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REPUBLIC OF CYPRUS



MINISTRY OF AGRICULTURE & NATURAL RESOURCES

WATER DEVELOPMENT DEPARTMENT

ANNUAL REPORT 1987

C. ST. LYTRAS, M Sc DIC B Sc

Director

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WATER DEVELOPMENT DEPARTMENT
ANNUAL REPORT 1987

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 1987 the value of the Cyprus £ on average (daily basis) was:-

\$	1.784
£ st	1.2684
DM	3.7212
Drachma	280.6684

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I GENERAL

Introduction

Significant activities of the Water Development Department during 1987 were:

Commencement of impoundment in Kouris Dam the sluice gate having been shut on 17th of December; continuation of construction works on all components of the first phase of the Southern Conveyor Project; continuation of construction on the irrigation distribution network for the Khrysokhou Irrigation Project; the winding up of the construction of the irrigation distribution network for Vasilikos-Pendaskinos Project; completion of the feasibility study for the Karyotis Project by the end of the year; the continuation of the design work for the Southern Conveyor Project 2nd Phase and last but not least the inauguration of the Evretou Dam and part of the distribution network of the Khrysokhou Irrigation Project.

During 1987 and for the thirteenth year running all activities of the Department were confined to the southern part of the Island due to the continuing occupation of northern Cyprus by the invading Turkish troops, which since the summer of 1974 has created a situation allowing no access, or contact with the north bar for communication through the good services of the UN peace keeping force for the unified water supply of Nicosia.

Precipitation was around 101% of normal and flow recorded at most river gauging stations was about normal and as a result of the high precipitation of March the water accumulated in dam reservoirs was higher than in recent years of low precipitation. As regards the groundwater situation in the most important aquifers a general drop of the water table was noted but in some others a slight rise, particularly in March, occurred.

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. Its aim is 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 and is 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 items 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 by the PIP.

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. Kalavassos area irrigation network will be completed in 1989.

The main components of the project are:

- Kalavassos Dam on Vasilikos river, having a capacity of 17 million cubic meters (MCM) of water,
- Dhyptamos 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 Dhyptamos Dam reservoir,
- A conveyance and distribution system for irrigation from Kalavassos 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 Dhyptamos 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 Kalavassos Dam up to the break pressure tank), pumping station at Tokhni and balancing reservoir at Khirokitia to convey water from Kalavassos 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 Dhyptamos 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 per year for the 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 Kalavastos, Mari, Zyyi, Tokhni and Psematismenos,
- The Pendaskinos area of land belonging to Ayios Theodoros 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, Kalavastos-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.

During 1987 the VPP was connected to the SCP main conveyor through a pipeline and balancing reservoir at Vasilikos near Kalavastos originally to augment the irrigation requirements of VPP.

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.

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 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 will be around 110 m high. The 5 km long reservoir will have a surface area of 360 ha. Construction work on Kouris Dam started in mid 1984 and will be 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 will convey the stored water upto Akhna reservoir.
- Akhna Reservoir: A 16 m high earthfill embankment dam it will retain 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 £95 million.

Phase 2 includes the diversion of water from Dhiazos 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 Pareklissha covering a total area of 4335 ha.

Khrysokhou Irrigation Project (See also Chapter VIII/2)

The Khrysokhou Irrigation Project (KIP) will develop the water resources of the north western part of Cyprus. When the two phases of the project will be completed it will irrigate 3000 ha net.

The first phase includes 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 started in January 1984, and it is estimated to cost about £9 million. 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.

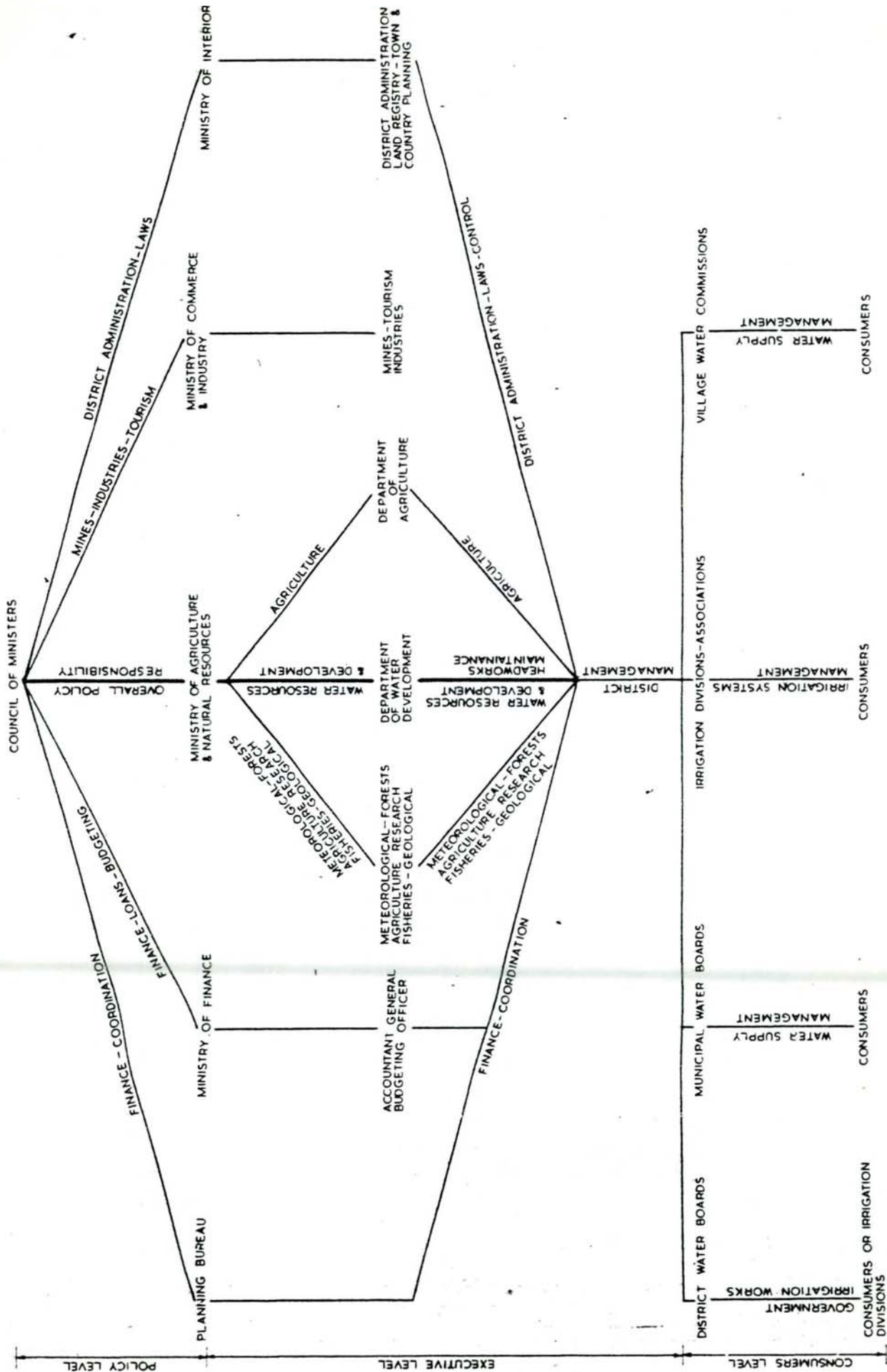
Land consolidation was applied on about 250 ha of the area as the rest has a high percentage of Turkish Cypriot property and was therefore excluded.

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.



WATER RESOURCES CONSERVATION & DEVELOPMENT
GOVERNMENT INSTITUTIONAL SET UP

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-8. 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.

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.

TECHNICAL STAFF OF WDD ON 31.12.1987

DRG No BM/G/225

1 TECHNICAL STAFF		D	AD	PWE	SWE	SH	EE	ME	Geo	H	CH	TIE	STS	TS	ST	T	CF	ACF	F	SE	TOTAL	REFERENCE		
i	Permanent Ordinary Staff	1	1	1	6	2	42	2	2	4	2	4	7	13	39	197	7	20	57	2	409	D Director		
ii	Casual Staff						5					2			4						77	AD Assistant Director		
TOTAL NUMBERS		1	1	1	6	2	47	2	2	4	2	6	7	13	39	267	7	20	57	2	486	PWE Principal Water Engineer		
DISTRIBUTION OF STAFF																								
2	DIRECTORATE	1	1	1																			SH Senior Hydrogeologist	
	i Water Resources Management					1		1	1				1	1	4	14							EE Executive Engineer	
	ii Hydrology					1		1	1				1	1	2	3							ME Mechanical Engineer	
	iii Planning					1	6	1	1				1	2	22	1	3						Geo Geologist	
	iv Design					1	1	1	1				1	3	16								H Hydrologist	
	v Construction					1	1	1	1				1	4	1	3	1	3					CH Chemist	
	vi Rural Projects Planning					1	2	1	1				1	1	2	2							TIE Topographer Irrigation Eng.	
	vii Operation & Maintenance - DWS					1	1	1	1				1	1	1	3	1	3					STS Senior Tech. Superintendent	
	viii Operation & Maintenance - Irrig.					1	1	1	1				1	1	1	2							TS Technical Superintendent	
	i Paphos Irrigation Project (PIP) O&M stage					1	1	1	1				2	1	1	1	2						ST Senior Technician	
	ii Pitsilia and Vasilikos-Pendaskinos Projects									2			1	1	3	1	3						T Technician	
	iii Southern Conveyor Project (SCP)																						CF Chief Foreman	
	iv Khrysohkhon Irrigation Project (KIP)																						ACF Assistant Chief Foreman	
	i Regional Office, Famagusta-Larnaca																						F Foreman	
	ii Regional Office, Limassol																						SE Sanitary Engineer	
	iii Regional Office, Paphos																						O&M Operation & Maintenance	
	iv Mechanical and Electrical Services																							
<p>Note: Four Executive Engineers, one Technical Superintendent and one Senior Technician and fifteen Technicians are transferred to Limassol Regional Office but posted at SCP sites and are listed under SCP on this table.</p>																								
7	Various Postings																						* Missing since 1974 invasion	
8	Vacancies																						** Under TS one post supernumerary	
TOTAL NUMBERS		1	1	1	10	2	47	2	2	4	2	6	7	14	39	267	7	20	57	2	487	** Against abolition of 4 EE posts		

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 Office Management Division is responsible for the office services, accounts, labour, personnel and stores. Also a financial control and co-ordination branch is included which deals with financial aspects and control of expenditure.

FOREIGN TECHNICAL ASSISTANCE

United Nations

Technical assistance received from United Nations during 1985 was:

Experts

T E H Sabben-Clare FAO expert, continued his services with us throughout the year in connection with the Vasilikos-Pendaskinos Project and Southern Conveyor Project.

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 design, contract documents and supervision of construction of the Southern Conveyor Project together with the SCP team of WDD staff,

Rofe Kennard and Lapworth jointly with Wallace Evans and Partners UK in association with C Chr Ioannides, Nicosia for the detail design, contract documents and supervision of construction of all engineering components of the Vasilikos-Pendaskinos Project and a study for a water authority for Cyprus.

Sir William Halcrow and Partners in association with A Prastitis and Associates, Nicosia for the detail design and supervision of construction of Evretou Dam, KIP.

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 detailed designs and contract documents for all engineering components of the 2nd phase of the Southern Conveyor Project.

SUMMARY OF ACTIVITIES

Water Resources

The collection and evaluation of hydrological data continued through 1987 covering also to 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 about normal. Groundwater recharge was again poor this year and a general drop in the static water level of most important aquifers was observed. In some aquifers a slight rise was observed in March.

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 1986-87 averaged 520.3 mm which is 101% of normal. The rainfall was below normal on the eastern and western coastal areas, in the Mesaoria plain, on the eastern Troodos slopes and in some parts of northern and western Troodos slopes while in the remaining areas precipitation was above normal. The extraordinary rainfall of March 1987 (300% of normal) must be recorded here for its beneficial effects on agriculture in general and the enormous quantities of water accumulated as a result in the dam reservoirs.

The maximum amount of rainfall in a 24-hour period was 113 mm recorded by an autographic raingauge on 9th March 1987 at Prodhromos rainfall station in Troodos.

The first snowfall occurred on Mount Olympus, the highest peak of Troodos mountain range, on the 8th November 1986 and the last snowfall on the 2nd May, 1987.

The air temperature as a whole was below normal. The extreme maximum temperature was 43.2°C reported by Nicosia town Climatological Station on the 27th July 1987 and the extreme minimum temperature was -8°C reported at Prodhromos on the 15th March 1987.

The maximum annual evaporation measured from a U.S.W.B. pan was 2,315 mm reported by Larnaca Airport Synoptic Station and the minimum annual evaporation was 1676 mm at Saittas.

Hydrology

The Division of Hydrology and Water Resources Management which was established in 1982, continued in 1985 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:

- Hydrologic data of various catchments involved in the Karyotis Feasibility Study and follow up of the runoff monitoring at selected sites.
- Updating of the hydrology and divertible quantities at Elea river in connection to the Vizakia Project.
- Hydrology and processing of observed runoff at Yermasoyia.
- Flood studies on minor catchments.
- Updating of the data bank with recent rainfall and runoff data.
- Development of surface hydrology software for computer application.
- Computerization of the 8000-well inventory carried out in 1986 in the Kokkinokhoria area. Issue of preliminary assessment report.
- Supervision of the well and land use survey carried out in the Akrotiri aquifer in connection to the SCP (Phase II).
- Sampling of groundwater in the Kouris Delta and Yermasoyia areas in connection to the isotope studies sponsored by the I.A.E.A.
- Follow up of the developing groundwater conditions in the Kokkinokhoria, Kiti-Pervolia, Parekklisia and Akrotiri areas. Monitoring of sea intrusion at the coastal areas of Yermasoyia, Akrotiri and Kokkinokhoria areas.
- Conjunctive operation of the Yermasoyia dam and downstream aquifer and Asprokremos dam with Xeros river aquifer. Artificial recharge through timely releases and monitoring allowed maximization of water resources availability.
- Monitoring of increased extraction from the Kouris Delta for the domestic water supply of Limassol.
- Monitoring of the Phasouri recharge pond to determine extent and scope of artificial recharge in the area.
- Seepage studies at Evretou dam.

- Simulation of past water levels in the Akrotiri Salt Lake through correlation of nearby observation wells as part of the overall environmental study for the Lake.

Planning of Projects

A great number of applications by villages for the planning of major water works have been dealt with during 1987 by the Planning Division. Most were only examined on the spot and some others were studied further at preliminary or feasibility level. Some other studies were also undertaken for unforeseen odd jobs, the most notable one being the safe disposal of the Askarel toxic substances. Finally a reevaluation of the irrigation component of the Krasokhoria Integrated Rural Development Project was carried out where as the feasibility study of the Karyotis Project, which was undertaken by Soviet Consultants, was substantially completed by the end of the year.

Design of Projects

During 1987 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.

Construction of Projects

Construction expenditure of the Department during 1987 reached the amount of £26,223,982 against £37,086,855 for 1986 (See table VII-1 under DIVISION OF CONSTRUCTION).

Southern Conveyor Project (SCP) 1st Phase

Construction work on Kouris Dam the main water source of SCP continued throughout 1987. Work on this 110 m high, 115 MCM water capacity dam started in September 1984 and will be completed in mid 1988. An impounding certificate was nevertheless issued to the contractors on the 2nd November 1987 (after the dam embankment mean elevation reached the level 215 m above mean sea level on 22nd October 1987) to shut the outlet tunnel gates of the dam to take advantage of the rainy season of Cyprus, December to March.

Work on the construction of the SCP main conveyor which started in October 1985 continued throughout 1987 and will be completed during the first half of 1988. The main conveyor, 1400 to 800 mm dia, 115 km long DI pipeline will convey water from Kouris Dam to Akhna reservoir. The first phase of SCP will supply irrigation water to Kokkinokhoria but allows also for water to be used for recharge in the riverbeds of Yermasoyia, Maroni and Tremithos rivers as well as a connection to the Vasilikos-Pendaskinos Project which feeds the Central Water Supply System for the water needs of Nicosia, Larnaca, Famagusta, several villages, refugee housing estates, the tourist and other industries of the homonymous Districts.

Construction of Akhna Dam started in mid 1986 and was completed by the end of 1987. Akhna Dam with a capacity of 5.8 MCM will act as a storage/balancing reservoir of water conveyed from Kouris dam to Kokkinokhoria irrigation areas.

Three contracts are currently in progress for the Kokkinokhoria distribution system. These contracts, of a total value of £5.25 million started in March-April 1987 and involve the construction of:

- (i) four balancing reservoirs
- (ii) fifteen reservoirs of the central distribution points (CDPs)
- (iii) the construction of 19 pumping stations, ie 3 for the balancing reservoirs, 15 for the CDPs and one at Akhna reservoir.

In addition to these three contracts the Construction Division of the Water Development Department has since June 1986 started the laying of the Kokkinokhoria pipeline irrigation network by direct labour covering an area of 9,200 ha. The total expenditure for this work which will be completed in 1991 is estimated at £5.5 million.

The 1st phase of the Southern Conveyor Project is estimated to cost £95 million and it is planned to be completed by the end of the 5th emergency five year plan of the government in 1991.

The actual cost of the Project up to the end of 1987 was £59,934,897 (Expenditure for the year 1987 reached the amount of £19,273,498).

Southern Conveyor Project 2nd Phase (Commencement of construction planned for 1988-89)

The SCP 2nd phase involves:-

The Dhiarizos diversion which consists of a diversion weir on Dhiarizos river and a 2.5 m dia diversion tunnel 14.5 km long from Dhiarizos to Kryos river. A quantity of 21.5 MCM will be diverted each year to Kouris Dam reservoir. The detail design for this work is currently being prepared as well as the process for contractor's prequalification.

The Limassol water treatment plant, for the water supply of Limassol and environs, having an output of 40,000 cubic meters per day initially and a future potential for 80,000 cubic meters per day. Turnkey tenders have already been issued for the construction of the plant the closing time of which is January 1988.

The irrigation distribution systems for the areas of Akrotiri (1,755 ha), Kiti (1600 ha), Mazotos (660 ha) and Parekklissha (320 ha) for which detail designs are also being prepared.

For the Akrotiri area, tenders have already been awarded for the supply of pipes and fittings 600-1000 mm dia for a total value of £336,000.

The construction of the Akrotiri irrigation network which will start early in 1988 will be undertaken by the Limassol Regional Office of the Water Development Department through direct labour and is estimated to cost £600,000.

The Tersephanou water treatment plant for Nicosia water supply with a design output of 60,000 cubic meter per day initially with a future potential of 90,000 cubic meters per day, including a conveyor pipeline from Tersephanou to Nicosia are also in the stage of preparation of detail design.

The design of all the works for the Southern conveyor Project 2nd Phase has been assigned to the Yugoslav Consultants Energoprojekt in cooperation with the Design Division of the Water Development Department.

The construction of the SCP 2nd phase works is estimated to cost £75 million of which approx. £65 millions or 85% will be spent during the 5th five year emergency plan of the Government.

It must be stated here that construction of the 2nd phase works of the project will overlap with construction of the 1st phase works Phasing of the SCP refers solely to financing of the project.

Khrysokhou Irrigation Project (KIP)

The construction of Evretou dam, the main water source of KIP, commenced in January 1984 and was completed in December 1986. The construction of this 25 MCM capacity dam was awarded to the joint venture Shephard Hill-Zachariades and it has cost approx. £9.2 million. By May 1987 a quantity of 10 MCM was impounded in the dam reservoir, part of which was used during the 1987 irrigation period in the areas where the irrigation distribution network was completed.

An area of 2000 ha will be irrigated from Evretou dam in the Khrysokhou valley extending from the dam to the sea including the coastal strip from Neokhorio to Limni as well as the areas of Peristerona and Sarama. Water will be fed to all irrigation areas by gravity except Peristerona and Sarama areas which lie higher than the dam.

In addition, 8 boreholes are included in the 1st phase of KIP for further exploitation of ground water in Khrysokhou Valley.

The construction of the irrigation distribution network including the construction of farm roads started in April 1986 and is planned to be completed during the first half of 1988. The contract for this work was awarded to G P Zachariades for £1.47 million.

The irrigation distribution system of the 1st phase of the KIP consists of a main conveyor pipeline of 900 mm max dia, 8 km long and irrigation network pipes 75-600 mm dia 120 km long. The main conveyor feeds the irrigation distribution network through four earth balancing reservoirs and an elevated tank.

The construction of the 8 km long main conveyor the four earth balancing reservoirs and the elevated tank (as well as 15 km length of the main conveyor and one earth reservoir of the 2nd phase of KIP) were awarded to General Construction Co. for the contract sum of £1,122,000 signed in November 1986. Work on this contract started in January 1987 and is expected to be completed by the middle of 1988.

The total actual expenditure to the end of 1987 on KIP, including construction work for the 2nd phase is £14,511,211. Expenditure for the year 1987 included in this sum reached the amount of £2,436,029.

Khrysokhou Irrigation Project (KIP) 2nd Phase (Construction of the 2nd phase of the KIP started in 1987 and is overlapping the construction of the 1st phase of the project)

The 2nd phase of the KIP allows for

- (i) the extension of the main conveyor to serve the areas of Argaka, Yialia, Ayia Marina and Pomos as well as
- (ii) the diversion of surplus water from the Magounda, Yialia and Livadhi rivers to Evretou dam making use of the main conveyor. Diversion will be from such a height as to allow some 5 MCM/year of diverted water to gravitate to Evretou Dam.

The first stage of this work is being constructed along with the 1st phase of the KIP and includes:

- (i) the extension of the main conveyor up to Argaka dam to increase it's irrigation area by 200 ha
- (ii) the diversion of Magounda river and
- (iii) the replacement of the Pomos dam main canal with a pipeline.

This work is expected to be completed in mid 1988.

Three smaller dams already exist in the area namely Argaka, Ayia Marina and Pomos with a total storage capacity of 2.3 MCM irrigating some 370 ha of land. On completion of the works of the 2nd phase the irrigation area will increase to 1,000 ha.

The total cost of the 2nd phase is estimated at £4 million.

Vasilikos-Pendaskinos Project

Construction of this project was completed in 1985-86 and was put into full operation during this period with the exception of part of the Vasilikos-Maroni irrigation area which together with the installation of the telemetry system were completed in 1986-87. Construction of the irrigation network for part of the Vasilikos area near Kalavassos has been delayed due to land consolidation procedures and will be completed in 1989.

Operation and Maintenance-Domestic Water Supplies

Up to the beginning of March the 1986-87 winter season was one of poor rainfall which, following five consecutive years of unsatisfactory rainfall, caused further depletion of aquifers and dams. Fortunately the exceptionally high rainfall of March supplied the badly needed quantities of water and it was therefore generally possible to meet the demand during the year.

The Department of Water Development is responsible for the operation and maintenance of all sources of water supply for Nicosia including the 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. 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 1987 was 11.930MCM out of which 10.816MCM came from government sources, 0.871MCM was purchased from private sources and 0.243MCM was the yield of Nicosia Water Commission sources. Included in the government sources is a quantity of 1.238MCM produced by the 1982-1984 emergency schemes BHs. Of the total production, the quantity of water delivered to the Nicosia service reservoirs was 10.969MCM. A quantity of 0.814MCM was consumed en-route by a number of villages, camps and industries connected to the system. The total quantity of water delivered to the Nicosia Water Board service reservoirs was 10.969 MCM 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 total expenditure during 1987 for the operation and maintenance of all sources and conveyance systems supplying Nicosia town was £711,345 and the revenue generated from the sale of water was £1,959,718, 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 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 Kalavastos 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 8.82MCM. The quantity of water drawn from Yermasoyia, Lefkara and Kalavastos Dams was 2.85, NIL and 4.74MCM respectively (net of losses at the

treatment works). The total expenditure for the operation and maintenance of the system during the year was £493,661 and the revenue generated £1,833,541 (including outstanding accounts).

The town of Larnaca received 3.21MCM of water from the Central Water Supply System and the production of its own and leased sources was 0.27MCM totalling 3.48MCM. This quantity could meet the demand of the town and the Water Board of Larnaca did not have to impose restrictions on the supply.

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 1987 was 9.29MCM.

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 0.009MCM. The total quantity of water available to the town during the year was 1.84MCM which could meet the increased demand and no restrictions were imposed on the supply except for a period of about 15 days in July necessitated by a break in the main conveyor to the town.

Operation and Maintenance of Projects - Irrigation Works

The management of major irrigation works is done either by the WDD or by the government waterworks 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 project river diversions in Cyprus, in the Government controlled areas, amounted to 124.257 MCM. From this quantity 31.864 MCM were used for the irrigation of 9207 hectares, 14.87 MCM were used for domestic water supplies, 5.860 MCM were used for recharge, 1.227 MCM seeped through or below the dams and 6.903 MCM were lost as evaporation. The remaining 63.531 MCM were retained in the dams as over-annual storage or lost in the form of overflow.

Water available for utilization from Government projects reached the figure of 117.996 MCM. Out of this only 48.350 MCM were utilized, 27.618 MCM for irrigation, 14.872 MCM for domestic water supply and 5.860 MCM for recharge. Irrigation water was utilized on 7966 hectares of land planted with citrus, bananas, vines, deciduous, vegetables, potatoes cereals and olives. The gross income from the sale of water amounted to £1,146,669. The total operation, maintenance and energy cost amounted to £745,613 and the net income to the Government was £401,056. The O&M expenses breakdown is as follows: Operation, £214,671, Maintenance £308,529 and energy cost £222,413.

Water available for utilization from contributory schemes was 6.261 MCM out of which 4.246 MCM were used for the irrigation of 1,341 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 no water 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 1987. In the same year a research contract was initiated for the "Use of isotopes in the operation and management of the Yermasoyia aquifer". In 1987 it reached its third and final year.

REGISTRE DES BARRAGES EN
REGISTER OF DAMS IN CYPRUS

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L I G N E L I N E N O.	NOM DU BARRAGE NAME OF DAM	ANNÉE D'ACHÈVE- MENT YEAR OF COMPLE- TION	SITUATION - LOCATION			SITUATION ET TYPE D'ÉTAN- CHÉITÉ POSITION AND NATURE OF SEALING ELEMENT	HAUTEUR DU DERRIÈRE DU BARRAGE HEIGHT ABOVE FOUN- DATION (m)	LONGUEUR DE CRÈTE LENGTH OF CREST (m)	VOLUME DU BARRAGE VOLUME CONTENT OF DAM (10 ⁶ m ³)	CAPACITÉ TOTALE DU RÉSÉROIR SURFACE DU RÉSÉROIR CAPACITY OF RESERVOIR AREA (100 m ²)	CAPACITÉ MAXI- MALE DES ÉVACUA- TEURS MAXIMUM CAPACITY OF SPILL- WAYS (m ³ /s)	TYPE DES ÉVACUA- TEURS TYPE OF SPILL- WAYS	PROPRIÉTAIRE OWNER	BUREAU D'ÉTUDES ENGINEERING BY	CONSTRUCTEUR CONSTRUCTION BY	L I G N E L I N E N O.	
			COURS D'EAU RIVER	VILLE LA PLUS PROCHE NEAREST CITY	ÉTAT OU DÉPAR- TEMENT PROVINCE OR COUNTY												
1	PALEKHORI KAMHI	1973	AKAKI	Sirostia	Nicosia	PG	31	131	27	620	1	I	Government & Palekhori Irr. Div.	MIP	J. & F. Cyprus	1	
2	ARAKAPAS	1975	YEMASOYLA	Limasol	Limasol	PG	23	92	10	110	1	I	Arakapas Irr. Div.	MIP	MIP	2	
3	AYI VAVATISINIAS No1	1980	Off-stream	Larnaca	Larnaca	TE	17	125	32	20	1	I	Palaichias-Mosphilomoutti Irr. Div.	MIP	Incovou Bros, Cyprus	3	
4	EPITAGORIA No1	1980	Off-stream	Limasol	Limasol	TE	16	90	66	55	1	I	Kokkinothos Irr. Div.	MIP	Incovou Bros, Cyprus	4	
5	KIANDRIA	1980	Off-stream	Limasol	Limasol	TE	35	82	61	92	1	I	Kambos tou Epiphiti Irr. Div.	MIP	CYBARCO, Cyprus	5	
6	MELENI	1980	Off-stream	Limasol	Larnaca	TE	22	116	32	59	1	I	Melini Irr. Div.	MIP	Incovou Bros, Cyprus	6	
7	PITELORIA	1980	Off-stream	Limasol	Limasol	TE	18	209	50	121	1	I	Amnos Irr. Div.	MIP	FYSCO, Cyprus	7	
8	AKAPOI-EPITAGORIA	1981	Off-stream	Limasol	Limasol	TE	18	280	67	21	1	I	Aspion - Epitagnonia Irr. Div.	MIP	Incovou Bros, Cyprus	8	
9	AYI VAVATISINIAS	1981	Vasilikos	Larnaca	Larnaca	VA	19	58	2	132	1	I	Palaichias-Mosphilomoutti Irr. Div.	MIP	MIP	9	
10	KATO MYLOS	1981	Off-stream	Limasol	Limasol	TE	21	250	61	12	1	I	Vatera Irr. Div.	MIP	Phoenix Constructions, Cyprus	10	
11	AGRIKHIA	1982	Off-stream	Limasol	Limasol	TE	18	119	25	59	1	I	Uthinos Irr. Div.	MIP	Incovou Bros, Cyprus	11	
12	ASERIKI-ZENOS	1982	Xelopotamos	Paphos	Paphos	TE	56*	280	7 000	12	1	I	Government	Sir M Macdonald & Partners UK	Joint Venture J & F and MENDON, Cyprus	12	
13	KYPERONIA	1982	Off-stream	Limasol	Limasol	TE	27	132	95	2 273	1	I	Pherika Irr. Div.	MIP	Incovou Bros, Cyprus	13	
14	XELIATOS	1982	Lagoudera	Sirostia	Sirostia	FR	62	155	250	36	1	I	Government	MIP	General Construction Co Cyprus	14	
15	LACOBIBERA	1983	Off-stream	Sirostia	Sirostia	TE	36	124	63	1 750	1	I	Amnos Irr. Div.	MIP	Joint Venture Phoenix Constr. & XIKON, Cyprus	15	
16	AYI VAVATISINIAS No2	1984	Off-stream	Larnaca	Larnaca	TE	25	130	30	63	1	I	Petalia - Palouto Irr. Div.	MIP	Chr. Charalambous, Cyprus	16	
17	DIFHERONA	1984	Off-stream	Limasol	Larnaca	TE	25	167	50	9	1	I	Western Irr. Div.	MIP	Ch. Apostolidis, Cyprus	17	
18	KIHKOKITIA	1984	Off-stream	Larnaca	Larnaca	TE	16	560	95	23	1	I	Irr. Div. to be set up	MIP	Incovou Bros, Cyprus	18	
19	DIYOTAMOS	1985	Pendaskinos	Larnaca	Larnaca	FR	69	300	1 000	31	5/1	I	Government	Rofe, Kennard & Lapworth & M Evans & Partners, UK	Shephard-RH11, UK with G P Zacharindes, Cyprus	19	
20	SAVAZOS	1985	Vasilikos	Larnaca	Larnaca	FR	57	682	1 700	17 000	1/5	I	Government	Rofe, Kennard & Lapworth & M Evans & Partners, UK	J & F with MENDON, Cyprus	20	
21	EVRETI	1986	Stavros tis Pafos	Pafos	Pafos	FR	20**	760	1 400	25 000	1	I	Government	Sir William Harewood and Partners, UK	Shephard-RH11, UK with G P Zacharindes, Cyprus	21	
22	AKHIA	1987	Off-stream	Limasol	Limasol	TE	23	272	273	1 250	1	I	Government	Sir William Harewood and Partners, UK	Incovou Bros, Cyprus	22	
23	EPHRES	1988	Kouris	Limasol	Limasol	TE	113	550	9 400	115 000	1/5	I	Government	Imprello, Italy with J & F, Cyprus	Imprello, Italy with J & F, Cyprus	23	
24																	24
25																	25

NOTES

FOOTNOTES

* ITEM 17 Concrete cut-off wall 2m deep below lowest foundation

** ITEM 46 Flexible concrete cut-off wall 1.5m deep below lowest foundation

**REGISTRE DES BARRAGES EN
REGISTER OF DAMS IN CYPRUS**

Drg.No. AG/IR/169
19

L I G N E L I N E No.	NOM DU BARRAGE NAME OF DAM	ANNÉE D'ACHÈVEMENT YEAR OF COMPLETION	SITUATION - LOCATION				SITUATION ET TYPE D'ÉTANCHÉITÉ POSITION AND NATURE OF SEALING ELEMENT	HAUTEUR AU DESSUS DE LA FONDATION HEIGHT ABOVE LOWEST FOUNDATION (m)	LONGUEUR DE CRÈTE LENGTH OF CREST (m)	VOLUME DU BARRAGE CONTENT OF DAM (10 ⁶ m ³)	LIGNE DE PROFILS POUR DACTYLOGRAPHIE SLIDING LINE FOR TRACING		CAPACITÉ TOTALE DU RÉSERVOIR GROSS CAPACITY OF RESERVOIR (10 ⁶ m ³)	DÉPENSES EXPENSES (10 ⁶ £)	CAPACITÉ MAXIMALE D'ÉVACUATION MAXIMUM DISCHARGE CAPACITY OF SPILLWAYS (m ³ /h)	TYPE DES ÉVACUEURS TYPE OF SPILLWAYS	PROPRIÉTAIRE OWNER	BUREAU D'ÉTUDES ENGINEERING BY	CONSTRUCTEUR CONSTRUCTION BY
			COURS D'EAU RIVER	VILLE LA PLUS PROCHE NEAREST CITY	ÉTAT PROVINCE	PROVINCE OU DÉPARTEMENT STATE OR PROVINCE					DR COUNTRY	DR COUNTRY							
1	KATIZES	1953	Xeros (Morphou)	Nicosia	Nicosia	PG	R	23	27	4	113	1	53	L	Lefka Irr. Div.				
2	KANDI	1956	Kouris	Limasol	Limasol	PG	R	15	53	2	36	1	59	L	Kandou Irr. Div.				
3	PERAFTHI	1956	Kouris	Limasol	Limasol	PG	R	22	62	4	12	1	107	L	Perafthi Irr. Div.				
4	PIYGOS	1957	Katorta	Nicosia	Nicosia	PG	R	22	66	5	285	1	125	L	Pygos Irr. Div.				
5	TRIKLINI	1958	Kouris	Limasol	Limasol	PG	R	31	76	6	30	1	59	L	Triklini Irr. Div.				
6	ATHALASSA	1962	Pedhios	Nicosia	Nicosia	TE	R/S	18	457	103	791	1	68	L	Government				
7	GEINVELI	1962	Pedhios	Nicosia	Nicosia	TE	R/S	15	255	50	239	1	173	L	Geinveli Irr. Div.				
8	LEFKA	1962	Morathou	Nicosia	Nicosia	PG	R	35	169	11	276	1	256	L	Lefka Irr. Div.				
9	MORPHI	1962	Serrakhia	Nicosia	Nicosia	TE	S	13	1,436	296	45	1	765	L	Morphou Irr. Div.				
10	PROTHRINOS	1962	Off. - from	Limasol	Limasol	TE	R/S	10	756	23	480	1	122	L	Prothrinou Irr. Div.				
11	KANLI KEUY	1963	Pedhios	Nicosia	Nicosia	TE	R/S	19	311	57	113	1	116	L	Kanli Keuy Irr. Div.				
12	AGROS	1964	Kouris	Limasol	Limasol	TE	R	26	180	61	99	1	6	L	Agros Irr. Div.				
13	ARGAKA	1964	Mogoula	Paphos	Paphos	EP	R	61	173	138	130	1	280	L	Government	Howard Humphreys & Sons, UK			
14	KITI	1964	Tremithou	Larnaca	Larnaca	TE	S	22	990	143	107	1	602	L	Government	Il Nuovo Cantoro, Italy			
15	LIOFETI	1964	Potamos	Famagusta	Famagusta	TE	S	18	579	50	605	1	150	L	Liofeti Irr. Div.				
16	MIA MILEA	1964	Pedhios	Nicosia	Nicosia	TE	R/S	22	140	54	355	1	26	L	Mia Milea Irr. Div.				
17	OUGOS	1964	Serrakhia	Nicosia	Nicosia	TE	S	16	245	130	68	1	786	L	Morphou Irr. Div.				
18	ATIA MARINA	1965	Xeros	Paphos	Paphos	EP	R	33	162	61	311	1	161	L	Atia Marina Irr. Div.	Energoprojekt, Yugoslavia	Med. Constr. Greece - G.P. Zachariades Cyprus		
19	POLENTHIA	1965	Garyllie	Limasol	Limasol	TE	R/S	45	196	215	1,864	1	581	L	Government	Energoprojekt, Yugoslavia	Moulou & Ridgway of UK		
20	KALOPANAYIOTIS	1966	Morathou	Nicosia	Nicosia	TE	R	50	137	156	391	1	207	L	Government	Howard Humphreys & Sons, UK			
21	MAVRORODIYIOS	1966	Morathou	Paphos	Paphos	TE	R/S	45	528	267	2,180	1	340	L	Government	Energoprojekt, Yugoslavia	CYBARCO, Cyprus		
22	POPOS	1966	Lionthi	Paphos	Paphos	EP	R	38	302	153	175	1	300	L	Pamos Irr. Div.	Med. Constr. Greece - G.P. Zachariades Cyprus			
23	YERASOYIA	1968	Yeramosia	Limasol	Limasol	TE	R	49	409	539	83	1	850	L	Government	Energoprojekt, Yugoslavia	CYBARCO, Cyprus		
24	LEFKARA	1973	Sykratis	Larnaca	Larnaca	EP	R	24	260	820	1,100	5/1	316	L	Famagusta Water Board & Lefkara Irr. Div.	Howard Humphreys & Sons, UK	L Fairclough UK and HEBOR Cyprus		
25	SASARI	1973	Serrakhia	Nicosia	Nicosia	TE	S	15	929	265	650	1	622	V	Government				

NOTES
FOOTNOTES
MDD & Water Development Department
Irr. Div. Irrigation Division

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.

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 (CYNOLD) was elected to full membership of ICOLD in 1969. During 1987 the National Committee was composed of the following:

Chairman

C St Lytras, Director, WDD

Vice-Chairman

K C Hassabis, Assistant Director, WDD

Past-Chairman

C A Konteatis, Ex. 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 Papadopoulos, Representative of the Association of Civil Engineers and Architects

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

The 55th Executive Meeting of ICOLD was held in Beijing, CHINA, between 22 and 23 May 1985. Unfortunately the Cyprus National Committee was not represented at this meeting.

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.

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

Question 60: Reservoirs and the Environment

Question 61: Embankment Dams. Imprevious Elements other than Clay Cores.

Question 62: New Developments in the Construction of Concrete Dams

Question 63: Design flood and Operational Flood Control.

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

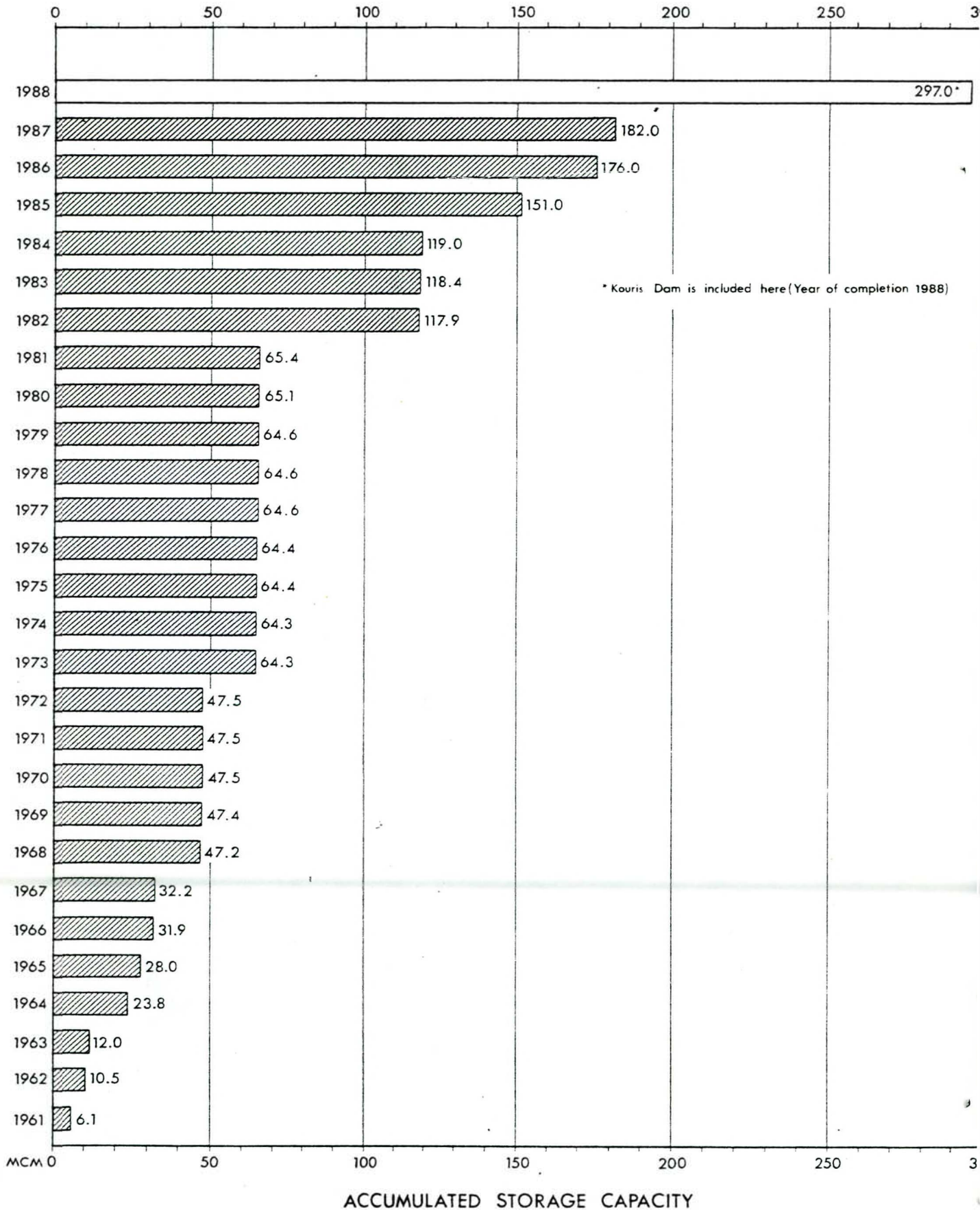
- The National Action Committee for the International Drinking Water Supply and Sanitation Decade (IDWSSD).
- International Commission on Irrigation and Drainage (ICID)
- International Water Supply Association (IWSA).

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



DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT 1000m ³	YEAR
1	Koaklia	Earth	6	4,545
2	Lymbia*	Gravity	5	18
3	Lythrodhonda	Gravity	11	32
4	Kalekhorio (K1)	Gravity	9	82
5	Akraounda	Gravity	7	23
6	Galini	Gravity	11	23
7	Petra	Gravity	9	32
8	Petra	Gravity	9	23
9	Lythrodhonda	Gravity	10	32
10	Kalifzes	Gravity	23	113
11	Ayios Loucas	Earth	3	455
12	Gypsos	Earth	3	100
13	Kandou	Gravity	15	34
14	Perapedhi	Gravity	22	55
15	Pyrgos	Gravity	22	285
16	Frimiklini	Gravity	33	340

Total Storage Capacity 6,174 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT 1000m ³	YEAR
17	Pradhromas	Earth	10	122
18	Morphou	Earth	13	1,879
19	Lefka	Gravity	35	368
20	Geunylli	Earth	15	1,045
21	Althalassa	Earth	18	791
22	Kanli Keuy	Earth	17	1,113
23	Argaka	Rockfill	41	1,150
24	Mia Milla	Earth	22	355
25	Ovgos	Earth	16	845
26	Kiti	Earth	22	1,614
27	Agros	Earth	26	99
28	Liapetri	Earth	18	340
29	Polemithia	Earth	45	3,864
30	Ayia Marina	Rockfill	33	311
31	Kalapanoyialis	Earth	40	391
32	Mavrokolymbos	Earth	45	2,180
33	Pamos	Rockfill	38	859
34	Yermasoyia	Earth	49	13,600
35	Syngariss	Earth	7	1,115

Total Storage Capacity 32,041 m³ x 10⁶

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT 1000m ³	YEAR
36	Ayios Yeoryios	Earth	6	90
37	Fxia Antilload	Earth	8	165
38	Ayios Nikolaos	Earth	2	1,365
39	Paralimni Lake	Earth	1	1,365
40	Fresh Water Lake	Earth	3	4,545
41	Makrasyka	Earth	8	1,95
42	Akhna (Mesania)	Earth	4	90
43	Morphou sprea-	Earth	5	130
44	ding grounds	Earth	5	100
45	Ormidhia	Earth	7	140
46	Vrysaules	Earth	6	90
47	Protapapas	Earth	6	90

Total Storage Capacity 8,275 m³ x 10⁶

HT refers to height in meters from foundation
YEAR is the year of completion
Phenarox (6) means six small dams in Phenarox area

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT 1000m ³	YEAR
47	Sotira	Earth	8	45
48	Panayia (F)	Earth	7	45
49	Paralimni (45)	Earth	5	115
50	Ayia Napa (7)	Earth	8	55
51	F'xia Recharge	Earth	5	50
52	Phenarox (6)	Earth	5	115
53	Dherynia	Earth	6	23
54	Phenarox (3)	Earth	7	45
55	Avgarou (7)	Earth	3	68
56	Kondea (2)	Earth	5	86
57	Xylophaghou (4)	Earth	5	32
58	Sotira (4)	Earth	7	77
59	Lysi	Earth	3	68
60	Ay Yeoryios (9)	Earth	6	34
61	Ay Epikritos (6)	Earth	6	45
62	Akanthou (6)	Earth	4	40
63	Akhna (3)	Earth	5	50
64	Xylolymbou (5)	Earth	5	50

Total Storage Capacity 1,075 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1971-80

No	DAM	TYPE	HT 1000m ³	YEAR
65	Lefkara	Rockfill	71	13,850
66	Massari recharge-dam	Earth	15	2,273
67	Palekhorio-Kambi	Gravity	33	620
68	Anakapas	Gravity	23	129
69	New Lymbia	Gravity	12	220
70	Ayii Vavatsimias	Arch	14	53
71	Ayii Vavatsimias	Earth	10	55
72	Ephthragonia No 1	Earth	10	92
73	Khandria	Earth	10	70
74	Melini	Earth	10	59
75	Pelenandia	Earth	10	123

Total Storage Capacity 17,544 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1981-90

No	DAM	TYPE	HT 1000m ³	YEAR
76	Ephthragonia No 3	Earth	10	65
77	Alapnou-Ephthragonia	Earth	9	132
78	Kato Mylos	Earth	10	104
79	Ephthragonia No 2	Earth	8	127
80	Anakapas	Earth	10	192
81	Asprokremmos	Earth	53	51,000
82	Xylitatos	Rockfill	42	1,250
83	Agriothia	Earth	10	59
84	Kyperounda	Earth	10	270
85	Lagoudera	Earth	10	71
86	Ora	Earth	10	62
87	Ayii Vavatsimias No 2	Earth	10	43
88	Pharmakos No 1	Earth	10	21
89	Pharmakos No 2	Earth	10	61
90	Anakapas No 2	Earth	8	120
91	Dhironas	Earth	10	159
92	Khirkolia	Earth	10	205
93	Exo Galatia	Earth	10	35
94	Kalavatos	Rockfill	60	17,000
95	Dhrypatomas	Rockfill	60	15,000
96	Evretoi	Rockfill	70	25,000
97	Akhna	Earth	16	5,800
98	Aradhippou (Barth)	Gravity	10	90

Total Storage Capacity 116,866 m³ x 10⁶

UNDER CONSTRUCTION

No	DAM	TYPE	HT 1000m ³	YEAR
99	Kouris	Rockfill	110	115,000

Total Storage Capacity 115,000 m³ x 10⁶

PROPOSED DAMS

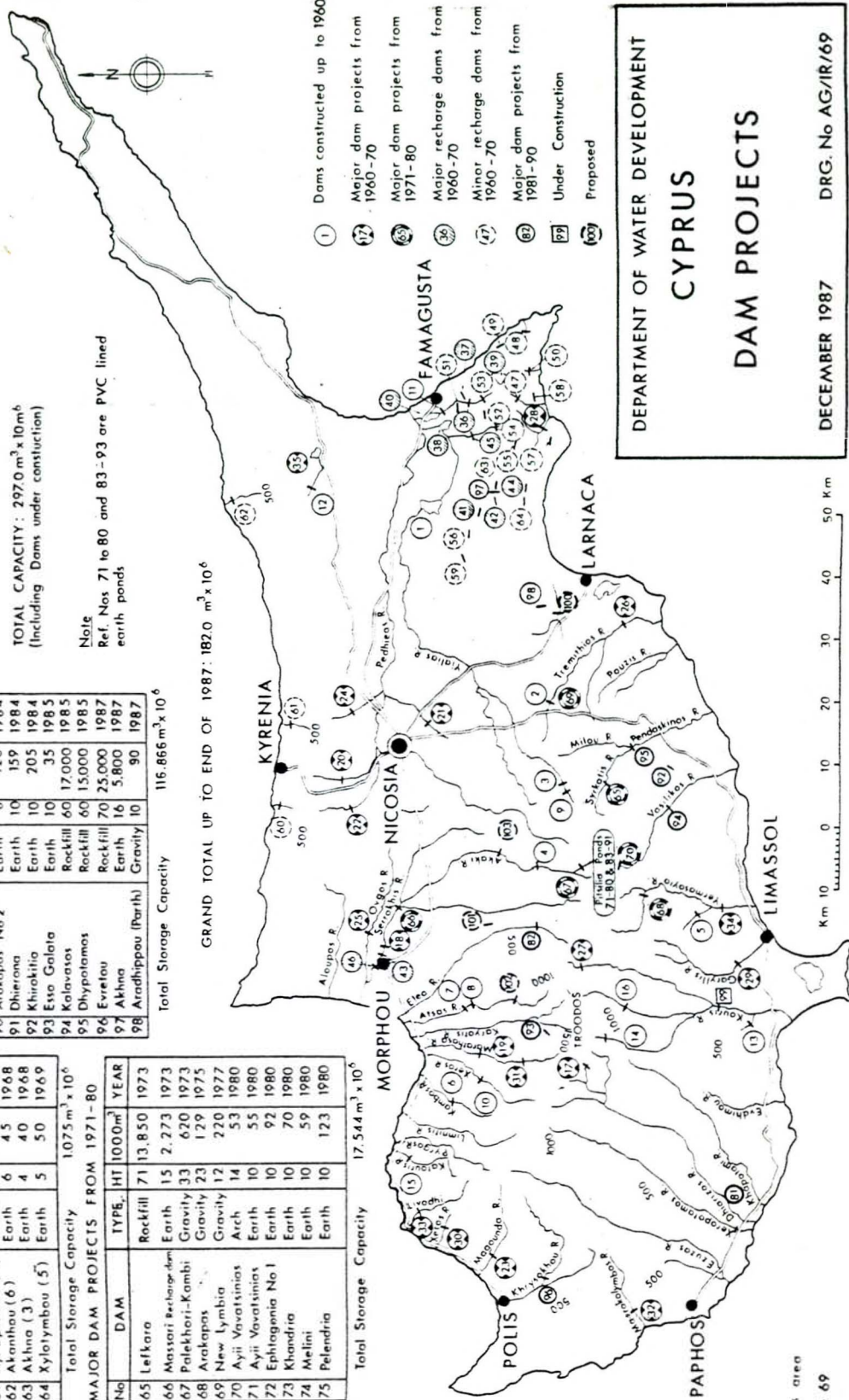
No	DAM	TYPE	HT 1000m ³	YEAR
100	Aradhippou (Rech.)	Earth	14	375
101	Vizakia	Earth	30	900
102	Ayios Theodoros	Rockfill	100	22,500
103	Akaki-Malounda	Earth	39	2,000

Total Storage Capacity 25,775 m³ x 10⁶

TOTAL CAPACITY: 297.0 m³ x 10⁶
(Including Dams under construction)

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

GRAND TOTAL UP TO END OF 1987: 182.0 m³ x 10⁶



- ① Dams constructed up to 1960
- ② Major dam projects from 1960-70
- ③ Major dam projects from 1971-80
- ④ Major recharge dams from 1960-70
- ⑤ Minor recharge dams from 1960-70
- ⑥ Major dam projects from 1981-90
- ⑦ Under Construction
- ⑧ Proposed

DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
DAM PROJECTS
DECEMBER 1987
DRG. No AG/IR/69

FINANCE EXPENDITURE AND REVENUE

During the year 1987 the total actual expenditure by the Department of WDD budgeted and other non-budgeted votes amounted to £31,578,536 out of total budget of £37,329,538.

This is again a record expenditure made since the creation of the Department.

The general picture is as follows:

TABLE I-1
GENERAL BUDGET-EXPENDITURE FIGURES FOR 1987

Description	Budget £	Expenditure £
a. WDD Development Estimates		
Govt. £28,664,093		24 307 94
including loans)		
Loan: 658,062		504 83
Total	29 322 155	£24 812 78
b. WDD Ordinary Estimates	5 246 597	4 700 48
c. Non-budgeted votes for Pitsilia Project, refugee housing estates, works for other Government Departments, private developers and village deposits	2 760 786	2 065 27
Total	£37 329 538	£31 578 53

The level of construction works carried out during 1987 was again an all-time record expenditure amounting to £26,588,272 from WDD and other votes.

See table V-1 under CONSTRUCTION DIVISION

The largest single item of expenditure was major waterworks' Southern Conveyor Project at £19,273,498.

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	231 134
- Loan No. 1.1572.00 EUROPEAN INVEST. BANK ECU9,000,000 FOR VPP	(completed)
- Loan No. 2279 CY (IBRD) US\$ 16,000,000 for major waterworks, Khrysokhou	3 067 819

Loans for SCP

	Amount received in 1987 CY £
- Loan No. 2386 CY from IBRD US\$27,000.000	2 678 064
- Loan No. 1.2109 from E.I.B (Major Loan) ECUS 26,500,000	6 367 912
- Loan No. 6.0553 from E.I.B. (Special term Loan) ECU'S 3,700.000	889 762
- Loan No. 277 from K.F.A.E.D.K.D. 2,940,000	1 513 920
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	3 238 261

Revenue

A sum of £4,541,845 was collected during the year 1987 as revenue mainly from the sale of water for Nicosia and Famagusta Water Supplies and Paphos Irrigation Project (See table I-5).

TABLE I-2
EXPENDITURE FOR THE YEAR 1987

Ser. No.	Description	Government Contr.		Village Contr.	Total £
		Ordinary £	Development £	(Loans) £	
A WDD Votes					
1	Administration	2 797 800	3 428	-	2 801 228
2	Greater Nicosia W S scheme running expenses	448 296	-	-	448 296
3	Nicosia-Larnaca- Famagusta, Central W S system (formerly styled Famagusta W S scheme)	736 512	-	-	736 512
4	Government W S schemes for villages running expenses	82 616	-	-	82 616
5	Irrigation, drainage and dams	618 560	23 216 588	101 149	23 936 297
6	Town water supplies	-	58 390	25 620	84 010
7	Village water supplies .	-	590 559	378 069	968 628
8	Government water supply schemes	-	152 621	-	152 621
9	Drilling & prospecting .	16 696	-	-	16 696
10	Hydrology	-	124 841	-	124 841
11	Surveys & investigations	-	81 752	-	81 752
12	Purchase of machinery and equipment	-	74 861	-	74 861
13	Others	-	1 444	-	1 444
14	Studies for the Utilization of Treated Sewage Effluent	-	3 458	-	3 458
Total		£4 700 480	£24 307 942	£504 838	£29 513 260

TABLE 1-2 (cont.)

B Non-budgeted Votes

	£
1 Pitsilia Project	18 20
2 Refugee housing estates	115 30
3 Works for other Government Departments	
(i) Government Contribution	1 311 572
(ii) Villages Contribution	217 406
4 Works through village deposits	197 60
5 Works for private developers	205 40
 Total	 £ 2 065 20
 Grand Total	 £31 578 50

(i) Breakdown of Administration Expenditure

	Ordinary £	Development £	Total £
1 Personal emoluments	2 585 626	-	2 585 626
2 Casual technical assistance	36 135	-	36 135
3 Extra Assistance	8 887	-	8 887
4 Travelling	80 558	-	80 558
5 M'ce & operation of motor transport	13 034	-	13 034
6a Office expenses	46 339	-	46 339
6b Purchase of drawing materials - Tools etc.	15 218	3 428	18 646
7 Government water supply	12 003	-	12 003
 Total	 £2 797 800	 £ 3 428	 £2 801 228

(ii) Breakdown of Irrigation
Drainage and Dams Expenditure

	Government £	Village £	Total £
1 Minor irrigation works	245 070	84 824	329 894
2 Consultants fees	-	-	-
3 Major waterworks Paphos	246 014	-	246 014
4 Major waterworks Vasilikos- Pendaskinos	541 347	-	541 347
5 Major waterworks Southern Conveyor	19 273 498	-	19 273 498
6 Major waterworks Khrysokhou	2 436 029	-	2 436 029
7 Other major waterworks	384 138	16 325	400 463
8 M'ce of dams & distribution system	618 560	-	618 560
9 River training	4 271	-	4 271
10 Major waterworks Karyotis	90 492	-	90 492
 Total	 £23 835 148	 £101 149	 £24 936 297

TABLE I-3
WDD ORDINARY BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1987

Head 20A Water Development

	£
1987 Approved	5 070 448
Add special warrants	176 149
Total	<u>£5 246 597</u>

Month	Monthly expenditure £	Cumulative expenditure £	%
January	253 241	253 241	4.83
February	320 816	574 057	10.94
March	334 782	908 839	17.32
April	311 544	1 220 383	23.26
May	357 029	1 577 412	30.07
June	310 139	1 887 551	35.98
July	322 947	2 210 498	42.13
August	388 169	2 598 667	49.53
September	459 664	3 058 331	58.29
October	376 637	3 434 968	65.47
November	552 942	3 987 910	76.01
December	712 570	4 700 480	89.59

Summary

	£	%
Amount approved	5 246 597	100
Less actual expenditure ..	4 700 480	89.59
Balance	<u>£ 546 117</u>	<u>10.41</u>

TABLE I-4
WDD DEVELOPMENT BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1987
(Not including village loans)
Head 2D Water Development

	£
1987 Approved	26 598 062
Add Special warrants	2 066 031
Total	<u>£28 664 093</u>

TABLE I-4 (Cont)

Month	Monthly expenditure £	Cumulative expenditure £	%
January	408 091	408 091	1.42
February	1 574 099	1 982 190	6.92
March	1 468 520	3 450 710	12.04
April	1 391 210	4 841 920	16.89
May	4 314 824	9 156 744	31.94
June	1 408 251	10 564 995	36.86
July	2 291 353	12 856 348	44.85
August	2 078 205	14 934 553	52.10
September	1 502 993	16 437 546	57.35
October	1 436 446	17 873 992	62.36
November	2 348 106	20 222 098	70.55
December	4 085 845	24 307 943	84.80
Summary			
Amount approved	£ 28 664 093	% 100	
Less actual expenditure .	24 307 943	84.80	
Balance	£4 356 150	15.20	

TABLE I-5
STATEMENT OF REVENUE COLLECTED
DURING THE YEAR 1987

Description	£
Drilling charges	390
Nicosia water supply	1 731 147
Nicosia-Larnaca-Famagusta Central water supply system	1 568 157
Regional village water supply schemes Khrysokhou Irrigation Scheme -	65 218
Sale of water	17 739
Paphos Irrigation Scheme - Sale of water	630 623
Xyliatos Irrigation Scheme	21 282
Repayment of Nicosia Water Board's dept capital	69 241
Repayment of Nicosia Water Board's debt interest	117 209
Other fees	320 839
Total	£4 541 845

Note: The amount contributed from TAEI (Cyprus relief fund for displaced and affected persons) are not included in this chapter and for the exact amount contributed from TAEI refer to the relevant schemes on chapter V DIVISION OF CONSTRUCTION.

STAFF MATTERS

Appointments

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

Kyriaki Ioannou-Kalyva, on probation to the permanent (Ord.) post of Chemist II, with effect from 2.3.87.

Theodoros HjiGeorghiou, on a casual basis, to the post of Topographer Irrigation Engineer II with effect from 1.6.87.

Panayiota HjiGeorghiou, on a casual basis, to the post of Topographer Irrigation Engineer II, with effect from 1.7.87

The following, on a casual basis, to the post of Clerk 2nd Grade General Clerical Staff with effect from 1.7.87.

Maria Kita

Haroulla Toumazou

Florendia Marangou, on a casual basis, to the post of Clerk 2nd Grade, General Clerical Staff with effect from 1.9.87.

Charalambos Christophides, on a casual basis, to the post of Executive Engineer II with effect from 1.6.87.

The following to the post of Executive Engineer II, on a casual basis with effect from 14.9.87.

George Alexandrou Dionysios Mavronicolas Charis Omorphos

Christos Michaelides, on a casual basis, to the post of Executive Engineer II with effect from 2.10.87.

Acting Appointments

Kyprianos Hassabis as acting Director for the period between 16.3.87-24.3.87, 26.10.87-11.11.87, 17.12.87-22.12.87.

Promotions

The following were promoted as follows:

Petros Makkoulas	George Dicomitis
Eleftherios Phinikarides	Panos Antoniadis
Ioannis Mouskoundis	Nicos Mavromatis
George Saparillas	Andreas Aniftos
George Pashiardis	Constantinos Stavrou
George Andreou	Loucas Loizou
Athanasios Klitou	Eleni HjiKyriacou
Kypros Mourouzides	Aphrodite Rodosthenous
Vassos Zenios	Stavroulla Selipa
Michael Michaelides	Stelios Constantinides
Andreas Sofocleous	

to the permanent (Ord.) post of Senior Technician with effect from 15.2.87.

Xenia Voskou to the permanent (Ord.) post of Clerical Officer General Clerical Staff with effect from 15.11.85.

George HjiIoannou to the Permanent (Ord.) post of Technician 1st Grade with effect from 1.12.85.

The following to the permanent (Ord.) post of Assistant Chief Foreman with effect from 1.12.87.

Kyriacos Sfikouris, George Mamantos, Yiannis Papadopoullos, Costas Avlonitis.

Retirements

Nicos Kaisis, Chief Foreman with effect from 1.3.87.

Chrysanthos Metaxas, Chief Foreman with effect from 1.7.87.

Antonis Zakheos, Chief Foreman with effect from 1.4.87.

Yiannakis Savva, Messenger with effect from 12.6.87.

Leonidhas Triteos, Chief Foreman with effect from 1.11.87.

Charalambos HadjiChristodoulou, Foreman with effect from 1.12.87.

Resignation

Christos Phanartzis, Hydrologist II, with effect from 10.6.87.

Deaths

Takis Ioannou, Technician 1st Grade died on 29.6.87.

Transfers

The followings Technicians 2nd Grade to Khrysokhou Irrigation Project with effect from 16.2.87.

Andreas Papasavvas

Yiannakis Markou

George Neophytou

Kyriacos Kyrou, Executive Engineer I to Nicosia Head Quarters with effect from 9.3.87.

Christakis Christofi, Clerk 2nd Grade, General Clerical Staff to Electromechanical Services with effect from 9.3.87.

Eleni G Demetriou, Telephone Operator to the Law Office with effect from 4.5.87.

Andreas Nikitas, Messenger to the District Office of Public Works Department Paphos with effect from 5.6.87.

Panayiotis Stelikos, Messenger to the District Office of this Department at Paphos with effect from 5.6.87.

Angela Skouroupathi, Technician 2nd Grade to the District Office of this Department at Paphos with effect from 8.6.87.

Scholarships and study leave

Theodoros Nicolaides, Executive Engineer I, has been granted a scholarship by China Govt and Unesco for a two months course between 19.2.87-18.4.87 on International Training Course on Environmental Impacts of Reservoirs.

Costas Andreou, Senior Water Engineer selected to attend the course on Rural Water Supply and Sanitation in Bangkok Thailand between 2.2.87-27.2.87.

Adonis Georghiou, Hydrologist I, has been granted a scholarship by I A E A in Vienna between 2.3.87-11.6.87 in the field of Isotope Hydrology.

Joseph Pekris, Technician 2nd Grade, who has been granted study leave in USA, completed his studies and resumed duties on 15.6.87.

Andreas Demetriou, Executive Engineer I, has been granted a scholarship offered by U S S R on Modern Problems of Constructing Science and Practice, Acceleration of Scientific and Technical Progress in the field of the Construction in the U S S R and abroad between 20.5.87-20.6.87.

Christos Ioannou, Hydrologist I, who has been granted scholarship by Hubert Humphreys U S A completed his studies and resumed duties on 21.12.87.

Seminars, Conferences, Duty Abroad.

Christodoulos Christodoulou, Principal Water Engineer visited Athens Greece between 21.1.87-26.1.87 to participate to the Agriculture and Food Production in the Middle East Conference.

Kyriacos Spanos, Executive Engineer I, visited Thessaloniki Greece between 19.1.87-22.1.87 for inspection of the manufacture of Hydrants for the Khrysoxhou Irrigation Project.

Demosthenis Patsalides, Executive Engineer I, Vlasis Partassides, Executive Engineer I, visited Greece between 22.1.87-7.2.87 for inspection of the manufacture of Asbestos Cement Pipes for the Southern Conveyor Project.

Costas HadjiSavvas, Mechanical Engineer I, visited Yugoslavia and Germany between 31.1.87-6.2.87 for inspection of the manufacture of butterfly valves and their hydraulic units and electromechanical equipment for Kouris Dam.

Constantinos Lytras, Director, Branco Milinusic, Consultant, visited England between 16.3.87-21.3.87 for the Arbitration of Asprokremmos dam.

Christodoulos Artemis, Senior Water Engineer, visited England between 20.7.87-25.7.87 to be informed on Integrated Data Management System on Water Board Nicosia by Thames Water Authority.

Nicos Tsiourtis, Senior Water Engineer, Constantinos HadjiSavvas, Mechanical Engineer I, visited Thessaloniki Greece for inspection of the manufacture of hydrants for the Khrysokhou Irrigation Project.

Chr. Christodolou, Principal Water Engineer, visited Washington U S A on 21.9.87 for discussions with the World Bank on loan agreement for the Southern Conveyor Project 2nd Phase.

Constantinos Lytras Director, Savvas Theodosiou Mechanical Engineer I, Christodoulos Artemis, Senior Water Engineer, visited England between 25.10.87-31.10.87 to be informed on Water Treatment.

Kyriacos Spanos, Executive Engineer I, Spyros Stephanou, Executive Engineer I, Andreas Ioannou, Agriculturist Officer, visited France between 16.11.87-20.11.87 to get informed about the manufacture of ductile iron pipes by the Pont-a-Mousson factory.

Constantinos Lytras, Director, Mr. Branco Milinusic, Consultant visited England between 12.12.87-23.12.87, for the Arbitration of Asprokremmos dam.

Christos Marcoullis, Senior Water Engineer visited the island of Rhodes between the 2.12.87-10.12.87 to offer his services for an overall consideration of the water problem of the island and by the exchange of views and experiences to transfer to them some methods and solutions to the problem, which were applied in Cyprus and which could be practicable in the case of Rhodes.

II DIVISION OF WATER RESOURCES

by
D C Kypris
Senior Hydrogeologist
Head of Division

General

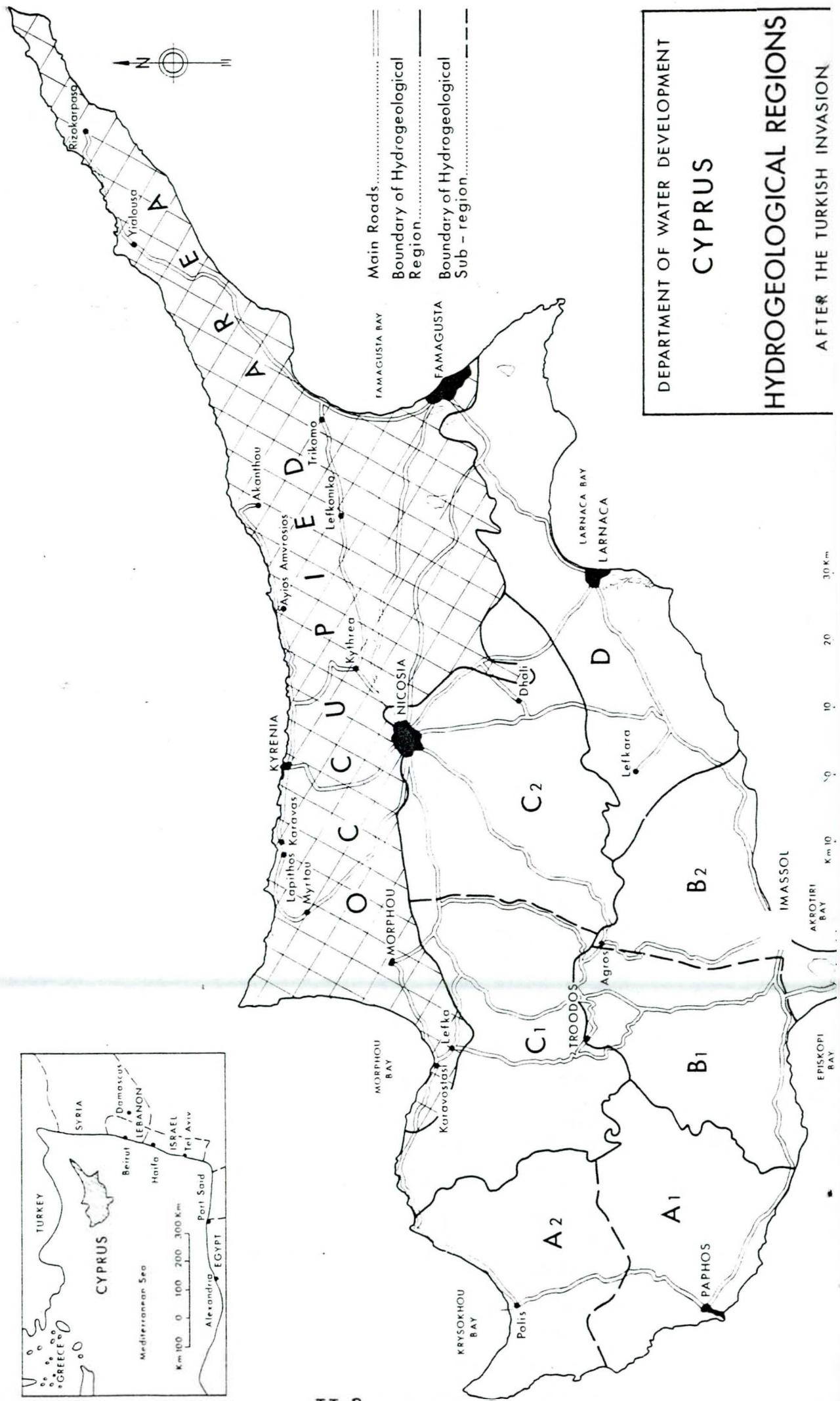
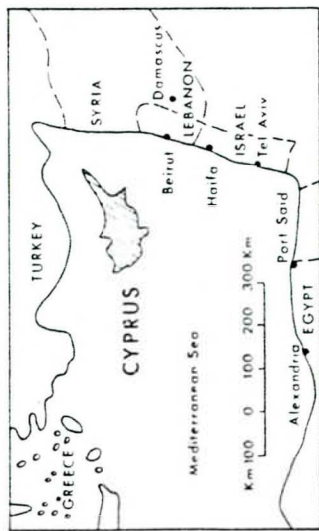
During 1987 again no hydrological data could be collected by this Department in the Northern part of Cyprus still occupied for the thirteenth year by the Turkish troops and approximately amounting to 40% of the Cyprus land. So the behaviour of both surface runoff and groundwater bodies could not be followed 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 part of Cyprus, a new arrangement is followed. (see page II-2).

During 1987, 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.



DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
 HYDROGEOLOGICAL REGIONS
 AFTER THE TURKISH INVASION

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 6 existing boreholes
- Drilling of 11 boreholes. Ten boreholes were drilled at Kiti and one was drilled at Yermasoyia village. Total penetrated depth 230m.

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 1987, 63 test pumpings were carried out as follows:-

- 6 for division of land with total hours pumped..... 288
- 56 for building permits with total hours pumped..... 168
- 1 for town and village water supplies with total hours pumped..... 48

METEOROLOGICAL SUMMARY FOR THE HYDROMETEOROLOGICAL YEAR 1986-1987

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 1986-1987.

Precipitation

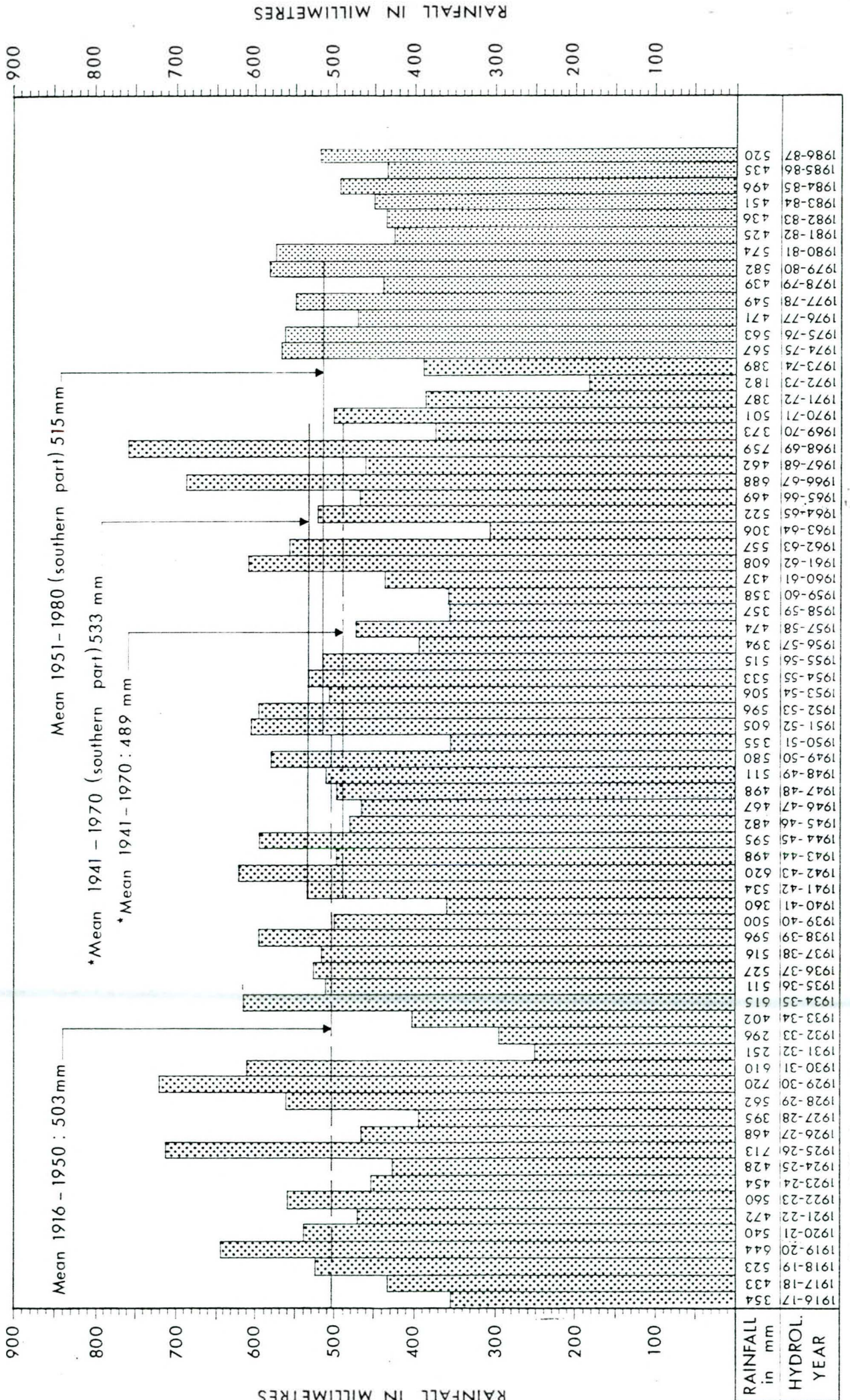
The yearly total precipitation averaged over the part of the island under Government control during the hydrometeorological year October 1986 - September 1987 was 520.3 mm which is 101% of normal. Normal is considered the average rainfall over the southern part of the island during the period 1951-1980. (see page II-4).

The total precipitation amounts during the period ranged mainly between 70% and 90% of normal in the major part of eastern and western coastal areas, in Mesaoria plain and eastern Troodos slopes, in parts of northern and western Troodos slopes and over part of eastern Troodos mountains, while in the remaining areas precipitation amounts were above normal and ranged mainly between 100% and 125% of normal. Precipitation amounts slightly higher than 125% of normal occurred over small parts of Troodos mountains and southern coasts, and in a small area of northern Troodos slopes. (see page II-5).

As regards the monthly distribution of precipitation, it was well above normal only in March and below normal in all the remaining months. (see page II-6).

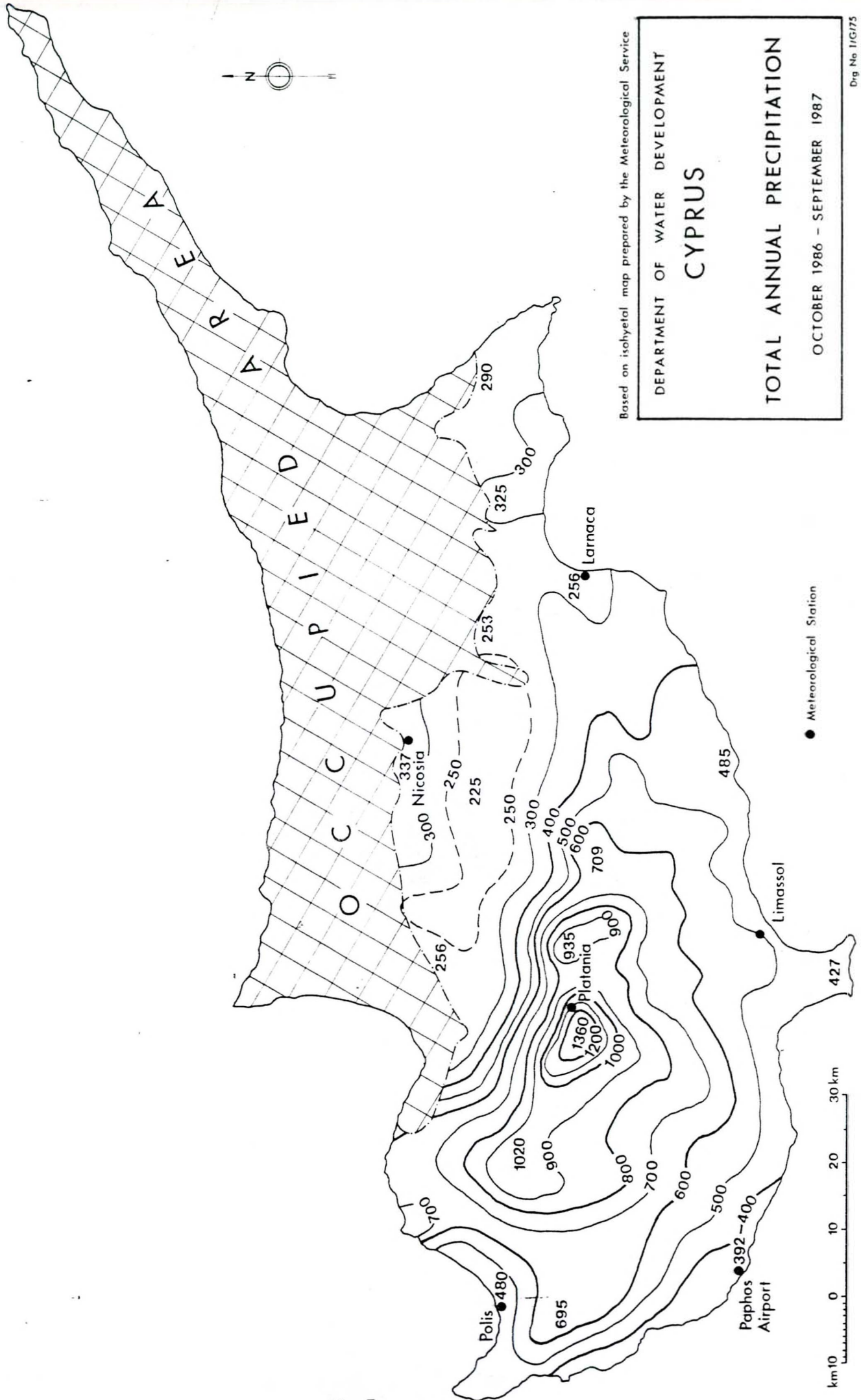
The table II-1, giving the incidence of rainfall during the hydrometeorological year 1986-87, illustrates the situation:-

ANNUAL AVERAGE RAINFALL OF CYPRUS 1916 - 1987



* Mean rainfall refers to calendar years here

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



Based on isohyetal map prepared by the Meteorological Service
 DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
 TOTAL ANNUAL PRECIPITATION
 OCTOBER 1986 - SEPTEMBER 1987

GRAPHICAL PRESENTATION
OF INCIDENCE OF RAINFALL 1986-1987

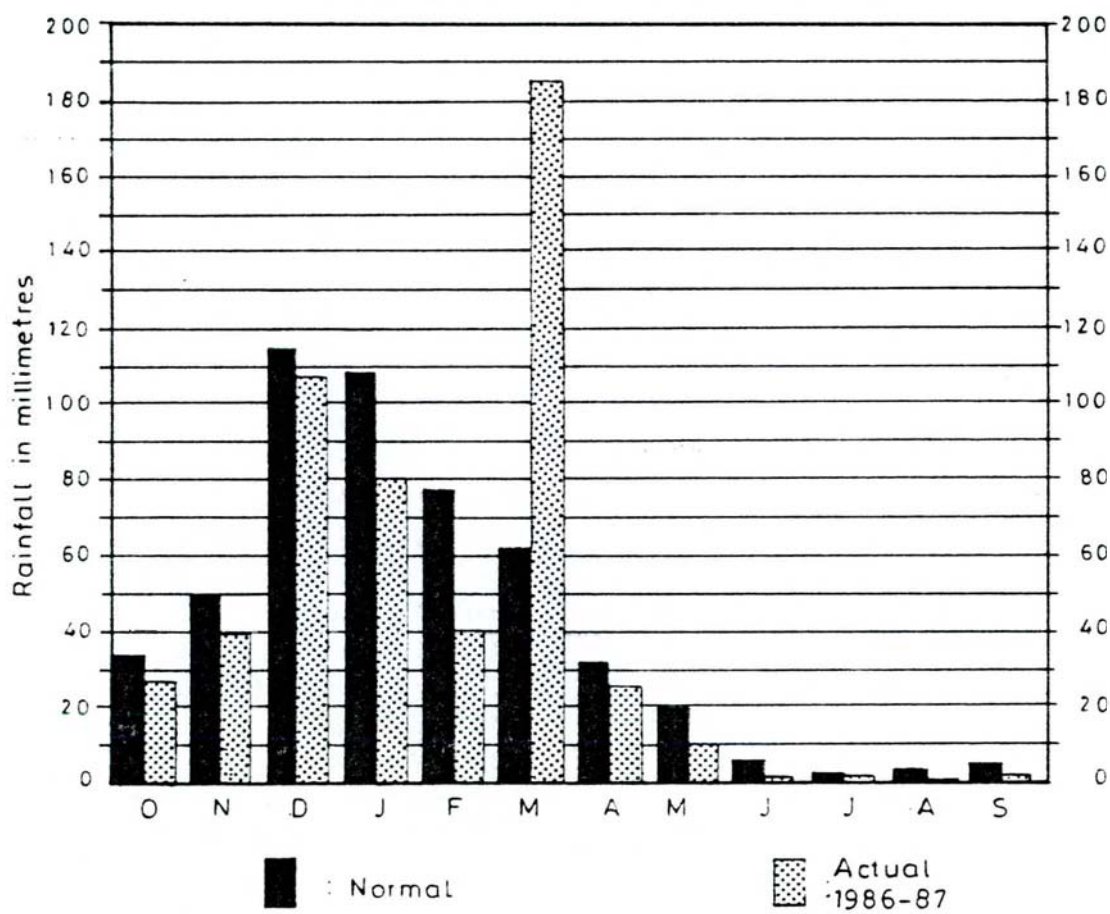


TABLE II-1
INCIDENCE OF RAINFALL DURING THE HYDROMETEOROLOGICAL YEAR 1986-1987

Months	Rainfall (in mm)	Rainfall (in inches)	Percentage of yearly total	Percentage of monthly normal
October	28.4	1.12	5	88
November	39.4	1.55	8	78
December	107.2	4.22	21	93
January	80.6	3.17	15	73
February	39.7	1.56	8	52
March	185.1	7.29	35	297
April	24.9	0.98	5	77
May	10.0	0.39	2	51
June	1.0	0.04	0.2	15
July	1.7	0.07	0.3	71
August	0.4	0.02	0.1	13
September	1.9	0.07	0.4	38
Totals	520.3	20.48	100.0	-

Note: Yearly total as percentage of yearly normal: 101%

The maximum amount of rainfall in a 24-hour period during the hydrometeorological year was 113.0 mm. This was reported on the 9th March 1987 by Prodhromos rainfall station.

The first snowfall occurred on the higher parts of Troodos mountains on the 8th November 1986, which is about three weeks earlier than the median date for the first snowfall in Cyprus. Subsequent snowfalls occurred during the ensuing months till May. The last one occurred on Olympus on the 2nd May 1987 which is about a fortnight beyond the median date for the last snowfall in Cyprus.

Hail occurred in November and December 1986, in the period January to May 1987, in July and September 1987.

Temperature

During the hydrometeorological year 1986-1987 as a whole air temperature was below normal. In particular, monthly mean temperatures were well below normal in November 1986 and March 1987 and below normal in October and December 1986 and in the period April to June 1987; they were higher than normal in January, February, July and September 1987, while in August 1987 temperatures were around normal.

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 1986-1987

Station	Extreme maximum temperature and date °C	Extreme minimum temperature and date °C
Nicosia.....	43.2 27th July	0.9 15th March
Limassol Port (new)..	39.9 6th August	2.5 9th March
Larnaca Airport.....	38.0 6th August	1.5 9th March
Paphos Airport.....	36.1 24th July	2.9 19th March
Panayia Bridge.....	40.8 27th July	-3.5 15th March
Saittas.....	41.0 27th July	-2.0 14th March

TABLE II-2

INCIDENCE OF MAXIMUM AND MINIMUM TEMPERATURES 1986-1987 (cont.)

Amiandos.....	33.5	28th July & 7th August	-5.0	15th March
Prodhromos.....	33.6	8th August	-8.0	15th March
Stavros.....	38.6	26th July	-1.5	9th March
Kornos.....	40.2	27th July	-1.0	15th March
Platania.....	35.4	7th August	-4.5	15th March
Phasouri.....	37.5	24th July	0.5	14th March

Evaporation

Monthly total evaporation (in mm) measured from United States Weather Bureau (U.S.W.B.) class "A" pan during the hydrometeorological year 1986-1987 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.....	115	66	47	41	60	70	141	207	273	301	269	210	1800
Paralimni.....	142	103	75	63	74	86	138	215	240	284	275	224	1919
Larnaca Airport	190	134	104	93	111	123	184	250	281	309	292	244	2315
Saittas.....	95	70	50	56	55	67	118	170	256	275	259	205	1676
Akhelia.....	135	103	93	81	72	93	134	191	221	254	234	205	1816
Yermasoyia.....	116	81	60	53	64	86	137	182	239	261	254	194	1727
Polemihia.....	145	101	84	79	85	107	146	170	237	263	262	207	1886
Prodhromos.....	68	36	30	54	39	*	94	151	209	220	233	151	-

* No records available for March 1987.

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 checking 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 about normal in spite of the low precipitation of December, January and February. The high precipitation of March brought it to about normal.

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 1986-1987

Ser. No.	Station	Stream	Location	Annual flow $10^6 m^3$
1	1-2-7-90	Dhiarizos	Kouklia	
2	1-4-9-80	Ezusas	Akhelia	16.0
3	2-2-8-95	Khrysokhou	Coast	2.2
4	2-8-3-10	Limnitis	Saw Mill	17.5
5	3-3-3-95	Karyotis	Evrykhou	14.5
6	3-5-4-40	Elea	Vyzakia	4.3
7	3-7-1-50	Peristerona	Panayia Br.	17.3
8	3-7-3-90	Akaki	Malounda	9.7
9	6-1-1-80	Ay. Onoufrios	Kambia	2.6
10	6-1-1-85	Pedhieos	Kambia	3.3
11	6-5-3-15	Yialias	Nisou	1.2
12	8-4-5-30	Tremithios	Klavdhia	0.01
13	8-9-5-40	Vasilikos	U/S Kalavasos Dam	9.4
14	9-2-3-85	Yermasoyia	U/S Yermasoyia Dam	18.3
15	9-6-2-90	Kryos	U/S Kouris Dam	8.5
16	9-6-4-90	Kouris	U/S Kouris Dam	23.4
17	9-6-7-70	Limnatis	U/S Kouris Dam	19.4

Construction of New Flow Gauging Stations

During the year under review the following flow gauging stations were constructed.

Xeros river near Nata. Construction of a "V" shaped structure 20 m wide, slope 1:20 and installation of a foot bridge for high flow measurements.

Stavros-tis-Psokas river downstream Evretou Dam. Construction of two small "V" shaped structures, 4m wide, slope 1:10 to record releases from Evretou dam.

Repairs and Improvements to Existing Flow Gauging Stations

Karyotis river near Skouriotissa. Alterations to the invert of the flow gauging station by the construction of a "V" shaped structure 3.5 m wide slope 1:10.

Khrysokhou river near Skoulli. Alterations to the invert of the flow gauging station by the construction of a half "V" shaped structure 5m wide, slope 1:10 and installation of a foot bridge for high flow measurements.

Flood Discharges

All months during the hydrometeorological year under review had a low precipitation except March. Consequently most of the noteworthy floods occurred during this month as shown on table II-5.

TABLE II-5

FLOOD DISCHARGES

Stream	Location	Watershed area (Km ²)	Maximum flow (m ³ /s)	Date
Ezusas	Moronero	180	27	16. 3.87
Peristerona	Panayia Br.F.S.	77	19	29.12.86
			25	9. 3.87
Yermasoyia	Phinikaria	110	24	10. 3.87
Khrysokhou	Coast	195	21	10. 3.87
Ezusas	Akhelia	210	19	9. 3.87
Akaki	Malounda	90	18	9. 3.87
Limnitis	Limnitis Saw Mill	48	15	10. 3.87
Mylou	Kornos	32	14.5	7. 3.87
Limnatis	U/S Kouris Dam	115	14.5	9. 3.87
Xeros	Lazaridhes	67	13.5	9. 3.87
Khrysokhou	Skoulli	64	13	9. 3.87
Marathasa	U/S Kalopanayiotis Dam	23	11.5	6. 7.87
Livadhi	U/S Pomos Dam	28	9	10. 3.87

Inflow of Water in Dams and Ponds

During 1987 out of 74 most important dams and ponds in Cyprus which were under regular observations in the past, only 57 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 57 dams and ponds under regular observations was higher than the previous few years because of the high precipitation of March. The maximum volume accumulated was 92.3 MCM or 60.1% of the total capacity of these dams and ponds which is 151.5 MCM. Out of these dams and ponds almost all small ones overflowed most of them in March. One of the bigger dams overflowed in April. Analytically the situation is shown in table 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 1986-87, 1996 spring and minor stream discharges were taken on 106 springs and minor streams; 600 discharges were taken on 50 springs which are under regular monthly observations and 1396 discharges were taken on 56 springs and minor streams for a certain period at various intervals.

As the rainfall during the hydrological year under review was below normal upto February most of the springs maintained a low flow upto this month. After the high precipitation of March they had an increase of flow. A high flow continued during the whole summer.

TABLE II-6

ACCUMULATIONS OF WATER IN THE DAMS AND PONDS DURING 1987

Ser. No.	DAMS - PONDS	CAPACITY m ³ X 10 ³	WATER IN 1.10.87 m ³ X 10 ³	MINIMUM WATER IN. STORAGE 1987 m ³ X 10 ³	DATE OF MINIMUM STORAGE	MAXIMUM WATER IN. STORAGE 1987 m ³ X 10 ³	DATE OF MAXIMUM STORAGE	REMARKS
1	ASPROKREMMOS	51000	35507	33432	11.12.87	43146	18. 5.87	
2	EVRETOU	25500	8618	8102	19.12.87	10113	21. 5.87	
3	KALAVASOS	17100	4522	3240	18.12.87	7822	15. 4.87	
4	LEFKARA	13950	776	315	21.12.87	2404	20. 5.87	
5	DHYPOTAMOS	13700	1570	721	11.12.87	3256	22. 4.87	
6	YERMASOYIA	13502	8109	5447	20.12.87	13502	1. 4.87	Overfl. 1.4-17.5
7	POLEMIDHIA	3400	1161	967	19.12.87	2719	22. 4.87	
8	MAVROKOLYMBOS	2180	195	150	31.10.87	877	22. 5.87	
9	KITI	1625	0	0		0		
10	XYLIATOS	1220	612	512	19.12.87	1220	5. 3.87	Overfl. 5.3-15.5
11	ARGAKA	990	236	84	4.12.87	990	11. 2.87	Overfl. 11.2-20.5
12	POMOS	860	205	122	23.10.87	860	26. 1.87	Overfl. 26.1-20.5
13	ATHALASSA	790	0	0		0		
14	KALOPANAYIOTIS	363	100	46	23.10.87	363	6. 3.87	Overfl. 6.3-13.7
15	AYIA MARINA	298	76	50	31.10.87	298	14. 3.87	Overfl. 14.3-25.5
16	AGROS	80	17	17	30.10.87	80	3. 4.87	Overflowed
17	AGROUNDA	22	21	22		22	5.12.86	"
18	ARAKAPAS	128	42	43	30. 9.87	128	8. 1.87	"
19	AYII VAVATSINIAS	53	20	23	27.10.87	53	4. 1.87	"
20	KALOKHORIO	32	4	0	27.10.87	32	29.12.86	"
21	KANDOU	38	4	5	30. 9.87	38	25. 4.87	"
22	LEFKA KAFIZES	113	12	15	28. 9.87	113	27.12.86	"
23	LEFKA MARATHASA	368	220	230	23. 9.87	368	6. 1.87	"
24	LIOPETRI	325	0	0		0		
25	LYTHRODHONDA U	32	0	0	29. 9.87	32	10. 3.87	"
26	LYTHRODHONDA L	32	8	4	30.10.87	32	10. 3.87	"
27	LYMBIA	220	36	15	27.11.87	220	15. 3.87	"
28	PALEKHORI	620	108	0	10.12.87*	620	18. 1.87	Opened for * overflowed
29	PERAPEDHI	55	5	5	30. 9.87	55	19. 2.87	Maintenance Overflowed
30	PETRA UPPER	10	0	0	30. 8.87	10	19. 2.87	Overflowed
31	PETRA LOWER	25	0	0	30. 8.87	25	15. 3.87	"
32	PYRGOS	283	40	0	20.10.87	283	27. 1.87	"
33	TRIMIKLINI	340	340	0	15.11.87*	340	20. 5.87	* Open Overflowed
34	AGRIDHIA	59	25	24	27.11.87	59	11. 3.87	Overflowed
35	AKAPNOU-EPHTAGONIA	132	40	11	27.11.87	132	1. 2.87	"
36	ARAKAPAS No. 1	192	35	0	27.11.87	175	6. 4.87	Opened for Maintenance
37	ARAKAPAS No. 2	119	23	13	27.11.87	119	6. 3.87	Overflowed
38	AY. VAVATSINIAS No. 1	55	25	22	27.10.87	55	6. 3.87	"
39	AY. VAVATSINIAS No. 2	43	20	21	27.10.87	43	26. 3.87	"
40	DHIERONA	159	12	2	2.11.87	159	16. 2.87	"
41	EPHTAGONIA No. 1	92	26	14	27.11.87	92	29. 3.87	"
42	EPHTAGONIA No. 2	127	35	21	27.11.87	127	10. 3.87	"
43	EPHTAGONIA No. 3	65	32	26	27.11.87	65	29. 3.87	"
44	ESSO GALATA	35	17	14	27.10.87	35	15. 3.87	"
45	KATO MYLOS	104	26	18	30.10.87	104	16. 2.87	"
46	KHIROKITIA	205	28	4	24.11.87	174	29. 4.87	"
47	KHANDRIA	70	17	12	27.11.87	70	11. 3.87	"
48	KYPEROUNDA No. 1	53	12	12	30.10.87	53	18. 1.87	"
49	KYPEROUNDA No. 2	273	53	36	30.10.87	273	25. 3.87	"
50	LAGODHERA	70	28	27	16.10.87	70	5. 3.87	"
51	MELINI	59	18	10	27.10.87	59	28. 1.87	"
52	ORA	62	2	1	27.10.87	62	13. 3.87	"
53	PAKHYAMMOS	43	0	0	30. 9.87	43	13. 3.87	"
54	PELENDRIA	123	38	32	27.11.87	123	11. 3.87	"
55	PHARMAKAS No. 1	21	5	5	27.10.87	21	10. 1.87	"
56	PHARMAKAS No. 2	61	20	17	27.10.87	61	9. 3.87	"
57	PRODHROMOS	110	56	54	27.10.87	110	8. 4.87	"
	TOTALS	151476	63157	53941		92305		
	%			35.6		60.9		

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 3 066 sq. km (see page II-13). The springs wells/boreholes which were on register at the end of 1987 were 29 995.

The new areas brought under hydrological observation during the year have an extent of about 5 square kilometers. A number of 17 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 1 730 new wells/boreholes.

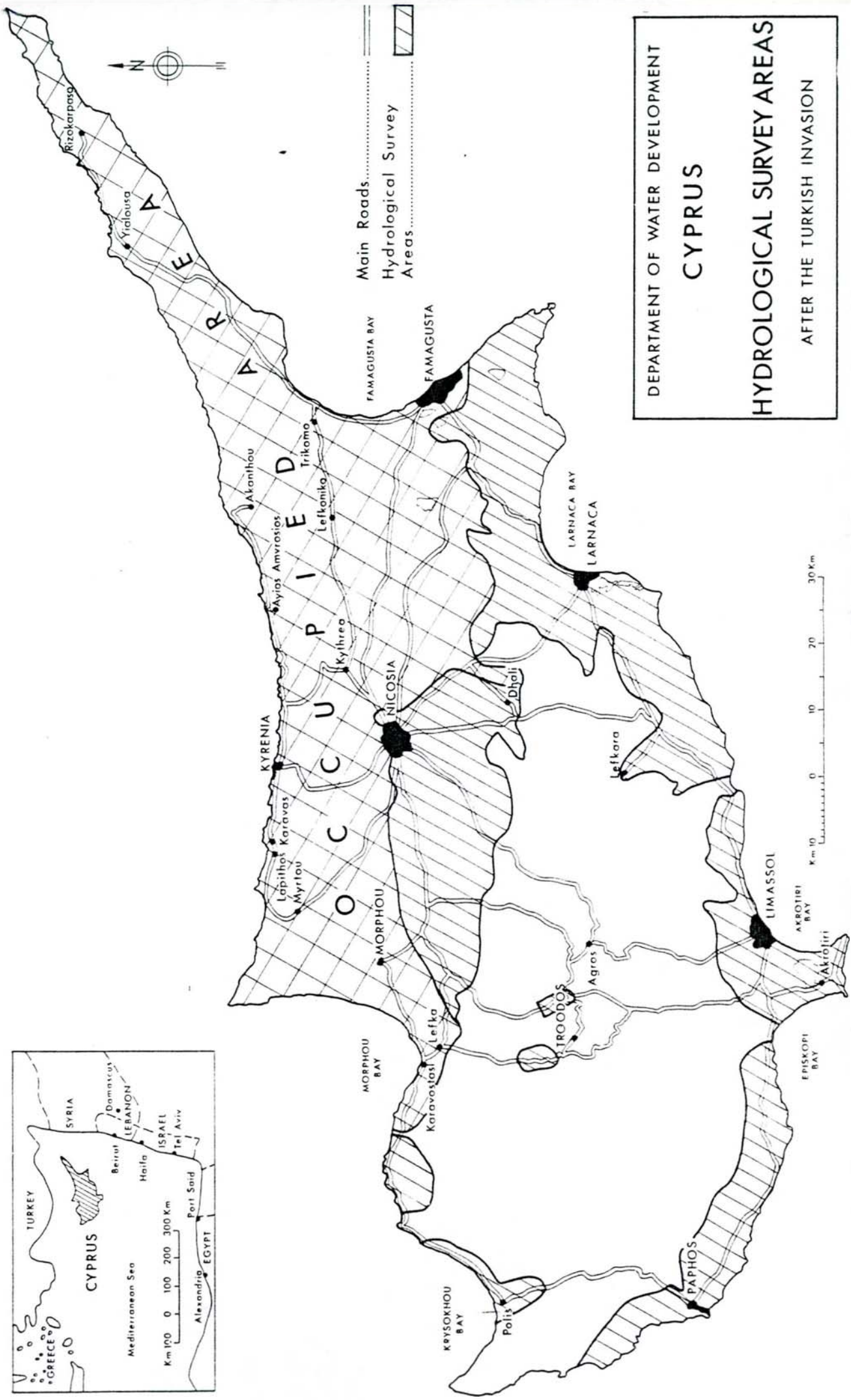
Through the Hydrological Surveys all wells/boreholes, springs and chain-of-wells are registered and plotted on maps. A dense network of observation boreholes, is being levelled. Through these observation boreholes/wells, the water level is being measured twice a year, at the end of the dry season (November), 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 1987 is 1 242 and, every month or fortnight 585.

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 1987 13400 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 1987 the number of groundwater samples from observation boreholes analysed for Cl was 3152.

As regards groundwater situation, in the most important aquifers a general drop of the water table was noted but in some others a slight rise, particularly in March. Details may be seen in the table II-7 of selected observation boreholes.



DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

HYDROLOGICAL SURVEY AREAS

AFTER THE TURKISH INVASION

TABLE II-7
SELECTED OBSERVATION BOREHOLES

Serial No.	Hydr. No.	Village	Water Level increase (+) or decrease (-)					
			March 1986	November 1986	March 1987	November 1987	March 1986-87	November 1986-87
56/56	192	Liopetri.....	- 1.04	- 0.66	- 1.04	- 0.66	0.00	0.00
126/50	105	Ormidhia.....	- 27.50	- 29.50	- 26.18	- 30.00	+ 1.32	- 0.50
94/52	234	Ormidhia.....	+ 11.22	+ 11.28	+ 11.58	+ 11.18	+ 0.36	- 0.10
72/56	975	Phrenaros....	+ 8.28	+ 8.11	+ 8.28	+ 8.38	0.00	+ 0.27
Priv.B/H	429	Sotira.....	- 1.52	- 1.05	- 1.37	- 1.37	+ 0.15	- 0.32
88/54	24	Kolossi.....	+ 1.60	- 1.80	+ 1.60	- 0.95	0.00	+ 0.85
51/63	813	Limassol.....	+ 1.22	+ 0.73	+ 1.63	+ 1.13	+ 0.41	+ 0.40
45/63	811	Zakaki.....	+ 0.93	+ 0.18	+ 1.58	+ 0.53	+ 0.65	+ 0.35
161/50	180	K. Trimithia.	+186.22	+186.14	+186.65	+186.44	+ 0.43	+ 0.30
90/50	106	"	+188.48	+190.40	+190.41	+190.25	+ 1.93	- 0.15
125/60	15	Episkopi.....	+ 24.91	+ 20.66	+ 28.46	+ 18.01	+ 3.55	- 2.65
EB 94/70	1236	Akrotiri.....	+ 1.26	- 1.44	+ 1.26	- 0.79	0.00	+ 0.65
P.B. 12	2671	Kouklia.....	+ 1.70	+ 0.45	+ 1.50	+ 0.35	- 0.20	- 0.10
51/72	2946	Nikoklia.....	+ 40.04	+ 37.84	+ 40.69	+ 38.84	+ 0.65	+ 1.00
43/63	2948	Mandria.....	+ 2.85	+ 10.68	+ 16.50	+ 6.55	+13.65	- 4.13
Priv.B/H	639	Kouklia.....	+ 0.82	+ 1.28	+ 3.26	+ 1.10	+ 2.44	- 0.18

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 1987, 35 meeting and examined 3581 applications sent to the Director, WDD by the District Officers, as follows:-

Water Supply (Special Measures) Law areas.....	626
Water Conservation areas.....	1 878
Non Water Conservation areas.....	640

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 page II-18 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	Cazette 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
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
3	South-Eastern Mesaoria (F'sta - Paralimni-Ormidhia-Akhna), later withdrawn.....	-	-	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

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 Limassol-Akrotiri area during 1987 there were 421 water meters installed of which 404 are in continuous operation. The total volume of water recorded is 15.1 MCM. During the year 16 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 1987 this Department issued 16 Drillers licences and renewed 62 others. The number of private drilling rigs which drilled for water during 1987, was 60.

During 1987, 17 private Drillers were reported to the District Officers for illegal drilling.

WATER QUALITY

Chemical Analyses

During the year 1987, 534 samples of water were sent to the Government Analyst and Geological Department Laboratory and 726 to the WDD Laboratory for chemical analyses. Out of those, 473 samples were taken from springs, wells or boreholes, which are used or proposed as water supply sources. The remaining 787 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 66 samples were sent to the Government Analyst.

Suspended Sediment Analyses

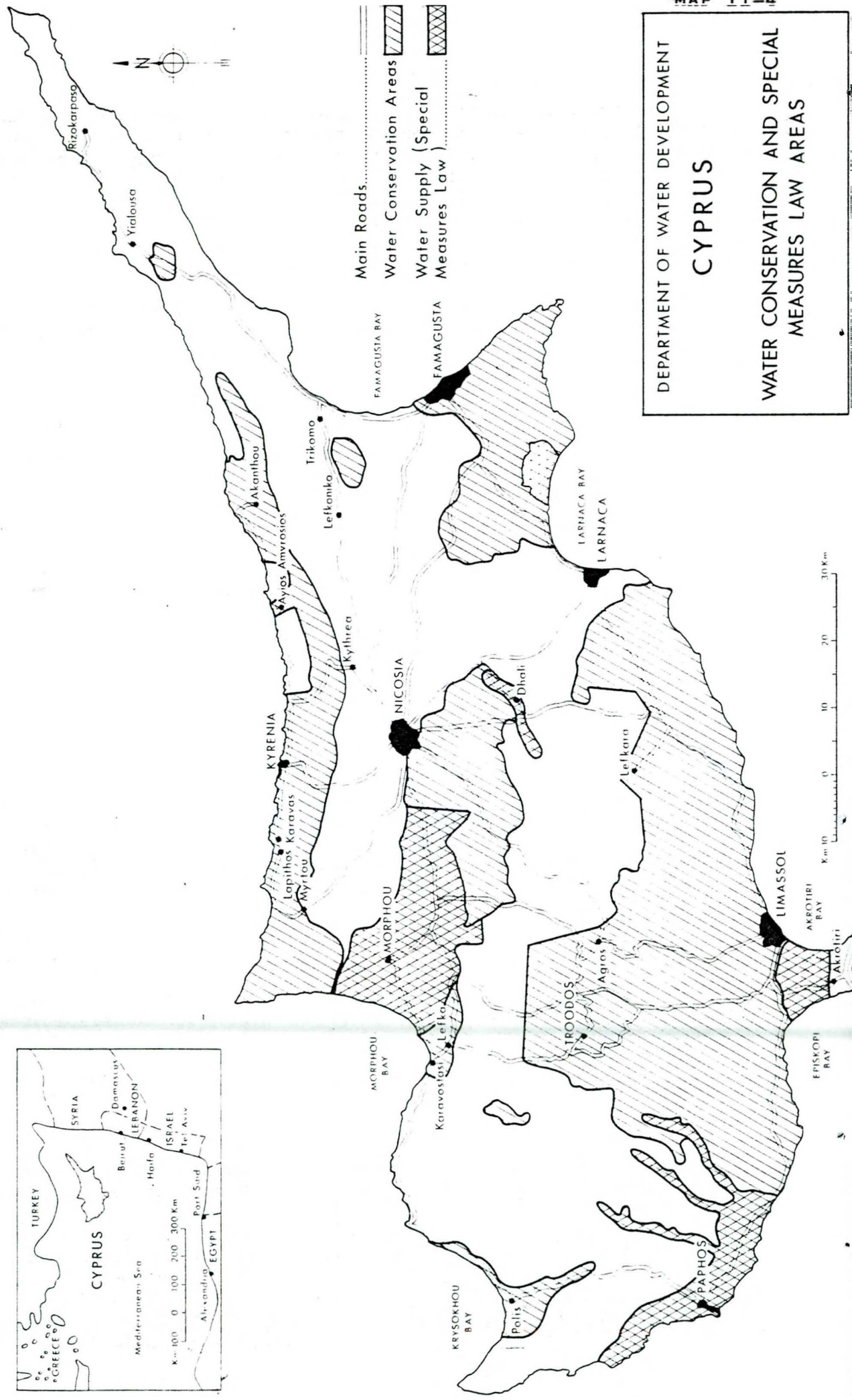
A number of large dams have been constructed in Cyprus. The evaluation of reservoir sedimentation may prove important, so the sediment sampling programme was continued this year also.

During the year 128 samples of river water were taken for suspended sediment analyses.

DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

WATER CONSERVATION AND SPECIAL MEASURES LAW AREAS





Mylou River flow gauging station at Kornos WDD Photo No. D58EN-15A (12.3.87)



Yermasoyia River flow gauging station. WDD Photo No. D61EN-13 (20.3.87).

III DIVISION OF HYDROLOGY AND WATER RESOURCES MANAGEMENT

by
I St Iacovides
Senior Hydrogeologist
Head of Division

Introduction

The Division of Hydrology and Water Resources Management has been formally established since 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:

- a) Surface Hydrology Branch
- b) Groundwater Hydrology Branch
- c) Water Resources Management Branch and
- d) 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 1987, the Division consisted of the following staff:

1. I. St. Iacovides, Senior Hydrologist (A13), Head of Division.
2. A. Georghiou, Geologist (I) (P14) Head Groundwater Hydrology Branch.
3. A. Christodoulides, Hydrologist (I) (P14) Head Water Resources Management Branch.
4. P. Alexandrou, Technical Superintendent (A10), Surface Hydrology Branch.
5. S. Katsianis, Senior Technician (A9), Groundwater Hydrology Branch.
6. G. Pashiardis, Senior Technician (A9), Engineering Hydrology Branch.
7. L. Markides, Technician (I) (A7), Water Resources Mgmt Branch.
8. Chr. Nicolaou, Technician, (II) (A4).
9. Char. Makrides, Technician (II) (A4).
10. Popi Loutsiou, Typist (A2).

Surface Hydrology Branch

a) Karyotis Project

The Feasibility Study of utilization of the Karyotis river flow, and possibly that of other water courses in the adjoining areas, to provide the Nicosia area with potable water was carried out by the Soyuzgiprouodkhoz Institute of the USSR.

In this context the Hydrology Branch was involved in the following:

- Computation of the depth-area-rainfall for 1916 to 1984 and 1916 to 1986 for a number of subcatchments within the Karyotis valley;
- Collation of the observed runoff for the periods of 1965-1984 and 1965-1986 for the same subcatchments;
- Follow of the progress of monitoring of instantaneous flows at selected sites for Karyotis river at 5 weirs and 7 irrigation intakes, for Atsas river at one weir and at proposed dam site, for Elea river at one weir and one site, for Marathasa at one weir and two measuring sites and for Peristerona weir.
- The tentative results for the various subcatchments are as follows:

TABLE III-1

KARYOTIS RIVER RAINFALL - RUNOFF BY SUBCATCHMENT

Subcatchment	Area km ²	Depth-area-rainfall(mm)		Average runoff(Mm ³) annual	
		1916-1984	1916-1986	1965-84	1965-1986
Ayios					
Nicolaos	16.1	989	985	11.68	11.25
Platania	10.0	910	906	2.76	2.63
Galata	43.6	873	868	-	-
Evrykhon	63.0	803	798	13.62	12.87

- The runoff at Evrykhon was simulated using the rainfall-runoff model for the period of 1916-1984 resulting to an average gross runoff of 16.28 Mm³/y.

b) Other activitiesi) Vyzakia project

Updating of the hydrology was initiated to provide the necessary information for the potential divertible water quantities from the Elea river into the Vyzakia proposed dam.

In this connection, depth-area-rainfall was computed and observed runoff was collated for various subcatchments of the Elea river.

Runoff was simulated for the period of 1916 to 1982 using the rainfall-runoff model on the IBM PC AT computer of the Division and diversion studies were initiated.

TABLE III-2

ELEA RIVER RAINFALL - RUNOFF BY SUBCATCHMENT

Subcatchment	Area km ²	Depth-area-rainfall			observed runoff		Simu- lated runoff (Mm ³ /y) 1916-82
		1916-82	1916-86	1978-82	1978-86		
Laghoudhera	13.0	711	702	2.76	2.24	2.92	
Kapoura	21.1	665	658	-	-	3.91	
Kannavia	36.7	593	587	-	-	5.07	
Vyzakia	79.6	573	566	7.88*	6.67*	9.98	

* refers to 1965-82 and 1965-86

ii) Yermasoyia area

- Follow, checking and computation of observed runoff data on four weirs in the Yermasoyia riverbed aquifer downstream the dam monitoring the released water for artificial recharge.

- Updating of rainfall record at the Yermasoyia area for the years 1977 to 1987 for the purpose of simulating the runoff developed in the catchment areas near the dam and downstream of it.

iii) Other studies

- Flood studies for minor catchments as for Sotira-Liopetri and at Platys (Nicosia).
- Rainfall and runoff data were updated up to 1986 and punched and transferred on the IBM PC AT of the Division. This work involved filling in of missing data, punching and checking.
- Development of the software GEDIV used for diversion studies.

Groundwater Hydrology Branch

a) 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 and type of crop etc. This mass of data is being 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 Mm³/y of groundwater.

During the year, the data on 6000 boreholes were installed on the computer and reports on the groundwater resources of 5 irrigation Blocks were prepared namely:

SCP-KOKKINOKHORIA IRRIGATION BLOCKS PREPARED IN 1987

Report No.	Irrig. block	Area	Date of preparation
H/61	I	Akhna-Avgorou	Feb. 1987
H/63	II	Akhna-Avgorou	May 1987
H/64	VIIA	Liopetri	June 1987
H/67	VIII	Liopetri-Sotira	October 1987
H/68	XIIB	Avgorou-Phrenaros	November 1987

The above Irrigation blocks total 1035 pumping boreholes irrigating 978 hectares with a total quantity of groundwater

of 3.8 Mm³/y.

b) 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 500 wells and boreholes irrigating 2350 hectares of Citrus (1625 ha), vineyards (414 ha) and seasonal and other trees (311 ha).

The data from this survey will be stored on computer and will assist in the improved management of the water resources of the area together with the SCP and Polemidhia-Yermasoyia surface water.

c) Use of radiosotopes 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 this 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 IAFA in September 1985.

In addition to the above the IAEA is financing a study of the conjunctive use of the Yermasoyia aquifer with the dam. Samples of water have been collected during releases of water from both the surface and the groundwater. This study will enable a more efficient operation of Yermasoyia aquifer sustained by releases from the dam.

d) Other studies connected with the Southern Conveyor Project

- The developing groundwater conditions in the Kokkinokhoria aquifer, Kiti-Pervolia area, Pareklisia 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. Furthermore, the area of Anglisides was considered and a monitoring network was established.

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.

a) 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 4 years depends almost on the controlled releases of water from the Yermasoyia dam.

The total extraction from the aquifer in 1987 for water supply purposes was 6.5 Mm³ distributed as follows (in m³/yr):

Limassol W.S.	Amathous	Yermasoyia	Potamos Yermasoyias	Moutayiaka	Total
4265714	759920	176027	816307	479927	6497895

To maintain the extraction, releases were made from the dam and some quantities of water were imported from the Kouris Delta area for recharge of the aquifer. A total of 4.436 Mm³ were recharged into the aquifer of which some 0.091 Mm³ were imported from the Kouris Delta area. The net effect of recharge is shown on fig. III-1.

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

The Yermasoyia reservoir balance for 1987 was established to be as follows:

TABLE III-3

YERMASOYIA RESERVOIR WATER - BALANCE FOR 1987

INFLOW (Mm ³)	OUTFLOW (Mm ³)
Phinikaria river ... 17.536	Outflow for Irrigation and releases 10.245
Akrounda river 2.131	Evaporation 1.022
Catchment d/s weirs. 1.089	Spills 1.147
Subsurface inflow .. 0.273	Unaccounted losses ... 2.615
Rainfall on reservoir 0.347	
21.346	15.029

Net change in Storage: +6.317

b) Releases from the Asprokremmos reservoir

The total pumpage from the Xeropotamos aquifer downstream the dam was about 1.2 Mm³ whilst the total releases made during the year totalled 1.76 Mm³ of which 1.423 Mm³ were diverted from the Dhiarizos river.

The releases were made at an average rate of 4 to 5000 m³/d into a series of four recharge ponds immediately downstream

the dam.

The recharge was quite effective as shown on fig III-1.

c) Kouris Delta Emergency Scheme

The boreholes of the Kouris Delta continued to supplement the supply from Yermasoyia and Polemidhia dams for the irrigation of some areas in Akrotiri-Phasouri. The total quantity extracted during 1987 from the Kouris Delta aquifer was 0.31 Mm³ from 4 boreholes. From this quantity, 0.23 Mm³ was exported for the recharge of the Yermasoyia aquifer utilizing the same conveyor that imports water from Yermasoyia Dam for irrigation during the summer period.

A total quantity of 2.060 Mm³ 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.

Engineering Hydrology Branch

a) 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 Mm³ storage capacity).

For this purpose the inflow from Kouris diversions into the pond, the overflow and one intake used for irrigation were 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 1986 to June 1987 a total of 2.393 Mm³ were entered into the pond. Of this quantity 0.174 Mm³ were used for irrigation, spilled and evaporated allowing a total of 2.219 Mm³ to infiltrate into the groundwater. The average infiltration rate was 10500 m³/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.

b) Seepage studies at Evretou dam

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

- i) Temperature of groundwater in the left and right abutments and riverbed alluvium.
- ii) Water level measurements of groundwater in the area and

- hydraulic gradient evaluation.
- iii) Execution and analysis of a 48 hr pumping test.
 - iv) Flownet analysis and
 - v) Simulation of the groundwater levels in the downstream alluvium.

Furthermore, hydrochemical and isotopic analyses were carried out. These investigations led us to consider the leakage being of reasonable quantities order of 12 to 30 l/s at full capacity of the reservoir with the left abutment and the diaphragm being the most likely flowpath areas. The investigations are being continued.

c) Seepage at the Kouris dam

Seepages oozing at the right abutment were investigated using among other methods the isotopic analyses.

The evaluation resulted that these seepages were rather due to local groundwater appearing at the excavation site rather than from the reservoir.

d) Akrotiri Salt lake

In the effort of simulating past water levels using available local groundwater fluctuations, the topography of the salt lake and the storage capacity curve was carried out. This work is in connection to the environmental issues being considered for this area.

e) Computer software application and development of new software

The existing software LOTUS 1-2-3, dBase III, WORDSTAR and 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-4

DIVISION OF HYDROLOGY
AND
WATER RESOURCES MANAGEMENT

1. SURFACE HYDROLOGY BRANCH	2. GROUNDWATER HYDROLOGY BRANCH	3. WATER RESOURCES MANAGEMENT BRANCH	4. ENGINEERING HYDROLOGY BRANCH
Function:	Function:	Function:	Function:
1.1 Regional surface hydrology evaluation; watershed behaviour.	2.1 Regional groundwater balance evaluations	3.1 Based on the studies and results of Eng. Hydrology, Groundwater and Surf. Hydrology branches, formulation of constraints for decision making on the availability and use of water resources; allowable yields of aquifers; spacing of wells	4.1 Water balance of surface storages
1.2 Evaluation of runoff	2.2 Evaluation of hydrogeological properties for aquifers through pumping tests	3.2 Advice on new development projects and follow-up of these projects, water-supply or irrigation	4.2 Evaluation of leakage from dams
1.3 Forecasts of flow	2.3 Siting of wells, design and evaluation of yield	3.3 Operation studies on surface and groundwater resources and their conjunctive use; operation rules; emergency schemes on droughts; frequency of droughts	4.3 Evaluation of evaporation losses from surface storages
1.4 Watershed runoff simulation by rainfall-runoff models	2.4 Aquifer simulation models; description and forecast of behaviour as to quantity and quality	3.4 Appraisal of the exploitation policy of water resources and its consequences as to quantity and quality	4.4 Optimization and forecast models for operating and managing surface water systems and resources
1.5 Evaluation of floods and droughts	2.5 Updating of the inventory of groundwater resources	3.5 Recommendation with respect to pollution control	4.5 Stratification and limnological aspects of dams
1.6 Recommendations for updating of networks for surface hydrology	2.6 Groundwater recharge; artificial recharge; Streambed recharge	3.6 Inventory of existing and planned demands on surface and groundwater according to catchment and potential of area. Data storage and retrieval on computer	4.6 Flood studies
1.7 Surface water pollution evaluation and studies for its prevention	2.7 Spring flow phenomena; evaluation of potential storage and yield of springs	3.7 Publications and reports	4.7 Design of surface water measuring structures
1.8 Sediment transport evaluation	2.8 Status and inventory of domestic water supply resources		4.8 Hydrological aspects of artificial recharge
1.9 Surface water quality	2.9 Groundwater pollution, evaluation management; sea-intrusion evaluation		4.9 Hydrologic aspects of river training diversion structures etc.
1.10 Applied research on the above fields	2.10 Environmental radioisotopes use in Hydrology		4.10 Operation methods, software and computer control aspects of hydrological data
1.11 Maintenance of processed data on rainfall, runoff, floods, droughts, diversions and other hydrologic parameters on computer. Surface water inventory.	2.11 Safe yield of wells, springs, aquifers		4.11 Applied research on the above fields
1.12 Contact with the International Hydrologic Programme (I.H.P.) of UNESCO and with WHO.	2.12 Applied research on the above fields		
	2.13 Maintenance of hydrographs, quality trends, groundwater level contours, extractions etc for immediate use in the various studies, on computer. Groundwater inventory.		

Fig. III-1
Xeropotamos recharge
pond, looking
upstream. Third recharge
pond with measuring
weir.
WDD Photo No. D40EN-14
(21.1.87)

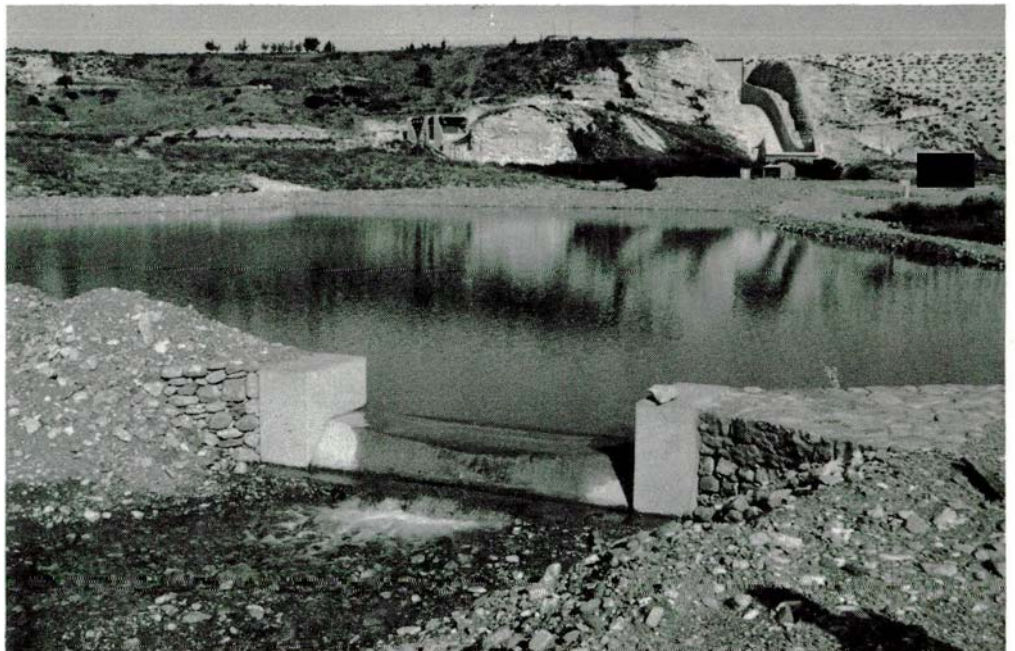
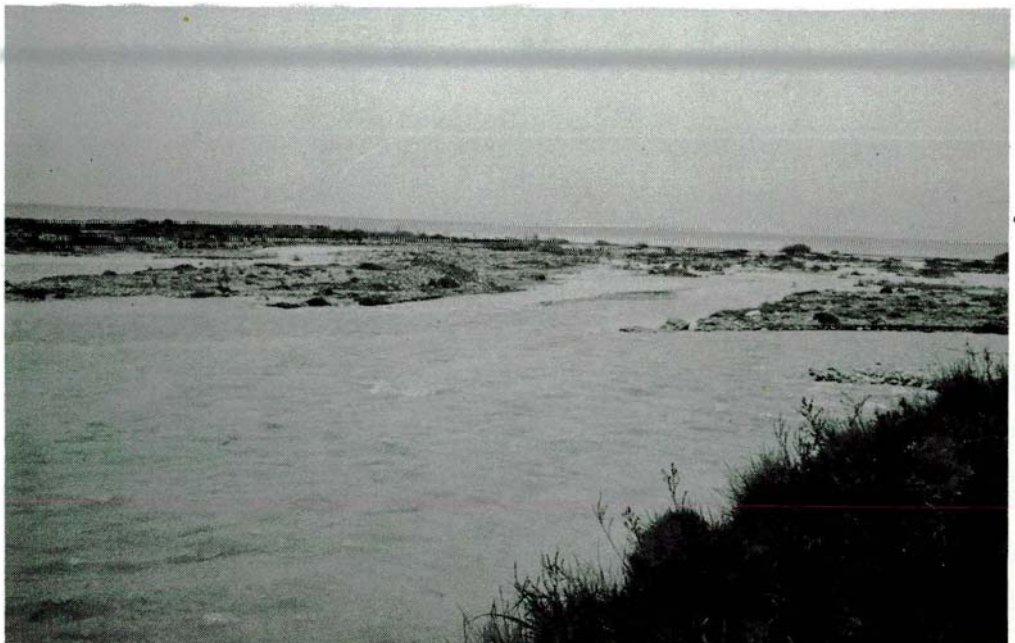


Fig. III-2
Kouris Delta
recharge pond
looking Downstream
inflow in the Pond
WDD Photo No. D62EN-17
(23.3.87)



Fig. III-3
Kouris River
flowing to the sea
Estimated flow
500,000 m³/day
WDD Photo No. D62EN-13
(23.3.87)



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 1987 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
- Two Irrigation Engineers on Contract
- One Senior Technician
- One Technician Class II

Summary of Activities

As with 1986 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.

Finally some other matters, which strictly speaking do not fall within the sphere of activities of this Division have been dealt with, in an effort to cope with unanticipated assignments of either the Department or the Ministry. Such studies were carried out for the relocation of main conveyors because of their interference with the new Larnaca highways, for the safe disposal of the Askarel toxic substances etc.

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 Vasilikos-Pendaskinos, and Khrysokhou Irrigation Project including Evretou Dam and the Southern Conveyor Project including Kouris Dam.

Studies for water works of local importance

During 1987 the Division has dealt with the applications by 45 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 unfavorable, 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 1987 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	Examination		Preliminary Study		Feasibility Study	
	On the Spot Pond	Dam Other	Pond	Dam	Pond	Dam
Nicosia	7	11 1	3	3	2	1
Limassol	5	3 5	-	-	1	-
Larnaca	3	2 -	-	1	6	-
Paphos	-	1 -	-	-	-	-
	--	-- --	--	--	--	--
Total	15	17 6	3	4	9	1

Preliminary studies were prepared for:

- A dam and a pond for Kannavia village
- A pond for Alithinou village
- A dam for Alona village
- A dam on Yialias river for Lythrodhontas and other villages
- A pond for Kalokhorio Klirou village
- A recharge dam for Athienou village

Feasibility studies were completed or initiated for:

- Two ponds for Saranti village
- A pond for Pelendria village
- Three ponds for Vavatsinia, Ora and Melini village respectively
- 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

Major Projects Planning

The two major water development projects under planning during 1987 were those of Karyotis Project and the Krasokhoria Integrated Rural Development Project. Some details of the projects and progress of the studies during 1987 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 Theodoros" 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 800 mm dia, 2.6 km long up to about Ayios Theodoros village.
 - The irrigation pipeline 500 mm dia, 2.6 km long up to Evrykhou village.
 - The Nicosia DWS pipeline 500 mm dia, 31.8 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 18,000m³/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 pipeline, is estimated at about £27 million.

During 1987 most of the work was carried out in Moscow for the elaboration of the designs and late in August 1987 the draft final feasibility report was sent to WDD. In addition to the feasibility study of the above formulated project, the report included at a prefeasibility stage a study 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.

The draft final report was reviewed and corrected by WDD and the other Departments involved. The changes, corrections and other comments as well as the procedure for the detailed designs and construction of the works, were discussed with the Soviet consultants in Nicosia in November 1987. The final feasibility report will be prepared and sent to Cyprus by the end of March 1988.

Krasokhoria Integrated Rural Development Project

The water development component of the Project as it was finally formulated in 1985 comprised:

- a) The construction of two dams, one on the Platys tributary of Dhiarizos river and the other on the Xylourikos tributary

(Limnatis) of the Kouris river. The first one having a storage capacity of 1.37 MCM will be used for the irrigation of 244 ha in the upper Dhiarizos valley. The second with a storage capacity of 0.85 MCM will irrigate an area of 110 ha of the downstream villages.

- (b) The construction of 5 ponds of a combined storage capacity of 1.57 m³ for the irrigation of 275 ha in 6 villages.
- (c) The utilization of 6 boreholes in the Dhiarizos lower valley for the irrigation of 65 ha of land.
- (d) The rehabilitation of some small irrigation schemes.
- (e) The utilization of a new borehole, the improvement of the conveyance system and the provision of additional balancing storage for the enhancement of the Limassol Krasokhoria regional domestic water supply schemes.

The feasibility studies of the above components of the project was completed in 1986 and the combined internal rate of return was estimated at 8.2%. The relatively low rate of return was mainly attributed to the low crop yields because of the poor fertility of the lands to be irrigated. The problem of low fertility of the lands due to their high content in calcium carbonate (CaCO₃) was undertaken for study and research by the ARI. The first results of the research, which were made available by the end of July 1987, indicated that the effect of CaCO₃ on the productivity would be by far less than originally thought, provided the farmers would exercise proper management of soil and water. Based on the new agro-economic inputs, which were prepared by ARI in October 1987, a reevaluation of the economics of the project were undertaken including updating of costs. The new report, which was prepared in December 1987, showed a combined internal rate of return for the project of 11.5%.

It should be noted finally that most of the rehabilitation schemes have been implemented and the domestic water supply scheme is in progress.

Other Studies

As earlier mentioned some other studies were undertaken during 1987 which do not fall directly within the circle of activities of the Planning Division. Some of such studies are:

- (a) Disposal of Askarel toxic substances.

The problem of the safe disposal of the toxic Askarel substances was undertaken by the Geological Survey Department, which in turn asked for the cooperation of the WDD.

After a thorough examination of the problem, it was decided to bury the toxic material at the place it was first traced that is at the Limassol Industrial Area. The study involved the design of a cell, similar to the ponds used for water storage, located adjacent to the place the material was traced and lined with membrane and bentonite. The contaminated earth material would then be excavated,

transported, placed and sealed in the cell. Another such pond was designed at the depression created by the excavation of contaminated material, which would serve on one hand to cover the contaminated area and on the other to receive any further questionable material. The whole area would finally be covered with bentonite and other earth material, allowance having been made for proper surface drainage. The two ponds received about 15,000 m³ of contaminated material and polyethelene membrane was used instead of PVC, which would be sensitive to this kind of toxic material.

Due to the urgency of the case the preparation of the designs took about 15 days.

(b) PWD highways crossings with WDD main conveyors.

During 1987 the Division undertook to coordinate the activities of the Department and provide designs for:

(a) Two major crossings of the Nicosia-Larnaca highway with the Khirokitia-Famagusta potable water pipeline at Rizoelia (Aradhippou) and with the Dhyptomamos-Nicosia potable water pipeline at the Ayia Varvara interchange. Both designs were completed in 1987.

(b) Eight major crossings of the new Larnaca-Kophinou road with the Khirokitia-Famagusta pipeline and another crossing with the future Tersephanou-Nicosia potable water pipeline. Preliminary designs were prepared by August 1987, but final designs were postponed due to a change on the road route which would affect the designs.

(c) Detailed designs for the Kokkinokhoria area distribution network (Southern Conveyor Project).

The preparation of the detailed designs for the Kokkinokhoria area within the framework of the Southern Conveyor Project was assigned to this Division as of April 1987. During 1987 the following progress was recorded:

(a) Blocks II and VIIA covering an area of 465 and 327 ha respectively were given the final touches early in 1987.

(b) Blocks XIIB, XIIA, VIII, IX, XA and VIIB covering areas of 500, 392, 440, 362, 433 and 408 ha or a total of 2535 ha were fully completed and passed over for construction.

(c) Blocks XI and XB covering a total area of 838 ha were in progress and will be completed early in 1988.

In addition the tertiary irrigation system of Block VIIA was also completed in 1987.

In total by the end of 1987, detailed designs were prepared for 9 Blocks out of 23, covering an area of 3,680 ha out of 9,000 ha.

(d) Computer network

As with 1986, personnel from this Division undertook the coordination and management of the installation of the computer network of the Department.

During 1987 the computer network has been augmented with another three personal computers to a total of nine stations. Each station has been equipped with a hard disk of 20 MB. This offers the flexibility of each station working in a stand alone mode or in a network environment.

The software library has been enriched with a number of packages covering a mode spectrum of activities such as engineering, economics, statistics.

Computer courses in DOS., LOTUS, DBASE and Wordprocessing have been organised by WDD staff and attended by more than sixty (60) WDD staff members.

(e) Water-rates studies

A major study has been completed for monitoring the water rates both for the domestic water supplies and irrigation. The study has been undertaken in accordance with the section 4.05 of the Southern Conveyor Project Phase I Loan Agreement with the World Bank. The Agreement requires WDD to set domestic water rates at a level sufficient to cover full operating and maintenance costs, working capital requirements and the higher of debt service requirements or depreciation. Irrigation water rates are similarly calculated but government subsidies var with time and project (water source) are also considered in the analysis.

An extensive data base, such as annual operating expenses, assets, investments, loans, is required for the analysis described above. Such data base was not available and considerable time and effort was spent for collecting and establishing the data which stems as back as the year 1940 and projects into the future till the year 1995.

The analysis of the extensive data as well as the complicated financial analysis calculations have been performed by using a specially built computer model. This model will prove to be a valuable tool for setting rapidly and inexpensively the water tariffs both at present and in the future.

INVESTIGATIONS AND LABORATORY BRANCH

by
C Kridiotis,
Executive Engineer I

General

In 1987 the work of the Site Investigations, Laboratory and Grouting Section of the Division of Planning, related to a number of major and minor projects undertaken by the Department. Furthermore, at the request of other Government Departments and private organizations, a number of projects were undertaken and completed during the year.

The increased volume of work noted in previous years persisted in 1987 and this led to the full utilization of available machinery and equipment throughout the year.

Site investigation work performed was mainly involved with subsurface geological, foundation and construction material investigations at the feasibility/final design study stages and during construction.

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

Southern Conveyor Project - Phase I:

- (i) Akhna Terminal Storage Reservoir: Scaling of borehole in reservoir area and drilling of relief holes downstream of embankment. Installation of piezometers.
- (ii) Kokkinokhoria Irrigation Area: Foundation investigations for pumping stations and reservoirs.
- (iii) Kouris Dam: Drilling of boreholes for piezometer installation. Site investigations for Kouris pumping station.

Southern Conveyor Project - Phase II:

- (i) Dhiarizos Diversion: Drilling of four (4) deep boreholes (maximum depth attained 340 meters) with core recovery along diversion tunnel alignment.
- (ii) Akrotiri Irrigation Project: Foundation and fill-material investigations along irrigation network.
- (iii) Tersephanou Water Treatment Plant: Site investigations by the use of a mobile angr rig and backactor tractor.

Evretou Dam

Geotechnical investigations at upstream portal slide area with associated laboratory testing. Drilling of monitoring holes at left and right abutments and in river alluvium downstream of embankment.

Yermasoyia Dam

Drilling of two monitoring holes in downstream alluvium.

Asprokremmos Dam

Remedial grouting in drainage and cap galleries. Drilling of monitoring holes in downstream alluvium.

Aradhippou Proposed Dam

Site and material investigations by the use of an auger rig and a backactor tractor.

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

- New Limassol Hospital: Foundation investigations and associated laboratory testing.
- Nicosia Municipality/Kophinou Slaughter House: Site investigations.
- Archangelos Michael Monastery: Foundation investigations.

Following the example of previous years, for site investigations, a very close collaboration was maintained with the Engineering Geology Section of the Geological Survey Department.

The work of the Laboratories Section may be distinguished into that of the main and field laboratories. In the main (soils/concrete) laboratories in Nicosia, tests were performed in connection to foundation and construction materials investigations related to Departmental Projects. Tests were also performed at the request of other Government Departments and private organizations.

The work performed in the Main Laboratory is analyzed in Table IV-1 with relevant details as to type and number of tests performed for each project.

Machinery and equipment

During 1987 the laboratory acquired the following equipment:

- Small shear box machine
- Ring shear machine for residual testing
- Water distillation apparatus
- Concrete mixer.

In 1987 the following drilling and grouting equipment was also acquired.

- grout pump, - grout mixer - crawler drilling rig, type soil Mec. SM305.

TABLE IV-1
SOIL LABORATORY TESTS DURING 1987

PROJECT TYPE OF TEST	SOUTHERN CONVEYOR										CONCRETE					
	KOURIS DAM	AKINA DAM	AKROTIRI	KOKKINOKHORIA IRR. AREA	DHIARIZOS	TERSEFANOI	VASILIKOS PENDAS	EVRETOU	PARTHENITIS	KITI-PERVOLIA	PRIVATE FIRMS	MISCELLENEOUS	TENDERS	TOTAL	PRIVATE FIRMS	TOTAL
Sieve Analysis	6	21		11			4				15	3	29		89	
Hydrometer	9	10	6	28		16	1	19		65					154	
Atterberg Limits	7	5	7	26	12	18	7	18				3			97	
Specific Gravity	9	10	6	28		16	1	19	6	65	3				163	
Moisture Content					59	51		25				2			138	
Compaction Test	4	9	3	27							6	2			51	
Permeability		15													15	
Shear Box	7							14							21	
Water Absorption		4		6					6		5				21	
Soundness	6	7		7					7		5				32	
Swelling Pressure		1	1	13		3						1			19	
Los Angeles	3	3		2											8	
Linear Shrinkage				1											1	
Consolidation	7			1											8	
Potential Volume Change Tests												4			4	
In Situ Density											3				3	
Impact Test	1										4				5	
Flakiness and Elongation ...	2								4		5				11	
Organic Matter								6							6	
Alkali Reactivity												2			2	
C.B.R.		1		1											2	
Colour													14		14	
Suspended Sediment												75			75	
Crushing Strength (cones) ...					59			20				14			94	
Cube crushing strength											1			237	237	
TOTAL	61	86	23	145	130	104	13	122	23	130	47	106	43	1033	237	237

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 1987 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:-

Southern Conveyor Project

- Akrotiri irrigation networks ; Setting out the routes, BH's and profile levelling.
- Kokkinokhoria irrigation network - Setting out of routes, BH's and profile levelling. Plotting on plans the field boundaries of a block located in Dhekelia area.
- Dhiarizos Diversion tunnel - Levelling of the investigation BH's along the route of tunnel - Connecting with M.S.L. datum the two BH's which were drilled at each portal of the tunnel.
- Tersephanou-Nicosia pipeline - Setting out of route, levelling, site surveys.
- N S R 1 (night storage reservoirs) - Site survey.
- Tersephanou water treatment plant - Site survey.
- Kiti irrigation network N S R 11 site survey and pipeline - Setting out, BH's and profile levelling.
- Mazotos irrigation network - Setting out of routes, BH's, profile levelling.
- Parekklisha irrigation network - Setting out the routes, BH's and profile levelling.
- Kouris dam - Contour survey of the reservoir.

Karyotis Project

- Korakou d/site - Extension contour survey.
- Ortou d/site - Contour survey - Cross section - Profile levelling.
- Kaliaana reservoir - Contour survey.
- Kaliaana irrigation scheme - Route, BH's and profile levelling.

Routine

- Aradhippou dam (Archangelos R.) - Contour survey.
- Agros dam - Setting out and profile levelling of pipe line to convey water in the dam reservoir.
- Aradhippou dam (Parthenitis R.) - Topographical works during the construction of the dam and completion plan.
- Pelendria pond - Site survey.
- Ora main conveyor - Setting out. BH's and profile levelling.
- Vizakia dam - Extension contour survey.
- Pano Koutraphas - Site survey.
- Amiandos mines - Monitoring readings.
- Asgata pond - Site survey.
- Peristerona reservoir - Recharge scheme: Site surveys and sections.
- Akrotiri lake - Site survey.
- Dhali waste disposal - Site survey scheme
- Chakistra irrigation - Levelling scheme
- Kapoura dam - Site survey for the borrow area.
- Kalopanayiotis, Lefkara, Xyliatos, Dhypotamos and Kalavassos Dams - Observations for horizontal and vertical movements.

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) Organise 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 incorporates 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 1987 the following qualified personnel were working with the Design Division.

- One Senior Water Engineer, Head of the Division
- Two Executive Engineers Class I

The personnel of the Drawing and Records Branch is given in the respective section of this chapter.

MAIN ACTIVITIES - (Southern Conveyor Project - Phase 2)

During 1987, the main activities of the Design Division were the supervision of the design work for the various components of Phase 2 of the Conveyor Project (SCP). The final design work was undertaken by Energoproject, 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 are the following:

1. Dhiarizos Diversion, which will convey water from Dhiarizos river into Kouris reservoir. The maximum diversion capacity of the works will be about $6.5 \text{ m}^3/\text{sec}$ 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 1987, the draft design and draft construction drawings were prepared by the Consultants and reviewed by the Design Division.

Additional site investigations and laboratory testing were carried out as requested by the consultants.

The prequalification of the specialist contractors who will bid for the construction of the works was completed. In all, thirty three contractors were prequalified to bid for the construction of Dhiarizos Diversion Works.

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 irrigated a total area of about 1700 hectares out of which 550 will undergo hand consolidation. Because of the time required for the land consolidation work to be implemented, the design and construction of the Network was divided into two phases. It is envisaged that two civil four supply contracts will have to be prepared 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 £7.00 million.

During 1987 the work on the topographic surveys and geotechnical investigations for the pipelines and might storage reservoirs was completed and the results submitted to the Consultants. Work on the land consolidation continued by the Land Consolidation Department. The Consultants submitted the first draft design of the Network which was reviewed by the Design Division and returned to the Consultants for modifications. In addition, the Consultants submitted the draft contract documents for the supply contracts and Volume 1 of the civil contracts for our review.

In order to enable the continuation of the supply of water to existing irrigation intakes after the closing of the gates of the Kouris dam in November 1987, the government decided to start the construction of the main conveyors of the Akrotiri Irrigation Network. This involves the installation of about 11 km long pipelines, ranging in diameter from 800 to 1000 mm. For this reason tenders were invited for the supply of Ductile Iron Pipes, Asbestos Cement (A.C.) Pipes and Fittings, and various types of valves and water meters. The tender for the A.C. pipes was awarded and delivery of pipes started late 1987. Construction of the conveyor will be undertaken directly by the Construction Division of WDD early 1988.

- (ii) Kiti Irrigation Network, will irrigate a total area of about 1660 hectares out of which about 1000 hectares will undergo land consolidation. Due to the land consolidation, the design and construction of this scheme was again divided into two phases, as for the Akrotiri Network. Two civil and four supply contracts will also be prepared for this scheme. The total estimated cost for the Network is about £4.90 million.

During 1987 work on the land consolidation continued and topographical survey work started.

- (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 1987 the work for the land consolidation continued.

- (iv) Parekklissha 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 1987 work on the land consolidation continued.

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 m³/day, to be increased to 80,000 m³/day at a later stage.

The design and construction of the treatment works will be on a turkey basis and the estimated total cost is £5.40 million.

During 1987, the contract documents were completed and finalised and tenders were invited at the end of July 1987. The original date for the submission of tenders was extended by one month and the new submission date was the 5th of January, 1988.

- (ii) Tersephanou Water Treatment Plant

The plant will have an output of 60,000 m³/day, increased to 90,000 m³/day at a later stage. The treated water will be conveyed to Nicosia and Larnaca. The estimated cost for this project is about £6.00 million.

New site surveys were carried out and site investigations and laboratory testing have started during 1987.

(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. The 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 the pipeline route has been finalised and the relevant topography work was completed. Dhali balancing reservoir has been moved to a new position. Work on the geological investigations has started.

DRAWING AND RECORDS BRANCH

by S C Pitsillides STS

Head of Branch

The Drawing and Records Branch (D&RB) 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 Technical Information Section.

At the end of 1987 the Drawing and Records Branch staff numbered 22 i.e. 2 Senior Technicians, 11 Technicians I, 7 Technicians II and 2 hourly paid assistants of the plan reproduction section. Two of the Technicians included above (one grade I and one grade II) were transferred to the D&RB on 1.12.87.

Two Technicians worked throughout the year on SCP construction sites. Similarly members of the HQs Drawing Office staff worked on a rota of two months basis, two at a time at SCP construction sites. During the latter half of 1987 another Technician was posted with the SCP design team at HQs with one of the hourly paid assistants of the plan reproduction section affording time to the design team for printing and recording of drawings issued to construction sites.

The work carried out by the Drawing and Records Branch during 1987 is listed on Table V-1.

TABLE V-1
WORK CARRIED OUT BY THE DRAWING AND RECORDS BRANCH DURING 1987.

Ref.	Description	Time spent in hrs.	Man months	% of total
a.	Existing dams (completion plans, sedimentation maps, control monuments etc.) and proposed dams	1569	10.4	4.2
b.	Irrigation distribution systems for dams	135	0.9	0.4
c.	Routine irrigation schemes	388	2.5	1.0
d.	Routine domestic water supply schemes	2355	15.2	6.3
e.	Krasokhoria project	54	0.6	0.2
f.	Pitsilia integrated rural development project	148	0.9	0.4
g.	Vasilikos-Pendaskinos project ..	2957	19.1	7.9
h.	Southern Conveyor project	13812	89.0	36.9
i.	Khrysokhou irrigation project...	526	3.4	1.4
j.	Karyotis project	19	0.1	-
k.	Larnaca-Orini project	44	0.3	0.1
i.	Recharge works	96	0.6	0.3

TABLE V-1
 WORK CARRIED OUT BY THE DRAWING AND RECORDS BRANCH DURING 1987.
 (Cont.)

Ref.	Description	Time spent in hr.	Man months	% of total
m.	Antiflood and river training works	6	-	-
n.	Watershed surveys	186	1.2	0.5
o.	Hydrological	143	0.9	0.4
p.	Programmes and organisation	551	3.9	1.5
q.	Sewage disposal	359	2.3	0.9
r.	Completion plans and reports ...	1042	6.7	2.8
s.	General-Odd jobs	1022	6.9	2.7
t.	Computer lessons	77	0.5	0.2
u.	Productivity centre courses	165	1.1	0.4
v.	Auxiliary services			
	(i) Library	1515	9.9	4.0
	(ii) Plan registry	702	4.8	1.9
	(iii) Plan reproduction	2253	14.5	6.0
	(iv) Drawing materials store ..	398	2.6	1.1
	(v) Photographic section and photo process lab	1862	12.0	4.9
	Total for auxiliary services ...	6730	43.8	17.9
w.	Leave etc.			
	(i) Leave paid	3576	23.0	9.5
	(ii) Leave without pay	-	-	-
	(iii) Sick leave	890	5.7	2.4
	(iv) Maternity leave	423	2.7	1.1
	(v) D.C.	206	1.3	0.6
	Total for leave etc.	5097	32.7	13.6
	Grand total	37481	243	100%

Drawing and Cartography Section

A significant development during the year was the promotion of two of the Drawing Office staff to the post of Senior Technician thus allowing for the long awaited re-organisation of the Drawing and Records Branch. One of the new Senior Technicians has been assigned to be assistant head of the Branch and the other has been assigned to oversee the plan registry, plan reproduction and purchases of drawing instruments and the drawing materials stores.

In addition committees are established 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.

TABLE V-2

WDD - DRAWING AND RECORDS BRANCH (D & RB)

ORGANIZATION CHART 31.12.1987

Head : S C Pitsillides STS
Asst head : S Selipa STPlan registry, plan repro-
duction & drg materials : E Hikyriakou ST

A INCOMING WORK		B AUXILIARY SERVICES (DEPARTMENTAL)	
1	2	1	2
MAJOR PROJECTS	ROUTINE DWS, IRRIGATION SEWAGE DISPOSALS & OTHER WORKS	PLAN REPRODUCTION DRG MATERIALS (PURCHASE & STORE)	PHOTOGRAPHIC, VIDEO - GRAPHIC SECTION, PHOTOLITHOGRAPHY PROCESS LAB
Distributed to the Drawing and Records Branch staff by the Head and Asst Hd - Where several staff are required for a particular job a senior member is asked to take charge	COMPLETION PLANS AND FOLLOW -UPS	-Plan printing -Machine maintenance & operation -Requirements of instruments, equipment and materials -Orders, tenders and local purchases -Drg materials store -Report collation binding (For Branch)	-Photo process lab for enlargements reductions, repros -Photolithography for cartographic work -Site visits for still, cine and video from ground and air -Negatives and process lab registry -Purchases, photo materials -equipt -Maintenance & records for equipment -Orders & distribution of photos -Video documentaries production -Computer input for photos, slides films, videos
DRAWING AND RECORDS BRANCH STAFF ON 31.12.87			
Senior Technical Superintendent.	1 No		
Senior Technicians	2 No		
Technician grade I	11 No		
Technician grade II	7 No		
Plan reproduction assistants (Hourly)	2 No		
Total	23 No staff		
C COMMITTEES - SPECIALIZED WORK Etc			
1	2	3	4
COMMITTEES	SITE & REGIONAL OFFICES D & RB STAFF	STAFF TRAINING	CARTOGRAPHIC SECTION GRAPHICS, MODEL MAKING, EXHIBITIONS etc
I. Instruments, equipment & materials purchase D & RB Head and Asst Head plus 2 or 3 D & RB staff	-Materials, instruments supplies -Periodic visits by D & RB Head	-Within D & RB -Within the Department & Productivity Centre courses	D & RB Head and Asst Head plus 2 or 3 D & RB staff
II Exhibitions	D. SUNDRY DUTIES OF DO STAFF		
D & RB Head and Asst Head plus 2 or 3 D & RB staff	a Dam capacities files b D's office graphs - map c Annual report graphs etc d Staff charts e Orders to print room f Maps store g Watershed surveys store	g Requisitions to DLS h Standard sheets j Log paper k Lettraset - leitratone l Plans in tubes & archives tubes m P R box files n Drawing tags	
III Drafting standards D & RB Head and Asst Head plus 2 or 3 D & RB staff			

Training of staff is a never ending process and is carried out along with the execution of work. Nevertheless during 1987 members of the D&RB have for varying periods followed the following courses:-

- Cyprus productivity Centre lessons on basic topographic instruments and their use.
- WDD interdepartmental classes in computer programming in dBASEIII PLUS.
- WDD interdepartmental classes in DOS and FORTRAN 77 computer language (1986).
- Extra departmental classes in AUTOCAD (Computer aided drawing) at the IBM Center.

The largest load of work during 1987 was again by far for the Southern Conveyor Project being 37% of the total time of the 22 No staff as can be seen on table V-1. Vasilikos Pendaskinos Project (mainly completion plans) was second with 8% of the time and routine domestic water supply schemes third with just over 6%.

The main demands of the Southern Conveyor Project was for assistance at the Project sites of Akhna Dam, Kouris Dam (although this was afforded by the WDD Limassol Regional Office) at Ayios Athanasios and Kalokhorio (L'ca) for the main conveyor and at Ormidhia for the Kokkinokhoria Irrigation Area (KIA). At the Nicosia WDD H.Qs the Drawing and Records Branch carried out work for the SCP design teams dealing mainly with revised drawings issued to the Contractors for KIA i.e. for the balancing reservoirs, the central distribution point (CDP) reservoirs and the CDP pumping stations as well as for the irrigation distribution network being constructed by the WDD by direct labour. The Drawing Office HQs staff have also had to deal with information furnished to the SCP 2nd phase Consultants, Energoprojekt of Yugoslavia. This was mainly on contour maps for various sites such as the Dhiarizos diversion, the sites of the Limassol and Tersephanou water treatment plants and longitudinal sections and plans for the Tersephanou-Nicosia pipeline and the pipeline networks for Akrotiri, Kiti and Mazotos irrigation areas.

Extraordinary demands on the D&RB was:-

-- For the inauguration of Khrysokhou Irrigation Project (KIP) at Evretou Dam on the 19th of September 1987. The D&RB took part in the organisation of the inauguration generally and also produced large information and photograph posters and the production of an information booklet on the occasion of the inauguration.

-- For the inauguration of Kouris Dam which was originally to take place on the first weekend of December 1987 to mark the beginning of the Kouris Dam first impoundment and which was later set for the 10.1.88 and then postponed indefinitely. As in the case of KIP the D&RB undertook a share of the organisation and the production of posters, leaflets etc. which are left in abeyance for use when the inauguration finally takes place.

-- In December 1987 a colour 1:250,000 map of Cyprus prepared by the D&RB (having the Administration and Road map of the Department

of Lands and Surveys as background) was issued showing the recent major water development works of Cyprus.

Plan Reproduction and Plan Registry Section

A total number of 23,330 prints were prepared of all types and sizes through some 2865 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 1987 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 planned automatic compact cameras (5 No) were purchased during 1987 and distributed to various construction sites for on the spot photographic coverage. At the end of 1987 two of those cameras were held at SCP Kokkinokhoria Irrigation Area for the contracts in progress there, two were used at SCP main conveyor construction sites (one of which was purchased in 1986) and one at Khrysokhou Project.

The photographic section was non-the-less required to cover special features such as the closing of the outlet tunnel gates at Kouris Dam with 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 £1020 was spent on the purchase of 34 books and subscription to 15 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.

MATERIAL PURCHASED IN 1987

Books

JOHN SCOTT. Dictionary of Civil Engineering. Third edition. London, 1980. Book Nos B53, B54. St.£ 4.90 each.

DENNIS R MUDD. Estimating and tendering for construction work. U.K. 1984. Book No. B55. St.£ 20.40.

J K BALLANTYNE. The Resident engineer. Second edition. London, 1986. Book No. B68. St.£ 5.50.

WILLIAM R WALDROP. Hydraulics and hydrology in the small computer Age. Volume 1 and Volume 2. New York, 1985. Book Nos B69, B70. Stg.£ 112.50.

E N BROMHEAD. The Stability of slopes. London, 1986. Book No. B71. Stg.£ 46.00.

M J JACKSON. Computers in Construction Planning and Control. London, 1986. Book No. B72 Stg.£ 36.00.

AMERICAN WATER WORKS ASSOCIATION. Standards & Seminar Proceedings.

- AWWA Standard B300-80, for hypochlorites. Denver, 1980. Book No. B73. US\$9.00.
- AWWA Standard B301-81, for liquid chlorine. Denver, 1981. Book No. B74. US\$9.00.
- AWWA Standard B202-83, for quicklime and hydrated lime. Denver, 1983. Book No. B75. US\$12.50.
- AWWA Standard B403-82, for aluminum sulfate-liquid, ground or lump. Denver, 1982. Book No. B76. US\$12.50.
- AWWA Standard B600-78, for powdered activated carbon. Denver, 1978. Book No. B77. US\$12.00.
- AWWA Standard B602-86, for copper sulfate. Denver, 1986. Book No. B78. US\$9.00.
- AWWA Standard B603-83, for potassium permanganate. Denver, 1983. Book No. B79. US\$9.00.
- AWWA Standard B701-84, for sodium fluoride. Denver, 1984. Book No. B80. US\$9.00.
- AWWA Seminar Proceedings. Water disinfection with ozone, chloramines, or chlorine dioxide. Denver, 1980. Book No. B81. US\$18.00.
- AWWA Seminar Proceedings. Disinfection. Denver, 1977. Book No. B82. US\$19.50.
- AWWA Seminar Proceedings. Controlling organics in drinking water. Denver, 1979. Book No. B83. US\$16.80.
- AWWA Seminar Proceedings. Taste and odor. Denver, 1975. Book No. B84. US\$7.50.
- AWWA Seminar Proceedings. Polyelectrolytes - aids to better water quality. Denver, 1972. Book No. B85 US\$10.00.
- AWWA Seminar Proceedings. Use of organic polyelectrolytes in water treatment. Denver, 1983. Book No. B86. US\$18.50.

CONCRETE SOCIETY & INSTITUTION OF STRUCTURAL ENGINEERS. Formwork. A guide to good practice. London, 1986. Book No. B100 £STG 47.50.

D STEPHENSON. Stormwater hydrology and drainage-Developments in water science No. 14. Netherlands, 1981. Book No. B101. D.G.160.

H C RIGGS. Streamflow characteristics. Development in water science No. 22. Netherlands, 1985. Book No. B102. D.G. 145.00.

W KINZELBACH. Groundwater modelling. An introduction with sample programs in BASIC. Developments in water science No. 25. Netherlands, 1986. Book No. B103. D.G. 140.000.

CENTRAL BOARD OF IRRIGATION & POWER. Irrigation map of India. India, 1986. Book No. B104. US\$20.00.

D W QUINION & G R QUINION. ICE works construction guides. Control of groundwater. London, 1987. Book No. B105. £STG 5.50.

ΣΤΑΘΗ ΔΗΜΟΠΟΥΛΟΥ. Μονοτονικό ερμηνευτικό λεξικό της δημοτικής γλώσσας. Αθήνα, 1982. Αρ. βιβλίων B127, B128. ΔΚ£6.00.

ICID. - ALLIAN HAMPHERYS. Automated farm surface irrigation. New Delhi, 1986. Book No. B129. US\$5.00.

U S DEPARTMENT OF THE INTERIOR-BUREAU OF RECLAMATION:-

- Herbicide manual. Denver, 1984. Book No. B162 US\$9.00
- Paint manual. Denver, 1976. Book No. B163. US\$6.00
- Safety evaluation of existing dams. Denver, 1983. Book No. B164. US\$9.50.
- Training for dam operators. A manual for instructors. Denver, 1981. Book No. B165. US\$4.50.
- Water measurement. Revised reprint. Denver, 1984. Book No. B166. US\$13.00.

Subscription to Periodicals. (15 No.).

ASCE. Construction Engineering and Management US\$53.00.

ASCE. Geotechnical Engineering US\$108.50.

ASCE. Hydraulic Engineering US\$126.50.

ASCE. Irrigation and Drainage Engineering US\$51.00.

ASCE. Structural Engineering US\$158.00.

ASCE. Surveying Engineering US\$37.50.

ASCE. Water Resources Planning and management. US\$81.00.

AWWA. Municipal Wastewater Reuse News US\$60.00.

Employment Gazette Stg.£35.00.

Water and Waste Treatment Stg.£31.00.

Journal of the Irrigation Engineering and Rural Planning. US\$38.00.

Journal of the Institution of Water and Environmental Management. Stg.£39.00.

Concrete Magazine US\$75.00.

ICE Proceedings Stg.£106.00.

ICE Geotechnique Stg.£95.00.

WDD Reports (47 No.)

WDD - PANEL OF EXPERTS. Akhna dam. Report No. 4. Nicosia, February, 1987. Book Nos B49, B50.

WDD - Dam storage data, 1986. Nicosia, January, 1987. Book No. B5.

WDD - PANEL OF EXPERTS. Kouris dam. Report No.8. Nicosia, February, 1987. Book No. B51.

WDD - PANEL OF EXPERTS. Evretou dam. Report No.9. Nicosia, February, 1987. Book No. B52.

Π ΝΕΟΦΥΤΙΔΗΣ. Αρδεύσεις στον ποταμό Περιστερώνας. Αρδευτικά Περιστερώνας-Αστρομερίτη. Λευκωσία, Γενάρης, 1987. Αρ. Δ/160. Αρ. Βιβλίων B6, B7.

K SPANOS. Khrysokhou Irrigation Project. Progress report No.7. Covering the period 1.1.86 - 31.6.86. Nicosia, December, 1986. Report No. D/307. Book Nos B8, B9.

K SPANOS. Khrysokhou Irrigation Project. Progress report No.8. Covering the period 1.7.86 - 31.12.86. Nicosia, December, 1986. Report No. D/308. Book Nos B10, B11.

D M PATSALIDES with S N ALETRAS, C SAVVA & SIR WILLIAM HALCROW & PARTNERS. Southern Conveyor Project (Phase 1) Progress report No.5. Covering period from 1.10.86 to 31.12.86. Nicosia, January, 1987. Report No. D/405. Book Nos B12, B13.

C KRIDIOTIS. ESEL - Limassol site investigations. Nicosia, February, 1987. Report No. F/85. Book Nos B14, B15.

I IACOVIDES & A GEORGHIOU. Southern Conveyor Project. Kokkinokhoria Irrigation Area. Block 1. Report on the groundwater resources. Nicosia, February, 1987. Report No. H/61. Book Nos B16, B17.

I IACOVIDES. Southern Conveyor Project. Kokkinokhoria Irrigation Area. Report on the current groundwater conditions in the Kokkinokhoria area (Preliminary evaluation based on the 1986 survey). Nicosia, February, 1987. Report No. H/62. Book Nos B18, B19.

N TSIOURTIS. Report on review of irrigation water charges for 1986, 1987, 1988 from Government waterworks. Nicosia, February, 1987. Report No. L/36. Book No. B20.

M ZACHARIOU-MICHAELIDOU. Industrial effluents guidelines and recommendations. Nicosia, January, 1987. Report No. L/37. Book No. B27.

DEGREMONT LAING. Texas Instruments Video Programmer for Kornos Treatment Plant. Contract C5A. Hert's January, 1987. Book Nos B21, B22.

SIR WILLIAM HALCROW & PARTNERS. Southern Conveyor Project. 'Finalised-design' Surge Analysis. Swindon, January, 1987. Book Nos B23, B24.

WDD - C LYTRAS. Water Development Department. Annual Report 1983 Nicosia, November 1986. Book No B56.

WDD - C LYTRAS. Water Development Department. Annual Report 1984 Nicosia, November, 1986. Book No. B57.

WDD. Dam storage data, 1986. Nicosia, January, 1987. Book No. B5.

WDD - T E H SABBEN-CLARE. Vasilikos-Pendaskinos Project. Progress report No. 17. Covering the period 1st July-31st December, 1986. Report No. D/217. Nicosia, February, 1987. Book Nos B58, B59.

Π ΝΕΟΦΥΤΙΔΗΣ. Φρόγμα Αγρού. Επένδυση-Τροφοδοσία. Αρ. Δ/161 Λευκωσία, Απρίλιος 1987. Αρχειός Βιβλίων, B50, B51.

WDD - JAROSLAV CERNI INSTITUTE FOR THE DEVELOPMENT OF WATER RESOURCES. Southern Conveyor Project - Phase 2. Dhiazizos River Diversion report on laboratory tests for shear strength parameters. Beograd, Yugoslavia, March, 1987. Book No. B62.

I IACOVIDES - A CHRISTODOULIDES and S KATSIANIS. Southern Conveyor Project Kokkinokhoria area. Irrigation block 2 Report on the groundwater resources. Report No. H/63. Nicosia, May, 1987. Book Nos B87 and B88.

S PAPAGEORGIOU. Contracts for Cyprus Major water development works. Report No. L/40 Nicosia, May, 1987. Book Nos B98, B99.

Dr. G SOCRATOUS. Computer network news. Bulletin No. 1. Report No. L/39/1. Nicosia, June, 1987. Book Nos B106, B107.

M ZACHARIOU-MICHAELIDOU. Southern Conveyor Project. Kokkinokhoria irrigation scheme. Paralimni pond. Report No. D/162. Nicosia, April, 1987. Book Nos B110, B111.

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VI RURAL PROJECTS PLANNING DIVISION

by

C Andreou

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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, within the Pitsilia Integrated Rural Development Project, 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 the examination of applications for building permits and permits for the division of building plots.

By the end of 1987 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 Technical Superintendent
- Two Senior Technicians
- Two Technicians I
- One Secretary - Typist

VILLAGE WATER SUPPLY SCHEMES

The general village water supply situation during 1987 is described in Tables VI - 1 and VI - 2. There are no villages in Cyprus without piped water.

During 1987 only 55 out of a total number of 619 villages remained with public fountains ie 1.88% of the total village population.

Out of 563 villages with house to house supply systems 543 enjoyed a per capita daily rate of over 130 litres (29 gallons).

Water Supply Schemes Prepared During 1987

A total number of 96 schemes were prepared and submitted to the District Officers during 1987 at a total estimated cost of £2,466,246 as shown on Table VI-3.

Another 61 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 25 water supply schemes were prepared for the housing of displaced persons (Refugee self- housing and housing estates), at a total estimated cost of £165,900 as per table VI-3A, which were submitted to the Department of Town Planning and Housing.

In 1987, nine schemes to supply water to livestock areas were prepared at a total estimated cost of £249,000 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 1987

Nicosia District

Astromeritis : Scheme prepared for the improvement of the existing house to house system. Total estimated cost £86,000

Ayia Varvara : Scheme prepared for the improvement of the existing house to house system. Total estimated cost £69,000.

Mitsero : Scheme prepared for additional supply to the village from B/H 129/85. Total estimated cost £39,582.

Dhali (Ind.Zone): Scheme prepared for the supply of water from Dhypotamos - Nicosia pipeline. Total estimated cost £117,000.

Limassol District

Erimi-Kolossi : Scheme prepared for additional supply from B/H 69/86.

Avdhimou : Scheme prepared for additional supply from B/H 165/86

Ayios Athanasios: Scheme prepared for construction of new st.tank - conveyor pipeline.

Paphos District

Peyia : Additional water supply from B/H PB43. The scheme includes the installation of a booster pump and the laying of 150 mm dia. steel pumping main 5000 m long.

Yeroskipos: The scheme includes the construction of 500m³ capacity st. tank and the laying of distribution pipelines.

Larnaca District

Meneou-Pervolia-Kiti-Sophtadhes-Kivisili-Mazotos

Tourist Area Water Supply

The source of supply of the above scheme is the Famagusta Pipeline. The connection will be made near Alethrico village and will convey over 5000 m³ of water to the tourist areas of the above villages. The estimated cost of the above scheme is £648,000.

Famagusta District

Sotira-Liopetri tourist area water supply

The source of supply of the above scheme is the Famagusta pipeline. The connection will be made at Liopetri-Avgorou area and the whole scheme will convey over 5000m³ of water to the tourist areas of Sotira (Ayia Thekla) and Liopetri (Potamos). The estimated cost of the above scheme is £215,000. The scheme is expected to be executed in 1988 by the improvement boards of Sotira and Liopetri.

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 agro-economic 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 1987 a total number of 12 irrigation schemes was prepared and submitted to District Officers at a total estimated cost of £587,760 as per Table VI-5.

Another 27 schemes were in the course of preparation or under investigation by the end of 1987 as per Table VI-7.

Brief Description of Important Irrigation Schemes prepared during 1987

NICOSIA DISTRICT

Kato Pyrgos : Pumping scheme and distribution pipelines at a cost of £354,000.

Galata : Distribution pipeline at a cost of £35,000

Moutoullas: Distribution pipeline at a cost of £25,000

Limassol District

Moniatis : The scheme includes the construction of weir and storage tank and improvement of irrigation network.

Paphos District

Phasoula : The scheme includes the installation of two electrosubmersible pumps on two B/Hs, the construction of a balancing tank and the laying of distribution pipelines at a cost of £145,000.

Larnaca District

Aradippou stadiums and schools irrigation project

Borehole 139/85 will be the source of supply of the above irrigation scheme. B/H 139/85 with an output of over 60m³ of water per hour will be used for irrigating the stadium lawn and all the school gardens of Aradippou village. The estimated cost of the above scheme is £60,000.

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 co-ordinates the activities of the District Agriculture Services for the supply of agro-economic data in the preparatory stages of the projects. During 1987, schemes have been approved by the Committee as per Table VI-6.

Sewage Schemes

During the year under review 4 Sewage Schemes were prepared at an estimated cost of £516,500 as per Table VI-8.

Building and Division of Building Plots Permits

During 1987 a total of 1295 cases were investigated and sent to the District Officers for further action.

TABLE VI-1

VILLAGE WATER SUPPLIES SITUATION 1969-1987

Year	Schemes completed	Villages with House-to House distribution system			Villages with Public fountains			Villages without a piped supply			
		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

TABLE VI-2

WATER SUPPLY SITUATION AT THE END OF 1987

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 1969	Total popula- tion 1969								
	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	112	84.85	48559	93.93	12	9.1	2079	4.02	5	3.78	685	1.32	3	2.28	372	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	543	87.72	394017	95.34	33	5.53	4033	0.98	21	3.39	11441	2.77	22	3.56	3786	0.92	619	413277

TABLE VI - 3

VILLAGE WATER SUPPLY SCHEMES
PREPARED IN 1987 AND SUBMITTED TO
DISTRICT OFFICERS

NICOSIA DISTRICT

Ser. No	Village	Nature of Scheme	Est, Cost £
1	Astromeritis	Additional supply from B/H100/86	40 000
2	Gourri	Replacement of pipes	3 200
3	Shia	Water supply to plots for poor families	13 600
4	Astromeritis	Replacement of pipes	86 000
5	Xyliatos	Extensions	1 300
6	Galata	Extra cost for the installation of pipe lines	4 500
7	Kokkinotrimithia	Construction of new storage tank	28 000
8	Mitsero	Additional supply for B/H129/85	39 582
9	Yerakies	Additional supply from B/H 111/86	26 000
10	Kato Koutraphas	Replacement of pipes	2 900
11	Ayia Varvara	New house to house scheme	69 000
12	Kambos	Additional supply from B/H 29/68	11 000
13	Lythrodhondas	Replacement of pipes due to road widening	13 000
14	Aredhiou	Additional supply from B/H 59/86	24 500
15	Evrykhou	Replacement of pipes	7 000
16	Strovolos fire brigade station	Supply from B/H 169/96	3 000
17	Kalopana yiotis	Additional supply from B/H 161/86	23 500
18	Lymbia	Replacement of pipes due to road widening	7 500
19	Nikos	Replacement of pipes	660
20	Nikos	Additional supply from B/H 143/86	26 500
21	Paleometokho	Temporary supply from B/H 86/85	4 100
22	Lakatamia	Installation of valves	1 600
23	Kokkinotrimithia	Supply from B/H 114/82	28 000

TABLE VI - 3 (cont)

NICOSIA DISTRICT

Ser. No.	Village	Nature of Scheme	Est. Cost £
24	Yeri	Additional supply from B/H 37/82	20 000
25	Nisou-Perakhorio	Replacement of pipes	38 500
26	Dhali-Industrial Zone	Installation of pipes	1 200
27	Polystipos	Supply from B/H 106/85	22 500
28	Dhali-Industrial zone	Water supply from Dhypotamos-Nicosia pipeline	117 000
29	Alona	Extensions	2 900
30	Sha	Improvement of the existing water supply system	38 000
31	Agrokypia	Construction of storage tank capacity 90m ³	2 700
32	Laxia	Construction of storage tank capacity 500m ³ and new conveyor main from Dhypotamos-Nicosia pipeline	36 000
33	Apliki	New conveyor main from 'Kalogyros spring'	10 000
TOTAL			£ 753 242

LIMASSOL DISTRICT

1	Erimi-Kolossi	Additional supply from B/H 69/86	25 000
2	Pano Polemidhia	Replacement of distribution pipes	3 500
3	Ayios Kon/nos	Replacement of distribution pipes	6 400
4	Avdhimou	Additional supply from B/H 165/86	44 250
5	Ayios Athanasios	Construction of new storage tank	66 800
6	Asomatos-Trakhoni	Construction of new storage tank	15 000
7	Amathous Gover. beach	Water supply of camping site	12 000
8	Erimi-Kolossi	Temporary supply from B/H69/86	3 300
9	Kolossi	Additional supply	7 950
10	Ayios Theodoros	Construction of new storage tank	6 400
11	Vouni	Construction of new storage tank	8 100
12	Ayios Dhemetrios	Additional supply	4 300
TOTAL			£ 203 000

TABLE VI - 3 (cont)

VILLAGE WATER SUPPLY SCHEMES PREPARED IN 1987 AND SUBMITTED TO
DISTRICT OFFICERS

PAPHOS DISTRICT

Ser. No.	Village	Nature of Scheme	Est. Cost £
1	Paphos higher villages 'Appidhes'	Pumping scheme B/H 64/79	9 304
2	Paphos	Pumping scheme	25 800
3	Peyia	Pumping scheme B/H PB 43	94 000
4	Paphos higher villages 'Aya'	Pumping scheme B/H 78/77	2 800
5	Paphos lower villages	Pumping scheme B/H 10/75&26/87	100 000
6	Yeroskipos	House-to-House distribution system	192 000
7	Mandria	Pumping scheme B/H 15/87	30 000
8	Kannaviou	Pumping scheme B/H 8/86	30 000
9	Paphos lower village	Replacement of pumping main	38 960
TOTAL			£ 522 904

LARNACA DISTRICT

1	Melousha	Supplementary supply B/H63/86	8 500
2	Zyyi	New distribution system	12 500
3	Kophinou slaughter house	Pumping scheme from B/H 132	12 000
4	Anglisidhes	New distribution system	57 000
5	Livadhia	New distribution system	14 000
6	Ormidhia	Rural building sites water supply	5 500
7	Kophinou	Supplementary supply from B/H34/87	20 000
8	Vavatsinia	Supplementary supply from B/H20/87	20 000
9	Delikipos	New distribution system	10 000
10	Stavrovouni Army Camp	New distribution system	22 000
11	Xylophagou	Rural building sites Water supply	7 300
12	Xylotymbou	" " "	2 800
13	Psevdas	New storage tank	15 000
14	Meneou-Pervolia-Kiti-Sophtades-Kivisil - Mazotos Tourist Areas	Supply of water from Famagusta Pipeline to Tourist Areas	648 000
Total			£ 754 600

TABLE VI - 3 (cont)

VILLAGE WATER SUPPLY SCHEMES PREPARED IN 1987 AND SUBMITTED TO
DISTRICT OFFICERS

FAMAGUSTA DISTRICT

Ser. No	Village	Nature of Scheme	Est.Cost £
1	Sotria - Liopetri	Supply of water to Tourist Areas	215 000
2	Sotira	Supply of water to Industrial Zone	11 500
3	Paralimni	Supply of water to Rural Building Sites	6 000
Total			£ 232 500

Summary of Table VI - 3

District	No of Schemes	Est.Cost £
Nicosia	33	753 242
Limassol	12	203 000
Paphos	9	522 904
Larnaca	14	754 600
Famagusta	3	232 500
Total	71	£ 2 466 246

TABLE VI - 3A

WATER SUPPLY SCHEMES FOR REFUGEE HOUSING OR SELF HOUSING ESTATES PREPARED
AND SUBMITTED IN 1987

NICOSIA DISTRICT

Ser No	Village	Nature of Scheme	Est.Cost £
1	Ayios Mamas Govn.Housing (Lakatamia)	House to House Scheme	1 900
2	Ayios Elefterios Govn.Housing (Laxia)	House to House Scheme	5 000

TABLE VI - 3A(cont)

NICOSIA DISTRICT

Ser. No.	Village	Nature of Scheme	Est. Cost £
3	Archangelos Michael Govn. Housing (Lakatamia)	House to House Scheme	2 700
4	Nisou	House to House Scheme (self housing 'phase D')	1 150
5	Pano Lakatamia Govn. Housing	House to House	5 200
6	Yeri-self housing	Water supply 'phase K'	3 600
7	Laxia-self housing	Water supply to 'phase G'	3 500
8	Pano Lakatamia Govn. Housing	Additional supply from Nicosia pipeline	4 700
9	Xeri-self housing	House to House Scheme 'phase K'	1 600
10	Pano Lakatamia Govn. Housing	Installation of booster pump	1 000
11	Phlasou-self housing	House to House Scheme 'Phase A'	800
Total			£ 73 450

LIMASSOL DISTRICT

1	Kolossi	Water supply of self housing estate VI	42 000
2	Pano Polemidhia	Water supply of self housing estate (H)	4 900
3	Polemidhia	Water supply of 29 new buildings sites	7 400
Total			£ 54 300

PAPHOS DISTRICT

1	Paphos 'Kyneras II'	Distribution system	3 700
2	Prodhromas	" "	3 600
3	Mandria	" "	950
4	Kouklia	" "	4 200
5	Paphos 'Axiothea'	" "	2 900
Total			£ 15 350

TABLE VI - 3A (cont)

WATER SUPPLY SCHEMES FOR REFUGEE HOUSING OR SELF HOUSING ESTATES
PREPARED AND SUBMITTED IN 1987

LARNACA DISTRICT

Ser No	Village	Nature of Schemes	Est.Cost £
1	Dromolaxia	Extensions to self housing	1 800
2	Dromolaxia	" "	3 000
3	Kiti	" "	7 500
4	Kellia	" "	<u>2 000</u>
		Total	£ 14 300

FAMAGUSTA DISTRICT

1	Paralimni	Extensions to self housing	2 000
2	Akhna Forest	" " " "	6 500
		Total	<u>£ 8 500</u>

Summary of Table VI-3A

District	No of Schemes	Est.Cost £
Nicosia	11	73 450
Limassol	3	54 300
Paphos	5	15 350
Larnaca	4	14 300
Famagusta	2	8 500
	Total	<u>£ 165 900</u>

TABLE VI-3B
WATER SUPPLY TO LIVESTOCK AREAS

NICOSIA DISTRICT

Village	Nature of Scheme	Est. Cost £
Yeri (Livestock Area)	Water supply to new plots	1 300
Nisou-Perakhorio) Livestock Areas	Water supply from Nicosia- Dhypotamos pipeline	24 000
Yeri(Livestock Area)	Installation of water meter	400
	Total	£ 25 700

LIMASSOL DISTRICT

Kolossi	Water supply of livestock area from B/H 75/77	30 000
Episkopi	Water supply of livestock area	24 000
	Total	£ 54 000

LARNACA DISTRICT

Aradippou livestock	New livestock area for pigs	140 000
Kellia livestock	Water supply scheme from village sources	14 000
Klavdhia livestock	Water supply scheme from village sources	6 500
	Total	£ 160 500

FAMAGUSTA DISTRICT

Liopetri livestock	Water supply scheme from village source	£ 8 800
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Summary of Table VI-3B

District	No. of schemes	Est. cost £
Nicosia	3	25 700
Limassol	2	54 000
Paphos	-	-
Larnaca	3	160 500
Famagusta	1	8 800
Total	9	£ 249 000

TABLE VI-4

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1987

NICOSIA DISTRICT

Ser. No	Village	Nature of Scheme
1	Alambra	Improvements to the exist. House to House
2	Kaliana	Additional supply from B/H 131/86
3	Kaliana	New conveyor main from 'Koufi Vrysi spring'
4	Korakou	Water supply and new spring
5	Mitsero	Improvements to the existing house to house system
6	Nikitari	Additional supply from B/H
7	Pedhoulas	New house to house system
8	Kannavia	Additional supply from new B/H
9	Phlasou	New storage tank
10	Pherikoudhi	Additional supply from B/H 9/82
11	Platanistassa	" " "
12	Kapedhes	Additional supply from B/H 162/87
13	Dhali	Water supply to 'Ambeleri Loc'
14	Pera (N)	New house to house supply
15	Lymbia	Installation of new booster pump
16	Tembria	New storage tank
17	Arghates	Improvements to the exist. House to house system
18	Psomolophou	Connection of the old village storage tank with the existing water supply system.

TABLE VI-4 (cont)

Ser. No.	Village	Nature of Scheme
19	Lakatamia	Water supply to livestock area
20	Lymbia	Improvements to the existing house to house system
21	Nisou-Perakhorio	Additional supply from Dhypotamos-Nicosia pipeline

LIMASSOL DISTRICT

Ser. No.	Village	Nature of Scheme
1	Apsiou	Additional water supply from Kakomallis spring
2	Moniatis	Additional water supply from several springs
3	Armenokhori	Improvement of village water supply
4	Kouka	Additional water supply
5	Mouttayiaka	Water supply of building sites self housing estate
6	Kilani	Replacement of distribution pipes in the village
7	Apesia	Additional water supply
8	Moni	Improvement and extensions of village water supply
9	Kolossi	Water supply of 7 new livestock plots
10	Kato Polemidhia	Water supply of new Limassol Hospital
11	Ypsonas	Replacement of existing pipeline
12	Agridhia	Use of B/H 95/87 for additional water supply
13	Kato Polemidhia	Use of Anthoupolis B/H
14	Kato Polemidhia	Water supply of building sites (pl. 1 sheet plan 54/57)
15	Omodhos	protection of kramriotis spring
16	Trachoni	Use of B/H 97/70

TABLE VI-4 (cont)

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1987

PAPHOS DISTRICT

Ser. No.	Village	Nature of Scheme
1	Anarita	Improvements of New Storage Tank
2	Timi	Improvements
3	Argaka	Pumping scheme additional supply
4	Ayia Marina (Khrysokhou)	Replacement of main conveyor pipeline
5	Xeropi Regional Scheme (Simou-Dhrymou-Drinia)	Additional supply from B/H 93/78
6	Pomos-Pakhyammos	Additional supply from ''Teratsia'' springs
7	Theletra	Additional supply from B/H 128/85
8	Kouklia	Extensions
9	Yialia	Improvements
10	Peyia	Replacement of distribution system
11	Ayia Marinoudha	Extensions

LARNACA DISTRICT

1	Ayios Theodoros	New distribution system
2	Alaminos	'' '' ''
3	Kato Lefkara	'' '' ''
4	Psematismenos	'' '' ''
5	Kalavastos	Supplementary supply
6	Pyla	New distribution system
7	Pyrga	Supplementary supply
8	Kalon Khorion	'' ''
9	Kornos	'' ''
10	Vavatsinia	New distribution system

FAMAGUSTA DISTRICT

1	Liopetri	Industrial zone water supply
2	Ayia Napa	Extensions
3	Phrenaros-Sotira	Developments

TABLE VI-5
IRRIGATION SCHEMES PREPARED IN 1987 AND SUBMITTED TO DISTRICT OFFICERS

Ser No	Village	Division of Association	Locality	Nature of proposed work	Est.cost £	Village cont. %
NICOSIA DISTRICT						
1	Galata	Division	Esso Galata	Distribution pipelines	35 000	1/3
2	Lythrodondas	"	-	"	17 000	1/3
3	Moutoullas	"	-	"	25 000	1/3
4	Tsakkistra	"	Pallo Ardheftico	Pipelines & Improvement works	20 500	1/3
5	Kato Pyrgos	"	Katouris	Distribution system & pumping scheme	354 000	£88 550
6	Kato Pyrgos	"	Platys	Distribution system	7 000	1 750
Total					£ 458 500	
LIMASSOL DISTRICT						
1	Moniatis	Irr.Division	Zaraes, Trabahana, Lakouphidhes, Mouskarkou	Construction of storage tank & weir & improvement of Irr. Network	40 000	1/3
2	Arsos	"	-	Improvement works	24 000	1/3
3	Kyperounda	"	Stremmata-Koutsinas	"	7 100	1/3
Total					£ 71 100	

TABLE VI-5 (cont)

PAPHOS DISTRICT

Ser. No	Village	Division or Association	Locality	Nature of Proposed work	Est. cost £	Village contr. %
1	Phasoula	Division	Kalamos	Pumping scheme B/H 236/62&166/83	145 000	£ 20 660
2	Nikoklia	"	Potamos	Pumping scheme B/H 64/83	52 500	17 500
Total						£ 38 160

LARNACA DISTRICT

1	Aradhippou	Municipality		Irrigation of stadium lawn and school garden	£ 60 000	£ 20 000
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Summary of Table VI-5

Distance	No of schemes	Est. cost £
Nicosia	6	458 500
Limassol	3	71 100
Paphos	2	38 160
Larnaca	1	20 000
Famagusta	-	-
Total	12.	£ 587 760

TABLE VI - 6

MINOR IRRIGATION SCHEMES APPROVED BY THE INTERDEPARTMENTAL
COMMITTEE IN 1987

Ser No	Village	Locality
1	Galata	Esso Galata
2	Kyperounda	Stremata Koutsinas
3	Kato Platres	-
4	Potamitissa	Pano Potamos
5	Moniatis	-
6	Moutoullas	-
7	Tsakkistra	Paleo Artheftico

TABLE VI-7

IRRIGATION SCHEMES IN THE COURSE OF PREPARATION, UNDER INVESTIGATION
OR PENDING DURING 1987

NICOSIA DISTRICT

Orounda	Limni	Lining of canals
Phlasou	Selloshis	"
Evrykhrou	-	"
Kambos	-	Repairs
Tsakkistra	-	Pending scheme(BH)
Pera-Phassera	-	Repairs
Akaki	Piscopos	Lining of canals
Klirou	Laoura	Develo. of BH
Ayios Yeoryios	Kafkallou	Lining of canals
Nikitari	-	Extension of pipes
Palekhorri	Pera Avlaki-Halkomatas	Improvement works
Meniko	-	Lining of canals
Aredhiou	-	"
Akaki	Riatico	"
Kambos	Mara	B/H development
Milikouri	Kato Pateritsa	Extension of pipes

TABLE VI-7(cont)

LIMASSOL DISTRICT

Village	Locality	Nature of proposed work
Paliomylos	Xymarkos	Construction of storage tank
Agridhia	Pano Enetikos	Use of B/H 95/87 for Irr.Div.
Yermasoyia-Polemidhia	Pano pampakera	Removal of pipeline
Pissouri-Alektora	Plot 56 sheet plan 53/60	Supply of water

PAPHOS DISTRICT

Amargeti	Ziripillis	Extensions
Theletra		Diversion weir & distr.system
Yiolou-Miliou		Pumping scheme B/H 111/81 & 55/78
Kritou Terra		Pumping scheme B/H 115/85 & distribution system
Lemona		Pumping scheme B/H 134/84
Panayia	'Sarka'	New storage tank

LARNACA DISTRICT

Odhou new irrigation division.

An irrigation Scheme is under preparation by the use of B/H 83/85 at Odhou village. A new irrigation division will be established and new land of a about 100 hectares will be irrigated.

TABLE VI-8

SEWAGE SCHEMES PREPARED IN 1987

Ser. No.	Village	Nature of Work	Est. Cost £
1	Dhali	Sewerage scheme	370 000
2	Askas	Sewage scheme	103 000
3	Ayios Sozomenos	Disposal scheme	35 000
4	Mental Hospital	Sewage disposal scheme (pond)	8 500
Total			£516 500



Ayios Sozomenos biological sewage treatment plant. Facultative aerated lagoon.
WDD Photo No. D91EN-11 (10.6.87).

VII DIVISION OF CONSTRUCTION

by
A P Georgiades
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 into the three following branches:

- The Planning and Control Branch (including the Tender section).
- The Major Projects Branch.
- The Minor Projects Branch.

During 1987 the Division consisted of the following staff:

- 1 Senior Water Engineer - Head of the Division
- 7 Executive Engineer, Class I - Assistant Head of the Division
- 1 Senior Technical Superintendent
- 7 Technical Superintendents
- 9 Senior Technicians
- 6 Technicians Grade I & II
- 1 Chief Foreman
- 5 Assistant Chief Foremen
- 38 Monthly paid Foremen (Including Regional Offices)
- 47 Weekly paid Foremen (Including Regional Offices)

Included above are personnel working at major projects construction sites.

The Department engaged a daily average of 749 regular workmen of various trades, mostly skilled and also 117 casual labour, mostly unskilled for the execution of the various schemes approved for construction during 1987 throughout the Island.

The Planning Branch of the Division continued during 1987 to collect data regarding actual rates of Construction, standards of materials and equipment for the revision of the manual "Schedule of Rates and Prices" which was published in 1984, and was distributed to all Divisions and Technical Officers of the Department.

The commencement of the construction of the new minor projects, especially the contributory ones again started late in the year due to the delay in the allocation of the necessary funds. This delay causes quite a lot of problems and upsets the construction programme, especially in Summer and early Autumn, when the demand for executing contributory and emergency schemes is at its peak. The delay in the availability of funds is attributed to the late approval of the Development Budget by the House of Representatives, the long procedure required for the approval of the loans from the Loan Commissioners, the late action taken by District Officer, the de-dagging of funds, etc.

Over and above the usual problems caused by the delay in the starting of the construction programme, a lot of minor projects cannot be completed as scheduled and approved by Government by the end of the year, due to other emergency work not included in the budget and have to be re-voted for completion in the next year.

It is believed that more attention must be given on this problem by the Ministry of Interior and the Planning Bureau so that the administrative formalities and the allocation of funds are completed earlier in the year.

Provided this is achieved, the work distribution of the Division will be more effective and the construction programmes will materialise as planned.

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 1987 and were included in the Development Budget of our Department, or 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 1987, may be classified into three main groups as follows:

- All projects, new and carry over, approved in our 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 1987 the Department had to deal with 635 schemes of an estimated value of £31,205,569. The overall expenditure incurred on all these projects during 1987 reached the amount of £26,223,982 against £37,086,855 for 1986, £22,462,514 for 1985, £18,905,999 for 1984, £12,654,747 for 1983.

Table VII-1 gives a summary of the work executed by the Department during 1987. Detailed lists showing all the schemes undertaken for construction, and more information are given in separate tables and short description reports that follow, further on in this report.

PLANNING BRANCH

During 1987 the main activities of this branch may be classified as follows:

- The programming and cost control of all schemes approved for construction,
- The preparation of a construction programme for all schemes approved for construction,
- The preparation of monthly progress report showing all budgeted schemes, and the progress and expenditure incurred each month.
- The assessment of our Department's requirements 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 equipments, and their appraisal and utilization for the up-to-date information of the "Schedule of Rates and Prices" manual, which is being reprinted and distributed each year to all Technical Officers concerned.
- The distribution of resources, such as labour force, plant and materials to the various schemes under construction.
- The invitation of tenders direct for the supply of such materials that are not available at the Central Stores, i.e. building materials, and for the hiring of machinery from the private sector when such machinery is not available at the E.M.S., and
- The acquisition/requisition of immovable property which is affected by the construction of the schemes.

TABLE VII-1
SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1987

Ser.	Description	No of schemes	Amount alloc. for 1987 £	Expenditure incurred during 1987 £
1	Rural domestic water supply schemes	54	1 623 017	1 058 151
2	Minor irrigation schemes	37	673 696	351 207
3	Other major irrigation works	15	570 213	400 462
4	Town water supply schemes and Government water supply schemes	11	287 568	205 432
5	Pitsilia Integrated Rural Development Project (mainly compensation)	17	76 062	18 204
6	Refugee housing and self-housing schemes	21	179 684	115 381
7	Schemes undertaken for construction for other Government Departments	134	1 636 968	1 177 341
8	Schemes undertaken for construction for villages (non-budgeted) from deposits	76	220 425	197 612
9	Schemes undertaken for construction for private developers (non-budgeted) from deposits	262	263 291	205 107
10	Vasilikos Pendaskinos Project	2	815 000	539 544
11	Southern Conveyor Project ...	4	21 500 000	19 273 498
12	Paphos Irrigation Project ...	1	359 645	246 014
13	Khrysokhou Irrigation Project	1	3 000 000	2 436 029
	Total	635	£31 205 569	£26 223 982

CONTROL BRANCH

The main activity of this branch is to exercise control over the construction of all 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 work on all schemes under construction has also to be followed up very carefully and be kept always at the highest possible standards.

Another important objective of this branch is to ensure that the schemes undertaken for construction are completed within the estimated time and approved amount. As most of the budgeted schemes are contributory (village water supplies, minor irrigation schemes, etc.) serious problems arise if a project is put in hand and the funds available are not sufficient for its completion. In such cases the scheme should not be put in hand but should be revised and be approved by the Government and the beneficiaries prior to its commencement.

The technical staff of this branch work in close co-operation with the supervising technical staff for the construction of a scheme, and solve all problems that might arise before, or during the execution of the project.

All projects other than Nicosia District ones are constructed direct by the three Regional Offices of the Department, i.e. Larnaca - Famagusta, Limassol and Paphos, in close association with a senior technical officer of the Division who acts as the co-ordinator between the District offices and the headquarters in Nicosia. In addition to that, the head of the Division and other Senior Officers carry out periodic visits to the District offices and to the sites of the works under construction.

The Division is always kept informed on the progress of the schemes in the Districts through the technical Co-Ordinator, and the monthly progress reports which are prepared by the supervising staff of the Districts and forwarded to the headquarters. Those monthly progress reports are being utilized for the preparation by the planning branch of the Division of the general monthly progress report which covers all schemes in all Districts.

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 Department including the Workshops during 1987 for the construction of all the projects was 866. Out of this figure 749 employees were regular and 117 were casual. They cover a variety of trades i.e. builders carpenters, pipelayers, etc.

The total expenditure incurred during 1987 on wages alone on schemes constructed by direct labour by the Department reached the amount of £2,964,014. Out of this amount £2,639,802 represented the wages of the regular workers, and £324,212 represented the wages of the casual workers.

Table VII-2 shows the monthly average labour force engaged direct by the Department in 1987.

TABLE VII-2
LABOUR FORCE FOR 1987

Month	Skilled	Unskilled	Regular	Casual	Total
January	714	135	720	129	849
February	706	128	728	106	834
March	697	125	755	67	822
April	676	121	732	65	797
May	670	133	717	86	803
June	705	132	732	105	837
July	713	144	741	116	857

TABLE VII-2
LABOUR FORCE FOR 1987

Month	Skilled	Unskilled	Regular	Casual	Total
August	724	145	760	109	869
September	733	175	772	136	908
October	746	178	784	140	924
November	778	191	778	191	969
December	741	179	772	148	920
Daily average No.	717	149	749	117	866
Daily average %	83	17	86	14	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 1987, were purchased through the Government Central Stores Departments. 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 was 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, are 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 1987 a length of 572,087 running meters of various types and diameters were purchased at a value of £2,329,657 and laid all over the island for the execution of all the schemes approved in the 1987 Development Budget. The pipes laid during 1987 for the main conveyor of the Southern Conveyor Project are not included on the above figures because informations were not available when this report was prepared.

Table VII-3 shows in detail all types, lengths and value of pipes laid during 1987.

SUMMARY OF ALL TYPES OF PIPES LAID DURING 1987

Ser. No.	Type	Length m	Value £
I	Galvanized steel pipes	164 284	307 384
II	Steel pipes (coated) plain ended .	16 397	125 980
III	Asbestos cement pressure pipes - class 15	168 368	920 904
IV	Asbestos cement pressure pipes - class 20	60 135	374 477
V	Asbestos cement pressure pipes - class 25	4 178	185 271
VI	Polythene pipes	40 040	9 546
VII	Unplasticized PVC pipes	114 327	189 382
VIII	Ductile iron pipes	4 358	216 713
Total		£ 572 087	£ 2 329 657

TABLE VII-3
PIPES LAID DURING 1987
I GALVANIZED STEEL PIPES

Dia inches	Length m	Value £
1/2	5 568	2 707
3/4	2 158	1 401
1	4 597	3 921
1 1/4	4 588	4 990
1 1/2	8 872	10 280
2	17 973	30 861
2 1/2	25 917	51 643
3	36 144	100 005
4	58 467	101 576
Total	164 284	£ 307 384

II STEEL PIPES (COATED-PLAIN ENDED)

Dia mm	Length m	Value £
150	3 613	18 647
200	5 335	31 046
250	1 272	9 386
300	3 664	36 861
350	2 471	29 279
550	36	631
600	6	130
Total	16 397	£ 125 980

III ASBESTOS CEMENT PRESSURE PIPES - CLASS 15

Dia mm	Length m	Value £
75	20	16
100	64 588	211 726
150	28 501	114 252
200	23 743	102 190
225	1 786	7 644
250	10 116	50 168
300	13 169	83 124
350	7 056	56 270
400	9 417	128 542
450	5 995	91 840
500	2 270	35 969
600	1 707	39 163
Total	<u>168 368</u>	£ <u>920 904</u>

IV ASBESTOS CEMENT PRESSURE PIPES - CLASS 20

Dia mm	Length m	Value £
75	648	1 967
100	21 186	72 267
125	1 000	4 020
150	14 551	72 075
200	8 323	57 203
250	6 759	54 815
300	1 066	8 350
350	4 103	39 963
400	1 485	27 757
500	53	858
600	961	35 202
Total	<u>60 135</u>	£ <u>374 477</u>

V ASBESTOS CEMENT PRESSURE PIPES - CLASS 25

Dia mm	Length m	Value £
250	68	937
600	4 110	184 334
Total	<u>4 178</u>	£ <u>185 271</u>

VI POLYTHENE PIPES

Dia mm	Length m	Value £
12.50	314	1 430
16	3 134	188
20	4 838	466
25	12 758	2 447
32	16 728	3 973
40	6	4
50	2 262	1 038
Total	<u>40 040</u>	£ <u>9 546</u>

VII UNPLASTICIZED PVC PIPES - (6 atm, 10 atm and 16 atm)

Dia mm	Length m	Value £
63	12 679	6 919
75	13 162	13 222
90	15 258	13 470
100	3 201	3 009
110	27 569	47 391

VII UNPLASTICIZED PVC PIPES - (6 atm, 10 atm and 16 atm) (cont)

Dia mm	Length m	Value £
140	12 709	26 378
150	2 083	4 068
160	25 756	71 003
200	1 086	3 444
250	24	126
450	800	352
Total	<u>114 327</u>	£ <u>189 382</u>

VII DUCTILE IRON PIPES

Dia mm	Length m	Value £
200	33	359
600	2 837	128 091
700	1 471	85 509
1400	17	2 754
Total	<u>4 358</u>	£ <u>216 713</u>

CONSTRUCTION PLANT

For the execution of the schemes approved for construction in 1987, 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.

WATER METERS INSTALLED DURING 1987

Ser. No.	Dia inches	Number	Value £
1	1/2	608	2 912
2	3/4	488	1 988
3	1	14	102
4	1 1/4		
5	1 1/2	3	45
6	2	28	1 021
7	2 1/2	24	918
8	3	248	12 454
9	4	104	6 303
10	6	14	1 280
11	8	6	809
12	10	1	166
Total		<u>1 619</u>	<u>£ 27 998</u>

RURAL DOMESTIC WATER SUPPLY SCHEMES

The construction programme for 1987 included 54 rural domestic supply schemes of an estimated value of £1,623,017. The expenditure incurred on all these schemes during the year reached the amount of £ 1,058,151.

These 54 schemes were split all over the island and mostly were related to supplementary water supply schemes and improvements to existing schemes.

All these schemes are indicated in detail in Table VII-4 below.

SUMMARY OF RURAL DOMESTIC WATER SUPPLY SCHEMES
UNDERTAKEN FOR CONSTRUCTION DURING 1987

District	No. of schemes	Amount allocated for 1987 £	Expenditure incurred in 1987 £
Nicosia	14	401 828	272 047 ✓
Larnaca	9	375 024	261 108
Famagusta	3	189 000	104 731
Limassol	15	400 970	273 690
Paphos	13	256 195	146 575
Totals	<u>54</u>	£ <u>1 623 017</u>	£ <u>1 058 151</u>

TABLE VII-4
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1987

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt. £	Village £	Total £	Govt. £	Village £	Total £	
NICOSIA DISTRICT								
1	Agrokipia - Replacement and improv. to existing distribution system	5 000	5 000	10 000	--	--	--	Funds not made available
2	Astromeritis - Supplementary supply from BH 82/83, and 121/83 & construction of new reservoir	36 000	5 778	66 411*	26 339	5 373	52 678*	Work in progress
3	Ayii Trimitias Supply from BH 140/85	12 500	7 000	25 000*	8 391	4 699	16 782*	Work in progress
4	Klirou - Supplementary supply from BH 51/83	18 000	18 000	36 000	12 581	12 581	25 162	Completed pending the reinstatement of asphalt cuttings
5	Lythrodhondas - Supplementary supply from BH 181/83	23 000	23 000	46 000	21 518	21 518	43 036	Work in progress
6	Lymbia - Improvements to existing system	5 000	--	5 000	5 000	--	5 000	Work in progress
7	Palekhorl (Morphou) Improvements to existing system	2 300	2 300	4 600	--	--	--	Funds not made available
8	Palekhorl (Orinis) Improvements to existing system	2 267	1 133	3 400	--	--	--	Funds not made available
9	Paleometokho - Replacement and improvements to existing distribution system	15 000	15 000	30 000	8 005	8 005	16 011	Work in progress
10	Peristerona - Supplementary supply from BH 96/84	3 956	3 562	10 975*	3 430	3 562	10 449*	Completed
11	Perakhorio Nisou New reservoir and improvements to distribution system	37 500	21 375	75 000*	27 312	15 568	54 624*	Work in progress
12	Tseri Supplementary supply from BH 16/85	31 000	31 000	62 000	21 156	21 156	42 312	Completed. Pending reinstatement of asphalt cuttings
13	Tseri - Replacement of distribution system	11 221	3 748	22 442*	2 996	1 002	5 993*	Completed
14	Yeri - Supplementary supply from BH 103/85	5 000	--	5 000	--	--	--	Subject to allocation of funds.
Total for Nicosia District		<u>£209 744</u>	<u>£136 896</u>	<u>£401 828</u>	<u>£136 728</u>	<u>£93 465</u>	<u>£272 047</u>	

TABLE VII-4
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1987 (cont)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
LARNACA DISTRICT (Constructed by F'sta -L'ca Regional Office of the Department)								
1	Aradhippou - Improvements of distribution system	4 000	4 024	8 024	4 000	4 024	8 024	Completed
2	Athienou - Supplementary Supply Scheme	110 000	--	110 000	105 000	--	105 000	Completed
3	Anglisides - Replacement of distribution system	38 000	19 000	57 000	6 780	3 390	10 170	Work in progress
4	Dhromolaxia - Improvements to distribution system	3 350	3 350	67 000*	2 260	2 260	45 201*	Work in progress
5	Kiti - Improvements to Distribution system	15 000	15 000	30 000	13 242	13 242	26 484	Completed
6	Mazotos - New distribution system	40 000	20 000	60 000	23 391	11 696	35 087	Work in progress
7	Perivolia - Improvements to distribution system	5 000	5 000	10 000	1 251	1 251	2 502	Completed
8	Psematismenos - Construction of new water tank	6 000	6 000	12 000	3 910	3 910	7 820	Completed
9	Voroklini - Improvements to distribution system	10 500	10 500	21 000	10 366	10 366	20 732	Completed
Total for Larnaca District		£231 850	£82 674	£375 024	£170 288	£50 139	£261 108	
FAMAGUSTA DISTRICT (Constructed by F'sta-L'ca Regional Office of the Department)								
1	Avgorou - Improvements to distribution system	40 500	40 500	81 000	24 697	24 697	49 394	Work in progress
2	Dherynia - Improvements to existing distribution system	34 000	34 000	68 000	25 415	25 415	50 830	Completed
3	Liopetri - Supplementary supply from Famagusta main pipeline	20 000	20 000	40 000	2 253	2 254	4 507	Work in progress
Total for Famagusta District		£94 500	£94 500	£189 000	£52 365	£52 366	£104 731	
LIMASSOL DISTRICT (Constructed by the Limassol Regional Office of the Department)								
1	Akrouda Supplementary supply from BH 21/85	16 635	16 635	33 270	13 593	13 593	27 186	Completed
2	Amiandos - Supplementary supply from Mavrolaxia spring	2 350	2 350	4 700	2 157	2 157	4 314	Completed
3	Asgata - New reservoir	6 500	6 500	13 000	6 232	6 228	12 460	Completed
4	Ayios Ioannis Agrou Combined irrig. & water supply from BH	8 000	--	8 000	5 235	--	5 235	Work in progress
5	Episkopi - Replacement and improvements to distribution system	20 250	20 250	40 500	8 953	8 953	17 906	Work in progress

TABLE VII-4
RURAL DOMESTIC WATER SUPPLY SCHEMES—EXPENDITURE 1987 (Cont.)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
6	Ephitagonia - Supplementary supply from BH 50/85	20 000	20 000	40 000	16 657	16 658	33 315	Work in progress
7	Kolossi - Replacement of existing distribution	28 000	28 000	56 000	26 726	26 726	53 452	Completed
8	Kalo Khorio - Supplementary supply from BH 20/81	18 000	18 000	36 000	9 595	9 595	19 190	Work in progress
9	Kellaki - Supplementary supply from BH 5/83	5 718	2 859	8 577	3 818	1 909	5 727	Completed
10	Moni - Replacement of existing distribution system	20 750	20 750	41 500	10 963	10 963	21 926	Work in progress
11	Mouttayaika - Replacement of main conveyor	39 535	39 535	79 070	12 026	12 026	24 052	Work in progress
12	Pyrgos - Supplementary supply from BH 19/84	8 304	8 304	16 608	8 077	8 077	16 154	Completed
13	Yermasoyia - Improvement of existing distribution system	5 000	—	5 000	4 338	—	4 338	Completed
14	Yermasoyia "Green Area" Improvement of existing distribution system	10 430	10 430	20 860	10 066	10 066	20 132	Completed
15	Ypsonas - Polemidhia New pumping unit	19 193	10 556	38 385*	13 105	7 207	26 209*	Work in progress
Total for Limassol District		£208 415	£183 919	£400 970	£142 588	£125 224	£273 690	

PAPHOS DISTRICT (Constructed by the Paphos Regional Office of the Department)

1	Akoursos - Supplementary water supply from kelli spring and new distribution system	17 150	5 850	23 000	14 964	4 988	19 952	Work in progress
2	Goudhi - New distribution system and supplementary water supply from BH	1 000	1 000	3 200*	424	424	1 940*	Completed
3	Khlorakas - New distribution system	24 000	24 000	48 000	21 308	21 307	42 615	Completed
4	Kissonerga - Supplementary water supply	3 000	—	3 000	2 767	—	2 767	Completed
5	Kritou Terra - Supplementary water supply	2 000	—	2 000	1 779	—	1 779	Completed
6	Milia - Supplementary water supply from Appidhes scheme and distr. system ...	5 250	1 750	7 000	3 514	1 171	4 685	Work in progress
7	Mesoyi - New distribution system	25 000	25 000	50 000	3 204	3 204	6 408	Work in progress
8	Polemi - Stroumbi Supplementary supply from BH 139/84	14 668	7 332	22 000	10 716	5 357	16 074	Completed
9	Pomos - New distribution system	10 000	10 000	20 000	4 620	4 620	9 240	Work in progress

TABLE VII-4
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1987 (Cont)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
10	Tala - Supplementary Supply scheme from Paphos Lower Villages	4 000	1 495	5 495	2 586	966	3 552	Completed
11	Theletra - Supplementary water supply	2 000	—	2 000	1 945	—	1 945	Completed
12	Yioliou - New distribution system	20 000	10 000	30 000	11 809	5 903	17 712	Work started
Total for Paphos District		<u>£148 318</u>	<u>£106 677</u>	<u>£256 195</u>	<u>£88 589</u>	<u>£56 894</u>	<u>£146 575</u>	

Note: * Indicates that a contribution from TAETI is included

MINOR IRRIGATION SCHEMES

The construction programme for 1987 included 37 minor irrigation schemes of an estimated value of £673,696. The overall expenditure incurred on all these 37 schemes during the year reached the amount of £351,207.

These 37 schemes were split all over the island and were mostly related to:

- Pumping schemes from boreholes.
- Piped distribution systems.
- Improvements to existing irrigation schemes.
- Lining of channels with reinforced concrete.

A summary of these schemes by district is given below. Detailed list showing all 37 schemes which were undertaken by the Division for construction during 1987 are given below on table VII-5.

SUMMARY OF MINOR IRRIGATION SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1987

District	No. of schemes	Amount allocated for 1987 £	Expenditure incurred during 1987 £
Nicosia	14	283,120	45,015
Larnaca	2	124,681	105,325
Limassol	11	93,465	60,384
Paphos	10	172,430	140,483
Total	<u>37</u>	<u>£673,696</u>	<u>£351,207</u>

TABLE VII-5
MINOR IRRIGATION SCHEMES-EXPENDITURE 1987

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
NICOSIA DISTRICT								
1	Apliki- Extension to distribution system	1 200	600	1 800	—	—	—	Postponed
2	Akaki "Riatiko" Supplementary supply from BH 101 & 102	13 210	11 228	26 420*	12 125	10 307	24 251*	Completed
3	Aredhiou - Pumping scheme from BH 58/81 and distribution system	18 000	9 000	27 000	—	—	—	Funds not made available
4	Ayia Varvara - Lining of channels	15 000	13 637	42 516*	1 694	1 117	3 851*	Work in progress
5	Yialias River - Gabions - Recharge Works	3 000	—	3 000	2 839	—	2 839	Completed
6	Katydhata - Extension to distribution system	7 333	3 667	11 000	4 706	2 353	7 059	Work in progress
7	Kambia - BH 105/83 and distribution system	28 333	14 167	42 500	—	—	—	Fund not made available
8	Kato Moni - BH 14/84, reservoir and distribution system	46 667	23 333	70 000	4 648	2 324	6 972	Work in progress
9	Kochati - Lining of channels	5 000	2 500	7 500	—	—	—	Funds not made available
10	Palekhorí "Maroullena" Extension to distribution system	9 520	7 480	17 000	—	—	—	Funds not made available
11	Palekhorí "Milourí" Extension to distribution system	3 200	1 600	4 800	—	—	—	Not started
12	Pera-Politiko - Lining of channels	1 000	500	1 500	157	78	235	Completed
13	Pharmakas - New reservoir ..	5 000	3 928	8 928	107 CR	85 CR	192 CR	
14	Spilia - Extension to distribution system	12 771	6 385	19 156	—	—	—	Not put in hand
Total for Nicosia District		£169 234	£98 025	£283 120	£26 062	£16 094	£45 015	
LARNACA DISTRICT (Constructed by the F'sta-L'ca Regional Office of the Department)								
1	Aradhippou - "Parthenitis" Construction of Partenis Dam	79 681	—	79 681	79 455	—	79 455	Completed
2	Aradhippou R/H 139/85 To be used for irrigation within the village	30 000	15 000	45 000	17 247	8 623	25 870	Completed
Total for Larnaca District		£109 681	£15 000	£124 681	£96 702	£8 623	£105 325	

TABLE VII-5
MINOR IRRIGATION SCHEMES-EXPENDITURE 1987 (Cont.)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
LIMASSOL DISTRICT (Constructed by the Limassol Regional Office of the Department)								
1	Agridhia - Replacement of pipes	520	260	780	109	55	164	Completed
2	Agros "Pano Taliou" New reservoir and distribution system	1 533	767	2 300	1 468	734	2 202	Completed
3	Agros "Kokkinoyi I.D." Diversion weir and distribution system	1 867	933	2 800	1 722	861	2 583	Completed
4	Asgata - Pumping scheme from BH 95/85	40 000	20 000	60 000	22 600	11 300	33 900	Work in progress
5	Ayios Ioannis (Agrou) - Combined with W.S.	3 412	--	3 412	2 942	--	2 942	Work in progress
6	Dhymes "Chaji Pelentros" New reservoir	2 600	1 300	3 900	1 946	973	2 919	Work in progress
7	Kalokhorio - Installation of distribution network	5 432	2 716	8 148	4 627	2 313	6 940	Completed
8	Louvaras "Pano Pervolia Koutroutsas" New reservoir and distribution system	2 079	1 771	3 850	1 849	1 575	3 424	Completed
9	Pelendria "Potamoulia" Installation of distribution system	2 633	1 317	3 950	2 072	1 036	3 108	Work in progress
10	Pelendria "Kato Psilovrisi" Installation of distribution system	2 028	1 352	3 380	598	896	1 494	Work in progress
11	Piatres Pano - Rehabilitation work	630	316	945	472	236	708	Completed
	Total for Limassol District	£62 734	£30 731	£93 465	£40 405	£19 979	£60 384	
PAPHOS DISTRICT (Constructed by the Paphos Regional Office of the Department)								
1	Kholetria - Pumping scheme from BH 27/69	14 400	7 200	21 600	14 400	7 200	21 600	Work in progress
2	Kelokedhara "Psathes" Raising the river embankments	13 000	--	13 000	11 436	--	11 436	Completed
3	Lemona-Khoulou "Ammati" Utilization of the "ammati" spring and installation of distribution system	15 000	7 500	22 500	14 600	7 300	21 900	Work in progress
4	Nikoklia - Pumping scheme from BH 173/61	10 200	5 000	15 000	4 868	2 434	7 302	Completed
5	Pano Akourdhalia - Pumping scheme from BH 93/76	17 800	8 900	26 700	15 517	7 759	23 276	Completed
6	Polemi - Improvements of pumping scheme	1 400	740	2 140	944	712	1 656	Completed

TABLE VII-5
MINOR IRRIGATION SCHEMES-EXPENDITURE 1987 (Cont.)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
7	Souskiou - Pumping scheme from BH 96/62	5 470	7 172	32 490*	5 470	7 390	31 314*	Completed
8	Steni - Pumping scheme from BH 113/78	4 000	2 000	6 000	3 598	1 799	5 397	Completed
9	Statos - Ayios Photios storage tank	7 000	3 500	10 500	—	—	—	Work not started
10	Yiolou - Pumping scheme from BH 96/80	15 000	7 500	22 500	11 068	5 534	16 602	Work completed, pending electricity supply and pumping units.
Total for Paphos District ..		<u>£103 070</u>	<u>£49 512</u>	<u>£172 430</u>	<u>£81 901</u>	<u>£40 128</u>	<u>£140 483</u>	

Note: * Indicates that a contribution from TAETI is included.

OTHER MAJOR IRRIGATION WORKS
(SUPPLEMENTARY WORKS)

During 1987 the Division had to deal with supplementary works for 15 other major irrigation schemes of an estimated value of £570,213. The overall expenditure incurred on these 15 schemes during the year reached the amount of £400,462.

Out of this category of schemes the Evdhimou-Paramali project featured first in expenditure reaching the amount of £168,697 which represents 29.6% of the expenditure and involves the diversion of Kryos river to enrich Paramali river. These schemes were constructed accordingly by the WDD Regional Offices the Construction Division undertaking the Nicosia District Schemes.

A list showing details of all the 15 major irrigation works which were undertaken for construction during 1987 is shown on Table VII-6.

TABLE VII-6
OTHER MAJOR IRRIGATION WORKS - EXPENDITURE 1987.

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
1	Akrotiri - Inst. of new distr. system & new main conveyor	28 500	—	28 500	24 248	—	24 248	Completed
2	Arakapas - Pipe distribution system	14 990	7 495	22 485	8 907	4 453	13 360	Completed
3	Alaminos	70 000	—	70 000	54 304	—	54 304	Completed
4	Ayios Ioannis (Agrou) Combined pumping scheme for W.S. and irr. scheme	37 333	18 667	56 000	21 148	10 574	31 722	Work in progress
5	Evdhimou - Paramali Diversion of Kryos River to enrich Paramali river ..	222 000	—	222 000	168 697	—	168 697	Work in progress
6	Lefkara - Extension to distribution system	35 000	—	35 000	31 740	—	31 740	Completed
7	Pakhyamos - Improvements to irrigation work	4 630	—	4 630	2 461	—	2 461	Work in progress
8	Palekhori "Sklidros" Replacement of main conveyor	22 000	—	22 000	10 944	—	10 944	
9	Trakhoni - Ypsonas Installation of farm outlet and minor extensions	20 000	—	20 000	9 467	—	9 467	Work in progress
10	Yermasoyia - Polemidhia Connection of Garyllis B/HS	2 400	—	2 400	2 258	—	2 258	Completed
11	Yerakies - Kambos - Chakistra Stand-by pumping units	5 600	—	5 600	2 028	—	2 028	Completed
12	Yerakies - Kambos - Chakistra Stand-by pumping units	4 122	1 374	5 496	3 889	1 298	5 187	Completed
13	Yermasoyia - Polemidhia Garyllis BHS	10 000	—	10 000	8 712	—	8 712	
14	Yerakies - Kambos - Chakistra Stand-by pumping units	36 102	—	36 102	35 301	—	35 301	
15	Yermasoyia - Polemidhia - Akrounda - Replacement of pipes in Akrounda area	30 000	—	30 000	33	—	33	Not started due to the non availability of pipes
Total		<u>£542 677</u>	<u>£27 536</u>	<u>£570 213</u>	<u>£384 137</u>	<u>£16 325</u>	<u>£400 462</u>	

TOWN WATER SUPPLY AND GOVERNMENT
WATER SUPPLY SCHEMES

The construction programme for 1987 included three main categories of schemes regarding Town and Government Water Supplies:-

- New schemes for Town Water Supplies,
- New Government water supply schemes, and
- Improvement of water supply sources, refineries, pumping stations and conveyors.

For the three above categories of schemes an amount of £287,568 was allocated during 1987 for the execution of 11 different schemes. The overall expenditure incurred during 1987 on these schemes was £205,432.

Most of these schemes aimed to improve the existing water supplies of Towns or villages which depend on Government sources of supply.

A list showing all schemes executed during the year for Town Water Supplies and Government Water Supply Schemes is given on table VII-7.

For more details regarding the above, refer to chapter IX.

Table VII-7
TOWN WATER SUPPLY AND GOVERNMENT WATER SUPPLY SCHEMES

Ser. No.	Scheme	Amount allocated in 1987 £	Expenditure incurred during 1987 £
A IMPROVEMENT OF WATER SUPPLY SOURCES, PUMPING STATIONS AND CONVEYORS			
1	Kokkini Trimithia	15 000	7 295
	Total	<u>£15 000</u>	<u>£7 295</u>
B NEW SCHEMES FOR TOWN AND OTHER MUNICIPALITIES WATER SUPPLIES			
2	Paralimni	25 000	10 176
3	Pano Lefkara	16 500	11 857
4	Paphos	20 000	8 189
5	Emergency schemes from new B.H and recharge schemes (special warrant 5/87)	25 000	15 293
	Total	<u>£86 500</u>	<u>£45 515</u>

C NEW GOVERNMENT WATER
SUPPLY SCHEMES

6	Nata-Paphos	17 400	10 585
7	Armou-Tala	18 368	11 806
8	Amathous	29 100	19 385
9	Governor's Beach	57 000	56 761
10	Paralimni-Protaras	6 000	4 643
11	Inia-Drousia, Terra	58 200	49 442
	Total	<u>£186 068</u>	<u>£152 622</u>
	Grand Total	<u>£287 568</u>	<u>£205 432</u>

REFUGEE HOUSING AND SELF-HOUSING SCHEMES

During 1987 the Department had to deal with 21 schemes of various categories for the housing of the refugees.

Two schemes were related to sewage systems for Housing Estates, seven were related to water supplies to Housing Estates and twelve were related to water supplies to self-housing schemes.

For all these schemes an amount of £179,684 was allocated during 1987 and the expenditure incurred by the end of 1987 reached the amount of £115,381.

Table VII-8 shows in detail all 21 Refugee Housing and self-housing schemes which were approved for construction during 1987, as well as expenditure incurred on each one separately.

TABLE VII-8
REFUGEE HOUSING AND SELF-HOUSING SCHEMES UNDERTAKEN
FOR CONSTRUCTION IN 1987

Ser. No.	Scheme	Amount allocated in 1987 £	Expenditure incurred during 1987 £
	A HOUSING ESTATES SEWAGE DISPOSAL AND WATER SUPPLY SCHEMES		
	<u>i Sewage Systems</u>		
1	Anglisides	7 260	28
2	Tersephanou	50 000	36 047
	Total	<u>£57 260</u>	<u>£36 075</u>

TABLE VII-8
REFUGEE HOUSING AND SELF-HOUSING SCHEMES UNDERTAKEN
FOR CONSTRUCTION IN 1987 (Cont.)

Ser. No.	Scheme	Amount allocated in 1987 £	Expenditure incurred during 1987 £
<u>ii Water Supplies</u>			
1	Athalassa	1 405	391
2	Archangelos Michael	9 846	7 274
3	Apostolos Loukas	460	403
4	Ayia Varvara	148	157
5	Ayios Eleftherios Latsia .	5 000	3 078
6	Ayios Mamas	5 754	4 637
7	Pano Lakatamia	49 000	30 519
	Total	<u>£71 613</u>	<u>£46 459</u>

B WATER SUPPLY FOR SELF HOUSING SCHEMES

i Nicosia District

Yeri	4 340	3 618
Total	<u>£4 340</u>	<u>£3 618</u>

ii Famaqusta District (Constructed by F'sta-L'ca
Regional Office)

1	Akhna B	10 982	1 336
2	Akhna C	4 389	692
3	Phrenaros E	2 500	1 906
4	Vrysoulles A	17 624	17 646
5	Vrysoulles B	2 951	2 200
6	Vrysoulles D	916	173
	Total	<u>£39 362</u>	<u>£22 953</u>

iii Larnaca District (Constructed by F'sta-L'ca
Regional Office)

1	Dhekelia	723	49
2	Dhromolaxia H	1 516	1 200
3	Dhromolaxia	3 270	3 109
4	Kophinou	300	124
5	Mosphiloti	1 300	794
	Total	<u>£7 109</u>	<u>£5 276</u>

REFUGEES HOUSING AND SELF-HOUSING SCHEMES
SUMMARY OF ALL DISTRICTS

Ser. No.	Description	Number of schemes	Amount allocated in 1987 £	Expenditure incurred during 1987 £
A HOUSING ESTATES				
i	Sewage systems	2	57 260	36 075
ii	Water supplies	7	71 613	46 459
B WATER SUPPLY FOR SELF-HOUSING SCHEMES				
i	Nicosia District ...	1	4 340	3 618
ii	Famagusta District .	6	39 362	23 953
iii	Larnaca District ...	5	7 109	5 276
Total		26	£179 684	£115 381

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR
OTHER GOVERNMENT DEPARTMENTS

For many years, it has become normal practice for the Department to undertake the construction of any 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 livestock, ,
- Relocation of water pipelines which are affected by the construction of new roads,
- Sewage schemes,
- Improvements of water supply or irrigation schemes for Turkish villages where now Refugees have been housed.

During 1987 the Division had to deal with the Construction of 134 such different schemes all over the island of an estimated value of £1,636,968. The overall expenditure incurred on all schemes during the year reached the amount of £1,177,341. It is obvious from this figure that this category of works represents a fair amount of the Departments activities.

A list showing in detail all 134 schemes which were undertaken for construction during 1987 is given on table VII-9.

TABLE VII-9
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1987

Ser. No.	Description	Amount allocated in 1987 £	Expenditure incurred during 1987 £
NICOSIA DISTRICT			
1	Alambra irrigation	7 400	7 241
2	Akaki (Riatico) water supply	1 982	1 819
3	Argates Ind. Area water supply	400	350
4	Aredhiou irrigation	5 870	2 143
5	Aredhiou irrigation	10 000	9 329
6	Agrokipia water supply	11 000	8 699
7	Astromeritis water supply .	22 558	20 967
8	Astromeritis - Prodhromos irrigation	800	598
9	Astromeritis water supply .	8 267	4 380
10	Aredhiou		
11	Ayia Varvara - Kochatis irrigation	12 879	1 040
12	Ayii Trimithias irrigation	5 500	3 693
13	Ayios Sozomonos irrigation	40 000	31 383
14	Ayios Sozomonos sewage	3 500	3 192
15	Evrykhou water supply	200	200
16	Gourri - Phikardhou water supply	3 200	2 220
17	Archangelos Michael Monastery water supply	1 000	633
18	Kalo Khorio Klirou water supply	8 548	5 261
19	Kalo Khorio Klirou irrigation	1 400	761
20	Kalo Khorio Nisou water supply	16 125	11 744
21	Kambia - Kapedhes water supply	8 291	8 076
22	Kakopetria pine wood water supply	10 000	8 861
23	Kakopetria	50 000	13 085
24	Kalopanayiotis	1 000	459
25	Kato Pyrgos (Platys) irrigation	72 000	71 316
26	Kato Pyrgos (Tzinourgos) water supply	67 750	47 354
27	Kakopetria sewage		
28	Klirou water supply	2 000	1 463
29	Kotsiatis water supply	2 000	1 306
30	Livadhia Pitsilias water supply	200	270
31	Louroujina water supply ...	1 500	1 199

TABLE VII-9
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1987 (Cont.)

Ser. No.	Description	Amount allocated in 1987 £	Expenditure incurred during 1987 £
32	Lymbia - Kornos - Sha water supply	15 657	15 657
33	Lythrodhontas irrigation ..	1 640	1 640
34	Lythrodhontas water supply	16 300	12 837
35	Marki water supply	22 633	5 896
36	Makedonitissa (Tymbos) water supply	5 400	17
37	Mammari water supply	5 856	4 771
38	Malounda - Aredhiou		
39	Mathiatis water supply	18 200	11 629
40	Mitseron water supply	3 000	1 209
41	Moutoullas irrigation	51 333	20 656
42	Nea Eleousa water supply ..	2 800	1 982
43	Orounda (Ornitharis) water supply	10 000	2 315
44	Paleometocho - KokkiniTrimithia water supply	44 537	44 046
45	Paleometocho	360	247
46	Pedhoulas - Prodhromos irrigation	600	561
47	Pera Orinis water supply ..	100	100
48	Peristerona - Orounda - K.Moni water supply	31 500	31 416
49	Peristerona water supply ..	9 857	9 512
50	Peristerona irrigation	500	500
51	Pharmakas water supply	10 041	9 407
52	Pharmakas irrigation	39 636	35 906
53	Pharmakas R/d water supply	700	681
54	Piyenia water supply	300	272
55	Prodhromos irrigation	2 838	2 760
56	Pyrgos (Katouris) water supply	11 837	7 888
57	Sha irrigation	12 750	10 438
58	Stavrovouni water supply ..	900	899
59	Tseri livestock area	21 511	19 778
60	Tseri water supply	21 544	16 206
61	Yerakies water supply	1 882	1 890
62	Yeri livestock area	1 300	706
63	Yerakies	19 500	16 847
	Total	£761 382	£557 711
LARNACA AND FAMAGUSTA DISTRICT (Undertaken by F'sta-L'ca Regional Office)			
64	Aradhippou livestock area	50 000	25 898
65	Anaphotia water supply	4 500	4 672
66	Anglisidhes water supply ..	4 000	2 037

TABLE VII-9
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1987 (Cont.)

Ser. No.	Description	Amount allocated in 1987 £	Expenditure incurred during 1987 £
67	Ayia Napa - Ayia Mavri- water supply	3 660	936
68	Ayia Napa - J Anthia irrigation	5 500	4 980
69	Ayii Vavatsinias water supply	26 250	15 065
70	Ayii Vavatsinias irrigation	675	198
71	Avgorou - Liopetri water supply	8 500	8 545
72	Avgorou - Larnaca - Famagusta water supply	2 500	1 339
73	Dherynia - Ayia Napa R/d irrigation	1 020	550
74	Dhromolaxia irrigation	60 300	40 681
75	Kalokhorion water supply ..	5 768	5 233
76	Khirokitia (Anefantis) irrigation	4 018	1 571
77	Khirokitia water supply ...	500	500
78	Kiti-Meneou water supply ..	21 771	20 383
79	Kornos National Guard	8 000	6 923
80	Kornos - K. Khorion - Zyvi irrigation	1 320	575
81	Kophinou water supply	20 000	2 791
82	Lefkara water supply	4 000	4 000
83	Lefkara water supply	12 000	828
84	Liopetri - Avgorou R/d water supply	2 000	466
85	Livadhia water supply	500	197
86	Lymbia irrigation	30 000	14 821
87	Mari water supply	17 500	15 569
88	Makronesos irrigation	30 000	26 995
89	Melini Cemetery	450	199
90	Melini (Laoumia) water supply	7 000	7 107
91	Melini irrigation	8 271	752
92	Ora - Khirokitia water supply	3 000	1 332
93	Ormidhia water supply	14 500	9 492
94	Ormidhia water supply	3 500	1 745
95	Ormidhia irrigation	1 000	559
96	Paralimni Protaras water supply	8 500	7 123
97	Psematismenos irrigation ..	200	166
98	Psematismenos R/d water supply	200	31
99	Psematismenos water supply	250	160
100	Psevðhas - Mosphilote - Ayia Anna	27 200	22 014

TABLE VII-9
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1987 (Cont.)

Ser. No.	Description	Amount allocated in 1987 £	Expenditure incurred during 1987 £
101	Pyrga water supply	900	560
102	Vavla	10 500	9 087
103	Xylophagou veterinary station	1 890	1 155
	Total	<u>£411 643</u>	<u>£267 235</u>
LIMASSOL DISTRICT (Undertaken by Limassol Regional Office)			
104	Anogira water supply	2 500	2 495
105	Arsos irrigation	16 000	7 903
106	Askarel	40 000	7 448
107	Ayios Dhimitrios (Kryonero) water supply	11 071	8 049
108	Ayios Constantinos water supply	11 071	8 049
109	Episkope water supply	8 000	4 107
110	Kaminaria irrigation	17 334	11 776
111	Lania Dhoros irrigation ...	60 000	60 000
112	Lemithou irrigation	25 736	26 593
113	Lemithou (Platanoudhia- Sykoudhi)	17 334	10 836
114	Louvaras water supply	2 750	2 669
115	Monagri	14 000	11 530
116	Monagroulli irrigation	1 780	1 766
117	Pareklisha water supply ...	4 760	4 666
118	Paleomylos irrigation	1 923	1 796
119	Pelendria irrigation	900	895
120	Phini (Mylos) irrigation ..	1 967	1 958
121	Phylarga Arkolachania irrigation	75 000	72 079
122	Pissouri water supply	23 100	14 293
123	Prodhromos irrigation	586	410
124	Prodhromos (Hardjis Phraktis) irrigation	6 913	5 220
125	Silikou irrigation	5 800	5 280
126	Skarinou irrigation	20 250	8 699
127	Vasa (Kilaniou) irrigation	4 400	4 110
128	Vasa Kellakiou water supply	31 800	29 881
129	Yerasa water supply	11 350	6 754
130	Ypsonas - Polemidhia water supply	8 636	5 897
	Total	<u>£417 256</u>	<u>£318 231</u>

PAPHOS DISTRICT

131	Goudhi irrigation	1 200	1 093
132	Kholetria irrigation	21 866	10 867
133	Mamonia irrigation	3 773	3 750
134	Souskiou water supply	19 848	18 454
	Total	<u>£46 687</u>	<u>£34 164</u>
	Grand total	<u>£1 636 968</u>	<u>£1 177 341</u>

SCHEMES UNDERTAKEN FOR CONSTRUCTION WITH FUNDS FROM VILLAGE DEPOSITS

During 1987 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 76 schemes of various types.

Most of these 76 schemes undertaken by the Department during 1987 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 76 schemes an amount of £220,425 was deposited during 1987 and the overall expenditure incurred by the end of the year reached the amount of £197,612.

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR PRIVATE DEVELOPERS

During 1987 the Department responded to the request of private developers for the construction of 262 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 £263,291 and the overall expenditure incurred during 1987 reached the amount of £205,107. 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.

The supervision is not so effective as private Contractor, fail to call in the Department at appropriate time during construction, to check every step of progress, with the result that important work may be already covered up and difficult to inspect. The problem has been discussed with the Director and the procedure may be changed in future.

VIII IMPLEMENTATION OF MAJOR PROJECTS

VIII(i) VASILIKOS-PENDASKINOS PROJECT (VPP)

Although this project was completed in 1986 and has been in full operation since part of the Vasilikos irrigation distribution network at Kalavassos has not yet been constructed due to land consolidation procedure but it is planned to be constructed by 1989.

During 1987 the VPP was connected to the Southern conveyor Project main conveyor or pipeline through a connection pipe and balancing reservoir at Vasilikos near Kalavassos village initially to augment VPP irrigation requirements. See description of the Vasilikos-Pendaskinos Project in Chapter I of this report.



VPP - Balancing reservoir augmenting VPP irrigation requirements with SCP water. WDD Photo D30EN-9 (26.11.86).

VIII (ii) KHRYSOKHOU IRRIGATION PROJECT

by
K Spanos EEI
Project Manager

GENERAL

Evretou Dam, which is the main component of the Project and the main source of water for the irrigation of 2,000 ha of Phase I of the Project, was completed fully by the end of December 1986 and towards the end of May 1987 has reached a maximum storage of water of 10.1 MCM.

By the middle of 1987 some parts of the Main Conveyor and the Irrigation Networks of the Project were completed and handed over to the Department for operation. Eventually Sector IC of the Project was put under irrigation during summer 1987 with releases of water from the dam. Officially Phase I of the Project was inaugurated by the President of the Republic Mr Spyros Kyprianou on the 19th September 1987.

By the end of the year 1987 the construction works under the Contract for the Irrigation Networks and Farm Roads (KC2) were nearing completion while under the Contract for the Main Conveyor and Ponds (KC3) were completed by about 62%. The latter one includes extension of the Main Conveyor up to Argaka Dam and Magounda diversion structure which are parts of Phase II of the Project.

Project expenditure during 1987 was £2,436,029 bringing the total expenditure to £14,511,211 which represents about 85% of the estimated total cost of Phase I plus the parts of Phase II of the Project which refer to Argaka and Pomos areas.

STAFF

Management Team

One Executive Engineer I, Project Manager
One Clerical Assistant - Accounts
One Clerical Assistant - Typist/Secretary (part-time)

The posts of Deputy Project Manager (Eng.), Accounting Officer and Administrative Officer remained vacant.

Supervisory Staff

(i) Evretou Dam

One Resident Engineer from Consultants Sir William Halcrow and Partners
Two Executive Engineers I
One Technician I
Two Technicians II
One Dam Attendant (hourly)
One Clerical Assistant - Typist/Secretary (part-time)

(ii) Installation of Irrigation Networks and Farm Roads

One Executive Engineer I, Resident Engineer
One Executive Engineer I
Eight Technicians II

(iii) Installation of Main Conveyor and Construction of Ponds

Resident Engineer the same as in (ii) above
Five Technicians II

(iv) Other Components of the Project

For the remaining works like taking delivery of materials supplied through Contracts KSl, 2, 3, 4 and 5, design work for Phase II and Sector ID of the Project the following staff was occupied from time to time.

One Executive Engineer I
Two Technicians II
One Store-keeper (hourly)
One Foreman (hourly)

PROGRESS OF WORKS

1. EVRETOU DAM - Contract No 1

Contractor: Shephard Hill - Zachariades Joint Venture

General

The President of the Republic Mr Spyros Kyprianou inaugurated the Project at the dam on 19 September 1987.

The twelve month Maintenance Period of the dam construction contract (Contract No 1)

ended on 23 December 1987. Snag list for minor outstanding maintenance works was issued to the Contractor and as soon as these will be completed Maintenance Certificate will be issued.

Operation and Maintenance Manuals and "as built" drawings are in final draft and expected to be issued shortly.

Reservoir Operation

Further preliminary certificates for impounding were issued by the Engineer, approving raising of the impounding level to 153m amsl from 19 March 1987 and, subject to conditions with respect to intensity of monitoring and further investigations, to 160m amsl from 23 October 1987.

The reservoir rose to a level of 150.09m amsl (10.1Mm^3) in mid May 1987. The first length of the Conveyor for irrigation water was filled on 4 July 1987 allowing irrigation of limited areas from the reservoir. At year's end, following releases of water for irrigation, some releases from the Bottom Outlet and losses due to evaporation and seepages into reservoir banks and underseepages past the dam, the reservoir was at 144.47m amsl (8.4Mm^3).

Intake Cut

A major landslide which took place on 10 February 1987 in the reservoir bank above the intake provoked a reassessment of the stability of the intake portal cut. The slide, of about 15,000 to 25,000m³ of mostly colluvium material, was found not to have directly affected the intake. Concern that further slides might threaten the intake led to further site investigations and stability analysis of the portal cut. Taking all relevant geologic data and the results of the stability analysis into account the Panel of Experts concluded that the safety factor of the slope cut was satisfactory. However, at year's end it was agreed that investigation and monitoring should continue with a view to refining some of the assumptions used in the analysis.

Reservoir Bank Storage and Leakage

Crude water balance calculations showed up a deficit in reservoir storage in a range equivalent to 50 to 150 l/s going to leakage and bank storage. In May it became obvious that the water table in the alluvium downstream of the dam was rising significantly. New piezometers were installed in the alluvium and abutments, an existing well was test pumped and ground water temperature and resistivity surveys carried out to investigate. It was concluded that the underseepage flowing in the alluvium due to the reservoir was in the range of 12 to 27 l/s. This result indicated that the foundation cut-off was efficient and the large amounts of the initial loss was into bank storage. In order to establish the most likely path of the underseepage in the alluvium it was agreed to carry out some further investigations by the installation of extra borehole piezometers and by dye tests.

Performance

Except as noted above, the embankment and ancilliary structures are performing satisfactorily. All equipment is properly in service except the flow meter on the irrigation conveyor. Commissioning of this item could not start until the conveyor was filled in July; the flow meter is expected to be properly in service before issue of the Maintenance Certificate.



Khrysokhou Irrigation Project. Construction of farm roads. Contract KC2 (21.5.87).



Khrysokhou Irrigation Project. Installation of farm pipelines. Contract KC2 (3.9.87).

Contract Situation

Final measurement is virtually complete.

Work continued towards finalising issue of outstanding variation orders. The Contractor has referred four of these to the Engineer for his decision under Clause 67.

Assessment of several claims submitted by the Contractor remains also to be completed. Total claims submitted for about 10% of the Contract Sum are expected to be resolved a fraction of that amount.

Financial

Following the issue of three payment certificates by the Resident Engineer during 1987, the total gross payments to the Contractor have reached the sum of £9,095,367 at year's end. In fact actual cost of the Employer was around £8,988,000 due to fluctuations in the exchange rates of Stgf. With final assessment and settlement of all outstanding Variation Orders and claims it is expected that the final cost of the dam will be about £9.3 million.

2. INSTALLATION OF IRRIGATION NETWORKS AND CONSTRUCTION OF FARM ROADS

(i) Contract KC2 (Sector IA, IB, IC)

Contractor: G P Zachariades

The above Contract Covers the areas of Sectors IA, IB, IC (about 1,800 ha) along the Khrysokhou river valley downstream of Evretou and the coastal plain extending from Limni Mines to Latchi area.

Roadworks which were first started in April 1986 have continued throughout 1987 at a satisfactory rate. All earthworks for roads in Sectors IC and IB were completed by June 1987 and in Sector IA by August 1987. Placing of gravelly material to produce the surface layer of the roads has started towards the end of May 1987 and at year's end about 42 km out of the total of 65 km of roads were completed. Construction of road structures like culverts has moved in parallel with earthworks and by the end of the year 112 culverts were completed. Remaining eight culverts were to be constructed in January 1988.

Installation of Irrigation Networks has continued during 1987 in Sectors IC and IB and were substantially completed and were nearly for use by 7 July and 7 August respectively. All pipelines in Sector IA were also laid by the end of the year but about 30% of these pipelines remained to be tested during the first quarter of 1988.

In total 124,600 m length of pipes of diameters 200 mm to 600 mm Asbestos Cement and 90 mm to 150 mm UPVC were laid out of which 105,000 m were tested by the year's end. Also 215 No of hydrants and 1011 No of risers were installed representing 97% and 82% respectively of the total number of these structures.

Total payments to the Contractor up to the end of the year 1987 reached the sum of £1,201,371 which includes for work carried out up to the end of November 1987. According to the latest financial review of the Contract it is expected that final payments to the Contractor on completion of the works will be very close to the Contract Sum of £1,427,877.

(ii) Irrigation Networks and Farm Roads of Sector ID

Sector ID of the Project irrigated area extends above Evretou dam and along the river valley upstream the dam reservoir. Its total area of about 150 ha will come under land consolidation and includes areas from the villages of Peristerona, Philousa, Simou and Evretou. Water will be supplied to this area by pumping from the main conveyor of the Project just below the dam. Water will be raised to a reservoir at the elevation of about 265 m and then conveyed by gravity to all the areas of Sector ID through a pipe conveyor of about 3 km long.

Land Consolidation Department has started the implementation of land consolidation in this area in 1985 and in early 1987 has submitted to the Project the draft layout plans of the proposed farm road network in the areas and the new plot ownerships. On the basis of these layout plans the final designs Pumping Station which will be constructed below the dam have been prepared.

Construction of the Pumping Station and installation of the distribution system will be carried out by the Water Development Department through direct force account. The Department will be ready to start work as soon as Land Consolidation Department will finalise their plans and complete at least the first phase of the farm access roads which includes earthworks and culvert structures. According to the present progress of land consolidation procedure construction works are expected to start towards the end of 1988.

(iii) Supply of materials for Irrigation Networks through Contract KS1, KS2 and KS3

The remaining 42% to complete the supply of materials and equipment required for the above works have been delivered to the Project Stores within the first half of the year 1987. The actual cost of the materials delivered in Cyprus Pounds were as follows:-

Contract	Actual Cost of Materials £
A. KS1	
(i) Supply of AC pipes (Eternit, S A Libanaise)	270 141
(ii) Supply of fittings for AC pipes (Nappco, USA)	99 192
(iii) Supply of UPVC pipes and fittings (Kosmoplast, Cyprus)	100 182
B. KS2	
(i) Supply of gate valves (E Hawle, Austria)	19 700
(ii) Supply of butterfly valves (Vanadour, France)	7 686
(iii) Supply of ball valves and air valves (Glenfield, UK)	46 684
C. KS3	
(i) Supply of hydrants (APCO VALVE, Greece)	58 200
(ii) Supply of water meters (Schlumberger, France)	88 900
(iii) Supply of automatic water meters (Bernad, USA)	15 892
TOTAL	£706 577



Installation of DI pipes for main conveyor. Contract KC3 (2.9.87).



Construction of elevated break pressure tank. Contract KC3 (28.8.87).



Placing of PVC membrane of Khrysohou West Upper Pond. Contract KC3. (4.12.87).

3. INSTALLATION OF MAIN CONVEYOR AND CONSTRUCTION OF PONDS

(i) Contract KC3

Contractor: General Construction Co. Ltd.

General

The notice to proceed with the Works for above Contract was issued by the Engineer to the Contractor on 20 November 1986. The Works include installation of the Main Conveyor from Evretou Dam to the diversion point at Magounda river and which includes 19.5 km of ductile iron pipes of diameter between 900 to 300 mm and 4.5 km of AC pipes of 400 mm dia, and the construction of five storage ponds, one elevated break pressure tank and a diversion weir on Magounda river. The Contract Sum is £1,122,174 and the duration of the Contract was fixed at 18 months i.e. completion date 20 May 1988. Partial completion dates were also fixed for the various parts of the works as follows:-

Work	Contract Completion Date
1 First 3 km of Conveyor covering Sector IC	20/4/87
2 Further 4.6 km to complete Phase I of Conveyor with Elevated Tank	20/5/87
3 Khrysokhou East Lower Pond	20/6/87
4 Pelathousa Pond	20/7/87
5 Phase II pipeline (16.5 km) and diversion weir	20/2/88
6 Khrysokhou West Upper and Lower Pond	20/3/88
7 Argaka Pond	20/5/88

Pipe Laying

Trench excavation has started in January 1987 but the first pipes were laid towards the end of March 1987. The progress of this work was very slow during the first few months of the works. By the middle of 1987 the delays were of the order of two to three months whilst the Contractor was granted 23 days of extension of time due to heavy rains in March 1987, and some other unexpected interruptions in the works.

Finally the first 3 km of the Main Conveyor was substantially completed on 7/7/87 and its handing over to the Employer had enabled supply of water from the dam to the areas of Sector IC in order to irrigate mainly seasonal crops and some existing permanent plantations in this area.

During the second half of the year 1987 the Contractor had increased his production but he had not managed to recover fully the delays which occurred at the beginning of the works.

The progress achieved on pipeworks during the year 1987 is summarised below:-

Item	Contract Quantity	Completed by December 1987	Percentage of Completion
Trench Excavation	24 km	17.0 km	71%
Pipe Laying	24 km	17.0 km	71%
Pipe Testing	24 km	13.3 km	55%

Ponds

The Contract includes the construction of five storage earth ponds with PVC membrane as listed below:-

	Capacity m ³
(a) Khrysokhou East Lower	8200
(b) Pelathousa Pond	6900
(c) Khrysokhou West Lower	8000
(d) Khrysokhou West Upper	7100
(e) Argaka Pond	5000

Construction works on the Ponds have started with the Khrysokhou East Lower in February 1987 and continued with Pelathousa in April 1987. Both ponds were completed up to operational stage by the end of October 1987. Works on Khrysokhou West Upper and Lower have started in September and October 1987 respectively and most of the earthworks including placing of the membrane were completed by the end of the year 1987. A start was also made on Argaka pond in December 1987 and its earthworks are expected to be completed in February 1988.

Elevated Break Pressure Tank and Diversion Weir

Construction works on the elevated break pressure tank were started in March 1987 but due to a slow progress its completion was achieved early October 1987. For the diversion weir on Magounda river the works were started in August and were completed by the end of the year except for the installation of the gates which are expected to be imported early 1988.

Financial

Total payments to the Contractor up to the end of the year 1987 reached the sum of £694,435 which represents 62% of the Contract Sum.

(ii) Supply of materials for Main Conveyor through Contracts KS4 and KS5

The supply of Ductile Iron Pipes (KS4) and of various types of Valves and Water Meters (KS5) required for above Works has started during 1986 and was substantially completed by mid 1987. The actual total cost for each type of material in Cyprus Pounds delivered to the site was as follows:-

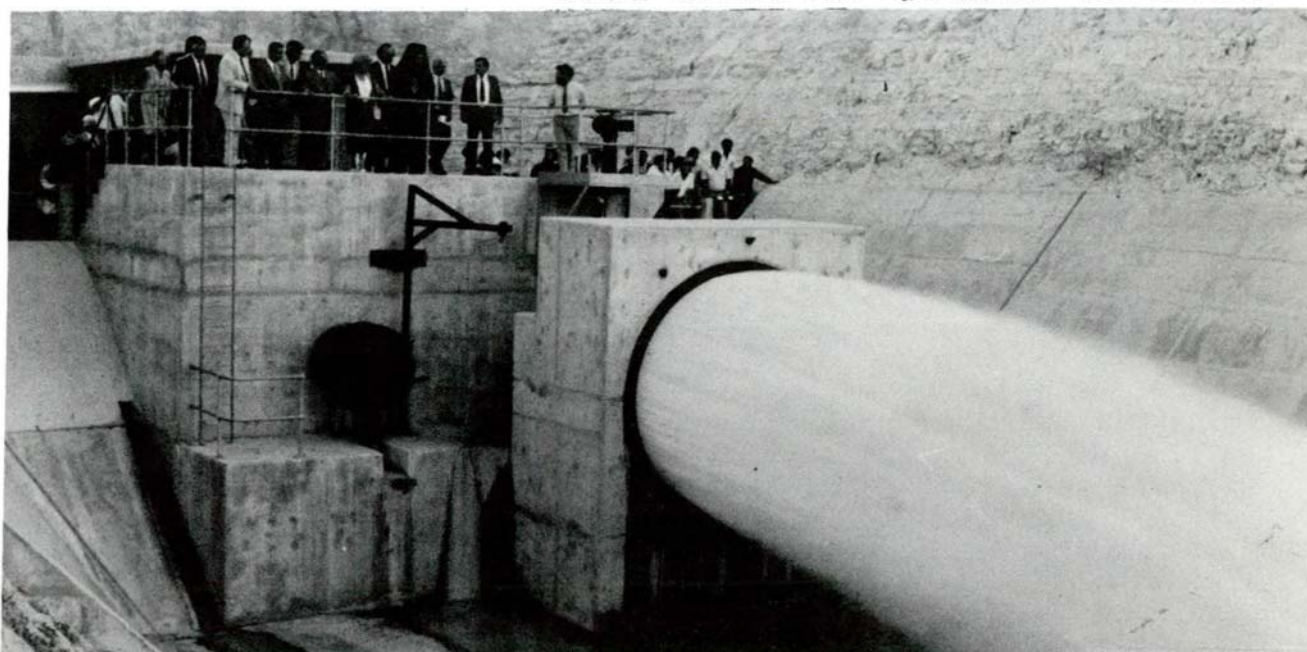
	Actual Cost £
KS4	
(i) Supply of Ductile Iron Pipes (Pond-A-Mousson)	1 665 804
KS5	
(i) Supply of Butterfly Valves (Erchard, Germany)	14 219
(ii) Supply of Gate Valves (Halwe, Austria)	17 449
(iii) Supply of Air Valves and Float Valves (ARI and Bernad, Israel)	26 976
(iv) Supply of Disc Valves (Neyrpic, France)	22 560
(v) Supply of Water Meters (Meinecke, Germany)	9 152
	<hr/>
	TOTAL £1 756 160

PROJECT COST ESTIMATES AND EXPENDITURES

Project expenditures by the end of the year 1987 reached the total of £14,511,211 of which £2,436,029 were spent in 1987. The total cost of Phase I of the Project together with the parts of Phase II related with Argaka and Pomos areas whose implementation has been already approved is now evaluated at about £17.2 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 herbelow:-

TABLE VIII-1
KIP EXPENDITURE DURING 1987

Item	Total Expenditure Up to 31/12/87	Expenditure during 1987	Estimated Total Cost
	£	£	£
1 Evretou Dam	8 988 154	125 483	9 350 000
2 Main Conveyor and Branches up to Argaka Diversion			
(i) Supplies	1 761 744	469 876	1 775 000
(ii) Installation	694 441	582 224	1 120 000
3 Irrigation Networks and Farm Roads Sectors IA, IB and IC			
(i) Supplies	695 606	294 945	725 000
(ii) Installation	1 210 194	689 341	1 450 000
4 Main Conveyor of Pomos and Irrigation Networks of Sector ID and Argaka and other works by WDD	88 063	21 531	940 000
5 Supervision and Management Costs	523 650	115 262	750 000
6 Consultants and Experts	270 862	40 460	303 000
7 Land Acquisition	209 529	27 949	300 000
8 Land Consolidation	68 958	68 958	220 000
	<hr/>	<hr/>	<hr/>
TOTAL	£14 511 211	£ 2 436 029	£17 183 000



Khrysoxhou Irrigation Project. Inauguration of the Project at Evretou Dam. (19.9.87).

VIII (iii) SOUTHERN CONVEYOR PROJECT

KOURIS DAM - CONTRACT C1

by
Dr C A Christodoulou
Principal Water Engineer
Project Manager

GENERAL

Kouris Dam with a capacity of 115 million cubic metres constitutes the main water storage component of the Southern Conveyor Project. It is located near Khalassa village about 20 km north-east of Limassol.

The main characteristics of the dam are the following:

Embankment

- Earthfill type with central clay core
- Height above foundation 110 m
- Crest length 550 m
- Volume of earthfill, 9.4 million cubic metres (allowing for both upstream and downstream toe weights).

Reservoir

- Area of lake (when full), 3.6 square kilometres
- Capacity, 115 million cubic metres

Spillway

- Discharge, 1925m³/s
- Volume of concrete, 61,000 m³

Draw-off Works

- Outlet tower, height 32 m
- Outlet tunnel, diameter 4.2 m, length 633 m
- Outlet tunnel roller gates (2 No.), 1.8 m x 2.3 m
- Outlet tunnel roller gates, discharge 140 m³/s
- Control tower, diameter 5.5 m, height 111 m, volume of concrete 16,000 m³
- Multi level draw-off galleries/points at elevations 164.5, 191.4, 211.4, 226.4 and 236.4 m AMSL
- Pipe penstock, diameter 1.2 m, discharge 3.4 m³/s

Grouting

- Total drilling 40,000 m
- Cement and bentonite grout 1,600,000 kg

Design

Consulting Engineers, SOGREAH of Grenoble, France, in association with HYDROCONSULT of Cyprus, undertook the design of Kouris Dam.

Construction

- Impregilo S.P.A. of Italy (65%) in Joint Venture with Ioannou and Paraskevaides of Cyprus (35%) have undertaken the construction of Kouris Dam.
- Contract sum £ 19,954,512
- Commencement of works 1st September 1984
- Initial impounding date 5th September 1987
- Contract period 1400 calendar days
- Initial contract completion date 1st July 1988

An extension of time of 60 days has already been awarded bringing the impounding date to the 5th of November 1987 and the contract completion date to 1st September 1988.

Following delays due to unforeseen geological conditions and the introduction of the upstream and downstream toe weights an acceleration agreement was reached in December 1986 between the Ministerial Committee for Tenders and the Contractor to achieve impounding on the 5th of November 1987 for the sum of £1,300,000.

With the engagement of additional earthmoving equipment all the conditions of the acceleration agreement were fulfilled by 31st December 1987 and a qualified impounding certificate was issued to the Contractor on 2nd November 1987.

Actual closing of the gates took place on 17th December 1987 with water overspilling the outlet tower (El. 180 m) on 22nd December 1987.

PROGRESS OF WORKS DURING 1987

Drilling and grouting works

Open air grouting works on (i) the left abutment, (ii) river bed (iii) right abutment and (iv) left abutment gallery have been completed. Drilling/grouting works from within the tunnel and the spillway-right abutment gallery area are also completed. Perimetral gallery grouting is continuing. It is expected that all drilling and grouting works will be completed in April 1988. The total drilling performed by the end of December 1987 was approximately 39,700 m (compared with 27,770 m in BOQ) and the total weight of dry material injected as grout was 1,490,000 kg (compared with 1,420,000 kg in the BOQ).

Perimetral gallery

Concreting of the perimetral gallery continues in advance of the clay placement. The total volume of concrete placed by the end of December 1987 was 7,230 m³ which represents 84% of the corresponding B0Q quantity.

Cofferdam

Completed in October 1985.

Embankment

Approximately 4.3 million cubic metres of fill was placed on the embankment in 1987. The total volume of fill placed by 31st December 1987 reached the quantity of 8.1 million cubic metres out of a total volume of about 9.4 million cubic metres (allowing both for the upstream and downstream toe weights).

The average level of fill above the river bed reached 84 m i.e. elevation 224 m AMSL.

Spillway

Total volume of excavation in the spillway area reached a figure of 534,500 m³ (477,000 m³ in the B0Q).

Concreting in the spillway area commenced in March 1986 and about 48,000 m³ of concrete had been placed by the end of December 1987, representing about 76% of the corresponding B0Q quantities. Completion of the spillway concreting is now scheduled for August 1988.

Draw off works

All concreting associated with the draw off works has been substantially completed.

By the end of December 1987, 16,050 m³ of concrete had been placed in the draw off works which represents 95% of the B0Q quantity.

Electromechanical works

The electromechanical subcontractor (METALNA of Yugoslavia) has been quite active on site during the period under consideration. All electromechanical works critical to the commencement of impounding were completed by December 1987. Dry tests for most of the equipment have already taken place and a certificate of "aptitude for precommissioning" was issued to the Contractor on the 23rd December 1987. A series of "wet" tests is programmed early in 1988 before the electromechanical works are handed over to the client.

An amount of £ 1,071,000 had been certified for payment to the Contractor by the end of 1987 which represents 88% of the corresponding B0Q amount.

Completion Schedule

During 1987 all the works on site progressed in accordance with the Contractor's approved "acceleration programme".

The impounding target mean elevation of 215 m. was achieved on the 23rd of October 1987 and a qualified impounding certificate was issued to the Contractor on the 2nd of November 1987.

It is worth noting that by the 31st of December 1987, 83% (1,214 calendar days) of the extended contract period (1,460 days) had elapsed whilst 80.5% of the "foreseen" value of the works had been completed. For more details please refer to the table attached.

The whole of the works are expected to be substantially completed in Autumn 1988.

TABLE "VIII-2 "
SOUTHERN CONVEYOR PROJECT
KOURIS DAM - CONTRACT C1
VALUATION PROGRESS FOR PERIOD ENDING 31ST DECEMBER 1987
Elapsed period to 31/12/87 is 1,214 days (i.e. 87% of the
Initial Contract Period (1400 Days)

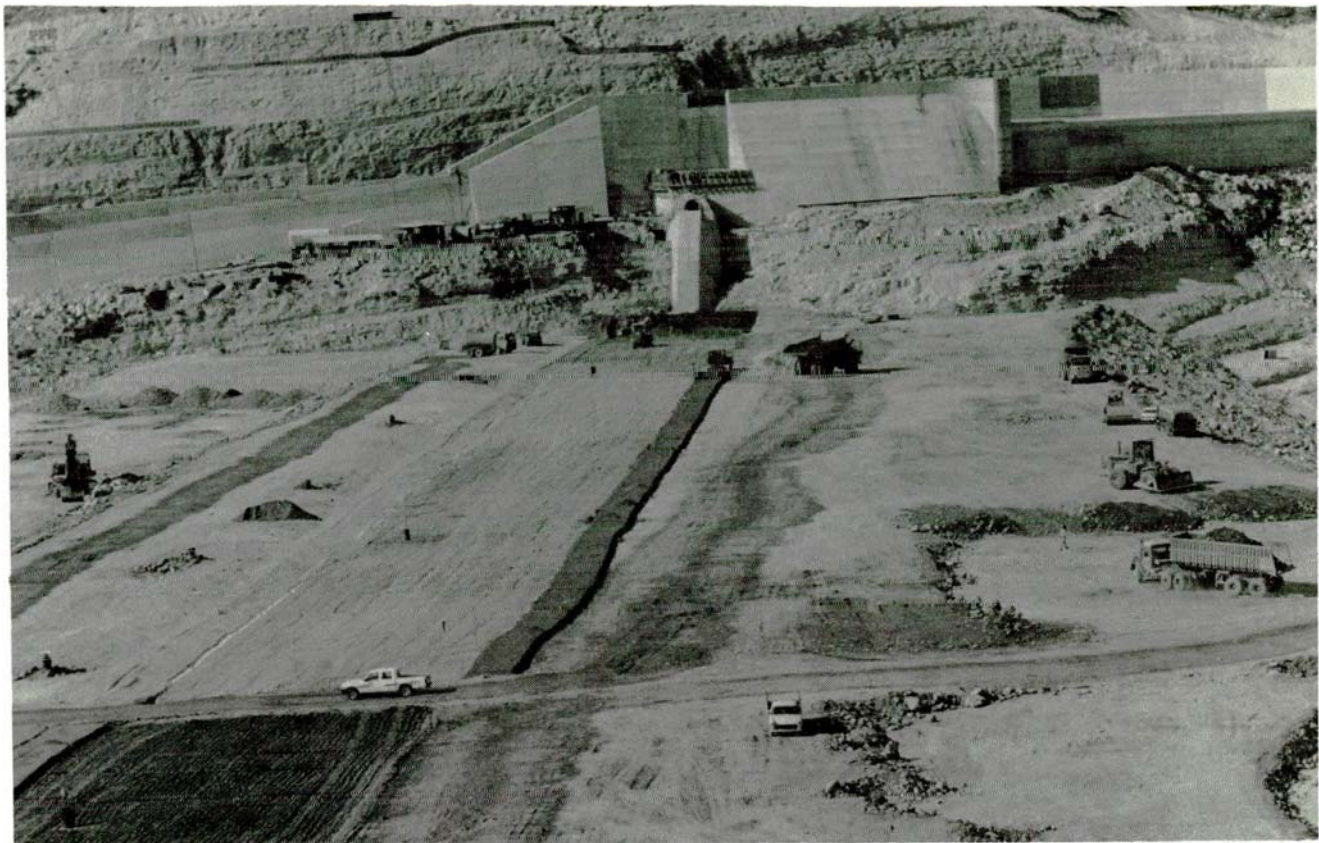
Bill No.	Description	Contract Amount £	Total Valuation to 31/12/87 Amount, £	Percentage of Contract Amount, £
<u>PART A - CIVIL WORKS</u>				
1	General Items	2 364 413	2 013 664	85.17%
2	Embankment, Cofferdam, Perimetral and Left Abutment Galleries	9 118 072	7 664 645	84.06%
3	Spillway, Right Abutment Gallery, Tail Escape	3 518 259	2 051 739	58.32%
4	Draw-off Works	2 017 419	1 755 688	87.03%
5	Grouting and Cofferdam Diaphragm Wall	1 165 648	1 220 882	104.74%
6	Instrumentation	143 828	119 440	83.04%
7	Building	81 088	-	-
8	Roads	128 563	31 912	24.82%
9	Additional Items for Works	-	-	-
	SUMMARY PART A SUB-TOTAL	£18 537 290	14 857 970	80.15%

PART B - ELECTRO-
MECHANICAL EQUIPMENT

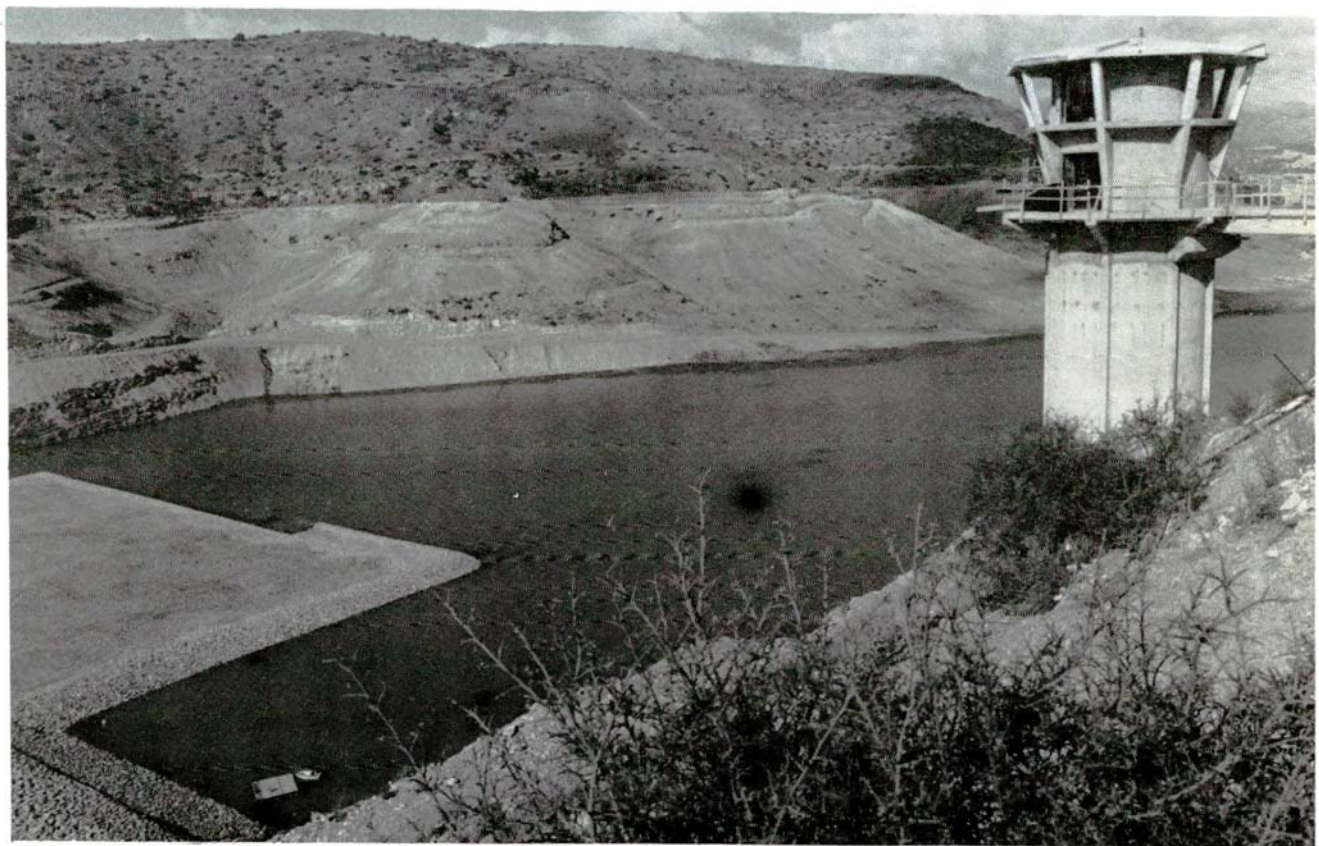
10	Penstock, Butterfly Valves and Penstock Accessories	593 671	535 134	90.14%
11	Fixed Roller Gates and Linings	309 345	284 398	91.94%
12	Handling and Lifting Equipment	118 836	103 786	87.34%
13	Ancillary and Electrical Equipment	195 089	147 848	75.78%
	SUMMARY PART B SUB-TOTAL	£1 216 941	1 071 166	88.02%

PART C - DAYWORKS

	SUMMARY PART C SUB-TOTAL	106 859	62 028	58.05%
	TOTAL PARTS A-B-C	£19 861 090	15 991 164	80.51%
	CONTRACT PRICE ADJUSTMENT	-	471 767	-
	ACCELERATION COSTS	£1 300 000	1 300 000	100.00%



Kouris Dam - General view of the construction works on the embankment.
WDD Photo No. E35EN-18 (27.12.87).



Kouris Dam - Looking u/s towards valve - house and valve-shaft.
WDD Photo No. E43EN-17 (27.12.87)

VIII (iv) SOUTHERN CONVEYOR PROJECT

MAIN CONVEYOR AND KOKKINOKHORIA IRRIGATION SYSTEM

By: K C Hassabis AD
Project Manager
and
D M Patsalides EEI
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 Network, 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 Kokkinokhoria 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 Akhna 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) 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

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 was commissioned by the Ministry of Agriculture and Natural Resources to Messrs Rofe Kennard & Lapworth, Consulting Engineers, in association with the Southern Water Authority from Great Britain. The study proceeded according to schedule and the above said consultants presented on December the third, report to the review committee convening in the office of the Director General, Ministry of Agriculture and Natural Resources.

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 operational and more data become available.

Water Abstraction and Well Inventory in Kokkinokhoria Area

The punching of the data obtained from the Inventory is being continued and already 87% (5674 boreholes) have been computerised. The remaining 13% (about 900 boreholes) are data from the villages of Dherinia, Paralimni, Ayia Napa and part of Phrenaros village.

Four new reports for the irrigation blocks 2, 7A, 8 and 12B have been prepared and the reports for the irrigation blocks 9, 10A and 12A 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 the dam on the 19th of February.

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.
- Stg£ 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 1987 disbursements were made by IBRD, EIB and the Consortium of French Banks only. The disbursement situation for each loan at the end of 1987 is given below in Table VIII/IV/1.

TABLE VIII - 1

LOAN DISBURSEMENTS

<u>Financier</u>	<u>Loan</u>	<u>Total Disbursements</u>	
IBRD	\$27 000 000	\$3 526 835.46	\$23 473 164.54
KFAED	KD2 940 000	-	KD2 940 000
EIB	ECU's 30 200 000	ECU's 4 738 412	ECU's 25 461 588
Consortium of French Banks	DM78 074 566	DM68 263 887	DM9 810 679
Standard Chartered Bank Ltd. (UK)	Stg£1 973 800	Stg£ -	Stg£1,973,800

PROGRESS ON PROJECT IMPLEMENTATION

Kouris Dam - Contract C1

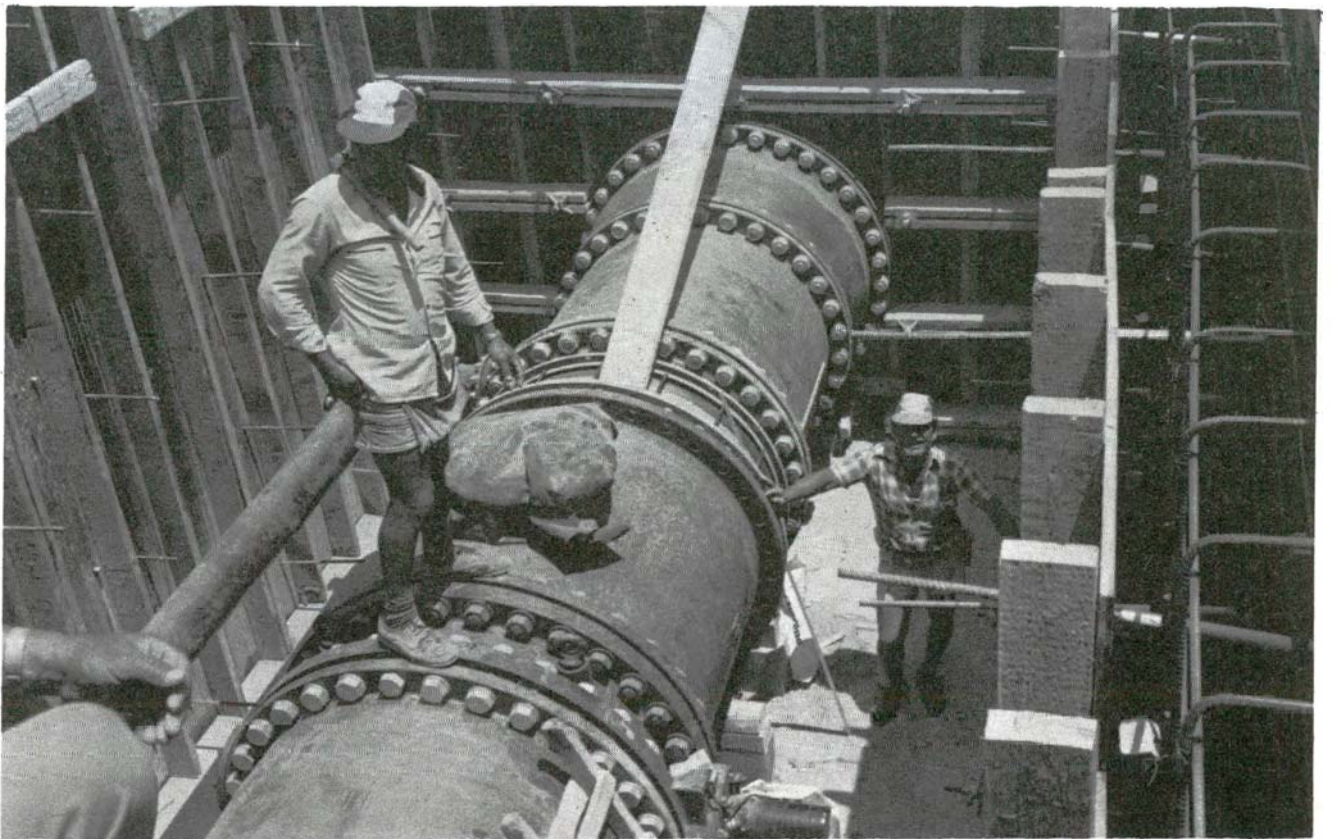
Details on progress for Kouris Dam are given in Chapter VIII/III of this report.

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



SCP - Main Conveyor. Culvert under the Larnaca-Kophinou Road.
WDD Photo No. E19EN-24A (16.10.87).



SCP - Main Conveyor. Special structure for over velocity valve before concreting
WDD Photo No. D90EN-18A (15.10.87).

Pipelaying

By the end of the year all 110,780 metres of pipeline had been laid from Kouris to Akhna Dam except for second stage test gaps which are expected to be completed early in 1988.

Testing

First stage hydraulic testing progressed well and all of the conveyor had been successfully pressure tested. A few problems were encountered during the second stage testing but all leaks had been found, rectified and retested.

Reinstatement

Reinstatement progressed well and by the end of the year 100,640 metres, which represents 90% of the whole conveyor were completed. The remaining sections should be completed early in 1988.

Trench Structures

The construction of on-line chambers progressed satisfactorily, despite continued disruption from the late arrival of valves and fittings. All butterfly valve chambers, branch structures and washout chambers were substantially completed by the end of the year.

Progress on Major Structures

Tunnel

The placing of concrete to the arch lining was complete by the end of July. Pipelaying in the tunnel commenced on 9th July and was completed during September.

Gravity grouting was completed at the end of September and this was followed by consolidation which was completed on 17th October. All concrete operations in the tunnel were complete on 4th November when concrete was placed to the last section of the inlet portal.

The installation of electrical lighting commenced in November and was still in progress at the end of December.

Work on the access road continued throughout the period and by the end of December excavation and filling and construction of culverts were substantially complete.

Break Pressure Tank No. 1

The watertightness test of the tank was complete by the end of October and backfilling to formation level followed. Construction of the underdrains was complete on 11th November and only the outlet structures remained at the end of December.

Work on the access road continued throughout the period and was completed, except surfacing, by the end of November.

Break Pressure Tank No. 2

The watertightness test of the tank was completed on 30th November and Backfilling around the tank followed. All concrete works are now substantially complete except the overflow outlet structure.

Work on the access road continued including the placing of subbase and the construction of cross drainage culverts.

Break Pressure Tank No. 3

The placing of concrete to the walls was completed early in August and this was followed by work on the external chambers. The watertightness test of the tank was completed on 12th December and backfilling to formation level followed.

Work recommenced on the access road on 30th November and by the end of December all the earthworks were substantially complete and a start had been made on the culverts.

Akhna Dam - Contract C4

Contractor	:	Iacovou Bros (Construction) Ltd.
Commencement date	:	18th June, 1986
Contractual Completion date	:	16th December, 1987
Actual substantial Completion date	:	3rd December, 1987
Contract Price	:	C£ 1,312,980
Total Certified (31.12.87)	:	C£ 918,794

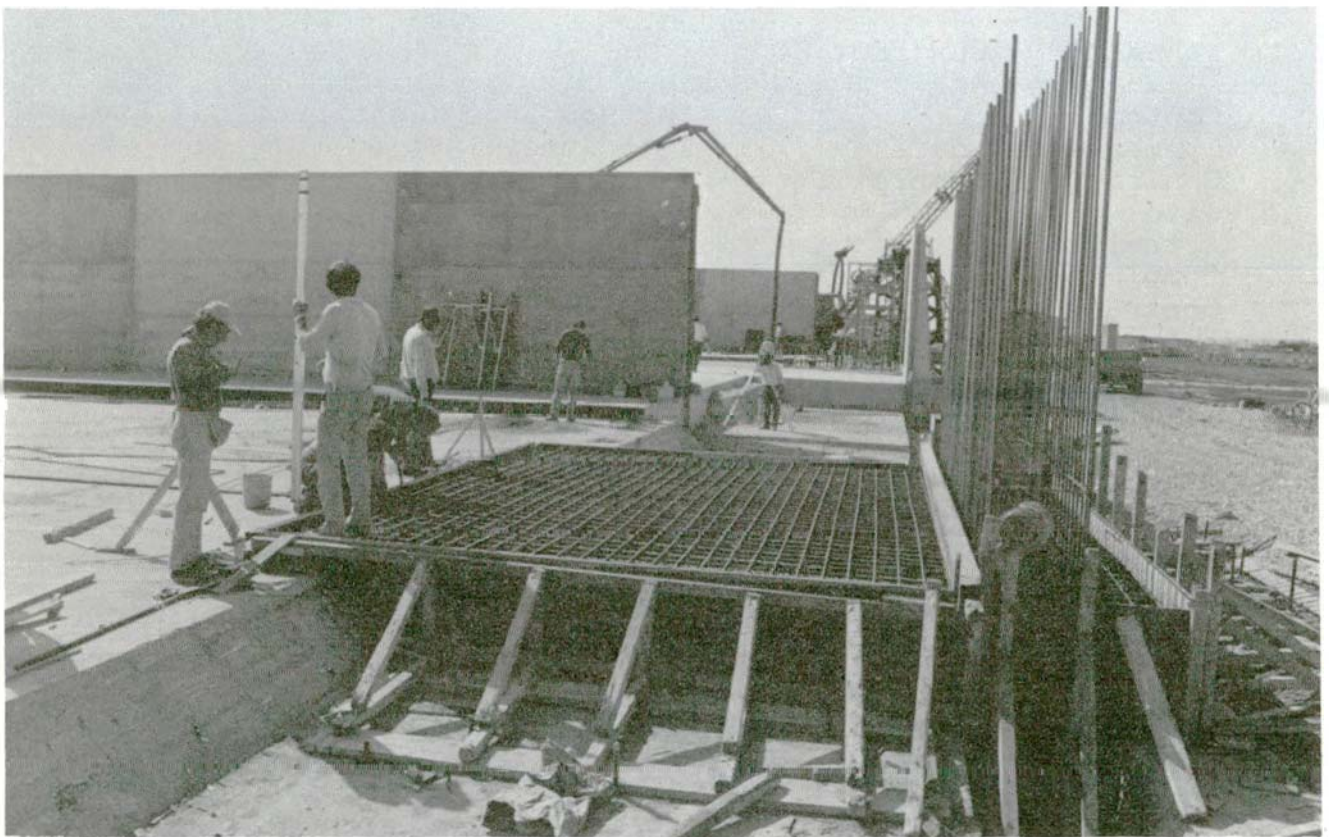
The Engineer's Certificate of Substantial Completion of the constructional works of the Dam was issued on 3rd December, 1987, following the Contractor's written assurance that he would complete the outstanding minor works during the maintenance period.

Construction of the downstream pressure relief wells and water table monitoring piezometers will be undertaken by the Water Development Department by Direct Labour.

By the end of the year the dam was ready to accept water but until the Akhna Pumping Station is completed, which is scheduled for the end of November, 1988, there will be no permanent means of abstracting or releasing water.



SCP Akhna Dam completed. WDD Photo E58EN-15 (9.2.88)



SCP Kokkinokhoria Irrigation Area. Contract C5A. Construction of Balancing Reservoir 1. WDD Photo No. E24EN-17A (27.10.87).

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 31.12.87 : C£459,726

The Contract got off to a rather slow start and is still running several weeks behind the Contractor's rather optimistic programme, by which he hoped to substantially complete all four reservoirs before the August 1988 holidays.

By the end of 1987 work on the largest of the reservoirs, BR1, was well advanced, the underdrain system for BR2 was complete and excavation was in progress for BR3.

The Contract requires completion of the first stage, consisting of half (one compartment) of BR1 and all of BR2 and BR3, by June 1988. The Contractor opted to construct BR1 first and to treat it as one unit, thereby effectively bringing the second compartment forward from Stage 2 to Stage 1. This approach combined with the rather slow initial progress has meant that he is now obliged to work simultaneously at three separate sites.

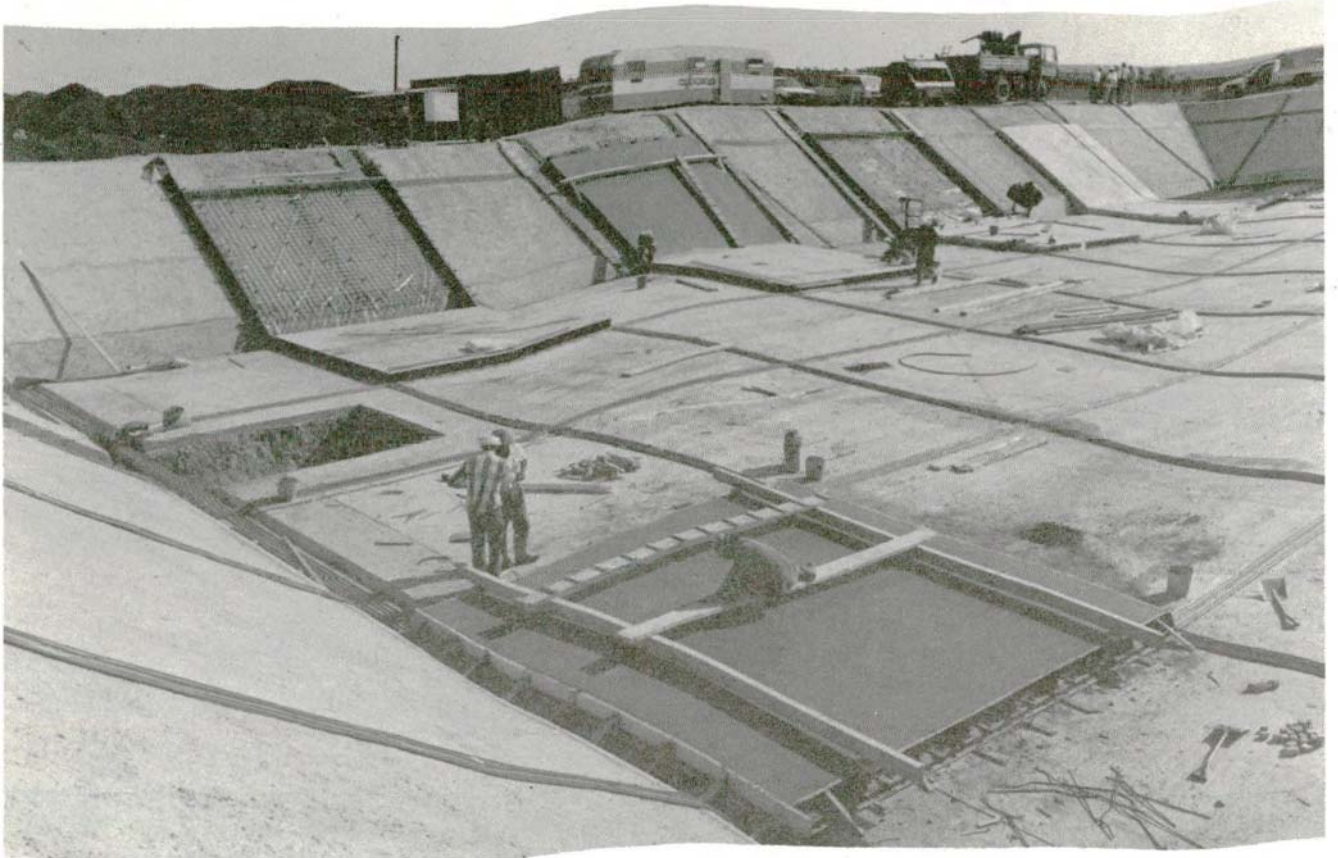
As a result he will be hard pressed to meet the Stage 1 completion date but should have no difficulty completing Stage 2 during the last quarter of 1988, several months ahead of the contract completion date.

Kokkinokhoria Irrigation System
Main Distribution Network - Central Distribution Points
Contract No. C5(C)

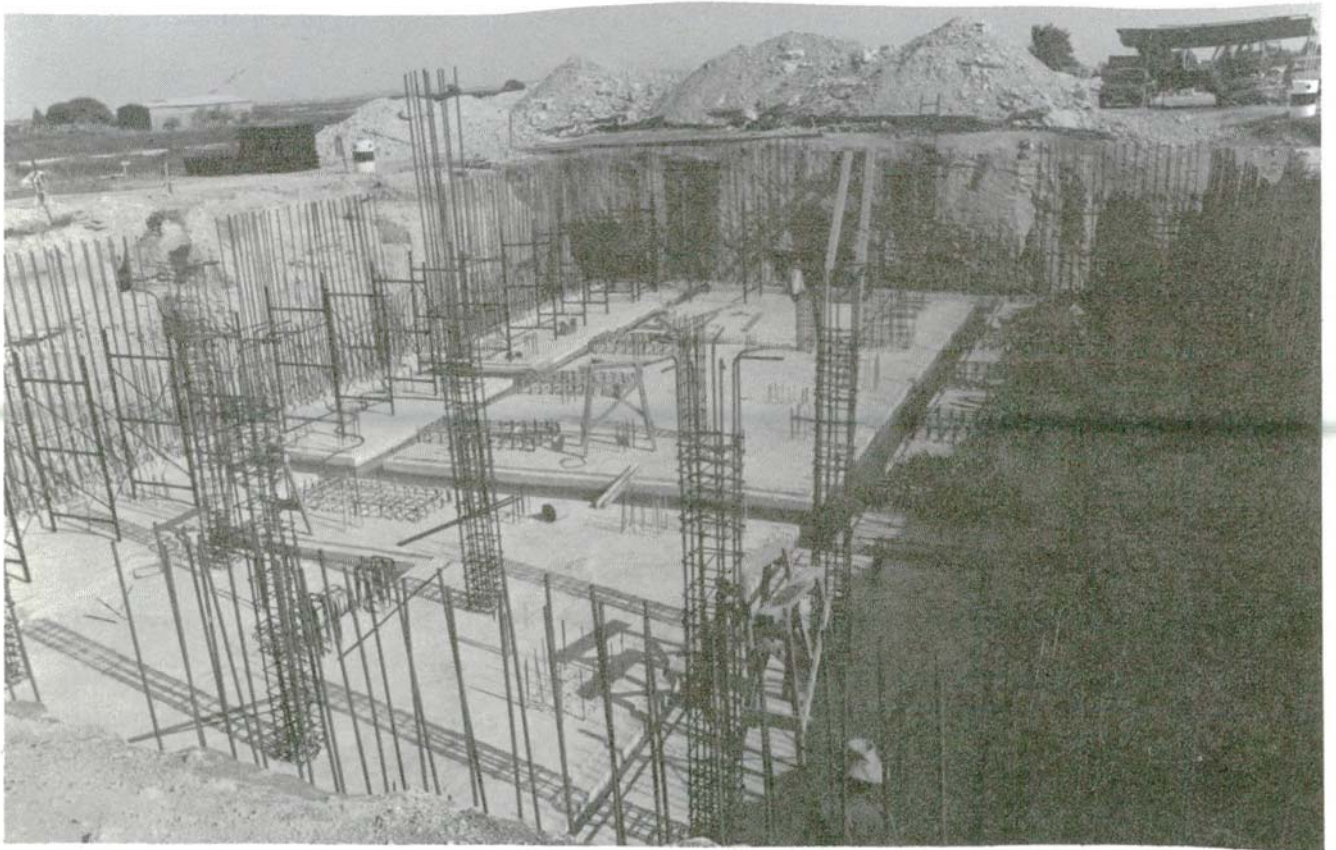
Contractor : Cybarco Ltd
Commencement date : 22nd April, 1987
Contractual Completion date : 22nd March, 1989
Contract Price : C£2,179,600
Total Certified 31.12.87 : C£480,176

This Contract also experienced a rather slow build-up of work momentum but this was partly due to the Contractor's emphasis on preparatory activities whose benefit are now being realized.

Some unanticipated social problems delayed land acquisition of certain of the CDP sites and necessitated programme reorganization. This has not seriously affected the Contractor's overall work progress but will inevitably mean that some of the CDP's in Stage 1 will not be completed by the target date.



SCP. Kokkinokhoria Irrigation Area. Contract No. C5C. Construction of CDP VII reservoir. WDD Photo No. E25EN-11 (27.10.87).



SCP Kokkinokhoria Irrigation Area. Contract No C6. Construction of CPD VII Pumping Station. WDD Photo E25EN-10 (27.10.87).

The Contractor is achieving a reasonably good level of organization and management, despite the heavy demands associated with executing work at ten scattered sites concurrently.

It is anticipated that the first three, and possibly four, reservoirs will be ready for testing by the end of February 1988.

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
Contract Price	:	C£1,649,000
Total Certified 31.12.87	:	C£281,548

This Contract also got off to a slow start for a number of reasons, the most significant of which was its direct link to the pump supply contract whose actual date of commencement was considerably later than planned due to the lengthy administrative procedures involved.

Final working drawings for the pump station foundations could not be prepared until the pump supplier provided the necessary information and this in turn was a constraint on the Contractor's progress. All the information has now been received and this aspect is no longer a limitation.

The Contractor has also experienced serious difficulties over recruiting suitable skilled labour, such as shutterers and steel fixers and has applied for work permits for Chinese nationals to fill the vacancies. The Contractor has also recently appointed a sub-contractor for steel fixing and is negotiating with another for formwork erection, thereby easing the problem.

A third cause for delay was the discovery that a substantial proportion of the reinforcing steel, purchased from a local supplier, was of below specification strength. The consequent investigations and remedial action resulted in a significant work hiatus at a critical juncture.

After the disappointing initial progress, resulting to a large degree from these constraints, the Contractor is now gathering momentum and there is a good prospect of his meeting the overall contract completion date. Intermediate phase completion dates will be overrun but this is not likely to be significant, in relation to the delivery dates for the pumping equipment, if the Contractor can keep to his most recent programme.

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 31.12.87 : C£20,194,672

Further small shipments and deliveries by truck and airfreight continued during the period, with 198 tons delivered bringing the total to 70,723 tons of pipes and fittings for SCP and Khrysokhou Irrigation Project. Inspection and taking over continued at the storage areas.

Shortages of certain essential fittings, and incompleteness of supply have continued causing some disruption to the completion of pipelaying. The manufacturer visited Cyprus at the end of October to finalise the programme for the remaining deliveries.

Final Certificate No. 1 was issued on 15th October. Arrangements were made for future payments by letter of credit rather than through the Buyer's Credit.

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 (31.12.87) : C£557,282

Two further shipments of valves and one airfreight delivery were received during the year, and only the recently ordered valves, due for delivery during the first quarter of 1988, are outstanding.

The Consulting Engineers' report "New Valve Orders" was approved at the end of July, and further valve orders totalling C£66,926 were placed.

Pumping Plant for Kokkinokhoria Irrigation - Contract S3

Contractor : SPP Projects Ltd (UK)
Commencement date : 21st May 1987
Completion date : 19th October 1989
Contract price : C£3,041,177
Total certified 31.12.87 : C£376,644 (Government funding) also Stg£407,356 paid through ECGD backed financed

Submission of pumping station drawings and equipment details have continued throughout the year. Approval has been given to the majority of equipment proposed, allowing the extensive programme



Kokkinokhoria Irrigation Area. Laying of 400 mm dia AC pipes.
WDD Photo No. F28EN-5

of manufacture and testing to proceed. Independent inspection and witness testing by the Purchaser and the Engineer was in hand.

The Contractor's staff visited Cyprus in July for technical meetings, and their electrical specialist visited Cyprus in November. The Engineer's Mechanical/Electrical Engineer visited Cyprus in July to attend those meetings, and in November/December to review the electrical drawings submitted at that time.

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 31.12.87 : C£892,354

Following the testing procedures put in hand and recorded previously, the Contract has proceeded smoothly, though well behind programme. Two partial shipments were made during the period, completing deliveries under this Contract. Final Certificate No. 1 was issued on 24th December.

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 31.12.87 : C£88,531

Manufacture and delivery of pipes to the Ormidhia Storage Area continued.

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 31.12.87 : C£32,280 (Final)

All deliveries under this contract have been satisfactorily completed.

Contract No. S4(d) - UPVC Pipes and fittings
for KIA Extensions

Tender documents were released by the end of the year.

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 31.12.87 - C£9,250

Manufacture commenced following submission and approval of drawings. By the end of the year the first shipment had been received and the second was ready for dispatch.

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 31.12.87 : C£20,680
DM729,567 paid under L.O.C.

An order was placed for more gate and butterfly valves, and discussions continued on the technical aspects of the float valves to be supplied.

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 (30.6.87) : C£35,451

An order for a further C£31,102 of air valves for the Kokkinokhoria Extension was placed under this Contract on 3rd December.

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 31.12.87 : NIL

5 tenderers submitted a total of 11 alternative tenders on 6th July, ranging in price from C£172,325 to C£719,390. The Contract was awarded on 3rd December to Spyros Stavrinides Ltd for hydrants by APCO (Greece) and pressure sustaining valves by Bermad (USA).

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 31.12.87: C£48,985

The two additional 800 mm dia flowmeters have been delivered.

Contract S8 -Telemetry

Preliminary discussions on the scope of the revised contract have continued between the Department and the Consulting Engineers. Meetings have been held concerning methods of communication.

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 31.12.87 : 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 31.12.87 : C£430,374

Delivery of asbestos - cement pipes has proceeded during the later half of the period.

PROJECT EXPENDITURE

The project expenditure for phase 1 of the project works, including expenditure incurred for Kouris Dam reached the figure of £59,632,527 out of which £19,119,678 was incurred in 1987.

Detail analysis of expenditure is given in Table VIII/iv/2.

TABLE VIII-2
SCP EXPENDITURE DURING 1987

Ser. No.	Description	Expenditure in 1987 £	Total Expenditure £
	PART 'A' of the Project - KOURIS DAM		
1	Kouris Dam Construction (Contract C1).....	6 769 078	18 053 576
2	Supervision/Administration by WDD	205 831	566 707
3	Surveys and Investigations (Topography/Laboratory) by WDD...	22 061	130 227
4	Removal and Relocation of CYTA Telecommunication Network.....	305	36 561
5	Installation of telephone at Kouris Dam	4 515	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	81 670
9	Acquisition of Land.....	114 949	1 809 610
10	Compensation to individuals.....	1 720	2 680
11	Improvements to the road Lofou-Ayios Therapon.....	-	3 685
12	Establishment of Hydroteorological Station.....	-	2 533
13	Kouris Dam Inauguration Expenses	1 607	1 607
14	Construction of access road to connect Lofou_Ypsonas villages...	911	911
15	Removal & Relocation of Alassa village.....	-	65 884
16	"Sogreah" Consultancy Services (Design/Supervision Kouris Dam)	115 443	426 659
17	Panel of Experts Consultancy Services for Kouris and Akhna Dam	8 373	33 165
	Total of Part 'A'	<u>£7 326 463</u>	<u>£21 325 306</u>

TABLE VIII/iv/2 (Cont.)

<u>Ser. No.</u>	<u>Description</u>	<u>Expenditure in 1987</u> £	<u>Total Expenditure</u> £
	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))	3 217 986	21 878 683
3	Supply of valves for Main Conveyor (Contract S2).....	220 616	580 824
4	Supply of flowmeters for the Main Conveyor (Contract S7).....	45 267	45 267
5	Supply of pipes and fittings from other schemes.....	2 087	2 087
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.....	28 090	39 743
10	Laying of Main Conveyor on two crossings of Limassol road (Ypsonas-Erimi).....	-	6 000
11	Construction of two culverts on the roads Larnaca-Kophinou and Larnaca-Nicosia.....	66 408	66 408
12	Relocation of EAC high voltage transmission towers in alignment with Main Conveyor (Yermasoyia)	-	23 116
13	Permanent Reinstatement of public roads.....	3 070	3 070
14	Construction and Laying of Main Conveyor from Kouris to Akhna (Contract C2/C3).....	2 572 239	4 984 093
15	Administration/Supervision of Contract C2/C3.....	128 389	214 754

TABLE VIII/IV/2 (Contd.)

<u>Ser. No.</u>	<u>Description</u>	<u>Expenditure in 1987</u> £	<u>Total Expenditure</u> £
16	Purchase of sand.....	22 750	22 750
17	Balancing Reservoir.....	5 795	322 680
18	Purchase of Poethelene Sleeving	1 931	1 931
19	Construction of Limassol Storage Area.....	-	71 146
20	Construction of Larnaca Storage Area.....	-	93 401
21	Construction of Ormidhia Storage Area.....	-	34 799
22	Construction of Kouris Dam Pumping Station	124 670	124 670
23	Administration of Main Conveyor (general) by WDD.....	10 172	46 088
24	Administration/Management of Storage Areas by WDD.....	50 138	93 250
25	Surveys and Investigations Topography/Laboratory) by WDD....	46 058	110 475
26	Acquisition of Land for the Main Conveyor.....	170 467	1 120 081
27	"Sir William Halcrow and Partners" Consultancy Services for the Main Conveyor etc.	185 484	680 854
	Total Part 'B' of the Project	6 901 617	31 441 385
	PART 'C' of the Project - Akhna Dam		
1	Construction of Akhna Dam (Contract C4).....	572 880	951 619
2	Supervision/Administration.....	29 011	41 872
3	Filling of Existing Boreholes & Wells in the Reservoir with Clay	7 512	9 974
4	"British Hydromechanics Research Association" Consultancy Services for the Akhna Dam Hydraulic Model Testing.....	-	12 905

TABLE VIII/iv/2 (Contd.)

<u>Ser. No.</u>	<u>Description</u>	<u>Expenditure in 1987</u> £	<u>Total Expenditure</u> £
5	Removal and Relocation of EAC high voltage transmission lines	15 573	15 573
6	Acquisition of Land.....	67 384	111 311
	Total Part 'C' of the Project	<u>£692 360</u>	<u>£1 143 254</u>
	PART 'D' of the Project - Kokkinokhoria Irrigation Distribution System		
1	Supply of Pumps and Ancillary Equipment for KIA Networks (Contract S3).....	308 521	308 521
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))	388 601	753 918
4	Supply of UPVC Pipes and Fittings (Contract S4(b)).....	66 899	93 191
5	Supply of C.I. Couplings and Fittings (Contract S4(c)).....	1 600	27 081
6	Supply of Fittings (Contract S4(e))	9 073	9 073
7	Supply of butterfly, Gate and Float Valves (Contract S5(a))....	8 098	128 770
8	Supply of Air Valves (Contract S5(b)).....	5	37 561
9	Supply of Hydrants (Contract S6)	-	-
10	Supply of Couplings and Fittings (Contract S12).....	-	27 372
11	Supply of AC Pipes (Contract S13)	453 026	453 026
12	Supply of D.I. fittings through extension of Contract K.S.1 of KIP.....	11 202	11 202
13	Supply of AC Pipes through extension of Contract K.S.1 of KIP.....	27 131	27 131

TABLE VIII/iv/2 (Cont.)

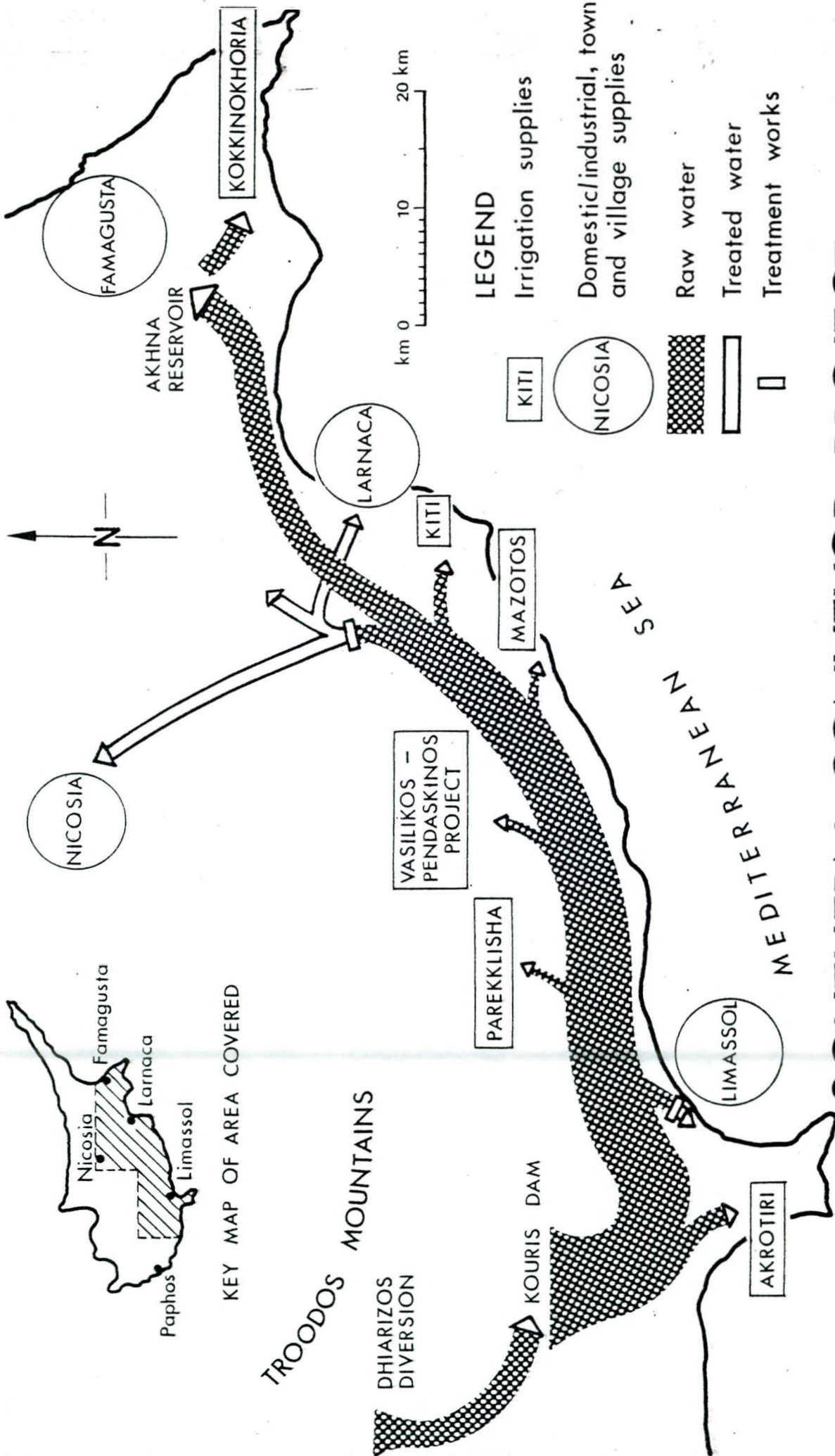
<u>Ser. No.</u>	<u>Description</u>	<u>Expenditure in 1987</u> £	<u>Total Expenditure</u> £
14	Construction of 4 Balancing Reservoirs (Contract C5(a)).....	559 754	559 754
15	Supervision/Administration of Contract C5(A).....	9 932	9 932
16	Construction of KIA Main Irrigation Networks (Contract C5B)	380 574	833 321
17	Design-Redesign of KIA Main Irrigation Networks.....	13 837	18 362
18	Construction of 14 Distribution Points Reservoirs (Contract C5C)	504 559	504 559
19	Supervision/Administration of Contract C5C.....	10 324	10 324
20	Construction of 19 Pumping Stations (Contract C6).....	291 488	291 488
21	Supervision/Administration of Contract C6	13 263	13 263
22	Construction of KIA Secondary Irrigation Networks (Contract C7)	847 079	889 987
23	Central Laboratory of Ormidhia (Quality Control of Works).....	15 562	15 562
24	Survey of Identification of Land Ownership.....	18 133	18 133
25	Acquisition and Requisition of Land.....	4 582	4 582
26	Administration.....	3 441	3 441
27	Land Consolidation (Preliminary and Administration Expenses).....	7 209	22 985
28	Land Consolidation of 1800 Hectares of Land.....	-	-
29	Construction of Farm Roads in the Land Consolidation Area.....	-	-
	Total Part 'D' of the Project	<u>£3 953 893</u>	<u>£5 377 862</u>

TABLE VIII/iv/2 (Cont.)

<u>Ser.</u> <u>No.</u>	<u>Description</u>	<u>Expenditure</u> <u>in 1987</u> £	<u>Total</u> <u>Expenditure</u> £
	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	-	14 475
	Total of Part 'E' of the Project	-	14 475
	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.....	49 912	49 912
	Total Part "G" of the Project....	49 912	55 489
	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	99 345

TABLE VIII/iv/2 (Cont.)

<u>Ser.</u> <u>No.</u>	<u>Description</u>	<u>Expenditure</u> <u>in 1987</u> £	<u>Total</u> <u>Expenditure</u> £
6	Purchase of one 'Crawler Rig and Compressor'.....	-	8 840
7	Purchase of Radio-telecommunication equipment for Kouris Dam.....	-	4 818
8	Purchase of 4 cameras.....	408	408
9	Reinforcement of Electricity Network at HQs Nicosia by EMS....	-	852
10	Purchase of Micro-Computers.....	19 570	19 570
11	Purchase of furniture & fittings for Micro-Computers at Nicosia HQs...	-	1 058
12	Purchase of Machinery and Drilling Equipment	74 648	74 648
13	Supply of Electricity to the Site selected for the erection of Offices and Stores at Ormidhia.....	-	3 955
	Total Part 'H' of Project	<u>193 971</u>	<u>273 294</u>
	TOTAL OF PHASE I	<u>£19 119 678</u> =====	<u>£59 632 527</u> =====



SOUTHERN CONVEYOR PROJECT

Diagrammatic Representation of Water Distribution 1st and 2nd Phase

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 consisting of the Larnaca-Famagusta Water Supply Scheme 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 first months of the winter season 1986-1987 was again unsatisfactory and had an adverse effect on the river flows. Consequently, the volume of water impounded in the dams up to the end of February was very small. Due to the low rainfall, the recharge of the aquifers was also poor which aggravated further the yield of boreholes. Fortunately, the exceptionally high rainfall of March yielded the badly needed quantities of water and covered the serious deficit that would have otherwise developed. As a result, the water supply of the towns, was maintained at satisfactory levels and no restrictions were imposed. The problems experienced in 1986 due to the decrease of the conveyance capacity of the Khirokitia-Famagusta pipeline were overcome after the first section of the pipeline from Khirokitia to Alethriko Break Pressure Tank was cleaned using foam swabs.

The water supply of Nicosia Town was augmented this year by 4.792MCM from Kornos Treatment Works which was in operation throughout the year under review.

A significant, though diminishing, contribution was also the production of the boreholes of the 1982/84 emergency schemes which in 1987 was 1.996MCM.

The scheme which was introduced in 1982 for subsidizing the drilling of private boreholes for the irrigation of gardens and other secondary uses, was not continued during 1987. The scheme had covered consumers in the areas of supply of Nicosia, Limassol and Larnaca water boards. The scheme had provided for a £50 subsidy for new boreholes. It is believed that the scheme had accomplished its aim of reducing the demand for potable water.

The total number of private boreholes subsidized during the 5 years of its operation and other relevant information is given in Table IX-1 below:

Table IX-1
DETAILS OF THE BOREHOLE SUBSIDY SCHEME

Town	Year	Total number of applications received	Total number of applications approved	Total number of applications subsidized
Nicosia	1982	847	689	375
	1983	525	410	332
	1984	482	388	291
	1985	275	215	128
	1986	237	179	106
Limassol	1983	4	4	4
	1984	6	6	6
	1985	3	3	3
	1986	15	6	6
Larnaca	1983	167	144	82
	1984	103	90	59
	1985	50	44	38
	1986	61	58	20
Totals		2 775	2 236	1 450

Nicosia Town

For the first time since 1971 Nicosia Town enjoyed unrestricted supply in 1987. A total of 10.911MCM of water was put into the distribution system at the service reservoirs representing an increase of only 6.8% 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 first 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 consumption of the town over the years 1985 to 1987. 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 water supply of the town is supplemented from the Central Water Supply System. On account of the increased quantities supplied to the town from this system and the measures taken by the Water Board to reduce unaccounted for water. The water supply demand could be met and no restrictions on the supply were

imposed. The total quantity of water supplied to the town from the Central Water Supply System during 1987 was 3.213MCM, which was 0.412MCM greater than that of 1986.

Paphos Town

The town did not experience a water shortage problem during the year and no restrictions were imposed on the supply except for a period of 15 days in July necessitated by a break 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 8,719m³ of water.

Table IX-2 gives some useful statistical data on the water supply of the towns over the last sixteen years.

Table IX-2
URBAN WATER SUPPLY IN CYPRUS

Year	Consumers* Number Increase		Input into System (at Service Reservoir Outlets) m ³ **
	at end of year	% Nicosia	
1972	17 601	-	7 564 804
1973	18 989	7.9	7 460 286
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
1984	41 297	4.4	9 450 498
1985	42 412	2.7	10 393 365
1986	43 984	3.7	10 218 459
1987	45 550	3.6	10 911 284

* 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 only.

** These figures cover the whole of Nicosia.

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

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
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

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	10.16	1 759 244*
1987	8 691	7.99	1 803 350*

* 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 conveys 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 operates its own sources which are 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.

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

For fifteen consecutive years from 1972 to 1986 restrictions have had to be imposed on the hours of supply to the consumers of Nicosia. For this reason the unrestricted demand of the town was not known. Nevertheless, it was estimated that the totally unrestricted demand, for 1986, was of the order of 13.80MCM per annum, which corresponds to an average daily demand, throughout the year, of 37,800m³. This estimate assumed an average daily consumption of 700 l/day per consumer meter.

As already mentioned, the supply to the town in 1987 was unrestricted. Nevertheless, the total consumption during the year including losses, only rose to 11.21MCM

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 water supply demand of the consumers. 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 1983 to 1987 are given in Table IX-3.

Table IX-3
NICOSIA WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1982-86

Source	1983	1984	1985	1986	1987
1 Morphou Bay Scheme	3.230	3.486	3.280	2.977	3.162
2 Dhikomo-Sykhari	0.112	NIL	NIL	NIL	NIL
3 Paliometokho-Kokkinotrimithia-Dhenia-Airport	0.466	0.451	0.431	0.286	0.256
4 Tseri	0.788	0.763	0.686	0.598	0.476
5 Dhali	NIL	NIL	NIL	NIL	NIL
6 Peristerona-Akaki	0.936	0.906	1.087	0.788	0.765
7 Laxia-Athalassa-Makedonitissa	0.358	0.232	0.142	0.182	0.127
8 Nicosia Water Commission Sources	0.453	0.390	0.419	0.199	0.243
9 Purchased from Private BH	1.669	1.277	1.114	1.019	0.871
10 Lefkara Dam (CWSS)	0.042	0.339	2.290	--	--
11 1982-84 Emergency Schemes					
(a) Stavrovouni	0.862	1.364	0.849	0.805	0.692
(b) Dhenia	0.389	0.278	0.182	0.186	0.136
(c) Dhali-Kattoudhia-Yeri	0.276	0.645	0.547	0.533	0.410
12 Korinos Treatment Works	--	--	0.266	3.414	4.792
	<u>9.581</u>	<u>10.131</u>	<u>11.293</u>	<u>10.987</u>	<u>11.930</u>

During 1987, the total quantity of water produced was 11.930MCM of which 10.816MCM came from Government sources 0.243MCM was the yield of the Nicosia Water Commission sources and 0.871MCM was purchased from private boreholes.

Consumption

Of the total 1987 production of 11.930MCM, 11.211MCM were delivered to Nicosia and 0.814MCM were consumed en route by a number of communities and other consumers connected to the system. The total consumption exceeds total production by 0.095MCM. 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 and assuming an average of 3.0 persons per consumer connection, it is estimated that an average supply of 172 l/capita/day or 515 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-4 below gives the communities and other consumers served by the Nicosia Water Supply System and the quantities supplied to them over the years 1983-1987.

Table IX-4
NICOSIA WATER SUPPLY SYSTEM
VILLAGES AND OTHER CONSUMERS SERVED

Community Served	Consumption in MCM				
	1983	1984	1985	1986	1987
Kokkinotrimithia	0.082	0.086	0.068	0.022	0.002
Mammari-Dhenia	--	--	0.037	0.045	0.059
Mosphiloti	0.052	0.049	0.049	0.045	0.055
Psevdhas	0.031	0.018	0.025	0.020	0.027
Pyrga	0.021	0.024	0.026	0.023	0.026
Lymbia, Sha, Kornos regional W.S. Scheme	0.060	0.043	0.042	0.093	0.145
Alambra	0.014	0.021	0.010	0.029	0.076
Dhali	0.009	0.059	0.047	0.122	0.146
Laxia	--	--	--	0.111	0.171
Various camps industries and miscellaneous consumers ...	0.083	0.100	0.157	0.146	0.107
Totals	0.352	0.400	0.461	0.656	0.814

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 up to 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 1987 is given in table IX-5.

Table IX-5
NICOSIA WATER SUPPLY
EXPENDITURE AND REVENUE ACCOUNT FOR 1987

Expenditure

Morphou Bay Scheme

	£
Maintenance expenses	140
Electricity	181 969
Wages	17 855
Miscellaneous expenses	16
Total	<u>£199 980</u>

Tseri Scheme

Maintenance expenses	2 280
Electricity and fuel	14 715
Wages	21 222
Miscellaneous expenses	320
Total	<u>£38 537</u>

Peristerona-Akaki Scheme

Maintenance expenses	5 593
Electricity and fuel	38 020
Wages	18 521
Miscellaneous expenses	1 292
Total	<u>£63 426</u>

Kokkini Trimithia-Paleometokho Installations

Maintenance expenses	5 273
Electricity and fuel	23 961
Wages	32 247
Miscellaneous expenses	1 139
Total	<u>£62 620</u>

Dhali-Laxia Installations

Maintenance expenses	178
Electricity	4 264
Wages	133
Miscellaneous expenses	860
Total	<u>£5 435</u>

Maintenance Expenses of Civil Engineering Works

	£
Motor Transport expenses	4 694
Wages	19 088
Purchase of materials & equipment	1 064
Miscellaneous expenses	3 582
Total	<u>£28 428</u>

Purchase of Water from Private Sources

£49 869

Yeri-Dhali-Kattoudhia Emergency Scheme

Maintenance expenses	1 930
Electricity and fuel	10 574
Wages	13 974
Miscellaneous expenses	239
Total	<u>£26 717</u>

Pyrga-Stavrovouni Emergency Scheme

Maintenance expenses	7 136
Electricity and fuel	35 774
Wages	12 711
Miscellaneous expenses	580
Total	<u>£56 201</u>

Dhyptomos-Lakatamia-Installations

Maintenance expenses	970
Electricity	60 184
Wages	12 816
Miscellaneous expenses	1 658
Total	<u>£75 628</u>

Kornos Water Treatment Works and Pumping Station

Maintenance expenses	676
Electricity	36 974
Wages	32 103
Miscellaneous expenses	34 751
Total	<u>£104 504</u>

GRAND TOTAL

£711 345

Revenue

Value of water delivered to Nicosia Water Board* (@ 16.3 cents/m ³)	1 787 874
Value of water delivered directly to other consumers in 1987	171 844
Total value of water delivered in 1987	<u>£1 959 718</u>

	£
Less amount actually collected in 1987 in respect of water delivered in 1987	1 305 935

Amount outstanding on 31.12.87 for water delivered in 1987	£ 653 783
Amount outstanding by 31.12.86	740 898
Less amount collected in 1987 in respect of water delivered before 31.12.86	441 117

Amount outstanding on 31.12.1987 for water delivered before 31.12.86	£ 313 669
Total amount outstanding on 31.12.1987	£1 004 349
Total amount collected in 1987	£1 747 052

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-6. Without taking into account office overheads the surplus for the year 1987 amounts to £36,513. If outstanding payments are not considered as revenue then there is a deficit of £617,270.

* 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-6
NICOSIA WATER SUPPLY
AMORTIZATION COSTS

Installations	Year compl.	Capital Cost	Period Years	Annual Amortization Cost
		£		£
Pre-1982 installations	--	1 748 300	Varies	107 760
Vasilikos-Pendaskinos Project Phase I (Dhyptomos Pumping Station and Dhyptomos-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

Installations	Year compl.	Capital Cost £	Period Years	Annual Amorti- zation Cost £
1983 Emergency Schemes (Pyrga-Stavrovouni- Yeri-Dhali-Kattoudhia)	1983	75 100	5	19 307
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
- M & E	1986	1 128 000	20	123 570
Dhypotamos Dam and Maroni Diversion Water Supply Component	1986	(5 900 800) 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 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 1987 was 109,142m³ which met satisfactorily the demand. The total expenditure, (which is borne by Government) for the operation and maintenance of this system for 1987 was £14,444 as follows:

- Electricity	1 031
- Wages	8 696
- Maintenance	220
- Miscellaneous expenses	4 497
Total	£14 444

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 1987, the Water Treatment Works at Kornos was operated at various throughputs upto its full capacity of 32000 m³ per day and covered a substantial part (about 40%) of Nicosia's water supply demand. A Chemist was appointed and placed in charge of the Works on 1.3.1987.

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 to the south of Nicosia.

The total quantity of water produced was 4,809,500 m³ against a total energy consumption (including pumping) of 368,100 KWh. The consumption of chemicals was as follows:

Aluminium Sulphate	138 700 kg
Polyelectrolyte	507 kg
Calcium Hydroxide (Lime)	21 500 kg
Chlorine Gas	10 737 kg

The water quality throughout all the steps from the source to the destination, was assured by a careful control and monitoring. Most of the chemical analyses were performed by the Kornos Chemist, at Khirokitia Water Treatment Laboratory, since the chemical laboratory at Kornos was not, yet, fully equipped with the necessary chemical reagents, glassware and the appropriate apparatus. However, certain simple tests regarding the physicochemical characteristics of water were carried out by the operators at the Plant. In addition the bacteriological analyses of the raw and treated water were performed by the state General Laboratory.

The operation and maintenance of the plant were organised on a programmed routine basis. Thus, the classification and proper storing of the electromechanical and hydraulic spare parts, has been started while the basis for the preventive maintenance has also been established. In addition, the training of the Plant's personnel in various safety and operational subjects has began.

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 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.

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 Kalavassos dam is conveyed by gravity along a pipeline to Tokhni Pumping Station and from there it is pumped to the 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 a 70 km pipeline from Khirokitia up 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, 1987 was 1,098,000m³ representing 8.1% of the reservoir capacity and by the 1st January, 1988 the total water storage was 7,341,000m³ representing 54.4% of the reservoir capacity. The total inflow net of overflow and net of seepage losses during the year was 17,773,000m³ and the total drawoff including water for irrigation, domestic, recharge and evaporation was 11,530,000m³. The quantity drawn off for domestic purposes was 3,163,869m³.

The water held in storage in the Kalavassos dam reservoir on 1st January, 1987 was 945,000m³ representing 5.5% of the reservoir capacity and by the 1st January, 1988 the total water storage was 4,100,000m³ representing 24.0% of the reservoir capacity. The draw off quantity for domestic purposes was 5,048,680m³. The total drawoff for domestic and irrigation purposes including evaporation was 7,405,000m³. The total inflow during the year was 10,560,000m³ net of seepage losses.

The total quantity of water pumped and/or treated from all sources of this scheme during 1987 was 8,823,878m³ (including losses and quantities supplied to Akrounda Phinikaria local irrigators) and the total consumption was 8,404,170m³. (excluding 326,250m³ supplied to Akrounda, Phinikaria irrigators and 13,090m³ raw water supplied en route for other purposes).

The total demand on the system during 1987 was 8.40MCM compared to 7.59MCM during 1986.

Sources and Production

The main sources of the Central Water Supply System and their production over the years 1984 to 1987 are given in table IX-7 below.

Table IX-7
CENTRAL WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1984-1987

Source	Year			
	1984	1985	1986	1987
Khirokitia Treat. Works				
- Drawing from Yermasoyia	2.487	2.646	2.315	2.854
- Drawing from Lefkara Dam	1.618	1.901	0.025	--
- Drawing from Vasilikos Subsurface Dam	0.745	0.001	--	0.044
- Drawing from Kalavasos Dam	--	3.456	3.876	4.739
Sub-total Khirokitia Treatment Works	4.850	8.004	6.216	7.637
Vasilikos & Old BHs				
- Vasilikos Sub-surface dam	--	0.001	--	--
- Boreholes				
Psematismenos group	--	--	--	--
Khirokitia group	0.139(2)	0.081(2)	0.091(2)	0.039(2)
Alethriko group	0.062(2)	0.061(1)	0.069(1)	0.051(1)
Sub-total Vasilikos & old boreholes	0.201	0.143	0.160	0.090
Yermasoyia dam (for irrigation)	0.281	0.290(4)	0.356	0.339
1982-83 Emerg. Schemes				
Tokhni	--	--	--	--
Skarinou	0.345(4)	0.202(4)	0.110(3)	0.104(3)
Alethriko	0.245(3)	0.220(3)	0.115(3)	0.119(3)
Klavdhia	0.400(5)	0.365(3)	0.294(5)	0.192(5)
Khirokitia	0.095(1)	0.087(1)	0.065(1)	0.029(1)
Anglisidhes	0.222(1)	0.235(1)	0.263(1)	0.314(1)
Sub-total Emerg. Schemes	1.307	1.109	0.847	0.758
Totals	6.639	9.546	7.579	8.824

Note: Figures in parentheses indicate the number of boreholes. The quantities for the treatment works production are given net of treatment losses.

The total quantity of water produced shows an increase of 16.40% in 1987 over the corresponding 1986 figure.

Bulk Consumption

Table IX-8 shows the bulk consumption of the various communities served by the CWSS over the years 1984-87.

Table IX-8
CENTRAL WATER SUPPLY SYSTEM
BULK CONSUMPTION IN MCM PER ANNUM 1984-1987

Community Served	Consumption from CWSS in MCM			
	1984	1985	1986	1987
Nicosia (via Dhypotamos)	0.339	2.290	--	--
Larnaca	2.467	2.793	2.801	3.213
Famagusta	0.986	0.983	0.980	0.976
Sub-total Towns	3.792	6.066	3.781	4.189
Western Region Villages				
Pano Lefkara	0.052	0.076	0.042	0.037
Kato Lefkara	0.009	0.008	0.009	0.008
Kato Dhrys	0.007	0.008	0.006	0.008
Vavla	0.007	0.007	0.006	0.007
Alethriko	0.028	0.026	0.039	0.036
Mazotos	0.041	0.049	0.048	0.042
Kivisil	0.023	0.025	0.024	0.026
Tokhni	0.027	0.030	0.029	0.026
Menoyia	0.005	0.005	0.005	0.005
Khirokitia	0.027	0.019	0.024	0.002
Maroni	0.037	0.039	0.033	0.036
Zyyi	0.028	0.032	0.027	0.036
Psematismenos	0.013	0.011	0.010	0.011
Kophinou	0.001	0.034	0.063	0.082
Alpanda-Anapha	0.033	0.037	0.040	0.037
Meneou-Dhrompaxia-Tersephanou	0.239	0.434	0.491	0.553
Klavdhia	0.022	0.036	0.034	0.030
Kalokhorio	0.019	--	0.002	0.023
Mari	--	--	0.004	0.025
Sub-total Western Villages	0.618	0.876	0.936	1.030
Eastern Villages				
Aradippou	0.231	0.282	0.274	0.298
Xyloymbou	0.117	0.128	0.135	0.142
Dherinia	0.149	0.174	0.180	0.192
Avgorou	0.120	0.130	0.156	0.177
Phrenaros	0.036	0.054	0.039	0.051
Livadhia	0.128	0.134	0.125	0.136
Voroklini	0.070	0.074	0.087	0.096
Sotira	0.088	0.110	0.137	0.146
Paralimni	0.302	0.383	0.462	0.618
Ayia Napa	0.336	0.426	0.475	0.719
Kellia	0.025	0.017	0.024	0.026
Troulli	0.041	0.041	0.041	0.042
Aradippou-Livestock area	0.017	0.001	--	--
Anzio Camp	0.027	0.025	0.028	0.013
Akhna Forest (Displaced Persons)	0.091	0.093	0.098	0.105
Pyla	0.027	0.041	0.098	0.103
Ormidhia	--	--	0.027	0.068
Xylophagou	--	--	0.127	0.217
Vrysoulles	--	--	--	0.007
Sub-total Eastern Villages	1.805	2.113	2.513	3.156
Irrigators & Minor Consumers	0.294	0.306	0.368	0.369
Grand Total	6.509	9.361	7.598	8.744

Expenditure and Revenue

A statement showing expenditure and revenue of the Central Water Supply System for the year 1987 is shown in table IX-9 below.

Table IX-9
LARNACA-FAMAGUSTA
CENTRAL WATER SUPPLY SYSTEM

EXPENDITURE AND REVENUE ACCOUNTS FOR 1987

Expenditure

Khirokitia Installations

	£
Electricity	5 313
Wages	43 859
Materials and others	44 300
Total	<u>£93 472</u>

Yermasoyia-Vasilikos Installations

Electricity	168 295
Wages	36 958
Materials and others	2 051
Total	<u>£207 304</u>

Pumping and Maintenance Expenses

Electricity	30 834
Wages	35 792
Materials and others	13 582
Total	<u>£80 208</u>

Khirokitia-Lefkara Regional Water Supply Scheme

Electricity	11 738
Maintenance	1 026
Total	<u>£12 764</u>

Maintenance expenses for Civil Engineering Works

Wages	13 916
Materials and others	5 250
Total	<u>£19 166</u>

Tokhni Pumping Station Installations

Electricity	40 726
Wages	19 884
Materials and others	324
Total	<u>£60 934</u>

GRAND TOTAL	<u>£493 661</u>
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Revenue

Revenue Generated in 1987

	£
Value of water delivered to Larnaca Water Board in 1987	697 115
Value of water delivered to Famagusta area occupied by Turks in 1987	211 764
Value of water delivered to other consumers in 1987 ..	924 662
<hr/>	
*Total value of water delivered in 1987	£1 833 541
Less amount actually collected in 1987 in respect of water delivered in 1987	842 703
<hr/>	
*Amount outstanding on 31.12.1987 for water delivered in 1986	£990 838
**Amount outstanding on 31.12.1986	1 836 454
Less amount collected in 1987 in respect of water delivered before 31.12.1986	580 705
<hr/>	
Amount outstanding by 31.12.87 for water delivered before 31.12.86	£1 255 749
***Total amount outstanding by 31.12.1987	£2 246 587
Total amount collected in 1987	£1 423 408

* Includes an amount of £211,764 representing the value of 975,870m³ of water supplied to Famagusta area occupied by Turks.

** Includes an amount of £1,179,082 representing the value of 12,031,859m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1986.

*** Includes an amount of £1 390 846 representing the value of 13,007,729m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1987.

Notes on expenditure and revenue account of the Central Water Supply System for 1987.

(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-10. 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 7,637,524m³ and the unit running cost was 1.22 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:

- * BHs no. 11/69, 4/69 in the Khirokitia area
- * BH no. 45/73 in the Alethriko area

1982-1983 Emergency Scheme Installations

- * BHs no. 114/80, 127/80, 112/80, 38/82, 16/79 in the Klavdhia area.
- * BHs no. 73/80, 15/83, 75/83 in the Alethriko area.
- * BHs no. 133/80, 80/83, 55/83, in the Skarinou area.
- * BH no. 45/61 in the Khirokitia area.
- * BH no. 141/83 in the Anglisidhes area.

The total quantity produced by these sources during 1987 was 847,014m³.

The unit cost of pumping and maintenance was therefore 9.47 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 60,740m³.

(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 Kalavassos dam to Khirokitia Reservoir.

Table IX-10

**LARNACA-FAMAGUSTA-CENTRAL WATER SUPPLY SYSTEM
AMORTIZATION COSTS OF CAPITAL INVESTMENTS**

Installations	Year compl.	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

Table IX-10 (cont.)
LARNACA-FAMAGUSTA-CENTRAL WATER SUPPLY SYSTEM
AMORTIZATION COSTS OF CAPITAL INVESTMENTS

Installations	Year compl.	Capital Cost £	Period Years	Annual Amortization Cost £
Khirokitia Treatment Works extension:				
- Civil	1985	136 955	40	12 730
- M & E	1985	112 726	20	12 350
Kalavassos Dam				
- 40% charged to W.S.	1985	(6 358 000)		
		2 543 200	40	236 420
Kalavassos pipeline				
- 40% charged to W.S.	1985	(2 194 000)		
		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 one Chemist and one Technical Assistant who works as a laboratory assistant. The laboratory undertakes all the chemical analyses of drinking water and carries out chemical tests for water conductivity, pH, total dissolved solids, total hardness, chlorides, sulphates, carbonates, fluoride, nitrite, 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 village 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 WDD (Such as the Vasilikos-Pendaskinos Project, the Southern Conveyor Project etc.) and in cases where water from a new borehole will be used for drinking purposes.

During the year 1987, 922 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 no. IX-11.

In addition to the chemical analyses mentioned above, samples of water from the Yermasoyia and Lefkara Dams were collected and jar tests for estimating coagulant dosing requirements were carried out.

Table IX-11
SUMMARY OF CHEMICAL ANALYSES

Month	Number of chemical analyses						Total
	Larnaca	Nicosia	Limassol	Paphos	Polis	Khirokitia	
January	--	--	--	--	--	35	35
February	--	30	--	--	--	5	35
March	--	60	1	3	--	--	64
April	11	22	--	--	--	4	37
May	16	30	8	18	12	4	88
June	88	--	5	17	--	5	115
July	31	63	--	--	--	1	95
August	7	58	--	--	--	24	89
September	9	15	--	65	--	6	95
October	11	9	--	33	59	10	122
November	--	71	--	--	--	3	74
December	41	28	4	--	--	--	73
Total	214	386	18	136	71	97	922

TOWN WATER BOARDS

NICOSIA WATER BOARD

For the first time since 1971 there were no restrictions imposed on the water supply of the capital. During the year the boundaries of the Area of Supply of the Water Board were extended to include large areas of the Municipalities of Nicosia, Eylendjia, Strovolos and Engomi and a small area of Ayios Dhometios. Given the time that has elapsed since the preparation of the last Master Plan for the development of its distribution system in 1973 and the change of development patterns caused by the invasion, the Water Board concluded an agreement with MacLaren Engineers Inc. of Canada for the preparation of a new comprehensive study of the water supply distribution system and the drawing up of a Master Plan of improvements and extensions to enable it to cope with the anticipated demands to the year 2010. The study will be ready in 1988.

During 1987 the Nicosia Water Board operated the Leak Detection and Monitoring System and worked with the Thames River Authority with the object of applying an Integrated Data Management System and hence achieving a better control on the distribution of water. Furthermore using modern technology the Nicosia Water Board can monitor the level of unaccounted for water and proceed with the systematic detection and correction of leakages. The

results of the implementation of the programme are very encouraging. The Water Board reports that the level of unaccounted for water within the individual areas of supply has been reduced by about 5% and is confident that through systematic work this level will be reduced further.

Water Supply Data

- Total quantity of water delivered to the service reservoirs.....	11 210 960m ³
- Total quantity of water consumed as registered by area meters (including Nicosia Water Commission).....	10 911 284m ³
- Total consumption during 1987 as registered by individual consumers meters in the Greek sector only	6 262 437m ³
- Unaccounted for water	23.50%
- Maximum daily summer consumption (Based on area meter readings and including Nicosia Water Commission. Registered on 27.7.1987-unrestricted supply)	42 740m ³
- Total number of consumers on 31.12.86 (Greek sector only)	43 984 no
- Total number of consumers connected in 1987 ...	1 763 no
- Total number of consumers on 31.12.1987	45 550 no
- Average number of consumers during 1987	44 767 no
- Average gross supply per consumer	515 l/day
- Extension of distribution system (100mm, A.C pipes)	2 819m
- Total length of distribution system as at 31.12.1987	554 874m
- Total number of Fire Hydrants installed during 1987	4 no
- Total number of Fire Hydrants installed as on 31.12.1987	1 888 no

From the information available, the quantity of water supplied to the area of Nicosia under Turkish control (As registered by area meters). was 2.888MCM or 25.8% 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 1987.

New Schemes

Works for the improvement of the distribution system and service reservoirs under contracts 1, 2 and 5 were at their final stages by the end of the year. The work included the construction of two new large service reservoirs and the laying of a number of trunk mains within the distribution system for improving its conveyance capacity.

Kouris Scheme

This scheme was designed to replace Garyllis boreholes a number of which were disconnected. These boreholes are situated within an inhabited area of the town and the quality of their water has deteriorated rendering it unsuitable for domestic consumption.

The scheme utilizes six boreholes with Nos 51/77, 153/83, 130/84, 76/85, 130/85 and 155/85. The scheme also comprises a 500m³ capacity collecting tank, a pumping station equipped with 3 no. boosters (one stand-by) of a capacity of 250m³/hr each and a pumping main, of ductile iron pipes, 400mm in dia and 10,900m long. The scheme was completed during the year.

Water Supply Data

- Total quantity of water produced from all sources during 1987	9 287 885m ³
- Total quantity of water consumed as registered by area meters	8 837 785m ³
- Total consumption during 1987 as registered by individual consumers meters	6 774 823m ³
- Unaccounted for water (Production/consumption)...	27.06%
- Maximum daily summer consumption (registered by area meters on 6.8.87).....	35 408m ³
- Total number of consumers connected in 1987 (new)	1 614 no
- Total number of consumers on 31.12.1986	39 921 no
- and on 31.12.1987	41 219 no
- Average number of consumers during 1987	40 570 no
- Average gross supply per consumer	627 l/day
- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C. and P.V.C. pipes).....	14 930m
- Total length of distribution system as at 31.12.87	472 762m
- Total number of Fire Hydrants installed during 1987	28 no
- Total number of Fire Hydrants installed as at 31.12.1987	1 541 no

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 1987 was 0.976MCM.

Larnaca Water Board

The water supply of this town is supplemented by 92% 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 1987 was 3.213MCM, which is greater by 0.412MCM than that of 1986. The production of the Water Board owned sources was 0.266MCM.

Water Supply Data

- Total quantity of water produced from all sources during 1987	3 478 506m ³
- Total quantity of water delivered from the service reservoirs or directly into the distribution system (Reservoir Outlet).....	3 382 840m ³
- Total quantity of water consumed as registered by area meters	3 372 380m ³
- Total consumption during 1987 as registered by individual consumers meters	2 786 065m ³
- Unaccounted for water (Production/Consumption)	19.91%
- Maximum daily summer consumption (Based on area meter readings registered on 7.8.87)	13 560m ³
- Total number of consumers connected in 1987 (24 consumers were disconnected)	1 075no
- Total number of consumers on 31.12.1986	18 441 no
- and on 31.12.1987	19 492 no
- Average number of consumers during 1987	18 966 no
- Average gross supply per consumer	502 l/day
- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C.pipes)	5 145 m
- Total number of Fire Hydrants installed during 1987	40 no
- Total number of Fire Hydrants installed as at 31.12.1987	828 no

Paphos Water Supply

The water supply of the town is administered by the Municipality. The Municipality's sources could meet the demand, after minor augmentation of 8,719m³ from the "Paphos Lower Villages" Government Water Supply Scheme. As a result no restrictions were imposed on the supply except for a period of a fortnight during July necessitated by a break in the main conveyor to the town.

Water Supply Data

- Total quantity of water produced from all sources during 1987	1 838 254m ³
- Total quantity delivered en route	34 904m ³
- Total quantity of water delivered to the service reservoirs or directly into the distribution system	1 803 350m ³
- Total consumption during 1987 as registered by individual consumers meters	1 358 522m ³
- Unaccounted for water	24.20%
- Average daily summer consumption (July-Sept.) ..	4 792m ³
- Total number of consumers connected in 1987 ...	643 no
- Total number of consumers on 31.12.1986	8 048 no
and on 31.12.1987	8 691 no
- Average number of consumers during 1987	8 369 no
- Average gross supply per consumer	590 l/day
- Extension of distribution system (100mm, 150mm, and 200mm A.C. pipes).....	3 745m
- Total length of distribution system as at 31.12.1987	154 488m
- Total number of Fire Hydrants installed during 1987	64 no
- Total number of Fire Hydrants installed as at 31.12.1987	235 no

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 1987 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 now 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 £45,065 and the revenue generated was £59,763. More details on expenditure and revenue are given on table IX-12 below:

The total quantity of water produced during 1987 was 1,051,122m³ and the total quantity delivered was 853,836m³.

Table IX-12
PAPHOS LOWER VILLAGES REGIONAL WATER SUPPLY SCHEME

EXPENDITURE AND REVENUE ACCOUNT FOR 1987

Expenditure	£
Electricity cost	35 239
Maintenance expenses	9 826

Total	£45 065
Revenue	
Amount collected for 1987	38 724
Outstanding accounts for 1987	21 045

Total	£59 769
Outstanding accounts by 31.12.1986	33 655
Less amount collected in 1987	20 714

Total	£12 941
Total amount outstanding by 31.12.1987	£33 986

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, the total deficit for the year 1987 amounts to £17,444.

Arminou Regional Scheme

This scheme supplies water to eight communities. The source of the scheme is BH 56/72 in Dhiarizos river near Arminou village. The total quantity of water distributed to the eight villages in 1987 was 28,701m³. An additional quantity of 9,203m³ was supplied for irrigation to individuals from Mesana and Kedhares. The total expenditure for the operation and maintenance of this scheme was £11,921 while the revenue generated for the same year was £2,182. More details on expenditure and revenue are given in table IX-13.

Table IX-13

ARMINOU REGIONAL SCHEME

EXPENDITURE AND REVENUE ACCOUNT FOR 1987

Expenditure

	£
Electricity cost	4 747
Maintenance expenses	7 174
Total	£11 921

Revenue

Amount collected for the year 1987	992
Amount outstanding for 1987	1 190
Total	£2 182
Outstanding account by 31.12.86	8 264
Less amount collected in 1987	1 838
Total	£6 426
Total amount outstanding by 31.12.1987	£7 411

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 £16,634.

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 1987 was 29,382m³.

The total expenditure for the operation and maintenance of the scheme was £1,459 and the revenue generated was £1,489. The total amount outstanding by 31.12.1987 was £1,603.

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 1987 was 63,360m³ and the total expenditure for the operation and maintenance of the scheme was £4,074 and the revenue generated was £5,069.

Amathus Scheme

This scheme has been established under the Government Water Works Law to supply water to Amathus Tourist Development Area. 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 two boreholes, Hydr. No. 946 and 993 situated in Yermasoyia River. The total quantity of water distributed during 1987 was 755,980m³. The total cost of the operation and maintenance of the scheme was £47,129 and the revenue generated for the same year was £90,976.

More details on expenditure and revenue are given on Table IX-14.

Table IX-14
AMATHUS WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1987

Expenditure

	£
Electricity cost	9 674
Maintenance expenses	9 490
Pumping fees (Yermasoyia aquifer)	27 965
Part of connection fees refunded	36 769
Total	<u>£83 898</u>

Revenue

Sale of water	38 791
Connection fees	52 185
Total	<u>£90 976</u>

Moutayiaka Regional Scheme

This scheme supplies water to 8 communities. The sources of the scheme are two boreholes, 64/64 (Hydr.No.287) and 180/59 (Hydr.no.8) situated in Yermasoyia River. 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 1987 was 437,428m³ as given below:

Villages	Consumption m ³
Ayia Phyla	--
Polemidhia National Guard Camp.....	--
Ayios Athanasios	235 180
Moutayiaka	80 540
Ayios Tykhonas	39 120
Parekklisha	53 560
Moni - Moni National Guard Camp	--
Monagroulli	12 660
Armenokhori	10 830
Phinikaria	5 538
Total	437 428m³

The total expenditure for the operation and maintenance of this scheme was £34,207 and the revenue generated was £40,000.

More details on expenditure and revenue are given on Table IX-15 below:

Table IX-15
MOUTAYIAKA REGIONAL WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1986

Expenditure

	£
Electricity cost	19 975
Operation and maintenance	14 232
Total	£34 207

Revenue

Amount collected in 1987	14 573
Amount outstanding by 31.12.1987	25 427
Total	£40 000
Outstanding amount by 31.12.1986	8 634
Less amount collected in 1987	5 494
Total amount outstanding for water delivered before 1987	3 140
Total amount outstanding by 31.12.1987	£28 567

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 number of hotels and other tourist installations in the 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 1987 was 981,470m³.

The total expenditure for the operation and maintenance of the scheme was £57,732 while the revenue generated was £119,934.

More details on expenditure and revenue are given on table IX-16 below:

Table IX-16
YERMASOYIA WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1986

Expenditure

	£
Electricity cost	24 645
Maintenance	4 173
Pumping fees (Yermasoyia Aquifer)*	28 914
Total	<u>£57 732</u>

Revenue

Sale of water	85 100
Connection fees	7 848
Capital expenditure	16 986
Amount outstanding for 1985	10 000
Total	<u>£119 934</u>

This amount has been charged by Government but has not been paid yet. A further amount of £26,598 representing pumping fees for 1986 is also outstanding bringing the total outstanding amount to £55,512.

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 1987 was 1,317,360m³ and the unit running cost excluding overheads and amortization costs was 1.50 cents/m³.

A statement showing expenditure and revenue of the scheme is shown in table IX-17 below.

Table IX-17
 PHRENAROS NEW PUMPING SCHEME
 EXPENDITURE AND REVENUE ACCOUNT FOR 1987






Expenditure

	£
Electricity	13 913
Wages	4 794
Materials and others	1 106
Total	<u>£19 813</u>

Revenue Generated in 1987

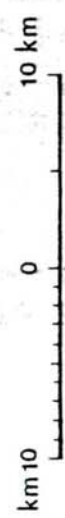
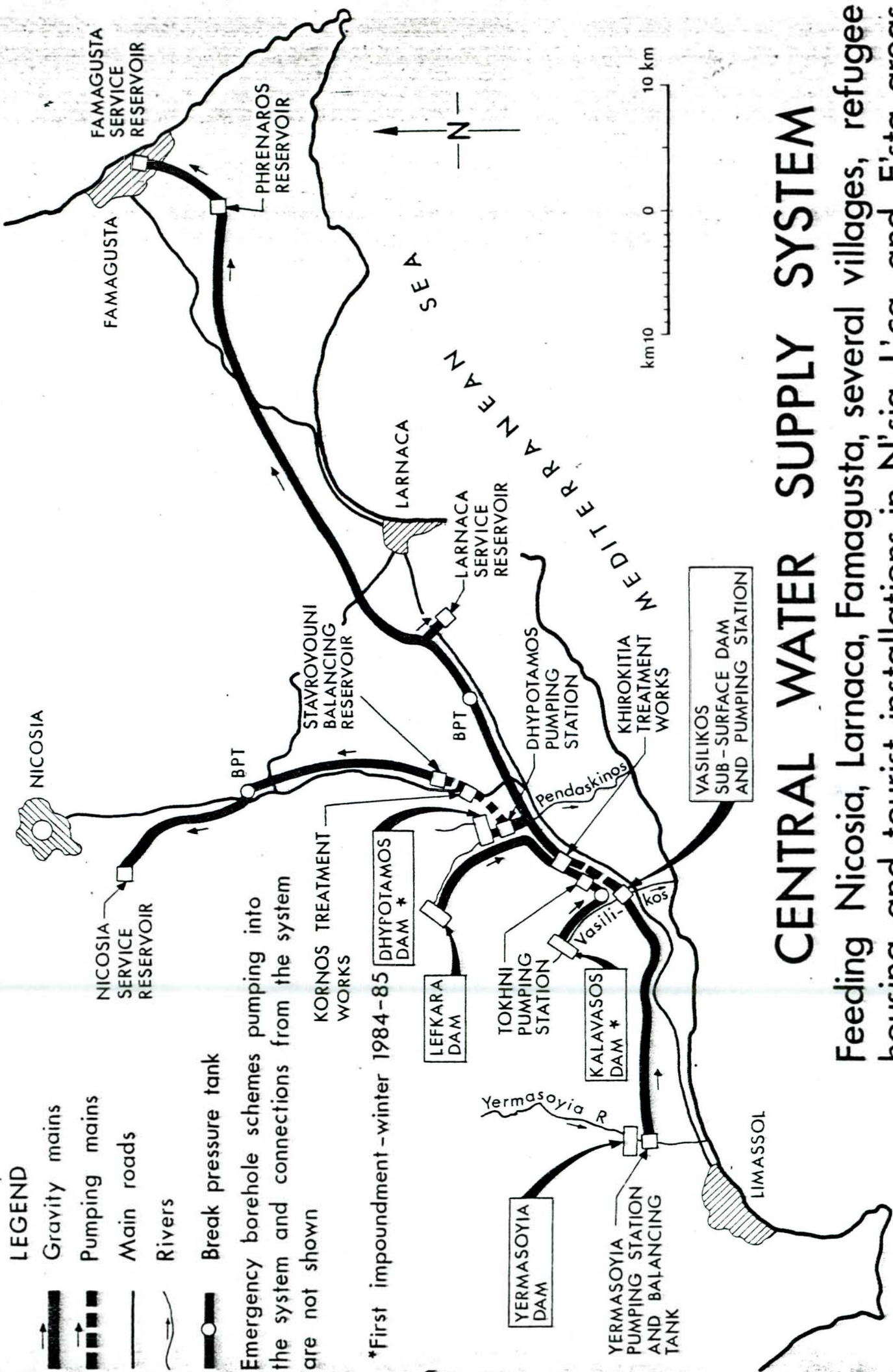
	£
Value added of water delivered to Ayia Napa, Paralimni and Protaras Tourist area. (Calculated at 4.6 cents/m ³ being the additional charge for pumping the water only)	60 598
Amount collected in 1987 in respect of water delivered in 1987 (There were no collections during the year pending approval by the Council of Ministers of the charge for pumping the water)	--
Amount outstanding on 31.12.1987 for water delivered in 1987	<u>60 598</u>
Amount outstanding by 31.12.87 for water delivered before 31.12.86	3 025
Total amount outstanding by 31.12.87	<u>£63 623</u>

LEGEND

-  Gravity mains
-  Pumping mains
-  Main roads
-  Rivers
-  Break pressure tank

Emergency borehole schemes pumping into the system and connections from the system are not shown

*First impoundment - winter 1984-85



CENTRAL WATER SUPPLY SYSTEM

Feeding Nicosia, Larnaca, Famagusta, several villages, refugee housing and tourist installations in N'sia, L'ca, and F'sta areas

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 1987 the Division consisted of the following staff:

- 1 Senior Water Engineer - Head
- 2 Topographer Irrigation Engineers I
- 1 Executive Engineer II
- 1 Senior Superintendent
- 1 Technical Superintendent
- 1 Senior Technician
- 2 Technician II
- 9 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-7.

Contributory Irrigation Projects

These are projects constructed under the Irrigation Division Law Cap. 342. A list of these projects is given in Tables X-6a and X-6b.

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 only projects whose operation and maintenance are with the Director of the WDD is the Paphos Irrigation Project, the Khrysokhou Valley Project, the Xyliatos Dam Project, Vasilikos-Pendaskinos Project and Khrysokhou Irrigation Project.

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-3a.

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-7).

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 174.959 MCM, 156.959 MCM for irrigation and domestic water supply and the rest 18.0 MCM for recharge purposes where the commanded area has risen to 19,441 hectares.

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 520 mm or 101% 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 area are amounted to 124.257 MCM. From this quantity 31.364 MCM were used for irrigation, 14.872 MCM were used for domestic water supplies, 5.860 MCM were used for groundwater recharge and another 1.227 MCM seeped through or below the dams and another 6.903 MCM were lost as evaporation. The rest 63.531 MCM remained in the dams for over year storage or lost in the distribution system or as overflow. Projects in the Turkish occupied area are not included here as we cannot collect the necessary information.

The total area commanded by the irrigation projects is estimated at 19,441 Hectars where an estimated area of 9,207 hectares, has been irrigated, planted with citrus, bananas, deciduous, vegetables, potatoes etc.

Maintenance works totalling £337,557 were carried out on fifty-one projects. These include routine maintenance on the dam structures and the distribution systems. For the Government irrigation works a total of £308,529 were spent where for the recharge works

an amount of 1.955 was spent. The rest £27 028 were spent on the contributory projects, £13,320 for Pitsilia and £13,708 for the other.

Government Waterworks

In the year under review, the total quantity available from Government irrigation projects reached the figure of 117.996 MCM.

From this total, a quantity of 48.350 MCM or 41% was utilized, 27.618 MCM for irrigation, 14.872 MCM for domestic water supply and 5.860 MCM for recharge purposes. The rest of the water remained in storage or lost in the form of overflow. In the same period 6.451 MCM were lost in the form of evaporation where another 1.227 MCM were lost as seepage or deep percolation (see Table X-1).

The irrigation water was used to irrigate fully or partly 7,966 hectares of land planted with citrus, bananas, vines, deciduous, vegetables, potatoes, cereals and olives (See Table X-2).

The gross income from the sale of water amounted to £1 146 669 being the income from the sale of water at the rates shown on Table X-3a. The operational expenses amounted to £214,671 being the cost for the payment of the watermen, and the bill collectors etc., which amounted to 0.8 cent/CM of water sold or 0.4 cent/CM of water utilized. The maintenance expenses on government projects amounted to £308,529 i.e. 1.1 cent/CM of water sold or 0.6 cent/CM of water utilized. The power expenses amounted to £222 413 i.e. 0.8 cent/CM of water sold or 0.5 cent/CM of water utilized.

The total annual operation, maintenance and power expenses amounted to £745,613 which amounts to 2.9 cent/CM of water sold or 1.6 cent/CM of water utilized.

Evaporation losses from the reservoirs amounted to 6.451 MCM or 6.4% of the total storage capacity available. The seepage losses were estimated at 1.227 MCM or 1.2% of the total storage.

The overall water utilization and land utilization indexes are 40.7% and 58.6% respectively. Of the 27.618 MCM used for irrigation 25.887 MCM were sold at the nominal rates, (93.9%) whereas the rest 1.731 MCM, (6.1%) 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-8 gives data on the operation and maintenance for the last two years.

Contributory Irrigation Projects

In general there are 70 contributory irrigation projects with total capacity 9.591 MCM commanding an area of 5,860 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 hectares belong to the Pitsilia Project. During the year under review the total quantity of water collected from the contributory schemes amounted to 6.261 MCM out of which 4.246 MCM were used for the irrigation of 1,241 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-6a and X-6b, 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 no water was collected for the year under review. For information on individual projects in the Government control areas see Tables X-7 and X-14.



Ora Pond. Cleaning of drainage ditch.
(26.11.87).

WDD Photo E34EN-5.

TABLE X-1 GOVERNMENT IRRIGATION PROJECTS - DATA FOR 1987

Project	Capacity m ³ x10 ³	Area Com. hect.	In Storage *	Water available m ³ x10 ³		Water used m ³ x10 ³		Losses m ³ x10 ³		Utilized Index %				
				From other resourc. **	Total	For irrig. DWS rech.	For DWS rech.	Total Evap.	Seep.	Area Irrig. hect.	Water	Land		
1. Argaka	990	314	1 366	212	1 578	1 222	NIL	NIL	85	4	200.6	77.4	64.0	
2. Ayia Marina	300	201	402	NIL	402	309	NIL	NIL	29	37	35.2	76.9	17.4	
3. Kalopanayiotis	363	60	466	NIL	466	209	NIL	NIL	47	150	56.2	44.8	93.7	
4. Kiti	1 610	831	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
5. Potos	860	381	1 125	122	1 247	814	NIL	NIL	74	125	140.4	65.3	36.7	
6. (i) Polemidhia	3 430	2 066	2 462	3 536	23 663	4 769	5 041	4 099	1 296	744	2066.0	58.8	100.0	
(ii) Yermasoyia	13 500	17 665	17 665	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	-	-	
7. Athalassa	791	41	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	-	-	
8. Paphos:														
(i) Asprokremmos	52 375	5 050	46 470	11 835	59 305	15 783	NIL	1 761	3 215	72	3325.0	29.6	77.7	
(ii) Mavrokolymbos	2 180	1 000	1 000	-	NIL	NIL	NIL	NIL	95	NIL	NIL	-	-	
9. Kha-Potami	-	567	-	848	848	848	NIL	NIL	-	-	567.0	100.0	100.0	
10. Khrysokhou Valley	-	237	-	452+	452	452	NIL	NIL	-	-	102.4	100.0	43.0	
11. Xyliatos	1 220	308	1 682	-	1 682	657	NIL	NIL	93	86	191.3	39.1	62.1	
12. Vasilikos-Pendaskinos														
(i) Kalavassos	17 100	1 071	10 822	-	NIL	NIL	NIL	NIL	683	NA	NA	-	-	
(ii) Dhyptomatos	13 700	372	4 507	-	18 288	2 337	9 831	NIL	451	NA	531.6	66.5	34.8	
(iii) Lefkara	13 850	82	2 959	-	NIL	NIL	NIL	NIL	211	9	NA	-	-	
13. Khrysokhou-(Evretou)	25 100	2 000	10 113	-	10 113	218	NIL	NIL	NA	NA	150.0	3.7	7.5	
Total	147 368	13 581	101 039	16 957	117 996	27 618	14 872	5 860	48 350	6 451	1 227	7965.7	40.7	58.6

* This 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 Groundwater scheme

+ Including a quantity of 48,000 m³ taken from Evretou Dam.

TABLE X-2 - CROPS AND AREAS IRRIGATED BY GOVERNMENT IRRIGATION PROJECTS

Ser No.	Crop	Area Hectars
1	Citrus	2334.9
2	Bananas	476.6
3	Table Grapes.....	1487.4
4	Deciduous	181.8
5	Vegetables	747.5
6	Potatoes	572.9
7	Cereals	16.0
8	Olives	26.4
9	Ground-Nuts	429.0
10	Seasonal	475.6
11	Tobacco	202.2
12	Avocados	59.8
13	Alfa-Alfa	77.2
14	Legumes	835.4
15	Kiwi	3.0
16	Pecan	40.0
	Total	7965.7

TABLE X-3a - GOVERNMENT IRRIGATION PROJECTS AND APPROVED WATER CHARGES IN CENT/M3

Ser. No.	Project	Over-flow	Indus-trial	Flat Rate	
				1.1.87-11.6.87	12.6.87-31.12.87
1	Argaka	Free		3.0	3.5
2	Ayia Marina	0.5	-	3.0	3.5
3	Kalopanayiotis	-	-	3.5	4.0
4	Kiti	-	-	-	-
5	Pomos.....	0.5	-	3.0	3.5
6	Yermasoyia Polemidhia	-	-	3.5, 3.0	4.0, 3.5
7	Paphos	-	9, 13	4.0	5.0
	Mavrokolymbos	-	-	3.5	4.5
8	Khrysokhou Valley ...	-	-	4.0	4.5
9	Xyliatos	-	13	-	-
10	Vasilikos-Pendaskinos	-	15.5, 17		
	(i) Kalavassos	-	-	4.5	4.5
	(ii) Dhypotamos	-	-	4.5	4.5
	(iii) Lefkara	-	-	3.5	4.0
11	Khrysokhou Irrigation	-	13	-	NA

TABLE X-3b - GOVERNMENT IRRIGATION PROJECTS - UNIT WATER COST INCLUDING CAPITAL AND ANNUAL COSTS

No.		cent/m3
1	Argaka	10.1
2	Ayia Marina	9.9
3	Kalopanayiotis	29.6
4	Kiti	-
5	Pomos	9.0
6	Polemidhia-Yermasoyia	12.7
7	Paphos	14.6
8	Khrysokhou Valley	10.9
9	Xyliatos	21.2
10	Vasilikos-Pendaskinos	18.7
11	Khrysokhou-Irrigation	15.7

TABLE X-4 DATA ON MANAGEMENT, OPERATION AND MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

Project	Capacity m ³ x10 ³	Area Com. hect.	In Storage *	From other resourc. **	Total Water used m ³ x10 ³	Water sold m ³ x10 ³	Area Irrig. hect.	Gross Income £	Power	Expenditure £			Net Income £	
										Operat.	Maint.	Total		
1. Argaka	990	314	1 366	212	1 578	1 222	852	200.6	29 219	2 765	9 892	3 737	16 394	12 825
2. Aya Marina	300	201	402	NIL	402	309	309	35.2	9 361	NIL	6 129	1 534	7 663	1 698
3. Kalopanayiotis	363	60	466	NIL	466	209	209	56.2	7 915	NIL	3 838	1 359	5 197	2 718
4. Kiti	1 610	831	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
5. Potos	860	381	1 125	122	1 247	814	814	140.4	23 740	1 754	12 691	3 225	17 670	6 070
6. (i) Polemidhia	3 430	2 066	2 462											
(ii) Yemasoyia	13 500	17 665		3 536	23 663	13 909	4 256	2066.0	164 709	24 233	91 016	22 748	137 997	26 712
7. Athalassa	791	41	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
8. Paphos:														
(i) Asprokremmos	52 375	5 050	46 470	11 835	59 305	17 544	15 783	3925.0	736 568	186 920	59 965	240 658	487 543	249 025
(ii) Mavrokolymbos	2 186		1 000											
9. Kha-Potami	-	567	-	848	848	848	-	567.0	***	-	-	-	-	-
10. Khrysokhou Valley	-	237	-	452+	452	452	452	102.4	20 793	6 741	7 214	5 671	19 626	1 167
11. Xyliatos	1 220	308	1 682	NIL	1 682	657	657	191.3	26 880	NIL	2 283	3 738	6 021	20 859
12. Vasilikos-Pendaskinos														
(i) Kalavassos	17 100	1 071	10 822	NIL										
(ii) Dhyptomatos	13 700	372	4 507	NIL	18 288	12 168	2 337	531.6	127 484	NIL	21 643	25 859	47 502	79 982
(iii) Lefkara	13 850	82	2 959	NIL										
13. Khrysokhou-Evretou	25 000	2 000	10 113	NIL	10 113	218	218	150.0	NA	NIL	NIL	NIL	NIL	-
Total	147 368	13 581	101 039	16 957	17 996	48 350	25 887	7965.7	1146669	222 413	214 671	308 529	745 613	401 056

* 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.

*** The water was given free of charge and the expenses were undertaken by the farmers.

+ Including a quantity of 48,000 m³ taken from Evretou Dam.

- 1 Diversion on river
- 2 Groundwater Scheme

TABLE X-5 DATA ON WATER USE FOR THE LAST 10 YEARS FOR THE GOVERNMENT PROJECTS

Ser. No.	Description	Unit	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	Capacity	1000m ³	38 061	37 874	37 874	37 874	89 874	91 094	91 094	120 894	120 894	147 368
2	Water available	"	27 380	28 282	34 408	50 660	35 278	37 441	55 019	68 951	67 006	117 196
3	Water utilized for irrigation	"	9 457	10 847	27 109	19 634	20 858	21 814	23 270	27 137	28 734	26 818
4	Water used for DWS	"	2 856	2 210	2 210	3 356	4 793	3 831	4 429	8 807	10 696	14 872
5	Water used for recharge	"	1 982	1 623	6 579	14 627	2 648	2 999	3 199	3 758	6 208	5 860
6	Total water used	"	14 295	15 426	23 609	37 617	28 299	28 644	30 898	39 702	45 548	48 350
7	Evaporation losses	"	2 683	2 409	2 587	2 618	2 646	3 218	3 789	4 219	3 152	6 451
8	Seepage losses	"	3 367	1 024	5 087	5 424	973	873	747	946	556	1 227
9	Water sold	"	8 447	12 642	11 748	18 644	19 542	20 101	21 210	23 988	27 359	25 887
10	Gross income	£	101 367	128 281	169 418	253 307	433 214	520 441	688 686	892 589	1043 594	1146 669
11	Power cost	"	-	-	-	117 689	215 577	247 838	355 186	380 785	307 011	222 413
12	Operation cost	"	33 592	55 197	84 496	207 738	119 906	264 039	212 831	217 711	182 750	214 671
13	Maintenance cost	"	8 165	7 202	18 563	50 539	76 131	100 069	160 771	172 166	279 893	308 529
14	Total expenditure	"	41 757	62 399	103 059	258 277	411 614	611 946	728 788	770 662	769 564	745 613
15	Net income	"	59 610	65 882	66 159	-4 838	21 600	-91 505	-40 102	121 927	274 030	401 056
16	Area irrigated	Hectars	1 994	2 687	3 267	4 936	5 266	6 112	6 697	6 837	7 215	7 966

TABLE X-6a DATA ON CONTRIBUTORY IRRIGATION WORKS

Ser. No.	Project	Capacity m ³ /103	Yield m ³ /h	Area com. hect.	Water avail. m ³ /103			Water used m ³ /103		Evap. Losses m ³ /103	Area Irrig. hect.
					In stor.	Other resour.	Total	From Dam	Total		
1	Akrounda	22	-	8	22	-	22	20	20	2	8
2*	Galini	22	-	174	-	-	-	-	-	-	-
3*	Geyneli	1 000	-	114	-	-	-	-	-	-	-
4*	Gypsos	113	-	85	-	-	-	-	-	-	-
5	Kalo Khorio (Klirou)	32	-	181	32	-	32	29	29	3	9
6	Kandou	38	-	75	38	-	38	30	30	3	7
7	Kotchatlis	1	-	NA	-	NA	NA	-	NA	-	NA
8*	Kanli	1 100	-	535	-	-	-	-	-	-	-
9*	Lefka Marathasa	368	-	174	368	-	368	331	331	37	59
10*	Lefka Kafizes	113	-	103	113	-	113	102	102	11	18
11	Lymbia	220	-	126	220	-	220	27	27	18	15
12	Lythrodontas Upper	32	-	15	32	-	32	29	29	3	88
13	Lythrodontas Lower	32	-	15	32	-	32	29	29	3	15
14*	Mia Milea	330	-	174	-	-	-	-	-	-	15
15*	Morphou	2 000	-	902	-	-	-	-	-	-	-
16*	Ovgos	250	-	852	-	-	-	-	-	-	-
17	Pakhyamos	43	-	54	43	-	43	40	40	3	18
18	Palekhorri (Kambt)	620	-	134	620	-	620	394	394	76	85
19	Pera Ferthi	55	-	26	55	-	55	44	44	4	8
20	Petra Upper	10)	-	628)	10	-	10	9	9	1	4
21	Petra Lower	25)	-	-	25	-	25	23	23	2	4
22	Prodromos	110	-	23	110	-	110	47	47	9	5
23	Fyrgos	283	-	214	283	-	283	260	260	23	28
24	Trimiklini	340	-	87	340	-	340	313	313	27	54
25	Kambos	2	70	36	-	58	58	-	37	21	24
26	Chakistra	2	70	44	-	68	68	-	56	12	44
27	Yerakies	2	70	29	-	30	30	-	30	NIL	13
28	Khioritlia Pond & B/H No.136/78	205	100	47	174	5	179	163	163	16	47
29	Esso Galata pond	35	-	7	35	-	35	NA	NA	3	NA
Total		7 398	310	4 862	2 552	161	2 713	1 890	2 018	277	476

* Project in Turkish occupied areas

1 River Diversion.

2 River Diversion with Dual Pumping stage.

xx River Diversion on Borehole Extraction.

TABLE X-6b DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

Ser. No.	Project	Capac. m ³ x10 ³	Yield m ³ /h	Area comm. Decans m ³ x10 ³	Water avail. stor. m ³ x10 ³	Water used for irrig. from dam m ³ x10 ³	Water extr. from b/h m ³ x10 ³	Total water avail. m ³ x10 ³	Total water used m ³ x10 ³	Evap. Losses m ³ x10 ³	Area irrig. hect.
1	Agros Dam & B/H 63/76	72	70	474	72	28	53	125	81*	6	230
2	Akapou-Epithagonia Pond	132	-	248	132	60	-	132	60	11	200
3	Arakapas Dam	128	-	293	128	100	-	128	100	10	293
4	Arakapas I	192	-	381	175	117	-	175	117	14	347
5	Ayii Vavatsinias dam	53	-	241	53	72	-	53	72	4	227
6	Ayii Vavatsinias pond I	55	-	201	55	17	-	55	17	4	-
7	Epithagonia I	92	-	234	92	24	-	92	24	7	185
8	Epithagonia II	127	-	120	127	145	-	127	145	10	-
9	Epithagonia III	65	-	401	65	26	-	65	26	5	340
10	Kato Mylos pond & B/H 66/76	104	62	187	104	37	23	127	60	8	228
11	Khandria	70	-	107	70	33	-	70	33	6	130
12	Kyperounda I	53	-	690	53	30	-	53	30	4	107
13	Kyperounda II	273	-	199	273	213	-	273	213	22	474
14	Lagouthera	70	-	147	70	25	-	70	25	6	39
15	Melini	59	-	123	59	31	-	59	31	5	128
16	Agrihia	59	-	642	50	41	-	50	41	4	100
17	Pelendria pond & B/H 53/76	123	160	123	123	64	97	220	161	10	501
18	Arakapas B/H "Angoulos" 124/76	-	50	123	-	-	16	16	16	-	100
19	Arakapas B/Hs "Scoli" 106/76 & 107/76	-	90	240	-	-	80	80	80	-	302
20	Polystypos B/H 21/77	-	15	84	-	-	8	8	8	-	84
21	Potamitissa B/Hs 67/76 & 69/79B	-	120	265	-	-	56	56	56	-	219
22	Kalon Khorio 54/76, 11/77	-	125	526	-	-	50	50	50	-	278
23	Ayios Theodoros B/H 105/76	-	65	126	-	-	33	33	33	-	126
24	Ora Pond & B/Hs 27/81, 66/81	62	42	181	62	50	7	69	57	5	178

TABLE X-6b DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSIILIA PROJECT (Cont.)

Ser. No.	Project	Capac. m ³ x10 ³	Yield m ³ /h	Area comm. Decars	Water avail. stor. m ³ x10 ³	Water used for irrig. from dam m ³ x10 ³	Water extr. from b/h m ³ x10 ³	Total water avail. m ³ x10 ³	Total water used m ³ x10 ³	Evap. Losses m ³ x10 ³	Area irrig. hect.
25	Pharmakas I)	21	-	181	21	12	-	21	12	2)	135
26	Pharmakas II)	61	-		61	32	-	61	32	5)	
27	Arakapas II	119	-	254	119	41	-	119	41	10	202
28	Ayii Vavatsimias II	44	-	183	44	19	-	44	19	4	52
29	Dhierona I	159	-	401	159	164	-	159	164	13	386
30	Dhierona B/H 14/82	-	54	127	-	-	33	33	33	-	149
31	Sykepetra B/H 48/82	-	45	120	-	-	22	22	22	-	115
32	Ayios Konstantinos B/Hs 123/76, 8/81	-	116	401	-	-	39	39	39	-	266
33	Louvaras B/Hs 32/77, 16/81,	-	140	355	-	-	70	70	70	-	227
34	Ayii Vavatsimias B/H 35/81	-	50	134	-	-	32	32	32	-	64
35	Askas B/H 98/80	-	60	214	-	-	40	40	40	-	173
36	Alona B/H 46/80	-	50	100	-	-	30	30	30	-	60
37	Lagoydhara B/H 53/80	-	25	60	-	-	9	9	9	-	12
38	Agros B/H 21/82	-	82	241	-	-	49	49	49	-	134
39	Dhymies B/H 81/80	-	80	265	-	-	63	63	63	-	262
40	Kato Amiantos scheme	1	56	674	-	-	13	13	13**	-	509
41	Zoopiyi B/H 9/81	-	49	134	-	-	24	24	24	-	86
		2193	1606	9977	2167	1361	847	3548	2226	175	7648

1. Borehole and river diversion scheme.

* Some quantity of the water from the borehole was given for DWS.

** Water utilization from the river flow and borehole.

TABLE X-7
RECHARGE WORKS DATA

Ser No.	Project	Capacity m3 x1000	Water available m3 x1000	Water used for recharge m3 x1000	Water lost in evaporation m3 x1000
1X	Kouklia	4 545	-	-	-
2X	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
7X	Famagusta Antiflood	50	-	-	-
8	Phrenaros	160	NIL	NIL	NIL
9	Dherinia	23	NIL	NIL	NIL
10	Avgorou	68	NIL	NIL	NIL
11X	Kondea	82	-	-	-
12	Xylophaghou ..	86	NIL	NIL	NIL
13X	Lysi	77	-	-	-
14X	Ayios Yeoryios (K)	68	-	-	-
15X	Ayios Epiktitos	34	-	-	-
16X	Akanthou	45	-	-	-
17XX	Akhna	40	NIL	NIL	NIL
18	Xylotymbou ...	50	NIL	NIL	NIL
19X	Syngrasis	1 115	-	-	-
20X	Ayios Yeoryios (F)..	190	-	-	-
21X	Famagusta Recharge	165	-	-	-
22X	Ayios Nicolaos Fam	1 365	-	-	-
23	Paralimni Lake	1 365	NIL	NIL	NIL
24X	Fresh Water Lake	4 545	-	-	-
25X	Makrasyka	195	-	-	-
26X	Akhna Mesaoria	90	NIL	NIL	NIL
27	Vrysoulles Fam.	140	-	-	-
28X	Morphou Recharge	130	-	-	-
29X	Morphou Proto- papas	90	-	-	-

TABLE X-7
RECHARGE WORKS DATA (Cont.)

Ser No.	Project	Capacity m3 x1000	Water available m3 x1000	Water used for recharge m3 x1000	Water lost in evapo- ration m3 x1000
30	Ormidhia (Vathys)	100	NIL	NIL	NIL
31X	Masari	2 273	-	-	-
32	Liopetri	325	NIL	NIL	NIL
33	Yialias	NA	NIL	NIL	NIL
34	Merikas	NA	NIL	NIL	NIL
	Total	18 063	NIL	NIL	NIL

X Projects in Turkish occupied area. Gate constantly open for recharge.

XX Some of the dams of the project are in Turkish occupied area.

TABLE X-8 DATA ON MANAGEMENT AND OPERATION OF GOVERNMENT IRRIGATION PROJECTS FOR THE LAST TWO YEARS

Item No.	Data	Unit	1986	1987	% Change on 1986
1	Capacity	1000m3	120 894	147 368	+21.9
2	Water available	"	67 006	117 996	+76.1
3	Water utilized for irrigation	"	28 734	27 618	-3.9
4	Water utilized for DWS	"	10 606	14 872	+40.2
5	Water utilized for recharge	"	6 208	5 860	- 5.6
6	Total water used ...	"	45 548	48 350	+ 6.2
7	Evaporation losses .	"	3 152	6 451	+104.7
8	Seepage losses	"	556	1 227	+120.7
9	Water sold	"	27 359	25 935	- 5.2
10	Gross income	£	1043 594	1146 669	+ 9.9
11	Power cost	"	307 011	222 413	-27.6
12	Operation cost	"	182 750	214 671	+117.5
13	Maintenance cost ...	"	279 803	308 529	+10.3
14	Total expenses	"	769 564	745 613	- 3.1
15	Net income	"	274 030	401 056	+46.4
16	Area irrigated	Hectars	7 215	7 966	+10.4
17	Area commanded	"	11 581	13 581	+17.3

COST OF OPERATION ON SOME GOVERNMENT PROJECT

The operational cost of a number of important projects are shown on Table X-9. This table shows the running costs (O+M and Power) and the unit cost of water.

TABLE X-9 - GOVERNMENT IRRIGATION PROJECTS - COST OF WATER

Ser.	Project	Water Sold m ³	Total water utilized m ³		Operation Cost		Maintenance Cost		Power cost £	Total annual cost £	Cost of water* cent/m ³	
			£	£	£	£	Sold water £	total utilized				
1	Angaka	852000	1222000	9892	3737	2755	16394	1.9	1.3			
2	Ayia Marina	305000	305000	6129	1534	NIL	7663	2.5	2.5			
3	Kalopanayiotis	209000	209000	3838	1359	NIL	5197	4.8	4.8			
4	Kiti	NIL	NIL	NIL	NIL	NIL	NIL	-	-			
5	Pomos	814000	814000	12691	3225	1754	17670	2.2	2.2			
6(i)	Polemihia	4256000	13905000	91016	22748	24233	137997	3.2	1.0			
	(ii) Yermasoyia											
7	Paphos	15783000	17544000	59965	240658	186920	487543	3.1	2.8			
8	Khrysokhou valley	452000	452000	7214	5671	6741	19626	4.3	4.3			
9	Xyliatos	657000	657000	2283	3738	NIL	6021	0.9	0.9			
10	V.P.P. (i) Kalavasos											
	(ii) Dhyopotamos	2337000	12168000	21643	25859	NIL	47502	2.0	0.4			
	(iii) Lefkara											
11	Khrysokhou (Evretou)	218000	218000	NIL	NIL	NIL	NIL	-	-			
Total		25887000	47076000	214671	308529	222413	745613	2.9	1.6			

* It does not include capital cost.

WATER QUALITY OF THE PROJECTS

During the year under review samples of water were taken from the various projects for chemical analysis. Remarks on water quality of the project are shown on tables X-10, X-11 and X-12.

TABLE X-10-GOVERNMENT IRRIGATION WORKS - REMARKS ON WATER QUALITY OF THE PROJECTS DURING 1987

Ser No.	Project Name	Remarks
1	Argaka	Normal elect. conductivity and high bicarbonate content.
2	Ayia Marina.....	" "
3	Kalopanayiotis ..	" "
4	Pomos	" "
5	Polemidhia	High bicarbonate content
6	Yermasoyia	" "
7	Asprokremmos	" "
8	Evretou	" "
9	Garyllis B/H No. 9/84	High sodium chloride Bicarbonate content and electrical conductivity
10	Garyllis B/H No. 47/84	" "
11	Garyllis B/H No. 38/84	High electrical conductivity and bicarbonate content.
12	Garyllis B/H No. 51/84	" "

TABLE X-11 - CONTRIBUTORY IRRIGATION WORKS - REMARKS ON WATER QUALITY OF THE PROJECTS DURING 1987

Ser No.	Project Name	Remarks
1	Akrounda	Very high electrical conductivity and bicarbonate content.
2	Kalon Khorio dam	Low electrical conductivity and high bicarbonate content.
3	Lefka Marathasa	Normal elect. conductivity and high bicarbonate content.
4	Lymbia	High: electrical conductivity, sodium chloride and bicarbonate content.
5	Lythrodontas Upper	Normal electr. conductivity and high bicarbonate content.
6	Lythrodontas Lower	" "
7	Pakhyammos	" "
8	Palekhori dam ...	Low elect. conductivity and high bicarbonate content.
9	Petra Upstream dam	High: elect. conductivity, sodium, Chloride and bicarbonate content.
10	Petra Downstream dam	High: elect. conductivity sodium and bicarbonate content.
11	Prodromos	Low electrical conductivity and high bicarbonate content.
12	Pyrgos	Normal elect. conductivity and high bicarbonate content.
13	Pera-Pedhi	Low electrical conductivity and High Bicarbonate content.
14	Khirokitia Pond	Normal elect. conductivity and high bicarbonate content.
15	Khirokitia B/H ..	High: elect. conductivity sodium, Chloride and bicarbonate content.
16	Galata Pond	Low elect. conductivity and high bicarbonate content.
17	Kandou	Normal elect. conductivity and high bicarbonate content.
18	Lefka Kafizes ...	" "

**TABLE X-12 - CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT
- REMARKS ON THE WATER QUALITY OF THE PROJECTS DURING 1987.**

Ser No.	Project Name	Remarks
1	Agros Dam	Low electrical conductivity and high bicarbonate content.
2	Agros B/H 73/76	" "
3	Akapnou-Ephtagonia Pond	Normal electr. conductivity and high bicarbonate content.
4	Arakapas Dam	" "
5	Arakapas I	" "
6	Ayii Vavatsinias dam	" "
7	Ayii Vavatsinias Pond I	" "
8	Ayii Vavatsinias Pond II	" "
9	Ephtagonia Pond I	" "
10	Ephtagonia Pond II	" "
11	Ephtagonia Pond III	" "
12	Kato Mylos Pond	Low electrical conductivity and high bicarbonate content.
13	Kato Mylos B/H	Normal electrical conductivity and high bicarbonate content.
14	Khandria Pond	Low electrical conductivity and high bicarbonate content.
15	Kyperounda Pond I	Low electrical conductivity and high bicarbonate content.
16	Kyperounda Pond II	Normal elect. conductivity and high bicarbonate content.
17	Lagoudhera B/H No 53/80	Low elect. conductivity and high bicarbonate content.
18	Melini Pond	Normal elect. conductivity and high bicarbonate content.
19	Agriidhia Pond ..	Low elect. conductivity and high bicarbonate content.
20	Pelendria Pond .	" "
21	Askas B/H No. 98/80.....	" "
22	Polystypos B/H	" "
23	Potamitissa B/H 69/79B	" "
24	Potamitissa B/H 67/76	" "
25	Dhynes B/H No. 81/80	" "

26	Ora Pond	Normal elect. conductivity and high bicarbonate content.
27	Pharmakas Pond I	Low electrical conductivity.
28	Pharmakas Pond II	" "
29	Arakapas Pond II	Normal electrical conductivity and high bicarbonate content.
30	Dhierona Pond	Low electrical conductivity and high bicarbonate content.

DETAILS OF MAINTENANCE WORKS

A. CONTRIBUTORY IRRIGATION WORKS

1. Palekhori dam:
Repair of main water meter.
Maintainance of metal structures and power generator.
2. Pakhyamos dam:
Cleaning of drainage ditch channels.
3. Prodromos dam:
Repairs to fence and sluice volves.
4. Pyrgos:
Purchase of penstock.
Repairs of sluice valves.
Cleaning of canal.
Construction of ports.
5. Pera Pedhi:
Removal of silt from dam reservoir.
6. Lymbia dam:
Repairs to canals and joints.
7. Kampos:
Repairs to pipe breakages. Replacing of electrical equipment
Replacement of electrical equipment.
Routine maintenance.
8. Chakistra:
Repairs to pipe breakages. Replacing of electrical equipment.
Replacement of electrical equipment.
Routine maintenance.
9. Yerakies:
Repairs to pipe breakages. Replacing of electrical equipment.
Replacement of electrical equipment.
Routine maintenance.
10. Petra:
Maintainance of penstocks.
11. Lythrodhondas:
Fencing of dam.
12. Lefka Kafizes:
Repairs to outlet system.
13. Khirokitia pond:
Cleaning of embankment from wild vegetation.
Cleaning of drainage ditch channels and diversion weir.

TABLE X-13a - CONTRIBUTORY IRRIGATION WORKS - MAINTENANCE COSTS

Ser No.	Project	Govt. Contrib. £	ID Contrib. £	Total Cost £
1	Palekhorl dam	436	218	654
2	Pakhyammos dam (Special case)	35	NIL	35
3	Prodromos dam	164	17	181
4	Pyrgos	2 363	NIL	2 363
5	Pera Pdhi	256	255	511
6*	Lymbia dam	313	NIL	313
7	Kambos)	688	229	917
8	Chakistra)	4 492	1 495	5 987
9	Yerakies)	203	68	271
10	Petra	55	28	83
11	Lythrodhondas	1 386	693	2 079
12	Lefka Kafizes	NIL	NIL	159
13	Khirokitia pond & B/H No. 136/78	209	105	314
	Total	10 600	3 108	13 708

* It operates like a government project.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

- 1 Alona B/H No.46/80:
Installation of two sluice valves.
Repairs to electric pumping unit and installation of a time switch.
- 2 Polystypos B/H No.21/77:
Repairs distribution system .
Repair of two water meters.
- 3 Lagoudhera B/H No.53/80:
Purchase of five sluice valves.
- 4 Arakapas pond No.1:
Improvements to diversion weir.
Repairs to main pipeline.
Removal of sand from the pond.
Cleaning of drainage ditch channels.
- 5 Kalon Khorio B/H Nos.11/77 & 54/76:
Extension to distribution system.
Repair to existing storage tank.
- 6 Dhierona pond:
Repairs to main pipeline.
- 7 Dhierona B/H No.14/82:
Improvements to distribution system.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT (Cont.)

- 8 Agros dam and B/H No. 63/76:
Installation of a water level indicator.
Extension and repairs to distribution system.
Cleaning of feeder channels.
- 9 Agridhia pond:
Repairs to distribution system.
- 10 Kato Mylos Pond and B/H No.66/76:
Repairs to electric pumping unit and to floating valve.
Installation of sluice valves and airvalves.
Improvements to diversion weir.
Cleaning of embankment of the pond from wild vegetation.
- 11 Arakapas B/H Nos. 106/76 & 107/76:
Repairs to distribution system.
- 12 Kyperounda No.2:
Cleaning of drainage ditch channels.
Installation of a water level indicator.
Extension and repairs to distribution system.
- 13 Ayios Theodoros B/H No. 105/76:
Repairs to electric pumping unit.
Installation of two airvalves.
- 14 Dhymes B/H No. 81/80:
Extension and repairs to pipelines.
Repair of water meters.
- 15 Potamitissa B/H Nos 67/76 & 69/79B.
Repairs to electric pumping units.
Repairs to main pipeline and distribution system.
- 16 Kyperounda pond No.1:
Extension and repairs to distribution system.
- 17 Agros B/H No.21/82:
Improvements to a block of the distribution system.
Installation of a float valve, check valve and sluice valves.
- 18 Zoopiysi B/H No. 9/81.
Repairs to distribution system.
- 19 Akapnou-Ephtagonia pond.
Extension to distribution system.
- 20 Ayii Vavatsinias dam and pond 1:
Cleaning of drainage ditch channels.
Maintenance of metal structures and watermeters.
- 21 Ayii Vavatsinias pond 2:
Cleaning of drainage ditch channels.
Connection of outlet with main pipeline.
- 22 Ora pond & B/H: Nos. 27/81 & 66/81.
Cleaning of drainage ditch channels.
- 23 Melini pond:
Cleaning of drainage ditch channels.

**TABLE X-13b CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT
MAINTENANCE COSTS**

Ser No.	Project	Maintenance Cost £		
		Gov. Cont.	I.D.Cont.	Total Cost
1	Alona B/H No.46/80	92	46	138
2	Polystypos B/H No.21/77 .	600	NIL	600
3	Lagoudera B/H No.53/80 ..	10	5	15
4	Arakapas pond No.1	800	400	1 200
5	Kalon Khorio B/H No.54/76	698	349	1 047
6	Dhierona pond	80	40	120
7	Dhierona B/H No.14/82 ...	228	114	342
8	Agros Dam and B/H No.63/76	760	380	1 140
9	Agridhia pond	170	85	255
10	Kato Mylos pond and B/H No.66/76	648	324	972
11	Arakapas B/H Nos.106/76 & 107/76	106	53	159
12	Kyperounda pond No.2	1 224	612	1 836
13	Ayios Theodoros B/H No.105/76	120	110	230
14	Dhymes B/H No.81/80	454	227	681
15	Potamitissa B/H Nos.67/76 & 69/79B	273	137	410
16	Kyperounda pond No.1	214	107	321
17	Agros B/H No.21/82	230	115	345
18	Zoopiyi B/H No.9/81	24	12	36
19	Akapnou-Ephtagonia & Pond	144	72	216
20	Ayii Vavatsinias dam & pond	333	167	500
21	Ayii Vavatsinias pond 2	455	227	682
22	Ora pond and B/H Nos.27/81 & 66/81	300	150	450
23	Melini pond	92	46	138
24	Pelendria pond and B/H Nos.53/78	1 093	99	1 192
25	Kato Amiantos	197	98	295
	Total	9 345	3 975	13 320

RECHARGE WORKS - DETAILS OF MAINTENANCE WORKS

1. Yialias:
Removal of accumulated silt from recharge dams.
Ripping of some dams.
2. Merikas:
Disilting of the dams.
3. Kokkinokhoria:
Cleaning of canal at Paralimni.

TABLE X-14 - RECHARGE WORKS - MAINTENANCE COSTS

Ser No.	Project	Maintenance cost
1	Yialias	880
2	Merical	775
3	Kokkinokhoria	300
	Total	----- 1 955

DETAILS ON OPERATION AND MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

ARGAKA PROJECT

The Argaka Irrigation Project consists of a dam reservoir of maximum capacity at Spillway crest 0.990 MCM and a distribution system made of closed conduits commanding an area of 3,136 decars. Irrigation in the Project area started late in January and lasted until late in December 1987. An area of 2,006 decars was irrigated by utilizing about 1.222 MCM of water.

The area irrigated was planted with citrus, bananas, vines, deciduous, vegetables, cereals and avocados. Out of the 1,222 MCM of water utilized 851 514 m³ were sold to the farmers at the nominal rates and an amount of 370 502 m³ was taken from the overflow, free of charge. The gross income from the sale of water was £29,219. The expenditure of management was £9,892 on power £2,765 and that on maintenance amounted to £3,737. Net income to the Project was £12,825.

Project Hydrology

The project hydrologic data, as recorded during the year, are tabulated on Table X-15. The dam reservoir was filled to spillway crest on February 11th and overflow continue until May 19th 1987. The overspilled quantity could not be measured. The minimum level of water in storage ever reached was in December with total quantity in storage around 84,000 m³.

TABLE X-15 - ARGAKA DAM & BOREHOLES - HYDROLOGY FOR 1987

Item No.	Description	Quantity m ³	% of Storage capacity
1	Intitial amount in storage	115 000	11.6
2	Inflow-Seepage	1 341 505	135.5
3	Total-Release	1 117 000	112.8
4	Leakages	4 250	0.4
5	Evaporation	85 255	8.6
6	Overflow	not measured	-
7	Final amount in storage	227 000	22.9
8	Minimum quantity in storage (Dec.)	84 000	8.5
9	Storage capacity	990 000	100.0
10	Water pumped from Boreholes	212 488	

Water Utilization and Crops Irrigated

The project was built for irrigation purposes and as such, a quantity of 1.222 MCM of water was utilized for the irrigation of 2,006 decars of land planted with various crops as indicated in Table X-17.

Table X-16 shows the utilization of the project water and Table X-17 shows the crops irrigated.

TABLE X-16 - ARGAKA DAM - WATER UTILIZATION

Item No.	Description	Quantity m3	% of Storage capacity
1	Water used for irrigation from dam	1 009 528	102.0
2	Water used for irrigation from boreholes	212 488	21.5
3	Water used for recharge	NIL	NIL
4	Total water utilized	1 222 016	123.5

TABLE X-17 - ARGAKA DAM - CROPS IRRIGATED

Ser No.	Crop	Area Decars
1	Citrus	965
2	Bananas	508
3	Table Crapes	17
4	Deciduous ..	174
5	Vegetables	80
6	Avocados	60
7	Alfa-Alfa	48
8	Olives	67
9	Beans	37
	Total	2 006

Water Sale, Income, Operation and Maintenance Costs

The total quantity of water utilized for irrigation, water released from the dam reservoir, water pumped from the boreholes and water taken from the overflow, amounted 1.222 MCM. Out of this a quantity of 351,514 m3 was sold to the farmers at the nominal rates and the rest 370,502 m3 was given free of charge because it was taken from the overflow. From the sale of water a total, of £29,219 was collected. For the operation of the project an amount of £9,892 was paid to the watermen and bill collectors, where for the maintenance of the project another £3,737 was spent and for the power £2,765. The net income for the benefit of the project was £12,825. All the data concerning water sale, operation and maintenance costs are shown in table X-18.

Maintenance Details

The maintenance works carried out during the year 1987 were the following:

- Cleaning of embankment from wild vegetation.
- Painting of manhole metal covers.
- Repair of sluice valves.
- Repair of watermeters.
- Repairs to pipelines.
- Cleaning of Break Pressure Tank.

TABLE X-18 - ARGAKA DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m3	Amount £
1	Water sold at nominal rates	851 514	29,219
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge*	370 502	NIL
4	Total quantity utilized and gross income	1 222 016	29,219
5	Operation cost	-	9,892
6	Power cost	-	2,765
7	Maintenance cost	-	3,737
8	Net income	-	12,825

* This quantity was taken from the overflow.

Project performance for the last two years

Table X-19 shows the performance of the project for the last two years. As shown there was a small decrease in the total volume of water used for irrigation and a small increase in the area irrigated. The net income to the project was decreased by 16.5%.

TABLE X-19 - ARGAKA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1986	1987	% Change on 1986
1	Capacity	1000 m3	990	990	NIL
2	Water available in storage	"	1423	1366	-4.0
3	Water utilized for irrigation	"	1253	1222	-2.5
4	Water sold	"	991	852	-14.0
5	Water given free	"	262	370	+41.2
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	"	29729	29219	-1.7
8	Operation cost	"	8340	9892	+18.6
9	Power cost	"	3343	2765	-17.3
10	Maintenance cost	"	2385	3737	+56.7
11	Total expenses	"	14068	16394	+16.5
12	Net income	"	15661	12825	-18.1
13	Area irrigated	decars	1942	2006	+3.3

AYIA MARINA PROJECT

The Ayia Marina Irrigation Project consist of a dam reservoir of capacity at spillway crest of 0.300 MCM and a distribution system commanding an area of 2,010 decars. The distribute the system consists of a main conduit at the terminal of which tertiary pipes branch-off to distribute water to each individual plot. Irrigation in the project area started early in January 1987 and continued throughout the year until late in December. An area of 352 decars was irrigated by utilizing about 0.309 MCM. The area irrigated was plant mainly with citrus, bananas and vegetables.

The water utilized was sold to farmers at the approved rates. The total gross income from the sale of water amounted to £9,362. The expenditure for the operation was £6,129 and that for maintenance £1,534. Net income to the project was a deficit of £1,698.

Project Hydrology

The project hydrologic data as recorded during the year, are tabulated on Table X-20.

The dam was filled up to the spillway crest on the 14th March 1987 and overflow continued until the 23rd of May 1987. Minimum quantity of water ever stored during the year under review was 50000m³ and this occurred in November 1987.

TABLE X-20 - AYIA MARINA DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage	66 300	22.1
2	Inflow - Seepage	401 684	133.8
3	Total release	331 629	110.5
4	Leakages	37 332	12.4
5	Evaporation	29 023	9.7
6	Overflow	Not measured	-
7	Final amount in storage	66 000	22.0
8	Minimum quantity in storage (Nov.)	50 000	16.7
9	Storage capacity	300 000	100.0

TABLE X-21 - AYIA MARINA DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water used for irrigation...	308 752	103.0
2	Water used for recharge	NIL	NIL
3	Total water utilized	308 752	103.0

Water Utilization and Crops Irrigated

During the year under review, a total quantity of 308 752 m³ of water was utilized for the irrigation of approximately 352 decars planted with various crops. Details about the water utilization and the crops irrigated and their extent are shown on Tables X-21 and X-22.

Water Sale, Income, Operation and Maintenance Costs

From the sale of 308,752 m³ of water, the gross income to the project, amounted to £9,361. Management and operation expenses being the wages of the water man and that of the dam attendant, amounted to £6,129.

Maintenance cost for the dam and the distribution system was £1,354 The net income to the project was £1,698. Details regarding sale of water, income and costs are given on Table X-23.

Maintenance Details

The maintenance works carried out during the year 1987 were the following:

- Cleaning of the embankment from wild vegetation.
- Cleaning of drainage ditch channels.
- Maintenance of guardhouse.
- Repairs of sluice valves and pipe breakages.
- Painting of metal works.

TABLE X-22 - AYIA MARINA DAM - CROPS IRRIGATED

Ser No.	Crop	Area decars
1	Citrus	168
2	Bananas	47
3	Deciduous	8
4	Vegetables	107
5	Table Grapes	4
6	Avocados	8
7	Alfa-Alfa	3
8	Legumes.....	7
	Total	352

TABLE X-23 - AYIA MARINA DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m3	Amount £
1	Water sold at nominal rates	267 378	9 154
2	Water sold at reduced rates	41 374	207
3	Water given free of charge	NIL	NIL
4	Total quantity utilized and gross income	308 752	9 361
5	Operation cost	-	6 129
6	Maintenance cost	-	1 534
7	Net income	-	1 698

Project Operation Data for the last two years

Table X-24 shows data on the operation of the project for the last two years. The water utilization was increased by 40.4% where the gross income by 42.0%. The total expenditure was decreased by 5.5%. The area under irrigation was increased by 11.0%.

TABLE X-24 - AYIA MARINA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1986	1987	% Change on 1986
1	Capacity	1000 m3	300	300	NIL
2	Water available in storage ...	"	388	402	+3.6
3	Water utilized for irrigation	"	220	309	+40.4
4	Water sold	"	220	309	+40.4
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	£	6593	9361	+42.0
8	Operation cost	£	6806	6129	-9.9
9	Maintenance cost	£	1301	1534	+17.9
10	Total expenses	£	8107	7663	- 5.5
11	Net income	£	-1514	1698	-
12	Area irrigated	decars	317	352	+11.1

KALOPANAYIOTIS PROJECT

The Kalopanayiotis irrigation project consists of a dam reservoir of capacity 363,000 m3 and a distribution system of closed conduits commanding an area of approximately 645 decars. Irrigation in the project area, started in April 1987 and continued throughout the year until the end of October 1987. During this period, a total quantity of 208,608 m3 of water was used for the irrigation of an area of approx. 562 decars planted mainly with deciduous, citrus and olive trees. The water was sold to the farmers at the approved rates. The gross income was £7,915. The operation expenses were £3,838 while the maintenance cost spent on routine works and emergency repairs, was £1,359. The project accounts presented a profit of £2,718.

Project Hydrology

The project hydrologic data, as recorded during the year under review, are tabulated on Table X-25. The dam scouring gate was on the 5th of January 1987 and closed on the 21st February 1987. Overflow over the spillway crest occurred during the period 6th March to 26th June 1987. The minimum quantity in storage ever occurred was in October with quantity 70050 m3.

TABLE X-25 - KALOPANAYIOTIS DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	363 000	100.0
2	Inflow - Seepage	500 000X	137.7
3	Total release	208 608	57.5
4	Leakages	150 000X	41.3
5	Evaporation	46 735	12.9
6	Overflow	NA	NA
7	Final amount in storage	363 000	100.0
8	Minimum quantity in storage (Oct.	71 000	19.6
9	Storage capacity	363 000	100.0

X Roughly estimated

NA Not Available

TABLE X-26 - KALOPANAYIOTIS DAM - WATER UTILIZATION

Item No.	Description	Quantity m3	% of Storage capacity
1	Water used for irrigation	208 608	57.5
2	Water allotted to Fishery Department and reutilized for irrigation	200 000	55.1
3	Total water utilized	208 608	57.5

Water Utilization

During the year under review, a total quantity of 208 608 m3 of water was utilized for the irrigation of 562 decars planted mainly with deciduous and small areas with citrus and olives. (See Table X-26 for water utilization). A quantity of 200 000 m3 was allotted to Fishery Department and reutilized for irrigation.

Water Sale, Income, Operation and Maintenance Costs and Details

For the sale of the water the gross income during the year under review, was £7,915. Operation expenses, including attendant and waterman wages and travelling costs, amounted to £3,838. Maintenance expenses were £1,359. The net income to the project was £2,718. Details on these are shown on Tables X-28 and X-29

Maintenance Details

- Replacing of floating valves of Break Pressure Tanks No.1 and No.2
- Repair of air valves and sluice valves.
- Repairs to breakages of main pipeline.
- Painting of metal covers of the manholes.
- Removing of the silt from the dam reservoir
- Painting of wood work of control room.

TABLE X-27 - KALOPANAYIOTIS DAM - CROPS IRRIGATED

Ser. No.	Crop	Area decars
1	Citrus	40
2	Olive trees	7
3	Deciduous	502
4	Kiwi	13

	Total	562

TABLE X-28 - KALOPANAYIOTIS DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m3	Amount £
1	Water sold at nominal rates	208 608	7 915
2	Water sold at reduced rates	NIL	NIL
3	Water given free	NIL	-
4	Total quantity utilized and gross income	208 608	7 915
5	Operation cost	-	3 838
6	Maintenance cost	-	1 359
7	Net income	-	2 718

TABLE X-29 - KALOPANAYIOTIS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1986	1987	% Change on 1986
1	Capacity	1000 m3	363	363	NIL
2	Water available in storage .	"	394	466	+18.3
3	Water utilized for irrigation	"	195	209	+ 7.2
4	Water sold	"	195	209	+ 7.2
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	£	6815	7915	+16.1
8	Operation cost	£	2834	3838	+35.4
9	Maintenance cost	£	1722	1359	-21.0
10	Total expenses	£	4556	5197	+14.1
11	Net income	£	2259	2718	+20.3
12	Area irrigated	decars	533	562	+ 5.4

Project Operation Data for the last two years

Table X-29 shows the operation data for the last two years. The amount of water utilized for irrigation, was increased by 7.2% and the area irrigated by 5.4%.

The operational costs were increased 35.4% whereas the maintenance costs were decreased by 21.0%. The net income to the project was increased by 20.3%. The water utilization in the project area seems satisfactory although further increase of the quantity utilized is expected.

KITI DAM

The Kiti dam irrigation project consists of a dam reservoir of storage capacity 1,610,000 m³ and a distribution system, made of open canals commanding an area of approximately 830 Hectars in the Kiti, Perivolia and Tersefanou villages. For the year under review the dam was dry.

POMOS PROJECT

The Pomos irrigation project consists of a dam reservoir of maximum capacity at spillway crest of 860,000 m³ of water and a distribution system made of a main canal and closed type distribution system commanding an area of 381 Hectars.

Irrigation in the project area started early in March 1987 and continued throughout the year until early in December 1987.

An area of 140 Hectars of land planted with citrus, bananas and vegetables was irrigated by utilizing 813,664 m³ of water. From the total water utilized, 691,139 m³ were taken directly from the dam reservoir, and the rest 122 525 m³ were pumped from the boreholes.

The total gross income from the sale of water amounted to £23,740. The expenditure for the maintenance was £3,225 whereas the power cost was £1,754 and the operation and management costs were £12,691. net income to the project for the year under review was £6,070.

Project Hydrology

The project hydrologic data as recorded during the year are tabulated on table X-30.

The reservoir was filled to spillway crest and overflow occurred during the period February 1st to May 21st 1987. Minimum water level in the reservoir occurred in October with water in storage around 122,000 m³.

TABLE X-30 - POMOS DAM & BOREHOLES - HYDROLOGY FOR 1987

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage ..	415 900	48.4
2	Inflow-Seepage-Overflow	769 349	89.4
3	Total release	816 426	94.9
4	Leakages	125 150	14.6
5	Evaporation	74 294	8.6
6	Overflow	not measured	-
7	Final amount in storage	168 000	19.5
8	Minimum quantity in storage (Oct.)	122 000	14.2
9	Storage capacity	860 000	100.0
10	Water pumped from boreholes	122 525	

Water Utilization and Crops Irrigated

The 813,664 m³ of water was utilized for the irrigation of 126 Hectars within the project area. Details about the water utilized and the crops irrigated are shown on tables X-31 and X-32.

TABLE X-31 - POMOS DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water used for irrigation from dam	691 139	80.4
2	Water used for irrigation from boreholes	122 525	14.2
3	Water used for recharge	NIL	
4	Total water utilized	813 664	94.6

TABLE X-32 - POMOS DAM - CROPS IRRIGATED

Item No.	Crop	Area Decars
1	Citrus	729
2	Bananas	311
3	Deciduous	11
4	Vegetables	80
5	Cereals	160
6	Avocados	59
7	Olive trees	34
8	Alfa-Alfa	20

		1 404

Water Sale, Income, Operation and Maintenance Costs

The total quantity utilized for irrigation, water released from the dam reservoir, water pumped from the boreholes and water taken from the overflow amounted to 813,664 m³. Out of this 673,706 m³ were sold at the nominal rates and the rest 139,958 m³ were sold at reduced rates because that quantity was taken from the overflow.

From the sale of water (see details on table X-33) the total gross income amounted to £23,740 whereas the operation and management costs were £12,691. Maintenance cost on the dam and the distribution system was £3,225. The power cost was £1754. The net income to the project for the year under review amounted to £6,070.

Maintenance Details

The maintenance works carried out during the year 1987 were the following:

- Cleaning of embankment from wild vegetation.
- Painting of metal structures and woodwork of the tower bridge.
- Replacement and repair of sluice valves.
- Cleaning of canals and repairing of joints.
- Cleaning of drainage ditch channels.

TABLE X-33 - POMOS DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m3	Amount £
1	Water sold at nominal rates	673 706	23 060
2	Water sold at reduced rates	139 958*	680
3	Water given free of charge	NIL	NIL
4	Total quantity utilized and gross income	813 664	23 740
5	Operation cost	-	12 691
6	Power cost	-	1 754
7	Maintenance cost	-	3 225
8	Net Income	-	6 070

* This quantity was taken from the overflow.

Project Performance Data for the Last Two Years

Table X-34 shows data regarding hydrology, water utilization, water sales, gross income, operation, maintenance costs, net income and areas irrigated for the last two years.

The last column of the table shows the change in percentages of the quantities of 1987 over the previous year.

The quantity of water utilized for irrigation was slightly increased while the gross income was slightly decreased of the rates.

TABLE X-34 - POMOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1986	1987	% Change on 1986
1	Capacity	1000m3	860	860	NIL
2	Water available in storage	"	1 217	1 125	- 7.5
3	Water utilized for irrigation	"	810	814	+ 0.5
4	Water sold	"	810	814	+ 0.5
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge .	"	NIL	NIL	NIL
7	Gross income	£	24 045	23 740	- 1.3
8	Operation	£	12 241	12 691	+ 5.2
9	Power cost	£	3 051	1 754	- 42.0
10	Maintenance cost	£	2 321	3 225	+ 38.9
11	Total expenses	£	17 613	17 670	+ 0.3
12	Net income	£	6 432	6 070	- 5.6
13	Area irrigated	Hectars	126	140	+ 11.1

YERMASOYIA - POLEMIDHIA PROJECT

The Yermasoyia-Polemihdia Project consists of the Yermasoyia dam, the reservoir of which has a capacity of 13.5 MCM and the Polemidhia dam with reservoir capacity of the order of 3.43 MCM. The distribution system of the project consists to closed conduits now commanding an area of about 2,066 Hectars.

To supplement the area with water due to shortage from the dam the Kouris and Garillis boreholes were set in operation. A quantity of 3.536 MCM of water was pumped from the boreholes 2.371 MCM from that of Kouris and 1.165 MCM from that of Garillis. From the amount of 2.371 MCM pumped from Kouris boreholes an amount of 2.060 MCM was used for domestic water supply, 88,000 m3 for irrigation and 223,000 m3 for recharge. The water pumped from Garillis Boreholes was used for irrigation.

A total quantity of 15.001 MCM was released from both dams and pumped from the boreholes (10.324 MCM from Yermasoyia, 1.141 MCM from Polemidhia, 2,371 MCM from Kouris and 1.165 MCM from Garillis). Out of the 15.001 MCM, 4.769 MCM were used for irrigation, 4.099 MCM for recharge and 5.041 MCM for Domestic Water Supply. The rest 1.092 MCM were lost.

Irrigation in the project area started early in January and continued throughout the year until late in December 1987. The quantity of 4.769 MCM was used for irrigation of 2066 Hectars (partial or full) in the Zakaki, Phasouri, Akrounda and Phinikaria areas and Yermasoyia and Polemidhia Irrigation Division. Of the quantity used for irrigation a quantity of 4,256,331 m3 were sold at the nominal rates. The rest 513,105 m3 were given free of charge as water rights to Yermasoyia and Polemidhia Irrigation Division (327,889 m3 for Yermasoyia ID and 185,216 m3 for Kato Polemidhia ID).

The quantity released and pumped for recharge 4.099 MCM was used to recharge the Yermasoyia aquifer downstream the dam structure. These aquifers are pumped for the supply of water for domestic use for the Limassol town, the Moutayiaka regional water supply scheme and for irrigation in the Zakaki area.

The total gross income from the sale of water amounted to £164,709. The operation costs amounted to 91,016, the power costs to £24,233 and the maintenance costs amounted to £22,748. The net income to the project was £26,712.

Water Resources

The project developmend a quantity of 15.001 MCM which it was taken from the dams, Kouris Boreholes and Garillis Boreholes as shown on table X-35.

TABLE X-35 YERMASOYIA-POLEMIDHIA PROJECT - WATER RESOURCES

Item No.	Source	Quantity m3
1	Yermasoyia Dam	10 323 640
2	Polemidhia Dam	1 140 953
3	Kouris Boreholes	2 371 030
4	Garillis Boreholes	1 165 400
	Total quantity delivered	15 001 023

Project Hydrology

The project hydrologic data as recorded during the year under review are tabulated on the following tables. The data for each dam reservoir are given separately.

POLEMIDHIA DAM

The inflow seepage to the Polemidhia dam during the year under review totalled 3.263 MCM representing 95.1% of the reservoir capacity. The reservoir was not filled to spillway crest but it remain much lower with maximum quantity in storage around 2.719 MCM on the 22nd April 1987. Leakages occurred through the dam and part of these were intercepted downstream for irrigation purposes. Releases from the dam reservoir were 1.141 MCM.

TABLE X-36 - POLEMIDHIA DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage ...	199 000	4.5
2	Inflow-Seepage	3 263 223	95.1
3	Total release	1 140 953	33.3
4	Leakages	744 159	21.7
5	Evaporation	256 111	7.5
6	Overflow	NIL	NIL
7	Final amount in storage	1 320 000	-
8	Minimum quantity in storage (Dec.)	967 000	28.2
9	Storage capacity	3 430 000	100.0

YERMASOYIA DAM

The Inflow-Seepage to the dam during the year review was estimated at 17.773 MCM mostly occurring in the months of January to May and in December. The dam reservoir was filled up the spillway crest on the 1st of April 1987 and overflow continued until the 17th of May 1987

TABLE X-37 - YERMASOYIA DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	1 098 000	8.1
2	Inflow-Seepage	17 772 818	131.6
3	Total release	10 323 640	76.5
4	Leakages	NIL	NIL
5	Evaporation	1 206 178	8.9
6	Overflow	NIL	NIL
7	Final amount in storage	7 334 000	54.3
8	Minimum quantity in storage (Dec.)	5 447 000	40.3
9	Storage capacity	13 500 000	100.0

* Roughly estimated

Water Utilization

Details regarding water utilization from both dams and aquifers separately and in combine with Kouris and Garillis Boreholes are shown on tables X-38, X-39, X-39a and X-40. In summary during the year under review a total quantity of 13.909 MCM was utilized for irrigation, domestic water supply and recharge purposes. Out of this quantity 4.769 MCM were utilized for irrigation, 4.099 for recharge and the rest 5.041 MCM were used for domestic water supply.

TABLE X-38 - POLEMIDHIA DAM - WATER UTILIZATION

Item No.	Description	Quantity m3	% of storage capacity
1	Water release for irrigation ...	1 140 953	33.3
2	Water used for recharge	NIL	NIL
3	Total water utilized	1 140 953	33.3

TABLE X-39 - YERMASOYIA DAM - WATER UTILIZATION

Item No.	Description	Quantity m3	% of Storage capacity
1	Water release for irrigation ..	3 466 640	25.7
2	Water used for recharge	3 875 800	28.7
3	Water used for D W S	2 981 200	22.1
4	Total water utilized	10 323 640	76.5

TABLE X-39A - AQUIFERS WATER UTILIZATION

Item	Description	Quantity m3
1	Water pumped for irrigation ...	1 253 900
2	Water used for DWS	2 059 560
3	Water used for recharge.....	222 970
	Total	3 536 430

TABLE X-40 - YERMASOYIA-POLEMIDHIA PROJECT - WATER UTILIZATION

Ser. No.	Description	Quantity m3
1	Water used for irrigation	4 769 436
2	Water used for recharge (Yermasoyia Dam & Kouris Delta boreholes)	4 098 770
3	Water used for DWS	5 040 760
4	Total water utilized	13 908 966
5	Total water delivered	15 001 023
6	Water losses in distribution system and water meter discrepancies	1 092 057

TABLE X-41 - YERMASOYIA-POLEMIDHIA PROJECT-IRRIGATED CROPS

Ser. No.	Crop	Area Hectars
1	Citrus	971
2	Vines	516
3	Deciduous	17
4	Vegetables	559
5	Olive trees	3

		2 066

From the sale of water the total gross income was £164,709. The operation cost totalled £91,016 and the power cost totalled £24,233 where the maintenance cost spent on routine works was £22,748. Details regarding and expenditure are show on table X-42.

Maintenance Details

The following works were carried out during the year under review.

Distribution system

- Repairs to pipe breakages.
- Repairs of water meters, sluice valves, flow regulators, air valves and float valves.
- Maintainance of water meters flow regulators and sluice valves.
- Replacement of watermeters.
- Repairs to plumbing installation of Trakhoni Pumping Station.
- Installation of a washout on main pipeline.
- Cleaning of manholes.
- Painting of metal structures in Trakhoni Pumping Station and Ypsonas Storage tank.
- Painting of metal parts of manholes.
- Installation of a gate valve.

TABLE X-42 - YERMASOYIA-POLEMIDHIA PROJECT-INCOME AND EXPENDITURE DATA

Ser No.	Description	Quantity m3	Amount £
1	Water sold at nominal rates	4 256 331	164 709
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge as water rights to:		
	- Yermasoyia Irrig. Division ..	327 889	NIL
	- Polemidhia Irrig. Division ...	185 216	NIL
4	Total quantity/income	4 769 436	164 709
5	Operation cost	-	91 016
6	Power cost	-	24 233
7	Maintenance cost (Yermasoyia & Polemidhia & Kouris Delta Boreholes)	-	22 748
8	Total cost	-	137 997
9	Net income	-	26 712

From the above table it can be seen that the net income from the sale of water was £26,712.

Project Operation Data for the last two years

Table X-43 gives data regarding operation for the last two years. The last column shows the percentage variation of these data with respect to 1986 figures.

TABLE X-43 - YERMASOYIA-POLEMIDHIA PROJECT - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser No.	Description	Unit	1986	1987	% change on 1986
1	Capacity	1000 m3	16 930	16 930	NIL
2	Water available (Y & P & Kouris & Garillis BHS)....	"	15 722	23 663	+50.7
3	Water utilized for irrigation	"	4 626	4 769	+ 3.1
4	Water sold	"	4 265	4 256	- 0.2
5	Water given free	"	361	513	+42.1
6	Water used for recharge ..	"	5 512	4 099	-25.6
7	Water used for DWS	"	3 055	5 041	+65.0
8	Total quantity used	"	13 194	13 909	+ 5.4
9	Gross income	"	143 347	164 709	+14.9
10	Operation cost	"	72 157	91 016	+26.1
11	Power cost	£	67 557	24 233	-64.1
12	Maintenance cost	£	28 333	22 748	-19.7
13	Total expenditure	£	168 048	137 997	-91.8
14	Net income	£	24 701	26 712	+ 3.1
15	Area irrigated	Hectars	2 066	2 066	NIL

PAPHOS IRRIGATION PROJECT

The Paphos Irrigation Project is the largest and most important project of its kind ever undertaken in Cyprus. Construction of the civil works commenced in 1976 and they were completed by the end of 1983. The project consists of the Asprokremmos dam of maximum capacity at spillway crest of 51.00 MCM. Mavrokolymbos dam of max. cap.2.180 MCM, a wellfield (24 nos boreholes) and Dhiarizos and Ezouza Diversions all sources of total annual safe yield of 32.00 MCM with a reliability of supply well above 92%. The project area is a coastal strip some 38 km long by 3 to 4 km wide with the town of Paphos at its centre. The total area commanded by the Project is 5,050 Hectars. The distribution system is made of canals and pipes and it is the first project on the island to operate on the "on demand" mode.

The water quantity used was taken from the Asprokremmos dam, the boreholes the diversion from the Dhiarizos and Ezouza rivers and the Mavrokolymbos dam. Irrigation in the project area started in January 1987 and was completed late in December 1987. During the period a quantity of 15.783 MCM of water was utilized for the irrigation of 3,925 hectares of land, planted with various crops.

In brief the water was utilized as shown on Table X-47. The crops irrigated were citrus, vegetables etc. as shown on Table X-48.

The operation and maintenance of the project is the responsibility of the WDD. From the sale of water at the nominal rates the income for 1987 is around £736,568. The operation expenses amounted to £59,965 whereas the maintenance expenses amounted to £240,658 and the power cost to 186,920. The total annual cost amounted to £487,543. The net income to the project was £249,025.

The hydroelectric power station of Asprokremmos dam was set in operation. On the 18th May 1987. The Station generated 43 million KWH of electricity during the period May to December 1987. From the sale of electricity to the system of the Electricity Authority of Cyprus an amount of £15,649 was received.

Project Hydrology & Water Resources

The water in the Asprokremmos dam did not reach spillway crest but it remained lower with maximum quantity in storage around 43.146 MCM on the 18th May 1987. The maximum quantity in storage in Mavrokolymbos dam was 378,000 m3 of water on the 22nd May 1987. A total quantity of 20.607 MCM was delivered from the dams reservoirs, Ezouza and Dhiarizos rivers diversion and from private boreholes in the project area as shown on table X-44.

TABLE X-44 - PAPHOS PROJECT - WATER RESOURCES

Item No.	Source	Quantity m3
1	Asprokremmos Dam	7 987 955
2	Ezouza and Dhiarizos surface flow diversion and boreholes..	10 834 628
3	Mavrokolymbos Dam	784 400
4	Private Boreholes	1 000 000*
	Total	20 606 623

* Roughly Estimated

Hydrology of Dams

The hydrologic data for Asprokremmos dam and Mavrokolymbos dam as recorded during the year under review are tabulated on Tables X-45 and X-46 respectively.

TABLE X-45 - ASPROKREMIOS DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	10 800 300	20.6
2	Inflow - Seepage	38 956 718	74.4
3	Total release	10 179 812	19.4
4	Leakages	71 680	0.2
5	Evaporation	3 215 526	6.1
6	Overflow	NIL	NIL
7	Final amount in storage	36 261 000	69.2
8	Minimum quantity in storage (Dec.)	33 432 000	63.8
9	Storage capacity	52 375 000	100.0
10	Water available in storage	46 469 812	88.7

TABLE X-46 - MAVROKOLYMBOS DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	274 000	12.6
2	Inflow-Seepage	821 171	37.7
3	Total release	772 800	35.4
4	Leakages	NIL	NIL
5	Evaporation	95 371	4.4
6	Overflow	NIL	NIL
7	Final amount in storage	227 000	10.4
8	Minimum quantity in storage (Oct.)	150 000	6.9
9	Storage capacity	2 180 000	100.0
10	Water available in storage	999 800	45.9

Water Utilization and Crops Irrigated

From the water developed, about 2.062 MCM were lost in the canal and distribution system, 54,525 m3 were used by industries and the remaining 15.728 MCM were used for the irrigation of 3,925 Hectars planted with various crops as shown on Table X-48 (See Table X-49 for water utilization).

TABLE X-47 - PAPFOS IRRIGATION PROJECT - WATER UTILIZATION

Item No.	Description	Quantity m3
1	Water used for irrigation	15 728 562
2	Water used by industries	54 525
3	Water used for recharge	1 761 100
4	Total water utilized	17 544 187
5	Total water lost	2 062 436
6	Total water delivered from headworks	20 606 623

TABLE X-48 - PAPHOS IRRIGATION PROJECT - CROPS IRRIGATED

Ser No.	Crop	Area Hectars
1	Citrus	770
2	Bananas	390
3	Vines	396
4	Onions	48
5	Vegetables	134
6	Potatoes	517
7	Melons	104
8	Avocados	44
9	Alfa-Alfa	65
10	Ground-nuts	429
11	Legumes	826
12	Deciduous	74
13	Pecan	40
14	Seasonal	60
15	Other	28
	Total	3 925

Water Sale, Income, Operation and Maintenance Costs

The project developed a quantity of 20.607 MCM out of which 15.729 MCM were used for irrigation, and 0.054 MCM were used for industrial purposes, while the rest 2.062 MCM were lost. The water was sold at the nominal rates. From the sale of water the total income amounted to £736,568 whereas the operation, maintenance and power costs were £487,543. Details are shown on Table X-49.

Maintenance Details

The maintenance works carried out on the project during the year 1987 were the following:

Distribution System

- Cleaning of main canal, canaletti and Mavrokolymbos canal.
- Cleaning of pumping stations, regulating and storage tanks.
- Cleaning of canaletti from aquatic vegetation.
- Painting of metal parts in pumping stations.
- Repairs of hydrants, water meters, flow limit devices pressure regulators and other hydraulic equipment.
- Maintenance of access roads and drainage ditch channels.
- The sewage system of Akhelia pumping station was changed to operate by gravity.
- Improvements to project warehouse.
- Repairs to pipe breakages.

Asprokremmos Dam

- Painting of metal structures and woodwork.
- Maintenance and painting of the Guardhouse.
- Grouting works in the galleries.

Mavrokolymbos Dam

- Maintenance and painting of the guardhouse.
- Fencing of the yard of the guardhouse.
- Painting of metal structures and woodwork.

TABLE X-49 - PAPHOS IRRIGATION PROJECT - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m3	Amount £
1	Water delivered from Headworks	20 606 623	-
2	Total water sold and gross income	15 783 087	736 568
3	Operation cost	-	59 965
4	Maintenance cost	-	240 658
5	Power cost	-	186 920
6	Total annual cost	-	487 543
7	Net income	-	249 025

Project Operation data for the last two years

Table X-50 gives details regarding the operation and maintenance for the last two years. The last column shows the percentage variation of these data with respect to 1986 figures.

TABLE X-50 - PAPHOS PROJECT-DATA ON OPERATION FOR THE LAST TWO YEARS

Item No.	Description	Unit	1986	1987	% change on 1986
1	Yield	1000m3	32 000	32 000	NIL
2	Water available*	"	33 270	59 305	+78.2
3	Water utilized	"	18 339	17 544	- 4.3
4	Water sold for irrigation and industrial use	"	17 643	15 783	-10.1
5	Water used for recharge	"	696	1 761	+153.0
6	Total water sold	"	17 643	15 783	-10.5
7	Gross income	£	691 536	736 568	+ 6.5
8	Operation	£	55 315	59 965	+ 8.4
9	Maintenance cost	£	223 879	240 658	+ 7.5
10	Power cost	£	217 267	186 920	-14.0
11	Total cost	£	496 461	487 543	- 1.8
12	Net income	£	195 075	249 025	+27.7
13	Area Irrigated	Hectars	3 837	3 925	+ 2.3

* This is the water available in the dams, the quantity taken from the boreholes and the river diversions.

ATHALASSA PROJECT

The Athalassa Project consists of a storage dam built, to prevent flooding of the Athalassa Government Farm and for supplying water for the needs of the Government farm in the area. The dam at spillway crest has a capacity of 0.79 MCM and the distribution system commands an area of 415 decars belonging to the Agriculture Research Institute and the Department of Agriculture Farm. The distribution system is made of pipelines. The project is operated by the Department of Agriculture Farm in the area. During the year under review the dam was dry.

KHRYSOKHOU VALLEY PROJECT

The Khrysokhou valley project consist of five boreholes equipped with electrosumbersible pumps, four balancing reservoirs and a distribution system made of pipes commanding an area of 237 Hectars. The project is situated in the Paphos District, Polis region in the Khrysokhou river valley.

Irrigation in the project area started in January and continued throughout the year until December 1987. During this period a total quantity of 452,142 m³ water was sold for irrigation to the farmers at the nominal rates.

The gross income amounted to £20,793. The operation expenses were £7,214, the maintenance expenses were £5,671 and the pumping expenses were £6,741. The total expenditure was around to £19,626. The net income to the project was £1,167. Out of the 237 hectares commanded by the distribution system only an area of 102 hectares was irrigated as shown on Table X-51.

TABLE X-51 - KHRYSOKHOU VALLEY PROJECT - CROPS AND AREA IRRIGATED

Ser No.	Crop	Area Decars
1	Citrus	305
2	Deciduous	32
3	Alfa-Alfa	38
4	Avocados	9
5	Tobacco	522
6	Seasonal	40
7	Table grapes	54
8	Potatoes	24
	Total	1 024

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 Alektora Irrigation Division. The area commanded by both Irrigation Divisions is around 567 hectares, 402 hectares in the Pissouri Irrigation Division and 165 hectares in the Alektora Irrigation Division. In both cases the area to be irrigated is planted totaly with vines.

Based on the existing water resources for each of the two irrigation divisions and having in mind the area served by each irrigation division, water is allocated as follows:

- If the works divert only 225 m³/hr the water will be given in total to the Pissouri Irrigation Division.
- If the works divert more than 225 m³/hr but less than 325 m³/hr the 225m³/hr will be diverted to the Pissouri Irrigation Division and the remaining to the Alektora Irrigation Division.
- If the works divert a flow of more than 325 m³/hr then the water will be allocated as follows:

225 m³/hr to Pissouri Irrigation Division.
200 m³/hr to Alektora 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 Alektora irrigation division.

During the year under review the diversion of water started early in January 1987 and was completed in June 1987 the river flow diminished. In this period a total of 848000 m³ of water was utilized for the supplementary irrigation of 567 hectares of land planted with vines.

PITSILIA PROJECT

XYLIATOS DAM

The Xyliatos irrigation project consists of a dam reservoir of maximum capacity at spillway crest 1,200,000 m³ of water and a closed type distribution system commanding an area of 3,082 decars. Irrigation in the project area started mid March 1987 and continued throughout the year until late in November 1987. During this period a total quantity of 657,061 m³ of water was used for the irrigation of an area of 1,913 decars planted with olive trees, citrus, vegetables and potatoes. The water was sold to the Farmers at the approved rates and the gross income was £26,880. The Operation expenses were £2,283 while the maintenance expenses were £3,738. The net income for the project for the year under review was £20,859.

Project Hydrology

The project hydrologic data as recorded during the year under review, are tabulated in table X-52. The dam reservoir was filled up to the spillway crest on 5th March and overflow continued until the 14th of May 1987. The minimum quantity of water ever stored in the reservoir during the irrigation period, was 512,000 m³ and occurred in December 1987.

TABLE X-52 - XYLIATOS DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	588 000	48.2
2	Inflow - Seepage	1 189 360	97.5
3	Total release for irrigation ..	644 409	52.8
4	Leakages	86 156	7.0
5	Evaporation	98 795	8.1
6	Overflow	NA	NA
7	Final amount in storage	932 000	76.4
8	Minimum quantity in storage (Dec.)	512 000	42.0
9	Storage capacity	1 220 000	100.0

TABLE X-53 - XYLIATOS DAM - WATER UTILIZATION

Item No.	Description	Quantity m3	% of Storage capacity
1	Water used for irrigation	657 061	53.8
2	Water used for recharge	NIL	NIL
3	Total water utilized	657 061	53.8

TABLE X-54 - XYLIATOS DAM - CROPS IRRIGATED

Item No.	Crop	Area Decars
1	Citrus	335
2	Seasonal	735
3	Potatoes	535
4	Olives	134
5	Deciduous	134
6	Alfa-Alfa	13
7	Avocados)	
8	Kiwi)	27

	Total	1 913

Water Utilization and Crops Irrigated

During the year under review a quantity of 657 061 m3 of water was utilized for the irrigation of 1 913 decars of land planted mainly with olive trees, citrus, vegetables, potatoes and avocados.

TABLE X-55 - XYLIATOS DAM - INCOME AND EXPENDITURE DATA

Item	Description	Quantity m3	Amount £
1	Water sold at nominal rates ..	657 061	26 880
2	Water sold at reduced rates ..	NIL	-
3	Water given free	NIL	NIL
4	Total quantity utilized and gross income	657 061	26 880
5	Operation cost	-	2 283
6	Maintenance cost	-	3 738
7	Net income	-	20 859

Water Sale, Income, Operation and Maintenance and Details

From the sale of water, the gross income during the year under review, was £26,880. Operation expenses, including attendant wages and travelling costs, amounted to £2,283 and Maintenance expenses were £3,738 and the net income to the project was £20,859. The following works were carried out during the year under review:

- Repairs to main pipeline.
- Cleaning of Filters and water meters.
- Repairs to breakages of the pipe system.
- Maintenance of the floating valves of Break Pressure Tanks.
- Reinstallation of a 50 mm dia pipeline.
- Installation of a piped system for the overflowing of Break Pressure Tanks.

TABLE X-56 - XYLIATOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Description	Unit	1986	1987	% change on 1986
1	Capacity	1000 m3	1 220	1 220	NIL
2	Water available in storage	"	1 508	1 682	+11.5
3	Water utilized for Irrigation	"	693	657	- 5.2
4	Water sold	"	693	657	- 5.2
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	£	22 162	26 880	+21.3
8	Operation cost	£	6 496	2 283	-64.8
9	Maintenance cost	£	2 621	3 738	+42.6
10	Total expenses	£	9 117	6 021	-34.0
11	Net income	£	13 045	20 859	+59.9
12	Area irrigated	decars	1 382	1 382	NIL

Project Operation Data for the last two years

Table X-56 shows the operation data for the last two years. The water sold for irrigation was increased by 5.2% and the net income to the project was increased by 59.9%.

VASILIKOS - PENDASKINOS PROJECT

The purpose of the Vasilikos-Pendaskinos project is the development of surface and groundwater 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:

- Kalavassos dam whose capacity is 17.1 MCM.
- Dhypotamos dam whose capacity is 13.7 MCM.
- Lefkara dam whose capacity is 13.85 MCM.
- Maroni Diversion to divert a proportion of the Maroni river flow to a point upstream of Dhypotamos dam.
- Maroni irrigation scheme which comprises an irrigation network covering about 233 Hectars in the delta area of Maroni river.
- Vasilikos irrigation scheme. This comprises a main conveyor from Kalavassos dam, break pressure tank and pipeline networks covering an area of about 838 Hectars.
- Pendaskinos irrigation area: An area of 372 Hectars in the Pendaskinos irrigation 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.
- Khirokitia domestic treatment plant.
- Kornos domestic treatment plant.
- Kalavassos-Khirokitia pipeline with Tokhni pumping station, which is the main conveyor for water from Kalavassos dam to the Khirokitia treatment plant and of irrigation water to the Vasilikos Irrigation area.

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 will be given in a separate section under the heading of Domestic Water Supply.

A total quantity of 12.350 MCM were utilized during 1987 from the three dams, 2.519 MCM for irrigation and 9.830 MCM for Domestic Water Supply. Out of 9.830 MCM used 3.341 MCM were taken from Dhypotamos dam, 6.722 MCM from Kalavassos Dam and 2.287 MCM from Lefkara dam. Out of 3.341 MCM 0.733 MCM were used for irrigation and the rest 2.607 MCM were diverted to Kornos Treatment Plant for Domestic Water Supply Purposes. Out of 6.721 MCM used from Kalavassos dam, 1.657 MCM were used for irrigation and the rest 5.065 MCM were diverted to Khirokitia Treatment Plant for Domestic Water Supply purposes. Out of 2.287 MCM used from Lefkara dam, 0.129 MCM were used for irrigation and the rest 2.158 MCM were diverted to Kornos Treatment Plant for Domestic Water Supply purposes.

Project Hydrology

The project hydrologic data a recorded during the year under review are tabulated on the following tables. The data for each dam reservoir are given separately. For the year under review the water in the dam reservoir did not reach the spillway crest but it remained lower with max quantity in storage for Kalavassos dam 7.822 MCM on the 14th May, for Dhypotamos dam 3.256 MCM on the 21st April and for Lefkara dam 2.404 MCM on the 20th May 1987.

TABLE X-57-V.P.P KALAVASSOS DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	945 000	5.5
2	Inflow during the year	10 559 905	61.8
3	Total release	6 721 760	39.3
4	Leakages	NA	-
5	Evaporation	683 145	4.0
6	Overflow	NIL	NIL
7	Final amount in storage	4 090 000	23.9
8	Minimum quantity storage (Dec.)	3 240 000	18.9
9	Storage capacity	17 100 000	100.0

TABLE X-58-VPP-DHYPOTAMOS DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of Storage capacity
1	Initial amount in storage	322 000	2.4
2	Inflow during the year	4 625 705	33.8
3	Total release	3 340 719	24.4
4	Leakages	NA	-
5	Evaporation	450 986	3.3
6	Overflow	NIL	-
7	Final amount in storage	1 184 000	8.6
8	Minimum quantity in storage (Dec.)	721 000	5.3
9	Storage capacity	13 700 000	100.0

TABLE X-59-VPP-LEFKARA DAM - HYDROLOGY FOR 1987

Item No.	Description	Quantity m3	% of storage Capacity
1	Initial amount in storage	316 000	2.3
2	Inflow - Seepage	2 862 945	20.7
3	Total release	2 287 684	16.5
4	Leakages	8 879	0.1
5	Evaporation	211 382	1.5
6	Overflow	NIL	-
7	Final amount in storage	670 000	4.8
8	Minimum quantity in storage (Dec.)	310 000	2.2
9	Storage capacity	13 850 000	100.0

Water Utilization and Crops Irrigated

Details regarding water utilization from both dams separately and in combine are shown on tables X-60, X-61 and X-62 and X-63. During the year under review a total quantity of 12.168 MCM of water was utilized. Out of this amount 2.337 MCM were used for irrigation of various crops and 9.831 MCM were used for Domestic Water Supply.

TABLE X-60-VPP KALAVASOS DAM - WATER UTILIZATION

Item No.	Description	Quantity m3	% of storage capacity
1	Water used for irrigation	1 367 970	8.0
2	Water used for D.W.S	5 064 860	29.0
3	Total water utilized	6 432 830	37.6

TABLE X-61-VPP-DHYPOTAMOS DAM-WATER UTILIZATION

1	Water used for irrigation	839 655	6.1
2	Water used for DWS	2 607 440	19.0
3	Total water utilized	3 447 095	25.1

TABLE X-62-VPP-LEFKARA DAM-WATER UTILIZATION

Item No.	Description	Quantity m3	% of storage capacity
1	Water used for domestic water supply	2 158 450	15.6
2	Water used for irrigation ...	129 234	0.9
3	Total water utilized	2 287 684	16.5

TABLE X-62-VPP-WATER UTILIZATION

Item No.	Description	Quantity m3
1	Water used for irrigation	2 336 859
2	Water used for D.W.S	9 830 750
3	Total water utilized	12 167 609

TABLE X-64-VASILIKOS-PENDASKINOS PROJECT-CROPS IRRIGATED

Item No.	Crop	Area Decars
1	Citrus	3 397
2	Olive trees	126
3	Deciduous	47
4	Avocados	12
5	Vegetables	278
6	Vines	9
7	Seasonal	1 447
	Total	5 316

Water Sale, Income, Operation and Maintenance Costs

From the sale of irrigation water the total gross income was £127 484. The Operation expenses amounted to £21,643 and the maintenance expenses amounted to £25,859. Details regarding income and expenditure are shown on table X-66.

MAINTENANCE DETAILS

Distribution System

- Cleaning of hydrant manholes from wild vegetation.
- Cleaning of Kalavastos, Maroni and Ayios Theodoros break pressure tanks and Maroni Diversion Weir.
- Repairs of outlets, watermeters, and airvalves.
- Repairs of pipelines.

Kalavastos dam

Cleaning of embankment and drainage ditch channels from wild vegetation.
Painting of pipes and valves.
Maintenance of the guardhouse.

Dhyopotamos dam

Cleaning of embankment and drainage ditch channels from wild vegetation.
Painting of pipes and valves.
Maintenance of the guardhouse.

Lefkara dam

Cleaning of embankment and drainage ditch channels from wild vegetation.
Painting of pipes and valves.
Maintenance of the guardhouse.

TABLE X-65-VPP-INCOME AND EXPENDITURE DATA

Ser No.	Description	Quantity m3	Amount £
1	Water sold at nominal rates	2 336 859	127 484
2	Operation cost	-	21,643
3	Maintenance cost	-	25,859
4	Total cost	-	47,502
5	Net income	-	79,982

**TABLE X-66-VASILIKOS-PENDASKINOS PROJECT-DATA
ON PROJECT FOR THE LAST TWO YEARS**

Item No.	Description	Unit	1986	1987	% change on 1986
1	Capacity	1000m3	44 650	44 650	NIL
2	Water available	"	NA	18 288	-
3	Water sold for irrigation "	"	2 047	2 337	+14.2
4	Water used for DWS	"	7 551	9 831	+30.2
5	Total quantity used ...	"	9 598	12 168	+26.8
6	Gross income	£	99 099	127 484	+28.6
7	Operation Cost	£	18 992	21 643	+14.0
8	Maintenance cost	£	11 409	25 859	+126.6
9	Total cost	£	30 502	47 502	+56.2
10	Net income	£	68 698	79 982	+16.4
11	Area Irrigated	Hectars	532	532	NIL

Project Operation Data for the last two years

From table X-66 above it can be seen that the water used was increased by 26.8% and the net income was increased by 16.4%.

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 consist of the following main elements:

- Evretou dam whose capacity is 25 MCM.
- Eight Storage ponds.
- Magounda, Yialia and Livadhi diversion intake structures.
- Main conveyance Pipeline which includes the main conveyor from Evretou dam to Pomos with branch 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 2 000 ha 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 Prodhromi villages.

The civil works of Evretou dam commenced in 1984 and they were completed by the end of 1986. The first inflow was recorded on 5th January 1987. The maximum quantity occurred was on the 18th May 1987 with quantity in storage 10.113 MCM. During the year under review a total quantity of 266,000 m3 was used for irrigation of 150 Ha in Goukhi Area planted mainly with tobacco.

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)
- 5 Waterguards (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 Hydrology :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 Maintenance :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 implementation of Major Projects - Southern Conveyor and Vasilikos-Pendaskinos Projects.

HYDROLOGY AND WATER RESOURCES

Stream Gauging

During the year 3 permanent gauging observation (one monthly at Liopetri Dam and two weekly at Paralimni Lake) stations 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 490 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 71 of these observation boreholes was taken every month and another 9 of them was taken every two months.

The water level of 49 boreholes used for village water supplies were also taken once during the year.

Chemical Analyses

A total number of 395 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 a number of 436 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 8 boreholes/wells for private use were carried out.

Plotting of Boreholes

During the year the plotting of wells/boreholes in the Famagusta-Larnaca Hydrological Area continued and the total number of wells/boreholes plotted were 1656.

Questioning

The annual questionnaire was carried out in the area where the plotting was completed. A total number of 7733 cases were carried out.

Village Water Supplies

During the year the water supply of each village in the two Districts were checked i.e. the flow of springs and boreholes used by each village were measured and a sample was sent to the Government Laboratory for Chemical Analysis.

Quarries

A total number of 10 applications for quarries which were sent to the Regional 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 1068 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 867 applications were of cases lying in the conservation areas and another 201 in the non-conservation area.

Apart from the above applications 660 cases dealing with wells/boreholes were also examined direct from the Regional Office of the WDD Larnaca-Famagusta and were submitted to the District Officers of the two Districts.

The above applications concerned cases for the renewal of leased agreements of wells/boreholes drilled on Government or Forest Land, or cases of cleaning of existing wells/boreholes or Cypriot-Turkish wells/boreholes, now working for refugees. From the above cases 408 were approved, 14 were not and 238 were for the check of conditions of permits or returned to the District Officers for further examination.

The 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 Agricultural Department investigated a total number of 960 wells/boreholes.

In Ormidhia and Xylophagou area 68 applications for new boreholes or covering permits or cleaning existing boreholes were examined, 47 of them were approved and another 21 were not approved.

INVESTIGATION AND DESIGN

Investigations

During 1987 the following investigations were carried out :

LARNACA DISTRICT

Anglisidhes : Investigation for improvement of the Government borehole 29/86 for temporary Irrigation Division and for improvement of the Village Water Supply with connection to Famagusta Pipeline.

Ayia Anna : Investigation for relocation of part of the village water supply network scheme to the main road of the village.

Ayios Theodoros : Investigation for the relocation of part of the conveyance pipeline of the village water supply to the main road of the

village and for improvement of the existing house to house scheme water supply. For the connection of the village water supply with Khirokitia-Famagusta pipeline and for the solution of water supply problems.

Ayii Vavatsinias :Investigation for the expansion of the irrigation division of borehole 35/81 and for the improvement of the village water supply.

Athienou :Water Supply to new refugee self housing plots (Phase B) and for the solution of water supply problems.

Alaminos :Improvement of the existing house to house scheme water supply and for the connection of the village water supply with Khirokitia Famagusta pipeline. Case of building a new house and for the solution of water supply problems. Investigation for improvement of the Government borehole 151/83 for temporary Irrigation Division

Alethriko :Investigation for the water supply of the proposed Stock Farming Area of the village and for the solution of water supply problems. Investigation for the construction of recharge works on the river bed of Pouzis river and for improvement of the Government borehole 83/85 for temporary irrigation division. Investigation for the relocation of part of the conveyance water supply pipeline which passes through private land and for the solution of irrigation problems.

Aradhippou : Investigation for the water supply of live stock area of the village and for the modification of the pumping scheme from BH 139/85 for the irrigation of the school gardens and for the Stadium lawn.

Vavatsinia :Supplementary water supply of the village from BH 20/87 and for the relocation of part of the conveyance pipeline of the spring. Investigation for improvement of the existing house to house water supply scheme.

Vasilikos CMC :Investigation for the water supply of the housing area and the cement industry from the Government Water Supply Scheme Mari-Zyyi.

Dhekalia E A C :Investigation for the connection of self housing refugee camp water supply with Famagusta Water Supply pipeline and for the water supply to new refugee self housing plots (Phase B). For the solution of water supply problems.

Delikipos :Investigation for improvement of the existing house to house scheme water supply.

Dhromolaxia :Investigation for the water supply to new refugee self housing plots (Phase I).

Kato Dhrys :Investigations for the solution of water supply problems.

Kalokhorio :Investigation for the connection of the village water supply with Khirokitia-Famagusta Pipeline and for the solution of water supply problems.

Kellia :Investigation for the water supply of the village stock farming area and for the water supply to the new refugee self housing plots (Phase B).

Kiti :Investigations for the relocation of R C C irrigation channel which passes through a new division of plots and for the water supply to new refugee self housing plots. Investigation for the solution of water supply problems.

Klavdhia :Investgations for the pumping of the village water supply from Khirokitia Famagusta Pipeline and for improvement of the village water supply from Stazousa nad Ayios Ioannis springs. Investigation for the water supply of the new stock farming area.

Kornos :Investigation for the connection of the village water supply with Nicosia pipeline and for cases of building houses and fencing of private land.

Kophinou :Study for the construction of the sewage scheme of the village self housing estate and for improvement of the Government borehole 34/87 of the village water supply. For improvement of the borehole Hydr. No. 132 for the new slaughter house of Nicosia-Limassol-Larnaca.

Layia :Investigation for relocation of part of the village water supply conveyance pipeline to the main road Vavla-Layia.

Livadhia :Investigation for improvement of the village water supply network scheme and for the solution of water supply problems.

Melini :Investigation for improvement of the village water supply springs and for the solution of water supply problems.

Meneou :Investigation for relocation of part of the village water supply network scheme.

Menoyia :Investigation for the live stock water supply from the Government borehole 121/86 of the temporary irrigation division of Anaphotia village and for water supply from the same borehole for irrigation purposes.

Mosphiloti :Investigation for the relocation of the village water supply pipeline to the main road of the village and for the solution of water supply problems.

Odhou :For improvement of the village water supply Dhimma Spring and investigation for improvement of the Government borehole 83/85 for irrigation purposes.

Voroklini :For the solution of the village water supply problems.

Pano Lefkara :For the solution of the village water supply problems.

Perivolia :Investigation for the water supply of Cape Kiti Lighthouse and for the solution of the village water supply problems.

Stavrovouni Army Camp :Investigation for improvement of the army camp water supply.

Pyrga :Investigation for the connection of the village water supply to Nicosia pipeline and for the solution of the village water supply problems. Investigation for relocation of part of the conveyor pipeline of the spring which passes through the school yard and for the fencing of private land.

Troulli :Investigation for improvement of the existing house to house water supply network scheme and for improvement of the village water supply with the pumping scheme from Famagusta pipeline. For the solution of the village water supply problems and for fencing of private land.

Tersephanou :Investigation for the connection of the village water supply to Khirokitia-Famagusta pipeline and for the water supply to the new refugee self housing plots (Phase D). For the solution of water supply problems.

Psematismenos :Investigation for improvement of the existing house to house water supply scheme and for the solution of water supply problems.

Psevdas :Investigation for relocation of part of the village water supply conveyance pipeline from Nicosia pipeline to the main road Mosphiloti-Psevdas and for the water supply to the new division of community plots. For the solution of the village water supply problems.

Kiti-Meneou-Perivolvia-Mazotos :For the water supply to the Tourist Areas.

FAMAGUSTA DISTRICT

Avgorou :Investigation for the solution of the village Water Supply problems.

Vrysoulles :Investigation for the connection of the refugee self-housing estate water supply with Khirokitia-Famagusta pipeline and for the solution of the refugee self housing estate problems.

Dherynia :Investigation for the water supply of the village stock farming area and for the solution of the village water supply problems.

Liopetri :Investigation for the water supply of the village stock farming area and for anti-flood works.

Sotira :For the water supply of the village industrial zone and for the solution of the village water supply problems.

Phrenaros :Investigation for improvement of the existing house to house water supply network scheme and for the solution of water supply of the village stock farming area.

Sotira-Liopetri :Investigation for the water supply of the village Tourist Areas.

TABLE XI-1
DESIGNS SUBMITTED TO THE DIRECTOR FOR APPROVAL

Ser. No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY		
<u>Larnaca District</u>		
1	Athienou :Refugee self housing house to house water supply scheme	2 300
2	Ayios Theodoros-Alaminos :Connection of the vil- lage water supply with Khirokitia-Famagusta pipeline	1 800
3	Ayios Theodoros-Alaminos-Skarinou :Supplementary water supply to the villages from the Government Boreholes 133/80, 80/83 and 55/83	1 300
4	Ayios Theodoros :Improvement of the existing house to house scheme water supply	51 500
5	Alaminos :Improvement of the existing house to house scheme water supply	25 000
6	Dhekelia Self Housing Estate :Connection of the self housing water supply with Khirokitia-Fama- gusta pipeline	37 000
7	Delikipos :House to house scheme water supply network	10 000
8	Dhromolaxia :Refugee self housing house to house scheme water supply phase J	5 000
9	Kalokhorio :Connection of the village water sup- ply with Khirokitia-Famagusta pipeline	45 000
10	Kellia :Water supply of new division of plots for refugee self housing Phase B	2 000
11	Kiti :Refugee self housing house to house scheme water supply Phase E	7 500
12	Klavdhia :Pumping scheme for the village water supply	5 800
13	Kornos :Connection of the village water supply with Nicosia pipeline	70 000
14	Kophinou :Pumping scheme of the Government bore- hole 34/87 for the village water supply	24 000
15	Kophinou :Water supply of the new slaughter house Nicosia-Limassol-Larnaca from borehole Hydr. No. 132	12 000

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY (cont.)		
16	Livadhia :Improvmenet of the existing house to house scheme water supply	14 000
17	Meneou :Improvement of part of the village water supply network scheme	1 100
18	Perivolia :Water Supply of the light house at Cape Kiti	1 200
19	Pyrga :Connection of the village water supply with Nicosia pipeline	25 500
20	Stavrovouni Army Camp :Improvement of the Army Camp water supply	22 000
21	Troulli :Pumping Scheme for improvement of the village water supply	10 000
22	Troulli :Improvement of the existing house to house scheme water supply	80 000
23	Tersephanou :Connection of the village water supply with Khirokitia Famagusta Pipeline	35 000
24	Vavatsinia :Pumping Scheme of the Government borehole 20/87 for the village water supply	20 000
25	Vasiliko C M C :Connection of Vasiliko cement industry and of the housing area with the Government water supply scheme (Zyyi-Mari)	36 000
26	Psematismenos :Improvement of the existing house to house water supply network scheme	25 000
27	Psevdhas-Mosphiloti :Relocation of part of the village water supply scheme to the main road Mosphiloti Psevdhas	37 000
28	Psevdhas :Improvement of part of the village water supply main conveyor pipeline.....	14 000
29	Psevdhas :Construction of a new water tank for the village water supply	15 000
30	Kiti-Meneou-Psevdhas-Mazotos :Water supply of the village Tourist Areas	648 000

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY (xont.)		
<u>Famagusta District</u>		
1	Strovilia :House to House Scheme water supply ..	18 000
2	Sotira :Water Supply of the village Industrial Area	11 500
3	Sotira-Liopetri :Water Supply of the village Tourist Area	292 000
STOCK FARMING AREAS WATER SUPPLY		
<u>Larnaca District</u>		
1	Aradhippou :Water supply for the village stock farming area (piggery)	130 000
2	Kellia :Water supply for the village stock farming area	22 500
3	Klavdhia :Water supply for the village stock farming area Phase C	6 500
<u>Famagusta District</u>		
1	Liopetri :Water supply for the village stock farming area	8 800
VARIOUS MINOR SCHEMES		
<u>Larnaca District</u>		
1.	Ayia Anna :Repairs to the village water supply network scheme	200
2	Ayios Theodoros :Relocation of part of the conveyance pipeline of the village water supply ...	400
3	Alehtriko :Relocation of a pipeline of the village water supply	400
4	Kiti :Relocation of R C C irrigation channel ...	1 860
5	Layia :Relocation of part of the conveyance pipeline of the village water supply	3 000
6	Vavatsinia :Relocation of part of the conveyance pipeline from the spring of the village water supply	1 080

TABLE XI -1

Ser No.	Village and Scheme	Est. Cost £
VARIOUS MINOR SCHEMES (cont.)		
7	Menoyia :Water supply of the village live stock area from Government Borehole 121/86	150
8	Tersephanou:Water supply of new division of plots for refugee self housing	300

IRRIGATION WORKS

Larnaca District

1	Anglisidhes :Improvement of the Government borehole 29/86 for temporary irrigation division ...	3 500
2	Alaminos :Improvement of the Government borehole 151/83 for temporary irrigation division	70 000
3	Alethriko :Improvement of the Government borehole 136/85 for temporary irrigation division	35 000

SEWAGE SCHEMES

Larnaca District

1	Kophinou :Sewage scheme for refugee self housing of the village	130 000
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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 membership of Water Boards the Regional Engineer acts as their Technical Adviser.

Irrigation Branch

The main activities 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 and Anaphotia 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 or 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-Pendaksinos Government Projects and Lefkara Dam.

SOUTHERN CONVEYOR PROJECT - 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

Within the frame of Kokkinokhoria Irrigation Project, special Investigations were carried out and reports were prepared and sent to the Director for the following cases :

C. for additional Land to be irrigated

The investigations for the revision and expansion of irrigation blocks for additional land to be irrigated covered the following communities:

- Akhna : A total area of 150 hectares
- Avgorou : A total area of 100 hectares
- Sotira : A total area of 60 hectares

Subtraction of land from Irrigation Areas

An area of about 40 hectares of land within the Irrigation Block 10B was excluded from irrigation.

Land to be Irrigated

The land to be irrigated by the Kokkinokhoria 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 is Private Land
- 483 hectares is Government Land
- 423 hectares is Forest Land

Communities to be benefited

12 Communities will be benefited from the Southern Conveyor Project-Kokkinokhoria 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

A team of 10 Technicians completed during the year the collection and preparation of the data necessary for the finalisation of the redesign process.

The following data was collected :

- Private Land Ownership data :This contains the ownership in the Irrigation Block by name. In total 5720 owners with 11090 plots of land covering approximately an area of 5982 hectares, were investigated and registered. This information was taken from the official records of the District Office of Land and Surveys Department and was verified by site visits.
- Government Forest Land :This covers an area of 425 hectares cultivated by 300 persons. All the above information was transferred on maps to a scale of 1:5000 which was used for the preparation of the layout and design of the distribution systems of the Irrigation Blocks.
- Government Hali Land :This covers an area of 483 hectares cultivated by 400 persons.

The following 16 Irrigation Blocks out of the 23 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
1	Akhna-Avgorou	390	221
2	Akhna-Avgorou	477	218
3A*	Akhna-Ormidhia	424	113
4A*	Avgorou-Ormidhia	484	218
6*	Xylophagou-Avgorou	453	118
7A	Liopetri	346	187
7B*	Liopetri-Xylophagou	428	205
8	Liopetri	440	236
9	Sotira	400	235
10A	Sotira-Liopetri	415	271
10B	Sotira-Ayia Napa	376	378
11	Liopetri-Phrenaros-Sotira	532	425
12A	Phrenaros-Liopetri-Avgorou	392	444
12B	Phrenaros-Avgorou	500	379
14	Ormidhia-Xylophagou	316	130
16	Vrysoulles (Phrenaros-Akhyritou)	120	232

Note : Part of the land of Irrigation Blocks 3A, 4A 6 and 7B is covered by the Land Consolidation Scheme.

Establishment of Irrigation Divisions

The District Officer in coordination with the Regional Engineer of the Water Development Department and the District Agricultural Officer has established two Irrigation Divisions Nos.1 and 2 of Akhna-Avgorou and their corresponding committees were elected.

VASILIKOS-PENDASKINOS PROJECT

During the year the Regional Office carried out surveys and investigations on :

- Communal claims for inclusion/irrigation areas of Irrigation Divisions which were not covered by the Vasilikos-Pendaskinos Project.
- The establishment of Water Rights of Irrigation Divisions from the Vasilikos, Maroni and Pendaskinos Rivers.

Within the framework of the Water Commissioner for water rights the Regional Office of the Water Development Department Larnaca/Famagusta in coordination with the District Agricultural Office and the District Administration, carried out surveys and investigations for the following 18 Irrigation Divisions :

Vasilikos River

Irrigation Divisions Kalavassos No.1
 Irrigation Divisions Kalavassos No.2
 Irrigation Division Syrmata-Kopetra
 Irrigation Division Tokhni-Zyyi
 Irrigation Division Mari

Community

Kalavassos
 Kalavassos
 Kalavassos
 Tokhni
 Mari

Maroni River

Community

Irrigation Division	Anefantis-Milianos	Khirokitia
Irrigation Division	Potamos	Khirokitia
Irrigation Division	Drakonties	Psematismenos
Irrigation Division	Ratsou	Psematismenos
Irrigation Division	Kannouva	Psematismenos
Irrigation Division	Laki-Xalona	Maroni
Irrigation Division	Asvestos	Maroni
Irrigation Division	Vasiliko	Maroni
Irrigation Division	Safto-Lourka	Maroni

Pendaskinos River

Community

Irrigation Division	Pendaskinos No.1	Ayios Theodoros
Irrigation Division	Pendaskinos No.2	Ayios Theodoros
Irrigation Division	Pittines	Ayios Theodoros
Irrigation Division	Skarinou	Skarinou

Also the Regional Engineer attended many meetings at the District Office of Larnaca for the above matters.

CONSTRUCTION WORKS

During the year under review a number of village water supply schemes, stock farm 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 54 skilled and unskilled labourers (All 59 are Government regular workers).



Aradhippou Dam under construction. WDD Photo No. E7EN-16 (17.7.87).

XII LIMASSOL REGIONAL OFFICE

by
N.E. Neocleous
Executive Engineer I
Regional Engineer

General

Limassol Regional Office is responsible for the activities of the Department within the District of Limassol. The office is divided into five main sections as follows:

- Water Resources
- Investigation and Design
- Construction
- Operation and Maintenance
- Control

The Regional Office is manned by 49 staff as follows:

- 1 Executive Engineer I
- 5 Senior Technicians
- 8 Technicians I
- 2 Assist. Chief Foremen
- 11 Technicians II
- 1 Accounting Officer
- 2 Clerk II
- 17 Foremen

For the execution of the construction works about 255 skilled and unskilled workers were engaged.

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 128) and at the same time 4 water samples were taken for suspended sediment analysis. Another 14 water samples were taken, for ionic analysis.

Springs and Streams

The discharge of 41 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 438 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-Evdhimou, Pissouri-Evdhimou, Pareklissha and the rest of Limassol District.

Special Measures Law - Akrotiri Pissouri 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/boreholes 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 393) 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 above area, from Yermasoyia and Polemidhia Dams, through the distribution system, of the Dams and from Kouris river, through the irrigation intakes.

Water extracted from Akrotiri Aquifer.

Purpose:	M.C.M.
Irrigation	10.4
Domestic	5.3
Industrial	0.7
Total	15.2
Water supplied from Dams	1.9
Total supplied for irrigation from the aquifer and from the Dams	12.3

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 1986, a quantity of 3.89 M.C.M. was released for recharge, in the aquifer, from Yermasoyia Dam. Also a quantity of 0.23 M.C.M. was pumped and released into the aquifer from Episkopi B/Hs (Kouris Delta). A considerable recharge of the aquifer was also occurred through the overflow of Yermasoyia Dam.

Salinity is also 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 investigated: Some 512 cases were investigated and permits were finally granted by the D.O. for 454 of them.

Limassol Water Supply

Water supply to Limassol, for domestic purpose from the springs and boreholes is gauged monthly. A total quantity of 9.29 MCM. was supplied, 1.20 MCM from springs and 8.09 MCM from boreholes. The supply of water from Khalassa springs was definitely interrupted, because of the construction of Kouris Dam.

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.

Meteorological Observations

Daily records were kept for rainfall (Max. 50.6 mm on 7/1/87) water evaporation (Max. 12.8 mm on 7/8/87) temperature (Max. 42.5 °C on 6.8.87), wind velocity and sun reflection, at Yermasoyia Dam.

Records were also kept for rainfall (Max. 56.6 mm on 21.12.87) and water evaporation (Max. 11.9 mm on 27.7.87), at Polemidhia Dam.

Quarry and Gravel Pits Permits

13 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 twice a month.

INVESTIGATION & DESIGN

The solution of the irrigation and water supply problems 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 28 cases were examined, studied and the relevant designs were prepared for the total cost of £243,445 as follows.

TABLE XII - 1

IRRIGATION SCHEMES PREPARED IN 1987

Ser. No.	Village & Description	Est. cost £
1	Asgata. Utilization of B/H 95/85 for "Asgata" Irrigation Division	57 000
2.	Pelendria. Rehabilitation of "Pano Phylagra" Irrigation Association	2 650
3	Tris Elies. Rehabilitation of "Kremmos" Irrigation Division	6 550
4	Arsos. Rehabilitation of "Arsos" Irrigation Division	24 000
5	Agros - Kato Mylos. Rehabilitation of "Pera Akros" Irrigation Division	9 250
6	Kyperounda. Rehabilitation of "Stremmata - Koutsinas" Irrigation Division	7 050
7	Trakhoni. Extension of Yermasoyia Polemidhia distribution system to plot 437 Sh/Pl. 58/7 . .	792
8	Ypsonas. Extension of Yermasoyia Polemidhia distribution system to plot 321 Sh/Pl. 58/7 . .	650

9	Perapedhi. Relocation of pipelines on the new road near Perapedhi village	10 500
10	Pelendria. Relocation of pipelines on the new road between Trimiklini and Pelendria	2 550
11	Ayios Ioannis (Agros). Re-evaluation of "Ayia Marina" Irrigation Division Scheme	11 800
12	Akrotiri. Extension of the distribution system of "Akrotiri" Irrigation Division to Forest Park	7 150
13	Moniatis. Re-evaluation of "Moniatis" Irrigation Division Scheme	40 000
14	Ypsonas. Extension of Yermasoyia Polemidhia distribution system to plots 260/1, 250, 258/2, 249, 248/1, Sh/Pl. 58/7	530
15	Omodhos. Relocation of pipelines on the new road between Omodhos and Ayios Nicolaos	7 700
16	Agros. Rehabilitation of "Pano Lambada" Irrigation Division	3 300
17	Kolossi. Extension of the distribution system of Erimi Kolossi Irrigation Division to "Merras" Irrigation Division	900
18	Kato Polemidhia. Relocation of pipeline near plot 38 Sh/Pl. 58/23 of "Polemidhia" Irrigation Division	1 830
19	Asomatos. Extension of Yermasoyia Polemidhia distribution system to plot 38 Sh/Pl. 58/23	930
20	Mallia. Rehabilitation of "Mallia" Irrigation Association	12 600
21	Agros - Kato Mylos. Revised scheme of "Pera Akros" Irrigation Division	8 200
22	Kyperounda. Relocation of pipelines on the new road of Karvounas - Kyperounda - Agros	19 800
23	Ayios Dhimitrios. Rehabilitation of "Kalogiros" Irrigation Division	6 700
24- 28	Five cases in five villages of total cost	1 013
	Total	£243 445

Domestic Water Supply

For the development of water supply systems of Limassol District, 82 cases were examined, studied and the relevant designs were prepared for the total cost of £939,656 as follows:

TABLE XII - 2

DOMESTIC WATER SUPPLY SCHEMES PREPARED IN 1987

Ser. No.	Village & Description	Est. cost £
1	Pelendria. Substitution of water supply distribution system	108 000

2	Pelendria - K. Amiandos. Utilization of "Pirillos" spring for supplementary supply of Pelendria and Kato Amiandos villages	8 300
3	Kolossi. Utilization of B/H 75/77 for supplementary supply of live stoke area	30 000
4	Erimi - Kolossi. Utilization of B/H 69/86 for supplementary supply of the two villages	25 000
5	Erimi - Kolossi. Temporary scheme for utilization the B/H 69/86	3 300
6	Yermasoyia. Water supply of plots 92/2/1, 92/1, Sh/Pl. 54/52	2 500
7	Kolossi. Re-evaluation of land division (File No. D.481/85)	2 240
8	Ayios Athanasios. Construction of a new storage tank for Domestic water supply	66 800
9	Khalassa. Re-evaluation of water supply scheme of plot 62/1, Sh/Pl. 53/14	1 450
10	Yermasoyia. Re-evaluation of land division (File No. D.192/80)	1 218
11	Yermasoyia. Re-evaluation of land division (File No. D.511/83)	1 375
12	Ayios Athanasios. Re-evaluation of land division (File No. D.724/85)	1 315
13	Evdhimou. Utilization of B/H 165/86 for suppl supplementary supply of the village	44 250
14	K. Polemidhia. Re-evaluation of land division (File No. D.30/83)	1 900
15	Lania. Relocation of pipelines of Lania distribution system from the village to the main road Limassol - Platres	4 400
16	Pissouri. Substitution of water supply distribution system	46 200
17	Ayios Athanasios. Re-evaluation of land division (File No. D.4/86)	4 152
18	Asomatos - Trakhoni. Construction of a new storage tank for Domestic water supply	15 000
19	Yermasoyia. Relocation of pipelines on the new road.	7 160
20	Perapedhi. Relocation of pipelines from plot 163/2 Sh/Pl. 47/28	1 206
21	Moniatis. Water supply of land division (File No. D.332/77)	1 182
22	Zoopiyi. Relocation of pipelines from plot 67 Sh/Pl. 47/32	2 034
23	Yermasoyia. Water supply of plots 114/23, 114/24, 114/19, 114/20, 114/21, 114/22, Sh/Pl. 54/52	550
24	Sykopetra. Utilization of B/H 72/86 for supplementary supply of Prophitis Elias	38 500
25	Ayios Konstantinos. Substitution of old pipelines in the village	5 050

26.	Amathus. Re-evaluation of water supply of plots 19/1/1, 18/3/1, 20/1/1 Sh/Pl. 54/46	895
27	Yermasoyia. Water supply of plot 59 Sh/Pl. 54/52	3 050
28	Ayios Athanasios. Re-evaluation of the land division (File No. D.432/84)	4 025
29	Ypsonas. Supervision of land division's water supply (File No. D.406/83)	600
30	Yermasoyia. Water supply of plots 89/1/1, 89/1/2, 89/1/3, Sh/Pl. 54/52	1 040
31	Ayios Amvrosios. Re-evaluation of distribution system's extension	6 050
32	Yermasoyia. Extension of the distribution system to Green Area	20 860
33	K. Polemidhia. Re-evaluation of the land division (File No. D.378/71)	7 350
34	Troodos. Water supply of Nation guard's camp	15 000
35	Trakhoni. Re-evaluation of the land division (File No. D.893/73)	3 100
36	Pano Polemidhia. Refuge Self-Housing scheme (phace H')	4 900
37	Pyrgos. Improvement of water supply scheme	8 600
38	K. Polemidhia. Water supply of land division (File No. D.381/84)	3 130
39	Amathus. Water supply of plot 59/1, Sh/Pl. 54/45	3 210
40	Amathus. Water supply of plot 170/1/1, Sh/Pl. 54/45	2 400
41	Yermasoyia. Water supply of plots 198/2, 197/2, Sh/Pl. 54/52	4 150
42	Limnatis. Construction of a new storage tank for Domestic water supply	7 000
43	Ypsonas. Re-evaluation of land division (File No. D.214/84)	8 300
44	Episkopi. Water supply of live stoke area	24 000
45	Amathus. Water supply of plot 77 Sh/Pl. 54/47	1 750
46	Ayios Theodoros. Construction of a new storage tank for Domestic water supply	6 400
47	Erimi. Water supply of land division (File No. D.273/80)	35 700
48	Pissouri. Relocation of pipelines on the new road Limassol - Paphos near Pissouri village . .	10 270
49	Vouni. Construction of a new storage tank for Domestic water supply	8 000
50	Limassol. Relocation of pipelene on the new road near Verengaria locality	7 930
51	Akrotiri. Water supply of plot 63 Sh/Pl. 58/38 & 58/39	10 900
52	K. Polemidhia. Substitution of old pipelines on several streets	3 770

53	Dhora. Water supply of sheep folds	1 200
54	P. Polemidhia. Refugee Self-Housing scheme (Phase I)	7 400
55	Moni. Water supply of plot 468/1 Sh/Pl. 54/40	1 500
56	Ypsonas - Polemidhia. Utilization of proposed B/H for supplementary supply of Ypsonas and Polemidhia villages	35 000
57	K. Mylos. Water supply scheme from B/H 66/76 of "Vatera" Irrigation Division	3 600
58	Ypsonas. Water supply scheme for "Vounaros" locality from "Kephalovrysos" spring	211 000
59	Dhymes. Water supply scheme from B/H 81/80 of "Kaminia" Irrigation Division	20 000
60	Paramali. Repairing the storage tank of water supply scheme	700
61	Ayios Amvrosios. Construction of a new storage tank for Domestic water supply	20 000
62	P. Polemidhia. Temporary extension of the distribution system for General Hospital of Limassol	900
63-82	Twenty cases in twenty villages of total cost	2 894
		<u>£939,656</u>

In addition to the above 103 cases (applications) were examined studied and the relevant technical 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 1987 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	-	4 153 00
Tiper lorries	W/hours	4 775	15 902 00
Buses	W/days	484	8 290 00

TABLE XII - 3 MACHINERY USED BY LIMASSOL REGIONAL OFFICE (Cont.)

Machinery Employed	Unit	Quantity	Value £
Electrowelding machines	W/hours	3 332	2 907 00
Electrowelding machines	agreed (w/days)	286 5	2 582 32
Caterpillars	W/hours	403	4 506 19
Caterpillars	agreed	-	1 670 25
Cutting machines . . .	W/hours	2 526	-
Bulldozer	W/days	60	1 800 00
Land rovers	W/days	4 528	37 800 00
Diggers	W/hours	16 629	60 030 00
Diggers	agreed (w/hours)	3 162	12 320 00
Compressors	W/hours	1 376	2 018 00
Concrete mixers	W/days	686	2 771 00
Concrete mixers	agreed (w/days)	162	622 00
Braker	agreed	-	120 00
Braker	W/hours	771	4 560 00
Hydraulic Excavator . .	W/hours	578	6 079 25
Hydraulic Excavator . .	agreed	-	47 447 00
Motor Roller	w/hours	690	2 329 48
Grader	W/hours	309	2 394 75
Mobile Concrete Mixer .	W/days	43	1 344 00
Drilling Machine . . .	agreed	-	300 00
Vibrator	W/days	7+75 (WDD)	65 00
Total			222 011 24

TABLE XII - 4

MATERIALS USED BY LIMASSOL REGIONAL OFFICE

Materials used	Unit	Quantity	Value £
Galvanized steel pipes	m	62 448	152 984 62
Steel pipes (coated or uncoated).	m	10 533	86 874 64
Ductile iron pipes . .	m	-	-

TABLE XII - 4 MATERIALS USED BY LIMASSOL REGIONAL OFFICE (Cont.)

Materials used	Unit	Quantity	Value £
Asbestos cement pressure			
Pipes - class 15	m	18 138	159 947 50
Pipes - class 20	m	14 584	97 656 99
Pipes - class 25	m	-	-
Pipes - class 30	m	-	-
P.V.C. and polythene pipes	m	23 385	9 988 89
Cement	tones	1 089.35	26 781 11
Sand	m ³	1 247	5 212 46
Fine and coarse sand	m ³	2 159	9 370 06
Gravels for Construction of field roads	m ³	12 111	7 838 08
Aggregates	m ³	3 378	11 147 00
Mild steel	tones	155.57	17 964 65
Sand for pipe bedding	m ³	8 994	19 525 42
Ready mixed concrete	m ³	441	3 933 70
Fittings	No.	28 695	71 402 33
Sluice valves	No.	1 967	17 685 45
Water meters	No.	580	6 350 33
Shingle	m ³	168	705 60
Total			<u>705 368 83</u>

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 Irrigation Scheme

For repairing and maintenance of water meters, valves and general maintenance and painting of metal structures, etc. a sum of £21 800 was spent on Yermasoyia-Polemidhia Dams and Distribution network and the sum of £358 was spent on Akrotiri 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 supervision, repairs and maintenance of water meters, valves and general maintenance and painting of metal structures etc.

was spent the sum of £5 100.

Village water supply schemes

For repairs and maintenance of 157 cases to water supply systems was spent the sum of £9 168.

MEETINGS

During the year under review the Regional Engineer attended several meetings as the representative of the Director of the Department.



Evdhimou-Paramali irrigation scheme
Diversion weir on Kryos river. WDD Photo No. E60EN-7.

XIII PAPHOS REGIONAL OFFICE

by
A. Lambrou
Executive Engineer I
Regional Engineer

General

In 1987 the staff of the Regional Office was composed of the following:

- 1 Executive Engineer I
- 4 Senior Technicians
- 6 Technicians I
- 11 Technicians II
- 1 Chief Foreman
- 1 Ass. Chief Foreman
- 4 Foremen Monthly
- 2 Foremen Weekly
- 1 Officer Clerk
- 7 Clerical and Accounting staff
- 1 Telephone Operator
- 1 Messenger

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 total number of 467 current meter measurements were taken during the year for calibration purposes. Also samples for suspended sediment load and boron analysis were taken regularly.

Springs

During the year 16 springs were under observation and a total number of 356 spring discharges were gauged, 26 by current meter and 330 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 rainfall observing stations equipped with automatic raingauge recorders were in operation during the year, under weekly and monthly visits for operation.

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/BH 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 at the end 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 159 wells/boreholes during the year for special studies.

During the year a total number of 2999 measurements were taken from wells/boreholes under observation as follows:

2613 Water levels from S.W. Paphos Hydrological Area

386 Water levels from Polis Project Area.

Analysis

A total number of 1004 samples for analysis were taken from wells/boreholes, springs and streams, 76 of which were submitted to the Government analyst for full boron and ionic analysis, 37 to the Departmental laboratory for silt content analysis, 128 to Khirokitia analyst for nitrates & ionic analysis and 763 for the determination of chloride content.

Questioning

The annual questioning was carried out in South Western Paphos Hydrological Area and in Dhiarizos - Xeros - Ezousa rivers beds on 3308 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 226 applications for sinking and covering permits for wells/boreholes were examined 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 applications were examined as follows:

APPROVED			NOT APPROVED		
SML Area	W.C.A	Non W.C.A	SML Area	W.C.A	Non W.C.A
62	106	14	15	24	5

Encroachments in rivers and streams

Twenty cases for land encroachments in rivers and streams were examined and the Director of Lands and Surveys Department was advised accordingly.

Quarries and gravel pits permits

Twenty seven applications for quarries and gravel pits permits were examined.

The Hydrological section undertook to supervise implementation of the special conditions laid by the Department to the Contractors exploiting the gravel and sand of the rivers beds.

Plotting

During 1987, 17 wells/boreholes were plotted on L.R.O plans at Tremithousa and Kouklia area covering a total area of 5 km

Pumping Tests

During the year five pumping tests, four of which for Tourist Development and one for Agriculture Development were carried out and relevant reports were submitted to the Director of the Department.

CONSTRUCTION

The construction programme at Paphos Regional Office for 1987 included 24 Water Supply and Irrigation Schemes of a total cost of £459,408.00. Also another £315,924.00 was expended for several other works, mainly coming from the Public Works Department and the District Officer Paphos. For all construction works, see tables under CONSTRUCTION DIVISION Chapter VII.

INVESTIGATION AND DESIGN

The planning and design of irrigation schemes were in progress during 1987 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 extent of land and the cost of each Irrigation Scheme.

TABLE XIII-1
IRRIGATION SCHEMES PREPARED IN 1987

Ser. No.	Village and Description	Est. cost £
1.	Kato Pyrgos "Platis"	7,000.00
2.	Phasoula "Kalamos" irrigation	145,000.00
3.	Nikoklia B/H 64/83	52,500.00
4.	Kato Pyrgos B/H 3/85 and Dam Distr.	354,000.00
5.	Kilinia "Groutis" spring	8,070.00

VILLAGE WATER SUPPLY SCHEMES

Ser. No.	Village and Description	Est. Cost £
1.	Kannaviou B/H 8/86	30,000.00
2.	Axiothea Government housing scheme .	2,900.00
3.	Mandria Water Supply B/H 15/87	30,000.00
4.	Koukklia Government housing scheme	4,200.00
5.	Mandria Refugee Housing	950.00
6.	Appides spring improvements	2,304.00
7.	Improvement to Paphos Water Supply	25,800.00
8.	Peyia pumping scheme B/H PB 43	94,400.00
9.	Ayia Water Supply B/H in the forest	2,800.00
10.	Yeroskipos Water Supply	192,000.00
11.	Kiniras Government housing scheme ..	3,700.00
12.	Prodromi Refugee Housing	3,600.00

Also 65 applications were investigated by this section during the year.

OPERATION AND MAINTENANCE

During 1987 the Paphos District Office dealt with the operation and maintenance of several water works in Paphos i.e. Paphos Dams, Khrysokhou Valley irrigation scheme and the various Government Water Supply Schemes.

Regarding the Government Water Supply Schemes a detail report covering both the expenditure and the revenue generated has been submitted to the Director.

Also 364 applications regarding E.A.C and CYTA way leaves were examined during 1987.

Committee Meetings

During the year under revenue 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 31-12-87
 In alphabetical order under post held

POST	NAME	EDUCATION	EXPERIENCE	POST	NAME	EDUCATION	EXPERIENCE
DIRECTORATE	Constantinos St	D	T	DESIGN	Nicos	ME	T
1	Byrras	AD	T	1	Kyriakou	ME	T
2	Marasias	FWE	T	2	Kyriakou	ME	T
3	Christodoulou	FWE	T	3	Marasias	ME	T
MISSING				4	Christodoulou	ME	T
1	Norellis	T-II	T	5	Christodoulou	ME	T
2	Norellis	T-II	T	6	Christodoulou	ME	T
3	Vyras	T-II	T	7	Christodoulou	ME	T
WATER RESOURCES				8	Christodoulou	ME	T
1	Kypris	SH	T	9	Christodoulou	ME	T
2	Peppis	G-I	T	10	Christodoulou	ME	T
3	Antonopoulos	TS	T	11	Christodoulou	ME	T
4	Neophytou	TS	T	12	Christodoulou	ME	T
5	Antonopoulos	TS	T	13	Christodoulou	ME	T
6	Antonopoulos	TS	T	14	Christodoulou	ME	T
7	Antonopoulos	TS	T	15	Christodoulou	ME	T
8	Antonopoulos	TS	T	16	Christodoulou	ME	T
9	Antonopoulos	TS	T	17	Christodoulou	ME	T
10	Antonopoulos	TS	T	18	Christodoulou	ME	T
11	Antonopoulos	TS	T	19	Christodoulou	ME	T
12	Antonopoulos	TS	T	20	Christodoulou	ME	T
13	Antonopoulos	TS	T	21	Christodoulou	ME	T
14	Antonopoulos	TS	T	22	Christodoulou	ME	T
15	Antonopoulos	TS	T	23	Christodoulou	ME	T
16	Antonopoulos	TS	T	24	Christodoulou	ME	T
17	Antonopoulos	TS	T	25	Christodoulou	ME	T
18	Antonopoulos	TS	T	26	Christodoulou	ME	T
19	Antonopoulos	TS	T	27	Christodoulou	ME	T
20	Antonopoulos	TS	T	28	Christodoulou	ME	T
21	Antonopoulos	TS	T	29	Christodoulou	ME	T
22	Antonopoulos	TS	T	30	Christodoulou	ME	T
23	Antonopoulos	TS	T	31	Christodoulou	ME	T
24	Christou	F	T	32	Christodoulou	ME	T
HYDROLOGY				33	Christodoulou	ME	T
1	Iakovos	SH	T	34	Christodoulou	ME	T
2	Iakovos	H-I	T	35	Christodoulou	ME	T
3	Christodoulou	D	T	36	Christodoulou	ME	T
4	Alexandrou	TS	T	37	Christodoulou	ME	T
5	Katsianis	TS	T	38	Christodoulou	ME	T
6	Pasharis	TS	T	39	Christodoulou	ME	T
7	Georgios	TS	T	40	Christodoulou	ME	T
8	Macrides	TS	T	41	Christodoulou	ME	T
9	Nicolaou	T-II	T	42	Christodoulou	ME	T
PLANNING				43	Christodoulou	ME	T
1	Christos	SH	T	44	Christodoulou	ME	T
2	Michalakis	H-I	T	45	Christodoulou	ME	T
3	Nicolaides	EE-I	T	46	Christodoulou	ME	T
4	Socratou	EE-I	T	47	Christodoulou	ME	T
5	Ioannou	H-I	T	48	Christodoulou	ME	T
6	Iodoathanous	SH	T	49	Christodoulou	ME	T
7	Hj-Panteli	SH	T	50	Christodoulou	ME	T
PLANNING(SOIL INVESTIGATION BRANCH)				51	Christodoulou	ME	T
1	Christodoulou	SH	T	52	Christodoulou	ME	T
2	Christodoulou	SH	T	53	Christodoulou	ME	T
3	Lozaidis	SH	T	54	Christodoulou	ME	T
4	Dhikomitis	SH	T	55	Christodoulou	ME	T
5	Georghiou	SH	T	56	Christodoulou	ME	T
6	Ioannou	SH	T	57	Christodoulou	ME	T
7	Ioannou	SH	T	58	Christodoulou	ME	T
8	Koutaloupis	SH	T	59	Christodoulou	ME	T
9	Kourpis	SH	T	60	Christodoulou	ME	T
10	Lambrides	SH	T	61	Christodoulou	ME	T
11	Marcou	SH	T	62	Christodoulou	ME	T
12	Marcou	SH	T	63	Christodoulou	ME	T
13	Louca	SH	T	64	Christodoulou	ME	T
14	Odysseos	SH	T	65	Christodoulou	ME	T
15	Papaloukou	SH	T	66	Christodoulou	ME	T
PLANNING(TOPOGRAPHY BRANCH)				67	Christodoulou	ME	T
1	Evrypidou	SH	T	68	Christodoulou	ME	T
2	Akritis	SH	T	69	Christodoulou	ME	T
3	Constantinou	SH	T	70	Christodoulou	ME	T
4	Charalambos	SH	T	71	Christodoulou	ME	T
5	Georghiou	SH	T	72	Christodoulou	ME	T
6	Ioannou	SH	T	73	Christodoulou	ME	T
7	Ioannou	SH	T	74	Christodoulou	ME	T
8	Michaelides	SH	T	75	Christodoulou	ME	T
9	Panayiotou	SH	T	76	Christodoulou	ME	T
10	Constantinou	SH	T	77	Christodoulou	ME	T
11	Georghiou	SH	T	78	Christodoulou	ME	T
12	Georghiou	SH	T	79	Christodoulou	ME	T
13	Kissopoda	SH	T	80	Christodoulou	ME	T
14	Liasides	SH	T	81	Christodoulou	ME	T
15	Michael	SH	T	82	Christodoulou	ME	T
16	Maris	SH	T	83	Christodoulou	ME	T
17	Thrasos	SH	T	84	Christodoulou	ME	T
18	Kyriakos	SH	T	85	Christodoulou	ME	T
19	Maris	SH	T	86	Christodoulou	ME	T
20	Georghiou	SH	T	87	Christodoulou	ME	T
21	Tsouris	SH	T	88	Christodoulou	ME	T
PLANNING(TOPOGRAPHY BRANCH)				89	Christodoulou	ME	T
1	Evrypidou	SH	T	90	Christodoulou	ME	T
2	Akritis	SH	T	91	Christodoulou	ME	T
3	Constantinou	SH	T	92	Christodoulou	ME	T
4	Charalambos	SH	T	93	Christodoulou	ME	T
5	Georghiou	SH	T	94	Christodoulou	ME	T
6	Ioannou	SH	T	95	Christodoulou	ME	T
7	Ioannou	SH	T	96	Christodoulou	ME	T
8	Michaelides	SH	T	97	Christodoulou	ME	T
9	Panayiotou	SH	T	98	Christodoulou	ME	T
10	Constantinou	SH	T	99	Christodoulou	ME	T
11	Georghiou	SH	T	100	Christodoulou	ME	T
12	Georghiou	SH	T	101	Christodoulou	ME	T
13	Kissopoda	SH	T	102	Christodoulou	ME	T
14	Liasides	SH	T	103	Christodoulou	ME	T
15	Michael	SH	T	104	Christodoulou	ME	T
16	Maris	SH	T	105	Christodoulou	ME	T
17	Thrasos	SH	T	106	Christodoulou	ME	T
18	Kyriakos	SH	T	107	Christodoulou	ME	T
19	Maris	SH	T	108	Christodoulou	ME	T
20	Georghiou	SH	T	109	Christodoulou	ME	T
21	Tsouris	SH	T	110	Christodoulou	ME	T
OPERATION & MAINTENANCE				111	Christodoulou	ME	T
1	Tsoulas	SH	T	112	Christodoulou	ME	T
2	Nicolaou	SH	T	113	Christodoulou	ME	T
3	Kalyvas	SH	T	114	Christodoulou	ME	T
4	Kazamias	SH	T	115	Christodoulou	ME	T
5	Hj-Panteli	SH	T	116	Christodoulou	ME	T
6	Hj-Panteli	SH	T	117	Christodoulou	ME	T
7	Michalidis	SH	T	118	Christodoulou	ME	T
8	Stavrou	SH	T	119	Christodoulou	ME	T
9	Constantinou	SH	T	120	Christodoulou	ME	T
10	Eleftheriou	SH	T	121	Christodoulou	ME	T
11	Eleftheriou	SH	T	122	Christodoulou	ME	T
12	Polios	SH	T	123	Christodoulou	ME	T
OPERATION & MAINTENANCE				124	Christodoulou	ME	T
1	Tsoulas	SH	T	125	Christodoulou	ME	T
2	Nicolaou	SH	T	126	Christodoulou	ME	T
3	Kalyvas	SH	T	127	Christodoulou	ME	T
4	Kazamias	SH	T	128	Christodoulou	ME	T
5	Hj-Panteli	SH	T	129	Christodoulou	ME	T
6	Hj-Panteli	SH	T	130	Christodoulou	ME	T
7	Michalidis	SH	T	131	Christodoulou	ME	T
8	Stavrou	SH	T	132	Christodoulou	ME	T
9	Constantinou	SH	T	133	Christodoulou	ME	T
10	Eleftheriou	SH	T	134	Christodoulou	ME	T
11	Eleftheriou	SH	T	135	Christodoulou	ME	T
12	Polios	SH	T	136	Christodoulou	ME	T
OPERATION & MAINTENANCE				137	Christodoulou	ME	T
1	Tsoulas	SH	T	138	Christodoulou	ME	T
2	Nicolaou	SH	T	139	Christodoulou	ME	T
3	Kalyvas	SH	T	140	Christodoulou	ME	T
4	Kazamias	SH	T	141	Christodoulou	ME	T
5	Hj-Panteli	SH	T	142	Christodoulou	ME	T
6	Hj-Panteli	SH	T	143	Christodoulou	ME	T
7	Michalidis	SH	T	144	Christodoulou	ME	T
8	Stavrou	SH	T	145	Christodoulou	ME	T
9	Constantinou	SH	T	146	Christodoulou	ME	T
10	Eleftheriou	SH	T	147	Christodoulou	ME	T
11	Eleftheriou	SH	T	148	Christodoulou	ME	T
12	Polios	SH	T	149	Christodoulou	ME	T
OPERATION & MAINTENANCE				150	Christodoulou	ME	T
1	Tsoulas	SH	T	151	Christodoulou	ME	T
2	Nicolaou	SH	T	152	Christodoulou	ME	T
3	Kalyvas	SH	T	153	Christodoulou	ME	T
4	Kazamias	SH	T	154	Christodoulou	ME	T
5	Hj-Panteli	SH	T	155	Christodoulou	ME	T
6	Hj-Panteli	SH	T	156	Christodoulou	ME	T
7	Michalidis	SH	T	157	Christodoulou	ME	T
8	Stavrou	SH	T	158	Christodoulou	ME	T
9	Constantinou	SH	T	159	Christodoulou	ME	T
10	Eleftheriou	SH	T	160	Christodoulou	ME	T
11	Eleftheriou	SH	T	161	Christodoulou	ME	T
12	Polios	SH	T	162	Christodoulou	ME	T
OPERATION & MAINTENANCE				163	Christodoulou	ME	T
1	Tsoulas	SH	T	164	Christodoulou	ME	T
2	Nicolaou	SH	T	165	Christodoulou	ME	T
3	Kalyvas	SH	T	166	Christodoulou	ME	T
4	Kazamias	SH	T	167	Christodoulou	ME	T
5	Hj-Panteli	SH	T	168	Christodoulou	ME	T
6	Hj-Panteli	SH	T	169	Christodoulou	ME	T
7	Michalidis	SH	T	170	Christodoulou	ME	T
8	Stavrou	SH	T	171	Christodoulou	ME	T
9	Constantinou	SH	T	172	Christodoulou	ME	T
10	Eleftheriou	SH	T	173	Christodoulou	ME	T
11	Eleftheriou	SH	T	174	Christodoulou	ME	T
12	Polios	SH	T	175	Christodoulou	ME	T
OPERATION & MAINTENANCE				176	Christodoulou	ME	T
1	Tsoulas	SH	T	177	Christodoulou	ME	T
2	Nicolaou	SH	T	178	Christodoulou	ME	T
3	Kalyvas	SH	T	179	Christodoulou	ME	T
4	Kazamias	SH	T	180	Christodoulou		

