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REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE & NATURAL RESOURCES

WATER DEVELOPMENT DEPARTMENT

ANNUAL REPORT 1988

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Director

Nicosia, July 1989

WATER DEVELOPMENT DEPARTMENT
ANNUAL REPORT 1988

Abbreviations

m	Metre
mm	Millimetre
MCM	Million cubic metres
m^3	Cubic metres
ha	Hectare
WDD	Water Development Dept.
£	Cyprus pound

Conversion factors

Donum	=	0.134	Hectares
	=	0.3306	Acres
	=	14,400	Sq. feet
	=	1,340	Sq. metres
hectare	=	7.4627	Donums
Acre	=	3.0248	Donums

In 1988 the value of the Cyprus £ on average (daily basis) was:-

$	2.0050
£ st	1.2320
DM	3.7940
Drachma	328.85

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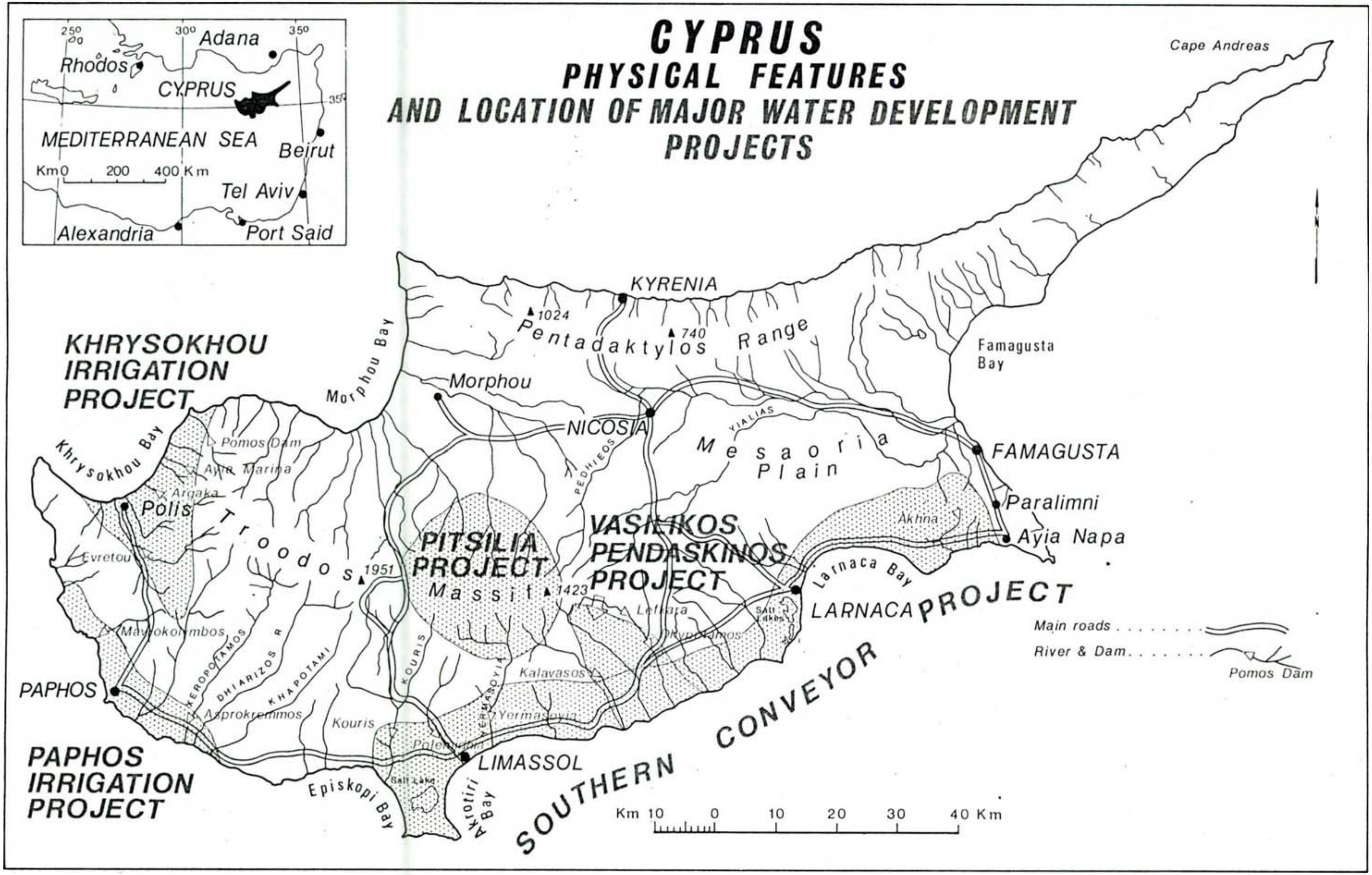
CYPRUS
PHYSICAL FEATURES
AND LOCATION OF MAJOR WATER DEVELOPMENT PROJECTS
Adana
Rhodos
CYPRUS
MEDITERRANEAN SEA
Beirut
Tel Aviv
Alexandria
Port Said
Km 0 200 400 Km
Cape Andreas
KYRENIA
Pentadaktylos Range
1024
740
Famagusta Bay
Morphou
Morphou Bay
NICOSIA
Mesaoria Plain
YIALIAS
PEDHIEOS
FAMAGUSTA
Paralimni
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Akhna
KHRYSOKHOU IRRIGATION PROJECT
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Mavrokolymbos
XEROPOTAMOS
DHIARIZOS R
KHAPOTAMI
KOURIS
YERMASOYIA
Kalavasos
Yermasoyia
PAPHOS
Asprokremmos
Kouris
Polemidhia
LIMASSOL
Salt Lake
Episkopi Bay
Akrotiri Bay
SOUTHERN CONVEYOR
Km 10 0 10 20 30 40 Km
PAPHOS IRRIGATION PROJECT

I GENERAL

Introduction

During 1988 the Water Development Department continued to concentrate its efforts on the realisation of the major water development projects the implementation of which is vital to growth in all sectors of development in Cyprus.

The Department's resources were utilised first and foremost for the execution of the various components of the Southern Conveyor Project (SCP) which is the largest single project ever undertaken by the Government of Cyprus. Construction work on SCP started in mid 1984 and by mid 1988 several of its components such as the Kouris and Akhna dams, the 110 km long pipeline connecting the two dams and approx. 50% of the Kokkinokhoria irrigation system were completed or put into operation signalling thus the start of the operation of the project.

Significant developments during 1988 were:-

- Above normal precipitation amounting to 122% of average rainfall, for the hydrological year 1987-1988.

- First impoundment of water in Kouris Dam. More than 67 MCM of water had flown into the dam reservoir during the hydrological year.

- Record water impoundment in dams amounting to 188 MCM up to the end of Sept. 1988 as compared to 118 MCM for the hydrological year 1986-87, 32 MCM for 1985-86, 43 MCM for 1984-85 and 35 MCM for 1983-84.

- Conveyance of water from Kouris Dam to Kokkinokhoria area for the first time and

- The first ever overspill of Asprokremmos dam since its construction in 1982 with a flow into its reservoir of 51 MCM which is equal to the total water capacity of the dam.

- A quantity of 136 MCM remained in the dam reservoirs at the end of the hydrological year 1987-88 for over-year storage, compared to 64 MCM for 1986-87, 20 MCM for 1985-86, 32 MCM for 1984-85 and 23 MCM for 1983-84. Thus the contingency of having over-year storage for years of low precipitation is served well.

During 1988 and for fifteen years running the only access with the northern part of Cyprus, occupied by Turkish troops since 1974, was through the good offices of the UN peace keeping force for the unified water supply of Nicosia.

BRIEF DESCRIPTION OF PROJECTS

Major Projects Under Full Operation and Maintenance

Paphos Irrigation Project

The Paphos Irrigation Project (PIP) is one of the largest and most important projects constructed by the Water Development Department for the irrigation of 5000 ha of net irrigable land in the south western coastal plain of Cyprus on both sides of the town of Paphos. The water requirements for the irrigation of this area are estimated at 36 MCM/year provided by the Xeropotamos River flow (22 MCM) regulated at Asprokremmos where an earth dam has been constructed, by the alluvial aquifers in the river beds of Dhiarizos, Xeropotamos (lower reach only) and Ezousas (10 MCM) and the coastal calcarenite aquifer (4 MCM).

Construction of the civil works of the Project commenced in 1976 and the target date for its full completion was the year 1981 while irrigation supplies from the boreholes in the river aquifers were available to the adjacent areas of the Project where distribution networks were completed as early as 1979. The PIP was fully completed in mid 1983 and the total cost of the Project up to the end of 1983 reached the amount of £24,450,000.

The main components of the project are a) Asprokremmos Dam with a 51 MCM capacity reservoir b) 24 boreholes c) the 12 km concrete lined trapezoidal canal, max. flow capacity 4.2 m3/s d) 14 pumping stations, e) 41 km long main conveyor pipelines and canaletti and f) 540 km long irrigation distribution networks for all sectors of eastern and western areas.

The Land Consolidation Authority has carried out land consolidation of an area of 2350 ha in 8 villages of the region and by mid 1982 approx. 100 km of farm roads were constructed by the same authority. In addition 26 km of farm access roads were built through other PIP contracts.

The Project beneficiaries are 3500 farm families (mostly small owners), 980 landless families (as seasonal labour) and 320 landless families leasing government land.

The permanent plantations which are planned to be developed in the project are citrus (47%), avocado (7%), table grapes (8%) bananas (5%) and deciduous fruit trees (5%). The seasonal crops will be vegetables (21%) and summer garden produce (7%).

The Project was financed by the Government of Cyprus and the World Bank which has financed 77% of the foreign exchange component of the project i.e. $14 million US dollars, based on the 1973 estimate which was US$18.2 million.

An organisation has been set up at the Paphos Regional Office of the Department which is dealing with the operation & maintenance of the project under the Operation and Maintenance Division (Irrigation) of Nicosia HQs of the WDD.

Pitsilia Integrated Rural Development Project

Pitsilia Integrated Rural Development Project (PIRDP) is a multipurpose project the main component of which is water development but which includes roads, education, health, agricultural extension services and research, loan facilities for agriculture etc.

The main objective of the PIRDP, is the stimulation of the economically depressed, mountainous region of Pitsilia thus raising the standard of living of the 21,000 inhabitants of some 50 villages of the region and checking the population drain to the towns.

The total cost of the PIRDP has exceeded £10 million of which $10 million represents a loan from the World Bank.

Construction of the water development works started in 1978 and was completed early in 1984 at a total cost of about £7 million.

The water development component of the project consists of:

- One earth-rockfill dam at Xyliatos of 1.25 MCM water capacity for the irrigation of an area of 308 ha of land.

- One small concrete gravity arch dam at Ayii Vavatsinias of 0.054 MCM capacity belonging to Ayii Vavatsinias irrigation scheme.

- 19 PVC lined off-stream earth ponds of a combined capacity of approx. 2 MCM for the irrigation of 495 ha of land.

- 20 borehole irrigation schemes for the irrigation of an area of 479 ha.

- Rehabilitation of numerous small irrigation schemes involving an area of approx. 250 ha.

- Domestic water supplies for various villages of the region.

The ponds are fed with water from diversion weirs which have been constructed on nearby streams through diversion pipelines laid for this purpose. The ponds are filled during the winter and early spring months so that the water can be used during the dry summer months.

The main crops irrigated are vegetables, deciduous fruit trees, citrus and olives. Land consolidation has been applied in some of the areas of the project and irrigation distribution networks have been constructed with farm hydrants reaching all farm holdings.

The Pitsilia Integrated Rural Development Project is unique in as much as it is made up of numerous small independent self contained schemes scattered all over the region.

The operation and maintenance of this project is undertaken directly by the Operation and Maintenance Division - Irrigation of the WDD operating from HQs.

Vasilikos-Pendaskinos Project

The Vasilikos-Pendaskinos Project (VPP) is located in the southern part of Cyprus between Vasilikos and Pendaskinos rivers approx. 50 km south of Nicosia and some 40 km east of Limassol. The basic objective of the Vasilikos-Pendaskinos Project is the development of the surface water resources of the region and their use for the agricultural development of the area as well as for the augmentation of the domestic water supply of other areas, particularly for Nicosia, Larnaca and Famagusta.

Construction of the VPP started at the end of 1982 and was completed in 1986 except for the irrigation distribution network for part of the Vasilikos area which was delayed due to land consolidation procedures. Kalavasos area irrigation network will be completed in 1989.

The main components of the project are:

- Kalavasos Dam on Vasilikos river, having a capacity of 17 million cubic meters (MCM) of water,

- Dhypotamos Dam on Pendaskinos river, having a capacity of 15 MCM,

- A diversion system to convey the excess flows of Maroni river- around 2 MCM per year-to the Dhypotamos Dam reservoir,

- A conveyance and distribution system for irrigation from Kalavasos Dam comprising, main conveyor, break pressure tank, and pipeline networks for the Vasilikos and Maroni irrigation areas,

- A conveyance and distribution system for irrigation from Dhypotamos Dam comprising main conveyor, break pressure tank and pipeline networks for the Pendaskinos irrigation area,

- A conveyance system comprising main conveyor (common with that from Kalavasos Dam up to the break pressure tank), pumping station at Tokhni and balancing reservoir at Khirokitia to convey water from Kalavasos Dam to the Khirokitia Water Treatment Plant,

- A water treatment plant, reservoirs and pumping station at Kornos for the Water Supply of Nicosia and

- A conveyor from Skarinou to Lakatamia reservoir Nicosia which was completed in January 1982. This work which is known as Nicosia Water Supply Scheme Phase I, includes also the Dhypotamos Pumping Station, the Stavrovouni Balancing Reservoir and a Break Pressure Tank at Nisou.

Approximately half the quantity of water cropped by the VPP is allocated each year for irrigation, mainly of citrus and vegetables. The remaining quantity is allocated for the augmentation of the domestic water supply of Nicosia, Larnaca and Famagusta, several villages, refugee estates and tourist installations.

The agricultural development of the project is mainly in 3 areas.

- The Vasilikos area of land belonging to Kalavasos, Mari, Zyyi, Tokhni and Psematismenos,

- The Pendaskinos area of land belonging to Ayios Theodhoros and Skarinou and

- The Maroni area of land belonging to the homonymous village.

Land consolidation has been carried out in three areas of the project namely Maroni, Kalavasos-Tokhni and Zyyi-Psematismenos-Maroni.

The Agricultural Research Institute has set up an Agricultural Research Station in the project area to carry out research on varieties of plants to be cultivated and experiments on cultivation and irrigation methods.

The land consolidation scheme includes the construction of farm roads. Agricultural Extension Services of the Department of Agriculture are based at the VPP operation control centre at Khirokitia Treatment Works.

In order to cover part of the foreign exchange component of the cost of the project, Government has secured three loans. One from the World Bank for an amount of $11 million, a second one for KD 2.5 million from the Kuwait Fund for Arab Economic Development and the third from the European Investment Bank for 8.3 million ECU's. The three loans are used for a parallel financing of the project, that is financing of separate components of the project and are worth in total about £14.2 million.

The foreign exchange component of the cost of Phase I was financed by a DM10 million loan (=approx. £1.9 million) secured in 1981 from Kreditanstalt Fur Wiederaufbau of West Germany who have also financed the construction of Lefkara Dam in the early 1970's. The overall project cost, including Phase I is about £27 million.

The VPP has already been connected to the SCP main conveyor through a pipeline and balancing reservoir at Vasilikos (near Kalavasos) to augment the irrigation requirements of VPP. At the end of 1988 a connection was also effected to augment VPP requirements for domestic water supply.

The operation and maintenance of VPP comes also under direct control of the O & M Division from HQs but making use of the VPP control centre at Khirokitia Treatment Works.

Khrysokhou Irrigation Project (See also Chapter VIII(2)

The Khrysokhou Irrigation Project (KIP) for the development of the water resources of the north western part of Cyprus was substantially completed by the end of 1988 for the irrigation of an area of 3000 ha.

The first phase involved the construction of Evretou Dam of 25 MCM capacity on the Stavros tis Psokas river, near Evretou village, and the irrigation of 2000 ha (net) of land in the Khrysokhou valley (mainly from the dam to the coast), including an area of 150 ha in the Sarama valley. Irrigation is done by gravity except for Sarama valley where water will be pumped. A main conveyor of maximum diameter 900 mm feeds 4 overnight storage ponds through a break pressure tank. From there water is fed to the farm hydrants via asbestos cement pipes and then to the fields via plastic pipes. Each field has its own outlet and water meter, with 2 to 3 atmospheres available pressure.

Construction of Evretou Dam which cost approx. £9 million started in January 1984. It was completed in December 1986 with first water impoundment during the wet season 1987. By the end of March 1987 a quantity of some 10 MCM of water was impounded in the dam mainly due to the extraordinary rainfall of March 1987 which was 300% of the normal March rainfall. The dam is of earth-rockfill type with clay core.

In some areas the network was ready for the irrigation season of 1987 thus taking advantage of the first impoundment of water in the dam.

Land consolidation was applied on about 250 ha of the area as the rest has a high percentage of Turkish Cypriot property and was therefore excluded from land consolidation.

In addition to the irrigation network, farm roads were constructed to serve almost all the fields.

The overall cost of the first phase is about £20 million including the cost of on-farm systems and a groundwater scheme that will extract water from the Khrysokhou river aquifer. The World Bank has financed the 1st phase with a loan of $16 million.

The second phase includes the extension of the irrigated area from Limni mines to Pomos, adding another 1000 ha net. This is achieved by extending the conveyor, and connecting it to the three existing dams of the area (Argaka, Ayia Marina, Pomos), and by diverting winter flows of three rivers (Magounda, Yialia and Livadhi) into Evretou Dam.

The overall project cost is about £24 million at current prices and is expected to provide work for 3000 people and increase the farm income of the area by 8 times. Crops to be cultivated include

citrus and avocado, early and late vegetables, nuts, olives, and early table grapes. The area is most suited for early crops due to its mild climate and most produce will be export orientated.

MAJOR PROJECTS UNDER CONSTRUCTION

Southern Conveyor Project (See also Chapters VIII(3) & (4)

The basic objective of the Southern Conveyor Project (SCP) is to collect and store surplus water and convey it by means of a regional water carrier for use in areas where the water is most needed.

The SCP will promote irrigated farming development in the south coastal region between Limassol and Famagusta that would benefit most from the Project and in addition it will meet the future domestic and industrial water demands up to the year 2010 for the towns of Limassol, Larnaca, Famagusta and Nicosia and numerous village communities, as well as for the needs of the tourist industry.

The Project is divided in two phases:

The main components of the Phase 1 of the Project are:

- Kouris Dam: This 115 MCM capacity dam is the main water storage component of the SCP and is designed to provide seasonal and interannual storage of the flows of Kouris River and its tributaries. Such storage, by balancing the variable inflows will permit a steady and reliable supply to the project benefit areas via the Main Conveyor. The Kouris Dam, of zoned earthfill embankment construction is around 113 m high. The 5 km long reservoir has a surface area of 360 ha. Construction work on Kouris Dam started in mid 1984 and was completed in the latter part of 1988.

- Main Conveyor: This 110 km long gravity pipeline of diameters ranging from 1400 mm down to 800 mm conveys the stored water upto Akhna reservoir.

- Akhna Reservoir: A 16 m high earthfill embankment dam it will retain upto 5.8 MCM of water conveyed from Kouris Dam enabling the reservoir to provide balancing storage in the Kokkinokhoria area. Water will be pumped to the nearby irrigation areas at times of peak irrigation demand to supplement flows in the main conveyor and thus reduce the size of pipeline otherwise required. Construction of Akhna Dam started in 1986 and was completed by the end of 1987.

- Kokkinokhoria Distribution Network covers an area of some 9000 ha and consists of four balancing reservoirs, fifteen reservoirs of the central distribution points and 19 pumping stations. Construction of these works started in March-April 1987 under 3 contracts. The irrigation distribution network of Kokkinokhoria consisting of main conveyors and distribution pipelines have been undertaken by the Construction Division of the Department under force account and construction work started in June 1986.

The cost of Phase 1 of the Project is estimated to reach the amount of £100 million.

Phase 2 includes the diversion of water from Dhiarizos river to Kouris Dam reservoir, two water treatment plants (one for Limassol and one at Tersephanou for Nicosia and Larnaca WS) and irrigation distribution networks for Akrotiri, Kiti, Mazotos and Parekklisha covering a total area of 4335 ha.

DEPARTMENTAL ORGANIZATION

The Water Development Department

The Department of Water Development, Ministry of Agriculture and Natural Resources, is responsible for the Government's overall policy on water resources, planning, design and construction on the Island. It also cooperates in the management of water resources and water development projects together with other departments and ministries.

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. As from 1982 the Department undertakes also the design and construction of sewerage and sewage disposal works.

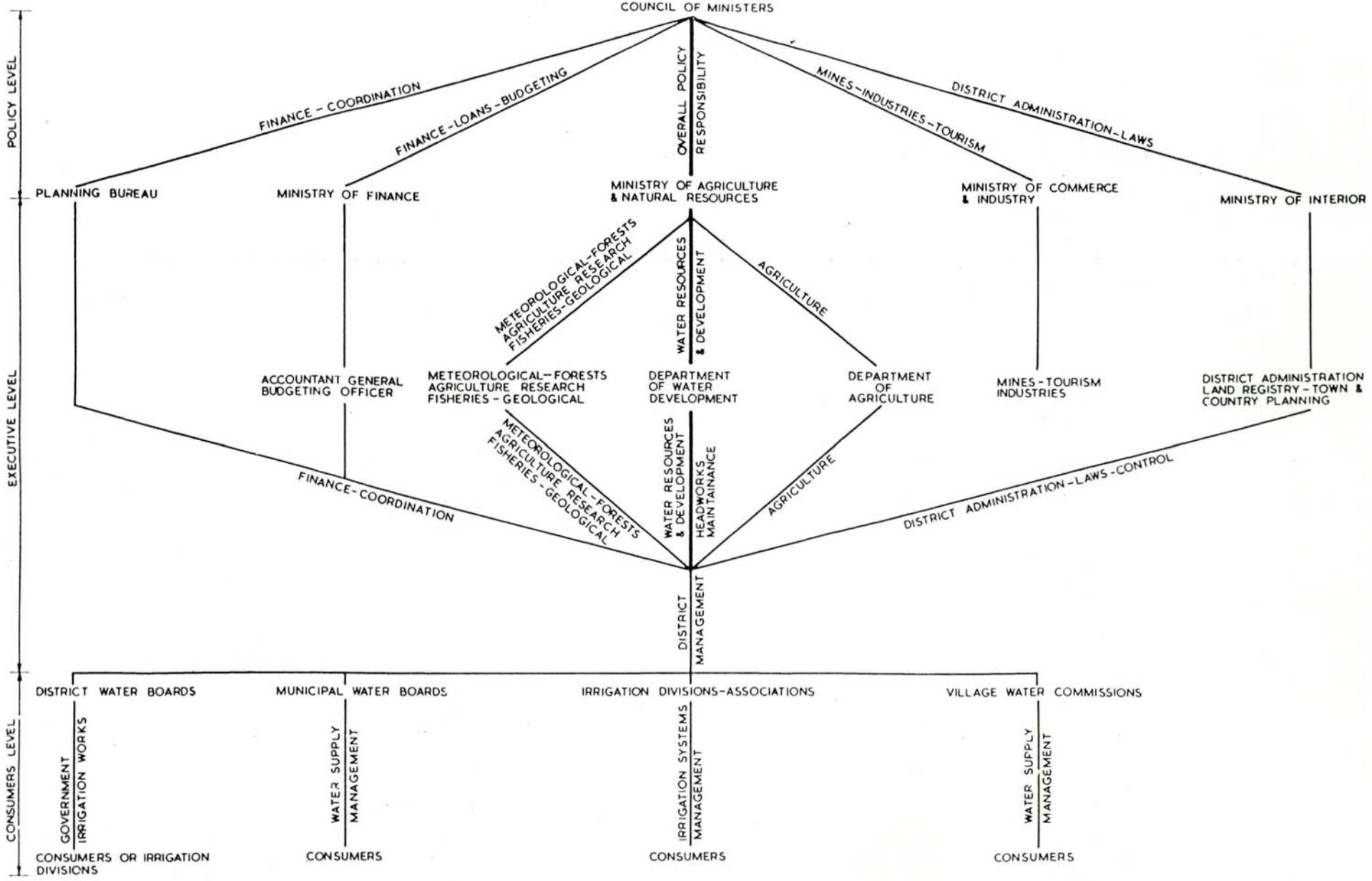
The Government institutional set up for water resources conservation and development and the role of the Department of Water Development is shown on page I-9. The Departmental Organization is shown on page I-10 and is made up of:

The Division of Water Resources which groups together all services required for the collection and interpretation of hydrological and hydrogeological data both for ground and surface water and control of groundwater extraction.

The Division of Hydrology which is responsible for the evaluation of the surface and groundwater resources and their present and future management.

The Division of Planning which deals with the preparation of reconnaissance and feasibility studies prior to the detailed design of major projects. The works for planning include field investigations for hydraulic structures, laboratory testing for these structures, water use studies, hydrological evaluations, evaluation of benefits, technoeconomic studies as well as engineering geology problems. Systems analysis and mathematical modelling techniques with the help of electronic computer are widely used in these studies.

The Division of Rural Projects Planning which deals with the planning and designing of rural irrigation and domestic water supply projects and sewage disposal schemes which are of a rather routine nature and do not need elaborate planning and design procedure.



WATER RESOURCES CONSERVATION & DEVELOPMENT
GOVERNMENT INSTITUTIONAL SET UP

Dec. No. PM/C/51

WATER DEVELOPMENT DEPARTMENT
ORGANIZATION CHART 31.12.1988

C ST LYTRAS
Director

K C Hassabis AD

Dr C Christodoulou PWE

DIVISION OF WATER RESOURCES (28)
D Kypris SH Head
M Peppis G-I

- HYDROMETRY AND DATA BRANCH
  - Dr S Papatryphonos H-I
- SURFACE WATER HYDROMETRY AND MAINTENANCE SECTION
  - P Neophytou STS
- GROUND WATER HYDROMETRY SECTION
  - M Antoniades TS
  - A Nicolaides ST
- DATA BANK AND REPORTING SECTION
  - Dr S Papatryphonos H-I
  - P Neophytou STS
- GROUND WATER CONTROL BRANCH
  - M Peppis G-I
- GROUND WATER CONTROL SECTION
  - M Antoniades TS
  - A Nicolaides ST
- DRILLING CONTROL SECTION
  - M Antoniades TS
  - A Aniftos ST
- COMPUTER WORK HYDROMETRIC DATA PROCESSING
  - D Kypris SH
  - I Koulas T-I
- COMPUTER WORK HYDROLOGICAL STUDIES
  - Dr A Christodoulides H-I

DIVISION OF HYDROLOGY (14)
I Iacovides SH Head
A Georghiou G-I

- ENGINEERING HYDROLOGY BRANCH (3)
  - P Skordis EE-I
  - P Alexandrou TS
- WATER RESOURCES MANAGEMENT AND APPLICATIONS BRANCH (4)
  - A Georghiou G-I
  - G Pasiardis ST
- GROUND WATER HYDROLOGY BRANCH (3)
  - Dr A Christodoulides H-I
  - S Katsianis ST
- SURFACE HYDROLOGY BRANCH (3)
  - M Panaretou H-II
  - P Alexandrou TS

DIVISION OF PLANNING (47)
Chr Marcoullis* SWE Head
Ch Kridiotis* EE-I

- RECONNAISSANCE AND FEASIBILITY REPORTING (9)
  - Chr Markoullis SWE
  - Dr G Socratous EE-I
  - Chr Ioannou H-I
- FEASIBILITY STUDIES SECTION
  - D Nicolaides EE-I
  - M Ioannou EE-I
  - P Marattheftou* EE-I
- IRRIGATION NETWORKS SECTION
  - N Michael⊙ TIE-I
- COMPUTER WORK PROJECT APPRAISAL PLANNING DESIGN
  - Dr G Socratous EE-I
  - A HjiPanteli T-II
- KARYOTIS PROJECT
  - Chr Markoullis SWE
- INVESTIGATIONS BRANCH AND LABORATORY (23)
  - Chr Kridiotis EE-I
  - G Loucaides EE-I
- SITE INVESTIGATIONS AND FOUNDATION TREATMENT
  - G Dicomitis ST
- SOILS CONCRETE AND MATERIALS LABORATORY
  - Dr K Kyrou EE-I
  - P Makkoulas ST
- COMPUTER WORKS DAM MONITORING AND SOIL MECHANICS
  - Dr K Kyrou EE-I
  - M Avgousti T-II
- TOPOGRAPHY BRANCH (15)
  - A Evripidhou STS

DIVISION OF DESIGN (26)
N P Stylianou* SWE Head
C Katsavras EE-I

- DAMS AND PONDS BRANCH
  - C Katsavras EE-I
  - E Shiakalli EE-I
- WATER CONVEYANCE AND DISTRIBUTION NETWORKS BRANCH
  - Dr Fr Louca⊙ EE-I
  - N Chrysostomou⊙ EE-I
- DRAWING AND RECORDS BRANCH (19)
  - S C Pitsillides* STS
  - S Selipa ST
  - E HjiKyriakou ST
- CONCRETE STRUCTURES AND WATER SUPPLY BRANCH
  - Sp Stephanou EE-I
  - A Nicolaou⊙ EE-II
- CONTRACT DOCUMENTS BRANCH
  - N P Stylianou SWE
  - C Katsavras EE-I
  - Sp Stephanou EE-I
- SOUTHERN CONVEYOR PROJECT - PHASE II
  - C Katsavras EE-I
  - Pavlos Neophytides EE-I

DIVISION OF RURAL PROJECTS PLANNING (11)
C Andreou SWE Head
E Kambourides* EE-I

- RURAL WATER SUPPLY AND IRRIGATION BRANCHES
  - M Michaelidou EE-I
- NICOSIA SECTION
  - S Giragosian STS
  - Chr Kyriacou ST
- F'STA-L'CA REGIONAL OFFICE CO-ORDINATION
  - P Photiou ST
- L'SSOL-PAPHOS REGIONAL OFFICES CO-ORDINATION
  - P HjiPakkos TS
  - T Tsangarides* ST
- SEWAGE BRANCH
  - M Michaelidou EE-I
  - Chr Kambanellas⊙ EE-II
- COMPUTER WORK VWS AND IRR RECORDS AND DATA PROCESSING
  - Chr HjiYiangou T-II

DIVISION OF CONSTRUCTION (20)
A Georghiades* SWE Head
Vl Partasides* EE-I

- PLANNING BRANCH
  - A Georghiades SWE
  - G Petrocostas EE-I
  - S Georghiou TS
- CONSTRUCTION CONTROL MAJOR PROJECTS
  - Vl Partasides* EE-I
  - A Tziakouris* EE-I
  - S Aletras* EE-I
  - Ph Hjioannou* TS
  - E Eliades* TS
  - A Eleftheriou* ST
  - A Marangos* ST
  - A Kourtellas* ST
  - S Nicolaou* ST
  - Chr Theodhorou* T-I
- CONSTRUCTION CONTROL ROUTINE WORKS
  - G Petrocostas EE-I
  - C Georghiou STS
  - V Ioannou TS
- NICOSIA DISTRICT
  - D Pitsillides TS
- REGIONAL OFFICES CO-ORDINATION
  - V Ioannou TS
- COMPUTER WORK CONSTRUCTION PROGRAMS COST ANALYSES
  - G Petrocostas EE-I
  - S Georghiou TS
- TENDERS, LABOUR, SAFETY (2)
  - A Georghiades SWE
  - C Georghiou STS
  - A K Savva* TS

DIVISION OF OPERATION & MAINTENANCE (DWS) (15)
C C Artemis SWE Head

- NICOSIA WATER SUPPLY
  - P Kazamias STS
  - M Michaelides ST
- CENTRAL W.S. SYSTEM
  - Ph Stavrou ST
- WATER TREATMENT PLANTS
  - K Savvides Ch I
  - K Ioannou Ch-II
- GOVERNMENT RESIDENCES AND INSTITUTIONS W.S.
  - S HjiPavlou TS
- RECORDS
  - C HjiLoizou ST
- COMPUTER WORK DOMESTIC WATER RECORDS AND DATA PROCESSING
  - C C Artemis SWE
  - M HjiCosti T-II

DIVISION OF OPERATION & MAINTENANCE (IRR) (18)
N Tsiourtis SWE Head

- WORKS MONITORING
  - Ph Photiou TIE-I
  - I Nicolaou EE-II
- OPERATION & MAINTENANCE
  - Minor Proj. A Josephin STS
  - S.C.P. I Kastanas TS
  - Pitsilia A Pengeros ST
  - V.P.P. G Lanitis TS
- PLANNING-DESIGN OF IMPROVEMENT WORK
  - Petr. Neophytides TIE
  - A Pengeros ST
- COMPUTER WORK IRRIGATION MANAGEMENT AND DATA
  - I Nicolaou EE-I
  - Ph Rousis T-II

PAPHOS IRR. PROJECT OPERATION & MAINTEN. (13)
V Socratous EE-I Head

- MAINTENANCE SECTION
  - C HjiSavva* ME-I
  - Technician I 2
  - Chief Foreman 1
- OPERATION SECTION
  - Technician I 1
  - Technician II 5
- OFFICE & PERSONNEL SERVICES
  - G Demetriades Cl O
- ACCOUNTS SECTION
  - E Christodoulou AO

Note Administratively under Paphos Regional Office

MAJOR PROJECTS IMPLEMENTATION (20)

SOUTHERN CONVEYOR PROJECT 1st PHASE
Dr C Christodoulou PWE, PM

- KOURIS DAM (16)
- CONSULTANT'S RESIDENT ENGINEER
  - A H Collings
- SUPPORTING STAFF (16)
  - P Eliades EE-I
  - St Aletras EE-I
  - M Televantos EE-I
  - P Marattheftou EE-I
  - Ph Hjioannou TS
  - 11 No Technicians etc (See Note 1)

SOUTHERN CONVEYOR PROJECT 2nd PHASE
- CONSULTANTS ENERGOPROJEKT
- SUPPORT CO-ORDINATORS
  - N Stylianou SWE
  - E Kambourides EE-I

SOUTHERN CONVEYOR PROJECT (1st + 2nd PHASE) Dy PROJECT MANAGERS (2)
D Patsalides EE-I (Eng.)
A Ioannou (Agr.)

VASILIKOS PENDASKINOS PROJECT
K C Hassabis AD

- MAIN CONVEYOR AND KOKKINOKHORIA DISTRIBUTION NETWORK (81)
  - K C Hassabis AD PM
- CONSULTANT'S CHIEF RESIDENT ENGINEER
  - M West
- CONSULTANT'S RE MAIN CONVEYOR
  - St Hodgkins
- SUPPORTING STAFF (19)
  - A Tziakouris EE-I (Senior Constr. Eng.)
  - I Eracleous EE-I
  - S Kountouris EE-I
  - Z HjiVasiliou EE-I
  - S Nicolaou ST
  - A Kourtellas ST
  - I Mouskoundis ST
  - 12 No Technicians etc (See Note 2)
- CONSULTANT'S RE KOKKINOKHORIA CONTRACTS
  - T E H Sabben-Clare
- SUPPORTING STAFF (54)
  - Vl Partasides EE-I (Senior Constr. Eng.)
  - S Aletraris TIE-I
  - A Demetriou EE-I
  - A Shamma EE-I
  - E Eliades TS
  - A Marangos ST
  - A Eleftheriou ST
  - T Tsangarides ST
  - P Antoniades ST
  - E Phinikarides ST
  - 5 No new EE's
  - 39 No Technicians etc (See Note 3)
- OPERATION AND MAINTENANCE
  - DOMESTIC WATER
    - C C Artemis SWE
  - IRRIGATION
    - N Tsiourtis SWE

KHRYSOKHOU IRRIGATION PROJECT
Dr C Christodoulou PWE,

- K Spanos EE-I PM
- P Michaelides (Agr Dept)
- G Orountiotis Dy PM(Agr)
- CONSULTANT'S RE EVRETOU DAM
  - J W Reeves☆
- SUPPORTING STAFF
  - S Paschalides EE-I
  - D Antoniou EE-I
  - 4 No Technicians
- ENGINEERING ADVISOR
  - A Georghiades SWE
- MAIN CONVEYORS AND DISTR. NETWORKS CONSTRUCTION RESIDENT ENGINEER
  - N Nicodemou EE-I
- SUPPORTING STAFF
  - G Chrysostomou EE-I
  - 6 No Technicians
- OPERATION AND MAINTENANCE
  - N Nicodemou EE-I
  - 4 No Technicians etc

☆Up to October 1988

MECHANICAL & ELECTRICAL SERVICES (17)
- S Theodosiou ME-I
- L Savva TS
- G Stavrakis ST
- C Stavrou ST

COMPUTER SYSTEMS
- Dr G Socratous EE-I
- A HjiPanteli T-II

DESIGN TEAMS (8)
- K C Hassabis A.D.
- Chr Marcoullis SWE
- N Stylianou SWE

KIA CONTRACTS
- Dr Fr Louca EE-I
- N Chrysostomou EE-I
- A Nicolaou EE-II
- Chr Kambanellas EE-II

KIA PIPELINE NETWORKS
- N Michael TIE-I
- 2 No new TIE's

REGIONAL OFFICES

REGIONAL OFFICE LARNACA (15)
T Hamatsos* EE-I
- WATER RESOURCES SECTION
  - G Pittas ST
- INVESTIGATIONS AND DESIGN SECTION
  - A Theodosiou T-II
- CONSTRUCTION SECTION
  - G Frangopoullos TS
- OPERATION-MAINTENANCE SECTION
  - G Zachariou T-I

REGIONAL OFFICE LIMASSOL (42)
N Neocleous* EE-I
- WATER RESOURCES SECTION
  - N Mavrommatis ST
- INVESTIGATIONS AND DESIGN SECTION
  - A Klitou ST
- CONSTRUCTION SECTION
  - A Makis* ST
- OPERATION-MAINTENANCE SECTION
  - Chr Georghiades ST

REGIONAL OFFICE PAPHOS (34)
A Lambrou EE-I
- WATER RESOURCES SECTION
  - L Loizou ST
- INVESTIGATIONS AND DESIGN SECTION
  - G Andreou ST
- CONSTRUCTION SECTION
  - S Constantinides ST
- OPERATION-MAINTENANCE SECTION
  - G Saparillas ST

OFFICE MANAGEMENT

ADMINISTRATION
- V Mavrakis Adm O-I
- J Nakouzi S Cl O

- OFFICE SERVICES BRANCH
  - G Demosthenous S Cl O
- FILING AND COMMUNICATIONS
  - A Kaspari Cl-I
  - G Laoutaris Cl-I
- LABOUR AND EMPLOYMENT SECTION
  - I Efstathiou Cl-I

FINANCIAL CONTROL & CO-ORDINATION BRANCH
- C Gavrielides SSA
- E Stavrinides SSA

- ACCOUNTS BRANCH
  - C Gavrielides SSA
- ACCOUNTS SECTION
  - C Savva SA
  - D Mitsineos AO-I
  - G HjiStillis AO-II
- STORES SECTION
  - A Nicolaou S-II

Abbreviations

DWS	Domestic Water Supplies
IRR	Irrigation
KIA	Kokkinokhoria Irrigation Area
AD	Assistant Director
PWE	Principal Water Engineer
SWE	Senior Water Engineer
PM	Project Manager
SH	Senior Hydrogeologist
EE-I	Executive Engineer I
EE-II	Executive Engineer II
ME-I	Mechanical Engineer I
G	Geologist
H	Hydrologist
TIE-I	Topographer Irrigation Engineer I
TIE-II	Topographer Irrigation Engineer II
Ch-I	Chemist I
STS	Senior Technical Superintendent
TS	Technical Superintendent
ST	Senior Technician
T-I	Technician I
T-II	Technician II
CF	Chief Foreman
SSA	Senior Supervisor of Accounts
SA	Supervisor of Accounts
Adm O-I	Administrative Officer I
AO-I	Accounting Officer I
AO-II	Accounting Officer II
S Cl O	Senior Clerical Officer
Cl-I	Clerk I
Cl-II	Clerk II
S-II	Storeman II

Notes on Technicians etc for Major Projects

1. SCP Kouris sites
   - 8 No Technicians II
   - 3 No Foremen CF, ACF and F
   - 11 No Total
2. SCP main conveyor sites
   - 9 No Technicians I and II
   - 3 No Foremen CF, ACF and F
   - 12 No Total
3. SCP Kokkinokhoria sites
   - 34 No Technicians I and II
   - 5 No Foremen CF, ACF and F
   - 39 No Total
4. Khrysokhou Project sites
   - 14 No Technicians I and II
   - 1 No Foreman
   - 15 Total

⊙ Working fulltime on major projects implementation
* Involved also in major projects implementation
• On construction site for major projects implementation

Note: Numbers in circles denote total number of staff in Division and numbers opposite Branches denote number of staff in Branches

For W.D.D. Technical Staff List as on 31.12.1988 see Org. No. BM/G/518

Org. No BM/G/519

TECHNICAL STAFF OF WDD ON 31.12.1988

DRG No BM/G/230

1	TECHNICAL STAFF		D	AD	PWE	SWE	SH	EE	TIE	SE	ME	Geo	H	Ch	STS	TS	ST	T	CF	ACF	F		TOTAL
i	Permanent Ordinary Staff		1	1	1	10	2	42	4	2	2	2	4	2	7	14	39	194	7	20	57		411
ii	Casual Staff							5	2									48					55
	TOTAL NUMBERS		1	1	1	10	2	47	6	2	2	2	4	2	7	14	39	242	7	20	57		466
	DISTRIBUTION OF STAFF																						
2	DIRECTORATE		1	1	1																		3
3	SERVICES	i Water Resources Management					1					1	1		1	1	5	17			1		28
		ii Hydrology					1	1				1	2			1	2	6					14
		iii Planning				1		6	1				1		1		3	30		1	3		47
		iv Rural Projects Planning				1		2							1	1	2	4					11
		v Design				1		4							1		3	17					26
		vi Construction				1		1							1	4		4	2	4	3		20
		vii Operation & Maintenance - DWS				1								2	1	1	3	5	1	1			15
		viii Operation & Maintenance - Irrig.				1		1	2						1	2	1	10					18
		i Mechanical and Electrical Services									1					1	2	8	1	2	2		17
4	REGIONAL OFFICES	ii Regional Office, Famagusta-Larnaca						1								1	1	10			2		15
		iii Regional Office, Limassol						1									5	22	1	3	10		42
		iv Regional Office, Paphos						1									4	24		1	4		34
5	MAJOR PROJECTS	i Paphos Irrigation Project (PIP) O&M stage						1			1							7		1	3		13
		ii Pitsilia and Vasilikos-Pendaskinos Projects	O&M carried out from HQs																				
		iii Southern Conveyor Project (SCP)						21	3							2	8	52	1	5	5		97
		iv Khrysokhou Irrigation Project (KIP)						5										14			1		20
Note: four Executive Engineers, one Technical Superintendent and eight Technicians are transferred to Limassol Regional Office but posted at SCP sites and are listed under SCP on this table																							
6	Various Postings							1*										1*/3•					5
7	Vacancies					4*		1		2								8	1	2	23		41
	TOTAL NUMBERS		1	1	1	10	2	47	6	2	2	2	4	2	7	14	39	242	7	20	57		466

REFERENCE

D Director
AD Assistant Director
PWE Principal Water Engineer
SWE Senior Water Engineer
SH Senior Hydrogeologist
EE Executive Engineer
TIE Topographer Irrigation Eng.
SE Sanitary Engineer
ME Mechanical Engineer
Geo Geologist
H Hydrologist
CH Chemist
STS Senior Tech. Superintendent
TS Technical Superintendent
ST Senior Technician
T Technician
CF Chief Foreman
ACF Assistant Chief Foreman
F Foreman
O&M Operation & Maintenance

* Missing since 1974 invasion
• Against abolition of 4 EE posts
▪ On scholarship or study leave

The Division of Design which deals with the preparation of detailed designs and contract documents and specifications required for major projects after feasibility stage.

The Division of Construction which is responsible for all construction work whether carried out by direct labour or by contract.

The Division of Operation and Maintenance (Town Water Supplies) which controls the administration, operation and maintenance of Government town water supply schemes and rural regional water supply schemes.

The Division of Operation and Maintenance (Irrigation) which deals with the management, operation and maintenance of Government irrigation works.

The Mechanical and Electrical Services Division which is responsible for all the mechanical and electrical activities of the Department including the electromechanical workshop.

Regional Offices after the 1974 Turkish invasion are confined to Larnaca-Famagusta, Limassol and Paphos.

In these Regional Offices the main works carried out are:

Hydrological measurements, collection of engineering data, operation and maintenance of projects, investigations and planning for small projects and control of construction work. In recent years the three Regional Offices of the Department were involved also with major projects in their Regions, in studies, investigations and force account construction work.

The Accounts Branch which is responsible for all accounting work, financial control and coordination and stores.

The Registry which is responsible for the office services, staff and labour matters.

CONSULTANTS EMPLOYED BY THE DEPARTMENT

The following consulting firms were employed by the Department for the design and supervision of various components of projects.

SOGREAH in association with Hydroconsult, Nicosia for the design and supervision of construction of Kouris Dam, Southern Conveyor Project,

Sir William Halcrow and Partners, Swindon, England in association with Balfours, London, for the design, contract documents and supervision of construction of the Southern Conveyor Project together with the SCP team of WDD staff,

Rofe Kennard and Lapworth in association with the Southern Water Authority for the institutional study for the establishment of an entity for the development, management and allocation of water resources in Cyprus.

Rofe, Kennard and Lapworth for the final design and construction drawings for Xylourikos dam on Limnatis River.

Soviet organisation "Shelkozpromexport" for the preparation of the feasibility study on utilization of the Karyotis river runoff to supply potable water to Nicosia.

Energoprojekt, a firm of consulting engineers from Yugoslavia for the preparation of the detail designs and contract documents for all engineering components of the 2nd phase of the Southern Conveyor Project.

Howard Humphreys & Sons of UK in association with I A Theophilou, Nicosia for the detail design, contract documents and supervision of construction of Vizakia dam.

SUMMARY OF ACTIVITIES
Water Resources

The collection and evaluation of hydrological data continued through 1988 covering also the requirements of the major projects.

The general conclusion obtained from the study of 61 river flow gauging stations is that the flow in most of them was above normal because of the high precipitation during the winter months. As a result of the high precipitation during the hydrometeorological year under review, a substantial improvement was noted on the ground water level of most aquifers. The situation however, in some places i.e. Kokkinokhoria remained critical.

The hydrometeorological situation given here refers to the southern part of the Island, as the northern part is still under the occupation of Turkish troops and no such data are available to us.

The precipitation during the hydrometeorological year 1987-88 averaged 625.4 mm which is 122% of normal. The total precipitation amounts during the period under review were above normal in most areas and ranged between 100% and 150% of normal while in Kokkinokhoria area ranged between 150% and 200% of normal.

The maximum amount of rainfall in a 24 hour period was 290 mm, recorded on 15th February at Dherinia rainfall station.

The first snowfall occurred on Mount Olympus, the highest peak of Troodos mountain range, on the 6th November 1987 and the last snowfall on the 20th April, 1988.

The air temperature as a whole was about normal. The extreme maximum temperature was 41.3oC reported by Nicosia town Climatological Station on the 17th July 1987 and the extreme minimum temperature was -6oC reported at Amiandos on the 16th January 1988.

The maximum annual evaporation measured from a U.S.W.B. pan was 2163 mm reported by Larnaca Airport Synoptic Station and minimum annual evaporation was 1328 mm at Prodhromos.

Hydrology

The Division of Hydrology and Water Resources Management which was established in 1982, continued in 1988 the formulation of methodology and processing of hydrological and hydrogeological data with the aim of providing the Department with the basic information about the water resources of the island so that decisions could be made on the exploitation, additional development and allocation for use of these resources.

Appraisal of the exploitation and development of water resources and its consequences as to quantity and quality as well as management and conjunctive use is carried out through the latest techniques including radioisotopes and mathematical models.

Some highlighted activities of the Division during 1987 were:

- Hydrology of the Elea river watershed. Water balance between demands and runoff on the basis of existing and envisaged schemes in the catchment.
- Water balance study of the Akrotiri Salt lake and the effect of water impoundment in the Kouris dam.
- Simulated runoff in the remaining catchment downstream the permanent weir and the Yermasoyia and Evretou dams; this was used in the water balance studies of these two reservoirs.
- Hydrometeorological input data preparation for the Gouri and Sylikou proposal ponds.
- Updating of computerized rainfall and runoff data up to year 1986.
- Current groundwater conditions in 9 Irrigation Blocks at the Kokkinokhoria area evaluating the groundwater available and the water required from the Southern Conveyor Project. This is done on the basis of the well inventory data base prepare for the area as a result of the 1986 survey.
- Survey and evaluation of groundwater pumping costs at the Kokkinokhoria area.
- Preparation of a well inventory and set up of a database for the Akrotiri aquifer.
- Continuation of sampling of groundwater in the Akrotiri aquifer for chemical analysis and radioisotopes. Application of isotope studies in the leakage studies of Evretou and Kouris dam. These studies are sponsored by IAEA.
- Completion of the Yermasoyia conjunctive use study using radiositopes. Preparation of report and groundwater mathematical model.
- Follow up of the developing groundwater conditions in the Akrotiri, Pareklishia, Anglissides, Kiti-Pervolia and Kokkinokhoria aquifers.
- Operation of the Yermasoyia reservoir and aquifer through controlled releases from the dam and increased extraction for the Limassol Water Supply.
- Operation of the Xeropotamos aquifer through controlled releases from Asprokremmos dam for increased extraction for the Paphos Water Supply.
- Monitoring of the Kouris Delta Emergency Scheme.
- Monitoring and evaluation of the Phassouri recharge pond.
- Monitoring of releases from the Kouris dam for recharge and spate irrigation.

- Monitoring and evaluation of the Akhna reservoir seepage to the aquifer.
- Evretou dam water balance and leakage studies.
- Study of seepage at Kouris dam.
- Evaluation of drainage problems at certain areas in the Kokkinokhoria area.
- Computer software application and development of new software for the needs of the Division.

Planning of Projects

A great number of applications by villages for the planning of major water works have been dealt with during 1988 by the Planing Division. Most were only examined at the spot and some others were studied further at preliminary or feasibility level.

Within the Krasokhoria Integrated Rural Development Project, Platys and Xylourikos dams were undertaken early in the year for their final design by the British Consultants who had prepared the feasibility designs. Platys dam was, however, later abandoned due to environmental reasons, whereas Xylourikos dam had to be raised in order to accommodated demands for irrigation by several more villages.

Karyotis Project feasibility report was completed by the Soviet Consultants in April. The Department undertook the preparation of the feasibility study of the irrigation component of the Project.

Within the framework of technical cooperation between Cyprus and Greece, the Department undertook the preparation of studies for the construction of two earth ponds to serve as pilot schemes in the Greek islands of Lesbos and Samos.

Design of Projects

During 1988 the Design Division was mainly involved with the appointed Consultants for the preparation of the final designs of the various components of the Second Phase of the Southern Conveyor Project. In addition, the designs or studies of other schemes started or were completed. Such schemes were Vizakia Irrigation, Athienou Irrigation, Paralimni Pond, Larnaca Water Supply, Khalassa Irrigation and two ponds in the Greek Islands.

Construction of Projects

Construction expenditure of the Department during 1988 reached the amount of £18,362,857 against £26,223,982 for 1987 (See table VII-1 under DIVISION OF CONSTRUCTION).

Following is a brief account on the implementation of major Water Development Projects.

Southern Conveyor Project (SCP) - 1st Phase

Construction work on Kouris Dam, which is the largest dam in Cyprus and constitutes the main water source of the Southern Conveyor Project, started in September 1984 and was substantially completed by September 1988. It is a 113 m high earth dam with a central clay core, a total fill volume of 9.4 MCM and a reservoir capacity of 115 MCM.

In December 1987 when the dam embankment construction reached a predefined elevation it was possible to start impoundment of water in the dam reservoir and by March 1988 a quantity of 51.25 MCM of water was collected which, by the end of September 1988 increased to 67.3 MCM. Out of this quantity some 17 MCM was conveyed to the Kokkinokhoria area for irrigation, or released for recharge downstream and to satisfy the Akrotiri area irrigation water rights.

The construction of Kouris Dam has been undertaken by the joint venture Impregilo of Italy and J & P of Cyprus for a contract value of £20 million. Acceleration of work was agreed for the additional sum of £1.3 million to enable us to achieve impoundment during the 1987-88 rainy season and this was achieved as seen above.

Construction work for the 1400-800 mm dia, 110 km long DI main conveyor pipeline from Kouris Dam to Akhna Dam started in October 1985 and was substantially completed by mid 1988. In February 1988 it was possible to convey water to Akhna Dam and in March 1988 CYBARCO-SHAND were issued with the first substantial completion certificate for the construction of the conveyor. In October 1988 a final certificate was issued for substantial completion of various structures such as break pressure tanks, valve chambers, access roads etc.

The joint venture of CYBARCO, Cyprus and SHAND, U.K. undertook the construction work for the main conveyor for a contract value of approx. £6 million. In addition a sum of £360,000 was agreed to be paid to the joint venture for acceleration of the work to enable us to convey water to the Kokkinokhoria area in time for the 1988 spring-summer irrigation season and this was again achieved.

Akhna Dam was completed in December 1987. It has a capacity of 5.8 MCM and it acts as a balancing reservoir for water conveyed from Kouris Dam to the Kokkinokhoria irrigation area. It must be mentioned here that water can be drawn also directly from the main conveyor.

Akhna dam construction was undertaken by Iacovou Brothers of Cyprus under a contract value of £1,313,000 but the final cost is estimated of £1.1 million.

Three construction contracts of a total value of £5.25 million for the construction of the Kokkinokhoria Irrigation System commenced in March-April 1987 as follows:-

(i) Construction of four balancing reservoirs awarded to G P Zachariades. Three of these reservoirs were completed by the end of 1988 and the fourth is expected to be completed at the beginning of 1989.

(ii) Construction of 15 reservoirs for the 15 central distribution points of the Kokkinokhoria distribution system awarded to CYBARCO. Ten of these reservoirs were completed by the end of 1988 with the remaining ones, scheduled to be completed at the beginning of the new year.

(iii) Construction of 19 pumping stations 15 of which belong to the central distribution points, 3 to the balancing reservoirs and one to Akhna dam awarded to the Chinese firm China Water + Electric who have already delivered 4 of them for pump installation. The remaining 15 pumping stations will be delivered up to the end of 1989. When the electromechanical installations are completed China Water will return to carry out all necessary finishing work. Four of the pumping stations will be ready for commissioning in April-May 1989. By mid 1990 all the pumping stations will be working.

The construction of Kokkinokhoria Distribution Network main and secondary pipelines was undertaken by the Construction Division of the Department in June 1986 at an estimated cost of £5.5 million. By the end of 1988 approx. 50% of the network was completed and the remaining part is expected to be completed by the end of 1989. The main conveyor consists of 1000-300 mm dia AC pipes approx. 30 km long and the secondary conveyor of 600-80 mm AC pipes approx. 250 km long.

Construction of the Tertiary Irrigation Network has in the meantime been approved to start by mid 1989. This work will also be carried out through direct labour by the WDD at an estimated cost of £3.5 million and is expected to be completed by the beginning of 1991.

Utilisation of SCP water during 1988. As from May 1988 it was possible to supply water for the irrigation of an area of 2045 ha by auxiliary pumping sets and temporary by-passes. A total quantity of 2.33 MCM was supplied to farms belonging to the communities of Akhna, Avgorou, Xylophaghou, Ormidhia, Liopetri and Phrenaros by September 1988. An additional quantity of 3.3 MCM was stored in Akhna Dam. At the same time a quantity of 4.27 MCM was made available for irrigation in other areas such as Kiti, Mazotos, Alaminos, Meneou etc. A quantity of 9.6 MCM was released from Kouris Dam for irrigation and recharge in the Akrotiri Delta.

SCP Interconnections other than those for the SCP 2nd Phase were made for the Vasilikos-Pendaskinos Project through a specially constructed balancing reservoir at Vasilikos as well as for recharge of the river valleys of Yermasoyia and Tremithos rivers.

By the end of 1988 most of the supply contracts for SCP have been executed. These were for the supply of DI pipes for the main conveyor (£19 million) pumping equipment (£3 million) and AC pipes, valves, water meters, farm hydrants etc. (approx. £5 million).

The total actual expenditure for SCP upto the end of 1988 including expenditure for design work etc. of the SCP 2nd phase is estimated at £72 million.

Southern Conveyor Project - 2nd Phase. (Commencement of construction work for the 2nd Phase of the SCP will be in 1989-90 except for Akrotiri irrigation system construction for which started and continued throughout 1989.

Work on the second phase of the Southern Conveyor Project continued during 1988 and was mainly focussed on the final design of the various schemes and the preparation of construction drawings and contract documents. Tenders were also invited for construction works and supply contracts. A brief description of the work carried out in 1988 is given below:

Dhiarizos Diversion: The construction drawings and contract documents were finalized and tenders are to be invited in January 1989. A Panel of Experts was appointed for the project.

Akrotiri Irrigation: Tenders for the supply of pipes and fittings for the main conveyors were awarded and work on the installation of these conveyors started and continued throughout the year. The final construction drawings are in their final stage and the contract documents for the supply contracts and civil works were submitted for review.

Kiti Irrigation: Work on land consolidation topographical surveys, and site investigations continued during 1988.

Parekklisha Irrigation: Work on land consolidation continued.

Limassol Water Treatment Plant: Tenders for the construction of the Plant under a turnkey contract were received in January 1988. The tenders were evaluated and the evaluation report submitted to the Tender Board on 2.11.88. Until the end of 1988 no tender award was made.

Tersephanou Water Treatment Plant: Work on site investigations was completed and the consultants started preparing the design and contract documents.

Tersephanou-Nicosia Conveyance system: Work on the site investigations was completed and the consultants submitted the draft design of the conveyor.

Khrysokhou Irrigation Project (KIP) 1st & 2nd Phase

Progress on the various components of the KIP

Irrigation Network. The construction of the irrigation distribution network and the farm roads covering a total area of 1850 ha of the 1st phase of the KIP from Evretou Dam to the coast and along the coast from Neokhorio to Limni mines area was completed by April 1988 and was put into operation. During the summer months of 1988 a quantity of 2 MCM of water was supplied to this area for the irrigation of new plantations. Evretou rockfill Dam, the main water source of the KIP with a capacity of 25 MCM was completed at the end of 1986. The maximum quantity of water impounded in Evretou dam reservoir in 1988 was 19.6 MCM (May, 1988).

Main Conveyor Pipeline. By April 1988 the laying of the part of the main conveyor pipeline belonging to the 1st phase of the project was completed as well as the construction of 4 earth reservoirs and an elevated storage tank through which the 1st phase area is fed. Work on the extension of the main conveyor (within the 2nd phase of KIP) by a length of 16 km upto the Magounda river diversion weir as well as work on the construction of an earth balancing reservoir at Agraka, were completed in August 1988.

Work on the replacement of the existing Pomos Dam open channel with a pipeline started in October 1988. A length of this pipeline will be connected to the 2nd phase main conveyor to convey surplus water from Pomos to Everetou Dam.

Construction work on the remaining part of the KIP 2nd phase for the connection of Ayia Marina Dam with Evretou Dam as well as the diversion of water from Yialia and Livadhi rivers to Evretou Dam through the main conveyor, which will be a two way conveyor, is planned to be put in hand at the beginning of 1990 and be completed by mid 1992. In the meantime the detail designs and tender documents are being prepared for this part of the project.

With the completion of both phases of KIP a total area of 3000 ha will be irrigated with water from Evretou, Argaka, Ayia Marina and Pomos Dams as well as from water diverted from upstream of the latter 3 dams.

Estimated costs

The total expenditure for the completion of both phases of KIP is estimated around £20 million. A total sum of £15.5 million was expended until the end of 1988. These sums do not include expenditure by the farmers themselves estimated at £4 million for the installation of improved irrigation systems within their farms.

Operation and Maintenance-Domestic Water Supplies

The 1987/88 winter season was good in rainfall after six consecutive years of drought or very poor rainfall, and consequently the water impounded in the various dams was adequate to meet the water supply demand satisfactorily.

The Department of Water Development is responsible for the management, operation and maintenance of the Nicosia Water Supply System comprising all sources of water supply for Nicosia including the treatment and conveyance of the water to the service reservoirs at the outskirts of the town. The water is sold in bulk to the Nicosia Water Board at the service reservoirs. The Nicosia Water Board undertakes the distribution of water within the area of supply. Responsibility for the distribution of water within the old, walled city is borne by the Nicosia Water Commission which operated its own sources up to October 1988. This division of responsibility has been in force since early 1980 when, by decision of the Council of Ministers, the Nicosia Water Board extended its area of Supply to cover the area of the Greater Nicosia Scheme.

The total quantity of water produced by the Nicosia Water Supply System in 1988 was 12.541MCM out of which 11.724MCM came from government sources and 0.817MCM was purchased from private sources. A further quantity of 0.271MCM was the yield of the Nicosia Water Commission sources. Included in the government sources is a quantity of 0.839MCM produced by the 1982-1984 emergency schemes. Of the total production, the quantity of water delivered to the Nicosia service reservoirs was 11.539MCM. A quantity of 1.020MCM was consumed en route by a number of villages, camps and industries connected to the system. The total expenditure during 1988 for the operation and maintenance of the Nicosia Water Supply System was £614,583 and the revenue generated from the sale of water was £2,094,055 including outstanding accounts.

The Department is also responsible for the management, operation and maintenance of the Central Water Supply System which includes a number of borehole sources at Khirokitia, Skarinou, Alethriko, Anglisidhes and Klavdhia, a Water Treatment Works at Khirokitia fed from Yermasoyia and Kalavasos Dams and a number of major conveyors extending from Yermasoyia to Famagusta.

The Central Water Supply System supplies water to Famagusta and Larnaca towns and a number of villages and Refugee Housing Estates in the Districts of Larnaca and Famagusta. The total quantity of water produced by the system was 8.49MCM. The quantity of water drawn from Yermasoyia, Lefkara and Kalavasos Dams was 2.75, 0.04 and 4.61MCM respectively (net of losses at the treatment works). The total expenditure for the operation and maintenance of the system during the year was £419,412 and the revenue generated £1,897,040 (including outstanding accounts).

Water continued to be supplied to the Turkish sector of Nicosia and the occupied town of Famagusta although no payment is being received for the supply.

The total quantity of water delivered to the Nicosia Water board service reservoirs was 11.810MCM which corresponds to the unrestricted demand of the town, as there was no deficit. No restrictions on the hours of supply to Nicosia town were imposed.

The Water Board of Limassol controls both the sources of supply and the distribution system of the town. The water supply demand was met satisfactorily and the town enjoyed a regular supply throughout the year. The total quantity of water produced from all sources during 1988 was 9.94MCM.

The town of Larnaca received 2.89MCM of water from the Central Water Supply System and the production of its own and leased sources was 0.71MCM totalling 3.60MCM. This quantity could meet the demand of the town and the Water Board of Larnaca did not have to impose restrictions on the supply.

Paphos Water Supply comes under the direct control of the Municipality. The water supply of the town was augmented from the Paphos Lower Villages Water Supply Scheme by only 0.001MCM. The total quantity of water available to the town during the year was 1.98MCM which could meet the increased demand and no restrictions were imposed on the supply except in two cases when the main conveyor to the town sustained severe damage.

The Department is also responsible for the operation of a number of Regional Water Supply Schemes. these schemes are "Paphos Lower Villages", "Ambelitis", "Arminou", "Timi" and "Phrenaros".

Operation and Maintenance of Projects - Irrigation Works

The management of major irrigation works is done either by the WDD or by the Government Water Works Committees as the case may be whilst the management of small irrigation and village water supply schemes is done by the District Administration and local committees.

In the year under review the total water available in all dams, extracted from project boreholes and taken from river diversions in Cyprus, in the Government controlled areas, amounted to 240.541 MCM. From this quantity 38.403 MCM were used for the irrigation of 9,663 hectares, 14.070 MCM were used for domestic water supplies, and 23.294 MCM were used for recharge. Another 2.326 MCM seeped through or below the dams and 12.106 MCM were lost as evaporation. The remaining 164.774 MCM were retained in the dams as over-annual storage or lost in the distribution systems. Water available for utilization from Government Projects reached the figure of 231.216 MCM. Out of this only 72.541 MCM were utilized, 32.428 MCM for irrigation 14.070 MCM for domestic water supply 21.604 MCM for recharge and 4.439 MCM for storage at Akhna reservoir. Irrigation water was utilized on 8,046 hectares, of land planted with citrus, bananas, vines, diciduous, vegetables, potatoes, cereals and olives. The gross income from the sale of water amounted to £1,487,169. The total operation, maintenance and energy costs amounted to £810,870 and the net income to the Government was £676,299. The O + M expenses breakdown is as follows. Operation £292,811, maintenance £379,253 and energy cost £138,806.

Water available for utilization from contributory schemes was 7.635 MCM out of which 5.975 MCM were used for the irrigation of 1,617 hectares.

Recharge works in the Government controlled areas represent only 13.1% of the total recharge capacity available in Cyprus. In the year under review a quantity of 1,690 MCM was collected in the recharge dams.

Regional Offices

Due to the occupation of northern Cyprus by Turkish troops there are only three regional offices in operation i.e. Famagusta-Larnaca, Limassol and Paphos. The regional offices are mostly responsible for the collection of water resources records and the design and supervision of construction for minor projects. In recent years the three regional offices were involve also with major projects in their regions in studies, investigations and force account construction work.

MEMBERSHIP OF WDD TO INTERNATIONAL ORGANISATIONS.

International Hydrologic Program

The main objective for the I.H.P., which is the major component of UNESCO'S Water Resources program is to develop a scientific and technological basis for the rational management of water resources, both as regards quantity and quality. The Cyprus National Committee for the I.H.P consists of the following:

Chairman
C.St. Lytras, Director of WDD
Secretary
I.St. Iacovides
Members
The Directors of
Agricultural Research Institute,
Department of Agriculture,
Department of Forests,
Geological Survey Department,
Meteorological Service.

During the year a number of questionnaires and data were prepared and supplied as requested by the IHP Secretariat of UNESCO regarding ongoing activities of the program. The Cyprus National Committee is convened only when special cases arise.

International Atomic Energy Agency (IAEA)

The IAEA continued to support studies and research on the use of radioisotopes in hydrology in Cyprus through their Regular Technical Assistance Program and also through the Research Contracts Program.

The study of "Isotopes in Hydrology-Kouris Delta", initiated in 1982 and continued in 1983 was extended to cover the whole of the Akrotiri aquifer in 1984. This has continued through 1988. In the same year a research contract was initiated for the "Use of isotopes in the operation and management of the Yermasoyia aquifer". In 1988 a final report (H/69) was prepared and submitted to IAEA. These two studies are being carried out with I. Iacovides, Senior Hydrogeologist as the chief investigator. The IAEA, besides the technical assistance and analytical facilities that it offers, it provides considerable support in equipment.

Furthermore, samples for isotopic analysis were obtained and analyzed in the IAEA laboratories in Vienna in connection to the Evretou, Asprokremmos and Kouris seepage studies.

International Commission on Large Dams

The International Commission on Large Dams (ICOLD) is a non-profit seeking organization with 75 member countries. As set out in its constitution: "The objects of the Commission are to encourage improvement in the design, construction, maintenance and operation of large dams by bringing together information thereon and by studying questions relating thereto".

The Cyprus National Committee on Large Dams (CYNCOLD) was elected to full membership of ICOLD in 1969. During 1988 the National Committee was composed of the following:

Chairman
C St Lytras, Director, WDD

Vice-Chairman
K C Hassabis, Assistant Director, WDD

Secretary
N P Stylianou, Senior Water Engineer, Head, Design Division, WDD

Members

Dr C A Christodoulou, Principal Water Engineer, WDD
Chr Marcoullis, Senior Water Engineer, Head Planning Division, WDD
A Papadopoullos, Representative of the Association of Civil Engineers and Architects

The post of the Representative of the Association of Building Contractors remained vacant.

During the year the secretary continued the exchange of correspondence with the Central Office of ICOLD in Paris and its technical committees and has both received and supplied technical information on dams and related subjects. The Departmental Technical Library has been enriched by the addition of several recent ICOLD publications.

REGISTRE DES BARRAGES EN *REGISTER OF DAMS IN* CYPRUS

Drg-No. AG/IR/68

1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18	19	
LIGNE *LINE* No.	NOM DU BARRAGE *NAME OF DAM*	ANNÉE D'ACHÈVEMENT *YEAR OF COMPLETION*	SITUATION – *LOCATION* COURS D'EAU *RIVER*	VILLE LA PLUS PROCHE *NEAREST CITY*	ÉTAT PROVINCE OU DÉPARTEMENT *STATE PROVINCE OR COUNTRY*	TYPE	SITUATION ET TYPE D'ÉTANCHÉITÉ *POSITION AND NATURE OF SEALING ELEMENT*	FONDATION *FOUNDATION*	HAUTEUR AU-DESSUS DE LA PLUS BASSE FONDATION *HEIGHT ABOVE LOWEST FOUNDATION* (m)	LONGUEUR DE CRÊTE *LENGTH OF CREST* (m)	VOLUME DU BARRAGE *VOLUME CONTENT OF DAM* (10^3 m^3)		CAPACITÉ TOTALE DU RÉSERVOIR / SURFACE DU RÉSERVOIR *GROSS CAPACITY OF RESERVOIR / RESERVOIR AREA* (10^3 m^3) / (10^3 m^2)	DESTINATION *PURPOSE*	CAPACITÉ MAXIMALE DES ÉVACUATEURS *MAXIMUM DISCHARGE CAPACITY OF SPILLWAYS* (m^3/s)	TYPE DES ÉVACUATEURS *TYPE OF SPILLWAYS*	PROPRIÉTAIRE *OWNER*	BUREAU D'ÉTUDES *ENGINEERING BY*	CONSTRUCTEUR *CONSTRUCTION BY*	LIGNE *LINE* No.
1	KAFIZES	1953	Xeros (Morphou)	Nicosia	Nicosia	PG		R	23	27	4	LIGNE DE PLIURE POUR DACTYLOGRAPHIE	113 / 20	I	54	L	Lefka Irr. Div.	WDD	WDD	1
2	KANDOU	1956	Kouris	Limassol	Limassol	PG		R	15	53	2		34 / 12	I	59	L	Kandou Irr. Div.	WDD	WDD	2
3	PERAPEDHI	1956	Kouris	Limassol	Limassol	PG		R	22	62	4		55 / 12	I	107	L	Perapedhi Irr. Div.	WDD	WDD	3
4	PYRGOS	1957	Katouris	Nicosia	Nicosia	PG		R	22	66	5		285 / 30	I	125	L	Pyrgos Irr. Div.	WDD	WDD	4
5	TRIMIKLINI	1958	Kouris	Limassol	Limassol	PG		R	33	76	6		340 / 23	I	59	L	Trimiklini Irr. Div.	WDD	WDD	5
6	ATHALASSA	1962	Pedhieos	Nicosia	Nicosia	TE	ie	R/S	18	447	103		791 / 230	I	48	L	Government	WDD	WDD	6
7	GEUNYELI	1962	Pedhieos	Nicosia	Nicosia	TE	he	R/S	15	254	50		1 045 / 276	I	173	L	Geunyeli Irr. Div.	WDD	WDD	7
8	LEFKA	1962	Marathasa	Nicosia	Nicosia	PG		R	35	149	11		368 / 45	I	246	L	Lefka Irr. Div.	WDD	WDD	8
9	MORPHOU	1962	Serrakhis	Nicosia	Nicosia	TE	ie	S	13	1 436	206		1 879 / 480	I	764	L	Morphou Irr. Div.	WDD	WDD	9
10	PRODHROMOS	1962	Off-stream	Limassol	Limassol	TE	fe	R/S	10	756	73		122 / 26	I	-	L	Prodhromos Irr. Div.	WDD	WDD	10
11	KANLI KEUY	1963	Pedhieos	Nicosia	Nicosia	TE	he	R/S	19	311	47		1 113 / 390	I	116	L	Kanli Keuy Irr. Div.	WDD	WDD	11
12	AGROS	1964	Kouris	Limassol	Limassol	TE	ie & fe	R	26	180	61		99 / 15	I	6	L	Agros Irr. Div.	WDD	WDD	12
13	ARGAKA	1964	Magounda	Paphos	Paphos	ER	ie	R	41	173	138		1 150 / 107	I	280	L	Government	Howard Humphreys & Sons, UK	WDD	13
14	KITI	1964	Tremithos	Larnaca	Larnaca	TE	ie	S	22	990	183		1 614 / 360	I	602	L	Government	Il Nuovo Castoro, Italy	WDD	14
15	LIOPETRI	1964	Potamos	Famagusta	Famagusta	TE	he	S	18	579	50		340 / 74	R	150	L	Liopetri Irr. Div.	WDD	WDD	15
16	MIA MILEA	1964	Pedhieos	Nicosia	Nicosia	TE	ie	R/S	22	140	54	FOLDING LINE FOR TYPING	355 / 68	I	24	L	Mia Milea Irr. Div.	WDD	WDD	16
17	OVGOS	1964	Serrakhis	Nicosia	Nicosia	TE	ie	S	16	745	130		845 / 260	I	786	L	Morphou Irr. Div.	WDD	WDD	17
18	AYIA MARINA	1965	Xeros	Paphos	Paphos	ER	ie	R	33	142	61		311 / 33	I	161	L	Ayia Marina Irr. Div.	Energoprojekt, Yugoslavia	Med. Constr. Greece – G P Zachariades Cyprus	18
19	POLEMIDHIA	1965	Garyllis	Limassol	Limassol	TE	ie	R/S	45	196	215		3 864 / 110	I	581	L	Government	Energoproject, Yugoslavia	Mowlem & Ridgway of U K	19
20	KALOPANAYIOTIS	1966	Marathasa	Nicosia	Nicosia	TE	ie	R	40	137	156		391 / 47	I	207	L	Government	Howard Humphreys & Sons, UK	WDD	20
21	MAVROKOLYMBOS	1966	Mavrokolymbos	Paphos	Paphos	TE	ie	R/S	45	528	267		2 180 / 175	I	340	L	Government	Energoprojekt, Yugoslavia	CYBARCO, Cyprus	21
22	POMOS	1966	Livadhi	Paphos	Paphos	ER	ie	R	38	302	153		859 / 83	I / I	300 / 300	L / L	Pomos Irr. Div.	Energoprojekt, Yugoslavia	Med. Constr. Greece – G P Zachariades Cyprus	22
23	YERMASOYIA	1968	Yermasoyia	Limassol	Limassol	TE	ie	R	49	409	539		13 600 / 1 100	I	850	V	Government	Energoprojekt, Yugoslavia	CYBARCO, Cyprus	23
24	LEFKARA	1973	Syrkatis	Larnaca	Larnaca	ER	ie	R	74	240	820		13 850 / 650	S/I	316	L	Famagusta Water Board & Lefkara Irr. Div.	Howard Humphreys & Sons, U K	L Fairclaugh UK and MEDCON Cyprus	24
25	MASARI	1973	Serrakhis	Nicosia	Nicosia	TE	ie	S	15	929	245		2 273 / 620	I	622	V	Government	WDD	WDD	25

NOTES
FOOTNOTES

WDD : Water Development Department
Irr. Div: Irrigation Division

REGISTRE DES BARRAGES EN
REGISTER OF DAMS IN CYPRUS

Drg. No.AG/IR/69

1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18	19	
LIGNE *LINE* No.	NOM DU BARRAGE *NAME OF DAM*	ANNÉE D'ACHÈVEMENT *YEAR OF COMPLETION*	SITUATION – *LOCATION* COURS D'EAU *RIVER*	VILLE LA PLUS PROCHE *NEAREST CITY*	ÉTAT PROVINCE OU DÉPARTEMENT *STATE PROVINCE OR COUNTRY*	TYPE	SITUATION ET TYPE D'ÉTANCHÉITÉ *POSITION AND NATURE OF SEALING ELEMENT*	FONDATION	HAUTEUR AU-DESSUS DE LA PLUS BASSE FONDATION *HEIGHT ABOVE LOWEST FOUNDATION* (m)	LONGUEUR DE CRÊTE *LENGTH OF CREST* (m)	VOLUME DU BARRAGE *VOLUME CONTENT OF DAM* (10^3 m^3)		CAPACITÉ TOTALE DU RÉSERVOIR / SURFACE DU RÉSERVOIR *GROSS CAPACITY OF RESERVOIR / RESERVOIR AREA* (10^3 m^3) / (10^3 m^2)	DESTINATION PURPOSE	CAPACITÉ MAXIMALE DES ÉVACUATEURS *MAXIMUM DISCHARGE CAPACITY OF SPILLWAYS* (m^3/s)	TYPE DES ÉVACUATEURS *TYPE OF SPILLWAYS*	PROPRIÉTAIRE *OWNER*	BUREAU D'ÉTUDES *ENGINEERING BY*	CONSTRUCTEUR *CONSTRUCTION BY*	LIGNE *LINE* No.
1	PALEKHORI KAMBI	1973	Akaki	Nicosia	Nicosia	PG		R	33	131	27	LIGNE DE PLIURE POUR DACTYLOGRAPHIE	620 110	I	65	L	Government & Palekhori Irr. Div.	WDD	J & P, Cyprus	1
2	ARAKAPAS	1975	Yermasoyia	Limassol	Limassol	PG		R	23	97	10		129 20	I	205	L	Arakapas Irr. Div.	WDD	WDD	2
3	AYII VAVATSINIAS No1	1980	Off-stream	Larnaca	Larnaca	TE	fp	S	17	125	32		55 11	I			Palambelia-Mosphilomouti Irri. Div.	WDD	Iacovou Bros, Cyprus	3
4	EPHTAGONIA No1	1980	Off-stream	Limassol	Limassol	TE	fp	S	16	390	46		92 17	I			Kokkinoyia Irr. Div.	WDD	Iacovou Bros, Cyprus	4
5	KHANDRIA	1980	Off-stream	Limassol	Limassol	TE	fp	S	35	82	41		70 14	I			Kambos tou Paphiti Irr. Div.	WDD	CYBARCO, Cyprus	5
6	MELINI	1980	Off-stream	Limassol	Larnaca	TE	fp	S	22	116	32		59 13	I			Melini Irr. Div.	WDD	Iacovou Bros, Cyprus	6
7	PELENDRIA	1980	Off-stream	Limassol	Limassol	TE	fp	S	18	229	59		123 21	I			Ammos Irr. Div.	WDD	FYSCO, Cyprus	7
8	AKAPNOU-EPHTAGONIA	1981	Off-stream	Limassol	Limassol	TE	fp	S	18	280	67		132 24	I			Akapnou - Ephtagonia Irr. Div.	WDD	Iacovou Bros, Cyprus	8
9	AYII VAVATSINIAS	1981	Vasilikos	Larnaca	Larnaca	VA		R	19	58	2		53 12	I			Palambelia-Mosphilomoutti Irr. Div.	WDD	WDD	9
10	KATO MYLOS	1981	Off-stream	Limassol	Limassol	TE	fp	S	23	240	41		104 20	I			Vatera Irr. Div.	WDD	Phoenix Constructions, Cyprus	10
11	AGRIDHIA	1982	Off-stream	Limassol	Limassol	TE	fp	S	18	119	25		59 12	I			Kladhos Irr. Div.	WDD	Iacovou Bros, Cyprus	11
12	ASPROKREMMOS	1982	Xeropotamos	Paphos	Paphos	TE	ie	R/S	56*	700	2 097		51 000 2 590	I	1 484	L	Government	Sir M MacDonald & Partners UK	Joint Venture J & P and MEDCON, Cyprus	12
13	KYPEROUNDA	1982	Off-stream	Limassol	Limassol	TE	fp	S	27	172	94		273 36	I			Phterika Irr. Div.	WDD	Iacovou Bros, Cyprus	13
14	XYLIATOS	1982	Lagoudhera	Nicosia	Nicosia	ER	ie	R	42	155	240		1 250 96	I	100	L	Government	WDD	General Construction Co Cyprus	14
15	LAGOUDHERA	1983	Off-stream	Nicosia	Nicosia	TE	fp	S	36	123	63		70 14	I			Axousa Irr. Div.	WDD	Joint Venture Phoenix Constr. & KYKON, Cyprus	15
16	AYII VAVATSINIAS No2	1984	Off-stream	Larnaca	Larnaca	TE	fp	S	25	130	30		43 9	I			Petalia - Palovato Irr. div.	WDD	Chr. Charalambous, Cyprus	16
17	DHIERONA	1984	Off-stream	Limassol	Larnaca	TE	fp	S	24	167	59		159 27	I			Dhiastera Irr. Div.	WDD	Ch. Apostolides, Cyprus	17
18	KHIROKITIA	1984	Off-stream	Larnaca	Larnaca	TE	fp	S	16	460	95		205 31	I			Irr. Div. to be set up	WDD	Iacovou Bros, Cyprus	18
19	DHYPOTAMOS	1985	Pendaskinos	Larnaca	Larnaca	ER	ie	R	49	390	1 090	FOLDING LINE FOR TYPING	15 000 1 000	S/I	1 130	L	Government	Rofe, Kennard & Lapworth & W Evans & Partners, UK	Shephard-Hill, UK with G P Zachariades, Cyprus	19
20	KALIVAZOS	1985	Vasilikos	Larnaca	Larnaca	ER	ie	R	57	482	1 700		17 000 875	I/S	1 268	L	Government	Rofe, Kennard & Lapworth & W Evans & Partners, UK	J & P with MEDCON, Cyprus	20
21	EVRETOU	1986	Stavros tis Psokas	Polis Khrysokhou	Paphos	ER	ie	R/S	70**	260	1 400		25 000 1 250	I	360	L	Government	Sir William Halcrow and Partners, UK	Shephard-Hill, UK with G P Zachariades, Cyprus	21
22	AKHNA	1987	Off-stream	Famagusta	Famagusta	TE	he	S	23	272	240		5 800 1 250	I	35	L	Government	Sir William Halcrow and Partners, UK	Iacovou Bros, Cyprus	22
23	KOURIS	1988	Kouris	Limassol	Limassol	TE	ie	R	113	550	9 400		115 000 3 600	I/S	1 428	L	Government	SOGREAH, France	Impregilo, Italy with J & P, Cyprus	23
24																				24
25																				25

NOTES

FOOTNOTES

* ITEM 37 Concrete cut-off wall 29m deep below lowest foundation

** ITEM 46 Plastic concrete cut-off wall 35m deep below lowest foundation

The 56th Executive Meeting of ICOLD was held in San Francisco, U.S.A, between 7 and 11 June 1988. The Executive Meeting was followed by the 16th Congress which will take place between 13 and 17 June 1988. A number of Study Tour were arrange during and after the Executive Meeting and Congress. Technical Questions or topics for which technical papers were presented at the Congress are the following:

Question 60: Reservoirs and the Environment
Question 61: Embankment Dams. Impervious Elements other than Clay Cores.
Question 62: New Developments in the Construction of Concrete Dams
Question 63: Design flood and Operational Flood Control.

A full set of the Proceeding of the 16th Congress was received from ICOLD and can be found in the Library of the Department. The Cyprus National Committee was not represented at the Congress or the Executive Meeting.

The 57th Executive meeting of ICOLD with Associated Meetings of the Technical Committees and Symposium will be held in Copenhagen in July 1989.

Other memberships

The Water Development Department also represents Cyprus on a national level to the following International Organisations through committees chaired by the Director.

- The National Action Committee for the International Drinking Water Supply and Sanitation Decade (IDWSSD).
- International Commission on Irrigation and Drainage (ICID)
- International Water Supply Association (IWSA).

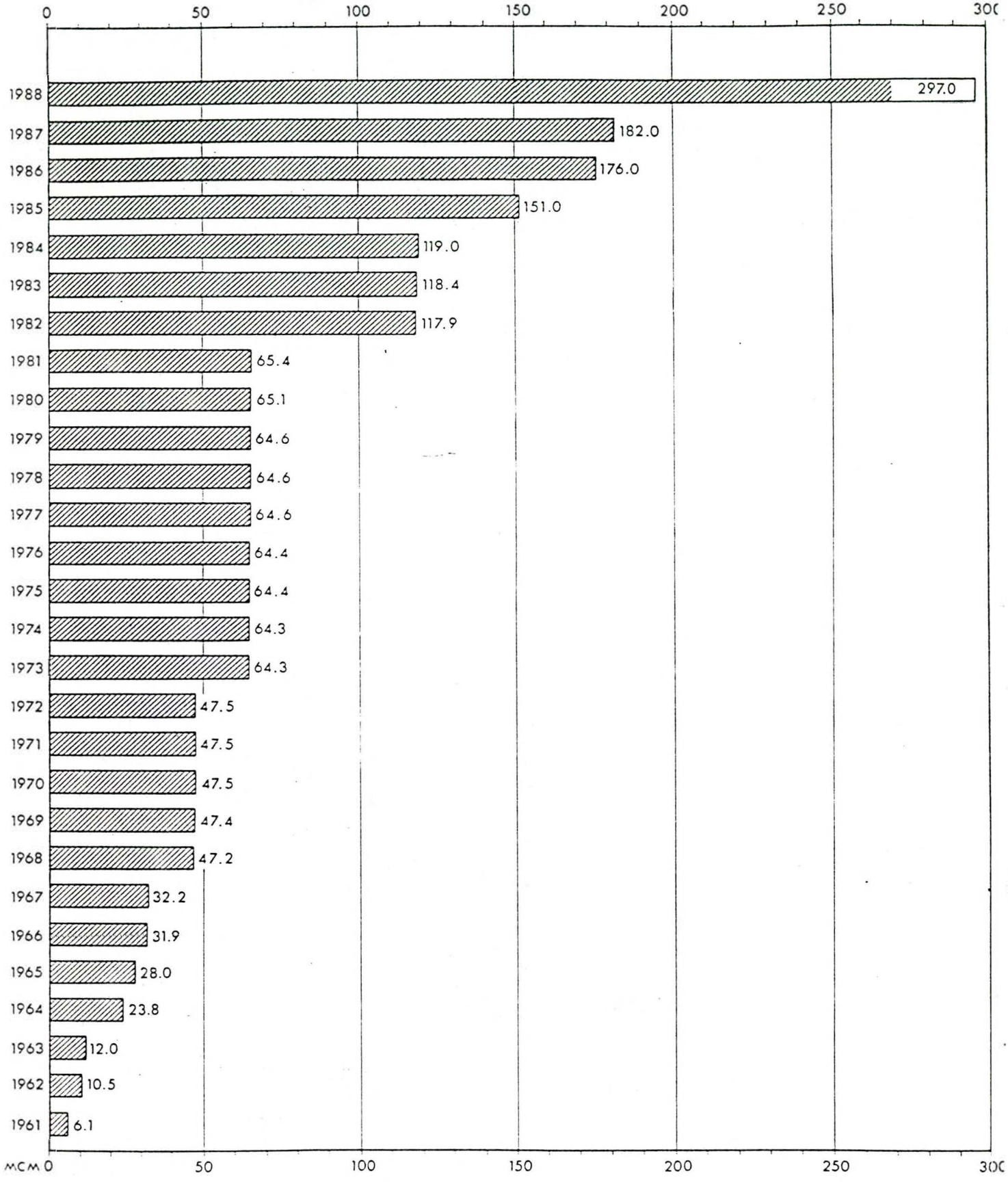
MEETINGS OF THE DIRECTOR WITH THE STAFF ETC.

Several meetings were held during the year under the chairmanship of the Director with the Heads of the various Divisions, Regional Engineers 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, ARI, the Geological Survey Department, Meteorological Office, Fisheries Department and the District Administrations were also held during the year.

DEPARTMENT OF WATER DEVELOPMENT

PROGRESS IN DAM CONSTRUCTION

AGIIR/72



ACCUMULATED STORAGE CAPACITY

DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT	1000m³	YEAR
1	Kouklia	Earth	6	4,545	1900
2	Lymbia *	Gravity	5	18	1945
3	Lythrodhonda	Gravity	11	32	1945
4	Kalokhorio (K1)	Gravity	9	82	1947
5	Akrounda	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	Gypsos	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 6.174 $m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT	1000m³	YEAR
17	Prodhromos	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	Polemidhia	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$m^3 \times 10^6$

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000m³	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	Makrasyka	Earth	8	195	1966
42	Akhna (Mesania)	Earth	4	90	1967
43	Morphou spreading grounds	Earth	5	130	1968
44	Ormidhia	Earth	5	100	1968
45	Vrysoules	Earth	7	140	1969
46	Protopapas	Earth	6	90	1970

Total Storage Capacity 8.275$m^3 \times 10^6$

HT refers to height in meters from foundation

YEAR is the year of completion

Phrenaros (6) means six small dams in Phrenaros area

*Inundated by New Lymbia Dam See ref. No 69

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000m³	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	Xylophaghou (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	Xylotymbou (5)	Earth	5	50	1969

Total Storage Capacity 1.075$m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1971-80

No	DAM	TYPE	HT	1000m³	YEAR
65	Lefkara	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	129	1975
69	New Lymbia	Gravity	12	220	1977
70	Ayii Vavatsinias	Arch	14	53	1980
71	Ayii Vavatsinias	Earth	10	55	1980
72	Ephtagonia No 1	Earth	10	92	1980
73	Khandria	Earth	10	70	1980
74	Melini	Earth	10	59	1980
75	Pelendria	Earth	10	123	1980

Total Storage Capacity 17.544$m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1981-90

No	DAM	TYPE	HT	1000m³	YEAR
76	Ephtagonia No 3	Earth	10	65	1981
77	Akapnou-Ephtagonia	Earth	9	132	1981
78	Kato Mylos	Earth	10	104	1981
79	Ephtagonia No 2	Earth	8	127	1982
80	Arakapas	Earth	10	192	1982
81	Asprokremmos	Earth	53	51,000	1982
82	Xyliatos	Rockfill	42	1,250	1982
83	Agridhia	Earth	10	59	1983
84	Kyperounda	Earth	10	270	1983
85	Lagoudhera	Earth	10	71	1983
86	Ora	Earth	10	62	1983
87	Ayii Vavatsinias No2	Earth	10	43	1984
88	Pharmakas No 1	Earth	10	21	1984
89	Pharmakas No 2	Earth	10	61	1984
90	Arakapas No 2	Earth	8	120	1984
91	Dhierona	Earth	10	159	1984
92	Khirokitia	Earth	10	205	1984
93	Esso Galata	Earth	10	35	1985
94	Kalavasos	Rockfill	60	17,000	1985
95	Dhypotamos	Rockfill	60	15,000	1985
96	Evretou	Rockfill	70	25,000	1987
97	Akhna	Earth	16	5,800	1987
98	Aradhippou (Parth)	Gravity	10	90	1987

*Total Storage Capacity 116.866 $m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1981-90 (Cont.)

No	DAM	TYPE	HT	1000m³	YEAR
99	Kouris	Rockfill	110	115,000	1988

Total Storage Capacity 115.000 $m^3 \times 10^6$

PROPOSED DAMS

No	DAM	TYPE	HT	1000m³	YEAR
100	Aradhippou (Rech.)	Earth	14	375	
101	Vizakia	Earth	30	900	
102	Ayios Theodhoros	Rockfill	100	22,500	
103	Akaki - Malounda	Earth	39	2,000	
104	Xylourikos	Rockfill	39	1,900	

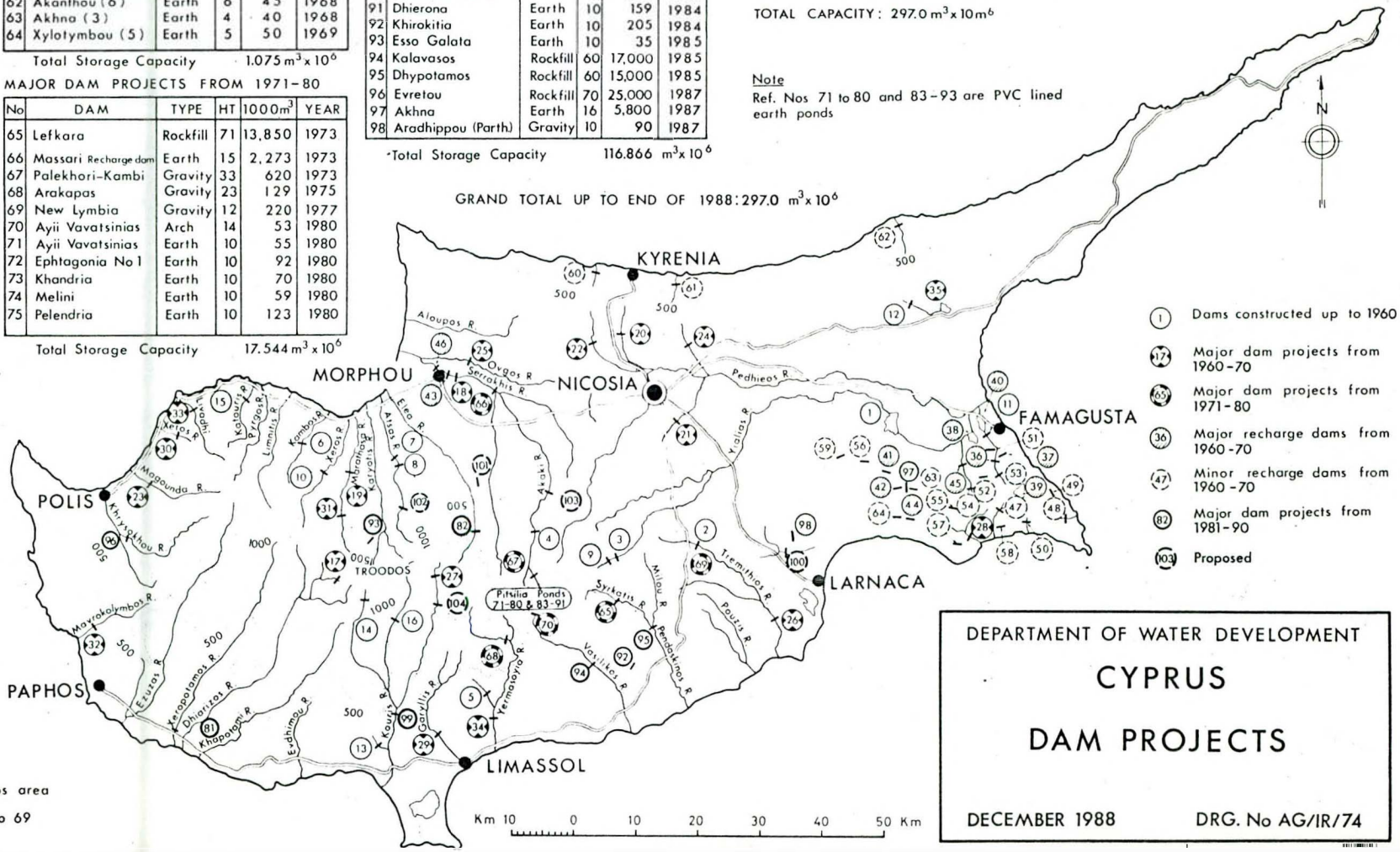
Total Storage Capacity 27,675$m^3 \times 10^6$

TOTAL CAPACITY: 297.0 $m^3 \times 10^6$

Note

Ref. Nos 71 to 80 and 83-93 are PVC lined earth ponds

GRAND TOTAL UP TO END OF 1988: 297.0 $m^3 \times 10^6$



DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

DAM PROJECTS

DECEMBER 1988 DRG. No AG/IR/74

FINANCE, EXPENDITURE AND REVENUE

During the year 1988 the total actual expenditure by the Department fron WDD budgeted and other non-budgeted votes amounted to £23,954,319 out of a total budget of £30,891,318.

The general picture is as follows:

TABLE I-1
GENERAL BUDGET-EXPENDITURE FIGURES FOR 1988

Description	Budget £	Expenditure £
a. WDD Development Estimates		
Govt. £21,322,749		16 143 928
including loans)		
Loan: 1,041,684		701 797
Total	22 364 433	£16 845 725
b. WDD Ordinary Estimates	5 602 707	4 886 009
c. Non-budgeted votes for Pitsilia Project, refugee housing estates, works for other Government Departments, private developers and village deposits	2 924 178	2 222 585
Total	£30 891 318	£23 954 319

For the level of expenditure on construction works carried out during 1988 from WDD and other votes, see table VII-1 under CONSTRUCTION DIVISION

The largest single item of expenditure was for the Southern Conveyor Project at £12,874,427.

Loan Proceeds

Description of loans	Amount withdrawn during 1987 £
- Loan No. 1658/5 CY (IBRD) US$9,910,000 for VPP	(completed)
- Loan No. 158 KUWAIT FUND KD2,500,000 for VPP	(completed)
- Loan No. 1.1572.00 EUROPEAN INVEST. BANK ECU9,000,000 FOR VPP	(completed)
- Loan No. 2279 CY(IBRD) US$ 16,000,000 for Khrysokhou Irrigation Project	498 377

Loans for SCP

	Amount received in 1987 £
- Loan No. 2386 CY from IBRD US$27,000,000	3 850 224
- Loan No. 1.2109 from E.I.B (Major Loan) ECUS 26,500,000	3 797 284
- Loan No. 6.0553 from E.I.B. (Special term Loan) ECU'S 3,700,000	494 541
- Loan No. 277 from K.F.A.E.D.K.D. 2,940,000	1 161 037
Credit facilities from Barclays Bank S.A., from Banque Indosuez and from Bank Francaise du Commerce Exterieur (Supply of ductile pipes and fittings for the Main Conveyor-from Pont-A-Mousson of France) D.M. 78,074,566	(completed)
Credit Facilities from the Standard Chartered Merchand Bank of U.K for part of the Contract S3 - S.P.P. Projects Ltd of U.K.	475,165

Revenue

A sum of £4,855,002 was collected during the year 1988 as revenue mainl from the sale of water for Nicosia and Famagusta Water Supplies and Paphc Irrigation Project (See table I-5).

TABLE I-2
EXPENDITURE FOR THE YEAR 1988

Ser. No.	Description	Government Contr. Ordinary £	Government Contr. Development £	Village Contr. (Loans) £	Total £
A	**WDD Votes**				
1	Administration	3 061 678		-	3 061 678
2	Greater Nicosia W S scheme running expenses	614 383	-	-	614 383
3	Nicosia-Larnaca-Famagusta, Central W S system (formerly styled Famagusta W S scheme)	419 487	-	-	419 487
4	Government W S schemes for villages running expenses	78 767	-	-	78 767
5	Irrigation, drainage and dams	693 908	15 044 222	174 820	15 912 950
6	Town water supplies	-	161 094	38 504	199 598
7	Village water supplies .	-	694 352	488 474	1 182 826
8	Government water supply schemes	-	25 247	-	25 247
9	Drilling & prospecting .	17 786	-	-	17 786
10	Hydrology	-	111 927	-	111 927
11	Surveys & investigations	-	89 732	-	89 732
12	Purchase of machinery and equipment	-	13 448	-	13 448
13	Others	-	3 905	-	3 905
14	Studies for the Utilization of treated sewage effluent	-	-	-	-
	Total	£4 886 009	£16 143 927	£701 798	£21 731 734

TABLE I-2 (cont.)

B Non-budgeted Votes

			£
1	Pitsilia Project (i) Government Contribution	£28,179	
	(ii) Village Contribution	£13,926	42,105
2	Refugee housing estates		167 486
3	Works for other Government Departments		
	(i) Government Contribution	1,562,929	
	(ii) Village Contribution	203,491	1 766 420
4	Works through village deposits		198 435
5	Works for private developers		48 139
	Total		£ 2 222 585
	Grand Total		£23 954 319

(i) **Breakdown of Administration Expenditure**

		Ordinary £	Development £	Total £
1	Personal emoluments	2 794 270	-	2 794 270
2	Casual technical assistance	9 549	-	9 549
3	Extra Assistance	78 537	-	78 537
4	Travelling	80 238	-	80 238
5	M'ce & operation of motor transport	15 410	-	15 410
6a	Office expenses	47 572	-	47 572
6b	Purchase of drawing materials - tools etc.	15 687	-	15 687
7	Government water supply	14 804	-	14 804
8	M'ce & operation of data processing and other equipment	5 611	-	5 611
	Total	£3 061 678	-	£3 061 678

(ii) **Breakdown of Irrigation, Drainage and Dams Expenditure**

		Government £	Village £	Total £
1	Minor irrigation works	288 602	146 293	434 895
2	Consultants fees (Shown under individual projects. See chapter VIII)	--	--	--
3	Major waterworks Paphos	147 663	-	147 663
4	Major waterworks Vasilikos-Pendaskinos	413 641	-	413 641
5	Major waterworks Southern Conveyor	12 874 426	-	12 874 426
6	Major waterworks Khrysokhou	1 047 090	-	1 047 090
7	Other major waterworks	161 217	28 527	189 744
8	M'ce of dams & distribution system	693 908	-	693 908
9	River training	-	-	-
10	Major waterworks Karyotis	70 927	-	70 927
11	Major waterworks Vizakia	40 655	-	40 655
	Total	£15 738 129	£174 820	£15 912 949

TABLE I-3
WDD ORDINARY BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1988

Head 20A Water Development

	£
1988 approved	5 464 946
Add special warrants	137 761
Total	£5 602 707

Month	Monthly expenditure £	Cumulative expenditurm £	%
January	275 294	275 294	4.91
February	298 193	573 487	10.24
March	350 618	924 105	16.49
April	345 600	1 269 705	22.66
May	357 566	1 627 271	29.04
June	359 701	1 986 972	35.46
July	386 794	2 373 766	42.37
August	366 628	2 740 394	48.91
September	454 344	3 194 738	57.02
October	449 610	3 644 348	65.05
November	443 380	4 087 728	72.96
December	798 281	4 886 009	87.21

Summary

	£	%
Amount approved	5 602 707	100
Less actual expenditure	4 886 009	87.21
Balance	£ 716 698	12.79

TABLE I-4
WDD DEVELOPMENT BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1988
(Not including village loans)
Head 2D Water Development

	£
1988 approved	29 977 603
Add special warrants	345 146
Total	£21 322 749

TABLE I-4 (Cont)

Month	Monthly expenditure £	Cumulative expenditure £	%
January	592 033	592 033	2.78
February	827 264	1 419 297	6.66
March	1 125 817	2 545 114	11.94
April	1 379 522	3 924 636	18.41
May	1 253 083	5 177 719	24.28
June	1 220 559	6 398 278	30.00
July	1 692 967	8 091 245	37.95
August	1 522 077	9 613 322	45.08
September	812 562	10 425 884	48.90
October	1 203 761	11 629 645	54.54
November	1 333 711	12 963 356	60.80
December	3 180 572	16 143 928	75.71

Summary

	£	%
Amount approved	21 322 749	100
Less actual expenditure .	16 143 928	75.71
Balance	£5 178 821	24.29

TABLE I-5
STATEMENT OF REVENUE COLLECTED
DURING THE YEAR 1988

Description	£
Drilling charges	355
Nicosia water supply	1 980 777
Nicosia-Larnaca-Famagusta Central water supply system	1 626 077
Regional village water supply schemes	78 371
Khrysokhou irrigation scheme - Sale of water	57 276
Paphos irrigation scheme - Sale of water	703 530
Xyliatos irrigation scheme	34 819
Repayment of Nicosia Water Board's debt capital	73 395
Repayment of Nicosia Water Board's debt interest	113 054
Other fees	140 593
Southern Conveyor Project	46 755
Total	£4 855 002

Note: The amounts contributed from TAEΠ (Cyprus relief fund for displace and affected persons) are not included in this chapter. For the exac amount contributed from TAEΠ please refer to the relevant schemes i chapter VII DIVISION OF CONSTRUCTION.

STAFF MATTERS

Technical Staff

The total number of technical staff employed during 1988 was 422. See Table WDD TECHNICAL STAFF AS ON 31.12.88.

Clerical Staff

The total number of clerical staff employed by the Water Development Department during 1988 was 60.

Appointments

During the period under review the following were appointed to the posts as indicated:

To the post of Technician 2nd Grade, on a casual basis, with effect from 1st February 1988.

Demetra Antoniou
Costas Violaris
Antonis Yianni
Andreas Demetriou
Elias Elia
Marios Iacovou
Emilios Ioannou
Eleni Koki-Gregoriou
Agathi Kourtella
Constantinos Constantinou
Prodromos Loucaides
Stephanos Malekkides
Anastasia Menikea
Elias Moutiris
Penelopi Pae
Soteris Proestos
Nicos Shiellis
Sonia Soteriou
Eleftherios Tsolakis
Anastasia Chomata
Antonis Hadjiantonis
Marios Hadjicostis
Thomas Hadjipieri
Theodoulos Dhionysiou
Myrianthi Avgousti
Andreas Yiangou
Ioannis Georgoudes
Constantinos Demetriades
Costas Themistocleous
Christakis Ioannides
George Katsambas
Theocharis Constantinou
Michalis Kylilis
Marios Leonidha
Androulla Makkouli
Maria Mathopoullou
Soteris Micahel
Philippos Nicolaou
Demetrios Pavlides
Yiola Rousou
Charalambos Kyriakou
Soteris Tooulakos
Matheos Christodoulou
Krinanthi Hdjiadamou
Christakis Hadjiyangou
Panayiotis Hadjipetrou
Fryne Loucaidou

Charalambos N. Charalambous to the post of Executive Engineer II, on a casual basis, with effect from 12.4.88.

Marilena Panaretou to the permanent post of Hydrologist Ii, on probation, with effect from 15.9.88.

Acting Appointments

Kyprianos Hassabis as acting Director for the period between 26.9.88-31.10.88.

Promotions

Chrysostomos Kambanellas to the permanent post of Executive Engineer I, with effect from 1.4.88.

To the permanent post of Clerk 1st Grade General Clerical Staff, with effect from 1.4.88.

Maria Papakyriacou
Chrystalla Papaevriviadou
Androulla Sevastidou
Krinoulla Menicou
Aphrodite Christodoulou
Maria Karamanidou
Andreas K Ioannou

To the permanent post of Chief Foreman with effect from 1.5.88.

George Kostrikki
Takis Kallis
Andreas M Assiotis

To the permanent post of Technician 1st Grade with effect from 1.8.88.

Nicolaos Stratis
Panayiotis Christodoulides
Yiannakis Marcou
George I Constantinou
Neophytos A Neophytou
Takis Hepis
Diamanto Iacovou
George P Neophytou
Kyriaki Panayiotou

Andreas Eleftheriou to the permanent post of Chief Foreman with effect from 15.8.88.

To the permanent post of Assistant Chief Foreman with effect from 1.12.88.

Charilaos Charalambous
Savvas Papapanteli
Costas K Nicolaides
Iacovos Contantinou

Ioanna Nicolaou to the permanent post of Executive Engineer I, with effect from 1.12.88.

Retirements

Kyriacos Sfikouris, Assistant Chief Foreman with effect from 1.5.88.

Savvas Zavros, Messenger with effect from 1.6.88.

Panayiotis Eracleous, Assistant Chief Foreman with effect from 1.8.88.

Sofoclis Kyriacou, Chief Foreman with effect from 1.11.88.

Andreas Petrou, Messenger with effect from 1.12.88.

Resignations

George Alexandrou, Executive Engineer II, on a casual basis, with effect from 1.3.88.

Thomas Hadjipieri, Technician 2nd Grade on a casual basis, with effect from 12.3.88.

Theocharis Constantinou, Technician 2nd Grade on a casual basis, with effect from 31.3.88.

Soteris Proestos, Technician 2nd Grade on a casual basis, with effect from 30.4.88.

Transfers

Spyros Stefanou, Executive Engineer I to Head Quarters Nicosia with effect from 1.4.88.

Pavlos Neophytides, Executive Engineer I, to Head Quarters Nicosia with effect from 1.4.88.

Eleni Shiakalli, Executive Engineer I, to Head Quarters Nicosia with effect from 1.4.88.

Tasoulla Ioseph, Clerk 2nd Grade General Clerical Staff to Public Administration and Personnel Services with effect from 29.2.88.

Kyriaki Arminioti, Clerk 2nd Grade General Clerical Staff to the Ministry of Finance with effect from 4.4.88.

Polyxeni Michaelidou, Clerk 2nd Grade, General Clerical Staff to the Accountant's General Office with effect from 3.5.88.

The following Technicians 2nd Grade, to the District Office of Water Development Department Paphos with effect from 15.7.88.

Diamanto Iacovou
Georghios Neophytou
Yiannakis Marcou
Neophytos A. Neophytou

Andreas Papasavvas, Technician 1st Grade, to District Office of Water Development Department Paphos with effect from 15.7.88.

Angela Skouroupathi, Technician 2nd Grade to Head Quarters Nicosia with effect from 3.10.88.

Petros Makkoulas, Senior Technician, to Head Quarters Nicosia with effect from 3.10.88.

Scholarships and study leave

George Christodoulou Ioannou, Technician 2nd Grade has been granted study leave in UK to obtain a BSc degree in Civil Engineering.

Nicolas Christophides, Executive Engineer I, has been granted study leave in U K to obtain MSc in Construction Engineering.

Costas Andreou, Senior Water Engineer, has been granted a scholarship offered by the European Institute for Water and the Commission of the European Communities in Malta between 30.10.88-10.11.88 to attend a short training course for the operation managers of waste water treatment plant.

Seminars, Conferences, Duty broad

Savvas Theothosiou, Mechanical Engineer I, visited U K between 31.1.88-11.2.88 for works inspection of pumps for the Contract S3.

Christodoulos Christodoulou, Principal Water Engineer, Charalambos Kridiotis, Executive Engineer I, participated to the first Panhellenic Conference on Geological Engineering between 3.2.88 - 5.2.88.

Nicos Stylianou, Senior Water Engineer, Elias Kambourides, Executive Engineer I, visited S. Korea between 25.1.88-3.2.88 to take part in the inspection and witness testing of the pipes and fittings for the Akrotiri Irrigation Sypply.

Nicos Tsiourtis, Senior Water Engineer, Elias Eliades, Technical Superintendent, Alexandros Avgousti, Chief Foreman visited Thessaliniki Greece between 29.1.88-12.2.88 for inspection of the manufacture of Hydrants for the Southern Conveyor Project Kokkinokhoria.

Andreas P Georghiades, Senior Water Engineer, Demos Patsalides, Executive Engineer I, visited England between 23.2.88-28.2.88 to witness testing of valves for kokkinokhoria.

Maria Zachariou, Executive Engineer I, visited Greece between 10.3.88-11.3.88 to participated a two days seminar on implementation of Technologies on Nature conservation in European and Mediterranean countries organized by the Technical Chamber of Greece.

Nicos Neocleous, Executive Engineer I, visited Greece between 29.2.88-5.3.88 for the inspection of the manufacture of A C pipes for the Southern Conveyor Project Akrotiri Area.

Nicos Tsiourtis, Senior Water Engineer, visited England between 27.3.88-1.4.88 in order to witness to testing of valves for Southern Conveyor Project Kokkinokhoria Irrigation area.

Kyprianos Hassabis, Assistant Director, Savvas Thodosiou, Mechanical Engineer I, visited S. Korea between 29.4.88-8.5.88 for the inspection of the manufacture of the ductile iron pipes and fittings for the S3 Contract.
Savvas Theodosiou, Mechanical Engineer I, visited England between 12.4.88 - 17.4.88 to attend co-ordination meeting between Contractor, Consultant and Employer at Reeding and Swindon for the Contract S3.

Elias Eliades, Technical Superintendent, Costas Avlonitis, Assistant Chief Foreman visited Thessaloniki Greece between 12.4.88-24.4.88 in order to witness to testing of Hydrants for Southern Conveyor Project Kokkinokhoria.

Nicos Tsiourtis, Senior Water Engineer participated to the 14th Ministerial Session of the World Food Council, at Nicosia between 23.5.88-26.5.88.

Constantinos Lytras, Director, visited Marceilles France between 17.5.88-21.5.88 to participate to the annual Meeting of Directors of the Mediterranean Water Institute.

Constantinos Lytras, Director, Christos Marcoullis, Senior Water Engineer, Iacovos Iacovides, Senior Hydrogeologist, Charalambos Kridiotis, Executive Engineer I, visited Greece between 22.5.88-30.5.88 and particularly some of the Greek islands, in order to examine the possibilities of construction of earth ponds as a solution to their water problems within the framework of technical cooperation of Greece and Cyprus.

Christodoulos Artemis, Senior Water Engineer, Nicos Neocleous, Executive Engineer I, visited RIO DE JANEIRO between 12.9.88-16.9.88 to participate to the 17th International Meeting on Water Supply.

Christodoulos Christodoulou, Principal Water Engineer, visited Washington USA between 26.7.88-29.7.88 for discussions with the World Bank for the tender documents of the Diarizos Diversion within SCP Phase II.

Constantinos Lytras, Director, Iacovos Iacovides, Senior Hydrogeologist, Branco Milinusc, Consultant, visited England between 7.9.88-10.9.88 for the Arbitration of Asprokremmos Dam.

Savvas Theodosiou, Mechanical Engineer I visited S. Korea between 2.9.88-14.9.88 for the inspection of the manufacture of the ductile iron pipes and fittings for the Contract S3.
Nicos Tsiourtis, Senior Water Engineer, Sofoclis Aletraris, Topoghrapher Irrigation Engineer I, visited Israel between 4.9.88-8.9.88 for study tour on filtration of water for irrigation purposes.

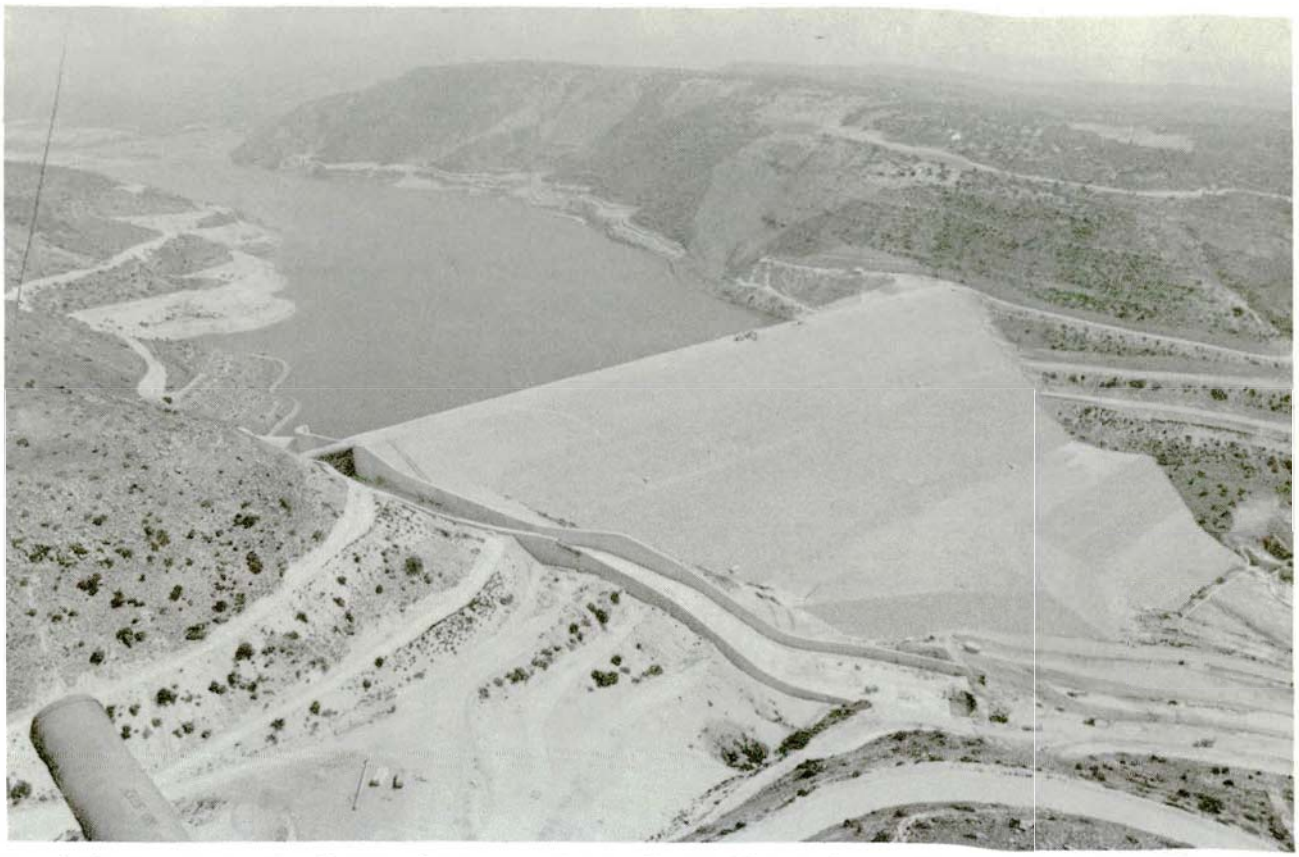
Maria Zachariou, Executive Engineer I, visited Jordan between 24.9.88-30.9.88 to attend the Seminar Organized by FAO-Regional Project on Treatment and Reuse of Sewage Effluent for Irrigation.

Savvas Theodosiou, Mechanical Engineer I, visited Glascow UK between 16.10.88-21.10.88 for works inspections of the pumps for the Kophinou Pumping Station.

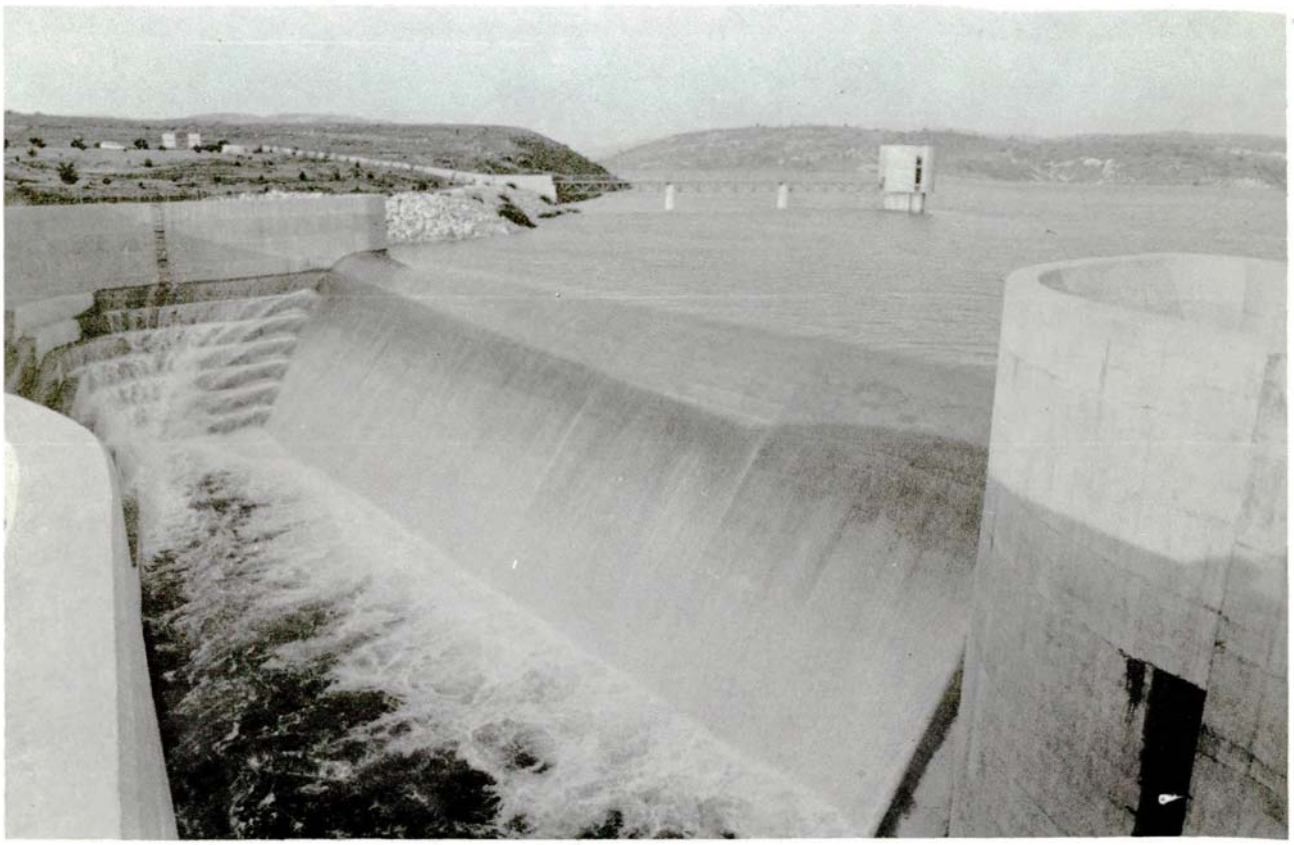
Kyprianos Hassabis, Assistant Director, Christodoulos Artemis, Senior Water Engineer, visited USSR between 11.11.88-20.11.88 as guests of the USSR Ministry of Water Resources.

Constantinos Lytras, Director, visited Kairo Egypt between 8.12.88-10.12.88 to attend the Meeting of Directors of the Mediterranean Water Institute.

Dhedalos Kypris, Senior Hydrogeologist, visited Kairo Egypt between 10.12.88-16.12.88 to attend the Seminar Organized by FAO Regional Project on the treatment and Reuse of Sewage Effluent for Irrigation.



Aerial photograph of Kouris Dam taken after first impoundment. The dam gates were shut on the 17.12.87 and by March 1988 a quantity of 51.25 MCM was impounded in the dam reservoir.
WDD photo F35EN-18. Taken on 30.8.88



The first overflow of Asprokremmos dam, which was constructed in 1982, was on the 2nd March 1988. The total inflow into the dam reservoir during 1988 exceeded the capacity of the dam which is 51 MCM.
WDD photo E70EN-3. Taken on 4.3.88.

The first flow of water from Kouris dam through the 110 km long, 1400-800 mm dia DI pipeline from Kouris to Akhna dam reservoir.
WDD photo E58EN-9.
Taken on 9.2.88.

Floods at the Pedhieos Irish bridge in Nicosia just below the Presidential Palace.
WDD phto E72EN-23. Taken on 8.3.88.

II DIVISION OF WATER RESOURCES

by
D C Kypris
Senior Hydrogeologist
Head of Division

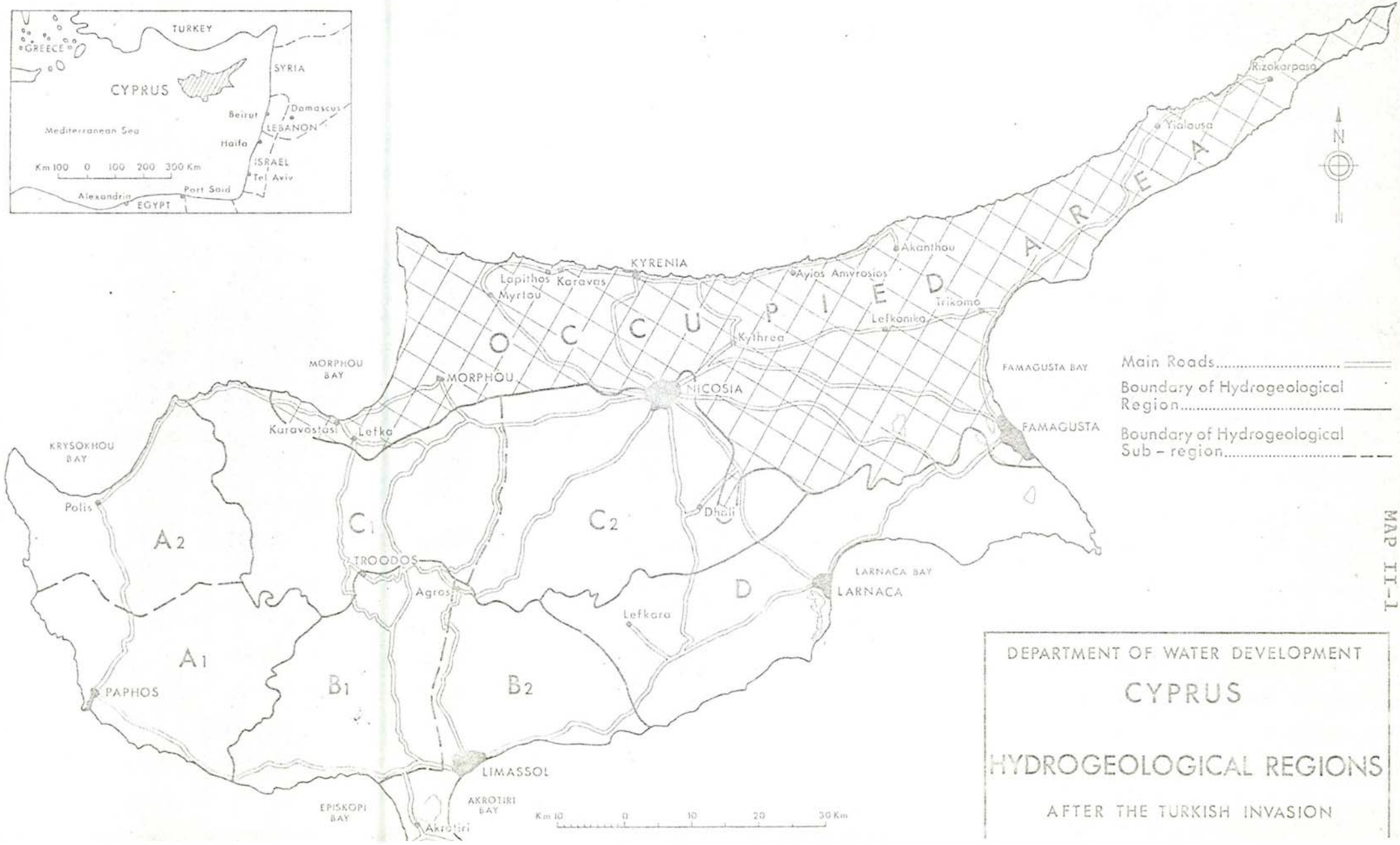
General

During 1988 again no hydrological data could be collected by this Department in the Northern part of Cyprus still occupied for the forteenth year by the Turkish troops and approximately amounting to 40% of the Cyprus land. So the behaviour of both surface runoff and groundwater bodies could not be followed or recorded in the Northern part of the country during the year under examination.

INTRODUCTION

The main tasks assigned to the Division of Water Resources are the collection and processing of Hydrological and Hydrogeological data, regarding both ground and surface water, to deal with hydrogeological problems as connected with the planning and execution of water works projects, to carry out auxiliary drilling operations, to control groundwater extraction and use and monitor water quality for the purpose of both pollution control and advising on water supply problems.

Cyprus has been divided into eleven hydrogeological regions based on both hydrogeological and administrative criteria, which were followed for reasons of better control on the collection of hydrogeological data and thorough hydrogeological studies, until July 1974 when the Turkish invasion occurred. For the year under examination since the Turkish troops are still occupying



DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

HYDROGEOLOGICAL REGIONS

AFTER THE TURKISH INVASION

part of Cyprus, a new arrangement is followed. (see map II-1).

During 1988, D C Kypris, Senior Hydrogeologist, was the Head of the Division. M Peppis, Geologist Class I, was the Assistant Head, the Head of the Drilling Permits and Water Control Branch and he acted also as the chairman of the specially formed advisory committee for the issue of well permits. Dr St. Papatryphonos, Hydrologist Class I, was the Head of Hydrometry Branch.

DRILLING OPERATIONS

Drilling operations 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:

- Cleaning of 17 existing boreholes

- Drilling of 21 boreholes. Total penetrated depth 633 m.

TEST PUMPING

In order that the Department will be in a position to express views on the water supply sources proposed to be used for the division of land into building plots or the erection of hotels, industries or other establishments, it undertakes to carry out pumping tests the results of which are communicated to the appropriate authorities.

Pumping tests are also carried out for Government works.

During 1988, 51 test pumpings were carried out as follows:-

- 12 for division of land with total hours pumped..... 504
- 39 for building permits with total hours pumped..... 116

METEOROLOGICAL SUMMARY FOR THE HYDROMETEOROLOGICAL YEAR 1987-1988

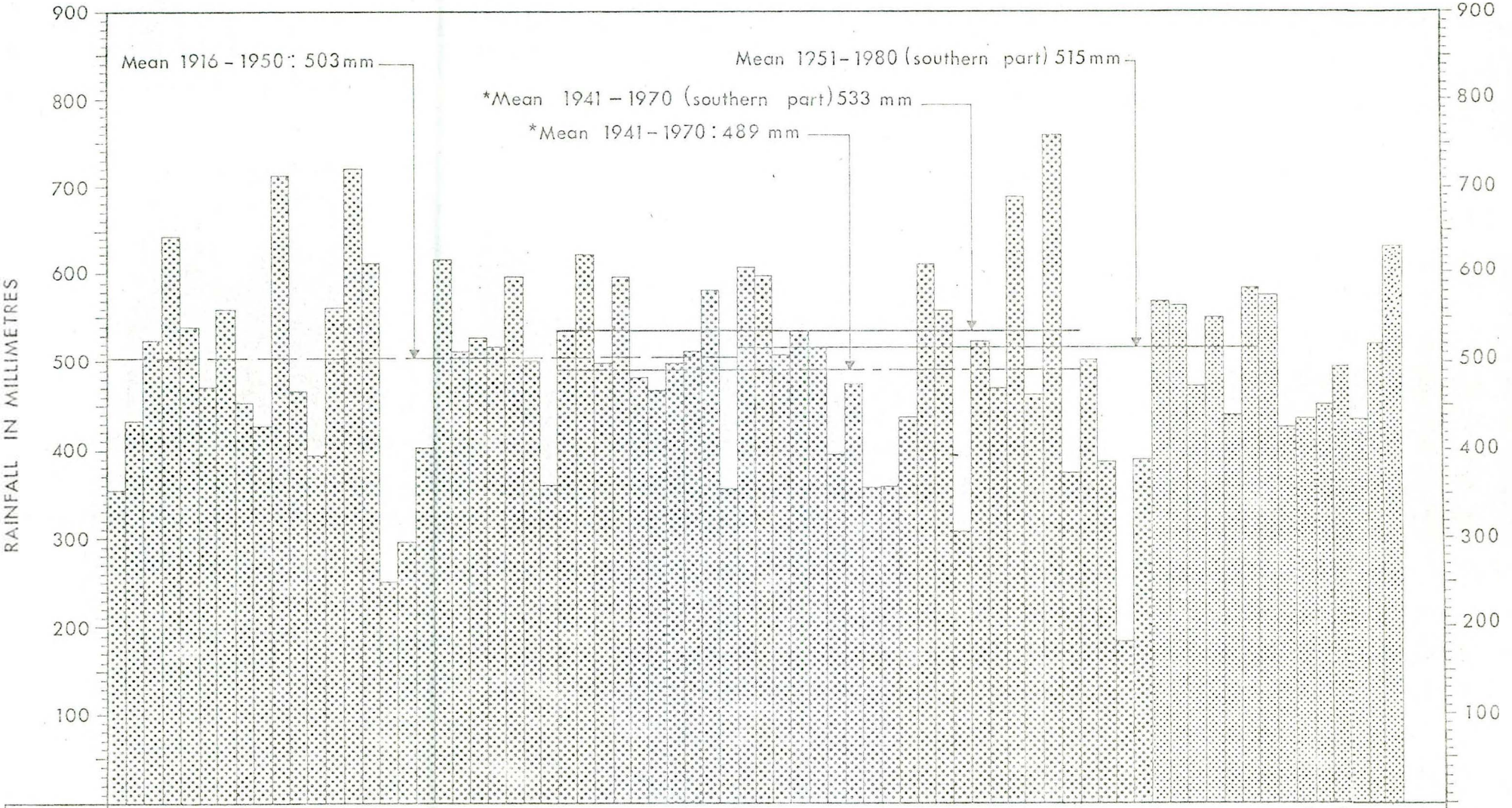
As it is not possible for the Meteorological Service of the Republic of Cyprus to obtain measurements of various meteorological elements in the Northern part of the island because it is occupied by Turkish troops, the data given below relate to the weather experienced in the southern part of the island during the hydrometeorological year 1987-1988.

Precipitation

The yearly total precipitation averaged over the part of the island under Government control during the hydrometeorological year October 1987 - September 1988 was 625.4 mm which is 121% of normal. Normal is considered the average rainfall over the southern part of the island during the period 1951-1980. (see diagram II-1)

The total precipitation amounts during the period were above normal in most areas and ranged mainly between 100% and 150% of normal, while in Kokkinokhoria area they ranged between 150% and 200% of normal. However the cumulative precipitation amounts were below normal in small parts of the eastern and northern Troodos Mountain slopes and western coastal areas. (see map II-2).

ANNUAL AVERAGE RAINFALL OF CYPRUS · 1916 - 1988



HYDROL. YEAR	RAINFALL in mm
1916-17	354
1917-18	433
1918-19	523
1919-20	644
1920-21	540
1921-22	472
1922-23	560
1923-24	454
1924-25	428
1925-26	713
1926-27	468
1927-28	395
1928-29	562
1929-30	720
1930-31	610
1931-32	251
1932-33	296
1933-34	402
1934-35	615
1935-36	511
1936-37	527
1937-38	516
1938-39	596
1939-40	500
1940-41	360
1941-42	534
1942-43	620
1943-44	498
1944-45	595
1945-46	482
1946-47	467
1947-48	498
1948-49	511
1949-50	580
1950-51	355
1951-52	605
1952-53	596
1953-54	506
1954-55	533
1955-56	515
1956-57	394
1957-58	474
1958-59	357
1959-60	358
1960-61	437
1961-62	608
1962-63	557
1963-64	306
1964-65	522
1965-66	469
1966-67	688
1967-68	462
1968-69	759
1969-70	373
1970-71	501
1971-72	387
1972-73	182
1973-74	389
1974-75	567
1975-76	563
1976-77	471
1977-78	549
1978-79	439
1979-80	582
1980-81	574
1981-82	425
1982-83	436
1983-84	451
1984-85	496
1985-86	435
1986-87	520
1987-88	631

*Mean rainfall refers to calendar years here

Note: Annual average as from 1974 - 75 refers to southern part of Cyprus only

Diagram II-1

As regards the monthly distribution of precipitation, it was well above normal in October 1987, well above normal in December 1987, February, March, July and August 1988 and below normal in all the remaining months. (see diagram II-2)

Table II-1 giving the incidence o rainfall during the hydrometeorologial year 1987-1988, illustrates the situation:

TABLE II-1
INCIDENCE OF RAINFALL DURING THE HYDROMETEOROLOGICAL YEAR 1987-1988

Months	Rainfall (in mm)	Rainfall (in inches)	Percentage of yearly total	Percentage of monthly normal
October	37.9	1.49	6	117
November	26.9	1.06	4	54
December	160.1	6.30	26	139
January	102.5	4.03	16	93
February	112.3	4.42	18	147
March	132.5	5.22	21	212
April	17.5	0.69	3	54
May	13.9	0.55	2	71
June	5.5	0.22	1	85
July	7.5	0.29	1	313
August	5.5	0.22	1	177
September	3.3	0.13	1	66
Totals	625.4	24.62	100	-

Note: Yearly total as percentage of yearly normal: 121%

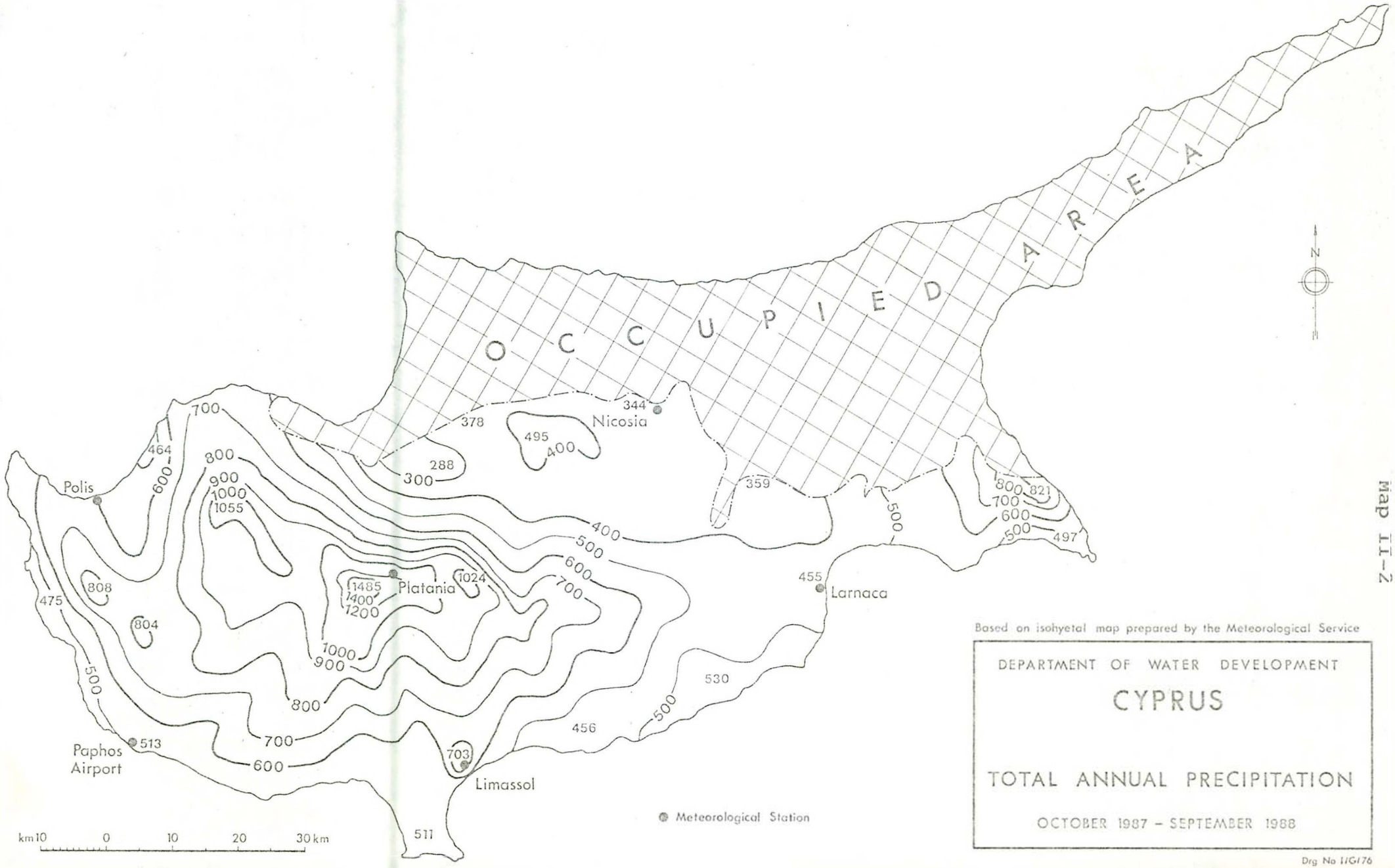
The maximum amount of rainfall in a 24-hour period during the hydrometeorological year was 290.0 mm. This was reported on the 15th February 1988 by Dherinia rainfall station.

The first snowfall occurred on the higher parts of Troodos mountains on the 6th November 1987, which is about three weeks earlier than the median date for the first snowfall in Cyprus. From the existing records which go back to 1961, this becomes the earliest date for the first snowfall in Cyprus. Subsequent snowfalls occurred during the ensuing months till April. The last one occurred on Olympus on the 20th April 1988 which is one week beyond the median date for the last snowfall in Cyprus.

Hail occurred in October and December 1987, and in the period January to July 1988. A heavy hailstorm affected parts of Kokkinokhoria area in the afternoon and night of the 15th February 1988 and caused severe damages to properties and crops.

Temperature

During the hydrometeorological year 1987-1988 as a whole air temperature was around normal. In particular, monthly mean temperatures were well below normal



Based on isohyetal map prepared by the Meteorological Service

DEPARTMENT OF WATER DEVELOPMENT

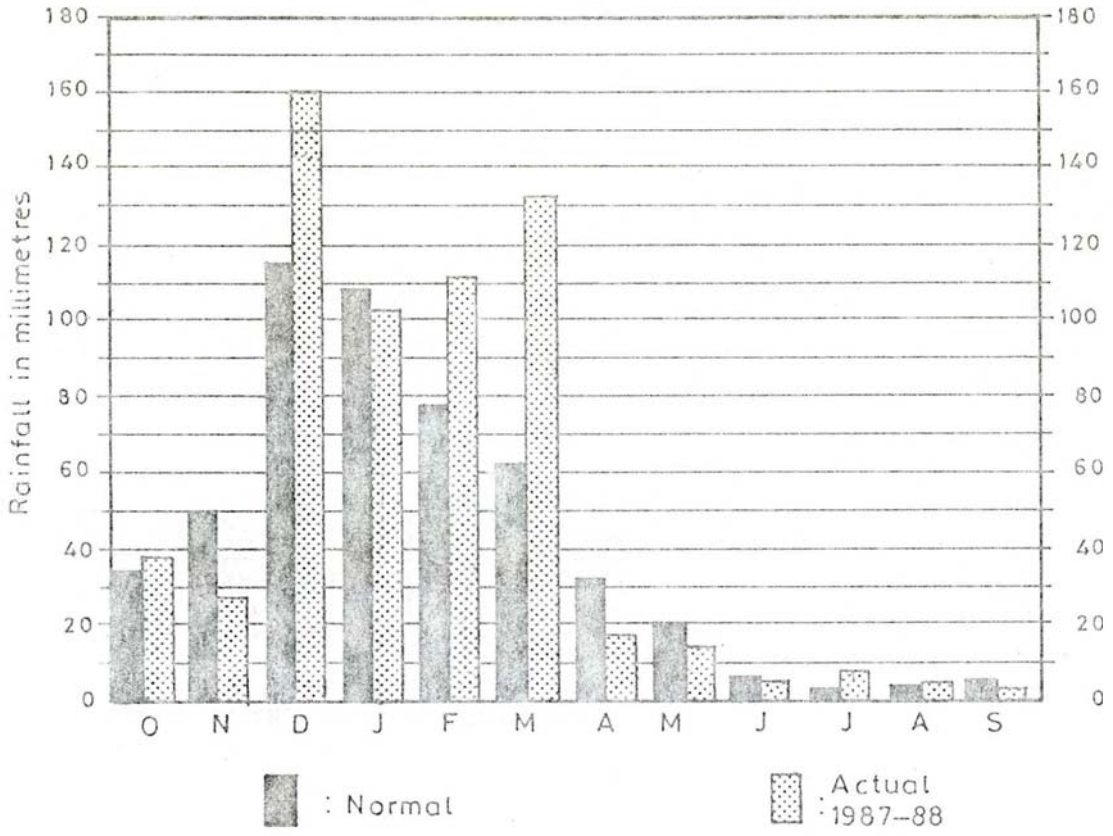
CYPRUS

TOTAL ANNUAL PRECIPITATION

OCTOBER 1987 – SEPTEMBER 1988

Drg No 1/G176

GRAPHICAL PRESENTATION
OF INCIDENCE OF RAINFALL 1987 -1988



in October November and December 1978 and in March 1988, around normal in January and February 1988, slightly above normal in April and June 1988, above normal in May, August and September 1988 and well above normal in July 1988.

The extreme maximum and extreme minimum air temperatures recorded during the hydrometeorological year under review are shown in table II-2.

TABLE II-2
INCIDENCE OF MAXIMUM AND MINIMUM TEMPERATURES 1987-1988

Station	Extreme maximum temperature and date		Extreme minimum temperature and date	
Nicosia.....	41.3	17th July	-0.1	28th December
Limassol Garden.....	40.3	8th July	3.7	18th January
Larnaca Airport.....	39.0	8th July	2.0	28th December
Paphos Airport.....	36.3	16th May	1.8	5th March
Panayia Bridge.....	39.3	7th July	-2.8	25th February
Saittas.....	40.0	8th July	-2.0	25th February
Amiandos.....	32.0	19th September	-6.0	16th January
Prodhromos.....	31.6	4th & 27th July	-5.0	16th & 17th January
Stavros.....	38.0	8th July	-2.1	25th February
Kornos.....	39.5	7th July	-1.0	25th February
Platania.....	33.5	16th May & 7th July	-5.1	25th February
Phasouri.....	40.5	8th July	0.0	5th March

Evaporation

Monthly total evaporation (in mm) measured from United States Weather Bureau (U.S.W.B.) class "A" pan during the hydrometeorological year 1987-1988 at selected stations is given in table II-3.

TABLE II-3

MONTHLY EVAPORATION FROM CLASS "A" PAN IN mm

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Total
Nicosia.....	123	54	31	36	39	75	130	228	269	317	263	202	1767
Paralimni.....	152	82	69	55	63	94	127	195	235	302	261	206	1841
Larnaca Airport	173	116	74	77	80	127	176	238	256	338	276	232	2163
Saittas.....	123	70	37	37	45	77	137	212	239	280	223	187	1667
Akhelia.....	143	89	69	58	62	94	131	192	216	257	229	194	1734
Yermasoyia.....	126	94	54	43	56	84	113	210	243	282	234	197	1736
Polemidhia.....	153	92	62	54	60	107	120	186	222	258	251	196	1761
Prodhromos.....	73	47	31	25	25	56	109	173	200	251	181	157	1328

SURFACE WATER

Permanent Stream Gauging Stations

On important streams at selected places, permanent flow gauging stations equipped with automatic water level recorders have been established for the

purpose of calculating the quantity of water flowing through each station. All these stations have to be inspected regularly i.e. every week, fortnight or month for the purpose of cheking and maintenance of equipment, change of charts, velocity measurements of flowing water with current meter for calibration purposes, etc. During the wet season the visits are more frequent for high flow measurements and sampling for suspended sediment and chemical analysis. The condition of float wells and weirs is also checked and cleaned when necessary.

Out of all our stations only 61 could be regularly inspected because, in the northern part of the island we have not been able to attend any flow gauging stations, due to the presence of the Turkish invasion troops, still occupying almost 40% of Cyprus for the thirteenth year now.

The general conclusion obtained from the study of this year's records of the above flow gauging stations, is that the flow of most of them was above normal because of the high precipitation during the winter months.

The annual flow of some selected flow gauging stations are presented in table II-4

TABLE II-4

DISCHARGE OF SELECTED STREAMS AS CALCULATED AT SELECTED FLOW GAUGING STATIONS FOR THE YEAR 1987-1988

Ser. No.	Station	Stream	Location	Annual flow 10 m
1	1-2-7-90	Dhiarizos	Kouklia	57.5
2	1-4-9-80	Ezusas	Akhelia	31.1
3	2-2-8-95	Khrysokhou	Coast	3.3
4	2-8-3-10	Limnitis	Saw Mill	18.4
5	3-3-3-95	Karyotis	Evrykhou	17.0
6	3-5-4-40	Elea	Vyzakia	8.2
7	3-7-1-50	Peristerona	Panayia Br.	21.4
8	3-7-3-90	Akaki	Malounda	15.8
9	6-1-1-80	Ay. Onoufrios	Kambia	2.5
10	6-1-1-85	Pedhieos	Kambia	5.5
11	6-5-3-15	Yialias	Nisou	4.1
12	8-4-5-30	Tremithios	Klavdhia	1.3
13	8-9-5-40	Vasilikos	U/S Kalavasos Dam	12.9
14	9-2-3-85	Yermasoyia	U/S Yermasoyia Dam	24.3
15	9-6-2-90	Kryos	U/S Kouris Dam	14.0
16	9-6-4-90	Kouris	U/S Kouris Dam	29.3
17	9-6-7-70	Limnatis	U/S Kouris Dam	26.4

Repairs and Improvements to Existing Flow Gauging Stations

During the year under review, repairs and improvements were carried out on the following flow gauging stations:

Yialias river near Kotchati: Construction of a masonry Kiosk to house the water level recorder.

Dhiarizos river near Kouklia: Extension of the invert of flume by 5m and repairs to the apron which suffered serious damages by the floods.

Limnitis river upstream Kouris Dam: Construction of access road.

Flood Discharges

All winter months during the hydrometeorological year had a high precipitation as a result of which our streams had a high flow during winter and spring months; A good number of floods were recorded on most of our stations; the most noteworthy are listed in table II-5.

TABLE II-5

FLOOD DISCHARGES

Stream	Location	Watershed area (Km)	Maximum flow (m /s)	Date
Dhiarizos	Kouklia	260	45	10. 3.88
Limnatis	U/S Kouris Dam	115	29	21.12.87
			12.0	22. 6.88
Peristerona	Panayia Br.	77	22	21.12.87
			20	24. 1.88
			24	9. 3.88
Kouris	U/S Kouris Dam	96	21	21.12.87
Dhiarizos	Phinikaria	125	20	10. 3.88
Yermasoyia	Phinikaria	110	20	21.12.87
			14	11. 3.88
Ezusas	Moronero	180	19.5	10. 3.88
Ezusas	Akhelia	210	18.0	20. 2.88
			15.5	10. 3.88
Limnitis	Limnitis Saw Mill	48	17.5	11. 3.88
Akaki	Malounda	90	17.0	9. 3.88
Xeros	Lazaridhes	67	16	24. 1.88
Karyotis	Skouriotissa	85	15.0	29. 7.88
Marathasa	U/S Kalopanayiotis Dam	23	14.0	29. 7.88
Ay. Nikolaos	Kakopetria	16.0	12.5	29. 7.88
Vasilikos	Layia	86	14.5	21.12.87
Yialias	Nisou	91	12.0	8. 3.88
Mylou	Kornos	32	10.0	8. 3.88
Vathys	Paralimni	12.0	5.6	21.12.87
			7.6	15. 2.88
Liopetri	Liopetri	11.5	5.5	15. 2.88

Inflow of Water in Dams and Ponds

During 1988 out of 76 most important dams and ponds in Cyprus which were under regular observations in the past, only 59 could be observed as the remaining are situated in the northern part of the island which is still under Turkish occupation.

The water accumulated in the 59 dams and ponds under regular observations, was the highest ever, because of the high precipitation of the hydrometerological year under review and the completion of Kouris and Akhna dams, which added to the already available reservoir capacity another 121.8 m.c.m. The maximum volume of water accumulated was 181.8 MCM or 66.5% of the total capacity of these dams and ponds which is 273.3 MCM. All small dams and ponds as well as some of the major dams were overflowing for a long period. Asprokremmos dam, the second biggest dam in the island, overflowed for the first time since its construction. Analytically the situation is shown on table II-6.

Spring Discharges

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

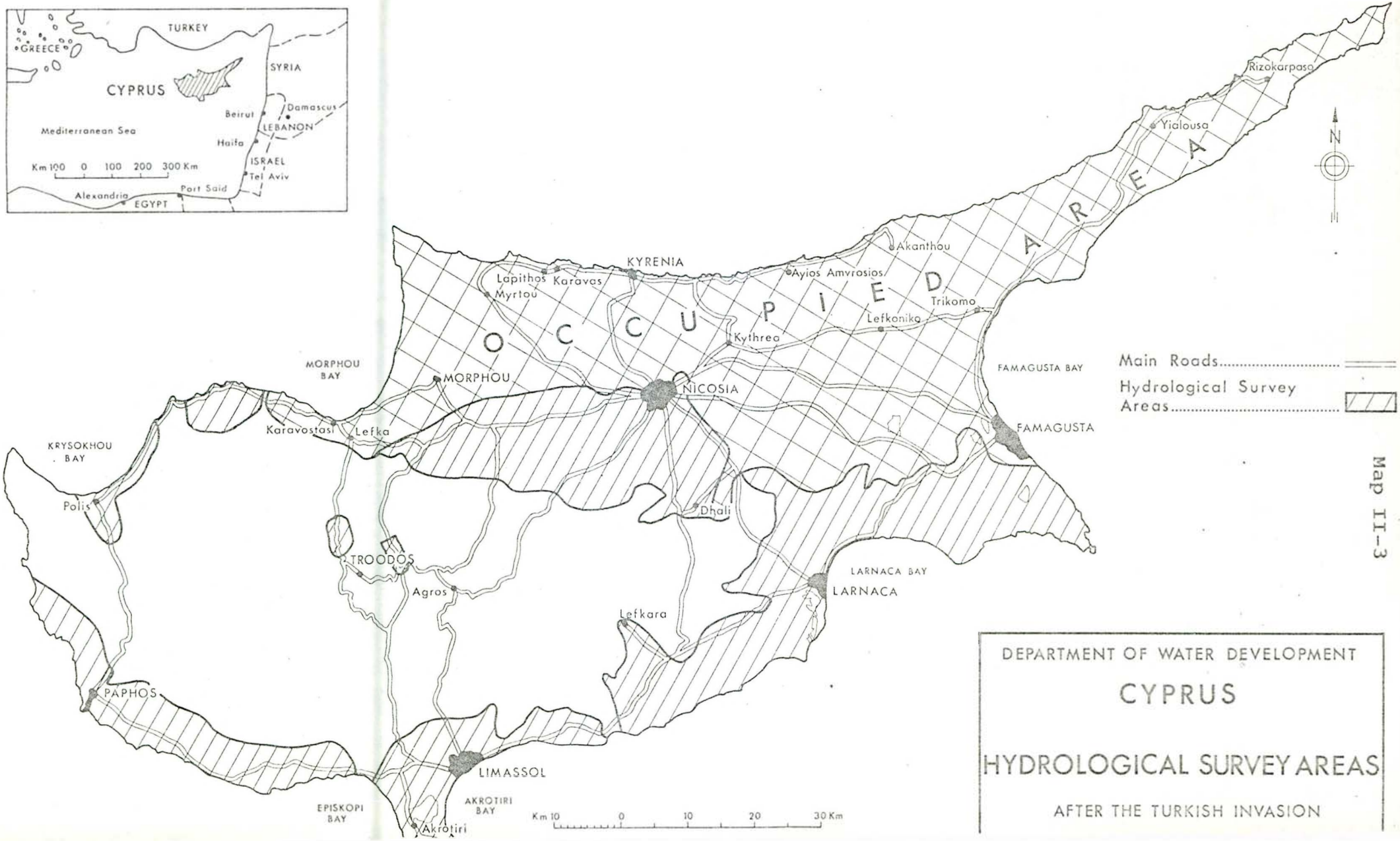
During the hydrological year under 1987-88 1415 spring and minor stream discharges were taken on 167 springs and minor streams; 420 discharges were taken on 35 springs which are under regular monthly observations and 995 discharges were taken on 133 springs and minor streams for a certain period at various intervals.

As the rainfall during the hydrometeorological year under review was above normal most springs maintained a high flow throught the whole year.

TABLE II-6

ACCUMULATION OF WATER IN THE DAMS AND PONDS DURING 1988

Ser. No.	Name of Dam/ Pond	Capacity M.C.M.	Storage 1.10.88 M.C.M.	Max. Storage M.C.M.-Date	Min. Storage M.C.M.-Date	Overflow Period
1	Agridhia	0.059	0.015	0.059-13.2.88	0.010- 1.11.88	13.2- 5.5
2	Agros	0.080	0.022	0.080-11.3.88	0.013- 2.12.88	11.3-20.4
3	Akapnou - Ephtagonia	0.13	0.037	0.13 - 5.2.88	0.035- 1.11.88	5.2-30.4
4	Akhna	6.8	1.8	2.9 -26.4.88	1.65 -28.11.88	
5	Akrounda	0.022	0.022	0.022	0.022	
6	Arakapas Dam	0.13	0.094	0.13 - 1.1.88	0.094-28. 9.88	1.1-10.8
7	Arakapas Pond No 1	0.19	0.052	0.19 -23.3.88	0.052- 1.10.88	23.3-20.4
8	Arakapas Pond No 2	0.12	0.027	0.12 -30.4.88	0.022- 1.11.88	15.4-10.5
9	Argaka	0.99	0.105	0.99 - 4.2.88	0.08 - 4.11.88	4.2-31.5
10	Asprokremmos	52.4	43.0	52.4 - 2.3.88	41.7 - 6.12.88	2.3- 2.4
11	Athalassa	0.80	0	0	0	
12	Ayia Marina	0.30	0.07	0.30 - 9.3.88	0.047-26.10.88	9.3-14.5
13	Ayii Vavatsinias	0.053	0.025	0.053-23.1.88	0.025- 1.10.88	1.1- 1.7
14	Ayii Vavatsinias No 1	0.055	0.036	0.055- 1.1.88	0.032-27.10.88	1.1-20.4
15	Ayii Vavatsinias No 2	0.043	0.022	0.043-23.3.88	0.020-27.10.88	23.3-10.5
16	Dhierona	0.16	0.049	0.16 -31.3.88	0.039- 1.11.88	10.3- 1.5



Map II-3

DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

HYDROLOGICAL SURVEY AREAS

AFTER THE TURKISH INVASION

TABLE II-6
ACCUMULATION OF WATER IN THE DAMS AND PONDS DURING 1988 (cont.)

17	Dhypotamos	13.7	4.65	7.3 - 9.5.88	4.0 -16.12.88	
18	Ephtagonia No 1	0.092	0.022	0.092-31.3.88	0.014- 1.11.88	20.3- 1.5
19	Ephtagonia No 2	0.13	0.043	0.13 -31.3.88	0.021- 1.11.88	20.3- 1.5
20	Ephtagonia No 3	0.065	0.023	0.065-31.3.88	0.021- 1.11.88	20.3- 1.5
21	Esso Galata	0.035	0.009	0.035-19.1.88	0.008-27.10.88	15.1-10.5
22	Evretou	25.5	15.9	19.6 - 4.5.88	15.1 -15.12.88	
23	Kalavasos	17.1	9.8	13.6 - 6.5.88	8.9 -15.12.88	
24	Kalokhorio	0.032	0.007	0.032- 1.1.88	0 -24.10.88	13.2- 4.5
25	Kalopanayiotis	0.36	0.070	0.36 -21.3.88	0.072- 4.10.88	21.3-25.6
26	Kandou	0.038	0.021	0.038- 1.1.88	0.017- 1.11.88	
27	Kato Mylos	0.10	0.014	0.10 -10.4.88	0.09 - 1.11.88	5.3-15.4
28	Khandria	0.070	0.005	0.070-13.2.88	0 - 1.11.88	13.2-10.5
29	Khirokitia	0.20	0.011	0.20 -30.4.88	0.002-27.10.88	2.5-20.5
30	Kiti	1.6	0	1.3 -27.4.88	0 -11.10.88	
31	Kourris	115	44.8	52.6 -24.6.88	44.1 -24.10.88	
32	Kyperounda No 1	0.053	0.012	0.053- 7.1.88	0.012- 1.11.88	7.1-20.5
33	Kyperounda No 2	0.27	0.051	0.27 -23.3.88	0.036- 1.11.88	23.3-15.5
34	Lagoudhera	0.070	0.027	0.070-14.2.88	0.021- 1.11.88	14.2-16.5
35	Lefka-Kafizes	0.11	0.025	0.11	0.025- 1.10.88	
36	Lefka Marathasa	0.37	0.30	0.37	0.30 - 1.10.88	
37	Lefkara	13.8	2.3	4.2 -15.4.88	1.6 -15.12.88	
38	Liopetri	0.32	0	0.32 March	0	16.2
39	Lythrodonda U	0.032	0	0.032-12.1.88	0 -29. 9.88	12.1-15.5
40	Lythrodonda L	0.032	0.010	0.032-25.1.88	0 -25.10.88	25.1-21.5
41	Lymbia	0.22	0.044	0.22 -24.1.88	0.030-30.10.88	25.1-18.5
42	Mavrokolymbos	2.2	0.60	2.2 -19.4.88	0.43 -29.10.88	
43	Melini	0.059	0.013	0.059-28.2.88	0.008-27.10.88	28.2-10.4
44	Ora	0.062	0.004	0.062- 5.3.88	0.001-27.10.88	5.3-10.5
45	Pakhyammos	0.043	0	0.043-14.2.88	0- 2. 9.88	14.2- 8.4
46	Palekhori	0.62	0.027	0.62 -21.2.88	0.015-25.10.88	21.2- 1.5
47	Pelendria	0.12	0.032	0.12 -23.3.88	0.032-28. 9.88	2.3-15.5
48	Pera Pedhi	0.055	0.020	0.055-April	0.020-28. 9.88	
49	Petra Upper	0.010	0	0.010-23.1.88	0-30. 8.88	25.1-10.5
50	Petra Lower	0.025	0	0.025- 4.2.88	0-30. 8.88	4.2-30.4
51	Pharmakas No 1	0.021	0.005	0.021-10.3.88	0.004-24.10.88	10.3- 2.5
52	Pharmakas No 2	0.061	0.008	0.061- 3.3.88	0.004-24.10.88	3.3- 2.5
53	Polemidhia	3.4	1.75	3.4 -11.3.88	1.55 -14.12.88	11.3- 2.5
54	Pomos	0.86	0.16	0.86 -18.2.88	0.10 -26.10.88	18.2-14.5
55	Prodhromos	0.12	0.035	0.11 -14.2.88	0.035-24.10.88	
56	Pyrgos	0.28	0	0.28 -31.1.88	0-20.10.88	31.1- 1.5
57	Trimiklini	0.34	0.32	0.34	0-15.11.88	
58	Xyliatos	1.2	0.62	1.2 -24.1.88	0.55 - 2.11.88	24.1- 5.5
59	Yermasoyia	13.5	7.5	13.5 - 6.3.88	6.1 -16.12.88	6.3-14.5
	Totals %	273	49.5	66.7	46.5	

GROUND WATER

Ground Water Hydrological Work

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 area occupied by the Turkish troops. So, during the year under review, the plotting of boreholes/wells and the collection of other hydrological information continued in the free areas, where hydrological work was being carried out before. The area during the current year where such work has been carried out was 3 092 sq. km (see map II-3). The springs wells/boreholes which were on register at the end of 1988 were 32 798.

The new areas brought under hydrological observation during the year have an extent of about 26.3 square kilometers. A number of 1258 wells/boreholes and srpings were plotted or replotted in this area with their relative information recorded. A supplementary plotting was also carried out in the areas already covered for 808 new wells/boreholes.

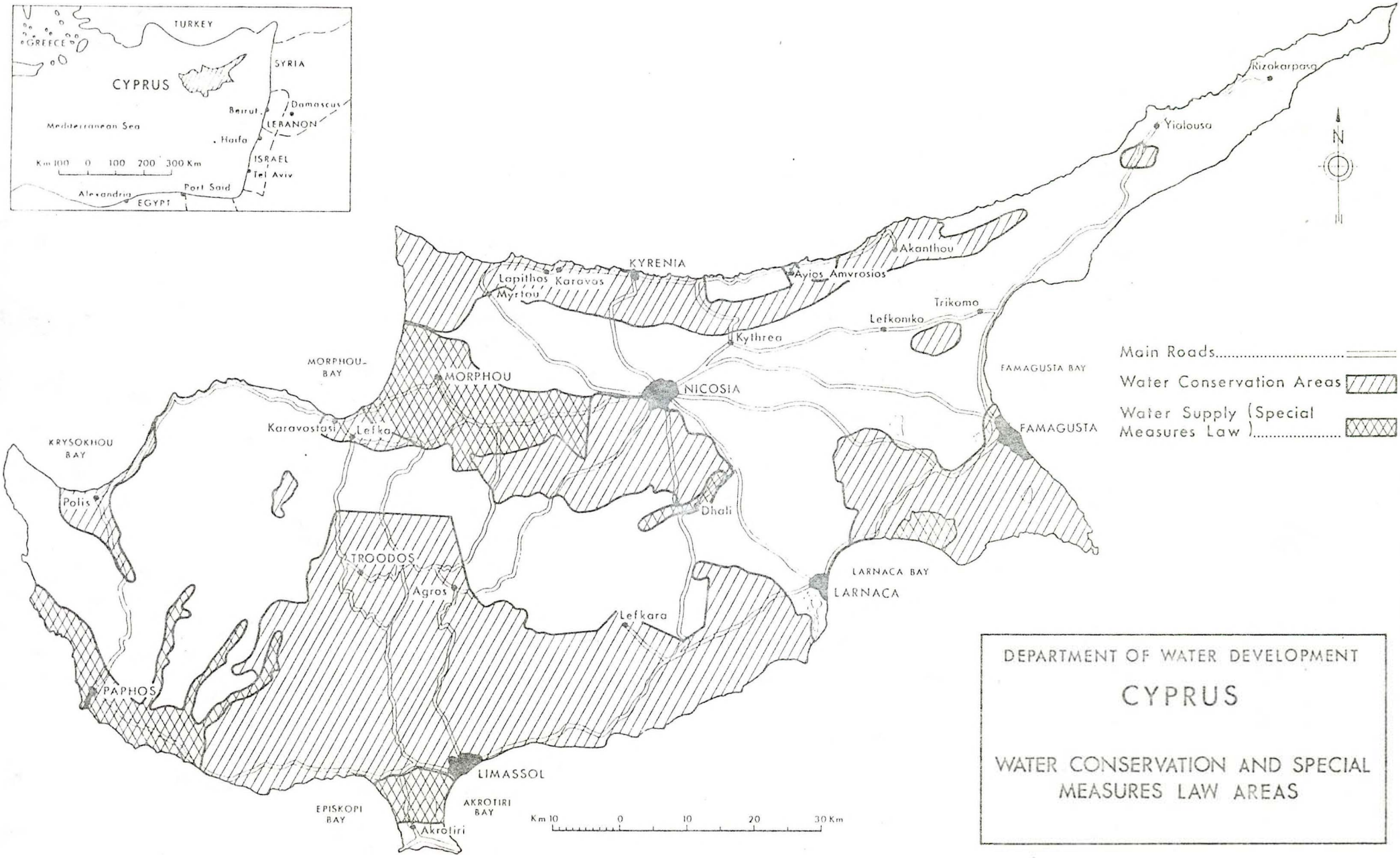
Through the Hydrological Surveys all wells/boreholes, springs and chain-of-wells are registered and plotted on maps. A dense network of observation boreholes, is being levelled. Through these observation boreholes/wells, the water level is being measured twice a year, at the end of the dry season (November), 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. The number of observation boreholes monitored twice during 1988 is 1 349 and, every month or fortnight 370.

For the purpose of establishing the quantity of water pumped from our aquifers a questioning program is carried out once a year, through which information from our farmers is sought as regards the extent and type of plantations, the irrigation system used and other relative information from which the amount of water used is determined, crosschecked wherever possible from water meter readings, or electricity meter readings and pump output. It has been established through questioning that during 1988 14580 wells/boreholes and springs were in use in our most important irrigating areas.

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.

During 1988 the number of groundwater samples from observation boreholes analysed for Cl was 1325.

As regards groundwater situation, due to the high mainfall that occured during the hydrometeorological year 87-88, a subtantial improvement was noted in general. But still in some places, i.e. Kokkinochoria area, the situation remains critical.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GREECE
SYRIA
CYPRUS
Beirut
Damascus
LEBANON
Mediterranean Sea
Haifa
ISRAEL
Km 100 0 100 200 300 Km
Tel Aviv
Port Said
Alexandria
EGYPT
Rizokarpasa
Yialousa
N
KYRENIA
Akanthou
Lapithos
Karavas
Myrtou
Ayios Amvrosios
Trikomo
Lefkoniko
Kythrea
MORPHOU-BAY
MORPHOU
NICOSIA
FAMAGUSTA BAY
Karavostasi
Lefka
FAMAGUSTA
KRYSOKHOU BAY
Polis
Dhali
TROODOS
Agros
LARNACA BAY
LARNACA
Lefkara
PAPHOS
LIMASSOL
EPISKOPI BAY
AKROTIRI BAY
Akrotiri
Km 10 0 10 20 30 Km
Main Roads
Water Conservation Areas
Water Supply (Special Measures Law)
DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
WATER CONSERVATION AND SPECIAL MEASURES LAW AREAS

TT-15

Map II-4

TABLE II-7
SELECTED OBSERVATION BOREHOLES

Serial No.	Hydr. No.	Village	March 1987	November 1987	March 1988	November 1988	Water Level increase (+) or decrease (-) March 1987-88	November 1987-88
71/51	66	Xylophagou...	- 19.57	- 18.79	- 18.59	- 17.71	+ 0.98	+ 1.08
126/59	26	Xylophagou...	- 7.16	- 7.40	- 6.31	- 6.38	+ 0.85	+ 1.02
56/56	192	Liopetri.....	- 1.04	- 0.66	- 0.18	- 0.28	0.86	+ 0.38
126/50	105	Ormidhia.....	- 26.18	- 30.00	- 29.20	- 28.10	+ 3.02	+ 1.90
94/52	234	Ormidhia.....	+ 11.58	+ 11.18	+ 11.62	+ 11.52	+ 0.04	+ 0.34
72/56	975	Phrenaros....	+ 8.25	+ 8.38	+ 8.19	+ 8.17	- 0.09	- 0.21
Priv.B/H	429	Sotira.....	- 1.37	- 1.37	- 1.17	- 1.10	+ 0.20	- 0.27
88/54	24	Kolossi.....	+ 1.60	- 0.95	+ 0.85	- 0.25	- 0.75	+ 0.70
51/63	813	Limassol.....	+ 1.63	+ 1.13	+ 2.13	+ 1.73	+ 0.50	+ 0.60
45/63	811	Zakaki.....	+ 1.58	+ 0.53	+ 1.43	+ 1.13	- 0.15	+ 0.60
107/61	17	Yermasoyia...	+ 1.74	+ 2.76	+ 11.83	+ 2.39	+10.09	- 0.37
180/59	8	Yermasoyia...	+ 21.68	+ 16.49	+ 33.52	+ 16.05	+11.84	- 0.44
134/59	27	Yermasoyia...	- 0.06	+ 2.08	+ 9.33	+ 1.70	+ 9.39	- 0.38
161/50	180	K. Trimithia.	+186.65	+186.84	+186.91	+186.84	+ 0.26	+ 0.40
90/50	106	K. Trimithia.	+190.41	+190.25	+190.28	+190.10	- 0.13	- 0.15
125/60	15	Episkopi.....	+ 28.46	+ 18.01	+ 27.06	+ 23.16	- 1.40	+ 5.15
EB 94/70	1236	Akrotiri.....	+ 1.26	- 0.79	+ 0.46	- 0.09	- 0.80	+ 0.70
P.B. 12	2671	Kouklia.....	+ 1.50	+ 0.35	+ 2.20	+ 1.40	- 0.70	+ 1.05
51/72	2946	Nikoklia.....	+ 40.69	+ 38.84	+ 40.49	+ 40.04	- 0.20	+ 1.20
43/63	2948	Mandria.....	+ 16.50	+ 6.55	+ 24.43	+ 5.10	+ 7.93	- 1.45
Priv.B/H	639	Kouklia.....	+ 3.26	+ 1.10	+ 4.46	+ 0.14	+ 1.20	- 0.96

CONTROL AND CONSERVATION OF GROUND WATER

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 chairman 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 District Engineer of the district where applications were to be examined, participated.

The committee performed during 1988, 38 meeting and examined 3581 applications sent to the Director, WDD by the District Officers, as follows:-

Water Supply (Special Measures) Law areas.....	470
Water Conservation areas.....	1 712
Non Water Conservation areas.....	2 095

Water Conservation Areas (Wells Law Cap 351)

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

On map II-4 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 in the table II-8.

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.

TABLE II-8
WATER CONSERVATION AREAS

Ser No	Water Conservation Area	Order No	Date	Gazette No	Date
1	Kokkinotrimithia-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.....	376	18. 8.52	3639	27. 8.52
4	Laxia.....	374	18. 8.52	3639	27. 8.52
5	F'sta, 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	Ayios 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	Vasilia, Lapithos, Kyrenia, Ayios Epiktitos, etc.....	245	28. 4.59	4228	30. 4.59
12	Makedonitissa, 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 (Djipi Loc.).....	324	21. 6.62	163	21. 6.62
16	Yialia, Ayia Marina, Argaka, Polis....	359	7. 7.62	168	7. 7.62
17	Yialias River (Potamia, Dhali, Nisou, Mathiati).....	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
20	Lapathos, Gypsos.....	545	9. 9.65	438	9. 9.65
21	Moni (Extension).....	642	14.10.65	444	14.10.65
22	Lakatamia, Dheftera, Anayia, Pera etc.	744	21.11.65	453	25.11.65
23	Ayia Erini.....	280	19. 5.66	499	2. 6.66
24	Paramali, Evdhimou.....	SBA 68	29. 7.67	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 (Extension).....	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

TABLE II-8
WATER CONSERVATION AREAS (cont.)

Ser. No	Water Conservation Area	Order No	Date	Cazette No	Date
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, Evdhimou.....	576	10. 8.72	958	25. 8.72
37	Kormakitis, Myrtou, Dhiorios.....	851	7.12.72	979	15.12.72
38	Akanthou (Extension).....	288	15.11.73	1054	30.11.73
39	Ayios Ioannis (Malounda).....	307	25.11.74	1158	25.11.74
40	Kambos Chakistra.....	-	-	1180	4. 4.75
41	Parekklisha.....	206	23.10.75	1233	7.11.75
42	L'ssol-Paphos-L'ca Extension pf W. Conservation areas.....	215	30. 9.77	1429	3. 3.78

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 Paphos Irrigation Project, have also been covered by that Law in 1974 and 1975.

The areas covered by this Law shown on map II-4 and particulars are given in the table II-9.

For the above areas:-

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

- 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.

TABLE II-9
WATER SUPPLY (SPECIAL MEASURES) LAW AREAS

Ser No	Area	Order No	Date	Cazette No	Date
1	Western Mesaoria (Pendayia-Morphou Kokkinotrimithia).....	-	-	331	9. 7.64
2	Akrotiri peninsula.....	-	-	331	9. 7.64

TABLE II-9
WATER SUPPLY (SPECIAL MEASURES) LAW AREAS (cont.)

3	South-Eastern Mesaoria (F'sta - Paralimni-Ormidhia-Akhna), later withdrawed.....	-	-	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	Ezouzas River.....	196	23. 5.74	1104	21. 6.74
8	Peyia-Aspros River (Ext. of Yeroskipos Peyia W C A West of Peyia village).....	196	23. 5.74	1104	21. 6.74
9	Mavrokolympos 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
11	Nisou-Potamia valley.....	274	15.12.78	1488	15.12.78
12	Xylophagou-Ormidhia Area.....	72	12. 3.78	1760	12. 3.82
13	Larnaca-Famagusta Area.....	247	21.10.88	2355	21.10.88

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 effected with out 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, Xylophagou-Ormidhia and Nisou-Potamia valley Area, the Law has not yet been completely enforced. In Limasssol-Akrotiri area during 1988 there were 422 water meters installed of which 412 are in continuous operation. The total volume of water recorded is 15.4 MCM. During the year 28 illegal pumpings have been presented by the District Officer, to Court.

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 the 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 a 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 send to the above said Director, together with a technical report on each borehole drilled.

During 1988 this Department renewed 72 Drillers Licences.
The number of private drilling rigs which drilled for water during 1988, was 72.

During 1988, 18 private Drillers were reported to the District Officers for illegal drilling.

WATER QUALITY

Chemical Analyses

During the year 1988, 561 samples of water were sent to the Government Analyst and Geological Department Laboratory and 1250 to the WDD Laboratory for chemical analyses. Out of those 684 samples were taken from springs, wells or boreholes, which are used or proposed as water supply sources. The remaining 800 samples were taken from rivers, springs, observation boreholes and other miscellaneous sources.

Bacteriological Analyses

The bulk of sampling for bacteriological analysis is carried out by the Health Inspectors. However for special purposes samples for bacteriological analysis are taken by this Department as well.

During the year 68 samples were sent to the Government Analyst.

Suspended Sediment Analyses

A number of large dams have been constructed in Cyprus. The evaluation of reservoir sedimentation may prove important, so the sediment sampling rogramme was continued this year also.

During the year 208 samples of river water were taken for suspended sediment analyses.

CENTRAL COMMITTEE FOR THE ISSUE OF LOANS AND THE REACTIVATION OF TURKISH CYPRIOT OWNED WELLS

The Council of Ministers, at its meeting of the 19th February, 1976-Decision No 14694 - decided the establishment of the above said Committee. The terms of reference of the committee are to accept and examine application from Greek Cypriot displaced farmers to use wells/boreholes abandoned by their Turkish Cypriot owners and to grant loans for the purchase, repair and installation of pumping plants and pipelines for the irrigation of abandoned fields of Turkish Cypriot ownership. For this purpose, the Government placed at the disposal of the Committee, the sum of 457,500 for the above said loans.

According to the above said decision of the Council of Ministers, the Committee is chaired by the Director-General, Ministry of Agriculture and Natural Resources, who transferred the chairmanship to the Director of Water Development Department. Other members are the Director-General, Ministry of the Interior, the Director-General, Ministry of Finance, the Director-General, Planning Bureau, the Commissioner for Co-operative Development, the Director, Department of Agriculture and the representatives of the Ministry of Agriculture and Natural Resources at the District Committees for the protection of Turkish Cypriot properties, or their representatives.

The Committee convened at its first session on 27th March, 1976 and at the beginning, the rules and procedures have been decided upon it would function.

Accordingly, special application forms have been prepared, obtainable from the District Officer and the Water Development Department, which displaced farmers could fill when applying to be granted a loan to purchase and install pumping plants and pipelines and/or permission to utilise existing pumping equipment on the specific well/borehole for which application was made. The applications which in most cases are from groups of farmers at the first stage are examined by the District Officer and the District Agricultural Officer. When the applicant or applicants are lawful tenants of abandoned by their owners Turkish Cypriot fields, leased to them by the Central Committee for the protection of Turkish Cypriot Property - the District Engineer tranmsmits the application with suggestions as to which fields may be irrigated from the same borehole or group of boreholes accompanied by an irrigation scheme, where necessary, with the estimated cost, to the Committee which decides as to the fields to be irrigated and the loan to be granted.

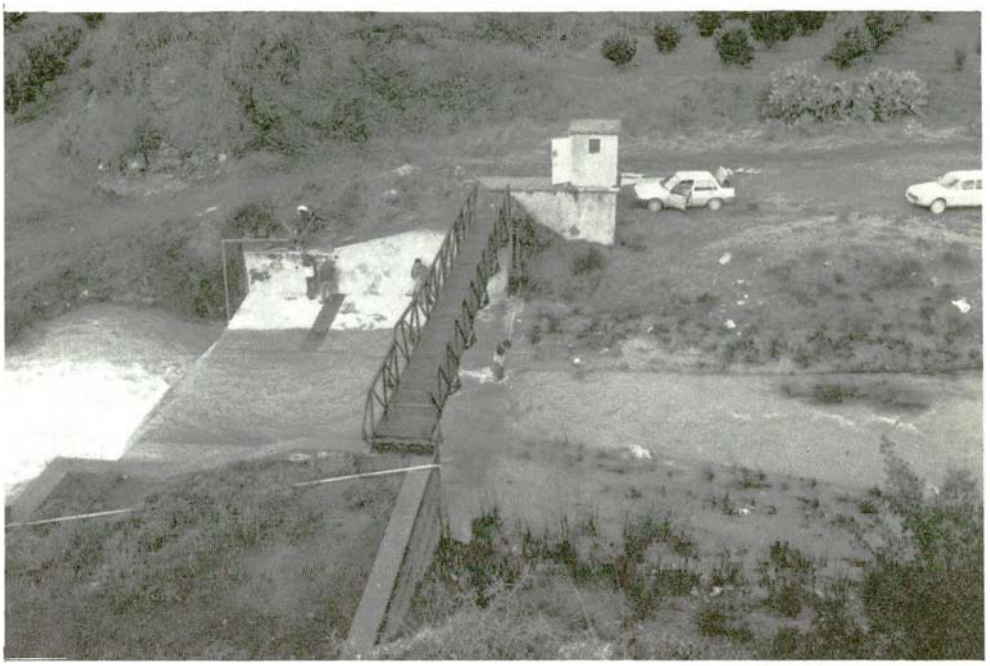
The decisions of the Committee are then notified to the Loan Commissioner who releases the proper amount, to the interested farmers, who sign an agreement for the repayment of 1/3 of loan and the running expenses as well. The remaining 2/3 of the amount is given to the farmer ex gratis. The repayment period for the loans has been set to ten years with an interest of 4.5%.

When part or the whole pumping unit of Turkish Cypriot ownership exists on the borehole/well, a loan may be granted for the purchase of what is missing and the value of the existing equipment with its anticipated life is calculated. Taking into account these parameters and after substracting the residual value which the pumping plant is expected to have after a maximum of eleven years or at the end of its expected life, an amortization rate is calculared which has to be repaid every year by the involved farmer or farmers. The farmer has to repay only the 1/3 of the amount the remaining 2/3 is give ex gratis.

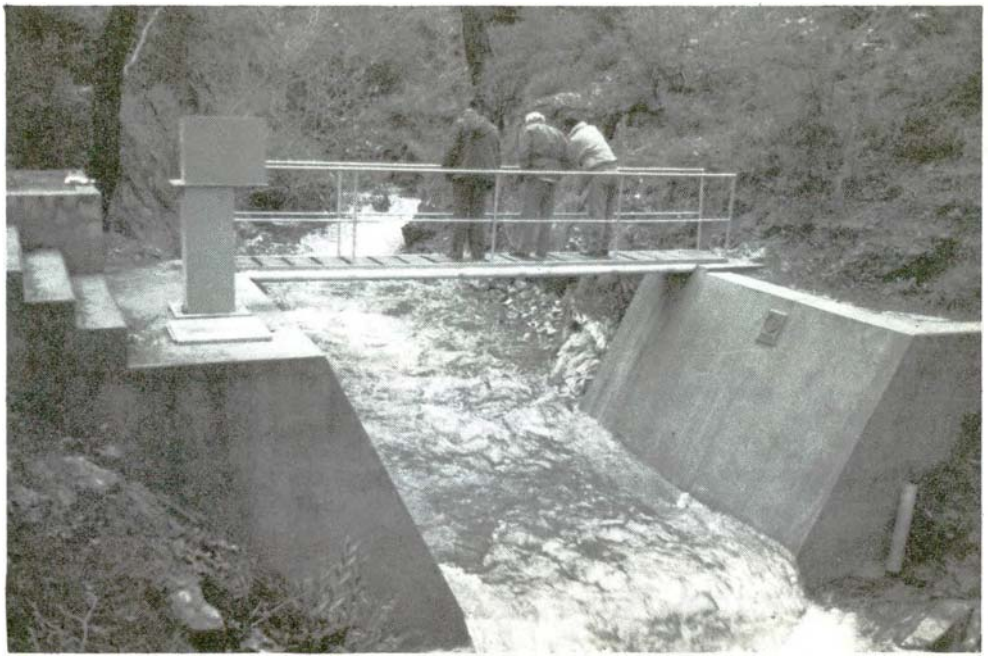
From its establishment the Central Committee for the issue of loans and the reactivation of Turkish Cypriot owned wells/boreholes had 57 meetings during which it approved 441 application from 1275 displaced farmers for the irrigation of 12293 donums of land. The amount of loans granted by the end of this year was 376904 and the pumping plants of Turkish Cypriot ownership to 42 190.-

During the year under examination no applications were made by farmers to be examined by the above said committee and so no meeting was convened.

Ezousas river flow gauging station near Kannaviou.
WDD photo E52EN-23.
Taken on 26.1.88



Magounda river flow gauging station at the inflow of Argaka dam.
WDD photo E52EN-20
Taken on 15.1.88.



Stavros tis Psokas river flow gauging station at the inflow of Evretou dam.
WDD photo E52EN-6.
Taken on 25.1.88.

III DIVISION OF HYDROLOGY AND WATER RESOURCES MANAGEMENT

by
I St Iacovides
Senior Hydrologist
Head of Division

Introduction

The Division of Hydrology and Water Resources Management was formally established in 1982 within the framework of the reorganization of the Department.

The main tasks and activities of the Division aim at providing the Department with basic information about the water resources to enable

- Decisions on the exploitation of water resources;
- Development of additional water resources;
- Allocation for water use;
- Appraisal of the exploitation and development policy of water resources and its consequences as to quantity and quality;
- Formulation and evaluation of new water projects;
- Management and conjunctive use of surface and groundwater resources;
- Applied research in all the above fields;

The Division of Hydrology and Water Resources Management operates as a central unit with minimal staff, making use of the staff available at the Regional offices for field data and observations.

The Division consists of four major Branches:

- Surface Hydrology Branch
- Groundwater Hydrology Branch
- Water Resources Management Branch and
- Engineering Hydrology Branch

The function of each Branch geared to the present and those of the immediate future needs of the Department are outlined on the organization chart.

During 1988, the Division consisted of the following staff:

- One Senior Hydrologist
- One Geologist I
- One Executive Engineer I
- One Hydrologist I
- One Hydrologist II
- One Technical Superintendent
- Two Senior Technicians
- One Technician I
- Five Technicians II (Three of them on contract)

Some of the main activities of each Branch are outlined herebelow. The four Branches do not operate as tight units. Instead, extensive contribution and exchange is made depending on the type of activity.

Main activities of each Branch

SURFACE HYDROLOGY BRANCH

- Hydrology of the Elea River Watershed

  Already in a large number of watersheds, through the various water-works, dams, ponds, diversions etc., a great proportion of the available water resources has been committed to prescribed demands. Additional water development schemes are always being requested and are under consideration. These new schemes though, must always be planned and implemented with due regard to the existing water commitments, the water rights and the water resource availability. Such a case that exemplifies this intensive water utilization is the watershed of the Elea river.

  A prototype hydrologic study was carried out for the Elea river watershed with the objectives of:

  - Defining the average flow of the river at the site of the various existing or under consideration, schemes.
  - Defining the effect or interference with the flow by the existence or planning of new schemes and
  - Reviewing of the performance of these schemes during droughts of various levels of severity.

The study was based on the simulated flows produced by the rainfall-runoff model using the rainfall data of 1916 to 1987 and the existing or planned capacity of the water works and defined water demands.

Various options were considered in the number of schemes that would be implemented examining thus the effect of each scheme by the flow left for downstream users beyond the Vizakia Weir.

A summary table of all the schemes, the average flow at each site, the upstream use, the specified demand and the resulting demand average and flow beyond the site considered are shown below.

This study has indicated that with all the existing or envisaged schemes being implemented some 54.5% of the average annual flow will be available for downstream the Vyzakia weir users. In the case of not implementing the Vyzakia dam the available flow increases to 67.7%.

TABLE III-1

Water balance of the Elea River Watershed (All in Mm^3/yr)

Point	Mean Annual Simulated flow	Upstream Use	Demand	Hydrology of 1916-87 Demand Satisfied	Hydrology of 1916-87 Quantity remaining
1. Sarandi pond	0.203	0.025	0.045	0.043	0.135
2. Lagoudhera pond	0.616	0.030	0.070	0.068	0.518
3. Lagoudhera weir	2.006	0.292	0	0	2.367
4. Xyliatos dam	0.656	0	1.220	1.157	1.866
5. Lagoudhera diversion	0.922	0.377	0	0	2.411
6. Kannavia Pond	0.894	0.079	0.100	0.096	0.719
7. Kapoura dam	3.013	0.267	0.420	0.414	3.051
8. Kannavia diversion*	1.132	0.354	1.100	1.029	2.800
9. Vyzakia dam	0.099	0	0	0	0.099
10. Vyzakia weir	0.377	0.279	0	0	5.408
Total	9.918	1.703	2.955	2.807	5.408

* Kannavia diversion discharges into Vyzakia dam.

- <u>The water-balance of the Akrotiri Salt Lake</u>

Concern has been expressed as to the possible effect of the impoundment of water in the Kouris dam on the annual operation of the Akrotiri Salt Lake.

A formal environmental study is envisaged to be carried out in 1989 and 1990. During the latter part of 1988 an effort was made to prepare the basic hydrologic data in view of this study.

An analysis of the water balance of the lake was undertaken to evaluate the importance of inflow from the Kouris river to its operation and consequently to its ecosystem.

A water balance simulating model was developed and calibrated for the period of 1982 to 1987. Although, the desired level of refinement was not achieved due to lack of continuous data, still the simulation clearly indicates the following:

- The storage in the lake is governed mainly by local rainfall,
- The subsurface groundwater inflow from the Akrotiri aquifer in the north, and
- The evaporation from the free water and damp ground in the lake.

Surface flows from the Kouris river do not appear to be of significance and only indirectly could the impoundment in Kouris dam could affect the lake. This indirect effect would be through the reduced recharge of the aquifer and reduction of subsurface inflows. The latter is not expected to occur though, due to the topographic conditions and the water resources management plan for the area.

In the table below, the water balance of the lake as depicted by the simulation is shown. This is expected to improve with additional data that are being collected.

ALL IN Mm^3		1982*	1983	1984	1985	1986	1987
Initial simul. storage		5.891	1.434	2.339	3.351	1.871	1.575
Inflow	rainfall	3.575	6.278	6.605	4.429	4.200	7.969
	seepage	4.187	4.745	4.745	4.745	4.745	4.745
	subtotal	7.762	11.023	11.350	9.174	8.945	12.714
Outflow	EVP-Free sfc	9.263	7.067	7.795	7.626	5.624	8.674
	EVP-damp sfc	2.956	3.051	2.543	3.028	3.617	2.342
	Subtotal	12.219	10.118	10.338	10.654	9.241	11.016
Balance		-4.457	0.905	1.012	-1.480	-0.296	1.698
Final simul. storage		1.434	2.339	3.351	1.871	1.575	3.273

Note: The January values are not included in 1982.

- Other studies

Simulation of the runoff for the catchment areas of Phinikaria and Akrounda rivers downstream the weirs up to and including the Yermasoyia dam. This was carried out for the evaluation of the Water Balance of the reservoir.

Simulation of the runoff downstream the Yermasoyia dam up to the coast. This was used in the calibration of the Yermasoyia aquifer mathematical model.

Simulation of the runoff of the Stavros-tis-Psokas river downstream the weir at Evretou up to and including the Evretou dam. This was used in the water balance of the Evretou reservoir in connection to the leakage study.

Simulation of the runoff and flood studies for Ayiassos and Theopiiti at Lesvos and Samos in connection to the cooperative effort for the design of ponds between the Ministries of Agriculture of Cyprus and Greece.

Updating of Karyotis river flows at Evrykhou for 1984-86.

Preparation of hydrometeorological data for the Gouri proposed dam at Ayios Mamas and for Sylikou pond.

Routine work; preparation of rainfall data on computer for 1982 to 1986; preparation of observed runoff data on computer.

GROUNDWATER HYDROLOGY BRANCH

- Inventory of wells and groundwater conditions at Kokkinokhoria area

A comprehensive survey was carried out in the Kokkinokhoria area in September to November 1986 by 7 Technical Assistants. This survey which covered 8500 wells and boreholes spread in 9 village boundaries was carried out within the framework of the SCP. It involved more than 80 items of information for each well ranging from data on the well itself, the pumping plant, the area irrigated, type of crop etc.

This mass of data was computerized using the dBase III software. The last survey of this type was carried out in 1979.

A preliminary report on the current groundwater conditions in the Kokkinokhoria area (H/62 Feb. 1987) indicated that the total number of boreholes in operation were 6194 irrigating a total of 7170 hectares by extracting 28.5 Mm^3/y of groundwater.

On the basis of this data bank, reports on the water resources of each of the Irrigation Blocks which are being set up under the Southern Conveyor Project were prepared. Reports of five of these Irrigation Blocks were prepared in 1987 whilst during 1988 nine more Blocks were completed as per table below.

TABLE III-2

SCP-KOKKINOKHORIA; IRRIGATION BLOCKS PREPARED IN 1988

Report No.	Irrig. block	Area	Date of preparation
H/70	Xa	Liopetri-Sotira	May 1988
H/71	IX	Sotira-Liopetri	June 1988
H/73	XIIa	Phrenaros-Avgorou-Liopetri	August 1988
H/74	VIIb	Liopetri-Xylophagou	September 1988
H/75	XI	Liopetri-Sotira-Phrenaros	September 1988
H/76	Xb	Sotira-Ayia Napa	October 1988
H/77	IVa	Avgorou-Xylophagou-Ormidhia	November 1988
H/78	XIIIb	Phrenaros-Sotira Dherinia	December 1988
H/79	XV	Xylotymbou	December 1988

On the basis of the 14 Irrigation blocks that were considered by the end of 1988 covering an area of 5696 ha and for a total of 11.3 MCM water demand that existed in 1980 some 3.7 MCM per year are expected to be met from local groundwater and 7.6 MCM are to be met from the Southern Conveyor Project.

The table that follows presents a comparison of selected information items between the 1978 and 1986 surveys for the Irrigation Blocks considered so far and indicates the changes that have occurred within this period.

- Survey for the estimation of groundwater pumping costs at Kokkinokhoria.

As a result of the well inventory survey carried out in 1986 at the Kokkinokhoria and on the basis of data for 2549 boreholes (45% of the total number) the fuel costs for pumping only was estimated to be 6.6 cent per cu.m. varying in the range of 4.0 to 9.5 cent per cu.m.

On November 1988 a random sample of 19 farmers was surveyed collecting data on pumping and boosting costs as well as for lubrication of pumping and boosting plants. Furthermore the cost of maintenance and service as well as replacement of pumps was considered.

The mean cost per cu.m of water was evaluated to be 9.67 cent analyzed into the following component-costs.

		Cents/m^3	Proportion to the total cost (%)
1.	Pumping cost (fuel)	6.63	68.6
2.	Lubrication of pumps	0.48	5.0
3.	Pumping cost (fuel) for boosting plant	1.09	11.3
4.	Lubrication for boosting	0.08	0.8
5.	Servicing of pumps & booster	0.55	5.7
6.	Maintenance & replacement	0.84	8.7
	Total	9.67	100.00

- Inventory of wells and groundwater use in the Akrotiri aquifer

Within the framework of the SCP (Phase II) a survey was set up by the Division and carried out by the WDD Regional Office in Limassol for all the wells in the Akrotiri aquifer.

The survey which was carried out in the Autumn of 1987 covered 664 wells and boreholes irrigating 2350 hectares consisting of citrus (1625 ha), vineyards (414 ha) and seasonal and other trees (311 ha).

For each well 89 items of information have been collected and have been stored on computer using the dBase III software.

The information for each well covers the location, the owner and his address, particulars of the well like elevation, depth, pump suction and fuel consumption, use, yield etc. Also for each well its legal status and the D.O file and permit number as well as quoted irrigated area are recorded. Furthermore details of the pumping facilities and water meter information are available. In addition, the facility of each former to obtain water from other sources like the Yermasoyia-Garyllis, distribution network, the Kouris dam or other wells is included in the database. Finally, the area irrigated and the type of crop including method used are available in the same database.

The database is at present well developed although further retirement is still required. It is expected that this database will assist in the improved management of the water resources of the area together with the SCP and Polemidhia-Yermasoyia Project.

- Use of radioisotopes in Hydrology

The sampling of groundwater in the area of the Kouris Delta aquifer was extended to cover the whole of the Akrotiri aquifer. The analytical work for Tritium and the Stable Isotopes is being done in Vienna at the International Atomic Energy Agency which finances the study. The groundwater flow

regime, sources of recharge and magnitudes as well as residence time of the water in the aquifer are the expected output of the Tracer mathematical model being developed for this area. The model is being developed on an IBM PC AT microcomputer which has been provided by the IAEA in September 1985. In 1988, the study concerning the evaluation of the operation of the Yermasoyia surface and groundwater reservoirs using environmental isotopes was completed. This study was carried out as a research contract (no: RC3976/RB) by the IAEA and covered the period 1984 to 1987. A report (H/69) was issued in April 1988 and was well received by the Agency.

The main results of this study were:

- The groundwater extraction was increased by 60% during the period of 1982-87 amounting to 6.5 MCM whilst the releases from the dam were increased by 120% amounting to 4.4 MCM/year.

- A total of 187 samples were analyzed for oxygen-18, 101 for deuterium and 77 for Tritium. Full ionic analyses were performed for 223 samples.

- From the isotopic results two regions were distinguished in the aquifer the upper part and the Delta area with distinct characteristics.

- The overall tracer average velocity in the aquifer was computed to 16$\pm$ 3m/d equivalent to a permeability of 160 m/d. Zones of varying permeability were determined.

- Water bodies originating from the very rare frequency spills of 1969 were identified at the coast on the basis of isotopic data.

- A successful simulation of the oxygen-18 in the water of the reservoir, increased the confidence in the water balance and verified the quantities estimated for evaporation and seepage.

- A groundwater mathematical model for the area was calibrated and a tracer model was developed.

Further to the above study areas, samples for isotopes were obtained at Evretou and Kouris dam to help in the studies for seepages from them.

- <u>Other studies connected with the Southern Conveyor Project</u>
The developing groundwater conditions in the Kokkinokhoria aquifer, Kiti-Pervolia area, Pareklishia aquifer and Akrotiri area were continued to be monitored and assessed throughout the year. Electrical conductivity surveys were carried out at Akrotiri, Yermasoyia and Kokkinokhoria aquifers for monitoring the sea intrusion trend.

In the aquifers connected with the Southern Conveyor Project the following can be observed for their water levels between November 1987 and November 1988.

Akrotiri aquifer: On the average about 0.5 m rise has been observed with a rise up to 6 meters in the Kouris Delta area and a zero to 0.2 m rise in the Asomatos area.
This is due to the controlled releases and recharge ponds in the Kouris delta area and the wetter conditions in October-November of 1988 compared to those of 1987.

Pareklisha aquifer: A 10 to 30 meter rise has been observed in this aquifer which reflects the wetter conditions of 1988 and the small specific yield of the aquifer.

Anglissides area: A general drop of 4 to 5 meters has been observed due to overpumping in the igneous part of the aquifer.

Kiti aquifer: A general recovery of 2 to 3 meters has been observed with a high 5 meter recovery along the Tremithios river. This reflects the wetter conditions of 1988 and the effect of recharge by the water released in the Tremithios river from the Southern Conveyor, which amounted to 3.5 Mm^3.

Kokkinokhoria aquifer A general rise of 1 to 2 meters has been observed with recoveries up to 5 meters in the sea intruded areas. This reflects the reduction of pumping in certain areas either due to lack of water or deterioration of the quality and also due to the favorable weather conditions during the pumping reason.

WATER RESOURCES MANAGEMENT BRANCH

This Branch was mainly involved in the conjunctive use of the Yermasoyia and the Asprokremmos reservoirs and aquifers as well as the monitoring of the Kouris Delta emergency scheme for irrigation and the supplementary supply to the Limassol Water Board. Monitoring of the performance of the Phassouri recharge pond was also maintained during the year under review.

- Operation of the Yermasoyia reservoir and aquifer
  The extraction from the Yermasoyia riverbed aquifer for the water supply of the Limassol Town, as well as of the Amathous, Yermasoyia, Potamos Yermasoyia and the Moutayiaka village for

the last 5 years depends almost completely on the controlled releases of water from the Yermasoyia dam.

The total extraction from the aquifer in 1988 for water supply purposes was 7.7 Mm^3 distributed as follows (in Mm^3/yr):

Limassol W.S.	Amathous	Yermasoyia	Potamos Yermasoyias	Moutayiaka	Total
5.234	0.834	0.147	0.953	0.535	7.703

The total extraction in 1988 thus increased by 18.5% compared to that of 1987. To maintain the extraction, releases were made from the dam for recharge of the aquifer. A total of 3.970 Mm^3 were recharged into the aquifer released from the Yermasoyia dam. In addition to this quantity additional recharge was accomplished during the period that the dam was overflowing (6.3.1988-14.5.1988).

The monitoring of all the hydrologic and hydrogeologic changes was maintained throughout the year.

- Releases from the Asprokremmos reservoir

The total pumpage from the Xeropotamos aquifer downstream the dam was about 0.9 Mm^3 whilst the total releases made during the year totalled 2.0 Mm^3 of which 1.8 Mm^3 were diverted from the Dhiarizos river. In addition to this, substantial recharge occurred from the overflow of the dam in the period of 2.3.1988 until 2.4.1988.

The releases were made at an average rate of 4 to 5000 m^3/d into a series of four recharge ponds immediately downstream the dam.

- Kouris Delta Emergency Scheme

The boreholes of the Kouris Delta did not have to supplement the supply from Yermasoyia and Polemidhia dams for the irrigation of some areas in Akrotiri-Phasouri during 1988.

A total quantity of 3.240 Mm^3 was extracted from four boreholes of the scheme for the Limassol Water Supply.

The performance of the aquifer was monitored during the year and on a monthly and/or a 15-day base the water level, quality changes and progressive yield records were monitored.

- Phassouri recharge pond.

For the purpose of evaluating the artificial recharge potential in the Akrotiri alluvial aquifer, the Division planned, equipped and monitored the existing recharge pond in the Phassouri plantation (0.054 Mm^3 storage capacity).

For this purpose the inflow from Kouris diversions into the pond, the overflow and one intake used for irrigation was equipped with weirs and continuous automatic water level recorders. Also a storage capacity curve was prepared for the

pond and a limnigraph recorder was installed. Existing observation wells and boreholes (11) were also monitored every 15 days. In the period of December 1987 to June 1988 a total of 1.8 Mm^3 were entered into the pond. Of this quantity 0.05 Mm^3 spilled and evaporated allowing a total of 1.75 Mm^3 to infiltrate into the aquifer. The average infiltration rate was 12500 m^3/day. This information is expected to be useful both in the water-balance evaluation of this aquifer but also in the case of designing similar waterworks in the future.

- Releases from the Kouris dam for recharge and spate irrigation
During 1988 a total quantity of 9.594 Mm^3 was released from the Kouris dam for recharge purposes and for spate irrigation. The latter is also considered as effective recharge since it allows a spatial distribution of the released water. The distribution of the releases was as follows:

Month	Quantity Mm^3	Month	Quantity Mm^3	Month	Quantity Mm^3
JAN	--	MAY	1.3	SEPT	2.0
FEB	0.2	JUN	0.4	OCT	0.1
MAR	1.4	JUL	0.7	NOV	--
APR	1.7	AUG	1.8	DEC	--
					9.6

ENGINEERING HYDROLOGY BRANCH

This branch deals with hydrological applications on waterworks as distinct to pure hydrological aspects of the Surface Hydrology Branch. Its main functions are, water balances of surfaces storages, evaluation of leakage and evaporation from dams, flood studies, hydrologic aspects of river training etc.

- Akhna reservoir seepage monitoring
The Akhna reservoir which offers a balancing storage of 5.8 Mm^3 within the Southern Conveyor Project was investigated before construction and seepages to the local aquifer were estimated to be of the order of 0.2 to 0.6 Mm^3/year. These seepages were expected to occur through a sandy horizon at the sides of the reservoir.

For the purpose of evaluating the quantity of seepage, 24 monitoring boreholes were drilled in the general area outside the reservoir, 15 of which were shallow tapping the upper horizon and a boreholes tapping the lower aquiferous horizon. Water level monitoring in these wells started on October 1988 and continued on a 15-days schedule. In addition, 4 continuous water-level recorders were installed.

During 1988 when the first filling of the Akhna reservoir occurred up to 2.5 Mm^3 of its capacity, the estimated losses through seepage were of the order of 0.3 to 0.4 Mm^3. These losses though include bank storage. The rate of seepage has

been tentatively put to 1100 m^3/d. Losses from evaporation have been estimated to be of the order of 1 $Mm^3/year$.

The water balance of this reservoir will be further monitored for obtaining more definite values of seepage, especially at full reservoir.

- Evretou dam water balance and leakage studies

For evaluating the quantity of leakage and its subsurface flowpath a number of investigations were carried out by the Division. These involved:

- Temperature of groundwater in the left and right abutments and riverbed alluvium.
- Water level measurements of groundwater in the area and hydraulic gradient evaluation.
- Execution and analysis of a 48 hr pumping test.
- Flownet analysis.
- Simulation of the groundwater levels in the downstream alluvium and
- A dye test

Furthermore, hydrochemical and isotopic analyses were carried out.

Finally a daily water balance was carried out using the data for the period of 1.6.1987 to 18.9.1988.

When the reservoir level is at 158 to 161 m.amsl the evaluated mean leakage was of the order of 102 l/s analyzed into 16 through the subsurface into the downstream alluvium, 20 appearing as leakage at the surface at the toe of the dam and 66 l/s as loss through the reservoir sides.

The flowpath for the leakage into the downstream alluvium appears to be the left abutment and the diaphragm area.

- Seepages at the Kouris dam

With the impoundment of water in the Kouris dam certain seepages appeared at both abutments at various points. The Division together with the site engineers monitored these seepages throughout the year and samples for chemical and isotopic analysis were obtained on a number of occasions. Furthermore a dye test using rhodamin B was carried out in October to investigate the flowpath of these leakages. Further detailed investigations are planned to be carried out in 1989.

- Other activities in connection to the Kouris dam
  - Forecast of the runoff at Kouris dam for April at average conditions and at 1% probability. This was carried out for anticipating conditions of flow and construction stage of the dam.
  - Investigation into the iron bacteria growth on the concrete tunnel lining of the Kouris dam.

- Investigation on the quality of water issuing from minor springs in the left abutment of the reservoir.
- Monitoring program of releases for recharge and diversions from the Kouris dam.
- Investigation into the subject of precipitate collected at the spillway filter outlet.

- Other activities
  - Evaluation of the drainage problem of certain areas on the Kokkinokhoria area and proposals for remedial works.
  - Consideration and comments on the subject of the dewatering at Asprokremmos damsite during construction (contractor's claim).

- Computer software application and development of new software
  The existing software LOTUS 1-2-3, dBase III, WORDSTAR, VOLKSWRITER PLUS were introduced to almost all the personnel of the Division and gradual application has been implemented for data storage, retrieval and processing. Furthermore computer software specific to the needs of the Division started being developed for data manipulation and processing.

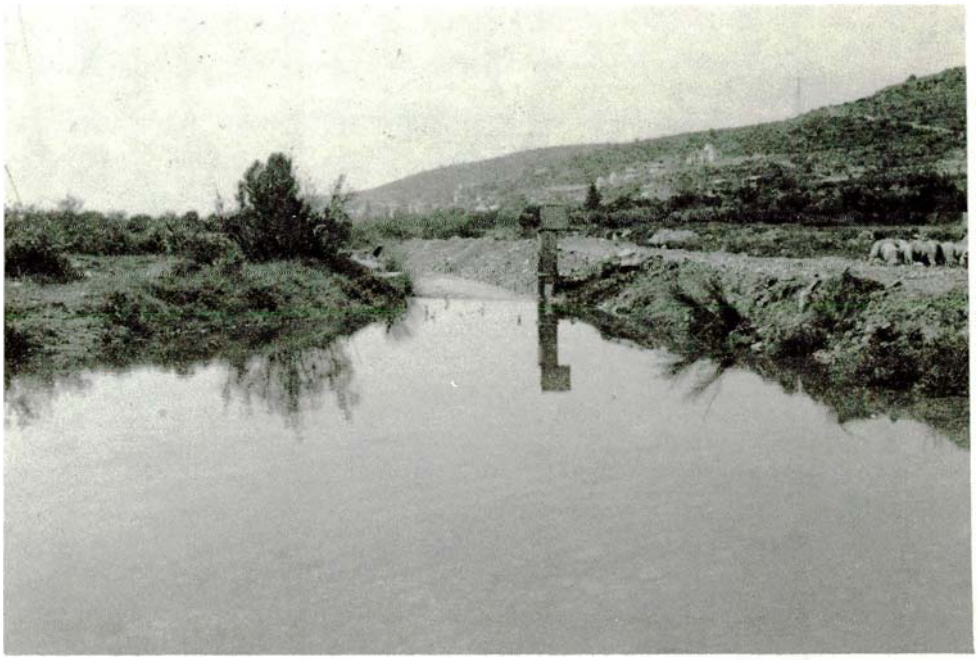
TABLE III-3

- Troodos - SOUTHERN CONVEYOR PROJECT - KOKKINOHORIA AREA

COMPARISON OF SELECTED ITEMS BETWEEN 1978 AND 1986 IN EACH IRRIGATION BLOCK

SERIAL No	IRR.BLOCK No	AREA (Ha)	VILLAGE BOUNDARY	No OF PUMPING BOREHOLES			AVERAGE YIELD/BOREHOLE (cu.m./h)			AVERAGE FUEL COST IN 1986 (cent/cu.m.)	AREA IRRIGATED IN 1986 (Ha)	EXTRACTION (10**3 cu.m.)			PONDS IN 1986 (cu.m.)	
				1978	1986	% INCREASE + DECREASE -	1978	1986	% INCREASE + DECREASE -			1978	1986	% INCREASE + DECREASE -	No	TOTAL CAPACITY
1	01	388	AVGOROU				2.6	1.0	-62	7.6	69.0					
			AKHNA				1.5	1.2	-20	3.1	40.5					
				104	136	+31						458	353	-23	60	7357
2	02	476	AVGOROU				2.0	1.0	-50	5.8	66.1					
			AKHNA				2.1	1.1	-48	6.3	48.4					
				54	125	+131						221	378	+71	46	4720
3	07a	274	LIOPETRI	30	109	+263	6.0	2.0	-67	5.0	132.9	319	427	+34	31	5050
4	08	440	LIOPETRI				14.7	4.3	-71		471.4					
			SOTIRA					6.4			17.4					
				146	328	+125				4.0		1701	2088	+23	109	20500
5	12b	500	AVGOROU				1.7	1.1	-35	6.0	63.0					
			PHRENAROS				10.0	3.4	-66	5.0	70.0					
				39	117	+200						413	551	+33	46	5250
6	10a	433	LIOPETRI				11.5	1.6	-86	7.0	150.0					
			SOTIRA				12.7	1.1	-91	9.5	130.4					
				120	337	+181						1117	1179	+6	96	12780
7	09	362	SOTIRA							9.0						
			LIOPETRI							8.2						
				151	508	+236	14.0	1.3	-91		371.2	1270	1918	+51	144	18730
8	12a	392	PHRENAROS				9.0	3.2	-64	4.7	92.0					
			AVGOROU				2.4	0.8	-67	6.6	34.2					
			LIOPETRI				4.0	2.0	-50	5.0	45.0					
				37	141	+281						285	704	+147	41	6500
9	07b	408	LIOPETRI							4.4	105.1					
			XYLOPHAGOU							4.0	75.7					
				46	110	+139	11.0	4.4	-60			677	604	-11	34	6250
10	11	481	LIOPETRI				6.0	2.6	-57	5.5	107.5					
			SOTIRA							8.7	63.5					
			PHRENAROS				5.4	2.0	-63	6.5	56.0					
				102	220	+116						613	918	+50	70	8800
11	10b	357	SOTIRA				9.6	2.3	-76	7.7	189.6					
			AYIA NAPA								16.7					
				90	221	+145						386	895	+132	77	7260
12	04a	513	AVGOROU					1.2		5.1	133.6					
			XYLOPHAGOU					2.8		5.7	101.0					
			ORMIDHIA					1.0			4.5					
				60	197	+228	4.0	1.6	-60			560	860	+228	48	5850
13	13b	475	PHRENAROS								49.3					
			SOTIRA								30.4					
			DHERINIA								1.1					
				109	120	+10				1.0		240	296	+23	43	4100
14	15	197	XYLOTYMBOU	34	38	+12				1.0		61	65	+7	5	700
TOTAL		5696		1122	2707	+141		2.1		6.3	2750.6	8321	11236	+35	850	113847

Artificial groundwater recharge in the Yermasoyia river bed aquifer by releasing water from Yermasoyia dam.
WDD photo D82EN-14.
Taken in April 1988.



Artificial tracer experiment using Rhodamine B in borehole to investigate possible path of leakage at Evretou dam.
WDD photo F3EN-7.
Taken on 13.5.88.

Sampling for radioisotopic analysis and temperature readings in the Kouris dam.
WDD photo F41EN-9.
Taken on 22.9.88.

IV DIVISION OF PLANNING

by
Chr Marcoullis
Senior Water Engineer
Head of Division

Introduction

The Planning Division of the Department comprises the following three branches:

- Reconnaissance and Feasibility Studies.
- Geotechnical Investigations and Laboratory
- Topography

The first one, which is almost entirely staffed with qualified personnel, is directed by the head of the Division and deals with the preparation of studies for water development projects involving major structures of local or interbasin importance.

The other two branches, which are headed by an Executive Engineer I and a Senior Technical Superintendent respectively, extend their services to cover the corresponding needs of the whole of the Department, including major works under construction. The activities of the two branches are described separately below.

The Division works in close cooperation with other Divisions of the Department and particularly with the Design Division in an effort to successfully cope with the increasing demand for water works.

During 1988 the personnel of the Division, not including that of the two separate branches, comprised:

- One Senior Water Engineer, Head of the Division
- Three Executive Engineers Class I
- One Irrigation Engineer Class I
- One Hydrologist Class I
- Two Irrigation Engineers on Contract
- One Senior Technician
- One Technician Class I

Summary of Activities

As with 1988 the activities of the Division were focussed on the reconnaissance and feasibility studies of small projects of rather local importance.

However the two major projects i.e. the Krasokhoria Integrated Rural Development Project and the Karyotis Project which were initiated in 1984 and 1985 respectively were also under consideration.

The Division has also extended its activities for studies at feasibility level of various other schemes including ponds in the Greek Islands as well as for jobs assigned to it because of particular specialization of members of its staff.

In addition the Division through its Head has taken part in the Technical Committees of the Department which deal with the evaluation of tenders or with decisions on Contract variations and claims associated with the major projects of Khrysokhou Irrigation Project including Evretou Dam and the Southern Conveyor Project including Kouris Dam.

Studies for water works of local importance

During 1988 the Division has dealt with the applications by villages for the construction of some kind of water works, mainly dams or off-stream ponds for irrigation. Some of these applications involved only an on the spot examination, which resulted either in a direct negative answer in cases where topographical, geological, or hydrological conditions were quite unfavourable, or taken up for a preliminary study.
Other cases involved the preparation or review of preliminary studies or feasibility studies of proposed schemes which were examined either in 1988 or during previous years. All the cases, which were dealt with, as classified by the study and the scheme involved and by district are tabulated below:

District	On the Spot Examination			Preliminary Study		Feasibility Study	
	Pond	Dam	Other	Pond	Dam	Pond	Dam
Nicosia	3	4	4	1	1	3	1
Limassol	3	1	2	-	1	1	-
Larnaca	1	-	3	-	1	1	1
Paphos	-	2	-	-	-	-	-
Total	7	7	9	1	3	5	2

Preliminary studies were prepared for:

- A dam for Gourri village
- A dam for Phini village
- A pond for Lymbia village
- A recharge dam for Alethriko village

Feasibility studies were completed or initiated for:

- A pond for Orounda village
- A pond for Spilia-Kourdali village
- A pond for Ay. Epiphanios village
- A pond for Pelendria village
- A pond for Melini village
- Review and reestimate of the studies for two ponds for Odhou village and one pond for Vavla-Kato Drys
- A dam for Ayios Yeoryios (Kafkalou) village
- A dam for Phini village

Major Projects Planning

The two major water development projects under planning during 1988 were those of Karyotis Project and the Krasokhoria Integrated Rural Development Project. Some details of the projects and progress of the studies during 1988 are described below:

Karyotis Project

The purpose of the project is to determine the most rational utilization of the flows of the Karyotis river and other neighbouring rivers for the enhancement of the Nicosia area domestic water supplies (D.W.S), after satisfying the local demand for irrigation.

The feasibility study of the project was undertaken by the Soviet Organization "Shelkozpromexport". The relevant contract was signed in Oct. 1984 and the study commenced in Sept. 1985. The contract was administered by WDD, which would contribute to the study in terms of general engineering, topographical work and geotechnical investigations. Other inputs to the study included geological investigations by GSD and agricultural data by the Dept. of Agriculture.

The project as formulated during the preliminary study which was completed in Feb. 1986 envisages:

a) The construction of a diversion dam on Karyotis river just downstream of Kakopetria village.

b) A diversion tunnel about 2.5km long to convey part of the flows of Karyotis river to the neighbouring Atsas valley.

c) The construction of the "Ayios Theodhoros" rockfill dam with a storage capacity of about 22.5 MCM located about 2.5 km upstream of the homonymous village, to receive the flows diverted from Karyotis river. The safe annual yield of the dam will be about 9.3 MCM. Some 5.5 MCM are intended for the enhancement of Nicosia domestic water supply whereas the remainder 3.8 MCM will be returned back into the Karyotis valley for the irrigation of about 750 ha of land located between Sina Oros and Skouriotissa.

d) The conveyance system which consists of:

- A common pipeline 900 mm dia, 2.6 km long up to about Ayios Theodhoros village.

- Two irrigation conveyance pipelines 600 mm dia, 3.5 and 3.8 km long up to Evrykhou village area and up to Phlassou village area respectively.

- The Nicosia DWS pipeline 500 mm dia, 29.2 km long up to Ayios Ioannis (Malounda) Water Treatment Works and another 400 mm dia, 11.2 km long up to Anthoupolis balancing reservoir.

e) The Ayios Ioannis Water Treatment Plant having a daily output of 18,000m^3/day and two small booster pumping stations for pumping potable water to villages en route.

The cost of the above works, not including the irrigation pipelines, is estimated at about £27 million.

At a prefeasibility stage a study was carried out for the possibility of diverting part of the Marathasa river flows into the Karyotis Project which would enable the increase of the quantity of water to be delivered to Nicosia by 2.5 to 3.0 MCM.

In April 1988 the final feasibility report was handed over to the Ministry of Agriculture and Natural Resources along with the Consultant's proposals for the detail design stage and the implementation of the Project.

During 1988 the Dept. undertook to prepare the feasibility study for the irrigation component of the Project which was not included in the Consultant's terms of reference.

The study involved the designs of the conveyance system to the Karyotis valley where:

(a) An area of about 800ha (6000 donums) will be irrigated from Ayios Theodhoros dam and

(b) An area of 105 ha (800 donums) will be irrigated with releases from the diversion dam.

Both areas will be covered with a fully pressurized distribution network for the application of modern irrigation methods. For the purpose of a better operational and economic arrangement the first area was broken into an upper and a lower area.

The cost of the irrigation works of the Project was estimated at £3.8 millions and the cost of the whole Project at £30.8 million. If however the cost of the common works were distributed into the two uses of water, the cost attributed to potable water supplies would be £18.8 million and that to irrigation £12.0 million. The combined I.R.R. is estimated at 9.52%.

By the end of 1988 a report on the above study was under preparation for submission to the Ministry of Agriculture and Natural Resources.

Krasokhoria Integrated Rural Development Project

A brief description of the water development component of the Project as formulated in 1985 was given in the 1987 annual report.

Early in 1988 the Government decided to proceed with the preparation of the final designs and construction drawings of the two dams of the Project namely the Xylourikos dam on the Limnatis river and the Platys dam on the homonymous tributary of the Dhiarizos river.To this effect an agreement was signed in March 1988 with the British consultants Rofe, Kennard and Lapworth who had undertaken in 1985 the feasibility designs of the two dams.

In May 1988 the new Government decided on the basis of environmental reasons to abandon the Platys damsite. Efforts were subsequently concentrated on locating a new site on the other main tributary of Dhiarizos (Phini), free of negative environmental impacts. Such a site was found in October 1988 and a preliminary study was undertaken along with field geotechnical investigations.

Regarding Xylourikos dam, on the request of members of the Parliament and interested villages, studies were undertaken for testing the economic feasibility of extending irrigation to villages located in the neighbouring valley of Garillis river. In particular the studies involved pumping of about 1.0 M.C.M. of water for the irrigation of an additional land of about 135 ha which belongs to 7 additional villages. The new proposal, which was approved by the Council of Ministers late in 1988, provided for the increase of the storage capacity of the Xylourikos dam from 0.85 to 1.90 M.C.M. All the changes in the dam's design data will be taken up for elaboration by the Consultants in 1989.

Other Studies

(a) Aradhippou Dam

Due to the interference of the Aradhippou damsite with the alignment of the Aradhippou-Larnaca Airport branch of the Larnaca By-Pass Highway which made impossible the independent construction of the two works, a preliminary design was undertaken for a combined scheme which involved the following:

a) The widening of the dam crest from 5 to 35m so that it could accommodate a four lane road.

b) The shifting of the dam axis downstream and the formulation of the crest long slope so as to coincide with those of the road.

c) The placing of the spillway on the eastern bank of the river.

The cost of the combined works was estimated at about £900,000 whereas that of two independant structures (if possible) would be £980,000.
The results of the study were reported to the Ministry of Agriculture and Natural Resources by the end of the year, requesting approval to proceed with the detail designs.

(b) Athienou Irrigation Works Within the S.C.P.

Within the framework of the S.C.P. a feasibility study was undertaken, to check the economic viability of the extension of irrigation and the supply of water for animal husbandry to the village of Athienou.

The scheme provides for tapping of the Southern Conveyor at Aradhippou the construction of a balancing reservoir and a pumping station near Avdellero and the conveyance of water to another balancing reservoir at Athienou. The annual quantities of water involved would be of the order of 1.75 M.C.M. for the annual irrigation of 267ha (2000d), one third of which will be cultivated with fodder crops. The irrigation network will cover an are of 400ha (3000d) and some 150,000m^3 of water will be used by animal farms.

The total cost of the works was estimated at £2.6 million and the internal rates of return at 10.15%.

Based on the above technoeconomic results which were coupled with serious social considerations the approval of the Council of Ministers was obtained in August 1988, which will allow the preparation of the detail designs of the scheme.

(c) Detailed designs for the Kokkinokhoria area distribution network (S.C.P.)

The preparation of the detailed designs for the Kokkinokhoria area within the framework of the Southern Conveyor Project was administered by this Division as of April 1987 under the personal supervision of the Assistant Director. During 1988 the following progress was recorded:

a) Blocks XI and Xb covering an area of 481 and 307 ha respectively or a total of 788 ha were given the final touches early in 1988.

b) Blocks IVa, XV and XIIIb covering areas of 512, 197 and 475 ha or a total of 1184 ha were fully completed and passed over for construction.

c) Blocks V, IIIb, IVb and XIIIa covering areas of 354, 484, 570, and 398 ha or a total of 1806ha were substiantially completed.

d) Block XVI covering an area of 317ha was in progress and will be completed early in 1989.

Concurrently the tertiary irrigation systems of Blocks II, XV, XIIIb, were fully completed in 1988 whereas design on Blocks IVa, V, IIIb, IVb and XIIIa was quite advanced.
In total by the end of 1988 (including 1987) detailed designs were prepared for 18 Blocks out of 22, covering an area of 7465 ha out of 9000 ha.

(d) Paphos Domestic Water Supply

Late in the year the Division was assigned to study the situation of the Paphos town water supply conbined with that of the so called Paphos Lower villages.

The sudden expansion of tourism in the Paphos area during the last five years is imposing a great burden on the availability of potable water supplies which are at present wholly dependent on groundwater.

The study, which was undertaken, will include examination of the present conditions, projections of future water demand and proposals for short and long term solutions to the problem including the timing and sizing of a water treatment plant which will utilise stored water from Asprokremmos dam and water from Ezouza river.

The work during 1988 was limited to the collection of basic information.

(e) Ponds in the Greek Islands

In April 1988 a technical team headed by the Special Secretary General of the Ministry of Agriculture of Greece visited the Pitsilia area where a number of earth ponds had been constructed within the Pitsilia Project, in an effort to examine the possibility of such structures to be adopted under similar conditions in the Greek Islands.

As a result of the visit a reconnaissance trip to several Greek Islands by a technical team of the Department headed by the Director was organised in June 1988. The team after considering the information made available to them and on the basis of the on the spot examination of the proposed pond sites suggested that two of such sites one in the island of Lesbos and one in Samos seemed suitable for the purpose and warranted some further study.

The Department undertook the drafting of instructions for the topographical surveys, geological and geotechnical investigations and hydrological data to be carried out or supplied by the Greek Ministry.

Based on the outcome of the investigations, it was decided that the Department would proceed with the detail designs of the two ponds which would serve as pilot schemes for other similar structures in other islands.

Other Assignments

(a) Computer Network

The management of the operation and maintenance of the Computer Network as well as its coordination was the responsibility of this Division.

New software packages have been added to the Network library which now covers a wide spectrum of subjects from hydraulics, hydrology, structural engineering, statistics, word processing computer languages and others.

By the end of 1988 a plotter, A size, and a digitizer, A3 size, have been installed at our Department. The plotter and digitizer have been immediately put into use for the preparation of such drawings as longitudinal cross sections of pipelines and contour maps.

Computer courses in DOS and the use of the Network have been organised by WDD personnel and attended by 25 WDD members. In addition three members of our staff have been trained in the use of Auto CAD and another six persons have taken the introductory course in computers offered by the Cyprus Productivity Center.

Finally the Department organised a course in the use of the computer package D BASEIII- Plus for the employees of the Geological Survey Department.

b) Water Rate Studies

As a result of the new financial covenants included in the Article 4.05 of the Loan Agreement CY2914, with the World Bank for the partial financing of the Southern Conveyor Project Phase II, the computerised water rate studies have been modified to include these changes. In addition the input data has been updated to include the 1987 actual data. Furthermore the assumptions for the forecasts have been re-evaluated on the basis of the new data that has been made available since the last analysis.

The derived bulk domestic water tariffs for the period 1989 to 1995, that are shown in Table IV-1, are set at a level sufficient to cover at least the full operating and maintenance costs the working capital requirements and the higher of debt service or depreciation. Debt service is the aggregate amount of amortisation and interest of both the foreign and the local loans. Local loans are the Government advances which are to be amortised over 40 years after a grace period of 5 years at an interest late of 9 percent per annum.

TABLE IV-1
Bulk Domestic Water Tariffs in cents/m^3

Tear	1988	1989	1990	1991	1992	1993	1994	1995
Tariff in cents/m^3	21.7	21.7	27.0	27.0	33.0	33.0	36.0	36.0

(d) Ascertainment and record of water rights

(i) Akaki-Malounda Dam

As part of the feasibility study of the Akaki-Malounda proposed dam, sited near the village of Malounda on the Akaki tributary of Serrakhis river, the Minister of Agriculture and Natural Resources appointed in April 1988 Water Commissioners under the Government Waterworks Law CAP 341 Article 6 in order to ascertain and record the nature, extent and situation of existing water rights that may be injuriously affected by the proposed dam.

During 1988 the Division representing the Director of the Dept. as one of the three Water Commissioners (the other two being, the District Officer and the Director of the Department of Agriculture) collected information from drawings and reports of the Department on the existing diversion weirs, channels, water mills, and irrigated area along the river, downstream the proposed dam and prepared a preliminary drawing. Furthermore the Water Commissioners made on the spot examinations of the Department's findings shown on the above drawing and prepared a preliminary written report. By the end of 1988 the work was still in progress.

(ii) Siphilos Dam

A similar investigation was also undertaken for the Peristerona River on the Platanistasa tributary of which "Siphilos" dam is under feasibility study. The inquiry was firstly assigned to the Director of the Dept, but due to the complexity of the case, the formal appointment of Water Commissioners seemed more appropriate for this river as well. The work which is similar to that described above for Akaki, was in progress by the end of 1988 although not as advanced.

INVESTIGATIONS AND LABORATORY BRANCH

by Ch. Kritiotis B.E.I., Head

General

In 1988 the Site Investigations, Laboratory and Grouting Section of the Division of Planning, was involved with almost all major and minor projects undertaken by the Department. Furthermore, site investigation and laboratory testing was carried out for other Government Departments and private organizations.

The full capacity of the section was mobilised in order to satisfy the requirements of both ongoing works and site investigations for proposed new projects.

Site investigation and laboratory work related mainly to providing subsurface geological, geotechnical and construction materials data for projects at the feasibility and final design stages. Laboratory work was also related to quality control at ongoing projects mainly for earthworks and concrete.

Departmental projects for which site investigation work was carried out were as follows:

- Southern Conveyor Project - Phase I:
  Akhna Terminal Storage Reservoir: Drilling of relief wells downstream of the embankment and drilling of observation wells in the vicinity of the reservoir.
  Kouris Dam: Drilling of observation wells for investigating and monitoring of leakages.
  Paralimni Pond: Site investigation for proposed pond involving drilling by coring and augering.

- Southern Conveyor Project - Phase II:
  Dhiarizos Diversion: completion of drilling of additional deep boreholes for investigation along diversion tunnel alignment.
  Dhali Balancing Reservoir: Site investigation by coredrilling.
  Athienou Break Pressure Reservoir: Site investigation by use of core and auger drilling.

- Evretou Dam:
  Geotechnical investigations at upstream portal slide area. Drilling of monitoring holes at left and right abutments and in downstream river alluvium. Continuation and completion of work started in 1987.

- Xylourikos Proposed Dam:
  Site and fill material investigations by the use of coredrills, auger rig and a backactor tractor for the final design stage.

- Vyzakia Proposed Dam:
  Site and fill material investigations by the use of core drills, back actor, tractor and dozer for the excavation of investigation trenches. Final design stage.

- Aradhippou Proposed Dam:
  Site investigations at location of new axis to coincide with proposed Aradhippou-Airport highway. Use of one Auger.

- Dhiarizos Phini Proposed Dam:
  Site investigations with the use of 2 no. coredrills.

Site investigations or drilling work undertaken for other Government Departments and private organizations, included:

- Proposed Symvoulos Dam/Episkopi: Full geotechnical investigations by use of core drills with associated laboratoring testing. Work undertaken at the request of British Bases.

- Pedhoulas Road: Site investigations by use of core drill in order to investigate the stability of road cut.

As in previous years close cooperation was maintained with the Engineering Geology Section of the Geological Survey Department as regards the geological input for site investigations.

Dam Monitoring Unit

During 1988 the dam monitoring unit was established within the Geotechnical Section of the Department. The establishment of the Dam Monitoring unit was also in line with the recommendations of the World Bank and the Panel of Experts.

The unit, which is presently under development, will be ultimately responsible for the collection and processing of data from dam instrumentation, as well as maintenance of instruments installed at the various large dams.

In view of the extremely large amount of data which has to be processed the use of computer aided methods are of paramount importance for the dam monitoring unit.

TABLE IV-2

SOIL LABORATORY TESTS DURING 1988

SOUTHERN CONVEYOR

PROJECT - Type of Test	KOURIS DAM	KOKKIN. IRR. AREA	DHIARIZOS	KAPOURAS DAM	VYZAKIA DAM	XYLOURIKOS DAM	ARADHIPPOU DAM	OROUNDA POND	PRIVATE FIRMS	MISCELLENEOUS	TENDERS	TOTAL
Sieve Analysis	328	457	2	--	27	23	2	6	64	9	25	948
Hydrometer	--	51	-	25	42	27	66	-	57	14	--	282
Atterberg Limits	36	43	62	25	41	28	57	-	47	4	--	343
Specific Gravity	5	--	64	24	42	11	32	-	21	1	--	200
Moisture Content	789	1 302	135	--	--	27	6	3	15	--	--	2 277
Compaction Test	31	110	--	5	18	8	4	-	6	8	--	190
Permeability	4	8	--	--	--	6	10	-	--	--	--	28
Shear Box	--	1	--	--	7	3	2	2	7	3	--	25
Water Absorption & Sp. Gr.	5	17	1	--	1	-	--	-	9	2	--	35
Soundness	--	9	13	--	--	--	--	-	16	3	--	41
Swelling pressure	--	15	--	--	--	--	--	-	--	--	--	15
Los Angeles	--	4	--	--	1	2	--	-	13	--	--	20
Linear Shrinkage	--	12	--	--	--	--	--	-	--	--	--	12
Consolidation	--	--	--	--	4	--	--	-	9	--	--	13
Potential volume change	--	--	--	--	--	--	--	-	--	--	--	--
In situ density	724	169	--	--	--	--	--	-	--	--	--	893
Impact Test	--	1	2	--	--	--	--	-	1	--	--	4
Pinhole	--	--	--	--	2	--	8	-	--	--	--	10
Triaxial (Undrained with PWP)	--	--	--	1	3	--	3	-	2	--	--	9
Bulk density	--	--	119	--	--	--	6	-	--	--	--	125
Ultrasonic pulse velocity	--	--	67	--	--	--	--	-	--	--	--	67
Q. U. Triaxial	--	--	--	--	--	--	--	36	1	--	--	37
Uniaxial	--	--	--	--	--	--	--	--	30	--	--	30
Residual shear strength	--	--	--	--	--	--	--	--	2	--	--	2
Flakiness and Elongation	--	1	--	--	--	--	--	--	2	--	--	3
Organic matter	--	--	--	--	--	--	--	--	--	--	--	--
Alkali Reactivity	--	--	4	--	--	--	--	--	--	--	--	4
Slump	1 172	3 600	--	--	--	--	--	--	--	--	--	4 772
CBR	8	11	--	--	--	--	--	--	--	--	--	19
Suspended sediment	--	--	--	--	--	--	--	--	--	131	--	131
Crushing strength (cores)	--	--	53	--	--	--	--	--	--	--	--	53
Cube Crushing Strength	1 094	6 400	--	--	--	--	--	--	--	--	325	7 819
TOTAL	4 191	12 221	522	80	188	135	196	47	302	175	350	18 407

TOPOGRAPHY BRANCH

by
A Evripidhou
Senior Technical Superintendent

The Topography Branch performs all the survey work required by the Department and operates within the Planning Division. These surveys are of the engineering type and are necessary during the investigation, design, construction and after construction stages of projects under consideration.

By the end of 1988 the staff of the Branch comprised 5 Technicians I, 10 Technician II, 20 Rodmen, 15 casual Labourers and 5 vehicle drivers. The technical personnel is trained interdepartmentally on engineering surveying methods and field procedures as well as the use of modern surveying instruments and equipment so as to be able to undertake to conduct surveys such as: cross-sectioning, profile levelling, contour surveys, setting-out of Project outlines and take instrumental observations for movement detection of major structures.

During the year under review the Topography Branch has dealt with the following Projects:-

PROJECT:- SOUTHERN CONVEYOR - PHASE I

SCHEME	TYPE OF TOPOGRAPHICAL WORK							Remarks
	Setting out	Contour survey	Profile levelling	Cross sectioning	Levelling of BMS	Monitoring observations	General work	
AKHNA DAM		X			X			RESERVOIR & BHS
KOURIS DAM		X						RESERVOIR

PROJECT:- SOUTHERN CONVEYOR - PHASE II

MAZOTOS			X					IRR. NETWORK
PAREKLISHA			X					-"-
KOKKINOKHORIA			X					-"-
TERSEPHANOU			X					-"-
AKROTIRI		X	X					-"-
N.S.R. 1			X					
ORMIDHIA			X					IRR. NETWORK
L'SSOL TR. PLANT			X					PIPELINE
ARADHIPPOU ATHIENOU			X					-"-
N.S.R. 3		X						
KITI			X					IRR. NETWORK
DHIARIZOS KRYOS R. - TUNNEL					X			CONVEYING MSL DATUM

PROJECT:- KRASOKHORIA

SCHEME	TYPE OF TOPOGRAPHICAL WORK							Remarks
	Setting out	Contour survey	Profile levelling	Cross sectioning	Levelling of BMS	Monitoring observations	General work	
XYLOURIKOS DAM							X	BH'S AND ACCESS RDS
PHINI DAM		X						
KAPILIO (Borrow area for Xylourikos)		X						

PROJECT:- ROUTINE WORKS

PARALIMNI LAKE							X	ANTIFLOOD
LIOPETRI DAM		X						ANTIFLOOD
VYZAKIA DAM		X						RESERVOIR
EFTAGONIA	X	X	X					WEIR & PIPELINE
EVRYKHOU			X					EX. IRRIGAT. CANALS
PARALIMNI POND		X						SCP II
LAKATAMIA (W.S)			X					PIPELINE
ALETHRIKO DAM		X						
KAKOPETRIA		X						SEWAGE SCHEME
KOPHINOU - L'CA W.S			X					FAMAGUSTA PIPELINE
KHIROKITIA TR. WORKS			X					
AKAKI IRR. PIPELINE			X					
NISOU-ALAMBRA WS			X					
MENIKO IRR. PIPELINE			X					

PROJECT:- ROUTINE WORKS

SCHEME	TYPE OF TOPOGRAPHICAL WORK							Remarks
	Setting out	Contour survey	Profile levelling	Cross sectioning	Levelling of BMS	Monitoring observations	General work	
OROUNDA POND		X						DIVERSION WEIR
AYIOS EPIPHANIOS POND		X						
ARADHIPPOU DAM		X						SUPPLEMENTARY
KOUTRAPHAS IRRIGATION			X					
ATHALASSA M. HOSPITAL			X					
LIOPETRI RECHARGE			X					
ALETHRIKO B.P.T.			X					
LOUMATA DAM					X			
ALAMBRA W.S.			X					
PLATANISTASSA POND		X						
PARALIMNI PROTARAS			X					EXISTING IRR. CANALS
ODHOU PONDS			X					CONVEYOR PIPELINE
VAVATSINIA POND			X					WEIR SITE
OROUNDA			X					EXISTING IRR. CANALS
PROJECT: MONITORING OBSERVATION								
KALOPANAYIOTIS DAM						X		
LEFKARA DAM						X		
XYLIATOS DAM						X		
KALAVASOS DAM						X		
DHIPOTAMOS DAM						X		

V DIVISION OF DESIGN

by N.P. Stylianou
Senior Water Engineer
Head of Division

Introduction

The Design Division of the Water Development Department deals mainly with the preparation of detailed designs of major projects undertaken by the Department. These projects may involve the design of dams, ponds and other hydraulic structures, irrigation networks and domestic water supply schemes.

When such works are to be constructed by contract, the designs are supplemented with all necessary contract documents.

In some cases the final design of major projects is undertaken by consulting firms. In these cases the Design Division undertakes the overall supervision of the work been carried out by the Consultants and forms the link between the Consultants and WDD. The supervision includes mainly:

(a) Discussions with the Consultants on all detail design aspects of the project.
(b) Supply all technical and other information required for the implementation of the designs.
(c) Organize and supervise all topographical survey works and geotechnical investigations required for the design.
(d) Review of the design work, contract documents and drawings prepared by the Consultants.
(e) Arrange for the invitation of tenders for the supply of plant and equipment or for the construction of the works.
(f) Carry out evaluation of tenders received.

Although in principle the activities of the Design Division are within the above mentioned frame of works, it is often required to extend its activities by undertaking the preparation of feasibility studies for projects of local importance. The activities of this Division extend even further into assisting in the supervision of the construction works, either to ensure that construction is carried out in full agreement with the designs and specifications or to help in solving problems encountered during the construction stage.

In addition to the Division Branches involved in the above mentioned type of works, this Division encorporates the Drawing and Records Branch of the Department. This Branch carries out all drawing work of all major and minor projects, keeps the technical records, helps in the preparation of technical reports, runs the library of the Department and undertakes all photographic reproduction and photo-process lab work.

During 1988 the following qualified personnel was working with the Design Division.

- One Senior Water Engineer, Head of the Division
- Six Executive Engineers Class I
- One Executive Engineer Class II
- One Senior Technical Superintendent
- Three Senior Technicians
- Eighteen Technicians (One qualified Civil Engineer)

MAIN ACTIVITIES

During 1988, the main activities of the Design Division were the supervision of the design work for the various components of Phase 2 of the Southern Conveyor Project (SCP) and the preparation of designs and studies for other schemes. The final design work for SCP - Phase 2 was undertaken by Energoprojekt, a firm of consulting engineers from Yugoslavia, who signed an agreement with WDD in November 1985 for the preparation of the detailed designs and contract documents for all engineering components of the Second Phase of the project. The supervision work undertaken by the Design Division was as outlined above at the beginning of this chapter.

The main components comprising the Second Phase of the Southern Conveyor Project and the work carried out during 1988 are as follows:

1. Dhiarizos Diversion, which will convey water from Dhiarizos river into Kouris reservoir. The maximum diversion capacity of the works will be about 6.5 m^3/sec with a mean annual diverted quantity of 4.5 million cubic metres. The works will comprise the construction of the following:

   (i) A concrete diversion weir with stilling basin and intake works on the upper reaches of Dhiarizos River.
   (ii) A 1.6 km long diversion pipeline, 1.6 metres in diameter, and
   (iii) A 14.5 km long concrete lined diversion tunnel of 2.5 metres internal diameter.

The estimated total cost of these works amounts to about £17.00 million.

During 1988, the construction drawings and contract documents were finalized and approved by the Government and the World Bank, after long discussions and negotiations between WDD, the Consultants and the World Bank. A Panel of Experts was appointed who also reviewed the drawings and contract documents and Tenders are to be invited in January 1989.

2. Irrigation Distribution Networks

An area of about 4300 hectares will be irrigated under Phase 2 of the Southern Conveyor Project. This area is distributed into four schemes as follows:

(i) Akrotiri Irrigation Network, which will irrigate a total area of about 1750 hectares out of which 550 will undergo land consolidation. Because of the delay in completing the design work and the progress of the land consolidation process, it was decided to design and construct the whole Network in one phase. One civil and two supply contracts are required for the construction of the Network. The supply contracts will include the supply of pipes and fittings, valves, water meters, hydrants etc. The total cost of the works was estimated to about £6.00 million.

During 1988 the design work was extended to include the land consolidated areas. The second draft designs were submitted by the Consultants and after our review they were returned for corrections and amendments. The draft documents for the supply contracts were reviewed, corrected and returned to the Consultants for the necessary corrections/amendments. The Consultants submitted also Volumes 2 and 3 of the civil contract for our review.

Work on the installation of the main conveyors of the Network started in early 1988 and continued throughout the year. The installation of the main conveyor became necessary to enable the continuation of water supply to existing irrigation intakes which would be affected after the closing of the gates of the Kouris Dam in November 1987. The construction work was undertaken by the WDD Limassol Regional Office and included the installation of about 11km long pipelines ranging in diameter from 800 to 1000mm. The work was substantially completed by the end of 1988.

(ii) Kiti Irrigation Network, will irrigate a total area of about 1660 hectares out of which about 1000 hectares will undergo land consolidation. Because of the good progress in the land consolidation work, it was decided that the design and construction of this scheme are performed in one phase, as for the Akrotiri Network. One civil and two supply contracts will be prepared for this scheme. The total estimated cost for the Network is about £4.00 million.

Work on the land consolidation and on topographical surveys continued during 1988. The night storage reservoir was moved to another location since the Department of Antiquities reserved the original site for archeological excavations. The design work will continue and be completed during 1989.

(iii) Mazotos Irrigation Network will irrigate an area of 660 hectares which will undergo land consolidation. The estimated total cost amounts to about £2.50 million. During 1988 no work for the land consolidation was carried out since the Land Consolidation Department concentrated its efforts on the other schemes.

(iv) Parekklisha Irrigation Network will irrigate a total area of 320 hectares which will undergo land consolidation except for 20 hectares. The estimated total cost for this scheme amounts to about £2.00 million. For an area of about 80 hectares, water will be pumped because of its high elevation and insufficient water pressure. For this reason a pumping station delivering about 80 lit/sec will be installed.

During 1988 work on the land consolidation continued and is expected to be completed in 1989.

3. Domestic Water Supply Works

(i) Limassol Water Treatment Plant
The Limassol treatment works will be supplied with raw water from the Southern Conveyor and deliver the treated water to regional storage tanks. The output of the plant will be 40,000 m^3/day, to be increased to 80,000 m^3/day at a later stage.

The design and construction of the treatment works will be on a turnkey basis and the estimated total cost is £5.90 million.

Tenders for the design, construction, supply and erection were received on 5.1.88. The tender prices ranged from £4.1 to £7.2 million. Evaluation of the tenders by the Consultants and WDD was completed by the end of October, 1988, and the recommendations were forwarded to the Tender Board for award on 2.11.88. Until the end of 1988, no award was made.

(ii) Tersephanou Water Treatment Plant
The plant will have an output of 60,000 m^3/day, increased to 90,000 m^3/day at a later stage. The treated water will be conveyed to Nicosia and Larnaca. The estimated cost for this project is about £6.4 million.

During 1988 the site investigations and laboratory testing were completed and forwarded to the Consultants who started work on the design and preparation of the contract documents.

(iii) Tersephanou-Nicosia Pipeline Conveyance System

The conveyor will deliver treated water from Tersephanou W.T.P. to Nicosia service reservoir at Lakatamia. The scheme comprises a 35 km long pipeline, 900 mm in diameter, a pumping station at Tersephanou W.T.P. and a Balancing Reservoir at Dhali. The water will be pumped into Dhali Reservoir and from there delivered by gravity to Lakatamia reservoir. The estimated total cost of the scheme is about £5.90 million.

During 1988 the geological investigations for the pipeline and Dhali balancing reservoir were completed and sent to the consultants who submitted the draft final design of the conveyor for review by WDD.

Other schemes for which the Design Division was involved or on which work was carried during 1988 are the following:

1. Vizakia Irrigation Scheme

The scheme comprises the construction of the Vizakia off-stream dam, a diversion weir with a diversion pipeline and of an irrigation network as described below.

The total area to be irrigated is 217 hectares (1,630 donums) gross and is distributed to the following villages:
925 donums for vizakia, 310 donums for Nikitari, 245 donums for Potami and 150 donums for Koutraphas. The irrigated area will undergo land consolidation and the estimated cost for the irrigation network is about £820,000.

The dam will have a capacity of 1,100,000m^3 which shows an increase from the capacities considered at the feasibility stage. The volume of the earthfill embankment will be about 300,000m^3 having a maximum height of 35.0 m. The spillway width will be 5.0 m and the discharge capacity 30.0 m^3/s. A diversion pipeline 2.0 km long and 450 mm in diameter will divert the water into the dam. The estimated cost for the construction of the dam and diversion works is about £1,560,000.

After a decision by the Council of Ministers the design and preparation of the contract drawings and documents for Vizakia dam were assigned to Consultants and the relevant contract was awarded to HOWARD HUMPHREYS & PARTNERS of England, U.K., in December 1987. The Agreement was signed on the 18th February 1988.

During 1988, additional topographical surveys and geotechnical investigation works were carried out by WDD at the request of the Consultants. The Consultants submitted their draft design and contract documents for our review in December 1988.

2. Athienou Irrigation Scheme

The purpose of this scheme is to convey water from the Main Conveyor of the Southern Conveyor Project to Athienou village and two other nearby villages mainly for irrigation and for a limited quantity for drinking of livestock.
Water from the main conveyor will gravitate towards a reservoir at Aradhippou through a 400mm diameter 1.8km long ductile iron pipeline and then will be pumped through a 450mm dia ductile iron pipeline 9.8 km long, to another reservoir at Athienou which is connected to the irrigation network. Both reservoirs have a storage capacity of 3,500m^3. A pumping station will be constructed adjacent to the Aradhippou reservoir. Three pumps will be installed (one stand-by) delivering 227 liters per second against a total head of 200 metres. The irrigated area is 267 ha at Athienou and 65 ha at the villages of Avdhellero and Troulli.

During the year 1988 the feasibility study was completed and topographical surveys and field investigation work started. Work on the final design and preparation of construction drawings started in parallel and will be completed in 1989.

The total cost of the scheme excluding irrigation for Avdhellero and Troulli, is estimated to be £2,620,000.

3. Paralimni Pond

During 1988, the detail design and construction drawings were completed for Paralimni Pond which is to be used for irrigating an area of 120 hectares in the Paralimni area. The scheme consists of an off-stream earthfill pond of 325,0000 m^3 capacity, a supply pipeline and an irrigation network.

Flood water from the Paralimni Lake is to be conveyed through an existing earth channel and be diverted into the proposed pond. The main volume of water however will be conveyed by a gravity main from the reservoir CDP XIII within the Kokkinokhoria irrigation area of the Southern Conveyor Project.

4. Ponds in the Greek Islands of Samos and Lesvos

As explained in Chapter IV the Water Development Department has undertaken the design of two off-stream earth ponds which are to be constructed in the Greek Islands of Samos and Lesvos. This work is a result of the agreement of technical co-operation between the respective Ministries of Agriculture of Greece and Cyprus. Both ponds will be used for irrigation purposes and will be rendered water-tight using the PVC membrane lining, a method used very successfully in Cyprus.

The pond in Samos island, called Theopyitos pond, is situated 3km north-east of Myteleni village and will have a storage capacity of about 150,000m^3. Water will be diverted into the pond from a nearby stream through a 1500m long, 300 mm diameter pvc pipeline at a maximum rate of 120 lit/sec. For this purpose a concrete diversion weir will be constructed on the stream. The total volume of earthworks involved is estimated at 58,300m^3 and the membrane lining required to line the pond, 27,000m^2. Apart from the preliminary studies, during 1988, the detail design and drawings

were completed by the end of December except for the weir and pipeline.

The pond in Lesvos, given the name of Ayiasos Pond, is situated about 4 km north-west of Ayiasos village and will have a storage capacity of about 530,000m^3. Water from a number of springs will be diverted into the pond from a nearby stream, through a 1100m long, 300mm diameter PVC pipeline, at a maximum discharge rate of 150 lit/sec. The total volume of earthworks for the construction of the pond is estimated at about 114,000m^3 and the membrane lining required to line the pond 184,000m^2.

The preliminary design work started in December 1988 and different layouts were studied and the quantities of earthworks involved and the pond capacities were estimated in order to choose the best possible solution for the final design.

5. Larnaca Water Supply

Because of the inadequate capacity of the existing main pipeline supplying water to Larnaca town from the Larnaca service reservoir, the Larnaca Water Board asked the Water Development Department to study the problem and prepare a desgin of a new water main, which together with the existing one should satisfy the demand for both Larnaca town and the tourist area along Larnaca-Dhekelia road.

To enable the design of the new water main, it was necessary to review and up-date the water demand for both Larnaca town and the tourist area up to the year 2020. For this reason, a study was undertaken and projections made for both the Larnaca population increase and the tourists expected in the area.

The study will be ready in early 1989 and the design of the new conveyor will follow.

6. Khalassa Irrigation Scheme

The purpose of this scheme is to develop perennial irrigation for the agricultural development of 276 donums gross area located southwest of the new Khalassa village.

Four alternative schemes were previously considered at the preliminary stage. Three of them proposed the construction of ponds, where the water would be taken from Kouris and Zygos river or from Kephalovrisos spring. In the fourth scheme, which was finally chosen as the most economical and was studied in more detail, water will be pumped from Kouris Reservoir up to the balancing water tank, through a 250mm diameter, 850 m long pumping main. The pumping rate will be 43.2 lit/sec and the pumping head will vary depending on the reservoir water level from 134 m to 191 m. From the water tank the water will be conveyed through a 250 mm diameter, 1,780m long gravity main to the proposed irrigated area.

It is proposed that the pump is erected on a floating platform and connected to the pumping main through a flexible pipe.

The total capital cost for the implementaion of the Khalassa irrigation Scheme is estimated at £260,000 and the annual pumping cost at £4,400.

DRAWING AND RECORDS BRANCH

by S C Pitsillides STS
Head of Branch

The Drawing and Records Branch is made up of the following sections:-

-- The Drawing and Cartography Section.
-- The Plan Registry and Plan Reproduction Section .
-- The Photographic Section and Photo Process Laboratory.
-- The Technical Library and the Technical Information Section.

At the end of 1988 the Drawing and Records Branch staff numbered 22 i.e. 2 Senior Technicians, 10 Technicians I, 7 Technicians II, one Technician II on casual basis and 2 hourly paid Assistants of the plan reproduction section.

Two Technicians worked throughout the year on SCP construction sites. At the end of the year the Technician II on casual basis was shared between the HQs design team of SCP and the Kokkinokhoria Irrigation Area site offices of SCP. One other Technician I worked throughout the year at Ayios Athanasios site offices of SCP.

Drawing and Cartography Section

The organisation of the Drawing and Records Branch continued on similar lines as that of the year 1987 except that during the latter half of the year the Assistant Head of the Branch was given full charge of the Drawing Office with the Head of the Branch having full knowledge of incoming work and final check of all finished outgoing work, thus affording him time for other general duties given him by the Director including publicity duties as required by the MANR.

Committees carried on work for:

-- Instruments, equipment and materials purchase
-- Exhibitions, inaugurations
-- Formulation of drafting standards and
-- a special team for cartographic work, model making and exhibitions-inaugurations supported as required by all the staff.

For the general organisation of the D & RB see Table V-2.

Training of staff is a never ending process and is carried out along with the execution of work. Nevertheless during 1988 members of the D&RB have, for varying periods attended the following courses:-

-- Cyprus Productivity Centre. Lessons on basic topographic instruments and their use.
-- Cyprus Productivity Center. Lessons in advance mechanical drawing.
--Autocad computer advanced level lessons with Palinex of Nicosia.

TABLE V-I
WORK CARRIED OUT BY THE DRAWING AND RECORDS BRANCH DURING 1988.

Ref.	Description	Time spent in hrs.	Man months	% of total
a.	Existing dams (completion plans, sedimentation maps, control monuments etc.) and proposed dams	3284	21.0	7.9
b.	Irrigation distribution systems for dams	75	0.5	0.2
c.	Routine irrigation schemes	1328	8.5	3.2
d.	Routine domestic water supply schemes	5524	35.4	13.3
e.	Krasokhoria project	271	1.7	0.7
f.	Pitsilia integrated rural development project	244	1.5	0.6
g.	Vasilikos-Pendaskinos project	2013	12.9	4.8
h.	Southern Conveyor project	12068	77.4	29.1
i.	Khrysokhou irrigation project	97	0.6	0.2
j.	Karyotis project	240	1.5	0.6
k.	Samos & Lesvos ponds	182	1.2	0.4
i.	Recharge works	76	0.5	0.2
m.	Antiflood and river training works	90	0.6	0.2
n.	Watershed surveys	140	0.9	0.3
o.	Hydrological	294	1.9	0.7
p.	Programmes and organisation	823	5.3	2.0
q.	Sewage disposal	305	1.9	0.7
r.	Completion plans and reports	1208	7.7	2.9
s.	Agricultural show	64	0.4	0.2
t.	General-Odd jobs	745	4.8	1.8
u.	Computer lessons	77	0.5	0.2
v.	Productivity centre courses	230	1.5	0.6
w.	Auxiliary services			
	(i) Library	1294	8.3	3.1
	(ii) Plan registry	681	4.4	1.6
	(iii) Plan reproduction	2444	15.7	5.9
	(iv) Drawing materials store	318	2.0	0.8
	(v) Photographic section and photo process lab	1986	12.7	4.8
	Total for auxiliary services	6723	43.1	16.2
x.	Leave etc.			
	(i) Leave paid	3986	25.6	9.6
	(ii) Leave without pay	32	0.2	0.1
	(iii) Sick leave	1180	7.5	2.8
	(iv) Maternity leave	-	-	-
	(v) D.C.	224	1.4	0.5
	Total for leave etc.	5422	34.7	13.0
	Grand total	41523	266	100%

TABLE V-2

WDD — DRAWING AND RECORDS BRANCH (D & R B)

ORGANIZATION CHART 31.12.1988

Head : S C Pitsillides STS
Asst head : S Selipa ST

Plan registry, plan reproduction & drg materials : E Hjkyriacou ST

A INCOMING WORK

1	2	3
MAJOR PROJECTS	ROUTINE DWS, IRRIGATION SEWAGE DISPOSAL & OTHER WORKS	COMPLETION PLANS AND FOLLOW-UPS

Distributed to the Drawing and Records Branch staff by the Asst Head — Where several staff are required for a particular job a senior member is asked to take charge

DRAWING AND RECORDS BRANCH STAFF ON 31.12.88

Senior Technical Superintendent	1 No
Senior Technicians	2 No
Technician grade I	10 No
Technician grade II	8 No
Plan reproduction assistants (Hourly)	2 No
Total	23 No staff

B AUXILIARY SERVICES (DEPARTMENTAL)

1	2	3	4
PLAN REGISTRY	PLAN REPRODUCTION DRG MATERIALS (PURCHASE & STORE)	PHOTOGRAPHIC, VIDEOGRAPHIC SECTION, PHOTOLITHOGRAPHY PROCESS LAB	TECHNICAL LIBRARY, TECHNICAL INFO & MISCELLANEOUS
-Card code system	-Plan printing	-Photo process lab for enlargements reductions, repros	-Requirements & orders of books periodicals etc
-Plan bins	-Machine maintenance & operation	-Photolithography for cartographic work	-Registr. of books, periodicals etc
-Archives	-Requirements of instruments, equipment and materials	-Site visits for still, cine and video from ground and air	-Computer input for books
-Computer input for plan registry	-Orders, tenders and local purchases	-Negatives and process lab registry	-Issue of library bulletin
	-Drg materials store	-Purchases, photo materials-equipt	-Library store
	-Report collation binding (For Branch)	-Maintenance & records for equipment	-Photo, cine and video records
		-Orders & distribution of photos	-Video, film shows
		-Video documentaries production	-Annual report — editing, printing distribution
		-Computer input for photos, slides films, videos.	-Technical brochures/ leaflets
			-Technical information-publicity
			-Technical staff postings board (D's)
			-Technical staff lists computer outputs
			-Electronic plotter

C COMMITTEES -SPECIALIZED WORK Etc

1	2	3	4
COMMITTEES	SITE & REGIONAL OFFICES D & R B STAFF	STAFF TRAINING	CARTOGRAPHIC SECTION GRAPHICS, MODEL MAKING, EXHIBITIONS etc
I. Instruments, equipment & materials purchase D & R B Head and Asst Head plus 2 or 3 D & R B staff	-Materials, instruments supplies	-Within D & R B	D & R B Head and Asst Head plus 2 or 3 D & R B staff
II Exhibitions D & R B Head and Asst Head plus 2 or 3 D & R B staff	-Periodic visits by D & R B Head	-Within the Department	
III Drafting standards D & R B Head and Asst Head plus 2 or 3 D & R B staff		-Productivity Centre	
		-The private sector	

D. SUNDRY DUTIES OF DO STAFF

a Dam capacities files	g Requisitions to D.L.S
b D's office graphs - map	h Standard sheets
c Annual report graphs etc	j Log. paper
d Staff charts	k Lettraset - letratone
e Orders to print room	l Plans in tubes & archives tubes
f Maps store	m P R box files
g Watershed surveys store	n Drawing tags

Drg. No. BM/G/222/3

The largest load of work during 1988 was again by far for the Southern Conveyor Project being 29.5% of the total time of the 22 No staff as can be seen on table V-I. Following was work for routine domestic water supply schemes (13.3%) and third was for existing and proposed dams (7.9%).

The main demand of the Southern Conveyor Project was for assistance at the Project site of Ayios Athanasios for the main conveyor, at Ormidhia for the Kokkinokhoria Irrigation Area (KIA) and Kouris Dam (although this was afforded by the WDD Limassol Regional Office). At the Nicosia HQs the Drawing and Records Branch carried out work for the SCP design teams mainly for KIA irrigation networks. To a lesser extent the WDD HQs staff have also had to deal with information furnished to the SCP 2nd Phase Consultants, Energoprojekt of Yugoslavia.

Extraordinary demands on the D&RB during 1988 was:-

-- For the preparation of the WDD stand for the 1988 Agri Fair. The main exhibits were Kouris Dam working model after extensive repairs for water tightness and large colour transparencies lighted frames which after the Agri-Fair found a permanent spot in the Director's office anteroom.

-- The preparation of a greek version of the map of Cyprus scale 1:250,000 showing the Major Water Development Projects in time for exhibition of the Agri Fair of 1988.

-- Preparation of a triptych for Kouris Dam - Southern Conveyor Project inauguration which was to be in January 1988 but was finally postponed indefinitely due to the oncoming Presidential Elections in February 1988. The triptych and other material were kept for use when the inauguration finally takes place in Spring 1989.

A significant development was the introduction towards the end of 1988 of an electronic plotter (AO size) and digitizer (A3 size) for the production of drawings working with existing PC system. Already programmes were developed for plotting of longitudinal sections and contour maps from the surveyors level books with fantastic time savings achieved.

Plan Reproduction and Plan Registry Section

Two continuous process ammonia plan printing machines have been used, the older one as a standby. A total number of 23,000 prints were prepared of all types and sizes through some 2,650 orders to the Print Room. The plan registry work was shared by the Drawing Office staff.

The Photographic Section and Photo Process Laboratory.

Photographic coverage of construction works of the Department was carried out throughout 1988 in black and white, colour and colour slides, still photography as well as colour video recording and in certain instances in colour cine filming. Periodic visits were made to Kouris Dam although the responsibility for photographic coverage lies with the Contractors.

As was the case for the past year automatic compact cameras (5 No) during 1988 were distributed to various construction sites for on the spot photographic coverage. At the end of 1988 two of those cameras were held at SCP Kokkinokhoria Irrigation Area for the contracts in progress there, one was used at SCP main conveyor construction sites, one at Kouris Dam and one at Khrysokhou Project construction sites.

The photographic section was non-the-less required to carry out monthly visits to the Kokkinokhoria Irrigation area contract sites for still colour photoes and video recording/cine filming.

The photo process laboratory carried out all the photolithographic work of the department including preparatory work for our colour maps, base maps for SCP distribution networks as well as enlargements reductions and reproduction of drawing/maps.

Technical Library and Technical Information Section

During the year under review £1210 was spent on the purchase of 17 books and subscription to 13 periodicals. The Library continued to issue monthly notes on material received and of articles of special interest in periodicals. Following are lists of books purchased, of periodical subscriptions and of WDD reports.

TABLE V-3

MATERIAL PURCHASED IN 1988

Books (17 No.)

OLIVIER LEROY. EEC initiatives to combat the pollution caused by the discharge of dangerous substances into the aquatic environment. Rixensart, 1987. Book No. B236. BF 9,500. (Requested by D Kypris SH).

Α ΓΕΩΡΓΟΠΑΠΑΔΑΚΟΥ. Ορθογραφικό Λεξικό της νεοελληνικής γλώσσας. Μονοτονικό. Θεσσαλονίκη, 1984. Αρ. βιβλίου B248 £2.50.

BSI. BS5163:1986. Specification for predominantly key-operated cast iron gate valves for waterworks purposes. London, 1986. Book No. B356 St.£27.20. (Requested by K C Hassabis, AD)

FIDIC. Conditions of contract for works of civil engineering construction. Part I. General conditions with forms of tender and agreement. Part II. Conditions of particular application with gidelines for preparation of part II clauses. London. Fourth edition, 1987. Book No. B362 Sw. Fr 30.00. Requested by K C Hassabis, AD).

FIDIC. Conditions of contract for electrical and mechanical works, including erection on site. With forms of tender and agreement. London, Third edition, 1987. Book No. B363 Sw. Fr. 30.00. (Requested by K C Hassabis, AD).

DAVID BUTLER & BRIAN PINKERTON. Gravity flow pipe design charts. London, 1987. Book No. B367 B£18.75. (Requested by C Katsavras, EE-I).

THE PIPELINES INDUSTRIES. Pipeline, Design, Construction and Operation. London, 1984. Book No. B368 B£31.20. (Requested by N Tsiourtis, SWE).

E M SHAW. Hydrology in practice. London, 1985. Book No. B369 B£13.75. Requested by I Iacovides, SH).

H C TORNO. Computer application in water resources. New York, 1985. Book No. B370 B£108.25. (Requested by N Tsiourtis, SWE).

L FLETCHER. Design and operation of pipeline control systems. New York, 1984. Book No. B371 B£14.25. Requested by N Tsiourtis, SWE).

G OMURA. Πλήρες εγχειρίδιο του Autocad. Αθήνα 1988. Αριθμός βιβλίου B417. £16.00. (Requested by Dr. G. Socratous, EE-I).

AUTOCAD - AutoCAD version 2.6. Book No. B390. £17.50.
(Requested by Dr. G. Socratous, EE-I).

R E CALVERT. Indroduction to building management. Fifth edition. London, 1986. Book No. B391. Stg.£14.95.
(Requested by N Christofides, EE-I)

J D VAN DER TUIN. Elsevier's dictionary of water and hydraulic engineering. Amsterdam, 1987. Book No. B393. Dfl 376.00.
(Requested by Dr. Christodoulides H-I)

HMSO. Royal commission on environmental pollution. Tenth report. Tackling pollution. Experience and prospects. Book No. B394. Stg.£11.25. (Requested by D. Kypris, SH)

FIDIC. Guide to the use of FIDIC conditions of contract for electrical and mechanical works. Third edition. Lausanne, 1988. Sw. Fr. 111.00 (Requested by K C Hassabis AD).

P WOOD - L GROVE. Developments in valves and actuators for fluid control. Proceedings of the second international conference. UK, 1988. Book No. Stg.£ 57.00.

Subscription to periodicals

ASCE. Journal of Irrigation and Drainage Engineering
ASCE. Journal of Geotechnical Engineering
ASCE. Journal of Hydraulic Engineering
ASCE. Journal of Construction Enginnering and Management
ASCE. Journal of Water Resources Planning and Management
THE INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMFENT. Journal of Water and Environmental Management.
CONCRETE SOCIETY. Journal of Concrete.
WATER & WASTE TREATMENT. Journal of Water & Waste Treatment.
DEPARTMENT OF EMPLOYMENT (UK) - HMSO. Employment Gazette.
THE INSTITUTION OF CIVIL ENGINEERS. Proceedings.
THE INSTITUTION OF CIVIL ENGINEERS. Geotechnique.
AMERICAN WATER WORKS ASSOCIATION. AWWA Journal.
Journal of the Irrigation Engineering and Rural Planning.

WDD AND Associated Reports (26 No.)

K SPANOS. Khrysokhou Irrigation Project. Progress report No. 9. Covering the period 1.1.87 - 31.12.87. Report No. D/309. Nicosia, February, 1988. Book Nos B234, B 235.

N TSIOURTIS. Report on review of irrigation water charges for 1986, 1987, 1988 from Government Waterworks. Report No. L/36 Nicosia, February, 1988. Book No. B237.

D PATSALIDES. Southern Conveyor Project (Phase 1) Progress report No. 7 covering period 1.7.87 to 31.12.87. Report No. D/407. Nicosia, March, 1988. Book Nos B272, B273.

I IACOVIDES - A GEORGHIOU & A CHRISTODOULIDES. International Atomic Energy Agency Research Contract 3976/RB. Evaluation of the operation of Yermasoyia surface and groundwater reservoirs using environmental isotopes. Report No. H/69. Nicosia, April, 1988. Book Nos B365, B366.

Π ΝΕΟΦΥΤΙΔΗΣ. Δεξαμενή Σπήλια-Κουρδάλη. Συνδυασμένο έργο άντλησης και βαρύτητος. Αρ. εκθέσεως D/166. Λευκωσία, Ιούνιος, 1988. Αρ. βιβλίων B372, B373.

S PAPAGEORGHIOU. Contracts for Cyprus. Major water development works. Report No. L/40. Nicosia, Revised May, 1988. Book No. B374.

S PAPAGEORGIOU T-I and MIRANDA AVGOUSTI T-II. WDD. Technical staff lists as on 31.12.1987. Report No. L/47. Nicosia, August, 1988. Book No. B395.

S PAPAGEORGIOU T-I and MIRANDA AVGOUSTI T-II. WDD. Technical staff lists as on 30.6.1988. Report No. L/48. Nicosia, August, 1988. Book No. B396.

WDD - C ST LYTRAS. Water Development Department Annual report 1987. Nicosia, September, 1988. Book No. B443.

P G ELIADES. Southern Conveyor Project. Kouris dam. Instrumentation results. Nicosia, September, 1988. Book Nos. B419, B420.

D M PATSALIDES. Southern Conveyor Project. (Phase 1) Progress report No. 8. Covering period 1.1.88 to 30.6.88. Report No. D/408. Nicosia, September, 1988. Book Nos B421, B422.

M C IOANNOU. Kapouras dam. Ayios Yeoryios Kafkalou Irrigation Scheme. Feasibility study, summary report. Report No. D/169. Book Nos B423, B424.

K SPANOS. Khrysokhou Irrigation Project. Progress report No. 10. Covering the period 1.1.88 to 30.6.88. Report No. D/310. Nicosia, September, 1988. Book Nos B425, B426.

PH ROUSSIS. Dam water balance, 1987. Report No. L/49. Book Nos. B427, B428.

Π ΝΕΟΦΥΤΙΔΗΣ. Αναδασμός στην Κύπρο. Αρ. εκθέσεως L/50. Λευκωσία, Σεπτέμβριος, 1988. Αρ. βιβλίων B429, B430.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES and S KATSIANIS. SCP Kokkinokhoria area. Irrigation block Xa - Liopetri - Sotira. Report on the ground-water resources. Report No. H/70, Nicosia, May, 1988. Book Nos B431, B432.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES & S KATSIANIS SCP Kokkinokhoria area. Irrigation block IX. Sotira - Liopetri Report on the ground-water resources. Report No. H/71, Nicosia, June, 1988. Book Nos B433, B434.

I IACOVIDES - A. GEORGHIOU - A CHRISTODOULIDES & S KATSIANIS. SCP Kokkinokhoria area. Irrigation block XIIa (Phrenaros-Avgorou-Liopetri) Report on the ground-water resources. Report No. H/73. Nicosia, August, 1988. Book Nos B435, B436.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES & S KATSIANIS. SCP. Kokkinokhoria area. Irrigation block VIIb (Liopetri-Xylophagou). Report on the ground-water resources. Report No. H/74 Nicosia, September, 1988. Book Nos B437, B438.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES & S KATSIANIS. SCP. Kokkinokhoria area. Irrigation block XI Liopetri-Sotira-Phrenaros) Report on the ground-water resources. Report No. H/75. Nicosia, September, 1988. Book Nos B439, B440.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES & S KATSIANIS. SCP. Kokkinokhoria area. Irrigation block xb (Sotira-Ayia Napa) Report on the ground-water resources. Report No. H/76. Nicosia, October, 1988. Book Nos B441, B442.

P MARATHEFTOU. Akaki-Malounda dam. Feasibility Study Report No. D/168. Nicosia, June, 1988. Book Nos B455, B456.

ΠΕΤΡΟΣ ΝΕΟΦΥΤΙΔΗΣ. Δεξαμενή Πλατανιστάσας. Αρδευτικόν έργο βαρύτητος Αρ. εκθέσεως Δ/170. Λευκωσία, Δεκέμβριος, 1988 Αρ. βιβλίων, B457, B458.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES & S KATSIANIS Southern Conveyor Project. Kokkinokhoria Area. Irrigation block IVa Avgorou - Xylophagou - Ormidhia. Report on the ground water resources. Report No. H/77. Nicosia, November, 1988. Book No. B459.

N TSIOURTIS - I NICOLAOU. Report on review of irrigation water charges for 1989 - 1995 from government waterworks. Report No. L/52. Nicosia, December, 1988. Book No. B460.

D KYPRIS - Standards and code of practice in the reuse of treated domestic sewage effluent for irrigation Report No. L/55. Nicosia, December, 1988 (Paper presented at the FAO Regional Seminar on the Treatment and Reuse Sewage Effluent in Cairo). Book Nos B461, B462.

VI RURAL PROJECTS PLANNING DIVISION

By

C Andreou

Senior Water Engineer

Head of Division

Introduction

The Rural Projects Planning Division deals especially with rural domestic water supply and the planning and design of contributory irrigation schemes. Other activities of the Division is the rehabilitation of water supply and irrigation schemes, in the Rural Development Project areas of Orini(Larnaca), Marathasa, Tylliria and Krasokhoria, water supply schemes of touristic and livestock areas, encroachment in rivers and streams, quarrying in river beds, design of sewage systems for Refugee Housing Estates and communities in Rural Areas and the examination of applications for building permits and permits for the division of building plots.

By the end of 1988 the staff of the Division was consisting of the following:

One Senior Water Engineer - Head of the Division
Two Executive Engineers Class I
One Senior Technical Superintendent
One One Technical Superintendednt
Two Senior Technicians
Two Technicians I
Two Technicians II(Temporary)
One Secretary-Typist

VILLAGE WATER SUPPLY SCHEMES

The general village water supply situation during 1988 is described in Tables VI - 1 and VI - 2. There are no villages in Cyrpus without piped water.

During 1988 only 53 out of a total number of 619 villages remained with public fountains ie 0.83% of the total village population.

Out of 566 villages with house to house supply systems 545 enjoyed a per capita daily rate of over 130 litres (29 gallons).

Water Supply Schemes Prepared During 1988

A total number of 92 schemes were prepared and submitted to the District Officers during 1988 at a total estimated cost of £3,750,693 as shown on Table VI-3.

Another 35 schemes were in the course of preparation by the end of the year as per Table VI-4.

Besides the above mentioned schemes a total number of 30 water supply schemes were prepared for the housing of displaced persons (Refugee self-housing and housing estates), at a total estimated cost of £330,030 as per table VI-3A, which were submitted to the Department of Town Planning and Housing.

In 1988, seven schemes to supply water to livestock areas were prepared at a total estimated cost of £288,000 as per table VI-3B.

Domestic water supply schemes for touristic areas are also included in the schemes already mentioned.

In cases where there are no established Water Boards, the Division deals also with the design of town water supply schemes.

Brief description of important water supply schemes prepared during 1988

Nicosia District

Lymbia: Scheme prepared for the replacement of all G.I pipes of the existing house to house system at a total estimated cost of £114,000.

Erghates: Scheme prepared for the replacement of all G.I pipes of the existing house to house system at a total estimated cost of £62,500.

Kato Moni: Scheme prepared for the replacement of all G.I pipes of the existing house to house system at a total estimated cost of £66,000.

Lakatamia: Additional supply from B/Hs 39/73,87/75 and 88/75 at a total estimated cost of £115,000.

Pedhoulas: New water supply scheme prepared at a total estimated cost of £203,310.

Pera(Orinis): Scheme prepared for the replacement of all G.I pipes of the existing house to house system at a total estimated cost of £138,000.

Nikitari: Additional supply from B/H 23/84 and new house to house system. Total estimated cost of proposed scheme prepared £148,000.

Limassol District

Pelendri: Replacement of water supply distribution system	£108 000
Ypsonas: Replacement of water supply distribution system	£ 75 000
Apesia: Additional water supply from Arkolakhania Spring	£ 52 200
Kato Polemidhia: New scheme for new Limassol Hospital.	£ 81 000

Paphos District

Xeropiyi Regional Scheme and Simou-Dhrymou-Dhrinia: During the summer time the flow of the springs from which the villages are at present supplied with water diminishes considerably and the house holders suffer from shortage of water.

For providing additional supply to the villages a scheme was designed using B/H No. 93/78.

Pomos - Pakhyammos: Both villages suffer from shortage of water during the summer time due to the low flow of their springs.

To provide adequate supply to the house holders a scheme was designed to pipe water from ''Teratsia'' springs situated in Paphos Forest.

Famagusta District

Sotira: The existing distribution system of Sotira village is very old. It was laid in 1962.

A new modern distribution scheme was prepared which includes the construction of 500 M^3 storage tank and the replacement of the old pipelines. The estimated cost is £300,000.

IRRIGATION SCHEMES

The planning and design of irrigation schemes aims at increasing the irrigated area near the sources for self employed farming organizations such as Village Irrigation Associations or Divisions.

The main target is to increase permanent irrigation annually which can be implemented with the financial participation by the farmers.

As the main principles of this special programme is the quick and effective use of water at or near the source combined with intensive agriculture methods, design considerations are usually based on land and water use data furnished by the District Agricultural Offices. Project evaluation is undertaken by a joint Interdepartmental Committee.

The advantages of the rural projects programme, the beginning of which dates back to the creation of the Department is ''speed of reaction'' in all phases of project development, ''wide participation'' of farming communities, ''greater flexibility'' in budgetary procedure and '' greater exploitation'' of the existing agriculture and agroeconomic background of the island.

The planning and design of these schemes can be undertaken at a greater advantage by technical staff, whose skill has been acquired by long experience in construction methods and long friction with local problems and practices.

The main types of schemes planned and designed, postulated water conservation either by the improvement of the old 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.

A certain number of schemes have been designed and are now under construction with government contribution.

During 1988 a total number of 13 irrigation schemes was prepared and submitted to District Officers at a total estimated cost of £358,425 as per Table VI-5.

Another 26 schemes were in the course of preparation or under investigation by the end of 1988 as per Table VI-7.

Brief Description of Important Irrigation Schemes prepared during 1988

Nicosia District

Kaliana: Pumping schemes from B/Hs 131/86 and 114/86 and distribution system for the irrigation of 23Ha at an estimated cost of £151,900.

Menico: Lining of existing earth channels in R C for a total length of 5580 meters for the irrigation of 124 Ha. Estimated cost £197,000.

Tsakkistra: Pumping scheme from B/H 65/87 using the existing distribution system. Estimated cost £43,100.

Limassol District

Prodhromos: Piping of snow water to Prodhromos dam.Estimated cost £33,200.

Kato Platres: Develópment of B/H 81/81 for irrigation and water supply purposes.Estimated cost £97,000.

Moniatis: Construction of weir and RCC reservoir 500m^3. Estimated cost £40,000.

Interdepartmental Committee for Small Irrigation Projects

The Committee is functioning in conformity with directions of the Director General of the Ministry of Agriculture and Natural Resources, for the purpose of assessing project viability for budgeting purposes and coordinates the activities of the District Agriculture Services for the supply of agroeconomic data in the preparatory stages of the projects. During 1988 five schemes have been approved by the Committee as per Table VI-6. Two schemes were not approved.

Sewage Schemes

During the year under review 3 Sewage Schemes were prepared at an estimated cost of £400,000 as per Table VI-8,

Building and Division of Building Plots Permits.

During 1988 a total of 1175 cases were investigated and sent to the District Officers for further action.

TABLE VI-1

VILLAGE WATER SUPPLIES

		Villages with House-to House distribution system			Villages with Public fountains			Villages without a piped supply			
Year	Schemes completed	Total No. of Villages	Villages %	Population %	Total No. of Villages	Villages %	Total No. of Villages	Villages %	Population %	Total No.of 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	66.86	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	40.90	24.28	-	-	-	619
1969	14	360	57.32	78.60	268	42.68	21.40	-	-	-	619
1970	32	392	62.42	83.23	236	37.58	16.77	-	-	-	619
1971	16	408	64.95	85.42	220	35.05	14.58	-	-	-	619
1972	29	437	69.60	88.70	191	30.40	11.30	-	-	-	619
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
1976	11	543	87.72	97.60	76	12.28	2.40	-	-	-	619
1977	8	551	89.02	98.04	68	10.98	1.96	-	-	-	619
1978	6	557	89.98	98.20	62	10.02	1.80	-	-	-	619
1979	2	559	90.30	98.27	60	9.70	1.73	-	-	-	619
1980	1	560	90.47	98.04	59	9.53	1.96	-	-	-	619
1981	1	561	90.63	98.06	58	9.37	1.94	-	-	-	619
1982	-	561	90.63	98.06	58	9.37	1.94	-	-	-	619
1983	-	561	90.63	98.06	58	9.37	1.94	-	-	-	619
1984	1	562	90.79	98.10	57	9.21	1.90	-	-	-	619
1985	1	563	90.95	98.11	56	9.05	1.89	-	-	-	619
1986	-	563	90.95	98.11	56	9.05	1.89	-	-	-	619
1987	1	564	91.12	98.12	55	8.88	1.88	-	-	-	619
1988	2	566	91.44	98.17	53	8.56	0.83	-	-	-	619

TABLE VI-2

WATER SUPPLY SITUATION AT THE END OF 1988

District	Satisfactory piped supply supply rate 90 litres/head/day&over								Unsatisfactory piped supply supply rate below 90 litres/head/day								Total No of Villages	Total population 1969
	Villages with House to House				Villages with fountains				Villages with House to House				Villages with Public fountains					
	No	%	pop.	%	No	%	pop.	%	No	%	pop.	%	No	%	pop	%		
Nicosia	150	88.76	119263	95.95	10	5.92	1230	0.99	5	2.96	3104	2.50	4	2.36	699	0.56	169	124296
Kyrenia	39	82.98	30786	93.50	2	4.26	59	0.18	1	2.13	540	1.64	5	10.63	1542	4.68	47	32927
Famagusta	82	83.68	82644	92.12	3	3.06	444	0.50	6	6.12	5695	6.34	7	7.14	934	1.04	98	89717
Limassol	104	91.22	72527	97.87	4	3.51	65	0.09	4	3.51	1417	1.91	2	1.76	99	0.13	114	74108
Paphos	114	84.85	48813	93.93	11	9.1	2.006	4.02	5	3.78	685	1.32	3	2.28	191	0.72	132	51695
Larnaca	56	94.92	40238	99.27	2	3.39	156	0.38	0	0.00	0	0.00	1	1.69	140	0.35	59	40534
TOTAL	545	88.05	394271	95.40	32	5.17	3960	0.96	21	3.39	11441	2.77	21	3.39	3605	0.87	617	413277

TABLE VI-3

VILLAGE WATER SUPPLY SCHEMES
PREPARED IN 1988 AND SUBMITTED TO
DISTRICT OFFICERS

Nicosia District

Ser. No.	Village	Nature of Scheme	Est.Cost £
1	Politiko	New pumping unit	1 850
2	Phlasou	Elevated tank capacity 137m^3	23 500
3	Kaliana	Additional supply from B/H 131/86	19 400
4	Lazania	Installation of pumping unit on B/H 140/80	320
5	Erghates	Improvements to the existing House to house system	62 000
6	Lymbia	Improvements to the existing house to house system	114 000
7	Athalassa farm	Replacement of pipes	5 600
8	Kato Moni	New house to house system	66 000
9	Lakatamia	Additional supply from B/Hs 39/73,87/75,88/75	115 600
10	Nisou-Perakhorio	Additional supply from Dhipotamos-Nicosia pipeline	19 000
11	Kaliana	Replacement of pipes	20 000
12	Xeri	Additional supply from B/H 52/54	12 837
13	Nisou-Perakhorio	Improvements	5 000
14	Kapedhes	Additional supply from B/H 162/87	35 500
15	Lymbia	New pumping unit	7 850
16	Epskopio	Extensions	10 400
17	Aredhiou	Replacement of pipes	4 300
18	Pedhoulas	New house to house system	203 310
19	Anayia	Water supply to plots for poor families	5 000
20	Apliki	Replacement of pipes	720
21	Malounda	Additional supply from Klirou network	4 200
22	Mitsero	Water supply to plots for poor families	6 200
23	Potamia	Additional supply from Dhali networks	10 500

TABLE VI-3 (cont)

Nicosia District (cont)

Ser. no.	Village	Nature of Scehme	Est.Cost £
24	Moutoullas	Replacement of pipes	24 000
25	Alambra	Installation of pumping unit on B/H	1 300
26	Kalopanayiotis	Replacement of pipes	25 000
27	Athalassa National Guard	Water supply to military camp	286
28	Kotchatis	New house to house scheme	27 000
29	Pera(O)	Improvements to the existing house to house scheme	138 000
30	Lakatamia	Replacement of pipes	1 200
31	Platanistasa-Phterikoudhi	Additional supply from B/H 9/82	57 800
32	Dhenia-Mammari	Additional supply from B/H 170/87	32 500
33	Galata	Laying of pipes	8 150
34	Psomolophou	Extensions	4 300
35	Dheftera Pano	Improvements	3 700
36	Dheftera Pano (Dheftera Kato)	Laying of pipes	13 000
37	Nikitari	Additional supply from B/H 23/84 & new house to house scheme	148 000
		TOTAL	£1237 323

Limassol District

1	Pelendri	Replacement of water supply distribution system	108 000
2	Pelendri	Additional water supply distribution system from pirillos spring	8 300
3	Pano Platres	Supplementary water supply	32 000
4	Ypsonas	Replacement of water supply distribution system	75 000
5	Phini	Additional water supply	22 550
6	Apesia	Additional water supply from Arkolakhania spring	52 200
7	Moni	Additional water supply from B/H 114/84	25 000

TABLE VI- 3 (cont)

Limassol District (cont)

8	Kato Mylos	Additional water supply from BH 66/76	3 600
9	Limnatis	Construction of water supply tank	5 900
10	Dhierona	Replacement of distribution system	30 400
11	Dhimes	Additional water supply from B/H 81/80	20 000
12	Lophou	Extension (Stavros area)	8 200
13	Ayios Ioannis (Agrou)	Replacement of pipes	3 570
14	Ayios Amvrosios	Extension	10 830
15	Omodhos	Extension	620
16	Kato Polemidhia	New scheme (new Limassol Hospital)	81 000
17	Pano Platres	Extension (water supply to camping place)	14 700
18	Limnatis	Improvement of spring Ayios Georghios	2 000

Paphos District

1	Kouklia	Distribution system	10 000
2	Ayia Marinoudha	Improvements	1 800
3	Xeropiyi Regional scheme and Simou-Dhrymou-Dhrinia	Additional supply from B/H No.93/78	171 400
4	Theletra	Additional supply from B/H No.128/85	23 500
5	Pomos-Pakhyammos	Additional supply from ''Teratsia'' springs	181 800
6	Paphos Lower Villages(Mesa-Khorio,Mesoyi Trimithousa Tala	Replacement of conveyor pipeline	94 300
7	Paphos Lower Villages	Replacement of part of the main conveyor pipeline	9 000
8	Anarita	New st.Tank & distribution system	74 000
9	Neokhorio	Additional supply from B/H 45/82	41 000
10	Paphos Lower Villages	Improvements	114 500
11	Nata	Improvements	3 300
		TOTAL	724 600

TABLE VI-3 (cont)

Larnaca District

1	Ayios Theodhoros	New Distribution system	34 500
2	Alaminos	'' '' ''	25 000
3	Kato Lefkara	'' '' ''	30 000
4	Psematismenos	'' '' ''	25 000
5	Kalavassos	Connection with Khirokitia Reservoir	66 000
6	Pyla	New distribution system	140 000
7	Pyrga	New connection from Nicosia pipeline	25 500
8	Tersephanou	New connection from Famagusta pipeline	35 000
9	Kornos	New connection from Nicosia pipeline	60 000
10	Vavatsinia	New distribution system	19 000
11	Ora	'' '' ''	30 000
12	Ayia Anna	'' '' ''	36 000
13	Anglisidhes	Connection from Famagusta pipeline	33 000
14	Psevdhas	New conveyor pipeline	14 000
15	Mosphiloti	New distribution system	26 000
16	Pervolia	'' '' ''	65 000
17	Anaphotia	'' '' ''	70 000
18	Livadhia	New connection with Famagusta pipeline	26 000
		TOTAL	£760 000

Famagusta District

1	Liopetri	Extensions to industrial zone	7 900
2	Strovilia-Dherinia	New supply from Vrysoulles distribution	18 000
3	Sotira	New distribution system	300 000
4	Phrenaros	'' '' ''	120 000
5	Ayia Napa	Developments	45 000
		TOTAL £	490 000

Summary of Table VI-3

District	No. of Schemes	Est. Cost £
Nicosia	37	1 237 323
Limassol	21	537 870
Paphos	11	724 600
Larnaca	18	760 000
Famagusta	5	490 900
Total	92	£ 3 750 693

TABLE VI-3A

WATER SUPPLY FOR REFUGEE HOUSING OR SELF HOUSING ESTATES PREPARED AND SUBMITTED IN 1988

Nicosia District

Ser. No.	Village	Nature of Schemes	Est.cost £
1	Perakhorio-Nisou	House to house scheme to self housing	2 600
2	Dhali	House to house scheme to ''phase D'' self housing	3 300
3	Laxia	House to house scheme to ''Phase D''	7 000
4	Lakatamia	House to house scheme to ''Archangelos Michael ''Phase III'' Government Housing	14 800
5	Lakatamia	House to house scheme to Ayia Paraskevi Government Housing	21 300
6	Laxia	House to house scheme to self hcusing '' phase C''	4 900
		Total £	52 900

TABLE VI-3A (cont)

WATER SUPPLY SCHEMES FOR REFUGEE HOUSING OR SELF HOUSING ESTATES PREPARED AND SUBMITTED IN 1988

Limassol District

Ser. No.	Village	Nature of Scheme	Est.cost £
1	Moutayiaka	Water supply for division of plots Area ''K''	6 400
2	Polemidhia	Water supply for division of plots area ''Z''	23 280
3	Moutayiaka	Water supply for division of plots area ''Θ''	11 000
4	Episkopi	Water supply for division of plots area ''H''	3 300
5	Moutayiaka	Water supply for division of plots area ''H''	29 400
		TOTAL	73 380

Paphos District

1	Khrysokhou	Distribution system	700
2	Mandria	'' ''	2 300
3	Lemba	'' ''	1 600
4	Yeroskipos	'' ''	2 400
5	Yeroskipos	'' ''	4 000
6	Yialia	Replacement of distribution system	37 500
		TOTAL £	48 500

Larnaca District

1	Dhekelia self Housing	New connection from Famagusta pipeline	37 000
2	Athienou self housing	Extensions	2 300
3	Kalon Khorion	New connection from Famagusta pipeline	43 000
4	Xylophagou self housing	Extensions	200

TABLE VI-3A (ccnt)

WATER SUPPLY SCHEMES FOR REFUGEE HOUSING OR SELF HOUSING ESTATES PREPARED AND SUBMITTED IN 1988

Larnaca District (cont)

Ser. No.	Village	Nature of Scheme	Est.cost £
5	Kalon Khorion self housing	Extensions	1 100
6	Kelia	New distribution systems	30 000
7	Kophinou	Extensions	4 300
8	Klavdhia	Improvements	6 800
9	Dromolaxia self housing	Extensions	6 000
10	Kelia self housing	Extensions	2 400
11	Xylophaghou	Extensions	650
12	Kophinou	Improvements	12 000
		TOTAL	£145 750

Famagusta District

1	Avgorou self housing	Extensions	£ 9 500

Summary of Table VI-3A

District	No. of Schemes	Est.cost £
Nicosia	6	52 900
Limassol	5	73 380
Paphos	6	48 500
Larnaca	12	145 750
Famagusta	1	9 500
Total	30	£330 030

TABLE VI-3B

WATER SUPPLY TO LIVESTOCK AREAS IN 1988

Nicosia District

Ser. No.	Village	Nature of Scheme	Est.Cost £
1	Lakatamia	Water supply to Lakatamia live-stock area	34 000
2	Yeri	Water supply to existing live-stock area from B/H 70/85	24 000
3	Lakatamia	Water supply to Lakatamia live-stock area (scheme B)	24 000
4	Kokkinotrimithia	Water supply to proposed live-stock areas from B/H 56/88	122 000
		Total £	204 000

Paphos District

1	Kouklia	Supply from B/H 77/87	12 500

Larnaca District

1	Livadhia live-stock area	New livestock area	24 500
2	Anglisidhes live-stock area	" " "	11 000
3	Klavdhia live-stock area	" " "	36 000
		Total	£ 71 500

Summary of Table VI-3b

District	No of Schemes	Est.cost £
Nicosia	4	204 000
Limassol	-	-
Paphos	1	12 500
Larnaca	3	71 500
Famagusta	-	-
Total	7	£ 288 000

TABLE VI-4

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1988

Nicosia District

Ser. no	Village	Nature of Scheme
1	Laghoudhera	Extensions
2	Palekhori (Orinis)	Improvements
	Palekhori(M)	"
3	Laxia Industrial zone	House to house scheme
4	Menico	Additional supply from B/H 99/88
5	Lakatamia	Additional supply from Peristerona pipeline
6	Lakatamia	Extensions
7	Archangelos Michael III Kato Lakatamia	House to house scheme
8	Kokkinotrimithia	Replacement of pipes
9	Pano Lakatamia Government housing	Replacement of pipes

Limassol District

1	Kilani	Additional water supply from ''Vounaros'' spring
2	Anoyira	Additional water supply from ''Pertika'' spring
3	Mouttayiaka	Additional water supply from B/H 81/62
4	Omodhos	Additional water from from ''Arkolakhania'' spring
5	Pelendri	Additional water supply from Phylagra spring
6	Souni-Zanatzia	Additional water supply from Kephalovrysos spring
7	Apsiou	Additional water supply from ''Loutsiaes'' spring
8	Sotira	Replacement of water supply distribution system
9	Paramali	Additional water supply from new B/H

TABLE VI-4 (cont)

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1988

Paphos District

Ser. no	Village	Nature of Scehme
1	Ayia Marina-New Dhimmata	Replacement of main conveyor
2	Timi	Replacement of distribution system
3	Argaka	Additional supply from B/H 15/86 & new distribution system
4	Peyia	New st. tank & replacement of distribution system
5	Lyso	Replacement of distribution system
6	Tala	Replacement of distribution system
7	Phylousa	Replacement of main conveyor pipeline
8	Kissonerga	Replacement of conveyor pipeline (Mavrokolymbos spring)
9	Anarita	Extensions
10	Pano Arhimandrita	Replacement of distribution system

Larnaca District

1	Alethrico	New connection from Famagusta pipeline
2	Kophinou	Replacement of existing conveyor pipeline
3	Alaminos-Skarinou-Ayios Theodhoros	Replacement of existing ''Vrisi tou Milou'' pipeline
4	Ormidhia	Improvements
5	Nicosia-Larnaca Road	Irrigation of central lane
6	Aradippou	Water supply scheme to Kamares area

TABLE VI-4 (cont)

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1988

FAMAGUSTA DISTRICT

Ser. No.	Village	Nature of Scheme
1	Ayia Napa	New storage tank and improvements

TABLE VI-4A

WATER SUPPLY TO LIVESTOCK AREAS PENDING BY THE END OF1988

Limassol District

Ser. No	Village	Nature of Scheme
1	Erimi	Water supply to livestock area
2	Episkopi	New livestock area(water supply)
3	Kolossi	Water supply to livestock area B/H 75/77

Larnaca District

1	Mazotos	Livestock area
2	Kiti	Livestock area
3	Pyla	Livestock area

TABLE VI-5

IRRIGATION SCHEMES PREPARED IN 1988 AND SUBMITTED TO DISTRICT OFFICES

Ser. No	Village	Division or Association	Locality	Nature of proposed work	Est.cost £	village cont. %
Nicosia District						
1	Kaliana	Division		Pumping scheme and distribution pipes	151 900	1/3
2	Pera Orinis	''		Raising of R C channels	3 250	1/3
3	Lythrodondas	''		Extension of distribution pipeline	7 500	1/3
4	Laxia	Olympic shooting club		Pumping scheme and distribution pipelines	7 500	100%
				TOTAL	170 150	

TABLE VI-5 (cont)

IRRIGATION SCHEMES PREPARED IN 1988 AND SUBMITTED TO DISTRICT OFFICERS

Limassol District

Ser. no.	Village	Division or Association	Locality	Nature of proposed work	Est.cost £	Village cont. %
1	Ayios Theodhoros	Division	Lois	Extensions	1 100	1/3
2	Kato Platres		Kato Platres	Pumping scheme from B/H 81/81	97 000	1/3
3	Agros	Division	Pano Lampadha	New scheme	3 300	1/3
4	Moniatis	Division	Zaves etc.	construction of weir and water tank 500m^3	40 000	1/3
5	Pelendri	Division	Pano Phylagra	Improvements	2 650	1/3
6	Prodhromos	Division	Prodhromos reservoir	Piping of snow water to Prodhromos reservoir	33 200	1/3
7	Pano Platres	Division	Pano Platres	Improvement of channels	1 725	1/3
8	Paleomylos	Division	Parvamos and Kambos	Construction of water tank at Potamia area and improvements of Ayios Yeorghios'' Irrigation division	1 500	1/3
				Total	180 475	

TABLE VI-5 (cont)

IRRIGATION SCHEMES PREPARED IN 1988 AND SUBMITTED TO DISTRICT OFFICERS

Paphos District

Ser. no.	Village	Division or Association	Locality	Nature of proposed work	Est.cost £	village cont. £
1	Ayios Nicolaos	Division	Meletses	Pumping scheme	7 800	20%

Summary of Table VI-5

District	No. of schemes	Est. cost £
Nicosia	4	170 150
Limassol	8	180 475
Paphos	1	7 800
Larnaca	-	-
Famagusta	-	-
Total	13	358 425

TABLE VI-6

MINOR IRRIGATION SCHEMES APPROVED BY THE INTERDEPARTMENTAL COMMITTEE IN 1988

Ser. no.	Village	Locality
1	Agros	Pano Lambadha
2	Ayios Demetrios(Limassol)	Kalogeros
3	Pelendri	Pano Philagra
4	Tseri	-
5	Linou	Linopsas

SCHEMES NOT APPROVED BY THE INTERDEPARTMENTAL COMMITTEE IN 1988

Ser. no	Village	Locality
1	Phterikoudi	
2	Agros	Pera Agros

TABLE VI-7

IRRIGATION SCHEMES IN THE COURSE OF PREPARATION, UNDER INVESTIGATION OR PENDING DURING 1988

Nicosia District

Ser. no	Village	Locality
1	Spilia	Distribution pipelines
2	Kakopetria(Buffer zone)	Pumping scheme B/H62/87 ''Kato Mazeri'' Irrigation division
3	Kakopetria	Apotheri Improvements
4	Orounda-Peristerona-Astromeritis	Lining of channels

TABLE VI-7(cont)

IRRIGATION SCHEMES IN THE COURSE OF PREPARATION, UNDER INVESTIGATION OR PENDING DURING 1988

Limassol District

Village	Locality	Nature of proposed work
Ayios Ioannis (Agrou)	Angoulos Irrigation Division	Distribution pipelines
Trimiklini	Zinonas Irrigation Association	Improvements
Agridhia	Panayia Irrigation Division	Improvements
Lemithou	New Irrigation Division ''Potamini a''	from B/H 76/87
Mandria	Liophandes-Mandres	New Irrigation Divsion
Pano Platres	Samatzia	Using B/H 30/74
Kaminaria	Irrigation Association Potamina	Improvements

Paphos District

Kelokedhara	Pumping scheme	B/H 7/88
Amargeti	Extensions	
Yiolou-Miliou	Pumping scheme	B/H 55/78 & 111/81
Kritou Terra	Pumping scheme	B/H
Lemona	Pumnping scheme	B/H 134/84
Panayia	Improvements	New storage tank
Eledhio	Pumping scheme	
Nea Dhimmata	Pumping scheme	B/H 41/88
Yialia	Construction of pond	
Pretori	Pumping scheme	B/H 21/88
Amargeti	Pumping scheme	B/H 127/87
Theletra	Distribution system	
Ayios Ioannis	Replacement of pumping unit	

TABLE VI-7(cont)

IRRIGATION SCHEMES IN THE COURSE OF PREPARATION, UNDER INVESTIGATION OR PENDING DURING 1988

Larnaca District

Village	Locality	Nature of proposed work
Odhou	New Irrigation Division	from B/H 83/85
Kophinou	New Irrigation Division	

TABLE VI-8

SEWAGE SCHEMES PREPARED IN 1988

Ser. no.	Village	Nature of work	Est.cost £
1	Aradippou-Livadhia	Biological Treatment plant for pigery waters	250 000
2	Limassol	Industrial area chemical treatment plant	150 000
3	Segedep	Feasibility study on treatment methods to be employed for industrial waste water	-
			£ 400 000

TABLE VI-9

RECHARGE SCHEMES PREPARED IN 1988 AND SUBMITTED TO DISTRICT OFFICERS

Nicosia District

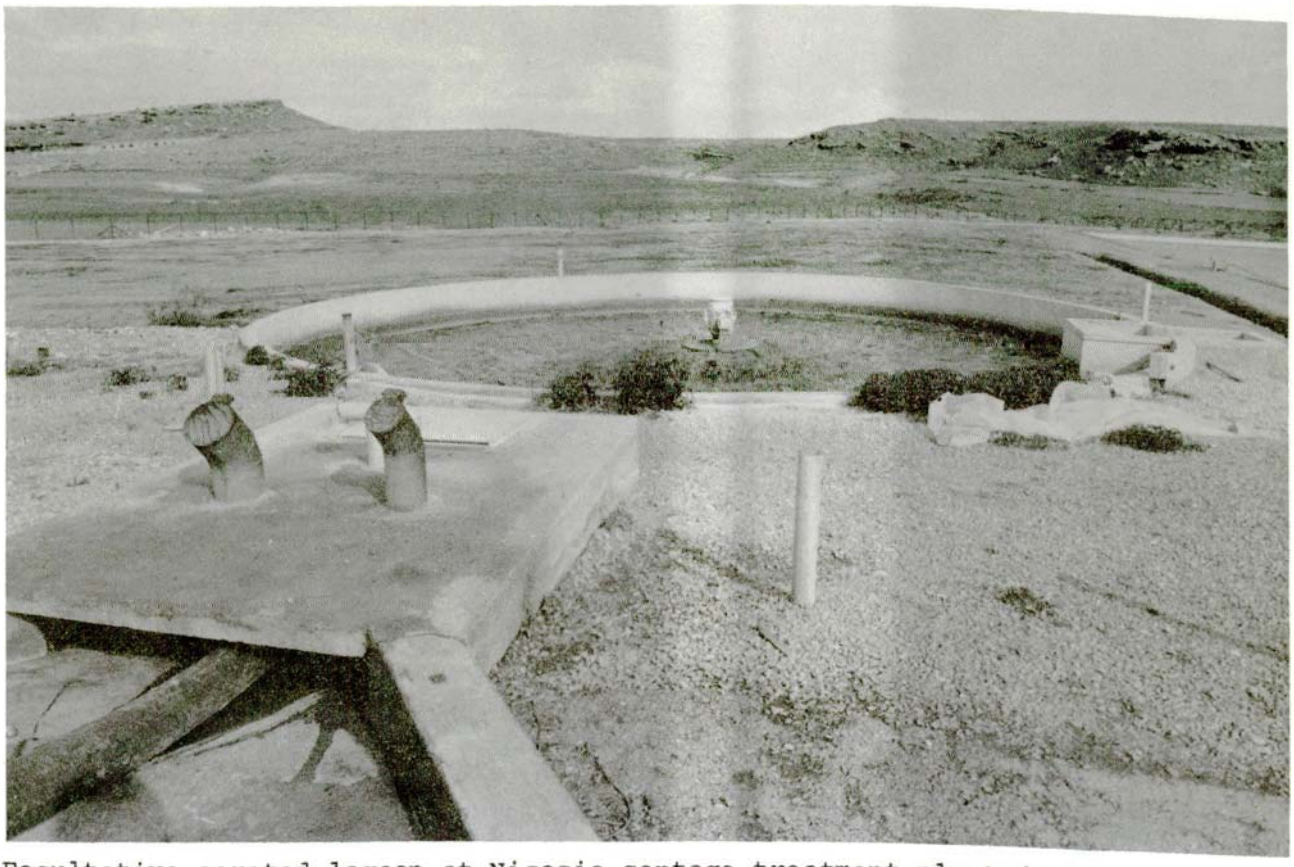
Ser. no.	Village	Division or Association	Locality	Nature of proposed work	Est.cost £	Village cost %
1	Politiko	Division	Moulos	Gabion weir	17 500	-

TABLE VI-10

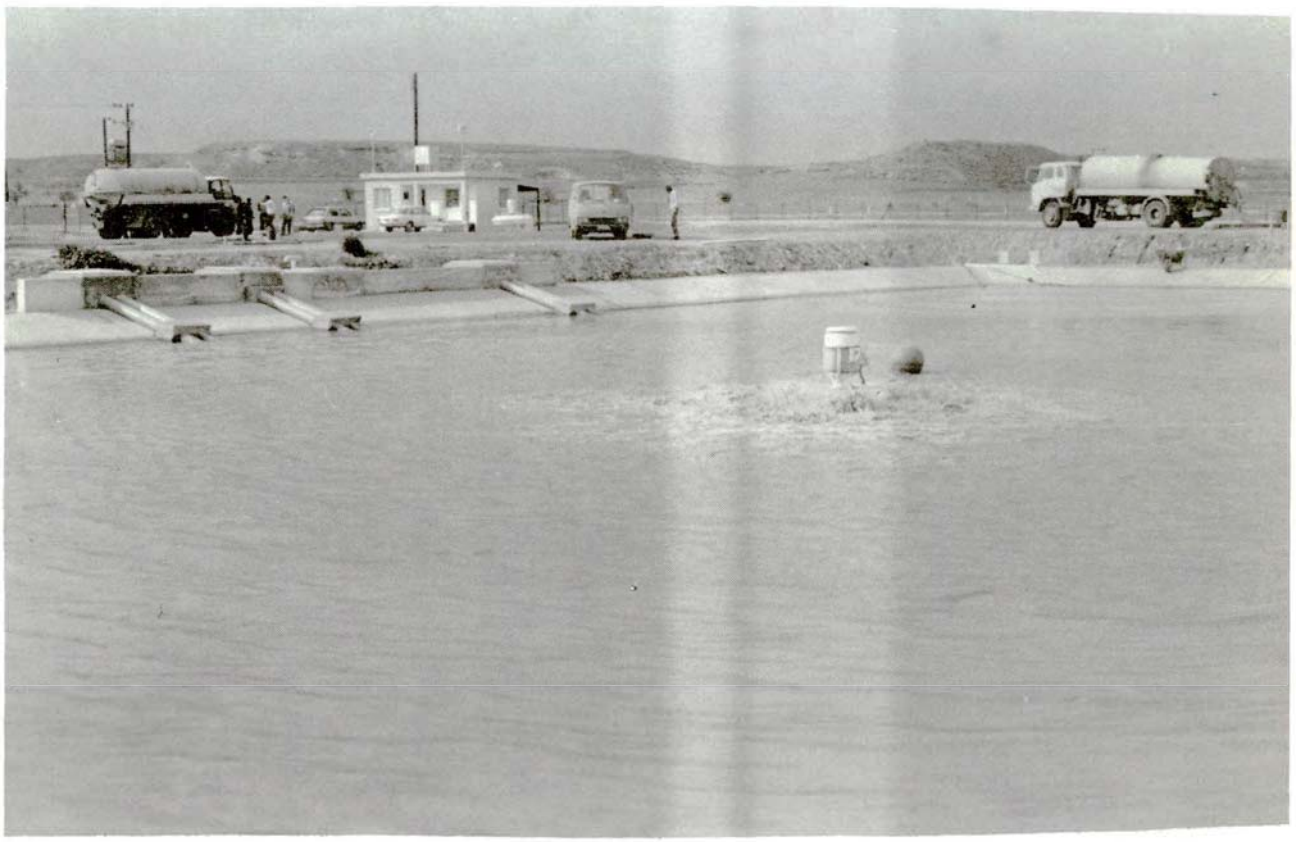
RIVER TRAINING SCHEMES

Famagusta District

Ser. no.	Village	Division or	Locality	Nature of proposed work	Est.cost £	Village cost %
1	Paralimni	-	-	Improvement of existing ''Vathys'' river	130 000	—



Facultative aerated lagoon at Nicosia septage treatment plant (Ayios Sozomenos).
WDD photo F57EN-5. Taken on 14.12.88.



Aerated lagoon for pre-treatment of non-toxic waste of high BOD at Nicosia septage treatment plant (Ayios Sozomenos).
WDD photo F57EN-11. Taken on 14.12.88

VII DIVISION OF CONSTRUCTION

by
A P Georghiades
Senior Water Engineer
Head of the Division

Introduction

The Division of Construction is one of the major divisions of the Department, and it deals with the planning, supervision and control of all the constructional activities of the Department by direct labour. The Division also plays an important role when projects are constructed by Contract. The Division is sub-divided in the following branches:

- The Planning and Control Branch
- The Tenders and Land Acquisition Branch.
- The Major Projects Construction and Control Branch.
- The Minor Projects Construction and Control Branch.

During 1988 the Division consisted of the following staff which was involved either directly or indirectly with its activities.

1	Senior Water Engineer - Head of the Division
1	Executive Engineer Grade I - Assistant Head of the Division.
12	Executive Engineers, Class I
5	Executive Engineers, Grade II
1	Senior Technical Superintendent
6	Technical Superintendents
8	Senior Technicians
54	Technicians Grade I & II
3	Chief Foreman
9	Assistant Chief Foremen
37	Monthly paid Foremen (Including Regional Offices)
32	Weekly paid Foremen (Including Regional Offices)
169	Total Staff

In addition to the above technical staff the Department engaged a daily average of 830 regular workmen of various trades, mostly skilled and also 156 casual labour, mostly unskilled for the execution of the various schemes approved for construction during 1988 throughout the Island.

The Planning Branch of the Division continued during 1988 to collect data regarding actual rates of construction, standards of materials and equipment for the revision of the manual "Schedule of Rates and Prices".

This year the commencement of the construction of the new schemes, especially the contributory ones, started earlier due to the early approval of the Development Budget by the House of Representatives.

Still we believe that the administrative formalities for the approval of the schemes and the procedure required for the allocation of the funds are considerably long and new methods should be introduced to speed up all these formalities.

CONSTRUCTION PROGRAMME AND PROGRESS

The Planning Branch of the Division prepared as usual, a construction programme for all the schemes that were approved for construction in 1988. Those schemes were mainly included in the Development Budget of the Department whilst few others in the budget of other Departments or Ministries. Over and above these budgeted schemes the Department had to respond and deal with all non-budgeted water projects for emergency schemes or for villages and private developers.

All these schemes undertaken for construction during 1988, may be classified into three main groups as follows:

- All projects, new and carry over, approved in the Department's Development Budget,
- All other projects, covering a wide range of types, i.e. water supply schemes for housing the Refugees, for livestock farms, industrial areas, Turkish Cypriot villages, relocation of pipes, etc., approved in the budgets of a number of Ministries, or Departments and
- All types of non-budgeted projects, i.e. improvements to existing water supply and irrigation schemes, laying of distribution mains for land development, etc., carried out from funds deposited in full by villages or private developers.

In total during 1988 the Department had to deal with 521 schemes of an estimated value of £20,922,870. The overall expenditure incurred on all these projects during 1988 reached the amount of £18,362,857 against £26,223,982 for 1987, £37,086,855 for 1986, and £22,462,514 for 1985. The major part of this expenditure was for Major Projects such as the Southern Conveyor Project and the Khrysokhou Irrigation Project constructed under Project Management.

Table VII-1 gives a summary of the work executed by the Department during 1988. Detailed lists showing all the schemes undertaken for construction, with more information are given in separate tables and short description reports that follow, further on in this report.

TABLE VII-1
SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1988

Ser.	Description	No of schemes	Amount alloc. for 1988 £	Expenditure incurred during 1988 £
1	Rural domestic water supply schemes	55	1 814 150	1 278 742
2	Minor irrigation schemes	32	611 282	447 277
3	Other major irrigation works	9	254 165	188 080
4	Town water supply schemes and Government water supply schemes	12	261 757	211 596
5	Vasilikos Pendaskinos Project	3	482 893	410 827
6	Southern Conveyor Project ...	10	13 911 882	12 874 427
7	Paphos Irrigation Project ...	1	154 913	147 663
8	Khrysokhou Irrigation Project	1	1 069 857	1 047 091
9	Pitsilia Integrated Rural Development Project (mainly maintenance).....	17	53 197	42 105
10	Refugee housing and self-housing schemes	41	257 469	177 856
11	Schemes undertaken for construction for other Government Departments	144	1 791 615	1 290 565
12	Schemes undertaken for construction for villages (non-budgeted) from deposits	69	200 274	198 435
13	Schemes undertaken for construction for private developers (non-budgeted) from deposits	127	59 416	48 193
	Total	521	£20 922 870	£18,362,857

PLANNING BRANCH

The main activities of this branch during 1988 may be classified as follows:

- The programming and pricing of all schemes approved for construction in the current year mainly by direct labour.
- The preparation of a construction programme for all schemes approved for construction, in the current year.

- The preparation of a monthly progress report showing all budgeted schemes, and the progress and expenditure incurred each month.
- The assessment of the Department's annual requirements for Minor Projects in materials and equipment, such as pipes and fittings, pumping units, etc., and their order through the Government Central Stores Department in time so that the schemes approved for construction are executed smoothly and uninterruptedly.
- The checking of the estimates of the schemes designed by other Divisions of the Department, so as to conform with the current rates and to ensure their execution within the estimated cost.
- The collection of data regarding actual rates of construction, standards of materials and equipment for the revision of the manual "Shedule of Rates and Prices."

TENDER AND LAND ACQUISITION BRANCH

The main activities of this Branch are:
The invitation of tenders direct for the supply of such materials that are not available at the Government Central Stores, such as pumping units building materials etc, for Minor Projects.

-The advertisement and distribution of contract documents prepared by other Divisions of the Department to prospective tenderers, for Major Projects.
-The evaluation of tenders, and award through Tender Board is dealt directly by the Division of Construction.
-All matters of land acquisition and requisition of the Department.

MINOR PROJECTS CONSTRUCTION AND CONTROL BRANCH

The main activities of this Branch are to plan, execute and control the construction of all the schemes where the Division is directly involved. It has to follow up and see that all construction programmes are adhered to, or revised if required by the supervising technical staff, that the progress of the works under construction is attained at reasonable standards and as planned. The quality of the works of all schemes under construciton has also to be followed up very carefully and controlled in consultation with the Soils and Concrete Laboratory.

Another objective of this Branch is to ensure that the schemes under construction are completed within the estimated time and approved amount. Another objective of this Branch is the distribution of resources and manpower to the various schemes under Construction.

All projects outside Nicosia District are constructed directly by the three Regional Offices of the Department i.e Limassol, Larnaca-Famagusta and Paphos in close association with the senior Technical Officer of the Division who acts as the co-ordinator between the Regional Offices and the Headquarters in Nicosia.

In addition to that, the head of the Division and the tender section play a great role in the planning and execution of the various schemes under construction in the Districts.

The Division is always kept informed on the progress of the schemes in the Districts through site vitsits by the technical co-ordinator, and the monthly progress reports which are prepared by the supervising staff of the Districts and forwarded to the headquarters. These monthly progress reports are being utilized for the preparation by the planning Branch of the Division of the general monthly progress chart which covers all schemes in all Districts.

MAJOR PROJECTS CONSTRUCTION AND CONTROL BRANCH

The Division is either involved directly in the execution of these major projects given to forced account or is involved indirectly through the head of the Division and supervising staff for these projects which are given to contract and are controlled by a project director on a project management basis.

The Head of the Division apart from being a member of the Major Project committee for the implementation and evaluation of claims he also participates on arbitration proceedings on various projects.

In the case of forced account works the Division plays a more important role in the planning, manpower distribution, recruitment of machinery and labour from the private sector and the preparation of progress reports and cost estimates.

LABOUR FORCE

For the construction of a scheme the Department usually engages gangs consisting of monthly, or weekly (hourly) paid foremen, regular artisans of the Department of various trades, and casual, skilled or unskilled labour force which is recruited locally through the Government Labour Offices.

The average daily labour force engaged by the Division including the Workshops during 1988 for the construction of all the schemes was 986. Out of this figure 830 employees were regular and 156 were casual. They cover a variety of trades i.e. builders carpenters, pipelayers, etc.

The total expenditure incurred during 1988 on wages alone on schemes constructed by direct labour by the Department reached the amount of £5,041,714.

Table VII-2 shows the monthly average labour force engaged direct by the Department in 1988.

TABLE VII-2
LABOUR FORCE FOR 1988

Month	Skilled	Unskilled	Regular	Casual	Total
January	827	171	831	167	998
February	821	184	827	178	1005
March	820	183	821	182	1003
April	772	173	802	143	945
May	762	172	791	149	940
June	759	171	809	121	930
July	789	173	819	143	962
August	806	173	835	144	979
September	779	197	834	142	976
October	829	203	861	171	1032
November	824	201	855	170	1025
December	829	210	874	165	1039
Daily average No.	802	184	830	156	986
Daily average %	81	19	84	16	100

PIPES AND PIPE FITTINGS

The majority of pipes and pipe-fittings of all types used by the Department for the execution of the schemes approved for construction during 1988, were purchased through the Government Central Stores Department. A reasonable stock of fast moving materials is always kept on a permanent basis for requisitioning by all Government Departments.

In exceptional cases where our requirements could not be met by the Central Stores Department due to the execution of emergency schemes, where a special type of pipes were used, such as P.V.C. or ductile iron, then these pipes were purchased direct either by our Department or, the Central Stores Department through the usual procedure of open public tenders.

However, it should be noted that for specific major projects which are being financed by the World Bank or other International Finance Organizations, pipes and pipe-fittings as well as other materials used, have to be purchased after the invitation of International tenders by our Department.

The annual requirements of our Department in pipes and pipe-fittings of all types, are assessed by the Planning Branch of the Division as soon as the Development Budget is approved and an order is put through the Government Central Stores, early before the commencement of the schemes. During 1988 a length of 525,188 running meters of various types and diameters of pipes were purchased at a value of £2,885,008 and laid all over the Island for the execution of all the schemes approved in the 1988 Development Budget.

Table VII-3 shows in detail all types, lengths and value of pipes laid during 1988.

SUMMARY OF ALL TYPES OF PIPES LAID DURING 1988

Ser. No.	Type	Length m	Value £
I	Galvanized steel pipes	101 733	283 263
II	Steel pipes (coated) plain ended .	12 687	143 939
III	Asbestos cement pressure pipes - class 15	155 808	1 476 378
IV	Asbestos cement pressure pipes - class 20	54 942	376 386
V	Polythene pipes	55 300	33 813
VI	Unplasticized PVC pipes	139 512	251 514
VII	Ductile iron pipes	5 206	319 715
	Total	525 188	£2 885 008

TABLE VII-3
PIPES LAID DURING 1988
I GALVANIZED STEEL PIPES

Nominal dia inches	Length m	Value £
1/2	2 015	980
3/4	718	420
1	3 383	2 884
1 1/4	2 070	2 416
1 1/2	8 267	10 547
2	10 025	19 328
2 1/2	21 708	43 559
3	26 084	81 412
4	27 463	121 717
Total	101 733	£283,263

TABLE VII-3
PIPES LAID DURING 1988
II STEEL PIPES (COATED-PLAIN ENDED)

Nominal dia mm	Length m	Value £
150	4 832	74 676
200	3 019	22 870
250	2 728	23 606
300	1 880	19 779
350	184	2 046
525	20	450
550	24	512
Total	12 687	£143 939

III ASBESTOS CEMENT PRESSURE PIPES - CLASS 15

Nominal Dia mm	Length m	Value £
75	236	148
100	36 292	115 957
150	9 015	42 980
200	22 531	132 571
225	3 482	22 598
250	20 990	170 598
300	13 674	138 418
350	9 296	106 542
400	16 246	179 617
450	7 629	141 441
500	4 106	88 912
600	1 360	39 141
700	914	17 085
800	2 415	54 302
900	7 622	226 068
Total	155 808	£1 476 378

TABLE VII-3
PIPES LAID DURING 1988
IV ASBESTOS CEMENT PRESSURE PIPES - CLASS 20

Nominal Dia mm	Length m	Value £
100	20 569	66 201
150	15 508	71 628
200	7 502	49 723
250	6 764	60 959
400	21	445
450	150	1 639
700	514	11 894
800	3 914	113 897
Total	54 942	£ 376 386

V POLYTHENE PIPES

Nominal dia inches	Length m	Value £
1/2	13 705	1 872
3/4	11 207	3 338
1	8 541	3 146
1 1/2	5 278	2 951
2	2 225	1 565
2 1/2	862	753
3	8 633	15 126
4	4 849	5 062
Total	55 300	£ 33 813

VI UNPLASTICIZED PVC PIPES - (6, 10 and 16 bar)

Nominal dia mm	Length m	Value £
38	170	186
50	25	24
63	15 558	9 391
75	6 534	4 640
90	1 632	2 094
100	19 930	39 513
110	53 864	72 652
140	13 784	26 466
150	3 278	10 948
160	20 097	54 516
200	4 640	31 084
Total	139 512	£ 251 514

TABLE VII-3
PIPES LAID DURING 1988
VII DUCTILE IRON PIPES

Nominal dia mm	Length m	Value £
150	549	4 572
200	819	9 195
300	242	4 544
350	297	7 045
500	270	10 477
600	47	4 796
700	495	36 559
800	2 214	206 875
900	146	17 033
1000	127	18 619
Total	5 206	£319 715

CONSTRUCTION PLANT

For the execution of the schemes approved for construction in 1988, the Department had to use Government machinery through the Electrical and Mechanical Services (E.M.S). If Government machinery was not available then the Department had to hire machinery from the private sector through open tenders.

BUILDING AND OTHER MATERIALS

All materials required for the construction of schemes have to be requisitioned from the Government Central Stores through the usual way. However, such materials that cannot be made available through the Government Central Stores i.e. aggregate, sand etc., are purchased locally from the private sector through public tenders. Table VII-4 shows in detail all water meters installed by the Department during 1988 for the execution of the schemes approved.

Table VII-4
WATER METERS INSTALLED DURING 1988

Ser. No.	Dia in inches	Water meters in Number	Value £
1	1/2	1058	4 172
2	3/4	5	24
3	1	7	51
4	1 1/4	6	67
5	1 1/2	11	167
6	2	26	1 014
7	2 1/2	175	6 740
8	3	19	3 867
9	4	31	1 838
10	6	18	1 658
11	8	10	1 112
12	10	1	166
13	16	1	737
Total		1 368	£ 21 613

RURAL DOMESTIC WATER SUPPLY SCHEMES

Year by year the overall expenditure incurred for the above schemes is constantly increasing. The expenditure incurred for the above schemes during 1986 was £318 166 and £1,058,151 during 1987.

The construction programme for 1988 included 55 rural domestic supply schemes of an estimated value of £1,814,150. The expenditure incurred on all these schemes during the year reached the amount of £1,278,742.

These 55 schemes were split all over the Island and mostly were related to supplementary water supply schemes and improvements to existing distribution systems and construction of new storage reservoirs.

A summary of those schemes by district is given below. Detailed list showing all 55 schemes which were undertaken by the Department for Construction during 1988 are given below in table VII-5.

SUMMARY OF RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1988

District	No. of schemes	Amount allocated for 1988 £	Expenditure incurred in 1988 £
Nicosia	23	637 390	431 170
Larnaca	10	200 682	137 360
Famagusta	4	199 596	109 855
Limassol	11	366 360	245 501
Paphos	7	410 122	354 856
Totals	55	£ 1 814 150	£ 1 278 742

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1988
NICOSIA DISTRICT

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Akaki - Improvements to distribution system	26 646	19 185	53 292*	26 646	19 185	53,291*	completed
2	Agrokipia - Replacement and improvements of existing distribution system	13 800	6 900	21 200*	12 520	6 260	19 280*	completed
3	Astromeritis-Supplementary Supply from BH 100/86	11 661	5 916cr	19 412	5 791	9 311cr	3 153	completed
4	Ayia Varvara -Supplementary supply from BH 82/86	7 267	3 313	10 900*	3 162	1 442	4 744*	Work in progress
5	Ayii Trimithias Supplementary supply from BH 40/85, replacement of distribution system.....	30 531	18 121	66 905*	22 135	12 396	44 271*	Completed
6	Evrykhou-Replacement of existing distribution system	3 500	7 000	10 500	3 034	3 034cr	-	Completed
7	Galata New Main Conveyor	21 000	21 000	42 000	19 574	19 573	39 147	Work in Progress
8	Klirou Supplementary supply from BH 51/83	4 000	6 274	10 274	1 732	1 732	3 464	Work completed. Pending the delivery instal-
9	Lythrodhondas Supplementary Supply from BH 181/83 and improvements to distribution system.....	31 920	27 810	59 730	27 229	24 309	51 539	Completed
10	Kokkinotrimithia New reservoir	14 000	9 814	28 000*	7 041	4 936	14 083*	Work in progress
11	Mitsero Supplementary Supply from BH 129/85	27 582	15 582	43 164	24 160	13 649	37 809	Completed. Pending of delivery and installation
12	Orounda Supplementary supply from BH 6/86.....	7 500	5 925	15 000*	4 791	3 785	9 582*	Completed. Pending the delivery and instal-
13	Palekhori (M) Improvements to existing distribution system	3 067	1 533	4 600	2 875	1 438	4 313	Completed.
14	Palekhori (O) Improvements to existing distribution system.	2 533	1 266	3 799	1 007	503	1 510	Completed
15	Paleometokho Replacement and improvement to distribution system.....	22 000	21 994	43 994	20 251	20 251	40 502	Work in progress

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1988
NICOSIA DISTRICT (Cont.)

Ser. No.	Scheme	Amount allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
16	Paleometokho-Phase C Supplementary supply from BH 86/85	16 500	16 500	33 000	4 488	4 488	8 976	work in progress
17	Perakhorio Nisou New reservoir and improvements to distribution system.....	10 000	12 527	41 188*	10 000	9 353	31 285*	completed
18	Pera Orinis Extension to existing distribution system and replacement of pumping unit.....	10 000	7 500	20 000*	6 923	5 192	13 846*	Work completed Pending the installation of a pumping unit.
19	Politiko Replacement of pumping unit of BH 48/79	1 234	616	1 850	1 109	554	1 663	Work completed Pending the Installation of a pumping unit.
20	Tseri Replacement of distribution syst.	5 000	8 282	13 282	4 100	4 100	8 200	Completed.
21	Xyliatos Extension to existing distribution system	975	325	1 300	968	325	1 293	Completed.
22	Yeri Improvements to distribution System	10 000	21 960	71 000*	7 088	1 814	36 585*	Work in progress
23	Yeri Supplementary supply from BH 103/85	11 500	4 140	23 000*	10 505	14 594cr	2 634*	Completed.
	Total for Nicosia District	292 216	231 651	637 390	105 306	128 346	431 170	

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1988 (cont)

LARNACA DISTRICT (Constructed by L'ca-F'sta Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Anglisidhes-Replacement of existing distribution system.....	31 220	15 610	46 830	30 864	15 432	46 296	Completed
2	Athienou - Supplementary Supply Scheme	1 000	-	1 000	701	-	701	Completed
3	Dhromolaxia - Replacement of existing distribution system and installation of new conveyor	1 000	1 090	21 709*	632	632	12 644*	Completed
4	Kiti - Installation of new Main Conveyor from new reservoir and improvements to existing distribution system	15 000	18 030	33 030	14 988	14 988	29 975	Completed
5	Khirokitia Improvements of'Ayios Spiridon' spring	900	300	1 200	640	213	853	Completed
6	Livadhia - Replacement of distribution system	7 000	7 000	14 000	6 685	2 241	8 926	Completed
7	Mazotos-Replacement of existing distribution system	14 609	8 304	22 913	7 559	3 780	11 340	Completed
8	Ormidhia-Replacement of existing distribution system	15 000	15 000	30 000	13 313	13 312	26 625	Completed
9	Psematismenos Construction of new Water tank	1 955	1 955cr	-	1 955cr	-	1 955	-
10	Pyla Extension of Irrigation System	-	30 000	30 000	-	-	-	not executed
	Total for Larnaca District	87 684	93 379	200 682	77 337	48 643	137 360	

TABLE VII-5 (Cont.)

FAMAGUSTA DISTRICT (Constructed by L'ca-F'sta Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Avgorou - Replacement of existing distribution system	25 000	16 916	41 916	7 541	7 541	15 082	Completed Phase A and B
2	Dherynia - Replacement of existing distribution system	29 000	13 187	42 187	1 623	1 623	3 246	Completed
3	Liopetri - Supplementary supply from Famagusta pipeline	37 747	47 746	85 493	37 747	47 361	85 108	Completed
4	Liopetri Replacement of existing distribution system	15 000	15 000	30 000	3 209	3 210	6 419	Work in progress
	Total for Famagusta District	106 747	92 849	199 596	50 120	59 735	109 855	

LIMASSOL DISTRICT (Constructed by the Limassol Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Asgata Extension of the distribution system.....	2 075	2 075cr	-	2 075	2 075cr	-	-
2	Episkopi - Replacement of existing distribution system	25 788	3 743	29 531	25 017	1 940cr	23 077	Completed
3	Ephtagonia-Supplementary supply from BH 50/85 and replacement of existing distribution system	44 553	21 342	65 895	35 053	9 198	44 251	Work in progress
4	Erimi-Kolossi Supplementary supply from BH 69/86.....	12 500	7 875	25 000*	8 988	5 662	17 975*	Work completed. Pending installation a pumping
5	Kalokhorio-Supplementary Supply from BH 20/81.....	14 405	8 405	22 810	6 065	1 765cr	4 300	Completed.
6	Kato Amiandos-Utilization of a spring.....	719	719cr	-	719	719cr	-	Completed.
7	Moutayiaka-Installation of new Conveyor	43 410	21 163	64 573	40 718	19 223	59 942	Work in progress
8	Moni-Supplementary supply from BH 114/84	29 822	18 120	47 942	21 536	5 287	26 823	Completed. Pending Installa-
9	Pissouri-Replacement improvements and extension to distribution system	30 000	28 808	58 808	22 153	22 152	44 305	Work in progress
10	Yermasoyia (Green Area W.s) Improvements of existing distribution system	850	364	1 214	153	153	306	Completed.
11	Ypsonas-Polemidhia Replacement of Pumping units.....	27 000	12 973	50 587*	12 261	6 743	24 522*	Work in progress
	Total for Limassol District	231 122	119 999	366 360	12 261	54 604	245 501	

TABLE VII-5 (Cont.)
PAPHOS DISTRICT (Constructed by the Paphos Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Akoursos - Supplementary supply from kelli spring and new distribution system.	3 225	861	4 086	3 225	1 154cr	2 071	Completed.
2	Khlorakas-Replacement of Main Conveyor and new reservoir..	30 000	100 000	130 000	30 000	89 114	119 114	Completed
3	Peyia-Supplementary supply from Borehole.....	51 500	50 000	101 500	49 248	49 247	98 495	Completed
4	Mesoyi-Replacement and extension to existing distribution system	36 296	36 296	72 592	28 610	28 610	57 220	Work in progress
5	Milia - Supplementary supply from Appidhes scheme and distr. system ...	2 319	578	2 897	595	349cr	246	Completed
6	Pomos-Replacement of existing distribution system.....	42 047	18 713	60 760	28 430	11 905	40 335	Completed
7	Yiolou-Replacement of existing distribution system.....	25 524	12 763	38 287	24 917	12 458	37 375	Completed
	Total for Pahos District	190 911	219 211	410 122	165 025	189 831	354 856	

Note: *Indicates that a contribution from TAEH is included Cr indicates credit.

MINOR IRRIGATION SCHEMES

The construction programme for 1988 included 32 minor irrigation schemes of an estimated value of £611,282. The overall expenditure incurred on all these 32 schemes during the year reached the amount of £447,277.

These 32 schemes were split all over the Island and were mostly related to:

- Improvements and extensions to existing irrigation systems.
- Pumping schemes from Boreholes.
- Lining of channels with reinforced concrete.
- New pipe distribution systems.

A summary of these schemes by district is given below. Detailed list showing all 32 schemes which were undertaken by the Division for construction during 1988 are given below on table VII-6.

SUMMARY OF MINOR IRRIGATION SCHEMES
UNDERTAKEN FOR CONSTRUCTION DURING 1988

District	No. of schemes	Amount allocated for 1988 £	Expenditure incurred during 1988 £
Nicosia	15	301,216	231,996
Larnaca	2	71,871	40,932
Limassol	9	71,842	45,974
Paphos	6	166,353	128,375
Total	32	£611,282	£447,277

TABLE VII-6
MINOR IRRIGATION SCHEMES-EXPENDITURE 1988
NICOSIA DISTRICT

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Akaki "Riatiko" Extension of concrete channels	12 000	9 000	24 000*	10 521	8 942	21 041*	Completed
2	Aredhiou - Pumping scheme from BH 58/81 and distribution system	18 000	9 000	27 000	10 102	5 051	15 153	Pending the supply of Electricity
3	Ayia Varvara-Kochatis Lining of channels	19 140	12 520	43 499*	17 607	11 605	40 017*	Completed
4	Ayia Lining of	1 533	660	2 193	1 320	660	1 980	Completed
5	Katydhata - Extension of distribution system.	2 626	1 314	3 940	1 489	745	2 234	Completed
6	Kambia - Utilization of B/H and distribution system.....	28 333	14 167	42 500	19 919	9 959	29 878	Completed. Pending the
7	Kato Moni - Utilization BH 14/84 Construction of new reservoir distribution system	42 019	21 009	63 028	34 477	17 238	51 715	Completed
8	Kato Moni Utilization of BH 14/84	1 067	533	1 600	--	--	--	Completed
9	Linou "Linopsas"-Construction of concrete irrigation ports.	2 167	1 083	3 250	1 835	917	2 753	Completed
10	Lythrodhontas Extension to irrigation system	16 333	8 167	24 500	14 371	7 186	21 557	Completed
11	Palekhori "Maroullena" Extension to distribution system	9 520	7 980	17 500	9 460	7 930	17 390	Completed
12	Palekhori "Milouri"-Extension to distribution system	3.200	1 600	4 800	3 199	1 600	4 799	Completed
13	Pera Orinis "Phassera" Raising of concrete channels	2 166	1 084	3 250	1 975	988	2 963	Completed
14	Spilia "Kleftis" Raising of concrete reservoir	12 771	6 385	19 156	11 745	5 873	17 618	Completed
15	Tseri Concrete channels	14 000	7 000	21 000	1 932	966	2 898	Work in progress
	Total for Nicosia District	184 875	101 502	301 216	139 952	79 660	231 996	

TABLE VII-6 (Cont.)
MINOR IRRIGATION SCHEMES-EXPENDITURE 1988
LARNACA DISTRICT (Constructed by the L'ca-F'sta Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Aradhippou - Utilization of BH 139/85 for Irrigation Purposes	22 753	9 118	31 871	17 919	8 959	26 878	Completed
2	Ormidhia "Pelekites" Recharge and antiflood dam	40 000	--	40 000	14 054	--	14 054	Completed
	Total for Larnaca District	62 753	9 118	71 871	31 973	8 959	40 932	

LIMASSOL DISTRICT (Constructed by the Limassol Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Agridhia - "Kato Enetikos" Irrigation System	407	205	612	233	117	350	Completed
2	Agridhia "Rousos I.D" Irrigation System.....	6 000	3 000	9 000	5 226	2 613	7 839	Completed
3	Agridhia "Mylos-Theotokis" Improvements to Irrigation System	1 972	1 428	3 400	1 716	1 242	2 958	Completed
4	Asgata - I.D. Utilization of BH 95/85.....	17 400	8 700	26 100	7 684	3 842	11 526	Completed
5	Ayios Ioannis (Agrou) - "Teratsia" Irrigation System and reservoir.....	8 000	4 000	12 000	6 663	3 331	9 994	Completed
6	Dhymes "Hadjipelendros" New reservoir	500	324	824	245	122	367	Completed
7	Pelendria "Potamoulia" Installation of distribution System	561	281	842	13	7	20	Completed
8	Pelendria "Kato Psilo Urysi Arhangelou" Installation of distribution system	1 108	456	1 564	602	96cr	507	Completed
9	Pelendria "Kolokasi I.D." Irrigation System	11 667	5 833	17 500	8 275	4 138	12 413	Completed
	Total for Limassol District	47 615	24 227	71 842	30 657	15 316	45 974	

TABLE VII-6 (Cont.)
MINOR IRRIGATION SCHEMES-EXPENDITURE 1988
PAPHOS DISTRICT (Constructed by the Paphos Regional Office)

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Kelokedhara "Ziripillis Psathaes" Raising the embankment	2 500	--	2 500	1 304	--	1 304	Completed
2	Lemona-Khoulou "Ammati" Utilization of the spring "Ammati" and installation of Irrigation System	35 400	17 700	53 100	32 529	16 264	48 793	Work in progress
3	Miliou "Leskiari" Installation of Irrigation System	15 000	15 221	30 221	13 452	6 726	20 178	Work in progress
4	Statos "Ayios Photios" Storage tank	10 533	5 267	15 800	10 146	5 073	15 219	Completed
5	Yiolou "Ayios Nipios" Utilization of B/Hs 66/80 and BH 90/80.....	26 000	13 000	39 000	23 098	11 549	34 647	Work in progress
6	Yiolou - "Ayiow Yeorghios" Pumping scheme from BH 96/80	16 932	8 800	25 732	5 489	2 745	8 234	Legal problem
	Total for Paphos District	106 365	59 988	166 353	86 018	42 357	128 375	

Note: *Indicates that a contribution from TAEP is included cr Indicates credit.

OTHER MAJOR IRRIGATION WORKS
(SUPPLEMENTARY WORKS)

During 1988 the Division had to deal with supplementary works for 9 major irrigation schemes of an estimated value of £254,165. The overall expenditure incurred on these 9 schemes during 1988 reached the amount of £188,080.

Out of this category of schemes the Ayios Ioannis Agrou project featured first in expenditure reaching the amount of £69,410 and involved a combined pumping scheme for water supply and irrigation.

Other important major schemes executed during 1988 are the Evdhimou-Paramali and the Yermasoyia Polemidhia projects.

Details of all the 9 major irrigation works which were undertaken for construction during 1988 is shown on table VII-7.

TABLE VII-7
OTHER MAJOR IRRIGATION WORKS - EXPENDITURE 1988.

Ser. No.	Scheme	Amount Allocated Govt £	Village £	Total £	Expenditure Govt £	Village £	Total £	Remarks
1	Agros Dam Improve the input from the nearby catchment area.....	11 333	5 667	17 000	--	--	--	Will be executed during 1989.
2	Ayios Ioannis Agrou Combined pumping scheme for w.s. and irrigation....	46 833	26 760	73 593	46 273	23 137	69 410	Work in progress
3	Evdhimou-Paramali Diversion of Kryos river to enrich Paramali river	60 000	--	60 000	52 747	--	52 747	Work in 4 progress
	Galata-Sina Oros Completion of pond and extension of irrigation network.	23 333	11 667	35 000	10 780	5 390	16 170	Work in progress
5	Pakhyammos Pond Improvements and watertightness of Pond	2 000	--	2 000	--	--	--	
6	Palekhori-Sklidros-Replacement of main conveyor.....	10 000	--	10 000	8 616	--	8 616	Completed
7	Trakhoni-Ypsonas-Installation of farm outlets.....	8 000	--	8 000	7 857	--	7 857	Completed
8	Yerakies-Kambos-Tsakistra stand-by pumping units.....	3 572	--	3 572	3 475	--	3 475	Completed
9	Yermasoyia-Polemidhia Farm outlets	45 000	--	45 000	29 805	--	29 805	Work in progress
	Total	210 071	44 094	254 165	159 553	28 527	188 080	

TOWN WATER SUPPLY AND GOVERNMENT WATER SUPPLY SCHEMES

The construction programme for 1988 included three main categories of schemes regarding Town and Government Water Supplies:-

- Improvement of water supply sources, refineries, pumping stations and conveyors.
- Government water supply schemes.
- New schemes for Town and other Municipalities water supplies.

For the three above categories of schemes an amount of £261,757 was allocated during 1988 for the execution of 12 different schemes. The overall expenditure incurred during 1988 on these schemes was £211,596.

Most of these schemes aimed to improve the existing water supply for towns, municipalities and villages which depend on Government sources of supply and replacement of existing distribution systems.

A list showing all schemes executed during 1988 is given on table VII-8.

Table VII-8
TOWN AND OTHER MUNICIPALITIES WATER SUPPLIES

A IMPROVEMENT OF WATER SUPPLY SOURCES, REFINERIES PUMPING STATIONS

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Kokkini-Trimithia ..... Replacement of main Conveyor	10 000	8 938
2	Khirokitia Treatment Plant Storage areas	20 000	18 164
	Total	£30 000	£27 102

B GOVERNMENT WATER SUPPLY SCHEMES

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Amathus .... Supplementary sypply from BH 49/85		
2	Governor's Beach..... Supplementary Water Supply	3 000	2 712
3	Armou ..... Utilization of BH 3/86	6 562	4 917
4	Tala..... Utilization of BH 7/85	6 815	4 820
5	Inia-Droushia..... Pumping scheme	3 500	1 552
	Total	£29 591	£19 870

C NEW SCHEMES FOR TOWN AND OTHER MUNICIPALITIES WATER SUPPLIES

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Paralimni..... Replacement of distribution system.	50 000	46 823
2	Pano Lefkara..... Replacement of distribution System.	82 666	60 371
3	Laxia ..... Replacement of distribution System.	4 500	--
4	Athienou..... Replacement of distribution System.	50 000	45 393
5	Lakatamia..... Replacement of distribution System.	15 000	12 037
	Total	£202 166	£164 624
	Grand Total	£261 757	£211 596

REFUGEE HOUSING AND SELF-HOUSING SCHEMES

During 1988 the Department had to deal with 41 schemes related to water supplies and sewage schemes for Government Housing Estates and Self Housing.

Thirtynine schemes were related to water supplies for Government Housing Estates and Self Housing and two schemes were related to Sewage schemes for Government Housing Estates and Self housing schemes.

A summary of these schemes by District is given below. Detailed list showing all 41 schemes which were undertaken by the Department for Construction during 1988 are given on table VII-9.

REFUGEES HOUSING AND SELF-HOUSING SCHEMES
SUMMARY OF ALL DISTRICTS

A. WATER SUPPLY FOR GOVERNMENT HOUSING ESTATES AND SELF HOUSING SCHEMES.

Ser. No.	Description	Number of schemes	Amount allocated in 1988 £	Expenditure incurred during 1988 £
i	Nicosia District...	6	30 005	18,905
ii	Limassol District..	10	75 038	51 948
iii	Larnaca District ..	10	61 700	24 509
iv	Famagusta District.	5	11 400	8 005
v	Paphos District ...	8	18 826	14 156
B	SEWAGE SCHEMES FOR GOVERNMENT AND SELF HOUSING SCHEMES			
i	Larnaca District ...	2	60 500	60 333
	Total	41	£257 469	£177 856

TABLE VII-9

A. WATER SUPPLY FOR REFUGEE HOUSING AND SELF HOUSING SCHEMES

I NICOSIA DISTRICT

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Pano Lakatamia.....	17 900	13 210
2	Pano Lakatamia (oldaged).	5 200	1 222
3	Archangelos	2 700	2 257
4	Archangelos-Phase A.....	1 133	893
5	Ayios Eleftherios	1 922	173
6	Nisou	1 150	1 150
	Total	£30 005	£18 905

II LIMASSOL DISTRICT (Constructed by Limassol Regional Office)

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Moutayiaka D	5 000	17
2	Trakhoni	30	30
3	Polemidhia E.....	4 900	4 651
4	Polemidhia H	7 874	7 072
5	Moutayiaka F	1 109	875
6	Polemidhia D	6 350	5 578
7	Moutayiaka E	4 356	--
8	Kolossi G	42 000	30 345
9	Polemidhia (Self Professional Housing)	3 019	2 980
10	Ayios Spiridon	400	400
	Total	£75 038	£51 948

TABLE VII-9
WATER SUPPLY FOR REFUGE HOUSING AND SELF HOUSING SCHEMES
III LARNACA DISTRICT (Constructed by Larnaca-Famagusta Regional office)

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Dhekelia EAC A.....	14 000	8 166
2	Dhekelia EAC B	18 500	10 380
3	Kelia	2 000	1 227
4	Dromolaxia K.....	3 000	2 278
5	Tersephanou	300	96
6	Athienou B	23 000	1 593
7	Meneou	100	24
8	Dhekelia	100	95
9	Xylophagou	200	150
10	Kophinou	500	500
	Total	£61 700	£24 509

IV FAMAGUSTA DISTRICT (Constructed by Larnaca-Famagusta Regional office)

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Akhna	1 460	1 460
2	Akhna	740	120
3	Akhna C	4 300	4 207
4	Akhna B	3 000	958
5	Paralimni D	1 900	1 260
	Total	£11 400	£8 005

TABLE VII-9
WATER SUPPLY FOR REFUGEE HOUSING AND SELF HOUSING SCHEMES
V PAPHOS DISTRICT (Constructed by Paphos Regional office)

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Koloni.....	270	153
2	Timi	1 300	996
3	Prodromi	3 600	2 887
4	Kouklia.....	4 200	3 027
5	Mandria.....	1 900	1 827
6	Mandria.....	950	859
7	Axiothea	2 906	1 603
8	Kiniras.....	3 700	2 804
	Total	£18 826	£14 156

B. SEWAGE SCHEMES FOR GOVERNMENT HOUSING ESTATES AND SELF HOUSING SCHEMES.

LARNACA DISTRICT (Constructed by Larnaca-Famagusta Regional office)

Ser. No.	Scheme	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Kophinou Self Housing Scheme	60 000	59 900
2	Zenon Government Housing Estates	500	433
	Total	£60 500	£60 333

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENTS

For many years, it has become normal practice for the Department to undertake the construction of all schemes related to water works which are included in the budget of other Government Departments.

Such schemes which cover a wide field of water development are mostly related to:-

- Domestic water supply schemes
- Minor irrigation schemes
- Water supply schemes to livestocks,
- Relocation of pipelines due to construction of new roads or widening of the existing roads.
- Sewage schemes,
- Improvements of water supply or irrigation schemes for Turkish villages where now Refugees have been housed.

During 1988 the Division had to deal with the Construction of 144 such different schemes all over the Island of an estimated value of £1,791,615. The overall expenditure incurred on all those schemes during the year reached the amount of £1,290,565 compared with £1,177,341 during 1987 and £541,441 during 1986. From the above figures it is obvious that this category of works represents a fair amount of the Department's constructional activities and the volume of works increase from year to year.

A list showing in detail all 144 schemes which were undertaken for construction during 1988 is given on table VII-10.

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENTS DURING 1988
NICOSIA DISTRICT

Ser. No.	Description	Amount allocated in 1988 £	Expenditure incurred during 1988 £
1	Kambi Pharmakas irrigation.	1 070	544
2	Agrokipia water supply	500	500
3	Athalassa irrigation	140	132
4	Athalassa Farm irrigation..	2 800	2 782
5	Athalassa water supply.....	850	771
6	Chsakistra irrigation	500	299
7	Athalassa irrigation.....	800	714
8	Lymbia water supply	56 679	43 629
9	Ayios Sozomenos water supply	53 000	52 167
10	Kakopetria sewage scheme...	98 000	95 068
11	T/Cypriot village water supply	2 500	2 437
12	Margi water supply	1 900	1 713
13	Perakhorio Nisou water supply	6 780	5 517
14	Stavrovouni water supply....	22 000	16 979
15	Kalopanayiotis water supply	1 000	1 000
16	Yeri water supply	39 040	34 405
17	Pera Orinis water supply ..	2 500	1 731
18	Orounda water supply	1 575	1 007
19	Ayii Trimithias water supply	18 253	9 740
20	Pera Khorio Nisou (Livestock Area).....	24 000	17 905
21	Astromeritis water supply	11 667	4 675
22	Akaki irrigation	7 461	7 461
23	Moutoullas water supply....	15 000	13 030
24	Moutoullas irrigation	16 667	7 927
25	Yerakies water supply	1 200	437
26	Nicos Marathasa water supply	19 875	16 752
27	Astromeritis irrigation ...	2 000	2 000
28	Yerakies	2 250	426
29	Koutraphas	2 416	2 258
30	K. Pyrgos (Tzinourgos) water supply	50 579	28 355
31	K. Pyrgos (Platis) irrigation	16 500	12 293
32	Kato Koutraphas	484	295
33	Yeri-Dhali relocation of pipes	5 100	5 004
34	Mammari.....	100	100
35	Army Camp Malounda sewage scheme	23 000	18 702
36	Kalopanayiotis water supply	23 500	14 251
37	Kochatis	154	154
38	Akaki (Riatiko) irrigation	1 800	1 578
39	Pedhoulas water supply	1 500	1 461
40	Ayios Sozomenos N. Quard water supply	235	204

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENTS DURING 1988 (Cont.)

Ser. No.	Description	Amount allocated in 1988 £	Expenditure incurred during 1988 £
41	Sha water supply	13 600	8 223
42	Pera Khorion Nisou	10 500	5 643
43	Ayia Varvara-Kochatis	25 600	10 627
44	Argates water supply	645	131
45	Argates water supply	2 600	528
46	Potamia water supply	534	534
47	Potamia water supply	7 000	3 213
48	Lakatamia Animal Husbaudry.	8 500	3 016
49	Moutoullas (Kokonomatos)...	4 533	1 318
50	Kokkinotrimithia	4 186	2 106
51	Ayia Varvara.....	320	140
52	Pera (Phassera)	2 166	988
53	Mathiatis relocation of pipes	8 424	8 424
54	Gourri Pharmakas water supply	10 300	1 724
55	Mitsero water supply	12 696	12 696
56	Agrokypia water supply.....	7 001	5 574
57	Lythrodhondas water supply.	9 746	10 239
58	Orounda (Ornitharis) water supply.....	28 685	28 340
59	Alambra	600	408
60	Kapedhes.....	800	800
61	Peristerona-Orounda (Maoutsos)	5 800	5 833
62	Lymbia.....	8 481	7 575
63	Athalassa relocation of pipes	8 600	5 320
64	Kalokhorion Klirou.....	5 000	4 398
65	Athalassa relocation of pipes	840	669
66	Ayia Marina Xyliatou	1 115	1 115
67	Aredhiou water supply.....	9 294	5 268
68	Argates (Phourkismenos) ...	4 250	3 024
69	Pano Dheftera relocation of pipes	1 400	1 162
70	Athalassa relocation of pipes	800	780
71	Dhali-L/ca relocation of pipes	1 400	971
72	Sha-Lymbia-Alambra	13 000	8 733
73	Kakopetria Sewage scheme...	57 000	56 129
74	Sewage treatment plant irrigation	3 000	2 511
75	Water supply to livestock area	800	324
76	Water supply for the veterinary station at Nisou	1 300	1 218
77	Acriculture exhibition	260	260
	Total	£816 151	£536 365

TABLE VII-10

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENTS DURING 1988 (Cont.)

LARNACA AND FAMAGUSTA DISTRICT (Constructed by Larnaca-Famagusta Regional office)

Ser. No.	Description	Amount allocated in 1988 £	Expenditure incurred during 1988 £
78	Aradhippou livestock area water supply	71 000	66 965
79	Kelia livestock area water supply	14 000	12 037
80	Livadhia livestock area water supply	14 500	6 244
81	Kophinou water supply	17 226	12 880
82	Dherinia Ind. Area.....	22 000	16 515
83	Paralimni Theomenia	51 000	19 332
84	Khirokitia water supply ...	300	300
85	Five Hydrants Irrigation ..	1 860	1 855
86	Sha-Lymbia water supply ...	610	610
87	Zyyi N. Quard water supply	300	239
88	Vavla water supply	2 000	1 010
89	Ayii Vavatsinias water supply	8 000	2 749
90	Skarinou water supply	10 000	8 699
91	Dhromolaxia	19 619	11 380
92	Goshi N. Quard water supply	8 200	5 018
93	Xylotymbou water supply ...	831	831
94	Kalokhorion L/ca water supply	43 000	21 605
95	Aplanda N. Quard water supply	20 000	11 341
96	Xylotymbou	2 800	2 453
97	Ayios Theodhoros water supply	270	270
98	Klavdhia water supply	5 000	17
99	Melini water supply	135	135
100	Maroni water supply	200	200
101	Klavdhia water supply	100	100
102	Troulli water supply	200	200
103	Mosphiloti	100	100
104	Dhenia Ind. Area irrigation	240	240
105	Strovilia	15 000	1 804
106	Kalavasos	44 000	18 588
107	Psevdhas-Mosphiloti-Ayia Anna relocation of pipes ...	10 000	10 672
108	Rizoelia area	13 000	1 975
109	Aradhippou phase A.....	28 000	8 769
110	Makronisos	3 000	417
111	Ayia Anna	5 200	5 309
112	Kophinou L/ca road	5 000	1 616
113	Goshi irrigation	7 500	2 865
114	Ayia Napa irrigation	5 000	4 995
	Total	£449 191	£260 335

TABLE VII-10

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENTS DURING 1988 (Cont.)

LIMASSOL DISTRICT (Constructed by Limassol Regional office)

Ser. No.	Description	Amount allocated in 1988 £	Expenditure incurred during 1988 £
115	Askarel	95 000	79 438
116	Pano Kividhes irrigation...	50 000	17 801
117	Yerasa water supply	5 000	2 616
118	Lemithou (Platanoudhi Sykoudhi)	4 000	1 618
119	Ayios Dhimitrios.....	5 725	1 636
120	Kaminaria-Ayios Vasilis-Tris Elies.....	29 945	19 097
121	Arsos Irrigation	8 097	7 574
122	Lania-Dhoros.....	68 000	63 284
123	Tris Elies (Dhrakordas)....	16 867	12 462
124	Ayios Dhimitrios.....	3 225	3 030
125	Ayios Amrosios	9 067	8 837
126	Arkolakhania Phylagra	40 000	40 000
127	Pakhna	4 750	4 750
128	Pakhna	3 916	3 507
129	Kolossi water supply	3 975	3 074
130	Ayios Konstantinos.....	2 563	1 201
131	Platys Xylouriko	7 600	7 373
132	Ypsonas-Polemidhia	10 614	5 518
133	Pissouri water supply	14 100	14 100
134	Arakapas (Stavros) water supply	100	100
135	K. Platres water supply ...	44 000	31 893
136	Erimi-Kolossi	4 625	3 326
	Total	£431 169	£332 235

PAPHOS DISTRICT (Constructed by Paphos Regional office)

Ser. No.	Description	Amount allocated in 1988 £	Expenditure incurred during 1988 £
137	Axylou water supply.....	3 600	3 588
138	Kholetria irrigation.....	10 000	9 105
139	Trakhypedhoula.....	16 500	12 283
140	Episkopi water supply.....	2 387	581
141	Ayios Georghios water supply	25 600	18 391
142	Salamiou water supply	20 000	8 884
143	Ayia Marinoudha	1 350	1 152
144	Theletra	15 667	7 646
	Total	£95 104	£61 630
	Grand Total £1,791,615		£1,290 565

SCHEMES UNDERTAKEN FOR CONSTRUCTION WITH FUNDS FROM VILLAGE DEPOSITS

During 1988 the Department had to respond to the requests of the District Officers or the Village Water Commissions, or Village Irrigation Committees for the execution of 69 schemes of various types.

Most of these 69 schemes undertaken by the Department during 1988 from funds deposited direct by the beneficiaries were mostly related to:

Maintenance and repairs to pumping units used for domestic or irrigation purposes, extensions, improvements or maintenance of existing water supply or irrigation distribution systems, etc. This practice is followed for many years because the villages do not have the means to execute the works by themselves, and because this Department has got the experience and expertise to design and execute such schemes.

It should be noted that the funds deposited for the execution of these schemes are borne entirely by the villages and there is no Government contribution at all. In addition the villages have to pay an amount ranging between 20% and 32% as departmental charges. For the execution of these 69 schemes an amount of £200,274 was deposited during 1988 and the overall expenditure incurred by the end of the year reached the amount of £198,435. Out of the 69 schemes 55 were related with water supply and 14 schemes with irrigation systems.

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR PRIVATE DEVELOPERS

During 1988 the Department responded to the request of private developers for the construction of 127 schemes relating to water works.

These schemes were related mainly to distribution systems for land developments, pumping tests, hiring of moulds for reservoirs, etc., and were split all over the island.

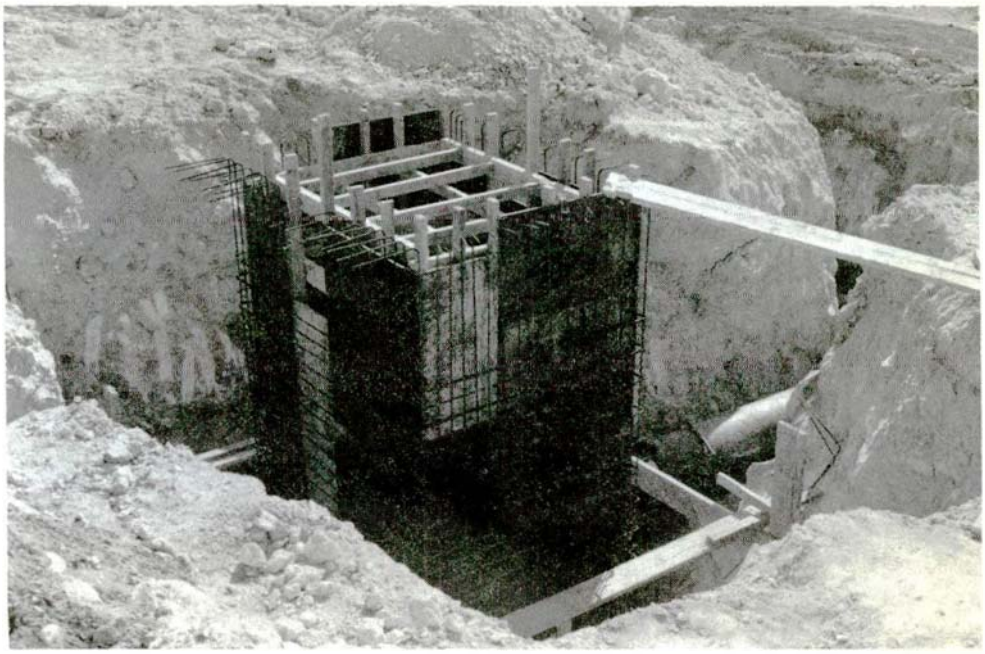
The amount deposited for the execution of these schemes was £59,416 and the overall expenditure incurred during 1988 reached the amount of £48,193. This expenditure includes departmental charges ranging between 20% and 32%.

In the past all such works were executed by the Department so that the standard of work was maintained at the same level as the existing schemes and the interests of towns and villages were safeguarded.

Recently and after the request of District Officers, private developers and land owners were allowed to give to the private sector the execution of some water supply schemes under the supervision of the Department.

It must be noted that no scheme can be constructed by a private Contractor unless it is supervised by a Technical Officer of the Department.

Kakopetria sewage effluent storage pond.
WDD photo F51EN-1.
Taken on 27.10.88.



Vasilikos-Pendaskinos Project is augmented with water from the SCP Main Conveyor both for irrigation and for domestic water supply. The photograph shows the connection point to Khirokitia Treatment Plant through Tokhni PS.
WDD photo F53EN-8.
Taken on 11.11.88.

Kophinou pumping station under construction on Khirokitia-Phrenaros pipeline. Booster pumps will be installed to increase the water capacity of this important pipeline which feeds Larnaca, Famagusta several villages and the tourist industry in the homonymous districts.
WDD photo F7EN-23A.
Taken on 27.5.88

VIII IMPLEMENTATION OF MAJOR PROJECTS

VIII(1) VASILIKOS-PENDASKINOS PROJECT

Although this project was completed in 1986 and has been in full operation since part of the Vasilikos irrigation distribution network at Kalavasos has not yet been constructed due to land consolidation procedure but it is planned to be constructed by 1989.

VIII(2) KHRYSOKHOU IRRIGATION PROJECT

by
K. Spanos SWE
Project Manager

Following completion of all major components of Phase I of the Project early in 1988, the most important activity during the year was its full operation. However, although 1800 ha of land could receive irrigation supplies through the project's pipe distribution system as from April 1988, only 1.9 MCM of water were utilised for irrigation purposes from the 19.6 MCM which were stored in Evretou Dam at the end of the 1987/88 winter season.

The main construction activities during 1988 were related with the extension of the Main Conveyor up to the diversion weir on the Magounda river and the replacement of the Pomos open canal by a Pipe Conveyor which form part of Phase II of the Project. Also some remedial stabilization works over the upstream portal cut of Evretou dam have been carried out during the second half of the year.

Project expenditure during 1988 reached the sum of about £1 million bringing the total to £15.5 million which represent about 91% of the estimated total cost of Phase I with the parts of Phase II of the Project which are related to Argaka and Pomos areas.

STAFF
With the gradual reduction in the construction works during the year 1988 some of the supervisory staff of the project had been transferred to the section of the Operation and Maintenance of the Project, as listed below.

Management
One Executive Engineer I, Project Manager
One Clerk II, Accounts
One clerk II - Typist/Secretary

Construction and Design
Two Executive Engineers I
Six Technicians I & II
One Foreman

Operation and Maintenance of Main Conveyors and Distribution Networks
One Executive Engineer I
Four Technicians II

Evretou Dam Monitoring, and safety measures
One Executive Engineer I
Four Technicians I & II
The services of the Resident Engineer from the Consultants Sir William Halcrow and Partners have been terminated in October 1988.

PROGRESS ON PROJECT IMPLEMENTATION

Evretou Dam - Contract No. 1
Contractor Shephard Hill-Zachariades J.V. (U.K. - Cyprus)
Commencement Date: 18th January 1984
Contract Completion Date: 14th April 1987
Actual Substantial
Completion date: 23rd December 1986
Contract Price: £8,366,588
Total certified by the Engineer: £9,127,322
Approved by the Employer: £8,978,259

General
The Maintenance Certificate for the civil works was issued on 22 March 1988. The Resident Engineer has completed his work on contractual matters and left the site in October 1988. There was a further major slip in the excavated slope above the intake portal cut in April 1988, partly blocking the bottom outlet. Remedial stabilization works over the upstream portal cut by reprofiling its upper section were undertaken by WDD during the second half of the year.

Reservoir Operation
On 22 March the Engineer issued a Final Certificate for Impounding, approving raising the reservoir to its full level of 165.0 masl on the understanding that investigations of the intake slope stability would continue. Following the slip at the intake slope in April it was finally recommended that the reservoir level should not exceed the 160.0 m elevation during the 1988/89 wet season.

The reservoir rose from 147.4 m (8.4 MCM) at the beginning of January to its maximum of 161.1 m (19.6 MCM) at the beginning of May and then gradually dropped to 156.5 m (15.1 MCM) at the beginning of December when the irrigation season has ended. About 1.9 MCM were released during the 1988 dry period for irrigation. The bottom outlet has been also opened from time to time to ensure that it remained unblocked.

During the last two weeks of the year the reservoir level was lowered further down to a minimum of 155.4 m (14.2 MCM) by opening the bottom outlet in order to maintain a safety margin of about 2-3 meters depth of water during the coming wet season.

Intake Cut
On 16 April there was a major landslide of "in-situ" rock from the excavated slope above the intake involving over 20,000 cu.m. of material most of which disappeared into the reservoir towards the intake structure, blocking only the lower part of the bottom outlet screens.

The stability of the intake cut was examined by a Rock Mechanics Specialist, Dr. J.C. Sharp from U.K., the Panel of Experts and the Engineer. Finally the slope reprofiling of the upper sections of the intake portal slope was considered to be the most practical method of improving the stability of the slope. The reprofiling works which were undertaken by WDD through the employment of a local Contractor involved the removal of about 100,000 cu.m. of overburden material and the formation of berms down to the elevation of 160 m. By the end of December excavation works reached down to elevation 171 m while completion was scheduled by the end February 1989. Monitoring of the slope would continue throughout the winter period and its stability will be finally assessed by mid 1989.

Reservoir Bank Storage and Leakages
Further water balance studies carried out by WDD showed that losses from the reservoir into the banks during the period July-September 1988 were of the order of 70 l/s. Investigations would continue in order to assess the distribution of these losses between bank storage and leakages to adjoining aquifers. In the meantime the seepages through the dam foundations have been reassessed and found to be of the order of 37 l/s in May when reservoir reached its maximum level of 161 m and then dropped to about 20 l/s towards the end of the year when reservoir was lowered to 155 m.

Performance
From the records of the instruments installed to check the behavior of the dam and abutments it was concluded that the embankment and ancillary structures are performing satisfactorily.

Contract Situation
The Contractor submitted his final account in July for the sum of £10,351,283, including all his claims. In response the Resident Engineer has presented the final statement in October for the sum of £9,127,322. The Employer, however, has approved only £8,978,259 as total payable amount to the Contractor because of disagreement with Engineer's decisions on nine Variation Orders which have been referred to arbitration. Another four Variation Orders are still expected to be referred by the Contractor to the Engineer for decision under Clause 67.

INSTALLATION OF IRRIGATION NETWORKS AND CONSTRUCTION OF FARM ROADS

Contract KC2 (Sectors IA, IB and IC)

Contractor	: G.P. Zachariades Ltd.
Commencement date	: 31st March 1986
Contract completion date	: 31st January 1988
Actual Substantial Completion date	: 26th April, 1988
Contract Price	: £1,427,880
Total Certified	: £1,443,465

The Engineer's Certificate of substantial completion of the works was issued as from 26th April, 1988 following the Contractor's undertaking to complete the outstanding minor works during the maintenance period.

According to the final measurement of the works the following quantities have been carried out:

Pipping	A.C. pipes	35,600 m
	UPVC pipes	92,540 m
Hydrants		219 no
Filter units		521 no
Farm Outlets		1275 no
Farm Access Roads		63 km

With the completion of the above works an area of about 1,800 ha of Sectors IA, IB and IC along the Khrysokhou river valley downstream of Evretou dam and the coastal plain extending from Limni Mines to Latchi area could receive irrigation supplies as from May. For the irrigation of about 450 ha of mostly previously existing plantations 1,814,000 cub.m. of water were supplied to the farmers during the dry period of 1988.

INSTALLATION OF MAIN CONVEYOR AND CONSTRUCTION OF PONDS

Contract KC3
Contractor : General Construction Co. Ltd.
Commencement date : 20th November 1986
Contract completion date: 20th May 1988
Actual substantial
completion date : 9th July 1988
Contract Price : £1,122,174
Total Certified : £1,170,384

The works under the above Contract which include the installation of the Main Conveyor of 19.5 km of ductile iron pipes and 4.5 km of A.C. pipes and the construction of five storage ponds, one elevated break pressure tank and a diversion weir on Magounda river have been substantially completed during the first half of the year. The above works have been operated during the Summer and the performance was found satisfactory.

REPLACEMENT OF POMOS OPEN CANAL BY PIPELINE

The replacement of the open canal of Pomos dam by pipeline is part of the components of Phase II of the Project which has been decided to be constructed as soon as possible in order to improve the operation of the existing distribution system of Pomos dam. The scheme includes the installation of about 13 km of main pipelines of diameters between 200 and 500 mm and of another 5 km distribution pipelines of 90/110 mm diameter. Part of the Installation works have been undertaken by the General Construction Company through an extension of Contract KC3 at the price of about £83,000. This part includes about 5 km of main pipelines their installation of which have started in September and expected to be completed early 1989. The remaining works, the cost of which was estimated at about £300,000, was undertaken by the Department through direct labour force. Their completion is scheduled for 1990.

PROJECT COST ESTIMATES AND EXPENDITURES

Project expenditure by the end of the year 1988 reached the total of £15 557 309 of which £1 046 098 were spent in 1988. The total cost of Phase I of the project together with the parts of Phase II related with Agraka and Pomos areas whose implementation has been already approved is now evaluated at about £17.5 million without the cost of on-farm equipment which will have to be born by the farmers. Breakdown of the expenditure and cost estimates are given in the table herebelow:-

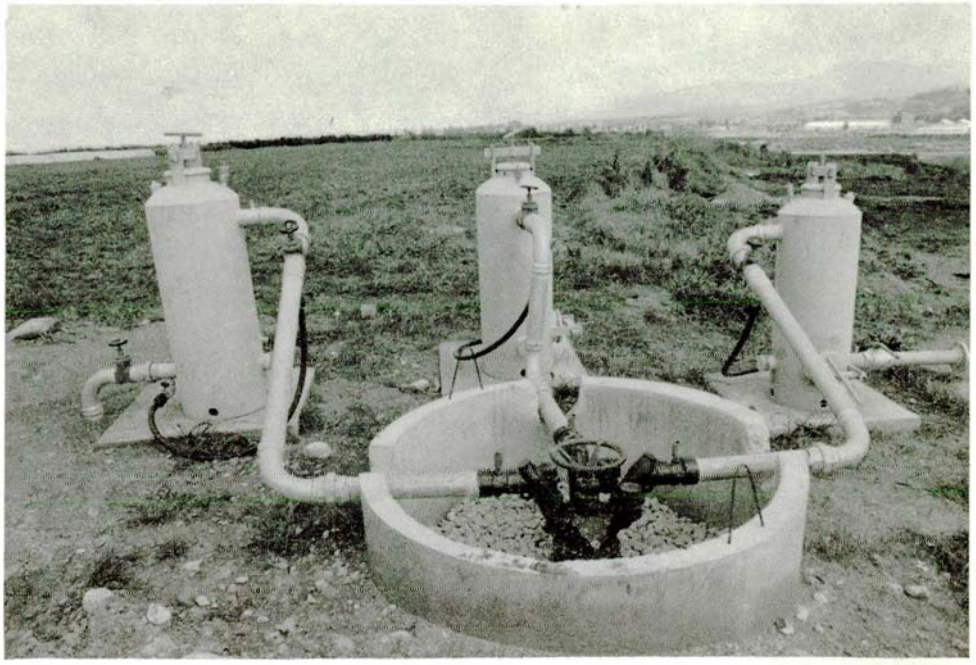
TABLE VIII-1
KIP EXPENDITURE DURING 1988

Item		Expenditure during 1988 £	Total Expend. Up to 31/12/88 £	Estimated Total cost £
1	Evretou Dam	65 358	9 053 522	9 350 000
2	Main Conveyor and Branches up to Argaka Diversion			
	(i) Supplies	7 114	1 768 858	1 770 000
	(ii) Installation ...	488 843	1 183 284	1 240 000
3	Irrigation Networks and Farm Roads Sectors IA, IB and IC			
	(i) Supplies	12 357	707 963	708 000
	(ii) Installation ...	237 772	1 447 966	1 500 000
4	Main Conveyor of Pomos and Irrigation Networks of Sector ID and Argaka and other works by WDD	45 240	133 303	990 000
5	Supervision and Management Costs	71 155	594 805	750 000
6	Consultants and Experts	56 415	327 277	340 000
7	Land Acquisition	32 219	241 748	300 000
8	Land Consolidation ...	29 625	98 583	280 000
9	Ground Water Development	-	-	250 000
	TOTAL	1 046 098	15 557 309	17 478 000

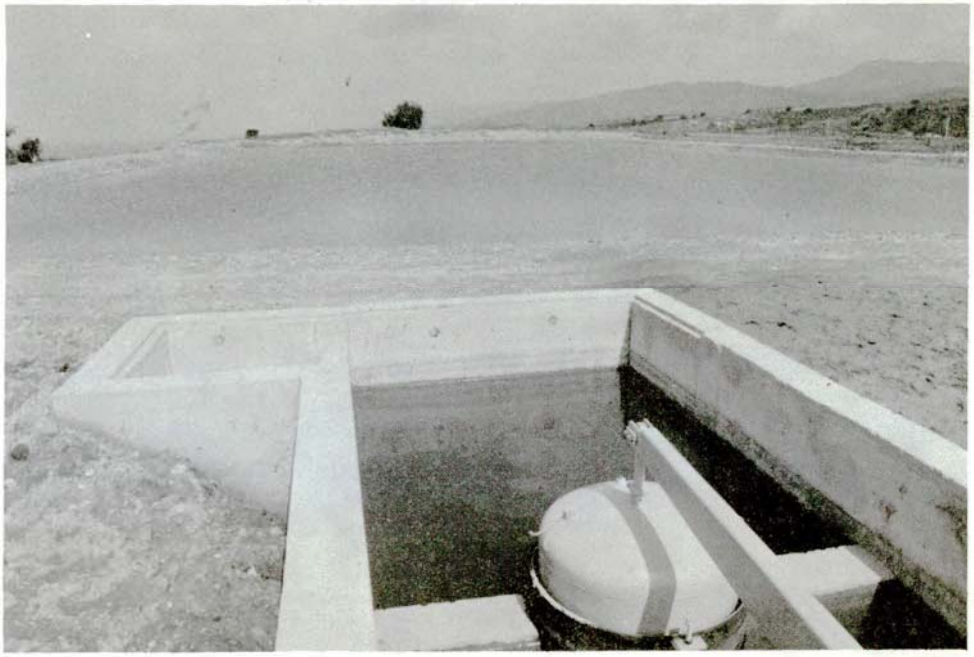
FOREIGN FINANCING

The Government of Cyprus has signed a loan agreement with the World Bank for the sum of $16 000 000 towards the financing of the foreign currencies of the Project costs. By the end of the year 1988 the total disbursements from this loan reached the sum of $15 597 870.

Treble outlet farm hydrant of the KIP irrigation network with gravel filter unit for each single outlet.
WDD photo E78EN-6.
Taken on 15.3.88.



KIP irrigation distribution system storage pond with its inlet break pressure tank.
WDD photo E78EN-11.
Taken on 15.3.88.



Diversion weir structure on Magounda river. Surplus winter flows (after the filling of Argaka dam downstream) will be diverted to Evretou dam.
WDD photo E79EN-18.
Taken on 15.3.88.

VIII(3) SOUTHERN CONVEYOR PROJECT

KOURIS DAM - CONTRACT C1

by
Dr C A Christodoulou
Principal Water Engineer
Project Manager

Kouris Dam constitutes the main water storage component of the Southern Conveyor Project, the basic objective of which is to collect and store surplus water and convey it by means of a regional carrier for use in areas where the water is most needed. Water collected in the Kouris reservoir will be used for irrigation as well as for domestic and industrial needs. Kouris Dam has been constructed on Kouris River near Khalassa village some 15 kilometres north-west of Limassol.

The dam has a central clay core zoned earthfill embankment with a height of 113 metres and a crest length of approximately 550 metres providing a water storage volume of 115 million cubic metres.

The volume of the embankment is approximately 9.4 million cubic metres consisting mainly of river gravel and older terrace gravel deposits excavated from borrow areas in the vicinity of the dam. The maximum discharge of the spillway is 1925 cubic metres per second and approximately 61,000 cubic metres of concrete have been used for its construction. The diversion tunnel is 633 m long and 4.2 m in diameter whilst the 5.4 m diameter intake tower/shaft reaches a height of 111 metres. For the grading works a total length of some 40,000 metres of holes had been drilled and approximately 1,500 tonnes of cement bentonite grout injected to the foundations and abutments.

The village of Khalassa which was located within the reservoir area has been relocated on a site overlooking the reservoir between the Kouris and Limnatis valleys.

The detailed design for the dam commenced in 1981 by Consulting Engineers SOGREAH of Grenoble France in association with Hydroconsult of Cyprus whilst the Water Development Department and the Geological Surveys Department carried out site and fill investigations testing. The Contract for the construction of Kouris Dam was awarded in July 1984 to a Joint Venture comprising of IMPREGILO S.p.A. of Italy and Ioannou and Paraskevaides of Cyprus.

Construction works for the dam commenced on 1st September 1984 and were substantially completed in September 1988. Outstanding finishing works such as the crest stone masonry walls, access road and reinstatement of borrow areas are expected to be completed in Spring 1989.

Recognising the importance of storage of water at the earliest practical moment, construction was programmed so that impounding of the river flows could commence in time for the winter of 1987/88 approximately 10 months before construction was due to be completed.

Despite difficult foundation conditions which necessitated a significant increase in the volume of construction work (introduction of upstream and downstream toe weights) the impounding target was achieved early in November 1987 by the use of additional earthmoving equipment, following an agreement with the Contractor to accelerate the works for the sum of £1,300,000.

Release of water from Kouris Dam started in February 1988 for irrigation (Akhna Dam, Kokkinokhoria area, Kiti Dam, Akrotiri area) and aquifer recharge purposes (Kouris Delta area). Up to the 31st December 1988 a quantity of 22 million cubic metres of water was released from Kouris Dam whilst another 50 million cubic metres of water were stored in the Kouris reservoir.

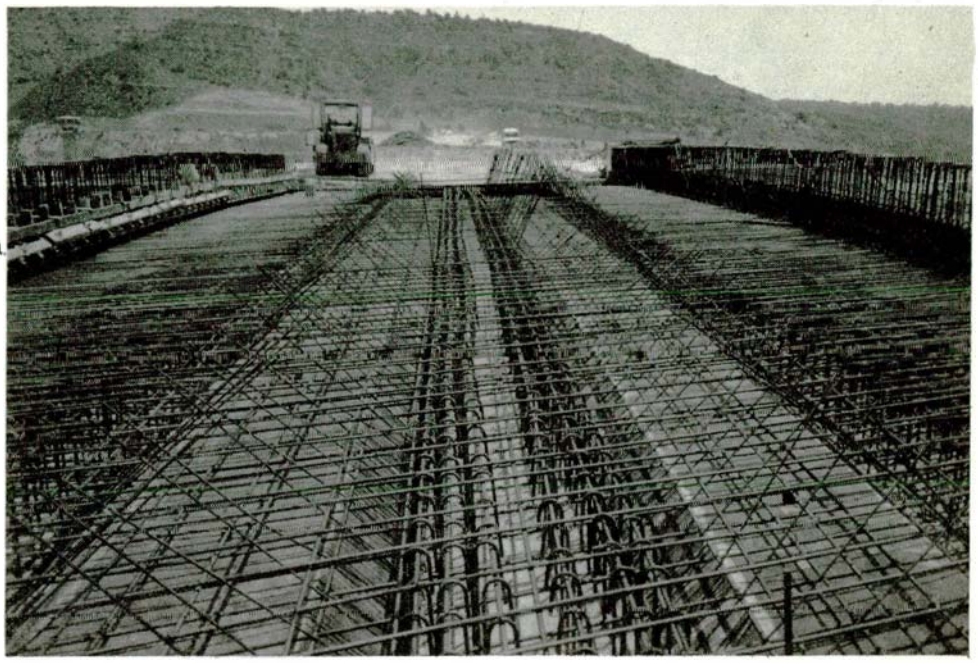
As part of the second phase of the Southern Conveyor Project water from Dhiarizos River will be diverted into the Kouris reservoir via a tunnel 15 km long.

Up to the end of 1988 a total amount of £ 19,747,442 was certified for payment to the Contractor. This amount includes a sum of £ 1,300,000 for the acceleration agreement and £ 574,482 for Contract Price Adjustment (Variation of Prices Cost). For more details please refer to Appendix A attached herewith. Moreover approximately half a million pounds due to the Contractor at the end of the maintenance period is currently retained by the Client.

It is worth noting that the Contractor's claims for additional payments as at the end of 1988 stood at £ 7.1 million.

SOUTHERN CONVEYOR PROJECT
KOURIS DAM - CONTRACT C1
VALUATION PROGRESS FOR PERIOD ENDING 31st DECEMBER 1988

Bill No.	Description	Contract Amount C£	Total Valuation to 31.12.88 Amount, C£	Percentage of Contract Amount, C£
	PART A - CIVIL WORKS			
1	General Items	2,364,413	2,320,451	98.14%
2	Embankment, Cofferdam, Perimetral and Left Abutment Galleries	9,118,072	9,167,307	100.54%
3	Spillway, Right Abutment Gallery, Tail Escape	3,518,259	2,587,076	73.53%
4	Draw-Off Works	2,017,419	1,764,058	87.44%
	Grouting and Cofferdam Diaphragm Wall	1,165,648	1,308,893	112.29%
6	Instrumentation	143,828	131,598	91.50%
7	Building	81,088	59,428	73.29%
8	Roads	128,563	41,668	32.41%
	SUMMARY PART A SUB-TOTAL	18,537,290	17,380,479	93.76%
	PART B - ELECTROMECHANICAL EQUIPMENT			
10	Penstock, Butterfly Valves and Penstock Accessories	593,671	600,579	101.16%
11	Fixed Roller Gates and Linings	309,345	309,595	100.08%
12	Handling and Lifting Equipment	118,836	112,797	94.92%
13	Ancillary and Electrical Equipment	195,089	196,789	100.87%
	SUMMARY PART B SUB-TOTAL	1,216,941	1,219,760	100.23%
	PART C - DAYWORKS			
	SUMMARY PART C SUB-TOTAL	106,859	88,861	83.16%
	TOTAL PARTS A-B-C	19,861,090	18,689,100	94.10%
	CONTRACT PRICE ADJUSTMENT	-	574,482	-
	ACCELERATION COSTS	1,300,000	1,300,000	100.00%



Kouris dam spillway bridge under construction WDD photo F29EN-21. Taken on 27.7.88.

What remained of Khalassa old village after construction of Kouris dam. All the houses were demolished as the village is to be inundated by the dam reservoir. In addition the underlying soil was used as fill for the 9.4 MCM dam embankment. It was agreed though, not to demolish the old church and grave yard which will be partly flooded. WDD photo F35EN-2. Taken from the air on 30.8.88.

The new Khalassa village built well above the water line of Kouris dam reservoir. WDD photo F35EN-7. Taken from the air on 30.8.88.

VIII (4) SOUTHERN CONVEYOR PROJECT
Main Conveyor and Kokkinokhoria Irrigation System

By: K C Hassabis AD
Project Manager
and
D M Patsalides SWE
Dy Project Manager

GENERAL

Objective

The purpose of the Southern Conveyor Project (SCP) for Water Resources Development is to collect and store surplus water from the South Catchments of the Island and convey this water eastwards, to areas of demand for both domestic water supply and irrigation.

The main SCP objectives at full development of the project would be:

(a) To secure a safe domestic water supply until at least the year 2010 to the four major population areas of Cyprus (Nicosia, Limassol, Larnaca and Famagusta).

(b) To provide irrigation water in order to maintain present agricultural production in Kokkinokhoria and to expand irrigated agriculture in four other areas along the southern coast of the Island.

Phasing of the Project

It has been decided to implement the project in two phases because of its large size and the high financial cost.

Phase I of the Project

Phase I includes the construction of Kouris Dam, the Main Conveyor, Akhna Dam, the Kokkinokhoria Irrigation System, and the extension of Khirokitia Treatment Works.

All other works would be postponed to Phase II.

Phase I Project Components and Contracts

The Phase I project components have been divided to the following civil and supply contracts.

(a) Civil Contracts

- Kouris Dam ..... Contract No. C1
- Main Conveyor (Kouris to Mari)..... Contract No. C2
- Main Conveyor (Mari to Akhna Dam)... Contract No. C3
- Akhna Dam ..... Contract No. C4
- Kokkinokhoria Irrigation System, Construction of Balancing Reservoirs Contract No. C5(A)
- Construction of Main Network..... Contract No. C5(B)

- Construction of Central Distribution Reservoirs ..... Contract No. C5(C)
- Construction of Pumping Stations.... Contract No. C6
- Construction of Secondary Network... Contract No. C7
- Construction of Domestic Water Supply Mains..... Contract No. C8
- Project Control Centre at Khirokitia Contract No. C9

(b) Supply Contracts

- Pipes and Fittings for the Main Conveyor (Limassol Bypass and EAC Section)..... Contract No. S1(a)
- Pipes and Fittings for the Main Conveyor and Connection to Vasilikos-Pendaskinos Project (VPP) Contract No. S1(b)
- Valves for the Main Conveyor and Connection to VPP..... Contract No. S2
- Pumping Plant and Ancillary Equipment for Kokkinokhoria Irrigation Network..... Contract No. S3
- AC Pipes and Fittings for Kokkinokhoria Irrigation Network, 200 mm to 800 mm dia. ..... Contract No. S4(a)
- UPVC Pipes and Fittings for Kokkinokhoria Irrigation Network 80 mm to 150 mm dia. ..... Contract No. S4(b)
- Cast Iron Fittings and Couplings for Kokkinokhoria Irrigation Network.... Contract No. S4(c)
- UPVC Pipes and Fittings for Kokkinokhoria Irrigation Network Extensions..... Contract No. S4(d)
- Cast Iron Fittings and Couplings for Kokkinokhoria Irrigation Network Extensions..... Contract No. S4(e)
- Butterfly, Gate and Float Valves for Kokkinokhoria Irrigation Network.... Contract No. S5(a)
- Air Valves for Kokkinokhoria Irrigation Network..... Contract No. S5(b)
- Irrigation Hydrants for Kokkinokhoria Irrigation Network..... Contract No. S6
- Ultrasonic Hydrants for Main Conveyor and Kokkkinokhoria Irrigation Network Contract No. S7
- Telemetry..... Contract No. S8
- Pipes and Fittings for Domestic Water Supply..... Contract No. S9
- Valves for Domestic Water Supply.... Contract No. S10
- Pipes for Domestic Water Supply, Yermasoyia and Tersephanou Aquifer Works..... Contract No. S11
- Fittings for Kokkinokhoria Main Irrigation Network..... Contract No. S12
- AC Pipes for Kokkinokhoria Secondary Network..... Contract No. S13
- Fittings for Kokkinokhoria Irrigation Area Secondary Network (Extensions)..... Contract No. S14

STAFF

Managing Team

- Mr K C Hassabis, Assistant Director, WDD, continued to practise his duties as Project Manager of the Main Conveyor and Irrigation Networks.

- Dr C A Christodoulou, Principal Water Engineer, WDD, has continued to practise his duties as Project Manager for Kouris Dam.

- Mr D M Patsalides, Executive Engineer I, has continued to practise his duties as Deputy Project Manager (Eng) while Mr A Ioannou, Agricultural Officer I, Department of Agriculture, has continued to practise his duties as Deputy Project Manager (Agr.).

Supervisory Staff

The appropriate supervisory staff consisting of engineers, technicians (surveyors, laboratory technicians etc.) have continued to practise their duties in the field and site offices at Kouris, Ayios Athanasios and Ormidhia for the respective contracts of Kouris Dam, Main Conveyor, Akhna Dam and Kokkinokhoria Irrigation System.

CONSULTING ENGINEERS

Sir William Halcrow and Partners, in association with Balfours, continued their duties in connection with site supervision of construction of the Main Conveyor, (Contract No. C2/C3), Akhna Dam (Contract No. C4) under maintenance and the Kokkinokhoria Irrigation Area (Contracts Nos C5(A) - Balancing Reservoirs, C5(C) - CDP Reservoirs, and C6 - Pumping Stations Civil Works.

Supervision of the supply contracts and contract No. S3 - Pumping Plant, continued. Tenders for Contracts Nos. S4(E) - Fittings for Kokkinokhoria irrigation Area Secondary Network, and S6 - Hydrants, were evaluated and awarded. Preparation of working drawings for the Kokkinokhoria construction contracts continued in Nicosia and for the Main Conveyor in Limassol site office.

FURTHER STUDIES

Water Entity

During the period under review the study for the establishment of a new Water Entity, or improvement of the existing arrangement for the development, management and allocation of water resources in Cyprus entered its second phase, which according to a decision of the Council of Ministers No. 30.937 dated 18.11.88 would include also a manpower study. The form of the entity to be studied in detail, according to the decision, would be of a semigovernmental nature, but should be compared with the option "present situation" and the option "present situation plus limited changes" for concentrating powers, as regards water

matters, which at the moment are scattered in various Government Departments.

The consultants are Rofe Kennard and Lapworth, Consulting Engineers, in collaboration with Southern Water Authority, arrived in Cyprus and commenced work on the second phase of the Study in the middle of November 1988.

Kouris Dam - Hydropower Plant

The working committee which was formed for this purpose has not taken a final decision on the matter. It is very likely however that final decision will be taken when Kouris Dam becomes fully operational and more data become available.

Water Abstraction and Well Inventory in Kokkinokhoria Area

The punching of the data obtained from the Inventory is completed. A total number of 6900 boreholes have been computerized.

Six new reports for the irrigation blocks 7b, 11, 10b, 4a, 13b and 15 have been prepared and published. The reports for the irrigation blocks 3b and 4b are under preparation.

Re-design of Kokkinokhoria Network

By the end of the year nine distribution systems out of 23 were finalized and handed over to the Construction Division for implementation.

PANEL OF EXPERTS

The members of the Panel for Akhna Dam are:

Prof. E Nonveiller
Dr. J Newbery
Mr. A A Abidi
Mr. C A C Konteatis

During the reporting period the Panel visited Kouris dam on the 10th of October, 1988.

FOREIGN FINANCING

With the award of Contract No. S3 (Pumping Plant and Ancillary Equipment for Kokkinokhoria Irrigation Area) of the UK firm SPP Projects Ltd., the number of financiers have been increased to five with the addition of the Standard Chartered Merchant Bank Ltd. of UK. The five foreign loans of the project are as follows:

- $27,000,000 from the international Bank for Reconstruction and Development (IBRD) to cover 40% of the cost for construction of Kouris Dam, 64% of the cost for construction of Akhna Dam,

Consultants' fees (100%) and cost for the supply of office equipment (95%).

- KD 2,940,000 from the Kuwait Fund for Arab Economic Development (KFAED) to meet expenditure for the supply of pipes and fittings for Kokkinokhoria Irrigation Network and Pumping Stations. Supply contracts are financed at rate ranging between 50% to 100% whilst construction contracts are financed at the rate of 50%.

- ECU's 30,200,000 from the European Investment Bank (EIB) to meet 60% of the cost for the construction of Kouris Dam.

- DM 78,074,566 from Consortium of French Banks to meet 85% of the contract price for the supply of ductile pipes and fittings for the Main Conveyor.

- StgE 1,973,800 from the Standard Merchant Bank Ltd. (UK) to meet expenditure for the supply of Pumping Plant for the Kokkinokhoria Irrigation Area.

During 1988 disbursements were made by IBRD, EIB and the Consortium of French Banks only. The disbursement situation for each loan at the end of 1988 is given below in Table VIII/IV/I.

TABLE VIII/ 4/I

LOAN DISBURSEMENTS

Financier	Loan	Total Disbursements	Balance Undisbursed
IBRD	$27,000,000	$19,367,250.57	$ 7,632,749.45
KFAED	KD2,940,000	KD1,622,814.880	KD1,317,185.120
EIB	ECU's30,200,000	ECU's25,189,059	ECU's 5,010,941
Consortium of French Banks	DM78,074,566	DM80,427,363.85	DM2,352,797.85*
Standard Chartered Bank Ltd. (UK)	Stg£1,973,800	Stg£ 569,589	Stg£1,402,211

* In addition it includes supplies for Khrysokhou Project

PROGRESS ON PROJECT IMPLEMENTATION

Kouris Dam - Contract C1

Details on progress for Kouris Dam are given in Chapter VIII/III of this report.

Main Conveyor (Kouris to Akhna) - Contract C2/C3

Contractor : Cybarco-Shand J.V. (Cyprus-UK)
Commencement Date: 17th October, 1985
Completion Date : 4th February, 1988
Contract Price : £6,157,031
Total Certified : £4,670,149.51
(31.12.88)

Pipelaying

The only pipelaying carried out during the period was the installation by the Water Development Department of discharge pipes downstream of each washout chamber. The Conveyor continued to operate with water being supplied primarily to the Kokkinokhoria Irrigation Network. Water was also released into the Kouris River Valley up to 3rd October 1988 for aquifer recharge. From 29th November 1988, the transfer of water to Akhna Reservoir resumed for storage.

Tranch Structures

All outstanding valves were delivered to Cyprus during the period and the following installations were completed:

(a) Flow control valves and isolating butterfly valves at the Flow Control complex near Ormidhia

(b) Regulating Valve at Akhna Outlet

(c) Recoil Check Valve at Branch Y2 (Yermasoyia Recharge)

The construction of the Kouris Aquifer Recharge Structure was completed by the end of october 1988 and only the installation of the Fixed Cone Valve remains for this facility to be fully operational.

The commissioning engineer from the valve supplier made his fifth visit to the Site between 19th September and 15th October 1988 and most of the valves were successfully commissioned during this visit. Some valve repairs were also carried out as required.

Reinstatement

Work on reinstatement and completion of outstanding works progressed slowly during the period and by 31st December 1988 significant remedial works still remained to be completed, including reinstatement of terraces and painting of pipework within chambers. The fixing of the pipeline marker posts along the Conveyor route was however substantially completed by the end of the year.

Progress on Major Structures

Tunnel

Additional drainage works, downstream of the culverts on the access road, were carried out during the period and completed by 22nd November 1988.

The access area at the tunnel inlet portal was surfaced with premix asphalt and this was completed on 14th September, 1988.

The access area at the tunnel outlet portal was surfaced with road base material and this was completed on 6th July 1988.

Break Pressure Tank No. 1

The access area around the tank and chambers was surfaced with road base material and this was completed on 15th July, 1988. All other works, including the EAC electrical connections, were substantially completed.

Break Pressure Tank No. 2

The access area around the tank and chambers was surfaced with road base material and this was completed on 18th July, 1988.

Work on the access road extension progressed well with the multi-pipe culverts being completed by 4th August, 1988. The earthworks progressed more slowly however with the general fill and subbase being completed by 8th October, 1988, the road base being completed by 26th October 1988, the surfacing with premix asphalt being completed by 1st November 1988, and the shoulders being completed by 16th November, 1988.

Break Pressure Tank No. 3

The acxcess area around the tank and chambers was surfaced with road base material and this was completed on 14th July 1988. All other work, except the installation of the isolating gate valve for branch to Tersephanou Water Treatment Works, was substantially complete.

Summary

All work on the Conveyor, except for some remedial works and reinstatement, is now substantially complete and the outstanding additional work, such as branches to the Kouris Pumping Station, will be executed directly by the WDD.

All parts of the Conveyor are now fully operational and water is being transferred to various locations along its route.

An inspection at the end of the maintenance period for the greater part of the Works was undertaken jointly by the Employer

and the Engineer, with the Contractor in attendance, on 16th December.

Akhna Dam - Contract C4

Contractor	:	Iacovou Bros (Construction) Ltd.
Commencement date	:	18th June, 1986
Date of Substantial Completion	:	3rd December, 1987
Tender Sum	:	C£ 1,312,980
Total Certified (31.12.88)	:	C£ 1,033,485

An inspection at the end of the maintenance period was undertaken jointly by the Employer and the Engineer, with the Contractor in attendance, on 1st December. The Contractor proceeded with the remaining items of work.

Filling of Akhna reservoir was resumed in November, and at the end of December it held some 3 Mm^3.

Kokkinokhoria Irrigation System
Main Distribution Network - Balancing Reservoirs
Contract No. C5(A)

Contractor	:	George P Zachariades Ltd
Commencement Date	:	22nd April, 1987
Contractual Completion Date	:	22nd March, 1989
Contract Price	:	C£1,416,964
Total Certified 31.12.88	:	C£1,102,172

Although the Contract got off to a rather slow start and was at one time several weeks behind programme, the Contractor managed to recover and substantially completed the first stage reservcoirs before August 1988.

The Contract requires completion of the first stage, consisting of half (one compartment) of BR1 and all of BR2 and BR3, by August 1988 and the remaining half of BR1 and BR4 reservoir by March 1989.

By the end of 1988 work on the remaining reservoir BR4 was well advanced, and testing was expected to be carried out in Fubruary 1989.

Kokkinokhoria Irrigation System
Main Distribution Network - Central Distribution Points
Contract No. C5(C)

Contractor	:	Cybarco Ltd
Commencement date	:	22nd April, 1987
Contractual Completion date	:	22nd March, 1989
Contract Price	:	C£2,179,600
Total Certified 31.12.88	:	C£1,249,633

During 1988, due to the satisfactory level of organisation and management and despite the numerous problems associated with executing work at up to ten scattered sites concurrently the Contractor achieved a remarkably high built-up of work momentum, which resulted in the timely completion of all of the Stage 1 CDP Reservoirs (7 Nos) and also, by December 1988, brought the works related to most of the Stage 2 CDPs to the near-completion stage. In fact, all the reservoirs are expected to be satisfactorily completed in time i.e. by 22nd March, 1989.

It is also important to be noted that, due to the non-use of the contingencies amounts, some of the preliminaries and most of the dayworks amounts etc, the final cost of the works is expected to be in the region of C£ 1,650,000.

Kokkinokhoria Irrigation System
Pumping Stations - Civil Works
Contract No. C6

Contractor	:	China International Water and Electric Corp.
Commencement Date	:	30th March, 1987
Contractual Completion Date	:	5th June 1989
Extension Awarded	:	20 weeks
Extension Completion Date	:	23rd October 1989
Contract Price	:	C£1,649,000
Total Certified 31.12.88	:	C£879,589

The progress of this Contract continued to be very slow, mainly due to labour shortage. This problem was solved only when the Contractor managed to import 73 Chinese workers during June-July after getting permission from the Immigration Department.

Intermediate phase completion dates were revised, taking into consideration the 20 weeks extension of time and the Contractor's productivity was extremely increased in an effort to meet his targets.

Although the Contractor failed to complete Stage I of Section 1 on 15 October 1988, (completed on 30 November 1988) he proved that he is able to complete the remaining 3 sections on their target dates.

Kokkinokhoria Irrigation System
Secondary Network - Contract C7

Contractor	:	Force Account WDD
Commencement Date	:	16th February 1987
Completion Date	:	31st December 1989
Estimated Cost	:	C£ 4,500,000
Expenditure 31.12.88	:	C£ 2,700,000

During 1988 the Force Account team completed the installation of the Irrigation Network in areas covering 5000 ha. This work included piped networks of 140 km in total length.

Furthermore by temporary arrangement (by-passes of reservoirs and pumping stations) it was possible to supply irrigation water to an area of 500 ha.

PROGRESS ON SUPPLY CONTRACTS

Pipes and Fittings for the Main Conveyor
Contract No. S1(b)

Contractor & Manufacturer	:	Pont-a-Mousson (France)
Commencement date	:	22nd August, 1985
Completion date	:	22nd August, 1987
Contract price	:	C£19,382,266
Total Certified 31.12.88	:	C£20,306,667 (including Khrysokhou)

Only minor items were delivered under this contract during the period.

A further and final pipes and fittings order, Schedule No. 11 comprising fittings for Paralimni was issued.

Final Certificate Nos 5 and 6 were issued on 20th August and 7th November, 1988, respectively.

Valves for the Main Conveyor - Contract No. S2

Contractor	:	Caramondani Bros Ltd (N/sia)
Manufacturer	:	Biwater-Glenfield (UK)
Commencement date	:	8th May 1985
Completion date	:	8th January 1987
Contract price	:	C£664,454
Total Certified (3112.88)	:	C£645,584

Two shipments of valves were received during the period, completing deliveried under this contract except for spares. The manufacturer's Technical Director visited Cyprus in August for discussions on valve performance, and the commissioning engineer made his fifth visit in September/October. His time was split between commissioning and rectifying valve defects.

Final Certificate No. 1 was issued on 2nd November, 1988.

Pumping Plant for Kokkinokhoria Irrigation
Contract S3

Contract	:	SPP Projects Ltd (UK)
Commencement Date	:	21st May 1987
Completion Date	:	19th October 1989
Tender Sum	:	C£3,041,177
Total Certified 31.12.88	:	C£129,298 Government funding, Stg£ 658,201 (C£529,565) UK Grant Aid and C£ 375,211 ECGD backed loan.

Delivery of materials to site commenced in June and the majority of pumping plant and equipment for Section 1 pumping stations, with the exception of pipework items was on site by late November. Witness testing by the Employer and Engineer continued throughout this period.

The Contractor formally appointed Ma-Stro Engineering Ltd of Cyprus as his Sub-contractor for the Electromechanical erection on 17th November.

The installation work commenced on 12th December and the Contractor carried out preparatory work to crane beams prior to their installation in the pumping station buildings.

Pipes and Fittings for Kokkinokhoria Irrigation Network
Contract No. S4(a) - Asbestos Cement Pipes

Contractor & Manufacturer	:	Amiantit S.A. (Greece)
Commencement date	:	14th January 1986
Completion date	:	14th January 1987
Contract price	:	C£890,456
Total certified 31.12.88	:	C£753,948

Despite the problems initially faced due to excessive breakages of pipes during field testing, the Contractor delivered all healthy pipes to Ormidhia Storage Area.

Contract No. S4(b) - UPVC Pipes and Fittings

Contractor & Manufacturer	:	Kosmo-Plast Ltd (Paphos)
Commencement date	:	14th January, 1986
Completion date	:	14th January, 1987
Contract price	:	C£167,743
Total certified 31.12.88	:	

Manufacture and delivery of pipes to the Ormidhia Storage Area was completed

Contract No. S4(c) - Fittings and Couplings

Contractor	:	P.N. Epiphaniou Ltd (N/sia)
Manufacturer	:	Fundiciones Metalicas S.A. Spain
Commencement date	:	14th January, 1986
Completion date	:	14th May 1986
Contract price	:	C£33,889
Total certified 31.12.88	:	C£27,081

All deliveries under this contract have been satisfactorily completed.

Contract No. S4(d) - UPVC Pipes and Fittings for KIA Extensions

Contractor & Manufacturer	:	Kosmpoplast Ltd (Paphos)
Commencement date	:	18th July 1988
Completion date	:	18th July 1989
Contract Price	:	C£ 139,042
Total Certified 31.12.88	:	C£ 46,828

Deliveries of UPVC pipes and fittings continued smoothly during 1988.

Contract No. S4(e) - Fittings for KIA Secondary Network

Contractor	-	Cyprus Waterworks Co. Ltd
Manufacturer	-	Fonderis Ohannes Kassardjian S.A.L. (Lebanon)
Commencement date	-	24th August, 1987
Completion date	-	30th May, 1988
Contract Price	-	C£173,553
Total Certified 31.12.88	-	C£165,565

Deliveries of cast iron fittings were completed by end of 1988.

Valves for Kokkinokhoria

Contract No. S5(a) - Butterfly, Gate and Float Valves

Contractor	:	Pipeline Engineering GmbH (West Germany)
Manufacturer	:	VAG, Krombach (West Germany)
Commencement date	:	24th September, 1985
Completion date	:	24th September, 1987
Contract price	:	C£176,717
Total certified 31.12.88	:	C£213,306

All valves ordered were delivered to Ormidhia Storage Area.

Contract S5(b) - Air Valves

Contractor & Manufacturer	:	Guest and Chrimes (UK)
Commencement date	:	1st November, 1985
Completion date	:	1st November, 1987
Contract price	:	C£44,857
Total certified 31.12.88	:	C£35,451

All air valves ordered were delivered to Ormidhia Storage Area.

Contract S6 - Irrigation Hydrants for Kokkinokhoria

Contractor	:	Spyros Stavrinides Ltd
Manufacturer	:	APCO (Greece) Bermad (USA)
Commencement date	:	9th December, 1987
Completion date	:	22 months from order to commence manufacture
Contract Price	:	C£333,446
Total certified 31.12.88	:	C£308,495

By the end of 1988 the Contractor delivered to Ormidhia Storage Area about 85% of the Irrigation Hydrants.

Contract S7 - Flowmeters for the Main Conveyor

Contractor & Manufacturer	:	Bestobell Sparling (UK)
Commencement date	:	22nd January 1986
Completion date	:	22nd January 1987
Contract price	:	C£58,639
Certified to date 31.12.88:		C£62,069

Final certificate No. 1 was issued on 12 December, 1988.

Contract S8 -Telemetry

On 31st October, firms interested in tendering were invited to submit applications to prequalify, with detailed information as to their relevant experience, financial status, etc. By the closing date, 5th December, 46 applications had been received and these were being evaluated by the end of the period.

Contract S12 - Fittings for Kokkinokhoria Main Network

Contractor	:	P N Epiphaniou Ltd (N/sia)
Manufacturer	:	Fundiciones Metalicas S.A. (Spain)
Commencement date	:	3rd April, 1986
Completion date	:	14th August, 1986
Contract price	:	C£30,585
Total Certified 31.12.88	:	C£28,885

All deliveries under this contract have been satisfactorily completed.

Contract S13 - Pipes for Kokkinokhoria Irrigation Area Extensions

Contractor & Manufacturer	:	Cyprus Pipes Industries Ltd
Commencement date	:	30th April 1987
Completion date	:	31st August 1988
Contract price	:	C£860,000
Total certified 31.12.88	:	C£860,092

Delivery of asbestos - cement pipes continued throughout the period.

Contract S14 -Fittings for Kokkinokhoria Secondary Network Extensions

Contractor	:	Cyprus Waterworks Co. Ltd.
Manufacturer	:	Fonderies Ohannes H. Kassardjian (Lebanon)
Commencement Date	:	31st August, 1988
Tender Sum	:	C£ 305,412
Total Certified 31.12.88	:	C£ 26,721

PROJECT EXPENDITURE

The project expenditure for phase 1 of the project works, including expenditure incurred for Kouris Dam reached the figure of £71,298,105 out of which £11,665,578 was incurred in 1988.

Detail analysis of expenditure is given in Table VIII/4/2.

SOUTHERN CONVEYOR PROJECT - TABLE VIII (4)-2

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
	PART 'A' of the Project - KOURIS DAM		
1	Kouris Dam Construction (Contract C1).....	2,581,712	20,635,288
2	Supervision/Administration by WDD	138,409	705,116
3	Surveys and Investigations (Topography/Laboratory) by WDD...	10,467	140,694
4	Removal and Relocation of CYTA Telecommunication Network.....	63	36,624
5	Installation of telephone at Kouris Dam.....	-	4,515
6	Construction of two water flow gauges on Kouris and Zyghos rivers	-	22,933
7	Removal and Relocation of EAC high voltage transmission lines.....	-	82,383
8	Supply of Electricity to the Dam and Pumping Station.....	-	81,670
9	Acquisition of Land.....	90,938	1,900,548
10	Compensation to individuals.....	-	2,680
11	Improvements to the road Lofou-Ayios Therapon.....	-	3,685
12	Establishment of Hydroteorological Station.....	-	2,533
13	Kouris Dam Inauguration Expenses	2,427	4,034
14	Construction of access road to connect Lofou-Ypsonas villages...	136,145	137,056
15	Removal & Relocation of Alassa village.....	-	65,884
16	"Sogreah" Consultancy Services (Design/Supervision Kouris Dam)	59,937	486,596
17	Panel of Experts Consultancy Services for Kouris and Akhna Dam	7,316	40,481

TABLE VIII/ 4 /2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
18	Relocation of Limassol Water Board Pipelines from Kouris river (B/Hole 40/69)	5,499	5,499
19	Construction of 3 iron grills for the control tower	2,665	2,665
20	Conservation of Kouris Dam with plants by Forest Department	2,774	2,774
21	Crest lighting of Kouris Dam	1,512	1,512
	Total of Part 'A'	3,039,684	24,365,170
	PART 'B' of the Project - MAIN CONVEYOR		
1	Supply of pipes and fittings for the Limassol By-Pass & EAC Section (Contract S1(a))	-	562,653
2	Supply of pipes and fittings for Main Conveyor (Contract S1(b))	297,515	22,176,198
3	Supply of valves for Main Conveyor (Contract S2)	98,979	679,803
4	Supply of flowmeters for the Main Conveyor (Contract S7)	13,632	58,899
5	Supply of pipes and fittings from other schemes	120	2,207
6	Preliminary Construction Works on the New Limassol Road	-	85,021
7	Construction and laying of Main Conveyor at EAC Section	-	117,563
8	Construction and laying of Main Conveyor at Limassol By-Pass Section	-	109,978
9	Construction of Wash-Outs	11,726	51,469
10	Extension of Washouts to bridges, ditches etc.	10,135	10,135

TABLE VIII/ 4/2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
11	Laying of Main Conveyor on two crossings of Limassol road (Ypsonas-Erimi).....	-	6,000
12	Construction of two culverts on the roads Larnaca-Kophinou and Larnaca-Nicosia.....	24,247	90,655
13	Relocation of EAC high voltage transmission towers in alignment with Main Conveyor (Yermasoyia)	-	23,116
14	Permanent Reinstatement of public roads, Limassol.....	-	3,070
15	Permanent Reinstatement of public roads at Larnaca	3,139	3,139
16	Permanent Reinstatement of public roads at K. Polemidhia.....	540	540
17	Connection of the Main Conveyor with kiti Dam with A.C. pipes	16,127	16,127
18	Compensation to individuals for the Main Conveyor.....	234	234
19	Fencing of Deep Cut at Ypsonas	2,391	2,391
20	Reinstatement of various fencings	472	472
21	Reinstatement of wall at Polemidhia cemetery.....	691	691
22	Construction and Laying of Main Conveyor from Kouris to Akhna (Contract C2/C3).....	2,572,239	4,984,093
23	Administration/Supervision of Contract C2/C3.....	128,389	214,754
24	Purchase of sand.....	-	22,750
25	Construction of Vasilikos (Kalavasos Balancing Reservoir	1,395	224,075
26	Purchase of Polethelene Sleeving	1,931	1,931
27	Construction of Limassol Storage Area.....	-	71,146

TABLE VIII/ 4 /2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
28	Construction of Larnaca Storage Area.....	-	93,401
29	Construction of Ormidhia Storage Area.....	-	34,799
30	Connection of Main Conveyor with Khirokitia Treatment Works	9,010	9,010
31	Construction of Kouris Dam Pumping Station.....	27,482	152,152
32	Construction of fixed cone valve structure at Kouris Dam.....	14,511	14,511
33	Administration of Main Conveyor (general) by WDD.....	4,382	50,470
34	Administration/Management of Storage Areas by WDD.....	28,947	122,197
35	Surveys and Investigations Topography/Laboratory) by WDD....	102,059	212,534
36	Acquisition of Land for the Main Conveyor.....	60,577	1,180,658
37	"Sir William Halcrow and Partners" Consultancy Services for the Main Conveyor etc.	190,138	870,992
	Total Part 'B' of the Project	1,818,524	33,259,909
	PART 'C' of the Project - Akhna Dam		
1	Construction of Akhna Dam (Contract C4).....	82,867	1,034,486
2	Supervision/Administration.....	-	41,872
3	Filling of Existing Boreholes & Wells in the Reservoir with Clay	-	9,974
4	Drilling of relief wells and monitoring B/holes.....	26,666	26,666
5	"British Hydromechanics Research Association" Consultancy Services for the Akhna Dam Hydraulic Model Testing.....	-	12,905

TABLE VIII/ 4/2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
6	Removal and Relocation of EAC high voltage transmission lines	-	15,573
7	Acquisition of Land.....	30,888	142,199
	Total Part 'C' of the Project	140,421	1,283,675
	PART 'D' of the Project - Kokkinokhoria Irrigation Distribution System		
1	Supply of Pumps and Ancillary Equipment for KIA Networks (Contract S3).....	825,457	1,133,978
2	Supply of AC Pipes for KIA Networks from CDP1. Council of Ministers' Decision 26.776 of 13.2.86.....	-	305,323
3	Supply of AC Pipes and Fittings (Contract S4(a).....	30	753,948
4	Supply of UPVC Pipes and Fittings (Contract S4(b).....	59,660	152,851
5	Supply of C.I. Couplings and Fittings (Contract S4(c).....	-	27,081
6	Supply of Fittings (Contract S4(e)	156,492	165,565
7	Supply of UPVC Pipes for KIA Networks extension (Contract S4d(i)	15,859	15,859
8	Supply of UPVC Fittings for KIA Networks extension (Contract S4d(ii)	30,969	30,969
9	Supply of butterfly, Gate and Float Valves (Contract S5(a)).....	84,536	213,316
10	Supply of Air Valves (Contract S5(b)).....	40,495	78,056
11	Supply of Hydrants (Contract S6)	308,495	308,495
12	Supply of Couplings and Fittings (Contract S12).....	-	27,372
13	Supply of AC Pipes (Contract S13)	407,066	860,092

TABLE VIII/ 4 /2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
14	Supply of D.I. fittings through extension of Contract K.S.1 of KIP.....	3	11,205
15	Supply of couplings for KIA Networks extension (Contract S14)	28,313	28,313
16	Supply of AC Pipes through extension of Contract K.S.1 of KIP.....	-	27,731
17	Construction of 4 Balancing Reservoirs (Contract C5(a).....	542,418	1,102,172
18	Supervision/Administration of Contract C5(A).....	38,700	48,632
19	Construction if KIA Main Irrigation Networks (Contract C5B)	-	833,321
20	Design-Redesign of KIA Main Irrigation Networks.....	1,821	20,183
21	Construction of 14 Distribution Points Reservoirs (Contract C5C)	745,074	1,249,633
22	Supervision/Administration of Contract C5C.....	50,165	60,489
23	Construction of 19 Pumping Stations (Contract C6).....	588,101	879,589
24	Supervision/Administration of Contract C6	70,438	83,701
25	Construction if KIA Secondary Irrigation Networks (Contract C7)	1,910,406	2,800,393
26	Central Laboratory of Ormidhia (Quality Control of Works).....	79,865	95,427
27	Survey of Identification of Land Ownership.....	7,234	25,367
28	Acquisition and Requisition of Land.....	13,851	18,433
29	Administration.....	-	3,441
30	Land Consolidation (Preliminary and Administration Expenses).....	26,460	49,445

TABLE VIII/ 4/2 (Contd.)

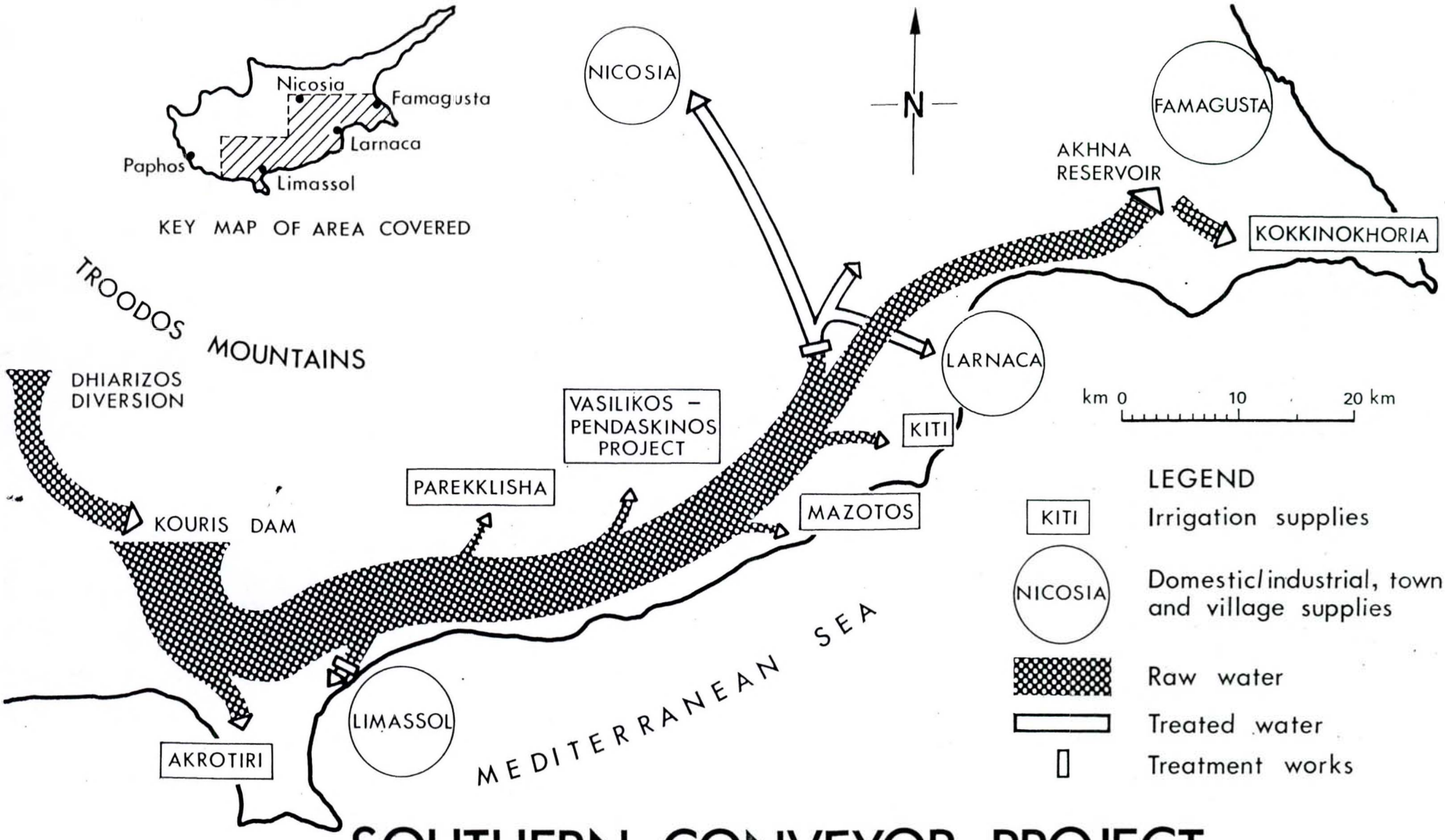
Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
31	Land Consolidation of 1800 Hectares of Land.....	-	-
32	Construction of Farm Roads in the Land Consolidation Area.....	399,999	399,999
33	Supervision/Overtime by Land Consolidation team	727	727
	Total Part 'D' of the Project	6,432,634	11,810,496
	PART 'E' of the Project - Development of Domestic Water Supply		
1	"Howard Humphreys and J A Theophilou" Consultancy Services for the preparation of the Study for the location of Limassol Water Treatment Plant		
2	Construction of Kophinou Pumping Station	122,157	123,619
3	Construction of new AC pipeline (4,500 meters) to connect Famagusta conveyor with Larnaca Water Board Reservoir (Alethrico Pipeline)	30,526	30,526
	Total of Part 'E' of the Project	152,683	168,620
	PART 'F' of the Project - Central Control System (Contract S8)	-	-
	PART 'G' of the Project - Institutional Restructuring - Preparatory Engineering Work		
1	"N G SCHULZ" of California USA Consultancy Services.....	-	5,577
2	Rofe Kennard & Lapworth of UK Preparation of Study on National Water Entity.....	10,514	60,426
	Total Part "G" of the Project....	10,514	66,003

TABLE VIII/ 4/2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
	PART 'H' of the Project - Buildings and Equipment		
1	Purchase of Laboratory Equipment (for Kouris Dam).....	-	10,350
2	Purchase of 2 Field Vehicles - Pajero type (for Kouris Dam).....	-	7,900
3	Purchase of 2 Vehicles (one 'Mazda' Saloon and one 'Isuzu' double cabin (for Main Conveyor).....	-	6,075
4	Purchase of 8 Vehicles (one 'Pajero' and seven 'Toyota' double cabin) for KIA Networks...	-	35,475
5	Purchase of 19 Field Vehicles (Mitsubishi Pajero and Toyota double cabin).....	-	99,345
6	Purchase of one 'Crowler Rig and Compressor'.....	-	8,840
7	Purchase of Radio-telecommunication equipment for Kouris Dam.....	-	4,818
8	Purchase of 4 cameras.....	-	408
9	Reinforcement of Electricity Network at HQs Nicosia by EMS....	-	852
10	Purchase of Micro-Computers.....	3,779	23,349
11	Purchase of furniture & fittings for Micro-Computers at Nicosia HQs...	509	1,567
12	Purchase of Machinery and Drilling Equipment	-	74,648
13	Supply of Electricity to the Site selected for the erection of Offices and Stores at Ormidhia.....	-	3,955
14	Purchase of drawing instruments for final drawings of the Main Conveyor	4,345	4,345
15	Construction of offices by PWD Contractor	57,396	57,396

TABLE VIII/ 4/2 (Contd.)

Ser. No.	Description	Expenditure in 1988 £	Total Expenditure £
16	Supply of furniture	4,909	4,909
	Total Part 'H' of Project	70,938	344,232
	TOTAL OF PHASE I	11,665,578	71,298,105

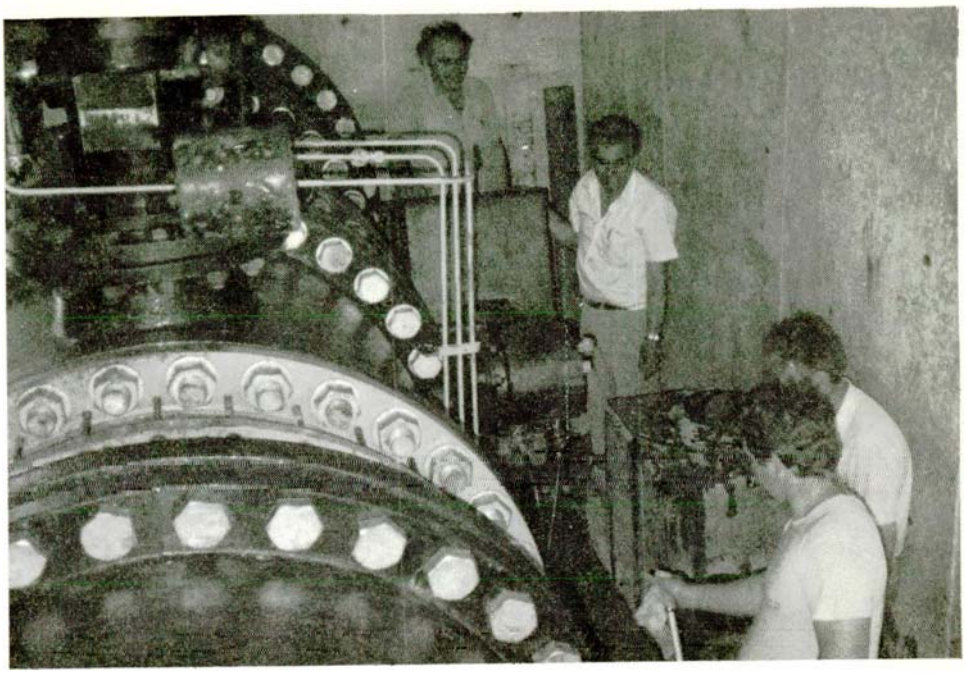


SOUTHERN CONVEYOR PROJECT

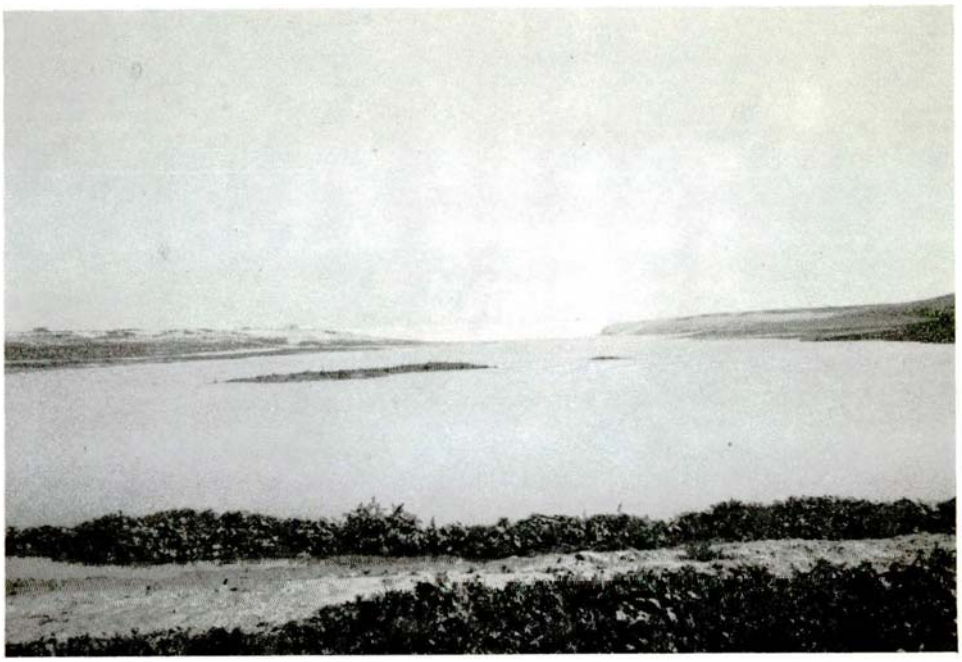
Diagrammatic Representation of Water Distribution

1st and 2nd Phase

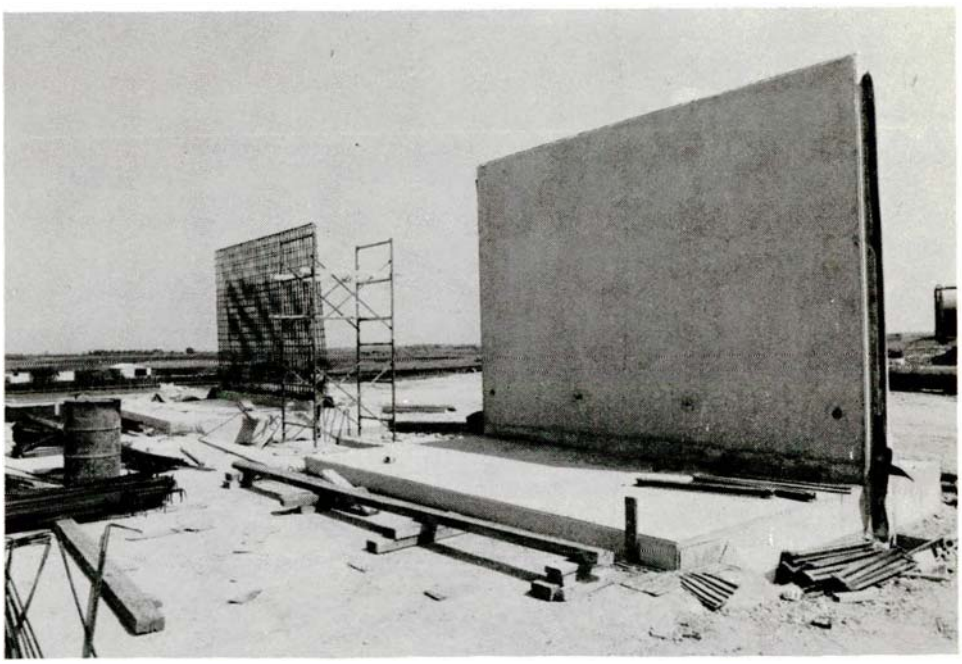
SCP Main Conveyor pipeline. Contract C2/C3 Commissioning of automatic self/ closing butterfly valve.
WDD photo F23EN-9.
Taken on 19.5.88.



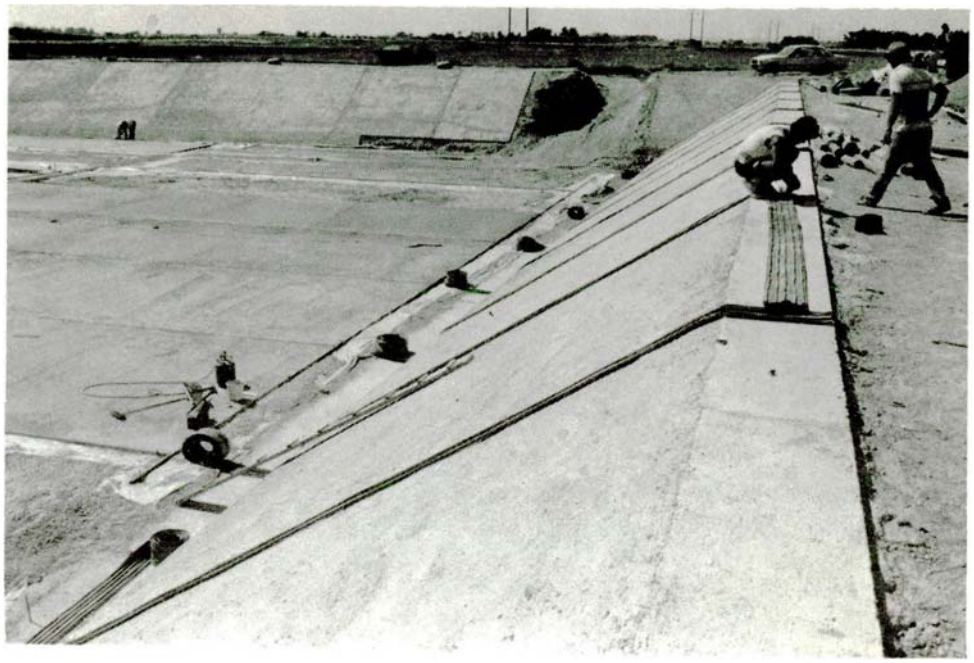
SCP Contract C4 Akhna dam partly full with water conveyed through the 110 km long 1400-800 mm DI pipeline from Kouris dam.
WDD photo E75EN-23A.
Taken on 14.3.88



SCP Contract C5A.
Balancing reservoir No. 4 under construction
WDD photo F37EN-16.
Taken on 1.9.88.



SCP Contract C5C.
Central distribution point V reservoir under construction.
WDD photo F44EN-18.
Taken on 29.9.88.



SCP Contract C6.
Reservoir and pumping station of CDP VII.
WDD photo F50EN-4A.
Taken on 3.11.88.

SCP Contract C7
(Force account).
Installation of 400 mm AC pipe of irrigation bock X of Kokkinokhoria Irrigation system.
WDD photo F56EN-7.
Taken on 8.12.88

IX DIVISION OF OPERATION AND MAINTENANCE-
TOWN WATER SUPPLY

by
C C Artemis
Senior Water Engineer
Head of Division

Introduction

The main activities of this Division are the administration, operation and maintenance of Government Town Water Supply Schemes and Rural Regional Water Supply Schemes. Presently, the following Government schemes are in operation.

- The Nicosia Water Supply System consisting of:

  (a) All sources of supply and conveyance systems for the water supply of Nicosia town and suburbs.

  (b) the Nicosia Water Supply component of the Vasilikos Pendaskinos Project. This component comprises Dhypotamos Pumping Station, Kornos Water Treatment Works and Pumping Station, Stavrovouni Balancing Reservoir, the Lefkara-Dhypotamos part of the old Lefkara-Khirokitia pipeline and the pipeline from Dhypotamos Pumping Station to Nicosia.

- The (non potable) water supply system of Government residences and institutions in Nicosia.

- The Central Water Supply System which is the main source of water supply of the towns of Famagusta and Larnaca and of over 40 communities and refugee housing estates in the above two districts and

- The Government Rural Water Supply Schemes, namely:

  (a) Paphos Lower Villages Regional Water Supply Scheme

  (b) Arminou Regional Water Supply Scheme

  (c) Timi Water Supply Scheme

  (d) Ambelitis Water Supply Scheme

  (e) Phrenaros pumping station and rising main for Paralimni and Ayia Napa water supplies.

Another activity of this Division is its participation in the administration of the Nicosia, Limassol, Famagusta and Larnaca Water Boards. Senior officers of the Division and the District Engineers attend water board meetings as representatives of the Director of the Department. In its capacity as a member of the Water Boards this Department acts as their technical adviser and also undertakes, other commitments permitting, the design and construction work for major developments in their distribution systems.

Water Supply Situation in General

The rainfall during the 1987/88 winter season was most satisfactory and had a positive effect on the river flows. Consequently the volume of water impounded in the dams was more than adequate to meet the demand. Due to the exceptional rainfall the recharge of aquifers was good and had a favourable effect on the yield of many boreholes. As a result, the water supply of the towns was maintained at satisfactory levels and no restrictions were imposed. Some problems were experienced in 1988 due to the decrease of the conveyance capacity of the second section of the Khirokitia-Famagusta pipeline indicating the need for swabbing. This work, which is expected to restore the capacity of the pipeline, has been programmed for early 1989.

A significant, though diminishing, contribution was also the production of the boreholes of the 1982/84 emergency schemes which in 1988 was 1.575MCM.

The water supply of Nicosia Town was augmented this year by 6.086MCM from Kornos Treatment Works which was in operation throughout the year under review.

Nicosia Town

The Town enjoyed unrestricted supply in 1988. A total of 11.810MCM of water was delivered to the service reservoirs representing an increase of only 5.34% on the previous year's figure. The low figure is partly due to the measures taken by the Water Board to reduce its unaccounted for water and partly due to the fact that this was the second year of unrestricted supply after so many years of restrictions and high water rates which have conditioned the consumer towards the saving of water. Figures IX-1 to IX-3 give in graphical condensed form the daily

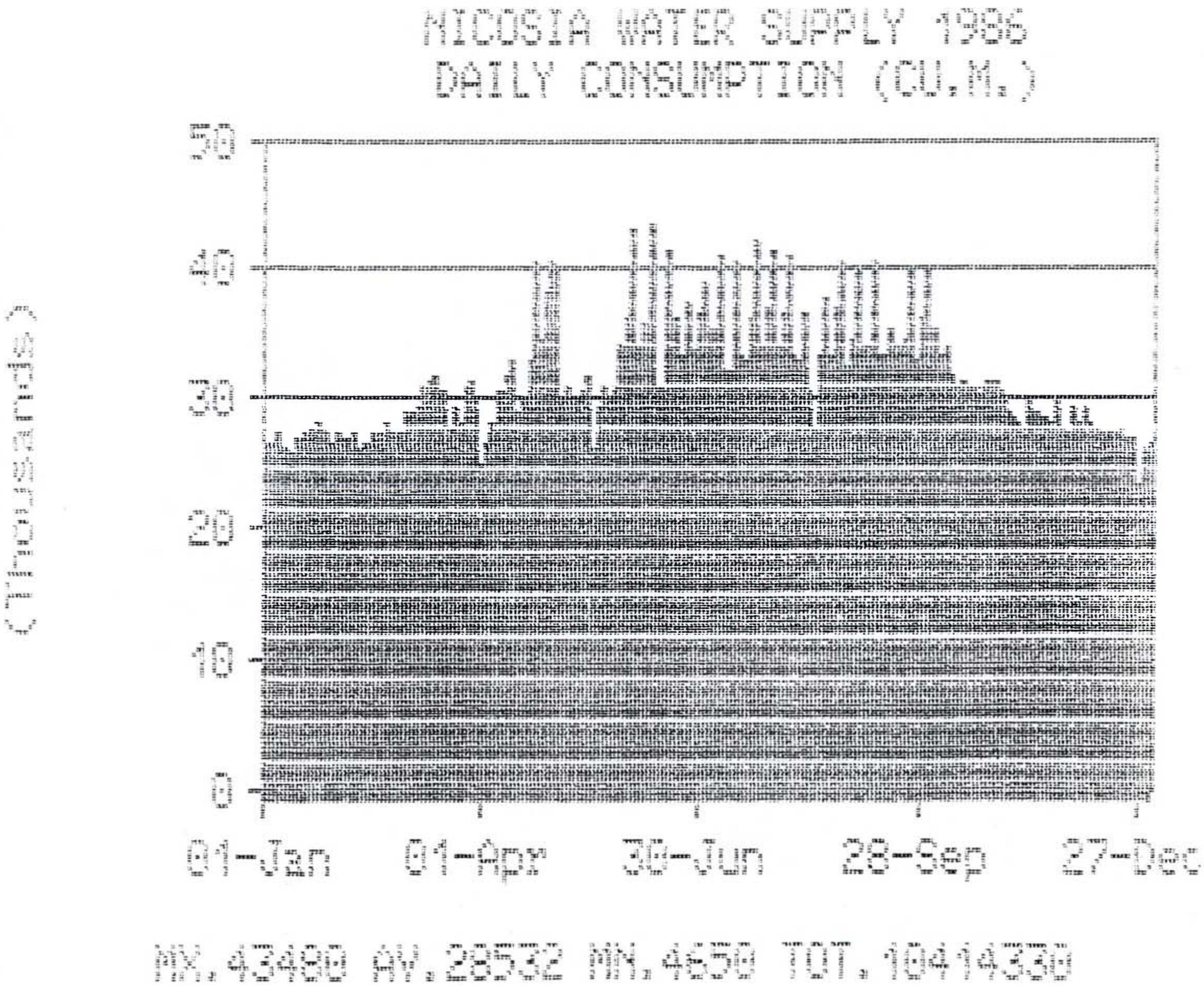

NICOSIA WATER SUPPLY 1986
DAILY CONSUMPTION (CU.M.)
50
40
30
20
10
0
(Thousands)
01-Jan
01-Apr
30-Jun
28-Sep
27-Dec
MX.43480 AV.28532 MN.4650 TOT.10414330

Figure IX-1

NICOSIA WATER SUPPLY 1987
DAILY CONSUMPTION (C.U.M.)
50
40
30
20
10
0
01-Jan
01-Apr
30-Jun
28-Sep
27-Dec

Figure IX-2

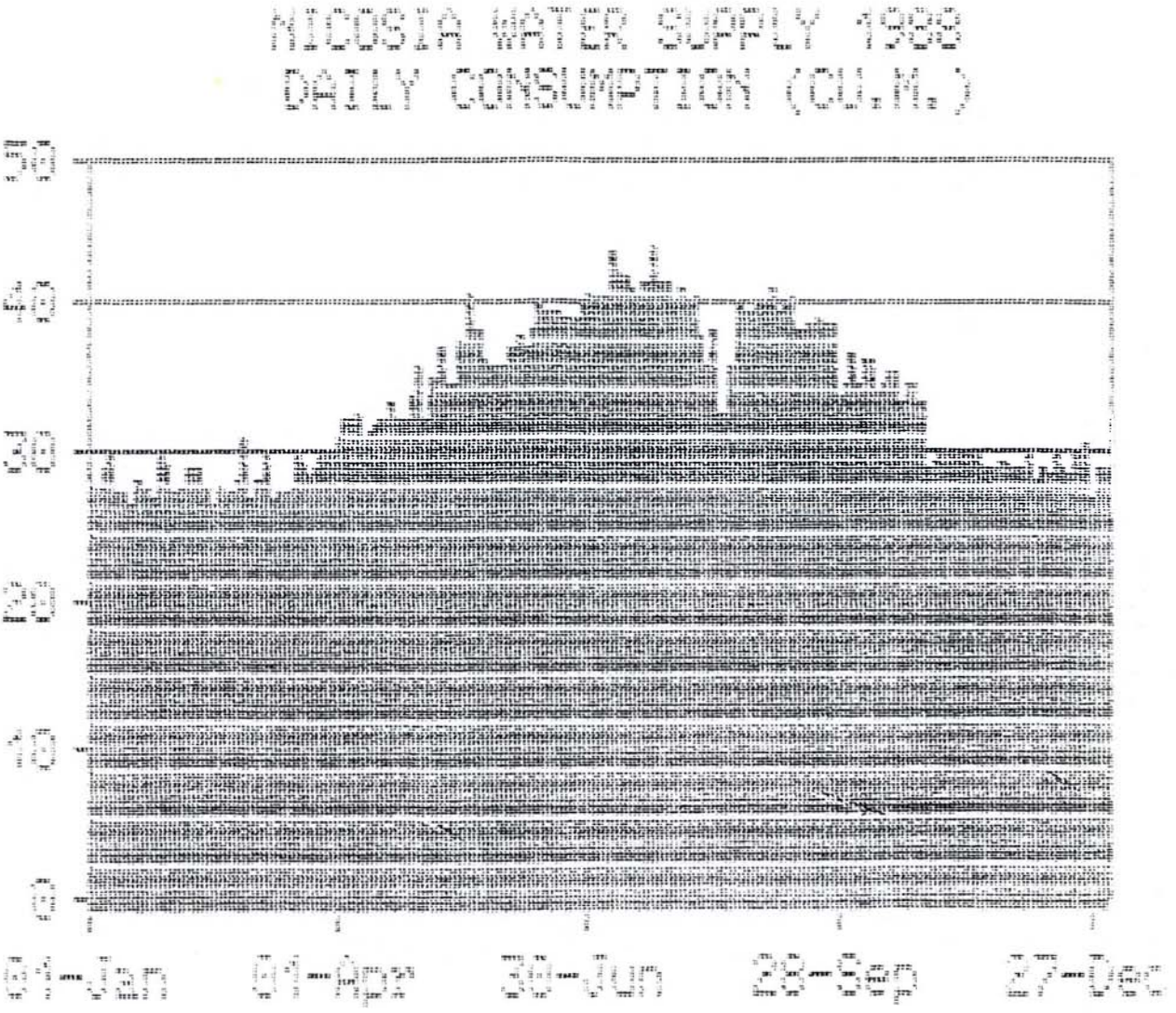

NYASA WATER SUPPLY 1988
DAILY CONSUMPTION (C.M.)
31-Jan
9-Apr
30-Jun
28-Sep
27-Dec

Figure IX-3

consumption of the town over the years 1986 to 1988. The seasonal variation in demand and the effects of restrictions and weather conditions are all reflected in these charts.

Limassol Town

The production of the Water Board owned sources met the water demand of the town satisfactorily and the town enjoyed an unrestricted supply throughout the year.

Larnaca Town

The town enjoyed unrestricted supply throughout the year. The total quantity delivered to its service reservoirs reached 3.599MCM of which 2.892MCM was supplied from the Central Water Supply System and 0.707MCM was produced by the Water Board's own borehole sources in the Tremithos river aquifer. The corresponding figures for 1987 were 3.479MCM, 3.213MCM and 0.266MCM. Comparison of the figures shows an increase in overall production of only 3.4% and reflects the effect of the measures taken by the Water Board to reduce its unaccounted for water. The Tremithos borehole yield shows a marked increase caused by the recharge of the aquifer. Thus the quantity equired by the town from the Central Water Supply System was less than in 1987.

Paphos Town

The town did not experience a water shortage problem during the year and no restrictions were imposed on the supply except on two occasions necessitated by breaks in the main conveyor to the town. The water supply of the town was supplemented from the Paphos Lower Village Water Supply Scheme with a quantity of only 839m^3 of water. The main weaknesses of the system are the limited capacities of service reservoirs and the main conveyor to the town.

Table IX-1 gives some useful statistical data on the water supply of the towns over the last seventeen years.

Table IX-1
URBAN WATER SUPPLY IN CYPRUS

Year	Consumers*		Input into System (at Service Area Outlets)
	Number at end of year	Increase	
		%	m^3 **
		Nicosia	
1972	17 601	-	7 564 804
1973	18 989	7.9	7 460 286

* Due to lack of information on the number of consumers in the Turkish occupied sector the figures in this column refer to the Government controlled area of Nicosia only.

** These figures cover the whole of Nicosia.

Table IX-1 (continued)
URBAN WATER SUPPLY IN CYPRUS

Year	Consumers*		Input into System (at Service Area Outlets)
	Number at end of year	Increase	
		%	m^3 **
		Nicosia	
1974	20 796	9.5	7 550 913
1975	21 978	5.7	7 532 363
1976	23 628	7.5	8 137 580
1977	25 646	8.5	8 551 570
1978	27 944	9.0	8 307 170
1979	30 337	8.6	8 559 184
1980	34 181	12.7	9 152 909
1981	35 366	3.5	8 676 120
1982	37 513	6.1	9 001 875
1983	39 554	5.4	8 984 890
1985	42 412	2.7	10 393 365
1986	43 984	3.7	10 218 459
1987	45 550	3.6	10 911 284
1988	47 200	3.6	11 314 893
		Limassol	
1972	17 927	-	4 952 521
1973	19 015	6.1	4 999 405
1974	19 435	2.2	4 990 401
1975	19 800	4.1	4 175 035
1976	20 305	2.6	5 181 567
1977	20 989	3.4	5 935 146
1978	21 908	4.4	6 342 758
1979	23 840	8.8	6 560 782
1980	26 416	10.8	7 214 542
1981	28 392	7.5	7 411 301
1982	30 311	6.7	7 692 378
1983	31 885	5.2	7 711 306
1984	34 034	6.7	7 831 767
1985	37 621	10.5	8 443 089
1986	39 921	6.1	8 837 964
1987	41 219	3.2	8 837 785
1988	42 592	3.3	9 694 918
		Larnaca	
1972	5 812	-	1 659 680
1973	5 950	2.4	1 313 750
1974	6 065	1.9	1 528 990
1975	6 023	0.7	1 819 820
1976	7 515	24.7	2 015 900

* Due to lack of information on the number of consumers in the Turkish occupied sector the figures in this column refer to the Government controlled area of Nicosia only.

** These figures cover the whole of Nicosia.

Table IX-1 (continued)
URBAN WATER SUPPLY IN CYPRUS

Year	Consumers		Input into System (at Service Area Outlets)
	Number at end of year	Increase	
		%	m^3
		Larnaca	
1977	8 133	8.3	2 315 590
1978	9 513	17.0	2 523 680
1979	10 578	11.2	2 669 100
1980	11 776	11.3	2 593 540
1981	13 487	14.5	2 931 690
1982	15 047	11.6	2 770 700
1983	16 453	9.3	2 471 510
1984	17 150	4.1	2 900 270
1985	17 979	4.6	3 474 580
1986	18 441	2.5	3 208 960
1987	19 492	5.7	3 372 380
1988	20 241	3.6	3 531 470
		Paphos	
1972	-	-	-
1973	-	-	-
1974	2 258	-	669 191
1975	2 332	3.3	645 228
1976	2 500	7.2	777 800
1977	2 706	8.2	808 772
1978	2 939	8.6	889 668
1979	3 851	31.0	973 361
1980	4 413	14.6	1 119 059*
1981	4 921	11.5	1 200 597*
1982	5 602	13.8	1 247 972*
1983	6 155	9.9	1 293 881*
1984	6 685	7.9	1 434 666*
1985	7 306	8.5	1 535 789*
1986	8 048	10.2	1 759 244*
1987	8 691	8.0	1 803 350*
1988	9 594	10.4	1 978 181*

* These figures have been corrected by subtracting quantities supplied to Mandria village en route.

NICOSIA WATER SUPPLY

Institutional Arrangements

The water supply of Nicosia town and suburbs is faced jointly by three authorities:

- the Water Development Department which is responsible for all

sources and conveyors up to the service reservoirs and sells the water in bulk to the Nicosia Water Board.

- the Nicosia Water Board which has the responsibility for the distribution of water to Nicosia town and suburbs, and,

- the Nicosia Water Commission which has the responsibility for the distribution of water to the old town of Nicosia within the walls. The Commission operated its own sources which were the boreholes P1 and P2 and the Arab Ahmet chain of wells. Use of the two boreholes for potable water supply was discontinued during the year 1985. Use of the Arab Ahmet chain of wells was suspended in October 1988.

Several important sources and conveyance systems serving the town of Nicosia are located within the occupied area. These sources are the Morphou-Pendayia boreholes which make a very significant contribution to the total water requirements of the capital and the Dhikomo boreholes and Sykhari Adit which have been reported dry. There is a common distribution system for the whole of the town which serves both the Greek and Turkish sectors. There are service reservoirs in both sectors. The water supply of the whole town thus operates as a single unified system and the cooperation of both sides is necessary to achieve the desired results.

The Government provides spare parts or replaces pumping units installed on sources of the systems within the area under Turkish occupation and also provides the Turkish side with repair materials for the pipelines conveying water to Nicosia in order to keep up a continuous supply to the town.

The contribution of the United Nations personnel, in providing liaison between the two sides, is much appreciated.

Demand Estimates

As already mentioned, the supply to the town in 1988 was unrestricted. The total consumption during the year including losses, was 11.81MCM. This figure is by 5.34% higher than that of 1987 which was 11.21MCM and corresponds to an average daily consumption of 506 l per consumer meter. For fifteen years, from 1972 to 1986, restrictions have had to be imposed on the hours of supply to the consumers and the unrestricted demand was not known. Estimates of unrestricted demand had until recently assumed an average daily consumption of 700 l per consumer meter, which is considerably higher than the actual unrestricted demand of 1988.

It is believed that the restrictions imposed on the water supply of the town for many years and the campaigns to save water, together with the introduction of increased water rates and measures to reduce unaccounted for water by the Nicosia Water Board in recent years have depressed the gross water supply demand. The totally unrestricted demand may therefore take a few years of unrestricted supply to develop and even then it may emerge that earlier estimates of totally unrestricted demand and the effect of restrictions may have been too high.

Sources and Production

The main water supply sources of Nicosia town and their production over the years 1984 to 1988 are given in Table IX-2.

Table IX-2
NICOSIA WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1984-88

	Source	1984	1985	1986	1987	1988
1	Morphou Bay Scheme	3.486	3.280	2.977	3.162	2.985
2	Dhikomo-Sykhari	NIL	NIL	NIL	NIL	NIL
3	Paliometokho-Kokkinotrimithia-Dhenia-Airport	0.451	0.431	0.286	0.256	0.258
4	Tseri	0.763	0.686	0.598	0.476	0.504
5	Dhali	NIL	NIL	NIL	NIL	NIL
6	Peristerona-Akaki	0.906	1.087	0.788	0.765	0.974
7	Laxia-Athalassa-Makedonitissa	0.232	0.142	0.182	0.127	0.078
8	Nicosia Water Commission Sources	0.390	0.419	0.199	0.243	0.271
9	Purchased from Private BH	1.277	1.114	1.019	0.871	0.817
10	Lefkara Dam (CWSS)	0.339	2.290	--	--	--
11	1982-84 Emergency Schemes					
	(a) Stavrovouni	1.364	0.849	0.805	0.692	0.663
	(b) Dhenia	0.278	0.182	0.186	0.136	0.140
	(c) Dhali-Kattoudhia-Yeri	0.645	0.547	0.533	0.410	0.036
12	Kornos Treatment Works ..	--	0.266	3.414	4.792	6.086
		10.131	11.293	10.987	11.930	12.812

During 1988, the total quantity of water produced was 12.812MCM of which 11.724MCM came from Government sources 0.271MCM was the yield of the Nicosia Water Commission sources and 0.817MCM was purchased from private boreholes.

Consumption

Of the total 1988 production of 12.812MCM, 11.810MCM were delivered to Nicosia and 1.020MCM were consumed en route by a number of communities and other consumers connected to the system. The total consumption exceeds total production by 0.018MCM. The difference is attributed to meter inaccuracies and/or the different times at which meter readings are taken.

The lack of information on population served in the Turkish controlled part of the area of supply makes it difficult to calculate accurate figures for per capita consumption of the town. Nevertheless, based on information available on the number of consumers within the Government controlled part of the area of supply, on the quantity consumed in the turkish sector and assuming an average of 3.0 persons per consumer connection, it is estimated that an average supply of 169 l/capita/day or 506 l per day per consumer meter was delivered to the service reservoirs of the town this year.

Villages and other Consumers served by the Nicosia Water Supply System

Table IX-3 below gives the communities and other consumers served by the Nicosia Water Supply System and the quantities supplied to them over the years 1984-1988.

Table IX-3
NICOSIA WATER SUPPLY SYSTEM
VILLAGES AND OTHER CONSUMERS SERVED

Community Served	Consumption in MCM				
	1984	1985	1986	1987	1988
Kokkinotrimithia	0.086	0.068	0.022	0.002	--
Mammari-Dhenia	--	0.037	0.045	0.059	0.066
Mosphiloti	0.049	0.049	0.045	0.055	0.051
Psevdhas	0.018	0.025	0.020	0.027	0.020
Pyrga	0.024	0.026	0.023	0.026	0.028
Lymbia, Sha, Kornos regional W.S. Scheme	0.043	0.042	0.093	0.145	0.218
Alambra	0.021	0.010	0.029	0.076	0.060
Dhali	0.059	0.047	0.122	0.146	0.105
Laxia	--	--	0.111	0.171	0.237
Various camps industries and miscellaneous consumers ...	0.100	0.157	0.146	0.107	0.236
Totals	0.400	0.461	0.656	0.814	1.021

New Schemes

There were no new schemes put into operation during the year under review.

Water Supply Prospects

The operation of Kornos Treatment Plant has solved the water shortage problem of Nicosia Town for a few years only. Due to the increasing demand for water and the continuous reduction in the yield of boreholes presently supplying Nicosia, deficits are likely to develop again especially if there is inadequate rainfall during the next few years.

The long term solution of the water shortage problem will be provided by the Southern Conveyor Project the second phase of which will become operational in 1992. This Project is planned to meet the water demands of Nicosia upto the year 2000 and of Limassol, Larnaca and Famagusta and of a large number of communities upto the year 2010.

Expenditure and Revenue

A statement showing expenditure for the operation and maintenance of sources and conveyors and revenue from the sale of water for the year 1988 is given in table IX-4.

Table IX-4
NICOSIA WATER SUPPLY
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Expenditure

Morphou Bay Scheme

	£
Maintenance expenses	--
Electricity	153 101
Wages	17 038
Miscellaneous expenses	3 023
Total	£173 162

Tseri Scheme

Maintenance expenses	2 454
Electricity and fuel	14 621
Wages	20 768
Miscellaneous expenses	151
Total	£37 994

Peristerona-Akaki Scheme

Maintenance expenses	1 687
Electricity and fuel	35 435
Wages	19 206
Miscellaneous expenses	2 214
Total	£58 542

Kokkinotrimithia-Paleometokho Installations

Maintenance expenses	7 725
Electricity and fuel	17 469
Wages	31 158
Miscellaneous expenses	1 012
Total	£57 364

Dhali-Laxia Installations

Maintenance expenses	1 576
Electricity	1 106
Wages	--
Miscellaneous expenses	86
Total	£2 768

Maintenance Expenses of Civil Engineering Works

Motor Transport expenses	5 421
Wages	25 043

Table IX-4 (continued)
NICOSIA WATER SUPPLY

EXPENDITURE AND REVENUE ACCOUNT FOR THE YEAR

Purchase of materials & equipment	4 865
Miscellaneous expenses	4 540
Total	£39 869

Pyrga-Stavrovouni and Yeri-Dhali-Kattoudhia Emergency Schemes

Maintenance expenses	6 295
Electricity and fuel	29 985
Wages	22 730
Miscellaneous expenses	1 015
Total	£60 025

Dhypotamos-Lakatamia-Installations

Maintenance expenses	1 702
Electricity	31 410
Wages	8 353
Miscellaneous expenses	1 148
Total	£42 613

Kornos Water Treatment Works and Pumping Station

Maintenance expenses	3 255
Electricity	33 881
Wages	32 701
Miscellaneous expenses	28 830
Total	£98 667

Purchase of Water from Private Sources	£43 579
GRAND TOTAL	£614 583

Revenue

Value of water delivered to Nicosia Water Board* (@ 16.3 cents/m^3)	1 880 847
Value of water delivered directly to other consumers in 1988	213 208
Total value of water delivered in 1988	£2 094 055
Less amount actually collected in 1988 in respect of water delivered in 1988	1 492 624
Amount outstanding on 31.12.88 for water delivered in 1988	£ 602 573

Table IX-4 (continued)
NICOSIA WATER SUPPLY

EXPENDITURE AND REVENUE ACCOUNT FOR 1988

	£
Amount outstanding by 31.12.87	1 003 623
Less amount collected in 1988 in respect of water delivered before 31.12.87	497 154
Amount outstanding on 31.12.1988 for water delivered before 31.12.87	£ 506 460
Total amount outstanding on 31.12.1988	£1 109 033
Total amount collected in 1988	£1 989 778

This statement does not include for the amortization of the Government installations and equipment of the system. The amortization cost of these installations and equipment is estimated at £1,211,860 annually as given in Table IX-5. Without taking into account office overheads the surplus for the year 1988 amounts to £267,512. If outstanding payments are not considered as revenue then there is a deficit of £335,061.

* This figure is calculated at the actual rates at which the Water Board is charged. As from 1.3.1982 these rates represent only 75% of the actual cost of the water. The balance is a government grant to the Water Board on account of the quantity it supplies to the turkish-occupied sector of Nicosia for which no payment is received by the Board.

Table IX-5
NICOSIA WATER SUPPLY
AMORTIZATION COSTS

Installations	Year completed	Capital Cost £	Period Years	Annual Amortization Cost £
Pre-1982 installations	--	1 748 300	Varies	107 760
Vasilikos-Pendaskinos Project Phase I (Dhypotamos Pumping Station and Dhypotamos-Stavrovouni-Lakatamia Pipeline)				
- Civil works	1982	2 650 000	40	246 344
- E & M plant	1982	350 000	15	43 420
1982 Emergency Schemes				
Dhenia	1982	90 000	5	23 138
Stavrovouni	1982	78 000	5	20 053
1983 Emergency Schemes (Pyrga-Stavrovouni-Yeri-Dhali-Kattoudhia)	1983	75 100	5	19 307

Table IX-5 (continued)
NICOSIA WATER SUPPLY
AMORTIZATION COSTS

Installations	Year completed	Capital Cost £	Period Years	Annual Amortization Cost £
1984 Emergency Schemes (Pyrga-Dhali-Kattoudhia)	1984	17 767	5	4 567
Vasilikos Pendaskinos Project Phase II (Kornos Treatment Works and Pumping Station)				
- Civil Works	1986	1 398 470	40	130 000
- E & M Plant	1986	1 128 000	20	123 570
Dhypotamos Dam and Maroni Diversion		(5 900 800)		
Water Supply Component	1986	4 337 090	40	403 180
Vehicles		(50 000)		
Allocated to Water Supply	1986	25 000	5	6 430
Consultants fees		(990 000)		
48.6% allocated to Water Supply	1986	481 140	40	44 730
Total				£1 211 860

Note: Figures in parentheses indicate total cost.

Water Supply to Government Residences and Institutions in Nicosia

In addition to the water supplied for domestic use by the Nicosia Water Board, Government houses, offices and other institutions are supplied, in most cases free of charge, with water for irrigation and cleaning purposes by a separate water supply system. The sources of this system are four boreholes situated within the built up area of Nicosia. The total quantity of water produced from these sources during 1988 was 100,748m^3 which met satisfactorily the demand. The total expenditure, (which is borne by Government) for the operation and maintenance of this system for 1988 was £14,805 as follows:

- Electricity	1,014
- Wages	10,344
- Maintenance	117
- Miscellaneous expenses	3,330
Total	£14,805

Note: Expenditure under the heading "Wages" includes also the wages for the maintenance and repairs to large water meters which are carried out by the same gang operating this system.

Kornos Water Treatment Works

During 1988, the Water Treatment Works at Kornos was operated at various throughputs upto its full capacity of 32,000m³ per day and covered a substantial part (about 50%) of Nicosia's water supply demand. Two temporary Technicians 2nd Grade were posted at Kornos Treatment Works. One was assigned the duties of Plant Superintendent and the other those of Laboratory Technician.

The raw water treated by the plant, is either obtained by gravity from Lefkara Dam or boosted from Dhypotamos Dam via Dhypotamos Pumping Station. After a well controlled treatment process the water is pumped via Kornos Pumping Station to Stavrovouni Balancing Reservoir and thence conveyed by gravity to Lakatamia Service Reservoir south of Nicosia.

The total quantity of water produced was 6,086,180m³ against a total energy consumption (including pumping) of 1,688,164kWh. The consumption of chemicals was as follows:

Aluminium Sulphate	173 050 kg
Polyelectrolyte	606 kg
Calcium Hydroxide (Lime)	11 800 kg
Chlorine Gas	10 737 kg

The water quality throughout all the steps from the source to the destination, was assured by careful control and monitoring. Bacteriological and chemical analyses were performed regularly by the Kornos Chemist, at Kornos Water Treatment Laboratory, which was equipped during the year with the necessary chemical reagents, glassware and the appropriate apparatus.

In addition to the above analyses, water samples from various sources of drinking and irrigation water supplies within the Nicosia district are also subjected to a complete ionic analysis on a routine basis. The ionic analysis includes determination of the electrical conductivity, hardness, pH, total dissolved solids, chlorides, sulphates, carbonates, bicarbonates, nitrates, sodium, potassium, calcium and magnesium. Other specific analyses concerning the determination of aluminium residual, total iron content, total alumina, suspended solids, sludge cohesion, turbidity, colour, chlorine residual, taste and odor, aggressiveness and alkalinity were also carried out.

Within the activities of the Kornos Water Treatment Laboratory were also:

i) The collection and analysis of various water samples in connection with: a) Plant-research projects aiming to improve certain operational parameters, related to the filtration and coagulation processes and/or to suggest treatment modifications which tend to lower the cost of water production (eg. use of direct filtration to treat the raw water from Lefkara dam). b) Departmental projects such as the monitoring of water quality in Kouris, Lefkara and Dhypotamos Reservoirs, Vasilikos-Pendaskinos irrigation area and "mobile" filtration units.

ii) The preparatory testing of analytical methods for the determination of boron, copper, manganese, fluoride, nitrites and chemical oxygen demand (COD) in water, by using UV/VIS spectrophotometer and ion-selective electrodes.

iii) The establishment of chemical reagents and glassware stores and records-keeping of various analytical methods and drinking water standards.

The chemical analyses carried out at Kornos Water Treatment Laboratory amounted to 689 of which 206 were complete sets of ionic analysis, (122 from Nicosia district, 32 from Engomi reservoir and the rest from Kornos Treatment Plant and Dhypotamos and Lefkara Dams) 240 were determinations of Aluminium residual, 10 were total iron determinations, 211 were analyses for suspended solids and 22 were sludge cohesion determinations. In addition to these, 30 jar-tests complete with physicochemical tests were performed for the accurate estimation of the chemical dosages.

The bacteriological analyses carried out on various water samples were 25. These analyses were performed within an "inter laboratory comparative testing programme" with two other well established bacteriological laboratories i.e. one at the State Laboratory and the other at the Department of Veterinary Services.

The operation of the Treatment Plant was carefully controlled throughout all stages and the routine maintenance was programmed and performed successfully. In addition, all items of mechanical equipment have been serviced and maintenance work has been carried out on buildings and civil engineering structures. Thus, water reservoirs, reagent tanks, pipelines, dosing pumps, chlorinators, valves, boosters and many other equipment and machinery were appropriately maintained and painted with standard characteristic colours. The modification of certain parts of the existing electromechanical installation and the application of additional accessories improved substantially the operational efficiency of the plant.

CENTRAL WATER SUPPLY SYSTEM

The System

The Central Water Supply System (CWSS) is the former Famagusta Water Supply Scheme which has gradually been enlarged with the addition of new sources and the connection of new demand centres to a point where it now serves the Towns of Larnaca and Famagusta and more than 40 communities in the respective districts.

The system provides both underground water being pumped from several boreholes in the areas of Khirokitia, Skarinou, Alethriko, Anglisidhes and Klavdhia villages and surface water from Yermasoyia and Kalavasos dams. As from this year raw water can be obtained from the Southern Conveyor via a temporary cross connection upstream of Tokhni Pumping Station.

The water from Yermasoyia dam is pumped to Akrounda Phinikaria Balancing Reservoir and thence, gravitated to Vasilikos Pumping

Station from where it is boosted to the Raw Water Balancing Reservoir at Khirokitia Treatment Works.

The water from Kalavasos dam is conveyed by gravity along a pipeline to Tokhni Pumping Station and from there it is pumped to the Raw Water Balancing Reservoir at Khirokitia Treatment Works.

The surface water is being treated at the Khirokitia Treatment Works which had been extended in 1985 and its capacity increased to 32,000m³/day. Treated and borehole water is conveyed along the 70 km long Famagusta pipeline running from Khirokitia to Phrenaros reservoir south of Famagusta.

Borehole sources and communities are connected at various points along the Famagusta pipeline which in effect forms the backbone of the CWSS.

The water held in storage in the Yermasoyia dam reservoir on 1st January, 1988 was 7,341,000m³ representing 54.4% of the reservoir capacity and by the 1st January, 1989 the total water storage was 7,420,000m³ representing 55% of the reservoir capacity. The total inflow net of overflow and net of seepage losses during the year was 13,152,000m³ and the total drawoff including water for irrigation, domestic, recharge and evaporation was 13,073,000m³. The quantity drawn off for domestic purposes was 2,895,000m³.

The water held in storage in the Kalavasos dam reservoir on 1st January, 1988 was 4,100,0000m³ representing 24% of the reservoir capacity and by the 1st January, 1989 the total water storage was 9,284,000m³ representing 54.3% of the reservoir capacity. The draw off quantity for domestic purposes including evaporation was 7,873,000³. The total inflow during the year was 13,055,000m³ net of seepage losses.

The total quantity of water pumped and/or treated from all sources of this scheme during 1988 was 8,798,758m³ (including losses and quantities supplied to Akrounda-Phinikaria local irrigators) and the total consumption was 8,390,391m³. (excluding 335,216m³ supplied to Akrounda-Phinikaria irrigators).

The total demand on the system during 1988 was 8.39MCM compared to 8.40MCM during 1987. The slightly reduced demand is attributed to the increased rainfall and increased yield of local borehole sources.

Sources and Production

The main sources of the Central Water Supply System and their production over the years 1985 to 1988 are given in table IX-6 below.

Table IX-6
CENTRAL WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1985-1988

Source	Year			
	1985	1986	1987	1988
Khirokitia Treatment Works				
- Drawing from Yermasoyia	2.646	2.315	2.854	2.745
- Drawing from Lefkara . Dam	1.901	0.025	--	0.040
- Drawing from Vasilikos Subsurface Dam	0.001	--	0.044	0.115
- Drawing from Kalavasos Dam	3.456	3.876	4.739	4.607
Sub-total Khirokitia Treatment Works	8.004	6.216	7.637	7.507
Vasilikos & Old BHs				
- Vasilikos Sub-surface dam	0.001	--	--	--
- Boreholes				
Psematismenos group ..	--	--	--	--
Khirokitia group	0.081(2)	0.091(2)	0.039(2)	0.039(1)
Alethriko group	0.061(1)	0.069(1)	0.051(1)	0.182(2)
Sub-total Vasilikos & old boreholes	0.143	0.160	0.090	0.221
Yermasoyia dam (for irrigation)	0.290(4)	0.356	0.339	0.335
1982-83 Emergency Schemes				
Tokhni	--	--	--	--
Skarinou	0.202(4)	0.110(3)	0.104(3)	0.092(3)
Alethriko	0.220(3)	0.115(3)	0.119(3)	0.156(3)
Klavdhia	0.365(3)	0.294(5)	0.192(5)	0.264(5)
Khirokitia	0.087(1)	0.065(1)	0.029(1)	0.002(1)
Anglisidhes	0.235(1)	0.263(1)	0.314(1)	0.222(1)
Sub-total Emerg.Schemes	1.109	0.847	0.758	0.736
Totals	9.546	7.579	8.824	8.792

Note: Figures in parentheses indicate the number of boreholes. The quantities for the treatment works production are given net of treatment losses.

Bulk Consumption

Table IX-7 shows the bulk consumption of the various communities served by the CWSS over the years 1985-88.

Table IX-7
CENTRAL WATER SUPPLY SYSTEM
BULK CONSUMPTION IN MCM PER ANNUM 1985-1988

Community Served	Consumption from CWSS in MCM 1985	1986	1987	1988
Western Region Villages				
Pano Lefkara	0.076	0.042	0.037	0.028
Kato Lefkara	0.008	0.009	0.008	0.008
Kato Dhrys	0.008	0.006	0.008	0.003
Vavla	0.007	0.006	0.007	0.005
Alethriko	0.026	0.039	0.036	0.028
Mazotos	0.049	0.048	0.042	0.045
Kivisil	0.025	0.024	0.026	0.024
Tokhni	0.030	0.029	0.026	0.026
Menoyia	0.005	0.005	0.005	0.005
Khirokitia	0.019	0.024	0.002	--
Maroni	0.039	0.033	0.036	0.041
Zyyi	0.032	0.027	0.036	0.045
Psematismenos	0.011	0.010	0.011	0.014
Kophinou	0.034	0.063	0.082	0.091
Alpanda-Anaphotia	0.037	0.040	0.037	0.043
Meneou-Dhromoaxia-Tersephanou	0.434	0.491	0.553	0.422
Klavdhia	0.036	0.034	0.030	0.031
KaloKhorio	--	0.002	0.023	0.006
Mari	--	0.004	0.025	0.023
Governor's Beach	--	--	--	0.001
Sub-total Western Villages	0.876	0.936	1.030	0.889
Eastern Villages				
Aradippou	0.282	0.274	0.298	0.331
Xylotymbou	0.128	0.135	0.142	0.151
Dherinia	0.174	0.180	0.192	0.205
Avgorou	0.130	0.156	0.177	0.201
Phrenaros	0.054	0.039	0.051	0.066
Livadhia	0.134	0.125	0.136	0.166
Voroklini	0.074	0.087	0.096	0.096
Sotira	0.110	0.137	0.146	0.148
Paralimni	0.383	0.462	0.618	0.694
Ayia Napa	0.426	0.475	0.719	0.855
Kellia	0.017	0.024	0.026	0.021
Troulli	0.041	0.041	0.042	0.048
Aradippou-Livestock area	0.001	--	--	--
Anzio Camp	0.025	0.028	0.013	0.017
Akhna Forest (Displaced Persons)	0.093	0.098	0.105	0.115
Pyla	0.041	0.098	0.103	0.116
Ormidhia	--	0.027	0.068	0.101
Xylophagou	--	0.127	0.217	0.202
Vrysoulles	--	--	0.007	0.204
Liopetri	--	--	--	0.060
Sub-total Eastern Villages	2.113	2.513	3.156	3.617

Table IX-7 (continued)
CENTRAL WATER SUPPLY SYSTEM
BULK CONSUMPTION IN MCM PER ANNUM 1985-1988

Community Served	Consumption from CWSS in MCM 1985	1986	1987	1988
Towns				
Nicosia (via Dhypotamos)	2.290	--	--	--
Larnaca	2.793	2.801	3.213	2.892
Famagusta	0.983	0.980	0.976	0.982
Sub-total Towns	6.066	3.781	4.189	3.874
Irrigators & Minor Consumers	0.306	0.368	0.369	0.346
Grand Total	9.361	7.598	8.744	8.726

Expenditure and Revenue

A statement showing expenditure and revenue of the Central Water Supply System for the year 1988 is shown in table IX-8 below.

Table IX-8
CENTRAL WATER SUPPLY SYSTEM
EXPENDITURE AND REVENUE ACCOUNTS FOR 1988

Expenditure

Khirokitia Installations

	£
Electricity	3 894
Wages	43 366
Materials and others	27 040
Total	£74 300

Yermasoyia-Vasilikos Installations

Electricity	157 443
Wages	35 059
Materials and others	1 595
Total	£194 097

Pumping and Maintenance Expenses

Electricity	24 861
Wages	33 832
Materials and others	15 312
Total	£74 005

Table IX-8 (continued)
CENTRAL WATER SUPPLY SYSTEM
EXPENDITURE AND REVENUE ACCOUNTS FOR 1988

Khirokitia-Lefkara Regional Water Supply Scheme

Electricity	7 884
Maintenance	--
Total	£7 884

Maintenance expenses for Civil Engineering Works

Wages	14 393
Materials and others	5 849
Total	£20 242

Tokhni Pumping Station Installations

Electricity	29 324
Wages	19 542
Materials and others	18
Total	£48 884
GRAND TOTAL	£419 412

Notes on Expenditure Account

(a) This statement does not include for the amortization cost of the installations of the CWSS. Details of capital costs and annual amortization are given in table IX-9. It is seen from the table that the total annual amortization cost of the system amounts to £979,580.

(b) Expenditure under the heading "Khirokitia Installations" refers to Khirokitia Treatment Works.

The total quantity of water treated during the year reached 7,506,862m³ and the unit running cost was 0.99 cents/m³.

(c) Expenditure under the heading "Yermasoyia-Vasilikos Installations" refers to the running expenses of Yermasoyia Boosting Station, Vasilikos Boosting Station and Vasilikos Subsurface Dam Pumping Scheme.

(d) Expenditure under the heading "Pumping and Maintenance Expenses" refers to the following installations:

BH 4/69 in the Khirokitia area
BHs 45/73, 35/73 in the Alethriko area

1982-1983 Emergency Scheme Installations

BHs 114/80, 127/80, 112/80, 38/82, 16/79 in the Klavdhia area.

Table IX-8 (continued)
CENTRAL WATER SUPPLY SYSTEM
EXPENDITURE AND REVENUE ACCOUNTS FOR 1988

BHs 73/80, 15/83, 75/83 in the Alethriko area.
BHs 80/83, 55/83, in the Skarinou area.
BH 45/61 in the Khirokitia area.
BH 141/83 in the Anglisidhes area.

The total quantity produced by these borehole sources during 1988 was 956,680m³. The unit cost of pumping and maintenance was therefore 7.74 cents/m³.

(e) Expenditure under the heading "Khirokitia-Lefkara Regional Water Supply Scheme" refers to the running expenses of two boosters, pumping treated water to Pano Lefkara, Kato Lefkara, Kato Dhrys and Vavla villages. The total quantity of water boosted during the year was 43,809m³.

(f) Expenditure under the heading "Maintenance Expenses for Civil Engineering Works" refers to maintenance expenses for the Yermasoyia-Khirokitia, Lefkara-Khirokitia Tokhni-Khirokitia and Khirokitia-Phrenaros pipeline conveyors.

(g) Expenditure under the heading "Tokhni Pumping Station Installations" refers to the running expenses of four boosters at Tokhni Pumping Station pumping raw water from Kalavasos dam to Khirokitia Reservoir.

Revenue

Revenue Generated in 1988

	£
Value of water delivered to Larnaca Water Board in 1988	627 662
Value of water delivered to Famagusta area occupied by Turks in 1988	213 059
Value of water delivered to other consumers in 1988	1 056 319
*Total value of water delivered in 1988	£1 897 040
Less amount actually collected in 1988 in respect of water delivered in 1988	776 361
*Amount outstanding on 31.12.1988 for water delivered in 1988	£1 120 679
**Amount outstanding on 31.12.1987	2 246 587
Less amount collected in 1988 in respect of water delivered before 31.12.1987	732 206
Amount outstanding by 31.12.88 for water delivered before 31.12.87	£1 514 381
***Total amount outstanding by 31.12.1988	£2 635 060
Total amount collected in 1988	£1 508 567

Table IX-8 (continued)
CENTRAL WATER SUPPLY SYSTEM
EXPENDITURE AND REVENUE ACCOUNTS FOR 1988

Notes on Revenue Account

* Includes an amount of £213,059 representing the value of 981,840m³ of water supplied to Famagusta area occupied by Turks.

** Includes an amount of £1,381,531 representing the value of 13,008,202m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1987.

*** Includes an amount of £1,594,590 representing the value of 13,990,042m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1988.

Table IX-9
LARNACA-FAMAGUSTA-CENTRAL WATER SUPPLY SYSTEM
AMORTIZATION COSTS OF CAPITAL INVESTMENTS

Installations	Year completed	Capital Cost £	Period Years	Annual Amortization Cost £
Vasilikos & Khirokitia BHs & Conveyors	1970	239 800	40	22 290
Khirokitia Phrenaros pipeline	1970	879 300	40	81 740
Lefkara Dam	1974	1 266 600	40	117 740
Lefkara-Khirokitia pipeline	1974	367 000	40	34 120
Khirokitia Treatment Works	1974	227 200	40	21 120
Yermasoyia Dam	1968	(950 000)		
- Charged to W.S.		330 430	40	30 720
Yermasoyia Conveyor	1982	950 000	10	148 030
Emergency BHs	1983	175 777	5	45 190
Khirokitia Treatment Works extension:				
- Civil	1985	136 955	40	12 730
- M & E	1985	112 726	20	12 350
Kalavasos Dam	1985	(6 358 000)		
- 40% charged to W.S.		2 543 200	40	236 420
Kalavasos pipeline	1985	(2 194 000)		
- 40% charged to W.S.		1 633 000	40	151 800
Tokhni Pumping Station:				
- Civil	1985	193 000	40	17 940
- M & E	1985	327 000	20	35 820
- Vehicles for VPP (part)	1985	45 000	5	11 570
Totals		£9 426 988		£979 580

Chemical Laboratory of Khirokitia Water Treatment Works

The Khirokitia Water Treatment Works were commissioned in 1974. For the period 1974-78 the operators at the works carried out

some simple chemical tests, (analyses) of the water to check its chlorine content, turbidity, pH and conductivity.

In early 1978 the WDD set up a modern chemical laboratory at Khirokitia Water Treatment Works which was to cater for the needs of the treatment works and to a large extent of WDD in respect of Drinking Water Supplies.

The laboratory is presently staffed with two persons only viz. one Chemist and one Technician 2nd Grade who works as a Laboratory Technician. The laboratory undertook all the chemical analyses of drinking water from Nicosia (until September, 1988) Famagusta, Larnaca, Limassol and Paphos districts and carried out chemical tests for water conductivity, pH, total dissolved solids, total hardness, chlorides, sulphates, carbonates, bicarbonates, nitrates, sodium, potassium, calcium, magnesium and aluminium. All the bacteriological tests of raw and drinking water are presently being carried out by the State General Laboratory in Nicosia.

Samples of water from existing boreholes and reservoirs being used for urban water supply are collected monthly by the WDD Regional Offices and are tested at the laboratory. Also samples of the water used for rural water supply are tested annually.

In addition to the above analyses, the laboratory also carries out several chemical tests in connection with new projects undertaken by the Department such as the Southern Conveyor Project and in cases where water from a new borehole will be used for drinking purposes.

During the year 1988, 895 chemical analyses of drinking water, were carried out at the laboratory of Khirokitia Water Treatment Works. Details of the chemical analyses are shown in table IX-10.

In addition to the chemical analyses mentioned above, samples of water from the Yermasoyia, Kalavasos and Kouris Dams were collected and jar tests for estimating coagulant dosing requirements were carried out.

Table IX-10
SUMMARY OF CHEMICAL ANALYSES-KHIROKITIA CHEMICAL LABORATORY

Month	Number of samples analysed in 1988						
	Larnaca	Nicosia	Limassol	Paphos	Polis	Khirokitia	Total
January	21	36	2	16	8	6	89
February	6	--	--	--	--	6	12
March	7	--	--	--	--	8	15
April	7	--	--	--	--	40	47
May	5	18	26	14	6	7	76
June	8	12	1	--	--	16	37
July	7	--	--	--	--	3	10
August	9	16	4	--	--	4	33
September	--	17	--	100	--	53	170
October	51	35	--	--	--	34	186

Table IX-10 (continued)
SUMMARY OF CHEMICAL ANALYSES-KHIROKITIA CHEMICAL LABORATORY

Month	Number of samples analysed in 1988						
	Larnaca	Nicosia	Limassol	Paphos	Polis	Khirokitia	Total
November	--	58	--	5	--	10	85
December	14	--	1	11	64	4	135
Total	135	192	34	146	78	191	895

TOWN WATER BOARDS

NICOSIA WATER BOARD

The town of Nicosia enjoyed again this year an unrestricted supply throughout the year. The final draft of the report on major improvements to the distribution system was submitted by the consultants Messrs. Maclaren Engineers Inc. of Canada. The study envisages improvements and extensions of the distribution system which will meet the anticipated demands to the year 2010.

The leak detection and monitoring system continued to work with very encouraging results throughout the year under review. The unaccounted for water during the year has been reduced to 21.7%.

Water Supply Data

- Total quantity of water delivered to the service reservoirs (adjusted for change in storage) 11 810 741m³
- Total quantity of water consumed as registered by area meters (including Nicosia Water Commission)..... 11 314 893m³
- Total quantity supplied to Turkish quarter 3 081 829m³
- Total consumption during 1988 as registered by individual consumers meters in the Greek sector only (incl. bulk and other known consumption and adjusted for 366 days) 6 834 468m³
- Unaccounted for water 21.7%
- Maximum daily summer consumption (Based on area meter readings and including Nicosia Water Commission. Registered on 22.7.1988-unrestricted supply) 43 996m³
- Total number of consumers on 31.12.87 (Greek sector only) 45 550
- Total number of consumers connected in 1988 ... 1 969
- Total number of consumers on 31.12.1988 ..... 47 200

- Average number of consumers during 1988 ..... 46 375

- Average gross supply per consumer ..... 506 l/day

- Extension of distribution system (100mm, A.C pipes) 642m

- Total length of distribution system as at 31.12.1988 ..... 535,677m

- Total number of Fire Hydrants installed during 1988 22

- Total number of Fire Hydrants installed as on 31.12.1988 1,910

From the information available, the quantity of water supplied to the area of Nicosia under Turkish control (As registered by area meters). was 3.082MCM or 26.1% of the total quantity delivered to the service reservoirs.

Limassol Water Board

The Water Board Sources met satisfactorily the water demand and the town enjoyed a satisfactory supply throughout the year 1988.

New Schemes

Work under contract No. 1 was completed at a total cost of about £1,000,000. The work included the extension of existing trunk mains to improve the conveyance capacity of the distribution system. Contracts Nos. 2, 5 and 6 were also completed at total cost of £1,890,000. Work under these contracts included the construction of Service Reservoirs and pump houses.

Work under contract No. 3 commenced at the end of the year and includes the connection of 11 Boreholes at Potamos-tis Yermasoyias Area and conveyance of the water to the new, 19,000m³ capacity, Service Reservoir of the Board.

Water Supply Data

- Total quantity of water produced from all sources during 1988 ..... 9 944 487m³

- Total quantity of water consumed as registered by area meters 9 694 918m³

- Total consumption during 1988 as registered by individual consumers meters 7 474 272m³

- Unaccounted for water (Production/consumption).. 24.84%

- Maximum daily summer consumption (registered by area meters on 8.7.88)..... 40 582m³

- Total number of consumers connected in 1988 (new) 1 373

- Total number of consumers on 31.12.1987 ..... 41 219
  and on 31.12.1988 ..... 42 592

- Average number of consumers during 1988 ..... 41 906

- Average gross supply per consumer ..... 648 l/day

- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C. and P.V.C. pipes)..... 13 625m

- Total length of distribution system as at 31.12.88 ..... 486 387m

- Total number of Fire Hydrants installed during 1988 25

- Total number of Fire Hydrants installed as at 31.12.1988 ..... 1 566

Famagusta Water Board

Since the Turkish occupation of Famagusta town in 1974, the Cyprus Government is supplying water free of charge to the Turkish residents of the town. The total quantity of water supplied during 1988 was 0.982MCM.

Larnaca Water Board

The water supply of this town was supplemented by 80% of its total water requirements from the Central Water Supply System. The total quantity of water delivered to Larnaca Water Board from this system during 1988 was 2.893MCM, which is less by 0.320MCM than that of 1987. The production of the Water Board owned sources was 0.707MCM representing an increase of 0.441MCM on the 1987 production.

Water Supply Data

- Total quantity of water produced from all sources during 1988 ..... 3 599 280m³

- Total quantity of water delivered from the service reservoirs or directly into the distribution system (Reservoir Outlet)..... 3 570 020m³

- Total quantity of water consumed as registered by area meters 3 531 470m³

- Total consumption during 1988 as registered by individual consumers meters 2 931 185m³

- Unaccounted for water (Production/Consumption) 18.56%

- Maximum daily summer consumption (Based on area meter readings registered on 8.7.88) 13 720m³

- Total number of consumers connected in 1988 (297 consumers were disconnected) 1 046

- Total number of consumers on 31.12.1987 ..... 19 492
  and on 31.12.1988 ..... 20 241

- Average number of consumers during 1988 ..... 19 866

- Average gross supply per consumer ..... 495 l/day

- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C.pipes) ..... 4 320 m

- Total number of Fire Hydrants installed during 1988 8

- Total number of Fire Hydrants installed as at 31.12.1988 836

Paphos Water Supply

The water supply of the town is administered by the Municipality. The Municipality's sources could meet the demand, and were only augmented this year by a minimal quantity of 839m³ from the "Paphos Lower Villages" Government Water Supply Scheme. Consequently the town enjoyed an unrestricted supply throughout the year except in two circumstances when temporary restrictions were imposed due to breaks of the main conveyor. The restrictions were necessitated because of the inadequate storage capacity of the existing reservoirs.

A new service reservoir to serve Anavargos quarter was completed.

Water Supply Data

- Total quantity of water produced from all sources during 1988 ..... 2 015 523m³

- Total quantity delivered en route 37 342m³

- Total quantity of water delivered to the service reservoirs or directly into the distribution system 1 978 181m³

- Total consumption during 1988 as registered by individual consumers meters 1 480 077m³

- Unaccounted for water 25.18%

- Average daily summer consumption (July-Sept.) . 5 500m³

- Total number of consumers connected in 1988 ... 676

- Total number of consumers on 31.12.1987 ..... 8 691
  and on 31.12.1988 (230 consumers of Anavargos quarter which are not covered by the town system and are supplied from Paphos Lower Villages Scheme, are not included.) 9 364

- Average number of consumers during 1988 ..... 9 027

- Average gross supply per consumer (excluding Anavargos consumers) ..... 610 l/day

- Extension of distribution system (100mm, 150mm, and 200mm A.C. pipes)..... 3 815m

- Total length of distribution system as at 31.12.1988 ..... 158 233m

- Total number of Fire Hydrants installed during 1988 15

- Total number of Fire Hydrants installed as at 31.12.1988 250

GOVERNMENT REGIONAL WATER SUPPLY SCHEMES

These schemes supply water to rural population on a regional basis. Water is supplied in bulk to the service reservoir of each community and the distribution is the responsibility of the village water supply committee. These schemes are composed of the sources, balancing tanks, conveyor pipelines and associated pumping installations and are wholly financed by Government. These schemes operate with automatic control equipment.

Periodic supervision as well as maintenance work are carried out by the District Offices of the Department. During 1988 the following regional schemes were in operation.

Paphos Lower Villages

This scheme supplies water to 22 communities, to Mesoyi Industrial Estate, Anatoliko Industrial Estate, Paphos Airport and supplements the Paphos Town water supply.

The sources of this scheme are five BHs 67/84, 72/85, 90/85,3/86 and 20/86 in Xeropotamos river and BH 7/85 near Armou village.

The total expenditure for the operation and maintenance of the scheme was £41,623 and the revenue generated was £76,429. More details on expenditure and revenue are given on table IX-11 below:

The total quantity of water produced during 1988 was 1,078,409m^3 and the total quantity delivered was 967,740m^3.

Table IX-11
PAPHOS LOWER VILLAGES REGIONAL WATER SUPPLY SCHEME EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Expenditure	£
Electricity cost	28 450
Maintenance expenses	13 173
Total	£41 623

Table IX-11 (continued)
PAPHOS LOWER VILLAGES REGIONAL WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Revenue

Amount collected for 1988	46 112
Outstanding accounts for 1988	30 317
Total value of water delivered in 1988	£76 429
Outstanding accounts by 31.12.1987	33 986
Less amount collected in 1988	17 115
Amount outstanding for water delivered before 31.12.1987	£16 871
Total amount outstanding by 31.12.1988	£47 188

This statement does not include for the amortization of the capital expenditure of the schemes. The amortization cost of the installations is estimated at £32,147 p.a. Without taking into account administration expenses and other overheads, for the first year there was a surplus of £2,659.

Arminou Regional Scheme

This scheme supplies water to nine communities. The source of the scheme is BH 56/72 in Dhiarizos river near Arminou village. The total quantity of water distributed to the nine villages in 1988 was 25,917m³. An additional quantity of 6,641m³ was supplied for irrigation to individuals from Mesana and Kedhares. The total expenditure for the operation and maintenance of this scheme was £10,178 while the revenue generated for the same year was £1,887. More details on expenditure and revenue are given in table IX-12.

Table IX-12
ARMINOU REGIONAL SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Expenditure

	£
Electricity cost	2 399
Maintenance expenses	7 779
Total	£10 178

Revenue

Amount collected for the year 1988	620
Amount outstanding for 1988	1 267
Value of water delivered in 1988	£1 887
Outstanding account by 31.12.87	7 411
Less amount collected in 1988	1 378

Amount outstanding by 31.12.88 for water delivered before 31.12.1987 ..... £6 033

Total amount outstanding by 31.12.1988 ..... £7 300

This statement does not include for the amortization cost of capital expenditure of the scheme. The amortization cost of the installations is estimated at £6,895 p.a. The total deficit for the year, without taking into account administration expenses and other overheads, amounts to £15,186.

Timi Water Supply Scheme

This scheme supplies water to Timi village only. The source is BH 2821, and the total quantity of water produced during 1988 was 32,117m³. The total expenditure for the operation and maintenance of the scheme was £1,409 and the revenue generated was £1,606. The total amount outstanding by 31.12.1988 was £1,858.

Ambelitis Water Supply Scheme

This scheme supplies water to Ambelitis village only. The source of the scheme is Kefalovrysos spring near Vrecha village. The water is conveyed to the village storage tank by a booster pump installed near the spring. The total quantity of water pumped in 1988 was 61,645m³. The total expenditure for the operation and maintenance of the scheme was £3,887 and the revenue generated was £4,932.

Amathus Scheme

This scheme has been established under the Government Water Works Law to supply water to Amathus Tourist Development Area of a total population of 6,000 persons during summer and 2,000 persons during winter. The scheme is administered by a committee composed of the Director General of the Ministry of Interior as Chairman and the Directors General of the Ministries of Agriculture and Natural Resources, Finance, Communications and Works and Commerce and Industry, as members. The scheme is operated by the Limassol District Engineer of the Department in cooperation with the District Officer, Limassol.

The sources of this scheme are three boreholes, Hydr. No. 946, 993 and 1099, situated in Yermasoyia River. The total quantity of water distributed during 1988 was 637 255m³. The total cost of the operation and maintenance of the scheme was £47,131 and the revenue generated for the same year was £99,184. More details on expenditure and revenue are given on Table IX-13.

Table IX-13
AMATHUS WATER SUPPLY SCHEME
EXPENDTITURE AND REVENUE ACCOUNT FOR 1988

Expenditure

	£
Electricity cost	8 783
Maintenance expenses (Includes £991 for compensations)	8 274

Table IX-13 (continued)
AMATHUS WATER SUPPLY SCHEME
EXPENDTITURE AND REVENUE ACCOUNT FOR 1988

Pumping fees (Yermasoyia aquifer) (includes £407 for 1987)	30 074
Total	£47 131

Revenue

Sale of water	41 640
Connection fees	57 544
Total	£99 184

Moutayiaka Regional Scheme

This scheme supplies water to 8 communities of a total population of 14,900 persons. The sources of the scheme are two boreholes, 64/64 (Hydr.No.287) and 180/59 (Hydr.No.8) situated in Yermasoyia River. In addition to the above sources, some of the said communities have supplementary sources from springs as follows:

1 Ayios Athanasios village from "Ayios Demetrios" spring (for the time being the water is unsuitable for domestic use).

2 Phinikaria village from "Zavrarkaka" and "Vrysi tou Yianni" springs.

3 Armenokhori village from "Kiparishia" spring (for the time being the water is unsuitable for domestic use).

The operation and maintenance of the scheme is the responsibility of the District Officer, Limassol.

The total quantity of water distributed to these eight communities in 1988 was 485,452m³ as given below:

Village	Consumption m³
Ayia Phyla	--
Polemidhia National Guard Camp.....	--
Ayios Athanasios	244 275
Moutayiaka	81 600
Ayios Tykhonas	49 800
Parekklisha	81 922
Moni - Moni National Guard Camp	--
Monagroulli	14 855
Armenokhori	8 400
Phinikaria	4 600
Total	485 452m³

The total expenditure for the operation and maintenance of this scheme was £38,899 and the revenue generated was £40,000.

More details on expenditure and revenue are given on Table IX-14:

Table IX-14
MOUTAYIAKA REGIONAL WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Expenditure

	£
Electricity cost	18 757
Operation and maintenance	15 646
Pumping fees (Yermasoyia Aquifer)	4 496
Total	£38 899

Revenue

Amount collected in 1988	15 146
Amount outstanding by 31.12.1988	24 854
Total	£40 000
Outstanding amount by 31.12.1987	25 427
Less amount collected in 1988	21 291
Total amount outstanding for water delivered before 1988	4 136
Total amount outstanding by 31.12.1988	£28 990

Yermasoyia Water Supply Scheme

This scheme supplies water to Yermasoyia village and Potamos tis Yermasoyias with a total population of 4,000 persons during winter and increasing to 30,000 persons during summer due to a coastal area of Potamos tis Yermasoyias.

The sources of the scheme are five boreholes, 63/64, 25/72, 72/75, 107/61 and 25/81 situated in Yermasoyia river, and Ayios Photis spring. The operation and maintenance of this scheme is the responsibility of Yermasoyia Improvement Board. The total quantity of water produced during 1988 was 1,101,700m^3.

The total expenditure for the operation and maintenance of the scheme was £88,560 while the revenue generated was £132,463.

More details on expenditure and revenue are given on table IX-15 below:

Table IX-15
YERMASOYIA WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Expenditure

	£
Electricity cost	33 958
Maintenance	21 239
Pumping fees (Yermasoyia Aquifer)*	33 363
Total	£88 560

Table IX-15 (continued)
YERMASOYIA WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Revenue

Sale of water	115 980
Connection fees	4 075
Capital expenditure	2 408
Amount outstanding for 1988	10 000
Total	£132 463

* This amount has been charged by Government but has not been paid yet. A further amount of £55,512 representing pumping fees for 1986/7 is also outstanding bringing the total outstanding amount to £88,875.

Phrenaros New Pumping Scheme

This scheme supplies additional quantities of water to Ayia Napa, Paralimni and Protaras Tourist area. The total quantity of water pumped during 1988 was 1,535,439m³ and the unit running cost excluding overheads and amortization costs was 1.42 cents/m³.

A statement showing expenditure and revenue of the scheme is shown in table IX-16 below.

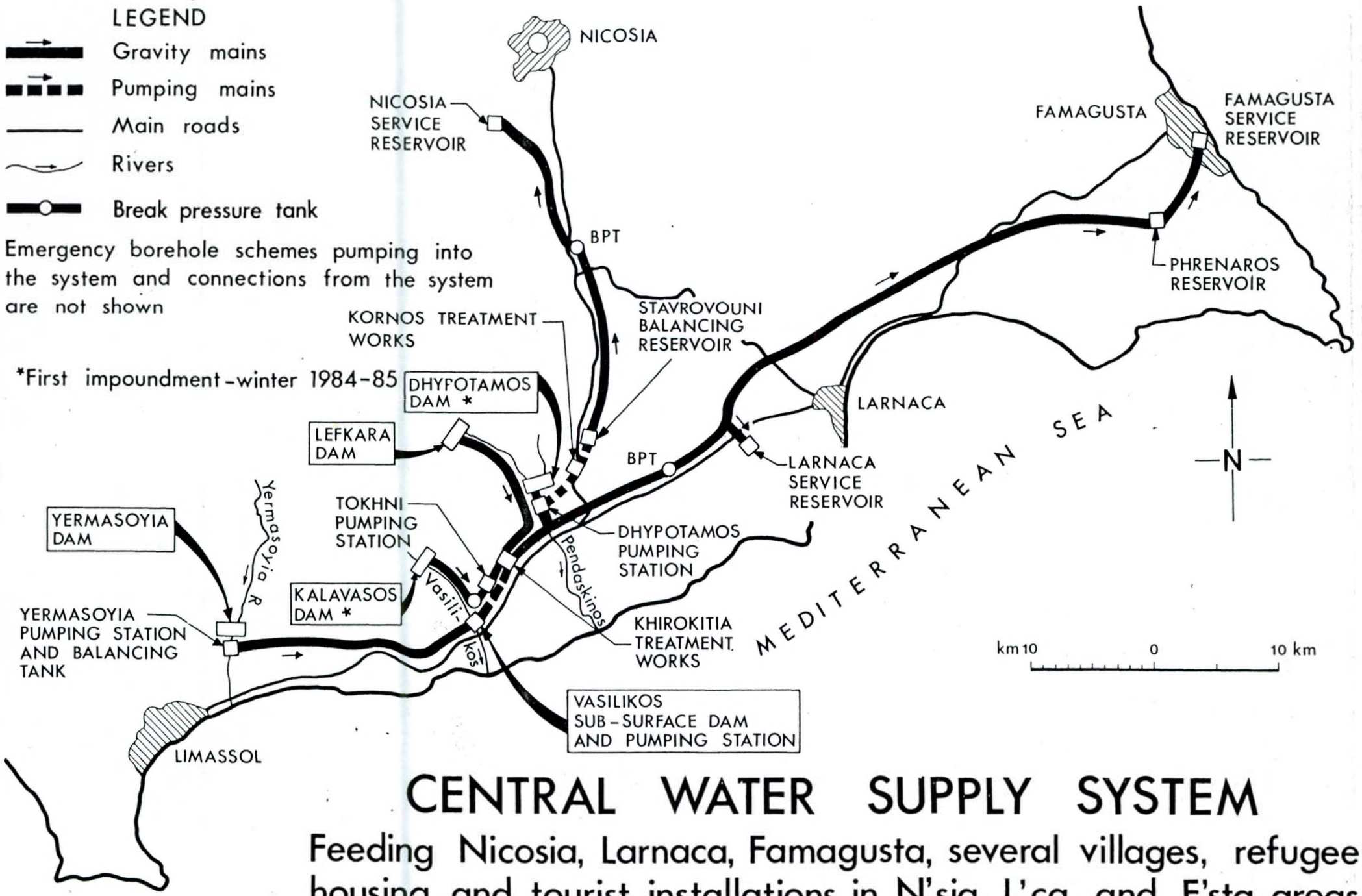
Table IX-16
PHRENAROS NEW PUMPING SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1988

Expenditure

	£
Electricity	14 171
Wages	5 893
Materials and others	1 745
Total	£21 809

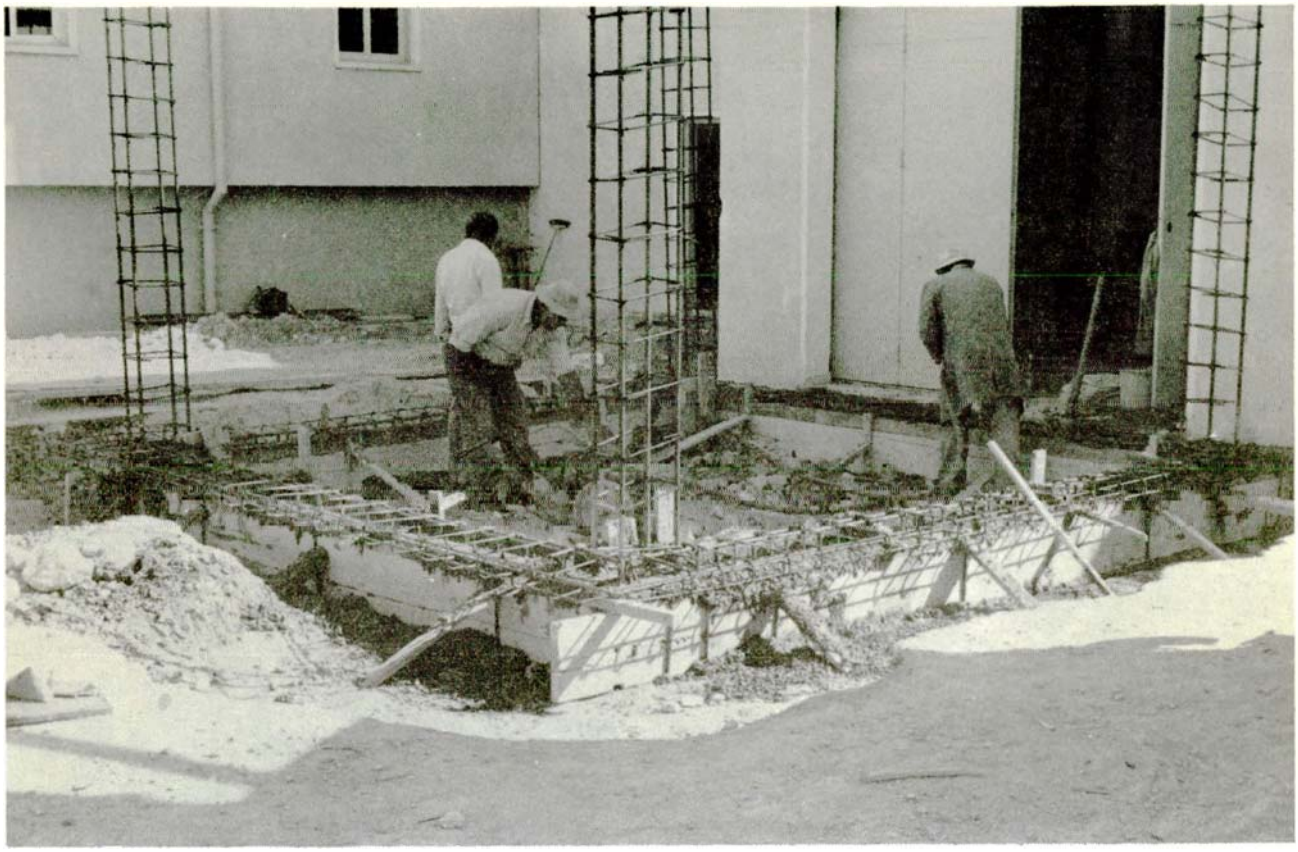
Revenue Generated in 1988

	£
Value added of water delivered to Ayia Napa, Paralimni and Protaras Tourist area. (Calculated at 4.6 cents/m³ being the additional charge for pumping the water only)	70 630
Amount collected in 1988 in respect of water delivered in 1988 (There were no collections during the year)	--
Amount outstanding on 31.12.1988 for water delivered in 1988 .	70 630
Amount outstanding by 31.12.88 for water delivered before 31.12.87 (There were no collections for the outstanding amount during the year)	63 623
Total amount outstanding by 31.12.88	£134 253



CENTRAL WATER SUPPLY SYSTEM

Feeding Nicosia, Larnaca, Famagusta, several villages, refugee housing and tourist installations in N'sia, L'ca, and F'sta areas



Khirokitia Treatment Plant. Extension of alum store.
WDD photo F53EN-4. Taken on 10.11.88.

Swabbing of the Khirokitia-Phrenaros pipeline.

X DIVISION OF OPERATION AND MAINTENANCE-IRRIGATION

BY
N. Tsiourtis
Senior Water Engineer

Introduction

This Division includes the Branches dealing with:

* The management, operation and maintenance of Government Waterworks.
* The maintenance of contributory irrigation projects.

During 1988 the Division consisted of the following staff:

1 Senior Water Engineer - Head
2 Topographer Irrigation Engineers Class I
1 Executive Engineer I
1 Senior Technical Superintendent
2 Technical Superintendents
1 Senior Technician
3 Technicians I
2 Technicians II
13 Total Staff

Definitions

Government Waterworks:

These are the projects constructed under the Government waterworks Law Cap. 341. These projects are listed in Tables X-1 and X-9.

Contributory Irrigation Projects

These are projects constructed under the Irrigation Division Law Cap. 342. A list of these projects is given in Tables X-6 and X-7.

MANAGEMENT AND OPERATION PROCEDURES

The management and operation of the various categories waterworks are carried out as follows:

1. Government Waterworks

The management and operation of these projects are carried out by:

(a) Waterworks Committees established according to the provision of the relevant Law. The waterworks Committees are usually composed of the following:

Chairman

District Officer of the district in which the projects are situated.

Members

Director of the Water Development Department or his representative. Director of the Department of Agriculture or his representative. Director of the Land and Surveys Department or his representative. Two or more members elected by the farmers.

The Committee is responsible for the overall administration and management of the Government Waterworks Project such as:

* To make recommendation on the development, conservation, management and efficient use of the available water resources of the project.
* To manage and operate the project with a view to:

- improve the standard of agricultural practices
- improve the methods of irrigation
- increase the revenue from land and water utilization to the full economic value
- to sell the water at the nominal rates approved by the Government and see that the fees and charges are collected (See Table X-1).

(b) The Director of the Water Development Department who undertakes to operate, manage and maintain the Government waterworks. The projects whose operation and maintenance are with the Director of the WDD are the following & Khrysokhou, Paphos, Southern Conveyor, Vasilikos-Pendaskinos and Xyliatos.

The Committees and the Director of WDD have their own budgets, approved by the Minister of Finance and the Council of Ministers respectively.

The water selling rates approved by the Council of Ministers are shown on Table X-2.

2. Contributory Irrigation Projects (Major and Minor)

The operation of the contributory projects is carried out by the Irrigation Division Committees. These committees are chaired by the District Officer and members to the committees are beneficiaries elected by the general assembly meetings of the Irrigation Division beneficiaries. The Water Development Department in such cases gives technical advice both to the District Officer and to the Committees. The cost of the operation of these projects is born in total by the beneficiaries.

3. Government Recharge Waterworks

These are managed directly by the Water Development Department (See Table X-9).

MAINTENANCE PROCEDURES

The maintenance of the irrigation waterworks is carried out by the Water Development Department but depending on the type of the Project the expenses are either paid in full by the Government or are shared between the Government and the Irrigation Division. The procedures are as follows:

A. Government Waterworks:

The maintenance of these projects is carried out by the Water Development Department being the Government's Agency for waterworks and the costs are paid in full by the Government. By the term maintenance we mean routine dam and pipeline maintenance, valves and watermeters repairs or replacements, paintings of metal works or woodworks etc.

B. Contributory Irrigation Projects:

The maintenance of these projects is carried out by the Water Development Department but the costs are shared between the Government and the specific Irrigation Division usually at a ratio of 2 to 1. Some maintenance or repair works are carried out by the respective I D directly.

WATER DEVELOPMENT DATA

Cyprus is an island and all available water resources are those that result from overall precipitation. The total precipitation in an average year is estimated at 4,600 MCM, where 1,270 MCM/annum are lost in the form of evaporation, 900 MCM/annum are lost in the form of evapotranspiration from cultivated crops, 1,480 MCM/a are lost in the form of evapotranspiration from forest pasture and grass and irrigated crops. The annual surface runoff is estimated

at 600 MCM and the groundwater and springs another 350 MCM. As it is seen from the above only 950 MCM or 21% of the total precipitation are available for development both surface and groundwater. The groundwater resources being easier to develop are at present overpumped. The annual extraction from the boreholes is estimated at 370 MCM and the total springs yield is around 30 MCM. Out of these quantities 300 MCM are used for irrigation where the rest 100 MCM are used for domestic and industrial consumption.

The surface water resources being such more expensive to be developed, remained undeveloped until the beginning of the 1960's. By the beginning of 1960 the total water storage capacity of dams all over the island amounted to 6.2 MCM commanding an area of 1,525 Hectars of irrigated land. Soon after this (after independence) the Government of the Republic started a construction program to develop as much as possible more surface water resources. Many projects were constructed which increased the water storage capacity of dams, to 288.130 MCM, 270.067 MCM for irrigation and domestic water supply and the rest 18.063 MCM for recharge purposes where the commanded are has risen to 33,289 hectars.

Details on the projects and the rate of storage development are given in Drg. No. AG/IR/37 "Cyprus Dam Project and Regional Development" and "progress in Dam Construction".

SUMMARY OF MANAGEMENT, OPERATION AND MAINTENANCE DATA

The overall average precipitation during the hydrological year under review was 625 mm or 121% of the 30 year average of the Government controlled area, where the total volume of water available in the dams from the boreholes and river diversions in the Government controlled are amounted to 240.541 MCM. From this quantity 38.403 MCM were used for irrigation, 14.070 MCM were used for domestic water supplies, 23.294 MCM were used for groundwater recharge. In the same period 2.326 MCM seeped through or below the dams and another 12.106 MCM were lost as evaporation. The rest 164.774 MCM remained in the dams for over year storage or lost in the distribution system. Projects in the Turkish occupied are not included here as we cannot collect the necessary information.

The total area commanded by the irrigation projects is estimated at 33,289 Hectars where an estimated area of 9,663 hectars, has been irrigated, planted with citrus, bananas, deciduous, vegetables, potatoes etc.

Maintenance works totalling £399,409 were carried out on fourty two projects. These include routine maintenance on the dam structures and the distribution systems. For the Government irrigation works a total of £379,253 were spent where for the recharge works an amount of £2,054, was spent. For the contributory projects a total of £18,102 were spent, £10,431 for the Pitsilia Project and £7,671 for the other contributory projects.

For the projects water quality smaples of water where chemically analysed. Details are shown on annexes 2, 3 & 4.

Government Waterworks

In the year under review, the total quantity available from Government irrigation projects reached the figure of 231.216 MCM, 223,759 MCM in storage and 7,457 MCM from other resources ie. river diversions and borehole extractions.

From this total, a quantity of 72.541 MCM or 31.4% was utilized, 32,428 MCM for irrigation, 14.070 MCM for domestic water supply and 21.604 MCM for recharge purposes and 4.439 MCM were given for storage (From Kouris dam to Akhna reservoir). The rest 158.675 MCM of water remained in storage or lost in the distribution systems. In the same period 11.527 MCM were lost in the form of evaporation where another 2.326 MCM were lost as seepage or deep percolation (see Table X-1).

The irrigation water was used to irrigate fully or partly 8,046 hectares of land planted with citrus, bananas, vines, deciduous, vegetables, potatoes, cereals and olives (See Annex 1).

The gross income from the sale of water amounted to £1 487 169 being the income from the sale of water at the rates shown on Table X-3. The operational expenses amounted to £292,811 being the cost for the payment of the watermen, and the bill collectors etc., which amounted to 1.0 cent/CM of water sold or 0.4 cent/CM of water utilized. The maintenance expenses on government projects amounted to £379,253 i.e. 1.3 cent/CM of water sold or 0.5 cent/CM of water utilized. The power expenses amounted to £138 806 i.e. 0.5 cent/CM of water sold or 0.2 cent/CM of water utilized.

The total annual operation, maintenance and power expenses amounted to £810 870 which amounts to 2.7 cent/CM of water sold or 1.1 cent/CM of water utilized.

Evaporation losses from the reservoirs amounted to 11.527 MCM or 5.1% of the total storage capacity available. The seepage losses where estimated at 2.326 MCM or 1.0% of the total storage.

The overall water utilization and land utilization indexes are 31.4% and 60.2% respectively. Of the 32.428 MCM used for irrigation 29.535 MCM were sold at the nominal rates, (91.1%) whereas the rest 2.893 MCM, (8.9%) were given free of charge as water rights or overflows.

A summary of the above data in detail is given in Tables X-1, X-4 and X-5 where more details are given on each project under separate headings.

Table X-5 gives data on the operation and maintenance of the government irrigation projects for the last 10 years.

Table X-10 gives data on the operation and maintenance for the last two years.

Table X-11 gives data on the cost of water.

Contributory Irrigation Projects

In general there are 70 contributory irrigation projects with total capacity 9.591 MCM commanding an area of 5,896 hectares. Nine projects of total capacity 5.296 MCM or 55.2% of the total capacity of contributory schemes, commanding an area of about 3,027 hectares are situated in the Turkish occupied area and on which no data are collected. Forty one projects of total capacity 2.193 MCM, commanding an area of 998 hectars belong to the Pitsilia Project. During the year under review the total quantity of water collected from the contributory schemes amounted to 7.635 MCM out of which 5.975 MCM were used for the irrigation of 1,617 hectares of land where the rest were lost in the form of evaporation or remained in the dams and/or ponds for over year storage. See Tables X-6, X-7, and X-8 for details.

The maintenance expenses amounted to £18 102, £12 317 as Government contribution and £5 785 as Irrigation Division Contribution.

See tables X-12 and X-13 for details.

Recharge Works

On the island there are about 34 recharge projects of total capacity 18.063 MCM. Out of these projects 19 of total capacity 15.534 MCM or 86.0% of the total recharge capacity are situated in the Turkish occupied areas. On these, projects no government control is possible and no data on their use is available. In the projects situated in the Government controlled area, a quantity of 1.690 MCM was collected by some recharge dams. For information on individual projects in the Government control areas see Tables X-9 and X-14.

TABLE X-1 GOVERNMENT IRRIGATION PROJECTS - DATA FOR 1988

Project	Capacity m3x103	Area Com. hect.	Water available m3x103			Water used m3x103					Losses m3x103		Utilized Index %		
			In Storage *	From other resourc. **	Total	For irrig.	For DWS	For rech.	For stor.	Total	Evap.	Seep.	Area Irrig. hect.	Water	Land
1. Argaka	990	314	1 581	Nil	1 581	1 051	Nil	Nil	Nil	1 051	76	4	211.9	66.4	67.5
2. Ayia Marina	298	201	682	Nil	682	319	Nil	Nil	Nil	319	28	38	37.2	46.8	18.5
3. Pomos	950	381	1 713	106	1 819	800	Nil	Nil	Nil	800	70	160	147.2	48.4	38.6
4. Khrysokhou-Evretou	24 000	2 000	20 118	Nil	20 118	1 690	Nil	Nil	Nil	1 690	1 285	NIL	407.8	8.3	20.4
5. Paphos:															
(i) Asprokremmos	52 375)		69 002	5 414)							3 715	121)			
(ii) Mavrokolymbos	2 180)	5 110	2 731	Nil)	77 147	14 483	Nil	2 021	Nil	16 504	176	Nil)	3675.6	21.9	72.8
6. Southern Conveyor-Kouris	115 000	13 500	72 106	Nil	72 106	3 442	Nil	13 766	4 439+	21 647	2 267	528	NA	30.0	NA
7. (i) Yermasoyia	13 500)		20 670)								1 226	Nil)			
(ii) Polemidhia	3 430)	2 066	3 590)	131	24 391	5 185	2 895	5 817	Nil	13 897	311	1 212)	2066.0	57.0	100.0
8. Vasilikos-Pendaskinos															
(i) Kalavasos	17 100	1 071	15 090	Nil)							1 066	Nil)			
(ii) Dhypotamos	13 700	372	8 225)	18)	28 782	2 630	11 175	Nil	Nil	13 805	832	Nil)	630.0	48.0	41.3
(iii) Lefkara	13 850	82	5 449)	Nil)							338	23)			
9. Xyliatos	1 220	308	1 941	Nil	1 941	586	Nil	Nil	Nil	586	95	90	205.9	30.2	66.8
10. Kalopanayiotis	363	60	861	Nil	861	210	Nil	Nil	Nil	210	42	150	56.2	24.4	93.7
11. Kiti	1 610	831	2	Nil	2	174	Nil	Nil	Nil	174	NA	NA	41.0	--	4.9
12. Kha-Potami	1	567	--	1 413	1 413	1 413	Nil	Nil	Nil	1 413	--	--	567.0	100.0	100.0
13. Evdimou-Paramali	1	530	--	375	375	375	Nil	Nil	Nil	375	--	--	NA	100.0	NA
Total	260 476	27 393	223 759	7 457	231 216	32 428	14 070	21 604	4 439	72 541	11 527	2 326	8045.8	31.4	60.2

* This the water that possibly may be utilized; storage and overlow or seepage that may be utilized after deducting evaporation and seepage losses.

** River Diversion and/or Borehole extraction used in project area.
1 Diversion on river
2 Impounding from Kouris dam

+ To Akhna dam

TABLE X-2 - GOVERNMENT IRRIGATION PROJECTS AND APPROVED WATER CHARGES IN CENT/M³

Ser. No.	Project	Overflow	Industrial	Flat Rate
1	Argaka	Free	--	3.5
2	Ayia Marina	0.5	--	3.5
3	Pomos	0.5	--	3.5
4	Khrysokhou.....	--	13	4.5
5	Paphos.....	--	9,13	
	(i) Asprokremmos....	--	--	5.0
	(ii) Mavrokolymbos...	--	--	4.5
6	Southern Conveyor....	0.5	--	8.0
7	(i) Yermasoyia.....	0.5	--	3.5, 4.0
	(ii) Polemidhia.....	--	--	3.5, 4.0
8	Vasilikos-Pendaskinos	--	--	
	(i) Kalavasos	--	17	4.5
	(ii) Dhypotamos	--	17	4.5
	(iii) Lefkara	--	--	4.0
9	Xyliatos.....	--	13	4.0
10	Kalopanayiotis.....	--	--	4.0
11	Kiti	--	--	3.0
12	Kha-Potami	--	--	
13	Evdimou-Paramali.....	--	--	2.0

TABLE X-3 - GOVERNMENT IRRIGATION PROJECTS TOTAL UNIT COST OF WATER

Ser. No.	Project	Unit Cost cent/m³
1	Argaka	15.10
2	Ayia Marina	9.86
3	Pomos.....	8.97
4	Khrysokhou.....	15.10
5	Paphos.....	14.36
6	Southern Conveyor.....	32.90
7	Yermasoyia-Polemidhia.....	12.75
8	Vasilikos-Pendaskinos.....	20.54
9	Xyliatos	21.30
10	Kalopanayiotis.....	29.75
11	Kiti.....	21.76

TABLE X-4 DATA ON MANAGEMENT, OPERATION AND MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

Project	Capacity m3x103	Area Com. hect.	Water available m3x103 In Storage *	From other resourc. **	Total	Water used m3x103	Water sold m3x103	Area Irrig. hect.	Gross Income £	Expenditure £ Power	Operat.	Maint.	Total	Net Income £
1. Argaka	990	314	1 581	Nil	1 581	1 051	632	211.9	22 132	Nil	10 486	2 823	13 309	8 823
2. Ayia Marina	298	201	682	Nil	682	319	319	37.2	9 872	Nil	7 107	2 460	9 567	305
3. Pomos	860	381	1 713	106	1 819	880	880	147.2	24 309	1 646	14 953	2 365	18 964	5 345
4. Khrysokhou-Evretou	24 000	2 000	20 118	Nil	20 118	1 680	1 680	407.8	77 577	1 248	18 136	44 583	63 967	13 610
5. Paphos:														
(i) Asprokremmos	52 375)		69 002	5 414)										
(ii) Mavrokolymbos	2 180)	5 110	2 731	Nil)	77 147	16 504	14 274	3675.6	709 277	116 755	67 618	251 991	436 364	272 913
6. Southern Conveyor-Kouris	115 000	13 500	72 106	Nil	72 105	21 647	3 442	NA	274 550	Nil	34 070	Nil	34 070	240 480
7. (i) Yermasoyia	13 500)		20 670)											
(ii) Polemidhia	3 430)	2 066	3 590)	131	24 391	13 897	4 333	2066.0	163 974	19 157	86 036	25 950	131 143	32 831
8. Vasilikos-Pendaskinos														
(i) Kalavasos	17 100	1 071	15 090											
(ii) Dhypotamos	13 700	372	8 225)	18	28 782	13 805	2 630	630.0	159 121	Nil	40 940	37 080	78 020	81 101
(iii) Lefkara	13 850	82	5 449)											
9. Xyliatos	1 220	308	1 941	Nil	1 941	586	586	205.9	24 602	Nil	5 019	3 992	9 011	15 591
10. Kalopanayiotis	363	60	861	Nil	861	210	210	56.2	8 391	Nil	4 045	4 618	8 663	- 272
11. Kiti	1 610	831	2	Nil	2	174	174	41.0	5 866	Nil	2 438	3 391	5 829	37
12. Kha-Potami	1	567	--	1 413	1 413	1 413	--	567.0	--	--	--	--	--	--
13. Evdimou-Paramali	1	530	--	375	375	375	375	NA	7 498	--	1 963	--	1 963	5 535
Total	260 476	27 393	223 759	7 457	231 216	72 541	29 535	8045.8	1487 169	138 806	292 811	379 253	810 870	676 299

* This is the water that possibly may be utilized; storage and overflow or seepage that may be utilized after deducting evaporation and seepage losses.
** River Diversion and/or borehole extraction used in project area.

1 Diversion on river
2 Impounding from Kouris dam

TABLE X-5 DATA ON WATER USE FOR THE LAST 10 YEARS FOR THE GOVERNMENT PROJECTS

Ser. No.	Description	Unit	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	Capacity	1000m3	37 874	37 874	37 874	89 874	91 094	91 094	120 894	120 894	147 368	260 476
2	Water available	"	28 282	34 408	50 660	35 278	37 441	55 019	68 951	67 006	117 196	231 216
3	Water utilized for irrigation	"	10 847	27 109	19 634	20 858	21 814	23 270	27 137	28 734	26 818	32 428
4	Water used for DWS	"	2 210	2 210	3 356	4 793	3 831	4 429	8 807	10 606	14 872	14 070
5	Water used for recharge	"	1 623	6 579	14 627	2 648	2 999	3 199	3 758	6 208	5 860	21 604
6	Total water used	"	15 426	23 609	37 617	28 299	28 644	30 898	39 702	45 548	48 350	68 103
7	Evaporation losses	"	2 409	2 587	2 618	2 646	3 218	3 789	4 219	3 152	6 451	11 527
8	Seepage losses	"	1 024	5 087	5 424	0 973	0 873	0 747	0 946	0 556	1 227	2 326
9	Water sold	"	12 642	11 748	18 644	19 542	20 101	21 210	23 958	27 359	25 897	29 536
10	Gross income	£	128 281	169 418	253 307	433 214	520 441	688 686	892 589	1043 594	1146 669	1 487 169
11	Power cost	"	-	-	117 689	215 577	247 838	355 186	390 785	307 011	222 413	138 806
12	Operation cost	"	55 197	84 496	207 738	119 906	264 039	212 831	217 711	182 750	214 671	292 811
13	Maintenance cost	"	7 202	18 563	50 539	76 131	100 069	160 771	172 166	279 893	308 529	379 253
14	Total expenditure	"	62 399	103 059	258 277	411 614	611 946	728 788	770 662	769 564	745 613	810 870
15	Net income	"	65 882	68 159	-4 838	21 600	-91 505	-40 102	121 927	274 030	401 056	676 299
16	Area irrigated	Hectares	2 687	3 267	4 996	5 286	6 112	6 697	6 837	7 215	7 966	8 046

TABLE X-6 DATA ON CONTRIBUTORY IRRIGATION WORKS

Ser. No.	Project	Capacity m3x103	Yield m3/h	Area com. hect.	Water avail. m3x103 In stor.	Other resour.	Total	Water used m3x103	Evap. Losses m3x103	Area Irrig hect.
1	Akrounda	22	-	8	22	-	22	20	1.8	8
2*	Galini	22	-	174	-	-	-	-	-	-
3*	Geyneli	1 000	-	114	-	-	-	-	-	-
4*	Gypsos	113	-	85	-	-	-	-	-	-
5	Kalo Khorio (Klirou)	32	-	181	32	-	32	23	2.6	9
6	Kandou	38	-	75	38	-	38	18	3.0	7
7	Kotchatis	1	-	NA	-	NA	NA	NA	-	NA
8*	Kanli	1 100	-	535	-	-	-	-	-	-
9*	Lefka Marathasa	368	-	174	1 200	-	1 200	800	29.4	174
10*	Lefka Kafizes	113	-	103	500	-	500	400	9.0	103
11	Lymbia	220	-	126	220	-	220	66	17.6	14
12	Lythrodontas Upper	32	-	15	32	-	32	28	2.6	15
13	Lythrodontas Lower	32	-	15	32	-	32	25	2.6	15
14*	Mia Milea	330	-	174	-	-	-	-	-	-
15*	Morphou	2 000	-	902	-	-	-	-	-	-
16*	Ovgos	250	-	852	-	-	-	-	-	-
17	Pakhyammos	43	-	54	43	-	43	30	3.4	18
18	Palekhori (Kambi)	620	-	134	1 000	-	1 000	855	49.6	134
19	Pera Pedhi	55	-	26	55	-	55	30	4.4	8
20	Petra Upper	10)	-	628)	10	-	10	9	0.8	8
21	Petra Lower	25)	-		25	-	25	22	2.0	23
22	Prodromos	110	-	23	110	-	110	65	8.8	58
23	Pyrgos	283	-	214	283	-	283	260	22.6	87
24	Trimiklini	340	-	87	340	-	340	300	27.2	24
25	Kambos	2	70	36	-	63	63	45	-	44
26	Chakistra	2	70	44	-	112	112	88	-	13
27	Yerakies	2	70	29	-	43	43	41	-	47
28	Khirokitia Pond & B/H No.136/78	205	100	47	205	12	217	187	30.0	43
29	Esso Galata pond	35	-	43	35	NA	35	24	2.8	NA
	Total	7 398	310	4 898	3 942	230	4 172	3 336	220.2	852

* Project in Turkish occupied areas
1 River Diversion.
2 River Diversion with Dual Pumping stage.
xx River Diversion on Borehole Extraction.

TABLE X-7 DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

Ser. No.	Project	Capac. m3x103	Yield m3/h	Area comm. Decars	Water avail. in stor. m3x103	Water used for irrig. from dam m3x103	Water extr. from b/h m3x103	Total water avail. m3x103	Total water used m3x103	Evap. Losses m3x103	Area irrig. hect. decars
1	Agros Dam & B/H 63/76	72	70	474	80	41	73*	153	114	24	230
2	Akapnou-Ephtagonia Pond	132	-	248	132	80	-	132	80	20	200
3	Arakapas Dam	128	-	293	450	360	-	450	360	25	293
4	Arakapas I	192	-	381	192	123	-	193	123	29	347
5	Ayii Vavatsinias dam	53	-)	241	53	45	-	53	45	93	227
6	Ayii Vavatsinias pond I	55	-)	201	55	10	-	55	10	13	-
7	Ephtagonia I	92	-	234	92	61	-	92	61	14	185
8	Ephtagonia II	127	-	120	127	64	-	127	64	20)	
9	Ephtagonia III	65	-	401	65	30	-	65	30	12)	340
10	Kato Mylos pond & B/H 66/76	104	62	187	92	68	43	135	111	15	228
11	Khandria	70	-	107	70	60	-	70	60	10	130
12	Kyperounda I	53	-	690	53	35	-	53	35	8	107
13	Kyperounda II	273	-	199	273	200	-	273	200	31	474
14	Lagoudhera	70	-	147	70	32	-	70	32	12	39
15	Melini	59	-	123	59	42	-	59	42	11	128
16	Agridhia	59	-	642	59	50	-	59	50	9	100
17	Pelendria pond & B/H 53/76	123	160		123	75	109	232	184	15	501
18	Arakapas B/H "Angoulos" 124/76..	-	50	123	-	-	15	15	15	-	100
19	Arakapas B/Hs "Scoli" 106/76 & 107/76	-	90	240	-	-	64	64	64	-	302
20	Polystypos B/H 21/77	-	15	84	-	-	7	7	7	-	84
21	Potamitissa B/Hs 67/76 & 69/798	-	120	265	-	-	80	80	80	-	219
22	Kalon Khorio 54/76 & 11/77	-	125	526	-	-	82	82	82	-	278
23	Ayios Theodhoros B/H 105/76 ...	-	65	126	-	-	Nil	Nil	**	-	126
24	Ora Pond & B/Hs 27/81 & 66/81..	62	42	181	62	49	6	68	55	-	178

TABLE X-7 DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT (Cont.)

Ser. No.	Project	Capac. m3x103	Yield m3/h	Area comm. Decars	Water avail. in stor. m3x103	Water used for irrig. from dam m3x103	Water extr. from b/h m3x103	Total water avail. m3x103	Total water used m3x103	Evap. Losses m3x103	Area irrig. hect. decars
25	Pharmakas I).....	21	-)	-	21	13	-	21	13	4)	135
26	Pharmakas II).....	61	-)	181	61	45	-	61	45	12)	
27	Arakapas II.....	119	-	254	119	70	-	119	70	23	202
28	Ayii Vavatsinias II	44	-	183	43	21	-	43	21	8	52
29	Dhierona I	159	-	401	159	112	-	159	112	24	386
30	Dhierona B/H 14/82	-	54	127	-	-	48	48	48	-	149
31	Sykopetra B/H 48/82	-	45	120	-	-	22	22	22	-	115
32	Ayios Konstantinos B/Hs 123/76,8/81	-	116	401	-	-	9	9	9	-	266
33	Louvaras B/Hs 32/77, 16/81,	-	140	355	-	-	102	102	102	-	227
34	Ayii Vavatsinias B/H 35/81	-	50	134	-	-	33	33	33	-	64
35	Askas B/H 98/80	-	60	214	-	-	44	44	44	-	173
36	Alona B/H 46/80	-	50	100	-	-	33	33	33	-	60
37	Lagoydhera B/H 53/80	-	25	60	-	-	15	15	15	-	12
38	Agros B/H 21/82	-	82	241	-	-	70	70	70	-	134
39	Dhymes B/H 81/80	-	80	265	-	-	76	76	76	-	262
40	Kato Amiantos scheme	1	56	674	-	-	NA	NA	NA	-	509
41	Zoopiyi B/H 9/81	-	49	134	-	-	21	21	21	-	86
		2193	1606	9977	2510	1686	953	3463	2639	359	7648

* Some quantity of the water from the borehole was given for DWS.
** Water utilization from the river flow.
*** Borehole and river diversion scheme.

TABLE X-8
CONTRIBUTORY IRRIGATION PROJECTS-DATA FOR 1988

Item No.	Description	Unit	Date
1.	Capacity	1000 m^3	9 591
2.	Boreholes yield	"	1 606
3.	Water available in storage	"	6 452
4.	Water extracted from boreholes and river diversions	"	1 183
5.	Total water available	"	7 635
6.	Water utilized for irrigation	"	5 975
7.	Evaporation losses	"	579
8.	Maintenance expenses	£	18 102
9.	Government contribution	"	12 317
10.	Irrigation Division Contribution	"	5 785
11.	Area Irrigated	Hectares	1 617
12.	Area Commanded	"	5 896

TABLE X-9
RECHARGE WATERWORKS DATA

Ser No.	Project	Capacity m^3 x1000	Water available m^3 x1000	Water used for recharge m^3 x1000	Water lost in evaporation m^3 x1000
1*	Kouklia	4 545	-	-	-
2*	Ayios Loucas	455	-	-	-
3	Sotira	77	NIL	NIL	NIL
4	Paralimni-Panayia	45	NIL	NIL	NIL
5	Paralimni	115	NIL	NIL	NIL
6	Ayia Napa	55	NIL	NIL	NIL
7*	Famagusta Antiflood	50	-	-	-
8	Phrenaros	160	NIL	NIL	NIL
9	Dherinia	23	NIL	NIL	NIL
10	Avgorou	68	NIL	NIL	NIL
11*	Kondea	82	-	-	-
12	Xylophaghou	86	NIL	NIL	NIL
13*	Lysi	77	-	-	-
14*	Ayios Yeoryios(K)	68	-	-	-
15*	Ayios Epiktitos	34	-	-	-
16*	Akanthou	45	-	-	-
17**	Akhna	40	NIL	NIL	NIL
18	Xylotymbou	50	NIL	NIL	NIL
19*	Syngrasis	1 115	-	-	-
20*	Ayios Yeoryios (F).	190	-	-	-

TABLE X-9
RECHARGE WATERWORKS DATA (Cont.)

Ser No.	Project	Capacity m^3 x1000	Water available m^3 x1000	Water used for recharge m^3 x1000	Water lost in evaporation m^3 x1000
21*	Famagusta Recharge	165	-	-	-
22*	Ayios Nicolaos Fam	1 365	-	-	-
23	Paralimni Lake	1 365	1 365	1 365	NA
24*	Fresh Water Lake	4 545	-	-	-
25*	Makrasyka	195	-	-	-
26*	Akhna Mesaoria	90	NIL	NIL	NIL
27	Vrysoulles Fam.	140	-	-	-
28*	Morphou Recharge	130	-	-	-
29*	Morphou Protopapas	90	-	-	-
30	Ormidhia (Vathys)	100	NIL	NIL	NIL
31*	Masari	2 273	-	-	-
32	Liopetri	325	325	325	NA
33	Yialias	NA	FULL	FULL	NA
34	Merikas	NA	FULL	FULL	NA
	Total	18 063	1 690	1 690	NIL

* Projects in Turkish occupied area. Gate constantly open for recharge.
** Some of the dams of the project are in Turkish occupied area.

TABLE X-10 DATA ON MANAGEMENT AND OPERATION OF GOVERNMENT IRRIGATION PROJECTS FOR THE LAST TWO YEARS

Item No.	Data	Unit	1987	1988	% Change on 1987
1	Capacity	$1000m^3$	147 368	260 476	76.8
2	Water available	"	117 996	231 216	96.0
3	Water utilized for irrigation	"	27 618	32 428	17.4
4	Water utilized for DWS	"	14 872	14 070	-5.4
5	Water utilized for recharge	"	5 860	21 604	+268.7
6	Water given for Storage to other dams..	"	NIL	4 439	--
7	Total water used ...	"	48 350	72 541	+50.0
8	Evaporation losses .	"	6 451	11 527	+78.7
9	Seepage losses	"	1 227	2 326	+89.6
10	Water sold	"	25 935	29 535	+13.9
11	Gross income	£	1 146 669	1487 169	+29.7
12	Power cost	"	222 413	138 806	-37.6
13	Operation cost	"	214 671	292 811	+22.9
14	Maintenance cost ...	"	308 529	379 253	+ 8.8
15	Total expenses	"	745 613	810 870	+68.6
16	Net income	"	401 056	676 299	+ 1.0
17	Area irrigated	Hectares	7 966	8 046	+10.4
18	Area commanded	"	13 581	27 393	+101.7

TABLE X-11 - GOVERNMENT IRRIGATION PROJECTS - COST OF WATER

Ser.	Project	Water Sold m3x103	Total water utilized m3x103	Operation Cost £	Maintenance Cost £	Power cost £	Total annual cost £	Cost of water* cent/m3 Sold water	Cost of water* cent/m3 total utilized
1	Argaka	632	1 051	10 486	2 823	Nil	13 309	2.1	1.3
2	Ayia Marina	319	319	7 107	2 460	Nil	9 567	3.0	3.0
3	Pomos.....	880	880	14 953	2 365	1 646	18 964	2.2	2.2
4	Khrysokhou.....	1 680	1 680	18 136	44 583	1 248	63 967	3.8	3.8
5	Paphos.....	14 274	16 504	67 618	251 991	116 755	436 364	3.1	2.6
6	Southern Conveyor.....	3 442	21 647	34 070	Nil	Nil	34 070	1.0	0.2
7(i)	Yermasoyia).....								
(ii)	Polemidhia)	4 333	13 897	86 036	25 950	19 157	131 143	3.0	0.9
8	Vasilikos-Pendaskinos..	2 630	13 005	40 940	37 080	Nil	78 020	3.0	0.6
9	Xyliatos.....	586	586	5 019	3 992	Nil	9 011	1.5	1.5
10	Kalopanayiotis.....	210	210	4 045	4 618	Nil	8 663	4.1	4.1
11	Kiti.....	174	174	2 438	3 391	Nil	5 829	3.3	3.3
12	Kha-Potami.....	Nil	1 413	--	--	--	--	--	--
13	Evdimou-Paramali.....	375	375	1 963	--	--	1 963	0.5	0.5
	Total	29 535	72 541	292 811	379 253	138 806	810 870	1.1	1.1

* It does not include capital cost.

DETAILS OF MAINTENANCE WORKS OF CONTRIBUTORY PROJECTS

A. CONTRIBUTORY IRRIGATION WORKS

1. Pera Pedhi:
   Disilting of the dam reservoir.
2. Palekhori dam:
   Repairs to Main pipeline and distribution system.
3. Kotchatis dam:
   Disilting of weir.
4. Yerakies:
   Repairs to electrical systems.
5. Chakkistra:
   Repairs to electrical systems.
6. Kambos:
   Re-installation of pumping unit main.
   Repairs to electrical systems and conveyor main.
7. Lymbia dam:
   Cleaning of canal and repair of joints.

TABLE X-12 CONTRIBUTORY IRRIGATION WORKS-MAINTENANCE COSTS

Ser No.	Project	Govt Contrib. £	ID Contrib. £	Total Cost £
1	Pera Pedhi dam	736	735	1 471
2	Palekhori dam	364	182	546
3	Kotchatis	133	67	200
4	Yerakies	198	66	264
5	Chakkistra	2 964	988	3 952
6	Kambos	810	270	1 080
7	Lymbia*	158	-	158
		5 363	2 308	7 671

* Operation by WDD: Operation Cost £612 as waterman wages.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

1 Polystypos B/H No. 21/77
Repairs to pumping unit and distribution system.

2 Lagoudhera B/H No. 53/80
Repairs and replacement of outlets.

3 Dhymes B/H No. 81/80
Extension of distribution system and installation of outlets and other fittings.
Repairs to distribution system.

4 Kyperounda pond No.2.
Cleaning of drainage ditch channels.
Repairs to the membrane.
Repairs to distribution system.

5 Dhierona B/H No.14/82.
Replacement of outlets.
Maintenance of distribution system.

6 Potamitissa B/H Nos 67/76 & 69/79B.
Repairs to pumping units and distribution system.

7 Agros dam and B/H No.63/76.
Extension to distribution system.

8 Kyperounda pond 1.
Extension and repairs to distribution system.

9 Agridhia pond.
Repairs to distribution system.
Installation of outlets and other fittings.
Cleaning of embankment.

10 Zoopiyi B/H No.9/81.
Repairs to pipelines passing through the access road.
Repairs to the earthing of the pumping unit.

11 Kato Mylos pond and B/H No.66/76.
Repairs to main pipelines.
Maintenance of the pipe system.
Cleaning of filters.

12 Akapnou pond
Improvements to distribution system

13 Ayios Konstantinos B/H Nos. 8/81 & 123/76.
Repairs to regulating tank.

14 Arakapas B/H Nos 106/76 & 107/76.
Repairs to pumping unit.

15 Ayii Vavatsinias dam & pond.
Installation of a metal water level indicator.
Cleaning of embankment form wild vegetation.
Cleaning of filters.
Improvements to distribution system.

16 Ayii Vavatsinias pond 2.
Improvements to distribution system.

17 Ayii Vavatsinias B/H No.35/81.
Repairs to pumping unit.
Repair of the float valve of the regulating tank.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT (Cont.)

18 Ora pond & B/H Nos.27/81 & 66/81.
Repairs to pumping unit.
19 Melini pond
Extension of distribution system.
20 Pelendria pond & B/H No.53/76.
Repairs to the membrane.
Repairs to pipe breakages and electrical system.
21 Pharmakas ponds 1 & 2.
Repairs to distribution system and water meters.
22 Kato Amiantos
Installation of new pipelines.
Repairs to distribution system.
Modifications to one inlet system.

TABLE X-13 CONTRIBUTORY IRRIGATION WORKS OF PITSILIA PROJECT MAINTENANCE COSTS

Ser No.	Project	Maintenance Cost £ Gov. Cont. £	I.D.Cont. £	Total Cost £
1	Polystypos B/H No.21/77..	164	82	246
2	Lagoudhera B/H No.53/80 .	54	27	81
3	Dhymes B/H No. 81/80.....	400	200	600
4	Kyperounda pond 1	1 192	596	1 788
5	Dhierona B/H No. 14/82...	200	100	300
6	Potamitissa B/H Nos 67/76) & 69/79B)	140	70	210
7	Agros dam and B/H No.63/76	665	332	997
8	Kyperounda pond &	200	100	300
9	Agridhia pond	220	110	330
10	Zoopiyi B/H No.9/81.....	116	58	174
11	Kato Mylos pond & B/H No. 66/76.....	416	208	624
12	Akapnou pond	130	65	195
13	Ayios Konstantinos B/H No.8/81 & 123/76).....	100	50	150
14	Arakapas B/H Nos. 106/76 & 107/76.....	40	20	60
15	Ayii Vavatsinias dam & Pond	395	197	592
16	Ayii Vavatsinias pond 2...	294	147	441
17	Ayii Vavatsinias B/H No.35/81.....	180	90	270
18	Ora pond & B/H Nos.27/81 & 66/81.....	200	100	300
19	Melini pond.....	338	169	507
20	Pelendria pond 4 B/H No.53/76	577	289	866
21	Pharmakas pond 1 & 2	81	41	122
22	Kato Amiantos scheme.....	852	426	1 278
	Total	6 954	3 477	10 431

C. RECHARGE WORKS

1. South Eastern Messaoria
   Repair of two recharge dams.
   Repair and part cleaning of Panayia Main canal.
2. Nicosia East
   Installation of gates at five recharge dams.
3. Nicosia West
   Disilting of recharge dams.

TABLE X-14 RECHARGE WORKS-MAINTENANCE COSTS

Ser No.	Project	Cost £
1.	South Eastern Mesaoria	674
2.	Nicosia East (Yialias river).....	487
3.	Nicosia West (Merikos river).....	893
	Total.....	2054

ANNEX 1
GOVERNMENT IRRIGATION PROJECTS-CROPS AND AREAS IRRIGATED IN HECTARES

Item No.	Crop	Argaka	Ayia Marina	Pomos	Khrysokhou	Paphos	SCP	Yermas.-Polem.	Vasilikos Pendaski-nos	Xyliatos	Kalopana-yiotis	Kiti	Kha-Potami	Total
1	Citrus	96.3	16.8	72.8	170.0	822.5	NA	971.0	349.3	36.1	4.0	6.2	-	2545.0
2	Bananas	50.9	4.7	31.0	-	320.0	"	-	-	-	-	-	-	406.6
3	Table Grapes	1.7	0.4	-	13.7	391.5	"	516.0	0.9	-	-	-	567.0	1491.2
4	Deciduous	18.7	0.8	1.1	43.4	79.1	"	17.0	15.4	20.1	50.2	-	-	245.8
5	Vegetables	16.1	8.0	8.0	-	129.2	"	559.0	-	-	-	-	-	720.3
6	Greenhouses	-	5.4	1.3	-	42.9	"	-	29.2	-	-	-	-	78.8
7	Poatoes	-	-	-	20.6	546.0	"	-	51.5	-	-	15.6	-	633.7
8	Beans	8.7	-	-	-	515.9	"	-	13.1	-	-	-	-	537.7
9	Olives	6.7	-	25.1	-	-	"	3.0	31.2	20.1	0.7	-	-	86.8
10	Ground-nuts	-	-	-	5.6	474.0	"	-	-	-	-	-	-	479.6
11	Seasonal	-	-	-	47.8	154.6	"	-	133.9	124.4	-	18.8	-	479.5
12	Tobbacco	-	-	-	86.6	-	"	-	-	-	-	0.4	-	87.0
13	Avocados	8.0	0.8	5.9	2.2	50.0	"	-	1.0	1.3	-	-	-	69.2
14	Alfa-Alfa	4.8	0.3	2.0	12.1	48.9	"	-	4.5	1.3	-	-	-	73.9
15	Legumes	-	-	-	-	23.2	"	-	-	-	-	-	-	23.2
16	Kiwi	-	-	-	-	-	"	-	-	1.3	1.3	-	-	2.6
17	Pistachio	-	-	-	-	-	"	-	-	1.3	-	-	-	1.3
18	Pecan	-	-	-	5.8	47.9	"	-	-	-	-	-	-	53.7
19	Other	-	-	-	-	30.1	"	-	-	-	-	-	-	30.1
	Total	211.9	37.2	147.2	407.8	3675.8	"	2066.0	630.0	205.9	56.2	41.0	567	8046.0

ANNEX 2
GOVERNMENT IRRIGATION PROJECTS-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations Mileq/lt				Anions Mileq/lt					Milg/lt B	PH
						Na	K	Ca	Mg	Cl	SO4	CO3	HCO3	NO3		
1	Argaka-Magounda	25.1.88	395	205	0.54	1.45	0.02	2.0	2.1	1.6	0.8	NIL	3.2	NIL	NIL	7.8
		7.9.88	580	290	0.74	2.4	0.02	2.5	3.4	2.1	1.7	NIL	4.6	NIL	0.05	7.9
2	Ayia Marina	27.1.88	670	370	0.92	2.5	0.05	2.7	4.8	3.4	1.6	NIL	4.9	NIL	0.04	8.0
		8.9.88	650	320	0.87	3.3	0.02	2.1	4.3	3.5	1.6	NIL	4.8	NIL	0.06	7.6
3	Pomos	26.1.88	410	220	0.54	1.5	0.02	1.9	2.5	1.7	0.7	NIL	3.4	NIL	0.04	7.8
		8.9.88	480	245	0.64	2.7	0.02	1.7	3.2	2.3	1.0	NIL	3.8	NIL	0.09	7.9
		19.12.88	515	270	0.62	2.4	0.02	2.2	3.2	2.4	1.4	NIL	3.7	NIL	0.05	8.0
4	Evretou	4.2.88	485	220	0.66	2.6	0.07	2.2	2.2	2.0	1.2	NIL	3.7	NIL	0.05	8.1
5	Asprokremmos	2.9.88	420	170	0.53	2.6	0.10	1.7	1.8	1.5	1.5	NIL	2.9	NIL	0.13	7.7
6	Mavrokolymbos	3.8.88	575	275	0.70	2.6	0.10	3.5	2.0	1.7	3.1	NIL	3.4	NIL	0.16	7.9
7	Kouris	9.2.88	510	250	0.65	2.3	0.07	1.7	3.3	2.3	0.8	NIL	4.0	0.20	0.14	8.1
		1.3.88	500	245	0.66	2.7	0.05	1.7	3.2	2.2	0.9	NIL	4.0	0.17	-	8.0
8	Yermasoyia	2.3.88	860	530	0.92	1.5	0.02	1.8	8.7	1.5	0.9	0.4	9.4	NIL	0.03	8.3
		12.12.88	550	335	0.66	1.21	0.02	1.7	5.0	1.4	1.1	0.4	5.1	NIL	0.03	8.5
9	Polemidhia	29.2.88	660	345	0.82	2.4	0.15	2.5	4.4	2.4	1.3	NIL	5.4	0.3	0.07	7.7
		30.6.88	630	320	0.84	2.9	0.17	1.6	4.8	3.0	1.3	0.4	4.7	NIL	NIL	8.4
10	Kalavasos	20.2.88	NA	355	0.70	1.4	0.02	2.7	4.4	1.5	1.8	NIL	5.0	0.11	NIL	8.0
11	Lefkara	2.6.88	385	200	0.46	1.4	0.02	1.2	2.8	1.1	0.9	NIL	3.4	NIL	0.09	7.9
12	Kalopanayiotis	4.2.88	350	190	0.41	0.9	0.02	1.5	2.3	0.8	0.6	NIL	3.4	0.14	NIL	7.8
		21.6.88	345	170	0.41	1.3	0.03	0.9	2.5	1.0	0.7	NIL	3.1	0.11	0.06	7.9
		23.11.88	380	220	0.47	0.9	0.02	1.0	3.3	0.8	0.6	NIL	3.9	NIL	NIL	7.7
13	Xyliatos	26.2.88	225	125	0.28	0.7	0.02	1.3	1.2	0.7	0.6	NIL	1.9	NIL	0.04	7.3
		18.7.88	220	120	0.30	0.9	NIL	0.9	1.4	1.0	0.7	NIL	1.6	NIL	NIL	8.0
		25.11.88	295	160	0.40	0.9	0.02	1.6	1.7	1.0	1.0	NIL	2.2	NIL	NIL	7.6

ANNEX 3
CONTRIBUTORY IRRIGATION WORKS-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations Mileq/lt				Anions Mileq/lt					Milg/lt	PH
						Na	K	Ca	Mg	Cl	SO4	CO3	HCO3	NO3	B	
1	Akrounda	2.3.88	860	520	0.93	1.5	0.02	1.9	8.7	1.5	0.9	0.4	9.3	-	0.07	8.3
		12.12.88	890	550	0.96	1.6	0.02	2.8	8.3	2.3	0.6	0.4	9.4	-	0.14	8.3
2	Kalo Khorio(Klirou)	9.5.88	305	160	0.37	1.1	-	1.6	1.7	1.0	1.0	-	2.4	-	-	7.7
		10.10.88	450	235	0.50	1.9	0.02	2.3	2.4	1.2	1.4	-	3.6	-	0.02	7.6
3	Kandou	3.3.88	520	270	0.66	2.0	0.05	3.1	2.2	2.4	0.5	-	4.3	0.1	0.04	7.3
			475	260	0.63	1.7	0.05	3.2	2.0	2.4	0.4	-	4.0	-	0.17	8.2
4	Lymbia	22.4.88	855	500	1.10	3.1	0.05	3.9	6.2	3.4	5.8	-	3.6	0.2	-	7.7
			995	520	1.30	5.2	0.08	4.7	3.7	2.0	8.7	-	2.0	-	0.40	7.7
5	Lythrodontas Upper	22.4.88	530	310	0.70	1.7	0.02	3.2	3.1	1.9	2.9	-	3.0	-	0.04	7.7
		5.8.88	665	375	0.90	2.4	0.02	3.2	4.3	2.2	4.5	-	3.3	-	0.05	7.7
6	Lythrodontas Lower	22.4.88	590	365	0.80	1.8	-	0.9	6.5	2.2	2.7	-	4.0	-	0.05	8.0
		5.8.88	680	360	0.86	3.0	0.03	2.1	5.0	2.7	3.0	-	2.7	-	0.12	7.5
7	Pakhyammos	26.1.88	535	280	0.71	2.1	0.08	2.6	-	2.3	1.6	-	3.8	-	0.04	7.9
8	Palekhori	9.5.88	260	140	0.30	0.7	-	1.5	1.3	0.6	0.7	-	2.1	0.2	0.01	7.7
		20.6.88	260	145	0.32	0.8	-	1.5	1.4	0.5	0.7	-	2.2	0.2	0.04	7.7
		10.10.88	300	165	0.38	0.8	0.02	1.7	1.6	0.6	0.8	-	2.7	-	0.05	7.6
		5.12.88	330	200	0.42	0.9	0.02	2.1	1.9	0.8	1.2	-	2.1	0.5	0.03	7.3
9	Pera Pedhi	29.2.88	270	165	0.32	0.3	-	0.7	2.6	0.4	0.2	-	3.1	-	-	7.8
		1.12.88	455	280	0.46	0.6	-	1.7	4.1	0.7	0.4	-	5.2	-	0.05	8.1
10	Petra Upper	5.2.88	730	360	0.86	3.0	0.02	3.2	4.0	2.8	1.7	-	6.0	0.03	0.04	7.8
11	Prodromos	19.7.88	135	110	0.20	0.2	-	0.3	2.0	0.3	-	1.0	1.0	-	-	8.9
12	Pyrgos	4.2.88	390	215	0.52	1.3	0.02	1.9	2.5	1.5	1.4	-	2.8	-	-	8.0
		6.9.88	660	360	0.82	2.3	0.05	3.2	4.1	2.4	2.4	-	4.8	0.06	0.02	7.2
		19.12.88	540	300	0.70	2.0	0.02	2.9	3.1	2.5	2.3	-	3.3	-	0.06	7.9
13	Khirokitia Pond	29.4.88	500	280	0.64	1.7	0.02	1.8	3.8	1.5	1.7	-	4.1	-	0.06	7.8
		3.8.88	445	220	0.56	2.1	0.05	1.4	3.0	1.9	1.5	-	3.1		0.15	8.0

ANNEX 4
CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations Mileq/lt				Anions Mileq/lt					Milg/lt	PH
						Na	K	Ca	Mg	Cl	SO4	CO3	HCO3	NO3	B	
1	Agros Dam	29.2.88	265	160	0.31	0.3	-	0.6	2.6	0.3	0.3	-	3.0	0.06	-	8.0
		2.12.88	195	100	0.22	0.9	0.02	0.7	1.3	0.5	0.7	0.4	1.3	-	0.01	8.4
2	Akapnou-Ephtagonia	29.2.88	445	265	0.59	1.0	-	2.4	2.9	1.1	2.1	-	3.0	0.24	-	8.1
		28.11.88	585	365	0.74	1.4	-	3.5	3.8	1.6	3.0	-	3.8	0.11	0.03	7.8
3	Arakapas Dam	31.3.88	435	260	0.50	0.9	-	1.6	3.7	0.9	0.7	-	4.4	0.03	-	8.2
		28.1.88	520	320	0.59	0.9	0.02	2.7	3.8	1.1	1.0	-	5.2	-	0.03	7.9
4	Arakapas I	29.2.88	440	240	0.53	1.1	-	2.3	2.5	1.0	0.9	-	4.0	0.14	-	8.2
		28.11.88	350	190	0.41	1.4	0.02	1.2	2.7	1.5	0.9	-	2.7	-	0.01	8.1
5	Ayii Vavatsinias Dam	12.4.88	390	230	0.47	1.0	-	2.2	2.4	1.0	1.0	-	3.4	0.03	0.05	7.5
		3.8.88	355	200	0.48	1.3	-	1.2	2.8	1.1	1.2	0.3	2.6	-	0.07	8.3
		9.12.88	515	300	0.67	1.5	0.02	3.2	2.8	1.3	1.8	-	4.2	-	0.04	7.5
6	Ayii Vavatsinias Pond I	12.4.88	360	215	0.51	1.5	0.02	1.1	3.2	1.4	2.0	0.3	1.7	-	0.04	8.3
		3.8.88	390	210	0.52	1.9	0.02	1.0	3.2	1.6	2.1	0.9	1.6	-	0.08	8.4
		9.12.88	470	265	0.60	1.6	0.02	2.3	3.0	1.4	2.2	-	3.3	-	0.04	7.9
7	Ephtagonia I	29.2.88	460	275	0.56	0.9	-	2.7	2.8	1.0	1.8	-	3.8	-	-	8.0
		28.11.88	345	210	0.47	1.0	-	1.3	3.0	1.2	1.5	-	2.4	-	0.04	8.1
8	Ephtagonia II	29.2.88	440	260	0.53	0.9	-	2.7	2.6	1.2	1.2	-	3.8	-	-	8.0
		28.11.88	300	180	0.41	1.0	-	1.0	2.7	1.2	1.1	0.4	1.9	-	0.03	8.4
9	Ephtagonia III	29.2.88	325	195	0.44	0.9	-	1.4	2.5	1.0	1.0	-	2.7	-	-	8.2
		28.11.88	265	155	0.38	1.0	-	0.7	2.4	1.2	1.1	-	1.5	-	0.05	8.7
10	Kato Mylos Pond	29.2.88	310	160	0.41	1.0	0.02	1.5	1.7	1.0	0.6	-	2.4	0.03	-	8.2
		2.12.88	260	140	0.34	1.4	-	1.3	1.5	1.0	1.1	-	1.6	-	0.05	8.0
11	Khandria Pond	29.2.88	175	90	0.20	0.8	-	0.9	0.9	0.5	0.4	-	1.5	-	-	7.3
		2.12.88	360	225	0.42	0.8	0.02	2.8	1.7	0.7	2.9	-	1.6	-	0.01	7.4
12	Kyperounda Pond I	29.2.88	245	130	0.30	0.6	-	1.4	1.2	0.7	0.3	-	2.3	0.1	-	8.0
		2.12.88	285	160	0.33	0.8	0.02	1.5	1.7	0.7	0.8	-	2.5	-	0.04	8.1
13	Kyperounda Pond II	29.2.88	520	280	0.68	2.1	0.05	0.3	5.4	2.3	0.2	1.0	4.4	0.03	0.39	8.4
		2.12.88	610	315	0.75	3.0	0.10	0.7	5.7	3.4	0.2	0.8	5.0	-	0.51	8.4
14	Lagoudhera Pond	26.2 88	215	120	0.28	0.6	-	1.3	1.0	0.7	0.5	-	1.8	0.03	-	7.8
		20.5.88	195	110	0.28	0.7	-	1.2	1.0	0.6	0.6	-	1.6	-	-	7.5
		18.7.88	195	100	0.26	0.9	-	1.0	1.0	0.7	0.6	-	1.5	-	-	7.9
		25.8.88	225	115	0.27	0.8	0.02	1.2	1.1	0.9	0.6	-	1.7	-	-	7.5
		25.11.88	260	150	0.34	0.9	-	1.5	1.6	0.8	1.1	-	1.9	-	-	8.0

ANNEX 4 (Cont.)
CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations Mileq/lt				Anions Mileq/lt					Milg/lt	PH
						Na	K	Ca	Mg	Cl	SO4	CO3	HCO3	NO3	B	
15	Malini Pond	3.8.88	375	210	0.48	1.4	-	0.7	2.7	1.2	1.5	0.5	2.2	0.24	0.06	8.3
		9.12.88	495	275	0.62	1.5	-	2.8	2.7	1.2	1.9	-	3.6	0.35	0.04	7.8
16	Agridhia Pond	29.2.88	330	195	0.39	0.6	-	1.1	2.8	0.7	0.5	-	3.3	0.10	-	8.0
		2.12.88	305	190	0.34	0.7	-	0.7	3.2	0.7	0.6	0.4	2.9	-	0.03	8.3
17	Pelendria Pond	29.2.88	275	145	0.34	0.9	-	1.3	1.6	0.8	0.6	0.5	2.1	0.10	-	8.4
		12.12.88	250	140	0.34	1.0	-	1.0	1.8	1.0	0.8	0.4	1.6	-	-	8.9
18	Ora Pond	11.4.88	400	220	0.46	1.2	-	2.0	2.4	1.0	1.0	-	3.5	-	0.04	7.9
		3.8.88	300	150	0.39	1.6	-	1.0	2.1	0.9	0.9	1.1	1.8	-	0.04	8.3
19	Pharmakas Pond 1	9.5.88	210	95	0.24	1.0	-	1.2	0.7	0.5	0.4	-	2.0	-	0.03	7.7
		20.6.88	185	80	0.25	1.0	-	0.7	0.7	0.5	0.4	-	1.6	-	0.09	7.1
		10.10.88	200	85	0.25	0.9	-	0.8	0.9	0.6	0.5	-	1.7	-	-	8.1
		5.12.88	205	95	0.28	0.8	-	1.3	0.7	0.3	0.4	-	2.0	-	0.12	8.1
20	Pharmakas Pond II	9.5.88	270	135	0.35	1.0	-	1.5	1.2	0.8	0.8	-	2.1	0.1	-	7.8
		20.6.88	240	125	0.32	1.0	-	1.2	1.3	0.6	0.8	-	1.8	0.1	0.04	8.2
		10.10.88	200	95	0.29	1.2	0.02	1.0	0.9	1.0	0.8	0.4	1.0	-	-	8.6
21	Arakapas Pond II	29.2.88	270	155	0.37	0.9	-	1.4	1.7	0.7	1.4	0.4	1.4	0.1	-	8.5
		28.11.88	385	225	0.50	1.1	-	2.5	2.1	1.1	1.4	-	2.9	-	0.05	7.6
22	Ayii Vavatsinias	11.4.88	375	210	0.44	1.1	-	1.8	2.4	1.1	0.8	-	3.3	-	-	7.7
	Pond II	3.8.88	330	180	0.41	1.3	-	1.2	2.4	1.0	0.7	0.1	2.5	-	0.07	8.3
23	Dhierona Pond	29.2.88	335	190	0.40	0.9	-	1.9	2.0	0.8	1.0	-	2.8	0.03	-	8.0
		28.2.88	260	145	0.35	1.1	-	1.0	1.9	1.0	1.0	0.4	1.5	-	0.04	8.6

DETAILS ON OPERATION AND MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

ARGAKA PROJECT

The Argaka Project consists of a rockfill type embankment dam with reservoir capacity at Spillway crest 0.990 MCM of water and a distribution system made of closed conduits commanding an area of 3,136 decars. The year of commencement of operation is 1968. During 1988 the main conveyor from Evretou to Argaka dam with branch to Argaka storage pond, was installed.

Project Operation

Project Management and Operation is carried out by the Waterworks Committee chaired by the Paphos District Officer. The operation team consists of a part time dam attendant, two watermen and one part time bill collector.

Project Hydrology

The project hydrologic data, as recorded during the year under review are shown on table X-15. The dam reservoir was filled up to the spillway crest on the 4th February and overflow continued until the 30th may 1988. The minimum quantity in storage ever occurred was on the 4th November 1988 with quantity in storage 80,000 m^3 of water.

Water Resources and System Efficiency

A quantity of 192,715m^3 was diverted to the dam reservoir from Evretou dam so that the water available reached the figure of 1.602 MCM. A quantity of 1.335 MCM of water was released from the dam reservoir out of which 1.244 MCM were used for irrigation and the rest 0.091 MCM were lost in the pipe system.

Water Utilization and Crops Irrigated

A quantity of 1.244 MCM of water was used for the irrigation of 2,119 decars of land planted with various crops as shown on Annex 1. Irrigation in the project area started mid January and continued throughout the year until the end of November 1988.

Water Quality.

Two samples of water taken from the dam reservoir were chemically analysed for the year under review as shown on Annex 2. From the results it can be seen that the project water was of good quality with only slightly high bicarbonate content.

Water Sale, Income and Expenditure

Out of 1.244 MCM of water utilized, a quantity of 419,144 m^3 were given free of charge because this quantity was utilized during the dam overflowing period, A quantity of 632,345 m^3 was sold to the farmers at 3.5 cent/m. The rest 192,715 m^3 were bought from Evretou Dam. The gross income from the sale of water amounted to £22,132. For the operation of the project an amount of £10,486 was paid to the dam attendant, water men and bill collectors. For the maintenance of the project an amount of £2,823 was spent. The net income to the project amounted to £8,823.

TABLE X-15

ARGAKA DAM-HYDROLOGY FOR 1988

STOR.CAPACITY 9*00000M3

MONTH	STORAGE BEG.OF MONTH m3	VOLUME CHANGE m3	EVAPOR-ATION m3	REL.FOR IRR. m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE -OVERFLOW m3	MEASURED SEEPAGE m3	TOTAL LOSSES m3	MEASURED INFLOW m3
JANUARY	239900	624600	1701	960	2929	627529	268	1969	650000
FEBRUARY	864500	125500	2920	1101	4521	130021	501	3421	1550000
MARCH	990000	0	5060	77072	82668	82668	536	5596	3400000
APRIL	990000	0	6231	112205	119034	119034	518	6749	7000000
MAY	990000	-10000	11905	127469	139910	129910	536	12441	2900000
JUNE	980000	-184000	15514	197031	213963	29963	518	16032	78000
JULY	796000	-273000	15610	244910	260046	-11944	536	16146	6000
AUGUST	523000	-275000	10014	230857	240682	-34318	311	10325	0
SEPTEMBER	248000	-143000	3873	208075	211948	68948	0	3873	0
OCTOBER	105000	-24900	2126	132939	135065	110165	0	2126	1100000
NOVEMBER	80100	38700	919	1540	2459	41159	0	919	45000
DECEMBER	118800	761200	504	0	504	761704	0	504	8000000
TOTALS		640100	76377	1334638	1414739	1421026	3724	80101	76190000
% TO STOR.CAPACITY			7.7	134.8	142.9	143.5	0.4	8.1	769.6

TABLE X-16 - ARGAKA DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold at nominal rates	632 345	22 132
2	Water given free of charge.....	419 144	Nil
3	Total quantity utilized and gross income	1 051 489	22 132
4	Purchase of water	192 715	See KIP
5	Operation cost	-	10 486
6	Maintenance cost	-	2 823
7	Total annual cost	-	13 309
8	Net Income	-	8 823

Maintenance Details

During the year under review the following maintenance works were carried out:

- Maintenance of the guardhouse
- Cleaning of embankment from wild vegetation
- Cleaning of Break Pressure Tank
- Repair of flow regulating valve.
- Replacement of sluice valves
- Painting of manhole metal covers
- Repair of water meters.

Project performance for the last two years

Table X-17 shows the data on operation of the project for the last two years and the change of the data over the previous year.

TABLE X-17 - ARGAKA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1987	1988	% Change on 1987
1	Capacity	MCM	0.990	0.990	Nil
2	Water available	"	1.366	1.581	+15.7
3	Water utilized for irrigation	"	1.222	1.244	+ 1.8
4	Water sold from Argaka dam	"	0.852	0.632	-25.8
5	Water given free	"	0.370	0.419	+13.2
6	Water sold from Evretou dam	"	--	193	See KIP
7	Gross income	£	29219	22132	-24.2
8	Cost of purchase of water	"	-	8672	-
9	Operation cost	"	9892	10486	+ 6.0
10	Power cost	"	2765	-	-
11	Maintenance cost	"	3737	2823	+24.4
12	Total expenses	"	16394	13309	-18.8
13	Net income	"	12825	8823	-31.2
14	Area irrigated	decars	2006	2119	+ 1.1

AYIA MARINA PROJECT

The Ayia Marina Project consist of an earthfill type embankment dam of capacity at spillway crest of 0.298 MCM and a distribution system made of closed conduits commanding an area of 2,010 decars. The project commenced its operation in 1968.

Project Operation.

The management and operation of the project is carried out by the Waterworks Committee chaired by the Paphos District Officer. The operation team consists of a part time dam attendant, a waterman and a part time bill collector.

Project Hydrology

The project hydrologic data as recorded during the year under review are shown on table X-21. The water reached the spillway crest on the 9th March and overflow continued until the 14th May 1988. The minimum quantity in storage at the end of the irrigation period was on the 26th October 1988 with quantity in storage 47,000 m^3 of water.

Water Resources and System Efficiency

A quantity of 289,834 m^3 of water was released for irrigation as shown on table X-18. The total quantity used for irrigation was 318,779 m^3. The difference is due to water meter discrepancies. It cannot be seen if there are any losses in the distribution system.

Water Utilization and Crops Irrigated

A quantity of 318,779 m^3 was used for irrigation of 372 decars of land planted with various crops as shown on annex 1. Irrigation in the project area started in January and continued throughout the year until December 1988.

Water Quality

Two samples taken from the dam reservoir were chemically analysed as shown on annex 2. From the result it can be seen that the project water is good with slightly high bicarbonate content.

Water Sale, Income and Expenditure

A quantity of 318,779 m^3 was sold to the farmers. Out of this quantity, 275,939 m^3 were sold at 3.5 cent/m^3 and the rest 42,840m^3 were sold at 0.5 cent/m^3 because this quantity was utilized during the overflowing period. The gross income from the sale of water amounted to £9,872. The expenditure amounted to £9,567 out of which £7,107 were spent for the operation of the project i.e. waterman and dam attendant wages. The rest £2,460 were spent for maintenance. The net income to the project amounted to £305.

TABLE X-10

AYIA MARINA DAM-HYDROLOGY FOR 1988

STOR.CAPACITY 298000 M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRR. m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE -OVERFLOW m3	TOTAL LOSSES m3	MEASURED SEEPAGE m3
JANUARY	68500	45000	480	2840	3925	49725	1085	605
FEBRUARY	114300	134300	696	2370	4431	138731	2061	1365
MARCH	248600	49400	1778	510	10211	59611	9701	7923
APRIL	298000	0	7216	24650	35160	35160	10510	8294
MAY	298000	-17000	4200	52260	65031	48031	12771	8571
JUNE	281000	-53000	5373	62260	72826	19826	10566	5193
JULY	228000	-56000	5495	55200	63589	7589	8389	2894
AUGUST	172000	-53000	3839	53020	58276	5276	5256	1417
SEPTEMBER	119000	-47000	2036	48820	51642	4642	2822	786
OCTOBER	72000	-23300	1003	32840	34206	10906	1366	363
NOVEMBER	48700	21700	443	3089	3895	25595	806	363
DECEMBER	70400	227600	711	3396	4487	232087	1091	380
TOT		229500	28270	341255	407679	637179	66424	38154
% TO STOR. CAPACITY			9.5	114.5	136.8	213.8	22.3	12.8

TABLE X-19 - AYIA MARINA DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold at nominal rates	275 939	9 658
2	Water sold at reduced rates	42 840	214
3	Total water sold and gross income .	318 779	9 872
4	Operation cost	-	7 107
5	Maintenance cost	-	2 460
6	Total cost	-	9 567
7	Net income	-	305

Maintenance Details

The amount of £2,460 was spent for the following works:

- Cleaning of embankment from wild vegetation
- Painting of metal works
- Cleaning of drainage ditch channels
- Maintenance of the guardhouse
- Replacement of sluice valves

Project performance for the last two years

Table X-20 shows the project operation data for the last two years and the percentage change of the year under review over the previous. An increase of 69.6% in the water available was observed. The water utilized and the area irrigated were increased by 3.2% and 5.7% respectively. The net income to the project was decreased due to the increase of the annual costs.

TABLE X-20 - AYIA MARINA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Description	Unit	1987	1988	% Change on 1987
1	Capacity	MCM	0.298	0.298	NIL
2	Water available	"	0.402	0.682	+69.6
3	Water utilized for irrigation	"	0.309	0.319	+ 3.2
4	Water sold at nominal rates...	"	0.268	0.276	+ 3.0
5	Water sold at reduced rates ..	"	0.041	0.043	+ 4.9
6	Gross income	"	9 361	9 872	+ 5.4
7	Operation cost	"	6 129	7 107	+16.0
8	Maintenance cost	"	1 534	2 460	+60.4
9	Total expenses	"	7 663	9 567	+24.8
10	Net income	"	1 698	305	-82.0
11	Area irrigated	decars	352	372	+ 5.7

POMOS PROJECT

The Pomos irrigation project consists of a rockfill type embankment dam with capacity at spillway crest of 0.860MCM of water and a distribution system made of a main canal and closed type distribution system commanding an area of 381 hectares. The year of the project commencement of operation is 1968.

Project Operation

The project management and operation is carried out by the Waterworks Committee chaired by the Paphos District Officer. The operation team consists of a part time dam attendant, two watermen and a part time bill collector.

Project Hydrology

The project hydrologic data as recorded during the year under review are shown on table X-21. The water reached the spillway crest on the 18th February and overflow continued until the 14th of May 1988. The minimum quantity ever remained in the reservoir during the irrigation period was recorded on the 26th October 1988 with quantity in storage 105,000 m^3 of water.

Water Resources and System Efficiency

A quantity of 0.797 MCM was released from the dam and 0.106 MCM were pumped from the boreholes in the project area. From the water released 0.674 MCM were used and the rest 0.123 MCM were lost in the pipe system. The system efficiency is of the order of 75%.

Water Utilization and Crops Irrigated

A total quantity of 879,975 m^3 was used for irrigation of 147 hectares of land planted with various crops as shown on annex 1. Irrigation in the project area started in April and continued throughout the year until December 1988.

Water Quality

Three samples of water, taken from the dam reservoir were chemically analysed. The results of the analyses are shown on annex 2. The project water seems to be good with slightly high bicarbonate content.

Water Sale, Income and Expenditure

A quantity of 879,975m^3 was sold to the farmers. Out of the quantity, 783,300m^3 were sold at 3.5 cent/m^3 and the rest 96,675m^3 were sold at 0.5 cent/m^3 because this quantity was used during the dam overflowing period. The gross income from the sale of water amounted to £24,309. The total annual expenses amounted to £18,964. Out of this amount £14,953 are operation expenses, including dam attendant and watermen wages, £1,646 are power expenses and the rest £2,365 were spent for routine maintenance on the dam and the distribution system. The net income to the project amounted to £5,345.

TABLE X-21

POMOS DAM-HYDROLOGY FOR 1988

STOR. CAPACITY 860000M3

MONTH	STORAGE BEG.OF MONTH m3	VOLUME CHANGE m3	EVAPOR-ATION m3	REL.FOR IRR. m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE -OVERFLOW m3	TOTAL LOSSES m3	MEASURED SEEPAGE m3	MEASURED INFLOW m3
JANUARY	2000	385900	616	0	6223	392123	6223	5607	4570000
FEBRUARY	387900	472100	2184	0	17200	489300	17200	15016	15400000
MARCH	860000	0	4541	0	23825	23825	23825	19284	3220000
APRIL	860000	0	5592	47324	71578	71578	24254	18662	677000
MAY	860000	-31000	10607	114232	143346	112346	29114	18507	2040000
JUNE	829000	-134000	13619	133424	163390	29390	29966	16347	520000
JULY	695000	-194000	13926	146971	175058	-18942	28087	14161	20000
AUGUST	501000	-181000	9145	138279	160617	-20383	22338	13193	0
SEPTEMBER	320000	-149600	4978	127342	140991	-8609	13649	9271	0
OCTOBER	170400	-52200	2166	69549	79154	26954	9605	7439	300000
NOVEMBER	118200	150000	1136	13146	22386	172386	9240	8104	2000000
DECEMBER	268200	591800	2035	6560	22357	614357	15997	13962	6200000
TOT		858000	69945	796827	1026325	1884325	229498	159553	70020000
% TO STOR.CAPACITY			8.1	92.7	119.3	219.1	26.7	18.6	814.2

TABLE X-22 - POMOS DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m^3	Amount £
1	Water sold at nominal rates	783 300	23 826
2	Water sold at reduced rates	96 675	483
3	Total quantity sold and gross income	879 975	24 309
4	Operation cost	-	14 953
5	Power cost	-	1 646
6	Maintenance cost	-	2 365
7	Total costs	-	18 964
8	Net income	-	5 345

Maintenance Details

The amount of £2,365 was spent for the following works on the dam and the distribution system.

- Cleaning of embankment from wild vegetation
- Maintenance of the guardhouse
- Painting of metal work and wood work
- Cleaning of drainage ditch channels
- Repairs to pipe breakages and canal joints
- Replacement of sluice valves.

Project Performance for the last two years

Table X-23 shows data regarding hydrology and operation for the last two years and the percentage change of the 1988 figures over the previous year.

TABLE X-23 - POMOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Description	Unit	1987	1988	% Change on 1987
1	Capacity	MCM	0.860	0.860	NIL
2	Water available	"	1.063	1.819	+71.1
3	Water utilized for irrigation	"	0.814	0.880	+ 8.1
4	Water sold at nominal rates...	"	0.674	0.783	+16.2
5	Water sold at reduced rates ..	"	0.140	0.097	-30.7
6	Gross income	£	23 740	24 309	+ 2.4
7	Operation cost	"	12 691	14 953	+17.8
8	Power cost	"	1 754	1 646	- 6.2
9	Maintenance cost	"	3 225	2 365	-26.7
10	Total cost	"	17 670	18 964	+ 7.3
11	Net income	"	6 070	5 345	-11.9
12	Area irrigated .....Hectares		140	147	+ 5.0

KHRYSOKHOU IRRIGATION PROJECT

The purpose of the Khrysokhou Irrigation Project is the development of the surface and ground water resources of the Polis tis Khrysokhou region. The areas to be irrigated 3,100 ha extend along the coastal belt from Neokhorio to Pomos and plains of the adjacent rivers.

The project consists of the following main elements:

- Evretou dam with rockfill type embankment and reservoir capacity 24.0 MCM at spillway crest.
- Eight storage ponds
- Magounda, Yialia and Livadhi diversion intake structures
- Main conveyance pipeline which includes the main conveyor from Evretou dam to Pomos with branches to the storage ponds, to the three existing small dam reservoirs of Pomos, Ayia Marina and Argaka-Magounda and to the three diversion intakes.
- Piped irrigation networks and farm access roads to cover the new areas to be irrigated of about 2000 hectares net.
- Groundwater development which includes the present ground water development of the existing boreholes in the Khrysokhou river as well as eight new boreholes in the area between Khrysokhou and Prodromi villages.

The civil works of phase I which includes Construction of Euretou dam, installation of main conveyor extending form dam up to Magounda diversion, four storage ponds and installation of the distribution system, were completed in 1988.

Project Operation

The project management and operation is the responsibility of the Water Development Department. The staff in charge for the project Operation and Maintenance for the year 1988 was the following:

1 Executive Engineer I (part time)
1 dam attendant
4 watermen
5 technicians
1 foreman
5 labourers
1 storekeeper
1 driver

Project Hydrology

The project hydrologic data as recorded during the year under review are shown on table X-24. The maximum quantity in storage was recorded on the 4th May 1988 with quantity 19.607 MCM. The minimum quantity in storage at the end of the irrigation period occurred on the 15th December 1988 with quantity in storage 15.079 MCM of water.

TABLE X-24

LYRETOU DAM-HYDROLOGY FOR 1988

STOR.CAPACITY 24000000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. m3	D.W.S. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3	MEASURED INFLOW m3
JANUARY	83640000	1180000	14756	510	0	0	510	15266	1195266	14000000
FEBRUARY	95440000	2816000	20056	170	0	0	170	20225	2836225	30000000
MARCH	123600000	6844000	43922	220	0	0	220	44142	6888142	75000000
APRIL	192044000	371000	76280	1670	0	0	1670	77950	448950	12000000
MAY	195750000	-3030000	157641	838628	0	0	838628	247269	-55731	4000000
JUNE	192720000	-829000	215602	372802	0	0	372802	588404	-240596	660000
JULY	184430000	-991000	243365	496217	0	0	496217	739582	-251418	20000
AUGUST	174520000	-784000	220693	396660	0	0	396660	617353	-166647	60000
SEPTEMBER	166680000	-798000	143116	357631	0	0	357631	500747	-297253	50000
OCTOBER	158700000	-488000	86424	2420889	0	0	2420889	328513	-159487	
NOVEMBER	153820000	-1360000	34655	8250	0	0	8250	42905	-153095	
DECEMBER	151960000	-1389000	28913	440	0	0	4354440	4383353	2994353	43540000
TOTALS		5433000	1285422	1966287	0	0	6390287	7605709	13038709	179330000
% TO MAX STOR.			6.6	10.0			32.2	38.8	66.5	
% TO STOR.CAPACITY			5.4	8.2			26.3	31.7	54.3	

Water Resources and System Efficiency

A total quantity of 1.966 MCM was released for irrigation form Evretou dam. Apart from this quantity small quantities were pumped from Khrysokhou boreholes and private boreholes. From the water released a quantity of 1.680 MCM was used and the rest 0.286 MCM were lost in the distribution system. The system efficiency is 85%.

Water Utilization and Crops Irrigated

Out of 1.680 MCM of water used, 1.463 MCM were used for irrigation of 407.8 Ha of land planted with various crops as shown on annex 1. Irrigation in existing Khrysokhou Valley area, areas of Irrigation Associations and new areas started in January and continued throughout the year until December 1988.
A quantity of 0.193 MCM was used to supplement irrigation in Argaka existing irrigation area. The rest 23,456 m^3 of water was used for industrial purposes.

Water Quality

A sample of water taken from the dam reservoir was chemically analysed as shown on annex 2. From the results of the analysis it can be seen that the project water is of good quality.

Water Sale, Income and Expenditure

A quantity of 1.680MCM was sold at nominal rates. Out of this quantity 0.555 MCM were sold at 4.5 cent/m^3 to Irrigation Associations and in bulk to Argaka dam, 1.102 MCM were sold at 4.5 cent/m^3 to new areas and the rest 23,456 m^3 were sold at 13 cent/m^3 to Industries. the gross income from the sale of 1.680 MCM of water amounted to £77,577. The operation maintenance and power costs amounted to £63,967. The net income to the project was £13,610.

TABLE X-25 - KHRYSOKHOU PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold to new areas	1 101 626	49 582
2	Water sold to Irrigation Associations	361 630	16 274
3	Water sold to Argaka	192 715	8 672
4	Water sold to industries	23 456	3 049
5	Total quantity sold and gross income	1 679 627	77 577
6	Operation cost	-	18 136
7	Maintenance cost	-	44 583
8	Power cost	-	1 248
9	Total costs	-	63 967
10	Net income	-	13 610

Maintenance Details

The maintenance works carried out during the year 1988 were the following.

- Replacement of flow limiting devices
- Repairs of pipelines and hydrants
- Cleaning and repair of water meters
- Cleaning of filters
- Cleaning of drainage ditch channels
- Cleaning of existing storage tanks in Khrysokhou Valley area
- Construction of access roads and drainage ditch channels.

PAPHOS PROJECT

The aim of the Paphos Project is to irrigate about 5,110 hectares of net irrigable area lying in the south-western coastal plain of Cyprus in both sides of the town of Paphos. The water requirements for the irrigation of this area are estimated to be 32 MCM/year.

The project water resources are the following:

- Asprokremmos dam of earthfill type embankment with capacity at spillway crest 52.375 MCM of water.
- A wellfield of 24 boreholes in Dhiarizos, Xeropotamos and Ezousa river beds and surface flow Diversions in Dhiarizos and Ezousa river is capable to supply 10 MCM.
- Mavrokolymbos dam of earthfill type embankment with capacity 2.180 MCM of water.

The conveyance of the water to the irrigation sectors is done through the following routes:

- The wellfield conveyance system collecting the water extracted from boreholes or surface flow and supplying the main canal.
- The main canal extending from Asprokremmos dam to Yeroskipos fed by the dam and the river aquifers.
- The western main pipe conveyor originating from the main pumping station of the end of the main canal and from there the water is conveyed by a gravity pipeline to Ayios Yeorgios.

Pressurisation of the water supplied by the main canal and the pipe conveyors is achieved by 14 automatic pumping stations and distribution of pressurised water is ensured by branched pipeline systems.

The project commenced operation in 1980 with water pumped from the 24 boreholes. The project was fully completed in 1983 and operates on the "on demand" mode.

TABLE X-26

ASPROKREMMOS DAM-HYDROLOGY FOR 1988

STOR.CAPACITY 52375000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. POWER ST. m3	OVER-FLOW m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3	MEASURED SEEPAGE m3	TOTAL LOSSES m3
JANUARY	36290000	6093000	96223	0	0	0	0	102945	6195945	6722	102945
FEBRUARY	42383000	9538000	109829	0	0	200600	200600	317842	9855842	7413	117242
MARCH	51921000	454000	169696	5296041	23351995	745459	6041500	29572358	30026358	9167	178863
APRIL	52375000	-93000	255074	2411810	238210	828490	3240300	3742397	3649397	8813	263887
MAY	52282000	-388000	409217	861273	0	21427	882700	1381205	993205	9288	498505
JUNE	51894000	-1321000	555579	1019000	0	0	1019000	1585336	264336	10757	566336
JULY	50573000	-2433000	613333	2095400	0	0	2095400	2721857	282857	13124	626457
AUGUST	48134000	-2778000	522887	2272339	0	36461	2308800	2844260	66260	12573	535460
SEPTEMBER	45356000	-2343000	389392	1735870	0	61430	1797300	2198442	-144558	11750	401142
OCTOBER	43013000	-1099000	256931	768360	0	45440	813800	1081557	-17443	10826	267757
NOVEMBER	41914000	-183000	129805	264400	0	26700	291100	430755	247755	9850	139655
DECEMBER	41731000	6569000	127328	159887	0	25313	185200	322861	6891861	10333	137661
TOTALS		12010000	3715294	16804380	23590205	1991320	18875700	46301815	58311815	120616	3835910
% TO STOR. CAPACITY			7.1	32.2	45.0	3.8	36.0	88.4	111.3	0.2	7.3

TABLE X-27
MAVROKOLYMBOS DAM-HYDROLOGY FOR 1988 STOR.CAPACITY 2180000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGATION m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3
JANUARY	227600	122400	1634	17500	19134	141534
FEBRUARY	350000	440000	2802	45500	48302	488302
MARCH	790000	1054000	9109	0	9109	1063109
APRIL	1844000	304000	15823	26000	41823	345823
MAY	2148000	-133000	26819	172800	199619	66619
JUNE	2015000	-240000	32863	276120	308983	68983
JULY	1775000	-410000	35736	431000	466736	56736
AUGUST	1365000	-381000	24928	388400	413328	32328
SEPTEMBER	984000	-398000	14003	406500	420503	22503
OCTOBER	586000	-151000	6614	175700	182314	31314
NOVEMBER	435000	2000	3360	30800	34160	36160
DECEMBER	437000	303000	2809	20000	22809	325809
TOTALS		512400	176500	1990320	2166820	2679220
% TO STOR.CAPACITY			8.1	91.3	99.4	122.9

Project Operation

The project management and operation is carried out by the Department of Water Development. The following staff was in charge for the project operation and maintenance:

1	Executive Engineer I
1	Mechanical Engineer I (part time)
3	Technicians I
5	Technicians II
1	Assistant Chief Foreman
5	Formen
11	Watermen
2	Electricians
2	Mechanics
1	Storekeeper
8	Drivers

Hydrology of dams

The project hydrologic data are shown on tables X-26 and X-27. The water in the Asprokremmos dam reached the spillway crest on the 2nd March and overflow continued until the 2nd of April 1988, for the first time since its construction. The minimum quantity in storage was recorded on 6th December 1988 with quantity 41.670 MCM of water.

The maximum quantity in storage in Mavrokolymbos dam was on the 19th April and the minimum on the 29th October 1988 with quantities 2.180 MCM and 0.431 MCM respectively.

Water Resources system Efficiency

The total water given for irrigation in project area amounted to 18.362 MCM. Out of this a small quantity of 0.900 MCM was pumped from private boreholes. The remaining 17.462 MCM were delivered from headworks. From the quantity delivered for irrigation only 14.274 MCM were used for irrigation and the rest 3.188 MCM were lost in the canal and pipe system. The system efficiency is 82%.

TABLE X-28
PAPHOS PROJECT - WATER RESOURCES

Item No.	Description	Quantity m^3
1	Water released for Irrigation and power station	16 884 380
2	Water released for recharge	1 991 320
3	Water given to Mavrokolymbos dam	1 114 000
4	Total water released from Asprokremmos dam	18 875 700
5	Water given for irrigation from Asprokremmos dam	10 957 688
6	Dhiarizos and Ezousa boreholes	1 035 009
7	Dhiarizos and Ezousa surface flow	3 479 403
8	Release from Mavrokolymbos dam	1 990 320
9	Total water delivered from Headworks	17 462 420
10	Water pumped from private boreholes	900 000
11	Total water given for irrigation	18 362 420

Water Utilization and Crops Irrigated

A total quantity of 16.295 MCM was utilized during the year under review. Out of this a quantity of 2.021 MCM was given for recharge and then used for Paphos Domestic Water Supply. Out of the remaining 14.274 MCM, a small quantity of 0.061 MCM was utilized for industrial purposes and the rest quantity 14.213 MCM was utilized for irrigation. Apart from the water used for irrigation from project resources an additional quantity of 0,900 MCM was used from private boreholes as shown on table X-28.

Irrigation in the project area started in January and continued all over the year under review. A total of 14.483 MCM of water was used for the irrigation of 3676 hectares of land planted with various crops as shown on annex 1.

Water Quality

One sample taken from each of the dams reservoirs was chemically analysed, as shown on annex 2. The water from the dams reservoirs is of good quality with slightly high bicarbonates.

Water Sale, Income and Expenditure

A total quantity of 14.274 MCM of water was sold at nominal rates. Out of this quantity 12.372 MCM were sold at 5 cent/m^3, 1,841 MCM was sold to Mavrokolymbos area at 4.5 cent/m^3 and the rest 0.061 MCM were sold at 9 and 13 cent/m^3 to the industries. A quantity of 0.209 MCM was given free of charge to Potima Chiflik. The total income from the sale of water amounted to £709 277. The total expenses on operation, maintenace and power amounted to £436,364. The net income was of the order of £272,913.

TABLE X-29
PAPHOS PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold at nominal rates	12 372 085	618 604
2	Water sold at reduced rates	1 840 566	82 825
3	Water sold at increased rates ...	61 079	7 848
4	Total water sold and gross income	14 273 730	709 277
5	Water given free of charge to Potima	209 484	Nil
6	Total water	14 483 214	709 277
7	Operation cost	--	67 618
8	Maintenance cost	--	251 991
9	Power cost	--	116 755
10	Total costs	--	436 364
11	Net Income	--	272 913

Operation of Power Station

The hydroelectric power station was set in operation in February 1988. The Station generated 1.237 million KWH of electricity during the period February-December 1988 and sold to the system of the Electricity Authority of Cyprus at the cost of £6,558.

Maintenance Details

The following maintenance works were carried out during the year under reviews:

- Cleaning of storage and regulating tanks.
- Cleaning of main canal, Canaletti and Mavrokolymbos canal.
- Cleaning of pumping stations.
- Maintenance of hydraulic equipment.
- Painting of pumping stations.
- Improvements to project warehouses.
- Repairs to pipe breakages.
- Installation of five control valves in Koloni Pumping Station.
- Improvement of recharge area downstream Asprokremmos dam structure.

Asprokremmos dam

- Planting of 562 nos forest trees
- Painting of metalwork and woodwork
- Maintenance and painting of the guardhouse.
- Cleaning of embankment from wild vegetation.

Mavrokolymbos dam

- Maintenance and painting of the guardhouse.
- Painting of metal work and woodwork.
- Cleaning of embankment from wild vegetation.

Project Performance for the last two years

The project operation for the last two years are shown on table X-30. The water available was increased due to high rainfall. The water used during 1988 was decreased compared to the water used during 1987 and the area irrigated was decreased too.

TABLE X-30

PAPHOS PROJECT - DATA ON OPERATION FOR THE LAST TWO YEARS

Item No.	Description	Unit	1987	1988	% change on 1987
1	Storage capacity	MCM	54.555	54.555	Nil
2	Yield	"	32.000	32.000	Nil
3	Water available	"	59.305	77.147	+30.1
4	Water sold	"	15.783	14.274	-9.6
5	Water given free	"	0.178	0.209	+17.4
6	Water used for recharge .	"	1.761	2.021	+14.8
7	Total water used	"	17.722	16.504	-6.9
8	Gross Income	£	736 568	709 247	-3.7
9	Operation cost	£	59 965	67 618	+12.8
10	Maintenance cost	£	240 658	251 991	+4.7
11	Total costs	£	487 543	436 364	+10.5
12	Net income	£	249 025	272 913	+9.6
13	Area irrigated .....hectares		3 925	3 676	-6.3

SOUTHERN CONVEYOR PROJECT

The purpose of the Southern Conveyor Project is to collect and store surplus water from south catchments and convey it Eastwards to areas of demand for both domestic water supply and irrigation.

The main SCP objectives at full development of the project would be:

- To secure a safe domestic water supply up to the year 2010 for the towns of Limassol, Larnaca, Famagusta and Nicosia.
- To provide irrigation water in order to maintain present agricultural production in Kokkinokhoria and to expand irrigated agriculture in four other areas along the southern coast of the Island.

It was decided to implement the project in two phases because of its large size and high financial cost. Phase I includes the following:

- Kouris dam of zoned earthfill embankment construction and capacity 115 MCM. Civil works commenced in 1984 and were completed by the end of 1988.

- Main conveyor which is 110 km long pipeline of diameters ranging from 1400 mm down to 800 mm conveys the stored water to Akhna reservoir. A branch off is allowed for recharge Yermasoyia river bed boreholes downstream of Yermasoyia dam. A second branch-off supplements Vasilikos-Pendaskinos Project through a balancing reservoir. Installation works started in 1986 and were completed in 1988.
- Akhna Reservoir, an earthfill embankment dam of capacity 5.8 MCM , which provides balancing storage in the Kokkinokhoria area. Construction works started in 1986 and were completed by the end of 1987.
- Kokkinokhoria irrigation network which consists of four balancing reservoirs, fifteen central distribution points, main conveyors, secondary and tertiary systems. The area to be irrigated is 9000 ha. The laying of the main conveyors was completed in 1987 and the other construction works will be completed in 1990.

Phase II includes the following:

- Dhiarizos Diversion, conveying water from Dhiarizos river to Kouris Dam through 16 km long pipeline and tunnel.
- Irrigation distribution networks for four irrigation areas totalling some 4300 ha., Akrotiri 1755 ha, Parekklisha 320 ha, Mazotos 660 ha and Kiti 1600 ha. This component will include all connecting and distribution pipes and regulating tanks between the SCP main conveyor and hydrants at farm level.
- Domestic water supply works.

  -For Limassol: Untreated water main from Southern Conveyor to treatment plant and conveyors from treatment plant to service reservoirs.
  -For Nicosia and Larnaca: Untreated water from southern conveyor to Tersefanou treatment plant and main conveyor from Tersefanou to Nicosia service reservoir at Lakatamia including pumping stations and balancing reservoirs.
  -Larnaca storage tank.
  -Two rural water supply schemes.

The second phase of the SCP will be constructed over a five year period 1988-1992.

TABLE X-31

KOURIS DAM-HYDROLOGY FOR 1988

STOR.CAPACITY 115000000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIG. m3	REL.FOR RECHARGE m3	REL.TO AKHNA DAM m3	REL.TO KITI DAM	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3	MEASURED SEEPAGE m3	MEASURED INFLOW m3
JAN	7955000	6273000	22461	0	0	0	0	0	66525	6339525	44064	6850000
FEB	14228000	8260000	34164	0	201510	36000	0	237510	315738	8575738	44064	8650000
MAR	22488000	28967000	118120	200000	1402200	1136700	664500	3403400	3565584	32532584	44064	30700000
APR	51455000	503000	161941	394845	1700000	2106000	2283800	6484645	6690650	7193650	44064	9600000
MAY	51958000	485000	289272	350775	1300000	0	503500	2154275	2487611	2972611	44064	3690000
JUN	52443000	95000	344282	269220	368920	0	0	638140	1026486	1121486	44064	1830000
JUL	52538000	-1387000	396812	257392	686110	0	0	943510	1384386	-2614	44064	538000
AUG	51151000	-2513000	373744	160366	1819890	0	65000	2045256	2463064	-49936	44064	690000
SEP	48638000	-3784000	244599	1447000	1982880	0	0	3429880	3718543	-65457	44064	165000
OCT	44854000	-3510000	149648	1095808	182192	0	0	1278000	1421712	1070712	44064	1100000
NOV	44503000	1309000	74490	147000	0	60000	0	207000	323221	1632221	41731	1700000
DEC	45812000	4428000	57536	68000	0	1100000	0	1168000	1271069	5699069	45533	5700000
TOTALS		42285000	2267069	4390406	9593710	4438700	3516800	21939616	24734589	67945530	527904	71213000
% TO MAX. STORAGE			4.3	8.3	18.2	8.4	6.7	41.7	47.0	129.2	1.0	135.4
% TO STOR.CAPACITY			2.0	3.8	8.3	3.9	3.1	19.1	21.5	59.1	0.5	61.9

× Estimated quantity

Project Operation

The project management and operation is carried out by the Water Development Department. The staff in charge for the operation was the following:

1	Technical Superintendent
2	Technicians I
2	Technicians II
10	Attendants
1	Foreman

Project Hydrology

The Kouris dam was closed on the 5th November 1987 and up to the end of December 1987 the total quantity in storage was of the order of 7.820 MCM. In 1988 the maximum quantity in storage occurred on the 24th June with quantity 52.595 MCM of water. The minimum quantity was recorded on the 24th October 1988 with quantity in storage 44.095 MCM. The measured inflow was 71.213 MCM.

Water Utilization

A total quantity of 21.940 MCM was released from Kouris dam out of which 10.424 MCM were given for recharge in Akrotiri, Mazotos, Alaminos and Kokkinokhoria areas. From the remaining 11.516 MCM 4.439 MCM were released for storage to Akhna reservoir, 3.517 MCM were released for storage and recharge to Kiti dam. From the rest 3.560 MCM 3.541 MCM were released for irrigation in Kiti, Mazotos, Limassol and Kokkinokhoria areas and 0.019 MCM used by the contractor in Mazotos, Alaminos and Kokkinokhoria areas. See table X-32.

TABLE X-32

SOUTHERN CONVEYOR PROJECT-WATER UTILIZATION

Item No.	Description	Quantity m^3
1	Water used for recharge	10 424 213
2	Water stored in Akhna reservoir	4 438 700
3	Water stored in Kiti dam	3 516 800
4	Water used for irrigation	3 540 613
5	Water used by the contractor	19 290
	Total water used	21 936 616

Water Quality

Two samples were taken from the dam reservoir and were chemically analysed. The results are shown on annex 2. The project water is of good quality with slightly high bicarbonates.

Water Sale Income and Expenditure

A total quantity of 3,540,613 m^3 was released for irrigation out of which 3,378,073 m^3 were sold at 8 cent/m^3 to Kiti-Mazotos, Limassol and Kokkinokhoria areas and 63,600 m^3 were sold to Kiti dam area at 7 cent/m^3. The rest 98,940 m^3 were lost in the canals of Kiti dam distribution system. The gross income from the sale

of 3,441,673 m^3 of water amounted to £274,550. The operation expenses representing waterman wages and purchasing of materials amounted to £34,070. The maintenance costs were covered by the constructional costs. The net income to the project amounted to £240,480.

TABLE X-33
SOUTHERN CONVEYOR PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No	Description	Quantity m^3	Amount £
1	Water sold to Limassol area	1 848	148
2	Water sold to Kiti, Mazotos area	250 563	20 045
3	Water sold to Kiti dam area	63 600	4 452
4	Water sold to Kokkinokhoria area	3 125 662	250 053
5	Total water sold and gross income	3 441 673	274 550
6	Operation costs	--	34 070
7	Maintenance costs	--	Nil
8	Net Income	--	240 480

YERMASOYIA - POLEMIDHIA PROJECT

The Yermasoyia-Polemidhia project consists of two earthfill type embankment dams, the Yermasoyia dam with capacity 13.5 MCM and the Polemidhia dam with capacity 3.43 MCM and a distribution system made of closed conduits commanding an area of 2066 hectares in the Zakaki, Phasouri, Akrounda and Phinikaria, Ypsonas, Trakhoni and Kolossi areas and Yermasoyia and Polemidhia Irrigation Divisions. The project started Operation since the year 1968. To supplement the area with water the Kouris and Garylis boreholes were developed during the years 1983 and 1986 respectively.

Project Operation

The project management and operation is carried out by the Waterworks Committee chaired the Limassol District Officer. The Operation and Maintenance of the project is carried out by the following staff.

Operation

1 Manager
12 Watermen/attendants
3 Clerks

Maintenance

1 Senior Technician
1 Technician II
2 Foremen
1 Driver
6 Labourers

TABLE X-34

YERMASOYIA DAM-HYDROLOGY FOR 1980

STOR.CAPACITY 13500000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. m3	REL.FOR D.W.S. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE -OVERFLOW m3	MEASURED INFLOW m3
JANUARY	7341000	2395000	20023	69330	266290	279490	615110	635133	3030133	3020000
FEBRUARY	9736000	2303000	34707	57700	239220	416390	713310	748017	3051017	3580000
MARCH	12039000	1461000	64415	10710	180110	84940	275760	340175	1801175	13100000
APRIL	13500000	0	87212	312370	241680	516890	1070940	1158152	1158152	2950000
MAY	13500000	-396000	184426	744490	245590	0	990080	1174506	838506	1270000
JUNE	13164000	-848000	209224	892100	256980	0	1149080	1358304	510304	573000
JULY	12316000	-1483000	232947	810150	260450	346720	1433320	1666267	183267	180000
AUGUST	10833000	-1650000	173405	597080	253050	765830	1615960	1789365	139365	282000
SEPTEMBER	9183000	-1647000	111459	536020	262990	646340	1446150	1557609	-89391	73000
OCTOBER	7536000	-964000	59057	343770	225000	510780	1079550	1138607	174607	180000
NOVEMBER	6572000	-265000	28839	19610	233080	452540	705230	734069	469069	500000
DECEMBER	6307000	1113000	20421	17480	222260	513000	752740	773161	1886161	200000
TOTALS		79000	1226135	4419610	2894700	4532920	11847230	13073365	13152365	25908000
% TO STOR.CAPACITY			9.1	32.7	21.4	33.6	87.8	96.8	97.4	191.9

TABLE X-35

POLEMIDHIA DAM -HYDROLOGY FOR 1988

STOR.CAPACITY 3400000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE -OVERFLOW m3	MEASURED SEEPAGE m3	TOTAL LOSSES m3	MEASURED INFLOW m3
JANUARY	1326000	656000	5816	0	0	0	62590	718590	56782	62590	920000
FEBRUARY	1982000	566000	7983	0	0	0	109633	675633	101650	109633	100000
MARCH	2548000	852000	21327	0	0	0	172917	1024917	151590	172917	3400000
APRIL	3400000	0	25200	0	0	0	171907	171907	146707	171907	880000
MAY	3400000	-170000	44025	5889	0	5889	222399	52399	172485	216510	230000
JUNE	3230000	-289000	49506	105306	0	105306	321737	32737	166925	216431	94000
JULY	2941000	-365000	53538	193792	0	193792	361966	-3034	114636	168174	43000
AUGUST	2576000	-444000	46645	367988	0	367988	503288	59288	88655	135300	29000
SEPTEMBER	2132000	-360000	28262	358329	0	358329	453724	93724	67133	95395	26000
OCTOBER	1772000	-130000	16088	74397	0	74397	146196	16196	55711	71799	60000 *
NOVEMBER	1642000	-41000	7681	42335	0	42335	96413	55413	46397	54078	50000 *
DECEMBER	1601000	141000	5073	110396	0	110396	158323	299323	42854	47927	300000 *
TOTALS		416000	311144	1258432	0	1258432	2781101	3197101	1211525	1522669	6132000
% TO STOR.CAPACITY			9.2	37.0		37.0	81.8	94.0	35.6	44.8	180.4

* Estimated inflow

Project Hydrology

The Project hydrologic data as recorded during the year under review are shown on tables X-34 and X-35. Overflow occurred for Yermasoyia dam during the period March 6th to may 14th and for Polemidhia March 11th to May 2nd. The minimum quantity in storage ever occurred during the irrigation period was recorded for Yermasoyia dam on the 16th December and for Polemidhia dam on the 14th December 1988.

Water Resources and System Efficiency

A total quantity of 15.230 MCM was developed from the project as shown on table X-36. Out of this quantity, 13.896 MCM were used and the rest 1.334 MCM were lost in the pipe system or as watermeter discrepancies. The system efficiency is 79% taken into consideration the water released and the water used for irrigation from both dams.

TABLE X-36

YERMASOYIA - POLEMIDHIA PROJECT - WATER RESOURCES

Item No.	Source	Quantity m^3
1	Yermasoyia dam	11 847 230
2	Polemidhia dam	1 258 432
3	Garillis boreholes	131 490
4	Overflow from Yermasoyia	1 403 108
5	Overflow and leakage from Polemidhia	589 957
	Total quantity developed	15 230 217

Water Utilization and Crops Irrigated

A total quantity of 13,896 MCM was used as shown on table X-37. Out of this, 5.817 were used for recharge of Yermasoyia aquifer (then pumped for DWS) and Kouris and West Limassol aquifers, 2.894 MCM were diverted to Khirokitia Treatment Plant for DWS and the rest 5.185 MCM were used for irrigation of 2066 Hectars of land planted with various crops as shown on Annex 1.

TABLE X-37

YERMASOYIA-POLEMIDHIA PROJECT - WATER UTILIZATION

Item No	Description	Quantity m^3
1	Water used for irrigation	5 184 670
2	Water used for recharge	5 817 127
3	Water used for D.W.S	2 894 700
	Total water used	13 896 497

Water Quality

Two samples of water from each dam reservoir were chemically analysed as shown on annex 2. The project water is considered to be of good quality with only high bicarbonates.

Water Sale, Income and Expenditure

From the quantity of 5.185 MCM of water used for irrigation 0.733 MCM were given free of charge to Yermasoyia and Polemidhia Irrigation Divisions, 0.119 MCM were also given free of charge as overflow and the rest 4.333 MCM were sold to the farmers at the nominal rates 4.0 cent/m^3 to the farmers and 3.5 cent/m^3 to I/Ds.From the sale of water an amount of £163,974 was received. The operation maintenance and power expenses amounted to £131,143. The net income to the project was £32,831 as shown on table X-38 below.

TABLE X-38
YERMASOYIA - POLEMIDHIA PROJECT - WATER SALE INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold at the nominal rates	4 332 573	163 974
2	Water given free of charge as overflow	118 901	Nil
3	Water given free of charge as water rights to:		
	- Yermasoyia Irrig. Division	490 289	Nil
	- Polemidhia Irrig. Division	242 907	Nil
4	Total quantity used for irrigation/income	5 184 670	163 974
5	Operation cost	--	86 036
6	Power cost	--	19 157
7	Maintenance cost	--	25 950
8	Total costs	--	131 143
9	Net Income	--	32 831

Maintenance Details

The following maintenance works were carried out during the year under review:

- Cleaning of embankments of dams from wild vegetation
- Dams routine Maintenance
- Repairs of main water meters
- Maintenance and repair of sluice valves, flow regulators, air valves, water meters, float valves and washouts.
- Improvements to outlets.
- Maintenance and cleaning of manholes.
- Painting of metal works.
- Repairs to pipe breakages.

Project Operation data for the last two years

Table X-39 gives data regarding operation for the last two years. Last column shows the percentage variation of the 1988 data with respect to 1987 figures. The water used for DWS was decreased where as the water used for recharge was increased. The net income was increased due to the decrease of the total expenditure.

TABLE X-39

YERMASOYIA - POLEMIDHIA PROJECT - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser. No.	Description	Unit	1987	1988	% change on 1987
1	Capacity.....	MCM	16.930	16.930	Nil
2	Water available	"	23.663	24.391	+3.1
3	Water utilized for irrig.	"	4.769	5.185	+8.7
4	Water sold.....	"	4.256	4.333	+1.8
5	Water given free	"	0.513	0.852	+66.1
6	Water used for recharge .	"	4.099	5.817	+41.9
7	Water used for DWS	"	5.041	2.895	-42.6
8	Total quantity used	"	13.909	13.896	-0.1
9	Gross income	£	164 709	163 974	-0.4
10	Operation cost	"	91 016	86 036	-5.5
11	Power cost	"	24 233	19 157	-20.9
12	Maintenance cost	"	22 748	25 950	+14.1
13	Total expenditure	"	137 997	131 143	-5.0
14	Net income	"	26 712	32 831	+22.9
15	Area irrigated	"	2 066	2 066	Nil

VASILIKOS-PENDASKINOS PROJECT

The purpose of the Vasilikos-Pendaskinos project is the development of surface and ground water resources from the Vasilikos, Pendaskinos and Maroni rivers both for the agricultural development of the area and the augmentation of the domestic water supply of Nicosia, Larnaca and Famagusta districts.

The project consists of the following:

- Kalavasos dam of rockfill type embankment and reservoir capacity 17.1 MCM.
- Dhypotamos dam of rockfill type embankment and reservoir capacity 13.7 MCM.
- Lefkara dam of rockfill type embankment and reservoir capacity 13.85 MCM.
- Maroni Diversion to divert a portion of the Maroni river flow to a point upstream of Dhypotamos dam.

- Maroni irrigation scheme which comprises an irrigation network covering about 233 hectares in the delta area of Maroni river.
- Vasilikos irrigation scheme which comprises a main conveyor from Kalavasos dam, break pressure tank and pipeline networks covering an area of about 838 hectares.
- Pendaskinos irrigation scheme which comprises an irrigation network covering about 372 hectares in the Pendaskinos area and delta area is served by the Dhypotamos dam and existing boreholes.
- A distribution system in Lefkara village for the supply of water to an area of 824 decars is served by Lefkara dam.
- Kalavasos-Khirokitia pipeline, with Tokhni pumping station, which is the main conveyor for water from Kalavasos dam to the Khirokitia treatment plant and of irrigation water to the Vasilikos irrigation area.
- Nicosia Water Supply Scheme.
  The project as a whole started operation in 1985.

This part of the report will deal only with details about water utilization for irrigation where details regarding domestic water supply will be given in a separate section under the heading of Domestic Water Supply.

Project Operation

The project management and operation is the responsibility of the WDD. The following staff is in charge for the project Operation and Maintenance.

1 Topographer Irrigation Engineer (part time)
1 Technical Superintendent
2 Technicians
6 Attendants
5 Labourers
1 Storekeeper

Project Hydrology

The project Hydrologic data are shown on tables X-40, X-41 and X-42. The maximum quantities in storage were 13.584 MCM in Kalavasos dam on the 6th May, 7.258 MCM in Dhypotamos dam on the 9th May and 4.223 MCM in Lefkara dam on the 15th April 1988. The minimum quantities in storage for the three dams were recorded on the 15th December 1988 with quantities 8.858 MCM in Kalavasos dam, 4.023 MCM in Dhypotamos dam and 1.585 MCM in Lefkara dam.

Water Resources and System Efficiency

A total of 13.872 MCM were released from the three dams 6.736 MCM from Kalavasos, 3.665 MCM from Dhypotamos and 3.401 MCM from Lefkara dam. From the total quantity released, 11.175 MCM were given for DWS and the rest 2.697 MCM were given for irrigation. Of the quantity given for irrigation, 2.630 MCM were utilized.

TABLE X-40

KALAVASOS DAM -HYDROLOGY FOR 1988

STOR.CAPACITY 17100000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGATION m3	REL.FOR D.W.S. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3	MEASURED INFLOW
JANUARY	4102000	830000	13224	48200	276560	0	324760	337984	1167984	1050000
FEBRUARY	4932000	1338000	16751	53300	248040	0	301340	318091	1656091	1750000
MARCH	6270000	6315000	48891	71700	258010	0	329710	378601	6693601	6600000
APRIL	12585000	951000	89074	142300	380850	0	523150	612224	1563224	1650000
MAY	13536000	-304000	150958	202400	485100	0	687500	838458	534458	530000
JUNE	13232000	-616000	159908	202900	533800	0	736700	896608	280608	210000
JULY	12616000	-962000	200789	244700	602260	0	846960	1047749	85749	29000
AUGUST	11654000	-973000	162309	259000	591120	0	850120	1012429	39429	21000
SEPTEMBER	10681000	-881000	107824	244300	528170	0	772470	880294	-706	5000
OCTOBER	9800000	-540000	64057	175500	498450	0	673950	738007	198007	190000
NOVEMBER	9260000	-310000	29075	93400	296200	0	389600	418675	108675	100000
DECEMBER	8950000	334000	23678	75700	294210	0	369910	393588	727588	700000
TOTALS		5182000	1066538	1813400	4992770	0	6806170	7872708	13054708	12835000
% TO MAX. STORAGE			7.9	13.3	36.8		50.1	58.0	96.1	94.5
% TO STOR.CAPACITY			6.2	10.6	29.2		39.8	46.0	76.3	75.1

* Estimated inflow

TABLE X-41

DHYPOTAMOS DAM -HYDROLOGY FOR 1988

STOR.CAPACITY 13700000M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. m3	REL.FOR D.W.S. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3	MARONI INFLOW m3	MEASURED INFLOW U/S m3
JANUARY	1187000	493000	7274	0	10000	0	10000	17274	510274	302620	345000
FEBRUARY	1680000	1112000	10524	0	4960	0	4960	15484	1127484	536320	530000
MARCH	2792000	3956000	35814	1650	186950	0	188600	224414	4180414	1643460	2480000
APRIL	6748000	423000	67860	32010	180860	0	212870	280730	703730	213335	530000
MAY	7171000	6000	125448	79303	7000	0	86303	212351	218351	0	206000
JUNE	7177000	-139000	142119	92520	39760	0	132280	274399	135399	0	74000
JULY	7038000	-638000	166514	136560	296650	0	433210	599724	-38276	0	26000
AUGUST	6400000	-800000	128713	145970	653460	0	799430	928143	128143	0	13000
SEPTEMBER	5600000	-934000	80384	129486	719830	0	849316	929700	-4300		0
OCTOBER	4666000	-208000	39831	99004	99004	0	198008	237839	29839	5800	20000 *
NOVEMBER	4458000	-200000	16879	12210	334660	0	346870	363749	163749		160000 *
DECEMBER	4258000	302000	11044	3690	398690	0	402380	413424	715424	221980	500000 *
TOTALS		3373000	832404	733003	2931824	0	3664827	4497231	7870231	2923515	4884000
% TO MAX. STORAGE			11.5	10.1	40.4		50.5	62.0	108.4	40.3	67.3
% TO STOR. CAPACITY			6.1	5.4	21.4		26.8	32.8	57.4	21.3	35.6

* Estimated inflow

TABLE X-42

LEFKARA DAM -HYDROLOGY FOR 1988

STOR.CAPACITY 13800000 M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. m3	REL.FOR D.W.S. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST.INFLOW -SEEPAGE m3	MEASURED SEEPAGE	TOTAL LOSSES
JANUARY	671500	406500	3060	0	320820	0	320820	325193	731693	1313	4373
FEBRUARY	1078000	502000	3948	0	296430	0	296430	302132	804132	1754	5702
MARCH	1580000	2461000	14536	0	185070	0	185070	202198	2663198	2592	17128
APRIL	4041000	92000	30419	3370	232530	0	235908	268919	360919	2592	33011
MAY	4133000	-499000	55611	17403	504420	0	521823	579801	80801	2367	57978
JUNE	3634000	-634000	58061	18242	541300	0	559542	619677	-14323	2074	60135
JULY	3000000	-456000	62538	35676	424050	0	459726	524139	68139	1875	64413
AUGUST	2544000	-132000	49757	36565	37100	0	73665	125297	-6703	1875	51632
SEPTEMBER	2412000	-96000	33915	31593	11820	0	43413	78883	-17117	1555	35470
OCTOBER	2316000	-554000	15890	6145	517120	0	523265	540494	-13506	1339	17229
NOVEMBER	1762000	-110000	5970	1620	110530	0	112150	119934	9934	1814	7784
DECEMBER	1652000	396000	4072	0	68730	0	68730	74945	470945	2143	6215
TOTALS		1376500	337777	150622	3249920	0	3400542	3761612	5138112	23293	361070
% TO MAX.STORAGE			8.0	3.6	77.0		80.5	89.1	121.7	0.6	8.6
% TO STOR. CAPACITY			2.4	1.1	23.5		24.6	27.2	37.1	0.2	2.6

The rest were either lost in the pipe system or in water meters discrepancies. The system efficiency cannot be calculated since large discrepancies of main and individual water meters readings, were recorded.

Water Utilization and Crops Irrigated

A total quantity of 13.804 MCM was utilized out of which 11.174 MCM for Domestic Water Supply. The rest 2.630 MCM were used irrigation of 630 hectares of land planted with various crops as shown on annex 1. Irrigation in the project area started in January and continued throughout the year until December 1988.

Water Quality

One sample from each of the dam reservoirs except Dhypotamos was chemically analysed for the year under review as shown on annex 2. The project water is considered to be of good quality with slightly high bicarbonates.

Water Sale, Income and Expenditure

A total quantity of 2.630 MCM was sold, 2.247 MCM for irrigation at 4.5 cent/m^3 for the water used in areas served by Kalavasos and Dhypotamos dam and 4.0 cent/m^3 for the water used in Lefkara area. The rest 0.383 MCM were sold for industrial use at 17.0 cent/m^3. The gross income amounted to £159,121. The total expenditure including dam and distribution system maintenance, wages and purchase of materials amounted to £78,020. The net income to the project amounted to £81,101.

TABLE X-43
VASILIKOS-PENDASKINOS PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold for irrigation	2 246 676	93 951
2	Water sold for industrial use	383 353	65 170
3	Total water sold and gross income	2 630 029	159 121
4	Operation cost	--	40 940
5	Maintenance cost	--	37 080
6	Total expenditure	--	78 020
7	Net income	--	81 101

Maintenance Details

During the year under review the following maintenance works were carried out:

- Painting of pipes and valves
- Cleaning of embankments
- Cleaning of drainage ditch channels

- Maintenance of the guard houses.
- Maintenance and cleaning of break pressure tanks.
- Maintenance and cleaning of hydrants.
- Maintenance and cleaning of Maroni diversion weir.

Project Performance for the last two years

Table X-44 shows project operation data for the last two years. Last column shows the percentage changes of data for the year under review over those of the previous year. The water available in storage was increased by 113.5%. The water sold, the gross income as well as the expenses were increased significantly.

TABLE X-44
VASILIKOS-PENDASKINOS PROJECT - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser. No.	Description	Unit	1987	1988	% change on 1987
1	Capacity	MCM	44.650	44.650	Nil
2	Water available	"	13.482	28.782	+113.5
3	Water sold	"	2.337	2.630	+12.5
4	Water used DWS	"	9.831	11.175	+13.7
5	Total water used	"	12.168	13.805	+13.4
6	Gross income	£	127 484	159 121	+24.8
7	Operation cost	"	21 643	40 940	+89.2
8	Maintenance cost	"	25 859	37 080	+43.4
9	Total expenses	"	47 502	78 020	+64.2
10	Net income	"	79 982	81 101	+1.4
11	Area irrigated	Hectares	532	630	+18.4

PITSILIA PROJECT

XYLIATOS DAM

The Xyliatos dam was constructed within the Pitsilia Integrated Rural Development Project. the project consists of a rockfill type dam with a reservoir capacity at spillway crest. 1.220 MCM of water and a closed type distribution system commanding an area of 3,082 decars in Xyliatos and Ayia Marina village. The project commenced operation since the year 1983.

Project Operation

The project operation is with the Director of WDD. A dam attendant is responsible for the dam monitoring and collecting of water charges.

Project Hydrology

the project hydrologic data as recorded for 1988 are tabulated on table X-45. The dam reservoir was filled upto the spillway crest on the 24th January and overflow continued until the 6th of May 1988. The minimum quantity in storage during the irrigation period was recorded on the 2nd November 1988 with quantity 554,000 m^3.

TABLE X-45

XYLIATOS DAM -HYDROLOGY FOR 1988

STOR.CAPACITY 1220000 M3

MONTH	STORAGE BEG. OF MONTH m3	VOL. CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL. FOR IRRIGAT. m3	MEASURED INFLOW m3	REL. FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST. INFLOW -SEEPAGE -OVERFLOW m3	MEASURED SEEPAGE m3	TOTAL LOSSES m3
JANUARY	944000	276000	1730	2390	660000	0	2390	12587	288587	8467	10197
FEBRUARY	1220000	0	2212	2420	820000	0	2420	12840	12840	8208	10420
MARCH	1220000	0	4570	2620	2100000	0	2620	17904	17904	10714	15284
APRIL	1220000	0	6263	52862	210000	0	52862	69493	69493	10368	16631
MAY	1220000	-67000	14811	101230	58000	0	101230	124724	57724	8683	23494
JUNE	1153000	-110000	17487	95100	15000	0	95100	120363	10363	7776	25263
JULY	1043000	-151000	19399	139788	1000	0	139788	166764	15764	7577	26976
AUGUST	892000	-157000	13887	134362	0	0	134362	154789	-2211	6540	20427
SEPTEMBER	735000	-109000	8319	110815	0	0	110815	125484	16484	6350	14669
OCTOBER	626000	-71000	3836	65210	0	0	65210	74221	3221	5175	9011
NOVEMBER	555000	16000	1614	9540	30000	0	9540	15560	31560	4406	6020
DECEMBER	571000	649000	1422	4520	700000	0	4520	11221	660221	5279	6701
TOTALS		276000	95550	720857	4594000	0	720857	905950	1181950	89543	185093
% TO STOR. CAPACITY			7.8	59.1	376.6		59.1	74.3	96.9	7.3	15.2

Water Resources and System Efficiency

The water available for utilization was 1.941 MCM. A quantity of 720,857 m^3 was released for irrigation, out of which 586,485 m^3 were used and the rest 134,372 m^3 were lost in the pipe system. The system efficiency is around 81%.

Water Utilization and Crops Irrigated

A total quantity of 586,485 m^3 was utilized. Out of this quantity, 573,787 m^3 were used for irrigation of 2,059 decars of land planted with various crops as shown on annex 1. A quantity of 12,698 m^3 was used for livestock.

Water Quality

Four samples of water taken from the dam reservoir and were chemically analysed as shown on annex 2. From the results it can be seen that the project water is of good quality with low electrical conductivity.

Water Sale, Income and Expenditure

The water used for irrigation was sold at 4 cent/m^3 and that used for livestock at 13 cent/m^3. The gross income from the sale of 586,485 m^3 of water, amounted to £24,602. Operation expenses including attendant wages and travelling costs amounted to £5,019 and the maintenance expenses spent on routine works amounted to £3,992 of the net income to the project was £15,591.

TABLE X-46

XYLIATOS DAM-WATER SALE INCOME AND EXPENDITURE

Item No.	Description	Quantity m^3	Amount £
1	Water sold for irrigation	573 787	22 951
2	Water sold for livestock	12 698	1 651
3	Total water sold and gross income	586 485	24 602
4	Operation cost	--	5 019
5	Maintenance cost	--	3 992
6	Total expenditure	--	9 011
7	Net income	--	15 591

Maintenance Details

The following works were carried out during the year under review:

- Installation of a washout at Kornos Break Pressure Tank.
- Maintenance of float valves.
- Replacement of sluice valves.
- Repair of main outlet pipe in the gallery.
- Repairs of pipe breakages.
- Cleaning of filters.

Project Performance for the last two year

Table X-47 shows the project operation data for the last two years. Last column shows the percentage variation of 1988 figures with respect to the previous year. Due to the increase of the operation cost a decrease of 25% of the net income was observed.

TABLE X-47
XYLIATOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser. No.	Description	Unit	1987	1988	% change on 1987
1	Capacity	MCM	1.220	1.220	Nil
2	Water available in storage	"	1.682	1.941	+15.4
3	Water sold	"	0.657	0.586	-10.8
4	Gross income	£	26 880	24 602	-8.5
5	Operation cost	"	2 283	5 019	+119.8
6	Maintenance cost	"	3 738	3 992	+6.8
7	Total expenditure	"	6 021	9 011	+49.7
8	Net income	"	20 859	15 591	-25.2
9	Area irrigated	Decars	1 913	2 059	+7.8

KALOPANAYIOTIS DAM

the Kalopanayiotis irrigation project consists of an earthfill type embankment dam reservoir of capacity 363,000 m^3 and a distribution system made of closed conducts commanding an area of approximately 645 decars. The project commenced operation since the year 1967.

Project Operation

The project Management and Operation is carried out by the Waterworks Committee chaired by the Nicosia District Officer. A dam attendant is responsible for the dam monitoring and collecting of water charges.

Project Hydrology

The project hydrologic data as recorded during the year 1988 are shown on table X-48. Overflow started on the 21st March and continued until 25th June 1988. The minimum quantity in storage during the irrigation period occurred on the 4th October with quantity in storage around 72,000 m^3.

Water Resources and System Efficiency

The water released from dam was not measured, so the system efficiency could not be calculated.

Water Utilization and Crops Irrigated

A total quantity of 209,777 m^3 of water was used for irrigation of 562 decars of land planted with various crops as shown on annex 1. Irrigation in the project area started early in May and continued throughout the year until late in October 1989.

TABLE X-48

KALOPANAYIOTIS DAM -HYDROLOGY 1988

STOR.CAPACITY 363000 M3

MONTH	STORAGE BEG.OF MONTH m3	VOL.CHANGE DURING MONTH m3	EVAPOR-ATION m3	REL.FOR IRRIGAT. m3	REL.FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	MEASURED INFLOW m3	MEASURED SEEPAGE
JANUARY	363000	-293000	607	0	0	0	607	740000	0
FEBRUARY	70000	-70000	0	0	0	0	0	1150000	0
MARCH	0	363000	0	0	0	0	0	3400000	0
APRIL	363000	0	3146	0	0	0	3146	1150000	0
MAY	363000	0	6428	34707	0	34707	41135	580000	0
JUNE	363000	-18200	8203	34708	0	34708	42911	270000	0
JULY	344800	-96800	8735	40693	0	40693	49428	190000	0
AUGUST	248000	-78000	6454	40693	0	40693	47147	175000	0
SEPTEMBER	170000	-91670	4000	29488	0	29488	33488	53000	0
OCTOBER	78330	55070	2000	29488	0	29488	31488	90000	0
NOVEMBER	133400	154600	1500	0	0	0	1500		0
DECEMBER	288000	-104000	1000	0	0	0	1000		0
TOTALS		-179000	42073	209777	0	209777	251850	7790000	0
% TO STOR.CAPACITY			11.6	57.8		57.8	69.4		

Water Quality

Three samples of water taken from the dam reservoir were chemically analysed as shown on annex 2. The project water is of good quality with slightly high bicarbonates.

Water Sale, Income and Expenditure

A quantity of 209,777m³ of water was sold at 4 cent/m³ and used for irrigation. The income from the sale of water amounted to £8,391. The operation expenses including attendant wages and travelling costs amounted to £4,045 whereas the maintenance expenses spent on routine works and emergency repairs amounted to £4,618. An annual deficit of £272 was presented.

TABLE X-49 - KALOPANAYIOTIS DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m³	Amount £
1	Water sold and gross income ..	209 777	8 391
2	Operation cost	-	4 045
3	Maintenance cost	-	4 618
4	Total expenses	-	8 663
5	Net Income	-	- 272

Maintenance Details

The following maintenance works were carried out during the year under review.

- Repairs to pipe breakages
- Repair of main water meter
- Repair of Float valve of one of the Break Pressure Tanks
- Replacement of washouts
- Installation of an inlet pipe, a float valve and a water meter on the weir
- Disilting of dam reservoir
- Cleaning the yard of the guardhouse from wild vegetation and construction of a shed.

Project Performance for the last two years.

Table X-50 shows the project operation data for the last two years. Last column shows the percentage variation of the 1988's data over those of the previous year.

TABLE X-50 - KALOPANAYIOTIS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS.

Item No.	Description	Unit	1987	1988	% change on 1987
1	Capacity	MCM	0.363	0.363	NIL
2	Water available in storage	"	0.466	0.861	+84.8
3	Water sold for irrigation	"	0.209	0.210	+0.5
4	Gross Income	£	7 915	8 391	+6.0
5	Operation cost	"	3 838	4 045	+5.4
6	Maintenance cost	"	1 359	4 618	+251.5
7	Total expenses	"	5 197	8 663	+69.8
8	Net Income	"	2 718	- 272	-
9	Area Irrigated	Decars	562	562	NIL

KITI DAM

The Kiti dam irrigation project consists of zoned earthfill type embankment dam reservoir of storage capacity 1.610MCM and a distribution system made of open canals commanding an area of approximately 830 hectars of land in the Kiti, Perivolia and Tersefanou villages. The project commenced operation since the year 1968.

Project Operation

Project Management and Operation is carried out by the waterworks Committee chaired by the Larnaca District Officer. A part time waterman is in charge for collecting of water charges.

Project Hydrology

A quantity of 3.517 MCM of water was given from Kouris dam to Kiti dam for storage. Up to 8th of March 1988 the dam was dry. From the 9th March impounding started from the Kouris dam. The maximum quantity in storage was recorded on the 27th April with quantity 1.325 MCM of water. Before the end of the irrigation period, on the 11th October the dam was dry.

Water Resources and System Efficiency

The quantity released for irrigation from Kiti dam could not be measured. The quantity used was 174,340m^3. To supplement irrigation during the months September-December a quantity of 162,540 was released from Kouris dam and given for irrigation. Out of this only 63,600m^3 were used where as the rest 98,940m^3 were lost in the canal system. As it can be seen the efficiency of the system is about 66%.

Water Utilization and Crops Irrigated

A total quantity of 237,940m^3 were used for irrigation of 41 hectars of land planted with various crops as shown on Annex 1. Irrigation in the project area started in April and continued throughout the year until December, 1988.

Water Sale, Income and Expenditure

A quantity of 174,340m³ was sold to the farmers at 3.0 cent/m³ and the income amounted to £5230. The income from the sale of the quantity of 63,600m³ from Kouris dam is referred in the section on the SCP. This quantity was bought at 7 cent/m³ from SCP and sold to the farmers at 8 cent/m³. The difference of 1 cent/m³ was accounted to the gross income of Kiti dam. The operation cost including waterman wages amounted to £2438. The maintenance cost amounted to £3391 and the net income to the project amounted to £37.

TABLE X-51 - KITI DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m³	Amount £
1	Water sold from dam	174 340	5 230
2	Water sold from SCP	63 600	636(See SCP)
3	Total water used for irrigation and gross income ..	237 940	5 866
4	Operation cost	-	2 438
5	Maintenance cost	-	3 391
6	Total costs	-	5 829
7	Net income	-	37

Maintenance Details

The following works were carried out during the year under review:

- Removal and repair of the hydraulic system of penstock and piston assembly.
- Cleaning of the canal system.

KHA-POTAMI PROJECT

The Kha-Potami Irrigation project consists of a diversion Weir and a diversion pipeline capable of diverting a flow of 500 CM/Hour where the Kha-Potami river is flowing in the months January-June.

The Project is supplying water in bulk during the winter, spring and early summer months, to the Pissouri and Alekhtora Irrigation Divisions. The area commanded by both Irrigation Divisions is around 567 hectars, 402 hectars in the Pissouri Irrigation Division and 165 hectares in the Alekhtora Irrigation Division. In both cases the area to be irrigated is planted tottaly with vines.

Based on the existing water resources for each of the two irrigation divisions having in mind the area served by each irrigation division, the water is allocated as follows:

- If the works divert only 225m³/hr the water will be given in total to the Pissouri Irrigation Division.

- If the works divert more than 225m³/hr but less than 325m³/hr the 225m³/hr will be diverted to the Pissouri Irrigation Division and the remaining to the Alekhtora Irrigation Division.
- If the works divert a flow of more than 325m³/hr then the water will be allocated as follows:

  . 225m³/hr to Pissouri Irrigation Division
  . 200m³/hr to Alekhtora Irrigation Division
  . The remaining flow will be divided between the two irrigation divisions at a ratio of 3:1 (3 parts to the Pissouri irrigation division and 1 part to the Alekhtora irrigation division.

The project started operation in the year 1979.

Project Operation

The project management and operation is carried out by the Irrigation Division Committees chaired by the Limassol District Officer after an agreement has been made between the Government and the Committees according to which a rent of £2000 annually is paid to the Government.

Water Utilization and Crops Irrigates

A total quantity of 1,413 MCM was utilized for the supplementary irrigation of 567 hectares of land planted with vines. Out of the total quantity used 1.091 MCM m³ were used by the Pissouri irrigation Division and 0.322 M0C^{M} were used by the Alekhtora Irrigation Division.

EVDIMOU-PARAMALI PROJECT

The Evdimou-Paramali project includes three diversion weirs on Evdimou, Farkonias and Kryos rivers, conveyance pipelines and storage tanks. The Kryos diversion diverts the river flow to a point upstream of Farconias diversion weir. The conveyance pipelines of Evdimou and Farkonias diversion weirs are connected to each other so that water from Farkonias river is diverted to Evdimou. The project is supplying water in bulk during the winter, spring and early summer months, to Evdimou and Paramali irrigation Divisions. The area commanded by both Irrigation Divisions is around 530 hectars, 309 hectars in the Evdimou irrigation Division and 221 hectars in Paramali Irrigation Division. The project started operation in 1987.

Project Operation

The project management and operation is carried out by both the Water Development Department and the irrigation Division Committees. The responsibility of the WDD is for the Diversion weirs and parts of the conveyance pipelines while the responsibility of the Committees is the distribution systems.

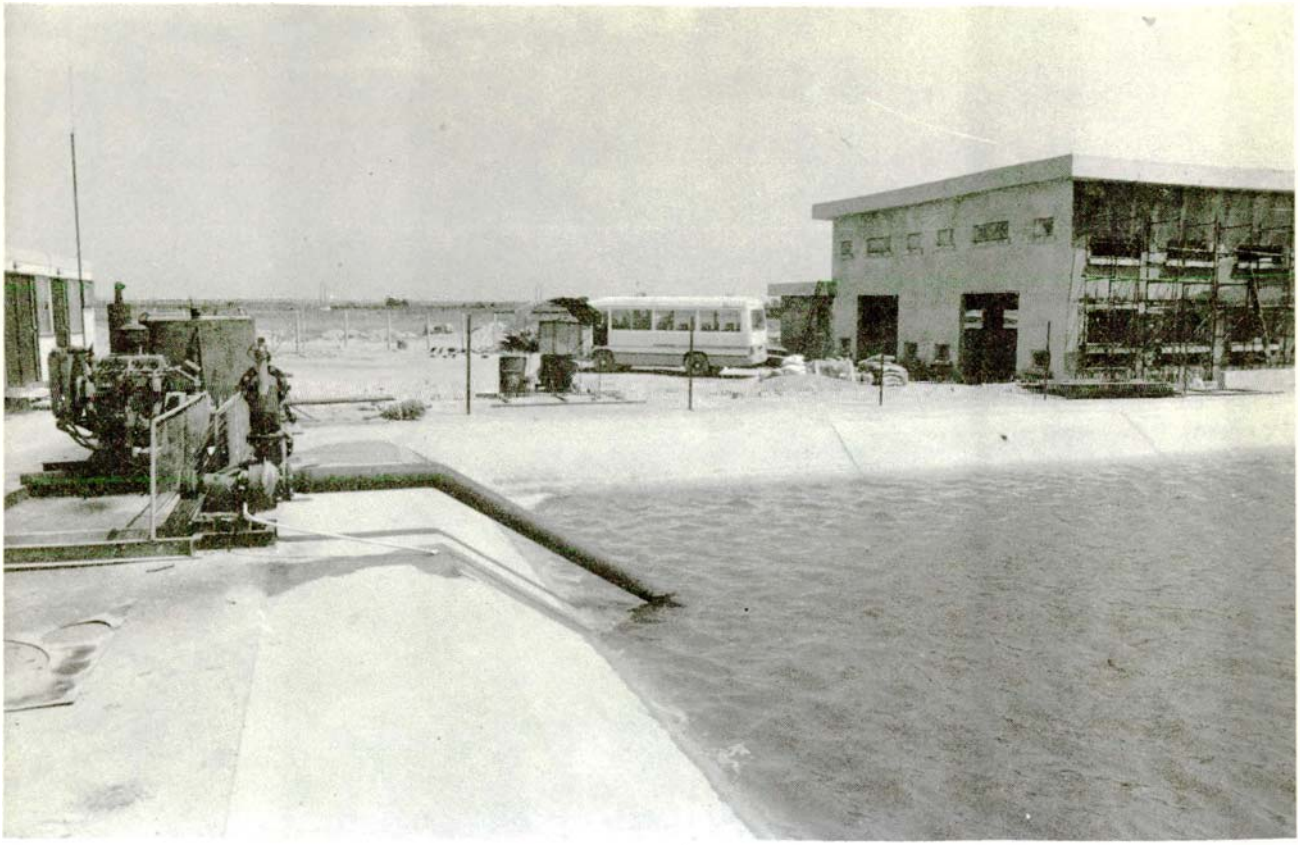
A part time attendant/waterman is in charge for operating the Diversion Weirs and parts of the conveyance pipelines.

Water Utilization and Crops Irrigated.

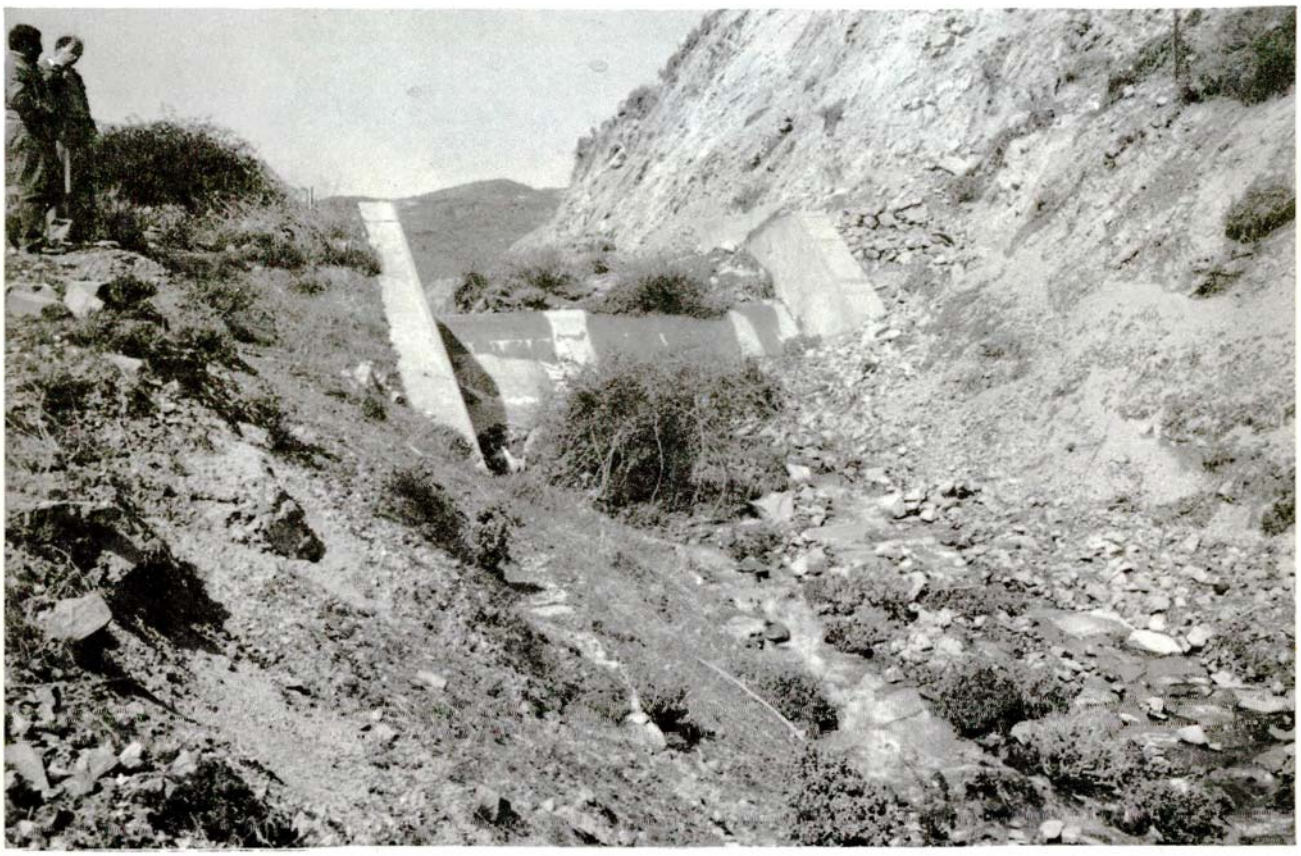
A total quantity of 374,918m³ of water was used for irrigation, 271,166m³ by the Evdimou I/D and 103,752m³ by the Paramali I/D. The water was used for the irrigation of land planted mainly with vines, citrus and cereals.

Water Sale, Income and Expenditure

A total quantity of 374, 918 m³ of water was sold in bulk at 2 cent/m³ to both Irrigation Divisions. The gross income from the sale of water amounted to £7,498. The Operation and Maintenance expenses amounted to £1,963. The net income to the project amounted to £5,535.



At Kokkinokhoria irrigation area of the Southern Conveyor Project temporary arrangements were made to supply water for irrigation until the completion and commissioning of the pumping stations.
WDD photo F37EN-20, taken on 1.9.88 shows diesel engine and pump of the reservoir crest pumping water for irrigation.



The early 1988 winter floods have caused damages to several ponds and small dams in Pitsilia.
WDD photo E83EN-4A, taken on 15.3.88 shows the effect of the floods on Agros dam spillay.

XI LARNACA-FAMAGUSTA REGIONAL OFFICE

by
T N Hamatsos
Executive Engineer I
Regional Engineer

General

By the end of the year the staff of the Larnaca-Famagusta Regional Office was composed of the following Officers :

1 Executive Engineer I - Head
1 Technical Superintendent
1 Senior Technician
4 Technicians I
7 Technicians II
2 Foremen
3 Technicians (hourly)
1 Secretary-Typist

The activities of this office cover the Districts of Larnaca and Famagusta. Its functions are divided into four main categories as follows :

- Water Resources and Hydrodlogy : Groups together all services for surface and groundwater data, measurements, studies and control of ground water extraction.

- Investigation and Design : Deals with the detail design of rural irrigation and domestic water supply projects.

- Construction : Deals with the construction of rural irrigation, domestic water supply and small dams.

- Operation and Maitenance : Deals with the control, operation and maintenance of rural water supply schemes and irrigation works.

- Additionally this year the office continued its activities and services for the implementaion of Major Projects - Southern Conveyor and Vasilikos-Pendaskinos Projects.

HYDROLOGY AND WATER RESOURCES

Stream Gauging

During the year 3 permanent gauging observation stations (one monthly at Liopetri Dam and two weekly at Paralimni Lake) equipped with automatic water level recorders were in operation and weekly or monthly visits were paid for observation and maintenance.

Ground Water Hydrology

The ground water conditions of the two Districts Famagusta and Larnaca were observed by means of 506 wells/boreholes.

The water level (i.e. the distance from established bench marks on the top of the observation wells/boreholes to the ground water level) of 361 of them were taken twice this year i.e. in March before the irrigation period and in November after the irrigation period.

The water level of 96 of these observation boreholes was taken every month and another 9 of them was taken every two months.

The water level of 40 boreholes used for village water supplies were also taken once during the whole year.

Chemical Analyses

A total number of 138 samples were taken from Government and Communal or private boreholes/wells or springs and were sent to the Government or Departmental Laboratories for Chemical Analysis.

Also 476 samples taken from wells and boreholes were analysed in the Regional Office for chloride content.

Boreholes Test Pumping

During the year the test pumping of 9 boreholes/wells for Government or private use were carried out.

Plotting of Boreholes

During the year the plotting of wells/boreholes in Famagusta and Larnaca Hydrological Area continued and the total number of wells/boreholes plotted were 544.

Questioning

The annual questionnaire was carried out in the area where the plotting was completed. A total number of 10 482 cases were carried out.

Village Water Supplies

During the year the water supply of each village in the two Districts was checked i.e. the flow of springs and boreholes used by each village were measured and samples were sent to the Government Laboratory for chemical analysis .

Quarries

A total number of 58 applications for quarries which were sent to the District Office by the Department of Mines were examined on the spot, and returned to the above Department with the comments of this Office.

Wells Sinking Permits

A total number of 780 applications for sinking, covering permits and the change of conditions of permits of wells/boreholes were examined in the two Districts and were presented to the Central Advisory Committee for wells/boreholes of the Ministry of Agriculture and Natural Resources. Some 617 applications are of cases lying in the conservation areas and another 163 in the non-conservation area.

Apart from the above applications 574 cases dealing with wells/boreholes were also examined direct from the District Office of the W D D Larnaca-Famagusta and were submitted to the District Officers of the two Districts.

The above applications concerned cases for the renewal of leased agreement of wells/boreholes drilled on Government or Forest Land, or cases of cleaning or deepening of existing wells/boreholes or Cypriot-Turkish wells/boreholes, now working for refugees. From the above 352 cases were approved, 15 were not and 207 were for the check of the condition of permits or returned to the District Officers for further examination.

Water Supply (Special Measures) Law 32/64

The control of the aquifers of Ormidhia and Xylophagou under the Water Supply (Special Measures) Law 32/64 was continued and the District Officer in concurrence with the Water Development Department and the Agricultural Department investigated a total number of 903 boreholes.

In Ormidhia and Xylophagou Area 26 applications for new boreholes or covering permits were examined. Seventeen of them were approved and another 9 were not approved.

INVESTIGATION AND DESIGN

Investigations

During 1988 the following investigations were carried out :

LARNACA DISTRICT

Avdhellero : Investigation for the solution of water supply problems.

Anglisidhes : (a) Investigation for the inclusion of new plots in the temporary irrigation division (b) investigation for the connection of the village water supply with Khirokitita-Famagusta pipeline.

Ayia Anna : (a) Investigation for relocation of part of the village water supply network scheme to the main road of the village (b) In-

vestigation for the improvement of borehole 11/86 and replacement of the village water supply (c) investigation for the solution of water supply problems.

Ayii Vavatsinias : (a) Investigation for improvement of the village water supply from Adhkia spring (b) investigation for the installation of the air valves on the conveyance pipeline of the Irrigation Division.

Athienou : Investigation for the solution of water supply problems.

Alaminos : (a) Investigation for the solution of water supply problems.(b) supplementary water supply of the village from BH 151/83 for the temporary Irrigation Divison (c) investigation for the relocation of part of the conveyance pipeline which passes through private land (d) investigation for the temporary connection of the temporary Irrigation Division with the Southern Conveyor.

Alethrico : (a) Investigation for the solution of water supply problems (b) investigation for the connection of the village water supply with Khirokitia-Famagusta pipeline and for improvement of the village water supply network.

Anaphotia : (a) Investigation for the temporary connection of the temporary Irrigation Division with the Southern Conveyor (b) Investigation for improvement of the existing house to house scheme water supply (c) investigation for the live stock water supply from the Government borehole 121/86 of the temporary Irrigation Division.

Aplanda : (a)Investigation for the improvement of the army camp water supply (b) investigation for the improvement of borehole No.9 for the army camp.

Aradhippou : Investigation for the relocation of part of the village water supply pipelines due to the construction of the new Aradhippou-Dhekelia road.

Dhekelia E A C : Investigation for the connection of E A C water supply to the self housing refugee camp water supply.

Dhromolaxia : (a) Investigation for the solution of water supply problems (b) water supply to new refugee self housing plots (phase J and K).

Kalavasos : (a) Investigation for the connection of the village warer supply with Khirokitia-Famagusta pipeline (b) investigation for the registration of part of the river as a private road (c) investigation for the solution of water supply problems.

Kalochorio : (a) Investigation for relocation of part of the village water supply network scheme to the main road of the village (b) investigation for the connection of the village water supply with Khirokitia-Famagusta pipeline (c) water supply to new refugee self housing plots (Phase F).

Kato Lefkara : Investigation for improvement of the existing house to house water supply scheme.

Kellia-Troulli : Investigation for relocation of part of the village water supply pipeline due to the construction of the new Aradhippou Dhekelia road.

Kellia : (a) Investigation for the connection of the village water supply with Klima spring pipeline (b) water supply to new refugee self housing plots (Phase C) (c) Investigation for improvement of the existing house to house water supply scheme.

Khirokitia : Investigation for the solution of water supply problems.

Kiti : Investigation for the solution of the refugee self housing estate problems.

Klavdhia : (a) Investigation for the solution of water supply problems (b) investigation for pumping water from the Khirokitia-Famagusta pipeline to the village water supply (c) investigation for the water supply of the proposed stock farming area of the village (Phase C)

Kornos : (a) Investigation for the connection of the village water supply with Stavrovouni reservoir and for the expansion of the village water supply (b) investigation for the construction of a small dam on the river (c) Investigation for the solution of water supply problems (d) investigation for improvement of a borehole for the army camp.

Kophinou : (a) Investigation for the registration of BH 79/75 for the irrigation division (b) investigation for the water supply of a new division of plots (c) investigation for the relocation of the conveyor pipeline of Koundouros spring.

Goshi : (a) Investigation for the connection of the army camp water supply with Lymbia water supply (b) investigation for the relocation of part of the conveynace pipeline of the army camp water supply due to the construction of the new Nicosia-Larnaca road.

Livadhia : (a) Investigation for the solution of the refugee self housing estate problems (b) investigation for the connection of the village water supply with Khirokitia-Famagusta pipeline (c) investigtion for the water supply of the proposed stock farming area of the village (d) investigation for relocation of part of the village water supply pipelines due to the construction of the new Aradhippou-Dhekelia road.

Mari : (a) Investigation for the live stock area water supply from borehole No.92 of the village water supply (b) investigation for the solution of irrigation problems.

Maroni : Investigation for the relocation of part of the village water supply pipeline.

Meneou Investigation for relocation of part of the village water supply pipeline to the main road.

Menoyia : (a) Investigation for the improvement of boreholes 1/75 and 7/87 for the live stock water supply (b) investigation for the water supply of the live stock area.

Mosphiloti : (a) Investigation for the relocation of the village water supply conveyance pipeline (b) investigation for the improvement of the existing house to house water supply scheme (c) improvement of the village water supply (installation of a new sluice valve).

Ora : Investigation for improvement of the existing house to house water supply scheme.

Oroklini : (a) Investigation for leasing Government land for the erection of the live stock farm (b) investigation for the relocation of part of the village water supply pipelines due to the construction of the new Aradhippou-Dhekelia road (c) investigation for the expansion of part of the village water supply network (d) investigation for the repair of the existing water tank.

Odhou : (a) Investigation for improvement of Government borehole 83/85 for irrigation purposes of Kaloupos Irrigation Division (b) investigation for improvement of Government borehole 21/84/85 for the supplementary water supply for Odhou B Irrigation Division.

Pervolia : (a) Investigation for improvement of part of the existing house to house water supply scheme (b) investigation for the solution of Faros village water supply problems.

Pyla : (a) Investigation for the relocation of part of the village water supply pipelines due to the construction of the new Aradhippou Dhekelia road (b) investigation for the improvement of part of the existing house to house water supply scheme.

Pyrga : Investigation for the solution of water supply problems.

Psematismenos : Investigation for the solution of water supply problems.

Psevdas : Investigation for the relocation of part of the conveyance water supply pipeline which passes through private land.

Skarinou-Ayios Theodhoros-Alaminos : (a) Investigation for the repair of part of the conveynace water supply pipeline from Vrysi tou Mylou spring (b) investigation for the relocation of part of the conveyance water supply pipeline which passes through Dhypotamos Dam (c) investigation for the solution of water supply problems.

Stavrovouni : Investigation for the distribution of water from the conveyance pipeline for the slaughter house (N/sia-L/ca-L/ssol) to Pytharokolymbos area of Stavrovouni Forest for the game breeding area.

Troulli : Investigation for the solution of water supply problems.

Vavatsinia : Investigation for improvement of the existing house to house water supply scheme.

Xylophagou : Investigation for the water supply to the new refugee self housing plots (Phase G and H).

Zyyi : (a) Investigation for the solution of water supply problems (b) investigation for the connection of the army camp water supply from Zyyi water supply.

FAMAGUSTA DISTRICT

Ayia Napa :(a) Investigation for the water supply to the Athletic Centre (b) investigation for the expansion of part of the village water supply network (c) investigation for relocation of part of the village water supply pipelines (d) investigation for the solution of water supply problems.

Avgorou : Investigation for the water supply to the new refugee self housing plots (Phase G).

Akhna Forest : (a) Investigation for the relocation of part of the conveynace water supply pipeline which passes through private land (b) investigation for the water supply to the Commercial Centre.

Liopetri : Investigation for the water supply of the village industrial zone.

Phrenaros : (a) Investigation for relocation of part of the village water supply network scheme to the main road of the village (b) investigation for improvement of the existing house to house water supply scheme.

Sotira : (a) Investigation for improvement of the village water supply to the main road of Sotira-Ayia Thekla (b) investigation for the connection of the village water supply with the abandoned Paralimni Ayia Nápa conveyance pipeline (c) investigation for the relocation of part of the village water supply to the main road of Sotira-Phrenaros (d) investigation for improvement of the existing house to house water supply scheme.

Vrysoulles : (a) Investigation for the solution of water supply problems (b) investigation for the water supply to the new refugee self housing plots.

TABLE XI - 1
DESIGNS SUBMITTED TO THE DIRECTOR FOR APPROVAL

Ser. No.	Village and Scheme	Est.Cost £
	VILLAGE WATER SUPPLY	
	Larnaca District	
1	Anglisidhes : Connection of the village water supply with Khirokitia-Famagusta pipeline	33 000
2	Ayia Anna : Improvement of the existing house to house water supply scheme	36 000
	Repairs to the village water supply network scheme	5 200
3	Alethriko : Connection of the village water supply with Khirokitia-Famagusta pipeline and for improvement of the village water supply network	56 000

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY (cont.)		
4	Anaphotia : Improvement of the existing house to house water supply scheme	67 000
5	Aplanda : Improvement of the army camp water supply	30 000
6	Aradhippou : Relocation of a pipeline of the village water supply	11 000
7	Dhekelia E A C : Connection of the E A C water supply with refugee self housing water supply ...	3 600
8	Dhromolaxia : Refugee self housing house to house water supply scheme (Phase I £3000 and K (£6000)	9 000
9	Goshi : Connection of the army camp water supply with Lymbia water supply	20 500
	Relocation of a pipeline of the village water supply	7 500
10	Kalavassos : Connection of the village water supply with Khirokitia-Famagusta pipeline	66 000
11	Kalo Khorio : Connection of the village water supply with Khirokitia-Famagusta pipeline	43 000
	Refugee self housing house to house scheme water supply phase F	1 100
	Relocation of a pipeline of the village water supply	7 000
12	Kalo Lefkara : Improvement of the existing house to house water supply scheme	30 000
13	Kellia : Improvement of the existing house to house water supply scheme	26 000
	Refugee self housing house to house scheme water supply Phase C	2 400
14	Klavdhia : Pumping scheme for the village water supply	8 500
15	Kornos : Connection of the village water supply with Stavrovouni reservoir and for the expansion of the village water supply	60 000
16	Kophinou : Water supply of new division of plots	8 000
	Relocation of the conveyor pipeline of Koundouros spring	70 000

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
	VILLAGE WATER SUPPLY (cont.)	
4	Phrenaros : Improvement of the existing house to house scheme	120 000
	Relocation of part of the village water supply pipelines	6 000
5	Sotira : Improvement of the existing house to house water supply scheme	300 000
	Relocation of part of the village water supply pipeline to the main road of Sotira-Phrenaros ...	8 000
	Relocation of part of the village water supply pipeline to the main road of Sotira-Ayia Thekla ..	11 500
6	Vrysoulles : House to house water supply scheme ..	14 000
	STOCK FARMING AREAS WATER SUPPLY	
	Larnaca District	
1	Anglisidhes : Water supply for the village stock farming area	11 000
2	Anaphotia : Water supply for the live stock area from borehole 121/86 from the temporary irrigation division	3 200
3	Klavdhia : Water supply for the village stock farming area Phase C	36 000
4	Livadhia : Water supply for the village stock farming area	24 500
5	Menoyia : Water supply for the live stock area ...	3 200
	IRRIGATION WORKS	
	Larnaca District	
1	Odhou : Improvement of the Government borehole 83/85 for the irrigation division	41 000
	VARIOUS MINOR SCHEMES	
	Larnaca District	
1	Ayii Vavatsinias : Installation of air valves on the conveyance pipeline	100
2	Alaminos : Connection of the village water supply with borehole 151/83	300

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY (cont.)		
17	Livadhia : Connection of the village water supply with Khirokitia-Famagusta pipeline	26 000
	Relocation of a pipeline of the village water supply	4 700
18	Mosphiloti : Relocation of part of the conveyance pipeline of the village water supply	2 500
	Improvement of the existing house to house water supply scheme	26 000
19	Ora : Improvement of the existing house to house water supply scheme	30 000
20	Oroklini : Expansion of part of the village water supply network schme	5 750
	Relocation of a pipeline of the village water supply	6 500
21	Pervolia : Improvement of the existing house to house water supply scheme	65 000
22	Pyla : Improvement of part of the existing house to house water supply scheme	6 000
	Relocation of a pipeline of the village water supply	3 000
23	Skarinou-Ayios Theodhoros-Alaminos : Reloc of part of the conveynace water supply pipel which passes through Dhypotamos Dam	48 000
24	Vavatsinia : Improvement of the existing house to house water supply scheme	19 000
Famagusta District		
1	Ayia Napa : Relocation of part of the village water supply pipelines	45 000
	Expansion of part of the village water supply network	14 400
	Expansion of part of the village water supply network	5 000
	Water supply for the village Athletic Centre	65 000
2	Avgorou : Refugee self housing house to house scheme water supply Phase G	9 500
3	Liopetri : Water supply for the village Industrial Area	7 900

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
VARIOUS MINOR SCHEMES (cont.)		
3	Kellia-Troulli : Relocation of a pipeline of the village water supply	1 200
4	Kellia : Connection of the village water supply with Klima spring pipeline	2 500
5	KLavdhia : Improvement of the village water supply network	100
6	Maroni : Relocation of part of the village water supply pipeline	1 800
7	Meneou : Relocation of part of the village water supply pipeline	560
8	Menoyia : Water supply of the village live stock area from borehole 121/86	700
9	Mosphiloti : Installation of a new sluice valve	100
10	Oroklini : Repair of the existing water tank ...	150
11	Psevdas : Relocation of part of the conveyance pipeline of the village water supply network ...	280
12	Skarinou-Ayios Theodhoros-Alaminos : Improvement of the village water supply network	500
13	Stavrovouni : Water supply for the game breeding area	2 100
14	Xylophagou : Refugee self housing house to house water supply scheme (Phase G)	200
	Refugee self housing house to house water supply scheme (Phase H)	400
15	Zyyi : Improvement of the Army Camp water supply	300
Famagusta District		
1	Akhna Forest : Relocation of part of the village water supply pipeline	850
	Water supply of the village Commercial Centre ...	600
2	Sotira : Relocation of part of the village water supply pipeline	900
	Improvement of the village water supply network .	2 300

OPERATION AND MAINTENANCE

General

The Operation and Maintenance Branch consists of two sections :

- The Domestic Water Supply Section dealing with matters concerning water supply schemes, and ,

- The Irrigation Branch dealing with matters concerning irrigation projects.

Domestic Water Supply Branch

The main activities of this Branch during the year were the following :

- Controlling and adjusting the quantity of water given to villages and refugee housing estates connected to the Khirokitia-Famagusta main pipeline.

- The Branch offers technical advice and assistance to several Government, semi-Government and Communal Improvement Boards on water supply matters.

- The Branch is involved in the administration of the Larnaca and Famagusta Water Boards through the participation of the Regional Engineer in the Water Board meetings as a representative of the Director. Through its memebership of Water Boards the Regional Engineer acts as their Technical Adviser.

Irrigation Branch

The main activites of this branch during the year were the following:

- Was involved in the administration and management of Government Waterwork Projects, through participation in the Committees of these Projects.(Kiti Dam, Alaminos, Anaphotia, Anglisides and Alethriko Temporary Irrigation Schemes.)

- Carried out the maintenance of these projects performing routine dam and pipeline maintenance, valves and water meter repairs or replacement, painting of metal of wood work components etc.

- Gave technical advice and technical assistance concerning the maintenance of contributory irrigation projects.

- Performed routine checks to 53 Government Recharge Waterworks (12 in Larnaca District and 41 in Famagusta District) and undertook the maintenance procedures where it was necessary.

- The Branch participated in the meetings of the Committees of the Water Commissioners of Vasilikos-Pendaskinos Government Projects and Lefka a Dam.

SOUTHERN CONVEYOR PROJECTS - KOKKINOKHORIA IRRIGATION

Hydrological Investigations

During the year the following works were carried out for the Southern Conveyor Project :

- The groundwater level of 94 wells/boreholes was taken once a month in South-Eastern Mesaoria and another 44 in the area of Kiti. In addition the water level was measured by 4 automatic recorders situated at Kiti, Xylophagou, Liopetri and Phrenaros and were visited once a month.

Control of Wells/Boreholes round Akhna Dam Reservoir

90 private boreholes at Akhna Dam lying within a radius of 200 meters around the Dam Reservoir have been surveyed, studied and checked twice this year (July and October) and their yield was established.

The yield of the boreholes established by this study will constitute the basis for the control of water pumped from these boreholes for irrigation purposes, when the Dam-Reservoir will be filled with water and the Kokkinokhoria Irrigation Project will be put in operation.

Land Consolidation

The Regional Engineer as a member of the Land Consolidation Committees of Xylophagou, Xylotymbou and Ormidhia villages has participated in meetings for the promotion and establishment of Land Consolidation in the above villages.

A total area of 2142 hectares of land has been included in the Land Consolidation Schemes as follows :

Village	Area in Hectares	Owners of Land
Ormidhia	870	483
Xylophagou	1093	1121
Xylotymbou	179	149
Total	2142	1753

Special Investigations and Reports on Communal Claims in the Kokkinochoria Area

Within the frame of Kokkinochoria Irrigation Project, special Investigations were carried out and reports were prepared and sent to the Director for the following cases :

Permanent Plantations (Citrus) not covered by the Kokkinochoria Irrigation Project

Detail investigations were carried out and reports were prepared for all the permanent plantations - mainly citrus - which are not covered by the Irrigation Blocks. The findings were transferred and put

on maps and together with the report were sent to the Director.

Land to be Irrigated

The land to be irrigated by the Kokkinochoria Irrigation Distribution System spreads all over the Kokkinokhoria Area and has an area of about 9030 hectares, owned by 7473 persons. This land is distributed as follows :

- 2142 hectares are within the Land Consolidation Scheme
- 5982 hectares are Private Land
- 483 hecrares are Government Land
- 423 hectares are Forest Land

Communities to be benefited

12 Communities will be benefited from the Southern Conveyor Project-Kokkinochoria Irrigation Scheme as follows :

Community	Area to be Irrigated (in hectares)
Akhna	555
Avgorou	1274
Ayia Napa	119
Dherynia	345
Liopetri	1615
Ormidhia	911
Phrenaros	948
Sotira	1189
Xylophagou	1288
Xylotymbou	179
Akhyritou (Vrysoulles-Strovilia)	180
Paralimni	112
Xylophagou-Ormidhia (Forest Land)	315
Total Area	9030

Redesign of Kokkinokhoria Irrigation System

The following 4 Irrigation Blocks were completed and sent to the appropriate section for the preparation of the layout and design of the secondary distribution systems.

Irr.Block	Village	Area (hectares)	No. of owners
13A	Dherynia-Phrenaros-Sotira	395	515
13B	Sotira-Phrenaros	485	619
16	Vrysoulles-Akhyritou-Strovilia	120	341
17	Paralimni	115	320

Establishmen of Irrigation Divisions

The District Officer in coordination with the Regional Engineer of

the Water Development Department and the District Agricultural Officer established the following Irrigation Divisions.

Irrigation Division	No.	Date established	Total Area Hectares
Liopetri	8	29/4/88	440
Liopetri	7A	8/5/88	280
Phrenaros-Avgorou	12B	15/5/88	500
Liopetri-Phrenaros-Avgorou	12A	24/6/88	392
Sotira	9	2/9/88	362
Liopetri-Sotira-Phrenaros	11	9/9/88	481
Liopetri-Sotira	10A	16/9/88	436

Water utilized for Irrigation

Irrigation Blocks

During the year the total quantity of water supplied to 200 farmers from 4 Irrigation Blocks amounted to 644 517 cubic meters and a total number of 174 hectares of land was irrigated. A detailed table is given below :

Irr. Block	Farmers	Water utilized cm	Land Irrigated (hectares) Potatoes	Permanent Plantations	Seasonal Crops
I	60	147 110	15.0	15	1.0
II	50	228 681	17.5	11	3.5
VIIA	32	60 115	24.5	5	2.5
XIIB	58	208 711	24.0	44	1.0
Total	200	644 517	81.0	75	8.0

Irrigation through connections on main pipelines

The total quantity of water released through connections on main pipelines to 207 farmers amounted to 2 317 869 cm. The water was used mainly to cover scattered permanent plantations (citrus), seasonal crops and for stock farming purposes.

Special Investigations and Reports on Communal Claims in the Kiti-Mazotos Area

Detail investigations for supplying irrigation water to farmers by temporary connections on the main Southern Conveyor Project were carried out and reports were prepared and sent to the Director for the following cases :

- Alaminos : Irrigation water was supplied through a temporary connection for the irrigation of about 50 hectares of Permanent Plantations (mainly citrus).

- Mazotos : A number of temporary connections supplied irrigation water to farmers for seasonal crops.

- Softadhes : A number of temporary connections supplied irrigation water to farmers for seasonal crops.

- Kiti-Pervolia-Meneou : A temporary connection supplied water direct to the main irrigation canal of the Kiti-Pervolia-Meneou Irrigation Division.

Special Investigations and reports concerning Sport Stadiums

Detail investigations for 13 sport stadiums covering the two Districts (Larnaca-Famagusta) were carried out and a detail report was sent to the Director.

CONSTRUCTION WORKS

During the year under review a number of village water supply schemes, stock farming water supply schemes and minor irrigation schemes were undertaken by the Larnaca-Famagusta Regional Office as shown on tables under CONSTRUCTION DIVISION.

For the execution of the construction work the Regional Office employed 5 Foremen and 57 skilled and unskilled labourers (All 62 are Government regular workers).

XII LIMASSOL REGIONAL OFFICE

by
N.E. Neocleous
Executive engineer I
Regional Engineer I

General

Limassol Regional Office is responsible for the activities of the Department within the District of Limassol. The office is devided into five main sections as follows:

- Water Resources
- Investigation and Design
- Construction
- Operation and Maintenance
- Control

The Regional Office is manned by 243 staff as follows:

1 Executive Engineer I
5 Senior Technicians
8 Technicians I
1 Chief Foreman
3 Assist. Chief Foremen
14 Technicians II
1 Accounting Officer
2 Clerk II
16 Foremen
192 Labourers

WATER RESOURCES

Hydrological measurements were carried out in the prescribed areas which are under the Special Measures or Conservation Law as listed under DIVISION OF WATER RESOURCES.

Surface Water Hydrology

Rivers

The flow of the rivers is gauged by means of automatic water level recorders and the results are calibrated by means of current meter measurements.

Eight gauging stations equipped with automatic water level recorders are established on main rivers of Limassol District.

- The total discharges calculated for each river are given in the Hydrological Year Book of the Department.

- Kouris river, at Monagri gauging station & Amathos river at Phinikaria had a continuous flow throughout the year.

- Current meter measurements were taken at weekly intervals except at times of flood, when additional measurements were taken (total measurements 140) and at the same time 6 water samples were taken for suspended sediment analysis. Another 12 water samples were taken, for ionic analysis.

Springs and Streams

The discharge of 20 springs and streams were measured at monthly intervals for the benefit of village water supplies, Limassol water supply, the design of minor irrigation and water supply schemes and for hydrological observations.

A total of 240 springs discharges were taken either volumetrically or by means of a current meter.

Water samples from the above springs and streams were taken once during the year, for chemical analysis.

Groundwater Hydrology

Hydrological investigations and measurements were carried out in the Special Measures Law area of Akrotiri and the water conservation areas of Yermasoyia, Moni-Pyrgos, Paramali-Evdhimoy, Pissouri-Evdhimou, Parekklisha and the rest of Limassol District.

Special Measures Law - Akrotiri Phasouri Area

Hydrological observation and control is exercised by means of 195 wells/boreholes strategically situated in the area.

Water level measurements are taken twice a year from the above wells/boreholes except from 148 wells/boreholes where water levels are observed monthly, so that the behaviour of the water table in the aquifer, is observed more closely. A contour map showing the water situation in the aquifer, is drawn monthly.

Sea water intrusion in the aquifer is observed and studied by means of 67 wells/boreholes at Zakaki-Asomatos area and 23 wells/boregoles at Akrotiri area, water samples from which area taken 3-4 times a year. In addition the salinity of the water of 25 wells/boreholes in Episkopi-Akrotiri area was observed once a week during the months, July-September

Water pumped from the aquifer for irrigation, domestic and industrial purpose is noted monthly for each individual licenced well, by means of water meter, (total 421) 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 the necessary to preserve the existing plantations in good and productive condition and at the same time ensuring that the aquifer is not extensively damaged.

Water for irrigation was also supplied in the area, from Yermasoyia and Polemidhia Dams, through the distribution system, of the Dams. A quantity of 9.59 M.C.M. was also released from Kouris Dam into the river bed d/s of Dam, both, for recharge purposes and direct irrigation through the irrigation intakes.

Water extracted from Akrotiri Aquifer.

Purpose:	M.C.M.
Irrigation	
Domestic	
Industrial	
Total	
Water supplied from Dams	
Total supplied for irrigation from the aquifer and from the Dams	

Water Conservation Areas

The Water situation within the Water Conservation Areas is observed by means of a number of wells/boreholes, the water level of which is measured twice a year and the total of water extracted is estimated by the method of the questioning.

The Aquifer of Yermasoyia river is observed more closely, by means of 42 wells/boreholes, the water level of which is measured once every week. During 1988, a quantity of 4.02 M.C.M. was released or recharge, in the aquifer, from Yermasoyia Dam. A significant recharge of the aquifer has occurred due to the spills of Yermasoyia Dam.

Salinity is aiso observed taking water samples for analysis, twice a year, from a number of wells/boreholes.

The total number of observation wells/boreholes, in the Water Conservation Areas, which are measured twice a year, is 211.

Well Sinking Permits

Applications for well sinking permits and applications to transfer water to other plots, engine installations or Adjustment of pumping permits were envestigated: Some 457 cases were investigated and permits were finally granted by the D.O. for 396 of them.

Limassol Water Supply

The water supply to Limassol, for domestic purpose, is qauged monthly. A Quantity of 9.95 M.C.M. was supplied as follow.

From Yermasoyia aquifer	5.23 M.C.M.
From Episkopi - Akrotiri - Fassouri aquifer	3.22 "
From Garyllis aquifer	1.42 "
From Kandou Borehole	0.08 "
Total	9.95 M.C.M.

Village Water Supply

The water supply of 106 villages was measured during the period September November, when springs and boreholes are at their minimum output or maximum drawdown, respectively.

The quality of the water is being examined at regular intervals by the Medical Department.

Metereological Observations

Daily records were kept for rainfall (Max. 43.8 mm on 30/7/88) water evaporation (Max. 12.8 mm on 6.7.88) temperature (Max. 41.8 ^{o}C on 8.7.88), wind velocity and sun reflection, at Yermasoyia Dam.

Records were also kept for rainfall (Max. 40.0 mm on 23.1.88) and water evaporation (Max. 10.4 mm on 7.7.88), at Polemidhia Dam.

Quarry and Gravel Pits Permits

24 applications for quarries and gravel pits licences, were examined and submitted to the Senior Mines Officer.

Dams and Reservoirs

In the District of Limassol there are 21 Dams and Reservoirs. Maximum water stored during 1987 and other data are recorded under OPERATION AND MAINTENANCE DIVISION. The water stored elevation of the above was measured once a month.

INVESTIGATION & DESIGN

The solution of the irrigation and water supply proplems of all the populated area of Limassol District was the major task of this section.

Irrigation

For the development of irrigation systems of Limassol District 30 cases were examined, studied and the relevant designs were prepared for the total cost of £209,245 as follows.

TABLE XII - 1

IRRIGATION SCHEMES PREPARED IN 1988

Ser. No.	Village & Description	Est. cost £
1	Karvounas - Agros. Relocation of pipelines on the new road between Karvounas and Agros.....	11,900
2	Saittas - Perapedhi - Platres. Relocation of pipelines on the new road between Perapedhi and Platres.....	10,650
3	Agridhia. Rehabilitation of "Panayia" Irrigation Division.....	3,600

4	Zoopiyi - Agros. Relocation of pipelines on the new road between Zoopiyi and Agros.....	9,700
5	K. Platres - Phini - Paleomylos, Relocation of pipelines on the new road of Phini village.....	8,100
6	Ayios Theodhoros (Agros). Rehabilitation of "Lois" Irrigation Division.....	1,100
7	Kato Polemidhia - Ypsonas. Relocation of pipelines on the new road between Kato Polemidhia and Ypsonas	1,030
8	Vasa. Relocation of pipelines on the new road near Vasa village.....	4,900
9	Trakhoni Extension. Extension of Yermasoyia - Polemidhia distribution system to plot 437 Sh/Pl. 58/7.....	960
10	Limassol - Nicosia. Relocation of pipelines near underground passings of Pareklishia and Ayios Tykhonas.....	850
11	K. Polemidhia - Ypsonas. Relocation of pipelines on the new road between Polemidhia and Ypsonas.....	16,300
12	Ayios Ioannis (Agros). Rehabilitation of "Ayia Marina" Irrigation Division.....	12,100
13	P. Platres. Relocation of pipelines on the road near International Hotel.....	2,500
14	Kyperounda. Rehabilitation of "Kyperounda" Irrigation Division.....	5,300
15	Trimiklini. Rehabilitation of "Zenonas" Irrigation Association.....	8,700
16	K. Polemidhia. Relocation of pipelines near plot 520 Sh/Pl 53/56 of "Polemidhia" Irrigation Division	1,300
17	Limassol. Study of the industrial effluent at the Limassol Industrial Estate.....	58,500
18	Paleomylos. Rehabilitation of "Hartji - Ayios Yeorghios" Irrigation Division.....	1,400
19	Prodromos. Extension of Prodromos Dam to carry water from Chrome locality of Troodos.....	33,200
20	Limassol - Platres. Relocation of pipelines on the road between Polemidhia and Alassa.....	560
21	K. Polemidhia. Extension of the distribution System of "Polemidhia" Irrigation Division.....	630
22	K. Polemidhia. Relocation of pipelines near fly-over passing at 11th street of the village	3,600
23	P. Platres. Rehabilitation of "Pano Platres" Irrigation Division near Spring Hotel.....	1,725
24	Trimiklini. Rehabilitation of "Fraktis" Irrigation Division.....	8,900
25-30	Six cases in six villages of total cost	1,740
		209,245

Domestic Water Supply

For the development of water supply systems of Limassol District 116 cases were examined studied and the relevant designs were prepared for the total cost of £1,292,478 as follows:

TABLE XII - 2

DOMESTIC WATER SUPPLY SCHEMES PREPARED IN 1988

Ser. No.	Village & Description	Est. cost £
1	P. Platres. Utilization of B/H 86/86 for supplementary supply of the village.....	32,800
2	Kyperounda. Improvement of water supply scheme	206,000
3	Amathus. Water supply of plot 103/2/1, Sh/Pl. 54/45.....	3,430
4	Moutayiaka. Refugee self-housing scheme (phace H)	29,800
5	Apesha. Improvement of water supply from Arkolakhania B/H.....	52,200
6	Asgata. Extension of the distribution system to plots 639 and 514 of Sh/Pl. 55/2.....	2,350
7	Kolossi. Water supply of live stoke plots	2,900
8	Yermasoyia. Water supply of land division File No. D.304/81.....	2,130
9	K. Polemidhia. Water supply of new Limassol Hospital.....	82,500
10	Ypsonas. Improvement of water supply scheme	74,600
11	Yermasoyia. Water supply of plot 384 Sh/Pl. 54/44	1,230
12	Ayios Tykhonas. Water supply of plots 274, 276, Sh/Pl. 54/45.....	2,700
13	Amathus. Water supply of plot 124/1, Sh/Pl. 54/45	7,820
14	Erimi. Water supply of live stoke plots	2,850
15	Kolossi. Re-evaluation of land division for the inhabitans of Kolossi in Merras locality.....	6,450
16	Yermasoyia. Water sypply of land division (File No. D.388/86.....	2,100
17	Amathus. Water supply of plot 237/1, Sh/Pl. 54/45	1,700
18	Yermasoyia. Extension of the distribution system to "Ktimatici" area.....	2,550
19	Amathus. Water supply of plot 182/1/1, Sh/Pl. 54/47.....	1,670
20	P. Polemidhia. Improvement of self-housing estate Phace "D".....	6,350
21	Souni-Zanatzia. Improvement of water supply from "Kefalovrysos" spring.....	116,000
22	Amathus. Relocation of pipelines near plots 64, 65, Sh/Pl. 54/45.....	1,500
23	Amathus. Water supply of plots (Files No. B.559/77, B.727/85, B.158/79, B.109/79, B.470/85.	44,200

24	K. Polemidhia. Re-evaluation of land division (File No. D.482/83)	2,700
25	P. Polemidhia. Temporary extension of the distribution system for General Hospital of Limassol.....	2,860
26	K. Polemidhia. Re-evaluation of land division (File No. D.335/84).....	4,850
27	Kouka. Water supply of land division (File No. D.505/84.....	32,400
28	Limnatis. Construction of a new storage tank for Domestic water supply.....	5,900
29	Amathus. Water supply of plots 200/1/1/1, 199/2 Sh/Pl. 54/45.....	10,000
30	Moyttayiaka. Refugee self-housing scheme (Phace "Θ")	11,000
31	Souni-Zanaja. Extension from main storage tank to "Latsi" locality.....	4,000
32	Phini. Substitution of the main pipeline from the spring to the storage tank.....	22,550
23	Phini. Substitution of the main pipeline from the spring to the storage tank and construction a new storage tank.....	39,000
34	Ayios Athanasios. Water supply of plots 234, 235 Sh/Pi. 54/42.....	2,310
35	Moniatis. Water supply of plot 147/1/1/1/2, Sh/Pl. 47/21.....	1,310
36	Omodhos. Water supply of the new slaughter house	620
37	Perapedhi. Improvement of the distribution system.....	1,130
38	K. Polemidhia. Refugee self-housing scheme phace "Z"	23,280
39	Trozena. Water supply scheme from "Titsilia" spring.....	17,400
40	Trozena. Water supply scheme from "Titsilia" spring and distribution system.....	20,000
41	Louvaras. Improvement of the distribution system	2,600
42	Ayios Ambrosios. Water supply of the plot 345 Sh/Pl. 53/2.....	10,830
43	Amathus. Water supply of the plot 105/2, Sh/Pl. 54/45.....	1,296
44	Pano Platres. Water supply of the plot 18, 234, Sh/Pl. 47/12.....	14,700
45	Kolossi. Water supply of Industrial Estate Phace "C"	156,000
46	Moni. Extension of the distribution system to a new petrol station.....	6,600
47	Amathus. Water supply of plot 72 Sh/Pl. 54/47	1,716

48	Moutayiaka. Re-evaluation of self-housing scheme phace "H".....	29,400
49	Moutayiaka. Water supply of plot 19/4, Sh/Pl. 54/45.....	2,320
50	Khalassa. Extension of the distribution system to the cemetery.....	1,400
51	Limnatis. Improvement of the spring "Ayios Yeoryios"	2,000
52	Limnati. Improvement of the spring "Ayios Yeoryios" and substitution of the pipeline from the spring to the public fountain.....	2,550
53	K. Polemidhia. Water supply of the land division (File No. D.741/85)	8,400
54	Amathus. Water supply of plot 337, Sh/Pl. 54/40	5,500
55	Pyrgos. Water supply of land division (File No. D.408/55.....	6,500
56	Asgata. Relocation of pipelines from plot 666 Sh/Pl. 55/2	1,300
57	Sotira. Substitution of the distibution system	14,800
58	Ayios Athanasios. Water supply of land division (File No. D.779/85).....	1,500
59	Pissouri. Relocation of pipelines of the distribution system.....	2,000
60	Moutayiaka. Refugee self housing scheme (Phace K)	6,400
61	Alectora. Repairing the storage tank of water supply scheme.....	650
62	Trachoni. Water supply of 20 plots of self-housing scheme.....	1,100
63	Kilani. Substitution of the distribution system	62,500
64	Yerasa. Substitution of the distribution system	12,600
65	Dierona. Substitution of the distribution system	30,400
66	Lofos. Extension from the storage tank to "Stavros" locality.....	8,200
67	Ayios Ioannis (Agros). Substitution of the pipeline from the new storage tank to the other.....	3,570
68	Amathus. Water supply of plots 70/1, 71, Sh/Pl. 54/45.....	2,090
69-116	Forty eight cases in forty eight villages of total cost.....	6,416
	Total	1,292,478

In addition to the above 259 cases (applications) were examined studied and the relevant advice was given to the people concerned.

CONSTRUCTION

Irrigation and Domestic Water Supply Schemes

Several schemes were constructed by the Limassol Regional Office for major and minor irrigation schemes, village water supply, water supply for refugee housing estates and other schemes. These are listed UNDER CONSTRUCTION DIVISION, chapter VII.

Materials and Machinery

By the end of the year 1988 the following materials and machinery for water supply and irrigation schemes have been used.

TABLE XII - 3

MACHINERY USED BY LIMASSOL REGIONAL OFFICE

Machinery Employed	Unit	Quantity	Value £
Tiper lorries	agreed	-	3,912.00
Tiper lorries	W/hours	5 067	16,063.00
Buses	W/days	296	5,212.00
Buses	agreed (w/days)	70	1,296.00
Electrowelding machines	W/hours	3 745	3,549.00
Electrowelding machines	agreed (w/days)	266	2,363.00
Caterpillars	W/hours	1 854	23,640.00
Caterpillars	agreed	-	2,529.00
Cutting machines	W/hours	1 125	-
Bulldozer	W/hours	3 414	20,922.00
Land rovers	W/days	4 398	35,672.00
Diggers	W/hours	18 716	74,170.00
Diggers	agreed (w/hours)	1 233	5,070.00
Compressors	W/days	176	2,212.00
Compressors	agreed (w/hours)	166	376.00
Concrete mixers	W/days	727	2,013.00
Concrete mixers	agreed (w/days)	35	168.00
Braker	agreed (w/hours)	126	737.00
Braker	W/hours	521	3,049.00

TABLE XII - 3 MACHINERY USED BY LIMASSOL REGIONAL OFFICE (Cont.)

Machinery Employed	Unit	Quantity	Value £
Hydraulic Excavator ...	W/hours	905	9,408.00
Hydraulic Excavator ...	agreed (w/hours)	233	2,440.00
Motor Roller	W/hours	75	390.00
Mobile Concrete Mixer..	W/days	80	2,000.00
Mobile Concrete Mixer..	agreed	-	333.00
Vibrator	W/days	70	-
Vibrator	agreed (w/days)	5	27,00
Crane	W/hours	964	7,302.00
Total..			224,853.00

TABLE XII - 4

MATERIALS USED BY LIMASSOL REGIONAL OFFICE

Materials used	Unit	Quantity	Value £
Galvanized steel pipes	m	58 430	169,871.00
Steel pipes (coated or uncoated)	m	6 366	60,217.00
Ductile iron pipes	m	2 003	113,604.00
Asbestos cement pressure Pipes - class 15	m	11 426	142,994.00
Pipes - class 20	m	10 491	105,334.00
Pipes - class 25	m	-	-
Pipes - class 30	m	-	-
P.V.C. and polythene pipes	m	30 370	21,692.00
Cement	tones	568	14,008.00
Sand	m^3	837	3,428.00
Fine and corse sand	m^3	808	3,454.00
Aggregates	m^3	60	209.00
Mild steel	tones	69.4	8,833.00
Sand for pipe bedding	m^3	18 362	23,959.00
Ready mixed concrete	m^3	29	516.00
Fittings	No.	25 400	63,000.00
Sluice valves	No.	903	9,305.00

TABLE XII - 4 MATERIALS USED BY LIMASSOL REGIONAL OFFICE (Cont.)

Materials used	Unit	Quantity	Value £
Water meters	No.	171	2,026.00
Shingle	m^3	1 158	4,083.00
Total			746,533.00

OPERATION AND MAINTENANCE

The Limassol Regional Office was responsible for the operation and maintenance of all projects in the District of Limassol.

Yermasoyia-Polemidhia Project

Akrotiri, Evdhimou-Paramali Irrigation Schemes

For repairing and maintenance of water meters, valves general maintenance and painting of metal structures, etc. a sum of £26,000 was spent on Yermasoyia-Polemidhia Dams and Disrtribution network. An amount of £2,000 was spent on Akrotiri Irrigation scheme and the sum of £2,000 was spent on Evdhimou-Paramali Irrigation scheme.

Amathus Water Supply

The scheme operates with automatic control equipment. The operation and maintenance are carried out by the Regional office of the Department in co-operation with Limassol District Office. For the supervision, repairs and maintenance of water meters, valves general maintenance and painting of metal structures etc. was spent the sum of £6,000.

Village water supply schemes

For repairs and maintenance in 135 water supply cases was spent the sum of £9,172.

MEETINGS

During the year under review the Regional Engineer attended several meetings as the representative of the Director of the Department.

LIMASSOL REGIONAL OFFICE

1	Neocleous	Nicos	EE-I	.T.
2	Georghiades	Christakis	ST	.T.
3	Klitou	Athanasios	ST	.T.
4	Makis	Andreas	ST	.T.
5	Mavrommatis	Nicos	ST	.T.
6	Zenios	Vasos	ST	.T.
7	Achilleos	Yiannakis	T-I	.T.
8	Anastasiou	Charalambos	T-I	.T.
9	Aristotelous	Anastasios	T-I	.T.
10	Kountoureshis	Charalambos	T-I	.T.
11	Michaelidou	Fereniki Tasoula	T-I	.T.
12	Neophutou	Adamos	T-I	.T.
13	Onisiphorou	Nearchos	T-I	.T.
14	Papageorghiou	Petros	T-I	.T.
15	Antoniou	Demetra (HTI)	T-II	.F.
16	Charalambous	Andreas	T-II	.T.
17	Christodoulou	Matheos (TIE)	T-II	.F.
18	Constantinou	Andreas	T-II	.T.
19	HjiDavid	Christalla Christodoulou	T-II	.T.
20	Iacovou	Kyriakos D	T-II	.T.
21	Ioannides	Christakis (CE)	T-II	.F.
22	Kounnis	Christos	T-II	.T.
23	Larkos	Charalambos	T-II	.T.
24	Neophytou	Nicos	T-II	.T.
25	Orthodhoxou	Soteris	T-II	.T.
26	Pelopidas	Costas	T-II	.T.
27	Potamitou	Sophia Papanastasiou	T-II	.T.
28	Yiorkas	Vasos	T-II	.T.
29	Kostrikkis	George	CF	.T.
30	Karayiannis	Cosmas	ACF	.T.
31	Metaxas	Phedias	ACF	.T.
32	Papapanteli	Savvas	ACF	.T.
33	Charalambous	Kyriakos	F	.T.
34	Dhyplaros	Pambos	F	.T.
35	Eracleous	Stelios	F	.T.
36	Ioannou	Charalambos	F	.T.
37	Marcou	Kyriakos	F	.T.
38	Neophytou	Onouphrios	F	.T.
39	Nicolaou	Savvas	F	.T.
40	Skordis	Michael	F	.T.
41	Tsioullis	Costas	F	.T.
42	Yerocostas	Savvas	F	.T.

XIII PAPHOS REGIONAL OFFICE

By
A. Lambrou
Executive Engineer I
Regional Engireer

General

In 1988 the staff of the Regional office was composed of the following:

Executive Engineer I	1
Senior Technicians	4
Technicians I	11
Technicians II	12
Chief Foreman	1
Ass. Chief Foremen	1
Foremen Monthly	4
Foremen Weekly	9
Officer Clerk	1
Clerical & Accounting Staff	8
Telephone Operator	1
Messenger	1

WATER RESOURCES

Surface Hydrology

During the year 14 permanent stream gauging stations equipped with automatic water level recorders were in operation and weekly visits were made for observation maintenance and calibration purposes by the use of current meter.

A tatal number of 365 current meter measurements were taken during the year for calibration purposes. Also samples for suspended sediment load and boron analysis were taken regurarly.

Springs

During the year 35 springs were under observation and a total number of 383 spring discharges were gauged, 33 by current meter and 350 volumetrically.

Water Supply

The water supply of 132 villages was gauged during the months of July and August and samples for Ionic & Nitrates analysis were taken.

Rainfall observing stations

Five raifall observing stations equippedwith automatic raingauge recorders were in operation during the year, under weekly and monthly visits for observation.

Ground Water Hydrology

Ground water conditions in South Western Paphos were observed with the help of 128 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 at the end of the wet season (March) when it is expected to be at the highest level and of the dry season (November-December) when it is expected to be at the lowest level.

In addition monthly or weekly measurements of the ground water level were taken from 154 wells/boreholes during the year for special studies.

In addition monthly or weekly measurements of the ground water level were taken from 154 wells/boreholes during the year for special studies.

During the year a total number of 3171 measurements were taken from wells/boreholes under observation as follows:

2881 Water levels from S.W. Paphos Hydrological Area
290 " " " Polis Project Area

Analysis

A total number of 764 samples for analysis were taken from wells/boreholes springs and streams, 102 of which were submitted to the Goverment analyst for full, Boron & Ionic and chemical analysis, 42 to the Departmental laboratory for silt content analysis, 120 to Khirokitia analyst for Nitrates & Ionic analysis and 500 for the determination the Chloride content.

Questioning

The annual questioning was carried out in South Western Paphos Hydrological Area and in Dhiarizos-xeros- Ezousa river beds on 3511 owners of wells during summer for determining the ground water extracted, area irrigated and Kind of crop planted.

Well sinking permits

A total number of 187 applications for sinking and covering permits for wells/boreholes were exanined and submitted to the District Officer of Paphos.

These applications were finally examined and approved by the Advisory committee of the Ministry of Agriculture and Natural Resources.

The applica tions were examined as follows:

APPROVED			NOT APPROVED		
S.M.L. Area	W.C.A	Non W.C.A	S.M.L. Area	W.C.A	Non W.C.A
46	79	14	8	27	5

Encroachments in Rivers and Streams

Twenty one cases for land encroachments in rivers and streams were examined and the Director of Land and Survey Department , was advised accordingly.

Guarries and gravel permits

Thirty six applications for puarries and gravel pits permits were examined.

The Hydrological section undrtook to supervise implementation of the special conditions laid by the Department to the contractors exploting the gravel and sand of the river beds.

Plotting

During 1988, 18 new wells/boreholes were plotted on LRO plans at Peyia and Mesa Khoeio area covering a total area of 3 km^2.

Pumping Tests

During the year seven pumping tests, five of which for Tourist Development and two for Agriculture Development were carried out and relevant reports were submitted to the Director of the Department.

CONSTRUCTION

The construction programe of Paphos District office for 1988 included 33 water supply and irrigations schemes of a total cost of £737,695. Also another £79,000 was expended for several otherworks, mainly comming from public works Departments and the District officer Paphos. A table for all constructions works, has been submitted to the Director. See tables under CONSTRUCTION DIVISION Chapter VII.

INVESTIGATION AND DESIGN

The planning and design of irrigation schemes were in progress during 1988 and a total number of 17 new and old projects were prepared. The schemes were submitted to the Director for approval and submission to the interdepartmental committee for evaluation. The table below shows separately the extend of land and the cost of each irrigation sceme.

TABLE XI-I

Irrigation Schemes prepared in 1988

		£
1	Kato Pyrgos Extension "Katouris"	8 200
2	Kritou Terra	70 500
3	Ayios Nikolaos	6 000
4	Kelokedara-Ziripillis	52 000
5	Ayios Ioannis	7 800

Village Water Supply Schemes

1	Yeroskipou Refugee Housing	4 000
2	" " "	2 400
3	Armou - Tala- Lower Village	94 300
4	Lemba Government housing Scheme	1 600
5	Pomos- Pachiamos	181 800
6	Mandria Goverment Housing Scheme	23 000
7	Kouklia Lifestock farm area	12 500
8	Khrysokhou Goverment Housing scheme	700
9	Ayia Marinouda extension	1 800
10	Timi Water Supply	40 000
11	Theledra Water Supply	23 500
12	Anarita Water Supply	74 000
13	Pigenia Water Supply	51 000
14	Lysos- Simou Water Supply	171 400
15	Kouklia Goverment Housing Scheme	1 600
16	Ayia Marina Water Supply (Khrysokhou)	22 200
17	Anatoliko Lower Village Water Supply	30 000
18	Peyia Water Supply	238 000
19	Neo Chorio Water Supply	41 000
20	Paphiana (Lower Village) Water Supply	114 000
21	Yialia Water Supply	37 500

River Trainning

1	Trachipedoula (Ayios Savvas Irrig.)	57 000

Also 98 applications were investigated by this section during the year.

OPERATION AND MAINTENANCE

During 1988 the Paphos District office dealt with the operation and Maintenance of the several water works in Paphos i.e Paphos Dams Khrysokhou Valley Irrigation Scheme and various Goverment Water Supply schemes.

Regarding the Goverment water supply schemes a detail report covering both the expenditure and the revenue generated has been submitted to the Director of the Department.

Also several applications regarding E.A.C , C.Y.T.A wayleaves and water supply or Irrigation problems were examined in 1988.

COMMITTEE MEETINGS

During the year under review the District Engineer attended several meetings as the representative of the Director or as member of several local committees.

WATER DEVELOPMENT DEPARTMENT
TECHNICAL STAFF AS ON 31-12-88
BY FUNCTION In alphabetical order under post held

DIRECTORATE

1 Lytras	Constantinos St	D	.T.	
2 Hassabis	Kypros C	AD	.T.	
3 Christodoulou	Dr Christodoulos	PWE	.T.	

MISSING

1 Korellis	Antonis	T-II	.T.	
2 Nicolaou	Pantelis	T-II	.T.	
3 Vyras	Vasos	T-II	.T.	

WATER RESOURCES

1 Kypris	Dedalos	SH	.T.	
2 Peppis	Michalakis	G-I	.T.	
3 Papatryphonos	Dr Stephanos	H-I	.T.	
4 Neophytou	Panayiotis	STS	.T.	
5 Antoniades	Michalakis	TS	.T.	
6 Aniftos	Andreas	ST	.T.	
7 Constantinides	Polynikis	ST	.T.	
8 Nicolaides	Andreas	ST	.T.	
9 Sophocleous	Andreas	ST	.T.	
10 Theodhorou	Andreas	ST	.T.	
11 Antoniou	Ioannis	T-I	.T.	
12 Charilaou	Nicos	T-I	.T.	
13 Georghiou	Panikkos	T-I	.T.	
14 HjiPakkos	Andreas	T-I	.T.	
15 HjiStavrou	Charalambos	T-I	.T.	
16 Karoullas	Andreas	T-I	.T.	
17 Koulas	Ioannis	T-I	.T.	
18 Nicolaou	Loizos	T-I	.T.	
19 Phylactou	Andreas	T-I	.T.	
20 Christophorou	Constantinos	T-II	.T.	
21 Constantinou	Costas	T-II	.T.	
22 Dionysiou	Theodhoulos	T-II	.F.	
23 Homata	Anastasia	T-II	.F.	
24 Kyprou	Solon	T-II	.T.	
25 Loucaides	Prodhromos (MATHS)	T-II	.F.	
26 Nicolaou	Nicos Ant.	T-II	.T.	
27 Phylaktou	Charalambos	T-II	.T.	
28 Christou	Sophocles	F	.T.	

HYDROLOGY

1 Iacovides	Iacovos	SH	.T.	
2 Skordis	Panikos	EE-I	.T.	
3 Georghiou	Adonis	G-I	.T.	
4 Christodoulides	Dr Andreas	H-I	.T.	
5 Panaretou	Marilena	H-II	.T.	
6 Alexandrou	Pantelis	TS	.T.	
7 Katsianis	Savvas	ST	.T.	
8 Pashardis	George	ST	.T.	
9 Markides	Leandros	T-I	.T.	
10 Christou	Agathi Kourtella (CE)	T-II	.F.	
11 HjiAdamou	Krinanthi Kazamia (HTI)	T-II	.F.	
12 Macrides	Charalambos	T-II	.T.	
13 Nicolaou	Christakis	T-II	.T.	
14 Nicolaou	Philippos (HTI)	T-II	.F.	

PLANNING

1 Marcoullis	Christos	SWE	.T.	
2 Ioannou	Michalakis	EE-I	.T.	
3 Nicolaides	Theodhoros	EE-I	.T.	
4 Socratous	Dr George	EE-I	.T.	
5 Ioannou	Christos	H-I	.T.	
6 HjiGeorghiou	Panayiota	TIE-II	.F.	
7 Rodosthenous	Aphrodite Zachariou	ST	.T.	
8 HjiPanteli	Agathi Theodoulou(HTI)	T-II	.T.	
9 Rousou	Yiola (TIE)	T-II	.F.	

PLANNING(SOIL INVESTIGATION BRANCH)

1 Kridiotis	Charalambos	EE-I	.T.	
2 Kyrou	Dr Kyriakos	EE-I	.T.	
3 Loucaides	George	EE-I	.T.	
4 Dhikomitis	George	ST	.T.	
5 Makkoulas	Petros	ST	.T.	
6 Georghiou	Poly Neophytou(HTI)	T-I	.T.	
7 Antoniou	George	T-II	.T.	
8 Avgousti	Miranda (HTI)	T-II	.F.	
9 Ioannou	Yiannoula Mitilineou	T-II	.T.	
10 Ioannou	George	T-II	.T.	
11 Koutsioupis	Charalambos	T-II	.T.	
12 Kouppis	George	T-II	.F.	
13 Kyriakou	Yiannakis	T-II	.T.	
14 Marcou	Eleni Pisti(HTI)	T-II	.T.	
15 Menikea	Anastasia (CE-Roumania)	T-II	.F.	
16 Pereas	Sophocles	T-II	.T.	
17 Pentaliotou	Elina Papapavlou(HTI)	T-II	.T.	
18 Pittas	Aristodemos	T-II	.T.	
19 Skouroupathi	Angela Chrysanthou(HTI)	T-II	.T.	
20 Nicolaou	Neophytos	ACF	.T.	
21 Louca	Ioannis	F	.T.	
22 Odhysseos	George	F	.T.	
23 Papaioannou	Sergios	F	.T.	

PLANNING(TOPOGRAPHY BRANCH)

1 Evrypidou	Andreas	STS	.T.	
2 Akritas	Haris	T-I	.T.	
3 Constantinou	Charalambos	T-I	.T.	
4 Georghiou	Omiros	T-I	.T.	
5 HjiIoannou	George	T-I	.T.	
6 Michaelides	Michael A	T-I	.T.	
7 Panayides	Andreas	T-I	.T.	
8 Economou	George	T-II	.F.	
9 Ioannou	Emilios	T-II	.F.	
10 Katsouras	Michael	T-II	.T.	
11 Kissopodas	George	T-II	.T.	
12 Liasides	Thrasos	T-II	.F.	
13 Michael	Kyriakos	T-II	.T.	
14 Terzis	Marios	T-II	.T.	
15 Tsouris	George	T-II	.T.	

RURAL PROJECT PLANNING

1 Andreou	Costas	SWE	.T.	
2 Kampourides	Elias	EE-I	.T.	
3 Michaelidou	Maria Zachariou	EE-I	.T.	
4 Giragosian	Samuel	STS	.T.	
5 HjiPakkos	Panayiotis	TS	.T.	
6 Kyriakou	Christakis	ST	.T.	
7 Photiou	Panayiotis	ST	.T.	
8 Papageorghiou	Antonis	T-I	.T.	
9 Constantinou	Christodoulos	T-II	.T.	
10 HjiYiangou	Christakis (TIE)	T-II	.F.	
11 Mathopoulou	Maria (CE-Russia)	T-II	.F.	

DESIGN

1 Stylianou	Nicos	SWE	.T.	
2 Katsavras	Costas	EE-I	.T.	
3 Neophytides	Pavlos	EE-I	.T.	
4 Shiakalli	Eleni	EE-I	.T.	
5 Stephanou	Spyros	EE-I	.T.	
6 Mourouzides	Kypros	ST	.T.	
7 Gregoriou	Eleni Koki (CE)	T-II	.F.	

DESIGN(DRAWING & RECORDS BRANCH)

1 Pitsillides	Stavros	STS	.T.	
2 HjiKyriakou	Eleni Nicolaidou	ST	.T.	
3 Selipa	Stavroulla Papadopoulou	ST	.T.	
4 Andreou	Panos	T-I	.T.	
5 Antoniadou	Elpida Posporidou	T-I	.T.	
6 Georghiou	Eleni Adamidou	T-I	.T.	
7 HjiProkopi	Yiannoula HjiProkopi	T-I	.T.	
8 Markitsi	Georgina Christodoulou	T-I	.T.	
9 Nicolaou	Eleni HjiConstantinou	T-I	.T.	
10 Nicolaou	Eleni Tsangari	T-I	.T.	
11 Papageorghiou	Anastasia Kelogregori	T-I	.T.	
12 Papageorghiou	Droso Krashia	T-I	.T.	
13 Yangou	Maria Chrysokhou	T-I	.T.	
14 Constantinou	Anna Demetriou	T-II	.T.	
15 Gavrielidhou	Soula Della	T-II	.T.	
16 Ioannidou	Christalla	T-II	.T.	
17 Panayi	Evgenia Parpouna	T-II	.T.	
18 Pavlidou	Eve Mahlouzaridou	T-II	.T.	
19 Sophocleous	Androula Charalambous	T-II	.T.	

CONSTRUCTION

1 Georghiades	Andreas	SWE	.T.	
2 Petrocostas	George	EE-I	.T.	
3 Georghiou	Costas	STS	.T.	
4 Georghiou	Simos	TS	.T.	
5 Ioannou	Vrahimis	TS	.T.	
6 Pitsillides	Doloros	TS	.T.	
7 Iacovou	Marios (HTI)	T-II	.F.	
8 Petrou	Petros	T-II	.T.	
9 Pitta	Kyriaki Michaelidou	T-II	.T.	
10 Ashiotis	Andreas	CF	.T.	
11 Matheou	Costas	CF	.T.	
12 Charalambous	Harilaos-askarel	ACF	.T.	
13 Constantinou	Aristotelis	ACF	.T.	
14 Kyriakou	Savvas	ACF	.T.	
15 Potamitis	Ioannis	ACF	.T.	
16 Ioannou	Demosthenis	F	.T.	
17 Panteli	Thrasyvoulos	F	.T.	
18 Rousou	Antonis	F	.T.	

CONSTRUCTION(TENDER BRANCH)

1 Savva	Andreas K	TS	.T.	
2 Makouli	Androulla Pilatsi	T-II	.F.	

OPERATION & MAINTENANCE DWS

1 Artemis	Christodoulos	SWE	.T.	
2 Savvides	Kyros	CH-I	.T.	
3 Kalyva	Kyriaki Ioannou	CH-II	.T.	
4 Kazamias	Panayiotis	STS	.T.	
5 HjiPavlou	Savvas	TS	.T.	
6 HjiLoizou	Costas	ST	.T.	
7 Michaelides	Michael	ST	.T.	
8 Stavrou	Phedon	ST	.T.	
9 Constantinou	Androulla Stavrou	T-II	.T.	
10 Demetriou	Andreas N (ME-Hung.)	T-II	.F.	
11 HjiCosti	Marios (HTI)	T-II	.F.	
12 Pai	Penelopi (CE)	T-II	.F.	
13 Yianni	Antonis (Chemist- Chec.)	T-II	.F.	
14 Eleftheriou	Andreas	CF	.T.	
15 Poullos	George	ACF	.T.	

OPERATION & MAINTENANCE IRR

1 Tsiourtis	Nicos	SWE	.T.	
2 Nicolaou	Ioanna Kaskiri	EE-I	.T.	
3 Neophytides	Petros	TIE-I	.T.	
4 Photiou	Photos	TIE-I	.T.	
5 Josephin	Armand	STS	.T.	
6 Kastanas	Iacovos	TS	.T.	
7 Lanitis	George	TS	.T.	
8 Pengeros	Andreas	ST	.T.	
9 Kyriacou	Irene Loizou	T-I	.T.	
10 Yiasoumi	Zacharias	T-I	.T.	
11 Zachariou	George	T-I	.T.	
12 Aristodemou	Mikis	T-II	.T.	
13 Charalambous	George A	T-II	.T.	
14 Lambrides	Constantinos	T-II	.T.	
15 Malekkides	Stephanos(HTI)	T-II	.F.	
16 Pavlides	Demetris (HTI)	T-II	.F.	
17 Rousis	Phedros	T-II	.T.	
18 Yiangou	Andreas	T-II	.T.	

MECHANICAL & ELECTRICAL SERVICES

1 Theodhosiou	Savvas	ME-I	.T.	
2 Savva	Liasis	TS	.T.	
3 Stavrakis	Glafcos	ST	.T.	
4 Stavrou	Costakis	ST	.T.	
5 Constantinou	Costas (HTI)	T-II	.F.	
6 Efstathiou	Efstathios	T-II	.T.	
7 Elia	Elias Georghiou (HTI)	T-II	.F.	
8 Kyriakou	Charalambos (HTI)	T-II	.F.	
9 Kyllis	Michael (HTI)	T-II	.F.	
10 Themistocleous	Costas (HTI)	T-II	.F.	
11 Tooulakos	Soteris	T-II	.T.	
12 Violaris	Costas (HTI)	T-II	.F.	
13 Avgousti	Alexandros	CF	.T.	
14 Avlonitis	Costas	ACF	.T.	
15 Constantinides	Costas	ACF	.T.	
16 Neophytou	Charalambos	F	.T.	
17 Pavlou	Michael	F	.T.	

L'CA-F'STA REGIONAL OFFICE

1 Hamatsos	Tassos	EE-I	.T.	
2 Frangopoullos	George	TS	.T.	
3 Pittas	George	ST	.T.	
4 HjiIoannou	Antonis	T-I	.T.	
5 Tsimittis	Iacovos	T-I	.T.	
6 Araklitis	Costas	T-II	.T.	
7 HjiAntonis	Antonis	T-II	.F.	
8 Nicolaou	Nicos Andreou	T-II	.T.	
9 Pamporis	Michael	T-II	.T.	
10 Pagonis	Marios	T-II	.T.	
11 Theodhosiou	Andreas	T-II	.T.	
12 Tokkaris	Nicos	T-II	.T.	
13 Zaros	Panayiotis	F	.T.	
14 Constantinou	Panayiotis	F	.T.	
15 Theodhorou	Theophilos	F	.T.	

LIMASSOL REGIONAL OFFICE

1 Neocleous	Nicos	EE-I	.T.	
2 Georghiades	Christakis	ST	.T.	
3 Klitou	Athanasios	ST	.T.	
4 Makis	Andreas	ST	.T.	
5 Mavrommatis	Nicos	ST	.T.	
6 Zenios	Vasos	ST	.T.	
7 Achilleos	Yiannakis	T-I	.T.	
8 Anastasiou	Charalambos	T-I	.T.	
9 Aristotelous	Anastasios	T-I	.T.	
10 Koutoureshis	Charalamns	T-I	.T.	
11 Michaelidou	Fereniki Tasoula	T-I	.T.	
12 Neophytou	Adamos	T-I	.T.	
13 Onisiphorou	Nearchos	T-I	.T.	
14 Papageorghiou	Petros	T-I	.T.	
15 Antoniou	Demetra (HTI)	T-II	.F.	
16 Charalambous	Andreas	T-II	.T.	
17 Christodoulou	Matheos (TIE)	T-II	.T.	
18 Constantinou	Andreas	T-II	.T.	
19 HjiDavid	Christalla Christodoulou	T-II	.T.	
20 Iacovou	Kyriakos D	T-II	.T.	
21 Ioannides	Christakis (CE)	T-II	.T.	
22 Kounnis	Christos	T-II	.T.	
23 Larkos	Charlamabos	T-II	.T.	
24 Neophytou	Nicos	T-II	.T.	
25 Orthodhoxou	Soteris	T-II	.T.	
26 Pelopidas	Costas	T-II	.T.	
27 Potamitou	Sophia Papanastasiou	T-II	.T.	
28 Yiorkas	Vasos	T-II	.T.	
29 Kosmikkis	George	CF	.T.	
30 Karayiannis	Cosmas	ACF	.T.	
31 Metaxas	Phedias	ACF	.T.	
32 Papapanteli	Savvas	ACF	.T.	
33 Charalambous	Kyriakos	F	.T.	
34 Dhyplaros	Pambos	F	.T.	
35 Eracleous	Stelios	F	.T.	
36 Ioannou	Charalambos	F	.T.	
37 Marcou	Kyriakos	F	.T.	
38 Neophytou	Onouphrios	F	.T.	
39 Nicolaou	Savvas	F	.T.	
40 Skordis	Michael	F	.T.	
41 Tsioullis	Costas	F	.T.	
42 Yerocostas	Savvas	F	.T.	

PAPHOS REGIONAL OFFICE

1 Lambrou	Andreas	EE-I	.T.	
2 Andreou	George	ST	.T.	
3 Constantinides	Stelios	ST	.T.	
4 Loizou	Loucas	ST	.T.	
5 Saparillas	George	ST	.T.	
6 Andreou	Athinoula (HTI)	T-I	.T.	
7 Constantinides	Christos	T-I	.T.	
8 Constantinou	George	T-I	.T.	
9 Frangoullides	George	T-I	.T.	
10 Iacovou	Iacovos Chr	T-I	.T.	
11 Iacovou	Diamando Theophanous	T-I	.T.	
12 Kallasides	Thrasos	T-I	.T.	
13 Marcou	Yiannakis	T-I	.T.	
14 Neophytou	George	T-I	.T.	
15 Neophytou	Neophytos A	T-I	.T.	
16 Papasavvas	Andreas	T-I	.T.	
17 Shellis	Antonis	T-I	.T.	
18 Aspris	Takis	T-II	.T.	
19 Kaizer	Andreas	T-II	.T.	
20 Kitsis	Panayiotis	T-II	.T.	
21 Kyprianou	Phevos	T-II	.T.	
22 Leonidou	George	T-II	.T.	
23 Leonidha	Marios	T-II	.T.	
24 Nicolaou	Kyriaki HjiKleovoulou	T-II	.T.	
25 Papouris	Frixos	T-II	.T.	
26 Pantelides	George	T-II	.T.	
27 Pittakas	Kyriakos	T-II	.T.	
28 Theophanous	Theotokis	T-II	.T.	
29 Vasiliou	Michael	T-II	.T.	
30 Stephanou	Christodhoulos	ACF	.T.	
31 Aristotelous	Pavlos	F	.T.	
32 Christou	Nicolas	F	.T.	
33 Kommatos	Chrysanthos	F	.T.	
34 Neophytou	Evgenios	F	.T.	

PAPHOS IRRIGATION PROJECT

1 Socratous	Vasos	EE-I	.T.	
2 HjiSavvas	Constantinos	ME-I	.T.	
3 Christodoulides	Panayiotis	T-I	.T.	
4 Demetriades	Andreas	T-I	.T.	
5 Hepis	Takis	T-I	.T.	
6 Georghiou	George	T-II	.T.	
7 HjiKleovoulou	Andreas	T-II	.T.	
8 Papadopoulos	Ioannis	T-II	.T.	
9 Zenonos	Nicolas	T-II	.T.	
10 Papadopoullos	Ioannis	ACF	.T.	
11 Kleovoulou	George	F	.T.	
12 Michael	Christos	F	.T.	
13 Moyseos	Michael	F	.T.	

SCP KOURIS DAM

1 Aletras	Stavros	EE-I	.T.	
2 Eliades	Pantelis	EE-I	.T.	
3 Maratheftou	Paraskevi	EE-I	.T.	
4 Televantos	Michael	EE-I	.T.	
5 HjiIoannou	Phevos	TS	.T.	
6 Chrysanthou	Chrysanthos	T-II	.T.	
7 Demetriou	Christina Antoniou	T-II	.T.	
8 Kanonistis	Elias	T-II	.T.	
9 Karaiskakis	Michael	T-II	.T.	
10 Kolokotronis	Ioannis	T-II	.T.	
11 Odhysseas	Odhysseas	T-II	.T.	
12 Paroutis	Charalambos	T-II	.T.	
13 Parouti	Louiza Kassinidhou	T-II	.F.	
14 Elia	Eleftherios	ACF	.T.	
15 Nicolaides	Costas A	ACF	.T.	
16 Socratous	George	F	.T.	

SCP MAIN CONVEYOR

1 Eracleous	Yiannakis	EE-I	.T.	
2 HjiVasiliou	Zoe Voskaridou	EE-I	.T.	
3 Kountouris	Socrates	EE-I	.T.	
4 Tziakouris	Andreas	EE-I	.T.	
5 Kourtellas	Andreas	ST	.T.	
6 Mouskountis	Ioannis	ST	.T.	
7 Nicolaou	Sophocles	ST	.T.	
8 Theodhorou	Christakis	T-I	.T.	
9 Antoniou	Aristotelis	T-II	.T.	
10 Aresti	Aresti Chr	T-II	.F.	
11 Avgousti	Andreas	T-II	.T.	
12 Charalambous	Evgenios	T-II	.T.	
13 Hannoullis	Antonis	T-II	.T.	
14 Kkolas	Pavlos P	T-II	.T.	
15 Naoum	Stavros	T-II	.T.	
16 Toumba	Elli Socratous	T-II	.T.	
17 Avgousti	Savvas	ACF	.T.	
18 Christophorou	Ioannis	F	.T.	
19 Orphanides	Neophytos	F	.T.	

SCP KOKKINOKHORIA IRRIGATION AREA

1 Demetriou	Andreas	EE-I	.T.	
2 Partasides	Vlasis	EE-I	.T.	
3 Shiamma	Anthoulla Symeou	EE-I	.T.	
4 Christophides	Charalambos	EE-II	.F.	
5 Charalambous	Charalambos	EE-II	.F.	
6 Mavronicolas	Dionisios	EE-II	.F.	
7 Michaelides	Christos	EE-II	.F.	
8 Omorphos	Haris	EE-II	.F.	
9 Aletraris	Sophocles	TIE-I	.T.	
10 Eliades	Elias	TS	.T.	
11 Antoniades	Panos	ST	.T.	
12 Eleftheriou	Andreas	ST	.T.	
13 Marangos	Andreas	ST	.T.	
14 Phinikarides	Eleftherios	ST	.T.	
15 Tsangarides	Tefkros	ST	.T.	
16 Despotis	Elias	T-I	.T.	
17 Philippides	Nicos	T-I	.T.	
18 Socratous	Stavros	T-I	.T.	
19 Stratis	Nicos	T-I	.T.	
20 Angastiniotis	Themis	T-II	.T.	
21 Christodoulides	Xanthos	T-II	.T.	
22 Christodoulou	George	T-II	.T.	
23 Christou	Achilleas	T-II	.T.	
24 Demetriades	Costas (HTI)	T-II	.F.	
25 Efthyvoulou	Kypros	T-II	.T.	
26 Ellinas	Antonis	T-II	.T.	
27 Georgoudis	Ioannis	T-II	.F.	
28 HjiYiakoumis	Spyros	T-II	.T.	
29 HjiPetrou	Panayiotis	T-II	.F.	
30 Ioannou	Charalambos	T-II	.T.	
31 Kaouros	Michael	T-II	.T.	
32 Katsampas	George (HTI)	T-II	.F.	
33 Kouppis	Andreas	T-II	.T.	
34 Loucaidou	Phrini Kavallari	T-II	.T.	
35 Masouris	Marios	T-II	.T.	
36 Michaelides	Moises	T-II	.T.	
37 Michael	Marinos	T-II	.T.	
38 Michael	Soteris	T-II	.F.	
39 Moudhouris	Elias (HTI)	T-II	.F.	
40 Neocleous	Charalambos	T-II	.T.	
41 Nicolaou	Nicos K	T-II	.T.	
42 Nicolaides	Kyriakos	T-II	.T.	
43 Papashiantis	Costas	T-II	.T.	
44 Panayi	Ioannis	T-II	.T.	
45 Pekris	Joseph(HTI)	T-II	.T.	
46 Soteriou	Sonia (HTI)	T-II	.F.	
47 Tsiaoukkas	Kyriakos	T-II	.T.	
48 Tsiolakkis	Eleftherios	T-II	.F.	
49 Vyras	Antonis	T-II	.T.	
50 Kallis	Takis	CF	.T.	
51 Constantinou	Iacovos	ACF	.T.	
52 Mamantos	George	ACF	.T.	
53 HjiPakkos	George	F	.T.	
54 Kyriakou	Nicos	F	.T.	

SCP ADMINISTRATION & DESIGN

1 Chrysostomou	Ermioni Kouzouli	EE-I	.T.	
2 Kambanellas	Chrysostomos	EE-I	.T.	
3 Louca	Dr Froso Germanou	EE-I	.T.	
4 Patsalides	Demos	EE-I	.T.	
5 Nicolaou	Androulla Papachristod.	EE-II	.T.	
6 Michael	Niki	TIE-I	.T.	
7 HjiGeorghiou	Theodhoros	TIE-II	.F.	
8 Lambrianidhou	Georghia Masouri(HTI)	T-II	.T.	

KHRYSOKHOU IRRIGATION PROJECT

1 Antoniou	Demos	EE-I	.T.	
2 Chrysostomou	Georgoula Cleanthous	EE-I	.T.	
3 Nicodemou	Nicodemos	EE-I	.T.	
4 Paschalides	Soteris	EE-I	.T.	
5 Spanos	Kyriakos	EE-I	.T.	
6 Loizides	Christakis	T-I	.T.	
7 Panayiotou	Kyriaki	T-I	.T.	
8 Alkiviades	Christos	T-II	.T.	
9 Charalambous	Yiannakis	T-II	.T.	
10 Christodoulou	Photios	T-II	.T.	
11 Christophi	Costas	T-II	.T.	
12 Christodoulou	Antonis	T-II	.T.	
13 Christou	Lambros	T-II	.T.	
14 Koukliotis	Michael Chr	T-II	.T.	
15 Kyriakou	Eleni Kyriakou	T-II	.T.	
16 Magos	Tassos	T-II	.T.	
17 Poumpouris	Michael	T-II	.T.	
18 Shellis	Nicos	T-II	.F.	
19 Symeou	Demetris N	T-II	.T.	
20 Pitta	Tasos	F	.T.	

STUDY LEAVE SCHOLARSHIP ETC.

1 Christophides	Nicos	EE-I	.T.	
2 Christodoulou	George I	T-II	.T.	

Abbreviations

(a) For Posts

D	Director
AD	Assistant Director
PWE	Principal Water Engineer
SWE	Senior Water Engineer
SH	Senior Hydrogeologist
EE-I	Executive Engineer I
EE-II	Executive Engineer II
G-I	Geologist I
H-I	Hydrologist I
H-II	Hydrologist II
CH-I	Chemist I
CH-II	Chemist II
ME-I	Mechanical Engineer I
TIE-I	Topographer Irrigation Engineer I
TIE-II	Topographer Irrigation Engineer II
STS	Senior Technical Superintendent
TS	Technical Superintendent
ST	Senior Technician
T-I	Technician I
T-II	Technician II
CF	Chief Foreman
ACF	Assistant Chief Foreman
F	Foreman

.T. Permanent staff

.F. On casual basis

WATER DEVELOPMENT DEPARTMENT
TECHNICAL STAFF AS ON 31.12.88
BY FUNCTION AND GIVING POST
In alphabetical order under post held

January 1989 Drg No. BMIG/2 41