakontas	Division		- do -	£ 5,700	1/3	180 don. P.	
		(iii) Diplomata	Division		- do -	£ 2,300	1/3	25 don. P.	
10	(43/42/II)	Kilani	Division	Asematos Skotini- Ay. Mavri etc.	Distribution Works	£ 6,650	1/3	150 don. P.	
11	(127/40/59/II)	Louvaras		Tsoukalas	Tank & Distribution Pipes.	£ 630		6 don. P., 4 don. S.	
12		Ay. Demetrios	Division	Kalogiros	Tank & Distribution Pipes	£ 2,700	1/3	151 don. P. 34 don S.	
13	(127/40/22)	Dymes		Hadjipele-ndrou.	Distribution Works	£ 900		16 don. P.	
						C/F		£53,340	



Schemes Ready For Construction At The End Of 1968

Limassol District

No.	W.D.D. Reference	Village	Division or Association	Name of Division or Assoc. (Locality)	Description of Schemes	Total Estimated Cost	Village contribution	Remarks	Date.
					B/F	£53,340			
		<u>Lower Limassol District</u>							
14	(45/44/2)	Pyrgos							
		(i) Alayrovryssi	Division	-	Distribution Works	£ 4,000	¼	80 don.S.	
		(ii) Dimma-tis-Rigenas	Division	-	Distribution Works	£ 3,500	¼	300 don.S.	
	<u>B. New Schemes Submitted in 1968</u>								
15		<u>Louvaras</u>	Division	Kato-Pervolia	Irrigation Tank & Distribution Works	£ 600	1/3		16.9.68.
16		Agros	Division	Pano-Taliou	Distribution Works	£ 1,260	1/3		16.9.68.
17		Mandria	Division	Koutsi	Weirs & Distribution Works.	£ 570	1/3		21.10.68
18		Dhierona	Division	Mylos	Extension Pipelines	£ 1,170	1/3		24.10.68
19		Kouka	Division	Andriades	Distribution Pipes	£ 450	1/3		20.12.68
					Total	£64,890			



List Of Small Irrigation Schemes

Paphos District

(Ready for Construction at  
the end of 1968)

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed Works	Estimated Cost £	Village Contrib. %	Remarks
A. <u>Old Schemes Revised in 1968</u>								
1.	20/42	Kritou	Division	Kefalovrysos	Composite Channel & Distribution System.	£ 7,500	1/3	Old scheme Revised 88 Don. Perennial 162 Don. Seasonal.
2.	127/40/164	Konia	Division	Near the village	Repairs & Improvement to the old works	£ 780	1/3	6 don. Perennial 9 don. Seasonal
B. <u>New Schemes Submitted in 1968</u>								
3.	127/40/114	Galataria	Division	Fleva	Distribution Pipes	£ 1,260	1/3	44 don. Permanent 88 don. spring
4.	127/40/58	Kilinia	Division	(1) Morris	Distribution Pipes	£ 480	1/3	6 don. permanent
				(2) Argaki-tou-Zissimou	Distribution Pipes	£ 540	1/3	4 dons. S.
5.	127/40/115/II	Statos	Division	Kato-Vryssi	-- do --	£ 960	1/3	4 don. P.
6.	65/12	Kholou	Division	Kartavidhes	Pumping Scheme	£ 3,450	1/3	30 don. P. 18 don. S.
7.	21/42	Phiti	Division	Akrikou	Distribution Pipe	£ 1,200	1/3	9 P, 19 S.
8.	30/1941	Kissone-rga	Division	Appis	Distribution Pipes (not covered by Mavrokolymbos Dam)	£ 2,550	1/3	24 P. 134 S. March 1969.
Total						£18,720		

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2. Small Schemes, Proposed for Implementation in 1969.

A total number of 22 small schemes were proposed for construction at the end of the year and approved by the Planning Bureau for the 1969 Development Estimates for a total cost estimated at £46,210. Most of these schemes were designed in 1968 and do not include Recharge and Pumping Schemes which will be dealt with separately in this report. The list includes a series of small works at Agros, and other mountain villages in the Limassol District; a gravity diversion scheme at Khirckitia in the Larnaca District, extension works in Psevdas and a distribution system at Miliou in Paphos. Some larger works in the Nicosia District were included of which the more noteworthy are at:

a. Galini: Consisting of a Watertight Distribution network for irrigation form boreholes at a total cost of £20,000 out of which £6,000 was approved for 1969.

b. Galata: The completion phase of an entirely new project in the picturesque Ezzo Galata valley between forested hills at £4,000. The works were started and continued from 1967 and consist of the tapping of a new source of water from a tunnel, a stream diversion weir and pipe distribution on 350 donums of land, levelled and terraced by the Soil Conservation Services of the Department of Agriculture. The whole scheme was estimated at about £24,000.

c. Pyrgos (Tylliria): Supplementary Distribution Works on the Katouris valley irrigated from a Dam Reservoir Project, Constructed in 1957. Cost at £10,000.

3. Lining of Irrigation Canals in Western Messaoria.

The principle of water conservation is more pronounced in this particular field of work, which is carried out mainly on the Morphou Plain where underground water storage is being gradually depleted from overpumping.

4. The Design of Watertight Canals

In our designs for 1968 we have specified the prefabricated reinforced concrete canals at places where it was possible to do so at greater advantage and saving in cost. It was the first time that these ready-made channels were erected in Cyprus and there might have been some minor defects in the erection technique, and this has given the cause of alarm to the farmers concerned. It is undoubtedly certain that these first difficulties will be overcome by improving our erection methods, but we have had to be very cautious in specifying these channels in our new schemes for 1969, and will continue doing so until the system will be perfected and until we prove by actual practice the added benefits derivable



from these structures. One great advantage of these channels which are made in an organised factory and carried to the site of erection instead of casting them in situ with timber moulds as usual, is that they can be easily dismantled and removed, in case of any future reform in agricultural practices and Water management. Such reforms, particularly in water management, are not hard to visualise in a rapidly developing country like Cyprus, especially in areas where existing sources of underground water supply show definite sign of constant depletion.

### B. Recharge Schemes

#### 1. Morphou Recharge Project:

This is one of the more notable and larger schemes for which we had to continue design work during the year. It can be regarded more as a pilot scheme which can be extended and have wider application in principle in the course of time, and as the results and benefits derived thereof will become apparent.

It has been proved by actual observation and measurements that in one particular and well defined area nearer to the coast of Morphou the station ground water table has dropped below sea-level and that there is an imminent danger of ground water pollution by sea-water infiltration. The object of the scheme is to safeguard against a widespread pollution of the underground water whose incidence may have catastrophic results on a profitable citrus industry, by effecting a quick stop in the depression and eventual rise of the water table in the depressed zone. For this purpose, the scheme postulates a drastic reduction of a complete stoppage of pumping for irrigation in that particular area and alternative sources of supply from new boreholes situated in safer zones further inland; these boreholes are sited on river gravel beds where any water table depressions that might be created. The object in the design of these works is to reduce losses of water by lining with cement concrete the old existing earth channels which are now used to convey water pumped by borehole owners to other neighbouring farmers. The channels form part of an ab-antiquo distribution system for collective irrigation with seasonal flows of river water, and to a lesser extent from shallow chain-of-wells which have now ceased to operate. These channels are offered, as they are, very conveniently and economically for the present purpose as against an entirely new distribution network involving land acquisition and many legal complications. Lower down in the Morphou area the old earth channels are used with a greater advantage for the distribution of water from the Serakhis and the



Ovgos dam-reservoir, hence the greater and more persistent demand for watertight canals in Morphou.

The total estimated cost of this scheme is £ 213,000 and implementation started in 1967 by provision of a first instalment at £ 70,000. The scheme was been planned for completion in 1970 when a provision of £ 65,000 will be required from the Development Budget as a final instalment, until the results of the scheme will have been definitely established by continued operation. Funds allocated for this scheme in 1968 and 1969 are £ 25,000 and £ 53,000 respectively.

The programme of Canal Lining in Western Messaoria - as we call the plain west of Nicosia - was started in 1965 with £ 90,000 and £ 40,000 was spent in the following two years for lining a large section of the principal distributories where the need was greatest. In 1968 we have completed the design for lining all the principal conveyor canals in all the main citrus-producing Village Divisions and the total cost was estimated at £ 780,000 - details of this programme are shown on page 120. We are currently engaged in the design of a complete system of watertight distribution in the Morphou Serakhis and Ovgos Divisions which will increase the overall cost of the Western Messaoria Scheme to over £ 1,000,000. Considering that the amount that will have been spent on this scheme including the provision in the 1969 development estimate (£ 85,000) will be of the order of £ 400,000 we shall require a balance of over £ 600,000 to complete the Scheme. Current budgeting Policy is to provide about £ 50,000 every year for the whole scheme, or £ 5,000 for each of the 12 Divisions involved.



WESTERN MESSAORIA  
LINING OF CANALS

No.	Name of Division	Quantity of Water Conveyed in Gallon/Hour	Total estimated - cost	Amount spent up to the end of 1968	Amount Allocated 1969	Balance required to complete	Remarks
1.	P. Zodia	305,000	£ 48,000	£ 24,550	£ 5,000	£ 18,450	
2.	K. Zodia	473,000	56,000	24,550	5,000	26,450	
3.	Argaki	895,000	82,000	21,550	5,000	55,450	
4.	Katokopia	258,000	77,000	21,550	5,000	50,450	
5.	Prastio Morphou	619,000	63,000	24,550	15,000	23,450	
6.	Nikitas	246,000	30,000	19,000	-	11,000	
7.	Morphou Serakhis	2,000,000 (approximately)	105,000	90,000 (1965)	15,000	-	Additional £25,000 in connection with Recharge.
8.	Morphou Ovgos (Phase A)	1,000,000	84,000	62,500 (from 1965)	5,000	16,500	
9.	Astromeritis	249,000	60,000	5,550	5,000	49,450	
10.	Peristerona	384,000	100,000	5,550	5,000	89,450	
11.	Akaki	190,000	80,000	5,550	5,000	69,450	
12.	Syrianokhori (Division)	-	15,000	-	15,000	-	£27,000 Additional in connection with Recharge.
	Morphou Serrakhis (Phase B) Completion	In the course of preparation.					These two schemes are in the course of preparation (Morphou Serakhis & Morphou Ovgos)
	Morphou Ovgos (Phase E) Completion						
	Total						



## 2. Other Recharge Works.

Supplementary works for the Famagusta Recharge Division designed earlier in 1967 was revised in cost at £19,000 in 1968 and proposed for the development budget of 1969. This is the largest project of it's kind in Cyprus; works started during the Colonial Administration and continued by stages in recent years, the total cost now reaching the order of £300,000. Details of this project were given in earlier annual and other Departmental reports; it is worth mentioning that the floods which occurred late in the year have caused an unprecedented water storage in the artificial lakes in Ay. Loucas which forms part of the scheme. The volume of water stored is reckoned to exceed 1,000 million gallons and measures have been taken to prevent damage to the works from excess storage and pollution from saline waters. It is expected that a large quantity of this water will be used not only for recharge but for direct surface irrigation later in the year. The operation of the project during 1969 estimated to cost £15,000 will be closely followed with a view to effecting further improvements if and where necessary.

A small scheme for Akhna at £4,200 was designed in 1968 and approved for implementation in 1969. This is one of the typical small recharge scheme which have become very popular in areas with underground water and consist of small earth dams forming a spreading ground for vertical infiltration of rainfall water into the underground aquifer. Over 100 of these small dams have been constructed during the last few years and new ones, particularly in the Kyrenia area are being currently investigated.

### C. Pumping Schemes.

In spite of the high benefit as compared with capital cost, there has not been a great demand for pumping schemes for collective irrigation; this is probably due to the marked jealousy in our farming community for individual exploitation of the underground water wherever it could be found.

Schemes which we have prepared in 1968 and budgeted for execution, include Massari, Nissou and Philia in the Nicosia District, Angastina and Tripimeni of Famagusta District and in Larnaca District at Voroklini, and a series of 3 schemes at Kalavassos, Zygi and Anghlissides which have been planned in connection with the projected pumping of water from that area to Famagusta Town Supply. The cost of all these schemes is estimated at £44,750 and have been designed to provide permanent irrigation to a total area of about 1,000 donums.



At the end of the year we have completed the design of a set of pumping schemes on the Khrysokhou valley where several very successful boreholes were constructed by the Department in recent years. The order of expenditure for these works will exceed £100,000 and we bear in mind to propose staged implementation in the years 1970 - 1971. We are also investigating pumping schemes in Maroni and Psematismenos in Larnaca District, mainly for furtherance of our objectives vis-a-vis the Famagusta Water Supply Project, and a new Pumping scheme at Pyrgos (Tylliria) and at Karavostassi.

#### D. River Training and Antiflood Works.

##### 1. Pediaeos River.

A scheme for river training on the Pediaeos River round the Presidential Palace was prepared and approved for execution in 1969 at a cost of £24,500; the object of the works is to train flood flows within a defined a protected course and reclaim marginal lands for the extension of the Presidential Grounds or other urban development.

##### 2. Komitis River in Kato Zochia.

River Training within the village has been designed mainly as an antiflood measure at a cost of £11,000 and a certain amount of money has been approved from development Funds of 1969. This scheme has not been proceeded with because the villagers prefer an alternative proposal for river diversion which will be more expensive but preferable from the point of view of residential planning.

We are currently investigating the possibility of a major diversion of the Komitis torrent from Astromeritis along the neighbouring stream course of "Potami", to by-pass all the residential area of Zochia and Morphou and terminate in the old coastal marshes of Syrianokhori.

##### 3. River Training in General.

The problem of damage to land property by flood torrents in Cyprus has not yet been seriously tackled. River Training Works are inevitably very expensive if they were designed to cope effectively with extreme floods that many occur once in one hundred years. But the crux of the problem may not rest so much with design and construction but with the fact that the works will have to be continuously kept in fairly good order of maintenance even if they have to operate against a very far-fetched incidence of major floods. In most cases capital cost of construction and maintenance may prove greater than the value of land to be



safeguarded or cost of damage resulting from floods. It is more justifiable to design and carry out river-training works at places where the land has been fully developed like in the gardens of Syrianokhori-Morphou etc., or developed for residential or tourist purposes (Lower Yermasoyia and Kyrenia Coast).

Torrential floods which have occurred in Cyprus at the end of the year will give rise to many individual and/or collective representations to Government. Flood damage to Irrigation and Water Supply Works have been assessed and reparation measures in detail were being designed for submission to the District Officers, early in the new year. Cases of damage to riverbed marginal land will have to be very carefully examined in the course of the new year but the observed tendency for spontaneous and totally haphazard earthworks by authorised or unauthorised bodies for flood protection may cause greater harm than good and should be discouraged. In the absence of a specialised scheme of works the best policy is to avoid all interference with river beds.

E. Some Special Irrigation Schemes (In the course of Preparation).

A list of the more promising works for which we propose to complete the design and put forward in time, for consideration in the next budget, is given on pages 125-126. The following schemes which have not been previously referred to, deserve mentioning in brief detail:

1. Kouklia Reservoir Recharge Project (Famagusta District).

A preliminary plan estimated at £60,000 was sent to the District Officer for consideration prior to more detail drawings. This postulates the use of occasional storage in the Kouklia Reservoir for artificial recharge and/or Irrigation in the neighbouring developed area of Kondea, Kouklia and Kalopsidha, where the ground water table is suffering from excess pumping. A later phase of this project will be to train the river course of Pediaeos and Yialias through the plain and to provide proper and appropriate control intakes to all rightful irrigation systems. This scheme will be of some magnitude and the object will be (a) to harness and control the large quantities of surplus water debouching from these two rivers and now causing considerable damage to land and crops by overflowing from innumerable earth canals and gullies, and (b) put this water to profitable use either for irrigation of seasonal crops and/or artificial recharge. The possibility of another dam of the Kouklia type may be envisaged.



2. Liopetri Reservoir Pumping Scheme (Famagusta).

Here, we shall design a typical Overhead Irrigation of seasonal crops (potatoes) in the precincts of the Liopetri earth dam where a large quantity of water in excess of the natural recharge capacity of the reservoir remains un-exploited. The water supply will be supplemented with a pumping borehole near the reservoir.

3. Kyperounda Pilot Scheme (Limassol)

This has been prepared and is due for submission to the District Officer with a view to implimentation in 1969, in connection with projected development in the Pitsillia villages. This provides winter storage of nearly 10 million gallons in an earth reservoir to be formed by mechanical excavation and lined with clay material. It will be a smaller but much cheaper replica of the Prodromos scheme and will serve as a pilot scheme for irrigation development in Pitsillia. The cost inclusive of a pipe distribution network is estimated at £25,000 for 40 donums under permanent crops and another 40 under seasonal crops. Although a bit on the expensive side yet there is hardly any other conceivable means of water development in this mountain region.

4. Ayios Theodoros (Agros).

A small concrete gravity dam for winter storage has been considered feasible from a first survey. The design of this scheme will depend on further data to be collected in 1969.



List of Priority Schemes  
In Course Of Investigation and/or  
Preparation at the End of 1968

No.	Village	Nature of Works	Remarks
<u>A. Nicosia District</u>			
1.	Palekhor (Pera Avlaki)	Consolidation of Works	
2.	Karavostassi	Pumping scheme	
3.	Pyrgos Tylliria	Pumping scheme	
4.	Argaki	Pumping scheme	
5.	Kapouti	Consolidation Works	
6.	Kazaphani (K) Ay. Epiktitos (K) Vasillia (K) Thermia (K)	Recharge Works	
7.	Komitis (River)	River Training	
8.	Syrianokhori	River Training	
<u>B. Limassol District</u>			
1.	Kyperounda	Pilot Irrig. Project	(see more details in the report)
2.	Lower Kourris	Consolidation of Intakes & Lining of Canals	
3.	Limassol Town	Flood Diversion Scheme Ay. Trias	The need for this has arisen from recent flood damage.
4.	Ay. Theodoros	Construction of a small concrete gravity dam.	Investigations only
<u>C. Famagusta District</u>			
1.	Liopetri	Overhead Irrig. Scheme from the dam.	
2.	Kouklia Reservoir	Combined Irrig. a recharge Project	(see more details in the report)
<u>D. Larnaca District</u>			
1.	Athienou	Pumping Scheme	
2.	Gastria	River Training	
3.	Maroni	Pumping Scheme.	



No.	Name	Nature of Work	Remarks
1.	E. <u>Paphos District</u> Polis (Khrysokhou)	Pumping Scheme	It includes also neighbouring villages.
2.	<u>Paphos Chiftliks</u>	General Improvements of the main Intake & Channels.	
3.	Nikoklia	River Training & Flood Control	A preliminary estimate was submitted pending proper design.
	F. <u>Other Small Recharge Schemes in Famagusta &amp; Larnaca.</u>		
1.	Avgorou		
2.	Ay. Napa		
3.	Makrasyka		
4.	Akanthou		
	G. <u>Lining of Canals in Western Mesaoria</u>	(completion stage at Morphou Serakhis & Ovgos Irrigation Division).	
	H. <u>Morphou Recharge Project,</u>	(Detail of Completion of Phase A)	



F. Rural Domestic Water Supplies

A typical village water supply scheme consists of the source (spring or well), the conveyer (pipeline), the storage tank (reinforced Concrete tank for one day's supply) and the distribution ( a pipe network to street fountains or house-to-house).

All villages in Cyprus have a piped water supply system and about 30% have house-to-house connection.

The rate of water consumption in villages has so far been reckoned at 20 gallons per head per day. At this rate a village with a population of 1000 people will require 20,000 gallons of water per day and a larger village will require say 100,000 gallons per day.

Up to present, the design of the village domestic water supply scheme has been based on the population census of 1960. On this bases and at 20 gallons per head per day only about 15% of all villages in Cyprus, have at present an unsatisfactory water supply - in other words they are short of water, especially in summer when many sources yield less water than in winter and spring.

From existing statistical records there is an annual increase at 3% of the village population and this means that in 1970 the village population will have been increased by 30%, and a further increase at 30% will be effected by the end of the following 10 years in 1980. So, in actual fact, and because of the increase in population during the last 9 or 10 years there is at present a much greater number of villages with inadequate water supply and a still greater number if we allow a higher rate of consumption at 30 gallons per head per day which present condition of village life demands. Because of these constantly rising standards it is conservatively estimated that by the end of 1970 the number of villages with inadequate supply will reach 50% and ten years later by 1980 the proportion of inadequacy will perhaps exceed 90% when consumption rate will be 40 gallons/head/day, unless of course in the meantime we take measures to meet the mounting demand for more water.

Shortage of water may be caused by an insufficient supply at the source or insufficiency in any of the component part of the scheme, or a combination of these. Of course the shortage of supply will not appear in all villages all to once, but in every successive year a number of villages will show signs of shortage. So it appears that to maintain adequate water supplies in all villages we shall have to maintain an



annual budget to meet the incidence of inadequacy with proper and appropriate waterworks. It is very difficult at this stage to give an accurate figure of cost of this budget but the figure of £200,000 p.a. can be taken for guidance. We hope to be able to give a more accurate figure at the end of 1969 after compilation of records and data. In addition to this "supply maintenance budget" we have to consider the cost of house-to-house connections in the remaining 280 villages with street fountains because with the rising rate of rural development this will become an absolute necessity by 10 years from now in all villages. So, for the next ten years an annual budget of the order of £300,000 for village water supplies will have to be considered.

The more pertinent problems which will arise in village water supplies in the next few years by 1980, when the requirements will be double as much as in 1960, will rest in the development of the requisite sources of supply. It will not be so difficult in areas with underground aquifers, or large perennial springs but in certain dry regions the problem will not be so easy to solve. The solution of such problems may be found in the development of "master" sources, at suitable sites, for supplementary supply to the distribution tanks of groups of villages - what we may call "Regional Supplementary Supply Schemes"; with this method, the existing village scheme will operate at the satisfactory rate for the greater part of the year and, therefore, capital investment on these works will continue to be amortised; on the other hand the cost of supplementary supplies will be considerably reduced for individual villages.

We have now adopted a new and comprehensive method of presenting a village water supply scheme; with a covering letter indicating the nature of works and the apportionment of finance, we attach a printed form containing all technical data of the scheme and the remarks about the date on which any particular part of the scheme will fall short of anticipated requirements; also bill of quantities and copy of the plan. By keeping copies of these records in alphabetical order by Districts we will be able at any moment to read the position regarding the efficiency of any particular village water supply scheme.

A list of schemes ready for construction at the end of 1968 are shown on pages 130, 131, 132, 133, 134, 135, at a total estimate cost of £725,000, two typical schemes are



described in very brief detail here below:-

(a) Morphou Water Supply:

This is a case where rapid development and expansion has brought about the need of a new distribution and storage system, although the source of supply is adequate and new sources are readily available. The scheme provides for extra storage of 400,000 gallons and about 120,000 feet of distribution pipes at total cost estimated at £111,000.

(b) Vatili-Strongylos-Arsos-Tremetoushia-Meloushia  
(Regional Supplementary Water Supply Scheme)

This is typical example of regional supplementary supply to a group of a village facing shortage in summer. A new "master" source will be tapped in the gravels of Idalias and the water distributed to the storage tanks of each village in proportion with their present needs.

The cost is estimated at £75,000.



Village Domestic Water Supply Schemes

Ready for Construction at the end

of 1968

(Including Schemes approved for execution in 1969)

Nicosia & Kyrenia District

Ser. No.	Village	Nature of Scheme	Estimated Cost
1.	Kythrea Lower Village (i) Neokhorio (ii) Trakhoni (iii) Palekythro (iv) Voni (v) Exometochi	Phase II Distribution system with house-to-house	11,000
2.	Vasilia Livera Panagra Agridhaki Sysklipos Ayios Ermolaos Asomatos Ayia Marina (Skyl.)	Phase II Additional supply	36,000
3.	Aredhiou	New pumping scheme and house-to-house.	6,700
4.	Nikitari	Additional supply & house-to-house.	6,600
5.	Alona & Platanistassa	Additional supply	40,000
*6.	Morphou	New Distribution system with house-to-house	111,000
7.	Kato Pyrgos	Pumping scheme and house-to-house	16,800
8.	Palekhorio (Crinis)	House-to-house	5,200
9.	Dhiorios	Supply of Electricity & Motor.	1,533
10.	Limbria	Additional supply & house-to-house.	11,600
11.	Gourri	House-to-house scheme	1,900
12.	Pyroi	" " " "	2,000
13.	Apliki	" " " "	1,750
14.	Sarandi	Improvement & house- to-house	2,500
		C/F.	254,583



Nicosia & Kyrenia District (Contd.)

Ser. No.	Village	Nature of Scheme	Estimated Cost £
		B/F.	254,583
15.	Varishia	House-to-house	2,600
16	Vroishia	Improvement & house-to-house	2,700
17.	Pharmakas	Improvement & house-to-house	3,200
18.	Ay. Marina (Xyl.)	Improvement & house-to-house.	6,900
19.	Kaliana	Improvement & house-to-house.	2,700
*20.	Kakopetria	Additional supply for new area.	18,100
*21.	Mammari	Extension to the distribution.	520
*22.	Pygenia	Additional supply & house-to-house.	26,000
*23.	Potami	Additional supply & house-to-house	9,500
*24.	Pahyammos	House-to-house	9,300
25.	Katokopia	Extensions to the distribution system.	550
*26.	Peristeronari	House-to-house	1,300
*27.	Thermia	House-to-house	3,100
*28.	Xyliatos	House-to-house	1,900
*29.	Philia Massari	Installation of motor	400
*30.	Astromerides		
*31.	Xeri	Supply of Electricity & Motor.	1,362
*32.	Ayios Epiktitos	Extensions to the distribution system.	300
*33.	Palekythro	Extensions	440
*34.	Ayios Amvrosios	Supply of Electricity	2,204
*35.	Galata	Improvements	320
		Total	348,629



Famagusta District

Ser. No.	Village	Nature of Scheme	Estimated Cost £
1.	Marathovounos	House-to-house	9,900
2.	Angastina	House-to-house	6,800
3.	Aphania	House-to-house	6,680
4.	Ashia	House-to-house	19,500
5.	Mousoulita	House-to-house	1,330
* 6.	Yenagra	House-to-house	4,350
* 7.	Pyrga	House-to-house	3,900
8.	Komi Kebir	Storage tank & House-to-house	10,500
9.	Patriki	Improvement & house-to-house	7,310
*10.	Vatili	Additional supply Pumping scheme house-to-house	74,950
	Strongylos		
*	Arsos		
*	Tremetoushia		
*	Melousia		
11.	Phrenaros	Elevated Storage tank	4,000
12.	Yialousa	Two storage tanks	2,600
13.	Korovia regional Scheme.	Improvements	3,600
14.	Vitsadha	House-to-house	3,500
15.	Kondea	House-to-house	7,850
16.	Ayios Serghios	Extensions to the distribution system.	800
17.	Rizokarpasso	Improvements	700
*18.	Engomi	Extensions to the distribution system.	2,000
19.	Ayios Andronikos	House-to-house to the Turkish Quarter	7,000
Total			<u>£177,270</u>



Limassol District

Ser. No.	Village	Nature of Scheme	Estimated Cost £
* 1.	Mathikoloni	Pumping Scheme for the rested village	2,600
* 2.	Zoopiyi ) Louvara )	New scheme & house-to-house from "Arkolakhania" spring	11,284
* 3.	Souni-Zanadja	New scheme	4,000
4.	Sykopetra	Improvements & house-to-house	2,800
5.	Pendakomo	Additional Supply & house-to-house	11,900
6.	Prastio (Evdimou)	Improvements and house-to-house	3,300
7.	Ayios Demetrios	Improvement & house-to-house	3,900
8.	Phini	Improvement & house-to-house	5,000
9.	Paleomylos	House-to-house	1,700
10.	Anoyira	House-to-house	4,000
11.	Kouka	Additional Supply & house-to-house	1,100
*12.	Phinikaria	House-to-house	1,000
*13.	Paramytha	House-to-house	1,500
*14.	Ayia Phyla	Additional Storage tank	1,700
*15.	Pendakomo	House-to-house	3,900
*16.	Potamos tis Yermasoyias	New Scheme	33,400
*17.	Apsiou	Improvements to the spring	300
		Total	<u>£101,020</u>



Paphos District

Ser. No.	Village	Nature of Work	Estimated cost £
1.	"Papaloukas" combined scheme	Replacement of the main line	10,000
2.	Galataria	Construction of a storage tank	820
3.	Statos	House-to-house	3,600
4.	Tsadha	House-to-house	4,000
5.	Kritou Terra	House-to-house	1,900
6.	Emba	House-to-house	6,500
7.	Peristerona	House-to-house	2,000
8.	Ayios Nicolaos	House-to-house	3,200
9.	Episkopi	House-to-house	5,600
10.	Ayios Ioannis	House-to-house	2,900
11.	Lemona	House-to-house	1,400
12.	Magounda	House-to-house	700
13.	Akoursos	Improvements & house-to-house	2,200
14.	Annadhiou	Improvement & house-to-house	1,500
15.	Kilinia	Improvements	500
16.	Kedhares	House-to-house	3,350
17.	Loukrounou	House-to-house	350
18.	Pretori	Improvements	720
19.	Stavrokonnou	Additional Supply	1,000
20.	Dhrymou	House-to-house	4,100
*21.	Trakhypedhoula	House-to-house	1,800
*22.	Skoulli	House-to-house	1,400
23.	Akhelia	House-to-house	1,200
*24.	Trozena	Improvements to the spring.	300
*25.	Kalokedhara	Improvement to the spring	340
*26.	Nata	Replacement of the engine	410
*27.	Steni	Improvements	100
		Total	<u>£61,890</u>



Larnaca District

Ser. No.	Village	Nature of Work	Estimated Cost £
1.	Paevdhas	Additional supply & House-to-house	7,100
2.	Melini .	House-to-house	3,000
3.	Alaminos	House-to-house	1,100
4.	Pyrga	Additional supply & house-to-house	3,600
*5.	Alethriko	Additional supply & house-to-house	5,106
*6.	Ora	House-to-house Improvements	1,600
*7.	Aradhippou	House-to-house	16,500
*8.	Aradhippou	Extensions	760
		Total	<u>£38,766</u>

Summary

1.	Nicosia & Kyrenia	£346,629
2.	Famagusta	177,270
3.	Limassol	101,020
4.	Paphos	61,890
5.	Larnaca	38,766
	Total	<u>£ 725,575</u>

Domestic Water Supply

Schemes approved for execution in 1968

Nicosia & Kyrenia	£ 134,553
Famagusta	94,146
Limassol	21,500
Larnaca	16,354
Paphos	18,420
	<u>£ 284,973</u>

Note:--\* Schemes marked with an asterisk are those which have been prepared in 1968.