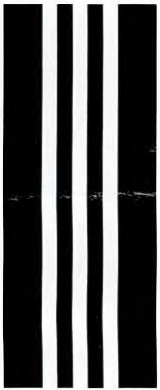


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REPUBLIC OF CYPRUS



MINISTRY OF AGRICULTURE AND NATURAL RESOURCES
DEPARTMENT OF WATER DEVELOPMENT

ANNUAL REPORT
OF THE
DEPARTMENT
OF
WATER DEVELOPMENT
FOR THE YEAR
1975

By
C. A. C. KONTEATIS
Director of the Department of Water Development
NICOSIA — CYPRUS
October, 1976

(5)

REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

A N N U A L R E P O R T
OF THE
DEPARTMENT OF WATER DEVELOPMENT
FOR THE YEAR
1975

Με τὰς προσησεις
τοῦ Διευθυντοῦ τοῦ
Τμήματος Ἀναπτύξεως Ὑδάτων
Λευκωσία — Κύπρος

By
C.A.C. KONTEATIS
Director
of the Department of Water Development
Nicosia - CYPRUS
October, 1976.

CONVERSION TABLE

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

ABBREVIATIONS USED

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

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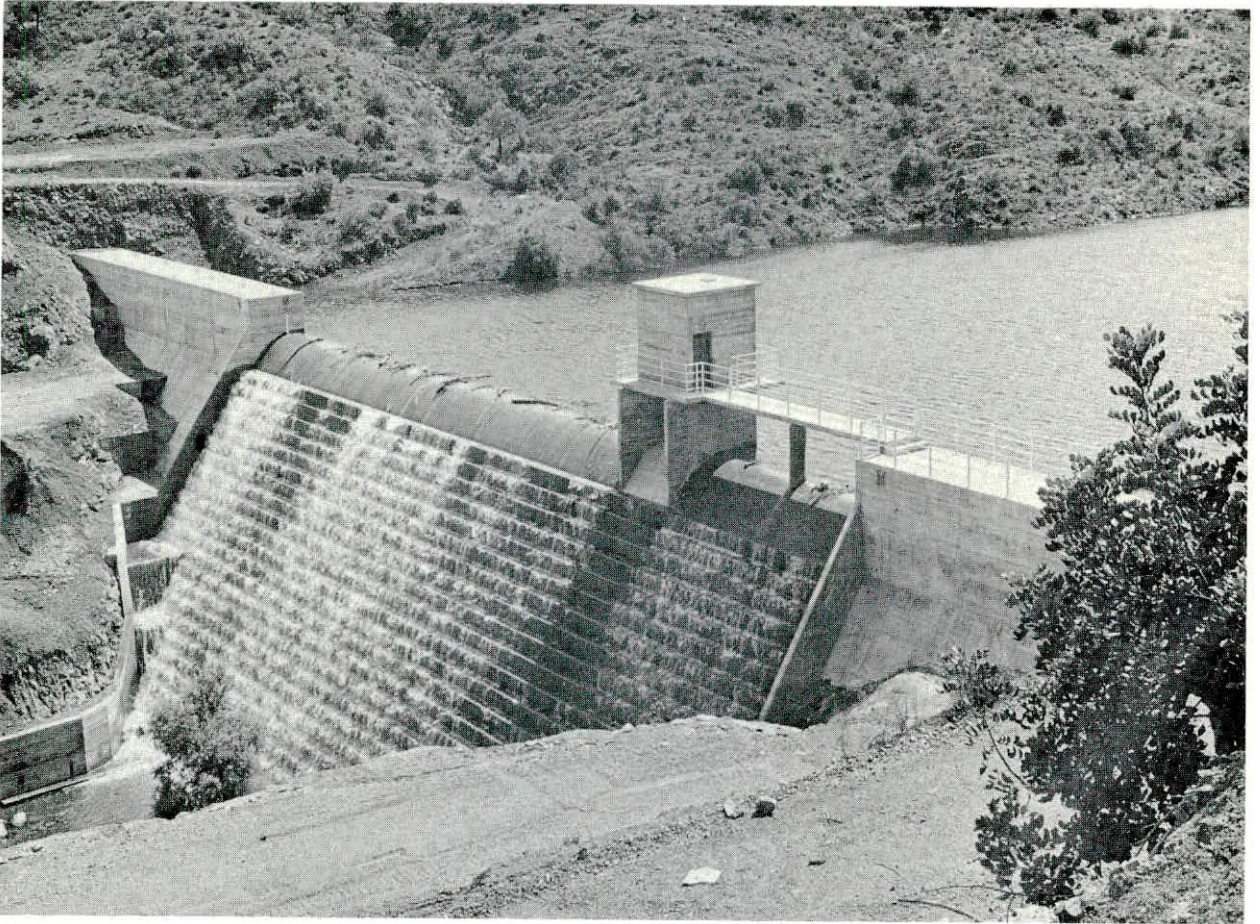
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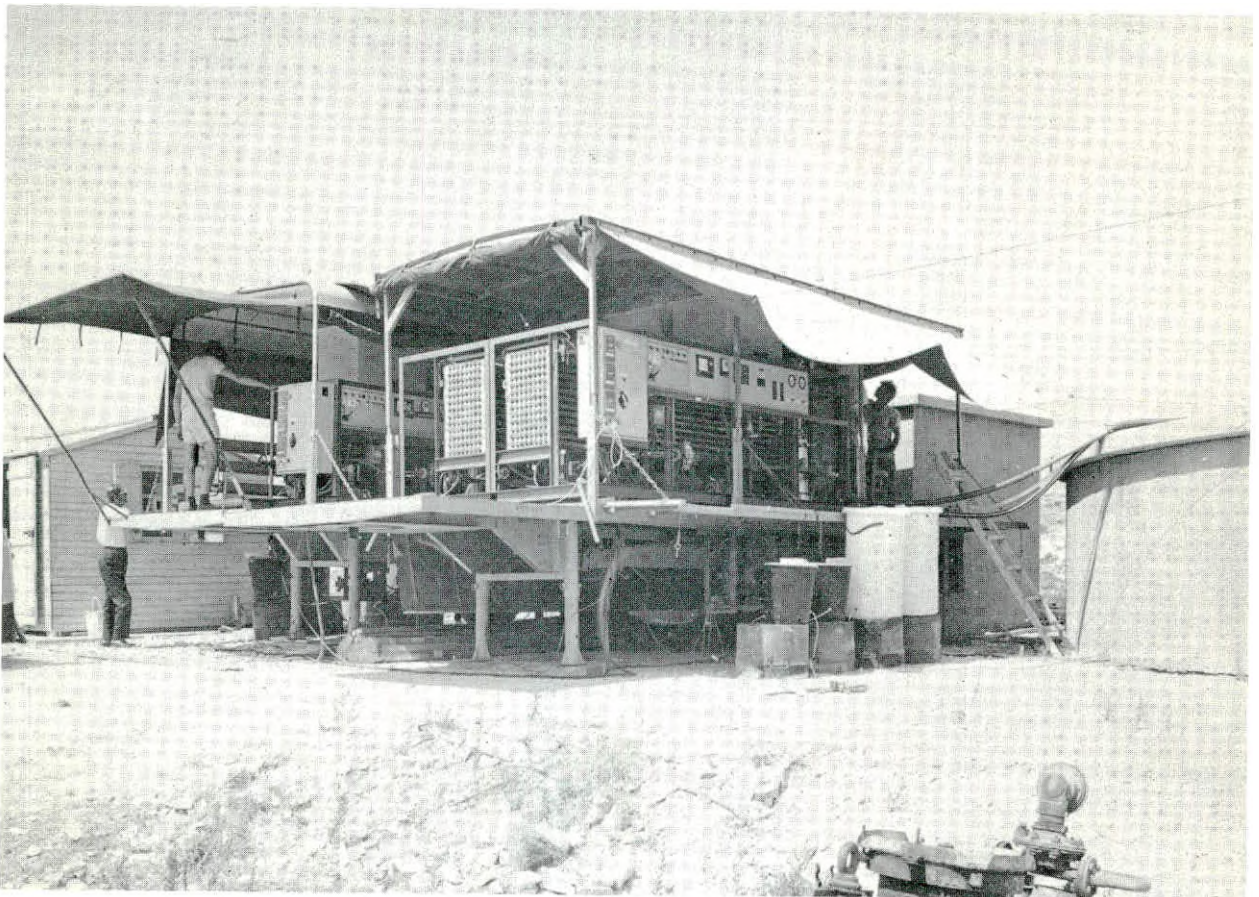
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The Arakapas concrete gravity dam



Reverse Osmosis mobile plant for testing
brackish water

I. GENERAL

1.1 Introduction

The end of 1975 found 40% of the northern part of Island under Turkish army occupation with still about 200,000 Greeks and 50,000 Turks displaced from their houses and leaving in different parts of their own Country as refugees with a great number of them under appalling conditions.

No news are still available as to whether the missing staff and relatives mentioned in the 1974 report are alive or dead.

Also no personal or Government property has been recovered in any way. Furthermore, it is known although not accurately, that extensive agricultural areas planted mainly with citrus more particularly in the Morphou plain have or are being dying away due to intentional or unintentional lack of irrigation water. Many times unintentional because of a breakdown of hundreds of pumps due to a lack of knowledge or interest in maintenance.

Our knowledge of the hydrometeorological situation in the occupied part of the Island is almost entirely non available due to the fact that there are no contacts with the Turkish side on any level even through the United Nations, except very rarely in cases of an emergency on a common domestic water supply system such as for Nicosia or Famagusta.

As an example of these extreme case emergency contacts, it would be of interest to refer to the breakdown on the 1st of August 1975 of a pump at Syrianochori main pumping station supplying water to Nicosia. In this case the responsible Turkish Authorities although unable themselves to repair the damage, refused our staff an access to inspect and repair the pump. After prolonged telephone contacts and an eventual meeting at a "neutral" place, it became possible for the Turkish Authorities to accept British specialists from the pump manufacturers to inspect the Pumping Station. Prolonged discussions took also place in connection with where the British specialist would land, the Turks demanding that they should land on the Turkish side. Eventually, and in view of the fact that payments of expenses was to be incurred by the Cyprus Government, the Turks accepted landing on the Larnaca airport. The result was, that from the 1st August that the pump broke down, the British specialists arrived on the 3rd of December and became possible to repair the pump only on the 27th of February, a lot of the delay being again attributed to formalities for accepting three British Specialists instead of one as originally though necessary.

It is regretted that the presentation of the hydrological data in this report does not cover the occupied part of Cyprus as no information whatsoever can be made available to us either directly from the Turkish side or through the United Nations or through any other source. Actually, it is very doubtful that any data of any significance are kept for this part of the Country.

However, in spite of the fact that 40% of the Island is occupied, we have been very active throughout the year in water development project planning, design and construction.

In the field of construction an expenditure of about £1,500,000 was incurred which is normal as compared with previous years when the whole Island was free. A lot of works were carried out aiming at satisfying expanded domestic water supply requirements and increased agricultural demand due to the settlement of refugees.

A \$ 15 million loan from the World Bank was issued in September 1975 for the Paphos Irrigation Project which is by far the largest Project ever undertaken in Cyprus. It can be said, that with the exception of the hydrometeorological data, our output in Water Development has been brought up to normal by the end of 1975.

1.2 The Water Development Department

The Department of Water Development is one of the Department of the Ministry of Agriculture and Natural Resources and is responsible for the Government's overall policy water resources, planning, design and construction on the Island. It also contributes towards the management of water resources and water development projects together with other interested Ministries and Departments. Such water development projects include domestic water supplies, irrigation and drainage projects, flood protection works, protection works against pollution of water resources, groundwater recharge works and other relevant works. The Government institutional set up for water resources conservation and development and the role of the Department of Water Development is shown on page 14.

1.3 Departmental Organization

The Departmental Organization is shown on page 15. and is made up of :

1.3.1 Division of Water Resources

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

1.3.2 Division of Planning

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

1.3.3 Division of Design

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

1.3.4 Division of Construction

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

1.3.5 Division of Operation and Maintenance

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

1.3.6 Division of Small Projects Planning

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

1.3.7 Regional Offices

The Regional Offices have this year changed due to the Turkish Invasion. These now are Larnaca, Limassol and Paphos.

In these regional offices the main work carried out is hydrological measurements, collection of engineering data, operation and maintenance of projects investigation and planning for small projects and control of construction work.

1.3.8 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.

1.3.9 Legal Advisor

The Legal Advisor gives advice on the various legal problems of the Department which include water legislation, contractor's works, and water right problems. Also he drafts now water legislation whenever required for approval by the Attorney General. He also deals with important legal matters of the Ministry of Agriculture and Natural Resources whenever requested to do so.

The legal adviser of the Department in the course of the year 1975 besides his every day work, inter alia executed the following :

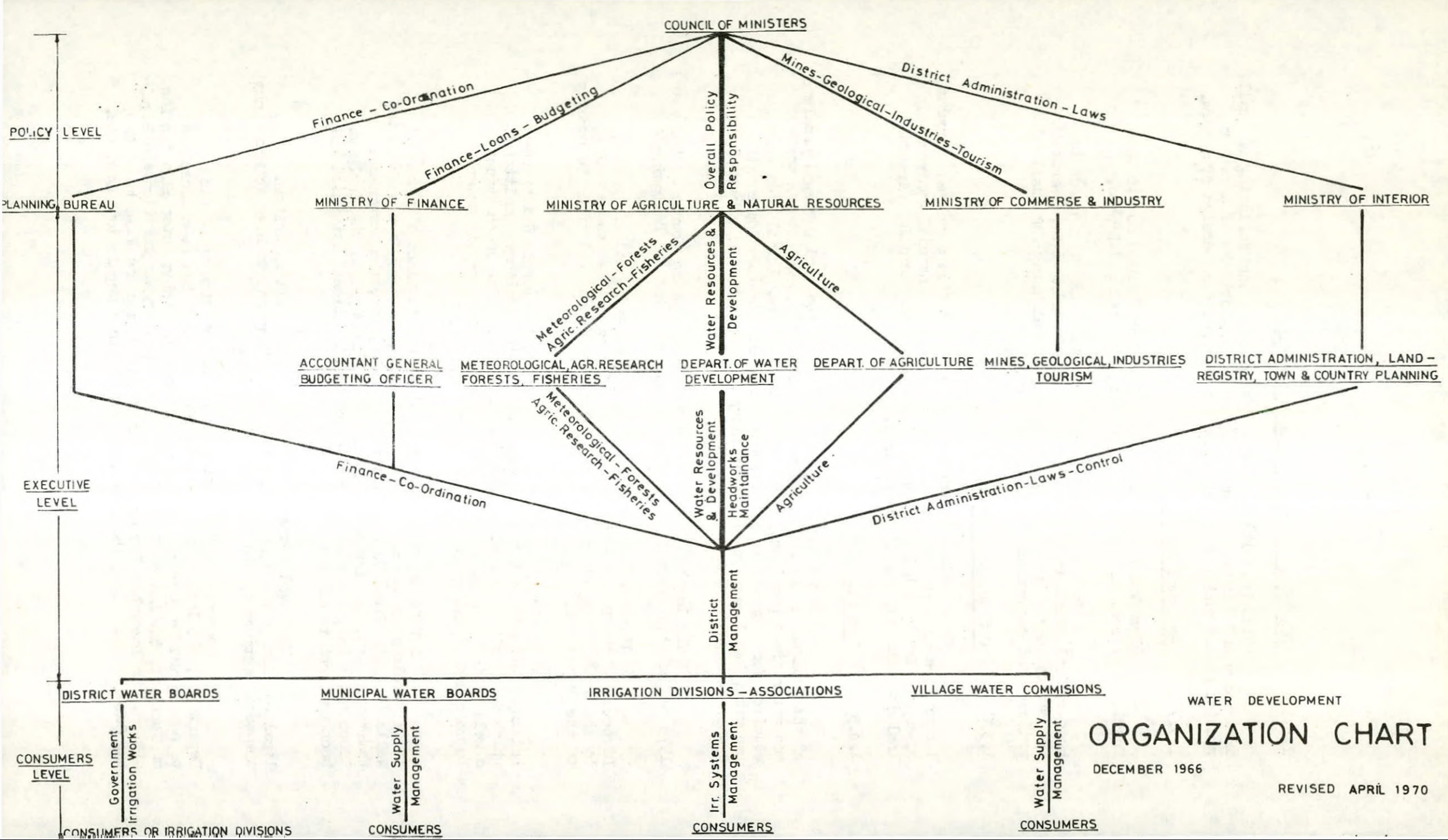
Attended all inter-departmental meetings called by the Director of the Department from time to time as well as those called by the heads of departments on various matters connected with the running of the Department.

In addition to these attendances, the legal adviser un-failingly attended all the meetings held by the Advisory Committee which deals with the applications for permits to sink or construct a well or to renew such permit, or to install machinery in order to make use of underground or surface water.

During the examination of these applications a number of legal problems arose which involved questions of many laws such as the Wells Law, the Water Supply (Special Measures) Law, the Government Waterworks Law, the Irrigation Division (Villages) Law, the Irrigation Association Law, the Administrative and Constitutional Law which had been referred to him for advice.

The legal adviser gave both oral as well as written legal opinions for all legal problems which happened to have arisen during the said meetings of the Advisory Committee.

Consequent of the wide nature of functioning of the Department, the legal adviser during the year 1975 had been consulted to advise and he gave his advice on problems involving inter alia the Law of Contract, the Law of Tort, the Law of Compulsory Acquisition and Requisition, the Immovable Property (Tenure Registration and Valuation) Law, the Sale of Goods Law, the Streets and Buildings Regulations Law, etc.



ORGANIZATION CHART

DECEMBER 1966

REVISED APRIL 1970

With the approval of the Attorney General the legal adviser prepared a draft amendment of sections 2 and 5 of the Government Waterworks Law Cap. 341., which has been laid before the House of Representatives.

The object of the proposed amendment is that the Council of Ministers may, in addition to the defining of the benefitted area, for the purpose of Cap 341, define the water supply area as well and may proceed to charge the Director of Department of Water Development with the responsibility of executing the necessary works in order to conserve, regulate, distribute and administer the existing water resources both in the benefitted area as well as in the water supply area, whereupon, notwithstanding the provisions of any other law, no permit can be granted by the District Officer, to sink or construct a well or to install machinery and use either underground or surface water or to do anything which may be liable to pollute or to affect in any way the underground water resources, without first consulting the Director of the Department of Water Development in order to obtain his concurrence.

The legal adviser drafted a number of orders connected with various matters such as the declaration of certain open areas into water conservation areas as provided by the Wells Law Cap 351 and the increase of water rates for the Greater Nicosia Water Supply Scheme, the declaration of certain waterworks into Government Waterworks as provided by the respective law, etc.

He is occupied with the drafting of the Cyprus Water Legislation by which it is provided the establishment of the Cyprus Water Authority.

Furthermore, in the course of the year 1975 the legal adviser has been entrusted with the preparation of the draft of the National Water Resources Law Inventory, which it is proposed to be published in the volume under title "Water Law in Selected European Countries" edited by the Food and Agriculture Organization of the United Nations.

Finally the legal adviser by special authorization by the Attorney General appeared and defended the Republic in a number of cases which came up for hearing before the Courts of Law including the Supreme Court of Cyprus.

He prepared all necessary pleadings and other relevant documents for which sometimes it became necessary to carry out an inspection of the locus in quo in order to understand better the actual facts of a case.

1.4 Staff

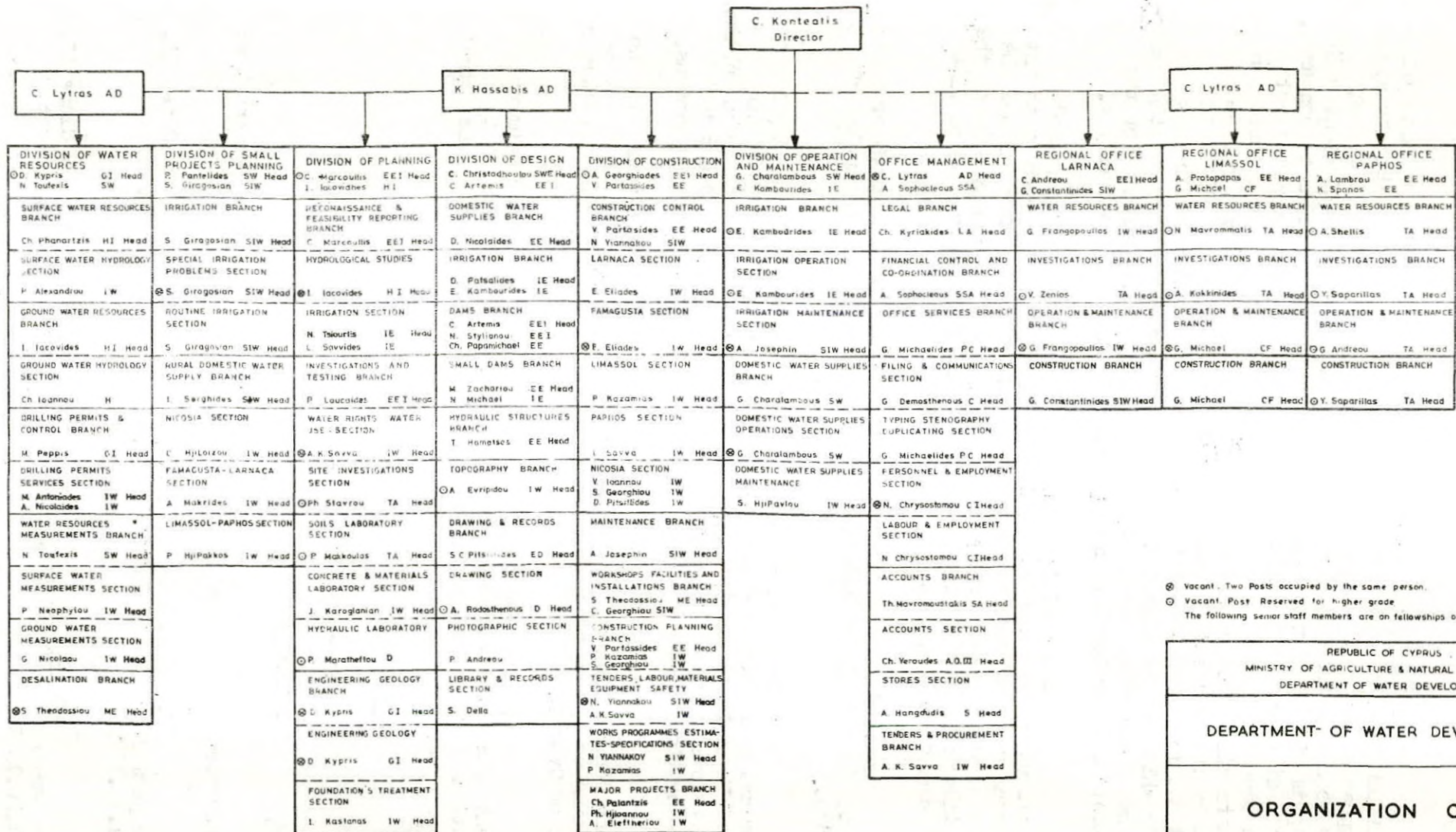
The Senior Staff is listed on table page 50.

1.4.1 Promotions

During the period under review the following persons have been promoted to the posts as indicated :

Mr. Vlassis Partassides, from Executive Engineer Class II, to the permanent post of Executive Engineer, Class I, with effect from 1.10.1975

Mr. Andreas Protopapas, from Executive Engineer Class II, to the permanent post of Executive Engineer, class I, with effect from 1.10.1975.



⊗ Vacant. Two Posts occupied by the same person.
 ○ Vacant. Post Reserved for higher grade.
 The following senior staff members are on fellowships or leave (H. Lopus, Ch. Kridiotis)

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

DEPARTMENT OF WATER DEVELOPMENT

ORGANIZATION CHART

JUNE 1975 D.O. DRG. No. BM/G/28

Mr. Charalambos Palantzis, from Executive Engineer Class II, to the permanent post of Executive Engineer, Class I, with effect from 1.10.1975.

Mr. Savvas A. Theodosiou, from Mechanical Engineer, Class II, to the permanent post of Mechanical Engineer, Class I, with effect from 1.10.1975.

Mr. Costas N. Papallis, from Foreman 2nd Grade, to the Permanent post of Foreman 1st Grade, with effect from 1.10.1975.

Mr. Meletios Michael, from Foreman 2nd Grade, to the Permanent post of Foreman 1st Grade, with effect from 1.10.1975.

Mr. Kyriacos G. Nicolaidis, from Foreman 2nd Grade, to the Permanent post of Foreman 1st Grade, with effect from 1.10.1975.

Mr. Costas Mattheou, from Foreman 2nd Grade, to the Permanent post of Foreman, 1st Grade, (on an unestablished basis), with effect from 1.10.1975.

Mr. Andreas Ashiotis, from Foreman 2nd Grade, to the Permanent post of Foreman 1st Grade, (on an unestablished basis), with effect from 1.10.1975.

1.4.2 On Contract

The contract of Mr. Charalambos Kyriakides, Legal Adviser, was renewed for one more year, with effect from 1.7.1975.

1.4.3 Transfers, Retirements, Deaths

1.4.3.1 Transfers

Mr. Charalambos Kridiotis, Executive Engineer, Class II, was transferred from Paphos to Nicosia, with effect from 17.11.1975.

Mr. Iacovos Kastanas, Inspector of Works, was transferred from Limassol to Nicosia, with effect from 1.12.1975.

Mrs. Eleni Hji Kyriacou, Draughtsman, was transferred from Nicosia to Paphos Regional Office, with effect from 17.11.1975.

1.4.3.2 Retirements

Mr. Demetris Petris, Foreman 1st Grade, retired from the Government Service, with effect from 1.2.1975.

Mr. Modestos Themistocleous, Foreman 1st Grade, retired from Government Service, with effect from 1.3.1975.

Mr. George Kaisis, Foreman 1st Grade, retired from the Government Service, with effect from 1.3.1975.

Mr. Costas Papadakis, Senior Inspector of Works, retired from the Government Service with effect from 1.5.1975.

1.4.3.3 Deaths

Mr. Andreas Panayiotou, Foreman 2nd Grade, died on the 22.9.1975

1.4.4. Scholarships, Conferences and Duty Abroad

1.4.4.1 Scholarships

Mr. Christodoulos Christodoulou, Senior Water Engineer, was awarded a scholarship by the U.K. Programme of Technical Assistance, in Water Resources Planning and Economics at the Kings College of London with a view to obtaining the M. Phil. He left Cyprus on the 1st September, 1975, and the duration of his scholarship is for 21 months.

Mr. Elias Kambourides, Topographer/Irrigation Engineer, was awarded a scholarship by the Netherlands Government, for the M.Sc. Course in Soil Science and Water Management. He left Cyprus on the 7th August, 1975, and his scholarship is also for a duration of 21 months.

Mr. Loucas Savvides, Topographer/Irrigation Engineer, was awarded a scholarship by the Government of Israel for the 7th international Course on Irrigation from 16th November, 1975, to the 12th December, 1975.

Mr. Charalambos Kridiotis, Executive Engineer, Class II, who had been granted a scholarship by the U.K. Programme of Technical Assistance in Engineering Geology, at the University of Leeds completed his studies and was awarded the M.Sc. in Engineering Geology. He resumed his duties on the 1st October, 1975.

1.4.4.2 Conferences

Mr. C.A.C. Konteatis, Director, W.D.D., attended the 18th Conference of the Food and Agricultural Organization which was held in Rome from the 8th to the 27th November, 1975.

1.4.4.3 Duty Abroad

Mr. Chr. Marcoullis, Executive Engineer, Class I, participated in the computerized design of the main canal of the Paphos Project by SOGREAH Engineering Company, in Grenoble, France, from the 27th October to 22nd November, 1975.

Mr. Kyriacos Spanos, Executive Engineer, Class II, left Cyprus on 8.11.1975, for Grenoble, France, where he is participating in the design of the distribution system of the Paphos Project by SOGREAH Engineering Company.

1.4.5 Grant of leave without pay, to Government Employees who had secured temporary employment overseas

The following three officers were granted one year's leave without pay, not on grounds of public policy, but on personal grounds as a result of the Turkish Invasion, from the dates appearing opposite their names on the strength of Circular No. 365 of 1/2/75 from the Director-General, Ministry of Finance, as they had secured temporary employment outside Cyprus:

Mr. Charis Iapas, Executive Engineer, Class I (from the 21/3/75) due to loss of his house in Nicosia due to bombardment.

Mr. Liassis Savva, Inspector of Works (from the 6/3/75) due to loss of his house at Kaimakli.

Mr. Erricos Ioannou, Chief Foreman (from 3/10/75) due to loss of his house in Kyrenia.

1.5 Foreign Technical Assistance

The following sections of work were dealt with during the year.

1.5.1 United Nations

Technical Assistance received from the United Nations during 1974 was :

1.5.1.1 Experts

Mr. B. Milinusic, FAO Senior Irrigation Engineer continued his services with us throughout the year mostly being occupied with the Paphos Irrigation Project, for which he has been appointed as a Project Manager.

Mr. H. Molkenboer continued throughout the year as an Associate Expert offered by the Netherlands Government and worked as assistant to Mr. Millinusic on various irrigation projects.

1.5.1.2 Studies

During the year (following a request by the Cyprus Government) UNESCO sent Mr. Rodger Thunvic from Sweden as an expert to study processing of hydrological data using a computerised system. Mr. Thunvic submitted a recommendation to UNESCO to undertake a project on the computerisation of hydrological and hydrogeological data in Cyprus. It is hoped that this project which will facilitate largely the collection of interpretation of hydrological data will be soon undertaken.

1.5.2 British Technical Assistance

Pending studies undertaken by the British Technical assistance in previous years have been the Southern Conveyor Project and Brackish Water Desalination.

1.5.2.1 Southern Conveyor Project

During the year it did not become possible for the British Government to revive interest on this project, which has been left pending in the meantime.

1.5.2.2 Brackish Water Desalination

During the year, project using four different types of reverse osmosis was initiated for desalting of brackish waters. This plant was made in England by different companies and it is mobile unit mounted on a truck,

The units are 2 Nos. R₂ Spagetti, 1 No. Dupond Hollow Fiber Permaceb made by PCI and 1 No. spiral Rub made by Aines Crosta.

Mr. Knibbs a socialist from the UK AEA has been assigned under the supervision of Mr. Taylor of the same Authority to undertake a one's year project in Cyprus which started in August 1975.

An assessment of the capacity of the different types of reverse osmosis using different quality waters is being undertaken by this Project. In the first instance, it is anticipated to test brackish waters at Aradhippou, Alethrico, Iatsia, Tseri and Zyghi.

1.6 Cyprus National, Inter-Departmental and Departmental Committee

1.6.1 International Hydrological Programme

With the completion of the International Hydrologic Decade (1965-1974), UNESCO sponsored a new program, the International Hydrologic Program which will implement and carry on the findings and activities of the IHD.

The Cyprus National Committee for the IHD has been reconstituted into a permanent Cyprus National Committee for the IHP consisting of the following :

<u>Chairman</u>	Mr. C.A.C. Konteatis, Director, Water Development Department
<u>Secretary</u>	Mr. J.S. Jacovides, Hydrologist, Water Development Department
<u>Members</u>	Dr. Th. Christou, Director, Agricultural Research Institute Mr. C.C. Parisinos, Ag. Director, Department of Agriculture Mr. E. Michaelides, Ag. Director, Department of Forest Mr. Y. HjiStavrinou, Director, Geological Survey Department Mr. Cl. Philaniotis, Head, Meteorological Office

The main activities during the year were :

- a) Contribution of information and data from Cyprus to the "World Catalogue of Low Stream Flow".
- b) Observational Data taken from the Cyprus Decade Stations.
- c) Initialization of a project on "computer storage and retrieval of hydrological data" which started by a fact-finding consultancy mission by R.J. Thunvic sponsored by UNESCO, after our request, under the auspices of the IHP activities.

1.6.2 Research Contract sponsored by the International Atomic Energy Agency

The renewed for a second year research contract on the "Environmental Isotope Survey of Cyprus" by the IAEA with Mr. J.S. Jacovides, Hydrologist, of this Department as principal investigator was virtually completed by the end of 1974.

The emphasis was on the Western Mesaoria aquifer. In view of the inaccessibility to the area for further investigation, the research was left idle for 1975 expecting further political developments that could enable the continuation of the research.

By the end of 1975 it was decided to request a renewal of the research contract to investigate the hydrologic regime of the Troodos mountainous range and this is expected to begin in 1976.

1.6.3 International Commission on Large Dams

The Cyprus National Committee on Large Dams (CY.N.C.O.L.D.) was elected to full membership of the International Commission on Large Dams in 1969. During 1975 the National Committee was composed of the following:

<u>Chairman</u>	Mr. C.A.C. Konteatis, Director, Department of Water Development
<u>Secretary</u>	Mr. C.C. Artemis, Executive Engineer I, Division of Design, Water Development Department
<u>Members</u>	Mr. K.C. Hassabis, Assistant Director, D.W.D. Mr. A. Papadopoulos, Representative of the Association of Civil Engineers and Architects The Representative of the Association of Building Contractors

The 43rd Executive Meeting of the International Commission on Large Dams was held in Teheran, Iran, between 6th and 9th October 1975. Unfortunately it was not possible for the Cyprus National Committee to be represented. The XIIIth Congress on Large Dams is scheduled to be held in Mexico City, Mexico between 29th March and 2nd April 1976 and will be followed by organized study tours.

The technical questions for the Congress are :

- Question No. 44. Problems associated with special types of fill dams.
- Question No. 45. Leakage investigations and drainage of dams and their foundations.
- Question No. 46. Preliminary planning of dam developments.
- Question No. 47. The effects on dams and reservoirs of some environmental factors.

1.6.4 International Commission on Irrigation and Drainage

The International Commission on Irrigation and Drainage is a non-profit organization whose objectives are to stimulate and promote the development and application of the science and techniques of irrigation, drainage, flood control and river training in the engineering, economic and social aspects.

Cyprus is a member country of the International Commission on Irrigation and Drainage, (which was set up in 1950) since 1954. The Cyprus Committee on Irrigation and Drainage was formed in 1964 and it is now composed of the following :

<u>Chairman</u>	Mr. C.A.C. Konteatis, Director, Water Development Department
<u>Secretary</u>	Mr. N. Tsiourtis, Irrigation Engineer, Water Development Department
<u>Ex-Officio</u>	Director, Department of Forest
<u>Members</u>	Director, Department of Agriculture Director, Agricultural Research Institute

DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT	1000m ³	YEAR
1	Kouklia	Earth	6	4,545	1900
2	Lymbia	Gravity	5	18	1945
3	Lythrodhonda	Gravity	11	32	1945
4	Kalakhorio (K1)	Gravity	9	82	1947
5	Akraounda	Gravity	7	23	1947
6	Galini	Gravity	11	23	1947
7	Petra	Gravity	9	32	1948
8	Petra	Gravity	9	23	1951
9	Lythrodhonda	Gravity	10	32	1952
10	Kafizes	Gravity	23	113	1953
11	Ayios Loucas	Earth	3	455	1955
12	Gypso	Earth	3	100	1955
13	Kandou	Gravity	15	34	1956
14	Perapedhi	Gravity	22	55	1956
15	Pyrgos	Gravity	22	285	1957
16	Trimiklini	Gravity	33	340	1958

Total Storage Capacity 6,192 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT	1000m ³	YEAR
17	Pradhromos	Earth	10	122	1962
18	Morphou	Earth	13	1,879	1962
19	Lefka	Gravity	35	368	1962
20	Geunyeli	Earth	15	1,045	1962
21	Athalassa	Earth	18	791	1962
22	Kanli Keuy	Earth	19	1,113	1963
23	Argaka	Rockfill	41	1,150	1964
24	Mia Milia	Earth	22	355	1964
25	Ovgos	Earth	16	845	1964
26	Kiti	Earth	22	1,614	1964
27	Agros	Earth	26	99	1964
28	Liopetri	Earth	18	340	1964
29	Polemithia	Earth	45	3,864	1965
30	Ayia Marina	Rockfill	33	311	1965
31	Kalopanayiotis	Earth	40	391	1966
32	Mavrokolymbos	Earth	45	2,180	1966
33	Pomos	Rockfill	38	859	1966
34	Yermasoyia	Earth	49	13,600	1968
35	Syngrasis	Earth	7	1,115	1968

Total Storage Capacity 32,041 m³ x 10⁶

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000m ³	YEAR
36	Ayios Yeoryios	Earth	6	90	1962
37	F'sta Antiflood	Earth	8	165	1963
38	Ayios Nikolaos	Earth	2	1,365	1964
39	Paralimni Lake	Earth	1	1,365	1964
40	Fresh Water Lake	Earth	3	4,545	1964
41	Makrosyka	Earth	8	195	1966
42	Akhna (Mesania)	Earth	4	90	1967
43	Morphou spreading grounds	Earth	5	130	1969
44	Ormithia	Earth	5	100	1968
45	Vrysoules	Earth	7	140	1969
46	Protapapas	Earth	6	90	1970

Total Storage Capacity 8,275 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1971-75

No	DAM	TYPE	HT	1000m ³	YEAR
65	Lefkara	Earth Rockfill	71	13,850	1973
66	Massari Recharge dam	Earth	15	2,273	1973
67	Palekhori-Kambi	Gravity	33	620	1973
68	Arakapas	Gravity	23	130	1975

Total Storage Capacity 16,873 m³ x 10⁶

GRAND TOTAL UP TO END OF 1975: 64.5m³ x 10⁶

MINOR RECHARGE DAMS FROM 1960-70

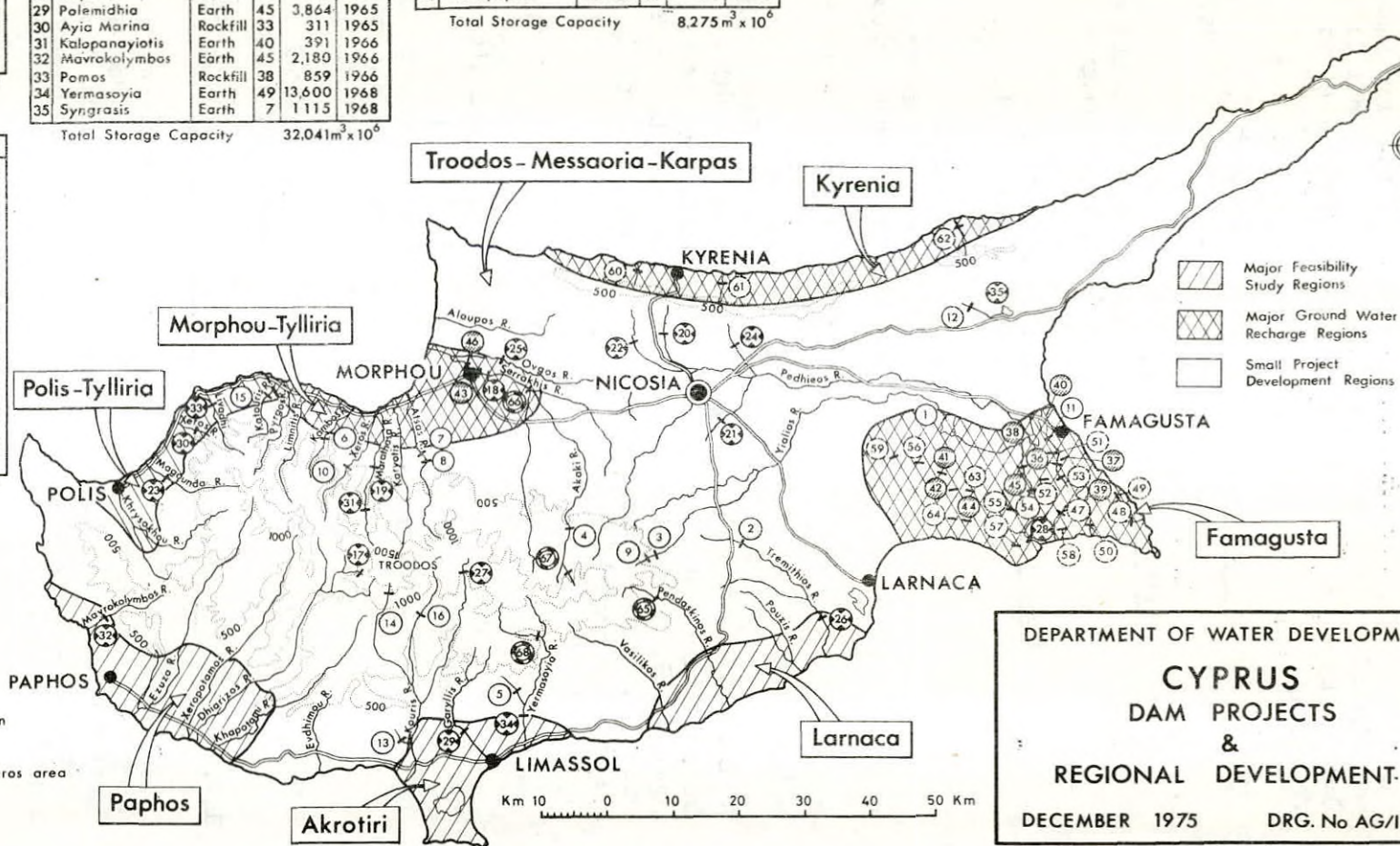
No	DAM	TYPE	HT	1000m ³	YEAR
47	Sotira	Earth	8	45	1962
48	Panayia (F)	Earth	7	45	1962
49	Paralimni (45)	Earth	5	115	1963
50	Ayia Napa (7)	Earth	8	55	1963
51	F'sta Recharge	Earth	5	50	1963
52	Phrenaros (6)	Earth	5	115	1964
53	Dherynia	Earth	6	23	1964
54	Phrenaros (3)	Earth	7	45	1966
55	Avgorou (7)	Earth	3	68	1966
56	Kondea (2)	Earth	5	82	1966
57	Xylophaghos (4)	Earth	7	86	1966
58	Sotira (4)	Earth	5	32	1966
59	Lysi	Earth	7	77	1967
60	Ay. Yeoryios (9)	Earth	3	68	1967
61	Ay. Epiktitos (6)	Earth	6	34	1968
62	Akanthou (6)	Earth	6	45	1968
63	Akhna (3)	Earth	4	40	1968
64	Xylatymbou (5)	Earth	5	50	1969

Total Storage Capacity 1,075 m³ x 10⁶

- ① Dams constructed up to 1960
- ② Major dam projects from 1960-70
- ③ Major dam projects from 1971-75
- ④ Major recharge dams from 1960-70
- ⑤ Minor recharge dams from 1960-70

HT refers to height in meters from foundation
YEAR is the year of completion

Phrenaros (6) means six small dams in Phrenaros area



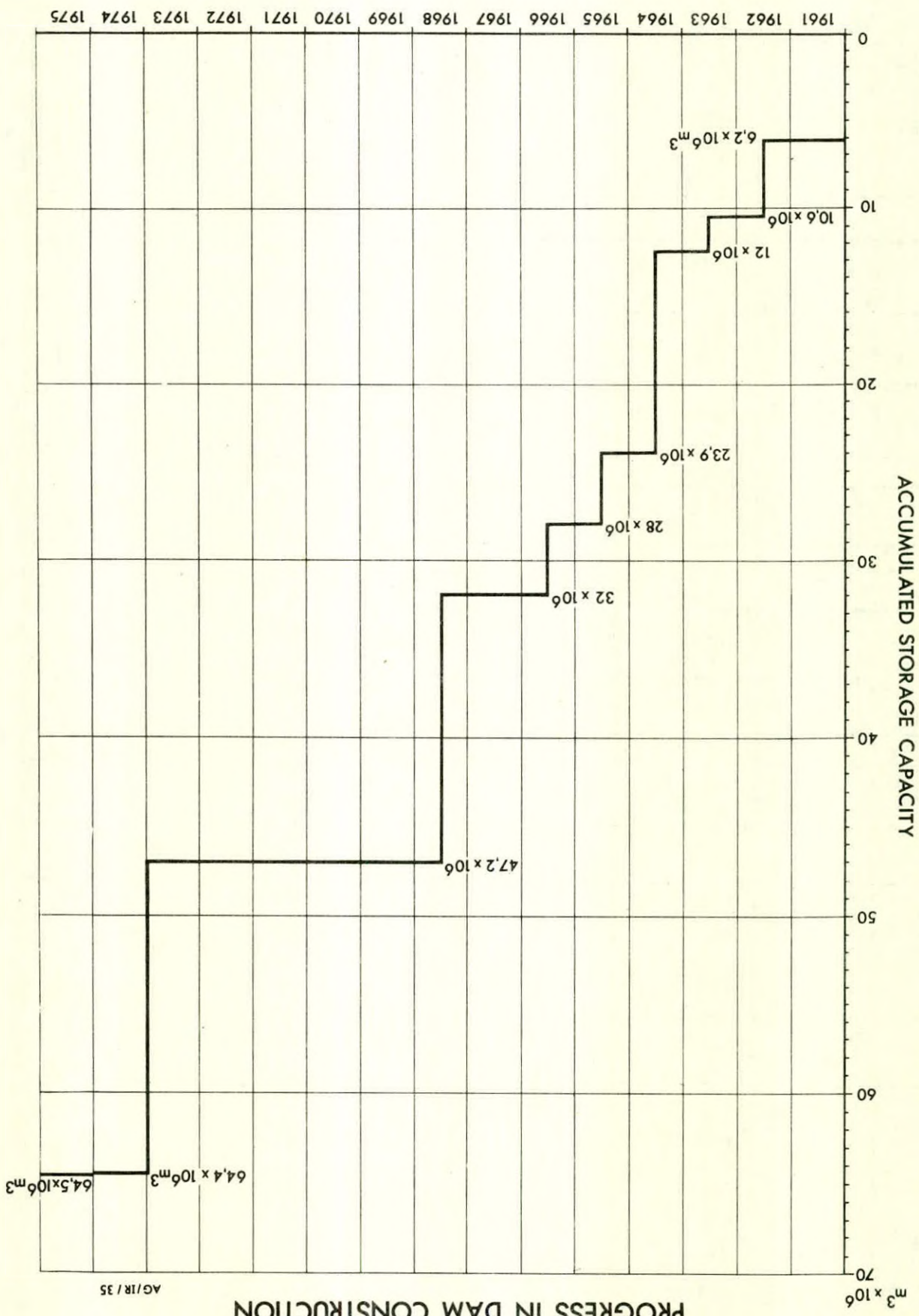
DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
DAM PROJECTS
&
REGIONAL DEVELOPMENT.
DECEMBER 1975 DRG. No AG/IR/37

REGISTRE DES BARRAGES EN CHYPRE

REGISTER OF DAMS IN CYPRUS

DRG. No. AG/IR/39

L I N E N O	NOM DU BARRAGE NAME OF DAM	ANNEE D'ACHE- VEMENT YEAR OF COMP- LETION	SITUATION LOCATION			T Y P E	HAUTEUR AU DESSUS DE LA PLUS BASSE FONDATION HEIGHT ABOVE LOWEST FOUND- ATION (m)	LONGUEUR DE CRETE LENGTH OF CREST (m)	VOLUME DU BARRAGE VOLUME CONTENT OF DAM (10 ⁶ m ³)	CAPACITE TOTALE DU RESERVOIR GROSS CAPACITY OF RESERVOIR (10 ⁶ m ³)	D E S P O S I T I O N S	CAPACITE MAXIMALE DES EVA- CUATEURS MAXIMUM DISCHARGE CAPACITY OF SPILLWAYS (m ³ /s)	T Y P E D E S E V A C U A T E U R S T Y P E O F S P I L L W A Y S	PROPRIETAIRE OWNER	BUREAU D'ETUDES ENGINEERING BY	CONSTRUCTEUR CONSTRUCTION BY	L I N E N O
			COURS D'EAU RIVER	VILLE LA PLUS PROCHE NEAREST CITY	ETAT PROVINCE OU DIPARTE- MENT STATE PROVINCE OR COUNTY												
1	KAFIZES	1953	Xeros (Morphou)	Nicosia	Nicosia	PG	23	27	4	113	I	54	L	Lefka Irrigation Division	Department of Water Development	Department of Water Development	1
2	KANDOU	1956	Kouris	Limassol	Limassol	PG	15	53	2	34	I	59	L	Kandou Irrigation Division	Department of Water Development	Department of Water Development	2
3	PERAPEDHI	1956	Kouris	Limassol	Limassol	PG	22	62	4	55	I	107	L	Perapedhi Irrigation Division	Department of Water Development	Department of Water Development	3
4	PYRGOS	1957	Katouris	Nicosia	Nicosia	PG	22	66	5	285	I	125	L	Pyrgos Irrigation Division	Department of Water Development	Department of Water Development	4
5	TRIMIKLINI	1958	Kouris	Limassol	Limassol	PG	33	76	6	340	I	59	L	Trimiklini Irrigation Division	Department of Water Development	Department of Water Development	5
6	ATHALASSA	1962	Pedhieos	Nicosia	Nicosia	TE	18	447	103	791	I	48	L	Government	Department of Water Development	Department of Water Development	6
7	GEUNYELI	1962	Pedhieos	Nicosia	Nicosia	TE	15	254	50	1 045	I	173	L	Geunyeli Irrigation Division	Department of Water Development	Department of Water Development	7
8	LEFKA	1962	Marathasa	Nicosia	Nicosia	PG	35	149	11	368	I	246	L	Lefka Irrigation Division	Department of Water Development	Department of Water Development	8
9	MORPHOU	1962	Serakhis	Nicosia	Nicosia	TE	13	1 436	206	1 879	I	764	L	Morphou Irrigation Division	Department of Water Development	Department of Water Development	9
10	PRODHROMOS	1962	off stream	Limassol	Limassol	TE	10	756	73	122	I	-	L	Prodhromos Irrigation Division	Department of Water Development	Department of Water Development	10
11	KANLI KEUY	1963	Pedhieos	Nicosia	Nicosia	TE	19	311	47	1 113	I	116	L	Kanli Keuy Irrigation Division	Department of Water Development	Department of Water Development	11
12	AGROS	1964	Kouris	Limassol	Limassol	TE	26	180	61	99	I	6	L	Agros Irrigation Division	Department of Water Development	Department of Water Development	12
13	ARGAKA	1964	Magounda	Paphos	Paphos	ER	41	173	138	1 150	I	0.3	L	Government	Howard Humphreys & Sons of U.K.	Department of Water Development	13
14	KITI	1964	Tremithos	Larnaca	Larnaca	TE	22	990	183	1 614	I	602	L	Government	Il Nuovo Castoro of Italy	Department of Water Development	14
15	LIOPETRI	1964	Potamos	Famagusta	Famagusta	TE	18	579	50	340	R	150	L	Liopetri Irrigation Division	Department of Water Development	Department of Water Development	15
16	MIA MILEA	1964	Pedhieos	Nicosia	Nicosia	TE	22	140	54	355	I	24	L	Mia Milea Irrigation Division	Department of Water Development	Department of Water Development	16
17	OVGOS	1964	Serakhis	Nicosia	Nicosia	TE	16	745	130	845	I	786	L	Morphou Irrigation Division	Department of Water Development	Department of Water Development	17
18	AYIA MARINA	1965	Xeros (Tyllirias)	Paphos	Paphos	ER	33	142	61	311	I	161	L	Ayia Marina Irrigation Division	Energoprojekt of Yugoslavia	Mediterranean Constructors Greece - G.P.Zachariades Cyprus	18
19	POLEMIDHIA	1965	Garyllis	Limassol	Limassol	TE	45	196	215	3 864	I	581	L	Government	Energoprojekt of Yugoslavia	Mowlem & Ridgway of U.K.	19
20	KALOPANAYIOTIS	1966	Marathasa	Nicosia	Nicosia	TE	40	137	156	391	I	207	L	Government	Howard Humphreys & Sons of U.K.	Department of Water Development	20
21	MAVROKOLYMBOS	1966	Mavrokolym- bos	Paphos	Paphos	TE	45	528	267	2 180	I	340	L	Government	Energoprojekt of Yugoslavia	Cybarco of Cyprus	21
22	POMOS	1966	Livadhi	Paphos	Paphos	ER	38	302	153	859	I	300	L	Pomos Irrigation Division	Energoprojekt of Yugoslavia	Mediterranean Constructors Greece - G.P.Zachariades Cyprus	22
23	YERMASOYIA	1968	Yermasoyia	Limassol	Limassol	TE	49	409	539	13 600	I	850	V	Government	Energoprojekt of Yugoslavia	Cybarco of Cyprus	23
24	LEFKARA	1973	Pendaskinos	Larnaca	Larnaca	TE/ ER	74	240	820	13 850	S/I	316	L	Famagusta Water Board & Lefkara Irrigation Division	Howard Humphreys & Sons of U.K.	L. Fairclough & Medcon Construction Ltd.	24
25	MASARI	1973	Serakhis	Nicosia	Nicosia	TE	15	929	245	2 273	I	622	V	Government	Department of Water Development	Department of Water Development	25
26	PALEKHORI-KAMBI	1973	Akaki	Nicosia	Nicosia	PG	33	131	27	620	I	65	L	Government & Palekhori Irrigation Division	Department of Water Development	Department of Water Development	26
27	ARAKAPAS	1975	Yermasoyia	Limassol	Limassol	PG	23	97	10	129	I	205	L	Arakapas Irrigation Division	Department of Water Development	Department of Water Development	27



DEPARTMENT OF WATER DEVELOPMENT
PROGRESS IN DAM CONSTRUCTION

AG/IR/35

During the year 1975 the Cyprus Committee on Irrigation and Drainage continued to keep correspondence with the Central Office of the International Commission on Irrigation and Drainage for the interchange of information between the National Committees of its member countries.

All publications such as bulletins, annual reports and other documents which were sent by I.C.I.D. or by any other member country of I.C.I.D. were distributed to all members of the Cyprus Committee of Irrigation and Drainage.

During 1975, the 26th International Executive Meeting of I.C.I.D. was held in Moscow on July 25 and 26. At the same time the European National Committees held meetings in Moscow.

1.6.5. International Water Supply Association

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

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

Mr. G. Charalambous,
Superintendent of Works of the Water Development Department
as Secretary

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

The Cyprus National Committee of the International Water Supply Association exchanged regular correspondence with the Head Office of the Association relative to the activities of this Organization.

Due to tragic events in Cyprus, resulting from the Turkish Invasion, participation of this National Committee to the 10th Congress held in Brighton, England was not possible nor it would be possible to participate to 11th Congress which is scheduled to be held in Amsterdam, Holland between 13th - 17th September, 1976.

1.6.6 Meetings of the Director with the Staff

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

1.7 Water Resources

1975 was a rather wet year for Cyprus which received an average of 567 mm between October 1974 and September 1975 being 116% of normal. Most of the Island received precipitation above average, whereas an area south of Larnaca received a rainfall below normal. The distribution of rainfall in time showed that the January, February, April, May and June were wetter than normal, whereas March, October, November and December were below normal.

As a result of the good rainfall all rivers discharged substantial quantities of water, most of it having being lost to the sea. The big rivers such as Dhiarrizos, Ezouza and Xeropotamos of Paphos and Kouris of Limassol had discharges as measured, which exceeded 50 cm/second in January. As a result of high runoff all dams have overflowed, except the Lefkara dam which received a storage of about $4\frac{1}{2}$ million cm, Polemidhia dam which received an amount of $2\frac{1}{2}$ million cm and Kiti dam which received an amount of about $1\frac{1}{2}$ million cm.

Regarding groundwater resources, these also received important replenishment due to the high precipitation and runoff.

The situation in southeastern Messaoria aquifer is still grave and the overpumping has continued. However, the fact that most of the irrigation now in this region is done during spring time and using sprinkler irrigation for growing of potatoes, has been a great improvement in the region and the rate of the aquifers decline now has been reduced.

At Akrotiri, the aquifer has shown some improvement during the year, but certain areas around Zakaki still contain brackish water.

The situation, at Western Messaoria is not known due to the Turkish Troops occupation of the area, but it may be possible that the hydrological situation would improve somewhat due to the neglect of many of the gardens which resulted to an extensive area in particular young citrus to have been totally abandoned and dried up.

A great number of new boreholes have being drilled during the year in many areas mainly for displaced persons to help them to revive irrigated agriculture which they have lost in occupied areas. The expansion of agriculture is mainly done for vegetables and potatoes for which the production has been higher than normal.

1.8 Planning and Design of Projects

During the year planning and design of water projects has been intensified both for domestic and irrigation projects.

The most important project is the Paphos Irrigation Project for which design of work is being done both Departmentally and by Consultants in order to enable construction in 1976.

The Vasilikos-Pendaskinos project is another important project involving the design of two dams, one diversion structure and intensive canalization and pipe system to cover an area of 2,200 ha of land. The feasibility study for this project is being undertaken Departmentally and is scheduled to be completed in 1976.

Planning work is being done for the Southern Conveyor Project which involves the conveyance of surplus water from Paphos and Limassol eastwards. Due to its complexity interbasin multi-purpose and multi-component system, a computerized programme is being used for this project to derive optimum hydrological balances and reservoir operation studies, conjunctive use of surface and groundwater sources and economically optimum solutions. This is a very complicated project and its feasibility study will take a number of years to be accomplished. In any case it has to follow the implementation of local projects in Paphos and Limassol before it is possible to divert surplus water eastwards.

In Limassol, at Akrotiri, planning work is being continued on the implementation of the Akrotiri project which involves conjunctive use of surface and groundwater resources. At this stage, with the Yermasoyia and Polemidhia dams having been completed, and with the large section of the groundwater resources under full operation, the long term phase of studies is now for a region at Trakhoni, Phassouri, using water from the above mentioned sources and scheduled for implementation during the year 1976-1977.

Important irrigation studies on a more limited technical scale but of great social importance is being undertaken for the Pitsilia area as a part of an integrated rural development project about which the World Bank has shown interest for financing.

A preliminary plan has been completed and submitted for the long term supply of water to Nicosia from the Famagusta Water Supply System at Khirokitia. As it is known this System is envisaged to be extended and receive additional water through the implementation of the Vasilikos-Pendaskinos project in the next few years, the Southern Conveyor Project during the 1980's and in the long run through sea water desalination possibly in conjunction with power supply.

With the Morphou area under Turkish occupation for an unforeseen period of time, the only alternative now remaining for long term supplies to Nicosia are the southern sources.

1.9 Construction of Projects

During the year 493 different projects have been under construction, out of which about 200 were for village water supplies, about 80 for irrigation, 140 for other Departments and about 70 for private individuals.

The total funds made available for the above works was £2,621,000, whereas the actual expenditure incurred during the year reached £1,652,000.

1.9.1 Major Projects

The major projects under construction during the year were :

- The Arakapas dam being a gravity mass concrete dam on which about £38,000 were spent,
- The largest work during the year was the Main Pipe Conveyor from Yermasoyia dam to the Akrotiri area passing through the main Makarios Avenue of Limassol. On this project, an amount of £325,000 was spent.
- Another major project was the expansion of the distribution system from the Mavrokolymbos dam in Paphos on which an amount of £110,000 was spent.
- On the Palekhori dam distribution system an amount of £44,000 was spent.

A number of other works were undertaken on major projects having reached a total expenditure of £688,000.

1.9.2 Town Water Supplies

An amount of £260,000 was spent on the construction of the Engomi and Strovolos reservoirs, a new reservoir for Larnaca which are being built in order to increase the storage availability in Nicosia and Larnaca.

1.9.3 Village Water Supply Schemes

A number of 200 village water supply schemes were executed at a total expenditure of about £256,000. These village water supply schemes are mainly for augmenting the water supply and for house to house distribution. Also a number of them have been necessary due to the increased demand from new settlements of displaced persons.

Also new supplies have been made for displaced persons. The Famagusta Water Supply System has been one of the sources for supplying additional water in the region of the Pipe Conveyor as far as Famagusta.

1.9.4 Minor Irrigation Schemes

About 80 such schemes were under construction during the year, the total expenditure having reached £606,000. These schemes are pipe and channel distributions for efficient use of water, diversion structures and storage tanks, borehole pumping schemes and distribution networks, and a variety of other irrigation projects.

1.9.5 Constructional Plant

During the year, after decision of the Government, a Central Government Department was established under the jurisdiction of the Ministry of Finance under which all Government mechanical plant, equipment and workshops have been placed. This decision has been done against our advise, having being considered that it would not be to the benefit of the efficiency of our works.

During one year operation of the new Department, we still believe that the losses and delays incurred are far more than any benefits due to centralization that may have been derived.

1.9.6 Labour

The average number of labourers employed by the Department during 1975 was 880 as compared with 884 in 1974. 38% were classed as regulars and 62% as casual labourers.

Approximately 60% were skilled employees, 11% semiskilled and 29% unskilled. No Turkish labourers were employed in 1975, and they have all been forcibly moved to the occupied area.

The approximate daily average of labourers engaged per months was as follows:

January	856
February	778
March	799
April	753
May	814
June	921
July	976
August	882
September	887
October	945
November	993
December	953

Monthly average	880
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1.10 Operation and Maintenance of Projects

Our Department is directly responsible for the maintenance of all major projects and undertakes maintenance works of minor projects as requested. Regarding the operation of projects, we are co-operating with the District Administration and the Department of Agriculture as far as irrigation projects are concerned and with the District Administration, Water Boards and Village Water Commissions as far as the domestic water supplies are concerned. All head works such as dam and main sources of water supply are under our direct administration.

1.10.1 Major Irrigation Projects

All dams except Polemidhia and Kiti were filled and overflowed. The amount of water collected in all the dams including Lefkara, reached the record amount of 27.6 million cm. A total quantity of about 7.8 million cm which represents about 28% of the total quantity stored was utilized for the irrigation of about 12,500 donums in the project areas, whilst another 1 million cm was released for recharging of aquifers. It may also be mentioned that 2.3 million cm of water has been lost through evaporation. The balance of 14.5 million cm remaining in the dams is mainly accounted for storage in the Yermasoyia dam which could not be utilized because the conveyor had not been completed, and in the Lefkara dam where water is being stored up for future use for domestic purposes. The gross income from the sale of water for irrigation was £60,720 as compared with £26,140 for 1974. As the expenditure during the year reached £15,800 the net income from the sale of water was £44,920 as compared with £10,490 in 1974. The crops irrigated from the dams include citrus, vines, deciduous, bananas and some cereals.

1.10.2 Town Water Supplies

The major Town Water Supplies with which we deal is Nicosia, Famagusta, Larnaca and Limassol. The situation of water supply in these towns was average as usual with no major problems encountered.

1.10.2.1 Nicosia Water Supply

Nicosia Water Supply was received from the existing sources including those under Turkish occupation at Morphou and in the northern range. In addition, some extra boreholes have been drilled south of Nicosia for reinforcing the supply. Some problems with the Turkish Authorities have been encountered as regards Nicosia Water Supply which have been mentioned previously, but in general it can be said that the supply was not interrupted or interfered with without reason.

During the year, an amount of 8,138,000 cm of water was distributed for sale which was pumped from the sources mentioned. The peak daily demand reached 31,650 cm.

Important work was carried out during the year for augmenting the storage available by constructing major reservoirs at Engomi and Strovolos.

The revenue of water from the Greater Nicosia Scheme during the year was £220,800 with an expenditure of £120,665. Of course, this does not include any revenue from the Turkish population. Similarly it does not include any pumping costs from the occupied area of Morphou.

1.10.2.2 Famagusta-Larnaca Water Supply

We have continued during the year to supply water both to Famagusta and Larnaca Water Supply Project. To Famagusta an amount of 580,000 cm was supplied, to Larnaca 1,030,000 cm, to regional villages 355,000 cm, to refugee camps 148,000 and to some local irrigators 135,000 cm. The revenue from the sale of water which excludes revenue from the Turkish occupied Famagusta has reached £97,000 against an expenditure of £51,000.

1.10.2.3 Limassol Water Supply

Limassol Water Supply derives its water from sources belonging to the Water Board of Limassol. An agreement has been reached with the Water Board to be supplied with water from Yermasoyia dam if and when required.

1.11 District Offices

As it is known with the occupation of Famagusta and Kyrenia by the Turkish forces, we now have only 3 District Offices. One is in Larnaca district which is in charge of the parts of Famagusta mainly Kokkonochoria area and Larnaca which have not been occupied by the Turkish forces. The other is for the Limassol district and the third district office is at Paphos.

The responsibility of the District Officers include measurements, evaluation and control, of hydrological data investigations and planning for minor irrigation and village water supplies under the supervision of the Head Office in Nicosia and finally they help in the supervision of construction works under the direct control from the Nicosia Head Office.

1.11.1 Larnaca-Famagusta Regional Office

A lot of the work undertaken by this office during the year dealt with emergency water supplies to displaced persons, settlements and refugees camps. The water to these areas was supplied either from emergency boreholes drilled or from extensions of existing village water supplies or from the Famagusta Water Supply Project.

1.11.2 Limassol Regional Office

The main work of the regional office during the year has been the Main Conveyor from Yermasoyia dam which passes through the City of Limassol to supply water to the existing plantations and an extended area for a new plantation at Akrotiri. Included in the project is a major pumping plant situated at the dam to lift water above the level of the dam in order to command lands of the villages of Akrounda and Phinikaria, mainly granted to them as a compensation and concession due to the inundation of their lands by the reservoir water.

Important work in the regional office is also the management of the Yermasoyia and Polemidhia dams in connection with the control of the Akrotiri aquifer.

A large project in Limassol district has finally been the completion of the Arakapas Mass Concrete Dam.

1.11.3 Paphos Regional Office

Important works in the district during the year have been the extension of the Mavrokolymbos dam distribution network.

Extensive investigations have been going on during the year in connection with the major Paphos Irrigation Project which is scheduled to start in 1976.

1.12 Finance, Expenditure and Revenue

During the year, the total expenditure (Government Ordinary and Development including Loans) was £2,163,259 including all administration costs (1964 Expenditure was £2,172,647).

The largest item of expenditure was on Major Waterworks Projects for which the sum of £690,107 was spent (including Loans).

The administration costs, including hydrological observations Consultants' Fees and Major Projects Investigations reached the sum of £475,146 during the year, represents 31% of the total Departmental expenditure. This, as can be seen from Table 4, is only 5% higher than that of 1974 (26%).

The level of the construction works carried out during 1975 was £1,688,113 (1974 was £1,716,250).

During the summer of 1975, the Council of Ministers announced the commencement of the 1975-1976 Emergency Plan for the Reactivation of the Island's Economy thus approving the additional amount of £737,555 in 1975, for the construction of Major, Minor and Village Water Supply Schemes.

The monthly expenditure of the Department, as can be seen from Table 3 is again very unevenly distributed, ranging from 1.62% in January and increasing to 58.02% in December.

This obviously is very unsatisfactory and it has to be attributed on the institutional set up of the Government in General, and the various Departments and Ministries dealing with water in particular. The formalities to authorize projects obviously take a long time and the first few months of the year are almost wasted as far as construction works are involved.

The sum of £203,927 was collected during the year (1974 £219,000) as revenue, mainly from the sale of water for the Greater Nicosia Scheme, and the Famagusta Water Supply Scheme.

Table 1 - 1975 Expenditure-Water Development Department

D e t a i l s		Government	Village	Total
1	Administration	350,818	-	350,818
2	Irrigation Drainage Dams	871,997	125,047	997,044
3	Town Water Supplies	57,525	112,000	169,525
4	Village Water Supplies	151,082	93,655	244,737
5	Drilling Prospecting	2,920	-	2,920
6	Hydrol.Obs.Research and Weirs	26,642	-	26,462
7	Construction	13,823	-	13,823
8	Purchases Machineries Tools and Equipments	6,405	-	6,405
9	Consultants' Fees	29,856	-	29,856
10	Major Projects Investigations and Surveys	41,769	-	41,769
11	Covt. Water Supplies	2,266	-	2,266
12	Greater Nicosia Scheme	271,379	-	271,379
13	Water Supply Special Measures Law	242	-	242
14	Stores	5,833	-	5,833
Total		1,832,557	330,702	2,163,259
<u>Breakdown of Administration</u>				
1	Personal Emoluments	206,433	-	206,433
2	Casual Assistance	14,612	-	14,612
3	Technical Assistance	42,054	-	42,054
4	Travelling	22,950	-	22,950
5	M'ce and Operation of Motor Transport	30,512	-	30,512
6	Office Expenses	3,246	-	3,246
7	Leave pay to Reg.Employees	31,011	-	31,011
Total		350,818	-	350,818

Table 2 - Monthly Statement of Ordinary Expenditure for the year 1975

HEAD : 17 A - Water Development

1975 Approved £ 391,487

Month	Monthly Expenditure £	Expenditure up-to-date £	Balance £	% to-date
January	21,950	21,950	369,537	5.61
February	22,146	44,096	347,391	11.26
March	30,288	74,384	317,103	19.00
April	27,322	101,706	289,781	25.98
May	32,664	134,370	257,117	34.32
June	23,428	157,798	233,689	40.31
July	28,874	186,672	204,815	47.68
August	23,366	210,038	181,449	53.65
September	35,985	246,023	145,464	62.84
October	22,805	268,828	122,659	68.67
November	30,770	299,598	91,889	76.53
December	47,197	346,795	44,692	88.58

Summary:

	Approved amount	£ 391,487	= 100 %
<u>Less</u>	Actual Expenditure	£ 346,795	= 88.58%
	Unspent Balance	£ 44,692	= 11.42%

Table 3 - Monthly Statement of Development Expenditure for year 1975

HEAD : 2D - Water Development

1975 Approved	£ 2,023,807
Add. Special Warrants	£ 536,902
Total	£ 2,560,709

Month	Monthly Expenditure £	Expenditure up-to-date £	Balance £	% to-date
January	41,477	41,477	2,519,232	1.62
February	56,857	98,334	2,462,375	3.84
March	130,644	228,978	2,331,731	8.94
April	91,870	320,848	2,239,861	12.53
May	148,865	469,713	2,090,996	18.34
June	86,316	556,029	2,004,680	21.71
July	61,505	617,534	1,943,175	24.12
August	105,412	722,946	1,837,763	28.23
September	129,847	852,793	1,709,916	33.30
October	88,486	941,279	1,619,430	36.76
November	169,288	1,110,567	1,450,142	43.37
December	375,195	1,485,762	1,074,947	58.02

Summary :

	Approved amount	£ 2,560,709 = 100%
<u>Less</u>	Actual Expenditure	£ 1,485,762 = 58.02 %
	Unspent Balance	£ 1,074,947 = 41.98%

Table 4 - Statement of Expenditure

HEAD 17 A - 2D and Loans

D e t a i l s		1 9 7 5
1	Administration	350,818
2	Construction	13,823
3	Stores	5,833
4	Purchase of Machineries Tools etc.	6,405
5	Hydrological Observations	26,642
6	Consultants' Fees	29,856
7	Major Projects Investigations	41,769
Sub-Total "A"		475,146
8	Drilling and Prospecting	2,920
9	Water Meter Special Measures Law	242
10	Town Water Supplies	443,170
11	Village Water Supplies	244,737
12	Small Irrigation Projects	300,717
13	Major Irrigation Projects	696,327
Sub-Total "B"		1,688,113
Grand Total		2,163,259
% of "A" to "B"		22%

Table 5 - Statement of Revenue collected during the year 1975

<u>HEAD Revenue No. 3</u>		
<u>Subheads</u>		£
121	Greater Nicosia Scheme	160,364
122	Famagusta Water Supply Scheme	24,813
123	Khirkitia Regional Water Supply Scheme	4,226
124	Drilling Charges	5,671
125	Other Fees	8,852
	Total	<u>203,926</u>

Table 6 - 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 & Misc of Plant	467	587	500	398	254	284	414	-	350	-
3	Purchase of Machinery, tools etc.	1,970	224	199	-	184	105	196	-	420	-
4	Hydrological Observations										
5	Consultants' Fees										
6	Major Project Investigations										
	Sub-total "A"	7,153	6,463	5,021	4,509	5,595	8,975	9,855	15,974	15,848	19,033
7	Drilling of water	680	952	527	486	642	2,700	3,180	660	360	25,171
8	Water Meters for Wells & Boreholes										
9	Town Water Supplies	1,169	925	908	1,043	1,169	1,827	2,448			
10	Village Water Supplies	8,980	1,613	5,560	4,956	6,887	5,730	3,413	19,000	31,871	42,190
11	Small Irrigation Projects	2,770	7,979	10,252	35,809	74,134	116,334	100,470	166,493	177,144	120,278
12	Major Irrigation Projects										
	Sub-total "B"	12,599	19,469	17,247	42,294	82,832	126,591	109,511	186,153	209,375	187,639
	Grand Total	19,752	25,932	22,268	46,803	88,427	135,566	119,366	202,127	225,223	206,672
	% of A to B	56.8	33.2	29.1	10.6	6.7	7.0	8.9	8.5	7.5	10.1

Ser. No.	Details	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
1	Administration	18,156	19,146	26,270	29,991	38,050	52,950	54,350	61,699	80,790	95,256
2	W/Shops & M'ce of Plant	-	-	39,111	10,826	14,150	13,000	13,000	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 Boreholes	-	-	-	-	-	-	-	-	-	-
9	Town Water Supplies	-	-	155,116	119,481	235,000	303,900	93,200	152,476	417,600	648,350
10	Village Water Supplies	53,410	106,370	100,137	214,732	256,000	255,000	196,850	280,955	215,600	87,225
11	Small Irrigation Projects	111,352	150,980	172,154	166,493	154,500	116,900	150,850	116,100	168,600	81,075
12	Major Irrigation Projects	-	-	-	15,000	15,000	20,000	30,000	35,000	35,000	50,000
Sub-Total "B"		£192,111	288,016	454,126	540,418	701,600	744,400	529,250	663,172	927,550	912,474
Grand Total		£210,267	307,162	522,846	585,141	771,800	821,900	611,400	852,172	1,064,000	1,049,125
% of A to B		9.4	6.6	15.1	8.2	10.0	10.4	15.5	28.4	14.7	14.9

Ser. No.	Details	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	Administration	81,677	64,255	70,527	81,983	151,580	130,164	135,410	145,389	183,927
2	W/Shops & M'ce of Plant & Stores	20,441	28,979	30,238	31,789	14,000	16,150	15,500	14,147	14,848
3	Purchase of Machinery, tools etc.	960	-	-	31,712	120,000	46,030	16,875	10,973	12,927
4	Hydrological Observations	7,090	6,059	10,640	40,520	40,500	43,223	28,200	18,863	20,538
5	Consultant's Fees	-	-	-	-	-	39,378	45,065	51,297	32,040
6	Major Projects Investigations	-	-	-	-	-	10,202	15,290	7,733	20,880
Sub-total "A"		£110,168	99,293	111,405	186,004	326,080	285,147	256,340	248,402	285,160
7	Drilling of Water	45,084	48,837	83,608	82,151	63,700	47,588	40,200	24,253	35,029
8	Water Meters for Wells & B/holes	-	-	-	-	-	-	-	983	2,672
9	Town Water Supplies	113,853	220,370	88,282	97,724	70,900	197,871	178,010	138,390	68,782
10	Village Water Supplies	113,493	137,825	602,436	602,537	486,600	507,679	404,600	108,926	130,340
11	Small Irrigation Projects	68,274	49,288	141,712	253,817	383,052	400,046	95,002	113,636	221,169
12	Major Irrigation Projects	50,000	50,000	120,000	150,000	414,943	369,420	691,349	689,010	941,131
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
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
% of A to B		28.2	19.6	10.7	15.4	22.9	18.7	18.1	23.1	80.3

Ser. No.	Details	1968	1969	1970	1971	1972	1973	1974
1	Administration	228,902	248,058	257,624	262,688	265,447	334,922	364,212
2	W/Shops & M'ce of Plant & Stores	25,594	38,268	24,896	24,200	29,415	28,512	29,589
3	Purchase of Machinery tools etc.	5,918	16,910	4,103	4,790	8,597	4,451	3,646
4	Hydrological Observations	19,768	22,365	42,393	19,359	21,816	19,984	21,478
5	Consultants' Fees	14,676	5,021	12,266	26,299	18,653	19,169	6,156
6	Major Projects Investigations	34,801	25,083	22,780	33,349	37,232	36,357	31,320
Sub-total "A"		329,659	355,705	364,062	370,685	381,160	443,395	456,401
7	Drilling of Water	49,095	22,938	46,033	50,388	11,168	10,727	9,678
8	Water Meters for Wells & B/holes	86	116	-	-	418	20	143
9	Town Water Supplies	171,190	937,325	265,062	184,804	342,129	275,964	374,604
10	Village Water Supplies	232,253	251,805	229,746	374,943	320,436	472,448	393,781
11	Small Irrigation Projects	174,065	237,594	151,386	99,178	118,341	159,713	242,662
12	Major Irrigation Projects	493,045	263,209	283,499	378,882	1,116,023	1,081,463	695,378
Sub-total "B"		1,119,734	1,717,987	975,726	1,088,195	1,908,515	2,000,335	1,716,246
Grand Total		1,449,393	2,073,692	1,339,788	1,458,880	2,289,675	2,443,730	2,172,647
% of A to B		20.3	17.2	37.3	25.0	20.0	22.0	26%

STATEMENT OF EXPENDITURE FOR THE YEAR 1975

Major Water Works (21-10) Year 1975

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
A. CONTRIBUTORY SCHEMES						
Arakapas Dam	29,142.000	9,714.000	38,856.000	28,505.624	9,501.877	38,007.501
Arakapas Distribution	2,215.000	738.000	2,953.000	2,207.718	735.907	2,943.625
Palekhori Kambi Dam	6,966.000	2,321.000	9,287.900	2,368.689	789.563	3,158.252
Palekhori River Diversion	7,054.000	2,350.000	9,404.000	4,270.584	1,423.529	5,694.113
Palekhori Kambi Distribution	45,000.000	15,000.000	60,000.000	32,485.976	10,828.658	43,314.634
Palekhori Kambi "Sklydros"	997.000	—	997.000	996.078	—	996.078
Palekhori Distribution	31.000	15.000	46.000	—	—	—
Agros Dam New Planket	193.000	30.000	223.000	—	—	—
Agros Pumping Scheme	44,000	31,000	95.000	—	—	—
<u>DAM GOVERNMENT ONLY</u>						
Massari Dam	6,503.000	—	6,503.000	6,318.817	—	6,318.817
Paphos Project	44,000.000	—	44,000.000	42,562.799	—	42,562.799
Yermasoyia Dam supervision	4,180.000	—	4,180.000	1,341.048	—	1,341.048
Lymbia Dam	1,000.000	—	1,000.000	353.000	—	353.000
Lefkara Dam (contractors)	1,218.000	—	1,218.000	1,212.013	—	1,212.013
Lefkara Dam	17,720.000	—	17,720.000	6,324.541	—	6,324.541
Khirokitia Treatment Works	11,744.000	—	11,744.000	7,176.515	—	7,176.515
Lefkara Khirokitia Pipeline	1,729.000	—	1,729.000	1,089.933	—	1,089.933
Mavrokolymbos	2,492.000	—	2,492.000	—	—	—
Paphos	9,000.000	—	9,000.000	1,239.426	—	1,239.426
<u>DISTRIBUTION</u>						
Mavrokolymbos Phase II	13,827.000	—	13,827.000	13,077.670	—	13,077.670
Mavrokolymbos Stago III	100,000.000	—	100,000.000	96,950.983	—	96,950.983
Polemichia Distribution	2,472.000	—	2,472.000	118.000	—	118.000
Ayia Marina	6,270.000	—	6,270.000	6,149.264	—	6,149.264
Pomos	10,000.000	—	10,000.000	9,621.869	—	9,621.869
Kiti	20,000.000	—	20,000.000	18,532.359	—	18,532.359
Argaka Makounda	3,249.000	—	3,249.000	3,247.831	—	3,247.831
Lefkara	56,000.000	—	56,000.000	54,618.798	—	54,618.798
C/F	403,066.000	30,199.000	433,265.000	340,769.535	23,279.534	364,049.069

Major Water Works (2D-10) Year 1975 (contd)

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
I/F	403,066.000	30,199.000	433,265.000	340,769.535	23,279.534	364,049.069
Yermasoyia Main Conveyer	158,220.000	—	158,220.000	135,149.618	—	135,149.618
Yermasoyia-Akronda-Phinikaria	81,618.000	—	81,618.000	66,425.186	—	66,425.186
Yermasoyia Zakaki Extension	38,250.000	—	38,250.000	38,246.847	—	38,246.847
Yermasoyia Ptasouri Extension	81,750.000	—	81,750.000	59,038.052	—	59,038.052
Yermasoyia Akronda-Phinikaria	28,700.000	—	28,700.000	27,197.316	—	27,197.316
Total	791,604.000	30,199.000	821,803.000	666,826.554	23,279.534	690,106.088

STATEMENT OF EXPENDITURE FOR THE YEAR 1975

Minor Irrigation Works (2L-11) YEAR 1975

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
Agros "K. Erimos"	330.000	260.000	590.000	327.020	256.945	583.965
Astromeritis	5,000.000	5,000.000	10,000.000	4,100.656	4,100.655	8,201.311
Ayios Theodoros "Koufes"	3,400.000	1,700.000	5,100.000	3,227.925	1,613.962	4,841.887
Ayios Theodoros "Lois"	933.000	467.000	1,400.000	823.625	411.812	1,235.437
Akaki	1,153.000	577.000	1,730.000	1,153.000	577.000	1,730.000
Agridhia	1,666.000	834.000	2,500.000	1,094.758	547.380	1,642.138
Dhali) "Ftelia"	14,466.000	4,040.000	21,700.000	7,182.534	2,005.723	10,773.801
) "Katevas"		3,194.000			1,585.544	
Dhierona	3,933.000	1,967.000	5,900.000	2,365.985	1,182.991	3,548.976
Episkopi Limassol	24,000.000	12,000.000	36,000.000	5,759.661	2,879.830	8,639.491
Erimi-Kolossi	784.036	392.018	1,176.054	758.109	379.055	1,137.164
Ergates Pumping Scheme	14,283.000	8,017.000	22,300.000	3,151.155	1,575.577	4,726.732
Ergates "Kourdoutsli"	5,232.329	4,829.842	10,062.171	4,773.184	4,406.016	9,179.200
Goudhi-Kholi-Skoulli	7,115.389	3,557.194	10,672.583	3,750.168	1,875.083	5,625.251
Idhalias River	12,459.765	—	12,459.765	8,239.744	—	8,239.744
Khoulou	17,666.000	8,834.000	26,500.000	8,938.659	4,469.330	13,407.989
Kato Platres	15,667.000	7,833.000	23,500.000	8,090.806	4,045.403	12,136.209
Kalopanayiotis	4,580.000	2,290.000	6,870.000	4,008.247	2,004.123	6,012.370
Kyperounda "Mavros Kolymbos"	1,040.000	520.000	1,560.000	772.965	386.481	1,159.446
Khandria	360.909	360.910	721.819	268.473	268.473	536.946
Khandria "Mavros Kolymbos"	1,266.000	634.000	1,900.000	1,082.029	541.014	1,623.043
Kalavassos	3,080.049	1,539.024	4,619.073	1,776.801	888.401	2,665.202
Klirou "Laoura"	1,743.683	1,162.456	2,906.139	1,743.586	1,162.390	2,905.976
Kolossi	12,666.000	6,334.000	19,000.000	2,116.076	1,058.038	3,174.114
Kyperounda "Vasilikos"	1,230.000	820.000	2,050.000	807.053	538.035	1,345.088
Lemona	16,333.000	8,167.000	24,500.000	7,161.693	3,580.847	10,742.540
Limatias "Alakati"	933.000	467.000	1,400.000	917.686	458.843	1,376.529
Mamonia	2,838.967	1,420.483	4,259.450	2,431.096	1,215.548	3,646.644
Mandria	3,677.503	1,838.752	5,516.255	2,151.609	1,075.804	3,227.413
Mandria "Mylaris"	5,733.000	2,867.000	8,600.000	4,399.416	2,199.707	6,599.123
Moutoullas	2,800.000	1,800.000	4,600.000	2,133.601	1,800.000	3,933.601
	186,370.540	93,722.679	280,093.309	95,507.320	49,090.010	144,597.330

C/F

Minor Irrigation Works (2D-11) YEAR 1975 (contd)

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
B/F	186,370.540	93,722.679	280,093.309	95,507.320	49,090.010	144,597.330
Nikoklia	2,200.000	1,100.000	3,300.000	1,217.053	608.525	1,825.578
Nikitari	3,267.000	1,633.000	4,900.000	3,098.855	1,549.429	4,648.284
Orounda	12,353.000	6,177.000	18,530.000	1,256.149	628.074	1,884.223
Palekchori "Maroullena"	1,120.000	880.000	2,000.000	900.485	707.525	1,608.010
Palekchori "Halkomatou"	1,000.000	500.000	1,500.000	787.008	393.504	1,180.512
Pharmakas	2,856.000	2,244.000	5,100.000	11.657	9.159	20.816
Prodrornos "Hardji"	191.996	95.998	287.994	191.996	95.998	287.994
Pelendria	1,720.000	860.000	2,580.000	1,289.302	644.650	1,933.952
Potamitissa "P. Potamos"	1,024.000	512.000	1,536.000	1,011.036	505.518	1,516.554
Potamitissa "Arsoulou"	933.000	467.000	1,400.000	851.470	425.736	1,277.206
Peyia	1,895,966	948.983	2,844.949	1,418.409	709.205	2,127.614
Pera-Politiko	5,082.585	2,543.293	7,625.878	5,082.585	2,543.718	7,626.303
Pissouri	7,893.855	3,947.930	11,841.785	7,047.163	3,523.581	10,570.744
Pera "Passera"	5,600.000	2,800.000	8,400.000	5,592.544	2,796.272	8,388.816
Phini	1,922.217	961.109	2,883.326	1,625.925	812.964	2,438.889
Peristerona	4,731.298	2,365.648	7,096.946	3,809.792	1,904.897	5,714.689
Paliometochi-Ayii Trimitias	10,000.000	—	10,000.000	7.000	—	7.000
Spilia	1,150.605	576.303	1,726.908	1,138.607	569.304	1,707.911
Skarinou Part II	1,310.176	85.538	1,395.714	646.441	42.142	688.583
<u>Solea Valley</u>						
Evrychou Phase I and II	11,133.000	5,567.000	16,700.000	8,492.841	4,246.421	12,739.262
Kakopetria Phase I and II	12,732.000	6,368.000	19,100.000	6,763.134	3,381.567	10,144.701
Koracou Phase I & II	15,693.000	7,847.000	23,540.000	10,313.300	5,156.650	15,469.950
Koracou-Phlasou-Linou	9,993.000	4,997.000	14,990.000	—	—	—
Katydhata "Jamin Mylos"	10,400.000	5,200.000	15,600.000	3,643.023	1,821.512	5,464.535
Kaliana Tembria	5,000.000	2,500.000	7,500.000	1,991.671	995.835	2,987.506
Linou "Linopsas"	10,926.000	5,464.000	16,390.000	41.667	20.833	62.500
Phlasou-Evrychou-Koracou Phase I & II	8,999.000	4,501.000	13,500.000	8,709.173	4,354.587	13,063.760
Phlasou "Ayios Epiphanytis"	13,973.000	6,987.000	20,960.000	9.727	4.863	14.590
C/T	351,471.238	174,851.481	523,322.809	172,455.333	87,542.479	259,997.812

Minor Irrigation Works (2D-11) YEAR 1975 (contd)

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
B/F	351,471.238	171,851.481	523,322.809	172,455.333	87,542.479	259,997.812
Tembria) Phase I and II	8,839.000	3,991.000	13,260.000	5,320.953	2,562.311	7,982.429
Koracou) (Phase II 4,573,+2,287)		430.000			99.165	
Tris Elies	4,082.086	2,041.043	6,123.129	3,341.230	1,670.615	5,011.845
Voroklini	1,143.576	572.288	1,715.864	1,097.330	548.665	1,645.995
Yiolou	15,667.000	7,833.000	23,500.000	14,550.685	7,275.342	21,826.027
Zoopiyi	2,600.000	1,300.000	3,900.000	2,452.494	1,300.000	3,752.494
Zyyi-Tohni	250.000	250.000	500.000	250.000	250.000	500.000
	384,052.990	188,268.812	572,321.802	199,468.025	101,248.577	300,716.602
Plus Adjust. 371 of August-Tsakkistre				380.000		
" " 163 of Sept.-Fyperounda "Frakti"				618.800		
				200,466.825		
			TOTAL			

STATEMENT OF EXPENDITURE FOR THE YEAR 1975

Village Water Supplies (2D-20)

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
Ayia Napa	2,500.000	2,500.000	5,000.000	1,357.920	1,357.920	2,715.840
Ayia Marina "Kelokedara"	2,100.000	2,940.000	5,040.000	1,288.491	1,802.898	3,091.389
Athienou	3,600.000	3,600.000	7,200.000	2,891.338	2,891.338	5,782.676
Ayios Theodoros Limassol	800.000	800.000	1,600.000	—	—	—
Apsiou	83.337	83.338	166.675	4.264	4.264	8.528
Arminou ¹ / ₃ Phase I	8,928.046	70.196	8,998.242	8,928.046	70.196	8,998.242
Arminou Phase II						
Kelokedara)		1,070.000			557.669	
Salamiou)	36,045.000	325.000	37,590.000	18,785.609	169.410	19,590.791
Mesara)		150.000			78.103	
Armou	1,680.729	1,968.107	3,648.836	151.884	177.870	329.754
Ayii Vavatsinias	1,494.646	1,494.646	2,989.292	1,011.087	1,011.087	2,022.174
Droushia	222.014	296.239	518.253	19.805	26.339	46.144
Ergates)		6,900.000			4,755.007	
Episkopio)	11,500.000	1,725.000	23,000.000	7,925.013	1,188.753	15,850.026
Kambia)		1,725.000			1,188.752	
Analiondas)		1,150.000			792.501	
Galata	14,900.000	14,900.000	29,800.000	4,068.075	4,068.074	8,136.149
Kiti	849.600	849.600	1,699.200	121.701	121.700	243.401
K. Khorio Limassol	2,319.000	2,319.000	4,638.000	1,388.668	1,388.667	2,777.335
Keravas	1,500.000	—	1,500.000	1,323.763	—	1,323.763
Kellaki	961.653	1,099.530	2,061.183	453.756	518.508	972.264
Koracou	76.257	88.281	164.538	76.285	87.801	164.086
Klirou)		28.655			25.966	
K. Khorio) Part I		—	34.746		—	32.057
Mitsero)		6.091			6.091	
Klirou) Part II						
K. Khorio	146.241	110.332	256.573	140.205	105.769	245.974
Klirou -K.Khorio Part B3	96.546	297.130	393.676	60.686	186.207	246.893
Lefkara Regional Scheme	3,266.140	—	3,266.140	206.277	—	206.277
C/F	93,069.209	46,496.145	139,565.354	50,163.263	22,528.212	72,691.475

Village Water Supplies (2D-20) contd.

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
Livadhia B/F	93,069.209 700.000	46,496.145 700.000	139,565.354 1,400.000	50,163.263 396.721	22,528.212 396.721	72,691.475 793.442
Lymbia } Shia } Kornos } Mosphiloti } Psevdas } Pyrga }	Part I 1,950.577	377.736 78.775 224.316 102.906 105.530 86.026	2,925.866	1,680.400	325.157 68.897 193.245 88.221 90.742 73.938	2,520.600
Lymbia Part II	2,736.066	1,368.032	4,104.098	1,165.166	582.583	1,747.749
Shia } Kornos } Mosphiloti } Psevdas } Pyrga }	Part B3 936.543	63.462 175.539 79.910 82.721 66.138	1,404.313	406.923	27.874 76.298 34.589 35.809 28.891	610.384
Lymbia Part B6	---	38.550	38.550	---	23.000	23.000
Mosphiloti } Psevdas } Pyrga }	Part B7 47.705	7.669 7.357 6.327	67.058	45.705	7.669 7.357 6.327	67.058
Mosphiloti Part B8	---	58.070	58.070	---	58.000	58.000
Psevdas Part B9	---	52.507	52.507	---	52.507	52.507
Psevdas Part B9+9A	676.216	11.123	687.339	588.213	9.322	597.535
Lymbia Part E13+104	1,279.606	---	1,279.606	590.015	---	590.015
Lymbia Part B6 New	12.888	---	12.888	1.000	---	1.000
Mosphiloti Part B8 New	14.709	5.230	19.939	2.495	0.878	3.373
Letymbou } Kallepia } Pittarkou }	Phase I & II 6,931.841	3,039.563 2,188.845 ---	12,160.249	3,592.264	1,575.556 1,134.400 ---	6,302.220
Mamonia	535.897	573.351	1,109.248	149.719	180.787	330.506
Malia	40.865	40.866	81.731	6.003	6.003	12.006
Marathounda	904.588	1,080.616	1,985.204	182.108	217.426	399.534
C/F	109,834.710	57,117.310	166,952.020	58,969.995	22,830.409	86,800.404

Village Water Supplies (20-20) conti.

Scheme	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
B/F	109,834.710	57,117.310	166,952.020	58,969.995	22,830.409	86,800.404
Ormidhia	2,000.000	276.000	2,276.000	1,993.134	275.142	2,268.276
Ormidhia	1,750.000	1,750.000	3,500.000	1,310.500	1,310.499	2,620.999
Pera	6,700.000	6,700.000	13,400.000	4,925.271	4,925.271	9,850.542
Pano Pyrgos Nicosia	526.321	265.163	791.484	386.541	193.272	579.813
Pendalia	3,250.000	4,690.000	7,940.000	1,620.523	2,338.732	3,959.255
Phrenaros	12,100.000	12,100.000	24,200.000	10,062.332	10,062.331	20,124.663
Piyenia	2,621.472	1,311.236	3,932.708	240.491	120.246	360.737
Paliometochos	5,000.000	5,000.000	10,000.000	3,960.081	3,960.080	7,920.161
Phinikaria	1,750.000	1,750.000	3,500.000	1,202.502	1,202.502	2,405.004
Paphos Lower Villages	48,085.000	1,915.000	50,000.000	22,350.430	890.113	23,240.543
Psathi	1,625.000	1,865.000	3,490.000	944.437	1,083.994	2,028.431
Polis-Prodromi	987.360	987.360	1,974.720	522.391	522.389	1,044.780
Panayia	741.072	964.062	1,705.134	5.681	7.384	13.065
Pano Kyvidhes } Souni Sanatzia }	5,507.038	3,755.099	11,014.077	5,223.492	3,561.376	10,446.984
		1,751.940			1,662.116	
Potami } Vyzakia }	221.403	66.166	442.805	155.199	69.839	310.397
		155.236			85.359	
Potami Part II	1,117.106	1,467.534	2,584.640	4.758	6.246	11.004
Pyrgos Limassol	3,338.048	3,338.049	6,676.097	2,109.387	2,109.386	4,218.773
Sanida	1,733.000	867.000	2,600.000	782.193	391.096	1,173.289
Simou	51.122	51.122	102.244	-116.309	-116.309	-232.618
Tala	4,850.000	6,290.000	11,140.000	3,157.191	4,094.053	7,251.244
Stroumbi } Polemi }	1,852.553	747.691	3,705.107	1,852.553	747.691	3,705.107
		1,104.863			1,104.863	
Stroumbi } Polemi }	9,550.000	3,632.000	19,100.000	4,927.821	1,874.051	9,855.643
		5,918.000			3,053.771	
Skarinou } Ayios Theodoros } Alaminos }	1,439.757	215.963	2,879.512	375.633	56.345	751.266
		935.842			244.162	
		287.950			75.126	
C/F	226,630.962	127,275.586	353,906.548	126,966.227	73,741.535	200,707.762

Village Water Supplies (20-20) contd.

S c h e m e	Estimated Cost			Actual Expenditure		
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils
B/F	226,630.962	127,275.586	353,906.548	126,966.227	73,741.535	200,707.762
Tsada	1,638.033	1,638.033	3,276.066	456.267	456.265	912.532
Trachoni	1,905.440	2,655.209	4,560.649	1,749.812	2,438.347	4,188.159
Vyzakia Part III	675.649	798.698	1,474.345	19.559	23.108	42.667
Voroklini	1,190.000	1,190.000	2,380.000	792.144	792.144	1,584.288
Xylotymbou	949.732	949.733	1,899.465	937.337	937.336	1,874.673
Xylotymbou	2,000.000	—	2,000.000	2,000.000	—	2,000.000
Yiolou	850.000	850.000	1,700.000	727.812	727.811	1,455.623
Ypsomas	12,314.693	3,694.408	24,629.387	11,680.913	3,504.273	23,361.826
Polemihia		8,620.286			8,176.640	
Xylotymbou	3,500.000	3,500.000	7,000.000	357.419	357.419	714.838
Phrenaros	2,500.000	2,500.000	5,000.000	2,500.000	2,500.000	5,000.000
Total	254,154.507	153,671.953	407,826.460	148,187.490	93,654.878	241,842.368

Plus Adjustment 153 of March - Ay. Demetrios

Plus Adjustment 556 of April - Paralimni

274.992
2,620.000
151,082.482

List of Senior Technical Staff

Name	Post	Qualifications
Christos A. Konteatis	Director	B.Sc. (Civil Eng.) University of London, F.I.C.E., F.I.W.E.
Constantinos Lytras	Assistant Director	Dipl. (Natural Science) University of Athens, M.Sc. (Geology) University of London, D.I.C. Engineering Geology
X Kyprianos C. Hassabis	Assistant Director	B.Sc. (Civil Eng.) University of London, M.E., M.I.C.E., M.A.S.C.E.
Christodoulos Christodoulou	Senior Water Engineer	Dipl. (Civil Eng.) National Technical University of Athens
Christos Marcoullis	Executive Engineer Class I	M.Sc. in Agricultural and Irrigation Engineering Dipl. (Civil Eng.) National Technical University of Athens
Andreas P. Georghiades	Executive Engineer Class I	Dipl. Tech. (Civil Eng.) University of London, M.Sc. University of Birmingham, M.I.C.E., M.I.W.E.
Costas Andreou	Executive Engineer Class I	Dipl. (Civil Eng.) University of Dresden, Diploma in Hydraulic Engineering, Delft, Water Works Engineering, Tokyo.
X Charis Lapas	Executive Engineer Class I	B.Sc., (Civil Eng.) University of Glasgow
Christodoulos Artemis	Executive Engineer Class I	B.Sc., (Civil Eng.) (Hons) University of London, A.C.G.I., M.Sc. (Soil Mechanics) D.I.C., Assoc. Memb. I.C.E., - F.G.S.
Nicos Stylianou	Executive Engineer Class I	Dipl. (Civil Eng.) The Polytechnic London, M.Sc. (Foundation Eng.) University of Birmingham, C. Eng., M.I.C.E.
X Pantelis Loucaides	Executive Engineer Class I	B.Sc. (Eng.) Civil Engin. London University, M.Sc. (Foundations) Birmingham University).
X Vlasis Partassides	Executive Engineer Class I	Dipl. (Civil Eng.) University of Moscow, M.Sc. (Civil and Industrial Eng.) University of Moscow.
X Andreas Protopapas	Executive Engineer Class I	B.Sc. (Civil Engineering) University of Newcastle
Charalambos Palantzis	Executive Engineer Class I	B.Sc. (Civil Eng.) University of London, Assoc. Member I.C.E.
Maria Zachariou	Executive Engineer Class II	B.Sc. (Eng.) Civil Eng. London University, Member of Institute of Civil Engineers and Architects

Name	Post	Qualifications
Andreas Lambou	Executive Engineer Class II	M.Sc. (Water Building Engineering) Dipl. (Civil Eng.) University of Budapest.
Charalambos Krikiotis	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London, M.Sc. (Eng. Geology) University of Leeds
Theodoros Nicolaides	Executive Engineer Class II	B.Sc. (Eng.) University of London, Kings College, A.K.I. (Associate of Kings College)
Kyriacos A. Spanos	Executive Engineer Class II	B.Sc. (Civil Eng.) University of Southampton U.K. (M.Sc. (Irr. Eng.) University of Southampton U.K.
Tassos N. Hamatsos	Executive Engineer Class II	B.Sc. (Civil Eng.) M.Sc. (Dipl. Eng.) Water and Hydraulic Engineering, University of Dresden, East Germany
X Christos Papamichael	Executive Engineer Class II	B.Sc. (Hons.) (Civil Engin.) University of Manchester M.Sc. (Concr. Structures of Technology) University of London, D.I.C
Dedalos Kypris	Geologist Class I	Dipl. (Natural Science) University of Athens, D.I.C. Applied Geophysics
③ Michalakis Peppis	Geologist Class I	B.Sc. (Geology) American University of Beirut, M.Sc. (Geology) American University of Beirut.
Iacovos Iacovides	Hydrologist Class I	B.Sc. (Hydrology) University of Arizona
Christos Phanartzis	Hydrologist Class I	M.Sc. (Hydrology) B.Sc. (Hydrology) University of Arizona, A.M.A.G.U.
Christos Ioannou	Hydrologist Class I	Diploma (Natural Science) University of Salonica, Dipl. (Hydrogeology) University of London, Dipl. (Groundwater Research) University of Jerusalem.
Savvas Theodossiou	Mechanical Engineer Class I	B.Sc. (Mechanical Eng.) University of Manchester, M. Eng. in Desalination Technology University of Glasgow.

Name	Post	Qualifications
Demosthenis Patsalides	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Institute of Technology, M.A.E.A.I., Assoc. Memb. I.C.E. Diploma in Hydraulic Engineering, Delft.
Nicos Tsiourtis	Topographer/Irrigation Eng.	M.Sc. (Civil Engineering) B.Sc. (Agricultural Eng.) Technion Israel Inst. of Technology, M.A.E.A.I., Assoc. Memb. I.C.E.
Elias Kambourides	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Inst. of Technology M.A.E.A.I. Assoc. Memb. I.C.E.
Loucas P. Savvides	Topographer/Irrigation Eng.	B.Sc. (Agricultural) Salonica University, M.Sc. Irrig. Davis University, California
P. Neophytides	Topographer/Irrigation Eng.	Dipl. (Rural and Topography Engineering) National Technical University of Athens
Niki Michael	Topographer/Irrigation Eng.	Dipl. (Rural and Topography Eng.) National Technical University of Athens
Panos Pantelides	Superintendent of Works	
Nicos Toufexis	Superintendent of Works	
George Charalambous	Superintendent of Works	

TECHNICAL STAFF OF W.D.D. ON 31.12.75

DRG. No. BM/G/29

MONTHLY AND DAILY PAID TECHNICAL STAFF		D	AD	SWE	EH	EE	ME	Geo	H	QS	TIE	LA	SW	SIW	EDR	IW	CF	ACF	TA	DR	F	Total Nos	REFERENCE	
1	Permanent staff	1	2	1	1	15	1	2	2				3	6	1	17	4	8	45		40	149	D Director	
2	Temporary staff					5			1	1	4	1		2		5		4	22	8	15	68	AD Assistant Director	
3	Daily paid staff					1					2								38			41	SWE Senior Water Engineer	
TOTAL NUMBERS		1	2	1	1	21	1	2	3	1	6	1	3	8	1	22	4	12	105	8	55	258	EH Engineer Hydrologist	
DISTRIBUTION OF STAFF																							EE Executive Engineer	
3	Divisions	i	Water Resources						2	2			1			5			20		2	32	ME Mechanical Engineer	
		ii	Planning				2									1			9		1	13	Geo Geologist	
		iii	Design				7				5				1	1			21	7		42	H Hydrologist	
		iv	Construction				3	1							2		9	1	10	3	33	62	QS Quantity Surveyor	
		v	Small Projects Planning											1	2		4	1	1	4			13	TIE Topographer/Irrigation Engineer
		vi	Operation & Maintenance											1	1		1		1	2		2	8	LA Legal Adviser (on contract)
4	Administration (Head Office)	1	2			1					1											5	SW Superintendent of Works	
5	Regional Offices (Limassol, Larnaca & Paphos)					5							1		1	1		25	1	2	36	SIW Senior Inspector of Works		
6	Turkish Officers absent from duty					2												13		2	17	EDR Engineering Draughtsman		
7	On scholarship			1				1			1											3	IW Inspector of Works	
8	Vacancies				1	1			1				2			1		8*		13	27	CF Chief Foreman		
TOTAL NUMBERS		1	2	1	1	21	1	2	3	1	6	1	3	8	1	22	4	12	105	8	55	258	ACF Assistant Chief Foreman	
																							TA Technical Assistant	
																							DR Draughtsman	
																							F Foreman	
																							* 7 monthly paid and one D. Paid	

II. DIVISION OF
WATER RESOURCES

By
D. Kypris
Head of Division

2.1 Preface

During the year under examination still 40% of Cyprus land was under Turkish occupation. In the Turkish occupied zone no hydrological data were allowed to be collected and for second year the behaviour both of surface run off and groundwater bodies could not be followed or recorded there.

During the year considerable effort has been made for reconstructing the hydrogeological archives, which are kept at this Division and which have been destroyed by fire during the events of July, 1974. So, 5880 springs, chain-of-wells and boreholes have been plotted again in an area of 477 sq.km. and new maps have been prepared for 22 villages.

In this unfortunate situation, where hydrological records of over 40 years duration have been lost, it was fortunate that a number of measurements have been found in old files where information was either originally recorded, or transferred from the archives for the purpose of designing water-works.

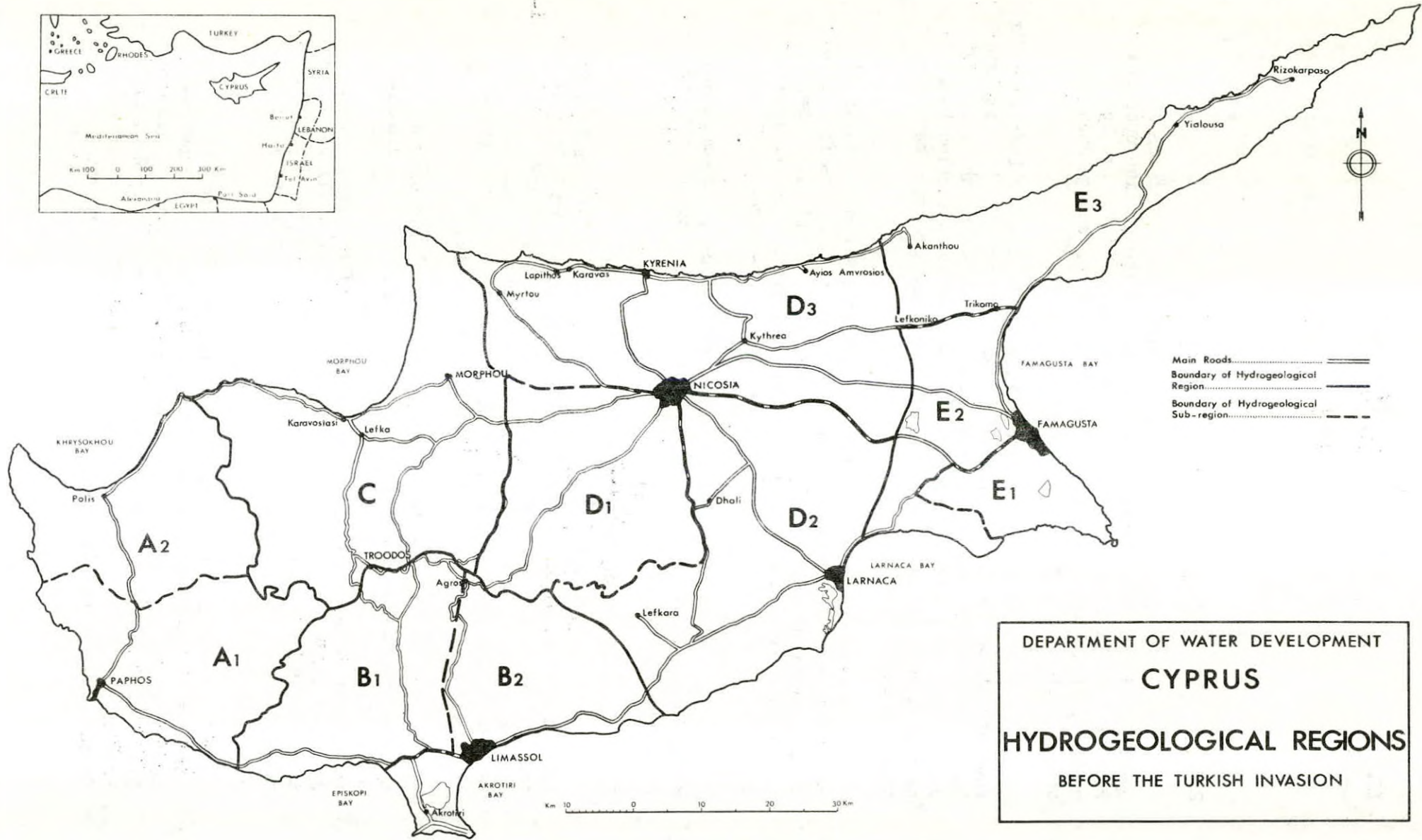
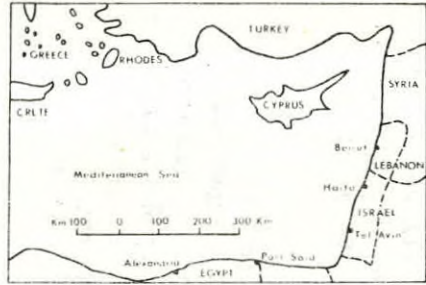
So, information about spring flows, stream flows, water supply records which originally was thought to be lost have been recovered by about 80%.

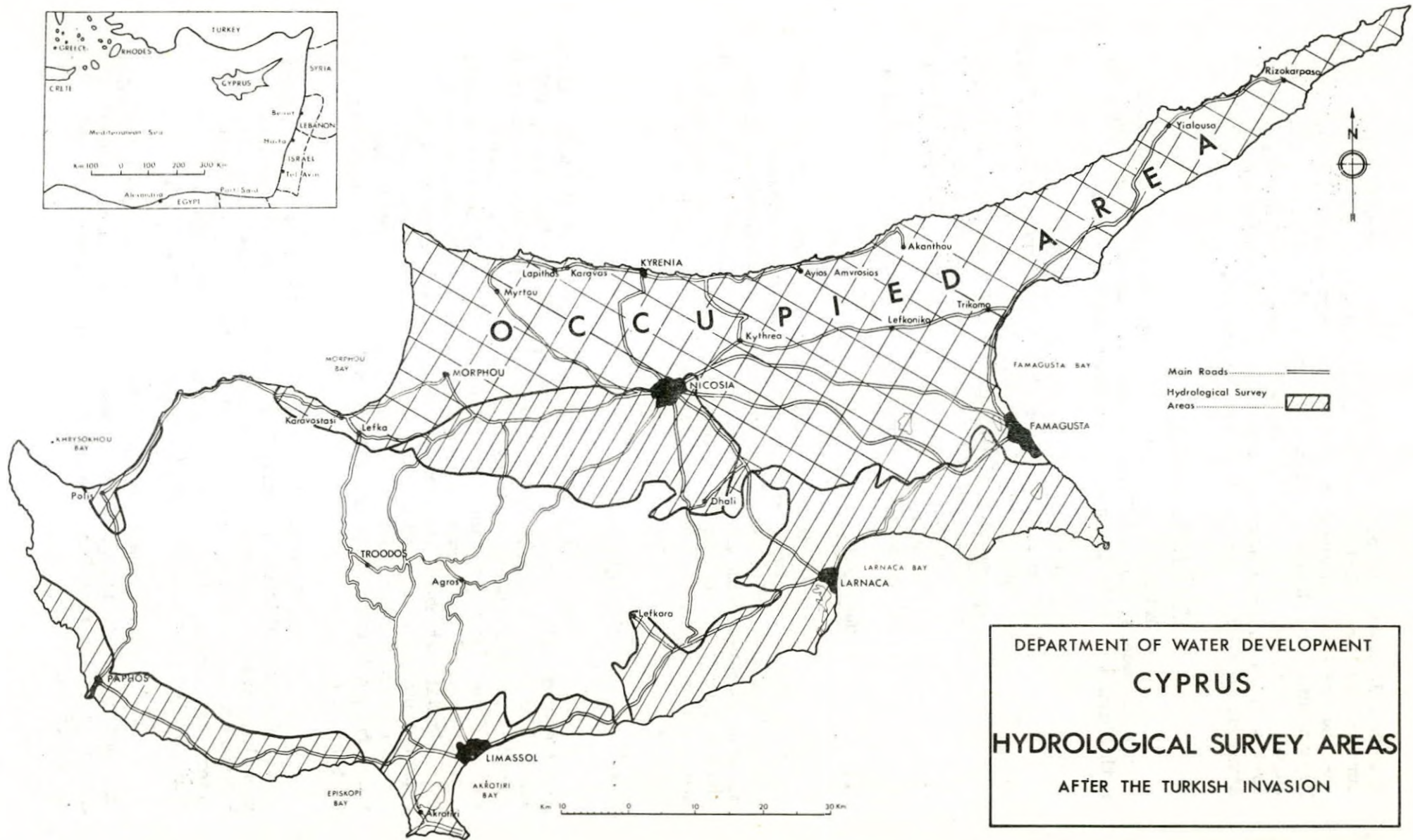
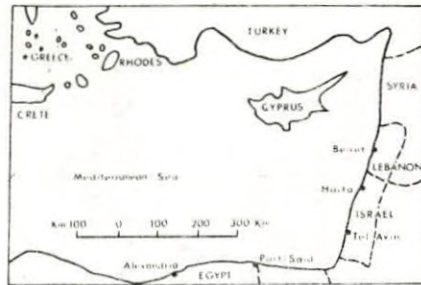
2.2 Introduction

The Division of Water Resources deals mainly with the collection and interpretation of Hydrological and Hydrogeological data regarding both ground and surface water, engineering geology problems as connected with the planning and execution of water works projects, carried out ancillary drilling operations and controls groundwater extraction and use.

The original division of Cyprus into eleven hydrogeological regions based on both hydrogeological and administrative criteria, which has been followed in the past for reasons of better control on the collection of hydrogeological data and thorough hydrogeological studies, was not followed during the year under examination, since the Turkish troops are still occupying part of Cyprus. The new arrangement followed is seen on map on page 57.

During 1975, Mr. D.C. Kypris, Geologist Class I, acted as the Head of Division. Mr. N. Chr. Toufexis, Superintendent of Works, was the Assistant Head. Mr. M. Peppis, Geologist Class I was the Head of the Drilling Permits and Water Control Branch. Mr. Peppis acted also as the president of the specially formed advisory committee for the issue of well permits.





Main Roads
 Hydrological Survey Areas

DEPARTMENT OF WATER DEVELOPMENT
 CYPRUS
 HYDROLOGICAL SURVEY AREAS
 AFTER THE TURKISH INVASION

Mr. Chr. Ioannou, Hydrologist Class I, acted as head of the Surface and Ground Water Branches of the Division until August, when he has been attached to special projects carried out by the Department. Mr. Chr. Phanartzis, Hydrologist Class I, until August, when he went abroad on leave and Mr. J. Jacovides, Hydrologist Class I, were serving during 1975, as Hydrologists attached to special projects of the Department.

2.3 Drilling Operations

Drilling operation for water continued this year on a small scale; one drilling rig Ruston Bucyrus 22W was engaged, with which the following operations were carried out :-

- (a) Cleaning of 3 existing boreholes
- (b) Drilling of 5 boreholes for Domestic Water Supply purposes. Penetrated depth 120.0 m.
- (c) Removing of casings from 2 Government boreholes
- (d) Enlarging and casing of 3 boreholes drilled for domestic water supply purposes. Penetrated depth 242.0 m.
- (e) Removing of pumps stuck or broken in boreholes

2.4 Meteorological Notes

The precipitation and other climatological elements recorded at the observing stations of the Cyprus Government Meteorological Service have been analysed. Meteorological information received from the Northern part of the island which is under the occupation of the Turkish troops, was very few and assumptions and extrapolations were necessary to complete the picture in the island.

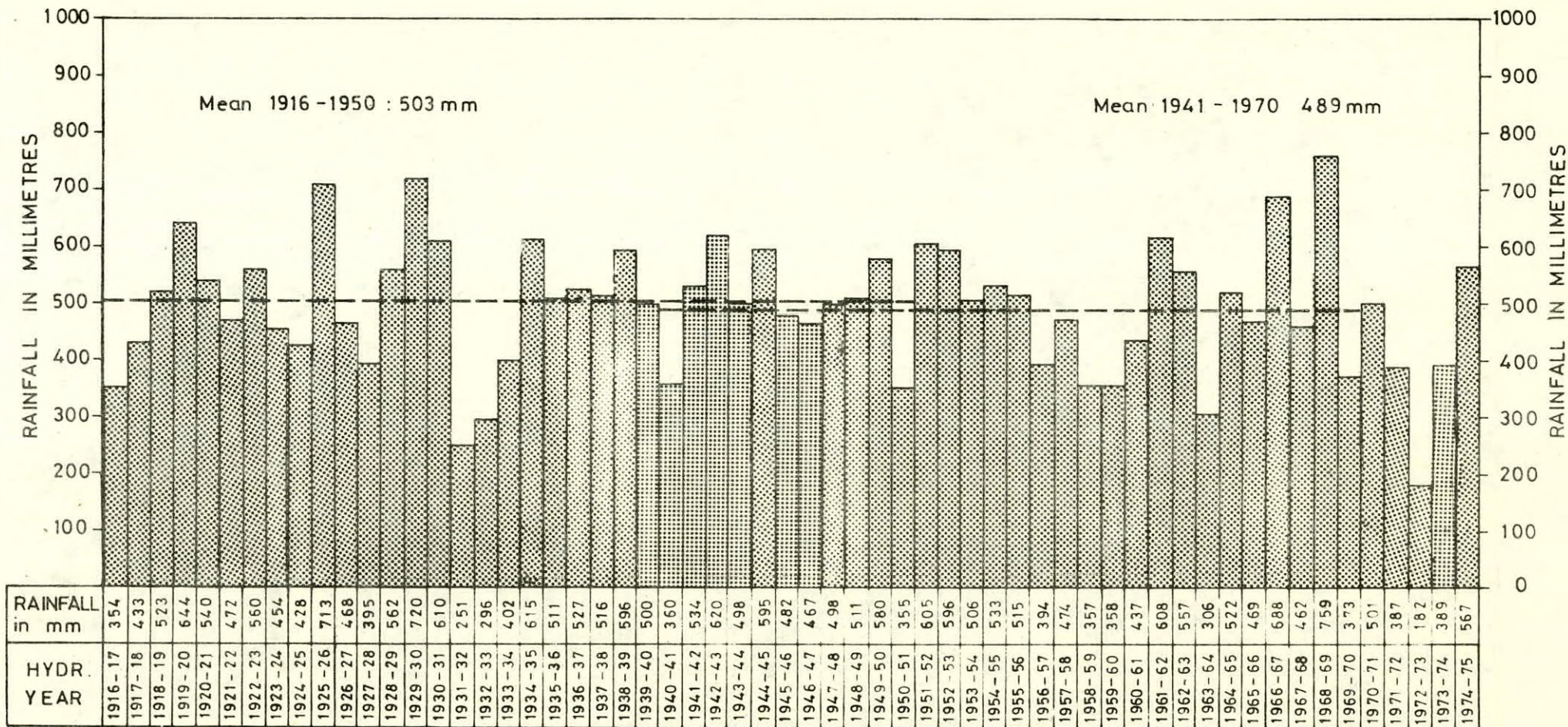
2.4.1 Precipitation

The total precipitation averaged over the whole island for the hydrometeorological year October, 1974, to September, 1975, was 567 mm which is 116% of normal (489 mm) this being, the average for the period 1941-1970 (see diagram on page 59). Over most of the island precipitation ranged between 105% and 125% of normal. A small area of the southern coast in Larnaca district received precipitation at about the normal level, and the major part of Paphos district with a small part of Limassol district received precipitation during the hydrometeorological year under review which ranged between 125% and 150% of normal (see Isohyetal map on page 60).

The distribution of precipitation in time was rather good. January, February, April, May and June were wetter than normal. November and December precipitation amounts were slightly below normal. October, March, August and September were much drier than normal, while July was absolutely dry. The wettest month of the year was February (see diagram on page 61).

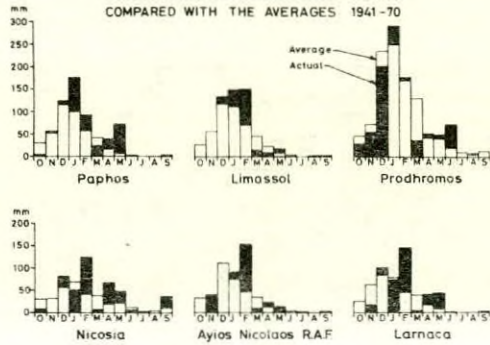
The highest 24 hours time rainfall recorded during the past hydrometeorological year, was measured from a standard rain gauge at Amiandos Pano Mines, on the 9th January, 1975 and was 126.5 mm.

ANNUAL AVERAGE RAINFALL OF CYPRUS FROM 1916 - 1975



TOTAL ANNUAL PRECIPITATION (IN MM) OF CYPRUS OCTOBER 1974 - SEPTEMBER 1975

ACTUAL MONTHLY PRECIPITATION 1974-75
COMPARED WITH THE AVERAGES 1941-70



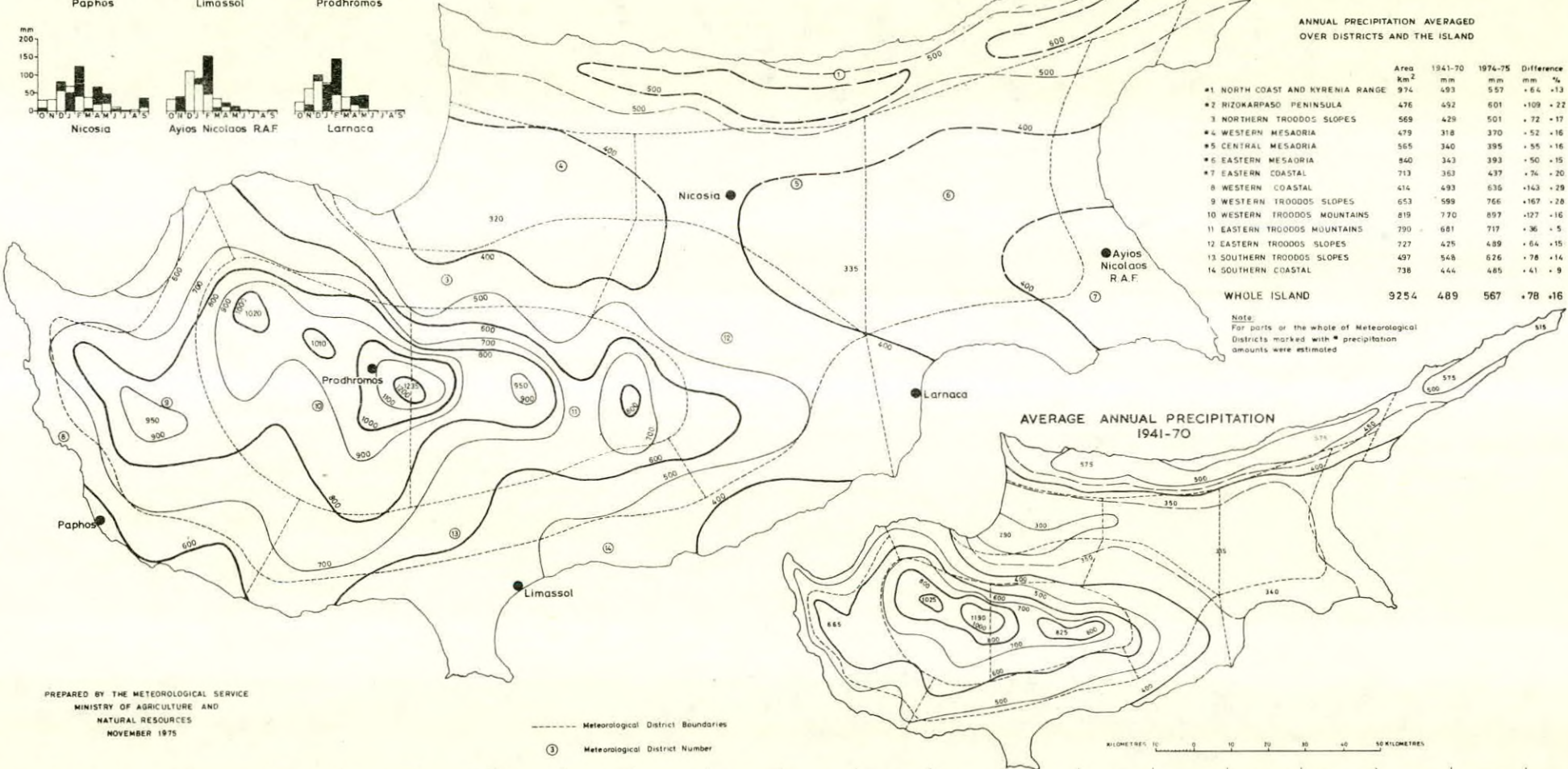
KILOMETRES 0 5 10 15 20 25 30 35 40 45 KILOMETRES

ANNUAL PRECIPITATION AVERAGED
OVER DISTRICTS AND THE ISLAND

	Area Km ²	1941-70 mm	1974-75 mm	Difference mm	%
*1 NORTH COAST AND KYRENIA RANGE	974	493	557	+64	+13
*2 RIZOKARPASO PENINSULA	476	452	601	+109	+22
3 NORTHERN TROODOS SLOPES	569	429	501	+72	+17
*4 WESTERN MESAORIA	479	318	370	+52	+16
*5 CENTRAL MESAORIA	565	340	395	+55	+16
*6 EASTERN MESAORIA	840	343	393	+50	+15
*7 EASTERN COASTAL	713	363	437	+74	+20
8 WESTERN COASTAL	414	493	636	+143	+29
9 WESTERN TROODOS SLOPES	653	589	766	+167	+28
10 WESTERN TROODOS MOUNTAINS	819	770	897	+127	+16
11 EASTERN TROODOS MOUNTAINS	790	681	717	+36	+5
12 EASTERN TROODOS SLOPES	727	425	489	+64	+15
13 SOUTHERN TROODOS SLOPES	497	548	626	+78	+14
14 SOUTHERN COASTAL	738	444	485	+41	+9
WHOLE ISLAND	9254	489	567	+78	+16

Notes:
For parts or the whole of Meteorological Districts marked with * precipitation amounts were estimated

AVERAGE ANNUAL PRECIPITATION
1941-70



PREPARED BY THE METEOROLOGICAL SERVICE
MINISTRY OF AGRICULTURE AND
NATURAL RESOURCES
NOVEMBER 1975

--- Meteorological District Boundaries
① Meteorological District Number

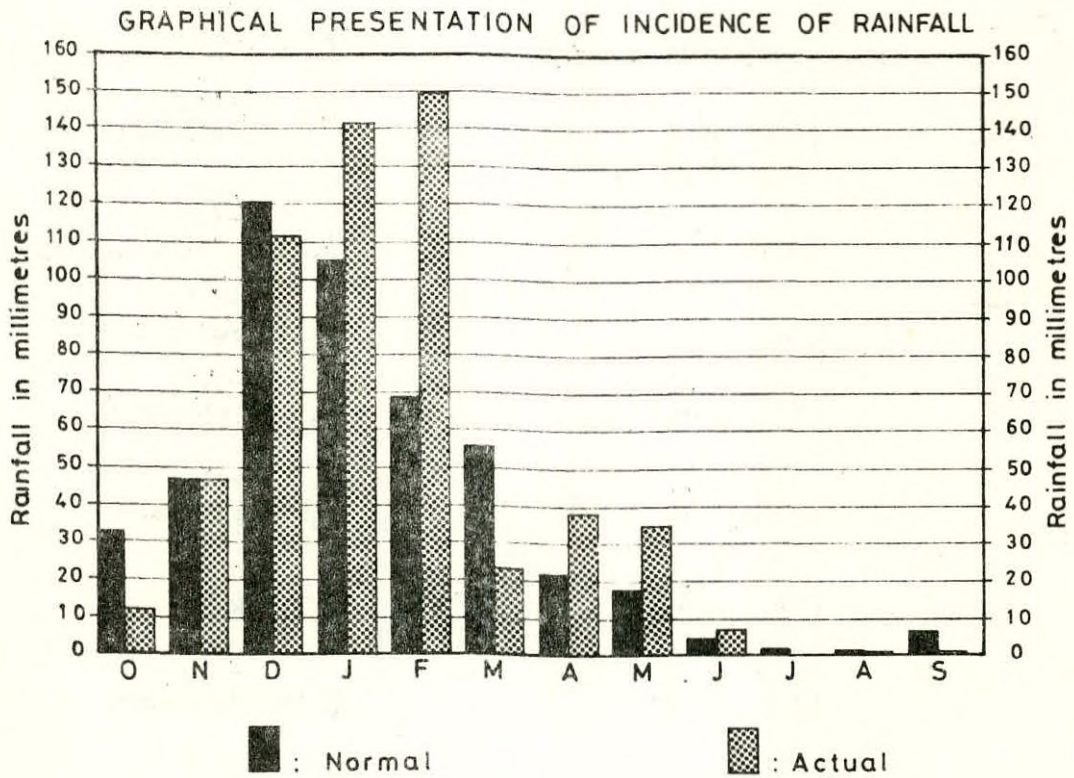
KILOMETRES 0 10 20 30 40 50 KILOMETRES

1/G/

INCIDENCE OF RAINFALL

The incidence of rainfall per month as worked out from selected rainfall stations during the hydrological year 1974-1975 is given as under :-

Month	Rainfall		Percentage %
	Rainfall in mm	Rainfall in inches	
October	11.9	0.47	2.1
November	47.0	1.85	8.3
December	111.7	4.40	19.7
January	141.7	5.58	25.0
February	149.8	5.90	26.4
March	23.3	0.92	4.1
April	38.2	1.50	6.8
May	34.7	1.36	6.1
June	7.5	0.29	1.3
July	0.0	0.0	0.0
August	0.7	0.03	0.1
September	0.5	0.02	0.1
Totals	567.0	22.32	100.0



The first snowfall occurred on Mount Olympus on the 4th December, 1974. The last snowfall occurred on the 29th April 1975, later in the season than usual.

2.4.2 Temperature

In the calendar year 1975, the monthly mean air temperatures were mainly above normal in October, March, April, July and September and mainly below normal in November, December, January, February, May, June and August.

The extreme maximum and minimum air temperature recorded during the past calendar year 1975 at various Meteorological Stations are given below :

Station	Extreme maximum temperature and date	Extreme minimum temperature and date
Nicosia	40.9 (29th August)	-0.2 (11th February)
Limassol	34.8 (28th May 6th June 17th July)	0.0 (11th February)
Larnaca	37.5 (16th July)	0.5 (11th February)
Ay.Nicolaos (Famagusta)	37.0 (2nd June)	-1.0 (11th, 12th February)
Paphos	34.2 (9th September)	2.1 (11th February)
Panayia Bridge	37.5 (29th, 30th August)	-4.0 (11th February)
Saittas	36.0 (26th July 28th August)	-3.5 (11th February)
Amiandos	33.0 (30th August)	-7.0 (10th, 11th February)
Prodromos F.S.	32.0 (31st August)	-7.5 (11th February)
Stavros tis Psokas	36.8 (30th August)	-3.7 (11th February)
Kornos	37.0 (25th, 26th July)	-1.5 (10th February)
Platania	34.5 (31st August)	-6.0 (11th February)
Phassouri	35.0 (26th July)	-4.5 (11th February)

2.4.3 Evaporation

Evaporation is an important constituent in hydrological balances and it has to be taken into account also in planning water-works. Systematic measurements of evaporation rates are taken at selected places a monthly summary of which appears on the relative table.

Total monthly evaporation in mm from the U.S.W.B. Class "A" Pan for the hydrometeorological year 1974-1975 at selected places

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual Total
Nicosia	137	72	33	40	47	115	152	180	239	285	241	210	1751
Athalassa	122	69	33	41	46	119	157	193	279	318	283	243	1900
Saittas	157	84	x*	≡	≡	≡	161	130	212	263	245	206	
Akheia	153	121	85	86	74	103	149	178	206	229	221	211	1816
Yermasoyia	160	97	47	53	72	126	187	198	283	291	254	225	1993
Polemihia	134	114	65	77	82	134	182	191	240	255	232	214	1920
Prodromos	125	55	≡	≡	≡	≡	148	125	186	228	196	153	

≡ No records

2.5 Surface Water

2.5.1 Permanent Stream Gauging Stations

On important rivers at selected places permanent flow gauging stations have been established equipped with automatic recorders, from the records of which the volume of flowing water may be deduced. In order that the recorders are kept operating properly, weekly or monthly visits are necessary to these for the rewinding of the clocks, the changing of charts and cleaning of the measuring weirs. It is also necessary to carry out velocity measurements of the flowing water for calibration purposes during floods. Unfortunately we have not been able to attend our gauging stations in the Northern part of Cyprus because the Turkish troops are still occupying the area. The condition of those marked in the table with an asterisk is not known to us.

Gauging station No.	Stream	Location	Co-ordinates
1-1-3-95	Khapotami	Kissousa	VD805513
1-1-7-95	Khapotami	Kouklia	VD627383
1-2-4-95	Dhiarizos	Philousa	VD754575
1-2-7-90	Dhiarizos	Kouklia	VD601411
1-3-5-05	Xeros	Lazaridhes	VD725652
1-3-8-60	Xeros	Phinikas	VD615470
1-4-4-50	Ezouza	Kannaviou	VD610633
1-4-9-80	Ezouza	Akheia	VD524444
1-8-2-80	Avgas	Toxeftra(Akamas)	VD394644
2-2-3-95	Khrysokhou	Skoulli	VD497709

Gauging Station No.	Stream	Location	Co-ordinates
2-2-6-90	Stavros-tis-Psokas	Evretou	VD520705
2-7-2-75	Pyrgos	Phileyia	VD717857
2-8-3-15	Limnitis	Limnitis Saw Mill	VD739830
2-9-3-40	Marathos	Varisha	VD770872
2-9-4-90	Kambos	Potamos tou Kambou	VD826892
3-1-3-95	Xeros	Karavostasi	VD852889
3-2-4-95	Marathasa	Karavostasi	VD863895
3-3-1-70	Ay. Nicolaos	Kakopetria	VD900707
3-3-2-60	Platania	Kakopetria	VD927698
3-3-3-95	Karyotis	Evrykhou	VD906773
3-3-5-95	Karyotis	Pendayia	VD883902
3-4-2-90	Atsas	Evrykhou	VD931810
3-5-4-40	Elea	Vizakia	WD018806
3-7-1-50	Peristerona	Panayia F.S	WD075754
3-7-3-90	Akaki	Malounda	WD163783
3-7-5-95	Merika	Avlona	WD093924
3-7-7-85	Skylloura	Ay. Vasilios	WD156969
3-7-8-60	Ovgos	Kyra	WD050964
3-7-8-65	Ovgos	Ovgos Dam	WD034973
3-7-9-50	Serakhis	Morphou Dam	WD007948
3-7-8-90	Ovgos	Morphou	VD973974
3-8-6-50	Aloupos	Aloupos Chiftlik	VE980018
4-2-3-70	Panagra	Panagra	WE077119
4-3-3-32	Kephalovrysos		
	Spring	Kythrea	WE077119
4-4-2-50	Boghazi	Kyrenia Road Forest	WE296077
5-2-3-50	Melini	Ay. Trias	XE125337
5-9-4-90	Kharangas	Boghaz (Famagusta)	WE883100
6-1-1-80	Ay. Onoufrios	Kambia	WE225735
6-1-1-85	Pedhieos	Kambia	WE224741
6-1-4-20	Tengelis	Kythrea	WE415010
6-1-4-50	Pedhieos	Mia Milia	WE376958
6-1-5-50	Vathys	Athalassa	WD345867
6-5-3-15	Yialias	Nisou	WE359765
6-5-2-95	Alikos	Ay. Sozomenos	WD413808
6-5-3-95	Yialias	Pyroi	WD446824
7-1-7-50	Kolopannes	Kalopsidha	WD746842
7-2-3-50	Liopetri	U/S Liopetri Dam	WD806732
7-2-7-05	Paralimni Lake Out Flow	Paralimni	WD892801
8-2-1-90	Aradhippou	Nicosia-Larnaca road	WD517683
8-2-2-90	Aradhippou	Panayia Yematousa	WD516689
8-4-3-40	Tremithos	Ayia Anna	WD442668
8-4-5-30	Tremithos	Klavdhia	WD490615
8-4-4-40	Tremithos	Kiti Dam	WD510590
8-5-1-90	Bouzis	Mazotos	WD472518
8-7-3-60	Mylou	Kornos	WD332613
8-7-4-80	Syrgatis	Skarinou Station	WD343535
8-8-2-50	Maroni	Vavla	WD261558
8-8-3-30	Maroni	Khirokitia Station	WD317503
8-9-6-50	Vasilikos	Kalavasos	WD275472

Gauging Station No.	Stream	Location	Co-ordinates
8-9-7-95	Vasilikos	Vasilikos	WD292425
9-2-3-85	Yermasoyia	Phinikaria	WD093475
9-2-4-95	Akrounda	U/S Yermasoyia Dam	WD078460
9-4-3-80	Garyllis	U/S Polemidhia Dam	VD977450
9-6-4-95	Kourris	Khalassa	VD920470
9-6-5-10	Zavos	Khandria	VD994672
9-6-7-75	Zyghos	Khalassa	VD941471
9-6-9-05	Kouris & Kryos	Khalassa	VD921466
9-8-1-95	Evdhimou	Evdhimou	VD780397

Note: * Stream gauging stations in the Turkish occupied area

2.5.2 Other Gauging Stations

Besides the permanent stream gauging stations, which are situated on main streams, a number of other gauging stations have been realized that it was necessary to be established, for measuring the amount of water abstracted from the streams from various intakes.

The following table shows the gauging stations established on intakes. Asterisk marks those stations that remained unattended due to the Turkish invasion in Cyprus.

Flow Gauging Stations on Irrigation Intakes for 1975

Ser.No.	Intake	Location	Co-ordinates
1	Mylos	Peristerona	WD077856
2	Astromeridhiano	Peristerona	WD078855
3	Orounda	Orounda	WD083837
4	Riatikon	Meniko	WD144854
5	Afxenti	Meniko	WD152848
6*	Naos	Peristerona	WD075895
7*	Vathys	Massari Dam	WD077925
8*	Avlona	Avlona	WD091913
9*	Massari	Massari	WD071934
10*	Kyra	Kyra	WD057942
11*	Katakrous	Kyra	WD053945
12*	Zavrazis	Morphou Dam	WD023951
13	Elea	Kato Koutraphas	WD978854
14	Episkopi-Kandou	Kandou	VD914394
15	Erimi-Kolossi	Erimi	VD919392
16	Erimi	Erimi Bridge	VD925370
17	Asprallou-Linopasa	Kato Phlassou	VD897800
18*	Ayios Nicolaos	Skouriotissa	VD892837
19*	Polemios	Pendayia	VD885888
20*	Kritikos	Pendayia	VD891881
21	Larnaca Salt Lake	Larnaca	

2.5.3 Repairs and improvements to the existing flow gauging stations

During the year under review minor improvements were carried out on the following flow gauging stations :

- (a) Peristerona River (Panayia Bridge)
Excavation and construction of a tunnel for the direct connection of the float well with the flow of the river for more accurate recording of the flow.
- (b) Pouzis River (mazotos)
Alterations on the lower section of the weir by the construction of a "V" shaped structure (slope 1:10)
- (c) Khapotami River (Kissousa)
Alterations to the lower section of the weir by the construction of a "V" shaped structure (slope 1:10)

In addition to the above, 4 flow gauging stations were established on an equal number of irrigation intakes, one on Ezuza river, one on Xeros River and two on Dhiarizos River in the Lower Paphos Coastal Plain. The above work involves the construction of a float well and the installation of a water level recorder on each flow gauging station and has been completed in December, so that these new flow gauging stations are expected to operate in 1976.

2.5.4 Flood Discharges

During the hydrological year 1974-75 the rainfall was in general above normal. In some places high intensity rainfall gave rise to remarkable floods which have been recorded at our flow gauging stations some of which are the following :

- (a) Dhiarizos river near Koukليا about 55 cubic meters per second on 31st January, 1975, the catchment area of which is 263.7 square kilometers.
- (b) Ezuza river near Akhelia about 50 cubic meters per second on 31st January, 1975, the catchment area of which is 211.3 square kilometers.
- (c) Aradhippou river near the Nicosia-Larnaca road old bridge about 50 cubic meters per second on 2nd January, 1975, the catchment area of which is 33.9 square kilometers.
- (d) Kourris and Kryos river near Khalassa about 50 cubic meters per second on 10th January 1975, the catchment area of which is 169.9 square kilometers.
- (e) Tremithios river near Larnaca-Limassol road about 45 cubic meters per second on 2nd January, 1975, the catchment area of which is 141.8 square kilometers.

2.5.5 Inflow of Water in Dams

During 1975 out of 47 dams which were the most important in Cyprus and were in previous years under regular observation, only 27 could be attended, the rest remaining in the Northern part of Cyprus, under occupation by the Turkish troops.

The water accumulated in these 27 dams was satisfactory, being in volume at its maximum 31.3 mill. cubic meters, or 73% of the total capacity of these dams, being 43.1 mill. cubic meters.

During this year twenty dams overflowed, most of them during January or February. In one of them no inflow has been recorded and in two others the inflow was at its maximum less than 25% of their capacity.

Analytically the situation is shown in the following table.

Table showing volume of water accumulated and commencing date of inflow for various dams during the year 1975

No.	Dam	Capacity 10^3 m^3	Inflow Commencing date 1975	Maximum volume accumu- lated 10^3 m^3	Date of maximum Accumu- lation 1974	Remarks
1	Agros	72	January	54	March	
2	Akrounda	22	January	22	January	Overflowed
3	Arakapas	130	January	130	April	Overflowed (Gate closed in March)
4	Argaka	1150	January	1150	January	Overflowed
5	Athalassa	790	March	190	March	
6	Ayia Marina	300	January	300	February	Overflowed
7	Kalo Khorio	81	January	81	February	Overflowed (Gate open in January)
8	Kalopanayiotis	390	January	390	January	Overflowed
9	Kandou	38	January	38	February	Overflowed
10	Kiti	1600	January	1390	March	
11	Kyperounda	60	January	60	February	Overflowed
12	Lefka Marathasa	360	January	360	January	Overflowed
13	Lefkara	14400	January	4602	June	
14	Liopetri	340	February	36	February	
15	Lythrodontas Upper	32	January	32	February	Overflowed
16	Lythrodontas Lower	32	January	32	February	Overflowed
17	Mavrokolymbos	2200	January	2200	February	Overflowed
18	Ormidhia (Vathys)	100	No inflow
19	Palekchori (Kambi)	640	January	640	January	Overflowed
20	Paralimni Lake	1365	February	1365	February	Full
21	Pera Pedhi	55	January	55	January	Overflowed
22	Pomos	860	January	860	March	
23	Poñemidhia	2400	January	2620	March	
24	Prodromos	110	January	110	April	Overflowed
25	Pyrgos	270	January	270	January	Overflowed
26	Trimiklini	330	January	330	March	Overflowed (Gate open in January)
27	Yermasoyia	14000	January	14000	March	Overflowed

2.5.6 Spring Discharges

Most of the springs are gauged on a routine basis while a number of them are gauged for a short period after the request of another Departmental Division.

During the hydrological year 1974-75, 1946 spring discharges were taken on 142 springs; 1248 discharges were taken on 104 springs which are under regular monthly observations, and 698 discharges were taken on 38 springs for a certain period at various intervals.

As the precipitation during the hydrological year under review was above normal, all springs had a considerable increase during the whole year; most of them, however, were below normal due to the effect of the previous three dry years.

2.6 Ground water

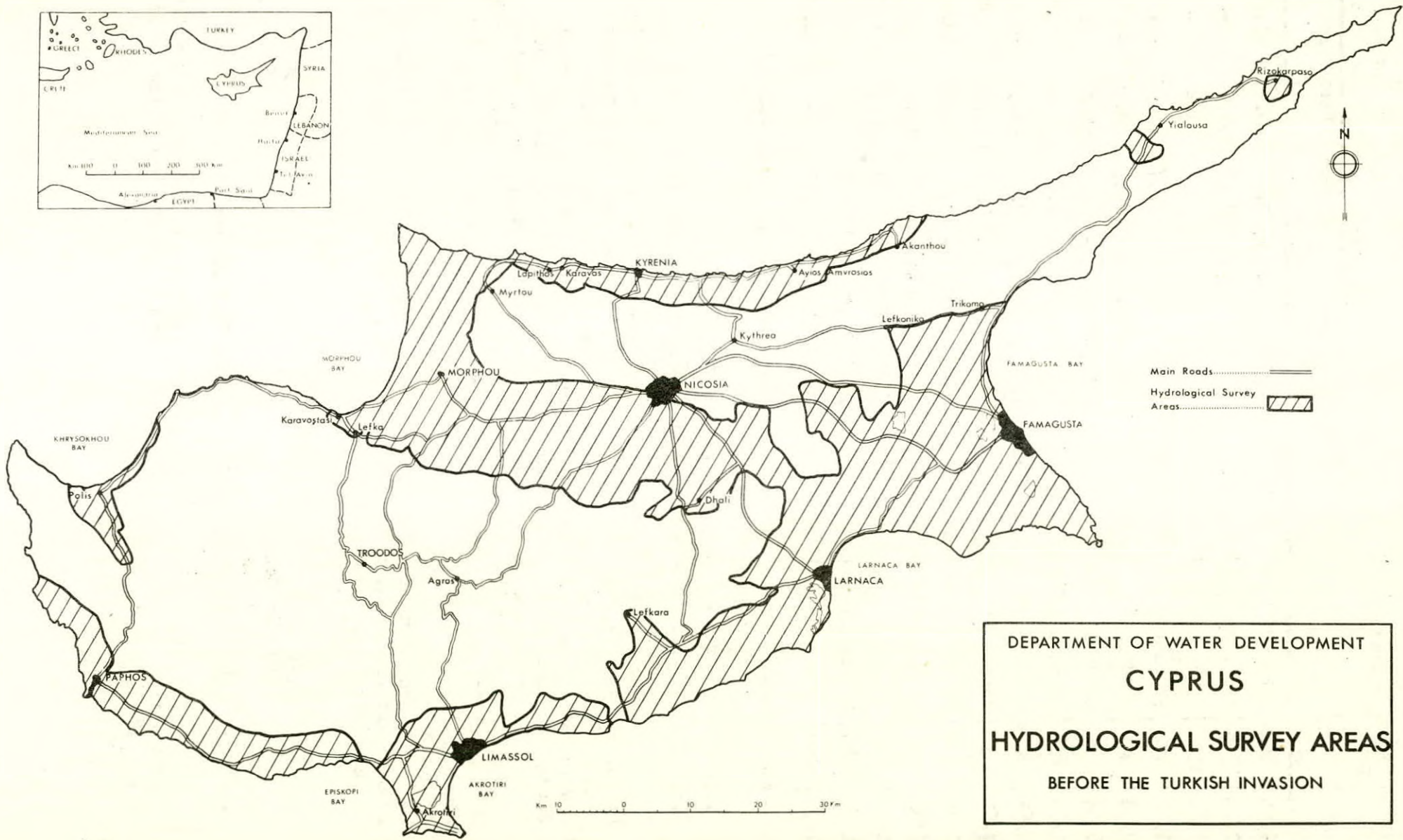
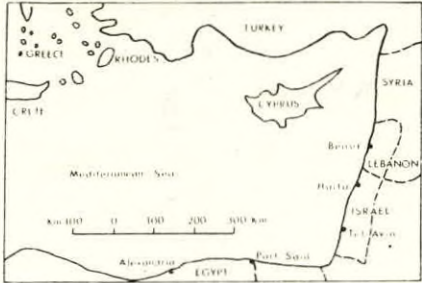
2.6.1 Groundwater Hydrological Works

Hydrological Surveys of the ground water bearing systems were carried out on small scale by this Department before 1960. Since then, they were rapidly amounting in scale until the most important known aquifer systems were brought in a few years time under Hydrological Observation. It is unfortunate that most of our maps with the well location and other information were destroyed by fire during the events of 1974 or lost in the occupied by the Turkish troops. So, in 1975 new plotting was carried out and other hydrological information collected in the free areas where hydrological work was being carried out before.

Through the Hydrological Surveys all wells boreholes, springs and chain-of-wells are registered and plotted on maps. A dense network of observation boreholes, is being leveled. Through these observation boreholes/wells, the water level is being measured twice a year, at the end of the dry season (November) when it is expected to be at lowest and at the end of the wet season (March) when it is expected to be at highest level. In areas where more detailed information is necessary, a network has been established of observation boreholes where monthly or bimonthly measurements are taken.

Out of a large portion of the above network of wells and boreholes, water samples are obtained twice a year (November and March) for chemical analysis to evaluate the trends of any quality change of the water in each aquifer. The extent of the areas which were covered by hydrological surveys was about 3.700 km² but now the free area where such work may be carried out is about 2/3 of that, (see map on page 71). Due to the destruction of our maps hydrological surveys have been carried out during 1975 in an area of only 1266 km².

As regards the groundwater situation, this was still very grave in the south-eastern part of the island since the extraction was much more in excess from the recharge, although rainfall was above average this year. In the other aquifers the water table stands at a higher level than in the previous year, but still the situation can not be considered satisfactory. Details may be seen in the following table of selected Observation boreholes.



Main Roads.....
 Hydrological Survey Areas.....

DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
HYDROLOGICAL SURVEY AREAS
 BEFORE THE TURKISH INVASION

Selected Observation Boreholes

Serial No.	Hydr. No.	Village	Water level a.m.s.l. in meters				Water level increase (+) or decrease (-)	
			1974		1975		March 74-75	November 74-75
			March	November	March	November		
56/56	192	Liopetri	+ 0.71	+ 0.42	+ 0.34	+ 0.22	-0.37	-0.20
20/63	1516	Paralimni	+19.37	-	+ 19.76	- 21.22	+0.39	-
22/63	1518	"	+ 5.70	-	+ 6.93	+ 6.07	+1.23	-
51/51	774	Phrenaros	+ 6.41	+ 6.02	+ 7.00	+ 4.97	+0.59	-1.05
79/56	975	"	+ 8.09	+ 8.08	+ 7.93	+ 7.53	-0.16	-0.55
88/54	24	Kolossi	- 1.22	- 2.55	+ 1.20	- 0.25	+2.42	+2.30
51/63	813	Limassol	+ 0.55	+ 0.21	+ 0.95	+ 0.47	+0.40	+0.26
13/63	807	Zakaki	- 0.61	- 1.04	+ 0.31	+ 0.62	+0.92	+0.42
107/61	17	Yermasoyia	+ 1.95	+ 1.95	+ 4.00	+ 2.98	+2.05	+1.03
180/59	8	"	+16.47	+ 14.95	+ 20.37	+ 18.82	+3.90	+3.87
7/60	22	"	+ 0.65	- 0.15	+ 1.23	+ 1.15	+0.58	+1.30
134/59	27	"	+ 0.84	- 1.94	+ 1.56	+ 1.33	+0.72	+3.27
161/50	559	K.Trimithia	-	+186.68	+187.18	+187.38	-	+0.70
160/50	150	"	-	+195.59	+196.33	+195.77	-	+0.18

2.6.2 Control and Conservation of Ground water

2.6.2.1 Advisory Committee for the issue of well permits

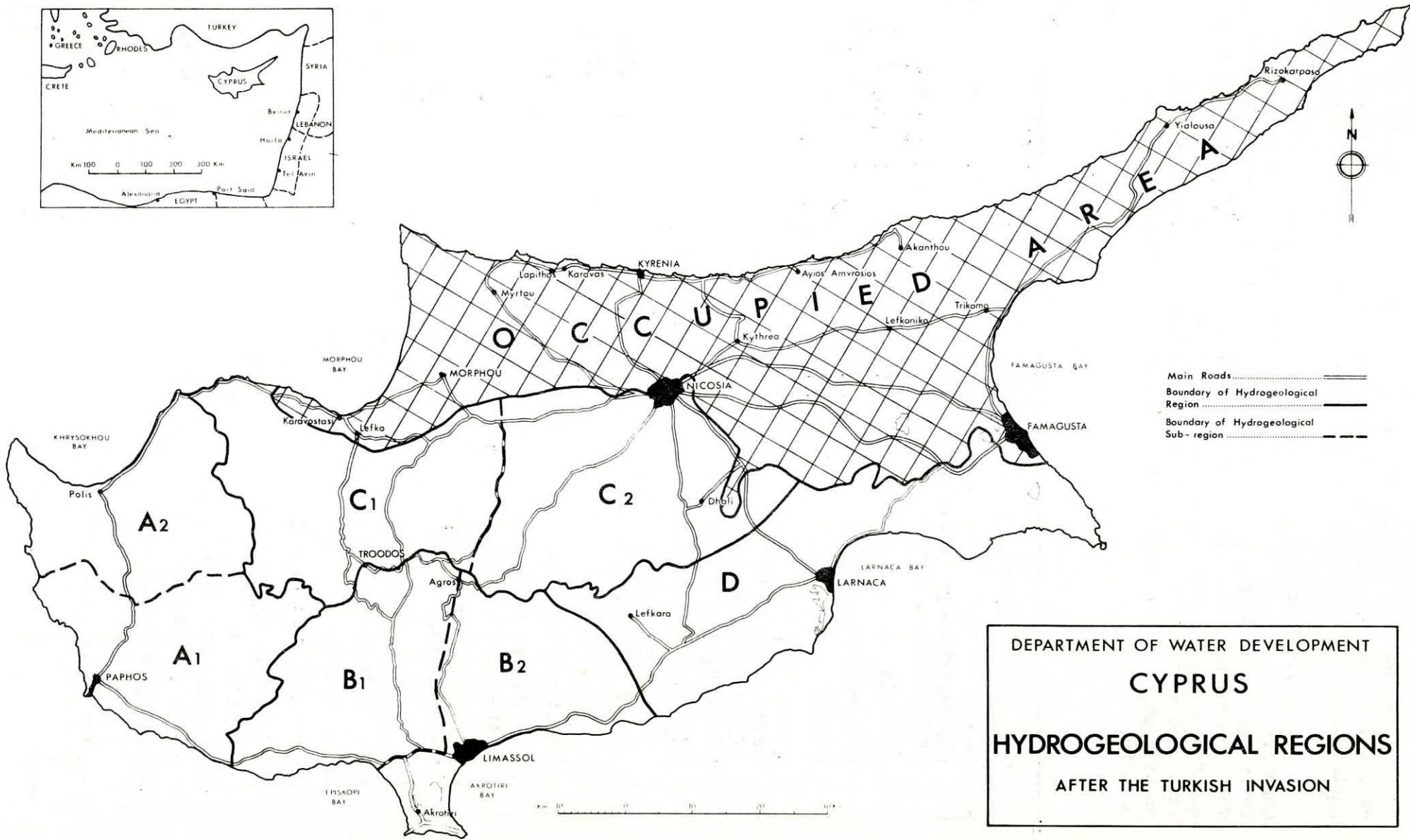
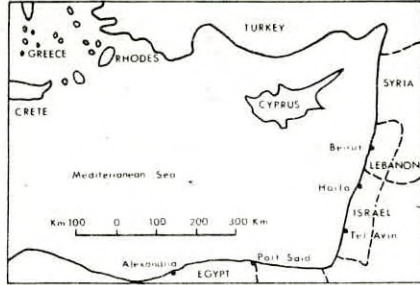
The Advisory Committee for the issue of well permits established by the Ministry of Agriculture and Natural Resources operated this year with Mr. M. Peppis as president on behalf of the Director of Water Development Department. Representatives of the Directors of Geological Survey and Agricultural Departments are members of this committee, whose task is to advise the Director of Water Development Department on matters related to well sinking permits. At the meetings the Legal Advisor of this Department Mr. Ch. Kyriakidhes and the District Engineer of the district where applications were to be examined, participated.

The committee performed during 1975, 58 meetings and examined 2090 applications sent to the Director of Water Development Department by the District Officers as follows :-

Water Supply (Special Measures) Law areas	120
Water Conservation areas	1490
Non Water Conservation areas	480

2.6.2.2 Water Conservation Areas (Wells Law Cap. 351)

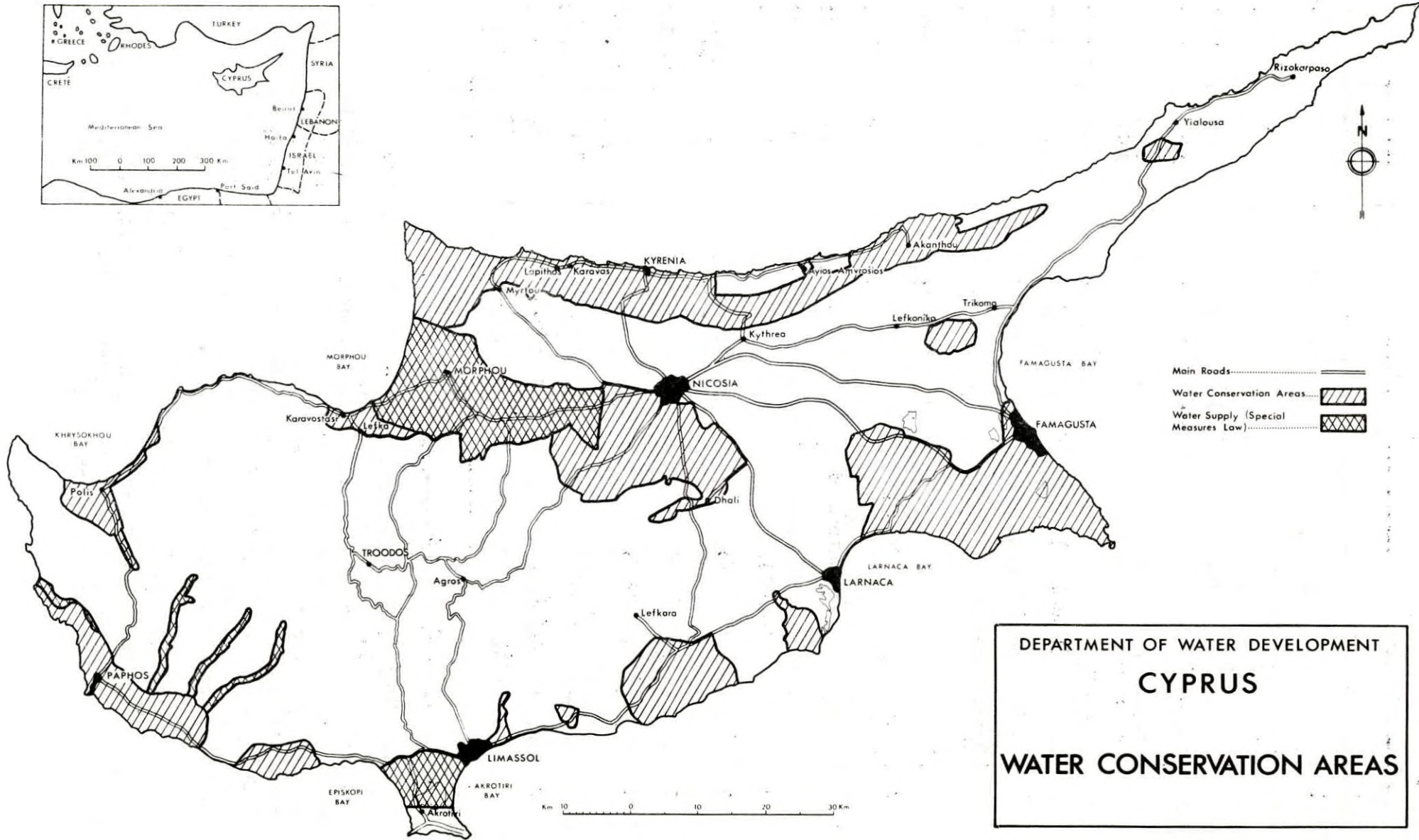
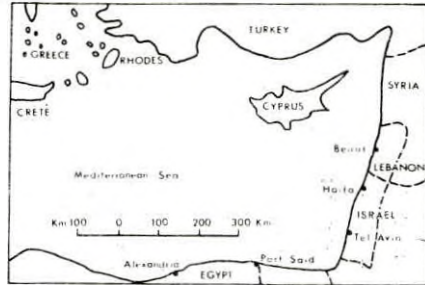
An area is declared as a Water Conservation Area when its water resources are such, that will affect the quantity or quality of the water of that area.



On map on page 73 the areas which have been declared as "Water Conservation Areas" under the wells Law Cap. 351 are shown. Particulars of these areas are also shown on the following table.

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 knowledge of the existing water situation of each aquifer, the development in the area and the existence of other wells or boreholes, chain-of-wells and springs, as well as any other Government water works, are mandatory to the District Officer.

Ser. No.	Water Conservation Area	Order No.	Date	Gazette No.	Date
1	K/Trimithia-Ayii Trimithias, Paleometokho, Mammari	556	31.10.51	3584	31.10.51
2	Nicosia	556	31.10.51	3584	31.10.51
3	Tersephanou, Klavdhia	374	18. 8.52	3639	27. 8.52
4	Lania	374	18. 8.52	3639	27. 8.52
5	Famagusta; Phrenaros, Paralimni, Ormidhia, Xylotymbou, Pergamos, Kouklia, Avgorou etc.	164	3. 3.56	3924	8. 3.56
6	Akrotiri, Phasouri etc.	165	3. 3.56	3924	8. 3.56
7	Morphou, Syrianokhori, Prastio Nikitas, Elea, Pendayia	1052	30.10.56	3995	8.11.56
8	Dhali, Potamia	1194	29.11.56	4008	6.12.56
9	Ay. Andronikos etc.	916	26. 9.57	4081	3.10.57
10	Morphou, Peristerona, Astromeritis, Akaki etc.	314	3. 5.58	4133	15. 5.58
11	Vasilias, Lapithos, Kyrenia, Ayios Epiktitos etc.	245	28. 4.59	4228	30. 4.59
12	Makeðhonitissa etc.	544	16.11.59	4277	26.11.59
13	Moni, Pyrgos	226	27. 7.61	75	27. 7.61
14	Yermasoyia	443	8.12.61	112	8.12.61
15	Dhiorios (Djibi Loc.)	324	21. 6.62	163	21. 6.62
16	Yialia, Ay. Marina, Argaka, Polis	359	7. 7.62	168	7. 7.62
17	Yialias, River (Potamia, Dhali, Nisou, Mathiatis)	189	25. 4.63	245	25. 4.63
18	Kiti, Pervolia, Meneou, Dromolaxia	50	28. 1.65	384	28. 1.65
19	Kouklia, Anarita, Timi, Akhelia	529	26. 8.65	435	26. 8.65



- Main Roads.....
- Water Conservation Areas.....
- Water Supply (Special Measures Law).....

DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
 WATER CONSERVATION AREAS

Ser. No.	Water Conservation Area	Order No.	Date	Gazette No.	Date
20	Lapathos, Gypsos	545	9. 9.65	438	9. 9.65
21	Moni (Extention)	642	14.10.65	444	14.10.65
22	Lakatamia, Dheftera, Anayia, Pera etc.	744	11.11.65	453	25.11.65
23	Ayia Iriņi	280	19. 5.66	499	2. 6.66
24	Paramali, Evdhimou	S.B.A 68	29. 7.67	S.B.A 212	29. 7.67
25	Lysi, Kondea	776	7. 9.67	599	22. 9.67
26	Akanthou	777	7. 9.67	599	22. 9.67
27	Pergamos (Extention)	889	19.10.67	606	3.11.67
28	Ayios Amvrosios	890	19.10.67	606	3.11.67
29	Kyrenia Range Limestone Mass	817	7.11.68	693	22.11.68
30	Vasilikos, Xeropotamos	862	28.11.68	697	13.12.68
31	Yeroskipos, Konia, Ktima, Peyia	741	4. 9.69	748	19. 9.69
32	Karavostasi, Peristeronari	50	29.12.69	771	16. 1.70
33	Yeri	75	8. 1.70	773	23. 1.70
34	Neokhorio, Androlikou	845	14.10.71	904	29.10.71
35	Yiolou, Loukrounou, Skoulli	845	14.10.71	904	29.10.71
36	Pissouri, Eydhimou	576	10. 8.72	958	25. 8.72
37	Kormakitis, Myrtou, Dhiorios	851	7.12.72	979	15.12.72
38	Akanthou (Extention)	288	15.11.73	1054	30.11.73
39	Ayios Ioannis (Malounda)	307	25.11.74	1158	25.11.74
40	Pareklisia	206	23.10.75	1233	7.11.75

2.6.2.3 Water Supply (Special Measures) Law 32/64

The major aquifers of Western-Mesaoria and Akrotiri Peninsula, which were declared as water conservation areas in the past, have been covered by the water supply (Special Measures) Law since 1965, whose purpose is to further and more efficiently protect and control the water resources. The Paphos coastal area and the Paphos Major river valleys, which will be covered by the Major Paphos Irrigation Project, have also been covered by that Law in 1974 and 1975.

For the above areas :

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

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

The areas covered by this Law are shown on map page and particulars given in the table below :

Water Supply (Special Measures) Law Areas

Ser. No.	Area	Order No.	Date	Gazette No.	Date
1	Western Mesaoria (Pendayia-Morphou-K/Trimithia)	-	-	331	9. 7.64
2	Akrotiri-Peninsula	-	-	331	9. 7.64
3	South Eastern Mesaoria (Famagusta-Paralimni-Ormidhia-Akhna)	-	-	331	9. 7.64
4	Potami	89	12. 2.66	479	24. 2.66
5	Dhiarizos River	196	23. 5.74	1104	21. 6.74
6	Xeropotamos River	196	23. 5.74	1104	21. 6.74
7	Ezuza River	196	23. 5.74	1104	21. 5.74
8	Peyia-Aspros River (Ext. of Yeroskipos-Peyia W.C.A. West of Peyia village)	196	23. 5.74	1104	21. 6.74
9	Mavrokolymbos River (Ext. of Yeroskipos-Peyia W.C.A.)	196	23. 5.74	1104	21. 6.74
10	Kouklia-Paphos-Peyia	111	6. 6.75	1193	6. 6.75

2.6.2.4 Water Meters

The preservation of the aquifers through the close control of the groundwater extraction and use, which is the object of the declaration of an area under the provisions of the Water Supply (Special Measures) Law, cannot be affected without metering the water pumped from each borehole or well.

According to the provisions of the above referred law, water meters should be installed in the Water Supply (Special Measures) law areas. Information about the installation and operation of water meters are not available for Western Mesaoria area, since this area is still under Turkish occupation. For Paphos area the Law has not yet been enforced. In Limassol-Akrotiri area 382 water meters have been installed 297 of which in continuous operation. The total volume of water recorded is 13.723.000 m3. During the year 360 illegal pumpings have been reported to the D.O. out of which 236 were presented to court.

2.6.2.5 Private Drillers (Wells Law, Section 36)

According to the above Law no one is allowed to operate a drilling rig without a Driller's Licence. Such a licence is issued by the Director of the Water Development Department, after an interested person to become a Driller applies for it and when the Director of the Department is satisfied that the applicant is competent to carry out such job. A fee is paid for the Licence and each year for its renewal.

According to the same law every driller has to notify the Director of the Water Development Department of his intention to drill a borehole, to keep samples from the rocks penetrated and sent to the above said Director together with a technical report on each borehole drilled.

During 1975 this Department issued 7 Drillers licences and renewed 26 others. Another 4 persons applied for a drillers licence but their application was turned down since they did not satisfy the examiners. The number of private drilling rigs which drilled for water during 1974 was 54 and this Department has been notified about the drilling or cleaning of 68 boreholes. Information from private drillers have been received by this Department for 17 boreholes. Also during 1975 drillers borehole records have been collected for 233 boreholes drilled by private drillers during the years 1971-1974.

2.7 Water Quality

2.7.1 Chemical analyses

During the year, 1970 samples of water were sent to the Government Analyst for Chemical Analysis. Of these 860 samples were taken from springs, wells or boreholes, which are used or proposed as water supply sources. The remaining 1110 samples derived from rivers, springs, observation boreholes and from other miscellaneous sources.

Also, 140 samples of water taken from observation boreholes in the Hydrological survey areas were analysed by the Water Resources Division for Chloride content.

2.7.2 Bacteriological Analyses

<u>Water Supply</u>	<u>No. of samples</u>	<u>No. of Unsatisfactory samples</u>
Nicosia	150	10
Limassol	109	11
Larnaca	54	4
Total	<u>313</u>	<u>25</u>

The Unsatisfactory samples at Nicosia, Limassol and Larnaca were usually of unchlorinated water. All chlorinated samples at main reservoirs were Highly Satisfactory.

2.7.3 Suspended Sediment Analyses

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

During the year approximately 165 samples of river water were taken for Suspended Sediment Analyses.

2.8 Cost of Hydrological Studies

	Approved Estimated Cost	Actual Expenditure
Hydrological Observations and Research	£24,500	£19,500
Construction & Maintenance of Measuring Weirs	£ 4,500	£ 4,000
Total	<u>£29,000</u>	<u>£23,500</u>

2.9 Special Studies

2.9.1 Use of Computer techniques for the storage and retrieval of hydrological and hydrogeological data

The accumulation of hydrological and hydrogeological data, which are being collected for years by this Department, made their handling and full evaluation increasingly difficult with the conventional ways these have been treated. The use also on an increasing scale in this Department of mathematical models, having as inputs hydrological and hydrogeological data, made the necessity of modernizing our conventional system of data storage and retrieval to be felt strongly.

In December, 1973, the Secretary of the Cyprus National Committee for the International Hydrological Decade, raised to the Secretary Co-ordinating Council, I.H.D. the matter of a consultant being provided through I.H.D. program to consult on the possibility of using computer techniques for the storage and retrieval of hydrological and hydrogeological data.

In June, 1975, after arrangements made by UNESCO, Mr. Roger Thunviç of Sweden, responsible for the processing of data and the development of computer programmes in the computer group of the Swedish Committee for the I.H.D. arrived in Cyprus "To advise the Government of Cyprus on the computerization of the accumulated hydrological and hydrogeological data in the form of an inventory for the country's stream gauging stations, main springs, wells and boreholes".

The consultant carried out his mission with the Water Development Department between the 3rd and 29th June, 1975, in close collaboration with officers of this Department, namely Mr. D. Kypris, Geologist, Head of the Water Resources Division, Mr. J. Jacovides, Hydrologist, Secretary of the I.H.P. Cyprus Committee and Mr. Chr. Phanartzis, Hydrologist.

During the presence of Mr. Thunvic in Cyprus a number of meetings were held between the consultant and the above referred officers, during which the targets of the new data storage and retrieval system were set, the data stored in the present files were examined and discussions on the use of computer techniques for data storage and retrieval were held.

The outcome was a report prepared by Mr. R. Thunvic and issued by UNESCO, Paris, 1975, under the title "Computerization of Hydrological and Hydrogeological Data" and serial No. FMR/SC/HYD/75/109.

A picture of the work done may be obtained from the summary of the above report reading as follows:-

"Cyprus' water resources are very important to the development of the country. The Government is paying great attention to this and large investments are made in water development projects. In the planning of these projects large amounts of data about various hydrological and hydrogeological parameters are being collected and analysed.

Data analysis is a tedious and time-consuming job since the data are at present stored in various manual files. This results in a considerable time-lag in producing statistics for such reports as the outstanding hydrological year-books. These problems have prompted the idea of introducing computer methods in the data-processing.

Computer models for surface and groundwater simulation have been successfully used for several years and have proved to be extremely useful tools in water managements studies.

The data stored in the present files were examined and a system of punching the data was worked out. In organizing the files a distinction was drawn between files containing information of a permanent character (these are called master files) and files containing measurements (these are called observation files). The master files will contain links to associated records in other files.

For various reasons, the main programming language to be used will be FORTRAN IV.

Some additional equipment to support the data-processing was suggested: a card punch machine for the data entry, a pencil follower for digitizing the data registered on diagrams, and a plotter to display various results.

The establishment of a special data-processing section is suggested.

In the meantime, it has been decided that the application of computer Techniques in the storage and retrieval of data should first be applied in a small area, so a pilot project has been initiated to cover the Yermasoyia region. By the end of 1975 the project was progressing satisfactorily.

III.

DIVISION OF
PLANNING

By
Chr. Marcoullis
Head of Division

3.1 Introduction

The Planning Division of the Water Development Department consists of the following two branches :

1. Reconnaissance and feasibility Reporting
2. Investigations and Testing

The activities of each branch are described below :

3.2 Reconnaissance and Feasibility Reporting Branch

3.2.1 Southern Conveyor Project

Further to the agroeconomic study which was prepared in 1974 and based on its findings as well as on hydrological data, a mathematical model is in the process of development on the optimum utilization of the surface and ground water.

As it is known this project covers that area from Paphos to Famagusta which was not included in any individual project such as Paphos, Akrotiri or Vasilikos-Pendaskinos. The water resources to be developed are those of the project area plus any surplus water from the mentioned individual projects.

- The aim of the project is the construction of a long canal which will receive or supply water through various other works and according to the potentiality of each particular region of the project area.

3.2.2 Paphos Project

After the agreement on the loan from the International Bank of Reconstruction and Development became effective in 1975 this branch contributed in the work of the preparation of the detailed designs by the contracted consultants in the following :-

- (i) Preparation of detailed maps of the project boundaries and clarification of problems concerning the land which was eventually included in the project.
- (ii) Participation in the hydraulic design of the main canal through a computer program prepared by the French Consultants.
- (iii) Preparation of irrigation data required for the detailed design of the distribution system.

All the above works were in progress by the end of

1975.

3.2.3 Vasilikos-Pendaskinos Project

This is a new irrigation project which covers the area between Vasilikos and Pendaskinos Rivers. The feasibility study commenced in 1975 although some of the engineering works, such as the design of Kalavastos and Dhypotamos dams and the diversion works on Maroni River, the progress of which is given elsewhere, started before 1975.

This project which is envisaged to supply water for irrigation from surface and ground water resources of the area, for about 2,200 ha of land and develop some more water for domestic and industrial uses, will consist of the following engineering works:

- (i) Kalavastos dam on Vasilikos river
- (ii) Dhypotamos dam on Pendaskinos river
- (iii) A diversion structure on Maroni river
- (iv) The conveyance canals from the dam to the irrigable land.
- (v) The irrigation network
- (vi) The drilling of boreholes on the existing aquifers

Existing Lefkara dam on the Syrgatis river will be included in the system of works for operation studies although economically and organizationally this dam does not form a constituent part of the project.

By the end of 1975 the progress of the study was as follows :

- (i) The designs of the dams and the diversion on a feasibility level were completed and the preparation of the relevant reports almost finished.
- (ii) The agricultural report was completed in a draft form, pending some individual aspects, which needed further study.
- (iii) The system operation studies on a digital computer had reached an advanced level pending only some further elaboration of data.

The feasibility study will continue next year and is expected to be completed by mid 1976. It is worth mentioning here that this is the first irrigation feasibility study wholly undertaken by the Government without contracting foreign consultants.

3.3 Site Investigation Laboratories and Grouting Sections

3.3.1 General

During 1975 the work of the Site Investigation, Laboratories and Grouting Sections, was confined to the non-occupied districts of Cyprus. By comparison to previous years, the volume of work carried out was considerably greater.

Site investigations were mainly involved with foundation and fill material investigations. During the year, a total of twenty such investigations were carried out (c.f. to 7 no. in 1974 and 11 no. in 1973). Ten of these investigations were performed in connection to Departmental projects, whilst the remaining were performed at the request of the Cyprus Grain Commission, the Larnaca Water Board, the Electricity Authority of Cyprus (E.A.C.) and other Government Departments, namely the Public Works Department (P.W.D.), the Geological Survey Department (G.S.D.) and the Ministry of Commerce and Industry.

Departmental projects, necessitating foundation and fill material investigations, included:

- (i) Water storage reservoirs of the earthfill and reinforced concrete types,
- (ii) dams of the rockfill, earthfill and concrete gravity types, and
- (iii) main conveyor canals

Site investigations requested by others were of a very diverse nature and included :

- (i) foundation investigation fieldwork for grain storage silos in Limassol, Larnaca and Nicosia.
- (ii) complete foundation investigations, including laboratory testing, for water storage reservoirs, multistory building complexes, the proposed modernisation of salt production at Larnaca Salt Lake.
- (iii) subsurface investigation, by drilling, for the location of possible cavities and/or caves underlying proposed building structure.
- (iv) making available departmental resources for the performance of site investigation fieldwork in connection to the feasibility study for the New Nicosia-Limassol road, the proposed extension of the Larnaca International Airport runway and the proposed construction of a Tourist Pavillion at Petra tou Romiou.

The increased volume of non-Departmental projects, undertaken in 1975, points out the overall usefulness of the Departments specialised resources and the positive contribution made in assisting, wherever possible, other Government Departments and the Private Sector in the field of soil mechanics and foundation engineering.

For site investigations a very close collaboration was maintained with the Engineering Geology Section of the G.S.D. The assistance of geologists, whenever requested, provided always for best results in the outcome of the work.

During 1975, the work of the Laboratories may be distinguished into the work of the Soils and Concrete main laboratories and the work of the field laboratories were mostly involved with testing for :

- (i) foundation investigations
- (ii) fill material investigations
- (iii) other Government Departments and the Private Sector, as requested
- (iv) various Departmental projects under construction and
- (v) an assessment of the suitability of concrete aggregate tendered for.

Field laboratories were manned and equipped at the following construction sites :

- (i) Arakapas dam of the concrete gravity type and
- (ii) New Engomi, new Strovolos and new Tremithos, water storage reservoirs of the reinforced concrete type.

The aim of field laboratories was the effective quality control of materials and workmanship during construction. At the Arakapas dam and Engomi reservoir sites, field laboratories continued to function up to the time of completion of the projects in July and October 1975 respectively. At the Strovolos and Tremithos reservoir sites, field laboratories were set up and started functioning in August and October 1975, respectively. Field laboratories were equipped for the performance of routine tests for the quality control of concrete aggregate and mixed concrete.

During 1975 the Grouting Section was involved with one project only, that is consolidation grouting of poorly compacted back-fill below a crusher plant at the Vasilikos Cement Factory of the Hellenic Mining Co. The work was carried out in co-operation with the client.

3.3.2 Site/Fill Material Investigations, Grouting

Details of site, fill material investigations and grouting works performed during the year are given in Table 1. Relevant details include the aim of the investigation, the fieldwork as carried out, the type and number of machinery used for the performance of fieldwork and finally total expenditure for the performance of the work.

Table 2, is a progress chart showing the time duration for each project and as carried out during the year.

3.3.3 Laboratories

The work of the Soils Laboratory is analysed on Table 3. Details shown, thereon, include the type and number of tests performed for both Departmental and non-Departmental projects.

The work of the Concrete and Field Laboratories is analysed on Table 4.

The total number of tests performed in 1975 may be further analysed as follows and this facilitates a direct comparison to the number of tests performed in 1974 :

	Description	1975	1974
(i)	Soils Laboratory		
	(a) Departmental Projects	625	858
	(b) Non-Departmental Projects	372	120
	Sub-Total	997	978
(ii)	Concrete Laboratory	397	528
(iii)	Field Laboratories	3417	1895
	Total	4811	3401

3.3.4 Personnel

On the 31st December 1975, the total number of personnel employed in the Site Investigation, Laboratories and Grouting Sections was 25, which when compared to 11 no. employed at the end of 1974, indicates a more than two fold increase. This in order to cater with the increased volume of work performed in 1975.

The number off, title and function of personnel was as shown in the table below :

No.	Title	Function			
		Supervising	Laboratory	Drilling	Other
1	Executive Engineer (I&M)	2			
2	Inspector of Works	2			
3	Technical Assistant		4		
4	Laboratory Technician		5		
5	Draughtsman				1
6	Foreman			1	
7	Driller			4	
8	Assistant Driller			2	
9	Casual Labour			4	
	Total	4	9	11	1

3.3.5 Machinery and Equipment

At the end of 1974, drilling machinery and laboratory equipment were available as shown on Tables 5 and 6, respectively.

In 1975, drilling accessories and laboratory equipment were purchased as shown on Tables 7 and 8, respectively. Cost of purchased equipment was as follows :

- (i) drilling = £2135
- (ii) laboratory = £3255

Grouting machinery and equipment, available in 1975, was as shown on Table 9.

3.3.6 Reports

Following the example of previous years, relevant reports were prepared on completion of each project. A list of reports prepared in 1975 is as follows :

- (i) F/48 "Larnaca Water Supply-Tremithos Reservoir, Additional Site Investigation",
May 1975
- (ii) F/49, "Cyprus Grain Commission - Grain Storage Silos, Site Investigations",
June 1975
- (iii) F/50 "Nicosia Water Supply-New Lakatamia Reservoir, Site Investigation",
August 1975
- (iv) F/51 "Cyprus Grain Commission-Limassol Silo Site- Insitu Density and Laboratory Testing",
November 1975
- (v) F/52 "Aradhippou Dam-1975 Fill Material Investigations",
January 1976
- (vi) "Manual on Concrete Quality Control at the Construction Site",
December 1975
- (vii) "Paphos Irrigation Project-Main Canal Site Investigation-Interim Reports"
- (viii) "Report on the Site Investigation performed for the New Fire Brigade Station at Strovolos"
- (ix) "Report on the Site Investigation for the Kiti Dam"
- (x) "Report on the Engineering Properties of Clay Blanket Fill Material for the proposed Pachyammos Reservoir"
- (xi) "Pitsillia Development Project-Reconnaissance Investigation for Clay Blanket Fill Material"

Table 1 - Details of Site/Fill Material Investigation and Grouting Projects

No.	Project	Aim of Investigation	Field work as carried out	Machinery Used	Expenditure
1	<u>SITE INVESTIGATIONS</u> <u>A. Departmental Projects</u> Nicosia Water Supply New Lakatamia Reservoir	Foundation Investigations	(a) 18 no. boreholes total depth 197m. (b) 6 no. trial pits. Total depth 21m. (c) 163 no. S.P.T's	(a) 2 no. Coredrills with S.P.T. equipment (b) 2 no. Flush Pumps (c) 1 no. Backactor Excavator	£1046
2	Vasilikos Pendaskinos Project: Kalavassos Dam	Subsurface geological investigation of: (i) dam-axis (ii) diversion tunnel (iii) spillway (iv) proposed rock-fill quarry	(a) 12 no. vertical and inclined boreholes. Total depth 345 m (b) 58 no. water-pressure permeability tests (c) 2 no. boreholes converted for ground-water table measurements	(a) 2 no. core drills with water pressure testing equipment (b) 2 no. flush pumps (c) 1 no. Traxcavator (for access roads)	£3145
3	New Lymbia Dam	Subsurface geological investigation of dam-axis	(a) 3 no. boreholes. Total depth 45 m (b) 14 no. water pressure permeability tests (c) 2 no. boreholes converted for groundwater table measurements	(a) 1 no. Mobile Auger/ Coredrill (b) 1 no. Flush Pump	£ 377
4	Kiti Dam (Remedial Works)	Investigation of possible subsurface water leakage hazards	3 no. boreholes. Total depth 30.5m	1 no. Mobile Auger/ drill	£ 45

No.	Project	Aim. of Investigation	Field work as carried out	Machinery Used	Expenditure
5	Paphos Irrigation Project : Main Canal	(a) Foundation Investigations for structures (bridges, pumping stations, water reservoirs syphon, watering places; regulators, aqueducts), (b) Investigation for excavation works	(a) Surface geological mapping (b) 38 no. boreholes. Total depth 242 m (c) 23 no. trial pits. Total depth 67 m. (d) 222 no. S.P.T's (e) 21 no. undisturbed (U4) samples	(a) 1 no. Mobile Auger drill (b) 1 no. backactor excavator (c) associated S.P.T. and undisturbed sampling equipment	£1100
1.	B. NON-DEPARTMENTAL PROJECTS Cyprus Grain Commission: Silos at Larnaca, Limassol and Nicosia	Foundation Investigations	(a) 14 no. boreholes. Total depth 300m. (b) 312 no. S.P.T's (c) 112 no. undisturbed (U4) samples (d) 16 no. in situ permeability tests (e) groundwater table measurements	1 no. Mobile Auger drill	£2851
2	Larnaca Water Supply- New Tremithos Reservoir	Additional Foundation and Earth works Investigations	(a) 6 no. trial pits. Total depth 14.5 m (b) disturbed (bulk) sampling	1 no. backactor Excavator	£ 20
3	Limassol New Court Bldgs: for the P.W.D.	Investigation for subsurface cavities	128 no. boreholes. Total depth 374 m.	(a) 1 no. Pneumatic Hand Drill (b) 1 no. Flush pump	£ 127

No.	Project	Aim of Investigation	Field work as carried out	Machinery Used	Expenditure
4.	E.A.C.-New District Headquarter Bldgs	Foundation Investigations	(a) 8 no. boreholes. Total depth 112 m. (b) 74 no. S.P.T's (c) 65 no. undisturbed (U4) samples (d) groundwater table measurements	1 no. Mobile Auger Drill with associated S.P.T. and U4 sampling equipment	£ 1520
5.	Larnaca Salt Lake: for the Ministry of Commerce and Industry	(a) Subsurface investigation of Lake sediments (b) Geological and hydrological Investigations (c) Fill Material Investigation	(a) 7 no. boreholes. Total depth 54 m. (b) 25 no. trial pits. Total depth 30 m (c) 23 no. S.P.T's (d) 27 no. undisturbed (U4) samples (e) water samples (f) in situ permeability tests	(a) 1 no. Shell and Auger Boring Machine (b) 1 no. Coredrill (c) 1 no. Flush Pump (d) 1 no. Backactor Excavator (e) associated equipment	£ 1200
6.	Tourist Pavilion at Petra tou Romiou: for the G.S.D.	Foundation investigation	(a) 3 no. boreholes Total depth 38.5 m (b) 37 no. S.P.T's	1 no. Mobile Auger drill with associated S.P.T. equipment	£ 343
7.	Larnaca Int. Air-port: Runway Extension: for the P.W.D.	Foundation Investigation (embankment)	(a) 3 no. boreholes. Total depth 24.5 m. (b) 10 no. S.P.T's (c) 14 no. undisturbed (U4) samples	1 no. Shell and Auger Boring Machine with associated S.P.T. and U4 sampling equipment	£ 65
8.	New Fire Station Strovolos: for the P.W.D.	Investigation for subsurface caves and cavities	(a) 20 no. boreholes. Total depth 173.5 m (b) 2 no. trial pits. Total depth 16.5 m	(a) 1 no. Pneumatic Head Drill (b) 1 no. Flush pump (c) 1 no. Air compressor	£ 100

No.	Project	Aim of Investigations	Fieldwork as carried out	Machinery Used	Expenditure
9.	New Nicosia-Limassol Road: for the P.W.D	(a) Roadstone Quarry Investigations (b) Foundation Investigations for bridge structures	(a) 3 no. coredrilled boreholes. Total depth 60m (b) 13 no. boreholes. Total depth 242 m (at 6 no. bridge sites) (c) 231 no. S.P.T's (d) 40 no. undisturbed (U4) samples	(a) 1 no. Coredrill with Flush Pump (b) 1 no. Mobile Auger Drill (c) 1 no. Shell and Auger Boring Machine (d) 2 no. Overburden Drills with Flush Pumps and Air Compressors (e) associated S.P.T and U4 sampling equipment	£2674
<u>FILL MATERIAL INVESTIGATIONS</u> A. Departmental Projects					
1.	Vasilikos-Pendaskinos Project: Kalavassos Dam	(a) Additional Filter Material Investigations (b) Additional Core Material Investigations	(a) 40 no. trial pits. Total depth 107 m. (b) 8 no. electrical resistivity traverses (c) disturbed (bulk) samples	(a) 1 no. Backactor Excavator (b) 1 no. Power Auger (c) Geophysical Equipment	£ 197
2.	Vasilikos-Pendaskinos. Project: Dhypotamos Dam	Additional Clay Core Material Investigations	57 no. trial pits. Total depth 80 m.	(a) 1 no. Backactor Excavator (b) 1 no. Power Auger	£ 90
3.	Pitsilia Development Project	Surface Reconnaissance for clay material	-	-	-
4.	Pachyammos Reservoir	Clay Blanket Material Investigation	Disturbed (bulk) sampling	-	-
5.	Aradhippou Dam	Additional Material Investigations	(a) Surface reconnaissance (b) disturbed (bulk) sampling	-	-

No.	Project	Aim of Investigations	Field work as carried out	Machinery Used	Expenditure
1.	<p>B. NON-DEPARTMENTAL PROJECTS</p> <p>Cyprus Grain Commission Limassol Silo Site</p>	<p>(a) In situ Density Tests (b) Engineering Properties of Fill Material</p>	<p>(a) 60 no. in situ density tests (b) disturbed (bulk) samples</p>	<p>In-situ density equipment</p>	<p>£ 324</p>
1.	<p>GROUTING WORKS</p> <p>Vasilikos Cement Factory: for the Hellenic Mining Co.</p>	<p>Consolidation grouting of poorly compacted backfill</p>	<p>(a) 72 no. vertical and included borcholes (b) cement under injection under pressure (c) 112000 kg. of dry cement consumed</p>	<p>(a) Overburden Drill with Flush Pump and air compressor (b) Grouting Equipment consisting of mixer, agitator and grout pump</p>	<p>£ 716</p>

Table 3 - 1975 Soils Laboratory Tests

No.	PROJECT TYPE OF TEST	Departmental							Non-Departmental					Total of each kind of test
		New Lakatamia Reservoir	Dhyptomatos Dam	Kalavassos Dam	Aradhippou Dam	Paphos Main Canal	Pachyannos Reservoir	Miscellaneous	Tremithos Reservoir	Larnaca Salt Lake	Electricity Authority	Cyprus Grain Commission	For G.S.D.	
1	Moisture Content	3				20			3	21	23			70
2	Bulk Density	3				20			3	21	23			70
3	Sieve Analysis			8	12	21	4	9	15	21		2		92
4	Hydrometer Analysis	15	36	15		21	4		15	19	9		9	143
5	Atterberg Limits	14	36	15		21	4	2	15	21	9	2	9	148
6	Specific Gravity	15	36	15		21	4		17	19	9		9	145
7	Standard Proctor Compaction		9	15	1		4		3	3		2		37
8	Modified Proctor Compaction			1					3	3				7
9	Coefficient of Permeability		9	16	1		4		3	3				36
10	Undrained Triaxial Shear Strength	3				20			3	12	23			61
11	Shear Box (Large)			1	1									2
12	Consolidation (Oedemeter)									10				10
13	California Bearing Ratio										10			10
14	Suspended Sediment Analysis							166						166
TOTAL		53	126	86	15	144	24	177	80	143	106	16	27	997

Table 4 - 1975 Concrete and Field Laboratory Tests

No.	Project Type of Test	Concrete Laboratory			Field Laboratory				Total of each kind of test
		Tenders for Concrete Aggregate	For Private Sector	Miscellaneous	Arakapas Dam	New Engomi Reservoir	New Strovolos Reservoir	New Tremithos Reservoir	
1	Sieve Analysis	105	2	4	6	110	85	16	328
2	Silt Content	61	1	2	3	262	50	8	387
3	Organic Impurities	61	1	2	3	262	50	8	387
4	Specific Gravity	5	1		1	5	4	2	18
5	Water Absorption		1	13		5	4	2	25
6	Moisture Content			15	45	48	120	15	243
7	Aggregate Crushing Value	4		2		5	2	2	15
8	Bulking of Sand					1	1	1	3
9	Cube Crushing		35	74	195	486	500	66	1356
10	Slump			8	47	243	680	40	1018
11	Sand Replacement					24	10		34
	Total	236	41	120	300	1451	1506	160	3814

Table 5 - Site Investigation Machinery and Equipment

(i) Drilling and Boring Rigs

No.	Description	Make	No. of	W.D.D. Ref. Nos
1	Rotary Percussion (Overburden) Drill	Atlas	3	294,455,477
2	Core Drill	Craelius	2	354,497
3	Core Drill	Boyles	4	459,460,555,557
4	Mobile Auger/Core Drill	Atlas	1	560
5	Wagon Drill	Atlas	1	423
6	Mini Wagon Drill	Atlas	1	587
7	Shell and Auger Boring Machine	Edeco	1	553

(ii) Air Compressors

No.	Description	Make	No. of	W.D.D. Ref. Nos
1	600 cu.ft. Compressor	Atlas	2	280,362
2	600 cu.ft. Compressor	Gardner	1	495
3	600 cu.ft. Compressor	Cumming	1	668

(iii) Flush Pumps

No.	Capacity H.P.	Make	No. of	W.D.D. Ref. Nos
1	4.75	Lister	1	354A
2	5.5	Petter	2	102,103
3	6.5	Lister	2	460A,554
4	6.5	Craelius	1	564
5	9.5	Simplex	3	499,628,629
7	11.75	Ruston	1	586
8	19.5	Lister	3	556,558,563

Table 5 - Site Investigation Machinery and Equipment (continued)

(iv) Associated Equipment for Use on Site

No.	Description
1	<p><u>Core Drilling Equipment:</u> to fit available coredrills and for boreholes of variable diameter and to depths greater than 100m., including :</p> <ul style="list-style-type: none"> (i) Casing tubes, (ii) Casing show bits (diamond, diaborit, T.C.), (iii) Double Tube Core Barrels, (iv) Core bits (diamond, diaborit, T.C., Rockbit), (v) Central drill rods, (vi) Reaming Shells etc.
2	<p><u>Auger Drilling Equipment:</u> to fit mobile Auger drill and for 0.20m. drilling to 30.0 m., or for 0.25 m. dia. drilling to 12.0m., including :</p> <ul style="list-style-type: none"> (i) Hollow stem auger flights of 1.5 m. length, (ii) Hard or soft formation cutters, (iii) Central boring rods, (iv) Head assembly
3	<p><u>Shell and Auger Boring Machine Equipment:</u> for 0.15 m. or 0.20 m. dia. boring to 25 m. depth in clayee or sandy formations.</p>
4	<p><u>2 Sets Standard Penetration Test Equipment complete with:</u></p> <ul style="list-style-type: none"> (i) 140 lb. automatic trip hammer, (ii) 30 m./set square connecting rods, (iii) Open ended Raymond (split spoon) sampler, (iv) 60° cone ended sampler
5	<p><u>Undisturbed sampling equipment complete with:</u></p> <ul style="list-style-type: none"> (i) 10 cm. dia. head assembly, (ii) 10 cm. dia. open drive (U4) tubes, (iii) 10 cm. dia. cutting head, (iv) 8 cm. dia. and 7 cm. dia. thin walled (Shellby) tube sampler

Table 6 - Laboratory Equipment

(i) Soils Laboratory Equipment

No.	Description	Year Acquired
1	5 No. Liquid Limit Apparatus	2 prior to 1967 1 in 1971 2 in 1974
2	Normal and rapid moisture apparatus	prior to 1967
3	2 No. Shrinkage Limit apparatus	prior to 1970
4	Standard and Modified Proctor apparatus	prior to 1967
5	Sand Replacement apparatus	prior to 1967
6	Sieve analysis and Hydrometer apparatus	prior to 1967 and in 1973
7	Falling and Constant Head Permeameters	prior to 1967
8	Unconfined Compression apparatus	prior to 1967
9	Triaxial shear strength test apparatus (1½" diameter specimens)	Prior to 1967
10	Small shear box machine (6x6 cm. specimen)	prior to 1967
11	3 No. Consolidation apparatus	1 prior to 1967 2 in 1971
12	1 no. 17 inch diameter by 10 inch high constant Head Permeameter	1967
13	2 No. sample extruders	1967 and 1974
14	1 no. High capacity triaxial machine for up to 4 inch diam. soil and rock specimens	1968
15	1 No. Norwegian type Pore Pressure apparatus	1968
16	1 No. Torsion dial balance	1969
17	2 No. Proctor Penetrometer sets	1969
18	Universal Hydraulic Extruder	1970
19	Large Shear Box machine (12"x12 samples)	1970
20	Platform beam scale	1971
21	2 No. multispeed, bench mounted, 1 ton, Triaxial compression machines	1972
22	1 No. multispeed, 5 ton, Triaxial machine	1972
23	2 No. Bishop type Pore Pressure apparatus 1 No. Volume Change indicator	1972
24	6 No. Bishop type Constant Pressure Systems	1972
25	1 No. Infra Red Drying Cabinet	1972
26	1 No. Kango Vibrating Hammer	1972

Table 6 - Laboratory Equipment

(i) Soils Laboratory Equipment (continued)

No.	Description	Year Acquired
27	2 No. Blader type Pressure Cylinders	1973
28	1 No. Constant Head Permeameter for sands	1972
29	Water De-airing Unit complete	1973
30	Automatic Proctor and Modified Proctor Compactor	1973
31	Automatic (hydraulic-electric) Extruder	1973
32	Soil Pocket Penetrometer	1973
33	2 No. stop clocks	1973
34	2 No. Geological Hammers	1974

(ii) Concrete Laboratory Equipment

No.	Description	Year Acquired
1	Aggregate Crushing test apparatus	1960
2	Balance capacity 700 lbs	1961
3	Compacting Factor apparatus for concrete	1961
4	Oven for drying sands and aggregates	1965
5	Concrete cube crushing machine (hand operated)	1957
6	Sieve Shaker	1964
7	Vicant Needle for cement test	1966
8	150 ton Concrete Cube Crushing machine (electrically operated)	1966
9	Laboratory Concrete Mixer	1968
10	Distillation apparatus	1969
11	Large Riffle Box for coarse aggregate	1969
12	Air Entrainment meter	1971
13	Electric Concrete Vibrator	1971
14	Core Cutting machine	1972
15	Portable Coring machine	1972
16	3 in. dia. drill bit for Portable Coring Machine	1973

Table 6 -- Laboratory Equipment

(ii) Concrete Laboratory Equipment(continued)

No.	Description	Year Acquired
17	4 in. dia. drill bit for Portable Coring machine	1973

5

(iii) In Situ Testing Equipment

1	Vane Shear Test Unit	1970
2	2 No. Plate Bearing Test Units	1970 and 1973
3	Well permeability Test Unit	1972
4	Point Load tester unit	1974

Table 7 - Drilling Accessories Purchased in 1975

No.	Quantity	Description
1		Drilling Accessories to fit T 76 Craelius Double Tube Core Barrel consisting of : 15 Diaborit Core Bits 6 Diamond Core Bits 4 Reaming Shells 4 Extension Tubes 4 Core lifter cases 20 Core lifter springs
2		Drilling Accessories to fit T 66 Craelius Double Tube Core Barrel consisting of : 3 Diaborit Core Bits 1 Reaming Shells 2 Extension Tubes 2 Core Lifter Cases 6 Core Lifter Springs
3		Drilling Accessories to fit NWF Boyles Bros. Drilling Equipment consisting of : 4 Diaborit Core Bits 2 Reaming Shells 2 Extension Tubes 2 Core Lifter Cases 8 Core Lifter Springs
4	6	Diaborit, NWX size Casing Shoe Bits
5	6	T.C., 76 mm. dia. Casing Show Bits

Table 8 - Laboratory Equipment Purchased in 1975

No.	Quantity	Description
1	1	Gas Oven
2	24	Pycnometers
3	1	Paschall Ball Mill with Stainless Steel Pot
4	1	Kango Vibrating Hammer
5	1	Andreasen Pipette Apparatus
6	1	Electrical Resistivity Geophysical Equipment
7		Triaxial shear strength Test Accessories consisting of :
	1	Air/Water Pressure Assembly
	2	Bishop Pots
	20m	Polythene Tube
48	Membrances	
8		Undisturbed Sampling (U4) Accessories consisting of :
	4	Cutting shoes
	4	Strap wrenches
9	1	Schmidt Concrete Test Hammer (Type N)

Table 9 - Grouting Machinery and Equipment

No.	Description
1.	1 No. "Moyno" Grout pump (pneumatic) Capacity = 50 psi/min Pumping Pressure = 200 psi
2.	2 No. "Craelius" Grout pumps Reciprocating with diesel engine Capacity = 11 gal/m Pumping Pressure = 1000 psi
3.	2 No. Z.A. 300 High Speed Mixers (Pneumatic), "Craelius" Capacity = 66 Imp. gallons
4.	2 No. Z.A. 600 Grout Agitators (Pneumatic), "Craelius" Capacity = 132 Imp. gallons
5.	1 No. Colloidal grout mixer "Semix 175" type "Craelius"
6.	1 No. Grout Agitator "Concrete" type - Capacity = 77 Imp. gallons

IV. DIVISION OF DESIGN

By

Chr. Marcoullis
Head of Division

4.1 The Design Division of the Water Development Department deals mainly with the detailed design of all major projects undertaken by the Department, preparing all drawings, specifications and conditions of contract.

The Division consists of the following Branches :-

1. Domestic Water Supplies
2. Irrigation
3. Dams
4. Small Dams
5. Hydraulic Structures
6. Topography
7. Drawing and Records.

During 1975, 13 qualified Engineers were periodically or permanently occupied with the works of the Design Division. Certain changes in the qualified personnel of the Division took place during 1975, as described in Section "Scholarships-Fellow-ships-Duty Abroad". In particular the Senior Water Engineer in charge of the Division was awarded a scholarship for postgraduate studies in England and left the Department in August 1975.

The last two of the above stated branches of the Division extend their services to all other Divisions of the Department. That is, the Topography Branch undertakes the topographical work, mapping etc. and the Drawing and Record Branch all drawing work of all major and minor projects carried out by the Department.

In particular the activities of each branch of the Division during 1975 are as follows :

4.2 Domestic Water Supplies Branch

4.2.1 Introduction

As a result of the detailed studies and analysis performed in 1973 by the consulting firm McLAREN INTERNATIONAL LTD., in co-operation with the Design Division of the Water Development Department, in addition to the improvement of the distribution system of the Nicosia Water Supply System, the necessity of reinforcing the system with new balancing reservoirs was recommended for a more effective operation. This involved the construction of a new reservoir at Engomi which has already been completed although not yet in operation, a new reservoir at Strovolos and another two at Lakatamia.

4.2.2 New Strovolos Reservoir

The detailed design of the new Strovolos Reservoir, which is located near the old one at the Nicosia Water Board's main offices, commenced early in 1975.

The reservoir's gross capacity is 8000 m³. This is a reinforced concrete rectangular reservoir with a flat slab designed roof. The reservoir will be about half below ground surface.

Because of the similarity of the reservoir to that of Engomi, the design was ready by July 1975, which enabled the commencement of the construction in August 1975.

4.2.3 New Lakatamia Reservoir

As recommended by the 1973 study two reservoirs will have to be constructed next to the existing Lakatamia Reservoir, providing a net storage of about 40,000 m³.

Although the construction of these new balancing reservoirs is not as urgent as that of the two already mentioned ones, work on the detailed design of one of the two reservoirs started in 1975.

This is also a reinforced concrete structure above ground surface and covered by a conventional slab. The design had proceeded quite well by the end of 1975 although some modifications may be necessary since this reservoir is directly connected to the future Nicosia Water Supply new water sources.

4.3 Irrigation Branch

An account of the work done on irrigation during the year 1975 is given below :

4.3.1 Mavrokolymbos: A design of an open, lined reservoir at the terminal of the main canal and the head of the Khlorakas main was carried out in 1975. This reservoir of a net capacity of 2000 m³ will be used as a balancing storage tank for more effective irrigation.

4.3.2 Yermasoyia

- a. Akrounda-Phinikaria - The design of the distribution system has been continued in collaboration with the Department of Agriculture.
- b. Phassouri-Zakaki Extensions-This scheme was redesigned after a survey of the existing land use and land tenure. Amendments were made on the general layout of the system.
- c. Trakhoni Extension-
 - (i) Pumping Station - Preliminary considerations were made for the design of this sub-system. General ideas were put in writing and recommendations were invited.
 - (ii) Pumping Main - A detail design of the pumping main was carried out and the construction drawings are at their final stage. Specifications for the pipeline and valves were prepared and tenders were invited for their supply.
 - (iii) Trakhoni Storage Reservoir - The Trakhoni extension scheme includes a night storage reservoir of a storage capacity around 20000 m³. Its design and detail drawings have been prepared.

(iv) Distribution system - The layout of the distribution system has been completed. The design of the network was carried out with the use of a digital computer. The bill of quantities, and specifications for the invitation of international tenders for the supply of the pipes and equipment were in progress by the end of 1975.

d. Yermasoyia Irrigation Division - The preparation of the drawings of the Irrigation network for the supply and proper distribution of water to the Yermasoyia Irrigation Division area from the Yermasoyia Dam continued during the year under review.

4.3.3. Palekchori

The designs of the system, which makes use of the existing channel, was finalized and construction works started early in the year.

4.3.4 Polemidthia Irrigation Division

The design work for the preparation of a plan of the distribution system, for the irrigation of the area included in the Kato Polemidhia Irrigation Division from the Polemidhia Dam, was in progress by the end of the year.

4.3.5 Land Consolidation

During the year 1975 the following areas were undergoing Land Consolidation : Kissonerga (New area) Khlorakas, Akrounda, Phinikaria, Palekchori, Ayios Ioannis Malounda, Pera, Monagroulli and Arsos. This Department was represented at the meetings of Land Consolidation Committees by Irrigation Engineers Mr. Elias Kambourides and then by Mr. N. Tsiourtis and the District Engineers of the Department.

4.4. Dams Branch

4.4.1 Dhyptamos dam has been incorporated in the Vasilikos-Pendaskinos Project whose Feasibility study was undertaken by W.D.D. during 1975. A detailed feasibility report was, therefore, prepared for Dhyptamos Dam during the year under review, as part of the Feasibility Study.

Work on the final design of the dam and ancillary works continued during 1975 and preparation of construction drawings was nearly completed.

A rockfill dam with an impervious central clay core was adopted. The type of dam was dictated by the topographical and geological conditions at the dam site and the availability of construction materials. The dam will have a maximum height above the river bed of approximately 49 m, a maximum height above foundation level of approximately 64 m, and a crest length of about 353 m. With its storage elevation at 175.0 m, its capacity would be 15 million cubic metres.

The spillway is located on the ridge in the right abutment and

consists of an unlined approach channel, an ogee crest spillway weir, a concrete-lined rectangular discharge channel and a flip bucket. In the left abutment a tunnel is driven for diverting the river flow during the construction stage and for housing the outlet pipes. A control shaft will provide access to the tunnel and will accommodate the control valves and raw water intakes for possible domestic water supply.

The dam itself will have a total volume of $870,000\text{m}^3$ and together with the ancillary works and other general costs, it is estimated to cost about £2.3 million.

4.4.2 Kalavastos Dam

Early in 1975 it was decided to include this dam as a constituent part of the Vasilikos-Pendaskinos Project. Therefore, all efforts during the year under review were focussed on bringing the design to such a level so that a report on the feasibility of the dam could be prepared.

The damsite is situated on the Vasilikos river near Kalavastos Mines Offices and Workshops and about 5.5 km. northwest of Kalavastos village.

The dam will have a gross storage capacity of 17 MCM with a full storage level of 176.5 m.a.s.l. The damsite lies wholly within the Upper and Lower Pillow Lavas. A rockfill section with a centrally located earthfill core has been adopted. The height of the embankment will reach 57 m. above river bed and the fill volume will be 1.27 million cu.m.

The original foundation and materials investigations were carried out in 1971. Additional field investigation were performed during the year on proposed construction materials as well as subsurface investigation at the damsite to study the location of the spillway and the tunnel alignment.

The adopted solution for the spillway comprises a free ogee crest 42 m. wide weir, discharging into a chute of the same width which ends in a side-channel type trough. The weir is located on the ridge formed by the right abutment and the spilled water will follow a natural gully immediately below this ridge and discharge safely into the river.

The other major feature of the dam is a 3.3 m. diameter diversion tunnel through the left abutment which will eventually be incorporated into the abstraction works. After the diversion stage a valve chamber will be constructed at the upstream end to block the entrance of the tunnel. This valve chamber will house the sluice valves controlling the Irrigation, Raw Water and Scour pipes. A horizontal slab will be constructed along the whole length of the tunnel dividing it into a scour conduit at the invert and an access and pipework gallery above the slab.

At the downstream end of the tunnel a control room and another valve chamber will be erected. The control room will house the console for the remote operation of the sluice valves in the upstream valve chamber as well as the terminals of the flow and reservoir level instrumentation.

The Irrigation and Raw water mains will pass through the downstream valve chamber where they will be fitted with flow regulating valves and will then go into the canal.

The overall estimated cost of the dam and ancillary works is £2.71 million.

The feasibility study for this work was completed by October 1975.

4.5 Small Dams Branch

4.5.1 Lymbia Irrigation Division Improvement Works

In view of the hydrological conditions of the area, it was decided to utilize only 10% of the mean annual runoff, so that downstream irrigation from wells and stream diversions at Psevdhas and Ayia Anna, would not be adversely affected.

The required storage will be provided by a new concrete gravity dam, which will be constructed downstream of the silted up old masonry dam, which has already been demolished.

The idea of raising the old dam was eventually dropped on technical grounds.

The capacity of the New Lymbia concrete gravity dam will be 220,000m³ and its height above river bed level to spillway crest 9.60 m. The spillway will be of the uncontrolled ogee crest type (25 m x 2 m).

The capacity of the main irrigation canal, will be 110 lit/sec.

The improvement works will be carried out in two phases as follows :

a. First Phase

- (i) Construction of the New Lymbia dam. Estimated Cost £86,000
- (ii) Lining of the existing canal. Estimated Cost £39,000.

b. Second Phase

- (i) Construction of secondary distribution system
Estimated Cost £35,000.

By the end of the year the detail engineering design of the dam and the main canal has been completed and the work for the preparation of drawings, bill of quantities and cost estimates was progressing.

When the whole scheme will be completed about 380 donums of land cultivated with potatoes, beans, tomatoes and melons will be irrigated.

4.5.2 Aradhippou Dam

During the second half of 1975 work started on the design of Aradhippou Dam. The damsite is located on Archangelos river about 1.0 km north of Aradhippou village. The reservoir will store water from the Archangelos river whose catchment area is of the order of 54.0 sq.km.

The topographical and geological conditions and the availability of construction materials have dictated the choice of an earth dam with central clay core and an upstream clay blanket. The maximum height of the dam above the river bed is 15.0 m.

The proposed maximum storage elevation is 58.0 m, which corresponds to a reservoir capacity of 375,000 cubic metres. The water will be used mainly for recharging the downstream aquifer and partly for direct irrigation.

For the type and location of the spillway several preliminary designs have been carried out. Finally two spillways have been adopted. A main spillway, of a free overflow type with a lined chute leading to a stilling basin, will be located at the right hand side of the dam. On the left abutment the dam will be provided with an emergency spillway which will be used in cases of much higher floods.

A steel pipe of a 0.60 m diameter will be used for desilting purposes and another of 0.30 m diameter will serve as an irrigation outlet.

By the end of the year under review the design was almost completed and most of the drawings prepared. It is expected to have the dam ready for construction early next year.

4.6 Hydraulic Structures Branch

4.6.1 Khirokitia-Dhyptomamos Diversion Works

During the first half of 1975 the work on the design of the above diversion, which started in 1974, has been completed and a report on its feasibility prepared.

The diversion works will consist of a Diversion weir situated on the Maroni river about 3.0 km. north of the Khirokitia village and a conveyor of a maximum discharge of 1.0 cubic meter per second.

Three alternative alignments have been studied for the conveyor. The alternative finally recommended has a total length of 10.3 km and is a combination of lined trapezoidal and rectangular canals, a 550 meter long Tunnel, 3 main Syphons and some bridges and aqueducts.

The total estimated cost of the Diversion Works will be about £490,000.

4.6.2 Hydraulics Laboratory

During the year under review the WDD Hydraulics Laboratory continued and completed testing the spillway model of Lefkara Dam which has been constructed at a scale of 1:50.

The tests were divided into two main categories namely hard surface tests for determination of the hydraulic behaviour of the spillway and erodible surface tests for a qualitative evaluation of the possible extent of erosion below the flip bucket.

The first category included such tests as the determination of the head-discharge relation, the profile of the discharge in the chute, the trajectory of the discharge from the flip bucket, the formation of a hydraulic jump in the flip-bucket at low flows and the extent of downstream flooding at various discharges.

The second category tests were designed to determine the extent of erosion below the flip bucket due to prolonged discharge. These tests were only of qualitative value due to the unavoidable difficulty of scaling the hardness sheeting, inhomogeneity and overall erodibility of the rock slope.

4.6.3 Flood Studies

In designing an earthfill or a rockfill dam the problem of optimising the spillway width always arises. This optimisation process involves the routing of the spillway design and freeboard floods of various spillway weir lengths, which would effectively entail a lot of work and time if carried out manually.

For speeding up this operation a programme on a digital computer was prepared which after passing from several degrees of generality it was developed to its most general form given the name ROUTE 3.

The principal purpose of this programme is to perform the routing of any flood when this is passing through a reservoir having a spillway with a free-ogee crested weir. Being given the inflow hydrograph, therefore, it computes the outflow hydrograph for this particular flood. In its final general form the programme involves three different methods of design according to different requirements. These give the programme the flexibility of being applicable both in the case of originally designing an ogee crested spillway when it is required to find first the design head of the weir based on the spillway design flood and then proceed to route any other floods, as well as the case of an already designed spillway where the design head is already fixed and simple routing of a certain flood is required.

In each run of the programme a maximum of four floods can be examined for upto 6 different spillway weir lengths.

4.7 Topography Branch

The Topography Branch, under the supervision and guidance of Inspector of Works A. Evripidhou, has performed all the survey works requested by all the Divisions of the Department. These surveys are mainly of the engineering type and consist of contour surveys for dam sites and reservoirs, profile levelling and cross-sectioning for canals and pipelines, setting out of project outlines, surveys for reservoir sedimentation studies and instrumental observations for movement detection of constructed Dams and the neighbouring slopes.

The survey works for the feasibility study of Vasilikos-Pendaskinos Project has been completed within the estimated time limits and the gathering of field data for the final design of this Project is expected to start early in 1976.

In spite of the tragedy of the Turkish invasion this Branch has been re-activated in an admirable manner due to the efforts and the responsible way the staff of this Branch and the Department as a whole confronted this difficult situation. Two colleagues, from this Branch, are still in the hands of the Turkish invaders and their families are still suffering and waiting for their return.

The staff of this Branch during the year 1975 was as follows:

Post	No.	Class	Remarks
Inspector of Works	1	Permanent	I/C of Branch
Technical Assistants	5	-do-	
Technical Assistants	2	Temporary	
Technical Assistants	1	Daily paid	
Technical Assistants	11	Hourly paid	Two of them missing

During this year the Branch has dealt with the following projects:

Project	Type of Survey	Remarks
Vasilikos-Pendaskinos	profile levelling and contour	Major Projects Investigation
Kiti Distribution system	Profile levelling	Minor works
Tremithos River	Contour	Preliminary Survey
Lymbia Dam	Contour	Minor works
Khirokitia treatment Plant	Contour	Completion plan
Pera-Politiko	Contour	Dam Reservoir
Lefkara Pipeline	Profile levelling	Construction purposes
Larnaca Salt Lake	Levelling	Investigations
Louvaras	Contour	Minor works
Ayia Marina Xyliatos	Contour	-do-
Alaminos Reservoir	Altimeter	Preliminary Survey
Paphos Canal	Setting out	Location of canal route
Aradhippou Dam	Contour	Dam Site
Kiti Dam	Contour	Sedimentation Studies
Politiko Reservoir	Contour	Minor Works
Athalassa Dam	Contour	Sedimentation Studies
Agros Dam	Contour	Completion plan
Gourri	Contour	Dam site I
Gourri	Contour	Dam site II
Gourri	Contour	Dam site III
Pharmakas Reser.	Contour	Minor Projects
Galata Reservoir	Contour	Minor Projects
Parekklissha Dam	Contour	Minor Projects
Kalopanayiotis Dam	(Instrumental	Movement detection
Lefkara Dam)Observations	

4.8 Drawing and Records Branch

4.8.1 The Drawing Branch consists of the following sections :

1. The Drawing Section
2. The Plan Printing Section
3. The Photographic Section
4. The Technical Library and Technical information section

The staff of the Drawing Branch during 1975 numbered 21 i.e. 8 Draughtsmen scale 5,9 daily paid assistants, 3 hourly paid assistants and the head of the Branch. For the whole year three of the assistants were loaned to the Social Welfare Services dealing with refugees and a fourth was on leave without pay from May to the end of the year. One of the Draughtsmen was transferred to the Paphos District Office of the Department.

4.8.2 Drawing Section

During the year under review the Drawing section undertook all normal drawing work of the Department as well as that for the Vasilikos-Pendaskinos and Paphos Irrigation Projects. In addition all the work for the colour Land Use Map of Cyprus scale 1:250,000 was completed.

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

	<u>Time spent in hours</u>	<u>Man months</u>
a. Existing and Proposed dams	4960	31
b. Irrigation distribution system for dams	1250	7.8
c. Routine irrigation schemes	1310	8.3
d. Domestic water supplies	3940	24.7
e. Recharge schemes	160	1
f. Hydrological	320	2
g. Programmes and organization	200	1.3
h. Completion plans	1260	7.9
i. Completion reports	550	3.5
j. Vasilikos-Pendaskinos Project	2720	17
k. Land use map of Cyprus	950	6
l. Paphos Irrigation Project	980	6.1
m. General	1470	9.2
n. Odd jobs	390	2.4
o. Reports	1380	8.6
p. Auxiliary services	16.0	10
i. Library	1610	10
ii. Plan registry	440	2.8
iii. Drawing materials store	100	.6
q. Leave etc.		
i. Leave paid	1880	11.7
ii. Leave without paid	890	5.6
iii. Sick leave	880	5.5
iv. Maternity leave	160	1
Totals (hours)	<u>27,800</u>	<u>174</u>

4.8.3 Plan Printing Section

Plan reproduction continued during 1975 with one continuous process and one still machines. Some 2500 orders were issued to the printing section for 25000 prints of various sizes and of all types.

4.8.4 Photographic Section

The photographic section comprises of 2 services. The photo-process lab for reproduction enlargement and reduction of maps in various materials and photographic coverage of works for publicity and records purposes. Black and white and colour still photographs were taken as well as colour 16 mm cine film.

4.8.5 Technical Library and Technical Information Section

Despite its total destruction by fire in July 1974, the Library having been housed elsewhere in the Department, is picking up again with some 1250 new registrations of books and reports.

During 1975, 26 new books were purchased at a cost £99 and subscription was continued on 8 Technical Periodicals at a cost of £45. In addition 40 reports were prepared by officers of the Department and numerous other material was received free of charge.

The Library is grateful to the U.S. Department of the Interior Bureau of Reclamation for the gift of 17 very useful books and manuals.

All books registered with the Library during 1975 are shown in the following tables:

WATER DEVELOPMENT DEPARTMENT LIBRARY STATEMENT FOR 1975
BOOKS PURCHASED DURING 1975

Library Reg.No.	Title	Author	Price
6847	The design of sewers and sewage treatment works	WHITE, J.B.	£ 5.000
6848	Legal pitfalls in architecture engineering and building construction	WALKER, N & ROHDENBURG, TH.K.	£ 6.300
6849	Applied hydrodynamics	VALLENTINE, H.R.	£ 2.500
6850	An introduction to fluid dynamics	BATCHELOR, G.K.	£ 2.950
6851	The mechanics of engineering soils	CAPPER, P.L. & CASSIE, W.F.	£ 2.150
6852	Problems in hydraulics and fluid mechanics	FRANCIS, J.R.D. & MINTON, P.	£ 1.500
6853	Land surveying	WILSON, R.J.P.	£ 1.500
6854	Analysis of singlebay frames	MORGAN, V.A.	£ 1.400
6855	Standard bridge beams for spans from 7 m to 36 m	SOMERVILLE, G.	£ 0.500
6856	Standard method of detailing reinforced concrete	THE CONCRETE SOCIETY & INSTITUTION OF STRUCTURAL ENGINEERS	£ 1.000
6857	The theory and practice of bearings and expansion joints for bridge	LEE, D.S.	£ 2.000
6858	Gunite a handbook for engineers	RYAN, T.F.	£ 1.500
6859	An English-Creek technical dictionary	HIONIDES, H.T.	£ 2.000
6860	Dictionary of technical terms	CRISPIN, F.S.	£ 3.500

Library Reg. No.	T i t l e	Author	Price
6861	Reinforced concrete detail- ing	BARKER, J.A.	£ 6.000
6862	Architect's data	NEUFERT, E.	£ 6.000
6863	Tables & diagrams for use in designing sewers and water mains	BRUGES, W.E.	£ 6.550
6500	B.S. 4504:1969 Flanges and bolting for pipes, valves and fittings. Amendment slip No.1,17/3/71 " " 2, 3/1/72 " " 3,15/2/72 " " 4,28/6/74 " " 5,31/ 7/75	BRITISH STANDARDS INSTITUTION	£ 4.550
7342	Foundation design and construction. Third Edition 1975	TOMLINSON, M.J.	£15.000
7470	Economics. Ninth edition	SAMUELSON, P.A.	£ 5.650
7483	CP 2007:Part 2:1970 Design and construction of reinforced and prestressed concrete structures for the storage of water and other aqueous liquids. Part 2. Metric units	BRITISH STANDARDS INSTITUTION	£ 3.500
7566	Timber: Properties and Use	FINDLAY, W.P.K.	£ 5.000
7567	Steel frame design examples	ROBB, LAN.	£ 2.400
7568	Properties of Concrete	NEVILLE, A.M.	£ 5.000
7569	Design and Construction of formwork for concrete Structure 6th edition	WYNN, A.E. & MANNING, G.P.	£ 4.000
7570	Safe-load tables for solid slabs. (In accor- dance with (CP.110)	ALLEN, A.H.	£ 1.500
	Total		£98.950

BOOKS PROVIDED BY U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION FREE OF CHARGE

Library Reg.No.	T i t l e	Author
7578	Estimating. Appendix 150A- Estimating Data(Handbook)	U.S.DPT., OF THE INTERIOR BUREAU OF RECLAMATION
7579	Construction (Handbook)	" "
7580	Concrete dams (Design Standards No.2) Chapter 1 Arch dams	" "
7581	Concrete dams (Design Standards No.2) Chapter 2 Gravity dams	" "
7582	Design Standards No.7 Valves,gates, and steel conduits	" "
7583	Design of small canal structures	" "
7584	Materials laboratory procedures manual	" "
7585	Engineering Monograph No.10 Reinforced Concrete Design Data	" "
7586	Engineering Monograph No.19 Design Criteria for concrete Arch and Gravity dams	" "
7587	Engineering Monograph No.25 Hydraulic Design of Stilling Basins and Energy Dissipators	" "
7588	Engineering Monograph No.33 Hydraulic Design of Transitions for small canals	" "
7589	Engineering Monograph No.34 Control of Cracking in Mass Concrete Structures	" "
7590	Linings for irrigation canals	" "
7591	Dams and Control Works 3rd edition	" "
7592	Technical Memorandum 646 Pressure Grouting	" "
7593	A Guide to Using Interest Factors in Economic Analysis of Water Projects	" "
7594	Water Measurement Manual	" "

SUBSCRIPTION TO TECHNICAL PERIODICALS 1975

Ser. No.	Title	Price
1	Journal of the American Waterworks Association	£12.150
2	Proceedings of the Society of Water Treatment and Examination	£ 1.000
3	Concrete	£ 3.000
4	Proceedings of the Institute of Civil Engineers	£ 8.000
5	Geotechnique	£ 6.500
6	Journal of the Institute of Water Engineers	£ 6.000
7	Magazine of Concrete Research	£ 2.000
8	Transactions of the American Society of Civil Engineers	£ 5.750
	Total	£44,400

DEPARTMENTAL REPORTS 1975

Library Reg.No.	Title	Author	Date
6803 6804	Larnaca water supply. Tremithos reservoir. Site investigation. Report No. F/47	P. LOUCAIDES	January, 1975
6807 6808	Palekchori Dam Project. Distribution System. (Working drawings & Bill of Quantities). Report No. I/6	N. TSIOURTIS	January, 1975
7102 7103	Prastio (Evdhimou) Water Supply House-to-House Scheme Report No. C/113	P.TH. KAZAMIAS	January, 1975
7460 7461	Athienou Water Supply-House-to-House Scheme. Pump House & High Level Reservoir. Report No. C/114	VR. IOANNOU	January, 1975
6805 6806	Hydrological year-book of Cyprus 1971-1972. Report No. H/34	N.CHR. TOUFEXIS CHR. PHANARTZIS J. JACOVIDES	February, 1975
6979 6980	Anglisidhes Irrigation Division No. 2 Report No. C/106	E. CHR. ELIADES	February, 1975
6985 6986	Kyra Summer Water Irrigation Division Report No. C/112	S. GEORGHIOU	February, 1975
6987 6988	Yerasa Irrigation Division Report No. C/115	P.TH. KAZAMIAS	February, 1975
6992 6993	Vasilikos-Pendaskinos Project (Preliminary Study) Vol. 1 (Text) & Vol. 2 (Drawings) Report No. P/5	B.M. MILINUSIC & L.P. SAVVIDES	February, 1975

Library Reg. No.	T i t l e	Author	Date
6981 6982	Pyroi Water Supply. House-to- House Scheme. Phase "A" Report No. C/107	E.CHR. ELIADES	March, 1975
6990 6991	Akrotiri Project with diversion from Paphos. Report No. P/4	C.A. CHRISTODOULOU	March, 1975
7462 7463	Potamos-tis-Yermasoyia Water Supply. House-to-House Scheme Supplementary Supply from BHs & trunk mains. Report No. C/116	P.TH. KAZAMIAS	March, 1975
7464 7465	Aradhippou Water Supply. House-to-house Scheme Supplementary Supply from B.H. Report No. C/117	E.CHR. ELIADES	March, 1975
7099 7100	Consumptive Use and Irrigation requirements of the main crops grown in Cyprus. Report No. I/9	L.SAVVIDES & CHR.PHANARTZIS	April, 1975
7101	Paphos Irrigation Project. Main Canal Structural & hydraulic study for culverts Report No. I/10	K.A. SPANOS	May, 1975
7109 7110	Vasilikos-Pendaskinos Projects System simulation model "Zylafa" (version 2) Report No. H/36	C.A. PHANARTZIS	May, 1975
7348 7349	Larnaca Water Supply. Tremithos Reservoir. Additional Site Investi- gation. Report No. F/48	P. LOUCAIDES	May, 1975
7486 7487	Kilani, Skotini, Ayia Mavri, Iacovides & Amouti Irrigation Division. Report No. C/118	P.Th. KAZAMIAS	May, 1975
7455	Application of dynamic programming in the conjunc- tive use of dams and aquifers Report No. H/38	J.S.JACOVIDES	June, 1975
7456	Cyprus Grain Commission, Grain Storage Silos Site Investigations. Report No. F/49	P. LOUCAIDES	June, 1975

Library Reg.No.	T i t l e	Author	Date
7453 7454	Water Distribution Systems. Flow and Economic Analysis, via Mathematical Programming Report No. I/11	N. TSIOURTIS	July, 1975
7466 7467	Annual Report of the Depart- ment of Water Development for the year 1974	C.A.C. KONTEATIS	July, 1975
7473 7474	Selection of Optimum Cropping Pattern. Via Linear Programm- ing Report No. I/12	N. TSIOURTIS	July, 1975
7493 7494	Akrotiri Project. Review Reports. Report No. P/6	C.A. CHRISTODOULOU	July, 1975
7471 7472	Southern Conveyor Project. Introductory Report. Report No. P/7	C.A. CHRISTODOULOU	August, 1975
7475 7476	Pitsilia Irrigation Project Preliminary Report. Report No. I/13	P. PANTELIDES	August, 1975
7477 7478	Paphos Irrigation Project. Main Canal Structural and Hydraulic Study for Bridges Report No. I/14	A. LAMBROU	August, 1975
7479 7480	Skarinou Regional Water Supply Scheme Supplementary Water Supply. Report No. C/119	E.CHR. ELIADES	August, 1975
7484 7485	Nicosia Water Supply. New Lakatamia Reservoir. Site Investigation. Report No. F/50	P. LOUCAIDES	August, 1975
7518 7519	Skarinou Irrigation Pumping Scheme from BH 35/70. Report No. C/120	E.CH. ELIADES	August, 1975
7520	Ayios Konstantinos (L ^I) W.S.	P.TH. KAZAMIAS	September, 1975
7521	House-to-House Scheme Report No. C/122		
7495 7496	Ephtagonia Water Supply. House-to-House Scheme. Pumping Scheme from B.H. 42/72. Report No. C/121	P.TH. KAZAMIAS	October, 1975

Library Reg. No.	T i t l e	Author	Date
7508 7509	The conjunctive Use of Aspro- kremos Reservoir and the Dhiarizos and Ezouza well- fields. Report No. H/39	J.S. JACOVIDES	October, 1975
7516 7517	Curve Fitting by Means of digital Computer. Report No. L/17	P. SKORDIS	October, 1975
7571 7572	Ayios Amvrosios (L ^L) W.S. House-to-House Scheme. Report No. C/123	P.TH. KAZAMIAS	October, 1975
7510 7511	Streamflow Recharge Evalua- tion for Dhiarizos Aquifer. Report No. H/40	J.S. JACOVIDES	November, 1975
7512 7513	Cyprus Grain Commission. Limassol Silo Site in Situ Density and Laboratory Testing. Report No. F/51	P. LOUCAIDES	November, 1975
7514 7515	Paphos Irrigation Project. Organization and management. Report No. 4 Report No. D/13	B.M. MILINUSIC	November, 1975
7573 7574	Ayia Vavatsinias. House- to-House Scheme Supplemen- tary Water Supply. Report No. C/124	G.A. CONSTANTI- NIDES	November, 1975
7600 7601	Yerasa Water Supply. House- to-House Scheme. Report No. C/125	P.TH. KAZAMIAS	November, 1975



Gabion Weir for recharge purpose on Yialias
river at Potamia village



Measuring the flow of Akaki river with a
Current Meter

V. DIVISION OF CONSTRUCTION
By

A. P. Georghiadhes
Head of Division

5.1 Introduction

The Division of Construction which is one of the major divisions of the Department is sub-divided into four main branches:

- (i) The Planning branch,
- (ii) The Major Projects branch,
- (iii) The Control branch for minor and major project, and,
- (iv) The Workshop

The Division is responsible for the Planning, supervision and control of all constructional works of the Department in the field of Domestic Water Supplies and Irrigation Works and in the capacity of Major and Minor Projects, whether carried out by direct labour or by contract. Another activity of the Division is the preparation of Completion Plans and Reports of all Schemes executed, as well as the checking of estimate at design stage.

The numerous functions of the Division and the different types of schemes executed, necessitate the manning of the division with an experienced personnel at all levels.

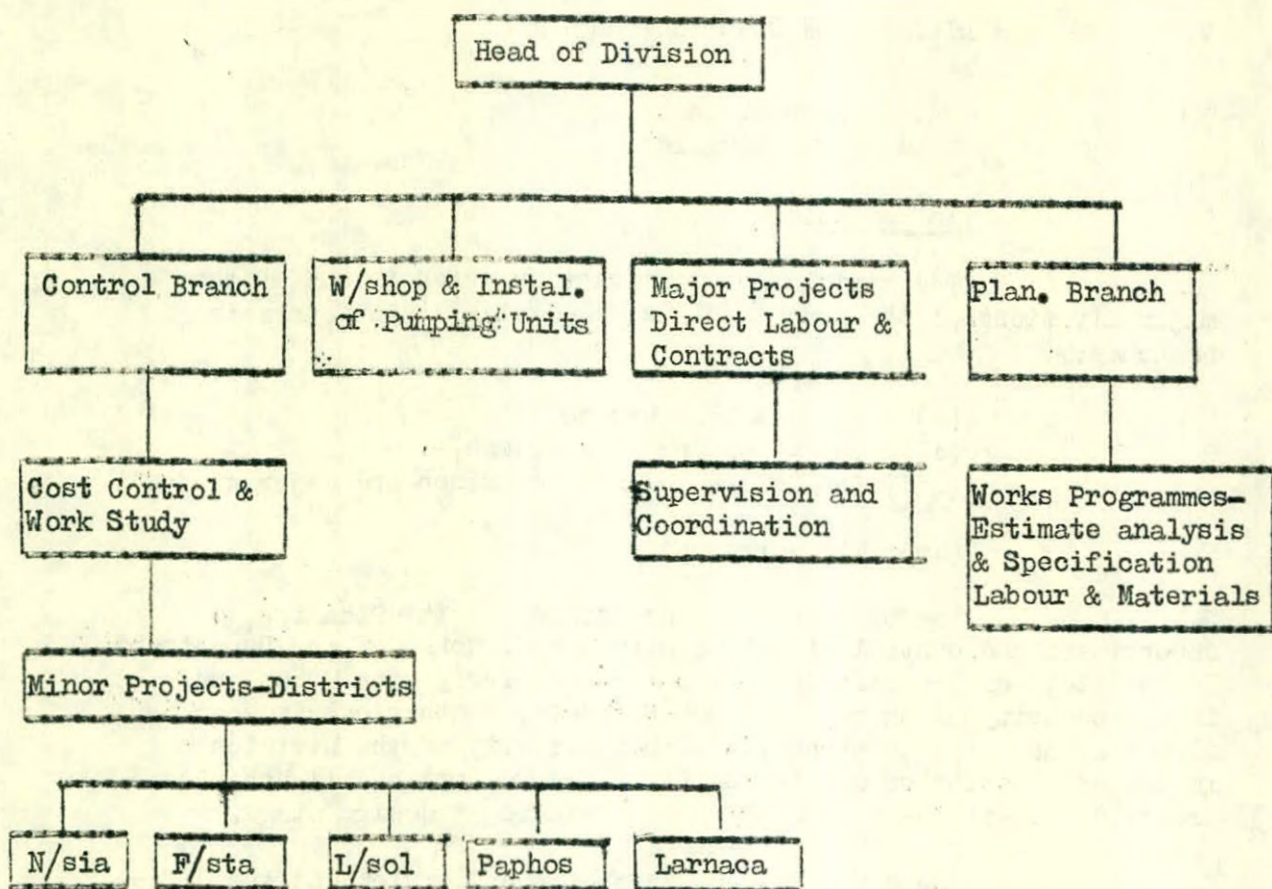
With the decision taken to assign to the District Offices (Larnaca, Limassol, Paphos) the direct supervision of all works executed in their respective District, three members of the staff of the Division had to be transferred to rank the District Offices with the necessary experienced supervising staff.

The staff of the Division in 1975 consisted of:

- 1 No. Executive Engineer - class I - Head of the Division
- 2 No. Executive Engineers class I
- 1 No. Mechanical Engineer class I
- 2 No. Senior Inspectors of Works
- 7 No. Inspectors of Works
- 1 No. Chief Foreman
- 9 No. Assistant Chief Foreman
- 2 No. Technical Assistants
- 1 No. Daily paid Technical Assistant
- 53 No. monthly paid Foremen
- 45 No. weekly paid Foremen

124 Nos. in total

5.2 The structural organization of the Divisions is as follows:



5.3 Planning Branch

This new Branch within the Division deals with the preparation of construction programmes and the planning of the execution of the schemes, throughout the island.

Planning, prior to the execution of the schemes, is considered a vital procedure for the construction process as this paves the way for the smooth, and economical execution of the works.

This branch deals with all matters related to:

- (i) The invitation of tenders for machinery, pumping units, pipes and pipefittings, and materials,
- (ii) The acquisition of immovable property effected by the works,
- (iii) The supply of electricity to pumping units,
- (iv) The distribution of resources, such as labour force, plant and materials, and,
- (v) The checking of the schemes designed by the Small Projects Planning Division, with regard to operation, rates and final estimate.

5.4 Control Branch

The staff of this Branch consists of one Executive Engineer I, a Senior Inspector and one Inspector of Works, with a wide experience in supervision and control techniques.

This Branch exercises control over the execution of the schemes, and its primary objective is to advise the supervising Technical Officers on any problems which might arise during the period of construction, or on any modifications that become inevitable in the light of actual data, with the least repercussion on the cost of the scheme.

In addition this Branch follows up and sees, that all construction programmes are observed, the progress of the work is attained at reasonable standard and that the Estimate of the scheme is not exceeded.

Another important function is the collection of data, regarding actual rates, standard of materials and equipment, the results of which are appraised and utilized for future planning and Cost Estimating.

5.5 Construction Programme and Progress

The initial construction programme of the Division for 1975 included 115 Major and Minor schemes, at a total estimated cost of £1,706,400.

The execution of most of these schemes commenced in April soon after the Development Estimates were approved by the Council of Ministers and the village loans made available.

Construction started with the maximum impetus possible, with a view to creating employment opportunities for the displaced labour force.

The construction programme for the minor schemes was almost completed by August of the year under review, and in view of this, a supplementary budget for £709,005 was approved by Government for the execution of 16 minor water supply schemes at a total estimated cost of £373,935, and 12 minor Irrigation schemes at a total estimated cost of £335,070. With the approval of the supplementary budget the overall construction programme of the Division for 1975 included 143 schemes at a total estimated cost of £2,415,403.

These schemes are divided into 4 main categories as stated below:

Ser. No.	No. of scheme	Nature of scheme	Amount Allocated for 1975
1	56	Village Water Supplies	£ 649,385
2	66	Minor Irrigation Schemes	£ 613,299
3	16	Major Irrigation Schemes	£ 808,729
4	5	Town Water Supply Schemes	£ 344,000
Total	143		£2,415,403

The supervision of the schemes under construction in Limassol, Larnaca-Famagusta and Paphos, was assigned to the respective Regional Offices of the Department with periodic supervision by the staff of Division at Head Quarters. The District Engineers were also reporting regularly to the Head of the Division on the progress of the works.

The Division also undertakes the execution of schemes which fall within the jurisdiction of the Department, on account of other Government Departments, Water Boards, Village Water Supply and Irrigation Commissions, as well as for Private Individuals regarding water supplies for land development, at full cost.

The total expenditure for such schemes undertaken in 1975 amounts to £161,438.

The overall expenditure incurred on all construction activities for the year 1975 reached the amount of £1,651,635. This amount includes also expenditure on carry over schemes from the year 1974 Development Budget.

Table 5A that follows indicates the number of schemes and the actual expenditure for each category of schemes.

Table 5A

Ser. No.	Nature of scheme	No. of schemes	Amount Allocated for 1975 £	Expenditure incurred in 1975 £
1.	Village Water Supply Schemes	56	649,385	236,658
2.	Minor Irrigation schemes	66	613,299	306,372
3.	Major Irrigation Schemes	16	808,729	687,645
4.	Town Water Supply Schemes Including Water Boards	5	344,000	259,522
5.	Minor Services to Water Boards and Municipalities	7	8,130	5,916
6.	Works for other Government Departments	140	134,087	111,562
7.	Village Water Supply Schemes from Village Funds	116	31,486	19,608
8.	Minor Irrigation Schemes from Village Funds	19	3,839	2,677
9.	Works for private Individuals	68	27,864	21,675
T o t a l s		493	2,620,819	1,651,635

5.6 Labour Force

The gangs for the execution of the schemes were composed of the Departmental Regular skilled artisans of various trades, and of casual unskilled labourers who were recruited locally, through the Government Labour Department.

The average daily labour force engaged during 1975 was 880 persons, out of which 335 were Regular Employees. The total expenditure on wages during 1975 reached the amount of £588,280.

The difficulties encountered in previous years for the recruitment of casual labourers for the execution of the construction programme, were not faced in 1975. There was an abundance of labour force which was created from the Turkish invasion, and the accommodation of the displaced people in villages all over the island on one hand, and the interruption of the activities of the private sector on the other hand. To this factor, the speedy completion of the construction programme can be partly attributed.

5.7 Construction Plant

After the decision by Government to establish the Electrical and Mechanical Services Department for the pooling of all Government machinery, the Departmental machinery was handed over in January 1975.

All machinery requirements, for constructional purposes were hired from the E.M.S. Department and in cases where such machinery was not available, it was hired from the private sector through open tenders.

During 1975 Government machinery was hired for 19,207 days at a total cost of £50,794, and machinery from the private sector for 37,164 hours at a total cost of £43,610.

Table 5B that follows indicates the working hours and expenditure for all types of machinery hired by the Division.

5.8 Materials

Most of the materials used for the construction of the schemes were purchased through the Government Central Stores. Such materials are, pipes and pipefittings, timber, reinforcement steel, pumping units, cement, water meters etc. Building materials such as gravel, sand and aggregates were purchased through local tenders.

The expenditure on such materials used by the Division reached the amount of £313,404 as shown in detail on Tables 5B and 5C on next page.

Table 5B - Materials and Hired Machinery

Ser. No.	Description	Quantity	Expenditure £	Total £
A.	<u>Materials</u>			
1.	Cement	3,650 tons	36,570	
2.	Sand	4,141 m ³	5,534	
3.	Shingle	9,411 m ³	11,150	
4.	Aggregate	4,643 m ³	3,363	
5.	Water meters $\frac{1}{2}$ " ϕ	1,435	5,740	
6.	Sand for pipe bedding	19,050 m ³	8,765	71,122
B.	<u>Hired Machinery through open tenders</u>			
1.	Heavy Machinery	668 hrs	1,922	
2.	Loaders	5,557 hrs	7,250	
3.	Excavators (Digger)	14,424 hrs	23,400	
4.	Lorries	4,993 hrs	5,083	
5.	Land Rovers	660 days	1,300	
6.	Compressors	5,582 hrs	4,655	43,610
C.	<u>Hired Machinery from E.M.S. Department</u>			
1.	Heavy Machinery	1,652 days	18,160	
2.	Concrete Mixers	5,990 days	7,820	
3.	Compressors	1,380 days	9,288	
4.	Land Rovers	10,185 days	15,526	50,794
	GRAND TOTAL			165,526

Table 5C - Pipes Laid

A. Galvanized iron pipes - Class "B"

Ser. No.	Nominal Diameter in inches	Length in running meters	Purchase Price £
1.	$\frac{1}{2}$	4,512	1,312
2.	1	4,254	2,178
3.	$1\frac{1}{4}$	11,244	6,060
4.	$1\frac{1}{2}$	5,406	3,362
5.	2	7,878	6,421
6.	$2\frac{1}{2}$	10,566	11,390
7.	3	15,090	21,126
8.	4	33,204	69,728
	Total	92,154	121,577

(b) Steel pipes (victaulic joint) - Class "B"

Ser. No.	Nominal Diameter in inches	Length in running meters	Purchase Price £
1	6	7,428	21,756
2	8	66	280
3	10	2,340	18,160
4	12	24	172
Total		9,858	40,368

(c) Asbestos Cement pipes - Class "B"

Ser. No.	Nominal Diameter in inches	Length in running meters	Purchase Price £
1	3	1,512	892
2	4	48,920	26,717
3	6	13,060	7,795
4	8	1,272	1,339
5	12	1,925	4,830
6	32	630	5,560
7	36	420	4,633
Total		67,739	51,766

(d) Asbestos Cement pipes - Class "C"

Ser. No.	Nominal Diameter in inches	Length in running meters	Purchase Price £
1	3	4,050	3,745
2	4	15,520	10,810
3	6	6,280	5,866
4	32	600	8,150
Total		26,450	28,571

5.9 Village Water Supply Schemes

As already mentioned above, the construction programme of the Division included 56 Village Water Supply Schemes at an estimated cost £649,385.

Out of the total number of 56 Village Water Supply Schemes scheduled for execution in 1975, 28 schemes were completed, 14 schemes were put in hand but not completed by the end of the year and carried over for completion in 1976, and 14 schemes could not be put in hand for various reasons and were carried over for execution in 1976.

The total expenditure incurred on all Water Supply Schemes reached the amount of £236,658. For easy reference these schemes are classified as under :

- (i) Village Water Supply Schemes completed in 1975;
- (ii) Village Water Supply Schemes put in hand in 1975 but not completed and carried over for completion in 1976, and
- (iii) Village Water Supply Schemes not put in hand for various reasons and carried over for execution in 1976.

Details for each of the above class is given below :

5.10 Village Water Supply Schemes completed in 1975

During 1975, 28 Water Supply Schemes were completed. The amount allocated in 1975 for these 28 schemes was £184,425, and the expenditure for their execution was £132,509. It must be noted that some of these schemes were carried over from 1974, and their actual cost was much higher than that indicated in the table that follow, as expenditure on these schemes was made in 1974.

These schemes and the expenditure incurred as well as a brief description of the scheme is given on table 5D below :

Table 5D - Village Water Supply Schemes completed in 1975

Ser. No.	Village	Approved Amount for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Nicosia District</u>				
1	Lymbia Regional Scheme	7,685	6,270	B/H and House to House.
2	Piyenia	3,932	360	New B/H and House to House.
3	Pano Pyrgos	791	580	Borehole and conveyor.
4	Ayia Irini	1,290	875	House to House.
<u>Limassol District</u>				
5	Pano Kyvidhes Reg.	11,010	10,446	Spring & conveyor.
6	Trachoni	4,560	4,188	St. Tank & House to House.
7	Ypsonas-Polemidhia	24,630	23,360	New B/H supplement. supply.
8	Kalo Khorio	4,638	2,777	New B/H supplementary supply.
9	Prastio (Kellaki)	1,480	—	Storage Tank.
10	Pyrgos	6,676	4,218	B/H, St. Tank & conveyor.

Ser. No.	Village	Approved Amount for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Famagusta District</u>				
11	Phrenaros	29,200	25,124	House to House distribution system.
12	Ayia Napa	5,000	2,715	B/H and conveyor.
<u>Larnaca District</u>				
13	Skarinou-Ayios Theodoros -Alaminos	2,880	750	B/H St. Tank House to House.
14	Ormidhia	5,776	4,890	B/H conveyor.
15	Xylotymbou	7,000	714	Conveyor.
16	Ayii Vavatsinias	2,990	2,022	St. Tank, conveyor.
17	Kiti	1,700	243	B/H and conveyor.
18	Athienou	7,200	5,782	B/H and conveyor.
19	Xylotymbou	1,900	1,875	B/H pumping main.
20	Xylotymbou	2,000	2,000	Emergency work.
<u>Paphos District</u>				
21	Arminou (Regional) Stage I	8,998	8,998	Boreholes-supplementary supplies.
22	Mamonia	1,110	330	Boreholes-supplementary supplies.
23	Polis Prodromi	1,974	1,044	B/H, St. Tank & conveyor.
24	Stroumbi-Polemi Stage I	3,705	3,705	B/H, conveyor, St. Tank.
25	Kallepia-Letymbou I)	12,160	6,302	B/H, St. Tank & conveyor.
26	Kallepia-Letymbou II)			
27	Stroumbi-Polemi II	19,100	9,850	B/H, St. Tank & conveyor.
28	Ayia Marina (Keloked.)	5,040	3,091	St. Tank & House to House.
Total		184,425	132,509	

5.11 Village Water Supply Schemes not completed in 1975 and carried over for completion in 1976

Some of the Water Supply Schemes put in hand in 1975 could not be completed and carried over for completion in 1976. The number of such schemes was 14 No. at an estimated cost of £208,461 and the expenditure incurred in 1975 was £104,149.

The main reason for not completing these schemes was that work for their execution commenced late in the year as most of these schemes belong to the supplementary budget approved in August 1975.

Another reason is the magnitude of the schemes, which did not permit the completion of the schemes in one year. Such schemes are the Paphos Lower Villages regional scheme, Arminou Regional scheme, Kambia-Analiontas-Ergates regional scheme etc.

Details of expenditure and a brief description of these 14 schemes are given on Table 5E below :

Table 5E - Village Water Supply Schemes not completed in 1975 and carried over for completion in 1976

Ser. No.	Village	Approved Amount for 1975 £	Expenditure incurred in 1975 £	Remarks
	<u>Nicosia District</u>			
1	Kambia-Analiontas			Pumping scheme-supplementary.
2	Episkopio-Ergates	23,000	15,850	Well & B/H. supplementary.
3	Pera	13,400	9,850	Storage tank & extensions.
4	Paleometokho	20,000	7,920	House to House & St.Tank.
	Galata	29,800	8,136	
	<u>Limassol District</u>			
5	Sanidha	2,600	1,173	Pending supply of electricity.
6	Phinikaria	3,500	2,405	Conveyor, Supplementary supply.
	<u>Famagusta District</u>			
7	Avgorou	5,000	145	Supplementary supply.
	<u>Larnaca District</u>			
8	Voroklini-Livadhia	10,700	2,377	B/H and conveyor.
	<u>Paphos District</u>			
9	Arminou Regional Stage II	36,045	19,590	B/H Supplementary supplies.
10	Paphos Lower Villages Regional Scheme II	50,000	23,240	B/H Conveyor & St.Tank.
11	Psathi	3,490	2,028	House to House.
12	Tala	11,940	7,250	-do-
13	Pendalia	7,940	3,960	-do-
14	Yiolou	1,846	225	Storage Tank
	Total	208,461	104,149	

5.12 Village Water Supply Schemes included in 1975 Development Estimates, but not put in hand for various reasons and carried over for construction in 1976.

Fourteen water supply schemes at an estimated cost of £256,499 included in the 1975 construction programme could not be put in hand during the year because, either the schemes were rejected by the community concerned or the village loans were not available. These difficulties are of administrative nature and lie beyond the control of this Department. All these schemes are shown on Table 5F below :

Table 5F - Village Water Supply Schemes included in 1975 Development Estimates, but not put in hand for various reasons and carried over for construction in 1976

Ser. No.	Village	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Nicosia District</u>				
1	Kambi (Pharmakas)	1,720	-	Administrative difficulties.
2	Linou	7,660	-	Scheme to be revised.
3	Kato Koutrafas	3,040	-	Rejected.
4	Pedhoulas-Prodromos	50,000	-	Loan not available.
5	Pitsilia Regional Scheme (Sarandi-Lagoudera etc.)	78,615	-	Loan not available.
6	Kourdhalı	2,660	-	Loan not available.
<u>Limassol District</u>				
7	Pissouri	2,900	-	Administrative difficulties.
8	Mouttayıaka Regional	82,120	-	Loan not available.
9	Ayios Theodoros (Agros)	1,600	-	Technical difficulties.
10	Pendakomo	7,200	-	Scheme not ready.
<u>Larnaca District</u>				
11	Vavla-Layia	4,000	-	Scheme rejected.
12	Avdellero	7,144	-	Scheme to be revised.
13	<u>Paphos District</u>			
13	Neon Khorion	4,640	-	Revision of scheme.
14	Kato Akourdhalia	3,200	-	Loan not available.
Total		256,499	-	

5.13 Minor Irrigation Schemes

The 1975 construction programme for Minor Irrigation schemes included 66 such schemes at an estimated cost of £613,299.

Of the overall programme, 37 schemes were completed by the end of the year under review, 26 schemes could not be completed and were carried over for completion in 1976, and work on 3 schemes could not start for various reasons that lie beyond the control of this Department, and carried over for execution in 1976.

The total expenditure incurred on Minor Irrigation Schemes in 1975 reached the amount of £306,372.

The 66 schemes have been classified as follows for easy reference:

- (i) Minor Irrigation Schemes completed in 1975,
- (ii) Minor Irrigation Schemes not completed in 1975 and carried over for completion in 1976, and
- (iii) Minor Irrigation Schemes not put in hand for various reasons, and carried over for execution in 1976.

More details for each of the above group is given hereunder :

5.14 Minor Irrigation Schemes completed in 1975

During 1975, 37 schemes at an estimated cost of £140,254 were completed, and the total expenditure for these schemes reached the amount of £118,103. As some of these schemes were brought forward from the previous year 1974, the amount indicated in the table below does not represent the actual cost of each scheme, as expenditure was also made in 1974.

These 37 schemes are given in a tabulated form below, together with a brief description of each schemes :

Table 5G - Minor Irrigation Schemes completed in 1975

Ser. No.	Village	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Nicosia District</u>				
1	Kalopanayiotis	6,870	6,012	Piped distribution system
2	Nikitari (Neron tou Nomadou)	4,900	4,648	R.C. Channels
3	Pera-Politiko Stage I)	7,626	7,626	R.C. Channels
4	Pera-Politiko Stage II)			
5	Ergates (Kourtoudji)	10,062	9,179	R.C. Channels
6	Pera (Fassera)	8,400	8,388	R.C. Channels
7	Klirou (Laoura)	2,906	2,905	R.C. Channels
8	Spilia	1,726	1,707	Piped Distribution system
9	Moutoullas	4,600	3,933	Pipes and R.C. Channels
10	Palekchori (Khalkomatas)	1,500	1,180	R.C. Channels and pipes
11	Palekchori (Maroullena)	2,000	1,608	Weir (St. Tank)
12	Akaki No.2 (Kamena)	1,730	1,730	R.C. Channels

Ser. No.	Village	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Limassol District</u>				
13	Pissouri	11,841	10,570	B/H. Irri. Tanks & pipe net work.
14	Tris Elies	6,123	5,011	Irr. Tanks & Pipe net work.
15	Limnatis	1,400	1,376	Improvement to chain of wells.
16	Mandria Phase I	5,516	3,227	Weir & Pipe net work.
17	Phini	2,883	2,438	Weir & Pipe net work.
18	Polendria	2,580	1,933	Pipe net work.
19	Khandria (Avlakou)	721	534	Pipe net work.
20	Mandria Phase II	8,600	6,600	B/H & Pumping main.
21	Potamitissa (Arsoullou)	1,400	1,277	Pipe net work.
22	Potamitissa (P. Potamos)	1,536	1,516	Improvements.
23	Kyperounda (Vasilikos)	2,050	1,345	Pipe net work.
24	Kyperounda (Frakti)	1,350	618	Pipe net work and well.
25	Khandria (Kolymbos)	1,900	1,623	Pipe net work.
26	Agridhia	2,500	1,642	Pipe net work.
27	Ayios Theodoros (Koufes)	5,100	4,841	Pipe net work.
28	Ayios Theodoros (Lois)	1,400	1,235	Pipe net work.
29	Zoopiyi	3,900	3,752	Pipe net work.
30	Dhierona	5,900	3,548	Pipe net work.
31	Agros (Kato Erimos)	590	584	Pipe net work.
32	Kyperounda (Mavros Kolymbos)	1,560	1,159	Extension of Distribution System.
<u>Larnaca District</u>				
33	Voroklini	1,715	1,645	B/H and pipe Distribution System.
34	Kalavasos	4,619	2,665	B/H and Pipe Distribution System.
35	Skarinou	1,395	688	B/H and Pipe Distribution System.
<u>Paphos District</u>				
36	Mamonia	4,259	3,646	B/H and Pipe net work.
37	Peristerona	7,096	5,714	B/H and Pipe net work.
Total		140,254	118,103	

5.15 Minor Irrigation Schemes put in hand in 1975 but not completed by the end of the year and carried over for completion in 1976.

Out of the 66 Minor Irrigation Schemes included in 1975 Construction Programme, 26 schemes at an estimated cost of £431,195 could not be completed by the end of the year and were carried over for completion in 1976. The expenditure incurred during 1975 on these schemes amounts to £182,269. As it can be seen from Table 5H below, most of these schemes are of a larger size and the period for their execution is more than a year.

An additional reason is that some of these schemes were approved late in the year by the Supplementary Budget, and the loans were secured late in the year and their completion would inevitably be materialized in 1976.

These schemes are given in a tabulated form below, together with a brief description of each scheme.

Table 5H - Minor Irrigation Schemes not completed in 1975 and carried over for completion in 1976

Ser. No.	Village	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Nicosia District</u>				
1	Astromeritis	10,000	8,201	R.C. channels.
2	Dhali (Ftelia&Katevas)	21,700	10,773	B/H and Piped Distribution System.
3	Orounda(Matsari)	18,530	1,884	B/H and -do-
4	Ergates (Pumping)	22,300	4,726	B/H, Irr.Tank,&Pipe net work.
5	Pharmakas	5,100	20	Pipe net work.
6	Tembria I & II	13,260	7,982	R.C. channels.
7	Evrykhoul I & II	16,700	12,739	-do-
8	Korakou I & II	23,540	15,469	-do-
9	Kakopetria	19,100	10,144	-do-
10	Evrykhoul-Phlasou-Korakou	13,500	13,063	-do-
11	Kaliana-Tembria	7,250	2,987	-do-
12	Korakou-Phlasou-Linou	14,990	-	-do-
13	Phlasou	20,960	14	-do-
14	Katydhata	15,600	5,464	-do-
15	Linou(Linopsas)	16,390	62	-do-
16	Nisou-Dhali	12,459	8,239	Recharge works(Gabbions).
17	Paleometokho	10,000	7,000	-do-
<u>Limassol District</u>				
18	Kato Platres	23,500	12,136	B/H and Pipe net work.
19	Episkopi	36,000	8,640	-do-
20	Kolossi	19,000	3,174	-do-

Ser. No.	Village	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Paphos District</u>				
21	Goudhi-Kholi-Skoulli	10,672	5,625	B/H and Pipe net work.
22	Peyia	2,844	2,127	-do-
23	Khoulou	26,500	13,407	Borehole, St. Tank & Pipes.
24	Lemona	24,500	10,742	-do-
25	Yiolou	23,500	21,826	Borehole and pipe net work.
26	Nikoklia	3,300	1,825	-do-
Total		431,195	188,269	

5.16 Minor Irrigation Schemes included in 1975 Development Estimates, but not put in hand for various difficulties and carried over for execution in 1976.

Four schemes which were included in 1975 development budget could not be put in hand for various reasons, and consequently they were carried over for execution in 1976.

The provision for these four schemes was £41,850

Table 5I below, shows all these schemes, stating also the reason for not being put in hand.

Table 5I - Minor irrigation schemes included in 1975. Development Estimates but not put in hand in 1975 and carried over for the execution in 1976

Ser. No.	Description	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
<u>Nicosia District</u>				
1	Galata (Esso)	6,000	-	Scheme not ready.
2	Peristerona Astromeritis	20,500	-	Loan not available.
3	Potami (Pumping)	14,000	-	-do-
<u>Limassol District</u>				
4	Trimiklini	1,350	-	Loan not available.
Total		41,850	-	

5.17 Major Irrigation Schemes

The 1975 Development Budget included 19 major irrigation schemes at an estimated cost of £808,729. The actual expenditure on these schemes was £687,645. Detailed report on these schemes are given on the pages that follow :

These schemes are shown on table 5J below which also indicates the amount allocated for 1975, and actual expenditure.

Table 5 J - Major Irrigation Schemes

Ser. No.	Scheme	Amount Approved for 1975 £	Expenditure incurred for 1975 £	Remarks
	<u>A. Dams (Government)</u>			
1	Yermasoyia	4,180	1,341	
2	Massari	6,503	6,318	
3	Lymbia	1,000	353	
4	Lefkara			
	(i) Dam	17,720	6,325	
	(ii) Khirokitia Treatment plant	11,744	7,176	
	(iii) Conveyor	1,729	1,089	
	<u>B. Dams (Contributory)</u>			
5	Arakapas	38,856	38,007	
6	Palekchori			
	(i) Dam	9,287	3,158	
	(ii) Diversion	9,404	5,694	
7	Paphos Project	44,000	42,562	
	<u>C. Distribution Schemes (Government)</u>			
8	Mavrokolymbos (Face II)	13,827	13,077	
9	Mavrokolymbos (Face III)	100,000	96,950	
10	Ayia Marina	6,270	6,149	
11	Yermasoyia			
	(i) Main conveyor	158,220	135,149	
	(ii) Akrounda-Phinikaria	81,618	66,425	
	(iii) Zakaki extension	38,250	38,246	
	(iv) Phasouri extension	81,750	59,040	
	(v) Akrounda Phinikaria	28,700	27,197	
12	Lefkara	56,000	54,618	
13	Arkaka Magounda	3,249	3,247	
14	Kiti	20,000	18,532	
15	Pomos	10,000	9,621	
16	Polemidthia	2,472	118	
	<u>D. Distribution systems (contributory)</u>			
17	Arakapas	2,953	2,943	
18	Palekchori-Kambi	60,000	43,314	
19	Palekchori-Kambi "Sklydros"	997	996	
	Total	808,729	687,645	

5.18 Town Water Supply Schemes

The construction programme for 1975 included 4 major town water supply schemes, and the total amount allocated for 1975 was £344,000. The expenditure incurred during 1975 on these schemes was £259,522. More details for these schemes are given on pages that follow:

These schemes are given on Table 5K below :

Table 5K - Town Water Supply Schemes

Ser. No.	Scheme	Amount Approved for 1975 £	Expenditure incurred in 1975 £	Remarks
1	Engomi Reservoir	139,000	134,860	
2	Greater Nicosia emergency works	55,000	14,136	
3	Strovolos Reservoir	107,000	80,000	
4	Larnaca Reservoir	43,000	30,526	
Total		344,000	259,522	

5.19 Arakapas Dam

5.19.1 General

The main purpose of the dam is irrigation. It is built on the Yermasoyia river at an elevation of about 400 m above sea level and at a distance at about 40 km N.E. from Limassol.

The dam is a mass concrete gravity type dam. It has a max. height of 20.0 m from the river bed level to the crest of the dam and 18.0m to spillway crest level. The length of the crest is about 96.5 m.

The capacity of the dam is about 130,000 cu.m. The dam consists of 9 vertical blocks extending over the entire height of the dam.

A continuous grout curtain extending over the entire length of the dam, was provided in the dam foundations, injections, being done through a concrete cap.

The 4th, 5th, 6th and partly the 7th blocks from the left abutment will be serving as a spillway, 45 m wide, discharging overflow water.

A ϕ 300 mm steel pipe situated in a recess along the sluiceway desilting outlet with cross section 1.80 x 1.80 will extent through the entire length of the dam.

The construction of the dam started on 10th September 1973 by the Construction Division of the Water Development Department and completed in August 1975.

5.19.2 Excavation

The mass excavation of the Dam foundation which was completed before the year 1975 and which lasted about 9 months, was carried out mostly in weathered rock material with limited excavation being carried out in sound rock. Light explosives were used during the process of excavation, but always with the max. care in order not to harm sound rock. At the abutments sound rock was met at an average depth of 5 meters.

5.19.3 Drilling and Grouting

Drilling and Grouting works were also started and completed before the year 1975 and lasted for a period of about 6 months. According to the drawings two grout curtains had to be constructed beneath the upstream part of the dam foundations. The main grout curtain of about 15m deep and the second of about 12 m deep. Grout mix was usually composed of water and ordinary Portland cement with the addition of 3% of bentonite. During the formation of the main grout curtain it was observed that initial permeability at some sections rather low, and the results obtained after grouting indicated that the permeability was reduced to the minimum required criterion. Therefore a considerable quantity of drilling and grouting for the second grout curtain was omitted, at these particular sections.

After the completion of the grouting works a number of control holes were drilled along the grouted zone in order to determine the effectiveness of grouting. Permeability water tests were performed and the results obtained were satisfactory.

The original estimated cost of drilling and grouting was finally reduced by nearly 60% due to the elimination of the work for the second line of grouting and the low rates achieved.

5.19.4 Progress achieved in 1975

Concreting - Concreting operations started before the year 1975 by forming the grout cap for grouting. The concrete mix used was mainly 1:2,5:5 and the total volume casted upto the beginning of 1975, was about 8,200 cu.m. Concreting of course continued about Mid- months of 1975 and with all external minor works it was not until June when the whole project was completed. The total amount of concrete casted was about 10,500 m³.

All natural materials used as well as plant employed were provided by sub-contractor and the construction of the dam was undertaken by the Water Development Department. Part of the plant was eventually provided by the E.M.S.

The final itemised expenditure of the project is as follows:

Item No.	Description	Estimated cost £	Revised cost £	Actual cost £
1	General	4,500	6,000	6,085
2	Drilling and grouting	6,133	6,133	3,822
3	Earthworks	4,582	8,668	8,628
4	Concrete	53,336	89,380	86,688
5	Pipes, Valves & Fittings	2,517	3,021	5,145
6	Metal works	4,300	5,500	5,636
7	Supervision	5,132	8,000	10,648
8	Land acquisition	700	1,000	-
	Sub-total	81,200	127,702	126,652
9	Distribution system	12,500	15,500	13,492
10	Contingencies	12,300	6,798	-
	Grand total	106,000	150,000	140,144

The dam and distribution scheme were officially handed over by his Excellency the Minister of Agriculture and Natural Resources Mr. Pnixos Kolotas to the Irrigation Division of Arakapas at a special ceremony held in August 1975 at the dam site.

5.20 Palekhori Irrigation Project

5.20.1 Introduction

The project is made up of three main components.

- a) Dam - A mass concrete gravity dam on the Kambi tributary of the Serrakhis river. The reservoir has a capacity of 640.000 m³ of water. The construction of the dam was completed in 1973.
- b) Diversion scheme - The Palekhori diversion scheme consisting of an intake diversion weir on the Mroulona tributary of AKaki river and a 12", 10" steel conveyor pipeline has been constructed for the purpose of supplementing the Palekhori-Kambi Dam water during years of low river flow. The length of this conveyor is 2000 m, and the capacity of this pipeline varies from 120 l/s at maximum water level in Kambi dam reservoir to 78 l/s at minimum water level.

The total cost of the diversion is £25.000 (estimated cost £28.000). Three quarters of this amount was borne by the Government. The irrigation division committee "Sklydros" of Palekhori contributes its share of 1/4 of the total cost.

The construction of the diversion started in May 1974 and completed at the end of May 1975.

- c) Distribution system - The distribution system which is now under construction commands an area of 131 ha out of which 70 ha is irrigable. From two alternative schemes A and B which were presented, alternative A was chosen from the financial and economical point of view. Alternative A makes the use of the existing irrigation division channel and for operation purposes the commanded area has been divided into 26 blocks. All blocks are served by 75 take off structures constructed along the main channel.

The detail designs were carried out after land consolidation and land levelling measures were implemented. The construction and pipe laying started in June 1975 and is expected to be completed in April 1976. The estimated cost of this scheme is £72.000.

5.21 New Engomi Reservoir

5.21.1 Introduction

For the efficient operation of the water supply system of Nicosia and for meeting present and future demands by the consumers it was found necessary to construct a New Water Reservoir by the existing Engomi Reservoir. This New Engomi Reservoir was designed for a capacity of 19,600 m³.

The structural analysis as well as the design drawings for this reservoir were both prepared by the Design Division of the Water Development Department. It is a reinforced concrete reservoir with free standing cantilevered walls with the roof designed as a flat slab.

The estimated cost for this project was £256,000.

The works for the construction of the New Engomi Reservoir started on the 15th of February, 1974. Both, the construction and supervision of the reservoir were undertaken by the Water Development Department.

5.21.2 Progress achieved in 1975

(i) Excavation

Although the mass excavation of the reservoir foundation which

was mainly carried in "havara" of medium hardness was started and completed in 1974, the limited space excavation was continued and completed in March 1975. Limited excavation included cutting and trimming of the key of the column footings the strip foundation of the external and dividing walls and the excavation of the drainage channels. Limited space excavation has been done using mostly pneumatic drills.

The total amount excavated was about 18,000 yds³ at a total cost of £15,744.

(ii) Filter materials

Most of the works in filter material were carried out in 1975. This material was placed mainly under the floor slab in two layers of about 10" each in gradings 3/8" to 3/4" to 2" and were heavily compacted to optimum proctor. Filter material was also placed after being properly graded in drainage trenches and behind retaining walls for drainage purposes after being wetted and compacted thoroughly.

As filters are of outmost importance in the case of concrete reservoirs, great effort was put into this process although the natural filter material supplied by sub-contractor was not a first quality. One however should consider the fact that after the Turkish Invasion the quarries for natural materials left are very limited. A total of 2,000 cu.yd was placed at a total cost £1,920.

(iii) Structural & Site Concrete

Site concreting started right after completion of the first stage of limited excavation and continued up to the end of July 1975 when it was completed. Site concrete mix 1:3:6 was mainly used to with old excavation slopes, under footings of walls and under slabs and drainages.

Structural concrete mix. 1:1½:3 was used for the main structure and accessories and was commenced in April 1974 and was continued throughout the year.

Chemical admixtures were used in the structural concrete mix in order to achieve better workability and curing of concrete, better bonding between old and new casted concrete etc.

This was a new procedure adopted as compared to similar structures constructed in the past but one can only say that these admixtures used were very effective and certainly worth the money spent for this purpose.

This was also obvious from the cube strength achieved. By the end of the year on amount of 7,500 cu.yd. of concrete was casted at a total cost of £66,500 thus giving on average rate both for structural and site concrete of £8,860 per yd³ which is most satisfactory.

(iv) Formwork & Reinforcement

A reasonable amount of time and money was spent throughout the year on formwork and steel reinforcement.

The formwork used was of woodwork with steel lining only in the case of wall pannels while the shuttering for the flat slab was purely wooden construction. The operation of shuttering was completed by November 1975 when the shuttering of the last roof slab was removed with minor formwork left in the case of external works such as manholes etc.

As in all cases the cost of shuttering in view of the high cost of timber is always considerable. In the case of Engomi Reservoir about £48,000 was spent for shuttering out of which £17,000 was the cost of timber. About £8,000 was later returned to Engomi Reservoir for shuttering used by Strovolos and Larnaca Reservoirs. An average rate of £3,000 per sq.yd. of concrete surface shuttered was obtained in this case which is considered reasonable for structures of this kind.

Ordinary mild steel reinforcement varying in diameters between 3/8" to 1" were used in the walls and slabs of the reservoir. About 650 tons of steel reinforcement was used at the total cost of £130 per ton including cutting and fixing. All work on reinforcement was completed by the end of 1975 except some minor works as regards manholes etc.

(v) Pipe Works

(v) Pipe Works

Among other operations carried out during 1975 was the internal and external pipe work systems. These included also perforated asbestos cement pipes of 4" and 6" ϕ used for the drainage of the reservoirs as well as steel pipes and fittings in the case of supply and overflow upto 21" ϕ . Although the major part of the work in the latter case was extended in 1976. The total cost of pipe work upto the end of the year was about £10,000.

(vi) Site Laboratory

As in the case of all major structures, a site laboratory was established at the site for the testing and control of materials and quality of concrete.

The testing of materials and quality control of concrete carried out throughout the year has been extremely useful and constructive.

Tests were being made daily on site to confirm the suitability of the materials, the concrete and filters. Such tests were:

- a) Estimation of silt content for sand and gravels (not to exceed 3% by weight)
- b) Crushing strength test on gravel according to B.S.S. 882
- c) Cubes were taken from every batch of concrete and crushed in 7 & 28 days for strength.
- d) Tests of grading and silt content on filter material as well as determination of compacting factor etc.

(vii) General Remarks

The work on the New Engomi Reservoir started early in 1974. Like any other project it proceeded with a rather slow rate on the beginning to reach the optimum rate of progress in the year 1975.

Obviously the Turkish Invasion and the resulted interruption of the works was a set back as regards the progress of the works. As a result the work was falling behind schedule as it was planned and programmed to be completed by March 1976. Soon though, due to the increased unemployment, in an effort to assist as many refugees as possible the labour force at the site was increased a lot. This increase in labour force resulted in a proportional increase in the rate of progress and the New Engomi Reservoir was expected to be completed as originally scheduled. The progress rate on the reservoir itself can be considered very satisfactory. Inevitably the same rate of progress could not be maintained during the external works. For the positioning of some of the external pipes we had to excavate at a depth of twenty feet below ground level. At that depth we also had to place sluice valves, water meters and construct manholes.

As far as the expenditure is concerned despite the fact that a considerable amount has been spent on items that they were not originally included in the estimate the works are to be completed without any financial problem.

By December 1975 about 95% of the works have been completed at a total expenditure of £250,000. The average cost in plant and labour by the end of the year were about £50 and £150 per year respectively.

5.23 New Strovolos Reservoir

5.23.1 Introduction

Amongst the long term planning of Nicosia Water Board to meet the demand in water supply for the people of Nicosia, has undertaken the construction of the New Strovolos Reservoir.

Capacity 7600m³
Estimated Cost £154,000

Though the financing of the project is undertaken by the Nicosia Water Board, the design as well as the execution of the works is being carried out by the Water Development Department.

The original design was prepared for a 4000m³ capacity reservoir but at a later stage it was decided that buying an adjacent plot of land and extending the reservoir to achieve a 7600 m³ capacity will be a more profitable solution for the Nicosia Water Board.

Work started on the New Strovolos Reservoir on the 2nd of June 1975, after all the necessary preliminaries were completed. The progress made on the various items of work during 1975 is as follows:

(i) General

Plant and Labour

On commencement of the works, all necessary plant and labour were secured for the permanent works including all necessary temporary works required for the construction of the major project.

Although both plant and labour force were variable throughout the year, depending on the progress and nature of the works in hand on the average, the main plant on site consisted of :

- a. A tower crane able to carry one ton weight to a distance of 35 meters
- b. A concrete mixer 15-21 ft³ capacity
- c. An air compressor with concrete vibrator and pneumatic drills
- d. A ~~trax~~cavator (during excavation) and a dumper.

The daily expenditure for the plant employed a site was on the average about £75. The labour force on site as well as the supervising staff consisted of :

- a. Eleven carpenters, 8 builders, 8 steel fixers 2 plumbers and 20 labourers.
- b. One executive engineer, 1 inspector of works, 1 foreman, 1 soil technician and 1 time keeper.

The daily cost of labour force employed on the site was on the average about £160.

The supervising cost per day taking into consideration the time spent as the works by monthly personnel of the Department was on the average £10.

(ii) Earthworks

Mass excavation commenced in August 1975 and was completed within 15 days, although limited excavation which was mainly carried out with pneumatic drills was continued till the end of the year. Some excavation will finally have to be done as regards external works at a later stage.

A total amount of 4,300 cu.m. was excavated and classified as mass excavation at the total cost of £1,290 thus giving a rate of 0.300 mils per m³ which is more than satisfactory.

Limited excavation quantity reached the 800 cu.m. at the total cost of £2,200 giving a rate of £2.750 per cu.m. which again is very reasonable taking into account that this excavation was mainly carried out by hand and pneumatic drills.

Filter materials as always, was again a problem and sieving and grading of the natural material had to be done in order to achieve the required filter grading. An amount of 190 cu.m. was placed at the total cost of £1,950 giving a rate of £2.200 per cu.m. which is on the high side.

This operation was almost completed by the end of this year.

(iii) Structural & Site

Concrete

Structural concreting 1:1½:3 started at the end of July 1975. The initial rate was very slow because we were waiting for the erection of the tower crane. After that concreting proceeded very satisfactorily.

Analytically the concreting completed during 1975 compared with the total amount to be done has as follows :

a. Column footings	80% completed
b. Wall footings	80% completed
c. Cantilever walls	70% completed
d. Columns	10% completed
e. Floor slabs	20% completed

At this stage more emphasis is being given to the construction of columns and floor slabs. Also all preliminaries will be done so as to complete the first roof slab pannel by the end of February 1976.

Regarding the site concrete mix 1: 3:3 it has been completed under all column footings and wall footings and about 30% of the site concrete of the floor slabs has also been completed.

On the whole upto the end of 1975 an amount of 1,500 cu.m. were casted both in structural and site concrete at the total cost of £22,000 thus giving an average rate of £14,500 per cu.m. This rate could be considered on the high side but one should take into account the cost of materials due to their abundance.

(iv) Formwork and Reinforcement

As always, formwork and reinforcement take a fare portion in time and money in the cost and execution of the whole project.

Nearly 85% of the shuttering and reinforcement work was completed by the end of the year and only a number of columns and floor and roof slabs are to be continued in 1976.

The formwork used was mainly of timber work with metal sheet lining in the case of walls. Most of the formwork was taken from Engomi Reservoir after £4,000 were paid by Nicosia Water Board towards the cost of timber.

By the end of the year about 2,600 sq.m. of concrete surface were shuttered at the total cost of £8,200 thus giving an average rate of £3.000 which is of the order expected.

As regards purchase cutting and fixing of steel reinforcement which again varied from $\frac{3}{8}$ " ϕ to 1" about 130 tons were used by the end of the year at the total cost of £21,000 giving an average rate of £190 per ton which is satisfactory.

(v) Pipe Work

Pipe work involves all internal and external placing of pipes both for drainage i.e. A.C. 4" ϕ & 6" ϕ pipes and steel pipes ϕ for water supply and overflow.

By the end of 1975 all drainage perforated internal A.C. pipes were placed in their respective channels and order for cost iron fittings, sluice valves etc. for the external works were placed. The total cost of pipework is expected to cost amount £8,000 although by the end of the year only £800 were spent.

(vi) Site Laboratory

In the case of Strovolos Reservoir also a site laboratory was established for the testing and quality control of materials and concrete.

Such tests are :

- a. Estimation of silt content for sand (at the worst case was within 3% by weight limit with no organic impurities).
- b. A crushing strength test on gravel according to B.S.882.
- c. Cubes are being taken and crushed so as control the quality of the structural concrete. Average crush strength at 28 days for 1:1 $\frac{1}{2}$:3 mix design using the additive "CONPLAST" is about 5500 lb/in².
- d. Estimation of silt content for filter material.
- e. Estimation of the permeability of the filter
- f. Control on the compaction of the filter material.

(vii) General Remarks

The progress of the works throughout the year 1975 can be considered very satisfactory as about 65% of the major item of work have been completed in less than 6 months period.

The fact however that a tower crane was used for the first time in such structures, has accelerated the works beyond any expectations and one might say that a fair save could be expected on completion of the project which is anticipated to be sometime in July 1976, thus comprising a total period of construction of one year.

By the end of the year 1975, an amount of £80,000 was spent, comprising about 55% of the total estimated cost for work done of about 65% which is most satisfactory.

5.24 Tremithios Reservoir

5.24.1 Introduction

Amongst the long term planning of the Larnaca Water Board for the future demands in water supply for Larnaca Town, was the undertaking of the construction of Tremithios Reservoir.

Both the design and construction of the reservoir were undertaken by the Water Development Department.

The reservoir is of reinforcement concrete cantilevered walls with a roof slab of flat construction of useful capacity of 7700m³ and at estimated cost of £180,000.

The reservoir is located at the 6th mile post of the Larnaca-Kophinou road and is situated near the existing storage tanks of the Larnaca Water Board.

The construction of the reservoir commenced early August 1975 with the excavation and erection of offices and other preliminary works.

(i) Earthworks

The mass excavation of the reservoir foundation commenced early August and was completed mid November 1975. All excavation was carried out by a bulldozer and a traxcavator and an amount of 15,500 m³ was excavated at the total cost of £3650 thus giving a rate of 0.235 per m³ which is very satisfactory.

Limited space excavation commenced mid October 1975 with the major part comprising of excavation of drainage channels.

Limited space excavation for wall footings is still continuing. This excavation is mainly carried out by hand and pneumatic drills. Upto the end of the year 1975 an amount of 600 m³ was excavated at the cost of £2,100 giving a rate of £3,500 per cu.m. which is reasonable taking into account the various difficulties met.

During 1975 filter materials were also placed in drainage trenches and by the end of the year 1975 about 500 m³ of filter were placed.

(ii) Concrete

Structural and site concrete were delayed in their commencement in view of bad foundation conditions met during excavation. Some time elapsed in site investigation and logging of faults etc. before any concreting could take place.

Site concreting commenced end October and is still continuing in the case of wall footings, drainage channels and floor slabs. About 250 cu.m. were placed till the end of the year at a rate of £8,000 per cu.m.

Structural concrete 1:1½:3 commenced in December and will continue till the end of 1976. A total amount of 350 cu.m. was casted mainly in wall footings till the end of 1975 at the cost of £4,000 giving a rate of about £11,400 per cu.m. of concrete, being within the order expected.

(iii) Formwork & Reinforcement

Nearly all the formwork for Larnaca Reservoir was purchased from Engomi Reservoir of the depositing £4,000 towards the amount spent by the latter for shuttering. In this way, on one hand the formwork will be costing less to Larnaca Water Board and on the other hand the cost of formwork of Engomi Reservoir will be reduced. Until the end of 1975 about 700 sq.m. of formwork were used.

Ordinary mild steel reinforcement was also purchased in 1975, through tenders and about 60 tons of reinforcement were bent and fixed till the end of the year at the cost of £130 per ton.

(iv) Pipe Works

The pipe works during 1975 were very limited as the construction of the reservoir started achieving its normal steps very late in the year. In any case some drainage, perforated pipes of 4" ϕ A C were placed in drainage channels but the greater portion of this work will come in 1976.

(v) Remarks

The Tremithos reservoir which is of similar type of that of Engomi and Strovolos Reservoirs started being constructed rather with a very slow rate of construction in view also of the number of difficulties encountered, both in materials and foundation wise. In spite of this, by the end of the year 1975 started reaching a satisfactory rate of construction and of the total estimated amount of £180,000 an amount of about £30,000 was spent by the end of the year 1975.

5.25 General Remarks

There is no doubt that the 1975 was a very occupied year for the division of construction. The planning, execution, supervision and control of minor and major schemes at the total cost of £1,651,635 involve an enormous effort and persuarance on behalf of all the personnel of the division as well as that of the regional offices.

The supplementary budget approved in the second half of 1975 with the government intention to create more employment for displaced persons, added even more hardship in the execution of the additional works.

Apart from the approved schemes in the Budget of 1975 a number of emergency scheme for the water supply of displaced persons housing were undertaken by the division both in Nicosia and Larnaca districts.

Contrary to other years and in view of shortage of staff in the design division the division of construction apart from constructional works has carried out a fair amount of design work for Engomi, Strovolos and Larnaca Reservoirs in reinforced concrete design with a flat slab type roof. All reservoirs now being under construction.

Two major charges which materialized in the year 1975 were :

- a. The pooling of workshop i.e. all plant and machinery coming under the Director of the Electrical and Mechanical Services.
- b. The undertaking by the regional offices the direct supervision of schemes under construction in their districts, although this arrangement started in the second half of 1974.

The pooling of workshop created of course quite a number of problems in the execution of the works, as all plant owned by the Water Development Department was taken over by the E.M.S. This being a newly created service had to meet demands from all government departments in plant and machinery and obviously was met with quite a number of difficulties to satisfy these demands.

On the other hand the department loosing the direct control of its plant inspite of the increased number of projects for execution had to find ways and means to overcome the great problem created.

Another repercussion of this arrangement on the schemes was that certain rates had to be paid for the use of government machinery which was not the case in the past with the result that schemes whose estimates had been prepared on the old basis came into excess costwise.

The assesment of hours worked of the government machinery and rates paid for such a great number of schemes both minor and major and getting to agree these amount with the E.M.S., assesment of idle time and breakcare time etc. which plant is to be charged and which to be exempted. All these were problems which has to be faced throughout the year. After a number of meetings with the E.M.S. we are still at the stage of getting things moving.

The control and co-ordination of the works executed in the districts by the main office was also a problem. The Planning Section of the Division, for the purpose of keeping contact with all works executed in the districts for the purpose of co-ordination and financial and technical control of these works, prepared progress charts indicating the name of the scheme, amount approved, cost upto date, percentage of work done against amount spent etc., and forwarded these forms to the District Engineers, whereby every month they should submit these forms

duly completed to headquarters. This step was most essential as a lot of preliminary work concerning these schemes as regards, tenders for materials, arrangements of machinery, programming of the works, loan secured etc. is dealt by the main office, which must be fully informed on the progress of the works.

Although many difficulties are met in this respect there is a continuous effort by the division to achieve the best co-ordination with the district offices for the most resulting and practical supervision and control of all constructional works.

5.26 Workshop

The workshop of the Department is part of the Construction Division and provides services of electromechanical nature to the whole of the Department, and specialised services to other Departments. Since the first of the year when pooling of the workshops of the Government took place the activities of the Workshop were confined to specialised services as the installation, repair and maintenance of pumping units and other activities associated with water supply schemes.

The workshop maintained a number of specialised crews very well qualified and equipped for the execution of the jobs. Nine crews are organized, two electrical, two for pumping installations, two for field metal fabrications, one gang of carpenters and one of mason with an assistant, and finally there is a crew for repair and maintenance of diesel engines for pumping units. The total number of technicians making up the crews is 32. In addition there is the dispatches section of the workshop responsible for despatching materials to the various locations where Teams of the Construction Division are working.

In 1975 the activities of the workshop were :

1.	32 new pumping installations for Domestic Water Supply	£ 22,130
2.	14 new pumping installations for irrigation	£ 7,130
3.	43 major repairs of pumping installations for Domestic Water Supply	£ 2,816
4.	8 major repairs for pumping installations for irrigation water supply	£ 302,000
5.	Various castings and fittings	£ 6,820
6.	Various carpentry works	£ 5,330
7.	Various masonry works	£ 610,000
8.	Despatching of materials and stores	£3680,000

In order to cover the emergency cases of pumping units breaking down and to ensure stand by supply the workshop keeps on standby the following equipment :

a.	Electrosubmersible pumps	10 No.
b.	Turbine pumps - line shaft	5 No.
c.	Diesel power generators	10 No.
d.	Diesel engines	13 No.
e.	Centrifugal pumps	30 No.

VI. DIVISION OF OPERATION AND MAINTENANCE

by

N. Tsiourtis
Executive Engineer (Irrigation)
and

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Superintendent of Works (Town Water
Supplies)

6.1 This Division includes the branches dealing with :

- (i) The operation and maintenance of Major Irrigation Projects,
- (ii) The maintenance of contributory Irrigation Projects and
- (iii) The operation and maintenance of Domestic Town Water Supplies

6.2 Management and Operation of Major Irrigation Projects

The year under review was a relatively wet year and almost all of the major dams, with the exception of Kiti and Lefkara dams, all the other dams were filled to spillway crest. Because of this and because of the increase in storage capacity (additional Lefkara and Palekhori dams) the water collected has reached a record of 27.612MCM compared with the previous years where the water collected and available for irrigation did not exceed the figure of 7.0 MCM.

A total quantity of 7,775,939 m³ of water representing about 28.16% of the total quantity stored was utilized for the irrigation of about 12458 donums of good land in the project areas, about 40.41% of the total area commanded. (Area commanded 30831). Another 1.075 MCM was released or seeped through gravels or chain of wells for recharge of gravel aquifers.

In addition a quantity of about 2286714 (8.28%) was lost in the form of evaporation losses.

Of the total quantity of 7,776000 cu. meters of water used for irrigation purposes only 5,522,000 cubic meters or 71.0% was sold to the farmers at the rates given in table 1. The rest 2,254 cubic meters i.e. 29.0% represents water rights and was given to the farmers free of charge. The gross income from the sale of water was £60,600 compared to £26,138 for 1974 while the net income was 44.807 compared with £10,487 for 1974. Table 6.2 gives comparative figures for income and expenditure for the last 8 years.

Table 6-1 Present Water Charges in mils/m³

Dam Project	Over Flow	Vege- tables	Vines	Deci- duous	Citrus	Flat
Argaka-Magounda	5	-	-	-	-	10
Ayia Marina	5	-	-	-	-	10
Kalopanayiotis	-	-	-	-	-	13
Kiti	3	-	-	-	-	10
Mavrokolymbos	5	10	15	15	15	-
Polemidthia+	-	-	-	-	-	-
Yermasoyia	-	7	15	15	15	-
Pomcs	5	-	-	-	-	10

The water was utilized to irrigate a total of 12458 donums of citrus, vines, deciduous, bananas, cereals and seasonal crops. Details of the crops irrigated and the corresponding areas are given in Table 6.3 of a Summary of the water sold, gross and net incomes is presented on Table 6.14.

Table 6.2 - Data on Water Usage for 1968-1975

Year	1968	1969	1970	1971	1972	1973	1974	1975
Capacity 1000 m ³	23420	23420	23420	23420	23420	23420	37890	37890
Water in storage	N.A.	N.A.	6160	5352	3777	1858	6367	27612
Water utilized for Irrigation 1000 m ³	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	7776
Water sold 1000 m ³	1185	1038	1961	2467	2757	971	2544	5522
Gross income £	15363	21241	22594	26891	29391	11137	26138	60600
Operational Cost £	3507	59111	5849	7688	7282	6450	11048	12619
Maintenance Cost £	858	7582	5328	3342	4849	4278	4603	3174
Total Expenses £	4365	13493	11177	11030	12131	10728	15651	15793
Net Income	10998	7748	11417	15861	17260	409	10487	44808

Note N.A.= Not available

Table 6.3 - Crops and areas irrigated in donums

Crop	Area in donums	Remarks
Citrus	2204	
Vines	1090	
Deciduous	637	
Bananas	477	
Cereals	1340	Supplementary
Potatoes	102	
Avocados	2	
Vegetables	6261	
Others	345	Olives etc
Total	12458	

Details for Operation and Management of the Major dam projects in Cyprus are given in the next section of this chapter. Under this heading only the 10 major dams are included, i.e.

- (i) Argaka Magounda,
- (ii) Ayia Marina
- (iii) Kalopanayiotis
- (iv) Kiti
- (v) Lefkara
- (vi) Mavrokolykbos
- (vii) Palekchori
- (viii) Pomos
- (ix) Polemidhia and
- (x) Yermasoyia

6.2.1 Details of Operation of Major Irrigation Projects

6.2.1.1 Argaka Magounda

This project with a dam of capacity 1.150 MCM commands an area of 2340 donums. The distribution system is completed and consists of closed conduits.

Irrigation in the project area started in January the 15th and ended in December the 12th 1975. A total quantity of 1271166 cubic meters of water, representing 110.54% of the water in storage (68.44% represents overflow) was utilized for irrigation of 2290 donums of Citrus, Bananas, Deciduous and Seasonal crops.

Gross income of the project from the sale of water in the year under review was £4843.940 mils and the expenditure (payments to the waterman and bill collector) was £781.615 mils. Maintenance cost was £121.000. Net income of the project in 1975 was £3941.325.

6.2.1.2 Project Hydrology

The water content in the dam fluctuated during the year under consideration as follows :

Initial amount in storage (first January 1975) was 534000 cubic meters of water, inflow to the dam reservoir was continuous for the next 7 months (January-July) and the water level reached spillway crest by January the 11th. Overflow continued until the end of May. After May the water level dropped steadily due to higher releases for irrigation, increased evaporation losses, reduced inflows and seepage losses. The water level reached its minimum by November the 15th with a total quantity in storage around 582000 cubic meters and then inflow again with reduced releases and evaporation losses caused the rising of the water level. The continuous inflow increased the amount in storage by the end of the year to 728000 cubic meters. Information on the water in storage, releases and overflow utilized is given on the next Table. (Table 6.4).

Table 6.4 - Argaka Magounda Management and Operation data

Item No.	Parameter Description	Quantity m ³	Percent of max. quantity in storage
1	Initial storage	534000	---
2	Final storage	728000	57.90
3	Water released for Irrigation	484394	42.10
4	Overflow Utilized	786772	68.41
5	Total Quantity Used for Irrigation	1271166	110.51
6	Maximum quantity in storage	1150000	100.00
7	Evaporation (about 8% of quantity in storage)	92000	8.00

6.2.1.3 Water Released, Water Sold and Crops irrigated

The total water utilized by the farmers amounted to 1271166 cubic meters where 786772 cubic meters was from the overflow and the rest was released from the dam reservoir.

The 786772 cubic meters of waters was supplied to the farmers free of charge as water rights. The rest of the quantities was supplied at a charge of 10 mils/m³.

The water was utilized to irrigate the following crops in two separate irrigation periods. The first period extends from January to mid June and the second from mid June to December.

1st Irrigation Period : Total area irrigated 1525 dons

Cereals	790 dons	Avocados	2 dons
Vines	30 dons	Deciduous	42 dons
Citrus	71 dons	Potatoes	18 dons
Bananas	64 dons	Vegetables	508 dons
	C.F. 955		
		B.F. 955	
			<u>1525</u>
		Total	1525 dons

2nd Irrigation period : Total area irrigated 786 don.

Citrus	71 don.	Deciduous	12 dons
Bananas	64 don.	Vegetables	637 dons
Avocados	2		
	C.F. 137		
		B.F. 197	
			<u>786</u>
		Total	786 dons

6.2.1.4 Gross and Net Incomes

Gross income of the project from the sale of water amounted to £4843.940 mils and the operational expenditure was £781.615 mils. Maintenance cost of the dam and distribution system was £121.000. Net income of the project was £3,941.325.

6.2.1.5 Ayia Marina

The Ayia Marina dam project is composed of a dam reservoir of max capacity 300,000 cubic meters and a distribution system (canals and pipes) commanding an area of 1500 donums.

Irrigation in the project area started in February the 25th and ended in November the 22nd. A total quantity of 346 556 cubic meters of water was utilized for irrigation purposes representing 115.51% of the maximum quantity stored (inflow was continuous). An area of 574 dons of cereals, citrus, bananas, deciduous vegetables and other crops was irrigated and the gross income from the sale of water was £3119.000 mils. The operational expenditure was £1136.000 where the maintenance cost of the project was £83.000. Net income was £1900.000.

6.2.1.6 Project Hydrology

The initial amount in storage in Jan. the 1st 1975 was 81000 cubic meters of water. River inflow continued in January and the next months to mid August when inflow was diminished. The water level reached spillway crest on February the 14th and continued overflowing up to the end of March. Then the water level dropped steadily due to higher releases for irrigation, increased evaporation losses and reduced inflow rates. The minimum quantity in storage occurred in October with 94900 cubic meters in storage. The level remained constant up to the end of November and by the beginning of December increased inflow caused the water level to rise thus increasing the water in storage by the end of December to 116,000 cubic meters.

Information on the water content state, releases, overflow and water utilization are shown on table 6.5

Table 6.5 - Ayia Marina Management and Operation data

Item No.	Parameter Description	Quantity	Percent of max. quantity in storage
1	Initial storage (January 1st)	81000	--
2	Final storage (December 31st)	116000	--
3	Water Released for irrigation	312640	104.21
4	Overflow utilized	33916	11.31
5	Total quantity used for irrigation	346556	115.51
6	Maximum quantity stored	300000	100.00
7	Evaporation (about 8% of quantity in storage)	24000	8.00

From the above table it is deduced that the utilization of water from the dam reservoir is quite satisfactory.

6.2.1.7 Water released, water sold and crops irrigated

The water utilized for irrigation purposes amounted to 346556 cubic meters. Out of this 33916 cubic meters was taken from the overflow and the rest was released from the reservoir. The overflow was charged 5 mils/m³ where the released from reservoir was charged 10 mils/m³.

An area of 574 donums of crops was irrigated in two separate irrigation periods as shown below :

1st Irrigation period (Jan. mid June) Total area irrigated 529 don.

Cereals	65 dons	Deciduous	B.F. 157 12 dons
Vines	12 dons	Potatoes	4 dons
Citrus	65 dons	Vegetables	356 dons
Bananas	13 dons		
Olive	2 dons		
	<u>C.F. 157</u>	Total	<u>529 don.</u>

2nd Irrigation period (mid June-December) Total area irrigated 135 don.

Citrus	65 dons	Potatoes	B.F. 86 4 dons
Bananas	13 dons	Vegetable	45 dons
Deciduous	8 dons		
	<u>C.F. 86</u>	Total	<u>135 don.</u>

6.2.1.8 Gross and Net Income

From the sale of water the project had a gross income of £3119,000 while its operational cost totalled £1136,000. Maintenance cost for the dam and the distribution system amounted to £83,000. Net income was 1900,000.

6.2.1.9 Kalopanayiotis

The Kalopanayiotis dam project consist of a dam reservoir of capacity 390 000 cum. and a distribution system, commanding an area of approximately 435 donums.

Irrigation in the project area started on April the 2nd and lasted up to the end of October. During this period a total quantity of 128277 cubic meters of water representing 32.89% was released for the irrigation of 435 donums of deciduous. Gross income from the sale of water amounted to £1667,601 while the operational costs totalled £1040,000. Maintenance cost for the project was £325,000 and the net income was only £302,601

6.2.1.10 Hydrology of the dam

The river flow was comparatively high during the months January-March and the dam outlet gate was open until March the 14th 1975. The gate was closed on the 14th of March and by March 24th the dam was overflowing. It continued overflowing until July the 4th and then the water level started falling reaching its minimum on October the 8th with total quantity in storage around 122000 m³. The dam water level started rising again and by the end of the year the dam had in storage about 320000 m³.

Details about the storage content, releases, and utilization factors are shown in Table 6.6

Table 6.6 - Kalopanayiotis Operation and Management data

Item No.	Parameter Description	Quantity m ³	Percent of max. quantity in storage
1	Initial storage (1st January)	Empty	0
2	Final storage (31st December)	320000	82.8
3	Releases	121821	32.89
4	Max. quantity in storage	390000	100.00
5	Evaporation losses	20000	5.12

Water released, water sold and crops irrigated

The water that was utilized, about 128277 m³ was either released from the dam or collected from seepage losses downstream the dam in the collection weir.

An area of 435 don mainly of deciduous was irrigated.

6.2.1.11 Gross and Net Income

The total gross income from the sale of water amounted to £1667.601 where the operational cost paid to the operator were £1040.000. The maintenance costs amounted to £325.000 and the net income was only £302.601.

6.2.1.12 Kiti

Kiti dam project is composed of a dam reservoir of storage capacity 1.610 MCM and a distribution system (open canals) commanding approximately 6200 donums in the Kiti, Pervolia and Tersephanou villages.

Irrigation in the project area commenced on the 23rd of March and was terminated on August the 8th when the water in the dam reservoir was exhausted. From the 1390000 cubic meters of water collected in the dam (maximum quantity stored) only 304000 cubic meters or 21.87 percent were used for irrigation while from the rest 986000 i.e. 70.93% of the quantity, in storage was lost by leakage through the Meneou chain of wells the Bekir Pasha chain of wells and the river gravels and 100.000 cu. meters representing about 7.20 percent were lost in the form of lake evaporation.

304000 m³ of water were used for the irrigation of about 723 donums of citrus and seasonal crops in the Kiti, Pervolia and Tersephanou villages. Gross income from the sale of water amounted to £3004.050, and the operational cost was £741.901. Maintenance costs amounted to £855.000 and the net income was only £1407.149.

6.2.1.13 Project Hydrology

Initial quantity in storage at the beginning of the year was only 30000 cubic meters. Inflow to the dam started early in January and by March the 8th the water in storage increased to 1,390.000 cubic meters. Further inflow did not raise the level because of increased losses through the gravel formation (recharge) and releases for irrigation.

After this a gradual decrease in the amount in storage followed because of higher releases for irrigation, increased evaporation losses and losses through the gravel formation as well through the Bekir Pasha and Meneou chain of wells. The dam was empty by August the 8th. A summary of the water resources and their use is shown in Table 6.7.

Table 6.7 - Kiti Management and Operation data

Item No.	Parameter Description	Quantity m ³	Percent of max. Quantity in storage
1	Initial Storage	30000	2.16
2	Final storage	---	---
3	Max. Quantity in storage	1390000	100.000
4	Water used for irrigation	304000	21.87
5	Water recharged	986000	70.93
6	Evaporation losses	180000	7.20

6.2.1.14 Water released, water sold, and crops irrigated

The 304000 cubic meters of water representing only 21.87% of the max. quantity in storage were utilized to irrigate about 723 donums of crops in three villages, Kiti Pervolia and Tersephanou as follows:

Crops	Kiti	Pervolia	Tersephanou
Citrus	262	-	-
Vegetables	174	171	116
Total	436	171	116

6.2.1.15 Gross and Net Income

During the year 1975 the gross income from the sale of water amounted to £3004.050 and the operational cost was £741.901. Maintenance costs for the dam and the distribution system amounted to £855.000. The net income was £1407.149.

6.2.1.16 Lefkara

This project consists of a dam constructed mainly for domestic water supplies of maximum capacity 13.850 MCM. The distribution system is planned to be completed late in 1976 and shall command an area of about 615 don. For the operation of this dam whose water was utilized mainly for domestic uses in the Larnaca and Famagusta towns please refer to the section "Management of Water Supplies under the Provision of Law Cap. 350". Water collected in the reservoir by the end of 1975 reached 4.602 MCM.

6.2.1.17 Mavrokolymbos

The Mavrokolymbos dam project consists of a dam reservoir of capacity 2.180 MCM and a distribution system, of canals and pipes commanding an area of about 3355 don.

Irrigation in the project area commenced in January and ended in December 1975. A total quantity of 1,225,250 cubic meters of water representing 56.2% of the maximum quantity in storage was utilized for the irrigation of 1677 dons of Bananas, Vines, Cereals and Vegetables and recharge of the Aliki in Khlorakas area. Gross income from the sale of water amounted to £10,251,375 mils and the operational costs totalled £2 761,781 mils. Maintenance costs totalled £498,000 thus reducing net income to £6,991,594.

6.2.1.18 Project Hydrology

The water in storage on the 1st of January was 395,000 cubic meters. Continuous inflow in January and the following month raised the level to spillway crest in February the 21st. The water level remained at the spillway crest level up to the 31st of March and then began dropping steadily due to increased demand and evaporation losses and reduced inflow. The storage in the dam by the end of the year was 1249,000 cubic meters.

A summary of water storage and water utilization is shown in Table, 6.8

Table 6.8 - Mavrokolymbos Management and Operation data

Item No.	Parameter Description	Quantity m ³	Percent of max. Quantity in storage
1	Initial storage (January 1st)	395000	18.10
2	Final storage (December 31st)	1249000	57.29
3	Water released for irrigation and recharge	1225250	56.20
4	Max. quantity in storage	2180000	100.00
5	Water released for irrigation only	1136176	52.12
6	Evaporation losses	175000	8.02

6.2.1.19 Water released, water sold and crops irrigated

The water that was released for irrigation was distributed as follows:

- (a) Potima chiflik: 263809 cubic meter. This quantity was released free of charge as compensation for the water rights for the irrigation of 630 dons of vegetables and Potatoes.
- (b) Kissonerga Village: A quantity of 431668 cubic meters of water was delivered to this area for the irrigation of seasonal and permanent crops. This quantity was charged at the normal rates, and was used to irrigate 547 donums of bananas (183 dons) vines (30 dons) and vegetables (334 donums).
- (c) Khlorakas village: For the irrigation of about 500 dons was (mainly vegetables and early vegetables) a total quantity of 440 699 cubic meters of water released. This quantity was charged at the normal rates.

(d) Recharge of the Khlorkas area: Part of the overflow was used for the recharge of the Khlorkas Alike area. A total quantity of 50186 m³ was diverted free of charge to the area through the distribution system main conduits.

6.2.1.20 Water released, water sold and crops irrigated

The water released from the dam except the quantity used for recharge works was utilized for the irrigation of the following crops in all three areas, Potima, Kissonerga and Khlorkas. Total quantity used for irrigation purposes 1175 064 m³.

			B.F. 705
Cereals	385 donms	Melons	400 donms
Potatoes	60 donms	vegetables	572 donms.
Bananas	200 donms		
Vines and			
Table Grapes	60 donms		
	C.F. 705	Total	<u>1677 donms</u>

6.2.1.21 Gross and Net Income

From the sale of water a total of £10251.375 was collected where the operational cost amounted to £2761.781 mils. Maintenance cost of the dam and distribution system amounted to £498.000 thus reducing the net income to £6991.594.

6.2.1.22 Palekhori

The Palekhori dam project is composed of a dam, capacity 620000 cubic meters and a distribution system (canals and pipes) commanding an area of about 986 don.

The water of this project has not been utilized because the distribution system was not completed. However irrigation by the existing irrigation canal was made to a limited extent of about 200 donums, and an estimated quantity of 100000 m³ was used. Evaporation losses was estimated at 30000 m³.

6.2.1.23 Pomos

The Pomos Dam project is composed of a dam with a capacity of 850000 cu.m. and a distribution system (canal and pipes) commanding an area of 2850 donums.

Irrigation in the project area commenced on the 16th of January and terminated on the 16th of December 1975. During this period a total quantity of 943745 cubic meters of water, representing approximately 109.74% of the maximum quantity in storage, was utilized for the irrigation of 929 donums of cereals, vegetables citrus, deciduous and other crops. Gross income from the sale of water was £7931.884 and the operational cost was £2567.230. Maintenance cost of this project was £244.000. Net income of the project was £5120.654.

6.2.1.24 Project Hydrology

Initial storage in the dam was about 308500 cubic meters of water. Inflow continued in the months of January, February, March up to mid April. The water level in the reservoir reached spillway crest on January the 12th and then started to overflow. Overflow lasted from

January the 12th to April the 4th and then from April the 20th to June the 3rd. After June the 3rd the water level started to fall steadily because of higher releases for irrigation, increased evaporation losses and reduced inflow. The water content was minimum on November the 11th with total quantity in storage around 367450 m³. After this date the level started rising again because of increased inflow, smaller releases for irrigation and reduced evaporation losses. By the end of the year the water in storage was increased to 569060 cubic meters.

Information on the water content, releases and water utilization is shown in table 6.9.

Table 6.9 - Pomos Management and Operation data

Item No.	Parameter Description	Quantity m ³	Percent of max. quantity in storage
1	Initial Storage (January 1st)	308500	35.87
2	Final storage (December 31st)	569060	66.17
3	Water Released for Irrigation	646007	75.12
4	Overflow utilized	297738	34.62
5	Total quantity used for irrigation	943745	109.74
6	Maximum quantity in storage	850000	100.00
7	Evaporation losses (about 8% of quantity in storage)	88800	8.

6.2.1.25 Water released, water sold and crops irrigated

The water utilized for irrigation was more than the maximum amount in storage at any time during the year.

About 297738 cubic meters of the overflowing water was utilized and was charged to the farmers at the rate of 5 mils/m³. The rest of the utilized water, 646007 cubic meters was released from the reservoir and was charged at a rate of 10 mils/m³.

An area of 929 donums was irrigated in two irrigation periods extending from January to December. The first period extends from January to mid June and the second from mid June to December.

1st Irrigation period: Total area irrigated 845 donums

Cereals	100	Potatoes	16 dons	B.F. 383
Citrus	52 dons	Vegetables	446 dons	
Bananas	200 dons			
Deciduous	31 dons	Total	<u>845 dons</u>	

2nd. Irrigation period: Total area irrigated 348 donums

Citrus	52 dons	Vegetables	84 dons	B.F. 264
Bananas	200 dons			
Deciduous	12 dons	Total	<u>348 don.</u>	

6.2.1.26 Gross and Net Income

Gross income from the sales of water was £7931,884 where the operational actual cost totalled £2567,230. Maintenance cost amounted to £244,000. Net income totalled £2323,230.

6.2.1.27 Yermasoyia Polemidhia Project

This project includes the Yermasoyia and Polemidhia dams and is planned to supply water to an area approximately 10000 dons, in the Zakaki, Phassouri, Trakhoni, Polemidhia, Yermasoyia, and Akrounda Phinikaria village areas.

In the year under consideration irrigation in the project area started on March and ended on December. A total quantity of 3546018 cubic meters of water (representing 23.45 percent of the total amount in storage) was utilized for irrigation of about 5630 donums of citrus, vines, deciduous, vegetables and Seasonal crops. Total gross income from sales of water amounted to £29782.610 and operational costs paid were £3590.251. Maintenance costs amounted to £1020.000. Net income of the project was £25172.359.

6.2.1.28 Project Hydrology

Yermasoyia (Dam reservoir capacity 13.5 MCM)

The water level in the Yermasoyia dam reservoir was at its lowest point on January the 1st 1975 with a total quantity in storage of 1300.000 cubic meters of water. Inflow was continuous during the months January to August. The dam water level reached spillway crest in March 1975 and continued overflowing until the end of May. Reduced inflow, increased release for irrigation and evaporation losses in the months of June, July and August had caused the reducing the amount of water in the reservoir, to a minimum of 10,500,000 m³.

Inflow to reservoir commenced again in December and when the water in storage was around 10 050 cubic meters. The inflows, outflows and losses from the dam summarized in the Table 6.10.

Generally the net inflow to the dam was below the estimated 51 year average. The evaporation losses were comparatively high and the utilization factor quite low. It is expected that both factors will improve next year with the completion of the distribution systems in the Zakaki, Phassouri and Akrounda Phinikaria areas.

6.2.1.129 Polemidhia Dam

The amount of water in storage at the beginning of the year under consideration was only 68000 cubic meters. Inflow to the dam reservoir was continuous for the period January-May and the dam water level reached its maximum point in March the 22nd with a maximum quantity in storage of 2620000 cubic meters of water. (Dam reservoir capacity 34300000 cubic meters). The water level started to drop in March because of increased water demand increased evaporation losses and reduced inflow.

Inflow to the reservoir commenced again in December 1975 when the amount in storage was 513000 cubic meters of water.

The inflow, outflow, and other losses are shown on Table 6.11.

Of great importance in this case is the interception and utilization of the seepage losses that occur. Out of 1248316 cubic meters of losses about 750000 cubic meters were recovered and utilized by the farmers in the Kato Polemidhia and Zakaki areas.

Table 6.10 - Yermasoyia Management and Operation data

Item No.	Description of Parameter	Quantity m ³	% of max. amount in storage	% of total Inflow	Remarks
1	Initial Storage (January 1st)	1300000	9.63	8.48	
2	Inflow (net) ■	15334464	113.59	100.00	Estimated
3	Overflow	566300	4.19	3.69	
4	Evaporation	1649140	12.21	10.79	Estimated from Evapora- tion Pan Class A.
5	Water Released for Irrigation	1419024	10.51	9.25	
6	Final Storage (December 31st)	13000000	96.30	84.78	
7	Max. amount in storage	13500000	100.00	88.12	

■ This is the net inflow to the dam reservoir excluding seepage losses etc.
Capacity of Dam Reservoir 13 500 000 m³

Table 6.11 - Polemidhia Management and Operation data

Item No.	Description of Parameter	Quantity	% of max. am. in storage	% of total net inflow	Remarks
1	Initial Storage (January 1st)	68000	2.59	2.06	
2	Inflow (net)	3298061	125.88	100.00	
3	Overflow	NIL			
4	Seepage	1248316	47.65	37.85	
5	Losses	498316	19.02	15.10	
6	Water reclaimed from losses (used for irrigation)	750000	28.63	22.74	Estimated 3/4 of losses during irrigation season
7	Evaporation	227750	8.69	6.90	
8	Water Released for Irrigation	1376995	52.56	41.75	
9	Final Storage (December 31st)	513000	19.58	15.55	
10	Maximum quantity in storage	2620000	100.00	79.44	
11	Total water utilized	2126995	81.18	64.49	

Generally the net inflow to the Polemidhia dam reservoir was below the estimated 51 year average. The evaporation losses were about 8.69% of the total water in storage and the utilization factor was quite high (81% of the amount in storage was utilized 64.48% of the total inflow).

6.2.1.30 Water Released, water sold and crops irrigated

Water released or utilized from both dams for irrigation purposes amounted to 3546018 cubic meters or 23.45% of the total quantity stored. This also represented about 19.03% of the net inflow that occurred in the same year. More details regarding the release from each dam and its utilization are given below.

6.2.1.31 Yermasoyia Dam

The release of water from Yermasoyia dam reservoir for irrigation purposes was very limited. The utilization of the stored water did not exceed 10% of the net inflow and represented only 10.51% of the water in storage.

Yermasoyia dam provided with irrigation water the following areas:

(a) Yermasoyia Irrigation Division. Total release. 1032084 cubic meters. This quantity was released and charged as follow :

From January - 15th June. 553,588 cubic meters free of charge as water rights.

From June 19th - July 10th. 224456 cubic meters free of charge.

From July 11th - September.6th 254040 cubic meters at the rate of 4 mils/m³. The irrigation Division refuses to pay at the agreed rate the cost of the water which amounts to £1016.160.

The water was utilized for the irrigation of 1400 donums as follows :

- Citrus 330 donms
- Deciduous 30 donms
- Seasonal and vegetables 1040 don.

(b) Akrounda Irrigation Division

At the request of the Akrounda Irrigation Division in the late summer water was released for the irrigation of an area of about 180 donms (supplementary irrigation). The quantity of water which amounted to about 13860 cubic meters was released free of charge and the Irrigation Division paid for the pumps and the pumping cost. The water was pumped to the Akrounda Dam through the Akrounda distribution system main conveyor.

(c) Zakaki area

In September the construction of the Yermasoyia main conveyor was completed and the connection to the Polemidhia main conveyor was made possible. Water from the Yermasoyia dam was released in the following months, September, October, November and December for the irrigation of plantations in the Zakaki area. The total quantity released amounted to 373080 cubic meters and was charged at the normal rates of 15 mils/m³ for citrus and 7 mils/m³ for the others.

The areas irrigated by this quantity of water are given later in this section.

6.2.1.32 Polemihia Dam

The utilization of the stored water in this dam was quite high, 2126995 cubic meters, 81.18% of the amount stored or 64.49% of the total net inflow for the year. Polemihia dam provided with irrigation water the following areas.

a) Kato Polemihia Irrigation Division (Total quantity released @ 430325 cubic meters)

311,000 cubic meters of water as water rights. This represents 12% of the total quantity in storage.

114625 cubic meters of water at a charge of 7 mils/m³

4700 cubic meters of water at a charge of 15 mils/m³

The above quantities of water were utilized for the irrigation of the following crops :

Deciduous	76 dons.
Vines	31 dons.
Olive trees	19 dons.
Seasonal	1024 dons.

Total 1150 donums

Income from the sale of water to the Kato Polemihia Irrigation Division amounted to £872.875. Polemihia dam project operational cost was £2285.251.

6.2.1.33 Combined Distribution System

Due to the fact that the areas downstream the connection of Polemihia and Yermasoyia main conveyors are supplied with water from both dams they shall be considered always as a combined distribution system area.

Apart from the water that was released from each dam for the irrigation of the areas that are commanded separately by each dam (Akrounda and Yermasoyia Irrigation Division by the Yermasoyia dam and Kato Polemihia Irrigation Division by the Polemihia dam) water was released from both dams for the irrigation of plantations in the Zakaki area. The releases were made separately or together and the water was utilized for the irrigation of the following crops:

Citrus	1244 dons.
Vines	957 dons.
Deciduous	11 dons.
Seasonal	688 dons.

Total 2900 dons.

Income from the sale of water in the Zakaki area (where 2069750 cubic meters of water was used amounted to £27,893.575 mils.

Of the water released to the Zakaki area 56.8% was sold to the Lanitis farm, 6.75% was sold to the Phassouri farm and the remainder to various other farms.

6.3 Maintenance of Government Irrigation Projects

6.3.1 General

During the year under review routine maintenance work was carried in all dams and their distribution systems. Routine works include the painting of metal works, removing of wild vegetation from embankment and maintenance of access roads, cleaning of canals and their structures etc.

For the maintenance of the major irrigation projects listed in Table 6.12 a total of £3412.000 was spent, £1884 for the dam structures and £1330 for the distribution systems.

6.3.2.3 Ayia Marina

Painting of metal structures, cleaning of drainage canals and removing of wild vegetation from embankment. Painting of 60 Manhole Covers, replacing of 5 sluice valves and repairing of distribution main at 5 points.

Expenditure :	Dam	32
	Distribution	<u>51</u>
		£83
		=====

6.3.2.4 Kalopanayiotis

Desilting of collector weir. Installing of a sluice gate on weir. Planting of coniferous trees in the guard house yard. Re-fencing of guard house yard and constructing of a cement concrete retaining wall. Repairing of 2 breakages of the distribution main (12" ϕ)

Expenditure :	Dam	310
	Distribution	<u>43</u>
		£353
		=====

Notes: The expenditure for the re-fencing and the construction of the retaining wall, i.e. £200, was totally covered by the P.W.D., whilst the expenditure for the desilting operation was equally met by the P.W.D. and W.D.D. each share being £275.

The above total sum of £475 is not included in the expenditure figure shown above.

6.3.2.5 Lefkara Dam

6.3.2.5.1 General

Lefkara Dam is currently the largest dam in Cyprus both from the point of view of height as well as storage capacity. It is situated on the Syrkatis tributary of the Pendaskinos River about 3 km NW of Pano Lefkara village. It is accessible from Nicosia via Kornos village, the road distance being 48 km.

The dam was designed in 1970 by Pietrangeli ed Humphreys of Rose, Consulting Engineers and constructed during 1971-1973 by joint venture contractors Leonard Fairclough (U.K) Ltd. and Medcon Construction Ltd. of Cyprus. The contract price was £1.125 million.

The dam is of the rockfill type with a centrally located rolled clay core. It is 74 metres high and has a crest length of 233 m. at an elevation of 361.0 m. above sea level. It has a total fill volume of 820,000 cu.m. and a storage capacity of 13.85 million cu.m. at a full storage level of 357.0 m. above sea level. The catchment area of 36.3 sq.km. was estimated to yield a mean annual flow of 8.2 million cu.m. It is estimated that about 5.3 million cu.m.p.a. of water will eventually be made available from the dam to the Famagusta Water Supply Scheme after treatment at the Khirokitia Treatment Plant. A small quantity of water will also be made available to satisfy local irrigation requirement.

6.3.2.5.2 Expenditure

The total expenditure incurred from the commencement of the works up to the end of December 1975 was £1,201,508 of which £1,090,673 was for work done by the contractor. The balance of £110,835 represents direct expenditure by the Department. In addition, a total sum of £61,254 has been paid as Consultants' Fees. The expenditure incurred during the year 1975 is as follows :

(i)	Payments to contractors	£1,212
(ii)	Direct expenditure by D.W.D.	£6,325
	Total for Dam in 1975	£7,537

Note: The figures quoted in the 1974 report only represented "commitments" whereas the figures quoted here have been outlined from "cleared" accounts, hence the apparent inconsistency with last years figures.

6.3.5.2.3 Progress achieved in 1975

A preliminary inspection was carried out on 8th January by representatives of the Consulting Engineers, the Contractor and the Department and a list of outstanding works and maintenance jobs was drawn up. The bulk of the retention money, up to then held by the Department, was released as a result of this inspection leaving only a small sum to cover outstanding work and required maintenance. The final inspection was carried out in February by Mr. J.M. Reid of the Consulting Engineers. Following these inspections the Contractor carried out the maintenance work required by him.

During March a Commissioning Engineer from Kent Instruments Ltd., visited the site and commissioned the hydraulic instrumentation of the dam which comprises flow and level measurement instruments.

The hydraulic control system for the valves of the outlet pipework was commissioned by officers of this Department during May.

During the year the Department purchased the temporary offices erected by the Contractor during the execution of the works. These offices are now being used as a guard house.

By the end of the year there was only some minor work outstanding, namely the connection of electricity to the guard house and the installation of the crest lighting fittings. This work is to be carried out early in 1976.

6.3.5.2.4 Impounding and Draw Off

On January 1st, 1975 the reservoir level was 307.29 m corresponding to a storage of 141,000 cu.m. It reached a maximum level of 337.07 m. by the 3rd June corresponding to a maximum storage of 4,602,000 cu.m. Very roughly and neglecting the various losses due to evaporation, seepages etc, the total volume of water impounded during the year represents about 60% of the estimated mean annual flow of the river and over 35% of the available storage capacity of the reservoir. From the point of view of the depth of the lake, the maximum level reached corresponds to about 60% of the depth when the dam is full.

The draw off period lasted from the 5th June and continued up to 19th January 1976. The minimum level to which the reservoir was drawn down was 332.04m. and was reached on December 27th. This level

corresponds to a minimum storage of 3,198,000 cu.m. By 31st December the reservoir had impounded the first inflow and had reached a level of 333.72m. representing a storage of 3,650,000 cu.m. Again neglecting the various losses due to evaporation and seepage the total volume of water drawn off is estimated at about 1,425,000 cu.m. This water was treated at the Khirokitia Treatment Plant during the year and delivered into the Famagusta Water Supply System, for use by the towns of Famagusta and Larnaca as well as several villages and refugee camps in the two districts.

6.3.5.2.5 Instrumentation

Regular readings of the instrumentation installed to monitor the structural behaviour of the dam were taken and recorded during the year.

The readings obtained upto now show normal behaviour in all respects.

6.3.5.2.6 Seepages

Seepage measurements are taken at various points. They have remained very small. The maximum flow rate measured at the downstream measuring weir, which collects seepages through the dam and its foundation (after subtracting the estimated effect of surface run-off) was about 32 lit/min. with the reservoir at maximum level.

The corresponding figure for the seepages measured at the tunnel exit was 27 lit/min.

These figures are very low indeed, considering that the reservoir reached 60% of full storage depth.

6.3.5.2.7 Recreation

Fishing has become a popular passtime at the dam. The reservoir has been stocked with trout and carp by the Fisheries Department which issues licences to interested individuals.

In December, the newly formed Community Welfare Committee of Lefkara officially expressed an interest to undertake the planting of trees and bushes in the vicinity of the dam. This gesture will be encouraged by the Department as it will help in covering up the scars left on the landscape by the construction such as borrow areas, quarries, spoil tips etc.

6.3.5.2.8 Kiti

Works in the Bekir Pasha chain of wells and drilling in front of the spillway for leakage observation purposes. Greasing and maintaining of penstock constructing of an R.C.C. bridge in the control room. Replacing of 24 No. Irrigation ports.

Expenditure :	Dam	759
	Distribution	<u>96</u>
		<u>£855</u>

6.3.5.2.9 Lefka (Special Case)

Emergency repairs to village water supply main

Expenditure :	£238
	<u>=====</u>

6.3.5.2.10 Lefkara See para. 6.3.2.5

6.3.5.2.11 Massari

Under Turkish occupation

6.3.5.2.12 Mavrokolymbos

Painting of all metal structure of dam. Treatment of woodwork of bridge with solignum. Removing of wild vegetation from embankment. Painting of 390 No. M/H covers. Painting and servicing of 260 No. Sluice valves and meters.

Expenditure	:	Dam	198
		Distribution	300
			<u>498</u>

6.3.5.2.13 Polemichia

Filling up of a pit in front of the spillway painting of all manhole covers and maintaining of 96 No. water meters, air valves and sluice valves. Replacement of 3 No. sluice valves.

Expenditure	:	Dam	219
		Distribution	570
			<u>789</u>

6.3.5.2.14 Pomos

Painting of all metal structures. Treating the woodwork of footbridge with solignum. Replacing 10 No. corrugated sheets on the roof of the guard house. Cleaning of spillway and drainage canals. Removing of wild vegetation from embankment covering of 1300' of RC channels and filling up of joints with gutta-terna.

Expenditure	:	Dam	44
		Distribution	200
			<u>244</u>

6.3.5.2.15 Syngrassis

Under Turkish Occupation

6.3.5.2.16 Yermasoyia

Painting of bridge railings. Planting of 300 No. Decorative and forest plants.

Expenditure	:	Dam	<u>231</u>
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6.6 Maintenance of contributory irrigation projects

6.6.1 General

As contributory irrigation project are classified those projects whose construction and operation is undertaken by the local irrigation divisions and to which by law the Government contributes 2/3 of their capital cost.

In the year 1975 a total of £1661,000 was spent for the maintenance of about 25 projects. Of these £1143 was paid by the government and the rest £518 was paid by the irrigation divisions.

Table 6.13 gives the expenses for each contributory dam and the type of maintenance work carried out.

Table 6.13 - Contributory dam project maintenance expenses

No.	Project	Expenditure			Remarks
		Govt. £	Contr. £	Total £	
1	Agros	318	106	424	Constructing of a silt trap and a retaining wall
2	Akrounda	-	-	-	-
3	Ayios Pappos	-	-	-	-
4	Famagusta Recharge Dams	-	-	-	The majority of the dams are under Turkish occupation
5	Galini	-	-	-	Under Turkish Occupation
6	Geunyeli	-	-	-	"
7	Gypsos	-	-	-	Under Turkish Occupation
8	Kandou	-	-	-	"
9	Kanli	-	-	-	-
10	Kalo Kherio(Klirou)	-	-	-	-
11	Kyperounda	39	19	58	For reduction of leakages
12	Kyrenia Recharge Dams	-	-	-	Under Turkish Occupation
13	Lefka Kafizes	-	-	-	"
14	Lefka Marathasa	-	-	-	-
15	Lythrodontas(Dams)	-	-	-	-
16	Mia Milia	-	-	-	Under Turkish Occupation
17	Morphou(Seryakhis)	-	-	-	-do-
18	Ovgos	-	-	-	-do-
19	Palekhori	30	15	45	Repairing of shaft doors
20	Pera Pedhi	41	20	61	Emergency desilting works
21	Petra (2 dams)	-	-	-	-
22	Prodromos	660	330	990	Constructin of 400' curbing, Fencing of dam, Improving the inlet system at the collector weir

Table 6.13 (contd)

No.	Project	Expenditure			Remarks
		Govt. £	Contr. £	Total £	
23	Pyrgos	55	28	83	Emergency repairs to dam outlet system. Replacing of main sluice valve.
24	River Training (General)	-	-	-	
25	Trimiklini	-	-	-	
	Totals	1143	518	1661	

Table 6.14 - Data on the Operation, Management and Maintenance of Major Irrigation Project

Ser. No.	Project	Capacity $m^3 \times 10^3$	Maximum water Stored $m^3 \times 10^3$	Water used $m^3 \times 10^3$	Water sold $m^3 \times 10^3$	Gross Income £	Expenditure			Net Income £	Remarks
							Operation £	Maintenance £	Total £		
	1	2	3	4	5	6	7	8	9	10	11
1	Argake-Magounda	1150	1150	1271	484	4843.940	781.615	121.000	902.615	3941.325	
2	Ayia Marina	300	300	347	347	3119.000	1136.000	83.000	1219.000	1900.000	
3	Kalopanayiotis	390	390	128	128	1667.601	1040.000	353.000	1393.000	302.601	
4	Kiti	1610	1390	1290	304	3004.050	741.901	855.000	1596.901	1407.149	
5	Lefkara	19850	4602	-	-	-	-	-	-	-	Net yet in operation
6	Mavrokolymbos	2180	2180	1225	872	10251.375	2761.781	498.000	3259.781	6991.594	
7	Palekchori	620	620	100	-	-	-	-	-	-	Contributory project
8	Pomos	850	850	944	944	7331.884	2567.230	244.000	2811.230	5120.654	
9	Polemihia	3430	2620	2127	1816	29782.610	3590.251	789.000 231.000	4610.251	25164.359	
10	Yermasoyia	13500	13500	1419	627			231.000			
		37890	27612	8851	5522	60600.460	12618.778	3174.000	15792.778	44807.682	

6.7 International Water Supply Association

The Cyprus National Committee of the International Water Supply Association exchanged regular correspondence with the Head Office of the Association relative to the activities of this Organization.

Due to tragic events in Cyprus, resulting from the Turkish invasion, participation of this National Committee to the 10th Congress held in Brighton, England was not possible nor it would be possible to participate to 11th Congress which is scheduled to be held in Amsterdam, Holland between 13th - 17th September, 1976.

6.8 Management of Water Supplies under provisions of Law Cap.350

6.8.1 Water Supply to Nicosia, Famagusta and Larnaca Towns, as well as providing water to Regional Village Schemes and Refugees Camps, were the main tasks of this Branch of the Maintenance and Operation Division of the Department.

Generally speaking, it can be said that water supply problems could be met satisfactorily. Conspicuous place, in this respect, is taken by the New Scheme of Famagusta which supplies Famagusta and Larnaca Towns and a great number of Communities and refugees camps. Rainfall reached the figure of 567 mm (by 162 higher than the normal) attributing to the replenishment of underground water and enabling the impounding into dams and reservoirs. Nicosia and suburbs, however experienced shortage of water and restrictions to the supply were imposed during summer.

6.8.1.1 Greater Nicosia Scheme

- (i) Administration: The proposal for the amalgamation of this scheme with that of the Nicosia Water Board was brought to surface and there is much hope to believe that finally amalgamation will materialize.
- (ii) Operation : All sources of this scheme were operated at full in order to minimize deficiency in the supply. More details on this aspect are given in the subject under heading "Nicosia & Suburbs Water Supply".
- (iii) The highest daily consumption in 1975, for Greater Nicosia Scheme "area of supply" was 13,390 c.m. on 22.7.1975 (under restrictions).
- (iv) During the year, the distribution system of Greater Nicosia Scheme was extended by 4,700' ft. of 6" ϕ and 4,800' ft. of 4" ϕ asbestos pipes laid mostly in new parcellations. In addition 442 new house connections were made. By 31st December 1975, the number of consumers was 12,457.
- (v) A statement showing expenditures and revenue for 1975 is given on page 60.

6.8.1.2 Nicosia Town and Suburbs Water Supply

- (i) Water supply to Nicosia and suburbs, including the Turkish Sector is faced commonly by the three existing Authorities i.e. the Government Water Development Department, the Nicosia Water Board and the Nicosia Water Commission.

The ever increasing demand in water, particularly due to the inhabitation of Nicosia area by Greek refugees and the apparent increase of consumption by the Turkish Sector could not be met by existing sources and restrictions to the supply were imposed on 8.4.1975. The restrictions applied, provided a supply of 24 hours in 48 to all consumers.

- (ii) Even though, position of water supply to Nicosia and suburbs became worse due to the disturbed operation of the Turkish occupied Morphou Pumping Station and Dhikomo boreholes. Regular stoppages in the delivery of water were observed and damages to installations were reported every now and then. The most serious damage occurred on one of the 500 H.P. motor which burnt up and on the compressor feeding air to surge vessels which stopped operating. In view of the dangerous situation so created and fearing of more serious damage to happen, it was decided that rewinding of the motor should go ahead and make at the same time arrangements for maintenance work of pumping installations at Morphou.
- (iii) In the circumstances, a proposal for maintenance works was brought up and discussed between Government officials and Turk representatives at a meeting which took place at Ledra Palace Hotel. After discussion, and considering that Greek Technicians were not allowed to carry out these works, it was agreed that such works are undertaken by British Firms who were the suppliers of electrical and pumping installations at the time. As a matter of fact, two service engineers were sent to Cyprus and carried out necessary maintenance works instructing at the same time the Turkish attendants of the Pumping Station how to operate and maintain existing installations.
- (iv) The total amount of water conveyed from all sources during the year 1975 reached the figure of 7,602,168 c.m., and was distributed excluding losses, as follows :

(a) Greater Nicosia Scheme "area of supply"3,192.110 c.m.
(b) Nicosia Water Board "area of supply"4,175.690 c.m.
(c) Nicosia "Town within Walls" 769.780 c.m.
Total	<u>8,137.580 c.m.</u>

Note: The difference observed between quantities pumped and consumed should be considered as water pumped from sources situated in Turkish occupied area, records of which could not be obtained.

- (v) The highest daily consumption for the "area of supply" described above was 30,590 cm (supply under restrictions) on 26.7.1975.
- (vi) Not only the brief description given on the Nicosia & Suburbs water supply as above, the imposition of restrictions to the supply during the last four years but also the creation of a number of refugee estates together with the new industrial estate, the water requirements of which will have to be met from Nicosia water supply, all these witness the extent of an urgent supplementation of the supply. In the course of time, if no supplementary supplies are found it is very likely that restrictions would be imposed even in winter months. Evidently, what is required is a new reliable scheme to provide safely the necessary quantities of water for future.

6.8.1.3 Water Supply to Government Residences and Institutions

Other than water for domestic use, all Government Residences and Institutions are supplied with water for irrigation from a number of sources situated within residential areas and producing low quality water. Such supply was regular throughout the year under review.

6.8.1.4 Famagusta Water Supply Project

- (i) Administration: This project, which was financed by Government, is administered by this Branch of the Division of Maintenance and Operation. No regulations exist to govern such administration and sale of water in "bulk" is made in agreement between this Department and the local authorities concerned.
- (ii) Operation : A scheduled programme of operation of the various sources of the Famagusta Water Supply Project is adopted, for a better utilization of each of them. The Khirokitia Treatment plant, however, is the last source to be put into commission, in order to meet water demands in summer.
- (iii) Resulting from good rainfall during winter months pumping of the "Vasilikos" source, in particular, could meet the required consumption until late in May, 1975, when treatment of surface water from Lefkara dam started on 5th June, 1976. By that time the impounding of water in the dam reached the figure of 4,602,000 c.m. corresponding to 35% of its total storage capacity.
- (iv) In an effort that staff operating the treatment plant could acquire all techniques and quality themselves in a more sufficient way, a fifteen days training course was arranged headed by Messrs. Rule and Shears from Messrs. Babcock the firm which supplied and installed the equipment of the Treatment Plant.
- (v) The total amount of water treated and/or pumped by this Project was 2,431,804 c.m. including losses and was distributed as follows :

Famagusta	579,699
Larnaca Water Board	1,029,475
Regional Village Water Supplies	355,179
Local Irrigators	104,466
Refugees Camps	147,922
Total	<u>2,216,741</u>

- (vi) A statement showing expenditure and revenue of the Famagusta Water Supply Project for the year 1975 is given on page

6.8.1.5 Technical Advice

Meetings of these organizations are regularly attended in our capacity as an official member and technical advice is offered whenever necessary. Such activity is extended to all Government Departments and Semi-Government Organization as far as water is concerned.

Facts about each of the existing Water Board and brief description on the position of their Water Supplies are outlined below.

(a) Nicosia Water Board

The acute necessity for the supplementation of its supply in conjunction with the Greater Nicosia Scheme's "area of supply" was described in previous chapter. Improvement of the distribution system as recommended by Consultants Messrs. McLaren International Ltd. are likely to start in 1976.

Some useful data are given below :

- (a) The total quantity of water supplied from own sources and private boreholes was 2,797.432 c.m.
- (b) The total quantity of water consumed as registered by area meters was 4,945.470 c.m. (including Nicosia Water Commission).
- (c) The total maximum consumption per day (including Nicosia Water Commission) was 18.260 c.m. on 7.7.75, (under restrictions).
- (d) The total number of consumers on 31.12.75, was 14,790.
- (e) (i) Extension of distribution system in feet run
3,341' ft. of 4" ϕ
90' ft. of 6" ϕ
- (ii) Total length of distribution system in feet run including extension for 1975
12,100' ft. of 12" ϕ
25,000' ft. of 10" ϕ
12,930' ft. of 8" ϕ
82,671' ft. of 6" ϕ
636,964' ft. of 4" ϕ
- (f) The total number of hydrants installed in 1975 was 3
The total number of hydrants installed up to 31.12.75 was 876.

(b) Limassol Water Board

Though a new Supplementary Scheme for this town is in progress, yet existing sources could suffice water requirements and a continuous supply was maintained. The maximum consumption reached the figure of 22,350 c.m.

The following information is given :-

- (a) Total quantity of water supplied from all sources = 5,212,882 c.m.
- (b) Total quantity of water consumed as registered by area meters = 5,175,035 c.m.
- (c) Total maximum daily consumption (18.7.75) = 22,350 c.m.
- (d) Total number of consumers on 31.12.75 was 19,800
- (e) Extensions of distribution system made in 1975

10,106' ft. of 4" ϕ
374' ft. of 6" ϕ

Total = 10,480' ft.

- (f) Total length of distribution system as at 31.12.75 = 974,218' ft.
- (g) Number of hydrants installed in 1975 was 10
- (h) Total number of hydrants installed within area of supply was 1,038.

(c) Famagusta Water Board

Since Turkish occupation of this town on 16.8.74 most of its personnel has been employed by other affiliated Organizations and Government Departments. No records are offered to serve the purpose of this report, other than to state that water has since been made available by the Government of the Republic, free of charge, to meet requirements of the Turkish people and Turkish troops in the area.

(d) Larnaca Water Board

The increased demand in water resulting from the settling of refugees was met efficiently thanks to "Famagusta Water Supply Project" which supplements its requirements in "bulk". The maximum consumption was 6,470 c.m. which is by 6.58% higher than the previous year. Erection of a new reservoir 8,000 c.m. capacity started and it is expected to be completed late in 1976. The following data are also collected.

(a) Water supplied during the year 1975

Own sources	900,120 c.m.
Government sources	1,020,470 c.m.
Private sources	9,260 c.m.

(b) Water Consumed during the year 1975

Registered by area meters = 1,819,820 c.m.

(c) Total Maximum daily consumption

= 3, 6,470 c.m. on 26.7.75

(d) Total number of consumers at 31.12.75

= 6,023

(e) (i) Extension of distribution system during the year 1975 in f.r.

9,050 f.r. of 6" ϕ

27,750 f.r. of 4" ϕ

(ii) The total length of distribution system is not available

(d) (i) Hydrants installed during the year 1975

60 No.

(ii) Total number of hydrants installed within water supply area

366 No.

GREATER NICOSIA SCHEME (Including Morphou Bay Scheme)

Revenue and Expenditure Account for 1975

<u>Expenditure</u>		<u>Revenue</u>	
(a) <u>Pumping Charges</u>		(a) Sale of water	
(i) Wages	17,033.346)	(i) In bulk	£ 60,436.075) £ 212,491.075
(ii) Electricity	6,006.112 (£ 24,752.302	(ii) To consumers	£152,055.000)
(iii) Materials	1,712.844)		
(b) <u>Maintenance Charges</u>		(b) Connection fees	£ 908.000
(i) Wages	5,627.130)	(c) Usage of pipelines	£ 4,112.620
(ii) Materials	2,572.248 (£ 8,199.378	(d) Other revenue	£ 3,288.573
(c) <u>Collection fees</u>	£ 23,027.055		
(d) <u>Morphou Running Expenses</u>		Total	= £ 220,800.268
(i) Wages	997.319)		
(ii) Electricity	44,487.588 (£ 47,437.437		
(iii) Materials	1,952.530 (
(e) <u>Tseri Running Expenses</u>			
(i) Wages	3,417.254)		
(ii) Electricity	8,528.407 (£ 11,949.111		
(iii) Materials	3.450 (
Administration	£ 5,000		
Grand Total	= <u>£120,365.283</u>		

Note: This statement does not include for the amortization of the installations and equipment of the scheme. The cost of the existing installations was approx. £1,976,000.- and the amortization was calculated to be £169,800 per year. Thus there is in fact a deficit between revenue and actual annual cost amounting to £69365 for 1976, although revised water rates were put into effect from August 1975.

FAMAGUSTA WATER SUPPLY PROJECT
Expenditure and revenue account for 1975

	<u>Expenditure</u>		<u>Revenue</u>	
(a) <u>Pumping Charges</u>			(a) Sale of water	£ 28,410.445
(i) Wages	£ 16,488.167)		(b) Outstanding payments 1975	£ 68,437.284
(ii) Electricity	£ 25,218.307)	£ 49,241.089		
(iii) Materials	£ 7,534.615)			
			Total amount =	£ 96,847.729
 (b) <u>Maintenance Charges</u>				
(i) Wages	£ 409,468)			
(ii) Materials	£ 1,367.179)	£ 1,776.647		
	Total =	£51,017.736		

The cost of the Government financed "Famagusta Scheme" up to the end of 1975 amounted to: £ 2,971.721.000
Roughly the amortization for this capital investment is £249,210 annually, (at 8% for 40 years)
Thus the deficit for the year 1975 amounts to £203,380.

VII.

DIVISION OF
SMALL PROJECTS PLANNING

By

P. Pantelides
Head of Division

7.1 Introduction

In spite of all the adversities brought about by the invasion of Cyprus, some notable progress has been achieved in the design of new domestic water supply projects for improving and supplementing the needs of villages suffering from water shortage, and new irrigation schemes for re-activation of the farming communities in the free zone of the Island.

7.2 Village Water Supplies

Because of the good rainfall in 1974-1975 the number of villages with satisfactory water supply has improved as described in the lists as follows :

- a. New house-to-house schemes for 6 villages were completed (List A).

The total number of villages with house-to-house supply is now 532 (List A) thus only 87 out of a total number of 619 villages still remain with public fountains i.e. 14.06 %

- b. From 532 villages with house to house systems, 450 enjoyed a per capita daily rate at over 90 liters or 20 gallons, and systems were working satisfactorily; 82 villages were getting less than 90 liters or 20 gallons per head per day and the supply situation at house-gate was inadequate and non-constant --(List B).

7.2.1 Water Supply Schemes Prepared in 1975

33 new schemes were prepared and submitted to the District Officers in 1975 at a total estimated cost of £347,577 as per "list C".

Another 35 schemes were in the course of preparation at the end of the year as per "list D".

7.2.2 Brief Description of Important Village Water Supply Schemes Prepared in 1975

(i) Kakopetria - Galata

House to house supply scheme for Kakopetria Village at a total estimated cost of £33,600 and house to house supply scheme for Galata village at a total estimated cost of £33,400.

(ii) Prodhromos-Pedhoulas-Moutoullas

Supplementary supply for the villages of Prodhromos-Pedhoulas and Moutoullas from springs issuing in a gallery at "Kannoures" locality on Troodos slopes.

(iii) Mouttayiaka Regional Scheme

General improvements of Mouttayiaka regional scheme at a total estimated cost of £82,120

(iv) Paphos Industrial Area

Convey water for the needs of the new Industrial area at Paphos at a total estimated cost of £35,800.

(v) Xylophagou

General improvements of Xylophagou water supply system at a total estimated cost of £25,000.

7.3 Irrigation

The main objective of this programme is to increase the irrigated area near the sources for self-employed farming organisations such as village Irrigation Divisions and/or Associations.

The main target which is being pursued is to extend permanent irrigation by 1000 to 1500 donums annually, by planning small irrigation projects which can be implemented with financial participation by the farmers.

As the main principles underlying the programme is the quick and effective use of water at or near the source combined with intensive agricultural methods, design considerations are always based on land and water use data furnished by the District or Regional Agricultural Officers; project evaluation is undertaken by a Joint Inter-Departmental Committee.

The advantages of the Small Project Programme whose beginning dates back to the creation of the Department, is "speed of reaction" in all phases of project development" wider participation" of farming communities, "greater flexibility" in budgetary procedure, and "greater exploitation" of the existing background.

The main types of schemes included in this programme postulate water conservation either by the improvement of the old-established obsolete intake and distribution system, the construction of small reservoirs for night or seasonal storage, the exploitation of new boreholes and the artificial recharge of depleted aquifers.

7.3.2 Schemes Prepared in 1974

All the schemes which were ready for implementation at the end of the year appear on list "A" estimated at a total cost of £676,000. The schemes which have been budgeted for implementation in 1976 are marked with an asterisk at a total cost of about £419,000.

Some of the more important schemes prepared in 1975 and submitted to the District Officers, or in the course of preparation are briefly described in next page ;

(i) Borehole pumping schemes (£276)

A total of ten irrigation pumping schemes from Government boreholes inequal numbers of villages have been finalised namely for :

Orounda	for new seasonal crops
Pera	for vegetables
Yerakies	for permanent crops
K. Platres	for permanent crops
Episkopi	for permanent and seasonal crops
Kolossi	for seasonal crops
Ay. Theodoros(L ^o ca)	for seasonal crops
Tokhni-Kalavasos	for permanent crops
Khoulou	for permanent crops
Lemona	for permanent crops

The total expenditure for these schemes is estimated at £276,000 and acreage of new permanent and seasonal irrigation envisaged thereof is in the order of 1191 and 758 don. respectively.

(ii) Small Storage Reservoirs

The scheme for constructing a storage reservoir at Pakhyamos village near Polis-tis-Khrysochou has reached its final stage and will be ready for implementation early in 1976.

(iii) Recharge Works

Investigation works were carried out for the completion stage of recharge works with Gabion Weirs, on the Idalias River bed near Nissou-Dhali where private boreholes are being used for the irrigation of about 1000 don. of citrus and other Government boreholes pumping domestic water for Nicosia.

(iv) Solea Valley (Stage II)

The objective of this stage of the project is the extension of irrigated area in the central Solea Valley, and the main feature is the construction of an off-stream earth dam-reservoir of storage capacity at 1,500,000 cubic meters at a selected site in a tributary valley west of Karkotis river and near the village of Korakou.

It is anticipated that the project will bring under new permanent irrigation an area of 1500 to 2000 donums and other 1500 donums under seasonal irrigation. Total 3000 to 3500 donums of the most productive lands in the valley.

(v) Pitsilia Irrigation Project

A preliminary report and survey has been conducted for an Integrated Rural Development Programme of Pitsilia. The project area as demarcated for development extends over the top of the central mountain range (top elevation 1600 m) and covers an area of about 300,000 donums.

The initial capital cost for irrigation works is of the order of £5,000,000 and implementation extends over 5 years with financial aid from abroad.

The Project envisages new irrigation and implementation to existing systems of the order of 20,000 donums in some 30 villages of the Pitsilia area.

(vi) Irrigation and Domestic Water Supply Projects Proposed for implementation with foreign capital aid (Federal Republic of Germany)

A list of Irrigation and Village Domestic Water Supply Projects was prepared and submitted for implementation with Foreign capital aid.

The total estimated cost of the schemes is over £1,000,000.

(vii) Inter-Departmental Committee for Small Irrigation Projects

The Committee is functioning in conformity with directions by the Director-General of the Ministry of Agriculture for the purpose of assessing project viability for budgeting purposes, and co-ordinate the activities of the District Agricultural Services for the supply of agro-economic data in the preparatory stages of the projects.

Some 17 schemes were considered and approved by this Committee as per list "F".

A general catalogue of villages where schemes were in the course of preparation or still under investigation is given on list "G".

Village Water Supplies

Total	Village with house to house distribution				Village with Public Fountains			Village without a pipe supply		Popula- tion %	Total of villages
	Schemes comple- ted	Total No. of villages	Villages %	Popula- tion %	Total No. of villages	Villages %	Popula- tion %	Total No. of villages	Villages %		
1960		90	14.33		441	70.23		97	15.44		628
1961	41	131	20.86		428	68.19		69	10.95		628
1962	59	190	30.25		380	60.55		58	9.20		628
1963	67	257	40.90		324	51.60		47	7.50		628
1964	39	296	47.13	66.71	323	51.43	32.29	9	7.44	1.00	628
1965	5	301	47.93	68.86	321	51.11	30.44	6	0.96	0.70	628
1966	7	308	49.05	69.81	316	50.31	29.95	4	0.64	0.24	628
1967	11	319	50.80	71.40	307	48.88	28.46	2	0.32	0.14	628
1968	27	346	55.10	75.72	282	44.90	24.28	-	-	-	628
1969	14	360	57.32	78.60	268	42.68	21.40	-	-	-	628
1970	32	392	62.42	83.23	236	37.58	16.77	-	-	-	628
1971	16	408	64.95	85.42	220	35.05	14.58	-	-	-	628
1972	29	437	69.60	88.70	191	30.40	11.30	-	-	-	628
1973	67	504	81.40	95.10	115	18.60	4.90	-	-	-	619
1974	22	526	85.00	97.20	93	15.00	2.80	-	-	-	619
1975	6	532	85.94	97.55	87	14.06	2.45	-	-	-	619

Water Supply Situation at the End of 1975

District	Satisfactory piped supply (Supply rate 90 lts/head/day & over)								Unsatisfactory piped supply (supply rate below 90 lts/head/day)								Total No. of Villages	Total Popula- tion 1969
	Villages with house-to-house				Villages with fountains				Villages with house-to-house				Villages with fountains					
	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%		
Nicosia	129	76.33	111.483	89.70	14	8.28	1658	1.33	18	10.65	9698	7.80	8	4.74	1457	1.17	169	124.296
Kyrenia	39	82.98	30.869	93.76	2	4.25	55	0.16	1	2.13	540	1.64	5	10.64	1463	4.44	47	32.927
Famagusta	81	82.66	82.990	92.50	3	3.06	100	0.11	7	7.14	5693	6.35	7	7.14	934	1.04	98	89.717
Limassol	92	80.70	68.826	92.87	5	4.38	269	0.38	9	7.90	4119	5.55	8	7.02	894	1.20	114	74.108
Paphos	59	44.70	25.693	49.56	14	10.60	2157	4.17	45	34.09	21981	42.55	14	10.61	1924	3.72	132	51.695
Larnaca	50	84.75	38.303	94.66	3	5.08	402	0.98	2	3.40	1674	4.12	4	6.77	95	0.24	59	40.534
Total	450	72.70	358.164	86.68	41	6.62	4641	1.12	82	13.25	43705	10.57	46	7.43	6767	1.63	619	413.277

Water Supply - Schemes Prepared
in 1975 and submitted to D.O's

Summary of List "C"

District	No. of Schemes	Estimated Cost £
Nicosia	11	137,905
Limassol	7	103,338
Paphos	4	45,590
Famagusta	3	13,000
Larnaca	8	47,744
Kyrenia	-	-
Total	33	347,577

Water Supply - Schemes Prepared in
1975 and submitted to District Officers

Nicosia District

Ser. No.	Village	Nature of Scheme	Estimated Cost £
1.	Kapedhes	Improvement to the storage tank	750
2.	Kakopetria	House to house and Improvements	33,600
3.	Agrokipia	Extensions to the distribution system	1,700
4.	Orounda	-do-	1,700
5.	Katydhata	Improvements to the spring	400
6.	Menikon	Extensions to the distribution system	3,200
7.	Galata	Additional storage and improvements to the distribution system	33,400
8.	Malounda	Supplementary supply from the existing scheme Klirou Mitsero-Kaloh Chorio	1,955
9.	Pedhoulas } Moutoullas } Prodhromos }	Additional supply from "Kannoures"	50,000
10.	Kato Moni	Supplementary supply from the spring "Ayii Eliophotes"	4,000
11.	Latsia } Yeri }	Supplementary supply from new B/H	7,200
Total			137,905

Limassol District

1.	Sanidha	Supplementary supply from New B/H	2,600
2.	Troodhos	Extensions to the distribution system	5,000
3.	Mouttayiaka regional scheme	General improvements to the mains	82,120
4.	Ypsonas-Polemidhia	Installation of a chlorinator	600
5.	Pyrgos	Improvement	450
6.	Vasa(Kilani)	New spring	5,600
7.	Sykopetra	House to house and improvement to the spring	6,968
Total			103,338

List "C" (cont.)

Paphos District

Ser. No.	Village	Nature of Scheme	Estimated Cost £
1.	Paphos	Installation of a new booster pump	3,600
2.	Psathi	House to house scheme	3,490
3.	Paphos Industrial Area	New scheme from Paphos town water supply	35,800
4.	Kinoussa	House to house	2,700
Total			45,590

Famagusta District

1.	Ayia Napa	Additional supply from new B/H	5,000
2.	Avgorou	Supplementary supply from Famagusta main	5,000
3.	Avgorou	Extensions	3,000
Total			13,000

Larnaca District

1.	Ormidhia	New B/H	4,000
2.	Avdholero	New scheme from a well	3,244
3.	Livadhia	Supplementary supply from Famagusta main	1,600
4.	Voroklini	-do-	3,000
5.	Xylophagou	Improvements to the distribution system and additional storage tank	25,000
6.	Kalavassos	Improvements to the distribution system	200
7.	Pyrga	Extensions	3,700
8.	Xylotymbou	Supplementary supply from Famagusta main	7,000
Total			47,744

Schemes under preparation
by Nicosia Main Office

Nicosia District

Ser. No.	Village	Nature of scheme
1.	Kalon Khorion (Orini)	Extensions to distribution system
2.	Evrykhou	-do-
3.	Kakopetria-Galata	Supplementary supply
4.	Palekhorion Morphou	-do-
5.	Palekhorion Orinis	-do-
6.	Apliki	-do-
7.	Gourri	-do-
8.	Phikardou	-do-
9.	Ay. Epiphaniou	-do-
10.	K. Koutraphas	-do-
11.	Pera Khorion (Nissou)	-do-
12.	Kannavia	-do-
13.	Kotchiatis	Improvements to the Existing Scheme

Limassol District

1.	Prodromos Forest College	New scheme from "Kannoures" spring
2.	Peledria	Supplementary supply from Livadhia "tou Pasha" area
3.	K. Amiantos	
4.	Kyperounda	
5.	Khandria	
6.	Agrihia	
7.	Agros	
8.	Ay. Theodoros	Supplementary supply from new spring
9.	Ay. Constantinos	-do-
10.	Dhierona	-do-
11.	Pano Platres	Additional supply from B/H No. 30/74
12.	Sanidha	House to house
13.	Lophos	House to house

Paphos District

1.	Kilinia	House to house scheme
2.	Galatargos	-do-
3.	Archimandrida	-do-

Famagusta District

Ser. No.	Village	Nature of scheme
1.	Paralimni-Ayia Napa	Supplementary supply from Famagusta main
2.	Vrysoulles	New scheme from new B/H
3.	Sotira	Supplementary supply from Famagusta main

Larnaca District

1.	Odhcu	Supplementary supply and house to house
2.	Khirokitia	Improvements to the Extensions
3.	Kornos	Extensions

LIST OF SMALL IRRIGATION SCHEMES
(Ready for Construction at the end of 1975)

List "E"

*Included in 1976 Estimates

Nicosia District

Ser. No.	W.D.D. Reference	Village	Division or Assoc.	Locality	Nature of Proposed Works	Estimated cost £	Village Contrib. %	Irrigation		Remarks
								Perm. don.	Seas. don.	
* 1	127/40/127	Kambos	Division	-	Improvement Works	1,600	1/3	64	-	
* 2	34/45	Anayia	Division	-	Lining of Channels	7,650	1/3	100	250	
3	27/39/III	Ergates	Division	-	-do-	18,800	1/3	110	140	
* 4	51/54	Foristerona	Division	-	-do-	10,000	1/2	-	2000	
* 5	31/46	Astromeritis	Division	-	-do-	10,000	1/2	-	2000	
*-6	127/40/138	Ay.Theodoros (Soleas)	-	-	Intake weir & channels	2,000	1/3	-	-	
7	127/40/41	Palekchori	Division	Milouri	Distribution pipes	3,600	1/3	17	-	
8	83/52/IV	Orounda	Division	Matsaris	Pump house & Distribution pipes B/H No.18/74	18,530	1/3	-	100	1975 Estimates (Supplementary)
9	43/44/II	Gourri	Division	-	Repairs to existing works	800	1/3	-	70	
10	73/40/II	Ay.Trimithias	Division	-	Intake	2,000	1/3	-	-	
11	127/40/3	Alona	Division	Kolybos-Papamichael	Lining of channels	1,700	1/3	18	-	
12	42/42	Pera	Division	-	Pumphouse and distribution pipes B/H No. 2/64	6,500	1/3	-	45	
13	42/42	Pera	Division	-	Pumphouse and distribution pipes B/H No.49/64	10,000	1/3	-	60	
14	70/73	Idalias River (Dhali)	-	-	Recharge weirs (Gabions)	11,000	-	-	-	

Ser. No.	W.D.D. Reference	Village	Division or Assoc.	Locality	Nature of Proposed Works	Estimated cost £	Village contrib. %	Irrigation		Remarks
								Perm. don.	Seas. don.	
15	127/40/10	Nisou	Associat.	Frangos	Pumphouse & pipelines B/H No.27/64	8,000				Compensation to Irrig. Associat.
16	63/52/III	Akaki-Meniko	Division	Riatikon	Lining of channels	45,000	1/3		500	400 don. winter
17	39/44	Vyzakia	Division	-	-do-	24,000	1/3		140	
18	55/61	Yerakies	Division	Xeros Potamos	Pumping scheme & distribution works	60,000	1/3	216	-	

Limassol District

1	127/40/49/48	Kyperounda	Associat.	Appis	Distribution works	2,300	1/2	6	-	
2	127/40/49/II	-do-	-do-	Khalospities	-do-	3,700	1/2	15	-	
3	68/52/II	Kato Platres	Division	-	Pumping scheme	23,500	1/3	140	-	1975 Estimates (Supplementary)
4	110/55	Episkopi	Division	-	Pumping scheme	36,000	1/3	250	67	-do-
5	42/43/III	Phini Phase "B"	Division	-	Distribution works	22,700	1/3	170	-	
6	127/40/52/III	Ayios Ioannis (Agrou)	Division	Teratsias	-do-	2,900	1/3	35	-	
7	127/40/59/II	Louvaras	Division	Tsoukallas	Irrigation Tank & Distribution works	1,300	1/3	7	3	
8	112/59	Kato Amiandos Pelendri	Division	-	-do-	3,050	1/3	135	-	
9	127/40/99	Agros	Division	Kato Enetikos	-do-	1,850	1/3	18	-	
10	127/40/99	Agros	Division	Anastasia	-do-	6,000	1/3	70	-	

Ser. No.	W.D.D. Reference	Village	Division or Associa.	Locality	Nature of Proposed Works	Estimated cost £	Village contrib. %	Irrigation		Remarks
								Perm. don.	Seas. don.	
# 11	28/42/II	Lemythou	Division	Tsangaroudhia	Distribution Works	2,250	1/3	8	15	
# 12	31/54/II	Ay. Demetrios	Division	Kaminia-Kryo Nero	-do-	21,600	1/3	187	-	
# 13	31/54/II	Ay. Demetrios	Division	Kalogeros	-do-	4,600	1/3	50	-	
# 14	127/40/134	Pelendria	Division	Koundourides	-do-	920	1/3	10	18	
# 15	-do-	-do-	Division	Avlaki Hji Stylianou	-do-	700	1/3			
# 16	-do-	-do-	Division	Englisis Psilou	-do-	4,450	1/3	24	-	
# 17	127/40/134	Pelendria	Division	Kato Englisis	Distribution pipes	4,400	1/3	33	-	
# 18	127/40/22	Dhymes	Division	Sykamēri	-do-	2,800	1/3	24	-	
# 19	127/40/17	Ay. Pavlos	Division	Dhima Khoriou	-do-	2,300	1/3	33	17	
# 20	127/40/133	Paleonylos	Division	Khardji	-do-	16,600	1/3	120	-	
# 21	127/40/49	Kyperounda	Associa.	Mavros Kolymbos	-do-	1,560	1/2			1975 Estimates (Supplementary)
# 22	95/61	Kolossi	Division	-	Pumping scheme & Distribution pipes BH 38/68	19,000	1/3	-	200	1975 Estimates (Supplementary)
# 23	127/40/59	Louvaras	Associa.	Pano Pervolia	Spring Development	930	1/2	17	-	
# 24	127/40/22	Dhymes	Associa.	Kato Livadhia	Distribution pipes	850	1/2	6	-	
# 25	110/44	Pano Platres	Division	-	Distribution pipes	13,500	1/3	90	-	
# 26	127/40/95	Potamitissa	Division	Kato Potami	Distribution pipes	830	1/3	5	1	
# 27	127/40/16	Kalokhorio	Division	Marammenos	Spring Development etc.	650	1/3	37.5	-	
# 28	127/40/18	Agridhia	Associa.	Panhya	Distribution pipes	3,330	1/2	25	-	

Limassol District (Contd)

List "E" (contd)

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of Proposed works	Estimated cost £	Village contrib. %	Irrigation		Remarks
								perm. don.	Seas. don.	
29	31/45/H	Prodromos	Division	Platania Antonidhes	Distribution pipes	2,000	1/3	50	-	
30	127/40/134	Pelendri	Associat.	Vrysi Archangelou	-do-	1,037	1/2	8	-	
31	127/40/134	Pelendri	Division	Livadhia	-do-	500	1/3	6	-	
32	84/52	Kouka	Division	-	-do-	760	1/3	6	-	
33	103/52	Mathazoloni	Division	Paleomylos Esso Pervolia	-do-	660	1/3	32	-	
34	127/40/59	Louvaras	Associat.	Koutrotsou	-do-	930	1/2	5.5	3	

Larnaca District

1	43/38/III	Ay. Theodoros Larnaca	Division	-	Pumping scheme & distribution pipes BH/EB24	26,500	1/3	-	286	
2	26/41	Tokhni-Kalavassos	Division	-	Pumping scheme & distribution pipes	25,000	1/3	225	-	
3	38/44	Alaminos	Division	-	Recharge Dam	19,300	1/3	-	-	

LIST OF SMALL IRRIGATION SCHEMES
(Ready for Construction at the end of 1975)

List "E" (cont.)

Paphos District

* Included in 1976 Estimates

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of Proposed Works	Estimated cost £	Village contrib. %	Irrigation		Remarks
								Perm. don.	Seas. don.	
# 1	87/47/III	Amargetti	Division	Likhoudhi	Pumping scheme & distribution pipelines	6,000	1/3	40	60	
# 2	65/62	Khoulou	Division	-	Pumping scheme and distribution pipes B/H 181/63	11,500	1/3	50	-	
3	65/62	Khoulou	Division	Filarotos	Pumping scheme and distribution pipes B/H 195/63	26,500	1/3	190	-	1975 Estimates (Supplementary)
4	94/53	Lemona	Division	-	Pumping scheme and distribution pipes B/H PB/61	24,500	1/3	170	-	-do-
# 5	63/45	Steni	Division	-	Pumping scheme and distribution pipes B/H PB/67	20,000	1/3	120	-	150 vines
# 6	127/51/III	Polis(Khrys.)	Division	-	Pumping scheme and distribution pipes B/H 449	11,000	1/3	105	-	
# 7	95/67	Polemi	Division	-	Pumping scheme and distribution pipes B/H 6/74	14,800	1/3	55	-	
# 8	69/64/II	Skoulli	Division	-	Pumping scheme and distribution pipes B/H 24/62	18,800	1/3	120	-	
# 9	69/64/II	Goudhi	Division	-	Pumping scheme and distribution pipes B/H PB 47	22,600	1/3	300	-	
Total						676,000				

List "F"

List of Small Irrigation Schemes Approved
by the Inter Departmental Committee in 1975

1. Pelendria (Kato Englisia)
2. Ayios Pavlos (Dhimna tou Khorion)
3. Kyperounda (Mavros Kolymbos)
4. Ayios Demetrios (Kaloyeros)
5. Ayios Demetrios (Kaminia - Kryon Neron)
6. Khandria (Limassol)
7. Episkopi (Pumping Scheme)
8. Pelendria (Avlaki Hji Stylianou)
9. Pelendria (Englisia Psilou)
10. Pelendria (Koundourides)
11. Kato Platres (Pumping Scheme)
12. Kyperounda (Khalospilies)
13. Alona (Kolymbos, Papamichael)
14. Dhali (Ftelia - Katevas)
15. Orounda (Matsiari)
16. Ergates (Pumping Scheme)
17. Amargetti (Likhoudhi)

List "G"

List of Schemes in the course of preparation
or Water Investigation at the end of 1975

Nicosia District

Pakhyammos (Reservoir and Distribution works)
Xyliatos
Akaki (Kamena)
Spilia - Kourdali (Mosphili - Kato Archondou)
Episkopio
Psomolophou
Politiko
Nisou
Klirou
Philani

Limassol District

Phini (Irrigation Tank)
Monogroulli (Dam)
Ay. Ioannis Agrou (Yeroubela)
Ay. Ioannis Agrou (Pera Akros)
Ay. Ioannis Agrou (Karpasitis - Vrysia)
Ay. Ioannis Agrou (Angoulos - Dhipotamia)
Yermasoyia (Irrigation Division)
Ay. Yeorghios Silikou (Syrka)
Kyperounda (Kardana - Potistrou)
Ypsonas (Kourris River)
Khandria (Reservoir)
Pelendria (Kato Englisis Pelendriou)
Agros (Vournes)
Potamiou
Prodhromos (Kyperissi)
Kaminaria (Dam)
Eptagonia (Dam)
Kyperounda (Zonismenos Diala)
Agridhia (P. Yeradja)
Prodhromos (Skledros)
Pyrgos (Almyrovrysi)
Moniatis
Tris Elies
Ayios Therapon
Kato Amiandos - Pelendri

List "G" (Cont.)

Paphos District

Statos (Akres)
Kelokedhara (Psathaes)
Goudhi (Phase II)
Dhroussia (Improvements)
Ay. Marina (Khrysokhou)
Potamiou (Ha Potami)

Larnaca District

Psevdas
Aradippou (Antiflood works)

VIII. REGIONAL OFFICES

8.1 Limassol Regional Office

By

A. P. Protopapas
District Engineer

8.1.1 General

The Limassol District Office of the Water Development Department is responsible for the Department's activities in the District of Limassol.

Manned with Twenty Six Officers and Draughtsmen and with direct supervision of Twenty Two (22 No.) foremen and a Labour force of Two Hundred Ninety Nine (299 No.) skilled and unskilled workers undertakes the commitments of the Department in conjunction and co-ordination with Officers from the Head Office.

This Office also advises in its capacity the District Officer Limassol on the water situation in aquifers, on water supply matters and irrigation matters and also undertakes the maintenance of all Water Supply and Irrigation Systems in operation which are under the jurisdiction of the District Officer.

Further more, this Office, co-ordinates with the District Engineers or Officers of all other Departments or Authorities, in common matters concerned particularly in the case of projects to be executed.

The main functions of this office can be summed up as follows:

- A - Hydrological measurements, Investigation and Studies
- B - Design of Major Water Works, Minor Irrigation Projects and Water Supply Schemes.
- C - Construction of Major Water Works, Minor Irrigation Projects and Water Supply Schemes.

The District Engineer exercises overall supervision in Hydrology, Design and Construction and carries out the administrative work of this office.

The District Engineer participates in a number of meetings representing the Director of the Water Development Department the most important of which are :

1. Limassol Water Board
2. Sewage Board of Limassol
3. District Co-ordination Committee
4. District Land Consolidation Committee
5. Joint Water Committee
6. Special Measures Law Committee

8.1.2 Hydrological Measurements, Investigations and Studies

There were eight (8 No.) officers engaged in this section for surface and ground water measurements keeping records and assessing the situation in the following areas:

- a. Special Measures Law Area Since
 - (i) Akrotiri Aquifer October, 1965
- b. Water Conservation Areas
 - (i) Yermasoyia December, 1961
 - (ii) Moni-Pyrgos July 1961
 - (iii) Pareklisia November, 1975
 - (iv) Pissouri-Evdhimou August, 1972
 - (v) Paramali-Evdhimou July, 1967
- c. The rest of Limassol District and in addition Tochni, Zygi and Vasilikos areas lying in the Larnaca District.

8.1.2.1 Surface Water Hydrology

a. Rivers

The flow in the rivers is gauged by means of automatic water level recorders and the results are calibrated by means of current meter measurements.

River	No. of recorders	Location	No. of current meter measurements
Kourris	2	Khalassa	47
		Khalassa	46
Zygos	2	Khalassa	23
		Khandria	10
Garylli	1	Ayia Erini	14
Kha-Potami	1	Kissousa	17
Amathos	2	Phoenikaria	36
		Akrounda	21
Vassilikos	2	Kalavassos	25
		Zygi	14
Evdhimou	1	Evdhimou	6
Total	11		259

Notes:

(i) Current meter measurements were taken at weekly intervals except at times of flood when additional measurements were taken and at the same time water samples were taken for suspended sediment analysis. Water Samples were also taken twice a year for chemical analysis.

(ii) Kourris River was the only river that had a flow throughout the year.

(iii) The total discharges calculated for each river are given in the "Hydrological Year Book" of this Department.

(iv) Four (4 No.) automatic recorders that were gauging the water from Kourris river at the intakes of Episkopi, Kantou, Erimi and Phassouri were removed having completed their purpose for which they had been installed.

(v) Another automatic recorder gauging the water in the Akrotiri Salt Lake was also removed.

b. Springs

The discharges of ninety (90 No.) Springs were measured at monthly intervals for the purpose of Villages Water Supply, Limassol Water Supply, the Design of Minor Irrigation Projects and Hydrological purposes.

A total of seven hundred and eighteen (718 No.) spring discharges were taken either volumetrically or by means of the Current Meter.

Water samples from these springs were taken once during the year for full chemical analysis.

8.1.2.2 Ground Water Hydrology

Ground Water Hydrological observations and measurements are taken all over the District and particularly in the Special Measure Law and Water Conservation areas:

Special Measures Law

a. Akrotiri Aquifer

Hydrological observations and control is exercised by means of 243 No. wells or boreholes strategically situated in the area.

Water level measurements are taken twice a year from all the above wells or boreholes except from 47 No. wells or boreholes where water levels are observed monthly, so that the behaviour of the water table in the aquifer is observed more closely.

Sea intrusion at Zakaki and Akrotiri is observed and studied by means of 60 No. wells or boreholes at Zakaki and Cherkez and 23 No. wells or boreholes at Akrotiri.

Water pumped from the aquifer for irrigation, domestic and industrial purposes is noted monthly for each individual licenced wells or borehole by means of water meters (total 382 No.) attached to each pumping unit in order to ensure that the quantity pumped does not exceed the quantity allocated.

It is thus ensured that pumping is kept at a minimum necessary to preserve the citrus plantations in good and productive condition and at the same time ensuring that the aquifer is not irrevocably damaged.

At places such as Zakaki where the Water Salinity is higher than 1000 p.p.m. pumping was prohibited and water for irrigation was supplied from Yermasoyia and Polemidhia Dams.

Water extracted from Akrotiri aquifer

Purpose	Quantity MCM
Irrigation	12.74
Domestic	1.40
Industrial	0.90
Total	15.04

Water supplied from Dams = 1.93
 Total supplied for Irrigation = 14.67

b. Conservation Area

The water situation within the Water Conservation Area is observed by means of a number of wells and boreholes and the total water extraction is estimated by means of questioning.

Salinity is also observed taking samples twice a year.

The number of observation boreholes in the Water Conservation Areas is distributed as follows :

<u>Conservation Area</u>	<u>No. of wells and boreholes</u>
Yermasoyia	77
Moni-Pyrgos	73
Kalavassos-Zygi-Tochni	68
Paramali-Evdhimou	37
Pissouri-Evdhimou	28
Total	<u>283</u>

8.1.2.3 Well Sinking Permits

Well sinking permits granted and applications to transfer water to other plots for irrigation or permits to install engine and turbine or adjustment of pumping permits were investigated as follows :

Area	No. Investigated	No. of permits granted
<u>Special Measures Law Area</u>		
a) Akrotiri Aquifer	45	11
<u>Conservation Areas</u>		
b) Yermasoyia	15	4
c) Moni-Pyrgos	5	4
d) Paramali-Evdhimou	2	-
e) Pissouri-Evdhimou	5	3
f) Rest of Limassol District	244	200
Total	316	222

8.1.2.4 Limassol Water Supply

Water supplied to Limassol from the Springs and boreholes is gauged and frequent samples are taken both at the water source and at the two reservoirs for chemical and bacteriological analyses.

Water supply figures from Springs and Boreholes are as follows :

Springs	1,839,346 c.m.
Boreholes	3,370,728 c.m.
Total	<u>5 210 074 c.m.</u>

8.1.2.5 Village Water Supply

The Water Supply of 105 No. Villages was checked during the period September-October when springs and boreholes are at their min. output or max. draw down respectively.

All villages in the District of Limassol had adequate water supply throughout the year.

Water samples taken (85 No.) from the village water supply springs and boreholes, were tested for their chemical consistency and found satisfactory.

Samples for bacteriological analysis were taken from the Zakaki and Kalo Khorio boreholes which were contaminated and remedial measures were applied.

8.1.2.6 Metecorological Observations

Daily records were kept for rainfall (Max. 60.2 mm 7.12.75) wind velocity, temperature (Max 39.2 °C 16.7.75) humidity, sun reflection and water evaporation (Max 6.4 mm 16.7.75) at Yermasyia Dam.

Daily records were kept for rainfall (Max 55.6 mm 7.12.75) temperature (Max 34.5 °C 16.7.75) and water evaporation (Max 5.2 mm 16.7.75) at Polemidhia Dam.

8.1.2.7 Quarry and Gravel pits permits

Sixteen (16 No.) applications for quarries and gravel pits permits were examined.

Also five (5 No.) applications for land encroachment in rivers were examined.

8.1.3.8 Design of Major Water Works, Minor Irrigation Projects and Water Supply Schemes

1. Major Water Works

Design of Major Water Works is carried out by the District Engineer in conjunction with officers from the Head Office.

Officers Preliminary work and Surveying is carried out by two aided by two draughtswomen.

Major Water Works designed were as follows:

a. Concrete Gravity Dam - Ayios Theodoros (Agrou)

The Dam was designed to store 259,000 m³ of water at max. capacity for the irrigation of 300 donums of deciduous trees to benefit the local Irrigation Division and will accumulate the winter flow of this tributary of Kourris river.

The hydrological study, considering monthly rainfall and springs flows, showed that this storage is sufficient to satisfy the needs of the 300 donums but once in 9 years.

The final cost was estimated to £222,700.

b. Yermasoyia - Polemidhia Project - Zakaki-Phassouri Extension

Extension of the Distribution System at Zakaki and Phassouri to irrigate 4,886 donums of citrus etc. in addition to the existing system which already irrigates 2,900 donums of citrus, vines and vegetables.

The cost for this extension is £251,000.

c. Yermasoyia - Polemidhia Project - Trachoni Extension

Extension of the Distribution System at Trachoni to irrigate 3,891 donums of citrus, vines and vegetables at a preliminary estimate of £480,000.

d. Yermasoyia - Polemidhia Project - Akrounda-Phinikaria Land Consolidation Scheme

Design of the Distribution System and reinforced concrete Reservoirs fed by water pumped from Yermasoyia Reservoir by means of three 430 KVA multistage centrifugal pumps housed at the base of the Dam.

This project is to irrigate a total of 1,064 donums of recently levelled and land consolidated area at the villages of Akrounda and Phinikaria.

The total cost of this scheme has risen £258,000.

8.1.4 Minor Irrigation Projects

The design of Minor Irrigation Projects is carried out by four (4 No.) officers aided by a draughtswoman.

Sixty four (64 No.) applications for improvement of existing irrigation systems or for the development of new ones were received.

Forty applications were studied and designs were prepared as follows below:

The other 24 No. applications were either rejected being non feasible or simply given advice on.

Ser. No.	Village	Irrigation Division or Association		Estimated cost
1	Agriidhia	"Panayia"	I.A.	3,300
2	Agros	"Anastasia"	I.D.	6,000
3	Agros	"Mylos"	I.D.	110
4	Ay.Demetrios	"Kalogeros"	I.D.	4,500
5	Ay.Demetrios	"Kaminia-Kryo Nero"	I.D.	21,600
6	Ay.Georghios			
	Sylikou	"Syrika"	I.D.	1,350
7	Ay.Ioannis	"Angoulos-Dhipotania"	I.D.	7,800
G/F				£44,660

Ser. No.	Village	Irrigation Division or Association	Estimated cost
8	Ay. Ioannis	"Yerampelos" I.D.	670
9	Dhymes	"Kambos" I.D.	800
10	Dhymes	"Kato Livadhia" I.D.	850
11	Dhymes	"Sykameri" I.A.	2 800
12	Episkopi	"Episkopi" I.D.	33 500
13	Kalo Chorio	"Maramenos" I.D.	550
14	Kato Amiandos	"Kato Amiandos-Pelendri" I.D.	4 800
15	Kato Polemidhia	"Kato Polemidhia" I.D.	60 600
16	Kato Platres	"Kato Platres" I.D.	20 100
17	Kolossi	"Merras" I.D.	17 700
18	Kouka	"Kouka" I.D.	760
19	Kilani	"Amoutti" I.D.	700
20	Kyperounda	"Appis" I.A.	1 700
21	Kyperounda	"Kardama-Potistron" I.D.	2 450
22	Louvaras	"Pano Pervolia-Paschali -Koutroutsou" I.D.	2 350
23	Louvaras	"Paralonia" I.D.	1 250
24	Mathikoloni	"Palomylos -Esso Pervolia" I.D.	660
25	Pano Platres	"Pano Platraes" I.D.	15 250
26	Pelendri	"Livadhia" I.D.	500
27	Phini	"Mylas" I.D.	6 200
28	Pissouri	"Pissouri" I.D.	7 000
29	Potamiou	"Potamiou" I.D.	1 000
30	Potamitissa	"Kato Potami" I.D.	830
31	Prodromos	"Platania-Antonidhes" I.D.	2 000
32	Prodromos	"Kyparissi" I.A.	1 500
33	Prodromos	"Skledros" I.D.	530
34	Tris Elies	"Drakondas" I.D.	2 100
35	Yerasa	"Yerasa" I.D.	450
36	Yermasoyia	"Yermasoyia" I.D.	82 600
37	Ypsonas	"Kourris" I.D.	7 500
38	Ypsonas	"Ypsonas" I.D.	35 500
39	Pelendri-Kato Amiandos	"Concrete Gravity Dam at "Lomata tous Aetous"	144 000
40	Episkopi	McFadden's Well-Department of Antiquities	420
Total			504 280

8.1.5 Water Supply Schemes

The same four officers prepared the designs for Seven (7 No.) Water Supply Schemes as follows:

Ser. No.	Village - Description	Estimated cost £
1	<u>Kakomallis Forest Station-Spring Development and pumping</u>	700
2	<u>Potamitissa - Installation of water meters</u>	800
3	<u>Phassoula - Utilization of B/H 134/62 to reinforce existing water supply from spring</u>	4 850
4	<u>Pano-Kividhes-Extension of water supply</u>	1 000
5	<u>Sykopetra- Reservoir and House-to-House distribution</u>	7 000
6	<u>Sanidha - Utilization of B/H 10/74 to reinforce existing water supply from spring</u>	2 600
7	<u>Vassa (Kilaniou)-Utilization of new spring to reinforce the existing water supply from spring</u>	5 600
Total		22 550

Also the existing water supply schemes of the Village of Aposha and Korphi, were investigated and remedial measures were applied.

An application by Pissouri Village to supply Pissouri bay with water from B/H 4/74 was adversely advised because of the high degree in hardness.

8.1.6 Construction of Major Water Works, Minor Irrigation Projects and Water Supply Schemes

Construction Works in the Limassol District for Major Water Works, Minor Irrigation Projects and Water Supply Schemes are supervised by the District Engineer assisted by the Chief Foreman, the Assistant Chief Foreman, two Technical Assistants and a Foreman stationed at the office for this purpose.

The personnel employed for construction works during 1975 consisted of 22 No. Foremen and 64 skilled workers and a maximum of 235 unskilled labourers.

8.1.6.1 Construction of Major Water Works

a. Yermasoyia Main Conveyor

The project commenced in June 1974 and was completed in September, 1975.

The pipeline is 13 km. long and can carry water at a rate of 850 l/sec from the Yermasoyia Dam to the area west of Limassol for irrigation purposes. The Conveyor merges with the pipeline from Polemidhia Dam and together the two Dams are to irrigate a total of 11,677 donums of citrus, vines, deciduous and vegetables.

The pipeline consists of 900 and 800 mm dia "salonit" pipes made of cement reinforced with asbestos fibres conforming to ISO R160 and which were supplied by "Dalmacira Cement" of Split Yugoslavia.

Cast Iron Specials and Joints to fit those pipes were supplied by "Dalit" also of Yugoslavia.

The project was scheduled to complete by April 1975 but due to an additional order for cast iron pieces essential for the completion of works that was not executed on time, there was considerable delay shifting the completion date to September, 1975.

This project apart from the purchase and installation of the A.C. pipes and cast iron specials and fittings and reinforced concrete chambers, it included the construction of the Break Pressure Tank by the Yermasoyia Dam. The final total cost including resurfacing of the asphalt roads, land acquisition and compensation was £420,000.

Labour Force Involved

(i)	Foremen	10
(ii)	Skilled Workers	34
(iii)	Unskilled Workers	100
		<u>144</u>

Machinery Employed

(i)	Land Levelling - Dozers D8 Bulldozer	1 No.
(ii)	Trenching-Excavators SMITH 21	2 No.
	Poclain	1 No.
	19-RB	1 No.
	JCB-4C	1 No.
		<hr/>
		5 No.
	Compressors	2 No.
(iii)	Lifting Machinery	
	Hydraulic crane on wheels	1 No.
	19-RB on crawlers	1 No.
		<hr/>
		2 No.
(iv)	Loading and Back filling Machinery	
	John Deer 120 hp	1 No.
	Massey Ferguson 70 hp	3 No.
		<hr/>
		4 No.
(v)	Muck shifting	
	10 ton Lorries	5 No.
(vi)	Compaction Machinery	
	Vibrating Rollers	2 No.

Other machinery used were Cutting and Turning Machines, Concrete Vibrators and Mixers, Test Pumps and Dumpers.

b. Akrounda-Phinikaria Land Consolidation Scheme

Land area of 567 donums at Akrounda Village and 497 donums at Phinikaria Village under land consolidation scheme and made level with dozers is to be supplied with water for irrigation from Yermasoyia Dam.

Since both villages lie upstream of the Dam the scheme is essentially a pumping scheme.

This project consists of the pumping plant, the balancing reservoirs and the distribution systems.

The project was to be completed within 1975 but was extensively delayed with consequence expenditure increase mainly due to the confiscation of the pumps at Famagusta port in August 1974.

Tenders for the three new 430 KVA centrifugal multistage pumps were awarded to Drakos and Polemis Greece.

The pumps and ancillary electrical machinery are now being installed and the scheme will be set to operation by the end of March, 1976.

Additional structures considered essential such as a 16'-0" high retaining wall and a reservoir 1,000 cu capacity were designed and erected.

Victaulic pipes up to 14" dia and galvanised steel pipes up to 4" dia were used the total length of piping being 17,800 m. for Akrounda Village and 10,000 m for Phinikaria Village.

The cost of the scheme originally estimated to 166,000 will finally cost, including the increase in prices for the steel pipes used and the power supply, £258,000.

c. Zakaki-Phassouri Extension

The extension of the distribution system of the Yermasoyia Polemidhia Project at Zakaki and Phassouri west of Limassol will include another 4,886 donams of land for irrigation from Yermasoyia and Polemidhia Dams.

Zakaki Extension works are now in progress and due for completion in April 1976 at an estimated cost of £77,000.

A.C. "HELLENIT" pipes 150-450 mm dia are being used the total length of which is 8,000 m.

Phassouri Extension works have commenced and scheduled for completion in August 1976 at an estimated cost of £174,000.

A.C. "HELLENIT" pipes 150-600 mm dia will be layed the total length of which will be 12,000 m.

8.1.6.2 Construction of Minor Irrigation Projects

Minor Irrigation Projects are constructed for the benefit of local Irrigation Divisions or Associations where as a rule the cost is shared one third by the interested party and two thirds by the Government.

The following works were executed during 1975.

Ser. No.	Village	Irrig. Division or Irrig. Association	Description of Works	Cost £
1	Agros	"Kato Erimos"	I.A. Spring improvement	590
2	Agridhia	"Agridhia"	I.D. Pipe laying	2,500
3	Ay.Theodoros	"Kouphaes"	I.D. Concrete Reservoir and Pipe Laying	5,100
4	Ay.Theodoros	"Lois"	I.D. Pipe Laying	1,400
5	Agrou	"Kolymbos"	I.D. Pipe Laying	1,000
6	Khandria	"Kamaroudhia"	I.D. Pipe Laying	5,900
7	Dhieronra	"Mavros"	Extension of the Kype-rounda reservoir Distribution System	1,560
8	Kyperounda	"Vassiliko"	I.A. Pipe Laying	2,050
9	Limatis	"Alakati"	I.D. Construction of tunnel with present U-shaped concrete sections and piping	1,400
10	Mandria	"Mylavris"	I.D. Phase II-Pumping Scheme for B/H EB. 108/73	8,600
11	Potamitissa	"Arsoulou"	I.D. Pipe Laying	1,400
12	Potamitissa	"Pano Potami"	I.D. River Training wall	780
13	Zoopygi	"Zoodochos Pygi"	I.D. Supplementary-Installation of sluice valves	650

Total

£33,830

8.1.6.3 Construction of Water Supply Schemes

a. Village Water Supply Schemes

These are constructed either on a Regional Scheme basis or for the benefit of a single village the cost as a rule being shared equally between the benefited village and the Government.

The following Schemes were executed during 1975

Ser. No.	Village	Description	Cost £
1	Kyvidhes	Pumping Scheme-Additional Supply from "Ayiasma" spring	24 000
2	Kakomallis Forest Station	Spring Development and pumping	250
3	Phinikaria	Additional Supply from Moutayiaka Regional Scheme	3 500
4	Sanidha	Additional Supply Utilizing B/H 10/74 Pumping Scheme	2 600
5	Trachoni	Concrete Reservoir and Turbine installation part of house to house scheme executed in 1974 (Total Cost £12,440)	2 600
6	Ypsonas-Polemidhia	Pumping Scheme-Additional Supply from B/H 105/73	30 000
Total			£52 950

b. Water Supply to Land Division for Building Sites

Water Supply network were laid to only four land divisions for building sites in the following areas :

1.	Kato Polemidhia	£ 1 085
2.	Ay. Phylaxis	600
3.	Kato Polemidhia	455
4.	Kato Polemidhia	500
Total		<u>£2 640</u>

8.1.7 Dams and Reservoirs

In the District of Limassol there are ten (10 No.) Dams and Reservoirs.

Ser.	Name of Dam	Reservoir Capacity-CM	Year	Type of Dam
1	Agros	72 000	1964	Earth fill
2	Akrounda	22 000	1947	Concrete Gravity
3	Arakapas	130 000	1974-75	Concrete Gravity
4	Kantou	38 000	1952-55	Concrete Gravity
5	Kyperounda	60 000	1974	Earth fill (off channel)
6	Pera Pedhi	55 000	1954-55	Concrete Gravity
7	Polemidhia	3 400 000	1963-65	Earth fill
8	Prodromos	110 000	1962	Earth fill (off channel)
9	Trimiklini	330 000	1956-58	Concrete Gravity
10	Yermasoyia	13 600 000	1966-68	Earth fill
Total		17 917 000		

Except from Yermasoyia and Polemidhia Dams all other dams and reservoirs are run by the committees of the local Irrigation Divisions.

All dams and reservoirs are periodically inspected for their structural soundness and water stored is recorded.

Yermasoyia and Polemidhia Dams are now part of a combined Project the main objective being to irrigate 11,677 donums west of Limassol.

Maximum quantity stored during 1975 for Polemidhia Dam was 2,620,000 cu m in March whilst Yermasoyia Dam commenced overflowing during the same month.

These Dams are checked at regular intervals for vertical and horizontal movements. Pore water pressures are also observed (Particularly Yermasoyia Dam which is gauged) and results are recorded in graphical representation.

Records for evaporation are kept daily and are as follows :

Dam	Method of measurement	Evaporation in mm and date	Estimated quantity evaporated m ³
Yermasoyia Dam	Sunken & Elevated Pans	6.4 16.7.75 max 0 10.1.75 min	1 640 000
Polemidhia Dam	Elevated pan	5.2 16.7.75 max 0.8 28.12.75 min	227 232

Both Dams were maintained and kept in good operational order.

Expenses incurred

Yermasoyia Dam	£ 230
Polemidhia Dam	250
Distribution System	<u>538</u>
Total	<u>£1018</u>

8.2 Paphos Regional Office
By

Andreas Lambrou
District Engineer

8.2.1 General

By the end of the year the staff of the Paphos Regional Office was composed of the District Engineer, Mr. A. Lambrou Head of the Paphos Regional Office, 3 Monthly Paid Technical Assistants, 6 Daily Paid T. As, 2 hourly paid Employees, one monthly paid female draughtsman, one daily female typists and one hourly female draughtsman.

The above personnel was divided in two groups, the first one was occupied with the Hydrology branch and the second with the construction works and investigations.

8.2.1.1.1 Hydrology Branch

The staff of the Hydrology Branch was engaged on the collection of Hydrological and Hydrogeological Data as follows :

a. Stream gauging and rainfall observing stations in operation

The following number of permanent stream gauging and rainfall observing stations were in operation during the year under weekly or monthly visits for observations, measurements and maintenance.

- (i) 10 stream gauging stations equipped with automatic water level recorders
- (ii) 1 rainfall observing station with automatic Raingauge Recorder
- (iii) 9 B/Hs equipped with automatic water level recorders

8.2.2.2 Surface Water Hydrology

Weekly and monthly visits were made during the year to the stream gauging stations or to the B/Hs equipped with automatic water level recorders for observation and for calibration purposes by the use of current meters. A total number of 689 current meter measurements were taken on rivers during the year for calibration and run off purposes. Also samples of stream water for chemical and suspended sediment analysis were taken regularly.

8.2.2.3 Ground Water Hydrology

Ground Water conditions in South Western Paphos and Polis Khrysokhou areas, were observed with the help of 218 wells/boreholes. The distance from established Bench Marks on top of every observation well/borehole to the ground water level was measured twice a year.

In March, before the irrigation period and in November, after the irrigation period.

In addition monthly or more frequent measurements of the ground water level were taken from 86 boreholes during the year for special studies.

Also 54 springs were under observation during the year and a total number of 640 spring discharges were gauged volumetrically or by current meter, while 316 spring measurements were taken from the village water supplies.

8.2.2.4 Chemical Analyses

Samples of stream and ground water were taken and sent to the Government Laboratory for chemical analyses.

245 samples of ground water taken from observation wells/boreholes during March and November were analysed by the Paphos Regional Office for Chloride content. Also 316 samples were taken from the villages springs and were submitted to the Government Analyst for Chemical Analyses.

8.2.2.5 Suspended Sediment Analyses

A total number of 222 samples of stream water were taken at the permanent gauging stations and analysed by the soil Laboratory for suspended sediment.

8.2.2.6 Questioning

The annual questioning was carried out on 3690 wells/boreholes and springs in south western Paphos and Polis Khrysokhou area during Summer for the determination of the ground water extracted, the area irrigated, and kind of crops planted.

8.2.2.7 Well sinking permits

A total number of 436 applications for well sinking permits were investigated and reports submitted to the District Officer Paphos.

8.2.2.8 Encroachments on Government Land and Quarries

8 Applications regarding encroachment on Government Land were investigated and reports were submitted to the Director of the Department. Also 10 cases for Quarry Licence were examined.

8.2.2.9 Court Cases

A total number of 30 illegal sinking or deepening of wells were presented to court according to our request to the District Officer.

8.2.2.10 Water Meters

27 water meters installed on the Dhiarizos Lower Catchment were observed once a month, and a total number of 16 readings were taken and recorded in the ledgers of this office.

8.2.3 Construction and Investigation Branch

The staff of the above branch was engaged on the following works:

8.2.3.1 Investigations

27 applications and complaints regarding small water supply and irrigation problems were investigated and reports submitted to the District Officer Paphos.

Also 8 applications for removing water supply and irrigation pipelines from certain fields that might be levelled were investigated and relevant action was taken by the staff of this office.

8.2.3.2 Small Projects Investigations

10 cases were investigated and reports were submitted to the District Officer Paphos or to the Director of the Department. Where necessary schemes were designed and bill of quantities with the estimated costs were submitted to the Nicosia small Projects Division.

8.2.3.3 Plotting and Levelling

50 new wells were plotted and 65 new B/Hs were levelled, while the settlement marks of Paphos Dams were levelled as follows:

Mavrokolymbos Dam	Every month
Pomos Dam	Every other month
Ayia Marina Dam	" " "
Argaka Dam	" " "

8.2.3.4 Operation and Maintenance of Paphos Dams

The operation and maintenance of Paphos Dams were carried out properly by the staff of this office and routine visits were carried out for this purpose. Detailed reports were prepared separately and submitted to the Director of the Department.

8.2.3.5 Construction Works

The construction of works was carried out properly and the following schemes were completed in 1975.

1. Ayia Marina Dam Distribution System
2. Goudhi Skoulli Irrigation Scheme
3. Peristerona (Khr.) " "
4. Peyia " "
5. Mamonnia " "
6. Mavrokolymbos Dam Distribution System Stage II
7. Arminou Regional W.S. Scheme face I & II
8. Kallepia-Letymbou W.S. Scheme
9. Ambelitis W.S. Scheme
10. Yiolou W.S. Scheme
11. Paliambela W.S. Scheme
12. Psathi W.S. Scheme
13. Ayia Marina (Kel.) W.S. Scheme
14. Steni W.S. Scheme
15. Stroumbi & Polemi W.S. Scheme Face II

The completion of the following schemes is expected in the next year.

1. Mavrokolymbos Dam Distribution System Stage III
2. Yiolou Irrigation Scheme
3. Lemona " "
4. Khoulou " "
5. Tala W.S. Scheme
6. Pandalia W.S. Scheme
7. Nata W.S. Scheme Face I (Lower Villages)
8. Paphos Industrial estate W.S. Scheme.

8.3 Famagusta-Larnaca
Regional Office

By

C. Andreou
District Engineer

8.3.1 General

By the end of the year the staff of the Regional Office was composed of the following eleven officers:

- 1 No. Executive Engineer I, Head of the Office
- 1 No. Senior Inspector of Works
- 1 No. Inspector of Works
- 2 No. Monthly Paid Technical Assistants
- 1 No. Daily paid Technical Assistant
- 1 No. Hourly Paid Technical Assistant
- 1 No. Foreman Grade I
- 2 No. Regular Employees
- 1 No. Female Secretary-Typist

The technical staff of the office was engaged in the following functions :

- a. Hydrology
- b. Investigations and Design
- c. Construction
- d. Maintenance

8.3.1.2 Hydrological Investigations

8.3.1.3 Stream Gauging

During the year the following permanent stream gauging observation stations were in operation and weekly or monthly visits were paid for observations and maintenance.

Two stream gauging stations equipped with automatic water level recorders (Paralimni; outfall of lake and Liopetri).

8.3.1.4 Groundwater Hydrology

The groundwater conditions of the Famagusta-Larnaca Region were observed by means of 400 boreholes/wells.

The water levels, (i.e. the distance from established bench mark on top of the observation wells/boreholes to the ground water level) were taken twice per year i.e. in March before the irrigation period and in November after the Irrigation period.

In addition, monthly measurements of the groundwater level as well as sampling of water for chemical analyses were taken from 80 Government boreholes.

8.3.1.5 Chemical Analyses

A total number of 300 samples were taken from boreholes/wells and sent to the Government Laboratory for chemical analysis.

Also a certain number of samples were taken from boreholes/wells and were analysed in the Regional Office.

8.3.1.6 Plotting of boreholes

During the year the plotting of the boreholes in the hydrological area of Famagusta-Larnaca was continued.

Up to the end of the year 1305 boreholes/wells were plotted in Liopetri, Xylophagou, Ormidhia and Achna.

8.3.1.7 Questioning

The annual questionnaire was carried out only in the areas where the plotting was completed.

8.3.1.8 Well sinking permits

A total number of 316 applications for sinking and covering permits of wells/boreholes in the conservation areas as well as 48 applications in the non-conservation areas were examined and submitted to the District Officers of Famagusta.

These applications were finally examined and approved/disapproved by the Advisory Committee of the Ministry of Agriculture and Natural Resources.

The applications examined per District are as follows:

	Conservation area		Non-conservation	
	Approved	Not Approved	Approved	Not Approved
Famagusta	99	109	-	-
Larnaca	50	58	38	40
Total	149	167	38	10

8.3.1.9 Investigations and Design

8.3.1.10 Investigations

8.3.1.11 Salt Lake

According to a request of the Ministry of Industry and Commerce, the following investigations were carried out at the Salt Lake of Larnaca :

- a. Daily measurements of the temperature and density of the sea, twice per day
- b. Measurements of rainfall, wind speed temperature of water and density of Salt Lake
- c. Measurement of evaporation
- d. Sampling of lake water after rainfall
- e. Changing of chart showing the water level of the lake.

8.3.1.12 Liopetri Sheep-Grazing Area

According to an invitation of the District Officer Famagusta a meeting was called on, to form a Committee to discuss and forward the improvement of the so called "Liopetri sheep grazing area". The Committee was composed of representative of the following Departments. District Office Famagusta, Agricultural Office, Town Planning and Housing, Geological Department, Land Registry Office and the Department of Water Development.

Our Department undertook to carry out investigations on the number of boreholes existing in the area, the yield of the boreholes and the area irrigation (kind of crops etc) within and outside the "Liopetri sheep grazing area". All the boreholes were plotted on maps and levelled accordingly. Also the water levels of all boreholes were taken within the above mentioned area.

8.3.1.14 Water Supplies and Irrigation Projects

Certain investigations were carried out for the water supply of Mazotos, Mennoyia, Aplanda Anaphotia, Dheryhia, Maroni (Irrigation) and Maroni-Zyghi, Psematismenos W.S. and Kato Dhrys water supply.

8.3.1.15 Designs

8.3.1.16 Village Water Supplies

During the year the following designs of various water supply schemes were designed and submitted for approval.

Larnaca District

Ser. No.	Village	Scheme	Estimated Cost £
1	Orimidhia	Supplementary water supply from new borehole	4000
2	Odhou	Supplementary water supply from "Dhasos" spring	6000
3	Kalavassos	Improvement of Distribution System	200
4	Pyrga	Improvement of Distribution System. Water supply to new building site	3700
5	Voroklini	Supplementary water supply from Famagusta Water Supply main conveyor pipe line	2380
6	Livadhia	Supplementary Water Supply from Famagusta Water Supply main conveyor pipeline	1600
7	Refugee Camp "AMMO DEPOT" Ormidhia	Water Supply to the camp from new borehole	3200
8	Khirokitia	Improvement of Ay. Spyridhon spring	1500
Total			22580

Famagusta District

Ser. No.	Village	Scheme	Estimated Cost £
1	Avgorou	Improvement of Distribution System	3,000
2	Sotira	Supplementary Water supply from new borehole	20,000
3	Sotira	Supplementary water supply from Famagusta water supply main conveyor pipeline	10,000
4	Paralimni Ay.Napa	Supplementary water supply from Famagusta water supply main conveyor pipeline	100,000
5	Refugee Camp Alkna Forest	Distribution system within the camp from Famagusta water supply main conveyor pipeline	1,300
Total			134,300

8.3.1.17 Irrigation Schemes

Larnaca District

Ser. No.	Village	Scheme	Estimated Cost £
1	Tochni	New scheme for the irrigation of 225 donums from borehole 48/72	25,000
2	Odhou	Irrigation Division No.57 from "Kefalovrysos" spring	8,200
3	Odhou	Irrigation Division No.2 47 donums	3,000
Total			36,200

8.3.1.18 Town Water Supplies

The District Engineer prepared a design for the construction of a reinforced concrete reservoir for the Water Board of Larnaca for a capacity of 8000 m³. The estimated cost amounts to £180000.

8.3.1.19 Construction

8.3.1.20 Village Water Supplies

During the year the Regional Office undertook the construction of the following projects :

Ser. No.	Village	Scheme	Estimated cost £	Remarks
1	Ay. Vavatsinias	Supplementary water supply from "Adhicia" spring	9100	Commenced in 1974 and completed in May 1975
2	Phrenaros	Supplementary water supply from new borehole 33/68	5000	Completed
3	Phrenaros	House-to-House Scheme	24200	Commenced in 1975 and work still goes on.
4	Ay. Napa	Supplementary water supply from new borehole	5000	Completed
5	Ormidhia	Supplementary water supply from new borehole	4000	Completed
6	Xylotymbou	Provisional supplementary water supply from Famagusta W.S. Main Conveyor pipe line	2000	This work was carried out upto the approval of the permanent scheme
7	Xylotymbou	Supplementary water supply from Famagusta W.S. Main conveyor pipeline	7000	Commencement: 1975 and work still goes on.
8	Maroni	Residing of pipeline within the village	400	Completed
9	Voroklini	Water supply from Famagusta W.S. main conveyor pipeline	2380	Completed
10	Livadhia	Water supply from Famagusta W.S. main conveyor pipeline	1400	Completed
Total			60480	

8.3.1.21 Refugee Camps

Ser. No.	Name of Camp	Scheme	Estimated cost £	Remarks
1	AMMO DEPOT Ormidhia	Water Supply from new borehole	3200	Completed
2	Alkha Forest	Distribution system within the camp from Famagusta W.S. Main Conveyor pipeline	1300	Completed
3	Aradhippou	Distribution and House-to-House Scheme from Larnaca Water Supply System	32000	Commenced in 1975 and work still goes on
Total			36500	

Besides the above minor repairs and maintenance on various village as well as refugee camps water supply systems were carried out.

8.3.1.22 Irrigation Systems

Ser. No.	Village	Scheme	Estimated cost £	Remarks
1	Kiti-Tersephanou	Kiti-Dam Distribution system	20000	Completed
2	Kalavassos	Syrmata-Kopetra Irr. Division	14000	Completed in 1975
3	Psematismenos	Repairs on Irrigation Association of Ratsou and Kannoura	1000	Completed
4	Ay, Theodoros	Construction of a small recharge project in Pendaskinos river	400	Completed
Total			35400	

8.3.1.23 Town Water Supplies

8.3.1.24 Famagusta Water Supply

8.3.1.25 Phrenaros Reservoir

During the year repairs were carried out on the Phrenaros reservoir. The walls and floor slab of the reservoir were covered with fibre glass canvas sheets and bitumen emulsions. The total cost of the work carried out was £5,500. The cost for the repairs were deposited by the Famagusta Water Board.

8.3.1.26 Larnaca Water Supply
Construction of new Tremithios Reservoir

The new Tremithios Reservoir is being constructed on behalf of the Water Board Larnaca.

It is located near the existing storage tanks of the Water Board near the sixth mile post of the Larnaca-Limassol road. The reservoir is partly under ground and it is constructed of reinforced concrete walls, with a partition wall and a flat slab. It has a storage capacity of 8000 m³ (live capacity 7200m³) and it is estimated to cost £180,000.

Work commenced with the open mass excavation on the 4th August 1975. During excavation it has been proved, that there was a fault along the foundations, so a redesign was necessary, and therefore a certain delay in the construction was observed.

Up to the end of the year the following works were carried out.

	Estimated Quantity	Work carried out
Open mass excavation	14500 m ³	15500 m ³
Limited Space Excavation	950 m ³	461 m ³
Filter materials	350 m ³	80 m ³
Reinforced concrete	2300 m ³	138 m ³
Site concrete	1420 m ³	216 m ³

Besides the above works, a certain length of drains were laid.

Staff

The following staff is engaged for the execution of the works:

1. Technical Assistant Monthly paid
2. Technical Assistants hourly paid
- 13 Skilled labourers
- 37 Unskilled labourers

The work is supervised by Mr. Andreas Tsiakouris monthly paid technical assistant.

Up to the end of the year the cost for the construction amounted to £30,526.

Meetings

During the year the District Engineer attended the following meetings as representative of the Director of the Department.

Larnaca Water Board	6
Famagusta Water Board	4
Kiti Dam	6
Famagusta Co-ordination Committee	2
Soil Consolidation	2
Boreholes Advisory Committee	14
Others (with Director, District Officer etc)	23
	<u>57</u>