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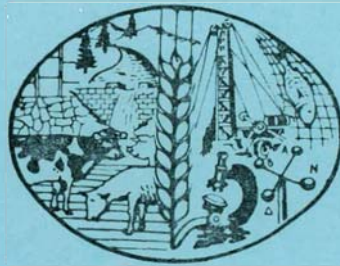
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REPUBLIC OF CYPRUS



MINISTRY OF AGRICULTURE & NATURAL RESOURCES

WATER DEVELOPMENT DEPARTMENT

ANNUAL REPORT 1986

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Director

Nicosia, September 1988

ΒΙΒΛΙΟΘΗΚΗ
ΤΜΗΜΑΤΟΣ ΑΝΑΠΤΥΞΕΩΣ ΥΔΑΤΩΝ

**WATER DEVELOPMENT DEPARTMENT
ANNUAL REPORT 1986**

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ΤΜΗΜΑΤΟΣ ΑΝΑΠΤΥΞΕΩΣ ΥΔΑΤΩΝ

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 1986 the value of the Cyprus £ on average (daily basis) was:-

\$	1.9374
£ st	1.3194
DM	4.1943
Drachma	270.4359

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I GENERAL

Throughout the year 1986 the Water Development Department concentrated its effort on the realisation of the major water development projects the implementation of which is vital to growth in all sectors of development in Cyprus.

The Southern Conveyor Project (SCP) alone, has absorbed a great amount of the Department's potential both for actual construction works for the 1st phase of the project and for the planning of its 2nd phase.

Notwithstanding the drain of the Department's resources to the implementation of the major projects, work continued on all other activities of the Department including hydrogeological investigations and research, the planning and design of major projects, geotechnical investigation and soil mechanics lab work, the construction of routine water supply and irrigation schemes, sewerage and sewage disposal schemes and last but not least the operation and maintenance of all existing water works. Great importance is attached to the efficient operation and maintenance of the major projects which are equipped with telemetry and remote control systems affording immediate availability of information and possibility of swift action especially in emergencies. The upkeep of these systems as well as the other electromechanical installations of the major projects require the proper manning and equipping of our Mechanical-Electrical Division of the Department.

During 1986 and for the twelfth 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.

An important development during 1986 was the acquisition of a system of microcomputers with several terminals serving all functions of the Department in addition to two personal computers acquired two years ago and the start of more systematic training on the use of computers of staff members of all ranks. Needless to say that the Department of Water Development has been using computers for the past 20 years mainly for its hydrological studies and project feasibility studies, making use of privately owned computers. With the advent of personal and microcomputer systems it has become imperative for the Department to become self sufficient in this respect and make extensive use of computers in all the fields of its activities.

The budget of the Department for 1986 from both Ordinary and Development votes as well as extra-departmental votes amounted to £50 million and the total expenditure was a record £41.75 million.

BRIEF DESCRIPTION OF PROJECTS

Major Projects Under Full Operation and Maintenance

Paphos Irrigation Project

The Paphos Irrigation Project (PIP) is one of the largest and most important projects constructed by the Water Development Department for the irrigation of 5000 ha of net irrigable land in the south western coastal plain of Cyprus east and west of the town of Paphos. The water requirements for the irrigation of this area are estimated at 36 MCM/year provided by the Xeropotamos River flow (22 MCM) regulated at Asprokremmos where an earth dam has been constructed, by the alluvial aquifers in the river beds of Dhiazizos, Xeropotamos (lower reaches 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 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,
- Dhypotamos Dam on Pendaskinos river, having a capacity of 15 MCM,
- A diversion system to convey the excess flows of Maroni river around 2 MCM per year to the Dhypotamos Dam reservoir,
- A conveyance and distribution system for irrigation from 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 Dhypotamos Dam comprising main conveyor, break pressure tank and pipeline networks for the Pendaskinos irrigation area,

- A conveyance system comprising main conveyor (common with that from Kalavastos Dam up to the break pressure tank), pumping station at Tokhni and balancing reservoir at Khirokitia to convey water from Kalavastos Dam to the Khirokitia Water Treatment Plant,
- A water treatment plant, reservoirs and pumping station at Kornos for the Water Supply of Nicosia and
- A conveyor from Skarinou to Lakatamia reservoir Nicosia which was completed in January 1982. This work which is known as Nicosia Water Supply Scheme Phase I, includes also the Dhypotamos Pumping Station, the Stavrovouni Balancing Reservoir and a Break Pressure Tank at Nisou.

Approximately half the quantity of water cropped by the VPP is allocated 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.

The domestic water supply components of the project such as the Kornos Treatment Plant come under the control of the O & M Division (DWS).

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. Construction on the main conveyor started in 1985 and was completed in 1988X.
- 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 Dhiarizos river to Kouris Dam reservoir, two water treatment plants (one for Limassol and one at Tersephanou for Nicosia and Larnaca WS) and irrigation distribution networks for Akrotiri, Kiti, Mazotos and Parekklisha covering a total area of 4335 ha.

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.

Footnote:

* Since this report was completed in December 1988 some of the information is given retrospectively here.

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.

DEPARTMENTAL ORGANIZATION

The Water Development Department

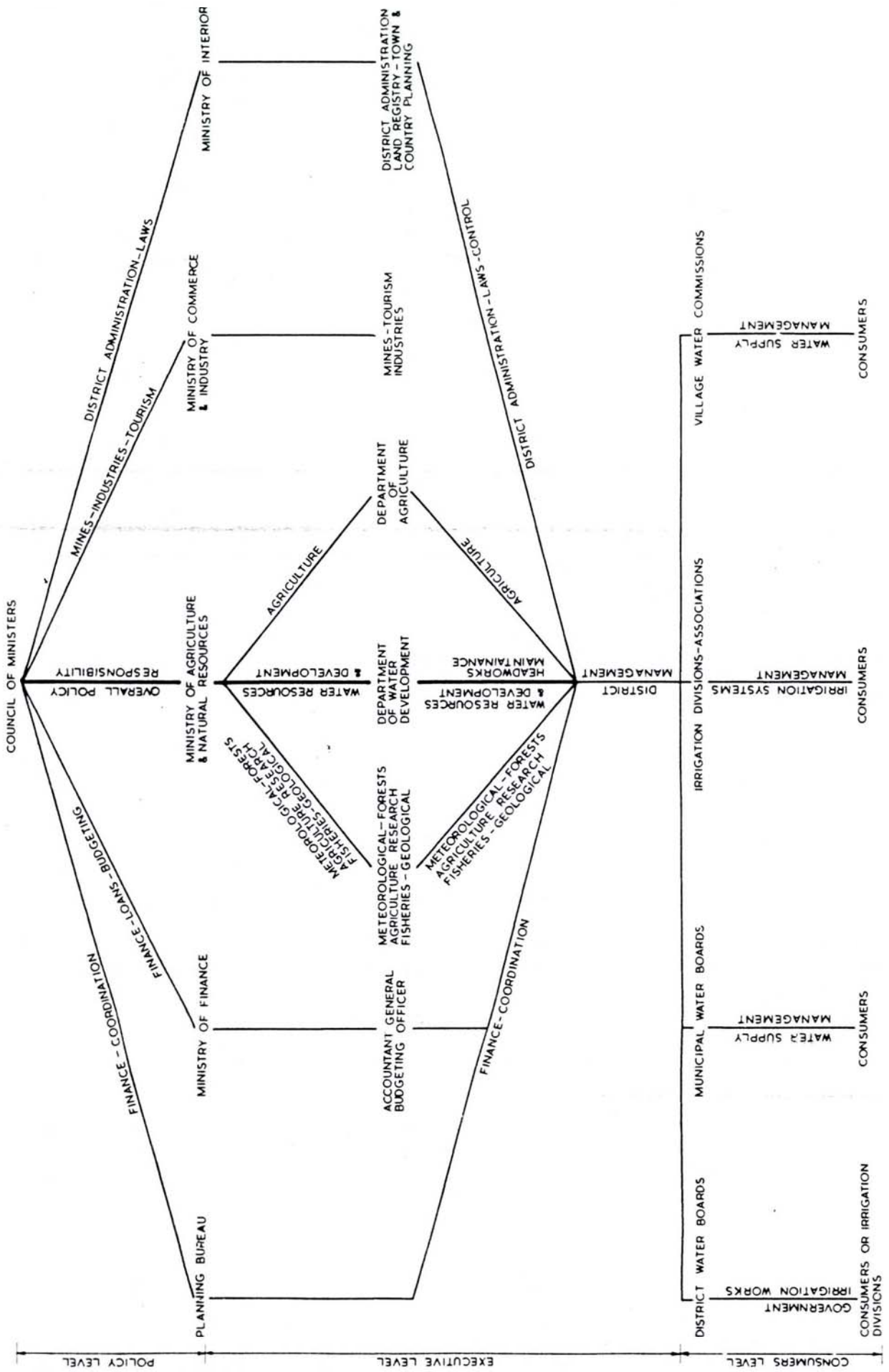
The Department of Water Development, Ministry of Agriculture and Natural Resources, is responsible for the Government's overall policy on water resources, planning, design and construction on the Island. It also cooperates in the management of water resources and water development projects together with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



WATER RESOURCES CONSERVATION & DEVELOPMENT
GOVERNMENT INSTITUTIONAL SET UP

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.

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.

TECHNICAL STAFF OF WDD ON 31.12.1986

DRG No BM/G/223

TECHNICAL STAFF		D	AD	PWE	SWE	SH	EE	ME	Geo	H	CH	TIE	STS	TS	ST	T	CF	ACF	F	SE	TOTAL	REFERENCE		
1	Permanent Ordinary Staff	1	1	1	6	2	42	2	2	4	2	4	7	13	39	197	7	20	57	2	409	D AD PWE SWE SH EE ME Geo H CH TIE STS TS ST T CF ACF F SE		
2	Casual Staff																						Director Assistant Director Principal Water Engineer Senior Water Engineer Senior Hydrogeologist Executive Engineer Mechanical Engineer Geologist Hydrologist Chemist Topographer Irrigation Eng. Senior Tech. Superintendent Technical Superintendent Senior Technician Technician Chief Foreman Assistant Chief Foreman Foreman Sanitary Engineer	
TOTAL NUMBERS		1	1	1	6	2	42	2	2	4	2	4	7	13	39	197	7	20	57	2	409			
DISTRIBUTION OF STAFF																								
4	DIRECTORATE	1	1	1																		3		
5	i Water Resources Management					1			1	1			1	1	2	17							25	Chemist
	ii Hydrology					1			1	1			1	1	4								9	Topographer Irrigation Eng. Senior Tech. Superintendent
	iii Planning											1	1		29		1	2					40	Technical Superintendent
	iv Design					1									16								19	Senior Technician
	v Construction					1								1	4	1	4	1	4	3			20	Technician
6	vi Rural Projects Planning					1							1	1	3	3							11	Chief Foreman
	vii Operation & Maintenance - DWS					1							1	1	2	2							11	Assistant Chief Foreman
	viii Operation & Maintenance - Irrig.					1							1	1	2	2	3						11	Foreman
7	i Paphos Irrigation Project (PIP) O&M					1																	10	Sanitary Engineer
	ii Southern Conveyor Project (SCP)												1	3	4	50		2	8				87	
	iii Vasilikos - Pendaskinos Project (VPP)																						1	
	iv Khrysokhou Irrigation Project (KIP)																						26	
8	i Regional Office, Famagusta-Larnaca													1	1	11		1	2				17	
	ii Regional Office, Limassol																	2	22	1	6	14	46	
	iii Regional Office, Paphos																						32	Missing since 1974 invasion
9	iv Mechanical and Electrical Services													1	1	2		2	4				11	On scholarship or Leave
	Various Postings																							
10	Vacancies																							
TOTAL NUMBERS		1	1	1	6	2	42	2	2	4	2	4	7	14	39	212	7	20	57	2	425			

Note: Six Executive Engineers, one Senior Technician and eight Technicians were transferred to Limassol Regional Office, but are posted at SCP sites and are listed under SCP on this table

* Under 'TS' one post supernumerary Under 'T' 15 posts supernumerary

FOREIGN TECHNICAL ASSISTANCE

United Nations

Technical assistance received from United Nations during 1986 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 the requirements of the major projects.

The general conclusion obtained from the study of 57 river flow gauging stations is that the flow in most of them was below normal and a general drop of the in the static water level of most important aquifers was observed. In some aquifers a slight rise was observed particularly 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 1985-86 averaged 435.0 mm which is 84% of normal. The rainfall was lower than normal in most areas, ranged between 70% and 95% of normal, while the monthly distribution of precipitation was above normal in October, May, June and September.

The maximum amount of rainfall in a 24-hour period was 124.0 mm recorded by Vavla rainfall station on the 22nd May 1986.

The first snowfall occurred on mount Olympus, the highest peak of Troodos mountain range, on 3rd December 1985 and the last snowfall on the 18th of March 1986. The air temperature as a whole was above normal.

The extreme maximum temperature was 41.3°C reported by Nicosia town climatological station on the 16th July 1986 and the extreme minimum temperature was -2.4°C reported at Panayia Bridge on 20th December 1987.

The maximum annual evaporation measured from a U.S.W.B pan was 2,222 mm reported by Larnaca Airport Synoptic Station and the minimum annual evaporation was 1,370 mm at Prodhromos.

Hydrology

The Division of Hydrology and Water Resources Management which was established in 1982, continued in 1986 with 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 1986 were:

- Hydrologic data of various catchments involved in the Karyotis Feasibility Study and follow up of the runoff monitoring at selected sites.
In this connection updating of rainfall data was performed at 10 stations and simulation of runoff was made at various subcatchments of the Karyotis river.
- Flood studies on minor catchments.
- Updating of the data bank with recent rainfall and runoff data.
- Development of surface hydrology software for computer application.

- A comprehensive survey covering 8500 wells was carried out in 1986 in the Kokkinokhoria area. This well-inventory is being computerized and stored in a data bank to assist in the planning and design of the Irrigation Blocks under the S.C.P.
- A hydrogeological study of the Tremithos riverbed was carried out.
- A hydrogeological study of the Xeropotamos riverbed aquifer, downstream the Asprokremmos Dam, was carried out and releases for recharge were initiated.
- A study on the operation of the Yermasoyia aquifer in connection to the concurrent studies made by the H. Humphries and Partners for the Limassol Water Board, was carried out.
- 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, Parekklisha 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 Asprokremmos 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.
- Monitoring of the Phassouri recharge pond to determine extent and scope of artificial recharge in the area.

Planning of Projects

During 1986 the Division of Planning was involved mainly in the feasibility studies of Krasokhoria Project and Karyotis Project. In addition numerous applications by villages for the planning of major water works were also dealt with during the year. The feasibility study for the water development component of the Krasokhoria Integrated Rural Development Project, was completed in 1986 and submitted to be evaluated with the other components of the Project. This Project is similar to the Pitsilia Integrated Rural Development Project, and includes a number of earth ponds and two dams, the design of which has been undertaken by foreign Consulting Engineers.

The feasibility of the Karyotis Project, the main purpose of which is the conveying of the Karyotis river surplus water to Nicosia for its domestic water supply, was undertaken by Soviet Consultants. The preliminary feasibility study of the Project was completed at the beginning of the year 1986. Topographical surveys as well as geological and geotechnical investigations for the final feasibility study which will be submitted to the Consultants in 1988 were undertaken by the Department in cooperation with the Geological Survey Department.

Design of Projects

At the beginning of the year 1986 the final design of the 2nd phase of the Southern conveyor Project was awarded to the Yugoslav consulting firm "Energoprojekt" and the Division was

mainly involved with the gathering of information required by the Consultants who are working in close cooperation with the Division of Design.

Construction of Projects

Construction expenditure of the Department during 1986 reached the amount of £37,086,855 against £22,462,514 for 1985 (See table VII-1 under DIVISION OF CONSTRUCTION).

Southern Conveyor Project (SCP) 1st Phase

Fourteen contracts of a total value of £57 million are currently in progress for the 1st phase of SCP ie four construction contracts of a combined value of £35.5 million and 10 supply contracts valued at £21.5 million.

The first SCP construction contract of approx. £20 million was signed in 1984 with Impregilo of Italy in joint venture with J & P of Cyprus for the construction of the 115 million cubic meters (MCM) water capacity Kouris Dam. The construction of Kouris dam which is the main source of water of SCP started in September of 1984 and is scheduled to be completed in 1988. It is nevertheless planned to start impoundment earlier to take advantage of the rainy season of 1987-88.

The second SCP construction contract of a value of over £6 million was signed with the joint venture CYBARCO-SHAND for the laying of 110 km long, 1400-800 mm dia ductile iron pipeline. Work on this contract started in October, 1985 and it is scheduled for completion in the first half of 1988. A 3.9 m dia 560 long tunnel on the Kouris Dam end is included in this contract.

Work on the construction of Akhna Dam of 5.8 MCM capacity started in mid 1986. Water from Kouris Dam will be conveyed to Akhna Dam which will act as a balancing reservoir for the irrigation of Kokkinokhoria area. The value of this contract which was signed with Iacovou Brothers is £1,313,000 and it is expected to be completed during the latter half of 1987.

In the meantime tenders were invited and force account work was started on the Kokkinokhoria irrigation distribution system as follows:

- In July 1986 gangs of the WDD Construction Division started the laying of the main conveyor of the Kokkinokhoria distribution system with the secondary distribution system scheduled for construction at the beginning of 1987.
- The award of the contracts for the construction of 4 balancing reservoirs (BRs) and 15 central distribution points (CDPs) is expected to take place in January 1987.
- Tenders for the construction of the CDP pumping stations have been asked and these will be awarded at the beginning of 1987.

The total cost of the Kokkinokhoria irrigation distribution system is estimated at £15 million.

SCP 1st Phase Supply Contracts

The main supply contracts of the 1st phase of the SCP are for pipes, valves, water meters, farm hydrants and pumps.

The biggest supply contract valued at £19,382,000 is for the supply of the ductile pipes for the 110 km long main conveyor which was signed in May 1985 with the French manufacturers, Pont-a-Mousson. The remaining supply contracts are of a smaller value and are estimated to total £3,600,000.

Total expenditure for 1st phase is estimated at approx. £95 million.

SCP 2nd Phase

The design of the 2nd phase of SCP was undertaken by Energoprojekt of Yugoslavia at the beginning of 1986. This work involves the designs for the Dhiarizos diversion, the Limassol Water Treatment Works the Tersephanou Water Treatment Works and the irrigation systems for Akrotiri, Parekklisha, Mazotos and Kiti areas.

Khrysokhou Irrigation Project

With regard to the Khrysokhou Irrigation Project (KIP) which covers the northwestern area of Cyprus around Polis, construction for the implementation of this project entered the 3rd year mainly with the continuation of construction of Evretou Dam and its completion at the end of 1986; the commencement of laying of the irrigation distribution network of the 1st phase of KIP; the water distribution tanks and ponds and farm roads.

Evretou Dam with 25 MCM water capacity has been constructed by the joint venture of Shephard Hill - G P Zachariades at a total cost of £9.2 million. The dam gates were closed for impoundment in September 1986.

G P Zachariades was also awarded the contract for the construction of the distribution network and farm roads at a total cost of £1.46 million and work started in March 1986.

The contract for the laying of the main conveyor and the construction of the distribution tanks and ponds valued at approx. £1,222,000 was signed with the General Construction Company in November 1986.

At completion of the 1st phase of the KIP an area of approx. 2000 ha of land in the Khrysokhou Valley will be irrigated with water from Evretou Dam and boreholes in the Khrysokhou river valley.

Five supply contracts of a total value of £2,360,000 have been signed for pipes, valves, water meters, farm hydrants etc. for the main conveyor and the irrigation distribution network. Delivery of

these pipes and fittings started in April 1986 and was completed by the end of the year. The single biggest cost was for the main conveyor pipes which amounted to approx. £1.3 million.

Vasilikos-Pendaskinos Project

Vasilikos-Pendaskinos Project (VPP) has entered into its operation stages with the first impoundment of water in the two dams of the project namely Kalavastos and Dhypotamos during the 1984-85 winter months and the commissioning of the Kornos Water Treatment Plant at the end of 1985.

During 1986 work continued on the construction of the Vasilikos area irrigation distribution network and some finishing works for Kornos Treatment Plant. The installation of the telemetry system of the VPP started towards the end of 1986.

In spite of our predictions that full operations of the VPP would contribute towards uninterrupted supplies to Nicosia and Larnaca our expectations have fallen short of this target for 1986 due to low rainfall and consequently limited impoundment of water in the VPP dams.

Operation and Maintenance-Domestic Water Supplies

The year 1986 came after five consecutive years of drought. The 1985-86 winter season was again poor in rainfall with the result that the volume of water impounded in the dams was limited and the aquifers were depleted further which had an adverse effect on the yield of existing water supply sources.

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 1986 was 10.987MCM out of which 9.768MCM came from government sources, 1.019MCM was purchased from private sources and 0.199MCM was the yield of Nicosia Water Commission sources. Included in the government sources is a quantity of 1.524MCM produced by the 1982-1984 emergency schemes BHs. Of the total production, the quantity of water delivered to the Nicosia service reservoirs was 10.435MCM. A quantity of 0.622MCM 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 10.435 MCM and compared to the unrestricted demand of the town, which is estimated for 1986 at 13.80MCM per annum there was a deficit of 3.36 MCM per annum and restrictions on the hours of supply to Nicosia town were imposed from 16.4.1986 to 1.5.1986 and from 16.6.86 to 4.10.86 and

provided 24 hours supply every 48 hours. The total expenditure during 1986 for the operation and maintenance of all sources and conveyance systems supplying Nicosia town was £759,970 and the revenue generated from the sale of water was £1,798,616, 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 7.58MCM. The quantity of water drawn from Yermasoyia, Lefkara and Kalavastos Dams was 2.32, 0.03 and 3.88MCM respectively (net of losses at the treatment works). The total expenditure for the operation and maintenance of the system during the year was £487,910 and the revenue generated £1,591,708 (including outstanding accounts).

The town of Larnaca received 2.80MCM of water from the Central Water Supply System and the production of its own and leased sources was 0.47MCM totalling 3.27MCM. This quantity could not meet the increased demand of the town and the Water Board of Larnaca had to impose restrictions on the supply.

The Water Board of Limassol controls both the sources of supply and the distribution system of the town. Despite the drought 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 1986 was 8.92MCM.

Paphos Water Supply comes under the direct control of the Municipality. Due to carrying capacity limitations of the main conveyor of the town, the water supply of the town was augmented from Paphos Lower Villages Water Supply Scheme by 0.55MCM. The total quantity of water available to the town during the year was 1.76 MCM which could not meet the increased demand and restrictions on the supply had to be introduced during the summer months.

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.

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

Dtg. No. AG/IR/68

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

L I G N E	NOM DU BARRAGE NAME OF DAM	ANNÉE D'ACHÈ- VEMENT YEAR OF COMPLE- TION	SITUATION - LOCATION			SITUATION ET TYPE D'ÉTAN- CHÉTE AND POSITION	HAUTEUR D'AU-DESSUS DU BASSE- FONDA- TION HEIGHT ABOVE LOWEST FOUN- DATION	VOLUME DU BARRAGE VOLUME CONTENT OF DAM (10 ³ m ³)	CAPACITÉ TOTALE DU RÉSÉROIR SÛRÉAGE DU RÉSÉROIR GROSS CAPACITY OF RESERVOIR AREA (10 ³ m ³)	D E S P I R I T A I O N S O F S P I L L I N G L I N E S	CAPACITÉ MAXI- MALE DES ÉVACUA- TEURS MAXIMUM DIS- CHARGE CAPACITY OF SPILL- WAYS (m ³ /h)	TYPE DES ÉVACUA- TEURS TYPE OF SPILL- WAYS	PROPRIÉTAIRE OWNER	BUREAU D'ÉTUDES ENGINEERING BY	CONSTRUCTEUR CONSTRUCTION BY	No.
			VILLE LA PLUS PROCHE NEAREST CITY	ÉTAT PROVINCE OU DÉPAR- TEMENT STATE PROVINCE OR COUNTRY	COURS D'EAU RIVER											
1	PALEHORI KAHRI	1973	Nicosia	Nicosia	PC	R	33	27	1	65	L	Government & Paleohori Irr. Div.		J & P, Cyprus	1	
2	ARAKAPAS	1975	Limassol	Limassol	PC	R	23	10	1	205	L	Arakapas Irr. Div.			2	
3	AYI VAVATSIMIAS No1	1980	Larnaca	Larnaca	TE	S	17	32	1	55	L	Palambelis-SophiTomouti Irr. Div.		Iacovou Bros, Cyprus	3	
4	EPHATAGONIA No1	1980	Limassol	Limassol	TE	S	16	46	1	92	L	Kokkinoyia Irr. Div.		Iacovou Bros, Cyprus	4	
5	KIARIFIA	1980	Limassol	Limassol	TE	S	35	41	1	70	L	Kambou tou Paphiti Irr. Div.		CYBARCO, Cyprus	5	
6	MELINI	1980	Larnaca	Larnaca	TE	S	22	32	1	59	L	Melini Irr. Div.		Iacovou Bros, Cyprus	6	
7	PELENDRIA	1980	Limassol	Limassol	TE	S	18	59	1	123	L	Amnos Irr. Div.		FYSCO, Cyprus	7	
8	AKAPPOU-EPHATAGONIA	1981	Limassol	Limassol	TE	S	18	67	1	132	L	Akapou - Ephatagonia Irr. Div.		Iacovou Bros, Cyprus	8	
9	AYI VAVATSIMIAS	1981	Larnaca	Larnaca	VA	R	19	2	1	24	L	Palambelis-SophiTomouti Irr. Div.			9	
10	KATO WYLOS	1981	Limassol	Limassol	TE	S	23	41	1	106	L	Vatera Irr. Div.		Phoenix Constructions, Cyprus	10	
11	AGRINIA	1982	Limassol	Limassol	TE	S	18	25	1	59	L	Kladhos Irr. Div.		Iacovou Bros, Cyprus	11	
12	ASPROKREPMOS	1982	Paphos	Paphos	TE	R/S	56*	2 097	1	51 000	L	Government	Sir M McDonald & Partners UK	Joint Venture J & P and HECOM, Cyprus	12	
13	KYPEROURA	1982	Limassol	Limassol	TE	S	27	94	1	2 290	L	Phterika Irr. Div.		Iacovou Bros, Cyprus	13	
14	XYLIATOS	1982	Nicosia	Nicosia	ER	R	42	260	1	36	L	Government		General Construction Co Cyprus	14	
15	LAGOURERA	1983	Nicosia	Nicosia	TE	S	36	63	1	96	L	Acones Irr. Div.		Joint Venture Phoenix Constr. & KYKOS, Cyprus	15	
16	AYI VAVATSIMIAS No2	1984	Larnaca	Larnaca	TE	S	25	30	1	43	L	Petalia - Fajovato Irr. Div.		Chr. Charalambous, Cyprus	16	
17	DIKERMA	1984	Larnaca	Larnaca	TE	S	24	59	1	159	L	Diastiera Irr. Div.		Ch. Apostolides, Cyprus	17	
18	KHROULTIA	1984	Larnaca	Larnaca	TE	S	16	95	1	205	L	Irr. Div. to be set up		Iacovou Bros, Cyprus	18	
19	DIYTOPANOS	1985	Larnaca	Larnaca	ER	R	49	1 090	S/I	15 000	L	Government	Rofe, Kennard & Lapworth & W Evans & Partners, UK	Shepherd-Hill, UK with G P Zachariades, Cyprus	19	
20	ALAVAZIS	1985	Larnaca	Larnaca	ER	R	57	1 700	L/S	17 000	L	Government	Rofe, Kennard & Lapworth & W Evans & Partners, UK	J & P with HECOM, Cyprus	20	
21	EVRETHI	1986	Paphos	Paphos	ER	R/S	70**	1 400	1	25 000	L	Government	Sir William Halcrow and Partners, UK	Shepherd-Hill, UK with G P Zachariades, Cyprus	21	
22	AKINA	1987	Famagusta	Famagusta	TE	S	23	250	1	5 800	L	Government	Sir William Halcrow and Partners, UK	Iacovou Bros, Cyprus	22	
23	KOUBIS	1988	Limassol	Limassol	TE	R	113	9 400	1/S	115 000	L	Government	Impregio, Italy	with J & P, Cyprus	23	
24															24	
25															25	

LIGNE DE PLUIRE POUR DACTYLOGRAPHIC

FOLDING LINE FOR TYPING

NOTES

*-4'11" 17 Concrete cut-off wall 29m deep below lowest foundation
**-11'11" 46 Plastic concrete cut-off wall 35m deep below lowest foundation

REGISTRE DES BARRAGES EN
REGISTER OF DAMS IN CYPRUS

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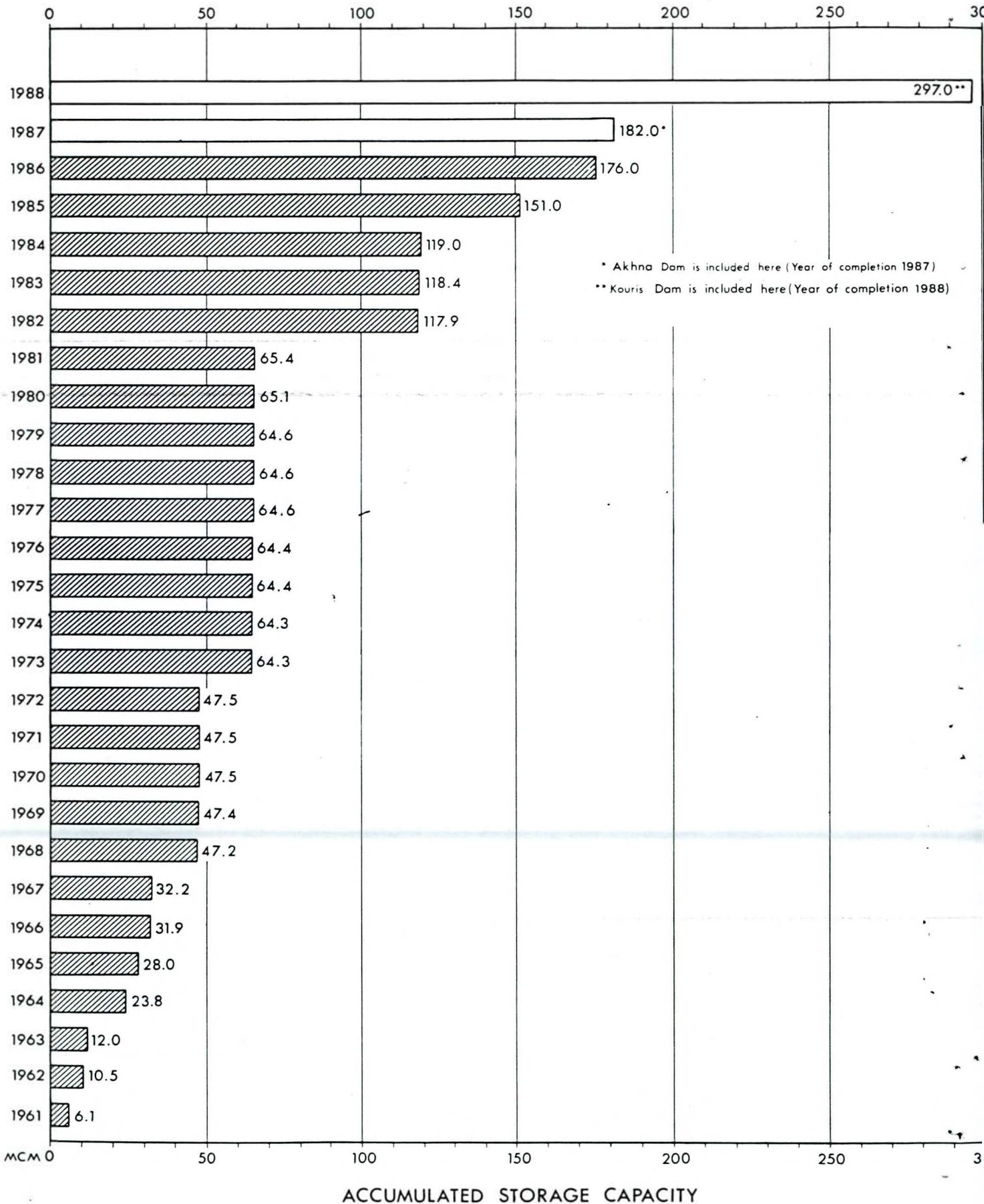
L I G N E L I N E N O	NOM DU BARRAGE NAME OF DAM	ANNÉE D'ACHÈ VEMENT YEAR OF COMPLE TION	SITUATION - LOCATION			SITUATION ET TYPE D'ÉLAN- CHÊTÉ POSITION AND NATURE OF SEALING ELEMENT	HAUTEUR AU DESSUS DE LA PLUS BASSE FONDA- TION HEIGHT ABOVE LOWEST FOUN- DATION	LON- GUEUR DE CRÊTE LENGTH OF CREST (m)	VOLUME DU BARRAGE CONTENT OF DAM (10 ³ m ³)	LIGNE DE FURE POUR DACTYLOGRAPHIE		CAPACITÉ TOTALE DU RÉSERVOIR SURFACE DU RÉSERVOIR GROSS CAPACITY OF RÉSERVOIR (10 ³ m ³)	CAPACITÉ MAXI- MALE DES ÉVACUA- TEURS N P MAXIMUM DIS- CHARGE 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
			COURS D'EAU RIVER	VILLE LA PLUS PROCHE NEAREST CITY	ÉTAT PROVINCE OU DÉPAR- TEMENT STATE PROVINCE OR COUNTRY					FOLDING LINE FOR TYPING							
1	KAFIZES	1953	Xeros (Morphou)	Nicosia	Nicosia	PG	R	23	27	6		113	I	L	Lefka Irr. Div.	WDD	
2	KANDOU	1956	Kouris	Limassol	Limassol	PG	R	15	53	2		36	I	L	Kandou Irr. Div.	WDD	
3	PERAPEDI	1956	Kouris	Limassol	Limassol	PG	R	22	62	4		55	I	L	Perapedi Irr. Div.	WDD	
4	PYRGOS	1957	Katouris	Nicosia	Nicosia	PG	R	22	66	5		12	I	L	Pyrgos Irr. Div.	WDD	
5	TRIFKLINE	1958	Kouris	Limassol	Limassol	PG	R	33	76	6		30 340 23	I	L	Trifkline Irr. Div.	WDD	
6	ATHALASSA	1962	Pedheos	Nicosia	Nicosia	TE	R/S	18	467	103		791	I	L	Government	WDD	
7	GEUNYELLI	1962	Pedheos	Nicosia	Nicosia	TE	R/S	15	254	50		230 1 045 276	I	L	Geunyelli Irr. Div.	WDD	
8	LEFKA	1962	Marathasa	Nicosia	Nicosia	PG	R	35	149	11		368 45	I	L	Lefka Irr. Div.	WDD	
9	MORPHOU	1962	Serrakhis	Nicosia	Nicosia	TE	S	13	1 436	206		1 879 480	I	L	Morphou Irr. Div.	WDD	
10	PRODHROMOS	1962	Off-stream	Limassol	Limassol	TE	R/S	10	756	73		122 26	I	L	Prodhromos Irr. Div.	WDD	
11	KANLI KEUY	1963	Pedheos	Nicosia	Nicosia	TE	R/S	19	311	47		1 113	I	L	Kanli Keuy Irr. Div.	WDD	
12	AGROS	1964	Kouris	Limassol	Limassol	TE	R	26	180	61		99 15	I	L	Agros Irr. Div.	WDD	
13	ARGAMA	1964	Mgounda	Paphos	Paphos	ER	R	41	173	138		1 150 107	I	L	Government	Howard Humphreys & Sons, UK	
14	KITI	1964	Tremithos	Larnaca	Larnaca	TE	S	22	990	183		1 614 360	I	L	Government	11 Nuovo Castoro, Italy	
15	LIOPETRI	1964	Potamos	Famagusta	Famagusta	TE	S	18	579	50		76	R	L	Liopetri Irr. Div.	WDD	
16	MIA MILEA	1964	Pedheos	Nicosia	Nicosia	TE	R/S	22	140	54		355 68	I	L	Mia Milea Irr. Div.	WDD	
17	ORGOS	1964	Serrakhis	Nicosia	Nicosia	TE	S	16	745	130		845 260	I	L	Morphou Irr. Div.	WDD	
18	AYIA MARTA	1965	Xeros	Paphos	Paphos	ER	R	33	142	61		311 33	I	L	Ayia Marina Irr. Div.	Med. Constr. Greece - G.P. Zachariades Cyprus	
19	POLETHIBIA	1965	Geryllis	Limassol	Limassol	TE	R/S	45	196	215		3 864 110	I	L	Government	Energo projekt, Yugoslavia	
20	KALOPANAYIOTIS	1966	Marathasa	Nicosia	Nicosia	TE	R	40	137	156		391 47	I	L	Government	Energo projekt, Yugoslavia	
21	MAVROKOLINHOS	1966	Havrakko- Lymbos	Paphos	Paphos	TE	R/S	45	528	267		2 180 175	I	L	Government	Energo projekt, Yugoslavia	CYBARCO, Cyprus
22	FORKOS	1966	Livnathi	Paphos	Paphos	ER	R	38	302	153		899 83	I	L	Pomos Irr. Div.	Energo projekt, Yugoslavia	Med. Constr. Greece - G.P. Zachariades Cyprus
23	VERMASOYIA	1968	Yermasoyia	Limassol	Limassol	TE	R	49	409	539		13 600 1 100	I	V	Government	Energo projekt, Yugoslavia	CYBARCO, Cyprus
24	LEFKARA	1973	Syrkatis	Larnaca	Larnaca	ER	R	74	240	820		13 850 650	S/I	L	Famagusta Water Board & Lefkara Irr. Div.	Energo projekt, Yugoslavia	L. Fairclough UK and MECON Cyprus
25	MUSAFI	1973	Serrakhis	Nicosia	Nicosia	TE	S	15	929	245		2 273 620	I	V	Government	Howard Humphreys & Sons, UK	WDD

NOTES

1 WDD : Water Development Department.
Irr. Div: Irrigation Division

DEPARTMENT OF WATER DEVELOPMENT
PROGRESS IN DAM CONSTRUCTION

AG/IR/63



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 72.285 MCM. From this quantity 32.663 MCM were used for the irrigation of 8449 hectares, 10.606 MCM were used for domestic water supplies, 6.208 MCM were used for recharge, 0.556 MCM seeped through or below the dams and 4.252 MCM were lost as evaporation. The remaining 18.000 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 67.006 MCM. Out of this only 45.548 MCM were utilized, 28.734 MCM for irrigation, 10.616 MCM for domestic water supply and 6.208 MCM for recharge. Irrigation water was utilized on 7,215 hectares of land planted with citrus, bananas, vines, deciduous, vegetables, potatoes cereals and olives. The gross income from the sale of water amounted to £1,043,594. The total operation, maintenance and energy cost amounted to £769,564 and the net income to the Government was £274,030. The O&M expenses breakdown is as follows: Operation, £182,750, Maintenance £279,893 and energy cost £307,011.

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 involved also with major projects in their regions in studies, investigations and force account construction work.

MEMBERSHIP OF WDD TO INTERNATIONAL ORGANISATIONS.

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

- International Hydrologic Program (I.H.P.)
- International Commission on Large Dams (ICOLD)
- 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

DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT 1000m	YEAR
1	Kouklia	Earth	6	1900
2	Lymbia	Gravily	5	1945
3	Lyrhadhonda	Gravily	11	1945
4	Kalokhorio (KI)	Gravily	9	1947
5	Akrounda	Gravily	7	1947
6	Galini	Gravily	11	1947
7	Petra	Gravily	9	1948
8	Petra	Gravily	9	1951
9	Lyrhadhonda	Gravily	10	1952
10	Kafizes	Gravily	23	1953
11	Ayios Loucas	Earth	3	1955
12	Gyptos	Earth	3	1955
13	Kandou	Gravily	15	1956
14	Perapedhi	Gravily	22	1957
15	Pyrgos	Gravily	22	1957
16	Trimiklmi	Gravily	33	1958
Total Storage Capacity				6.174 m ³ x 10 ⁶

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT 1000m	YEAR
17	Prodromos	Earth	10	1962
18	Morphou	Earth	13	1962
19	Lefka	Gravily	35	1962
20	Geunyei	Earth	15	1962
21	Athalassa	Earth	18	1962
22	Karri Key	Earth	19	1963
23	Argaka	Rockfill	41	1964
24	Mia Milia	Earth	22	1964
25	Ovgos	Earth	22	1964
26	Kiti	Earth	26	1964
27	Agros	Earth	26	1964
28	Lipetri	Earth	18	1964
29	Palemidhia	Earth	45	1965
30	Ayia Marina	Rockfill	33	1965
31	Kalopanayiotis	Earth	40	1966
32	Mavrokolymbos	Earth	45	1966
33	Pamos	Rockfill	38	1966
34	Yermasyia	Earth	49	1968
35	Syngariss	Earth	7	1968
Total Storage Capacity				32.041 m ³ x 10 ⁶

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT 1000m	YEAR
36	Ayios Yeoryios	Earth	6	1962
37	F'sia Antiflood	Earth	8	1963
38	Ayios Nikolaos	Earth	2	1965
39	Paralimni Lake	Earth	3	1965
40	Fresh Water Lake	Earth	3	1964
41	Makrasyka	Earth	4	1964
42	Akhna (Mesania)	Earth	4	1967
43	Morphou spreading grounds	Earth	5	1968
44	Grimidhia	Earth	5	1968
45	Vrysoulis	Earth	7	1969
46	Protapas	Earth	6	1970
Total Storage Capacity				8.275 m ³ x 10 ⁶

HT refers to height in meters from foundation

YEAR is the year of completion

Phenaros (6) means six small dams in Phenaros area

*founded by New Lymbia Dam See ref. No 69

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT 1000m	YEAR
47	Sotira	Earth	8	1962
48	Panayia (F)	Earth	7	1962
49	Paralimni (45)	Earth	5	1963
50	Ayia Napa (7)	Earth	5	1963
51	F'sia Recharge	Earth	5	1963
52	Phenaros (6)	Earth	5	1964
53	Dherynia	Earth	6	1964
54	Phenaros (3)	Earth	7	1966
55	Avgoros (7)	Earth	3	1966
56	Kandea (2)	Earth	5	1966
57	Xylophaghou (4)	Earth	7	1966
58	Sotira (4)	Earth	5	1966
59	Lysi	Earth	7	1967
60	Ay Yeoryios (9)	Earth	3	1967
61	Ay Epikritos (6)	Earth	6	1968
62	Akanthou (6)	Earth	4	1968
63	Akhna (3)	Earth	4	1968
64	Xyloymbou (5)	Earth	5	1969
Total Storage Capacity				1.075 m ³ x 10 ⁶

MAJOR DAM PROJECTS FROM 1971-80

No	DAM	TYPE	HT 1000m	YEAR
65	Lefkara	Rockfill	71	1973
66	Massara Recharge-dam	Earth	15	1973
67	Palekhari-Kambi	Gravily	33	1973
68	Arakapas	Gravily	23	1975
69	New Lymbia	Gravily	12	1977
70	Ayji Vavatsimias	Arch	14	1980
71	Ayji Vavatsimias	Earth	10	1980
72	Ephlagonia No 1	Earth	10	1980
73	Khandria	Earth	10	1980
74	Melini	Earth	10	1980
75	Pelenidria	Earth	10	1980
Total Storage Capacity				17.544 m ³ x 10 ⁶

MAJOR DAM PROJECTS FROM 1981-90

No	DAM	TYPE	HT 1000m	YEAR
76	Ephlagonia No 3	Earth	10	1981
77	Alapenu-Ephlagonia	Earth	9	1981
78	Kato Mylos	Earth	10	1981
79	Ephlagonia No 2	Earth	8	1982
80	Arakapas	Earth	10	1982
81	Asprakremmos	Earth	53	1982
82	Xyltiatos	Rockfill	42	1982
83	Agridhia	Earth	10	1983
84	Kyperounda	Earth	10	1983
85	Lagoudhera	Earth	10	1983
86	Ora	Earth	10	1983
87	Ayji Vavatsimias No 2	Earth	10	1984
88	Pharmakas No 1	Earth	10	1984
89	Pharmakas No 2	Earth	10	1984
90	Arakapas No 2	Earth	8	1984
91	Dhirona	Earth	10	1984
92	Khrokita	Earth	10	1985
93	Esso Galata	Earth	10	1985
94	Kalavatos	Rockfill	60	1985
95	Dhyptomatos	Rockfill	60	1985
96	Evretou	Rockfill	70	1986
Total Storage Capacity				110.976 m ³ x 10 ⁶

GRAND TOTAL UP TO END OF 1986: 176.0 m³ x 10⁶

UNDER CONSTRUCTION

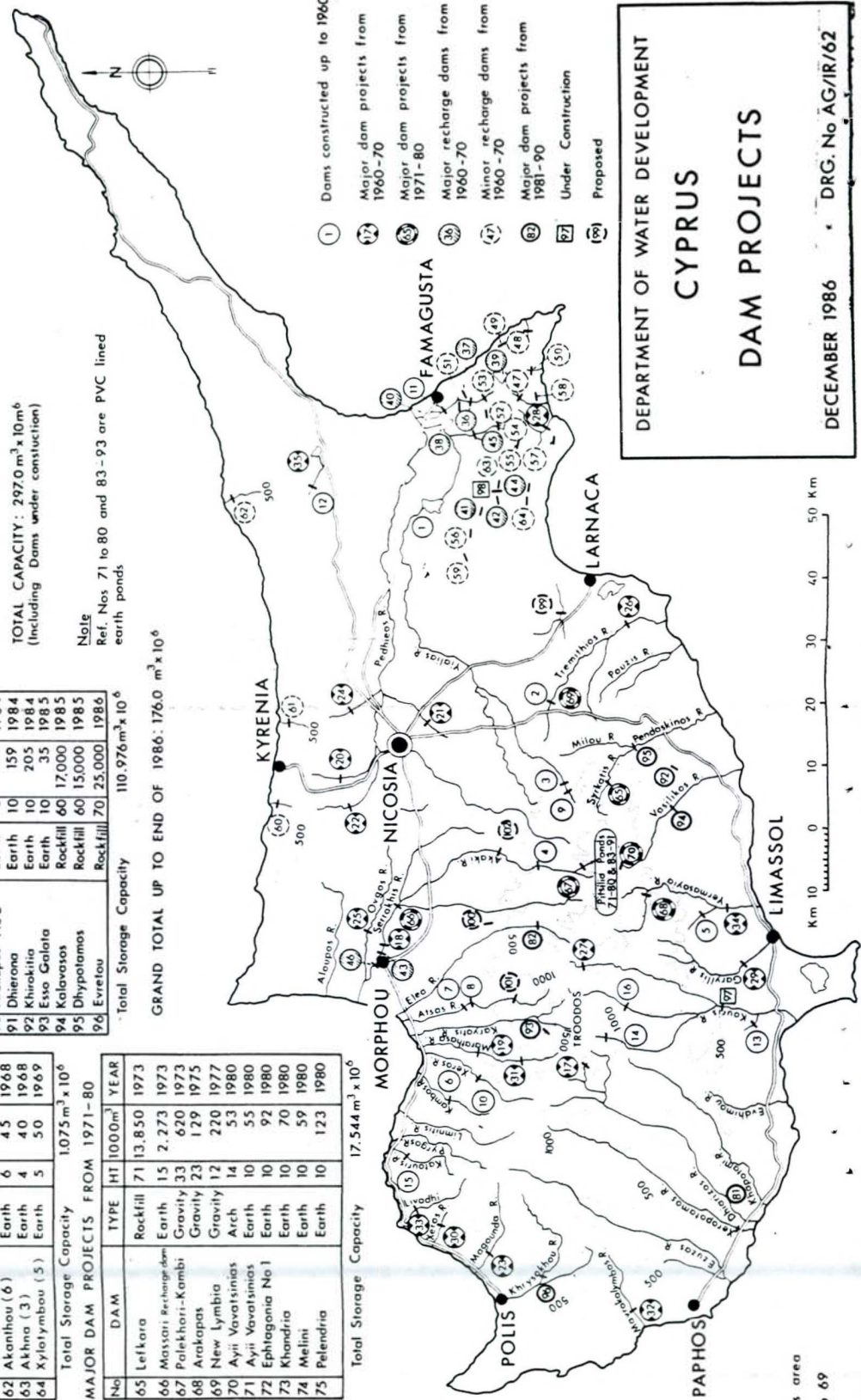
No	DAM	TYPE	HT 1000m	YEAR
97	Kouris	Rockfill	110	1988
98	Akhna	Earth	16	1988
Total Storage Capacity				120.800 m ³ x 10 ⁶

PROPOSED DAMS

No	DAM	TYPE	HT 1000m	YEAR
99	Aradhippou	Earth	14	375
100	Vizakia	Earth	30	900
101	Ayios Theodoros	Rockfill	100	22,500
102	Alaki - Moloundia	Earth	39	2,000
Total Storage Capacity				25.775 m ³ x 10 ⁶

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.



DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
DAM PROJECTS
DECEMBER 1986
DRG. No AG/IR/62

Department, the District Administrations and the Advisory Committee for the Southern Conveyor Project. Meetings were also held with the Panel of Experts, IBRD missions, Kuwait Fund, European Investment Bank etc.

FINANCE EXPENDITURE AND REVENUE

During the year 1986 the total actual expenditure by the Department from WDD budgeted and other non-budgeted votes amounted to £41,745,261 out of a total budget of £50,106,208.

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

The general picture is as follows:

TABLE I-1
GENERAL BUDGET-EXPENDITURE FIGURES FOR 1986

Description	Budget £	Expenditure £
WDD Development Estimates		
Govt. £40 979 369		35 558 582
including loans)		
Loan: 1 322 584	42 301 953	394 272
Total		<u>£35 952 854</u>
WDD Ordinary Estimates	5 871 045	4 380 818
Non-budgeted votes for Pitsi- lia Project, refugee housing estates, works for other Government Departments, private developers and village deposits	<u>1 933 210</u>	<u>1 411 589</u>
Total	£50 106 208	£41 745 261

The level of construction works carried out during 1986 was again an all time record expenditure amounting to £37,086,855 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 £27,629,389.

Loan Proceeds

Description of loans	Amount withdrawn during 1986 £
- Loan No. 1658/5 CY (IBRD) US\$9,910,000 for VPP	803 359
- Loan No. 158 KUWAIT FUND KD2,500,000 for VPP	506 705
- Loan No. 1.1572.00 EUROPEAN INVEST. BANK ECU9,000,000 for VPP	131 479
- Loan No. 2279 CY (IBRD) US\$ 16,000,000 for major waterworks, Khrysohou	NIL

Loans for SCP

Description of loans	Amount received in 1986 CY £
- Loan No. 2386 CY from IBRD US\$27,000,000	1 356 554
- Loan No. 1.2109 from E.I.B (Major Loan) ECU's 26,500,000	1 993 588
- Loan No. 6.0553 from E.I.B. (Special term Loan) ECU's 3,700,000	279 731
- Loan No. 277 from K.F.A.E.D. D. 2,940,000	NIL
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	16 127 607

Revenue

A sum of £3,951,766 was collected during the year 1986 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 1986

Ser. No.	Description	Government Contr.		Village Contr. (Loans)	Total	
		Ordinary	Development			
		£	£		£	
A WDD Votes						
1	Administration	2 444 046		620	-	2 444 666
2	Greater Nicosia W S scheme running expenses	499 165		-	-	499 165
3	Nicosia-Larnaca- Famagusta, Central WS system (formerly styled Famagusta WS scheme)	748 740		-	-	748 740
4	Regional village WS schemes running expenses	66 702		-	-	66 702

TABLE I-2
EXPENDITURE FOR THE YEAR 1986 (Cont.)

Ser. No.	Description	Government Contr.		Village Contr.	Total
		Ordinary	Development	(Loans)	
		£	£	£	£
5	Irrigation, drainage and dams	607 345	34 434 136	133 856	35 175 337
6	Town water supplies	-	87 888	-	87 888
7	Village water supplies .	-	288 058	260 416	548 474
8	Government water supply schemes	-	496 643	-	496 643
9	Drilling & prospecting .	14 820	-	-	14 820
10	Hydrology	-	113 291	-	113 291
11	Surveys & investigations	-	58 546	-	58 546
12	Purchase of machinery and equipment	-	63 468	-	63 468
13	Others	-	1 870	-	1 870
14	Save water campaign	-	14 062	-	14 062
	Total	£4 380 818	£35 558 580	£394 272	£40 333 672

B Non-budgeted Votes

	£
1 Pitsilia Project	27 901
2 Refugee housing estates	110 762
3 Works for other Government Departments	572 449
4 Works for private developers	580 587
5 Works through village deposits	119 890
Total	£ 1 411 589
Grand Total	£41 745 261

(i) Breakdown of Administration Expenditure

	Ordinary	Development	Total
	£	£	£
1 Personal emoluments	2 101 408	-	2 101 408
2 Casual technical assistance	166 316	-	166 316
3 Travelling	88 803	-	88 803
4 M'ce & operation of motor transport	28 755	-	28 755
5a Office expenses	46 335	-	46 335
5b Purchase of drawing materials		620	620
6 Government water supply	12 429	-	12 429
Total	£2 444 046	£ 620	£2 444 666

(ii) Breakdown of Irrigation
Drainage and Dams Expenditure

	Government £	Village £	Total £
1 Minor irrigation works	208 878	109 292	318 170
2 Consultants fees	3 066	-	3 066
3 Paphos Irrigation Project	90 781	-	90 781
4 Vasilikos Pendaskinos Project ...	1 464 261	-	1 464 261
5 Southern Conveyor Project	27 629 389	-	27 629 389
6 Khrysokhou Irrigation Project ...	4 322 786	-	4 322 786
7 Other major waterworks	416 200	24 564	440 764
8 M'ce of dams & distribution system	607 345	-	607 345
9 Karyotis Project	298 775	-	298 775
Total	£35 041 481	£133 856	£35 175 337

TABLE I-3
WDD ORDINARY BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1986

Head 20A Water Development

	£
1986 Approved	5 876 253
Less special warrants	5 208
Total	£5 871 045

Month	Monthly expenditure £	Cumulative expenditure £	%
January	232 909	232 909	3.96
February	388 206	621 115	10.57
March	387 861	1 008 976	17.04
April	332 149	1 341 125	22.84
May	338 165	1 679 290	28.60
June	334 071	2 013 362	34.29
July	370 365	2 383 727	40.60
August	260 652	2 644 379	45.04
September	414 665	3 059 044	52.10
October	324 738	3 383 782	57.63
November	383 375	3 767 157	64.16
December	613 661	4 380 818	74.61

Summary

	£	%
Amount approved	5 871 045	100
Less actual expenditure ..	4 380 818	74.61
Balance	£1 490 227	25.39

TABLE I-4
WDD DEVELOPMENT BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1986
(Not including village loans)
Head 2D Water Development

	£
1987 Approved	31 453 873
Add Special warrants	9 525 496
Total	<u>£40 979 369</u>

Month	Monthly expenditure £	Cumulative expenditure £	%
January	506 527	506 527	1.23
February	672 795	1 179 322	2.87
March	1 375 569	2 554 891	6.23
April	3 952 660	6 507 551	15.88
May	857 086	7 364 637	17.97
June	2 077 867	9 442 504	23.04
July	4 663 506	14 106 010	34.42
August	1 912 658	16 018 668	39.09
September	1 618 774	17 637 442	43.03
October	1 739 320	19 376 762	47.29
November	1 278 157	20 654 920	50.40
December	14 903 660	35 558 580	86.77

Summary

	£	%
Amount approved	40 979 369	100
Less actual expenditure .	35 558 580	86.77
Balance	<u>£5 420 789</u>	<u>13.23</u>

TABLE I-5
STATEMENT OF REVENUE COLLECTED
DURING THE YEAR 1986

Description	£
Drilling charges	325
Nicosia water supply	1 450 481
Paphos Irrigation Project	600 948
Main WS system	
Nicosia - Larnaca - Famagusta	1 622 390
Paphos Lower village water supplies	42 233
Khrysokhou Irrigation Project	21 917
Other fees	191 622
Xyliatos Irrigation Scheme	21 850
Total	<u>3 951 766</u>

STAFF MATTERS

Appointments

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

Paraskevoulla Maratheftou, Ioanna Nicolaou, Andriani Nicolaou, to the permanent (Ord.) post of Executive Engineer II, with effect from 8 November 1985.

The following to the post of Technician 2nd Grade, on a casual basis, with effect from 1st October 1985.

Nicos Andreou Nicolaou, Michael Chr. Koukliotis, Christakis Alkiviades

The following on probation to the permanent (Ord.) post of Technician 2nd Grade as from 8.11.85.

Nikos Tokkaris	Efstathios Efstathiou
George Kissopodas	Constantinos Lambrides
Costakis Araklitis	Evgenios Charalambous
Christos Kounnis	Kyriacos D Iacovou
Anastasia Della	Kyriacos Nicolaides
Christodoulos Constantinou	Kyriacos Tsiaoukkas
Chrystalla Christodoulou	Marios Masouris
Eleni Kyriacou	Xanthos Christodoulides
Andreas Kaizer	George Tsouris
Antonis Vyras	Antonis Ellinas
Kypros Efthyvoulou	Charalambos Koutsioupis
Michael Chr Michael	Yiannakis Charalambous
Michael Aristodemou	Michalakis Kaouros
Charalambos Larkos	Stavros Naoum
Vasos Yiorkas	George Ioannou
Aristodemos Pittas	Nicos Neophytou
Michael Katsouras	Androulla Stavrou
Costakis Pelopidas	Petros Petrou
Panayiotis Zaros	Koulla Pitta
Achilleas Christou	Ioannis Kolokotronis
Anna Constantinou	Yiannoulla Ioannou
Charalambos Phylactou	George A Charalambous
Nicos K Nicolaou	Pavlos Kkolas
George Antoniou	Christakis Alkiviades
Solon Kyprou	Nicos A Nicolaou
Christina Demetriou	Andreas Charalambous
Marios Pagonis	Antonis Hanoullis
Soteris Orthodoxou	Andreas Theodosiou
Constantinos Christoforou	Yiannakis Marcou
Andreas Constantinou	Ioannis Panayi
Michalis Pamboris	Marios Michael
Sophia Potamitou	Phivos Kyprianou
Kyriacos Michael	Arestis Chr Aresti
Charalambos Ioannou	Costas Constantinou
Themis Angastiniotis	George Leonidou
Michael Karaiskakis	Charalambos Neocleous
Nicos A. Nicolaou	Spyros HadjiYiacoumi

The following on probation to the permanent (Ord.) post of Clerk 2nd Grade General Clerical Staff with effect from 8 November 1985.

Yiola Ioannidou
Agathi Solomou
Xanthippi Zenonos

Kyriaki Ioakim Chrysanthou
Chrystalleni Gregoriou
Neophytos Michael

Acting Appointments

Kyprianos Hassabis as acting Director for the period between 4.10.86-24.10.86

Constantinos Lytras, as acting Director to the Geological Survey Department as from 25.11.86.

Promotions

The following were promoted as follows:

George Frangopoulos
Elias Chr. Eliades
Iacovos Kastanas

George Lanitis
Phivos HadjiIoannou
Pantelis Alexandrou

to the permanent (Dev.) post of Technical Superintendent as from 15.1.86

Photios Photiou to the permanent (Dev.) post of Topographer Irrigation Engineer I, with effect from 1st January 1986.

The following to the permanent (Ord.) post of Senior Technical Superintendent with effect from 15.3.86.

Armandos Josephin, Panayiotis Kazamias, Panayiotis Neophytou

The following to the permanent (Ord.) post of Technical Superintendent with effect from 15.3.86.

Liasis Savva, Andreas K. Savva Doloros Pitsillides

The following to the permanent (Ord.) post of Assistant Chief Foreman with effect from 15.7.86.

Costas Constantinides
Phidias Metaxas
Ioannis Potamaris

Elia Eleftherios
Christodoulos Stephanou

Antonis Zakheos to the permanent (Ord.) post of Chief Foreman with effect from 15.10.86

Georgoulla Chrysostomou to the permanent (Ord.) post of Executive Engineer I, as from 1.11.85.

The following to the permanent (Ord.) post of Clerk 1st Grade, General Clerical Staff with effect from 1.11.85.

Anna Adamidou
George Laoutaris
Athinoulla Poyiatzi

Androulla Kaspari
Anna Ioannou

Kyriacos Kyrou to the permanent (Ord.) post of Executive Engineer I, as from 15.2.85.

Nicos Neocleous to the permanent (Ord.) post of Executive Engineer I as from 15.2.85.

The following to the permanent (Ord.) post of Executive Engineer I with effect from 1.12.85.

Anthoulla Symeou;Siamma	Andreas Demetriou
Pavlos Neophytides	George Loucaides
Ioannis Eracleous	Michael Televantos
Zoe HjiVasiliou	Nicolas Christophides
Paraskevoulla Maratheftou	

Retirements

Joseph Karoglanian, Senior Technician with effect from 1.1.86

Antonis Nicola, Chief Foreman with effect from 1.1.86.

Meletios Michael, Chief Foreman with effect from 1.2.86.

Ioannis Metaxakis, Assistant Chief Foreman with effect from 1.10.86.

Iacovos Mazarakis, Clerk 1st Grade with effect from 1.10.86.

Dismissals

Kyriacos Constantinou, Technician 2nd Grade, on a casual basis, with effect from 22.11.86.

Transfers

Zoe HadjiVasiliou, Executive Engineer I to Regional Office Limassol for the Main Conveyor Souther Conveyor Project with effect from 10.3.86.

Charalambos Ioannides, Clerk 2nd Grade, General Clerical Staff to the Planning Bureau with effect from 2.4.86.

Kyriaki Polydorou, Clerk 2nd Grade, General Clerical Staff to this Department from the Ministry of Health with effect from 2.4.86.

Sofoclis Pereas, Technician 2nd Grade to Regional Office Limassol for Kouris Dam with effect from 1.1.86.

Eleftherios Stavriniades, Senior Supervisor of Accounts to this Department with effect from 30.6.86.

Andreas Papisavvas and George Neophytou, Technicians 2nd Grade to Khrysokhou Irrigation Project with effect from 19.5.86.

Yiannakis Markou, Technician 2nd Grade, to Khrysokhou Irrigation Project with effect from 13.5.86.

Socrates Koundouris, Executive Engineer I to Regional Office Limassol for Main Conveyor Southern Conveyor Project with effect from 15.7.86.

Panayiotis Stelikos, Messenger to Public Works Department, District Office Paphos with effect from 29.9.86.

Philippos Ioannou, Clerk 2nd Grade, General Clerical Staff to Wellfare Department with effect from 15.12.86.

Christakis Christofi, Clerk 2nd Grade, General Clerical Staff to this Department with effect from 9.12.86.

Scholarships and study leave

Constantinos HjiSavvas, Mechanical Engineer I, has been granted a scholarship between 2 May 1986-22 May 1986 offered by Italian Government on Solar Energy and other Renewable Energy Sources.

Kyriacos Kyrou, Executive Engineer I, has been granted a scholarship between 20.6.86-30.7.86 offered by the Cyprus-American Scholarship Programme on Earthquake Engineering in relation to Dams and other hydraulic structures.

Christos Ioannou, Hydrologist I, has been granted a scholarship between 16.8.86-31.12.87 offered by Hubert Humphreys USA, under Fulbright Commission for postgraduate studies in Hydrology.

Constantinos Katsavras, Executive Engineer I, who has been granted scholarship by USA Government (CASP) completed his studies and resumed duties on 16.8.86.

Ioseph Pekris, Technician 2nd Grade, has been granted study leave in USA to obtain a Bsc degree in Civil Engineering.

Seminars, Conferences, Duty Abroad.

George Socratous, Executive Engineer I visited Cairo, Egypt between 28.1.86-13.2.86 to participate to the FAO Workshop, DASI Computer Model.

Iacovos Iacovides, Senior Hydrogeologist, visited Lyon France between 3.3.86-4.3.86 to participate to the first meeting for the Organization of the European Network "Management of Water Resources" organized by the Council of Europe.

Christodoulos Christodoulou, Principal Water Engineer visited Greece to participate to the meeting on Water Management and Agricultural Development between 7.4.86-11.4.86

Christodoulos Christodoulou, Principal Water Engineer
Sofoclis Aletraris, Topographer Irrigation Engineer I visited Greece between 14.4.86 - 16.4.86 for inspection of the manufacture of pipes for the Southern Coneyor Project.

Constantinos HjiSavvas, Mechanical Engineer I, visited Grenoble, France for Electromechanical Works on Kouris Dam between 10.3.86-14.3.86.

Nicos Tiourtis, Senior Water Engineer,
Demosthenis Patsalides, Executive Engineer I
Vlasis Partassides, Executive Engineer I
Andreas Tziakouris, Executive Engineer I
Sofoclis Aletraris, Topographer Irrigation Engineer I,
visited France between 13.5.86-17.5.86 for inspection of the manufacture of pipes and parts by Pont-a-Mousson for Southern Conveyor Project.

Nicos Stylianou, Senior Water Engineer
Spyros Stephanou, Executive Engineer I,
visited Greece between 18.5.86-24.5.86 for inspection of the manufacture of Hydrants for the Khrysokhou Irrigation Project.

Dedalos Kypris, Senior Hydrogeologist, visited Kenya between 30.6.86-4.7.86 to participate to the Workshop on fundamentals of microprocessor based systems.

Constantinos St. Lytras, Director, visited Marceilles France, between 12.6.86 - 14.6.86 to attend the meeting of the board of Directors of the Mediterranean Water Institute.

Christodoulos Christodoulou, Principal Water Engineer
George Socratous, Executive Engineer I,
visited Rome Italy between 30.6.86-4.7.86 to participate to the Southern Conveyor Project Workshop.

Andreas Demetriou, Executive Engineer I
Andreas K Savva, Technical Superintendent
Elias Eliades, Technical Superintendent
Andreas Eletheriou, Senior Technician,
visited Spain between 13.7.86-19.7.86 for the inspection of the manufacture of fittings for the Southern Conveyor Project.

Christodoulos Christodoulou, Principal Water Engineer, visited Rome Italy between 25.8.86-30.8.86 to attend the Southern Conveyor Project Workshop.

Constantinos St. Lytras, Director, Branco Milinusic, Consultant, visited England between 21.7.86-23.7.86 for the Arbitration of Asprokremmos Dam.

Constantinos Lytras, Director, visited Greece between 24.7.86-28.7.86 as guest of the Greek Geological and Mineral Research Institute.

Nicodemos Nicodemou, Executive Engineer I, visited Thessaloniki, Greece between 25.8.86-28.8.86 for inspection of the manufacture of Hydrants for the Khrysokhou Irrigation Project.

Iacovos Iacovides, Senior Hydrogeologist, visited Chehoslovakia between 6.9.86-7.9.86 to attend a meeting for the International Hydrogeological Map of Europe.

Constantinos Stavrou, Technician 1st Grade, visited France between 14.9.86-20.9.86, for inspection of the manufacture of the Telemetry System for the Vasilikos-Pendaskinos Project.

Nicos Tsiourtis, Senior Water Engineer, visited Rome Italy between 22.9.86-26.9.86 to attend the Expert Consultation on Irrigation Water Charges.

Kyprianos Hassabis, Assistant Director, Savvas Theodosiou, Mechanical Engineer I, Andreas Tziakouris, Executive Engineer I, visited London between 21.9.86-30.9.86 for inspection of the manufacture of Valves for the Main Conveyor Southern Conveyor Project

Iacovos Iacovides, Senior Hydrogeologist, visited Spain between 22.9.86-27.9.86 to participate to the Seminar on Water Resources Management.

Kyriacos Spanos, Executive Engineer I, visited Austria between 19.10.86-23.10.86 for inspection of the manufacture of valves for Khrysokhou Irrigation Project.

Vlasis Partasides, Executive Engineer I, visited Greece for inspection of the manufacture of asbestos-cement pipes for the Southern Conveyor Project.

Maria Zachariou, Executive Engineer I, visited Rome Italy between 3.11.86-7.11.86, to attend the 16th International Water Supply Congress and Exhibition.

Iacovos Iacovides, Senior Hydrogeologist, visited Split Yugoslavia between 3.11.86-5.11.86 to attend the meeting of the Water Resources Management in Small Mediterranean Islands.

Demosthenis Patsalides, Executive Engineer I, participated in the Workshop on Appraisal of Comprehensive Water Resources Projects at Nicosia between 3.11.86-14.11.86.

Constantinos Lytras, Director, visited Marocco between 4.12.86-6.12.86 to attend the meeting on Mediterranean Water Institute

Constantinos HjiSavvas, Mechanical Engineer I, visited Maribor Yugoslavia between 1.12.86-7.12.86, for the Electromechanical Works on Kouris Dam.

Iacovos Iacovides, Senior Hydrogeologist, visited Malta between 9.12.86-12.12.86 to attend the working meeting on water and sanitation problems of big Mediterranean Islands and Isolated Coastal Areas with Fluctuating Population Caused by Tourism.

II DIVISION OF WATER RESOURCES

by

D C Kypris
Senior Hydrogeologist
Head of Division

General

During 1986 again no hydrological data could be collected by this Department in the Northern part of Cyprus still occupied for the twelfth 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 map II-1).

During 1986, D C Kypris, Senior Hydrogeologist, was the Head of the Division. M Peppis, Geologist Class I, was the Assistant Head, the Head of the Drilling Permits and Water Control Branch and he acted also as the chairman of the specially formed advisory committee for the issue of well permits. Dr St. Papatryphonos, Hydrologist Class I was the Head of Hydrometry Branch.

DRILLING OPERATIONS

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

- Cleaning of 17 existing boreholes
- Drilling of 10 boreholes. Five boreholes were drilled at Trachoni and five were drilled at Klavdhia village. Total penetrated depth 369m.

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 1986, 88 test pumpings were carried out as follows:-

- 9 for division of land with total hours pumped..... 246
- 78 for building permits with total hours pumped..... 234
- 1 for town and village water supplies with total hours pumped..... 6

METEOROLOGICAL SUMMARY FOR THE HYDROMETEOROLOGICAL YEAR 1985-1986

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 1985-1986.

Precipitation

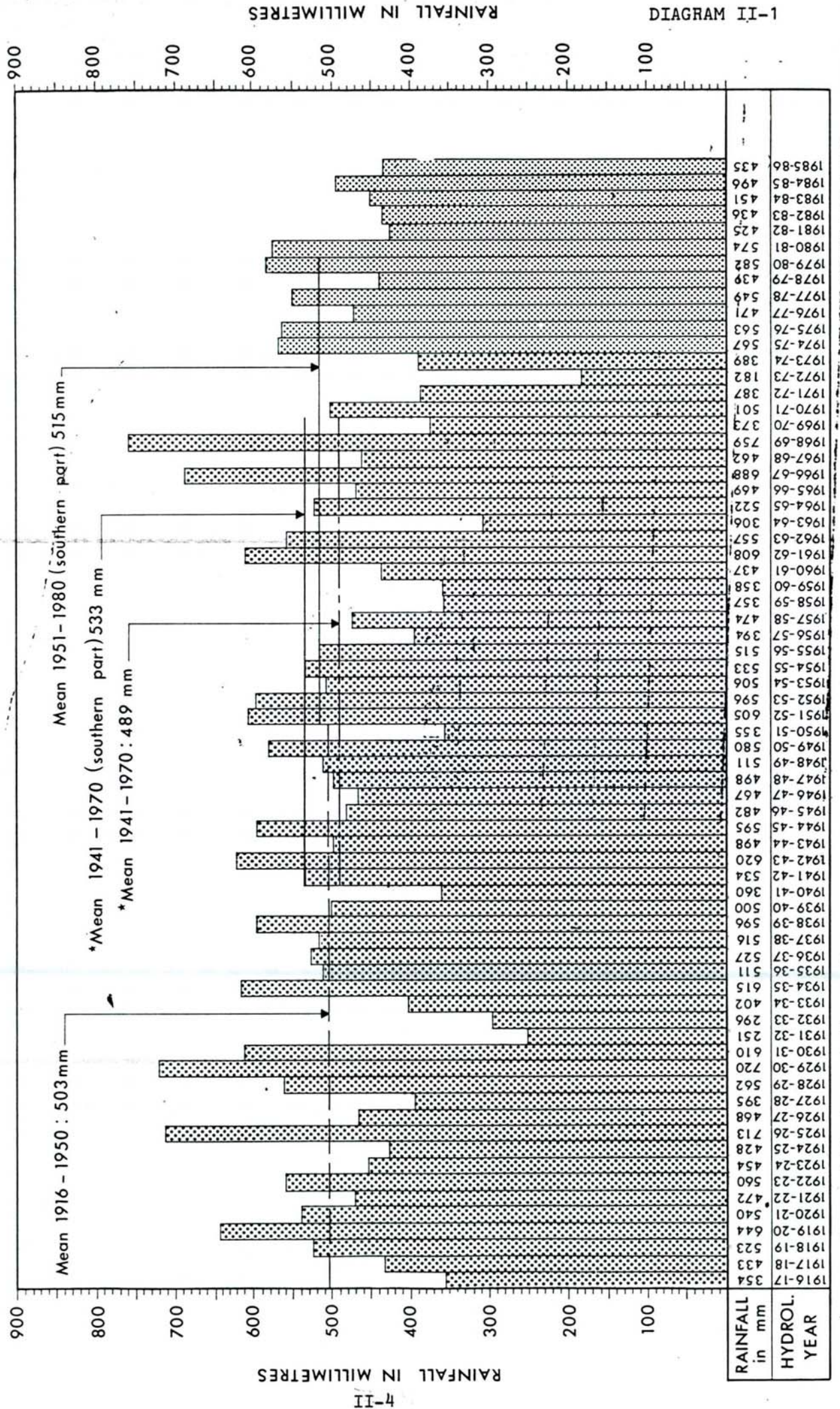
The yearly total precipitation averaged over the part of the island under Government control during the hydrometeorological year October 1985 - September 1986 was 435.0 mm which is 84% of normal. Normal is considered the average rainfall over the southern part of the island during the period 1951-1980. (see diagram II-1)

The total precipitation amounts during the period were lower than normal in most areas and ranged mainly between 70% and 95% of normal. (see map II-2).

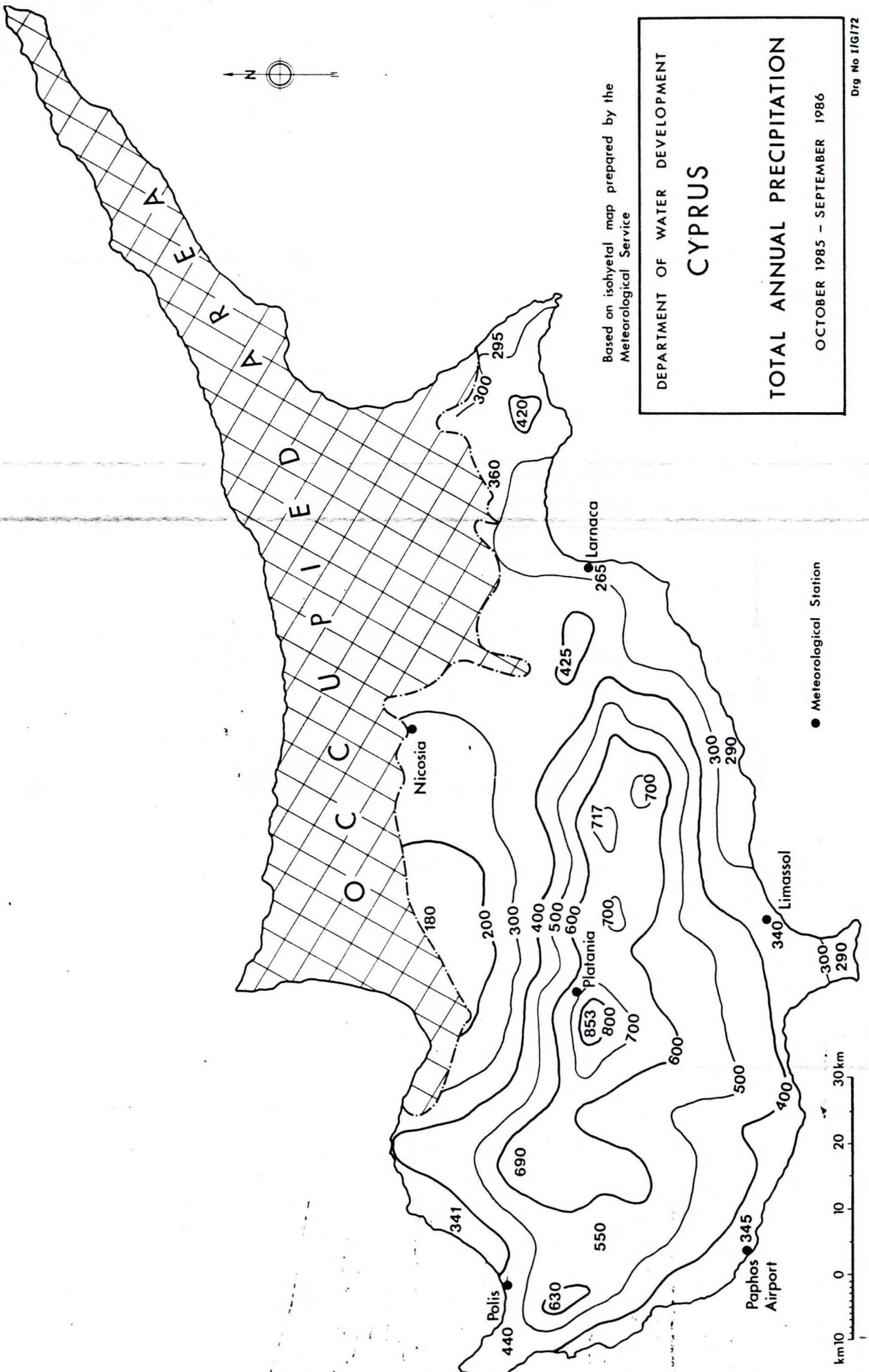
As regards the monthly distribution of precipitation, it was above normal in October, May, June and September and below normal in all the remaining months. (see diagram II-2).

The table II-1, giving the incidence of rainfall during the hydrometeorological year 1985-86, illustrates the situation:-

ANNUAL AVERAGE RAINFALL OF CYPRUS 1916 - 1986



* 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 1985 - SEPTEMBER 1986

Drg No 11/G/72

GRAPHICAL PRESENTATION
OF INCIDENCE OF RAINFALL 1985-1986

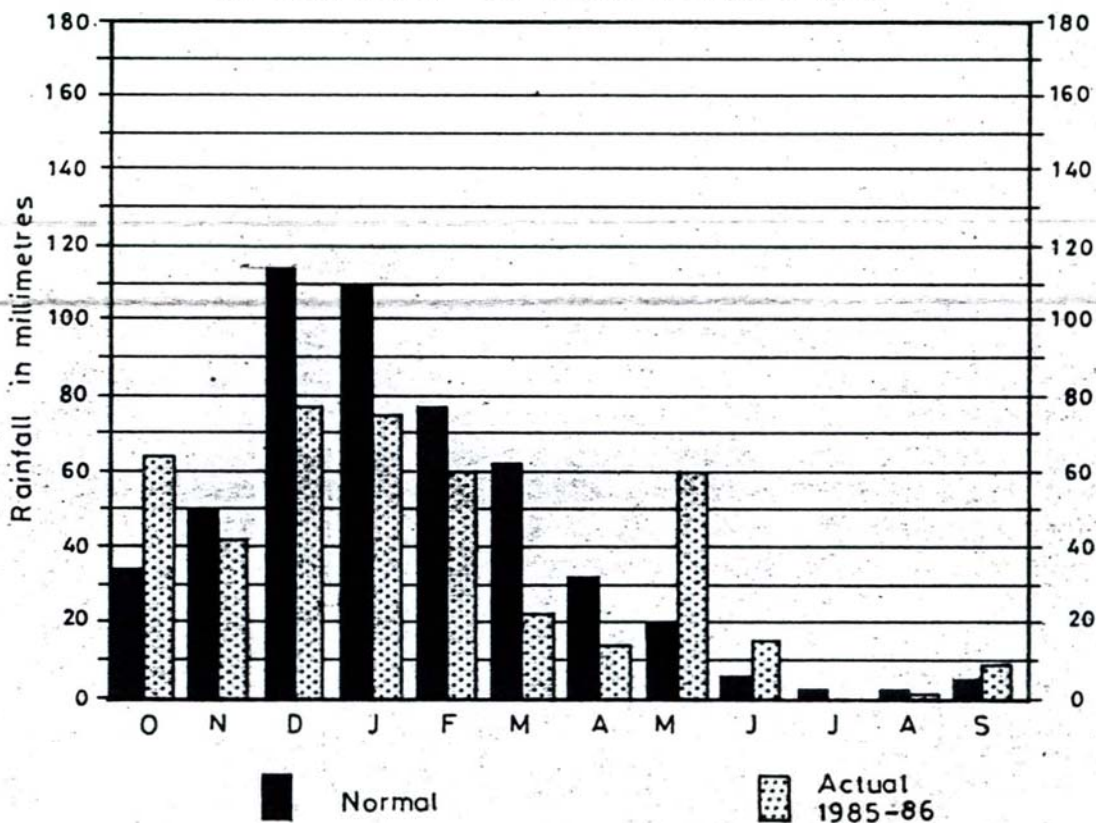


TABLE II-1

INCIDENCE OF RAINFALL DURING THE HYDROMETEOROLOGICAL YEAR 1985-1986

Months	Rainfall (in mm)	Rainfall (in inches)	Percentage of yearly total	Percentage of monthly normal
October	64.7	2.55	14.9	200
November	41.1	1.62	9.5	82
December	76.6	3.02	17.6	66
January	75.0	2.95	17.2	68
February	59.7	2.35	13.7	78
March	21.8	0.86	5.0	35
April	14.7	0.58	3.4	45
May	59.2	2.33	13.6	304
June	12.5	0.49	2.9	192
July	NIL	NIL	0	0
August	0.4	0.02	0.1	13
September	9.3	0.37	2.1	186
Totals	435.0	17.14	100.0	-

Note: Yearly total as percentage of yearly normal: 84%

The maximum amount of rainfall in a 24-hour period during the hydrometeorological year was 124.0 mm. This was reported on the 22nd May 1986 by Vavla rainfall station.

The first snowfall occurred on Mount Olympus on the 3rd December 1985 which is the median date for the first snowfall in Cyprus. Subsequent snowfalls occurred during the ensuing months till March. The last one occurred on the 18th March 1986 which is three weeks earlier than the median date for the last snowfall in Cyprus.

Hail occurred in November 1985, February, March, April and May 1986.

Temperature

During the hydrometeorological year 1985-1986 as a whole air temperature was above normal. In particular, monthly mean temperatures were well below normal in October 1985 and May 1986 and slightly below normal in June and July 1986; they were higher than normal in the period from November 1985 to April 1986 and in September 1986 and around normal in August 1986.

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 1985-1986

Station	Extreme maximum temperature and date °C	Extreme minimum temperature and date °C
Nicosia.....	41.3 16th July	0.9 20th December
Limassol Port (new) ..	36.2 18th July	1.3 20th January
Larnaca Airport.....	36.4 1st September	1.5 20th January
Paphos Airport.....	31.8 24th September	2.2 20th January
Panayia Bridge.....	39.0 17th July	-2.4 20th December
Saittas.....	38.0 19th July	-1.0 20th December & 20th January

TABLE II-2

INCIDENCE OF MAXIMUM AND MINIMUM TEMPERATURES 1985-1986 (cont.)

Amiandos.....	30.5	19th July & 21 August	-5.0	19th January
Prodhromos.....	31.0	17, 18, 22, 27th July	-6.0	19, 20th January
Stavros.....	37.5	16th July	-0.1	20th January
Kornos.....	38.0	17th July	0.5	20th January
Platania.....	33.8	16th July	-3.3	20th January
Phasouri.....	35.2	17th September	-0.3	20th January

Evaporation

Monthly total evaporation (in mm) measured from United States Weather Bureau (U.S.W.B.) class "A" pan during the hydrometeorological year 1985-1986 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.....	121	60	47	43	50	101	169	169	261	295	253	187	1756
Paralimni.....	165	75	69	61	57	97	175	199	261	305	271	220	1955
Larnaca Airport	160	94	90	73	81	129	201	230	299	310	294	261	2222
Saittas.....	105	66	57	40	51	93	160	136	209	264	223	164	1568
Akhelia.....	153	97	80	76	70	109	167	186	213	234	213	185	1783
Yermasoyia.....	129	67	57	47	53	98	162	158	219	237	223	180	1630
Polemihia.....	154	79	79	65	71	111	172	162	235	253	225	194	1800
Prodhromos.....	83	59	30	37	44	70	145	103	191	254	223	131	1370

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 57 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 twelfth year now.

The general conclusion obtained from the study of this years records of the above flow gauging stations, is that the flow of most of them was below normal because of the low precipitation of December, January, February and March.

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 1985-1986

Ser. No.	Station	Stream	Location	Annual flow $10^6 m^3$
1	1-2-7-90	Dhiarizos	Kouklia	6.1
2	1-4-9-80	Ezusas	Akhelia	3.0
3	2-2-8-95	Khrysokhou	Coast	3.4
4	2-8-3-10	Limnitis	Saw Mill	3.6
5	3-3-3-95	Karyotis	Evrykhou	3.4
6	3-5-4-40	Elea	Vyzakia	0.2
7	3-7-1-50	Peristerona	Panayia Br.	5.5
8	3-7-3-90	Akaki	Malounda	3.5
9	6-1-1-80	Ay. Onoufrios	Kambia	0.7
10	6-1-1-85	Pedhieos	Kambia	1.7
11	6-5-3-15	Yialias	Nisou	0.08
12	8-4-5-30	Tremithios	Klavdhia	0.1
13	8-9-5-40	Vasilikos	U/S Kalavastos Dam	5.4
14	9-2-3-85	Yermasoyia	U/S Yermasoyia Dam	7.9
15	9-6-2-90	Kryos	U/S Kouris Dam	1.7
16	9-6-4-90	Kouris	U/S Kouris Dam	7.1
17	9-6-7-70	Limnatis	U/S Kouris Dam	6.3

Construction of New Flow Gauging Stations

During the year under review the following flow gauging stations were constructed and equipped with water level recorders.

Maroni river downstream of recharge boreholes. Construction of a small "V" shaped structure 4m wide slope 1:10.

Yermasoyia river downstream Yermasoyia Dam. Construction of a small "V" shaped structure 4m wide, slope 1:10 to record releases from Yermasoyia dam for recharge purposes.

Xeros river downstream Asprokremmos dam. Construction of 4 small "V" shaped structures 3m wide, slope 1:10, to record overflow of recharge basins.

Karyotis river near Galata. Construction of a "V" shaped structure 4m wide, slope 1:10.

Karyotis river near Skouriotissa. Construction of a "V" shaped structure 3.5 m wide slope 1:10.

Improvements to Existing Flow Gauging Stations

Pyrgos river near Phlevas. Alterations to the invert of the flow gauging station by the construction of a "V" shaped structure 5m wide, slope 1:10.

Flood Discharges

As the precipitation during the hydrometeorological year under review was below normal no remarkable floods occurred. The most noteworthy, however, were recorded on the following flow gauging stations.

Tremithos river near Ayia Anna about $28 m^3/s$ on 1st April 1986. Its watershed area is $94 km^2$.

Mylou river near Kornos about 14 and 21 m³/s on 1st April and 21st May 1986 respectively. Its watershed area is 32 km².

Vasilikos river upstream Kalavassos dam about 25m³/s on 22nd May 1986. Its watershed area is 86 km².

Syrkatis river upstream Dhipotamos dam about 12 and 17 m³/s on 1st April and 13th May 1986 respectively. Its watershed area is 61 km².

Akaki river near Malounda about 17 m³/s on 13th June 1986. Its watershed area is 90 km².

Yermasoyia river upstream Yermasoyia dam about 16 m³/s on 13th June 1986. Its watershed area is 110 km².

Maroni river near Vavla about 11 and 15 m³/s on 22nd May and 13th June 1986. Its watershed area is 31 km².

Yialias river near Kotchati about 12 m³/s on 1st April 1986. Its watershed area is 73 km².

Pedhieos river near Kambia about 9 m³/s on 13th June 1986. Its watershed area is 29 km².

Inflow of Water in Dams

During 1986 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 under regular observations was very low because of the low precipitation during the hydrological year under review; the maximum volume accumulated was 46.3 MCM or 36.3% of the total capacity of these dams which is 127.5 MCM. Out of these dams 28, the smaller ones overflowed, most of them in November and December. Analytically the situation is shown in table II-5.

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 1985-86, 1966 spring and minor stream discharges were taken on 123 springs and minor streams; 600 discharges were taken on 50 springs which are under regular monthly observations and 1366 discharges were taken on 73 springs and minor streams for a certain period at various intervals.

As the rainfall during the hydrological year under review was below normal for the fifth successive year most of the springs maintained a low flow during the whole year. Some of them got dry in summer.

TABLE II-5
 VOLUME OF WATER ACCUMULATED AND COMMENCING DATE OF INFLOW FOR VARIOUS DAMS AND PONDS DURING
 THE YEAR 1986

DAMS - PONDS	Capacity $10^3 \times m^3$	Inflow Commencing date (1986)	Maximum Volume recorded $10^3 \times m^3$	Date of maximum record (1986)	Minimum Volume recorded $10^3 \times m^3$	Date of Minimum record (1986)	Remarks
1 Agridhia.....	59	December	50	10. 4.86	18	5.12.86	
2 Agros.....	72	December	66	6. 6.86	13	5.12.86	
3 Akrounda.....	22	November	22	12.85	20	8.11.86	
4 Akapnou-Ephtagonia.....	132	November	132	9. 2.86	42	5.12.86	
5 Arakapas Dam.....	128	October	128	27. 2.86	10	25. 9.86	Gate closed 19.2.86 Overflowed 27.2.86
6 Arakapas No 1.....	192	December	192	18. 2.86	72	5.12.86	
7 Arakapas No 2.....	119	December	119	18. 2.86	48	5.12.86	
8 Argaka.....	990	November	990	24. 1.86	18	8.11.86	
9 Asprokremmos.....	51000	December	21714	5. 4.86	9462	18.12.86	
10 Athalassa.....	790	Empty	Empty	-	Empty	-	
11 Ayia Marina.....	298	November	197	4. 4.86	25	1.11.86	
12 Ayii Vavatsinias Dam.....	53	November	53	13.12.86	28	4.11.86	
13 Ayii Vavatsinias No 1.....	55	December	55	13.12.86	30	18.11.86	
14 Ayii Vavatsinias No 2.....	43	December	43	8. 4.86	26	18.11.86	
15 Dhierona.....	159	November	159	21. 6.86	29	8.11.86	
16 Dhypotamos.....	13700	December	2144	19. 6.86	288	26.12.86	
17 Ephtagonia I.....	92	December	64	7. 6.86	11	5.12.86	
18 Ephtagonia II.....	127	December	103	7. 6.86	Empty	30.10.86	
19 Ephtagonia III.....	65	December	15	11. 4.86	Empty	30.10.86	
20 Kalavastos.....	17100	December	4182	18. 6.86	856	19.12.86	
21 Kalo Khorio.....	32	December	32	29.12.86	Empty	25.10.86	
22 Kalopanayiotis.....	363	November	363	10. 2.86	Empty	15. 9.86	
23 Kardou.....	38	December	27	11. 2.86	Empty	11.86	
24 Kato Mylos.....	104	December	104	29. 1.86	20	10.12.86	
25 Khandria.....	70	December	32	25. 4.86	2	15.12.86	
26 Khirokitia.....	205	December	205	4. 4.86	2	16.12.86	

TABLE II-5
VOLUME OF WATER ACCUMULATED AND COMMENCING DATE OF INFLOW FOR VARIOUS DAMS AND PONDS DURING
THE YEAR 1986 (Cont.)

27	Kiti.....	1625	-	Empty	-	Empty	18	-	7.11.86
28	Kyperounda I.....	50	November	50	5. 3.86	18	Empty	7.11.86	
29	Kyperounda II.....	273	December	213	25. 4.86	Empty	Empty	22.12.86	
30	Lagoudera.....	70	November	70	18. 2.86	40	Empty	8.11.86	
31	Lefka Marathasa.....	368	November	368	12.12.85	60	Empty	7.10.86	Overflowed 12.12.85
32	Lefka Kafizes.....	113	November	113	25.12.85	3	Empty	7.10.86	Overflowed 25.12.85
33	Lefkara.....	13850	December	1323	9. 4.86	300	Empty	20.12.86	
34	Liopetri.....	325	-	Empty	-	Empty	Empty	-	
35	Lymbia.....	220	December	220	24. 2.86	76	Empty	21.11.86	
36	Lythrodondas Upper.....	32	December	32	1. 4.86	15	Empty	19.12.86	
37	Lythrodondas Lower.....	32	December	32	1. 4.86	13	Empty	19.12.86	
38	Melini.....	59	December	59	8. 1.86	16	Empty	18.11.86	
39	Mavrokolymbos.....	2180	December	533	23. 4.86	244	Empty	30.11.86	
40	Ora Pond.....	62	December	47	21. 4.86	Empty	Empty	30.11.86	
41	Ormidhia (Vathys).....	100	-	Empty	-	Empty	Empty	-	
42	Pakhyamos.....	43	December	7	1. 3.86	7	Empty	30. 5.86	
43	Palekhori (Kambi).....	620	December	620	26. 1.86	145	Empty	12.12.86	
44	Paralimni Lake.....	1365	-	Empty	-	Empty	Empty	-	
45	Pelendri.....	123	December	92	10. 4.86	26	Empty	20.11.86	Gate closed 21.2.86.
46	Pera Pedhi.....	55	December	55	28. 3.86	Empty	Empty	16. 8.86	Overflowed 28.3.86
47	Petra Upper.....	10	December	10	7. 4.86	15	Empty	15. 9.86	
48	Petra Lower.....	25	December	5	4. 6.86	Empty	Empty	30. 7.86	
49	Pharmakas No 1.....	20.4	November	20.4	31. 3.86	9	Empty	3.11.86	
50	Pharmakas No 2.....	61	November	61	10. 4.86	23	Empty	3.11.86	
51	Pomos.....	860	November	860	7. 3.86	97	Empty	31.10.86	
52	Polemichia.....	3400	December	1175	11. 3.86	134	Empty	20.12.86	
53	Prodromos.....	110	December	43	10. 4.86	Empty	Empty	20. 8.86	
54	Pyrgos.....	283	December	215	1. 3.86	Empty	Empty	10. 7.86	
55	Trimiklini.....	340	November	340	5. 5.86	Empty	Empty	11.86	
56	Xyliatos.....	1220	December	1002	12. 4.86	298	Empty	11.12.86	
57	Yermasoyia.....	13600	December	7542	8. 4.86	565	Empty	20.12.86	

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 3,061 km (see map II-3). The springs wells/boreholes which were on register at the end of 1986 were 28,970.

The new areas brought under hydrological observation during the year have an extent of about 49 square kilometers. A number of 65 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 1167 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 1986 is 1196 and, every month or fortnight 495.

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 1986 12291 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 1986 the number of groundwater samples from observation boreholes analysed for Cl was 2821.

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-6 of selected observation boreholes.

DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

HYDROLOGICAL SURVEY AREAS

AFTER THE TURKISH INVASION

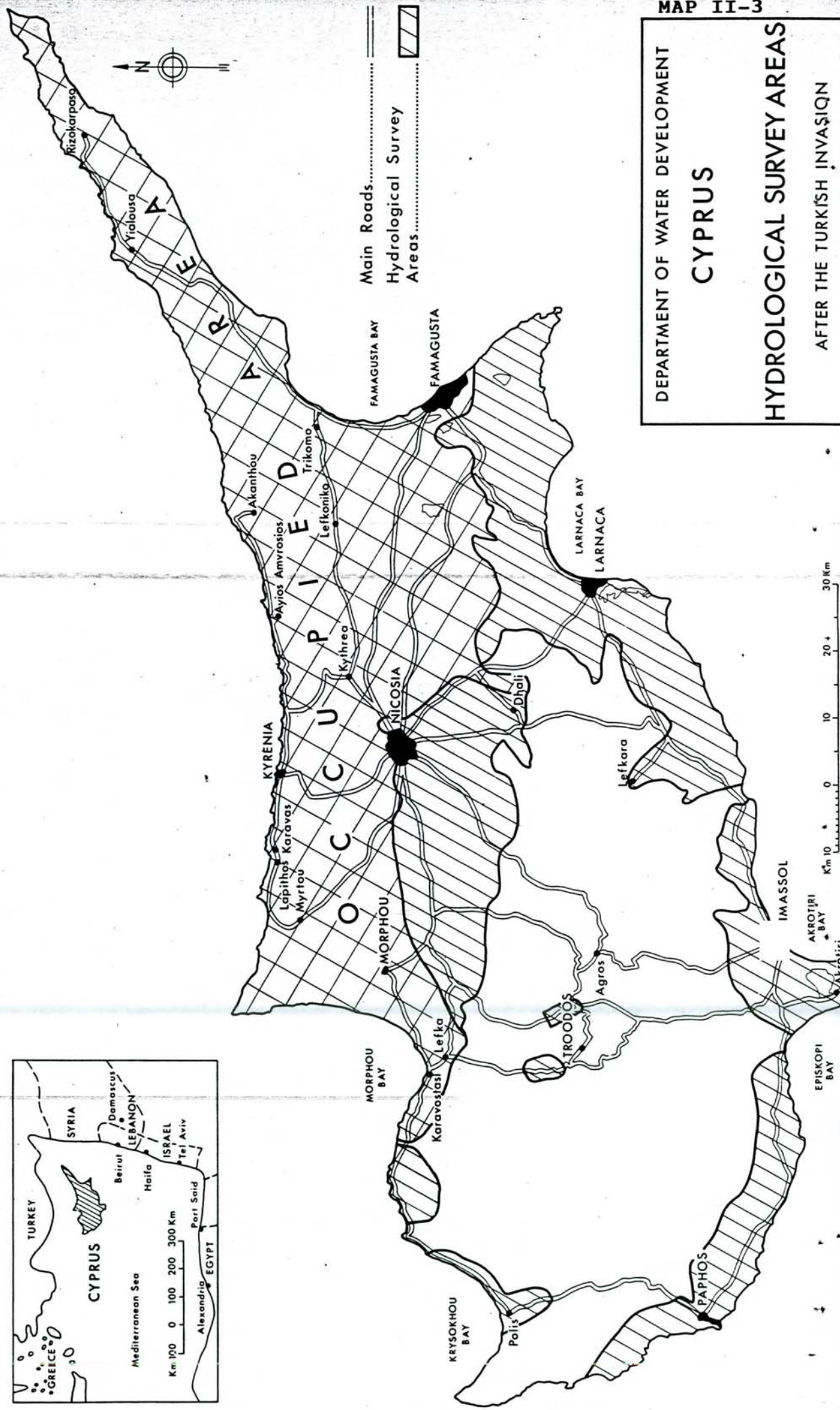


TABLE II-6
SELECTED OBSERVATION BOREHOLES

Serial No.	Hydr. No.	Village	Water Level increase (+) or decrease (-)					
			March 1985	November 1985	March 1986	November 1986	March 1985-86	November 1985-86
56/56	192	Liopetri.....	- 2.42	- 1.13	- 1.04	- 0.66	+ 1.38	+ 0.47
20/63	1516	Paralimni....	+ 20.03	+ 19.86	+ 19.79	+ 19.76	- 0.24	- 0.10
51/51	774	Phrenaros....	+ 0.26	- 0.16	- 0.04	DRY	- 0.30	-
79/56	975	"	+ 8.30	+ 8.21	+ 8.28	+ 8.11	- 0.02	- 0.10
88/54	24	Kolossi.....	+ 2.05	- 0.50	+ 1.60	- 1.80	- 0.45	- 1.30
51/63	813	Limassol.....	+ 1.18	+ 0.98	+ 1.22	+ 0.73	+ 0.04	- 0.25
45/63	811	Zakaki.....	+ 0.80	+ 0.43	+ 0.93	+ 0.18	+ 0.13	- 0.25
107/61	17	Yermasoyia...	+ 2.86	+ 0.32	+ 3.66	- 0.06	+ 0.80	- 0.38
180/59	8	" ...	+ 19.47	+ 14.20	+ 24.37	+ 15.45	+ 4.90	+ 1.25
134/59	27	" ...	+ 1.96	- 0.71	+ 1.27	- 0.33	- 0.69	+ 0.38
161/50	180	K. Trimithia.	+186.49	+186.17	+186.22	+186.14	- 0.27	- 0.03
90/50	106	" .	+190.73	+190.54	+188.48	+190.40	- 2.25	- 0.14
125/60	15	Episkopi.....	+ 22.91	+ 20.41	+ 24.91	+ 20.66	+ 2.00	+ 0.25
EB 94/70	1236	Akrotiri.....	+ 1.46	- 0.34	+ 1.26	- 1.44	- 0.20	- 1.10
P.B. 12	2671	Kouklia.....	+ 1.40	+ 1.78	+ 1.70	+ 0.45	+ 0.30	- 1.33
P.B. 17	2673	Akhelia.....	+ 6.92	+ 4.52	+ 6.32	Filled in	- 0.60	-

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 1986, 37 meeting and examined 3949 applications sent to the Director, WDD by the District Officers, as follows:-

Water Supply (Special Measures) Law areas.....	605
Water Conservation areas.....	2 758
Non Water Conservation areas.....	586

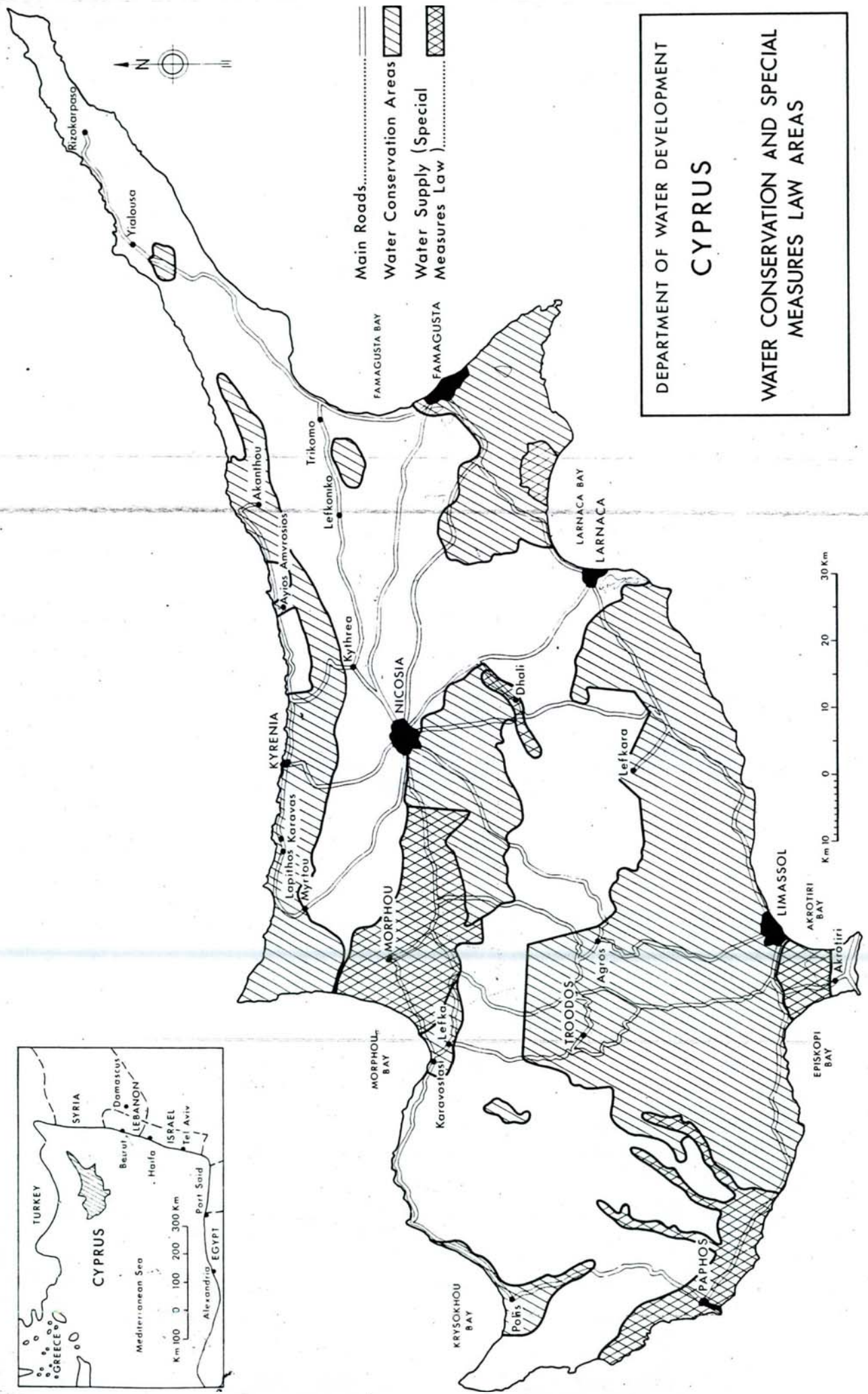
Water Conservation Areas (Wells Law Cap 351)

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

On map II-4 the areas which have been declared as "Water Conservation Areas" under the wells Law Cap 351 are shown. Particulars of these areas are also shown in the table II-7.

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.

DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
WATER CONSERVATION AND SPECIAL MEASURES LAW AREAS



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-8.

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-7
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, Pendaria.....	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

TABLE II-7
WATER CONSERVATION AREAS (cont.)

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

TABLE II-8
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	Mavrokolympo 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 1986 there were 416 water meters installed of which 393 are in continuous operation. The total volume of water recorded is 15.2 MCM. During the year 51 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 1986 this Department issued 2 Drillers licences and renewed 65 others. The number of private drilling rigs which drilled for water during 1986, was 57. Information from private drillers have been received by this Department for 100 boreholes.

During 1986, 22 private Drillers were reported to the District Officers for illegal drilling.

WATER QUALITY

Chemical Analyses

During the year, 617 samples of water were sent to the Government Analyst and 581 to the WDD Laboratory for chemical analyses. Out of those, 645 samples were taken from springs, wells or boreholes, which are used or proposed as water supply sources. The remaining 553 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 74 samples were sent to the Government Analyst.

Suspended Sediment Analyses

In view of the construction of large dams in Cyprus and the problem arising from reservoir sedimentation, the sediment sampling programme was continued. Though not very intensive, the programme provided for sampling in as many rivers as possible.

During the year 56 samples of river water were taken for suspended sediment analyses.

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

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

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

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

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

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

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

From its establishment the Central Committee for the issue of loans and the reactivation of Turkish Cypriot owned wells/boreholes had 57 meetings during which it approved 441 application from 1275 displaced farmers for the irrigation of 12293 donums of land. The amount of loans granted by the end of

this year was 376904 and the pumping plants of Turkish Cypriot ownership to 42 190.-

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

SPECIAL STUDIES

PROJECT CYP/81/002

Improvement of Hydrological Data Acquisition and Processing.

During 1986 the above project, preparatory work of which started in 1984, and attained its full swing during 1985, was finalized.

The Executing Agency for this Project is the World Meteorological Organization (WMO) through the Resident Representative in Cyprus of the United Nations Development Program (UNDP) and the Government Implementing Agency the Water Development Department, Ministry of Agriculture and Natural Resources.

The Project was providing for A UNDP contribution for subcontract, equipment and miscellaneous up to \$100 000 U.S. dollars and for Government contribution for Project personnel and other items up to 92 000 Cyprus pounds.

The Slovak Institute of Hydrometeorology, Bratislava, Czechoslovakia, through Polytechna which is the sole national contractor for Czechoslovakia in these matters, got the subcontract to carry out the work for \$50 000 U.S. dollars.

The title of the Project indicates clearly the goals aimed to be accomplished.

The direction of the project was the responsibility of the Water Development Department, with Mr Dedalos C. Kypris Head of the Water Resources Division being the Project Director and Mr. Jacovos S. Jacovides, Head of the Hydrology Division, the Co-Director.

It was felt that the hydrometric network of the country, for both surface and ground water, the collection and processing methods for hydrological data which were geared at supplying to the water development planners the necessary information for planning water works, had to be revised in view of the fact that our major waterworks have either been built or they are at an advanced stage of being implemented and hydrological information was now necessary for their management and new methods of data collection and processing as well to take advantage of the technological progress in this field and facilitate the flow of information.

According to the original workplan the Project was due to be completed by the end of 1985. However due to delays in the delivery of some equipment, certain computer peripherals and problems with their on line connection to the already installed microcomputer network, it was necessary for the subcontractor to postpone his final mission to Cyprus for the year 1986.

Typically the project was completed in June 1986 after the final mission to Cyprus of the subcontractors has been completed. The subcontractor submitted the following reports:

- 1 Revision of Methods for Collection, Control, Processing, Storage and Retrieval of Hydrological Data.
- 2 Master Plan for the Establishment and/or Upgrading of Country's Required Basic (Min/Opt) Surface Station Network.

- 3 Master Plan for the Establishment and/or Upgrading of Country's Required Basic (min/opt) Groundwater Station Network.
- 4 Master Plan for the Establishment and/or Upgrading of Country's Required Basic (MIN/OPT) Groundwater Station Network - Appendices.
- 5 Recommendations for the Upgrading of the Workshop.
- 6 Recommendations for Possible Modification of the WRD/WDD's Organizational Structure
- 7 Sediment Monitoring Programme - Approach.
- 8 Water Quality Monitoring Programme - Approach.
- 9 Improvement of Hydrological Data Acquisition and Processing - Executive Summary.
- 10 Hydrological Data Bank and Computerized Data Processing - User's Manual.
- 11 Hydrological Data Bank and Computerized Data Processing - User's Manual - Annexes 4 - 11.
- 12 Hydrological Data Bank and Computerized Data Processing-Reference Manual.

During the project specifications were drawn for equipment which were approved by the appropriate authorities in W.M.O. and ordered for the project.

Although the various steps until placing the final order for the above equipment to the manufacturers were taken during the project, certain equipment arrived several months after the project was typically finished.

The equipment ordered by the project and received is the following:

- 1 Three Microcomputers make Intertec type Headstart VPU-512 with 512 kb memory and one diskette drive.
- 2 One Microcomputer type MAC-XT with 640 kb memory, two diskette drives.
- 3 One Hard Disk make Intertec type Headstart DSS-50 of 50Mb storage with one fixed platter and one removable cardridge of 25Mb each.
- 4 One Dot Matrix Printer make Epson type RX-80.
- 5 One Diskette Drive make Intertec type Floppy 5 1/4".
- 6 One Plotter make Houston Instruments type EMP-29M, flat bed for A3 size paper and 8 pens.
- 7 One Digitizer make Houston Instruments type E7024, 19" X 26" total active area tablet.
- 8 One ion analyzer Make orion model EA 920 Digital pH/lSE meter with 14 electrodes and dot matrix printer.
- 9 One electronic balance make Sartorius.
- 10 One oxygen meter with electrodes make WTW.
- 11 One Vibratory sieve shaker make fritsch model Analysette-3 with 10 sieves.

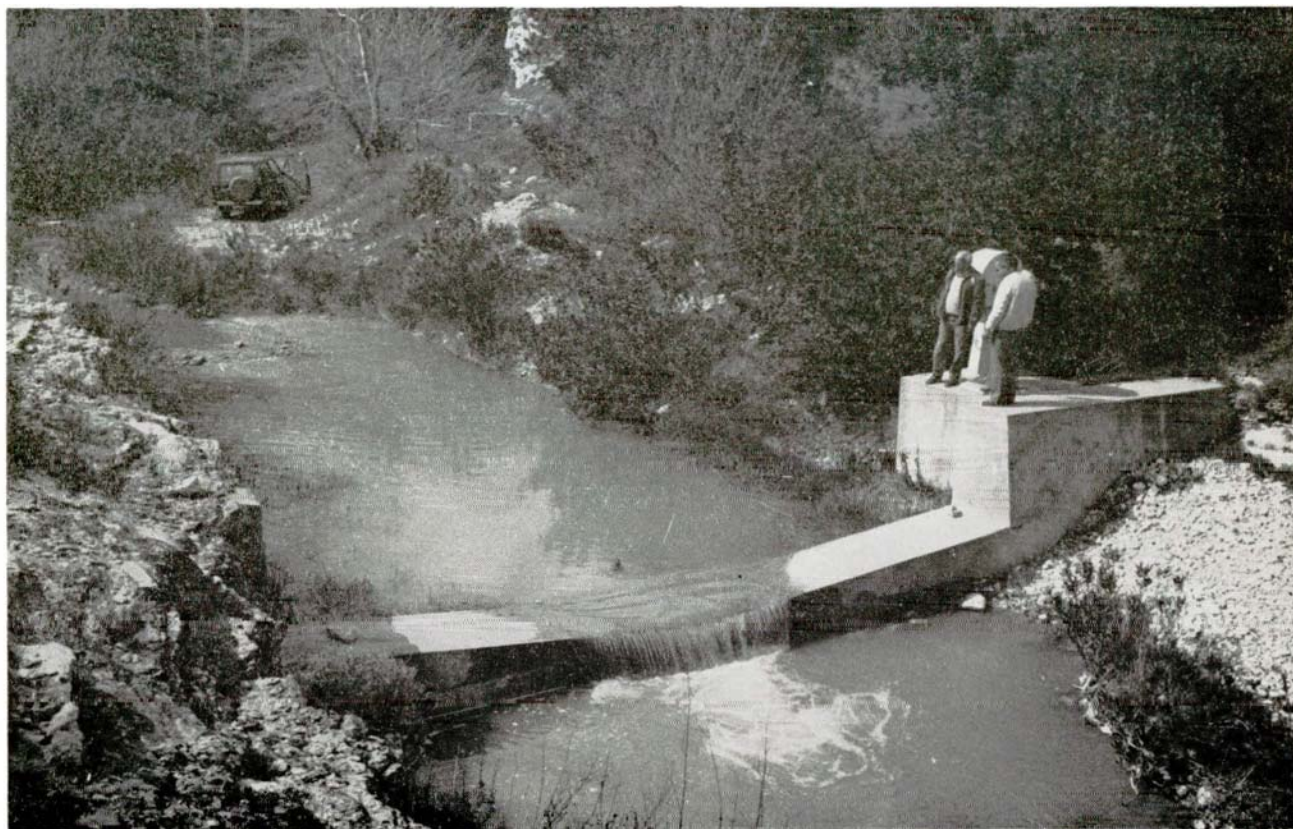
12 Sediment analysis equipment make Minnesota Fabricators Inc (two single-stage samplers U.S.DH-59 and one visual accumulation tube U.S. VA-53).

13 Five sediment samplers make Kovo type VUVH-BA.

In 1986 personnel of Water Resources Division was trained on the use of the computer system installed and the analysis of flow records from our autographic flow gauging stations with the digitizer and the preparation of Data for our computerized Data Bank started.



Dhiarizos River gauging station at Kouklia
W.D.D. Photo C68EN-29 (18.2.86)



Kryos River flow gauging station at Khalassa u/s Kouris Dam
W.D.D. Photo C71EN-18 (26.2.86)

III

DIVISION OF HYDROLOGY
AND WATER RESOURCES MANAGEMENT

by

I St Iacovides
Senior Hydrologist
Head of the Division

Introduction

The Division of Hydrology and Water Resources Management has been formally established on 1982 within the frame-work 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 1986, 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).

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:

- Preparation of pertinent hydrometeorological data.
- Updating of rainfall data from 1982 to 1984 for the stations of Pedhoulas, Trikoukkias, Troodos, Evrykhon, Amiandos, Kapoura, Panayia Bridge, Palekhoris, Ay. Epiphaniou and Platania, including statistical analysis for these records.
- Computation of the depth-area-rainfall (1916 to 1984) for the watersheds of Marathasa, Karyotis, Atsas, Elea, Akaki, Peristerona, Pedhieos and Koutis.
- The observed flows (1982 to 1984) were updated and statistical analysis was performed for the gauging stations of Ayios Nikolaos, Platania, Evrykhon, Kalopanayiotis, Lagoudhera, Vizakia, Atsas near Evrykhon.
- The flows of Karyotis river (1986-84) were simulated and statistical analysis was performed.
- Instantaneous flow measurements were carried out at selected points on Karyotis river at 5 weirs and diversion intakes, on Atsas weir, on Marathasa, Peristerona and Elea river weirs as requested by the Russian Mission.
- Finally the Division participated in numerous meetings and consultations regarding the hydrologic input required for this feasibility study.

b) Other activities

- Transfer and adaptation of the rainfall-runoff model and

- other related programmes from the IBM 4331 computer system in the private sector where all the work was carried out since 1968 to the IBM PC AT microcomputer acquired by the Division in 1985.
- Transfer of most of the rainfall and part of the runoff data on the IBM PC AT.
 - Updating of rainfall data and observed runoff of catchments and rivers within project areas of high priority.
 - Flood studies for various waterworks in small catchments as in Athienou, Sotira, Limassol etc.).

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.

In summary form the survey of 1986 indicated the following:

- 5700 wells irrigated 7200 hectares with a total extraction of 28.6 Mm³.
- 52% of the area was cultivated with Spring Potatoes, 17.7% with Autumn Potatoes, 11% was Citrus and other trees and the rest was melons and vegetables.
- An increase of 88% in wells has been noted since 1979 whilst the total extraction has been reduced by only 1.5%. The increase in wells varies from 16% in Ormidhia to 154% in Sotira.
- The yield of the wells has decreased by 50 to 150% whilst the daily operation has increased by 25%.
- The annual drop of the water level is about 1.5 to 2.0 meters whilst sea-intrusion has been noted up to 4 Km inland.

b) Hydrogeological study of Tremithios riverbed

In view of the possibility of releasing water from the Southern Conveyor for recharge purposes, the river-bed aquifer between the Limassol/Larnaca road bridge and Kiti dam has been studied. A number of boreholes in this area pump water for the needs of the Larnaca Water Supply (0.5 Mm³/yr.). During the year, the following were carried out:

- Collection of existing hydrogeological data.
- A network of boreholes was established for monitoring the water level fluctuation.
- Five new observation boreholes were drilled and geophysical work (G.S.Dept.) was carried out at four traverses.
- The geometry of the aquifer was delineated.

- An initial estimate of the potential capacity ($2 \text{ Mm}^3/\text{yr}$) of the aquifer and recharge requirements ($0.5 \text{ m}^3/\text{s}$) was made. made.

c) Hydrogeological Study of Xeropotamos riverbed aquifer

In view of the cutting off of recharge to the downstream riverbed aquifer by the Asprokremmos dam and the pumping made from this area for the Paphos Water Supply ($1.0 \text{ Mm}^3/\text{yr}$) and by other wells for local irrigation, controlled releases for recharge had to be made. These were necessary in view of the serious depletion of the groundwater reserves and the propagation of sea intrusion near the Paphos Water Supply wellfield at 1.5 km inland. The hydrogeology of the area was studied as to the best location of recharge works and rate of release required.

The following were carried out:

- Evaluation of existing hydrogeological data and delineation of aquifer geometry.
- Establishment of groundwater monitoring network.
- Drilling of 5 new boreholes for monitoring purposes one of which could be used for artificial recharge.
- Establishment of four recharge ponds in series in the most upstream part of the aquifer equipped with measuring weirs.

d) Study on the operation and control of the Yermasoyia aquifer

The Division carried out an evaluation of the drawdown that can be expected in the wellfield area of the Limassol Water Board boreholes as proposed by the study made by H. Humphreys and Partners for the Water Board of Limassol.

A wellfield drawdown simulation model was used on the IBM PC AT microcomputer.

Assuming maintenance of controlled releases from the dam, both upstream and downstream of the wellfield, then some $34000 \text{ m}^3/\text{d}$ could be pumped with a 2 to 2.6 m of drawdown.

e) 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 IAEA 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 sus-

tained by releases from the dam.

f) Other studies connected with the Southern Conveyor Project

- The developing groundwater conditions in the Kokkinokhoria aquifer, Kiti-Pervolia area, Pareklishia aquifer and Akrotiri area were continued to be monitored and assessed throughout the year. Electrical conductivity surveys were carried out at Akrotiri, Yermasoyia and Kokkinokhoria aquifers for monitoring the sea intrusion trend. Furthermore, the area of Anglisides was considered and a monitoring network was established.
- Meetings and consultations were carried out with World Bank experts and Missions reviewing the SCP. In particular, the study by N. Trac of the World Bank regarding the SCP (phase II) was considered and the overall water balance for the Akrotiri region was re-evaluated.
- The effect of Kouris dam on the Akrotiri aquifer was reviewed and the releases required were proposed.

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 1986 for water supply purposes was 6.9 Mm³ distributed as follows (in m³/yr):

TABLE III-1

EXTRACTION FROM THE YERMASOYIA AQUIFER (in m³/y)

Limassol W.S.	Amathous	Yermasoyia	Potamos Yermasoyias	Moutayiaka	Total
4816450	633180	109030	829570	511180	6899410

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 5.588 Mm³ were recharged into the aquifer of which some 0.296 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 1986 was established to be as follows:

TABLE III-2

YERMASOYIA RESERVOIR ; WATER BALANCE FOR 1986

INFLOW (Mm ³)	OUTFLOW (Mm ³)
Phinikaria river ... 7.860	Outflow for Irrigation and releases 9.734
Akrounda river 0.565	Evaporation 0.750
Catchment d/s weirs. 0.297	Spills 0.000
Subsurface inflow .. 0.273	Unaccounted losses ... 2.678
Rainfall on reservoir 0.151	
-----	-----
9.146	13.162
Net change in Storage: -4.016	

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 between September to the end of 1986 was 0.656 Mm³.

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 1986 from the Kouris Delta aquifer was 1.79 Mm³ from 6 boreholes. From this quantity, 0.30 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 0.37 Mm³ was extracted from two 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 October 1985 to March 1986 a total of 0.977 Mm³ were entered into the pond. Of this quantity 0.44 Mm³ were used for irrigation, spilled and evaporated allowing a total of 0.933 Mm³ to infiltrate into the groundwater. The average infiltration rate was 6160 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 water-works in the future.

b) Computer software application and development of new software

The existing software LOTUS 1-2-3, dBase III and WORDSTAR were introduced to almost all the personnel of the Division and gradual application has been implemented for data storage, retrieval and processing.

Furthermore computer software specific to the needs of the Division started being developed for data manipulation and processing.

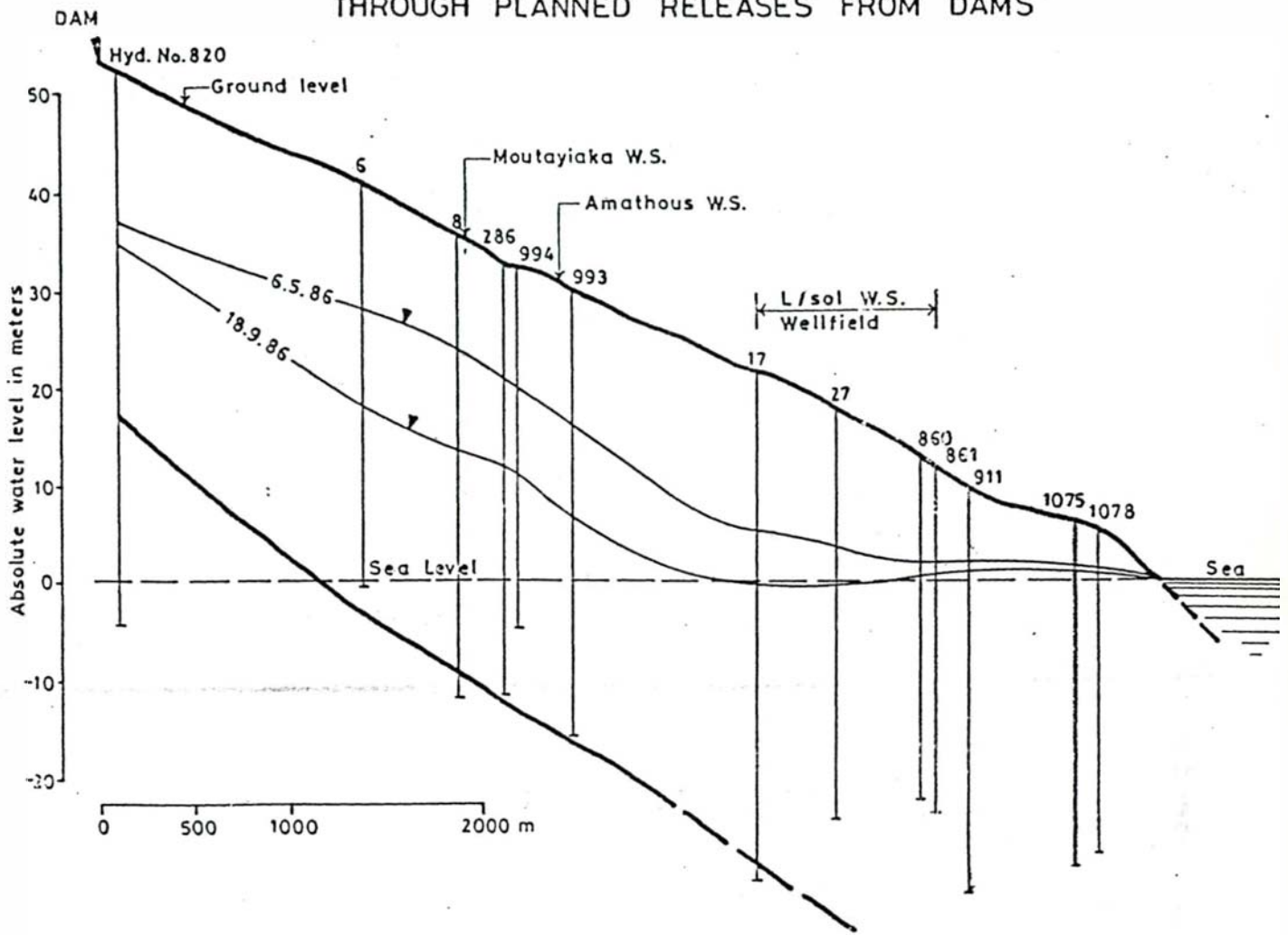
TABLE III-3

DIVISION OF HYDROLOGY
AND
WATER RESOURCES MANAGEMENT

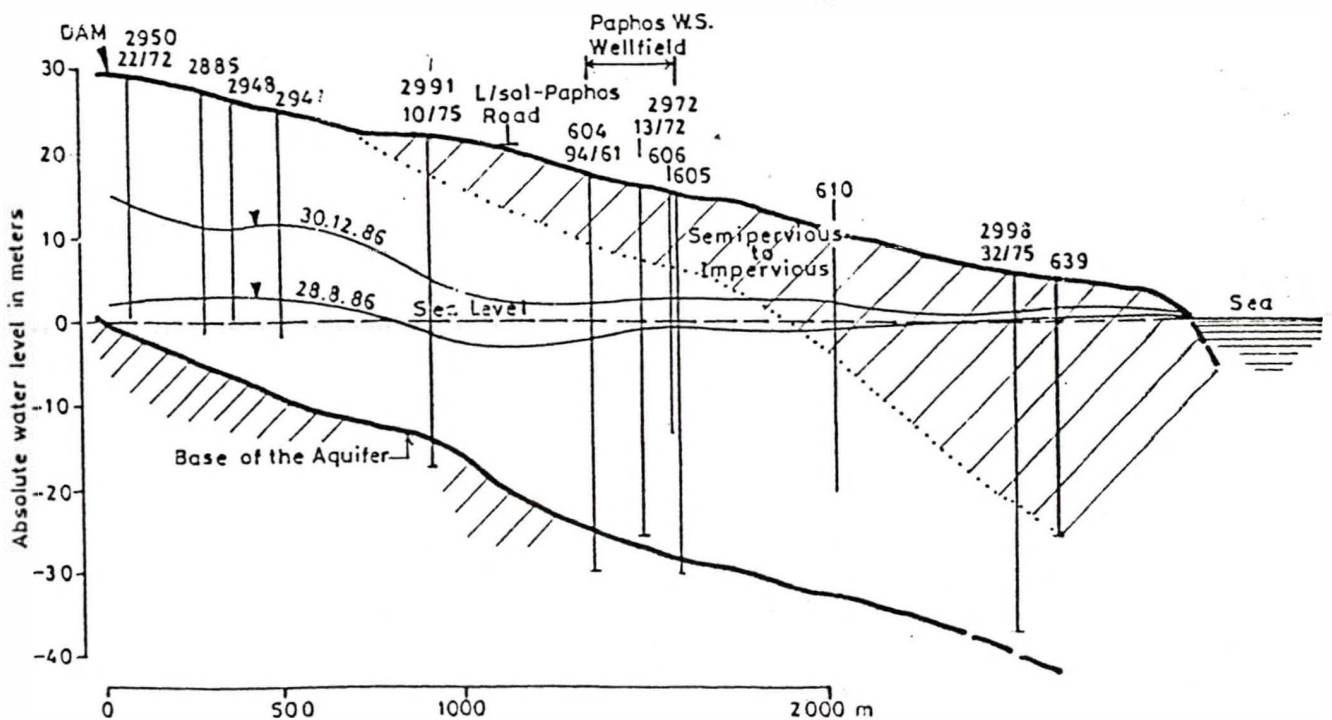
DIVISION OF HYDROLOGY
AND
WATER RESOURCES MANAGEMENT

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.		

CONTROL OF GROUNDWATER RESERVES BY ARTIFICIAL RECHARGE THROUGH PLANNED RELEASES FROM DAMS



a) Cross section and water levels of Yermasoyia Riverbed Aquifer



b) Cross section and water levels of Xeropotamos Riverbed Aquifer

Fig. III-1

Xeropotamos recharge
Ponds, looking
upstream

- Asprokremmos dam
Spillway in the
background
- First recharge
pond with weir on
spillway and con-
tinuous stage re-
corder on the
foreground

WDD Photo D40EN-8
(21.1.87)

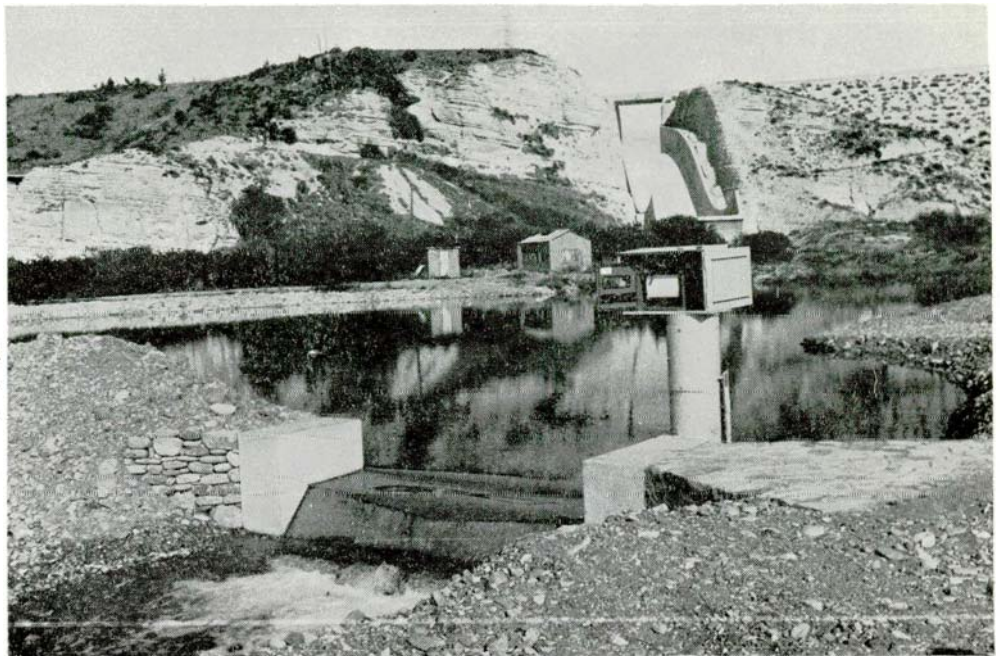


Fig. III-2

Xeropotamos recharge
Ponds, looking
downstream

- Four recharge
pond in series

WDD Photo D40EN-3
(21.1.87)

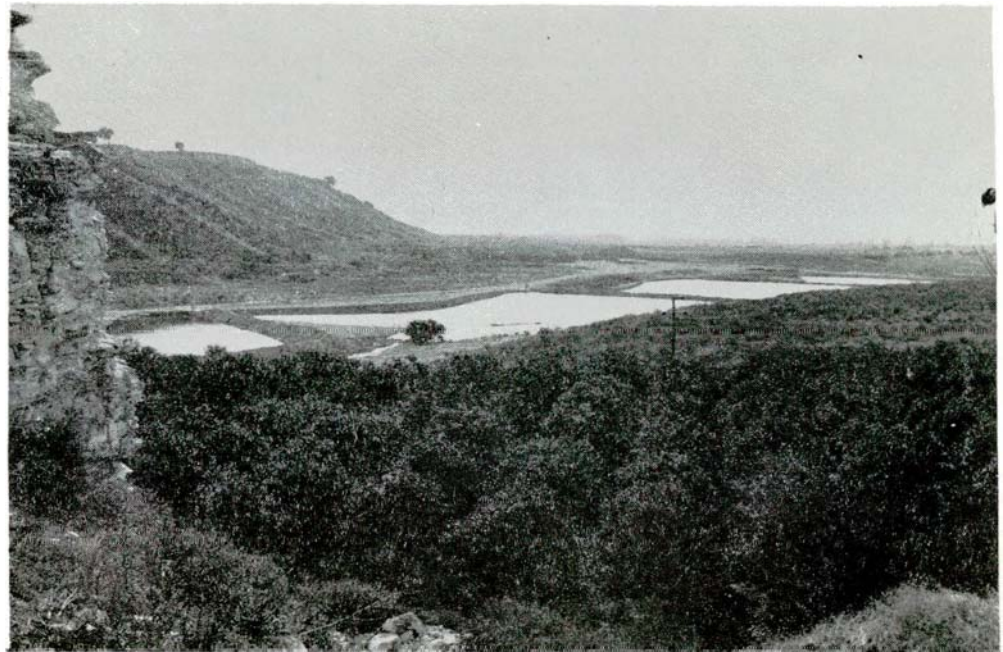


Fig. III-3

Kouris riverbed
recharge looking
downstream from
M1 bridge

- Water spreading
in trained river-
bed

WDD Photo D39EN-15
(15.1.87)



Fig. III-4

Yermasoyia controlled releases for recharge.

-Wash-out on main pipe line discharging water imported from the Kou-ris Delta boreholes.

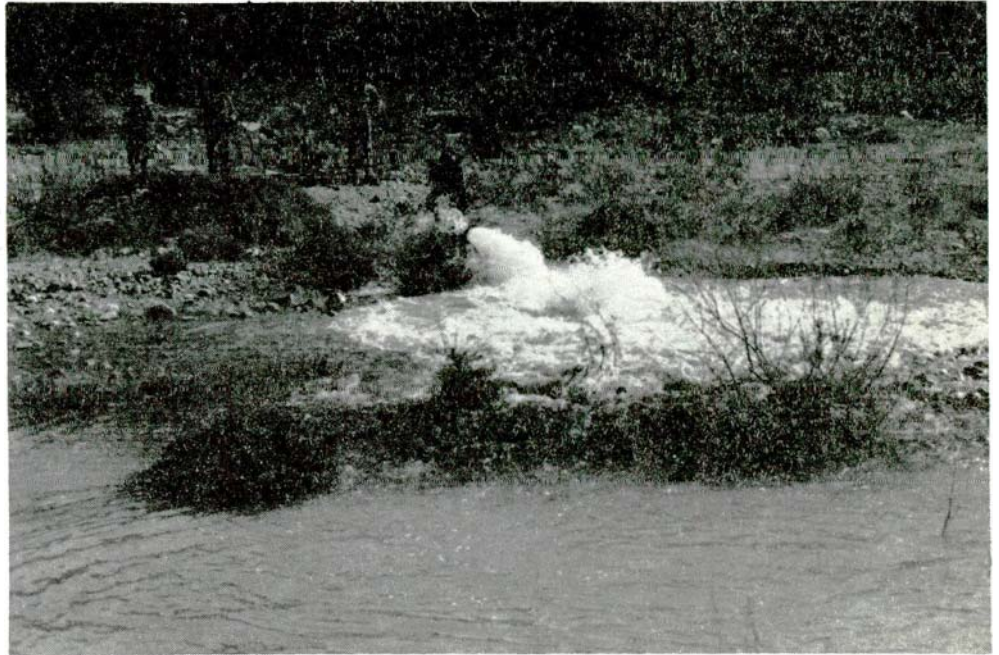


Fig. III-5

Yermasoyia controlled releases for recharge looking downstream the N/sia-L/sol Bridge

-Minor ponds in Series within riverbed channel with water from the dam spread for recharge.

W.D.D. Photo D40EN-0
(21 1.87)



Fig. III-6

Phassouri Recharge Pond.

-Continuous Stage recorder for water stored in pond.

W.D.D. Photo D62EN-7
(23.3.87)



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.

The Branch is headed by a Senior Technical Superintendent and staffed with 5 Technicians I, 10 Technicians 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

- Setting-out of conveyor pipeline - Setting-out and levelling.
- Arminou diversion - Contour survey.
- Khapotami drop-shaft - Contour survey.
- Dhiarizos tunnel - Setting-out and coordinates.
- Limassol treatment plant - Contour survey.
- Kokkinokhoria irrigation network - Setting-out & levelling.
- Akhna dam - Contour survey.
- Tersephanou pipeline - Setting-out & levelling.
- Akrotiri irrigation network - Setting-out & levelling.
- Night storage reservoirs - Contour survey.

Karyotis Project

- Ayios Theodoros dam - Contour survey.
- Panayia dam - Contour survey.
- Kakopetria Galata - Contour survey.
- Diversion sites - Contour survey.
- Karyotis main conveyor - Setting-out & levelling.
- Karyotis diversion tunnel - Setting-out & levelling.
- Karyotis borrow areas - Contour survey.
- Karyotis treatment plant - Contour survey.
- Cross sections on main conveyor - Cross sectioning.

Routine Surveys

- Rizoelea antiflood - Setting-out & levelling.
- Dherinia, Ayia Napa W S - Setting-out & levelling.
- Kakopetria Waste Disposal Scheme - Setting-out & levelling.
- Athienou pond - Contour survey.
- Khalassa pond - Contour survey.
- Observations for movement detection - Instrumental observations.

V-DRAWING AND RECORDS BRANCH
 by S.C. Pitsillides STS
 Head of Branch

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

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

At the end of 1986 the Drawing and Records Branch numbered 20 staff i.e. 12 Technicians I, 6 Technicians II and 2 hourly paid assistants of the plan reproduction section. For varying periods of the year 8 Technicians travelled every day to the construction sites of Vasilikos-Pendaskinos and Southern Conveyor Projects. By the end of the year only 4 Technicians worked away from HQs, at Khirokitia, Ayios Athanasios, Ormidhia and Akhna Dam site.

The work carried out by the Drawing and Records Branch during 1986 is listed on Table V - 1

TABLE V-1
 WORK CARRIED OUT BY THE DRAWING AND RECORDS BRANCH DURING 1986

Ref.	Description	Time spent in hours	Man months	% of total
a	Existing dams (completion plans, sedimentation maps, control monuments etc.) and proposed dams	2074	13.3	5.9
b	Irrigation distribution systems for dams.....			
c	Routine irrigation schemes.....	372	2.4	1.1
d	Routine domestic water supply schemes.....	1896	12.2	5.3
e	Krasokhoria Project.....	125	0.8	0.3
f	Pitsilia Integrated Rural Development Project.....	386	2.5	1.1
g	Vasilikos-Pendaskinos Project.....	5562	35.8	15.6
h	Southern Conveyor Project.....	10171	65.4	28.6
i	Khrysokhou Irrigation Project.....	217	1.4	0.6
j	Karyotis Project.....	494	3.2	1.4
k	Larnaca-Orini Project.....	43	0.3	0.1
l	Recharge works.....	114	0.7	0.3
m	Antiflood and river training works.....	30	0.2	0.1
n	Computer lessons.....	109	0.7	0.3
o	Watershed surveys.....			
p	Hydrological.....			
q	Programmes and organisation.....	414	2.7	1.1
r	Agriculture show.....	125	0.8	0.4
s	Productivity centre course.....	130	0.8	0.4
t	Sewage disposal.....	733	4.7	2.1
u	Completion plans and reports.....	582	3.8	1.7
v	Reports.....	419	2.7	1.2
w	Emergency schemes.....			
x	General-Odd jobs.....	870	5.6	2.5

TABLE V
WORK CARRIED OUT BY THE DRAWING AND RECORDS BRANCH DURING 1986 (Cont.)

Ref.	Description	Time spent in hours	Man months	% of total
y	Auxiliary services			
(i)	Library.....	1290	8.3	3.6
(ii)	Plan registry.....	730	4.7	2.1
(iii)	Plan reproduction.....	2026	13.0	5.6
(iv)	Drawing materials store.....	530	3.4	1.5
(v)	Photographic section and photo process lab.....	1867	12.0	5.3
	Total for auxiliary services.....	6443	41.4	18.1
z	Leave etc.			
(i)	Leave paid.....	2645	17.0	7.5
(ii)	Leave without pay.....	98	0.6	0.3
(iii)	Sick leave.....	696	4.5	2.0
(iv)	Maternity leave.....	318	2.0	0.9
(v)	D.C. (including site visits).....	407	2.6	1.2
	Total for leave etc.	4164	26.7	11.9
	Grand total.....	35473	228	100

Drawing and Cartography Section

The largest load of work was by far the Southern Conveyor Project followed by the Vasilikos-Pendaskinos Project (mainly for completion plans) as can be seen on table V- This is due to the fact that members of the Drawing Branch staff have been assigned to SCP and VPP sites in addition to work carried out for these projects at HQs.

During the first 5 months of 1986 there was a great demand on the Drawing Office for Southern Conveyor Project contract drawings. Over 200 drawings were prepared for Kokkinokhoria central distribution points, their pumping stations and reservoirs as well as main and secondary pipelines for the distribution network of Kokkinokhoria.

After May 1986 the Drawing and Records Branch had to deal also with the preparation for the Cyprus Agri Fair organised by the Ministry of Agriculture and Natural Resources. The preparation of a large scale map (1:100,000) of our major projects was accelerated to be completed to coincide with the Agri Fair and in fact the Lands and Surveys Department finished the printing of this map the day before the opening of the Fair. Another notable exhibit of WDD at the Fair was a working model of Kouris Dam prepared by the Drawing and Records Branch which proved to be one of the main attractions for young and old at the exhibition.

Plan Reproduction and Plan Registry Section

A number of 23,500 prints were prepared of all types and sizes through some 2670 orders to the Printing Section. Plan registry work was shared by the Drawing & Records Branch staff.

The Photographic Section and Photo Process Laboratory

Photographic coverage of construction works of the Department was carried out throughout 1986 in black and white, colour and colour slides still photography as well as colour 16 mm cine filming and video recording. Periodic visits were made to Kouris Dam and Evretou Dam although the responsibility for photographic coverage of these two dams lies with the respective contractors.

In addition photographic coverage of Akhna dam construction and the construction of the main conveyer from Kouris to Akhna were covered photographically. The work on the distribution network of Khrysokhou Irrigation Project was also covered and due to great distances from Nicosia an automatic camera will be supplied to the supervising staff so they can carry out day by day coverage where necessary. Already a camera has been supplied to the SCP main conveyer staff for day to day photographic coverage and 2 more will be supplied for Akhna Dam and Kokkinokhoria distribution network.

As planned, a video documentary was prepared during 1986 with assistance from a member of the staff of the Press and Information Office. This is the first documentary prepared by the Department and its subject is the Vasilikos-Pendaskinos Project one of our major projects just completed. Mr. A. Xinaris was kind enough to do the commentary for this 30 minute documentary which was also ready in time for showing at the 1986 Agri Fair.

The Photo Process Laboratory carried out all the photolithographic work of the Department including preparatory work for colour maps, base maps for the SCP distribution networks for Kokkinokhoria as well as enlargements, reductions and reproduction of drawings.

Technical Library and Technical Information Center

In 1986 £1250 was spent on the purchase of 36 technical books and subscription to 16 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.

Books Purchased

O LEROY. The EEC's fight against the pollution of the aquatic environment. Belgium, 1985. Book No. A686 BF8, 900.00

AWWA. Water fluoridation. Principles and practices. AWWA Manual/M4. Book No. A856. US\$22.50

FIDIC. Selection by ability. Lausanne, 1979. Book No. A763. Sw. Fr. 2.00

FIDIC. Tendering procedure. Lausanne, 1982. Book No. A764. Sw. Fr. 30.00

FIDIC. Responsibility and liability of the consulting engineer. Lausanne, 1979. Book No. A765. Sw. Fr. 10.00

FIDIC. Client/consultant relationships. Italy, 1983. Book No. A766. Sw. Fr. 15.00

CONSTRUCTION CONSULTANTS INTERNATIONAL CORP. International construction claims. Washington, 1986. Book No. A768. US\$230.

A SASSON. Biotechnologies. Challenges and promises. France, 1984. Book No. A769. C£7.00.

J SHARP & P SAWDEN. Basic hydrology. London, 1984. Book No. A770. St.£9.90.

ICE. Computer technology in construction. Proceedings of a conference organized by ICE and held in London on 25-27 September 1984. London, 1985. Book No. A851. St.£20.00.

ICE. New technology in water services. Proceedings of a symposium organized by the ICE and held in London on 20-21 February, 1985. London, 1985. Book No. A852. St.£20.00.

ICE. Reuse of sewage effluent. Proceedings of the international symposium organized by the Institution of Civil Engineers held in London on 30-31 October, 1984. London, 1985. Book No. A853. St.£20.00.

ICE. Failures in earthworks. Proceedings of the symposium on failures in earthworks, organized by the ICE and held in London, 6-7 March, 1985. London, 1985. Book No. A854. St.£29.00.

ISO. 1S05256. Steel pipes and fittings for buried or submerged pipelines. Sw. Fr. 82.00. Book No. A874.

J KENNA & B GILLET. A handbook solar water pumping. London, 1985. Book No. A887. St.£15.63.

R J BATEMAN. Basic draughtsmanship. London, 1985. Book No. A855. St.£3.50.

AWWA. Water Quality Treatment. Third edition. New York, 1971. Book No. A859. US\$68.50.

AWWA. Water Supply Operations Series:

- Vol. 1: Introduction to water sources and transmission. Denver, 1985. Book No. A857. US\$14.00.

- Vol. 2: Introduction to water treatment. Denver, 1984. Book No. A858. US\$29.50.

- Vol. 4: Introduction to water quality analyses, Denver, 1982. Book No. A860 US\$19.50.

- Reference Handbook: Basic science concepts and applications. Denver, 1984. Book No. A861 US\$43.50.

ICE. Improvement of concrete durability. Proceedings of the seminar held in London on 8 May, 1985. London, 1986. Book No. A889 St.£16.00.

D STEPHENSON. Developments in water science. Pipeflow analysis. Netherlands, 1984. Book No. A888 Dutch guilders 110.00.

ASCE. - COOKE & SHERARD. Concrete face rock fill dams - design, construction, and performance. Proceedings of a symposium held in Detroit, Michigan on October 21, 1985. New York, 1985. Book No. A890 US\$63.00.

Indian Geophysical Union.

- Proceedings of the Seminar on engineering geophysics - perspectives and prospects held in India on Dec. 19-20, 1984. Book No. A891. US\$20.00.

- Abstracts of seminar on "crustal dynamics" held in India on 22-23 Jan. 1986. Book No. A892 US\$5.00.

- Abstracts seminar on engineering geophysics - perspectives and prospects held in India 19-20 1984. Book No. A893 US\$5.00.

FREDERIC M. GARFIELD. Quality assurance principles for analytical laboratories. USA, 1984. Book No. A917. US\$ 42.50.

BHRA. (The Fluid Engineering Centre). The hydraulics of flood and flood control. Papers presented at the 2nd International Conference at Cambridge 24-26 September, 1985. Bedford, 1985. Book No. A920. St.£48.00.

A MEADOWS - M. GORDON & A SINGLETON. Dictionary of computing and new information technology. London, 1984. Book No. A948 C£2.95.

J MORTON. Introduction to Basic. London, 1983. Book No. A.949 C£7.65.

D MONRO. Interactive computing with Basic. A first course. London, 1983. Book No. A950. C£5.95.

O HANSON. Essentials of computer data files. London, 1985. Book No. A951. C£7.95.

P BISHOP. Structured programs in Basic. London, 1984. Book No. A952. C£6.95.

P BISHOP. Further computer programming in Basic. London, 1984. Book No. A953 C£12.25.

R NICKERSON. Fundamentals of FORTRAN 77 programming. A structured approach. Third edition. Toronto, 1985. Book No. A954. C£14.95.

1986 Subscription to Periodicals

ASCE. Construction engineering and management US\$51.00.

ASCE. Geotechnical engineering US\$102.00

ASCE. Hydraulic engineering US\$118.00.

ASCE. Irrigation and drainage engineering US\$46.50

ASCE. Structural engineering US\$148.00
ASCE. Surveying engineering US\$33.00
ASCE. Water resources planning and management. US\$59.00
AWWA. Journal. US\$75.00
Employment Gazette. St.£35.00
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VI RURAL PROJECTS PLANNING DIVISION

by
C Andreou
Senior Water Engineer
Head of Division

Introduction

The Rural Projects Planning Division deals especially with rural domestic water supply and the planning and design of contributory irrigation schemes. Other activities of the Division is the rehabilitation of water supply and irrigation schemes, 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 1986 the staff of the Division was consisting of the following:

- 1 Senior Water Engineer - Head of the Division
- 2 Executive Engineers Class I
- 1 Senior Technical Superintendent
- 1 Technical Superintendent
- 3 Senior Technicians
- 2 Technicians I
- 1 Daily Paid Technician
- 1 Secretary - Typist

VILLAGE WATER SUPPLY SCHEMES

The general village water supply situation during 1986 is described in Tables VI - 1 and VI - 2. There are no villages in Cyprus without piped water.

During 1986 only 56 out of a total number of 619 villages remained with public fountains ie 1.89% of the total village population.

Out of 563 villages with house to house supply systems 542 enjoyed a per capita daily rate of over 90 litres (20 gallons).

Water Supply Schemes Prepared During 1986

A total number of 96 schemes were prepared and submitted to the District Officers during 1986, at a total estimated cost of £3,020,824 as shown on Table VI-3.

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

Besides the above mentioned schemes a total number of 17 water supply schemes were prepared for the housing of displaced persons (Refugee self-housing and housing estates), at a total estimated cost of £105,790 as per table VI-3A, which were submitted to the Department of Town Planning and Housing.

In 1986, six schemes to supply water to livestock areas were prepared at a total estimated cost of £75,300 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 1986

NICOSIA DISTRICT

Lakatamia: Improvements to the existing House to House Scheme
Total Estimated Cost £ 190,000

Lýthrodhondas: Improvements to the existing House to House Scheme and additional supply from B/H 181/83
Total Estimated Cost £210,920

Moutoullas: Additional supply from B/H 166/84/85. Total Estimated Cost £38,000

Malounda: Additional supply from B/H 140/85. Total Estimated Cost £44,000.

Galata: New Conveyor Pipeline from Livadhi tou Papaphilippou Spring.
Total Estimated Cost £42,000.

Paleometokho: Additional Supply from B/H 86/85. Total Estimated Cost £33,000.

LIMASSOL DISTRICT

Arkolakhania-Philagra Regional Scheme: Pumping scheme from B/H 87/84 for Additional Water Supply £355,000

Amathus Government Water Supply Scheme: Distribution System Phase 'B' £138,500.

PAPHOS DISTRICT

Mesoyi: Improvements to House to House Distribution System £79,000

Paphos Town: Pumping Scheme for the supply to higher area £136,800.

FAMAGUSTA DISTRICT

Replacement of Liopetri Distribution System ,..... £225,000

LARNACA DISTRICT

Dromolaxia Water Supply - Replacement of Distribution System	£67,000
Ormidhia Water Supply - Replacement of Distribution System	£95,000
Xylotymbou Water Supply - Replacement of Distribution System	£180,000

IRRIGATION SCHEMES

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

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

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

The advantages of the rural projects programme, the beginning of which dates back to the creation of the Department is 'speed of reaction' in all phases of project development, 'wide participation' of farming communities, 'greater flexibility' in budgetary procedure and 'greater exploitation' of the existing agriculture and 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 1986 a total number of 26 irrigation schemes was prepared and submitted to District Officers at a total estimated cost of £763,660 as per Table VI-5.

Another 14 schemes were in the course of preparation or under investigation by the end of 1986 as per Table VI-7.

Brief Description of Important Irrigation Schemes prepared during 1986

Astromeritis: Lining of channels to save water £48,000

Akaki: : Lining of channels to save water £53,000

LIMASSOL DISTRICT

Kaminaria-Tris Elies: Pumping Scheme from B/h 117/78 £63,300

Ayios Ioannis (Agros): Improvements to Irrigation works £49,000

PAPHOS DISTRICT:

Pendalia: Pumping Scheme from B/H 67/83 £54,000

Kholetria: Pumping Scheme from B/H 18/69 £71,500

Mamonia: Pumping Scheme from B/Hs 61/51 and 133/83 £104,000

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 1986, 26 schemes have been considered by the Committee as per Table VI-6.

Sewage Schemes

During the year under review 5 Sewage Schemes were prepared at an estimated cost of £2,666,000 as per Table VI-8.

Building and Division of Building Plots Permits

During 1986 a total of 1607 cases were investigated and sent to the District Officers for further action.

TABLE VI - 1

VILLAGE WATER SUPPLIES

Year	Villages with House-to-House distribution system				Villages with Public fountains				Village without a piped supply		
	Schemes completed	Total No. of Villages	Villages %	Population %	Total No. of Villages	Villages &	Total No. of Villages	Villages %	Population %	Total No. of Villages	
1960	-	90	14.33	-	441	70.23	-	97	15.44	-	628
1961	41	131	20.86	-	428	68.19	-	69	10.95	-	628
1962	59	190	30.25	-	380	60.55	-	58	9.20	-	628
1963	67	257	40.90	-	324	51.60	-	47	7.50	-	628
1964	39	296	47.13	66.71	323	51.43	32.29	9	7.44	1.00	628
1965	5	301	47.93	68.86	321	51.11	30.44	6	0.96	0.70	628
1966	7	308	49.05	69.81	316	50.31	29.95	4	0.64	0.24	628
1967	11	319	50.80	71.40	307	48.88	28.46	2	0.32	0.14	628
1968	27	346	55.10	75.72	282	44.90	24.28	-	-	-	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

TABLE VI - 2

WATER SUPPLY SITUATION AT THE END OF 1986

District	Satisfactory piped supply supply rate 90 litres/head/day & over			Unsatisfactory piped supply supply rate below 90 litres/head/day			Total No of Villages	Total popula- tion 1969								
	No	%	pop.	No	%	pop.										
				Villages with - fountains		Villages with House to House										
				No	%	pop	No	%	pop	%						
Nicosia	150	88.76	119263	10	5.92	1230	5	2.96	3104	2.50	4	2.36	699	0.56	169	124296
Kyrenia	39	82.98	30786	2	4.26	59	1	2.13	540	1.64	5	10.63	1542	4.68	47	32927
Famgusta	82	83.68	82644	3	3.06	444	6	6.12	5695	6.34	7	7.14	934	1.04	98	89717
Limassol	104	91.22	72527	4	3.51	65	4	3.51	1417	1.91	2	1.76	99	0.13	114	74108
Paphos	111	84.09	48529	13	9.85	2109	5	3.78	685	1.32	3	2.28	372	0.72	132	51695
Larnaca	56	94.92	40238	2	3.39	156	0	0.00	0	0.00	1	1.69	140	0.35	59	40534
TOTAL	542	87.56	393987	34	5.49	4063	21	3.39	11441	2.77	22	3.56	3786	0.92	619	413277

TABLE VI - 3

VILLAGE WATER SUPPLY SCHEMES
PREPARED IN 1986 AND SUBMITTED TO
DISTRICT OFFICERS

Nicosia District

Ser. No.	Village	<u>Nature of Scheme</u>	Est. Cost £
1	Galata	New pipeline from Livadhi tou Papaphilippou spr.	42 000
2	Lakatamia	Improvements to the existing distr.system	190 000
3	Moutoullas	Add.supply from B/H 166/84/85	38 000
4	Xeri	" " " 16/85	21 221
5	Lythrocondas	New House to House Scheme and add.supply from B/H 181/83	210 920
6	Marki	Add. supply from B/H 101/85	32 000
7	Nea Eleousa	Supply from B/H 98/85	2 800
8	National Guard (398 T.P)	{ Supply from B/H 80/73 (Scheme A) (Scheme B)	{ 42 000 39 000
9	Lakatamia	Temporary Supply to Ayios Mamas Gov.Housing	6 100
10	KaloKhorio (Klirou)	Replacement of pipes	4 100
11	Pera(or)	Water Supply to C.Y.TA.installations	18 000
12	Troodos	New Station Tank	25 000
13	Ay.Trimithias	Add.Supply from B/H 140/85	25 000
14	Old Age People + Nat.Guard	Supply from B/H 109/59	10 190
15		Extensions	4 800
16	ELDYK (Malounda)	Supply from B.H 107/83	13 000
17	Lazania	Repairs to St.tank	150
18	Yeri	Laying of pipes	14 200
19	Kapedhes	" "	1 300
20	National Guard Yeri	Laying of pipes	10 700
21	K.Moni	Extensions	3 200

TABLE VI - 3 (cont.)

Ser. No.	Village	Nature of Scheme	Est. Cost £
22	Mathiatis	Laying of pipes	17 000
23	Kambia	" "	6 000
24	Lythrodondas	" "	6 300
25	Kotchatis	" "	4 500
26	Yeri Self Housing(Phase H)	House to House	3 300
27	Paleometokho	Laying of pipes	27 500
28	Malounda	Add.supply from B/H 140/85	44 000
29	Akaki	Laying of pipes	2 600
30	Paleometokho	Add.supply from B/H 86/85	33 000
31	Moutoullas	Replacement of pipes	6 800
32	Linou	Water Supply to plots	4 600
33	Yeri	Laying of pipes	1 200
34	Peristerona	" "	5 900
35	Orounda	" "	31 500
36	Yeri-Dhali Indust.Zone	Laying of pipes (Scheme A) (Scheme B)	5 100 2 100
37	Agrokipia	Laying of pipes	15 200
38	Archangelos Michael Govt. Housing	House to House	3 000
39	Kotchiatis	Laying of pipes	2 000
40	Ergates	Add.supply from well Hydr.No. 182	5 200
41	Orounda	" "	15 000
42	Polystipos	Temporary pump, under B/H 106/85	500
43	Dhenia-Mammari	Instal. of Chlorinators	2 400
44	Dhali	Extensions	1 800
45	Moutoullas	Drilling of B/H for E.A.C Transformer	1 000
46	Mitsero	Laying of pipes	29 000
47	Ay.Epiphaniios (Or.)	Add.supply from B/H 17/86	30 000
48	Ay.Varvara	" " B/H 82/86	10 900
TOTAL			£ 1071 081

TABLE VI - 3 (cont.)

Limassol District

<u>Ser. No.</u>	<u>Village</u>	<u>Nature of Scheme</u>	<u>Est. Cost £</u>
1	Kandou	Pumping Scheme from B/H 73/82 for additional supply	26 200
2	Yerasa	Pumping Scheme from B/H 106/82 for additional supply	22 700
3	Vasa(Kellaki)	Add.supply from B/H 165/83	6 600
4	Arkolakhania and Philágra regional scheme	Pumping scheme from B/H87/84 for additional supply	355 000
5	Trachoni	Installation of standby pumping unit on B/H 97/70	9 500
6	K. Amiandos	Add.Supply from Mavrolaxia 'B' spring	4 700
7	Amathus Govt. W.S.scheme	Distribution systems Phase 'B'	138 500
8	Ay.Athanasios	Supply to 8 new building plots	1 058
9	Ypsonas and K+P Polemidhia	Replacement of pumping unit for additional water supply	38 385
10	Akapnou	Installation of water meters	1 740
11	Kyperounda	Supply pipeline from storage tank to Hospital	13 560
12	Ay.Athanasios	Supply to 6 new building plots	300
14	Louvaras	Supply to Govt.building plots	6 900
15	Louvaras	Add.supply from B/H 32/77	5 500
16	Amathus(Governors Beach)	Supply to Governor's Beach from the Zygi-Mari Govt.Scheme	57 000
Total			£ 705 643

Paphos District

1	Polemi-Stroumbi	Supplementary supply from B/H 139/84	22 000
2	Akoursos	Supplementary supply from spring 'Kelli & House-to-House distribution system	23 400
3	Paphos Lower Vill.	Supplementary supply from B/H 90/85 & 72/85	51 500
4	Paphos Lower Vill.	Replacement of B/H 57/72 with B/H 3/86	7 300
5	Piyenia	Improvements	600

TABLE VI -3(cont)

<u>Ser. No.</u>	<u>Village</u>	<u>Nature of Scheme</u>	<u>Est. Cost</u> <u>£</u>
6	Milia	House-to-House Scheme	7 000
7	Yiolou	House-to-House Scheme	56 000
8	Mesoyi	Improvements to the House-House Distribution System	79 000
9	Stavrokonnou	Covering of conveyor pipeline	23 000
10	Trakhypedoula	Supplementary supply from Arminou Regional Scheme	22 000
11	Paphos Town	Pumping scheme for the supply of water to higher area	136 880
Total			£ 428 600

Famagusta District

1	Ayia Napa	Developments	10 000
2	Ayia Napa	Developments	5 200
3	Liopetri	Replacement of Distribution System	225 000
4	Ayia Napa	Developments	2 500
5	Sotira	Communal Building Sites	11 000
6	Ayia Napa	Developments	28 000
7	Vrysoulles	New Pumping Scheme	23 000
8	Liopetri	Developments	10 500
9	Phrenaros	Developments	6 500
Total			£ 321 700

Larnaca District

<u>Ser. No.</u>	<u>Village</u>	<u>Nature of Scheme</u>	<u>Est. Cost £</u>
1	Anglisidhes	Communal building sites	4 600
2	Dromolaxia	Replacement of Distribution System	67 000
3	Ormidhia	" "	95 000
4	Skarinou	" "	27 000
5	Psematismenos	New Storage Tank	12 000
6	Ayii Vavatsinias	Replacement of Distribution System	35 000
7	Xylymbou	" "	180 000
8	Kornos Military Camp	New St. Tank	8 000
9	Khirokitia	Improvements of Existing Spring	1 200
10	Kophinou	New Pumping Scheme	20 000
11	Maroni	Replacement of Distr. System	38 000
12	Kiti	Extensions	6 000
Total			£ 493 800
			=====

Summary of Table VI - 3

<u>District</u>	<u>No of Schemes</u>	<u>Est. Cost £</u>
Nicosia	48	1 071 081
Limassol	16	705 643
Paphos	11	428 600
Famagusta	9	321 700
Larnaca	12	493 800
Total	96	3 020 824
		=====

TABLE VI - 3A

WATER SUPPLY SCHEMES FOR REFUGEE HOUSING OR SELF HOUSING ESTATES
PREPARED AND SUBMITTED IN 1986

Nicosia District

<u>Ser. No</u>	<u>Village</u>	<u>Nature of Scheme</u>	<u>Est. Cost £</u>
1	Lakatamia	Temporary Supply to Ayios Mamas Govt. Housing	6 100
2	Yeri	House-to-House Supply(Phase H)	3 300
3	Archangelos Michael	House-to-House Supply	3 000
Total £			12 400

Limassol District

1	Armenokhori	Self-Housing Estate area 'B'	11 500
2	Episkopi	Self Housing Estate Area 'Z'	2 060
3	P.Polemidthia	" "	2 270
4	Polemidthia(Kambos)	Self Housing of displ. teachers	3 560
5	P.Polemidthia	Self Housing Area	5 400
6	Kolossi	Self Housing Estate Area	42 000
7	Mouttayaika	Self Housing Estate Area 'Z'	6 500
Total £			73 290

TABLE VI-3A

Paphos District

1	Koloni	Distribution System	2 500
2	Prodhromi	" "	6 200
3	Timi	" "	1 300
4	Mandria	" "	1 900
5	Yeroskidou	" "	1 700
Total £			13 600

TABLE VI-3A (cont.)

Larnaca District

<u>Ser. No.</u>	<u>Village</u>	<u>Nature of Scheme</u>	<u>Est. Cost £</u>
1	Dromolaxia Self Housing	Extensions	5 200
2	Mosphiloti	"	1 300
Total			£ 6 500 =====

Summary of Table VI-3A

<u>District</u>	<u>No of Schemes</u>	<u>Est. Cost £</u>
Nicosia	3	12 400
Limassol	7	73 290
Paphos	5	13 600
Famagusta	-	-
Larnaca	2	6 500
Total	17	£ 105 790

TABLE VI-3B

WATER SUPPLY TO LIVESTOCK AREAS

<u>Village</u>	<u>Nature of Scheme</u>	<u>Est. cost</u> £
<u>LIMASSOL DISTRICT</u>		
Erimi	Water supply to livestock area	18 000
Paramali	" "	9 800
Total £		27 800
<u>PAPHOS DISTRICT</u>		
Kouklia	Distribution system	15 500
Argaka	" "	10 000
Total £		25 500
<u>LARNACA DISTRICT</u>		
Tersephanou	Livestock areas	7 500
Ormidhia	" "	14 500
Total £		22 000

Summary of Table VI-3B

<u>District</u>	<u>No. of schemes</u>	<u>Est. cost</u> £
Nicosia	-	-
Limassol	2	27 800
Paphos	2	25 500
Larnaca	2	22 000
Total	6	£ 75 300
	====	=====

TABLE VI-4

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1986

NICOSIA DISTRICT

<u>Ser. No.</u>	<u>Village</u>	<u>Nature of Scheme</u>
1	Kokkinotrimithia	Construction of new st.tank
2	Mitsero	Additional supply from B/H 129/85
3	Yerakies	" " " 111/86
4	K.Koutraphas	Replacement of pipes
5	Ay.Varvara	Modifications to existing house-to-house scheme
6	Kambos	Additional supply from B/H 29/68
7	Astromeritis	Modifications to existing house-to-house scheme
8	Xyliatos	Extensions
9	Archangelos Michael Govt.Housing	House-to-house
10	Astromeritis	Additional Supply from B/H 100/86
11	Gourri	Relaying of pipes
12	Ay.Mamas Govt. Housing	House-to-house
13	Shia	Water Supply to plots for the village poor families
14	Ay.Eletherios Govt. Housing	House-to-house
15	Pedhoulas	House-to-house scheme
16	Evrykhou	Improvements
17	Korakou	New source of supply
18	Pera	New house-to-house scheme
19	Potami	New Storage tank
20	Aredhiou	Water supply from B/H 59/86
21	Phlasou	New Storage tank

TABLE VI-4 (cont.)

LIMASSOL DISTRICT

<u>Ser. No.</u>	<u>Village</u>	<u>Nature of Scheme</u>
1	Souni-Zanadjia	Additional Supply from Kanneri-Kamaroui Springs
2	Pano Platres	Pumping Scheme from B/H 86/86
3	Kato Platres	Pumping Scheme B/H 81/81

PAPHOS DISTRICT

1	Yeroskipos	Distribution systems & new Storage Tank
2	Anarita	Distribution System & New Storage Tank
3	Peyia	Additional Water Supply from B/H No.PB 43
4	Ayia Marina	Replacement of main conveyor pipeline
5	Xeropi Regional Scheme & Simou-Dhrymou-Drinia	Additional Water Supply from B/H No.93/78
6	Mandria	Additional Water Supply from B/H No.15/87

FAMAGUSTA DISTRICT

1	Sotira -Liopetri	Tourist Areas Water Supply Scheme
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LARNACA DISTRICT

1	Athienou	Water Supply, Replacement of Distribution System
2	Anglisidhes	Water Supply, Replacement of Distribution System
3	Livadhia	Water Supply. " " "
4	Delikipos	" " " " "

TABLE VI-4A

WATER SUPPLY SCHEMES TO LIVESTOCK AREAS PENDING DURING 1986

FAMAGUSTA DISTRICT

Liopetri Livestock Area

LARNACA DISTRICT

Kelia Livestock Area
Klavdia Livestock Area

TABLE VI-5

IRRIGATION SCHEMES PREPARED IN 1986 AND SUBMITTED TO DISTRICT OFFICERS

Ser. No	Village	Division or Association	Locality	Nature of Proposed work	Est. Cost £	Village cont. %
<u>NICOSIA DISTRICT</u>						
1	Astromeritis	Division	-	Lining of Channels	48 000	1/3
2	Akaki	"	-	"	53 000	1/3
3	Milikouri	"	Kefalovrysos	Distribution pipelines	1 600	1/3
4	Linou	"	Linopsas	Improvement works on Irrigation Ports	3 250	1/3
5	Tseri	"	-	Lining of channels	21 000	1/3
Total					£ 136 250	

TABLE V-5(cont.)

Ser No.	Village	Division or Association	Locality	Nature of Proposed work	Est. Cost £	Village Cont. %
LIMASSOL DISTRICT						
1	Kaminaria-Tris Elies	Division	-	Pumping scheme from B/H 117/78	63 300	1/3
2	Vasa (Kellakí)	"	-	" " 165/83	47 700	1/3
3	Ayios Ioannis(Agros)	"	Spilios Kouforovos	Improvements to existing works	21 000	1/3
4	Tris Elies	"	Drakondas	Pumping Scheme from B/H 146/84	25 300	1/3
5	Prodromos	"	Khardji	(Pond)Pumping Scheme from B/H158/84	25 100	1/3
6	Dhymes	"	HjiPelendros	Construction of Irrig. Tank	3 900	1/3
7	Ayios Ioannis(Agros)	"	Ayia Marina	Improvements to existing works	49 000	1/3
8	Agridhia	Assoc.	Mylos-Theotokos	" "	3 400	50%
9	Monagri	"	Sycallidhia	Distribution pipelines	21 000	50%
10	Sylikou	Div.	Lavrania	" "	8 700	1/3
11	Ayios Ioannis(Agros)	"	Makheras	Weir & Pipelines	31 600	1/3
12	Kilani	"	Mavris Weir	Replacement of R.C.C Channels with pipes	4 250	1/3
13	Agridhia	"	Rousos	Irrigation Works	9 000	1/3
Total					£ 314 050	

TABLE VI-5 (cont.)

PAPHOS DISTRICT

Ser No.	Village	Division or Association	Locality	Nature of proposed work	Est. cost £	Vill. Cont. %
1	Ayios Georghios	Division	B/H 107/60	Replacement of Pumping Unit and Construction of St. Tank	32 000	1/3
2	Statos	"	Kato Pigadhi	Improvements and St. Tank	15 800	1/3
3	Pendalia	"	B/H 67/83	Pumping Scheme	54 000	1/3
4	Kholetria	"	B/H 18/69	Pumping Scheme	71 500	1/3
5	Nea Dhinnata	"	Symvoulos	Supplementary Supply from B/H 53/85	26 400	1/3
6	Lasa	"	Romanos	Distribution pipelines	4 000	1/3
7	Mamonia	"	B/H 61/51 & 133/83	Pumping Scheme	104 000	1/3
8	Mamonia	"	B/H 4/69	Replacement of pumping main	5 660	1/3
				Total	£ 313 360	
					=====	
Summary of Table VI-5						
District	n	No. of Schemes	Est. Cost £			
Nicosia		5	136 250			
Famagusta		-	-			
Larnaca		-	-			
Limassol		13	314 050			
Paphos		8	313 360			
Total		26	£ 763 660	=====		

TABLE VI - 6

MINOR IRRIGATION SCHEMES APPROVED BY THE INTERDEPARTMENTAL
COMMITTEE IN 1986

<u>Ser No</u>	<u>Village</u>	<u>Locality</u>
1	Kato Moni	BH No 14/84
2	Phasoula	Kalamos BHs 236/62 & 166/83
3	Kholetria	BH No. 18/69
4	Pendalia	BH NO. 67/83
5	Mamonia	BH No. 61/51 & 133/83
6	Ayios Ioannis	Ayia Marina
7	Katydhata	Karydhis
8	Kambia	BH No.105/83
9	Aredhiou	BH No. 58/81
10	Statos	-
11	Vasa(Kellaki)	Kambidhes BH No.165/83
12	Phini	Mylos
13	Monagri	Sykallidhia
14	Silikou	Lavrana
15	Dymes	HjiPelendros
16	Astromeritis	-
17	Akaki	-
18	Ayios Ioannis	Spilios Kouforovos
19	Ayios Ioannis	Makheras
20	Tris Elies	Drakondas
21	Agridhia	Mylos Theotokos
22	Agridhia	Rousou
23	Arsos	-

SCHEMES NOT APPROVED

1	Kato Moni	Vayiannis
2	Missou	Frangos
3	Polemi	-

TABLE VI - 7

IRRIGATION SCHEMES IN, THE COURSE OF PREPARATION, UNDER INVESTIGATION
OR PENDING DURING 1986

NICOSIA DISTRICT

<u>Ser. No</u>	<u>Village</u>	<u>Nature of Proposed Work</u>
1	Galata (Esso Galata)	Distribution pipelines
2	Lythrodhontas	Extension pipeline

LIMASSOL DISTRICT

1	Potamitissa	Potamos Irrigation Division Improvements-Extension of Distribution System
2	Agridhia	Pano Enetikos Irrigation Division, Borehole
3	Ayios Georghios (Silikou)	Kato Pighadia-Livadhia Irrigation Division. Improvements
4	"	Mousa-Tsourides Irrigation Division, Improvements
5	Saittas-Moniatis	Irrigation Division BH Development for Additional Supply to Saittas Agric. Nursery

PAPHOS DISTRICT

1	Amargeti	"Ziripillis" Extensions
2	Theletra	"Villourga-Ayiasma" Diversion weir & Distribution System
3	Yiolou-Miliou	Pumping Scheme B/H 55/78&111/81
4	Kritou Terra	" " 115/85
5	Lemona	" " 134/84
6	Panayia	"Sarka" Improvements
7	Eledhiou	"Katinou" Turkish B/H

TABLE VI-8

SEWAGE SCHEMES PREPARED IN 1986

<u>Ser. No</u>	<u>Village</u>	<u>Nature of Work</u>	<u>Est. Cost £</u>
1	Agros	Sewage Scheme Phase A £ 99 000 " B 30 000 <u>Total £129 000</u>	129 000
2	Kakopetria	Sewage Effluent Disposal Scheme Alternative (Additional Amount)	11 6 000
3	Ayios Sozomenos	Sewage Treatment Plant	227 000
4	Larnaca	Preliminary Study for the reuse of sewage treated effluent from the Larnaca Sewage Scheme	2 171 000
5	Malounda Army Camp	Sewage Scheme	23 000
TOTAL			<u>£2 666 000</u> =====

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 following branches:

- The Planning, Pricing, Material & Equipment recruitment Branch
- The Tenders and Land Acquisition Branch
- The Major Projects Construction and Control Branch
- The Minor Projects Construction and Control Branch.

During 1986 the Division consisted of the following staff:

- 1 Senior Water Engineer - Head of the Division
- 1 Executive Engineer, Class I - Assistant head of the Division
- 6 Executive Engineers, Class I
- 1 Senior Technical Superintendent
- 7 Technical Superintendents
- 5 Senior Technicians
- 7 Technicians grade 1 & 2
- 2 Chief Foremen
- 6 Assistant Chief Foremen
- 41 Monthly paid Foremen (in all Districts)
- 31 Weekly paid Foremen (in all Districts)

108 Total staff

In addition to the above technical staff, the Department also engaged on a daily average of 70 regular workmen of various trades, mostly skilled, and semiskilled and also 164 casual labour, mostly unskilled for the execution of the various schemes approved in the Development budget of the year 1986.

The Construction Division has continued during 1986 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.

Over and above the usual problems caused by the delay in the starting of the construction programme a lot of minor projects could not be completed as scheduled and approved by Government by the end of the year and had to be revoted 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 in time for Construction Works to commence.

If this is achieved the work distribution of the Division will be more even and the construction programmes will materialised as planned.

CONSTRUCTION PROGRAMME AND PROGRESS

The Planning Branch of the Division prepared a construction programme for all the schemes that were approved for construction in 1986.

All these schemes were mainly included in the Development Budget of the Department, whilst few others in the Budget of other Departments, or Ministries. Over and above these budgeted schemes the Division had to respond and deal with all non-budgeted. Schemes such in the case of private developers and emergency water schemes for villages.

These schemes undertaken for construction during 1986 may be classified 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, such as the P.W.D 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 addition the Division plays an important role in the construction of specific major Projects with foreign financing both in the Tendering procedure as well as in the planning of the supervising team. In some cases the division undertakes direct forced account work instead of being given to contract.

In total during 1986 the Department had to deal with 684 projects of an estimated value of £42,937,516. The overall expenditure incurred on all these projects during 1986 reached the amount of £37,086,855, against £22,462,514 for 1985 and £18,905,999 for 1984. The above expenditure figures for the past three consecutive years prove that the Department's activities have increased substantially. With the Major Water Projects under construction such as the Kouris Dam, Akhna Dam, Evretou Dam, the installation of the Main conveyor, Kokkinokhoria Irrigation Project and Khrysokhou Irrigation Project, have increased the demand for experienced Technical personnel at all levels and to cope with this demand Engineers and experienced technical personnel were recruited to cover the gaps that have been created.

Table VII-1 gives a summary of the work executed by the Department during 1986. 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

The main activities of this branch during 1986 may be classified as follows:

- The programming and pricing of all schemes approved for construction, in the current year.
- The preparation of a construction programme for all schemes approved for construction, in the current year.
- The preparation of monthly progress chart report showing all budgeted schemes, and the progress and expenditure incurred each month.
- The assessment of the 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 equipment, 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.

TABLE VII-1
SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1986

Ser.	Description	No of schemes	Amount alloc. for 1986 £	Expenditure incurred during 1986 £
1	Rural domestic water supply schemes	49	1 202 533	548 474
2	Minor irrigation schemes	42	609 789	318 166
3	Other major irrigation works	14	559 665	440 764
4	Town water supply schemes ...	10	828 460	582 265
5	Vasilikos-Pendaskinos Project	2	1 882 200	1 464 261
6	Southern Conveyor Project ...	4	31 000 000	27 629 390
7	Khrysokhou Irrigation Project	1	4 400 000	4 322 786
8	Paphos Irrigation Project ...	1	175 000	90 781
9	Vizakia & Karyotis Project ..	1	298 775	298 775
10	Pitsilia Integrated Rural Development Project (mainly compensations)	17	47 512	37 916
11	Refugee housing and self-housing schemes	26	147 627	110 759
12	Schemes undertaken for construction for other Government Departments	102	870 393	541 441
13	Schemes undertaken for construction for villages (non-budgeted) from deposits	75	164 151	120 490
14	Schemes undertaken for construction for private developers (non-budgeted) from deposits !.....	340	751 411	580 587
	Total	684	£42 937 516	£37 086 855

TENDER AND LAND ACQUISITION BRANCH

The activities of this branch are:

- The invitation of tenders direct for the supply of such materials that are not available at the Central Stores, such as building materials pumping units and for the hiring of machinery from the private sector when such machinery is not available at the E.M.S.
- Preparation of Specification and Conditions of Contract for the above invitation of Tenders.
- The distribution of resources such as labour force, plants and materials to the various schemes under construction.
- Advertisement and distribution of contract documents prepared by other Divisions of the Department to prospective Tenderers.
- Evaluation of Tenders recommendations and award through tender Board for those Tenders dealt directly by the Division of Construction.
- All matters of land acquisition and requisition of the Department.

MINOR PROJECT CONSTRUCTION & CONTROL BRANCH

The main activity of this branch is to plan, execute and control the construction of all the schemes where the Division is directly involved. It has to follow up and see that all construction programmes are adhered to, or revised if required by the supervising technical staff, that the progress of the works under construction is attained at reasonable standards and as planned. The quality of the work of all schemes under construction has also to be followed up very carefully & controlled in consultation with the soils & concrete laboratory.

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.

The distribution of resources and manpower to the various schemes under construction and their future mobility is a major activity of this branch.

All projects outside Nicosia District are constructed directly by the three Regional Offices of the Department, i.e. Limassol, Paphos and Larnaca - Famagusta in close association with a senior Technical officer of the Division who acts as the Co-Ordinator between the Regional offices and the headquarters in Nicosia. In addition to that, the head of the Division and the Tender section play a great role in the planning and execution of the various works under construction in the other Districts.

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

MAJOR PROJECTS EXECUTION & CONTROL BRANCH

The Division is either involved directly in the execution of these major Projects given to forced account or is involved indirectly through the Head of Division and supervising staff for those Projects which are given to contract and are controlled by Project Director or in Project management basis.

The Head of Division apart from being a member of the Major Projects Committees for implementation and evaluation of claims, he was also Project Advisor on Evretou Dam Contract. He also participates on Arbitration proceeding in various Projects. In the case of forced account work the Division plays a more important role in the planning, man power distribution, recruitment of machinery and labour from the private sector, and the preparation of Progress reports and cost estimates.

LABOUR FORCE

For the construction of a scheme the Department usually engages gangs, consisting of monthly, or weekly (hourly) paid foremen, regular artisans of the Department of various trades, and casual, skilled or unskilled labour force which is recruited locally through the Government Labour Offices.

The average daily labour force engaged by the Department including the Workshops during 1986 for the construction of all the projects was 865. Out of this figure 701 employees were regular and 164 were casual. They cover a variety of trades i.e. builders carpenters, pipelayers, etc.

The total expenditure incurred during 1986 on wages alone on schemes constructed by direct labour by the Department reached the amount of £2,544,042. Out of this amount £2,248,443 represented the wages of the regular workers, and £295,599 represented the wages of the casual workers.

Table VII-2 shows the monthly average labour force engaged direct by the Department in 1986.

TABLE VII-2
LABOUR FORCE FOR 1986

Month	Skilled	Unskilled	Regular	Casual	Total
January	733	163	698	198	896
February	746	156	719	183	902
March	720	164	714	170	884
April	738	166	728	176	904
May	759	165	734	190	924
June	730	174	723	181	904
July	630	177	694	173	867
August	681	156	677	160	837
September	660	149	673	136	809
October	658	138	668	128	796
November	681	141	687	135	822
December	698	139	695	142	837
Daily average No. ..	703	157	701	164	865
Daily average %	82	18	81	19	100

PIPES USED DURING 1986

The majority of pipes and pipe-fittings of all types used by the Department for the execution of the schemes approved for construction during 1986, were purchased through the Government Central Stores Departments where a reasonable stock of fast moving materials is 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 the 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 1986 a length of 411,984 running meters of various types and diameters of pipes were purchased at a value of £14,783,834 and laid all over the island for the execution of all the schemes approved in the 1986 Development Budget.

Table VII-3 shows in detail all types, lengths and value of pipes laid during 1986.

TABLE VII-3
PIPES LAID DURING 1986
I GALVANIZED STEEL PIPES

Dia inches	Length m	Value £
1/2	3 714	1 730
3/4	1 902	1 179
1	2 520	1 917
1 1/4	1 770	1 879
1 1/2	2 682	3 528
2	11 536	20 985
2 1/2	2 534	5 079
3	14 816	41 247
4	15 370	62 316
Total	56 844	£ 139 860

II STEEL PIPES (COATED-PLAIN ENDED)

Dia mm	Length m	Value £
150	3 068	15 184
200	1 194	7 621
250	214	5 313
300	256	2 491
350	64	787
400	7 290	127 575
550	12	256
600	24	520
Total	<u>12 122</u>	£ <u>159 747</u>

III ASBESTOS CEMENT PRESSURE PIPES - CLASS 15

Dia mm	Length m	Value £
75	32	5
100	28 682	88 507
150	12 554	50 868
200	8 931	35 024
250	8 961	41 263
300	5 207	28 556
350	5 282	56 023
400	3 906	50 351
450	4 833	52 776
500	3 564	62 375
600	5 184	71 207
800	465	20 655
Total	<u>87 601</u>	£ <u>557 605</u>

IV ASBESTOS CEMENT PRESSURE PIPES - CLASS 20

Dia mm	Length m	Value £
100	3 812	13 539
150	3 066	15 059
200	7 855	50 811
250	5 777	51 349
300	10 642	140 663
400	1 932	23 744
500	200	3 236
Total	<u>33 284</u>	£ <u>298 401</u>

V ASBESTOS CEMENT PRESSURE PIPES - CLASS 25

Dia mm	Length m	Value £
250	572	3 546
300	45	382
Total	<u>617</u>	£ <u>3 928</u>

VI DUCTILE IRON PIPES

Dia mm	Length m	Value £
100	132	607
200	36	339
300	768	12 219
350	3 156	66 560
400	3 863	96 536
500	585	20 100
600	2 060	93 023
700	2 553	148 435
800	11 282	812 680
900	10 080	876 809
1000	33 899	3 324 198
1200	3 459	455 025
1400	46 857	7 623 745
Total	<u>118 730</u>	£ <u>13 530 276</u>

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

Outside Dia mm	Length m	Value £
16	1 300	78
20	9 900	874
25	11 160	1 926
32	4 460	1 161
50	430	170
63	13 133	5 740
75	23 575	11 586
90	8 429	7 017
110	9 528	12 458
140	7 220	15 360
160	11 169	27 121
200	3 382	10 526
Total	<u>102 786</u>	£ <u>94 017</u>

SUMMARY OF ALL TYPES OF PIPES LAID DURING 1986

Ser. No.	Type	Length m	Value £
I	Galvanized steel pipes	56 844	139 860
II	Steel pipes (coated-plain ended) .	12 122	159 747
III	Asbestos cement pressure pipes - class 15	87 601	557 605
IV	Asbestos cement pressure pipes - class 20	33 284	298 401
V	Asbestos cement pressure pipes - class 25	617	3 928
VI	Ductile iron pipes	118 730	13 530 276
VII	PVC/polythene pipes-(6atm & 10atm & 16 atm)	102 786	94 017
Total		£ 411 984	£ 14 783 834

CONSTRUCTION PLANT

For the execution of the schemes approved for construction in the 1986 Budget, and all other schemes undertaken for construction during 1986, the Department had to apply to the Department of Electrical and Mechanical Services (E.M.S) for all types of machinery considered necessary for the execution of the schemes. If E.M.S machinery were 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 G.C.S, i.e aggregate, sand etc., are purchased locally from the private sector through public tenders.

During 1986 the Department purchased direct from the two local cement factories through a general Government tender 2,444 tons of Ordinary Portland Cement at a value of £65,944 and 1,334 tons of sulphate resisting cement at a value of £40,805.

During 1986 the Department purchased through the G.C.S 364.58 tons of mild steel at a value of £57,583, also 2,385 water meters of various diameters at a value of £112,161 were purchased through the G.C.S.

All other building materials used during 1986 were purchased locally from the private sector through public tenders. In total during 1986 the Department purchased building materials and water meters of a value £289,386.

Table VII-4 shows in detail all building and other materials used by the Department during 1986, for the execution of the schemes approved.

Table VII-4

MATERIALS PURCHASED AND WATER METERS INSTALLED DURING 1986.**I BUILDING AND OTHER MATERIALS**

Ser. No.	Description	Quantity	Value £
1	Cement	2 444.45 tons	65 944
2	Sulphate Resisting Cement	1 333.5 tons	40 805
3	Mild steel	364.58 tons	57 583
4	Aggregate	700 cu.m	1 565
5	Sea sand	228 cu.m	1 233
6	Sand	553 cu.m	1 999
7	Sandy soil	2 362 cu.m	3 181
8	Shingle	1 305 cu.m	4 195
8	Havana	510 cu.m	570
10	Clay	agreed	150
	Total		£ 177,225

II WATER METERS

Ser. No.	Dia mm	Number	Value £
1	12	608	2 966
2	20	6	158
3	32	17	189
4	40	27	410
5	50	6	220
6	65	3	115
7	75	1 558	94 310
8	80	85	3 348
9	100	38	2 221
10	150	22	2 294
11	200	3	446
12	250	1	150
13	300	7	2 661
14	350	1	596
15	400	1	602
16	500	2	1 475
Total		2 385	£ 112 161

RURAL DOMESTIC WATER SUPPLY SCHEMES

The construction programme for 1986 included 49 rural domestic water supply schemes of an estimated cost of £1,202,533.

The expenditure incurred on all these schemes during the year 1986 reached the amount of £ 548,474.

These 49 schemes were split all over the island and mostly were related to supplementary water supply schemes or improvements to existing schemes.

All these schemes are indicated in detail in Table VII-5 below.

SUMMARY OF RURAL DOMESTIC WATER SUPPLY SCHEMES
 UNDERTAKEN FOR CONSTRUCTION DURING 1986

District	No. of schemes	Amount allocated for 1986 £	Expenditure incurred during 1986 £
Nicosia	11	273,489	156,418
Larnaca	13	344,030	146,797
Famagusta	3	94,000	46,254
Limassol	16	325,644	89,402
Paphos	6	165,370	109,603
Totals	<u>49</u>	<u>£1,202,533</u>	<u>£548,474</u>

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1986

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
NICOSIA DISTRICT								
1	Aredhiou - Supplementary supply new storage tank & extensions	11 550	3 970	15 520	10 485	3 604	14 090	Work in progress
2	Astromeritis - Supplementary supply from BH	69 105	16 605	85 710	17 325	9 941	27 266	Work in progress
3	Argates - Supplementary supply from BH	6 667	3 333	10 000	6 207	3 104	9 311	Work in progress
4	Arkhangelos Michael (Monastery) Supplementary supply - combined with Analiondas	1 000	--	1 000	387	--	387	Completed
5	Kambia - Supplementary supply from BH	2 247	1 140	3 387	66	36	102	Completed
6	Klirou - Supplementary supply from BH 51/83	20 000	20 000	40 000	17 145	17 145	34 290	Work in progress
7	Lythrodhondas - Supplementary supply from BH 181/83	20 000	20 000	40 000	10 672	10 672	21 344	Work in progress
8	Peristerona	22 667	11 333	34 000	15 754	7 877	23 631	Work in progress
9	Tseri - Replacement of existing distribution system	20 000	20 000	40 000	11 062	11 062	22 125	Work in progress
10	Tseri - Supplementary supply from BH 41/54	2 502	--	2 502	2 502	--	2 502	Completed
11	Yeraskies, Nikos, Sarandi, Mergi - Emergency W.S to cope with drought	1 370	--	1 370	1 370	--	1 370	Completed
Total for Nicosia District		£132 400	£196 361	£273 489	£74 862	£63 441	£156 418	

LARNACA DISTRICT (Constructed by L'ca-F'sta Regional Office of the Department)

1	Anaphotia - Supplementary W.S. from BH	1 500	--	1 500	1 500	--	1 500	Completed
2	Aradhippou	4 000	4 000	8 000	--	--	--	Work executed by village
3	Athienou - Supplementary water supply scheme	110 000	--	110 000	--	--	--	Pending allocation of funds
4	Ayios Theodoros - Replacement of main conveyor	3 500	3 500	7 000	3 089	3 090	6 179	Completed
5	Khrokittia - Improvements to distribution system	7 436	7 436	14 872	7 166	7 155	14 331	Completed
6	Kiti - New main conveyor	8 033	8 033	16 066	6 751	6 750	13 521	Completed
7	Kornos - Improvements to distribution system	4 055	4 055	8 110	3 459	3 459	6 918	Completed
8	Ormidhia - Xylophaghou - Supplementary supply from Khrokittia - Famagusta main conveyor	1 160	1 160	2 320	1 160	1 160	2 320	Completed

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1986 (Cont)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
9	Perivolia - Improvements to distribution system	11 649	11 649	23 298	7 637	7 637	15 274	Work in progress
10	Tersephanou - Improvements to existing distribution system	7 851	2 753	10 604	2 140	713	2 853	Completed
11	Voroklini - Improvements to existing distribution system	17 000	17 000	34 000	6 039	6 039	12 078	Work in progress
12	Xylophaghou - Supplementary W.S. from Khirokitia - Famagusta pipeline	71 508	35 754	107 262	52 217	18 608	70 825	Completed
13	Ayii Vavatsinias, Zygi, Troulli - Emergency W.S. to cope with drought	998	--	998	998	--	998	Completed
Total for Larnaca District		<u>£246 346</u>	<u>£95 340</u>	<u>£344 030</u>	<u>£91 453</u>	<u>£54 631</u>	<u>£146 797</u>	

FAMAGUSTA DISTRICT (Constructed by L'ca - F'sta Regional Office of the Department)

1	Avgorou - Improvements to existing distribution system	15 000	30 000	45 000	8 386	16 773	25 159	Work in progress
2	Dherynia - Improvements to existing distribution system	15 000	30 000	45 000	5 698	11 397	17 095	Work in progress
3	Phrenaros - Improvements to existing distribution system	2 000	2 000	4 000	2 000	2 000	4 000	Completed
Total for Famagusta District		<u>£32 000</u>	<u>£62 000</u>	<u>£94 000</u>	<u>£16 084</u>	<u>£30 170</u>	<u>£46 254</u>	

LIMASSOL DISTRICT (Constructed by Limassol Regional Office of the Department)

1	Akrounda BH 21/85 - Supplementary supply from BH 21/85 construction of new reservoir	22 500	22 500	45 000	5 867	5 868	11 735	Completed
2	Arkolahania - Phylagra - Supplementary supply from BH 87/84	25 100	25 000	50 100	12 042	11 643	23 685	Work in progress
3	Asomatos - Supplementary supply from BH 97/70	880	658	1 538	82	57	139	Completed
4	Ayios Konstantinos - Improvements to existing distribution system	1 000	1 687	2 687	995	1 692	2 687	Completed
5	Ayios Ioannis (Agros) - Supplementary supply from BH 65/76 construction of new reservoir combined with irrigation scheme	8 000	--	8 000	--	--	--	Work in progress
6	Episkopi - Replacement of existing distribution system	19 259	19 250	38 500	CR1 040	CR1 039	CR2 079	Subject to allocation of funds

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1986 (Cont)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
7	Kalokhorio "Pefkos" - Supplementary supply from BH 20/81. Construction of pump-house	18 000	18 000	36 000	--	--	--	Commenced 30/3/87. Work in progress
8	Kellaki - Supplementary supply from BH 5/83. Construction of new reservoir	22 000	11 000	33 000	16 282	8 141	24 423	Commenced 8/10/86. Completed 30/4/87
9	Kilani - Construction of new reservoir - Installation of new main conveyor	5 194	2 587	7 781	5 577	3 013	8 590	Completed 29/3/86
10	Moniatis - Improvements to existing distribution system Construction of new reservoir	1 078	1 078	2 156	1 027	1 028	2 055	Completed
11	Moutayiaka - Replacement of main conveyor pipeline	42 429	24 549	66 978	2 496	2 496	4 992	Commenced 23/9/85. Work in progress
12	Perapedhi - Supplementry supply from BH 109/75 combined with irrigation scheme	3 388	1 694	5 082	3 147	1 573	4 720	Completed
13	Prastio - Evdhimou - Supplementary supply from BH 57/81	3 730	3 730	7 460	2 055	2 055	4 110	Completed
14	Pyrgos - Supplementary supply from BH 19/84 Construction of pump house	9 300	9 300	18 600	996	997	1 993	Commenced 28/8/86 Work in progress
15	Troodhitissa monastery - Supplementary supply from BH 65/81. Construction of new reservoir & pump house	410	--	410	--	--	--	Completed
16	Korphi, Ayios Amvrosios, Sykopetra, Potamitissa - Emergency W.S to cope with drought	2 352	--	2 352	2 352	--	2 352	
Total for Limassol District		£184 500	£141 033	£325 644	£51 866	£37 524	£89 402	

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1986 (Cont)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt. £	Village £	Total £	Govt. £	Village £	Total £	
PAPHOS DISTRICT (Constructed by the Regional Office of the Department)								
1	Goudhi (Khrysokhou) - New distribution system and supplementary water supply from BH	10 031	2 807	12 838	3 901	1 091	4 992	Work in progress
2	Kallepia - Letimbou - Supplementary supply from BH in Paphos Forest	--	--	--	CR 3 290	--	CR 3 290	Purchase of pumping units
3	Khlorakas - New distribution system	46 952	46 952	93 904	30 173	30 173	60 346	Work in progress
4	Kissonerga - Improvements to existing distribution system	4 600	--	4 600	473	--	473	Work in progress
5	Paphos lower villages - Tala Supplementary W.S from lower villages	11 050	3 194	14 244	5 763	2 153	7 916	Work in progress
6	Violou - Supplementary supply scheme	19 892	19 892	39 784	19 583	19 583	39 166	Completed
Total for Paphos District		<u>£85 301</u>	<u>£72 845</u>	<u>£165 370</u>	<u>£53 793</u>	<u>£53 000</u>	<u>£109 603</u>	

MINOR IRRIGATION SCHEMES

The construction programme for 1986 included 42 minor irrigation schemes of an estimated cost of £609,789. The overall expenditure incurred on all the above schemes during 1986 reached the amount of £318,166. These 42 schemes were split in the four Districts of the Island and mostly were related to:

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

A summary of these schemes by district is given below. Detailed list showing all 42 minor irrigation schemes which were undertaken by the Division for construction during 1986 are given below on table VII-6

SUMMARY OF MINOR IRRIGATION SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1986

District	No. of schemes	Amount allocated for 1986 £	Expenditure incurred during 1986 £
Nicosia	15	182,673	120,019
Larnaca	2	50,000	3,611
Limassol	14	106,813	67,182
Paphos	11	270,303	127,354
Totals	<u>42</u>	<u>£609,789</u>	<u>£318,166</u>

TABLE VII-6
MINOR IRRIGATION SCHEMES-EXPENDITURE 1986

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
NICOSIA DISTRICT								
1	Akaki - Riatiko ID - Supplementary supply from BH 101/102	17 020	12 580	29 600	1 827	1 351	3 178	Work in progress
2	Kakopetria - ID Improvements to existing distribution system	6 500	3 250	9 750	6 487	3 243	9 730	Completed
3	Kannavia - Koumna ID Construction of newreservoir	3 400	1 100	5 100	2 666	1 334	4 000	Completed
4	Kochiati - Ayia Varvara ID Lining of channels	21 120	8 880	30 000	13 664	5 747	19 411	Completed
5	Lythrodhonda - ID	30 000	15 000	45 000	29 337	14 668	44 005	Work in progress
6	Nikitari Pumping scheme from BH 121/78	1 776	888	2 664	1 765	883	2 648	Completed
7	Orounda - Ornitharis ID Lining of channels	3 982	1 991	5 973	4 792	2 396	7 188	Completed
8	Orounda - Nero tou Philippou ID - Pumping scheme from BH	751	449	1 200	740	430	1 170	Completed
9	Palekchori - Maroullena ID Improvements to existing distribution	9 520	7 480	17 000	--	--	--	
10	Pera Politiko - Mou los ID Lining of channels	11 344	5 672	17 016	8 312	4 156	12 468	Work in progress
11	Pharmakas - Dhexameni tou Kaminiou ID	1 495	1 175	2 670	--	--	--	Completed
12	Pharmakas - Koskinas ID New reservoir	7 392	5 808	13 200	748	588	1 336	Work in progress
13	Polystipos - Aklari ID Improvements to distribution system	2 333	1 167	3 500	2 115	1 058	3 173	Completed
14	Pyrgos				8 686		8 686	
					400		400	
15	Pyrgos				2 626		2 626	
	Total for Nicosia District	£113 293	£66 040	£182 673	£83 202	£35 854	£120 019	

LARNACA DISTRICT (Constructed by L'ca - F'sta Regional Office of the Department)

1	Aradhippou - Parthenitis R ID	50 000	--	50 000	2 319	--	2 319	Work in progress
2	Odhou	--	--	1 292	--	--	1 292	
	Total for Larnaca District	£50 000	--	£50 000	£3 611	--	3 611	

TABLE VII-6
MINOR IRRIGATION SCHEMES-EXPENDITURE 1986 (Cont.)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
LIMASSOL DISTRICT (Constructed by L'ssol Regional Office of the Department)								
1	Agridhia - Kato Enetikos ID Replacement of pipes	520	260	780	--	--	--	Subject to allocation of funds
2	Ayios Ioannis - Agros - Combined Irrigation and water supply scheme	8 000	--	8 000	4 588	--	4 588	Work in progress
3	Ayios Mamas - Vatsellas - ID - Pumping scheme from BH 53/77. Instalation of distribution systems. Construction of new reservoir and pump house	13 087	6 543	19 630	5 548	2 774	8 322	Completed
4	Ayios Theodoros - Ayios Georghios ID - Installation of distribution network	4 000	2 000	6 000	3 655	1 827	5 482	Completed
5	Ayios Theodoros Fyntoukia ID - Improvements to existing distribution system	7 193	3 597	10 790	7 046	3 523	10 569	Completed
6	Kalokhorio Improvements to distribution system	9 333	4 667	14 000	3 901	1 950	5 851	Completed Commenced 8.2.87 30.4.87
7	Kellaki - Podhies ID - Construction of new weir. Installation of distribution network - Constrction of new reservoir	8 400	4 200	12 600	8 393	4 197	12 590	Completed Commenced 8.2.87 30.4.87.
8	Kyperounda - Mavros Kolymbos ID - Improvements to existing distribution system	3 000	1 500	4 500	2 945	1 473	4 418	Was carried out by our Nicosia Office.
9	Pano Platres Rehabilitation works	7 280	3 640	10 920	6 627	3 314	9 941	Completed
10	Pelendria - Dhimma tou Khoriou ID - R C channels	756	644	1 400	--	--	--	Not accepted by the villages
11	Pelendria - Kato Psilo Vrysi to Archangelou ID	2 028	1 352	3 380	--	--	--	Subject to allocation of funds.
12	Pelendria - Potamoulia ID - Installation of distribution network	2 633	1 317	3 950	--	--	--	Subject to allocation of funds.
13	Perapedhi Pumping scheme from BH 109/77 Construction of new reservoir & pump house	6 659	3 329	9 988	3 614	1 807	5 421	Completed
14	Saittas - Moniatis - Construction of new weir. Replacement of main canal with pipes	875	--	875	--	--	--	Completed
Total for Limassol District		£73 764	£33 049	£106 813	£46 317	£20 865	£67 182	

TABLE VII-6
MINOR IRRIGATION SCHEMES-EXPENDITURE 1986 (Cont.)

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
PAPHOS DISTRICT (Constructed by Paphos Regional Office of the Department)								
1	Kelokedhara - Psathaes ID	982	--	982	--	--	--	
2	Kholetria Pumping scheme from BH 27/69	22 000	11 000	33 000	7 899	3 949	11 848	Work in progress
3	Kritou Terra - Kephaloavrisses ID	1 328	665	1 993	1 328	665	1 993	Completed
4	Miliou - Kolokouris ID Replacement of pumping unit	584	292	876	13	7	20	
5	Nikoklia - BH 51/72	41 227	20 613	61 840	21 741	10 871	32 612	Work in progress
6	Pano Akourdhalia - Pumping scheme from BH 93/76	24 133	12 067	36 200	6 736	3 369	10 105	Work in progress
7	Polemi - Pumping scheme from BH 26/60	6 424	3 212	9 636	2 508	1 255	3 763	
8	Souskiou BH 96/62, PB 9	40 339	12 461	52 800	14 373	4 440	18 813	
9	Statos - Ayios Photios	10 533	5 267	15 800	22	11	33	Work in progress
10	Steni - Pumping scheme from BH 113/78	32 450	16 226	48 676	26 803	13 402	40 205	Work in progress
11	Theletra New storage tank	5 667	2 833	8 500	5 308	2 654	7 962	Work in progress
Total for Paphos District ..		£154 832	£84 636	£270 303	£75 744	£40 623	£127 354	

**OTHER MAJOR IRRIGATION WORKS
(SUPPLEMENTARY WORKS)**

During 1986 the Department had to deal with supplementary works for 14 major irrigation schemes of an estimated value of £559,665. The overall expenditure incurred on these 14 schemes during 1986 reached the amount of £440,764.

Out of this category of schemes the Evdhimou-Paramali project featured first in expenditure reaching the amount of £154,684 and involved the installation of new conveyor; construction of new weir, improvements to an existing weir and construction of two new reservoirs. Other important major schemes executed during 1986 are the Yermasoyia - Polemidhia which involved the connection of Garyllis Boreholes and the Akrotiri Project which involved the installation of new distribution system, installation of main conveyor and construction of new reservoir.

A list showing details of all the 14 major irrigation works which were undertaken for construction during 1986 is shown on Table VII-7.

TABLE VII-7
OTHER MAJOR IRRIGATION WORKS - EXPENDITURE 1986

Ser. No.	Scheme	Amount Allocated			Expenditure			Remarks
		Govt £	Village £	Total £	Govt £	Village £	Total £	
1	Akrotiri - Inst. of new distr. system - Constr. of new reservoir - Inst. of new main conveyor pipeline.	109 776	--	109 776	87 338	--	87 338	Commenced 21/6/87 Work in progress
2	Arakapas - Perasma tis Koutsis ID - Pipe distribution system	46 667	23 333	70 000	31 793	15 896	47 689	Commenced 7/10/86 Completed 1987.
3	Anaphotia - Anglisidhes - Minor improvements	200	--	200	41	--	41	
4	Erimi - Kolossi - Impr. to existing irrig. works	1 000	--	1 000	392 cv	--	392 cv	Completed.
5	Esso Galata Pond Irrigation works	14 106	7 053	21 159	13 640	6 820	20 460	Completed
6	Evdhimou - Paramali Constr. of new weir, Impr. of an exist. weir. Constr. of two new reservoirs. Installation of new main conveyor pipeline.	200 000	--	200 000	154 684	--	154 684	Commenced 28/10/86 Work in progress
7	Khirokitia Pond	2 200	1 100	3 300	773	396	1 169	
8	Palekhori Dam - Sklidros ID	893	298	1 191	634	211	845	
9	Pakhyamos - Repairs to pond	1 000	--	1 000	--	--	--	
10	Pomos Dam - Pakhyamos pond Repairs to new pond	5 000	--	5 000	374	--	374	
11	Trakhoni - Ypsonas Improvements of distribution system	8 699	--	8 699	6 725	--	6 725	Work in progress
12	Yerakies - Chakistra - Kambos Irrigation scheme. Stand-by pumping units	5 000	--	5 000	4 929	--	4 929	
13	Yermasoyia - Polemidhia Connection of Garyllis B/Hs	126 000	--	126 000	111 908	--	111 908	Commenced 1/6/86 Work in progress
14	Yerakies - Chakkistra - Kambos	5 505	1 835	7 340	3 753	1 251	5 004	
Total		£526 046	£33 619	£559 665	£416 200	£24 564	£440 764	

**TOWN WATER SUPPLY AND GOVERNMENT
WATER SUPPLY SCHEMES**

The construction programme for 1986 included three main categories of schemes regarding Town and Government Water Supplies:-

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

For the three above categories of schemes an amount of £828,460 was allocated during 1986 for the execution of 10 different schemes. The overall expenditure incurred during 1986 on these schemes was £582,265.

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

A list showing all 10 schemes executed during the year for Town Water Supplies and Government Water Supply Schemes is given on table VII-8.

Table VII-8
TOWN WATER SUPPLY AND GOVERNMENT WATER SUPPLY SCHEMES

Ser. No.	Scheme	Amount allocated in 1986 £	Expenditure incurred during 1986 £
A NEW SCHEMES FOR TOWN WATER SUPPLIES			
1	Compensations		1 686
2	Kouris Delta	82 150	23 107
3	New water supply schemes		4 585
4	Paphos W.S		16 763
	Total	<u>£82 150</u>	<u>£46 141</u>
B GOVERNMENT WATER SUPPLY SCHEMES			
5	Paphos lower villages		5 532
6	Inia - Dhrousha		7 146
7	Nata		40 729
8	Paralimni - Ayia Napa .		256 354
9	Mari - Zygi	691 600	186 882
	Total	<u>£691 600</u>	<u>£496 643</u>
C IMPROVEMENT OF WATER SUPPLY SOURCES, WATER TREATMENT WORKS, PUMPING STATIONS AND CONVEYORS			
10	Supply of Mechanical and electrical equipment	54 710	39 481
	Total	<u>£54 710</u>	<u>£39 481</u>
	Grand Total	<u>£828 460</u>	<u>£582 265</u>

REFUGEE HOUSING AND SELF-HOUSING SCHEMES

During 1986 the Department had to deal with 26 schemes of various categories for the housing of the refugees. Most of these schemes were put in hand in previous years and were carried for completion in 1986. Two schemes were related to sewage systems for Housing Estates, seven were related to water supplies to Housing Estates and seventeen were related to water supplies to self-housing schemes.

For these 26 schemes an amount of £147,627 was allocated during the year and the expenditure incurred by the end of 1986 reached the amount of £110,759.

Table VII-9 shows in detail all 26 Refugee Housing and self-housing schemes which were approved for construction during 1986, as well as expenditure incurred on each one separately.

TABLE VII-9
REFUGEE HOUSING AND SELF-HOUSING SCHEMES UNDERTAKEN
FOR CONSTRUCTION IN 1986

Ser. No.	Scheme	Amount allocated in 1986 £	Expenditure incurred during 1986 £
A HOUSING ESTATES SEWAGE DISPOSAL AND WATER SUPPLY SCHEMES			
i Sewage Systems			
1	Anglisides	31 000	25 577
2	Tersephanou	40 000	43 183
	Total	£71 000	£68 760
ii Water Supplies			
1	Athalassa (Nicosia)	5 350	4 081
2	Ayia Varvara (Nicosia) ...	3 350	3 213
3	Khrysospiliotissa (Nicosia)	250	165
4	Khrysospiliotissa (Nicosia)	4 200	3 320
5	Laxia (Nicosia)	125	26
6	Sotira (Famagusta)	355	355
7	Taht El Kale (Nicosia) ...	1 280	1 226
	Total	£14 910	£12 386

TABLE VII-9
REFUGEE HOUSING AND SELF-HOUSING SCHEMES UNDERTAKEN
FOR CONSTRUCTION IN 1986 (Cont.)

Ser. No.	Scheme	Amount allocated in 1986 £	Expenditure incurred during 1986 £
B WATER SUPPLY FOR SELF HOUSING SCHEMES			
i Famagusta District			
1	Akhna A and B	2 950	1 591
2	Akhna B	19 743	9 792
3	Akhna B	6 200	3 122
4	Akhna C	5 569	1 180
5	Akhna C	5 800	5 934
6	Akhna D	2 100	1 257
7	Vrysoulles	4 000	2 525
	Total	£46 362	£25 401
ii Larnaca District			
1	Dhekelia (A.H.K.)	2 600	1 876
2	Dhromolaxia H	1 900	339
3	Dhromolaxia Z	386	--
4	Dhromolaxia ç	3 300	30
5	Klavdhia A	868	2
6	Livadhia H	2 215	30
7	Perivolia D	2 200	1 727
8	Psevdhas	720	--
9	Xylophagou Z	500	208
10	Zyvi	666	--
	Total	£15 355	£4 212

REFUGEE HOUSING AND SELF-HOUSING SCHEMES
SUMMARY OF ALL DISTRICTS

Ser. No.	Description	Number of schemes	Amount allocated in 1986 £	Expenditure incurred during 1986 £
A HOUSING ESTATES				
i	Sewage systems	2	71 000	68 760
ii	Water supplies	7	14 910	12 386
B WATER SUPPLY FOR SELF-HOUSING SCHEMES				
i	Famagusta District	7	46 362	25 401
ii	Larnaca District ...	10	15 355	4 212
	Total	26	£147 627	£110 759

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 areas
- Relocation of water pipelines which are affected by the construction of new roads
- Sewage schemes
- Improvements of water supply or irrigation schemes for T/C villages where now Refugees have been housed.

During 1986 the Department had to deal with the Construction of 102 such different schemes all over the island of an estimated value of £870,393. The overall expenditure incurred on all 102 schemes during the year reached the amount of £541,441. A list showing in detail all 102 schemes which were undertaken for construction during 1986 is given on table VII-10.

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1986

Ser. No.	Description	Amount allocated in 1986 £	Expenditure incurred during 1986 £
NICOSIA DISTRICT			
1	Athalassa sewage scheme	28 192	25 481
2	Kykko Monastery water supply	700	691
3	Athalassa farm water supply	9 700	5 902
4	Lakatamia camp water supply	3 726	1 406
5	Kakopetria sewage scheme	71 778	69 370
6	Alona irrigation	1 048	272
7	Lymbia - Kornos water supply	2 500	2 500
8	Agricultural Institute	1 500	1 328
9	Sha water supply	650	608
10	Pera water supply	250	183
11	Meteorological (day's wages)	67	67
12	Lymbia - Sha - Kornos water supply	252	220
13	Lymbia - Sha - Kornos water supply	3 000	3 000
14	Lymbia - Sha - Kornos water supply.....	3 000	3 000

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1986 (Cont.)

Ser. No.	Description	Amount allocated in 1986 £	Expenditure incurred during 1986 £
15	Margi irrigation scheme ...	32 000	9 360
16	Aredhiou irrigation scheme	3 000	3 441
17	Astromeritis water supply	26 250	3 692
18	Moutoullas water supply ...	980	1 021
19	Lymbia - Sha - Kornos water supply	125	66
20	Kokkini Trimithia water supply	1 500	1 346
21	Khirokitia water supply ...	5 740	1 722
22	Tseri water supply	17 000	2 928
23	Mosphili water supply	370	264
24	Nicosia-Limassol new relocation	--	693
25	Mammari water supply	5 000	33
26	Nicos-Marathasa water supply	250	180
27	Tymbos Makedhonitissa water supply	5 400	4 679
28	Tseri water supply	13 289	13 281
29	Kachati water supply	4 500	2 322
30	Argates water supply	3 334	3 103
31	Kochati water supply	1 120	725
32	Lymbia - Sha - Kornos water supply	3 000	3 000
33	Peristerona water supply ..	11 334	7 877
34	Akaki - Riatiko I.D	2 220	238
35	Asomatos irrigation	111	12
36	Orounda Ornitharis irrigation	3 333	2 002
37	Mosphili water supply	150	150
38	Mosphili water supply	800	800
39	Aredhiou - Malounda - relocation of pipes	30 300	18 483
40	UNFICYP Yerolakkos water supply	350	225
41	Akaki irrigation	4 500	4 517
42	Makario stadium water supply	2 300	2 300
43	Klirou - relocation of pipes	32 000	28 710
44	Kalochorion - Klirou relocation of pipes	5 000	3 262
45	Argates - Palekhorion - relocation of pipes	35	35
46	Meteorological (days wages)	32	32
47	Yeri - Athalassa road - relocation of pipes	2 500	2 429
48	Yerakies - Kalopanayiotis road - relocation of pipes	400	371
49	Kakopetria - relocation of pipes	15 000	10 911

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1986 (Cont.)

Ser. No.	Description	Amount allocated in 1986 £	Expenditure incurred during 1986 £
50	Nicosia - Limassol road- relocation of pipes	3 590	3 304
51	Kalopanayiotis - Yerakies road - relocation or pipes	100	100
52	Presidential Palacewater supply	200	66
53	Police water supply	400	312
54	Aredhiou - relocation of pipes	5 000	2 205
55	Pharmakas - relocation of pipes	2 500	1 279
56	Pharmakas water supply	2 700	79
57	Klirou water supply	6 000	2 232
58	Training centre	210	140
59	Gourri	3 000	2 543
60	T/C property	500	433
61	Five services hydrants	1 740	1 740
62	Ayios Sozomenos sewage scheme	115 000	77 866
	Total	£500 526	£340 543

LARNACA AND FAMAGUSTA DISTRICT

63	Kiti-Meneou water supply ..	22 750	16 413
64	Ayii Vavatsinias water supply	150	150
65	Ayii Vavatsinias water supply	337	280
66	Ormidhia 'Vatera irrigation'	1 500	942
67	Xylophagou water supply	8 500	6 519
68	Kornos water supply	3 000	2 785
69	Kornos N. Quard water supply	140	38
70	Kalokhorion water supply ..	28 000	15 699
71	Kellia irrigation	1 000	226
72	Kellia irrigation	11 466	1 856
73	Tersephanou water supply ..	2 344	713
74	Tekkes water supply	979	901
75	Kellia	50	47
76	Dhromolaxia - Tersephanou water supply	7 500	4 300
77	Odhou irrigation	1 875	353
78	Melini irrigation	24 750	9 478
79	Layia irrigation	150	129
80	Avgorou-relocation of pipes	4 000	3 371
81	Ayia Napa-Cavo Grego- relocation of pipes	1 800	1 465

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1986 (Cont.)

Ser. No.	Description	Amount allocated in 1986 £	Expenditure incurred during 1986 £
82	Ayia Napa - Ayia Mavri-relocation of pipes	10 000	6 479
83	Stavrovouni Monastery water supply	200	187
84	Aradhippou Rizoelia irrigation	56 000	26 065
	Total	<u>£186 491</u>	<u>£98 396</u>
LIMASSOL DISTRICT			
85	Krasokhoria water supply	--	12 859
86	Kato Pyrgos-Katouris irrigation	33 750	13 227
87	Kato Pyrgos - Katouris irrigation	6 300	2 913
88	Lemithou water supply	20 000	10 307
89	Lemithou water supply	13 183	1 089
90	Ayios Dhimitrios - Kaminia irrigation	16 667	5 596
91	Alekhtora irrigation	7 522	4 255
92	Prodhromos Hardjis irrigation	16 733	9 820
93	Prodhromos Hardjis irrigation	9 700	3 628
94	Paleomylos irrigation	2 128	204
95	Ayios Yeorgios Alamanou water supply	1 500	1 170
96	Ayios Yeorgios Alamanou water supply	500	500
97	Phini - Mylos irrigation ..	3 467	1 500
98	Episkopi water supply	10 657	20 922
	Total	<u>£142 107</u>	<u>£87 990</u>
PAPHOS DISTRICT			
99	Goudhi water supply	5 000	2 810
100	Axylou irrigation	2 717	60
101	Souskiou irrigation	30 835	10 987
102	Axylou irrigation	2 717	655
	Total	<u>£41 269</u>	<u>£14 512</u>
	Grand total	<u>£870 393</u>	<u>£541 441</u>

SCHEMES UNDERTAKEN FOR CONSTRUCTION WITH FUNDS FROM VILLAGE DEPOSITS

During 1986 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 75 schemes of various types.

Most of these 75 schemes undertaken by the Department for Construction during 1986 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 villagers 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 75 schemes an amount of £164,151 was deposited during 1986 and the overall expenditure incurred by the end of the year reached the amount of £120,490.

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR PRIVATE DEVELOPERS

During 1986 the Department responded to the request of private developers for the construction of 340 schemes relating to water works.

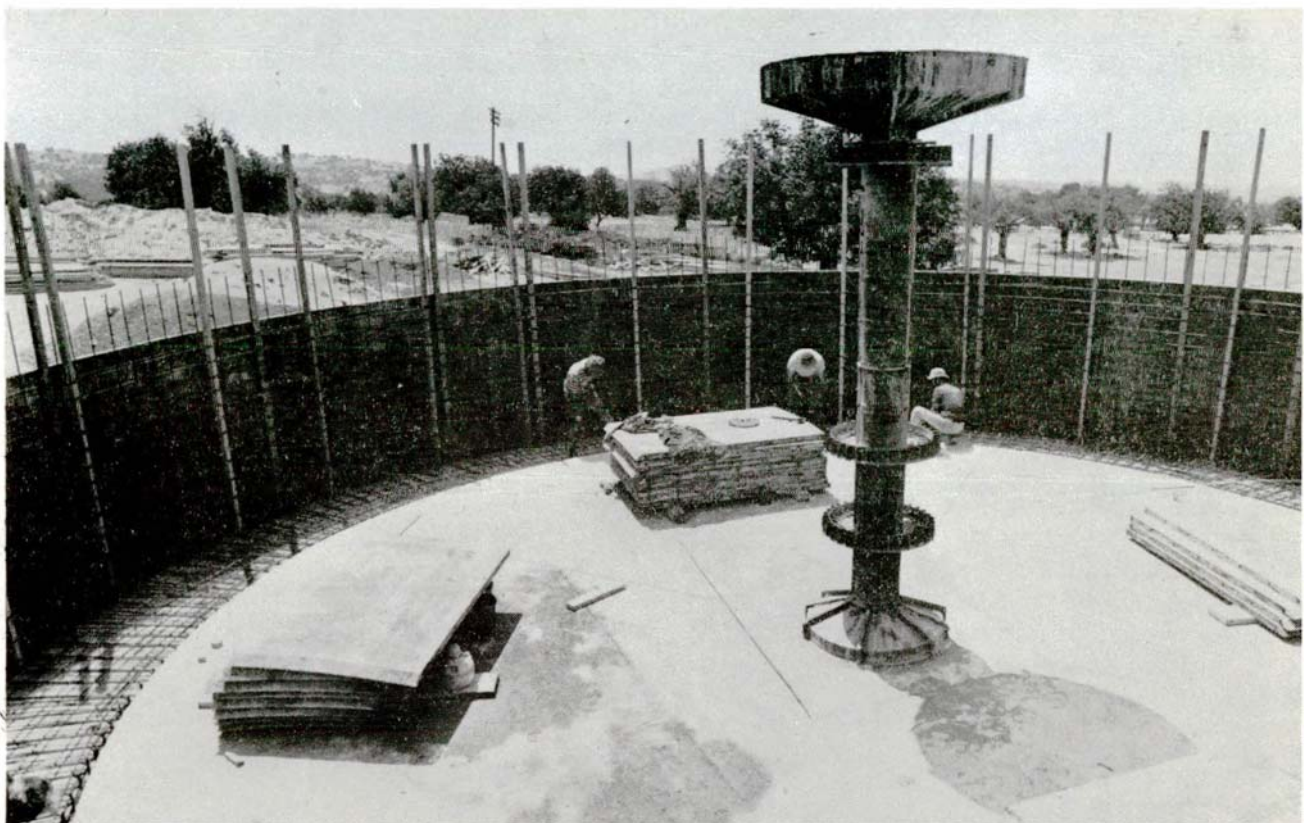
These 340 schemes were related mainly to distribution systems for land development, test pumping, hiring of moulds for reservoirs, etc, and were split all over the island.

The amount deposited for the execution of these schemes was £751,411 and the overall expenditure incurred during 1986 reached the amount of £580,587. 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.



Dhyptomamos Dam aeration operation
W.D.D. Photo D10EN-12 (3.9.86)



Mari - Zyvi & Governor's Beach WS. Construction of RCC circular storage tank
W.D.D. Photo C87EN-E (28.5.86)

JOR PROJECTS IMPLEMENTATION

VIII(i) VASILIKOS PENDASKINOS PROJECT

D M Patsalides, EEI
Dy Project Manager

GENERAL

By the end of the year most of the constructional work of Vasilikos Pendaskinos Project was satisfactorily completed and functioning well. Kalavastos Dam, Dhypotamos Dam, Maroni Diversion and the Pumping Stations at Kornos and Tokhni were completed and the relevant maintenance certificates were issued. The construction of Kornos Treatment Works and the irrigation areas of Vasilikos, Pendaskinos and Maroni are expected to be completed during 1987. Full details of the status of the various contracts are given at a later stage of this report.

CONSULTING ENGINEERS

By the end of the year all the Resident Engineers of Messrs Rofe Kennard and Lapworth having satisfactorily completed their work left Cyprus leaving behind only Mr R A Reader, the Chief Resident Engineer, to finalize all outstanding work such as settlement of claims, variation orders etc.

FOREIGN FINANCING

The status of the three foreign loans are shown on the following tables. It can be seen that the IBRD and EIB loans are fully disbursed while the KFAED loan is short of full disbursement by an applicable sum in spite of various measures taken during project implementation to improve the situation.

It is considered however that full disbursement of this loan will be possible when final expenditure, including outstanding variations and claims are reached.

International Bank for Reconstruction and Development
 Loan No. 1658/5 CY - total 9,910 US Dollars

Category	Amount of Loan in U.S. Dollars	Expenditure to be financed %	Actual Disbursement received to completion in U.S. Dollars
(1) Equipment, vehicles and other supplies (includes materials procured for Force Account, Works, except A.C. Pipes)	1 800 000	100% of foreign expenditures and 85% of local expenditures	1 773 507.64
(2) Civil Works			
(a) Under Contracts (includes Kalavastos Dam only)	5 100 000	75%	5 125 962.62
(b) Under Force Account Includes the following: -50% of Kalavastos to Khirokitia pipeline -Pendaskinos Irrigation Area -Maroni Irrigation Area -Vasilikos Irrigation Area -Land Consolidation Authority Works	1 800 000	60%	1 808 475.73
(3) Administration and Engineering Consultant's Services for Civil Works (includes fees to Consulting Engineer, Panel of Experts and cost of hydraulic model of dam spillway).	1 110 000	100%	1 136 330.95
(4) Unallocated	100 000	-	65 723.06
Total in US dollars	<u>9 910 000</u>		<u>9 910 000.00</u>

Total received in Cyprus Currency : £5 874 020.30

Kuwait Fund for Arab Economic Development
Loan No. 158 - Total 2,500,000 Kuwaiti Dinar

Category	Amount of Loan in K.D.	Expenditure to be financed	Actual Disbursement received in K.D.
1. Dhyptamos Dam and Lefkara Diversion	987 300	54%	1 218 486.703
2. Maroni Diversion	260 700	50%	285 902.108
3. Nicosia Water Supply etc.	628 000	74%	672 842.850
4. Engineering Services	124 000	45%	129 870.892
5. Unallocated	500 000	-	-
Total in K.D.	2 500 000		2 307 102.553
Balance to disburse			KD 192 897.447
Total received in CYE			£4 454 251.10

European Investment Bank
Loan No. 1572 - Total 8 000 000 ECU

Category	Amount of Loan in ECU	Expenditure to be financed	Actual Disbursement received to completion
1. Kalavassos Dam	3 300 000	30%	3 300 000
2. Pumping Station Mecha- nical & Elect. Equip.	1 400 000	100%	1 400 000
3. Kalavassos- Khirokitia Pipeline	3 300 000	70%	3 300 000
Total in ECU	8 000 000		8 000 000
Total received in CYE			£3 677 899.29

The other loan from EIB no 60,320, utilized for the emergency Yermasoyia-Khirokitia pipeline, has also been disbursed in the sum of 1,000,000 ECU.

STATUS OF CONTRACTS

Kalavassos Dam and Ancillary Works (Contract No. C1)

Contractor : Messrs Joannou and Paraskevaides
Medcon Ltd (Joint Venture)

Contract Value : £5,648,000 (incl. £200,000
contingencies)

Contract start date : 3rd January 1983

Contract early : 31st December, 1984 (was 8th
impounding September, 1985)

Actual impounding : 2nd November, 1984

Contract Completion : 17th June, 1985 (was 8th September,
1985)

Certificate of completion issued on 31st March, 1985

End of Maintenance period: 31st March, 1986

Maintenance Certificate : 31st March, 1986
date

Total certified : £5,951,765

Claims : 9 headings in the total sum of
£57,927

Benefits to 31st December, 1986:

	Impounding Level	Date	Capacity cu.m.
Maximum	157.42	18 June, 1986	4 182 000
Minimum	144.00 (Approx.)	22 Dec., 1986	862 000

Water pumped to
Khirokitia Treatment
Works

4 099 860

Water Gravitated to
irrigation network

Maroni area 594 843

Kalavassos area 446 257

1 041 100

Total water supplied in 1986

5 140 960

Dhypotamos Dam (Contract No. C2)

Contractor : Messrs Shephard Hill Ltd with
Messrs G P Zachariades (Joint
Venture)

Contract value : £4,268,896.568 (incl. £200,000
contingencies)

Contract start : 2nd November, 1982

Core Construction
started : 12th December, 1983

Contract early
impounding : 21st Dec., 1984 (was 2nd April 85)

Actual early impounding : 21st December, 1984

Contract Completion date: 21st April, 1985 (was 9th July 85)

Certificate of
completion issued : 14th April, 1985

End of maintenance period: 14th April 1985

Maintenance certificate
date : Not yet issued

Total certified : £3,757,794

Claims under
consideration : 2 headings in total sum of £27,597

Benefits to 31st December, 1986

	Impounding Level	Date	Capacity cu.m
Maximum	154.36	19 June 1986	2 144 000
Maximum	142.2 approx.	26 Dec. 1986	288 000 -----
Water pumped to Kornos Treatment Works			2 284 210
Water gravitated to Pendaskinos Irrigation Area			929 878 -----
Total water supplied			3 214 088

Maroni Diversion (Contract No. 3)

Contractor : G P Zachariades Ltd

Contract value : £1,255,554.40 (Incl. £70,000 contingencies)

Contract start date : 2nd May, 1984

Contract completion date : 31st July, 1985 (2 weeks extension granted)

Completion certificate issued : 3rd August, 1985

End of maintenance period : 3rd August, 1986

Maintenance certificate date : 25th August, 1986

Total Final Cost : £1,263,694

Claims : 3 headings in the total sum of £141,259.67. A settlement of £38,000 has been agreed by Board and included in the above.

Benefits : Diversion to Dhyptomamos Dam commenced in mid February, 1986. Total quantity diverted during the period February - 31st Dec., 1986 is 262,000 cu.m.

**Pumping Stations Mechanical and Electrical Plant
(Contract No. 4A)**

Contractor: : Weir Pumps Ltd (UK)

Contract Value: : £747,586 (Incl. £100,000 contingencies)

Contract start date : 10th December, 1982

Pump deliveries due : 31st July, 1984

Plant erection due: : November, 1984 (was originally August 1984)

Taking over certificate issued for:

Tokhni Pumping Station : 8th May, 1985

Kornos Pumping Station : 23rd December, 1985

Maintenance Certificate : Not yet issued

Expenditure:

Contract works	:	£649,856
Variations to date	:	£ 21,412
Contract Price Adjustment	:	£ 20,426

Total (excluding claims)	:	£691,694

Claims : Total submitted and under consideration: £18,306

Benefits : Volume pumped from Kalavassos Dam: 4,099,860 cu.m.

Tokhni Pumping Station (Contract 4B) Superstructure

Contractor	:	Direct labour by Water Development Department
Estimated cost	:	£152,000 (excl. EAC Power Supplies)
Contract start	:	24th November, 1984
Substantial completion	:	March, 1985
Expenditure		
Construction	:	£151,262
Electricity Supply Work to Complete (Estimate)	:	£ 41,546
	:	£ 1,377

Total Estimated Expenditure	:	£192,800

Kornos Treatment Works, Mechanical and Electrical Plant Contract 5A:

Contractor	:	Degremont Laing Ltd (UK)
Contract value	:	£810,885 (incl. £100,000 contingencies)
Contract start date	:	17th November, 1982
Plant delivery date	:	16th August, 1984
Actual Plant erection start date:	:	7th January, 1985

Taking over certificate
issued for the works : 20th January, 1986

Expenditure

Contract works : £710,885
Dayworks claimed : £ 25,199
Variations to date : £ 40,933
Contract Price
Adjustment to date : £ 32,594
Total excluding claims : £809,611

Claims : Total submitted and under
consideration: £165,383

Benefits : Total treated water into public
supply during the year
Ex Lefkara Dam 1,203,110
Ex Dhyptomamos Dam 2,284,210
3,487,320 cu.m.

Kornos Treatment Works (Contract 5B)

Contractor : Ch. Apostolides and Co. Ltd.
Contract value : £1,324,773 (incl. £100,000
contingencies)
Contract start date : 14th November, 1983
Contract completion date : 15th September 1985
Taking over certificate
issued for the last
section of the works : 10th February, 1986

Expenditure

Total paid to date : £1,147,600
Estimated Work to
complete : £ 10,000
Estimated Contract
Price Adjustment : £ 96,000
Total excluding Claims : £1,253,600

Claims : A large number of vague claims sub-
mitted without any figures. Due to
delays and in the absence of any
major extensions to the contract

period the Contractor's liability for liquidated damages now stands at £71,225.

Benefits : Treated water to Stavrovouni
Balancing Reservoir 3,413,550 cu.m.

Telemetry Contract No. 6

Contractor : Caramondani Bros with Flutec S.A.
Contract Value : £164,777 (excluding direct labour work)
Contract start date : Within 30 days of letter of acceptance dated 31st July 1985
Contract period : 11 months
Works by Contractor : The telemetry panels have been manufactured and satisfactorily witness tested at the manufacturers works and are already on site. Erection is expected to take place between January and end of March, 1987.

Works by WDD : Telemetry cable laying by WDD is virtually completed and the modifications, ducting etc. for the telemetry panel at Khirokitia Project Headquarters are nearing Completion to suite the panel installation (and later, if required, the Southern Conveyor Panel).

Expenditure

Telemetry Contract Sum	:	£165 000
Cable laying by WDD	:	£ 55 500
Total		<u>£220 500</u>

A claim arising from the delays is anticipated.

Kalavassos-Khirokitia Pipeline (Contract No. 7)

Contractor : Water Development Department -
Direct Labour

WDD estimate for
construction and laying : £1,233,000

Estimated final cost of
pipes, valves etc. : £1,175,000

Estimated final cost of
construction and laying : £ 931,000

Contract start date : 1st September 1983

Commissioning : April 1985

Total expenditure : £2,154,000

Kalavassos-Khirokitia Pipeline is in use since April, 1985 carrying water for irrigation and potable purposes from Kalavassos Dam to Khirokitia Treatment Works via Tokhni Pumping Station and to Vasilikos Irrigation area.

Vasilikos Irrigation Area (Contract No. 8)

Contractor : Water Development Department
Direct Labour

Construction start date : October, 1984

Estimated overall
completion date : July, 1988

Area by area estimated costs and completion dates:

Area Description	Area (ha)	Dates	Estimated Cost £
Maroni Vasilikos Connection	-	Sept. 84-Dec. 85	314 666
Maroni, Zyyi, Psematismenos	120	June 85-June 86	138 609
Vasilikos	577	Oct. 85-Jan. 87	1 200 000
Kalavassos 2	140	Dec. 87-June 88	
Field roads	-	Oct. 86-Feb. 87	81 000
Mari Connection	-	June/July 85	58 068
Administration Supervision, Transport	-		54 702
Total	837		£1 847 045

Work on the Vasilikos network started in July, 1985 and by the end of October, 1986, 697 ha out of a total of 837 ha had been installed. The remaining 140 ha in the Kalavassos 2 area are expected to be installed by June 1988 by which time the land consolidation procedures will be finalized. In the meantime the existing area plantations are irrigated by temporary connections.

Benefits : During 1986 water for irrigation purposes was supplied to:

Kalavassos-Zyyi-Tokhni area	: 222 392 cu.m.
Kalavassos village area	: 223 865 cu.m.
Total from Kalavassos Dam	: 446 257 cu.m.

Pendaskinos Irrigation Network - Contract No. 9
(Including Skarinou new area)

Contractor : Water Development Department - Direct Labour

Construction start date : October, 1984

Overall completion date : August 1986

Expected final cost : £1,303,672

Area by area estimated costs and completion dates:

Area Description	Area (ha)	Dates	Estimated Cost (£)
Pendaskinos original network	341	Oct. 85-Aug. 86	1 169 508
Skarinou new area	24	Sept.85-June 86	99 000
Field roads	-	Mar. 86-Aug. 86	35 164
Total	<u>365</u>		<u>£1 303 672</u>

The Pendaskinos irrigation area and field roads were completed in August, 1986. The only outstanding work is the installation of a mains electricity supply point with connection to a new electro-submersible borehole pump to be provided at borehole 64/73 (Skarinou).

During the year irrigation water was supplied to:

Ayios Theodoros and Skarinou	:	929 287 cu.m. (ex Dhypotamos Dam)
		43 121 cu.m. (ex boreholes)
Total	:	<u>972 408 cu.m.</u>

Maroni irrigation Area - Contract No. 10
Including new area near Maroni village

Contractor : Water Development Department - Direct Labour

Construction start date : October, 1984

Overall completion date : April, 1987

Estimated total cost including facilities to pump mixed water to the Maroni area : £915 000

Estimated cost and completion dates:

Area Description	Area (ha)	Dates	Cost (£)
Maroni original area	212	Sept.84-Dec. 85	676 500
Maroni new area and borehole connections	21	Oct. 86-Apr. 87	238 000
Total	<u>233</u>		<u>£914 500</u>

The original distribution network was completed in December, 1985, but was giving benefits from June 1985. Gravel filter installation has been completed through the area and their design and operation has proved very successful.

During the year 594,843 cu.m. of irrigation water was supplied from Kalavassos Dam.

PROJECT EXPENDITURE

The project expenditure for Vasilikos Pendaskinos Project, including expenditure for the Nicosia Water Supply 1st Phase reached the figure of £25,333,182 out of which £1,464,261 was incurred in 1986. Detail analysis of expenditure incurred is shown on Table VIII-4.

CHAPTER VIII

(ii) KHRYSOKHOU IRRIGATION PROJECT

by
K. Spanos
Project Manager

GENERAL

The main activities which have taken place during the year 1986 for the implementation of Khrysokhou Irrigation Project were the following:

Construction works on Evretou Dam have continued at a satisfactory rate and the dam was ready for impounding as from September 1986 whilst substantial completion certificate for all the works was issued by the Engineer on 23rd December 1986.

Delivery of various materials required for the Irrigation Networks and Main Conveyor of the Project to the site store like A.C.Pipes, UPVC Pipes, Pipe fittings, valves, hydrants, water meters e.t.c. have started towards the middle of 1986 and reached about 75% completion by the end of the year.

The Contract KC 2 for the Installation of Irrigation Networks and Construction of Farm Access Roads was awarded to G.P. Zachariades Ltd at the price of £ 1,427,877.

Works for farm access roads have started in April and about half of their earthworks were completed by end of the year while pipeworks have started in September.

Following receipt of tenders for Contract KC3- Installation of Main Conveyor and Construction of Ponds, the Contract was awarded to General Construction Co. Ltd at the price of £1,122,174 and the Agreement was signed on 2 November 1986.

The Project expenditure during the year 1986 was £4,332,786 bringing the total expenses to £12,075,182, which represents about 70% of the estimated costs of Project's Phase I, including Arqaka-Maqounda diversion.

STAFF

Staffing of the Project had become a serious issue due to the long delays which had been encountered in recruiting the new staff required for the Project.

Finally during 1986 there have been no recruitments of new staff but only some temporary transfers of existing staff from other works. At the end of the year 1986 the following number of staff were allocated to the various sites of the Project

(i) Management Staff

One Executive Engineer I -Project Manager
One Clerical Assistant -Accounts
One Clerk/Typist (temporary)

(ii) Evretou Dam

One Resident Engineer, Mr.J.W.Reeves from the Consultants Sir William Halcrow and Partners

Two Executive Engineers I
One Technician I
Six Technicians II
One Clerk/Typist

(iii) Installation of Irrigation Networks and Farm Roads

One Executive Engineer I- Resident Engineer
Two Executive Engineers I- (I Pipeworks, I Roadworks)
Ten Technicians II- (Topographers, Site Technicians and Draught girls).

(iv) Other Components of the Project

For the remaining works like supply of materials and equipment such as pipes, fittings, valves, etc, tendering and preliminary work before commencing works for Main Conveyor and Ponds and other small works by WDD the following staff were occupied.

One Executive Engineer I
One Technician II

PROGRESS OF WORKS

I. EVRETOU DAM- Contract No.I

Contractor:Shephard Hill-Zachariades Joint Venture.

General

Progress on the construction of the dam continued during 1986 as scheduled and substantial completion of the works was achieved by the end of the year or about 6 months earlier than the extended Contract completion date.

The Certificate of Completion for Readiness for Impounding was issued by the Engineer as from 14.9.86 while the Certificate of Substantial completion for the whole of the Works was issued as from 23.12.86. Due to low rainfall only minor quantity was stored in the dam by the end of December 1986.

Details of the works carried out during the year are given below:

Embankment

Fill material on the embankment was placed at the rate of about 30,000 m³ per week and its elevation was raised from 130 m el. in January to its top at 170m el. by the end of August. Rockfill material came mostly from lower quarry no.I which was yielding good type "B" material. Horizontal gravel drainage layers 60 cm thick were placed in the upstream shoulder at elevation 128 m and 148 m.

Placing of earthfill over the clay core had continued with no particular problems and was always kept at the same level as rockfill. On completion the embankment had a total volume of 1,460,000 m³ and a height of 71 m from its general foundation level.

Instruments were installed in the embankment at the elevations of 140 m comprising of 20 no. earth pressure cells and 4 no. hydraulic piezometers and at 153 m comprising of 6 no. settlement cells and 6 no. hydraulic piezometers.

Draw-Off Works Valve

The roof of the Chamber was concreted in June 1986. Also by the end of the same month the civil works of the Valve Control House were completed.

The 1200 mm fixed cone valve was connected at the end of the bottom outlet pipeline in July 1986. Both the Irrigation and the Bottom Outlet pipelines were successfully tested at test pressures of 7.00 and 7.5 bars respectively which are the maximum static pressures. Also all valves have been checked for opening/closing and subsequently all valves except the air valves isolating valves were fully closed and kept so as from the end of September 1986.

In order to minimise the area affected by the jet of water coming out of the jet dispenser of the fixed cone valve a hood steel liner was installed in October adjacent to the jet dispenser. Placing of rip-rap on the outfall channel of the Bottom Outlet was carried out towards the middle of November.

Rock Grouting

Rock grouting works along the right wing and the left abutment and Stenomata ridge were completed by the end of March 1986 and the results confirmed that the scope of the works was achieved satisfactorily and it was agreed by the Panel of Experts that underseepages should be reduced to safe, acceptable limits. A proper evaluation however, of the grout curtain will only be made as it will become subject to rising reservoir head and in the light of such an evaluation the need for additional grouting measures will be considered.

In total 1,200 grouting holes were drilled totalling to 55,000 m in length. Grout injected was 7,000 tonnes of cement and 100 tonnes of betonite to form a grout curtain of about 70,000 m² area. Average grout takes was about 130 Kg/m.

Spillway

All remaining concrete works for the spillway was fully completed in January 86 and backfilling behind the spillway was completed by the end of February. Excavation of the approach channel and the left side of the chute was started in April and fully completed by the end of October. In November some repair work was carried out on the concrete and berms of the spillway.

Access Road

Placing of the road base material on the dam access road started in January 86 and completed by the middle of the year. Asphaltting of the crest road and the right bank access road was carried out towards the end of the year. The dam site access road however has remained with road base in order to avoid damages from the installation of the dam's main conveyor along the side of the road which is planned to take place in 1987.

Electrical Sub-Contract.

Tenders from Sub-Contractors for the supply and installation of ventilation lighting and ancillary electrical equipment of the dam were invited in February 1986 and the award for this work was made to A&P. Paraskevaides Ltd at the total price of £20,795 in April 1986. The Nominated Sub-Contract Agreement was signed with the Main Contractor of the dam the same month.

The fans in the tunnel were mounted in place and supplied with power via a temporary connection in September.

All the cabling to the Instrument House and to the crest wall was carried out during October. The crest light fittings were also fixed in place and supplied with power by the end of the same month.

Financial

During the year 1986, 11 Monthly Payment Certificates have been issued by the Resident Engineer of total value of £1,804,332 bringing the cumulative payments to the Contractor at £8,961,258. This represents 97.4% of the total cost of the work which is estimated at £9.2 million.

2. INSTALLATION OF IRRIGATION NETWORKS AND CONSTRUCTION OF FARM ROADS

Contractor: G.P. Zachariades Ltd.

This Contract with Messrs G.P. Zachariades Ltd was signed on the 1st March 1986 for the sum of £1,427,880 and notice to proceed with the works was issued by the Engineer on the 31st March 1986. According to the Contract the works should be completed by the end of January 1988.

The works under this Contract include the installation of a total length of about 130 Km of A.C and UPVC pipes with all their relevant structures and the construction of about 64 Km of farm roads over an area of about 1,800 ha.

According to the Contractor's programme the earthworks for roads will proceed ahead of trenching for pipelaying whilst top surface of the roads will be placed after completion of the pipeworks.

Earthworks for roads started at the beginning of June 1986 at the rate of about 20,000 m³ per month and continued at a satisfactory rate. By the end of the year about 90,000 m³ of excavation and 50,000 m³ of fill were carried out over 32 Km of roads.

The trench excavations and pipelaying started at the beginning of September 1986 and the following quantities were carried out by the end of the year.

Trench Excavation	27 Km
Pipes Laid	25 Km
Pipes tested	12 Km

At the moment pipe testing operation falls quite behind the other operations. The main reasons being the capacity of the Contractor in this field and unexpected difficulties with testing UPVC pipes due to leakage through the joints which were attributed mostly on the method of installation.

Total payments to the Contractor up to the end of the year 1986 reached the sum of £487,000.

(ii) Supply of materials through Contracts KSI, KS2 and KS3, for the Irrigation Networks.

Delivery of necessary materials and equipment under above Contracts for the Irrigation Networks have started in April 86 and continued at a satisfactory rate throughout the year. Overall about 60% of the total quantities were on site by year's end. The table here below gives a summary of the position on the stage of supply for each type of materials.

Contract	Contract Sum in CE	Percentage of completion by 31.12.1986
A.KSI: Supply of		
(i) A.C.pipes (Eternit, SA Libanaise)	440,814	55 %
(ii) fittings for A.C.pipes (Nappco USA)	87,854	67 %

Contract	Contract Sum in £	Percentage of completion by 31.12.1986
(iii) UPVC pipes and fittings (Kosmoplast Cyprus)	104, 854	55%
B. KS2- Supply of		
(i) Gate Valves (E Hawle, Austria)	17, 108	100%
(ii) Butterfly Valves (Vanadour, France)	6, 595	100%
(iii) Ball Valves and Air Valves (Glenfield, UK)	47, 479	100%
C, KS 3- Supply of		
(i) Hydrants (Apco Valve, Greece)	64, 743	67%
(ii) Water meters (Schlumberger, France)	88, 900	81%
(iii) Automatic Water Meters (Bermad, USA)	18, 910	100%
Total Value	£ 877, 257	

3. INSTALLATION OF MAIN CONVEYOR AND CONSTRUCTION OF PONDS

(i) Contract KC 3

Contractor: General Construction Co. Ltd

This Contract includes the installation of lowlands Main Conveyor starting from Evretou Dam and extending up to Argaka-Maqounda Dam and the diversion weir on Maqounda river and the construction of five storage earth ponds, one elevated balancing tank and the diversion structure on the Maqounda river. Tenders from 26 prequalified Contractors were invited on the 19th March 1986 and were opened publicly on 19th May 1986.

Finally only 5 tenders were received which were all from local Contractors. Tender prices were spread over the range £1.1 to £1.4 million.

The Main Tender Board has finally awarded to the lowest bidder Messrs General Construction Co. Ltd at the sum of £1,122,174. The Agreement with the Contractor was signed on 2 November 1986 and the notice to proceed with the Works was issued by the Engineer on 20 November and completion date for the Contract was fixed the 20.5.1988.

(ii) Supply of Ductile Iron Pipes and Fittings through Contract KS4 for the Main Conveyor.

Agreement for the supply of the above items has been finally reached with Pont-A-Mousson on the basis of terms and conditions and prices applicable for the Southern Conveyor Project. The total quantities of the required items include 18 Km of D.I. pipes of diameters between 900 mm and of total value of £1,262,345 at basic prices plus about 30% due to increase of the value of D.M. Delivery of about 85% of the total required quantities of D.I. pipes have taken place during the second half of the year whilst the remaining are expected to arrive on site early in 1987.

(iii) Supply of Valves and Water Meters through Contract KS3 for the Main Conveyor.

The awards for the supply of the above items were made on 12 May 1986 by the Main Tender Board to five different suppliers. By the end of the year the position on stage of progress on the supply of each type of the required materials was as follows:

	Contract Sum	% of completion by 31.12.1986
Supply of Butterfly Valves (Erchard, Germany)	12, 442	0
Supply of Gate Valves (Hawle, Austria)	14, 615	100
Supply of Air Valves and Float Valves (ARI and Bermad, Israel)	28, 781	100

	Contract Sum	%of completion by 31.12.86
Supply of Water Meters (Meinecke, Germany)	7,819	100 %
Supply of Disc Valves (Neymic, France)	22,560	0

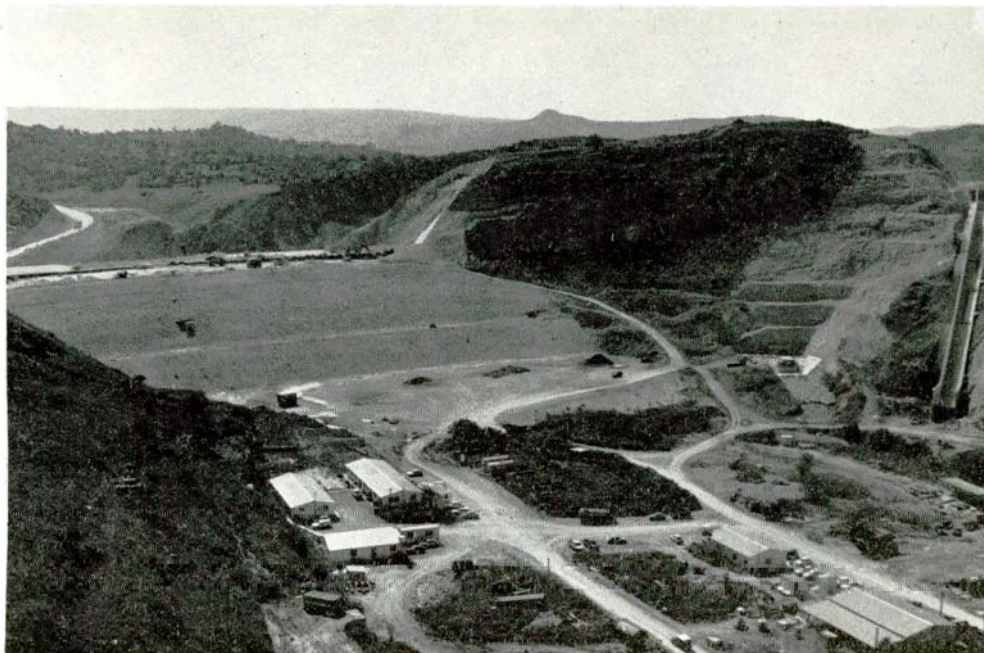
PROJECT COST ESTIMATES AND EXPENDITURES

Project expenditures by the end of the year 1986 reached the total of £12,075,182 of which £4,322,786 were spent in 1986. The total cost of Phase I of 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 herebelow:-

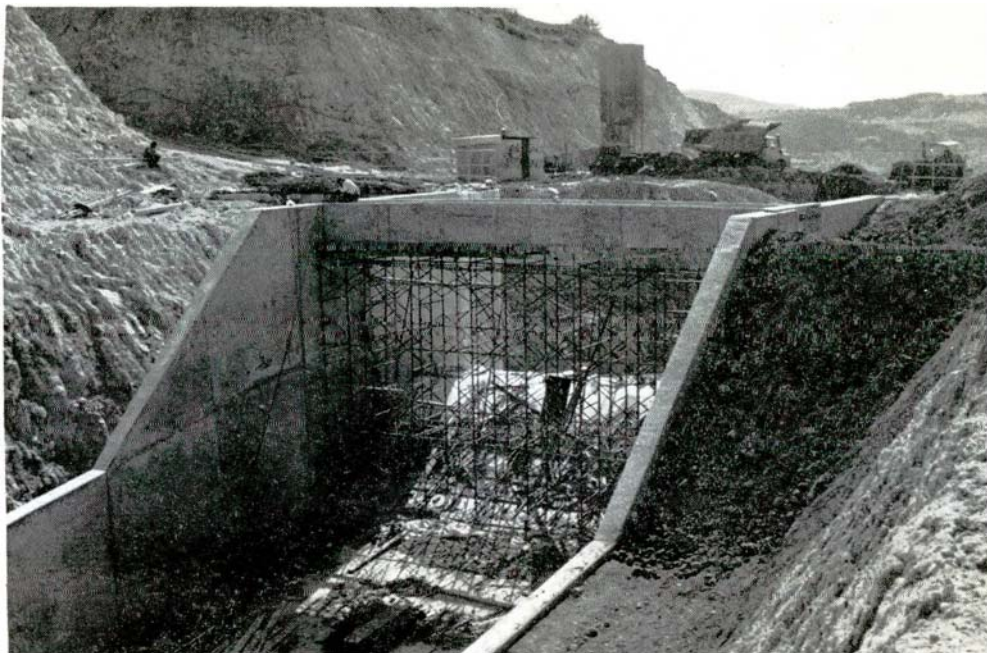
TABLE VIII - I

Item	Total Expenditure Up to 31.12.86 £	Expenditure during 1986 £	Estimated Total Cost £
I. Evretou Dam.....	8,862,681	1,768,450	9,350,000
2. Main Conveyor and Branches up to Argaka Diversion.			
(i) Supplies.....	1,291,868	1,291,868	1,775,000
(ii) Installation.....	112,217	112,217	1,120,000
3. Irrigation Networks and Farm Roads Sectors IA, IB, IC			
(i) Supplies.....	400,661	400,661	725,000
(ii) Installtion.....	520,853	520,853	1,450,000
4. Main Conveyor of Pomos and Irrigation Networks of Sector ID and Argaka and other works by WDD.....	66,532	128,349	750,000
6. Consultants and Experts.....	230,402	79,694	303,000
7. Land Consilidation.....	-	-	220,000
8. Land Acquisition.....	181,580	4,682	300,000
	<hr/>	<hr/>	<hr/>
TOTAL	£12,075,182	£ 4,322,786	£17,183,000

Evretou Dam
General view from
downstream



Evretou Dam
Spillway footbridgs



Farm access
road
Construction
of culvert

WDD Photo 08EN-7
(1.8.86)



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, 0.4 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	CE 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 CE1,300,000.

With the engagement of additional earthmoving equipment all the conditions of the acceleration agreement were fulfilled by 31st December 1988 and a qualified impounding certificate was issued to the Contractor on 2nd November 1987.

Drilling and grouting

Open air grouting works on (i) the left abutment, (ii) river bed (iii) right abutment and (iv) spillway area, (v) left abutment gallery and (vi) right abutment gallery are basically completed. Drilling/grouting works from within the perimetral gallery are still in progress. Tunnel grouting works were suspended late in December 1987 in view of the winter water river diversion. It is expected that these will be resumed late in spring 1987.

The total drilling performed by the end of December 1986 was approximately 32,060 m (compared with 27,770 m in BOQ) and the total weight of dry material injected as grout was 1,355,000 kg (cf with 1,420,000 kg in the BOQ).

Perimetral Gallery

Concreting of the perimetral gallery is well ahead of the clay placement totalling a length of about 450 m.

Cofferdam

Completed in October 1985.

Embankment

Approximately 2.94 million cubic metres of fill was placed on the embankment in 1986. The total volume of fill placed by 31st December 1986 reached the quantity of 3.84 out of a total volume of 9.4 million cubic metres (allowing for both the upstream and downstream toe weights).

The average level of fill above reached 44 m i.e. elevation 184 m. A.M.S.L.

Filling of the downstream toe weight commenced in February 1986 and it is expected to be completed in Spring 1987. Filling for the upstream toe weight commenced in November 1986 and is scheduled for completion in Summer of 1988.

Spillway

Total volume of excavation in the spillway area reached a figure of 461,000 m³ (cf B.O.Q. quantity of 477,000 m³).

Concreting in the Spillway area commenced in March 1986 and about 25,185 m³ of concrete had been placed by the end of December 1986, representing about 40% of the Bill of Quantity.

Draw-off Works

By the end of 1986 85% of the civil works associated with the draw-off works had been completed.

Concrete lining of the diversion tunnel was completed on 17 September 1986 and the intake shaft/draw-off galleries had been completed to elevation 251.30 m A.M.S.L. as at 31 December 1986.

With the speedy completion of the intake shaft/tower to elevation 251.30) using the slipforming method previously recorded delays to the draw-off works had been eliminated.

Electromechanical Works

Following the delays during the 1st phase of electromechanical works, much firmer procedures have been introduced to cover the planning of the 2nd phase by the Electromechanical Subcontractor, METALNA of Yugoslavia. By the end of December 1986 the value of executed electromechanical works represented about 47% of the Bill amount.

Inspection of roller gates and the transition lining took place in Yugoslavia late in 1986. Inspection of the servomotor (including full pressure hydraulic testing) and of the butterfly

valves (German supplier ERHARD) is planned to take place during the first two months of 1987.

Special Problems Encountered

1. Weak Beds

Following the discovery and investigations carried out on the extent and properties of weak beds encountered below the dam foundation in the river bed it was necessary to modify the design of the dam section. A toe weight downstream of about 400,000 m³ was necessary to ensure adequate stability of the downstream slope. Similar analysis for the upstream slope, led to the introduction of an upstream toe weight to about 530,000 m³. Following the September 1986 meeting with the Panel of Experts and further consultations between the Designer and the Panel of Experts the design criteria were eventually agreed and a final design report on the upstream toe weight was produced by SOGREAH in December 1986. Optimal use of low grade material is made in the construction of the upstream and downstream toe weights.

2. Deficiency of Terrace Gravel Material from Traoullomandres Borrow Area

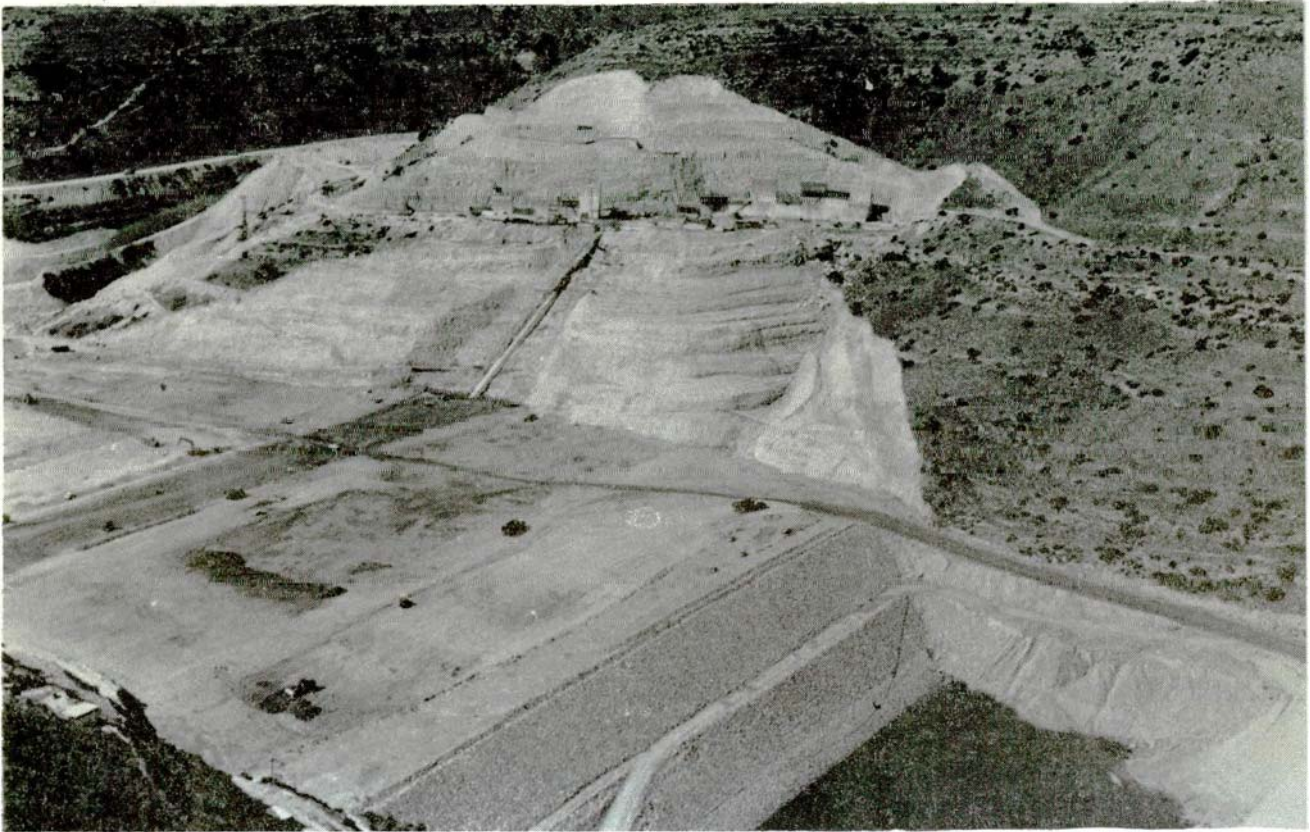
The important deficiency of terrace gravel material from Traoullomandres borrow area is currently being made good from similar material coming from Kandou borrow area with resultant overhaul. Various design alternatives are considered for incorporating lower good material from Traoullomandres. Despite increased quantity requirements due to the downstream and upstream toe weights no problem is anticipated in securing adequate quantities of suitable material (although at additional cost) as the hydrogeologists of the WDD have given their approval for the exploitation of river gravels downstream of the dam at greater depths.

3. Spillway - Slope Stability - Disturbance Zone

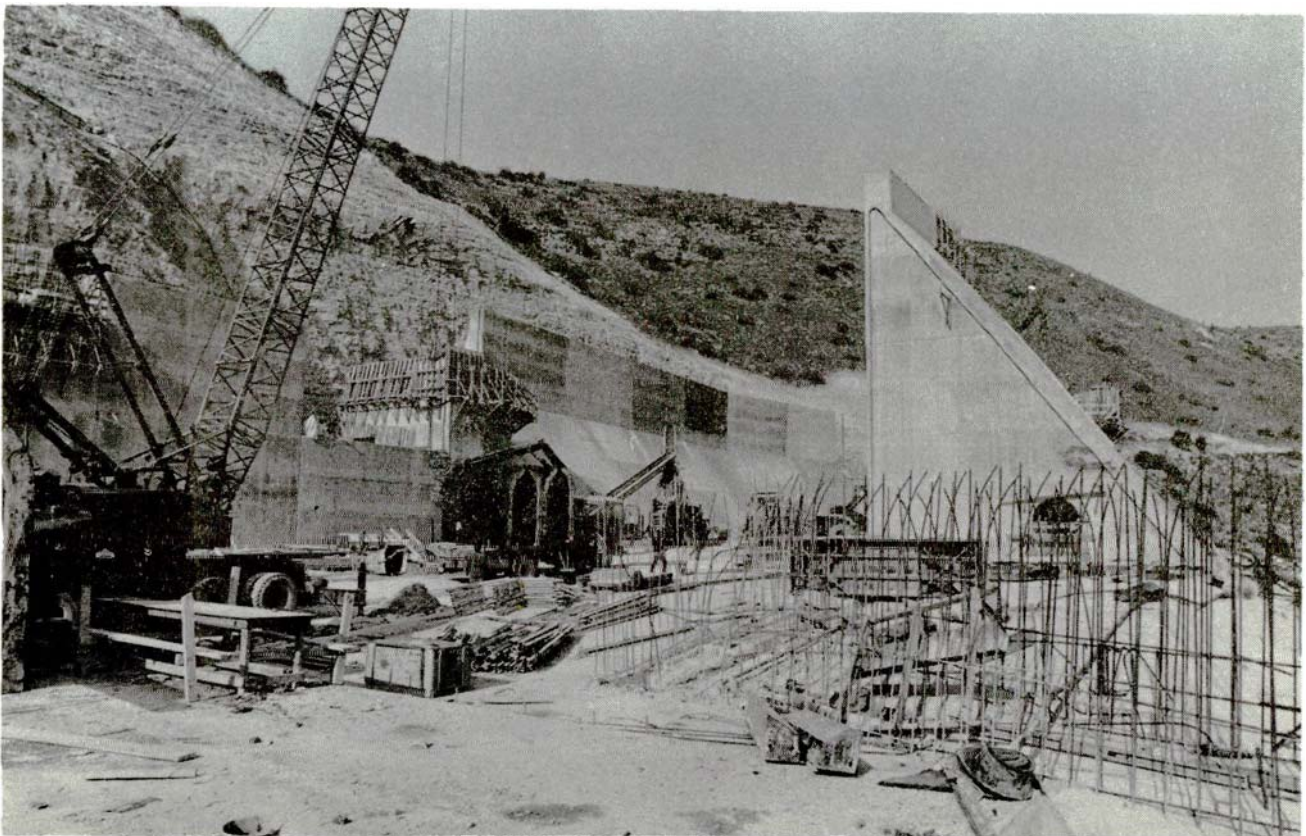
The debris-netting covering the spillway cut and the temporary parapet along the lower berm have proved effective in providing a safe working area at the toe of the slope during the dry summer months of 1986. The measures instituted by the Engineer to systematically inspect the excavated slope jointly with a representative of the Contractor has helped to generate workmen's confidence in regard to their safety. Fortunately the construction of the right hand massive spillway walls has progressed adequately thus substantially reducing the risk of accidents/injuries to the work force working underneath the suspect area.

4. Spillway - Chute Foundations

Due to the depth of weathered, open jointed material, foundations for the chute (especially for the left chute wall) have had to be excavated to lower grade and level than



Kouris Dam general view
W.D.D. Photo D16EN-16A (3.10.86)



Kouris Dam Construction works at spillway
W.D.D. Photo D33EN-3A (18.12.86)

anticipated at some locations. It is anticipated that it will be possible to modify the chute structure by additional mass concrete filling, rather than changing the design of the walls.

5. Penstock Paint Failure

Following the first year of operation of the 1.2 m dia. penstock in the tunnel it was observed that its bituminous paint system failed. Samples of the paint were taken and chemical and bacteriological analyses were carried out. The Contractor was asked to submit proposals for remedial measures and in the meantime specialist advice was sought by the Water Development Department.

Following lengthy investigations, advice from a British paint expert and discussions with the Contractor remedial measures for the defective paint system used on the penstocks were proposed by the Contractor and were approved by the Resident Engineer together with a new paint system for the roller gates and lining.

The measures approved are (i) polyimine epoxy paint for the penstocks and (ii) a coal-tar epoxy paint for the roller gates and steel lining and will be supported by a manufacturer's guarantee.

Repairs to the defective paint of the 1.2 m diameter penstock are expected to commence in February 1987.

6. Increased Fines Content of Fill Materials

Due to the excess fines content the grading envelopes for G, GT and GM materials had been revised following additional testing and further reassessment by the designer.

Completion Schedule - Acceleration Agreement

Following (i) the introduction of the upstream toe weight (ii) the delays resulting because of the deficiency of GM material in the Traoullomandres, (iii) the additionally instructed works in the river bed due to the weak bands and (iv) the introduction of the downstream toe weight it became quite evident that it would not be possible to store the winter water of 1987/88. An award of a two month extension of time was made to the Contractor bringing the impounding date to the 5th of November 1987 whilst a preliminary assessment of the Resident Engineer indicated a minimum of further delay of six months. It should be noted that the Contractor's assessment of delays (which he did not consider to be his default) was eighteen months.

In order to safeguard the storage of the winter water of 1987/88 the Contractor was asked to submit a proposal to accelerate the works. This was done and following negotiations with the Ministerial Committee for Tenders a verbal agreement was reached with the Minister of Finance on the 22nd December 1986 for an amount of CE1,300,000. The Contractor has activated a

number of acceleration measures (i.e. extended shift working, hire of local plant) whilst waiting for more plant from abroad.

It is worth noting that by the 31st of December 1986, 58.4% (852 days) of the extended contract period of 1460 days had elapsed whilst valuation rise 53% of the "foreseen works" were completed.

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, 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 flowmeters for the 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 watersupply, 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

STAFF

Managing Team

- Mr K C Hassabis, Asst Director WDD continued to practice his duties as Project Manager of the Main Conveyor and Irrigation Net Works.
- Dr C A Christodoulou, Principal Water Engineer WDD has continued to practice his duties as Project Manager for Kouris Dam.
- Mr D M Patsalides, Executive Engineer I, has continued to practice his duties as Deputy Project Manager (Eng) while Mr A Ioannou, Agricultural Officer I, Department of Agriculture, has continued to practice his duties as Deputy Project Manager (Agr.).

Supervisory Staff

The appropriate supervisory staff consisting of engineers, technicians (surveyors, laboratory technicians etc) have been transferred from Headquarters and Vasilikos Pendaskinos Project to SCP.

CONSULTING ENGINEERS

Sir William Halcrow and partners, in association with Balfours continued their duties in connection with the review of the irrigation design of the extended Irrigation area. Tenders for contract C5A, Balancing Reservoirs and Contract

C5(C), Central Distribution Point Reservoirs were evaluated and tender documents for Contract C6, Pumping Stations (Civil Works) were issued and returned during the year. The evaluation process for Contract S3 Pumping Plant for Kokkinokhoria, continued, and the Consulting Engineer's Addendum to their Tender Evaluation report was issued.

Site supervision of Contract C2/C3, the Main conveyor continued and supervision of contract C4, Akhna Dam commenced with the award of the Contract to Messrs Iacovou Bros of Larnaca on 4th June, 1986.

Administration of the supply contracts continued.

Following a departmental request the Consulting Engineers appointed Messers Haggie Patterson of Birmingham as Inspecting Engineer to investigate and report on the test failures of asbestos-cement pipes supplied by "AMIANITIT" of Greece undercontract S4(a). Inspection was duly undertaken and a report was issued.

FURTHER STUDIES

- Water Entity

Tenders have been received from prequalified tenders for technical and financial proposals for the establishment, allocation and management of water resources in Cyprus. The technical aspects of the tenders have been evaluated and it is hoped that the financial aspect will be evaluated soon.

- Water Abstruction and Well Inventory in Kokkinokhoria Area

The field work for the inventory has been completed. Some 6,500 boreholes have been surveyed and their owners have been questioned. The survey has covered the villages of Xylotymbou, Xylophaghou, Ormidhia, Akhna, Avgorou, Phrenaros, Dherinia, Sotira, Liopetri and part of the villages of Ayia Napa and Paralimni.

About 80 separate information items have been collected for each well covering landuse, pumping plant details, method of irrigation and water applied. All the data are being computerized and already the information for four village boundaries has been put on computer.

From the tentative overall assessment it appears that the total groundwater extraction has remained to about the same level as in 1980 but the number of wells has doubled. The hourly yield of the wells, has been reduced considerably.

On the basis of this work, detail analysis of the groundwater availability is being made for each of the Irrigation Blocks now under design. By the end of the year a report was ready for the Irrigation block 1 and a summary report for the survey was under preparation.

- Design of Kokkinokhoria Irrigation Network

Re-design of works

Following the unanimous decision of the Policy and Co-Ordination Committee the Water Development proceeded with the redesign of the distribution system by reducing the number of CDPs from 48 to 15. This modification is expected, based on estimation by the Consultants, to reduce the cost of the distribution system by at least one million pounds.

The redesign were carried out by a team of weight engineers of the Department and two Engineers from the Consultants working on a regular and overtime basis. Redesigns were carried out on the extended area of 9000 ha and included the following

- Design of 22 Distribution Systems
- Design and preparation plan of four Balancing Reservoirs
- Design and preparation of plan of 15 No. of CDP reservoirs
- Design and preparation of plans of four No. Pumping Stations
- Design and preparation of plans of 15 No. CDP Pumping Stations
- Preparation of contract documents the tendering of CDP Reservoirs, Balancing Reservoirs of CDP Stations, the main Pumping Station.

- Model Studies

Upon decision of the Project Management Committee the departments of Water Development and Agriculture (their District Offices) undertook to carry out for each block a model study of the existing land ownership and water use. This would enable designers to modify the distribution system so that supply of water is made to ownership and not to plot thus making the system more operational and to gether with the water resources investigation carried out in parallel by the WDD would enable the Department to submit proposals for the method of groundwater utilization within the Southern Conveyor Project.

- Final Design of the Distribution Network

As a result of the above changes the distribution system layout had to be modified. The designs are at present carried out by two Engineers (one Distribution Design Engineer and one Pipeline Engineer) assisted by a group of Surveyors and Technicians. By the end of the year two distribution systems in two block areas were finalized and handed over to the Construction Division for implementation.

The design works are progressing at a slower rate than originally anticipated and unless new staff is recruited there is danger of not completing the work in accordance with the original programs.

PANEL OF EXPERTS

The members of the panel for Akhna Dam are:

Prof. E Nonveiller
Dr J Newberry
Mr A A Abidi
Mr C A Konteadis

During the reporting period the panel of Experts met twice. The first visit took place on 10th of March and the second took place on 11th September, 1986.

FOREIGN FINANCING

Phase I of the Southern Conveyor Project is financed by four foreing financiers as follows:

- \$27,000,000 from the International Bank for Reconstruction and Development (IBRD) to cover 40% of the cost of construction of Kouris Dam, 64% of the cost for construction of Akhna Dam, Consultant's fees (100%) and cost for the supply of Office Equipment (95%).

- KD2,940,000 from the Kuwait Fund for Arab Economic Development (KFAED) to meet expenditure for the supply of pipes and fittings for Kokkinokhoria Irrigation Network and the Construction of Kokkinokhoria Irrigation Network and Pumping Stations. Supply contracts are financed at a rate ranging between 50% to 100% whilst construction contracts are financed at the rate of 50%.
- ECU's30,200,000 for the European Investment Bank (EIB) to meet 60% of the cost for the construction of Kouris Dam.
- DM78,074,566 from Consortium of French banks to meet 85% of the Contract price for the supply of ductile pipes and fittings for the Main Conveyor.

During 1986 disbursements were made by IBRD and the consortium of French Banks only. The disbursement situation for each loan at the end of 1986 is given below

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's30,200,000	ECU's4,738,412	ECU's25,461,588
Consortium of French banks	DM78,074,566	DM68,263,887	DM9,810,679

PROGRESS ON PROJECT IMPLEMENTATION

Kouris Dam - Contract C1

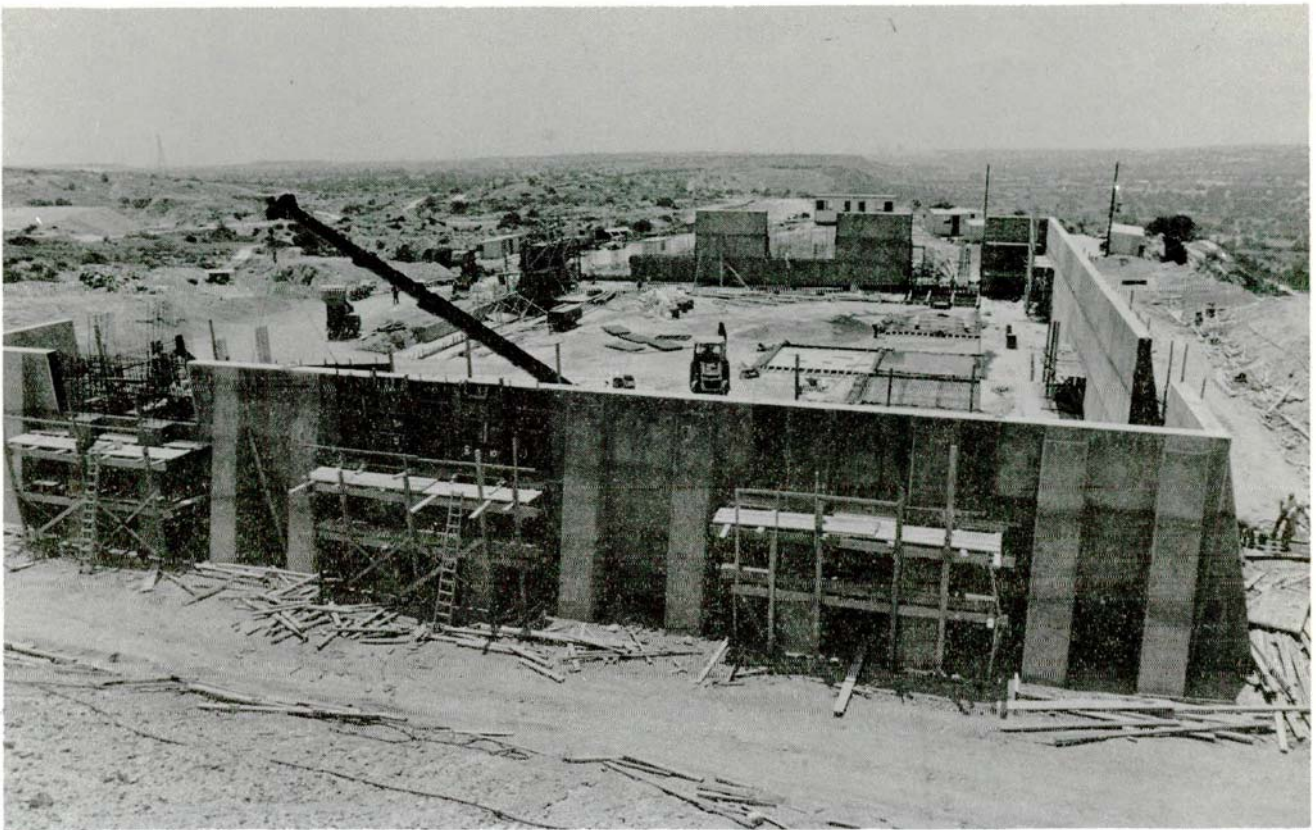
Details on progress for Kouris Dam are given in chapter VIII/III of this report.

Main Conveyor (Kouris to Akhna) - Contract C2/C3

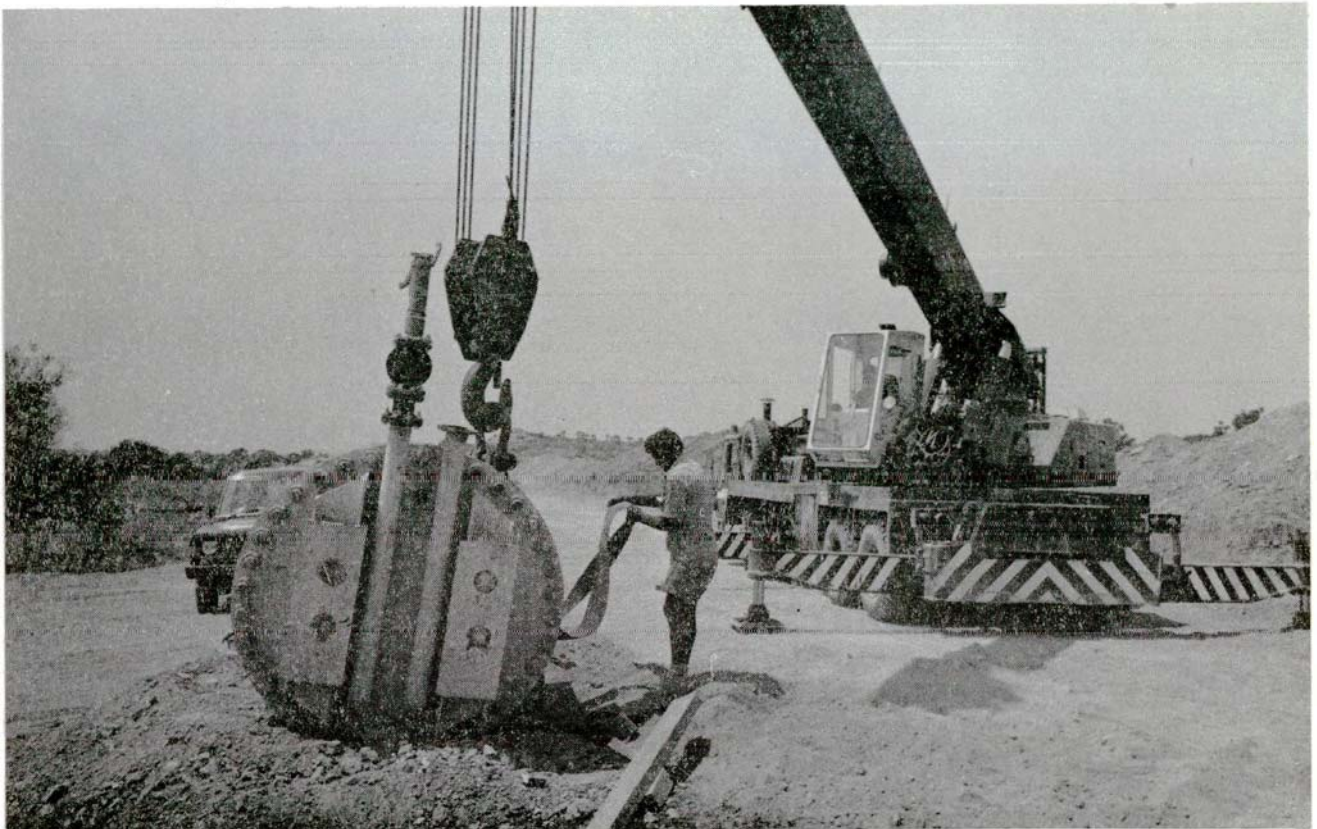
Contractor : Cybarco-Shand J.V. (Cyprus-UK)
 Commencement Date : 17th October, 1985
 Completion Date : 4th February, 1988
 Contract Price : £6,157,031

Following a lengthy mobilization period the Contractor commenced construction of the permanent works with topsoil stripping, pipe stringing and trench excavation. Pipelaying started in April 1986 originally by two separate gangs working west and east respectively from a point approximately half way along Pipeline 3 near Maroni. In order to expedite pipelaying at a later stage a third gang was introduced. By the end of the year a total of 47,545 metres of pipe had been laid by all three gangs which represents 43% of the whole length of the Conveyor. Despite the introduction of a third gang, very little improvement had been achieved mainly because of the following

- extensive plant breakdowns
- considerable quantities of hard material in the trench
- restrictions on access in the SBA (Dhekelia)



Vasilikos Balancing Reservoir under construction
W.D.D. Photo C98EN-21 (2.7.86)



Tasting flange being installed at chainage 3/13988
W.D.D. Photo D13EN-12 (20.8.86)

Pipe testing followed the pipelaying and progressed well until 27th October, 1986 when some test failures seriously disrupted work and the need to carry out remedial works and retesting significantly delayed progress.

The construction of trench structures also progressed well until 29th October, 1986 when serious problems with flange fittings supplied by Pont -a- Mousson resulted to suspension of all major on-line chamber construction.

A summary of the progress on all pipelines upto the end of the year is given below:

<u>Description</u>	<u>Total Meters To Date</u>	<u>% of Work Completed</u>
Pipe Stringing	50 450	46
Trench Excavation ...	48 980	44
Pipelaying	47 545	43
Hydraulic Testing ...	29 640	27
Final Backfilling ...	22 570	20
Reinstatement	8 330	8

- Major Structures

Excavation of the tunnel proceeded without any serious problem being encountered and a breakthrough with the AM75 Alpine Miner was achieved on the 26th November 1986. A total of 560 metres of tunnel, of 16.5 m² excavated cross section was completed in 3 months. Trimming of the tunnel in readiness for concrete lining then commenced including excavation of the Side drain.

Construction of Break Pressure Tank No. 1 commenced and progressed well so that by the end of the year all the concrete works were substantially complete. Excavation for BPT2 was also completed so that structural concrete works are expected to commence soon.

Earth works on the access roads to BPT1, BPT2 and the Tunnel were also substantially completed and ready for surfacing.

- Akhna Dam

Contractor : Iacovou Bros (Constructions) Ltd
 Commencement date : 18th June, 1986
 Completion date : 16th December, 1987
 Contract Price : £1,312,980

Following the signature of the contract on the 18th of June work on site commenced on the 28th July, 1986. Excavation and placing of the main earthfill commenced. Despite some difficulties encountered by the contractor in obtaining suitable drainage material, the placing of instrumentation itself did not constitute a constraint and the first face was completed without complication by 19th December, 1986.

Work on the draw-off culvert also commenced and despite some problems over availability of the correct waterstop by the end of the year work was 12 percent complete and running some six weeks behind programme. It is hoped that some of this slippage can be recovered after the waterstop is received but this activity will continue to be on the critical path.

The general progress for the construction of Akhna Dam can be summarised as follows:

- Formation excavation (on programme) main excavation:
Substantially complete core trench, including lateral cut offs: about 65%
- Draw off works (-6 weeks)
excavation : about 40%
concrete to culvert : about 12%
pipework : Nil
- Main embankment (+ 10 weeks)
nominal core zone : 31%
shoulders : 50%
- Drains and filters : about 15% (on programme)
- Face protection : material stockpiled on site
- Instrumentation : first face, about 50%, commissioned (on programme)
- Spillway : Nil
- Famagusta Pipeline Diversion (-6 weeks)
excavation : 40%
laying : 18%
structures : Nil
- Access Roads (On programme)
main access : foundation complete
pump station access : Nil
right bank gravel road : Nil
- Kokkinokhoria Main Distribution Network - Contract C5

Tenders for Contract C5(A), Balancing Reservoirs, C5(C1) and C5(C2), Central Distribution Point Reservoirs, were received on 9th October. Tenders for the whole of the works, from those prequalified to submit ranged from £3,146,021 to £4,981,967. The tenders were evaluated and award for the combination of all three contracts was made to Joannou & Paraskevaides Ltd on 17th December in the amount of £3,146,021. This award was challenged, however, in the courts by one tenderer and the outcome was still awaited at the end of the year.

- Following the decision of the government of Cyprus and the approval of KFAED the WDD undertook the construction of Kokkinokhoria Irrigation Main Network (Contract C5(b)). This contract includes the construction of the main network of Kokkinokhoria Irrigation System which is made out of ductile iron and asbestos/cement pipelines of a total length of about 30 km ranging in diameters from 300 mm to 1000 mm.

In June, 1986 WDD commenced mobilization and invited tenders from local sub-contractors for trench excavation, supply of sand from suitable for pipebedding, hiring of machinery etc. In mid-July actual work started in pipelines No. 2, 4, 8, 9 and 10. In November work started also on pipelines No. 1, 3, 6 and 7. Due to extension failures on pipeline No. 9 (300 mm AMIANTIT), pipeline No. 8 (400 mm AMIANTIT) and pipeline No.4 (600mm AMIANTIT) it became necessary to stop the pipelaying of AMIANTIT pipes and remove from trench all AMIANTIT pipes that were laid.

For all other pipelines, ETERNIT pipes (from Khrysokhou Project) were provided so as not to hold back the works. In spite of the problems faced with AMIANTIT pipes by the end of the year the work was substantially completed for pipelines No. 1, 2, 4 and 8 and was totally completed for pipeline No. 9. It should be also noted that the works are without exception ahead of programme and that the expenditure is well within the budgeted amount.

SUPPLY CONTRACTS

- Pipes and Fittings for the Main Conveyor: Contract S1(b)

Contract & Manufacturer : Pont -a- Mousson (France)
Commencement date : 22nd August, 1985
Completion date : 22nd August, 1987
Contract Price : £19,382,266

Eleven shipments of pipes and fittings arrived during the year and were delivered at the Water Development Department's Storage areas of ~~Ayios~~ Ayios Athanasios (Limassol), Larnaca and Ormedhia, bringing the totals to 13 shipments and 61,829 tonnes. Some priority items were additionally supplied by airfreight. During May, 1986 this contract was extended to include the supply and delivery of £1,275,190 worth of pipes and fittings for the Khrysokhou Irrigation Project.

The third, fourth and fifth co-ordination meetings attended by representatives of the Water Development, the Supply Contractor, the Installation Contractor and the Consulting Engineers, were held on 5th June, 4th September and 3rd December.

- Valves for the Main Conveyor Contract S2

Contractor : Caramondani Bros Ltd (Nicosia)
Manufacturer : Glenfield (UK)
Commencement date : 8th May, 1985
Completion Date : 8th January, 1987
Contract Price : £664,454

Submission and approval of valve drawings continued. Four shipment of valves were made during the year arriving at Limassol on 1st April, 14th June, 2nd and 30th September and subsequently delivered to the storage areas where inspection and taking over proceeded. Arrangements for further valve orders are in hand.

- Pumping Plant for Kokkinokhoria - Contract S3

Design and tender documents were completed and the Tenders were released on the 16th of April. Evaluation of 26 tenders out of 24 tenderers proceeded and the Consulting Engineers' Tender Evaluation was issued on 18th September. Further clarifications were requested and received from tenderers and discussion between the Water Development and the Consulting Engineer took place. The consulting Engineer's Addendum to their Tender Evaluation Report was issued on 21st November. Validity of tenders was extended to 19th January, 1987.

- Pipes and Fittings for Kokkinokhoria Irrigation Network

Contract No. S4(a) Asbestos Cement Pipes

Contractor and Manufacturer : AMIANTIT S.A. (Greece)
Commencement date : 14th January, 1986
Completion date : 14th January, 1987
Contract Price : £890,456

The first two consignments of pipes, amounting to 50% of the total quantity were delivered to the Ormidhia storage area. Pipelaying by force account commenced in July but the high number of test failures in the field (17 failures with no successful tests gave rise to serious doubts about the quality of the pipes delivered and pipelaying stopped. Testing by the Cyprus Bureau of standards commenced using the facilities (not the staff) of Cyprus Pipe Industries.

In view of the abnormally high incidence of field and test - failures the Consulting Engineers appointed the firm of Haggie Patterson from Birmingham, U.K. as Independed Inspecting Engineers to inspect and report on the manufacture and testing of pipes supplied by AMIANTIT. Their report concluded that the design and manufacture of the pipes were such that the pipes were insufficiently robust to withstand handling and transport from Greece to site. A proportion of these pipes, estimated at arround 10% had apparently suffered damage not detectable visually, but which led to failures under test conditions in the field.

The Contractor put forward rectifying proposals which, after series of meetings with the Water Development Department and the Consulting Engineers, were accepted in a modified form. The proposals involved testing every pipe below 700 mm diameter already delivered in Cyprus in a purpose made hydraulic press at Ormidhia Storage Area, and revising the design for future deliveries. Testing at Ormidhia is currently in progress, with a failure rate of 15%.

A consignment of 800 mm dia pipes, sub-contracted to Hellenit failed to meet test requirements at the factory and were rejected. As a result of the test failures described above the Contract is well behind programme.

Contract S4(b) - UPVC Pipes

Contractor and Manufacturer : Kosmo Plast Ltd
Commencement date : 14th January, 1986
Completion date : 14th January, 1988
Contract price : £167,743

Manufacture and delivery of pipes to the Ormidhia Storage area commenced.

Contract S4(C) - Fittings and couplings

Contractor : Phanos N Epiphaniou Ltd (Nicosia)
Manufacturer : Fundiciones, Metalicas S.A. (Spain)
Commencement date : 14th January, 1987
Completion date : 14th January, 1986
Contract Price : £33,889

Three shipments arrived during the year and deliveries were made at Ormidhia Storage area, completing deliveries under this contract.

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 : £176,717

Manufacture of butterfly and gate valves proceeded and the first consignment arrived in late November.

- Contract No. S5(b) - Air Valves

Contractor and
Manufacturer : Guest and Crimes (UK)
Commencement date : 1st November, 1985
Completion date : 1st November, 1987
Contract Price : £44,857

The first consignment of air valves, representing 50% of the requirements of the original irrigation area arrived at Limassol by the end of April and was delivered to the Ormidhia Storage Area in May. A further order was placed on 11th April and valves arrived in Limassol on 30th September, 1986.

- Contract No. S6 - Hydrants for Kokkinokhoria

Correspondence necessary to finalise the design was exchanged with manufacturers, but review of the draft tender document still remains to be completed pending completion of the design of the Irrigation network and consequent changes to quantities.

- Contract No. S7 - Flowmeters for the Main Conveyor

Contractor and
Manufacturer : Bestobell Sparling (UK)
Commencement date : 22nd January, 1986
Completion date : 22nd January, 1987
Contract price : £58,639

Drawings were submitted and approved after clarification and revision by the contractor. Manufacture and testing of the flowmeters commenced and seven out of ten billed arrived in Limassol on 25th September. The remaining three flowmeters were delivered late in November and arrangements are in hand to order two more.

- Contract No. S8 - Telemetry

An outline proposal has been put forward by the Consulting Engineers to revise the draft tender document (1983) in accordance with the latest requirements.

- Contract No. S12 - Fittings for Kokkinokhoria Main Network

Contractor : Phanos N Epiphaniou Ltd (Nicosia)
Manufacturer : Fundiciones Metalicas S.A. (Spain)
Commencement date : 3rd April, 1986
Completion date : 14th August, 1986
Contract Price : £30,585

The fittings arrived in mid-October completing deliveries under this contract.

PROJECT EXPENDITURE

The project expenditure for phase 1 of the project works, including expenditure incurred for the construction of Kouris Dam reached the figure of £40,512,849 out of which £27,519,044 incurred in 1986.

Detail analysis of expenditure incurred is given in table VIII - 2.

SOUTHERN CONVEYOR PROJECT - TABLE VIII - 2

<u>Ser No.</u>	<u>Description</u>	<u>Expenditure in 1986</u> £	<u>Total Expenditure up to 1986</u> £
PART 'A' of the Project-KOURIS DAM			
1	Kouris Dam Construction (Contract C.1).....	4 476 869	11 284 498
2	Supervision/Administration	180 219	360 876
3	Surveys and Investigations (Topography/ Laboratory) by WDD	14 209	108 166
4	Removal and Relocation of CYTA Telecommu- nication network	-	36 256
5	Construction of two water flow gauges on Kouris and Zyghos rivers	-	22 933
6	Removal and Relocation of EAC high voltage transmission lines	7 383	82 383
7	Acquisition of Land	256 120	1 694 661
8	Compensation to individuals	960	960
9	Improvements to the road Lofou-Ayios Therapon	-	3 685
10	Establishment of hydrometeorological Station	2 533	2 533
11	Removal & Relocation of Khalassa village ...	-	65 884
12	'Sogreah' consultancy services (Design/ Supervision Kouris Dam)	79 693	311 216
13	Panel of Experts consultancy services for Kouris and Akhna Dam	12 791	24 792
	Total of part 'A'	£ 5 030 777	£13 998 843
PART 'B' of the Project - MAIN CONVEYOR			
1	Supply of pipes and fittings for the L/ssol By-Pass & EAC Section (Contract S1(a)) ...	-	562 653
2	Supply of pipes and fittings for Main Conveyor (Contract S1(b))	18 389 378	19 899 008
3	Supply of pipes and fittings transferred to Khrysokhou Project (Contract KS4)	(1 238 311)	(1 238 311)

TABLE VIII/IV/2 (con/ed)

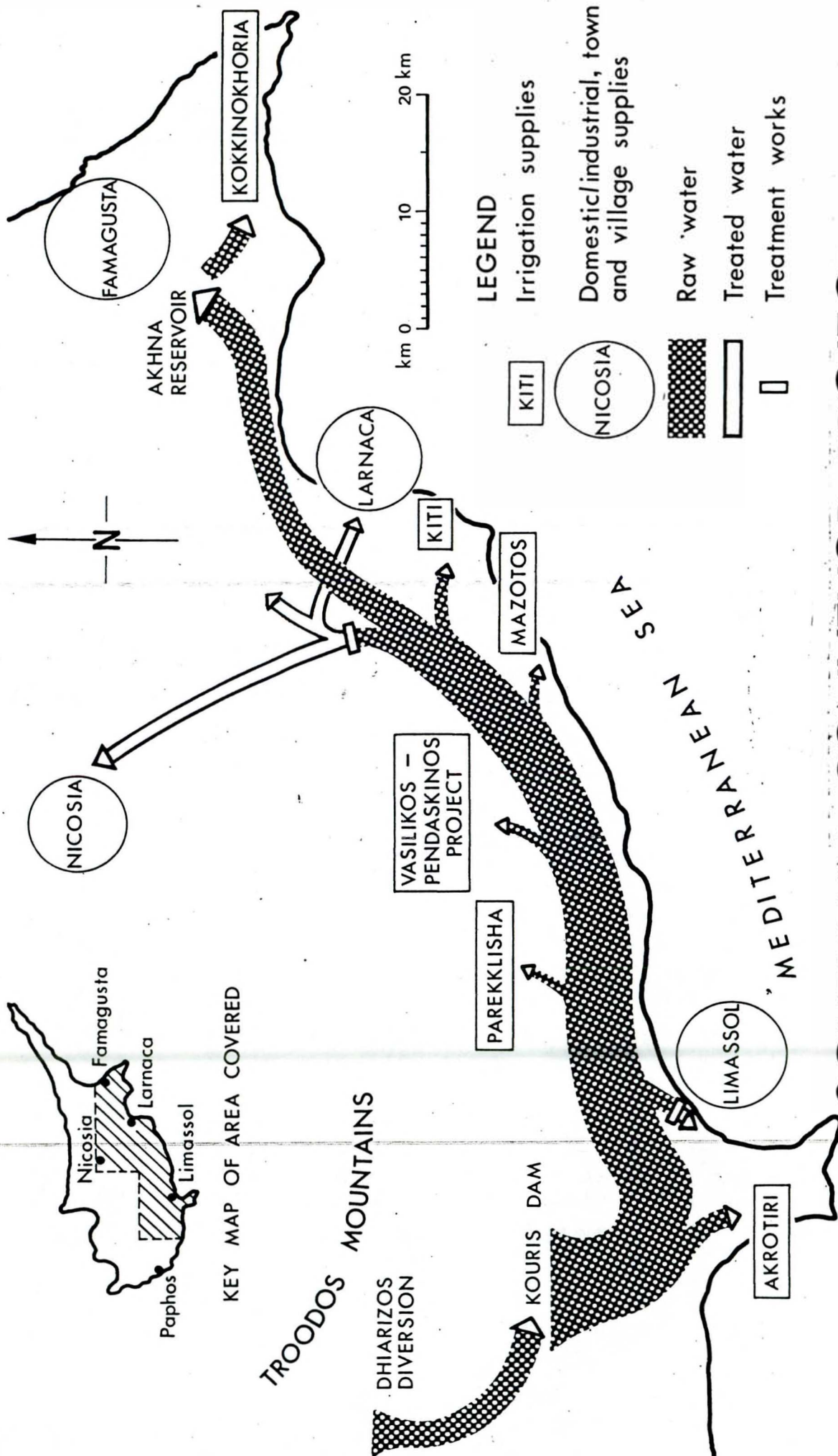
Ser No.	Description	Expenditure in 1986	Total Expenditure up to 1986
4	Supply of valves for Main Conveyor Contract S2)	360 208	360 208
5	Supply of flowmeters for the Main Conveyor (Contract S7)	-	-
6	Preliminary Construction works on the new L'ssol road	-	85 021
7	Construction and laying of Main Conveyor at EAC Section	1 981	117 563
8	Construction and laying of Main Conveyor at Limassol By-Pass Section	28	109 978
9	Construction of Wash-Outs	11 653	11 653
10	Laying of Main Conveyor on two crossings of L'ssol road (Ypsonas trim.)	-	6 000
11	Relocation of EAC high voltage transmission towers in alignment with Main Conveyor (Yermasoyia)	23 116	23 116
12	Construction and Laying of Main Conveyor from Kouris to Akhna (Contract C2/C3)	1 796 151	2 411 854
113	Administration/Supervision of Contract C2/C3	86 365	86 365
14	Construction of Vasilikos (Kalavassos) Balancing Reservoir	232 175	316 885
15	Construction of Limassol Storage Area	2 477	71 146
16	Construction of Larnaca Storage Area	3 013	93 401
17	Construction of Ormidhia Storage Area	347	34 799
18	Administration of Main Conveyer (general) by WDD	11 955	35 916
19	Administration/Management of Storage Areas by WDD	43 112	43 112
20	Surveys and Investigations (Topography/Laboratory) by WDD	43 313	64 417
21	Acquisition of Land for for the Main Conveyor	677 076	949 614
22	"Sir William Halcrow and Partners" Consultancy Services for the Main Conveyor etc	148 092	495 370
Total Part 'B' of the Project		£20 592 129	£24 539 768

TABLE VIII/IV/2 (Con/ed)

Ser No.	Description	Expenditure in 1986	Total Expenditure up to 1986
PART 'C' of the Project-Akhna Dam			
1	Construction of Akhna Dam (Contract C4)	378 739	378 739
2	Supervision/Administration	12 861	12 861
3	Filling of Existing Boreholes & Wells in the Reservoir with clay	2 462	2 462
4	"British Hydromechanics Research Association" Consultancy Services for the Akhna Dam Hydraulic Model testing	-	12 905
5	Acquisition of Land	43 927	43 927
Total part 'C' of the Project		£437 989	£450 894
PART 'D' of the Project - Kokkinokhoria Irrigation Distribution System			
1	Supply of Pumps and Ancillary equipment for KIA Networks (Contract S3)	-	-
2	Supply of AC Pipes for KIA Networks from CDP1. Council of Minister's decision 26.776 of 13.2.86	305 323	305 323
3	Supply of AC Pipes and fittings (Contract S4(a))	365 317	365 317
4	Supply of UPVC Pipes and fittings (Contract S4(b))	26 292	26 292
5	Supply of C.I. Couplings and Fittings (Contract S4(a))	25 481	25 481
6	Supply of Butterfly, gate and Float Valves (Contract S5(a))	102 198	120 672
7	Supply of Air Valves (Contract S5(b)).....	37 556	37 556
8	Supply of Hydrants (Contract S6)	-	-
9	Supply of Couplings and Fittings (Cont. S12)	27 372	27 372
10	Construction of 4 Balancing Reservoirs (Contract C5A)	-	-
11	Construction of KIA Main Irrigation Networks by force account	452 747	452 747
12	Design - Redesign of KIA Main Irrigation Networks by WDD	4 525	4 525
13	Construction of 19 Pumping Stations (Contract C6)	-	-
14	Construction of KIA Secondary Irrigation Networks by force Account	42 908	42 908
15	Land Consolidation (Preliminary Expences) ..	5 350	15 776
Total part 'D' of Project		£1 395 069	£1 423 969

TABLE VIII/IV/2 (Con/ed)

<u>Ser No.</u>	<u>Description</u>	<u>Expenditure in 1986</u>	<u>Total Expenditure up to 1986</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	10 752	14 475
	Total of Part 'E' of the project	<u>£10 752</u>	<u>£14 475</u>
	Part 'F' of the project - Central Control System (Contract S8)	-	-
	Part 'G' of the Project - Institutional Restructuring - Preparatory Engineering work		
1	"N.G. SCHLZ" of California USA Consultancy Services	-	5 577
	Total part "G" of the Project	<u>-</u>	<u>5 577</u>
	Part 'H' of the Project - Buildings and Equipment		
1	Purchase of laboratory Equipment (for Kouris Dam)	CR (59)	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	35 475
5	Purchase of one 'Crawler Rig and Compressor'	8 840	8 840
6	Purchase of Radio-telecommunication Equipment for Kouris Dam	2 207	4 818
7	Reinforcement of Electricity Network at HQrs Nicosia by EMS	852	852
8	Purchase of furniture and fittings for the Micro-Computers at Nicosia HQrs	1 058	1 058
9	Supply of Electricity to the site selected for the erection of Offices and Stores at Ormidhia	3 955	3 955
	Total Part 'H' of Project	<u>£52 328</u>	<u>£79 323</u>
	Total of Phase I	<u>£27 519 044</u>	<u>£40 512 849</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 & Pumping Station and 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 35 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 winter season 1985-1986 was again unsatisfactory and had an adverse effect on the river flows. Consequently, the volume of water impounded in the dams was very small. Due to the low rainfall, the recharge of the aquifers was also poor which aggravated further the yield of boreholes. Nevertheless, the water supply of the towns, especially that of Nicosia and Larnaca towns which depend mainly on surface water, was maintained at satisfactory levels due to the increased quantities which could be made available from Kalavassos Dam which came on stream in April 1985 and the extended Khirokitia Water Treatment Works. Despite the increased capacity of the Treatment Works problems were encountered due to the decrease of the conveyance capacity (19,500m³/day) of the Larnaca-Famagusta main conveyor and restrictions on the supply of Larnaca Town had to be imposed during the period April-December.

The water supply of Nicosia Town was augmented this year by 3.414MCM from Kornos Treatment Works which was put into operation early in the year under review.

A significant contribution was also the production of the boreholes of the 1982/84 emergency schemes which in 1986 was 2.371MCM.

A scheme which was introduced in 1982 for subsidizing the drilling of private boreholes for the irrigation of gardens and other secondary uses, continued during 1986. This scheme covers consumers in the areas of supply of Nicosia, Limassol and Larnaca water boards and provided for a £50 subsidy for new boreholes.

A total of 2,775 applications were received by the end of the year under review, of which 2,236 were approved and the

subsidy was paid to 1,450 applicants totalling £72,500. The total number of private boreholes subsidized 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

The major problem of the town is the shortage of water. Nevertheless, the town enjoyed a satisfactory supply due to the quantities which were made available during the year from Kornos Treatment Works which was put in operation in January 1986. Due to the limited quantities of water impounded in Lefkara and Dhypotamos dams, which are the sources of raw water to Kornos Treatment Works, the water supply demand of Nicosia Town could not be fully met and the available quantity of water had to be rationed to suffice till the end of the year. Restrictions on the water supply of the town were imposed from 16.4.1986-1.5.1986 and 16.6.-4.10.1986.

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 except for a limited number of consumers at high places where the supply was interrupted for some hours a day during the summer months.

Larnaca Town

The water supply of the town is supplemented from the Central Water Supply System. Despite the augmentation from the Central Water Supply System the water supply demand could not be met and restrictions on the supply were imposed from April-December. The total quantity of water supplied to the town from this system

during 1986 was 2.801MCM, which was 0.008MCM greater than that of 1985.

Paphos Town

The town experienced a water shortage problem during the summer months and restrictions on the supply were imposed in August. The water supply of the town was supplemented from the Paphos Lower Villages Water Supply Scheme with a quantity of 55,435m³ of water.

URBAN WATER SUPPLY IN CYPRUS

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

Table IX-2
STATISTICAL DATA ON URBAN AS OVER THE LAST 15 YEARS

Year	Number at end of year	Consumers* Increase	Input into System (at Service Reservoir Outlets)
%	m	**	
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

* 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

Year	Number at end of year	ConsumersX Increase %	Input into System (at Service Reservoir Outlets)	m	X X
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		

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

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 059X
1981	4 921	11.5	1 200 597X
1982	5 602	13.8	1 247 972X
1983	6 155	9.9	1 293 881X
1984	6 685	7.9	1 434 666X
1985	7 306	8.5	1 535 789X
1986	8 048	10.16	1 759 244X

X 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 many years now 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 is not known. Nevertheless, it is estimated that the 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. The seasonal variation in demand would push this figure to about 45,500m³ immediately upon the lifting of restrictions during the summer months, with single day maximum peaks as high as 49,800m³. This assumes an average daily consumption of 700 l/day per consumer meter.

However, the above estimated demands may not be realistic. 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 by the Nicosia Water Board in recent years have depressed the water supply demand of the consumers. The theoretical unrestricted demand given above may therefore take a few years of unrestricted supply to develop.

Sources and Production

The main water supply sources of Nicosia town and their production over the years 1982 to 1986 are given in Table IX-3.

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

Source	1982	1983	1984	1985	1986
1 Morphou Bay Scheme	3.198	3.230	3.486	3.280	2.977
2 Dhikomo-Sykhari	0.198	0.112	NIL	NIL	NIL
3 Paliometokho-Kokkinotrimithia-Dhenia-Airport	0.565	0.466	0.451	0.431	0.286
4 Tseri	0.812	0.788	0.763	0.686	0.598
5 Dhali	0.017	NIL	NIL	NIL	NIL
6 Peristerona-Akaki	1.040	0.936	0.906	1.087	0.788
7 Laxia-Athalassa-Makedonitissa	0.268	0.358	0.232	0.142	0.182
8 Nicosia Water Commission Sources	0.521	0.453	0.390	0.419	0.199
9 Purchased from Private BH	2.101	1.669	1.277	1.114	1.019
10 Lefkara Dam (CWSS)	0.891	0.042	0.339	2.290	--
11 1982-84 Emergency Schemes					
(a) Stavrovouni	0.277	0.862	1.364	0.849	0.805
(b) Dhenia	0.314	0.389	0.278	0.182	0.186
(c) Dhali-Kattoudhia-Yeri	--	0.276	0.645	0.547	0.533
12 Kornos Treatment Works	--	--	--	0.266	3.414
	10.202	9.581	10.131	11.293	10.987

During 1986, the total quantity of water produced was 10.987MCM of which 9.768MCM came from Government sources 0.199MCM was the yield of the Nicosia Water Commission sources and 1.019MCM was purchased from private boreholes.

Restrictions on Water Supply

Of the total 1986 production of 10.987MCM, 10.435MCM were delivered to Nicosia and 0.622MCM were consumed en route by a number of communities and other consumers connected to the system. The total consumption exceeds total production by 0.070MCM. The difference is attributed to meter inaccuracies and/or the different times at which meter readings are taken.

Compared, therefore, to the estimated theoretical unrestricted demand of 13.80MCM there was a theoretical deficit of 3.36MCM or 24% for the year, and restrictions on the supply had to imposed from 16.4.86-1.5.86 and 16.6.86-4.10.86 which provided for 24 hours supply every 48 hours.

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 3.2 persons per consumer connection, it is estimated that an average supply of 155 l/capita/day or 496 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 1982-1986.

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

Community Served	Consumption in MCM				
	1982	1983	1984	1985	1986
Kokkinotrimithia	0.091	0.082	0.086	0.068	0.022
Mammari-Dhenia	--	--	--	0.037	0.045
Mosphiloti	0.017	0.052	0.049	0.049	0.045
Psevdhas	0.009	0.031	0.018	0.025	0.020
Pyrga	0.006	0.021	0.024	0.026	0.023
Lymbia, Sha, Kornos regional W.S. Scheme	0.018	0.060	0.043	0.042	0.093
Alambra	0.004	0.014	0.021	0.010	0.029
Dhali	--	0.009	0.059	0.047	0.122
Laxia	--	--	--	--	0.111
Various camps industries and miscellaneous consumers	0.049	0.083	0.100	0.157	0.146
Totals	<u>0.194</u>	<u>0.352</u>	<u>0.400</u>	<u>0.461</u>	<u>0.656</u>

New Schemes

Kornos Treatment Works and Pumping Station, which are part of the water supply component of the Vasilikos Pendaskinos Project, Phase II, were put into operation in January 1986.

The construction of the Treatment Works and Pumping Station were undertaken by a private contractor. Work commenced in November 1983 and was completed in December 1985.

The Treatment Works utilizes water from Lefkara Dam, which upto 1985 was the source of raw water of Khirokitia Treatment Works, and Dhypotamos Dam. Water from Lefkara Dam is gravitated to the Works and water from Dhypotamos Dam is boosted via Dhypotamos Pumping Station. Treated water from the works is pumped via Kornos Pumping Station to the balancing Reservoir at Stavrovouni from where it gravitates to Nicosia.

The capacity of Kornos Treatment Works is 32,000m³. The total cost of the Treatment Works and Pumping Station was £2,626,470. The cost of the civil works was £1,398,470 and that of the electromechanical equipment £1,228,000.

Water Supply Prospects

The operation of Kornos Treatment Plant will solve 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 will develop again soon.

The long term solution of the water shortage problem will be 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 to 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 1986 is given in table IX-5.

Table IX-5
NICOSIA WATER SUPPLY
EXPENDITURE AND REVENUE ACCOUNT FOR 1986

Expenditure

Morphou Bay Scheme

	£
Maintenance expenses	--
Electricity.....	196 365
Wages.....	16 800
Miscellaneous expenses.....	300
Total.....	<u>£213 465</u>

Tseri Scheme

Maintenance expenses.....	1 422
Electricity and fuel.....	19 922
Wages.....	17 368
Miscellaneous expenses.....	373
Total.....	<u>£39 085</u>

Peristerona-Akaki Scheme

Maintenance expenses.....	1 303
Electricity and fuel.....	43 749
Wages.....	14 895
Miscellaneous expenses.....	1 440
Total.....	<u>£61 387</u>

Kokkini Trimithia-Paleometokho Installations

Maintenance expenses.....	8 877
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	£
Electricity and fuel.....	32 405
Wages.....	31 656
Miscellaneous expenses.....	9 150
Total	<u>£82 088</u>

Dhali-Laxia Installations

Maintenance expenses	2 169
Electricity	2 716
Wages	488
Miscellaneous expenses	230
Total	<u>£5 603</u>

Maintenance Expenses of Civil Engineering Works

Motor Transport expenses	4 813
Wages	18 041
Purchase of materials & equipment	1 896
Miscellaneous expenses	4 238
Total	<u>£28 988</u>

Purchase of Water from Private Sources £68 549

Yeri-Dhali-Kattoudhia Emergency Scheme

Maintenance expenses	6 476
Electricity and fuel	12 955
Wages	11 381
Miscellaneous expenses	202
Total	<u>£31 014</u>

Pyrga-Stavrovouni Emergency Scheme

Maintenance expenses	7 924
Electricity and fuel	38 785
Wages	10 768
Miscellaneous expenses	2 907
Total	<u>£60 384</u>

Dhypotamos-Lakatamia-Installations

	£
Maintenance expenses	2 029
Electricity	66 749
Wages	13 873
Miscellaneous expenses	1 852
Total	<u>£84 503</u>

Kornos Water Treatment Works and Pumping Station

Maintenance expenses	432
Electricity	34 595

	£
Wages	30 044
Miscellaneous expenses	19 833
Total	<u>£84 904</u>
GRAND TOTAL	£759 970

**Revenue
Revenue Generated**

Value of water delivered to Nicosia Water Board* (@ 16.3 c/m ³)	1 668 380
Value of water delivered directly to other consumers in 1986	130 236
Total value of water delivered in 1986	<u>£1 798 616</u>
Less amount actually collected in 1986 in respect of water delivered in 1986	1 063 332
Amount outstanding on 31.12.86 for water delivered in 1986	728 748
Amount outstanding by 31.12.85	660 228
Less amount collected in 1986 in respect of water delivered before 31.12.85	595 790
Amount outstanding on 31.12.1986 for water delivered before 31.12.85	64 438
Total amount outstanding on 31.12.1986	£793 185
Total amount collected in 1986	£1 659 122

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 deficit for the year 1986 amounts to £173,214. If outstanding payments are not considered as revenue then there is a deficit of £901,962.

* This figure is calculated at the actual rates at which the Water Board is charged. As from 1.3.1982 these rates represent only about 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 Amorti- zation Cost £
Pre-1982 installations	--	1 748 300	Varies	107 760
Vasilikos-Pendaskinos Project Phase I (Dhypotamos Pumping Station and Dhypotamos- Stavrovouni-Lakatamia Pipeline)				
- Civil works	1982	2 650 000	40	246 344
- E & M plant	1982	350 000	15	43 420
1982 Emergency Schemes				
Dhenia	1982	90 000	5	23 138
Stavrovouni	1982	78 000	5	20 053
1983 Emergency Schemes (Pyrga-Stavrovouni- Yeri-Dhali-Kattoudhia) ..				
	1983	75 100	5	19 307
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				
Allocated to Water Supply	1986	(50 000) 25 000	5	6 430
Consultants fees				
48.6% allocated to Water Supply	1986	(990 000) 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 inhabited area of Nicosia. The total quantity of water produced from these sources during 1986 was 104,600m³ which met satisfactorily the demand. The total expenditure, (which is borne by Government) for the operation and maintenance of this system for 1986 was £12,429 as follows:

	£
- Electricity	1 268
- Wages	8 177
- Maintenance	198
- Miscellaneous expenses	2 786
Total	<u>£12 429</u>

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 Chemical Laboratory

Pending the appointment of a Chemist, this laboratory was also supervised by the Khirokitia Chemist.

During the year simple analyses were carried out by the operators for the control of aluminium and chlorine content, turbidity, pH, colour and conductivity.

Being the first year of its establishment, this laboratory is not fully equipped regarding glassware, reagents and other equipment.

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 35 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 Kalavasos 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 1986 was 5,055,000m³ representing 37.4% of the reservoir capacity and by the end of the year the total water storage was 1,072,000m³ representing 7.9% of the reservoir capacity. The total inflow during the year was 6,390,000m³ and the total drawoff including water for irrigation, domestic, recharge and evaporation was 10,376,000m³. The quantity drawn off for domestic purposes was 2,612,993m³.

The water held in storage in the Kalavassos dam reservoir on 1st January, 1986 was 1,696,000m³ representing 9.9% of the reservoir capacity and by the end of the year the total water storage was 945,000m³ representing 5.5% of the reservoir capacity. The draw off quantity for domestic purposes was 4,099,860m³. The total drawoff for domestic and irrigation purposes including evaporation was 4,239,520m³.

The total quantity of water pumped and/or treated from all sources of this scheme during 1986 was 7,578,799m³ (including losses and quantities supplied to Akrounda Phinikaria local irrigators) and the total consumption was 9,360,504m³.

The total demand on the system during 1986 was 7.60MCM compared to 9.36MCM during 1985. The apparent sudden decrease in demand is due to the relief of this scheme from its obligations towards Nicosia Water Supply as a result of the operation of Kornos Treatment Plant.

New Schemes

Phrenaros Scheme. The scheme was designed to supply additional quantities of water to Ayia Napa, Paralimni and Protaras tourist development area. The scheme provides for a pump house near Phrenaros reservoir which is the source of supply, two sets of boosting units of 300m³/hr and 160m³/hr respectively, the installation of a 400mm dia 7,200m long steel pumping main, the construction of a balancing reservoir, at Kokkinokremos, and the installation of a trunk main, 3,000m long, 300mm dia from Kokkinokremos balancing reservoir to Ayia Napa storage tank. The pumping capacity of the scheme is 13,200m³/day and is estimated meet the demand upto the year 2000. The scheme was executed in stages and was completed and put into operation in July 1986.

Sources and Production

The main sources of the Central Water Supply System and their production over the years 1983 to 1986 are given in table IX-7 below.

Table IX-7
CENTRAL WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1983-1986

Source	Year			
	1983	1984	1985	1986
Khirokitia Treat. Works				
- Drawing from Yermasoyia	1.957	2.487	2.646	2.315
- Drawing from Lefkara Dam	1.429	1.618	1.901	0.025
- Drawing from Vasilikos Subsurface Dam	0.001	0.745	0.001	--
- Drawing from Kalavasos Dam	--	--	3.456	3.876
Sub-total Khirokitia Treatment Works	3.387	4.850	8.004	6.216
Vasilikos & Old BHs				
- Vasilikos Sub-surface dam	0.366	--	0.001	--
- Boreholes				
Psematismenos group	0.116(1)	--	--	
Khirokitia group	0.168(2)	0.139(2)	0.081(2)	0.091(2)
Alethriko group	0.093(2)	0.062(2)	0.061(1)	0.069(1)
Sub-total Vasilikos & old boreholes	0.743	0.201	0.143	0.160
Yermasoyia dam (for irrigation)	0.232	0.281	0.290(4)	0.356
1982-83 Emerg. Schemes				
Tokhni	--	--	--	--
Skarinou	0.337(6)	0.345(4)	0.202(4)	0.110(3)
Menoyia	--	--	--	--
Alethriko	0.159(1)	0.245(3)	0.220(3)	0.115(3)
Klavdhia	0.507(5)	0.400(5)	0.365(3)	0.294(5)
Khirokitia	0.123(1)	0.095(1)	0.087(1)	0.065(1)
Anglisidhes	--	0.222(1)	0.235(1)	0.263(1)
Sub-total Emerg. Schemes	1.126	1.307	1.109	0.847
Totals	5.488	6.639	9.546	7.579

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 a decrease of 20.6% in 1986 over the corresponding 1985 figure. (During 1985 a quantity of 2.290MCM was conveyed to Nicosia).

Bulk Consumption

Table IX-8 shows the bulk consumption of the various communities served by the CWSS over the years 1983-86.

Table IX-8
CENTRAL WATER SUPPLY SYSTEM
BULK CONSUMPTION IN MCM PER ANNUM 1983-1986

Community Served	Consumption from CWSS in MCM			
	1983	1984	1985	1986
Nicosia (via Dhypotamos)	0.042	0.339	2.290	--
Larnaca	2.111	2.467	2.793	2.801
Famagusta	0.985	0.986	0.983	0.980
Sub-total Towns	3.138	3.792	6.066	3.781
Western Region Villages				
Pano Lefkara	0.042	0.052	0.076	0.042
Kato Lefkara	0.008	0.009	0.008	0.009
Kato Dhrys	0.008	0.007	0.008	0.006
Vavla	0.008	0.007	0.007	0.006
Alethriko	0.029	0.028	0.026	0.039
Mazotos	0.031	0.041	0.049	0.048
Kivisil	0.021	0.023	0.025	0.024
Tokhni	0.025	0.027	0.030	0.029
Menoyia	0.002	0.005	0.005	0.005
Khirokitia	0.024	0.027	0.019	0.024
Maroni	0.031	0.037	0.039	0.033
Zyyi	0.026	0.028	0.032	0.027
Psematismenos	0.011	0.013	0.011	0.010
Kophinou	--	0.001	0.034	0.063
Alpanda-Anaphotia	0.005	0.033	0.037	0.040
Meneou-Dhromolaxia-Tersephanou ...	0.107	0.239	0.434	0.491
Klavdhia	0.020	0.022	0.036	0.034
KaloKhorio	0.041	0.019	--	0.002
Mari	--	--	--	0.004
Sub-total Western Villages	0.439	0.618	0.876	0.936
Eastern Villages				
Aradippou	0.104	0.231	0.282	0.274
Xylytymbou	0.121	0.117	0.128	0.135
Dherinia	0.137	0.149	0.174	0.180
Avgorou	0.121	0.120	0.130	0.156
Phrenaros	0.014	0.036	0.054	0.039
Livadhia	0.127	0.128	0.134	0.125
Voroklini	0.064	0.070	0.074	0.087
Sotira	0.073	0.088	0.110	0.137
Paralimni	0.247	0.302	0.383	0.462
Ayia Napa	0.255	0.336	0.426	0.475
Kellia	0.025	0.025	0.017	0.024
Troulli	0.036	0.041	0.041	0.041
Aradippou-Livestock area	0.011	0.017	0.001	--
Anzio Camp	0.013	0.027	0.025	0.028
Akhna Forest (Displaced Persons) .	0.097	0.091	0.093	0.098
Pyla	0.008	0.027	0.041	0.098
Ormidhia	--	--	--	0.027
Xylophagou	--	--	--	0.127
Sub-total Eastern Villages	1.453	1.805	2.113	2.513
Irrigators & Minor Consumers	0.305	0.294	0.306	0.368
Grand Total	5.335	6.509	9.361	7.598

Expenditure and Revenue

A statement showing expenditure and revenue of the Central Water Supply System for the year 1986 is shown in table IX-9 below. Operation of the Vasilikos Pendaskinos-First Phase supplying water to Nicosia is not included here as it is included in the accounts of the Nicosia System.

Table IX-9
LARNACA-FAMAGUSTA
CENTRAL WATER SUPPLY SYSTEM

EXPENDITURE AND REVENUE ACCOUNTS FOR 1986

Expenditure

Khirokitia and Lefkara Installations

	£
Electricity	6 368
Wages	51 255
Materials and others	32 988
Total	<u>£90 611</u>

Yermasoyia-Vasilikos Pumping and Maintenance Expenses

Electricity	192 352
Wages	29 205
Materials and others	3 433
Total	<u>£224 990</u>

Pumping and Maintenance Expenses

Electricity	41 257
Wages	32 036
Materials and others	14 580
Total	<u>£87 873</u>

Khirokitia-Lefkara Regional Water Supply Scheme

Electricity	14 580
Maintenance	567
Total	<u>£15 147</u>

Maintenance expenses for Civil Engineering Works

Wages	17 000
Materials and others	6 376
Total	<u>£23 376</u>

Kalavassos Dam and Tokhni Pumping Station Installations

	£
Electricity	29 101
Wages	15 918
Materials and others	894
Total.....	<u>£45 913</u>
GRAND TOTAL	<u>£487 910</u>

REVENUE

Revenue Generated in 1986

Value of water delivered to Larnaca Water Board in 1986	607 819
Value of water delivered to Famagusta area occupied by Turks in 1986	212 712
Value of water delivered to other consumers in 1986 ..	771 177

X Total value of water delivered in 1986	<u>£1 591 708</u>
Less amount actually collected in 1986 in respect of water delivered in 1986	782 460

X Amount outstanding on 31.12.1986 for water delivered in 1986	809 248
XX Amount outstanding on 31.12.1985	1 825 947
Less amount collected in 1986 in respect of water delivered before 31.12.1985	798 741

Amount outstanding by 31.12.85 for water delivered before 31.12.85	<u>1 027 206</u>
--	------------------

XXX Total amount outstanding by 31.12.1986	<u>£1 836 454</u>
--	-------------------

Total amount collected in 1986	<u>£1 581 201</u>
--------------------------------------	-------------------

X Includes an amount of £212,712 representing the value of 980,240m³ of water supplied to Famagusta area occupied by Turks.

XX Includes an amount of £966,370 representing the value of 11,051,619m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1985.

XXX 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.

Notes on expenditure and revenue account of the Central Water Supply System for 1986.

(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 and Lefkara Installations" refers to Khirokitia Treatment Works and Lefkara Dam.

The total quantity of water treated during the year reached 6,216,461m³ and the unit running cost was 1.46 cents/m³.

(c) Expenditure under the heading "Yermasoyia-Vasilikos Pumping and Maintenance Expenses" 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 1986 was 1,006,856m³.

The unit cost of pumping and maintenance was therefore 8.73 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 63,755m³.

(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 mains.

(g) Expenditure under the heading "Kalavastos Dam and Tokhni Pumping Station Installations" refers to the running expenses of four boosters at Tokhni Pumping Station pumping raw water from Kalavastos 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
Khirokitia Treatment Works extension:				
- Civil	1985	136 955	40	12 730
- M & E	1985	112 726	20	12 350
Kalavastos Dam	1985	(6 358 000)		
- 40% charged to W.S.		2 543 200	40	236 420
Kalavastos pipeline	1985	(2 194 000)		
- 40% charged to W.S.		1 633 000	40	151 800
Tokhni Pumping Station:				
- Civil	1985	193 000	40	17 940
- M & E	1985	327 000	20	35 820
- Vehicles for VPP (part)	1985	45 000	5	11 570
Totals		£9 426 988		£979 580

Chemical Laboratory of Khirokitia Water Treatment Works

The Khirokitia Water Treatment Works were commissioned in 1974. For the period 1974-78 the operators at the works carried out some simple chemical tests, (analyses) of the water to check its chlorine content, turbidity, pH and conductivity.

In early 1978 the WDD set up a modern chemical laboratory at Khirokitia Water Treatment Works which was to cater for the needs of the treatment works and to a large extent of WDD in respect of Drinking Water Supplies.

The laboratory is presently staffed with two persons only 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, sulfates, 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 District 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 1986, 1,840 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 monthly, 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	13	21	--	--	20	64	118
February	25	--	16	--	47	74	162
March	--	46	--	35	--	85	166
April	28	--	--	42	--	102	172
May	--	60	16	42	--	90	208
June	--	--	--	--	32	115	147
July	53	--	--	--	--	88	141
August	--	50	--	--	35	96	181
September	--	--	43	30	--	105	178
October	--	24	--	42	--	84	150
November	13	14	16	40	--	63	146
December	23	22	26	--	--	--	71
Total	155	237	117	231	134	966	1 840

TOWN WATER BOARDS

NICOSIA WATER BOARD

Water shortage was again this year the basic problem of this Water Board. Because of the drought, the total quantity of water supplied to the service reservoirs of the Water Board from all sources was by 0.306MCM less than that of 1985, despite the fact that the supply from Kornos Treatment Works was by 0.858MCM greater than the quantity supplied last year from Khirokitia Treatment Works.

The decrease in production, and the increased water supply demand, aggravated further the water shortage problem and therefore restrictions on the supply had to be imposed from 16.4-1.5.86 and 16.6-4.10.86.

During 1986 the Nicosia Water Board set up the Leak Detection and Monitoring System and worked with Thames water 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 first results are expected at the end of the year 1987.

New Schemes

The construction work, for the installation of a trunk main commencing from Lakatamia Reservoir and terminating at Platy Area, east of the town, which commenced in mid 1985 was completed on 31.7.86 at a total cost of £296,682. This trunk main is 6,382m long and consists of 500mm, 450mm, 400mm and 300mm dia. A.C. pipes class 20. The object of this pipeline is to improve the water supply of the Platy area of Eylanja and other areas en route, where an underpressure supply has been observed for the last few years.

Water Supply Data

- Total quantity of water delivered to the service reservoirs or directly into the distribution system	10 434 660m3
- Total quantity of water consumed as registered by area meters (including Nicosia Water Commission).....	10 218 459m3
- Total consumption during 1986 as registered by individual consumers meters in the Greek sector only	5 987 423m3
- Unaccounted for water	22.73%
- Maximum daily summer consumption (Based on area meter readings and including Nicosia Water Commission. Registered on 15.7.1986-restricted supply)	40 359m3
- Total number of consumers on 31.12.85 (Greek sector only)	42 412 no
- Total number of consumers connected in 1986 ...	1 768 no
- Total number of consumers on 31.12.1986	43 984 no
- Average number of consumers during 1986	43 198 no
- Average gross supply per consumer	499 l/day
- Extension of distribution system (100mm, A.C pipes)	4 568m
- Total length of distribution system as at 31.12.1986	545 770m

- Total number of Fire Hydrants installed during 1986 4 no
- Total number of Fire Hydrants installed as on 31.12.1986 1 876 no

From the information available, the quantity of water supplied to the area of Nicosia under Turkish control was 2.514MCM or 24.6% (As registered by area meters).

Limassol Water Board

The Water Board Sources met satisfactorily the water demand and the town enjoyed a satisfactory supply throughout the year 1986.

New Schemes

The improvement of the distribution system and service reservoirs were studied by Consulting Engineers and their report was submitted in 1981. It envisages the construction of two new service reservoirs and the laying of a number of trunk mains within the distribution system for improving its conveyance capacity.

During the year, construction work started for contracts 1 and 2 at a total cost of almost 3 million pounds. These contracts are related with the construction of service reservoirs and distribution trunk mains.

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 provides for the construction of a 500m³ capacity collecting tank, a pump house the installation of 3 no. boosters (one stand-by) of a capacity of 250m³/hr each and the laying of a pumping main, of ductile iron pipes, 400mm in dia and 10,900m long. The scheme was put in hand in January 1985 and almost completed by the end of the year 1986 at a total cost of one million pounds.

Water Supply Data

- Total quantity of water produced from all sources during 1986 8 922 782m³
- Total quantity of water consumed as registered by area meters 8 837 964m³
- Total consumption during 1986 as registered by individual consumers meters 6 737 301m³
- Unaccounted for water (Production/consumption).. 24.49%

- Maximum daily summer consumption (registered by area meters on 25.7.86)	33 478m ³
- Total number of consumers connected in 1986 (new)	1 879 no
- Total number of consumers on 31.12.1985	37 621 no
and on 31.12.1986	39 921 no
- Average number of consumers during 1986	38 771 no
- Average gross supply per consumer	631 l/day
- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C. and P.V.C. pipes).....	31 167m
- Total length of distribution system as at 31.12.86	457 832m
- Total number of Fire Hydrants installed during 1986	52 no
- Total number of Fire Hydrants installed as at 31.12.1986	1 513 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 1986 was 0.980MCM.

Larnaca Water Board

The water supply of this town is supplemented by 85% 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 1986 was 2.801MCM, which is greater by 0.008MCM than that of 1985. The production of the Water Board owned sources was 0.468MCM.

Water Supply Data

- Total quantity of water produced from all sources during 1986	3 268 503m ³
- Total quantity of water delivered from the service reservoirs or directly into the distribution system (Reservoir Outlet).....	3 154 610m ³
- Total quantity of water consumed as registered by area meters	3 208 960m ³
- Total consumption during 1986 as registered by individual consumers meters	2 652 565m ³
- Unaccounted for water (Production/Consumption)	18.85%

- Maximum daily summer consumption (Based on area meter readings registered on 4.8.86)	14 110m ³
- Total number of consumers connected in 1986 (483 consumers were disconnected)	945 no
- Total number of consumers on 31.12.1985	17 979 no
and on 31.12.1986	18 441 no
- Average number of consumers during 1986	18 210 no
- Average gross supply per consumer	492 l/day
- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C.pipes)	2 720 m
- Total number of Fire Hydrants installed during 1986	12 no
- Total number of Fire Hydrants installed as at 31.12.1986	790 no

Paphos Water Supply

The water supply of the town is administered by the Municipality. Although the capacity of the Municipality's sources could meet the demand, carrying capacity limitations of the main conveyor pipeline, have necessitated the augmentation of the town's supply from the "Paphos Lower Villages" Government Water Supply Scheme by 55,435m³. Despite this augmentation, the demand during the summer months could not be met and restrictions on the supply were imposed. The restrictions provided for a supply every other day.

Water Supply Data

- Total quantity of water produced from all sources during 1986	1 785 657m ³
- Total quantity delivered en route	26 413m ³
- Total quantity of water delivered to the service reservoir or directly into the distribution system	1 759 244m ³
- Total consumption during 1986 as registered by individual consumers meters	1 244 313m ³
- Unaccounted for water	28.84%
- Average daily summer consumption (July-Sept.) .	4 376m ³
- Total number of consumers connected in 1986 ...	742 no
- Total number of consumers on 31.12.1985	7 306 no
and on 31.12.1986	8 048 no
- Average number of consumers during 1986	7 677 no

- Average gross supply per consumer	628 l/day
- Extension of distribution system (100mm, 150mm, and 200mm A.C. pipes).....	3 149m
- Total length of distribution system as at 31.12.1986	150 743m
- Total number of Fire Hydrants installed during 1986	11 no
- Total number of Fire Hydrants installed as at 31.12.1986	171 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 1986 the following regional schemes were in operation.

Paphos Lower Villages

This scheme supplies water to 21 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.

Due to the drought, the yield of boreholes nos. 57/72 and 56/75 was aggravated further and it became evident early in the year that the water demand could not be met.

A scheme was designed early in the year to connect 3 new successful boreholes which were drilled in Xeropotamos river downstream of the existing ones. The scheme provided for the utilization of boreholes nos. 3/86, 72/85 and 90/85, the installation of steel pumping mains of 250mm, 200mm and 150mm dia, and of a total length of 1,330m, at a total cost of £58,800.

Work for the execution of this scheme commenced on 29.7.1986. By September 1986 the pipework was completed and the boreholes were put into operation on a temporary basis with pumping equipment made available through the workshop of the Department, pending the supply of electricity. The total expenditure incurred by December 1986 was £41,195.

The total expenditure for the operation and maintenance of the scheme was £40,830 and the revenue generated was £42,238. More details on expenditure and revenue are given on table IX-12 below:

The total quantity of water produced during 1986 was 868,807m³ and the total quantity delivered was 767,899m³.

Table IX-12
PAPHOS LOWER VILLAGES REGIONAL WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1986

Expenditure	£
Electricity cost	32 070
Maintenance expenses	8 760
	<hr/>
Total	£40 830
Revenue	
Amount collected for 1986	25 130
Outstanding accounts for 1986	17 108
	<hr/>
Total	£42 238
Outstanding accounts by 31.12.1985	30 660
Less amount collected in 1986	14 113
	<hr/>
Total	£16 547
Total amount outstanding by 31.12.1986	£33 655

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 1986 amounts to £33,990.

Arminou Regional Scheme

This scheme supplies water to eight communities. The source of this scheme is BH 56/72 in Dhiarizos river near Arminou village. The total quantity of water distributed to the eight villages in 1986 was 62,252m³. An additional quantity of 10,773m³ was supplied for irrigation to individuals from Mesana and Kedhares. The total expenditure for the operation and maintenance of this scheme was £17,631 while the revenue generated for the same year was £3,568. More details on expenditure and revenue are given in table IX-13.

Table IX-13
ARMINOU REGIONAL SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1986

Expenditure	£
Electricity cost	10 911
Maintenance expenses	6 720

Total	£17 631
Revenue	
Amount collected for the year 1986	1 425
Amount outstanding for 1986	2 143
Total	£3 568
Outstanding account by 31.12.85	6 159
Less amount collected in 1986	37
Total	£6 122
Total amount outstanding by 31.12.1986	£8 264

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 £13,922.

Timi Water Supply Scheme

This scheme supplies water to Timi village only. The source is BH2821, and the total quantity of water produced during 1986 was 23,031m³.

The total expenditure for the operation and maintenance of the scheme was £1,978 and the revenue generated was £461. The total amount outstanding by 31.12.1986 was £1,184.

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 1986 was 53,542m³ and the total expenditure for the operation and maintenance of the scheme was £5,958.

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, 946 and 933 situated in Yermasoyia River. The total quantity of water distributed during 1986 was 640,623m³. The total cost of the

operation and maintenance of the scheme was £42,716 and the revenue generated for the same year was £83,073.

More details on expenditure and revenue are given on Table IX-14.

Table IX-14
AMATHUS WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1986

Expenditure

	£
Electricity cost	8 512
Maintenance expenses	12 288
Pumping fees (Yermasoyia aquifer)	21 916
Total	<u>£42 716</u>

Revenue

Sale of water	30 489
Connection fees	52 584
Total	<u>£83 073</u>

Moutayiaka Regional Scheme

This scheme supplies water to 10 communities. Two 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 ten communities in 1986 was 466,880m³ as given below:

Villages	Consumption m ³
Ayia Phyla	100 000
Polemidthia National Guard Camp	4 000
Ayios Athanasios	168 260
Moutayiaka	77 480
Ayios Tykhonas	37 040
Parekklisha	52 610
Moni - Moni National Guard Camp	--
Monagroulli	16 160
Armenokhori	7 710
Phinikaria	3 620
Total	<u>466 880m³</u>

The total expenditure for the operation and maintenance of this scheme was £39,523 and the revenue generated was £20,000.

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		27 105
Operation and maintenance		12 418
Total		<u>£39 523</u>
Revenue		
Amount collected in 1986		29 320
Amount outstanding by 31.12.1986		20 680
Total		<u>£50 000</u>
Outstanding amount by 31.12.1985		8 634
Less amount collected in 1986		--
Total amount outstanding for water delivered before 1986		8 634
Total amount outstanding by 31.12.1986		<u>£29 314</u>

Yermasoyia Water Supply Scheme

This scheme supplies water to Yermasoyia village and Potamos tis Yermasoyias with a total population of 5,000 persons during winter and 20,000 persons during summer. This scheme supplies also a number of hotels and other tourist installations in the coastal area of Potamos tis Yermasoyias.

The sources of the scheme are four boreholes, 63/64, 25/72, 72/75 and 107/61 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 1986 was 941,169m³.

The total expenditure for the operation and maintenance of the scheme was £57,200 while the revenue generated was £96,937.

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		23 553
Maintenance		7 049
Pumping fees (Yermasoyia aquifer)		26 598
Total		<u>£57 200</u>

Revenue

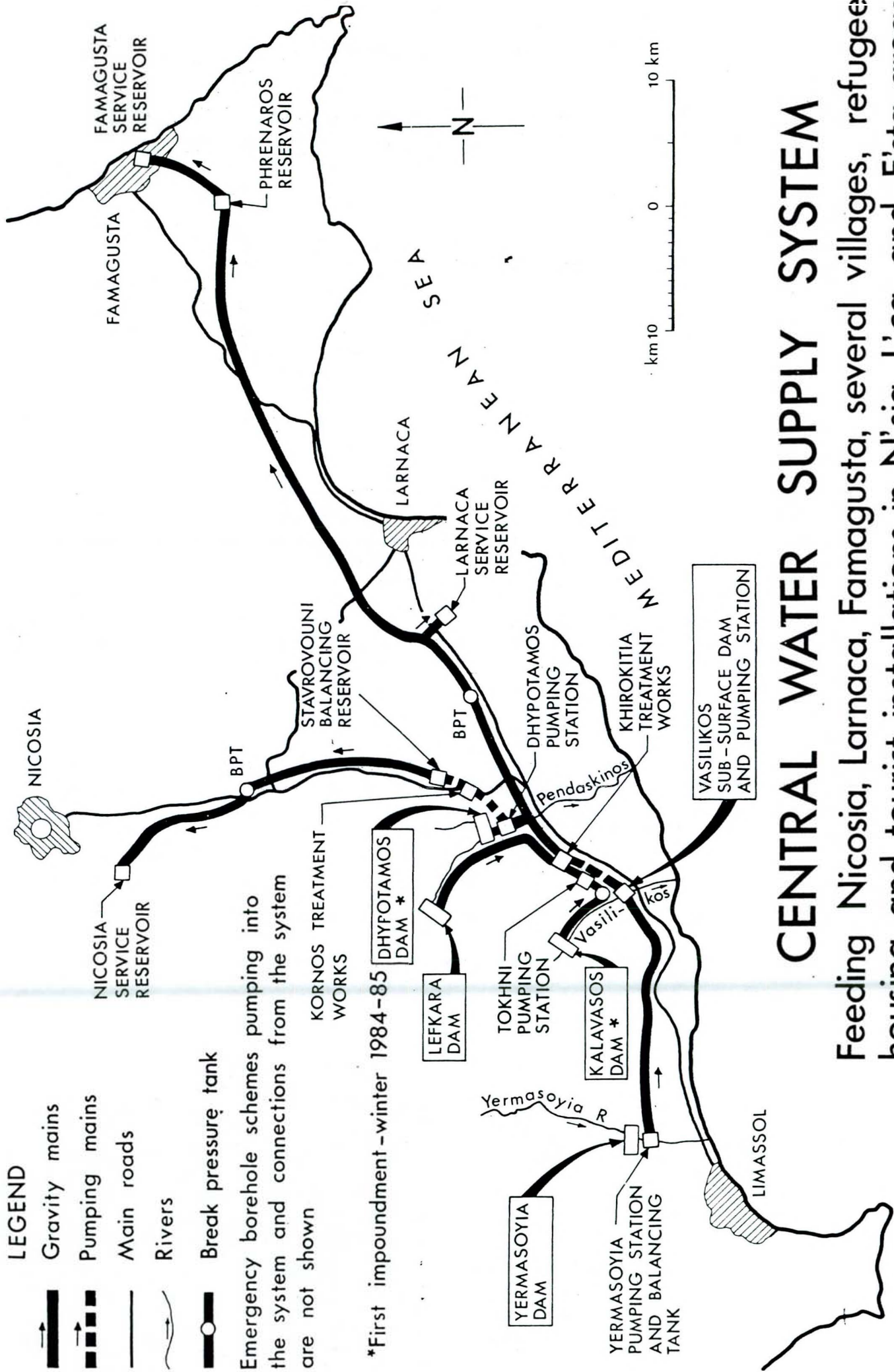
	£
Sale of water	72 844
Connection fees	14 793
Capital expenditure	1 300
Amount outstanding for 1985	8 000
Total	<u>£96 937</u>

Phrenaros New Pumping Scheme

This scheme was put in operation in August, 1986. It supplies additional quantities of water to Ayia Napa, Paralimni and Protaras tourist area. The total quantity of water pumped during 1986 was 65,755m³ and was distributed as follows:

Ayia Napa	33 079m ³
Paralimni & Protaras	32 676m ³
Total	<u>65 755m³</u>

The total expenditure for the operation and maintenance of the scheme during 1986 was £2,326 out of which £2,021, being expenses for the wages of the reservoir and pumping station attendant, is included under the heading "Maintenance Expenses for Civil Engineering Works" of Table IX-9. Revenue generated during the year was £3,025 (65755m³ @ 4.6 cent/m³). The whole amount was outstanding at the end of the year pending the approval of the unit rate of 4.6 cent/m³ by the Council of Ministers.



X DIVISION OF OPERATION AND MAINTENANCE OF IRRIGATION PROJECTS

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 1986 the Division consisted of the following staff:

- 1 Senior Water Engineer - Head
- 2 Topographer Irrigation Engineers Class I
- 1 Executive Engineer II
- 1 Senior Superintendent
- 2 Senior Technicians
- 1 Chief Foreman
- 2 Technician II
- 10 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 recommendations 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.

(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 and Vasilikos-Pendaskinos 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 procedure 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 148.5 MCM, 130.5 MCM for irrigation and domestic water supply and the rest 18.0 MCM for recharge purposes where the commanded area has risen to 17,434 hectars.

Details on the projects and the rate of storage development are given in Drg. No. AG/IR/37 "Cyprus Dam Project and Regional Development" and "progress in Dam Construction".

SUMMARY OF MANAGEMENT, OPERATION AND MAINTENANCE DATA

The overall average precipitation during the hydrological year under review was 435 mm or 84% 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 amounted to 72.285 MCM. From this quantity 32.663 MCM were used for irrigation, 10.606 MCM were used for domestic water supplies, 6.208 MCM were used for ground water recharge and another 0.556 MCM seeped through or below the dams and another 4.252 MCM were lost as evaporation. The rest 18.000 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 17,434 Hectars where an estimated area of 8,449 hectars, has been irrigated, planted with citrus, bananas, deciduous, vegetables, potatoes etc.

Maintenance works totalling £303,333 were carried out on fifty four projects. These include routine maintenance on the dam structures and the distribution systems. For the Government irrigation works a total of £279,803 were spent where for the recharge works an amount of £1,262, £12,828 for Pitsilia and £9,440 for the other.

Government Waterworks

In the year under review, the total quantity of water available from the Government irrigation projects reached the figure of 67.006 MCM.

From this total, a quantity of 45.548 MCM or 68.0% was utilized, 28.734 MCM for irrigation, 10.606 MCM for the domestic water supply and 6.208 MCM for recharge purposes. The rest of the water remained in storage or lost in the form of overflow. In the same period 3.152 MCM were lost in the form of evaporation where another 0.566 MCM were lost as seepage or deep percolation (see Table X-1).

The irrigation water was used to irrigate fully or partly 7,215 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 £1,043,594 being the income from the sale of water at the rates shown on Table X-3a. The operational expenses amounted to £182,750 being the cost for the payment of the watermen, and the bill collectors etc., which amounted to 0.7 cent/CM of water sold or 0.4 cent/CM of water utilized. The maintenance expenses on government projects amounted to £279,803 i.e. 1.0 cent/CM of water sold or 0.6 cent/CM of water utilized. The power expenses amounted to 307,011 i.e. 1.1 cent/CM of water sold or 0.7 cent/CM of water utilized.

The total annual operation, maintenance and power expenses amounted to 769,564 which amounts to 2.8 cent/CM of water sold or 1.7 cent/CM of water utilized.

Evaporation losses from the reservoirs amounted to 3.152 MCM or 5.9% of the total storage capacity available. The seepage losses were estimated at 0.556 MCM or 1.0% of the total storages.

The overall water utilization and land utilization indexes are 68.0% and 62.3% respectively. Of the 28.734 MCM used for irrigation 27.359 MCM were sold at the nominal rates, (95.2%) whereas the rest 1.375 MCM, (4.8%) 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 69 contributory irrigation projects with total capacity 9.556 MCM commanding an area of 5,853 hectares. Nine projects of total capacity 5.296 MCM or 55.4% 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 by the contributory schemes amounted to 5.279 MCM out of which 3.929 MCM were used for the irrigation of 1,234 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.

TABLE X-1 GOVERNMENT IRRIGATION PROJECTS - DATA FOR 1986

Project	Capacity m ³ x10 ³	Area Com. hect.	Water available m ³ x10 ³			Water used m ³ x10 ³			Losses m ³ x10 ³			Utilized Index %		
			In Storage *	From other resourc. **	Total	For irrig.	For DWS rech.	For	Total Evap.	Seep.	Area Irrig. hect.	Water	Land	
1. Argaka	990	314	1 423	321	1 744	1 253	NIL	1 253	85	4	194.2	71.8	61.8	
2. Avia Marina	390	201	388	10	398	220	NIL	220	27	32	31.7	55.3	15.8	
3. Kalopanayiotis	363	60	394	-	394	195	NIL	195	32	150	53.3	49.5	88.8	
4. Kiti	1 610	831	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
5. Lefkara	13 850	82	1 663	-	1 663	79	1 167	1 246	114	17	22.6	74.9	27.6	
6. Potos	860	381	1 217	120	1 337	810	NIL	810	70	112	125.4	48.7	32.9	
7. (i) Polemidhia	3 430	1 585							112	131				
		2 065		3 337	15 732	4 626	3 055	5 512	13 193		2055.0	83.9	100.0	
(ii) Vermasoyia	13 500	10 810							634	NIL				
8. Athalassa	791	41	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL			
9. Paphos:														
(i) Asprokremmos	51 000		22 520						1 918	39				
		5 050		8 940	32 371	17 643	NIL	696	18 339		3837.0	56.6	76.0	
(ii) Mavrokolymbos	2 180		911						100	NIL				
10. Kha-Potami	-	1 567	-	752	752	752	NIL	NIL	752	-	567	100.0	100.0	
11. Khrysokhou Valley	-	2 237	-	496	496	496	NIL	NIL	496	-	126.9	100.0	53.5	
12. Xyliatos	1 220	303	1 503	-	1 503	633	NIL	NIL	633	71	191.4	45.0	62.1	
13. Vasilikos-Fendaskinos														
(i) Kalavassos	17 100	1 071	7 000	-	7 000	1 039	4 100	NIL	5 139	NA	NA	73.4	NA	
(ii) Ohyptomatos	13 700	372	3 611	44	3 611	928	2 284	NIL	3 212	NA	NA	89.0	NA	
Total	120 894	11 581	53 030	14 020	67 006	28 734	10 606	6 208	45 548	3 152	556	7215.5	68.0	62.3

* 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

TABLE X-2 - CROPS AND AREAS IRRIGATED BY GOVERNMENT IRRIGATION PROJECTS

Ser No.	Crop	Area Hectars
1	Citrus	1955.9
2	Bananas	547.1
3	Table Grapes.....	1490.8
4	Deciduous	172.2
5	Vegetables	768.6
6	Potatoes	505.8
7	Cereals	5.4
8	Olives	24.3
9	Ground-Nuts	552.0
10	Seasonal	973.7
11	Tobacco	62.8
12	Avocados	46.3
13	Alfa-Alfa	110.6
	Total	7015.5

TABLE X-3a - GOVERNMENT IRRIGATION PROJECTS AND APPROVED WATER CHARGES IN CENT/M³

Ser. No.	Project	Over-flow	Industrial	Flat Rate
1	Argaka	Free		3.0
2	Ayia Marina	0.5	-	3.0
3	Kalopanayiotis	-	-	3.5
4	Kiti	-	-	-
5	Lefkara	-	-	3.5
6	Pomos	0.5	-	3.0
7	Yermasoyia Polemidhia	-	-	3.5, 3.0
8	Paphos	-	9, 13	4.0
	Mavrokolymbos	-	-	3.5
9	Khrysokhou Valley	-	-	4.0
10	Xyliatos	-	13	3.0
11	Vasilikos-Pendaskinos		15.5, 17	4.5

TABLE X-3b - GOVERNMENT IRRIGATION PROJECTS - UNIT WATER COST INCLUDING CAPITAL AND ANNUAL COSTS

No.		cent/m ³
1	Argaka	8.8
2	Ayia Marina	9.9
3	Kalopanayiotis	29.5
4	Kiti	20.8
5	Lefkara	8.0
6	Pomos	8.2
7	Polemidhia-Yermasoyia	11.1
8	Paphos	14.6
9	Khrysokhou Valley	10.1
10	Xyliatos	19.8
11	Vasilikos-Pendaskinos	17.7

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 used m ³ x10 ³	Water sold m ³ x10 ³	Area Irrig. hect.	Gross Income £	Expenditure £			Net Income £	
									Operat.	Maint.	Total		
1. Argaka	990	314	1 423	321	1 744	991	194.2	29 729	3 343	8 340	2 395	14 078	15 651
2. Ayia Marina	390	261	388	10	398	220	31.7	6 593	875	5 931	1 361	8 167	- 1 514
3. Kalopanayiotis	363	60	394	-	394	195	53.3	6 816	-	2 834	1 722	4 556	2 260
4. Kiti	1 610	831	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
5. Lefkara	13 850	82	1 663	-	1 663	79	22.6	2 784	-	*	1 604	1 604	1 180
6. Potos	860	381	1 217	120	1 337	810	125.4	24 045	3 051	12 241	2 321	17 613	6 432
7. (i) Polemidhia	3 430	2 066	1 585	3 337	15 732	13 193	4 265 2066.0	143 347	67 557	72 158	28 333	168 048	-24 701
(ii) Vermasoyia	13 500	10 810											
8. Athalassa	791	41	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
9. Pafnos:													
(i) Asprokremmos	51 000	5 050	22 520	8 940	32 371	18 339	17 643 3837.0	691 536	217 267	55 315	223 879	496 461	+195 075
(ii) Mavrokolymbos	2 180	567	911	752	752	752	567.0	-	-	-	NIL	NIL	NIL
10. Kha-Fotani	-	237	-	496	496	496	126.9	20 267	14 918	4 943	5 822	25 683	-5 416
11. Khrysokhou Valley	-	2	-	-	-	-	-	-	-	-	-	-	-
12. Xyliatos	1 220	308	1 508	-	1 508	693	191.4	22 162	-	6 496	2 621	9 117	13 045
13. Vasilikos-Pendaskinos													
(i) Kalavassos	17 100	1 071	7 000	-	7 000	5 139	NA	96 315	-	14 492	9 805	24 297	72 018
(ii) Dhyopotamos	13 700	372	3 611	44	3 611	3 212	NA						
Total	120 894	11 581	53 030	14 020	67 006	45 548	27 359 7215.5	1043594		182 750	279 803	769 564	274 030

* These costs are included in the Lefkara dam in the report on DMS.

** River Diversion and/or borehole extraction used in project area.

*** The water was given free of charge.

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	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	Capacity	1000m3	37 890	38 061	37 874	37 874	37 874	89 874	91 094	91 094	120 894	120 894
2	Water available	"	32 003	27 380	28 282	34 408	50 660	35 278	37 441	55 019	68 951	67 006
3	Water utilized for irrigation	"	9 704	9 457	10 847	27 109	19 634	20 858	21 814	23 270	27 137	28 734
4	Water used for DWS	"	2 058	2 856	2 210	2 210	3 356	4 793	3 831	4 429	8 897	10 606
5	Water used for recharge	"	3 323	1 982	1 623	6 579	14 627	2 648	2 999	3 199	3 758	6 208
6	Total water used	"	15 085	14 295	15 426	23 609	37 617	28 299	28 644	30 898	39 702	45 548
7	Evaporation losses	"	2 662	2 688	2 409	2 587	2 618	2 646	3 218	3 789	4 219	3 152
8	Seepage losses	"	359	3 357	1 024	5 087	5 424	973	873	747	946	556
9	Water sold	"	93 485	8 447	12 642	11 748	18 644	19 542	20 101	21 210	23 958	27 359
10	Gross income	£	7 999	101 367	128 281	169 418	253 307	433 214	520 441	688 686	892 599	1043 594
11	Power cost	£	-	-	-	-	117 689	215 577	247 838	355 186	360 785	307 011
12	Operation cost	£	34 500	33 592	55 197	84 496	207 738	119 906	264 039	212 831	217 711	182 750
13	Maintenance cost	£	8 059	8 165	7 202	18 563	50 539	76 131	100 069	160 771	172 166	279 893
14	Total expenditure	£	42 559	41 757	62 399	103 059	258 277	411 614	611 946	728 788	770 662	769 564
15	Net income	£	50 926	59 610	65 882	68 159	-4 838	21 600	-91 505	-40 102	121 927	274 030
16	Area irrigated	Hectars	2 068	1 994	2 687	3 267	4 996	5 286	6 112	6 697	6 837	7 215

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.	From Dam	Total			
1	Akrounda	22	-	8	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	-	29	29	3	9	
6	Kandou	38	-	75	27	-	25	25	2	7	
7	Kotchatis	-1	-	NA	-	NA	-	NA	-	NA	
8*	Kanli	1 100	-	535	-	-	-	-	-	-	
9*	Lefka Narathasa	368	-	174	368	-	331	331	37	59	
10*	Lefka Kafizes	113	-	103	113	-	102	102	11	18	
11	Lymbia	220	-	126	212	-	37	37	102	8	
12	Lythrodontas Upper	32	-	15	32	-	29	29	3	8	
13	Lythrodontas Lower	32	-	15	32	-	29	29	3	15	
14	Mia Milea	330	-	174	-	-	-	-	-	15	
15	Morphou	2 000	-	902	-	-	-	-	-	-	
16	Ovgos	250	-	852	-	-	-	-	-	-	
17	Pakhyamos	43	-	54	7	-	7	7	0.6	18	
18	Palekhori (Kambi)	620	-	134	620	-	394	394	76	85	
19	Pera Pedhi	55	-	26	55	-	44	44	4	8	
20	Petra Upper	10)	-	628)	10	-	9	9	1	4	
21	Petra Lower	25)	-	-	5	-	5	5	0.4	4	
22	Prodromos	110	-	23	43	-	40	40	3	5	
23	Pyrgos	283	-	214	215	-	208	208	23	28	
24	Trimiklini	340	-	87	340	-	313	313	27	54	
25	Kambos	-2	70	36	-	37	-	37	2	24	
26	Chakistra	-2	70	44	-	71	-	71	20	44	
27	Yerakies	-2	70	29	-	25	-	25	2	13	
28	Khrokittia Pond & B/H No.136/78	205	100	47	205	14	168	182	35	47	
Total		7 363	310	4 855	2 338	147	2 485	1 790	1 937	357	469

* Project in Turkish occupied areas

1 River Diversion

2 River Diversion with Dual Pumping Stage

xxx River Diversion or Boreholes 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. Decars in 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. decars
1	Agros Dam & B/H 63/76	72	70	474	46	53	119	99	14	230
2	Akarnou-Ephthagonia Pond	132	-	248	60	-	132	60	21	200
3	Arakapas Dam	128	-	293	100	-	130	100	20	293
4	Arakapas I	192	-	381	84	-	192	84	30	347
5	Ayii Vavatsinias dam	53	-	241	17	-	53	17	8	227
6	Ayii Vavatsinias pond I	55	-	55	17	-	55	17	8	-
7	Ephthagonia I	92	-	201	40	-	68	40	14	-
8	Ephthagonia II	127	-	234	77	-	108	77	24	-
9	Ephthagonia III	65	-	120	3	-	15	3	12	-
10	Kato Mylos pond & B/H 66/76	104	62	401	69	30	134	99	15	228
11	Khandria	70	-	187	23	-	33	23	10	130
12	Kyperounda I	53	-	107	31	-	53	31	8	107
13	Kyperounda II	273	-	690	181	-	213	181	29	474
14	Lagouthera	70	-	199	25	-	70	25	10	39
15	Melini	59	-	147	31	-	58	31	11	128
16	Agridhia	59	-	123	27	-	50	27	9	100
17	Pelendria pond & B/H 53/76	123	160	642	54	97	189	151	16	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	-	55	55	55	-	302
20	Polystypos B/H 21/77	-	15	84	-	14	14	14	-	84
21	Potamitissa B/Hs 67/76 & 69/79B	-	120	265	-	57	57	57	-	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	46	10	68	56	11	178

TABLE X-6b DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSIILIA PROJECT

Ser. No.	Project	Capac. m ³ x10 ³	Yield m ³ /h	Area comm. Decars in stor. m ³ x10 ³	Water avail. in 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. decars
25	Pharmakas I)	21	-	-	20	8	-	20	8	4	-
26	Pharmakas II)	61	-	181	61	28	-	61	28	11	135
27	Arakapas II)	119	-	254	119	41	-	119	41	24	202
28	Ayii Vavatsimias II)	44	-	183	44	35	-	44	35	8	52
29	Dhierona I)	159	-	401	159	108	-	159	108	26	386
30	Dhierona B/H 14/82)	-	54	127	-	-	41	41	41	-	149
31	Sykopetra B/H 48/82)	-	45	120	-	-	14	14	14	-	115
32	Ayios Konstantinos B/Hs 123/76)	-	116	401	-	-	50	50	50	-	266
33	Louvaras B/Hs 32/77, 16/81, 8/81)	-	140	355	-	-	95	95	95	-	227
34	Ayii Vavatsimias B/H 35/81)	-	50	134	-	-	22	22	22	-	64
35	Askas B/H 98/80)	-	60	214	-	-	36	36	36	-	173
36	Alona B/H 46/80)	-	50	100	-	-	28	28	28	-	60
37	Lagouthera B/H 53/80)	-	25	60	-	-	12	12	12	-	12
38	Agros B/H 21/82)	-	82	241	-	-	45	45	45	-	134
39	Dhymes B/H 81/80)	-	80	265	-	-	48	48	48	-	262
40	Kato Amiantos scheme)	-	56	674	-	-	13	13	13	-	509
41	Zoopiyi B/H 9/81)	-	49	134	-	-	22	22	22	-	86
		2193	1606	9977	1953	2694	841	2694	1992	343	7648

* Some quantity of the water from the borehole was given for DWS.

** Water utilization from the river flow and borehole.

*** Borehole and river diversion scheme.

TABLE X-7
RECHARGE WATERWORKS DATA

Ser No.	Project	Capacity m ³ x1000	Water available m ³ x1000	Water used for recharge m ³ x1000	Water lost in evapo- ration m ³ x1000
1*	Kouklia	4 545	-	-	-
2*	Ayios Loucas..	455	-	-	-
3	Sotira	77	NIL	NIL	NIL
4	Paralimni- Panayia	45	NIL	NIL	NIL
5	Paralimni	115	NIL	NIL	NIL
6	Ayia Napa	55	NIL	NIL	NIL
7*	Famagusta Antiflood	50	-	-	-
8	Phrenaros	160	NIL	NIL	NIL
9	Dherinia	23	NIL	NIL	NIL
10	Avgorou	68	NIL	NIL	NIL
11*	Kondea	82	-	-	-
12	Xylophaghou ..	86	NIL	NIL	NIL
13*	Lysi	77	-	-	-
14*	Ayios Yeoryios(K)	68	-	-	-
15*	Ayios Epiktitos	34	-	-	-
16*	Akanthou	45	-	-	-
17**	Akhna	40	NIL	NIL	NIL
18	Xylytymbou ...	50	NIL	NIL	NIL
19*	Syngrasis	1 115	-	-	-
20*	Ayios Yeoryios (F).	190	-	-	-
21*	Famagusta Recharge	165	-	-	-
22*	Ayios Nicolaos Fam	1 365	-	-	-
23	Paralimni Lake	1 365	NIL	NIL	NIL
24*	Fresh Water Lake	4 545	-	-	-
25*	Makrasyka	195	-	-	-
26*	Akhna Mesaoria	90	NIL	NIL	NIL
27	Vrysoulles Fam.	140	-	-	-
28*	Morphou Recharge	130	-	-	-
29*	Morphou Proto- papas	90	-	-	-

TABLE X-7
RECHARGE WATERWORKS DATA (Cont.)

Ser No.	Project	Capacity m ³ x1000	Water available m ³ x1000	Water used for recharge m ³ x1000	Water lost in evaporation m ³ x1000
30	Ormidhia (Vathys)	100	NIL	NIL	NIL
31*	Masari	2 273	-	-	-
32	Liopetri	325	4.5	4.5	NIL
33	Yialias	NA	NIL	NIL	NIL
34	Merikas	NA	NIL	NIL	NIL
	Total	18 063	4.5	4.5	NIL

* Projects in Turkish occupied area. Gate constantly open for recharge.

** Some of the dams of the project are in Turkish occupied area.

**TABLE X-8 DATA ON MANAGEMENT AND OPERATION OF GOVERNMENT
IRRIGATION PROJECTS FOR THE LAST TWO YEARS**

Item No.	Data	Unit	1985	1986	% Change on 1985
1	Capacity	1000m ³	120 894	120 894	NIL
2	Water available	"	68 951	67 006	-2.8
3	Water utilized for irrigation	"	27 137	28 734	+5.9
4	Water utilized for DWS	"	8 807	10 606	+20.4
5	Water utilized for recharge	"	3 758	6 208	+65.2
6	Total water used ...	"	39 702	45 548	+14.7
7	Evaporation losses .	"	4 219	3 152	-25.3
8	Seepage losses	"	946	556	-41.2
9	Water sold	"	23 958	27 359	+14.2
10	Gross income	£	892 589	1043 594	+16.9
11	Power cost	"	380 785	307 011	-19.4
12	Operation cost	"	217 711	182 750	-16.0
13	Maintenance cost ...	"	172 166	279 803	+62.5
14	Total expenses	"	770 662	769 554	- 1.4
15	Net income	"	121 927	274 030	+124.7
16	Area irrigated	Hectars	6 837	7 215	+5.5
17	Area commanded	"	11 581	11 581	NIL

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 m3	Total water utilized m3	Operation & Maintenance cost		Cost	Power cost		Total annual cost £	cost of water* cent/m3	
				£	£		£	£		total water utilized	total water utilized
1	Argaka	990972	1253135	8340	2395	3343	14078	1.4	1.1		
2	Ayia Marina	219781	219781	5931	1301	875	8107	3.7	3.7		
3	Kalopanayiotis	194698	194698	2834	1722	-	4556	2.3			
4	Kiti	NIL	NIL	NIL	NIL	NIL	NIL	-			
5	Pomos	810142	810142	1241	2321	3051	17613	2.2	2.2		
6(i)	Polemichia)	4264676	13193742	72158	28333	67557	168048	3.9	1.3		
	(ii) Yermasoyia)										
7	Paphos	17643297	18339515	55315	223879	217267	496461	2.8	2.8		
8	Khrysokhou valley	495723	495723	4943	5822	14918	25683	5.2	5.2		
9	Xyliatos	693290	693290	6496	2621	-	9117	1.3	1.3		
10	V.P.P. (i) Kalavassos)	1967063	8351139	14492	9805	-	24297	1.2	-		
	(ii) Dhypotamos)										
	Total	27279648	43551165	182750	278199	307011	767960	2.8	1.8		

* 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 1986

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	Khrysokhou Valley	High electrical conductivity, sodium, chloride and bicarbonate content
9	Xyliatos	Low electrical conductivity and high bicarbonate content
10	Kalavassos	High bicarbonate content
11	Dhypotamos	High bicarbonate content

TABLE X-11 - CONTRIBUTORY IRRIGATION WORKS - REMARKS ON WATER QUALITY OF THE PROJECTS DURING 1986

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	Trimiklini	High electrical conductivity, bicarbonate content, sodium and chloride.
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.

**TABLE X-12 - CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT
- REMARKS ON THE WATER QUALITY OF THE PROJECTS DURING 1986.**

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 Pond	Low elect. conductivity and high bicarbonate content.
18	Melini Pond	Normal elect. conductivity and high bicarbonate content.
19	Agridhia Pond ..	Low elect. conductivity and high bicarbonate content.
20	Pelendria Pond .	" "
21	Pelendria B/H No. 53/76	" "
22	Polystypos B/H	" "
23	Potamitissa B/H 69/79B	" "
24	Potamitissa B/H 67/76	" "
25	Ayios Theodoros B/H No. 105/76 .	" "

TABLE X-12 - CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT
- REMARKS ON THE WATER QUALITY OF THE PROJECTS DURING 1986.

Ser No.	Project Name	Remarks
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.

DETAILS OF MAINTENANCE WORKS

A. CONTRIBUTORY IRRIGATION WORKS

1. Palekhorí dam:
Repair of air valves. Repairs to main pipeline. Setting out of acquired land by the Department of Lands and Surveys.
2. Pakhyamos dam:
Repairs to distribution system.
3. Prodromos dam:
Repairs to distribution system and repair of sluice valves.
4. Kotchiatis Diversion Weirs:
Removal of silt from weirs.
5. Lefka dam:
Removal of silt from dam reservoir and repairs to outlet system.
6. Lymbia dam:
Construction of ports and repairs to canals and joints.
7. Kambos:
Repairs to pipe breakages. Replacement of electrical equipment.
Replacement of electrical equipment.
Routine maintenance.
8. Chakistra:
Repairs to pipe breakages. Replacement of electrical equipment.
Routine maintenance.
9. Yerakies:
Repairs to pipe breakages. Replacement of electrical equipment.
Routine maintenance.

TABLE X-13a - CONTRIBUTORY IRRIGATION WORKS - MAINTENANCE COSTS

Ser No.	Project	Govt. Contrib. £	ID Contrib. £	Total Cost £
1	Palekhorri dam	300	150	450
2	Pakhyammos dam (Special case)	218	-	218
3	Prodromos dam	675	337	1 012
4	Kotchatis diversion weir ...	119	60	179
5	Lefka dam (Special case) ...	658	-	658
6*	Lymbia dam	941	-	941
7	Kambos)			
8	Chakistra)	4 487	1 495	5 982
9	Yerakies)			
	Total	7 398	2 042	9 440

* It operates like a government project.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

- 1 Alona B/H No.46/80:
Installation of outlets, airvalves and a watermeter.
Repairs to electric pumping unit.
- 2 Polystypos B/H No.21/77:
Extension to distribution system. Installation of outlets and a watermeter.
- 3 Lagoudhera B/H No.53/80:
Repair works to regulating tank.
- 4 Arakapas pond No.1:
Improvements to outlet system of the pond.
- 5 Kalon Khorio B/H Nos.54/76 & 11/77:
Repairs to electrical equipments of pumping units.
- 6 Dhierona pond:
Repairs to distribution system. Improvements to manholes.
- 7 Dhierona B/H No.14/82:
Removal and reinstallation of pipelines.
- 8 Ephtagonia pond No.1:
Cleaning of drainage channels.
- 9 Ephtagonia pond No.2:
Cleaning of drainage channels.
- 10 Akapnou - Ephtagonia pond 8:
Cleaning of drainage channels. Flushing of distribution systems. Maintenance of water meters.
- 11 Ephtagonia pond No.3:
Cleaning of drainage channels.
- 12 Khandria pond:
Cleaning of drainage channels.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

- 13 Agros dam and B/H No. 63/76:
Repairs to electrical pumping unit. Improvements to distribution system.
- 14 Agridhia pond:
Cleaning of drainage channels and access road. Repairs to distribution system. Maintenance of filters.
- 15 Kato Mylos pond and B/H No. 66/76:
Cleaning of drainage channels. Repairs to membrane.
- 16 Arakapas B/H Nos. 106/76 & 107/76:
Installation of a check valve and repairing of another.
- 17 Kyperounda pond No.2:
Cleaning of drainage channels. Repairing of the clay blanket, installation of a water meter, an airvalve and other fittings.
Construction of a manhole. Installation of a water level indicator.
- 18 Louvaras B/H Nos. 16/81 & 32/77:
Installation of airvalves.
- 19 Ayios Theodoros B/H No. 105/76:
Repairs to electric pumping units.
- 20 Agros B/H No. 21/82:
Earthing of the electric pump.
- 21 Dhymes B/H No. 81/80:
Modifications to distribution system.
Installation of outlets and an airvalve.
- 22 Potamitissa B/H Nos. 67/76 & 69/79B:
Repairs to electric pumping unit. Replacement of the transformer and main switch. Installation of a new float valve in the regulating tank.
- 23 Ayios Konstantinos B/H Nos. 123/76 & 8/91:
Repairs to main pipeline. Construction of a retaining wall.
Repairings of watermeters. Repairs to distribution system.
- 24 Ayii Vavatsinias pond No.2:
Cleaning of drainage channels. Construction of a diversion weir.
- 25 Ayii Vavatsinias pond No.1 and dam:
Cleaning of drainage channels. Cleaning of the embankments of the pond from wild vegetation.
- 26 Melini pond:
Cleaning of drainage channels.
- 27 Ora pond and B/H Nos. 27/81 & 66/81:
Installation of a check valve.
- 28 Ayii Vavatsinias B/H No. 35/81:
Replacement of outlets, airvalves, a check valve and a watermeter.
- 29 Pelendria pond and B/H No. 53/76:
Repairs to distribution system. Repairs to clay blanket.
- 30 Pharmakas pond Nos. 1 & 2.
Repairs to distribution system.

**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	794	396	1 190
2	Polystypos B/H No.21/77 ..	200	100	300
3	Lagoudera B/H No.53/80 ..	22	11	33
4	Arakapas pond No.1	100	50	150
5	Kalon Khorio B/H No.54/76	144	72	216
6	Dhierona pond	340	170	510
7	Dhierona B/H No.14/82 ...	36	18	54
8	Ephtagonia pond No.1	100	50	150
9	Ephtagonia pond No.2.....	266	133	399
10	Akapnou-Ephtagonia pond ..	134	67	201
11	Ephtagonia pond No.3	66	33	99
12	Khandria pond	160	80	240
13	Agros Dam and B/H No. 63/76	300	150	450
14	Agridhia pond	340	170	510
15	Kato Mylos pond and B/H No. 66/76	380	190	570
16	Arakapas B/H Nos. 106/76 & 107/76	56	28	84
17	Kyperounda pond No. 2 ...	900	450	1 350
18	Louvaras B/H Nos. 16/81 & 32/77	200	100	300
19	Ayios Theodoros B/H No. 105/76	281	141	422
20	Ayios Theodoros B/H No. 105/76	53	27	80
21	Dhymes B/H No. 81/80	189	95	284
22	Potamitissa B/H Nos. 67/76 & 69/79B	374	187	561
23	Ayios Konstantinos B/H Nos. 123/76 & 8/81	400	200	600
24	Ayii Vavatsinias pond No.2	324	162	486
25	Ayii Vavatsinias pond No.1 & dam	200	100	300
26	Melini pond	160	80	240
27	Ora pond and B/H Nos. 27/81 & 66/81	54	27	81
28	Ayii Vavatsinias B/H No. 35/81	567	283	850
29	Pelendria pond and B/H No. 53/76	1 346	673	2 019
30	Pharmakas pond	66	33	99
		<u>8 552</u>	<u>4 276</u>	<u>12 828</u>

RECHARGE WATER 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 WATERWORKS - MAINTENANCE COSTS

Ser No.	Project	Maintenance cost
1	Yialias	982
2	Paralimni lake	280
	Total	1 262

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 1986. An area of 1,942 decars was irrigated by utilizing about 1.253 MCM of water.

The area irrigated was planted with citrus, bananas, vines, deciduous, vegetables, cereals and avocados. Out of the 1,253 MCM of water utilized 990,972 m³ were sold to the farmers at the nominal rates and an amount of 262,163 m³ was taken from the overflow, free of charge. The gross income from the sale of water was £29,729. The expenditure on management was £8,340 on power supply £3,343 and that on maintenance amounted to £2,385. Net income to the Project was £15,861.

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 January 24th and overflow continue until April 8th 1986. The overspilled quantity could not be measured. The minimum level of water in storage ever reached was in November with total quantity in storage around 18,000 m³.

TABLE X-15 - ARGAKA DAM & BOREHOLES - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of storage capacity
1	Intitial amount in storage	313 000	31.6
2	Inflow-Seepage	1 200 000	121.2
3	Total Release	669 721	67.6
4	Leakages	4 500	0.4
5	Evaporation	85 000	8.6
6	Overflow	not measured	-
7	Final amount in storage (Dec. 31)	89 000	8.9
8	Minimum quantity in storage (Nov.)	18 000	1.8
9	Storage capacity	990 000	100.0
10	Water Pumped from boreholes	321 251	

Water Utilization and Crops Irrigated

The project was built for irrigation purposes and as such, a quantity of 1.253 MCM of water was utilized for the irrigation of 1,942 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 m ³	% of Storage capacity
1	Water used for irrigation from dam	931 884	94.1
2	Water used for irrigation from boreholes	321 251	32.4
3	Water used for recharge	NIL	NIL
4	Total water utilized	1 253 135	126.5

TABLE X-17 - ARGAKA DAM - CROPS IRRIGATED

Ser No.	Crop	Area Decars
1	Citrus	958
2	Bananas	505
3	Table Grapes	40
4	Deciduous	173
5	Vegetables	173
6	Tobacco	53
7	Alfa-Alfa	40

		1,942

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 1.253 MCM. Out of this a quantity of 990,972 m³ was sold to the farmers at the nominal rates and the rest 262,163 m³ was given free of charge because it was taken from the overflow. From the sale of water a total, of £29,729 was collected. For the operation of the project an amount of £8,340 was paid to the watermen and bill collectors, where for the maintenance of the project another £2,385 was spent and for the power £3,343. The net income for the benefit of the project was £15,651. 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 1986 are the following:

- Cleaning of leakage collector channel.
- Painting of manhole metal covers and gate valves.
- Repair and replacement of sluice valves.
- Repair and replacement of watermeters.
- Repairs to pipelines.

TABLE X-18 - ARGAKA DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	990 972	29 729
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge*	262 163	NIL
4	Total quantity utilized and gross income	1 253 135	29 729
5	Operation cost	-	8 340
6	Power cost	-	3 343
7	Maintenance cost	-	2 395
8	Net income	-	15 651

* This quantity was taken from the overflow.

Project performance for the last two years

Table IX-19 shows the performance of the project for the last two years. As shown there was a small increase in the total volume of water used for irrigation and a small decrease in the area irrigated. The net income to the project was increased by 24.4%.

TABLE X-19 - ARGAKA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1985	1986	% Change on 1985
1	Capacity	1000 m ³	990	990	NIL
2	Water available in storage	"	1480	1423	-3.8
3	Water utilized for irrigation	"	1311	1253	-4.4
4	Water sold	"	886	991	+11.8
5	Water given free	"	425	262	-38.3
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	£	26572	29729	+11.9
8	Operation cost	"	6038	8340	+38.1
9	Power cost	"	3907	3343	-14.4
10	Maintenance cost	"	4035	2385	-40.9
11	Total expenses	"	13980	14068	+0.6
12	Net income	"	12592	15661	+24.4
13	Area irrigated	decars	2174	1942	-11.5

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 distribution system consists of a main conduit at the terminal of which tertiary pipes branch-off to distribute the water to each individual plot. Irrigation in the project area started early in January 1986 and continued throughout the year until late in December. An area of 316 decars was irrigated by utilizing about 0.220 MCM. The area irrigated was mainly planted 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 £6,593. The expenditure for the operation was £6,806 and that for maintenance £1,301. net income to the project was a deficit of £1,514.

Project Hydrology

The project hydrologic data as recorded during the year, are tabulated on Table X-20.

The dam was not filled up to the spillway crest and maximum storage occurred on 4th April 1986 with quantities 197,000 m³. Minimum quantity of water ever stored during the year under review, was 26,000 m³ and this occurred in October 1986.

TABLE X-20 - AYIA MARINA DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage	62 000	20.7
2	Inflow - Seepage	385 000	128.3
3	Total release	209 859	9.9
4	Leakages	32 000	10.7
5	Evaporation	27 000	9.0
6	Overflow	NIL	25.0
7	Final amount in storage	75 000	25.0
8	Minimum quantity in storage (Oct.)	26 000	8.7
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...	219 781	73.3
2	Water used for recharge	NIL	NIL
3	Total water utilized	219 781	73.3

Water Utilization and Crops Irrigated

During the year under review, a total quantity of 219,781 m³ of water was utilized for the irrigation of approximately 1942 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 219,781 m³ of water, the gross income to the project, amounted to £6,593. Management and operation expenses being the wages of the water man and that of the dam attendant, amounted to £6,806.

Maintenance cost for the dam and the distribution system was £1,301. The net income to the project was a deficit of £1,514. Details regarding sale of water, income and costs are given on Table X-23.

Maintenance Details

The maintenance works carried out during the year 1986 were the following:

- Cleaning of the embankment from wild vegetation.
- Cleaning of drainage ditch channels.
- Maintenance of guardhouse.
- Repair of a flow regulator.
- Repair and replacement of sluice valves and gate valves.
- Painting of manhole covers.

TABLE X-22 - AYIA MARINA DAM - CROPS IRRIGATED

Ser No.	Crop	Area decars
1	Citrus	168
2	Bananas	46
3	Deciduous	8
4	Vegetables	53
5	Table Grapes	4
6	Avocados	8
7	Alfa-Alfa	3
8	Olive trees	27
	Total	317

TABLE X-23 - AYIA MARINA DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	219 781	6 593
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge	NIL	NIL
4	Total quantity utilized and gross income	219 781	5 593
5	Operation cost	-	6 806
6	Maintenance cost	-	1 301
7	Net income	-	1 514

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 decreased by 23.9% where the gross income by 20.7%. The total expenditure was increased by 27.8%. The area under irrigation was decreased by 21.1%.

TABLE X-24 - AYIA MARINA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1985	1986	% Change on 1985
1	Capacity	1000 m ³	300	300	NIL
2	Water available in storage ...	"	371	388	+4.6
3	Water utilized for irrigation	"	289	220	-23.9
4	Water sold	"	289	220	-23.9

TABLE X-24 - AYIA MARINA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1985	1986	% Change on 1985
5	Water given free	m ³	NIL	NIL	NIL
6	Water used for recharge	m ³	NIL	NIL	NIL
7	Gross income	£	8320	6593	-20.7
8	Operation cost	£	5146	6806	+132.2
9	Maintenance cost	£	1197	1301	+8.7
10	Total expenses	£	6343	8107	+27.8
11	Net Income	£	1977	-1514	-
12	Area irrigated	decars	402	317	-21.1

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 1986 and continued throughout the year until the end of October 1986. During this period, a total quantity of 194,698 m³ of water was used for the irrigation of an area of approx. 533 decars planted mainly with deciduous, citrus and olive trees. The water was sold to the farmers at a fixed rate of 3.5 cent/m³. The gross income was £6,815. The operation expenses were £2,834 while the maintenance cost spent on routine works and emergency repairs, was £1,722. The project accounts presented a profit of £2,259.

Project Hydrology

The project hydrologic data, as recorded during the year under review, are tabulated on Table X-25. The dam scouring gate was not opened during the year under review. Overflow over the spillway crest occurred during the period 10th February to 25th April 1986. On the 14th September 1986 the dam was emptied.

TABLE X-25 - KALOPANAYIOTIS DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage	206 000	56.7
2	Inflow - Seepage	500 000*	137.7
3	Total release	194 698	53.6
4	Leakages	150 000*	41.3
5	Evaporation	32 000	8.8
6	Overflow	130 000	35.8
7	Final amount in storage	291 200	80.2
8	Minimum quantity in storage (Sept.)	NIL	NIL
9	Storage capacity	363 000	100.0

* Roughly estimated

TABLE X-26 - KALOPANAYIOTIS DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water used for irrigation	194 698	53.6
2	Water allotted to Fishery Department and reutilized for irrigation	200 000	55.1
3	Total water utilized	194 698	53.6

Water Utilization

During the year under review, a total quantity of 194 698 m³ of water was utilized for the irrigation of 533 decars planted mainly with deciduous and to small areas by citrus and olive trees. (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 £6,815. Operation expenses, including attendant and waterman wages and travelling costs, amounted to £2,834. Maintenance expenses were £1,722. The net income to the project was £2,259. Details on these are shown on Tables X-28 and X-29

Maintenance Details

- Repairs to breakages of Break Pressure Tank No.1.
- Repair of a float valve.
- Installation of a float valve.
- Repairs to breakages of main pipeline.
- Installation of a 100 mm dia pipeline connecting main pipeline with leakage collecting weir.
- Maintenance of sluice valves and gate valves.
- Replacement of the gates of the Break Pressure Tanks.
- Painting of woodwork of the quardhouse.
- Painting of metal covers of the manholes.

TABLE X-27 - KALOPANAYIOTIS DAM - CROPS IRRIGATED

Ser. No.	Crop	Area decars
1	Citrus	27
2	Olive trees	7
3	Deciduous	499

		533

TABLE X-28 - KALOPANAYIOTIS DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	194 698	6 815
2	Water sold at reduced rates	NIL	NIL
3	Water given free	NIL	-
4	Total quantity utilized and gross income	194 698	6 815
5	Operation cost	-	2 834
6	Maintenance cost	-	1 722
7	Net income	-	2 259

TABLE X-29 - KALOPANAYIOTIS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1985	1986	% Change on 1985
1	Capacity	1000 m ³	363	363	NIL
2	Water available in storage .	"	467	394	-15.6
3	Water utilized for irrigation	"	241	195	-19.1
4	Water sold	"	241	195	-19.1
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	£	8448	6815	-19.3
8	Operation cost	£	2552	2834	+11.0
9	Maintenance cost	£	1300	1722	+32.5
10	Total expenses	£	3852	4556	-18.3
11	Net income	£	4596	2259	-50.8
12	Area irrigated	decars	598	533	-10.9

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 decreased by 19.1% and the area irrigated by 10.9%.

The operational costs were increased 11.0% and the maintenance costs by 32.5%. The net income to the project was decreased by 50.8%. 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.

LEFKARA DAM

The Lefkara dam project is a dual purpose project, mainly for the supply of Domestic Water to Famagusta town and partly for the irrigation for agricultural land downstream of the dam. The dam consists of (a) a dam reservoir whose capacity is 13.85 MCM, (b) a distribution system (piped) for the supply of irrigation water to an area of approximately 824 decars (c) a feeder pipeline, (b) a domestic water treatment plant near Khirokitia and (f) a pipeline to Famagusta town.

As a result of the Turkish invasion and the occupation of the Famagusta town, the reserved water for Famagusta has been utilized to supply water to the Larnaca and Famagusta towns, other villages and refugee camps en route to Famagusta, whose population has been greatly increased or created accordingly from the refugees who were expelled from their villages and town by the occupation army.

This part of the report will deal only with the dam reservoir and water utilization for irrigation and water supply in general, where details, regarding domestic water supply will be given in the section dealing with domestic water supply.

From the sale of irrigation water, the income amounts to £2,784. Maintenance works were carried out at a total cost of £1,804.

Project Hydrology

The project hydrologic data as recorded during the year under review are tabulated on Table X-30.

The water in the dam reservoir did not reach spillway crest but it remained much lower, with maximum quantity in storage around 1,323,000 m³ or 9.6% of the total capacity, in April. The average Inflow-Seepage to the dam reservoir during the year was estimated at 981,920 m³. The minimum water level reached, occurred in December with minimum quantity in storage estimated at 300,000 m³.

TABLE X-30 - LEFKARA DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage	698 000	5.0
2	Inflow - Seepage	981 920	7.1
3	Total release	1 246 409	9.0
4	Leakages	17 000	0.1
5	Evaporation	114 511	0.8
6	Overflow	NIL	NIL
7	Final amount in storage	318 000	2.3
8	Minimum quantity in storage (Dec.)	300 000	2.2
9	Storage capacity	13 850 000	100.0

Water Utilization

As stated above the project was constructed mainly for the supply of domestic water and to a less extent to provide irrigation water for an area of 818 decars downstream the dam structure. The water utilization for the two main categories of use is shown on Table X-31.

Crops irrigated

The distribution system of the Lefkara irrigation project is still under construction. However, there has been a relatively small agricultural activity in the area and during the year under review, a total of 206 decars of land has been irrigated by using 79,544 m³ of water. The area was planted with citrus, vegetables and olive trees as shown on Table X-32.

TABLE X-31 - LEFKARA DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water used for domestic water supply	1 167 143	8.4
2	Water used for irrigation ..	79 544	0.6
3	Total water utilized	1 246 409	9.0

TABLE X-32 - LEFKARA DAM - IRRIGATED CROPS

Ser. No.	Crop	Area Decars
1	Citrus	173
2	Vegetables	40
3	Olive trees	13
	Total	226

Water Sale, Income and Maintenance Costs

The water was sold either for irrigation or domestic use at the fixed rates. Details on water sale for domestic purposes are given in the section on Domestic Water Supply. The irrigation water was sold at 3.5 cent/m³ and the income from the sale of irrigation water amounted to £2,784. The maintenance works were carried out at a cost of £1,604.

Maintenance Details

The following works were carried out during 1986:

- Cleaning and repairing of dam and distribution system access road.
- Repair of breakages to main and secondary pipelines.
- Replacement of a sluice valve.
- Repair of water meters, sluice valves and an air valve.

Project Operation Data for the Last Two Years

From the Table X-33 it is shown that the area irrigated was decreased by 0.9% and that resulted to a decrease of the water used for irrigation by 13.2%. The water used for domestic water supply was decreased by 36.4%.

TABLE X-33 - LEFKARA DAM - PROJECT OPERATION DATA FOR THE LAST TWO YEAR

1	Capacity	1000m ³	13 850	13 850	NIL
2	Water available	"	2 802	1 663	-40.6
3	Water utilized for irrigation	"	91	79	-13.2
4	Water utilized for domestic WS	"	1 835	1 167	-36.4
5	Total water utilized	"	1 926	1 246	-35.3
6	Inflow - Seepage	"	2 656	982	-63.0
7	Area irrigated	decars	228	226	- 0.9

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 1986 and continued throughout the year until early in December 1986.

An area of 126 Hectars of land planted with citrus, bananas and vegetables was irrigated by utilizing 810,142 m³ of water. From the total water utilized, 679,792 m³ were taken directly from the dam reservoir, 10,350 m³ were taken from the overflow and the rest 120,000 m³ were pumped from the boreholes.

The total gross income from the sale of water amounted to £24,045. The expenditure for the maintenance was £2,321 whereas the power cost was £3,051 and the operation and management costs were £12,241. net income to the project for the year under review was £6,432.

Project Hydrology

The project hydrologic data as recorded during the year are tabulated on table X-34.

The reservoir was filled to spillway crest and overflow occurred during the period 7th to 11th March 1986. Minimum water level in the reservoir occurred in October with water in storage around 97,000 m³.

TABLE X-34 - POMOS DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage ..	189 000	22.0
2	Inflow-Seepage-Overflow	1 100 000	127.9
3	Total release	679 792	79.0
4	Leakages	112 000	13.0
5	Evaporation	70 000	8.1
6	Overflow	not measured	-
7	Final amount in storage	344 000	40.0
8	Minimum quantity in storage (Oct.)	97 000	11.3
9	Storage capacity	850 000	100.0

Water Utilization and Crops Irrigated

The 810,142 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-35 and X-36.

TABLE X-35 - POMOS DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³
1	Water used for irrigation from dam	690 142
2	Water used for irrigation from boreholes	120 000
3	Water used for recharge	NIL
4	Total water utilized	810 142

TABLE X-36 - POMOS DAM - CROPS IRRIGATED

Item No.	Crop	Area Decars
1	Citrus	729
2	Bananas	31
3	Deciduous	11
4	Vegetables	80
5	Cereals	54
6	Avocados	19
7	Olive trees	32
8	Alfa-Alfa	20

		1 256

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 810,142 m³. Out of this 799,792 m³ were sold at the nominal rates and the rest 10,550 m³ were sold at reduced rates because that quantity was taken from the overflow.

From the sale of water (see details on table X-37) the total gross income amounted to £24,045 whereas the operation and management costs were £12,241. Maintenance works on the dam and the distribution system were £2,321. The net income to the project for the year under review amounted to £6,432.

Maintenance Details

The maintenance works carried out during the year 1986 were the following:

- Cleaning of embankment from wild vegetation.
- Removing of driftwood from the reservoir.
- Painting of metal structures and woodwork of the tower bridge.
- Replacement of sluice valves.
- Cleaning of canals and repairing of joints.
- Repairs to galvanized iron pipelines.
- Cleaning of drainage ditch channels.

TABLE X-37 - FOMOS DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	799 792	23 994
2	Water sold at reduced rates	10 350*	51
3	Water given free of charge	NIL	NIL
4	Total quantity utilized and gross income	810 142	24 045
5	Operation cost	-	12 241
6	Power cost	-	3 051
7	Maintenance cost	-	2 321
8	Net Income	-	6 432

* This quantity was taken from the overflow.

Project Performance Data for the Last Two Years

Table X-38 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 1986 over the previous year.

The quantity of water utilized for irrigation was slightly decreased while the gross income was significantly increased due to the increase of the water rates.

The operation and maintenance expenses were increased while the net income was decreased.

TABLE X-38 - POMOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1985	1986	% Change on 1985
1	Capacity	1000m ³	860	860	NIL
2	Water available in storage	"	1 052	1 217	+ 1.2
3	Water utilized for irrigation	"	875	810	- 1.5
4	Water sold	"	875	810	- 1.5
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge .	"	NIL	NIL	NIL
7	Gross income	£	23 970	24 045	+ 17.3
8	Operation	"	10 184	12 241	+ 20.2
9	Power cost	"	3 053	3 051	- 0.2
10	Maintenance cost	"	2 560	2 321	- 9.3
11	Total expenses	"	15 802	17 613	- 11.5
12	Net income	"	8 168	6 432	- 21.2
13	Area irrigated	Hectars	126	126	0.0

YERMASOYIA - POLEMIDHIA PROJECT

The Yermasoyia-Polemidthia 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.

The water for both the dams did not reach the spillway crest in the dam reservoir but it remained much lower with maximum quantity in storage for Yermasoyia dam 7.752 MCM on the 14th March and for Polemidhia 1.175 MCM on the 11th March 1986.

To supplement the area with water due to shortage from the dam the Kouris and Garillis boreholes were set in operation. A quantity of 3.337 MCM of water was pumped from the boreholes 2.151 MCM from that of Kouris and 1.186 MCM from that of Garillis. From the amount of 2.151 MCM pumped from Kouris boreholes an amount of 378,887 m³ was used for domestic water supply, 1,472,015 m³ for irrigation and 300,000 m³ for recharge. The water pumped from Garillis Boreholes was used for irrigation.

A total quantity of 14,497 MCM was released from dams and pumped from the boreholes (9,742 MCM from Yermasoyia, 1.418 MCM from Polemidhia, 2,151 MCM from Kouris and 1.186 MCM from Garillis). Out of the 14.497 MCM, 4.626 MCM were used for irrigation, 5.512 MCM for recharge (then pumped for Domestic use) and 3.055 MCM for Domestic Water Supply. The rest 1.304 MCM were lost.

Irrigation in the project area started early in January and continued throughout the year until late in December 1986. The quantity of 4.626 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 4,264,676 m³ were sold at the nominal rates of 3.0 and 3.5 cent/m³. The rest 361,684 m³ were given free of charge as water rights to Yermasoyia and Polemidhia Irrigation Divisions (293,480 m³ for Yermasoyia ID and 68,204 m³ for Kato Polemidhia ID).

The quantity released and pumped for recharge 5.512 MCM was used to recharge the Yermasoyia aquifer downstream the dam structure. This aquifer is 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 £143,347. The operation costs amounted to 72,156, the power costs to £67,557 and the maintenance costs amounted to £28,333. The net income to the project was a deficit of £24,701.

Water Resources

A quantity of the order of 14.497 MCM was taken from the dams, Kouris Boreholes and Garillis Boreholes as shown on Table X-39.

TABLE X-39 YERMASOYIA-POLEMIDHIA PROJECT - WATER RESOURCES

Item No.	Source	Quantity m ³
1	Yermasoyia Dam	9 741 851
2	Polemidthia Dam	1 418 212
3	Kouris Boreholes	2 150 902
4	Garillis Boreholes	1 186 430
	Total quantity delivered	14 497 395

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 1.215 MCM representing 35.4% of the reservoir capacity. The reservoir was not filled to spillway crest but it remain much lower with maximum quantity in storage around 1.175 MCM on the 11th March 1986. Leakages occurred through the dam and part of these were intercepted downstream for irrigation purposes. Releases from the dam reservoir amounted to 1.418 MCM.

TABLE X-40 - POLEMIDHIA DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage ...	613 000	17.9
2	Inflow-Seepage	1 215 105	35.4
3	Total release	1 418 212	41.3
4	Leakages	131 261	3.8
5	Evaporation	111 968	3.3
6	Overflow	NIL	NIL

TABLE X-40 - POLEMIDHIA DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
8	Minimum quantity in storage (Dec.)	134 000	3.9
9	Storage capacity	3 430 000	100.0

YERMASOYIA DAM

The Inflow-Seepage to the dam during the year under review was estimated at 6.390 MCM mostly occurring in the months of January to May and in December. The dam reservoir was not filled to the spillway crest but it remained much lower with maximum quantity in storage around 7.752 MCM on the 14th March 1986.

TABLE X-41 - YERMASOYIA DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage	5 055 000	37.4
2	Inflow-Seepage	6 389 833	47.3
3	Total release	9 741 851	72.2
4	Leakages	NIL	NIL
5	Evaporation	634 450	4.7
6	Overflow	NIL	NIL
7	Final amount in storage	6 944 090	51.4
8	Minimum quantity in storage (Dec.)	565 000	4.2
9	Storage capacity	13 500 000	100.0

* Roughly estimated

TABLE X-41A - WATER PUMPED FROM BOREHOLES

Item No.	Description	Quantity m ³
1	Garyllis boreholes	1 186 430
2	Kouris boreholes	2 150 902
3	Total	3 337 332

Water Utilization

Details regarding water utilization from both dams separately and in combine with Kouris and Garillis Boreholes are shown on tables X-42, X-43 and X-45. In summary during the year under review a total quantity of 13.193 MCM was utilized for irrigation, domestic water supply and recharge purposes. Out of this quantity 4.626 MCM were utilized for irrigation, 5.512 for recharge and the rest 3.055 MCM were used for domestic water supply.

TABLE X-42 - POLEMIDHIA DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water released for irrigation ..	1 418 212	41.3
2	Water used for recharge	NIL	NIL
3	Total water utilized	1 418 212	41.3

TABLE X-43 - YERMASOYIA DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water released for irrigation .	1 853 356	13.7
2	Water used for recharge	5 212 319	38.6
3	Water used for D W S	2 676 176	19.8
4	Total water utilized	9 741 851	70.1

TABLE X-43A - AQUIFERS WATER UTILIZATION

Item No.	Description	Quantity m ³
1	Water used for irrigation	2 638 445
2	Water used for D W S	378 887
3	Water used for recharge	300 000
	Total	3 337 332

TABLE X-44 - 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

TABLE X-45 - YERMASOYIA-POLEMIDHIA PROJECT - WATER UTILIZATION

Ser. No.	Description	Quantity m ³
1	Water used for irrigation	4 626 360
2	Water used for recharge (Yermasoyia Dam & Kouris Delta boreholes)	5 512 319
3	Water used for DWS	3 055 063
4	Total water used	13 193 742
5	Water losses in distribution system and/or W.M. discrepancies	1 303 653

From the sale of water the total gross income was £143,347. The operation cost totalled £72,158 and the power cost totalled £67,557 where the maintenance cost spent on routine works was £28,333. Details regarding and expenditure are show on table X-46.

Maintenance Details

The following works were carried out during the year under review.

Distribution system

- Repairs to pipe breakages.
- Repair of water meters, sluice valves, flow regulators, air valves and float valves.
- Maintenance of water meters flow regulators and sluice valves.
- Replacement of sluice valves.
- Construction of filters for Trakhoni Balancing Reservoir.
- Repairs to plumbing installation of Trakhoni Pumping Station.
- Installation of a new water meter and sluice valve.
- Cleaning of manholes.

Yermasoyia Dam

- Painting of water level indicators.
- Cleaning the yard of the Yermasoyia Dam Pumping station.

Polemichia Dam

- Cleaning from wild vegetation and regrading of access road.
- Cleaning of embankment and the yard of the guardhouse from wild vegetation.
- Replacement of main water meter.
- Painting of water level indicators.
- Construction of two metal water level indicators.

Kouris Boreholes

Repairs to pumps.

TABLE X-46 - YERMASOYIA-POLEMIDHIA PROJECT-INCOME AND EXPENDITURE DATA

Ser No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	4 264 676	143 347
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge as water rights to:		
	- Yermasoyia Irrig. Division ...	293 480	NIL
	- Polemidhia Irrig. Division ...	68 204	NIL
4	Total quantity/income	4 626 360	143 347
5	Operation cost	-	72 158
6	Power cost	-	67 557
7	Maintenance cost (Yermasoyia & Polemidhia & Kouris Delta Boreholes)	-	28 333
8	Total cost	-	168 048
9	Net income	-	-24701

From the above table it can be seen that the income from the sale of water did not cover the annual cost of operation, power and maintenance of the project.

Project Operation Data for the last two years

Table X-47 gives data regarding operation for the last two years. The last column shows the percentage variation of these data with respect to 1985 figures.

TABLE X-47 - YERMASOYIA-POLEMIDHIA PROJECT - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser No.	Description	Unit	1985	1986	% change on 1985
1	Capacity	1000 m ³	16 930	15 732	-12.6
2	Water available (Y & P & KAG BHS)	"	18 009	15 722	-12.7
3	Water utilized for irrigation	"	5 159	4 626	-10.3
4	Water sold	"	4 282	4 265	- 0.4
5	Water given free	"	877	361	-58.8
6	Water used for recharge ..	"	3 758	5 512	+46.7
7	Water used for DWS	"	3 032	3 055	+ 0.8
8	Total quantity used	"	11 949	13 194	+10.4
9	Gross income	£	144 784	143 347	- 1.0
10	Operation cost	£	68 463	72 158	+ 5.4
11	Power cost	£	65 575	67 557	+ 3.0
12	Maintenance cost	£	20 651	28 333	+37.2
13	Total expenditure	£	154 689	168 048	+ 8.6
14	Net income	£	9 905	24 701	NIL
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 4,916 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. During the year 1986 the extension of the Distribution system in Anarita area was completed. So the area commanded by the project was increased to 5050 Hectars. Irrigation in the project area started in January 1986 and was completed late

in December 1986. During the period a quantity of 17.591 MCM of water was utilized for the irrigation of 843 Hectars of land, planted with various crops. In brief the water was utilized as shown on Table X-51. The crops irrigated were citrus, vegetables etc. as shown on Table X-52.

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 1986 is around £691,536. The operation expenses amounted to £55,315 whereas the maintenance expenses amounted to £223,879 and the power cost to 217,267. The total annual cost amounted to £496,461. The net income to the project was £195,075.

The hydroelectric power station of Asprokremmos dam was not set in operation for the year under review because the water level in the reservoir was low.

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 21.714 MCM on the 5th April 1986. The quantity of water of the order of 21.859 MCM was taken from the Asprokremmos dam, the boreholes, in Dhiarizos and Ezouza rivers, surface flow from Dhiarizos and Ezouza rivers diversion the Mavrokolymbos dam and from private Boreholes in project area as shown on Table X-48.

TABLE X-48 - PAPHOS PROJECT - WATER RESOURCES

Item No.	Source	Quantity m ³
1	Asprokremmos Dam	11 616 475
2	Boreholes in Dhiarizos & Ezouza rivers	6 317 658
3	Surface flow diversion from Dhiarizos & Ezouza rivers	2 521 903*
4	Mavrokolymbos Dam	403 000
5	Private Boreholes	1 000 000*
	Total	21 859 036

* 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-49 and X-50 respectively.

TABLE X-49 - ASPROKREMMOS DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% Storage capacity
1	Initial amount in storage	16 235 600	31.8
2	Inflow - Seepage	8 241 648	16.2
3	Total release	11 616 475	22.8
4	Leakages	39 443	0.1
5	Evaporation	1 917 910	3.8
6	Overflow	NIL	NIL
7	Final amount in storage	10 652 000	20.9
8	Minimum quantity in storage (Dec.)	9 462 000	18.5
9	Storage capacity	51 000 000	100.0
10	Water available in storage	22 519 895	44.2

TABLE X-50 - MAVROKOLYMBOS DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% Storage capacity
1	Initial amount in storage	311 000	14.3
2	Inflow-Seepage	700 000	32.1
3	Total release	403 000	18.5
4	Leakages	NIL	NIL
5	Evaporation	100 000	4.6
6	Overflow	NIL	NIL
7	Final amount in storage	270 000	12.4
8	Minimum quantity in storage (Nov.)	244 000	11.2
9	Storage capacity	2 180 000	100.0
10	Water available in storage	911 000	41.8

Water Utilization and Crops Irrigated

From the water developed, about 3.520 MCM were lost in the canal and distribution system, 51,778 m³ were used by industries and the remaining 17.591 MCM were used for the irrigation of 3,837 Hectars planted with various crops as shown on Table X-52 (See Table X-51 for water utilization).

TABLE X-51 - PAPHOS IRRIGATION PROJECT - WATER UTILIZATION

Item No.	Description	Quantity m ³
1	Water used for irrigation	17 591 519
2	Water used by industries	51 778
3	Water used for recharge	696 218
4	Total water utilized	18 339 515
5	Total water lost	3 519 521
6	Total water delivered from headworks	21 859 036

TABLE X-52 - PAPHOS IRRIGATION PROJECT - CROPS IRRIGATED

Ser No.	Crop	Area Hectars
1	Citrus	717
2	Bananas	461
3	Vines	398
4	Onions	66
5	Vegetables	175
6	Potatoes	448
7	Melons	75
8	Avocados	40
9	Alfa-Alfa	84
10	Ground-nuts	552
11	Legumes	727
12	Deciduous	69
13	Other	25
	Total	3 837

Water Sale, Income, Operation and Maintenance Costs

The project developed a quantity £21.859 MCM out of which 17.591 MCM were used for irrigation, and 0.052 MCM were used for industrial purposes, while the rest 3.520 MCM were lost. The irrigation water was sold at the nominal rates of 4 cent/m³ except the water used for irrigation of the area commanded by Mavrokolymbos dam was sold at 3.5 cent/m³. The industrial water was sold at 9 and 13 cent/m³. From the sale of water the total income amounted to £691,536 whereas the operation, maintenance and power costs were £496,461. Details are shown on Table X-53.

Maintenance Details

The maintenance works carried out on the project during the year 1986 were the following:

Distribution System

- Cleaning of main canal, canaletti and Mavrokolymbos canal.
- Cleaning of pumping stations, regulating and storage tanks.
- Cleaning of canalletti from aquatic vegetation.
- Painting of metal parts in pumping stations.
- Maintenance of hydrants, water meters, flow limit devices pressure regulators and other hydraulic equipment.
- Replacement of a diesel engine pump with an electric one.
- Maintenance of access roads.
- The sewage system of three pumping stations were changed to operate by gravity.
- Installation of one pump in "Koloni Extension" pumping station.
- Improvements to project warehouse.

Asprokremmos Dam

- Painting of metal structures and woodwork.
- Removal of lime sediment from drainage ditch channels in the gallery.
- Maintenance of the guardhouse.
- Cleaning of embankment and the yard of the guardhouse from wild vegetation.

Mavrokolymbos Dam

- Repairing of access road.
- Cleaning of drainage ditch channels.
- Cleaning of embankment from wild vegetation.
- Painting of bridge and metal structures.

TABLE X-53 - PAPHOS IRRIGATION PROJECT - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m ³	Amount £
1	Water delivered from Headworks	21 859 036	-
2	Water sold for irrigation	17 643 297	691 536
3	Total water sold and gross income	17 643 297	691 536
4	Operation cost	-	55 315
5	Maintenance cost	-	223 879
6	Power cost	-	217 267
7	Total annual cost	-	496 461
8	Net income	-	496 461

Project Operation data for the last two years

Table X-54 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 1985 figures.

TABLE X-54 - PAPHOS PROJECT-DATA ON OPERATION FOR THE LAST TWO YEARS

Item No.	Description	Unit	1985	1986	% change on 1985
1	Yield	1000m ³	32 000	32 000	NIL
2	Water available*	"	28 138	33 270	+18.2
3	Water utilized	"	16 247	18 339	+12.9
4	Water sold for irrigation "	"	16 247	17 643	+ 8.6
5	Water used for recharge "	"	NIL	696	-
6	Total water sold	"	16 247	17 643	+ 8.6
7	Gross income	£	641 291	691 536	+ 7.8

TABLE X-54 - PAPHOS PROJECT-DATA ON OPERATION FOR THE LAST TWO YEARS

Item No.	Description	Unit	1985	1986	% change on 1985
8	Operation	£	48 470	55 315	+14.1
9	Maintenance cost	£	194 439	223 879	+15.1
10	Power cost	£	293 265	217 267	-25.9
11	Total cost	£	536 265	496 461	- 7.4
12	Net income	£	105 026	195 075	+85.7
13	Area Irrigated	Hectars	3 427	3 837	+12.0

* This is the water available in the dams, the quantity taken from the boreholes and the river diversion.

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 1986. During this period a total quantity of 495,732 m³ water was utilized by the farmers.

The water was sold at 4.0 cent/m³. The income amounted to £20,267. The operation expenses were £4,943, the maintenance expenses were £5,822 and the pumping expenses were £14,918. The total expenditure was around £25,683. This shows that the running costs of the project are not recovered by the income from the sale of water and an annual deficit of £5,416 was observed.

Out of the 237 Hectars commanded by the distribution system only an area of 127 Hectars was irrigated as shown on Table X-55.

TABLE X-55 - KHRYSOKHOU VALLEY PROJECT - CROPS AND AREA IRRIGATED

Ser No.	Crop	Area Decars
1	Citrus	290
2	Deciduous	37
3	Alfa-Alfa	190
4	Avocados	9
5	Tobacco	575
6	Seasonal	47
7	Table grapes	54
8	Potatoes	43
9	Beans	24
	Total	1 269

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 totally 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 1986 and was completed in June 1986 the river flow diminished. In this period a total of 751512 m³ of water was utilized for the supplementary irrigation of 567 hectares of land planted with vines. Out of 751512 m³ used an amount of 575756 m³ was used by Pissouri Irrigation Division and the rest 175756 m³ were used by Alektora Irrigation Division.

XYLIATOS PROJECT

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 1986 and continued throughout the year until late in November 1986. During this period a total quantity of 693,290 m³ of water was used for the irrigation of an area of 1,382 decars planted with olive trees, citrus, vegetables and potatoes. The water was sold to the Farmers at a fixed charge of 3 cent/m³ and the gross income was £22,162. The Operation expenses were £6,496 while the maintenance expenses were £2,621. The net income to the project for the year under review was £13,045.

Project Hydrology

The project hydrologic data as recorded during the year under review, are tabulated in table X-56. The dam reservoir was not filled up to the spillway crest but it remained lower with maximum in storage around 1,002,000 m³. The minimum quantity of water ever stored in the reservoir during the irrigation period, was 298,000 m³ and occurred in December 1986.

TABLE X-56 - XYLIATOS DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of Storage capacity
1	Initial amount in storage	599 000	49.1
2	Inflow - Seepage	819 443	67.2
3	Total release for irrigation ..	802 340	65.8
4	Leakages	70 875	5.8
5	Evaporation	60 435	5.0
6	Overflow	NIL	NIL
7	Final amount in storage	560 000	45.9
8	Minimum quantity in storage (Dec.)	298 000	24.4
9	Storage capacity	1 220 000	100.0

TABLE X-57 - XYLIATOS DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of Storage capacity
1	Water used for irrigation	693 290	56.8
2	Water used for recharge	NIL	NIL
3	Total water utilized	693 290	56.8

TABLE X-58 - XYLIATOS DAM - CROPS IRRIGATED

Item No.	Crop	Area Decars
1	Citrus	335
2	Seasonal	337
3	Potatoes	536
4	Olives	134
5	Deciduous	134
6	Alfa-Alfa	13
7	Avocados)	
8	Kiwi)	27
	Total	1 382

Water Utilization and Crops Irrigated

During the year under review a quantity of 693 290 m³ of water was utilized for the irrigation of 1 382 decars of land planted mainly with olive trees, citrus, vegetables, potatoes and avocados.

TABLE X-59 - XYLIATOS DAM - INCOME AND EXPENDITURE DATA

Item	Description	Quantity m ³	Amount £
1	Water sold at nominal rates ..	693 290	22 162
2	Water sold at reduced rates ..	NIL	-
3	Water given free	NIL	NIL
4	Total quantity utilized and gross income	693 290	22 162
5	Operation cost	-	6 496
6	Maintenance cost	-	2 621
7	Net income	-	13 045

Water Sale, Income, Operation and Maintenance and Details

From the sale of water, the gross income during the year under review, was £22,162. Operation expenses, including attendant wages and travelling costs, amounted to £6,496 and Maintenance expenses were £2,621 and the net income to the project was £13,045. The following works were carried out during the year under review:

- Repairs to main pipeline.
- Cleaning of Filters.
- Repairing of breakages of the pipe system.
- Maintenance of break pressure tanks.
- Installation of an air valve.

TABLE X-60 - XYLIATOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Description	Unit	1985	1986	% change on 1985
1	Capacity	1000 m ³	1 220	1 220	NIL
2	Water available in storage	"	1 322	1 508	+14.1
3	Water utilized for Irrigation	"	587	693	+18.0
4	Water sold	"	587	693	+18.0
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge	"	NIL	NIL	NIL
7	Gross income	£	17 615	22 162	+25.8
8	Operation cost	£	5 250	6 496	+23.7
9	Maintenance cost	£	3 985	2 621	-34.2
10	Total expenses	£	9 235	9 117	- 1.3
11	Net income	£	8 380	13 045	+55.6
12	Area irrigated	decars	1 382	1 382	NIL

Project Operation Data for the last two years

Table X-60 shows the operation data for the last two years. The water sold for irrigation was increased by 18% and the net income to the project was increased by 55.7%.

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.
- Maroni Diversion to divert a portion of the Maroni river flow to a point upstream of Dhypotamos dam.
- Maroni irrigation scheme which comprises an irrigation network covering about 233 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.
- 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.

Construction of civil works commenced in 1983 and they will be completed in 1987. The main works of both dams were completed by the end of 1984.

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.

A total quantity of 8.351 MCM were utilized during 1986 from both dams, 1.967 MCM for irrigation and 6.384 MCM for Domestic Water Supply. Out of 8.351 MCM used 3.212 MCM were taken from Dhypotamos dam and 5.139 MCM from Kalavassos Dam. Out of 3.212 MCM 0.928 MCM were used for irrigation and the rest 2.284 MCM were diverted to Kornos Treatment Plant for Domestic Water Supply purposes. Out of 5.139 MCM used 1.039 MCM were used for irrigation and the rest 4.100 MCM were diverted to Khirokitia Treatment Plant for Domestic Water Supply purposes.

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.

TABLE X-61-V.P.P KALAVASSOS DAM - HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of storage capacity
1	Initial amount in storage	1 698 000	9.9
2	Inflow during the year	NA	-
3	Total release	5 138 889	-
4	Leakages	NA	-
5	Evaporation	NA	-
6	Overflow	NIL	NIL
7	Final amount in storage	945 000	5.5
8	Minimum quantity storage (Dec.)	856 000	5.0
9	Storage capacity	17 100 000	100.0

TABLE X-62-VPP-DHYBOTAMOS DAM-HYDROLOGY FOR 1986

Item No.	Description	Quantity m ³	% of storage capacity
1	Initial amount in storage	1 279 500	9.3
2	Inflow during the year	2 332 425	17.0
3	Total release	3 076 866	22.4
4	Leakages	-	-
5	Evaporation	-	-
6	Overflow	NIL	NIL
7	Final amount in storage	336 000	2.4
8	Minimum quantity in storage (Dec.)	288 000	2.1
9	Storage capacity	13 700 000	100.0

Water Utilization and Crops Irrigated

Details regarding water utilization from both dams separately and in combine are shown on tables X-63, X-64 and X-65. During the year under review a total quantity of 8.351 MCM of water was utilized. Out of this amount 1.967 MCM were used for irrigation of various crops and 6.384 MCM were used for Domestic Water Supply.

TABLE X-63-VPP KALAVASOS DAM - WATER UTILIZATION

Item No.	Description	Quantity m ³	% of storage capacity
1	Water used for irrigation	1 039 029	6.0
2	Water used for D.W.S	4 099 860	24.0
3	Total water utilized	5 138 889	30.0

TABLE X-64-VPP-DHYPOTAMOS DAM-WATER UTILIZATION

Item No.	Description	Quantity m ³	% of storage capacity
1	Water used for irrigation	928 040	6.7
2	Water used for DWS	2 284 210	16.7
3	Total water utilized	3 212 250	23.4

TABLE X-65-VPP-WATER UTILIZATION

Item No.	Description	Quantity m ³	% of storage capacity
1	Water used for irrigation	1 967 069	6.4
2	Water used for D.W.S	6 384 070	20.7
3	Total water utilized	8 351 139	27.1

Water Sale, Income, Operation and Maintenance Costs

From the sale of irrigation water the total gross income was £96 315. The Operation expenses amounted to £14,492 and the maintenance expenses amounted to £9,805. Details regarding income and expenditure are shown on table X-66.

MAINTENANCE DETAILS

Distribution System

- Construction of metal boxes for water meter cards.
- Cleaning of hydrant manholes from wild vegetation.
- Maintaining of Kalavastos, Maroni and Ayios Theodoros break pressure tanks.
- Repairs to 14 No. outlets, 49 No. watermeters, 11 No. airvalves.
- Repairs to pipelines.

Kalavastos dam

Cleaning of embankment and drainage ditch channels from wild vegetation.
Painting of metal structures.

Dhypotamos dam

Cleaning of embankment and drainage ditch channels from wild vegetation.
Painting of metal structures.

TABLE X-66-VPP-INCOME AND EXPENDITURE DATA

Ser No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	1 967 069	96,315
2	Operation cost	-	14,492
3	Maintenance cost	-	9,805
4	Total cost	-	24,297
5	Net income	-	72,018

XI LARNACA - FAMAGUSTA

by

T N Hamatsos
Executive Engineer I
Regional Engineer

General

By the end of the year the staff of the Regional Office was composed of the following Officers :

1 Executive Engineer I - Head
1 Technical Superintendant
1 Senior Technician
4 Technicians I
7 Technicians II
1 Assistant Chief Foreman
4 Regular Employees
3 Waterguards
1 Secretary-Typist

For the execution of the construction works 6 foremen and 54 workers were engaged.

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 : Surface and groundwater measurements and studies
- Investigations and Design : Design of water supplies and irrigation schemes.
- Construction of water supply and irrigation schemes.
- Operations and Maintenance of existing irrigation and water supply schemes.

- Additionally this year the office extended its activities in 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 482 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 365 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 55 of these observation boreholes was taken every month and another 10 of them was taken every two months.

The water level of 52 boreholes used for village water supplies were also taken once during the year.

Chemical Analyses

A total number of 184 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 593 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 5 boreholes/wells for private use were carried out.

Plotting of Boreholes

During the year the plotting of wells/boreholes in Famagusta-Larnaca Hydrological Area continued and the total number of wells/boreholes plotted were 1075.

Questioning

The annual questionnaire was carried out in the area where the plotting was completed. A total number of 13 857 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 13 applications for quarries which were sent to the District Office by the Department of Mines were examined on the spot, and returned to the above Department with the comments of this office.

Wells Sinking Permits

A total number of 1132 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 for wells/boreholes. Some 916 applications were of cases lying in the conservation areas and another 216 in the non-conservation area.

Apart from the above applications 686 cases dealing with wells/boreholes were also examined direct from the District 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 419 were approved, 23 were not and 244 were for the check of the condition 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 925 boreholes.

In Ormidhia and Xylophagou area 99 applications for new boreholes/or covering permits or cleaning existing boreholes were examined, 49 of them were approved and another 50 were not approved.

INVESTIGATIONS AND DESIGN

Investigations

During 1986 the following investigations were carried out:-

LARNACA DISTRICT

Avdhellero : Investigation of two cases for building sites

Aradhippou : For improvement of part of the village water supply network and for relocation of a pipeline of the village water supply along the main road, Larnaca-Nicosia. For improvement of the Government Borehole 139/85 for irrigation of the village verdure, and for the water supply of diggeries. For water supply of new division of

of plots and for for the grant of passages through state land. For relocation of part of the village water supply network which passes through private land.

Anglisidhes :Investigation for the village water supply from the private borehole Hydr. No.2 and for the water supply of the village division of plots.

Anaphotia :For improvement of the Government borehole 121/86 for the village irrigation purposes, and for water supply permits of new division or plots. For the solution of water supply problems.

Anlanda :Investigation for the water supply of army camp

Ayios Theodoros :For improvement of the village water supply and for the solution of water supply problems.

Alaminos :For the water supply of the live stock of the village and for a case of building next to the river.

Ayia Anna :For the relocation of part of the village water supply network, to the main road of the village

Ayii Vavatsinias :For improvement of the village water supply network.

Alethrico :Investigation for fencing private land through which the main pipeline of Famagusta water supply passes.

Athienou :Improvement of the village water supply network and for the replacement of the main conveyor pipeline from the community boreholes of water supply. Study for the live stock water supply and for water supply permit of new division of plots. Investigation for recharge works.

Vavatsinia :Investigation for improvegent of the spring Ayia Marina for the village water supply and for the relocation of part of the conveyor pipeline of Ormanou spring which pases through private land.

Vavla :For the solution of water supply problems.

Dhromolaxia :Water supply of new division of plots for refugee self-housing to Turkish Cyprios plots and for water supply permit of new division of plots. For the solution of the stock farming areas water supply problems.

Dhekelia S B A :Study for improvement of the SBA Water Supply from the main pipeline of Famagusta Water supply.

Zyyi :For improvement of part of the village water supply network and for the water supply of the army camp near the village.

Zyyi-Mari :Investigation for improvement of the village water supply from Khirokitia treatment water supply plant.

Klavdhia :Investigation of the condition of the village water supply springs Ayios Ioannis and Stazousa and for the solution of water supply problems. Investigation for improvement of the Government bore-

holes to the area of the village for the live stock purposes of the village.

Kiti :Investigation for extension of the village water supply network and for the fencing of private land next to the river. For relocation of a pipeline which passes under a new building house and for water supply permit of new division of plots. Investigation for the removal of earth from the river bed of Tremithos river.

Kornos :Water supply of new division of plots and for the fencing of private land next to the river.

Kivisili :For the solution of the live stock water supply problems.

Kalavassos :Case of building next to the river

Kophinou :For improvement of the village water supply from the Government borehole 40/83 and for improvement of the borehole hydr.No.132 for the water supply of the slaughter house Nicosia-Limassol-Kornos. Investigation for the placing of a conveyance pipeline from Kornos treatment water supply plant for Nicosia-Limassol-Larnaca slaughter house.

Livadhia :Investigation for the repair of the village water supply storage tank.

Layia :For the relocation of part of the village water supply network to the main road of the village.

Maroni :Improvement of the village water supply network and for the relocation of part of the conveyor pipeline which passes through private land. Water supply of new division of plots.

Melini :Water supply of the village cemetery.

Meneou :Water supply of new division of plots and for the water supply of the fishing culture next to Meneou village.

Mosphiloti :Investigation for the water supply to new refugee self housing estate phase B and for the relocation of part of the water supply network to the main road of the village.

Odhou :For repair of the water tank of Odhou A Irrigation Division and for the relocation of a pipeline which passes through private plots. For the solution of problems of Dhimma spring of the village water supply.

Ormidhia :For the water supply of the village stock farming area and for the relocation of a pipeline of the village water supply of Vattena self housing Estate. For the water supply of the veterinary station and for the water supply of new division of plots.

Oroklini :For the water supply of the village stock farming area and for the water supply of new division of plots. For the relocation of part of the conveyor pipeline of the village water supply from the main pipeline of Famagusta Water supply which passes through private plots and for improvement of the old spring Ayias Ekaterinis of the

village water supply.

Perivolia :For the water supply of new division of plots and for the solution of water supply problems of Faros Village tourist complex. For the disuse of RCC channel of the Government water works of Kiti Dam.

Pyrga :Investigation for the water supply of new division of plots of the village Phase B

Psematismenos :For the construction of a new storage tank for the village water supply and investigation for improvement of the Government boreholes 46/61 and 71/76 for irrigation purposes of Dhrakon-dies Irrigation Division. Investigation for interventions on the river bed and for the solution of water supply problems.

Psevdas :Investigation for new division of plots next to the river bed and for the cleaning of the irrigation weir of the village.

Skarinou :For improvement of the village water supply network and for the solution of the village water supply problems. For improvement of the spring Mylos of the water supply of Skarinou-Ayios Theodoros-Alaminos complex.

Tersephanou :Study for the construction of the sewage scheme of the village self housing estate and for the water supply of the Stock Farming Area of the village.

Tochni :Investigation for improvement of the village water supply network.

Khirokitia :Investigation for improvement of the village water supply Ayios Spyridon spring.

Xylophagou :Water supply of new division of plots and for the relocation of a pipeline which passes through private land.

Xylotymbou :For improvement of the village water supply network and for the water supply of new division of plots.

Larnaca (Hala Sultan Tekke) :For the maintenance of the irrigation well of the garden at the archaeological monument and for the lease of an anti flood channel to the Electricity Authority of Cyprus for the construction of antiflood works.

FAMAGUSTA DISTRICT

Ayia Napa :Investigation for the expansion of the village water supply network and for the relocation of part of the village water supply network along the main road Ayia Napa-Cape Greco. For the exchange of private land to state land and for the construction of a road next to the river.

Ayios Yeorgios Refugee Camp Estate (Vrysoulles) :Supplementary water supply to the refugee camp from borehole 146/58 and for the solution of the refugee camp water supply problems.

Dherynia :Water supply for the village division of plots and for the solution of water supply problems of the refugee camp estate.

Paralimni :Investigation for the replacing of part of the village water supply network and for the water supply of new refugee camp estate plots Phase D. For the water supply of new division of plots.

Avgorou :Water supply of new division of plots.

Sotira :For the water supply for village division of plots and for the construction of a bridge on the river of Phonissa Dam.

Liopetri :For improvement of the village water supply network and for the lease of Hali Land for private purposes.

Phrenaros :Water supply of new refugee camp estate plots, of the village Phase E and for the replacing of part of the village water supply scheme to the main road Phrenaros-Dherynia.

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	Aradhippou :Improvement of the Government Bore-hole 139/85 for irrigation of the village verdure	43 000
2	Aradhippou :Relocation of a pipeline along the main road Larnaca-Nicosia	38 000
3	Aradhippou :Replacing of part of the village water supply network	8 000
4	Anglisidhes :Water Supply of village division of plots	4 400
5	Aplanda :Army Camp Water Supply Scheme	32 000
6	Athienou :Improvement of the existing house to house scheme water supply	340 000
7	Athienou :Construction of a new storage tank and replacing of the main conveyance water supply pipeline	110 000
8	Ahtienou :Replacing of part of the general scheme water supply network	26 000
9	Arsos-Vatyli-Tremetousia :Supplementary Water Supply of the complex from the new borehole 63/86	8 500

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost
VILLAGE WATER SUPPLY (cont.)		
10	Ayii Vavatsinias :Improvement of the existing house to house scheme water supply	35 000
11	Dhromolaxia :Water supply of new division of plots for refugee self housing to T/C land	1 800
12	Dhekelia S B A :Supplementary Water supply from the main pipeline of F/sta water supply.....	24 000
13	Zyyi :Improvement of the village water supply network	15 000
14	Zyyi-Mari :Modified water supply scheme of the village from Khirokitia Water Treatment Plant .	240 000
15	Kiti :Extension of the village water supply network to the main road Kiti-Meneou	6 000
16	Kophinou :Water supply of the new slaughter house Nicosia-Limassol-Larnaca from Kornos water treatment platn	56 400
17	Kophinou :Pumping scheme of the Government bore-hole 40/83 for the village water supply	38 000
18	Maroni :Improvement of the village water supply scheme	33 000
19	Meneou :Water supply of the village tourist area	75 000
20	Mosphiloti :Refugee self housing house to house scheme water supply phase B	1 300
21	Ormidhia :Water supply of veterinary station ...	2 000
22	Oroklini :Replacing of part of the conveyance water supply pipeline of the village	9 600
23	Pyrga :Water supply of village division of plots phase B	1 200
24	Skarinou :Improvement of the existing house to house scheme water supply	27 000
25	Skarinou :Replacing of part of the village water supply network	1 200
26	Khirokitia :Improvement of the village water supply (construction of a new storage tank)	12 000

TABLE XI-1

Ser. No.	Village and scheme	Est. Cost
VILLAGE WATER SUPPLY (cont.)		
27	Psematismenos :Improvement of the village water supply (construction of a new storage tank)	12 000
28	Xylotymbou :Improvement of the existing house to house scheme water supply	180 000
Famagusta District		
1	Ayia Napa :Extension of the village water supply scheme to the road Tefkrou Anthia	35 000
2	Ayia Napa :Relocation of part of the village water supply scheme to the road Ayia Napa-Cape Greco	5 200
3	Ayia Napa :Improvement of the village water supply network to Ayia Mavri area	10 000
4	Ayia Napa :Relocation of part of the village water supply network scheme to the road Dhionesiou Solomou	2 500
5	Vrysoulles :Supplementary water supply of the refugee self housing from borehole 146/58	23 000
6	Dherynia :Water supply of village division of plots	9 500
7	Liopetri :Improvement of the existing house to house scheme water supply	225 000
8	Paralimni :Replacing of part of the general scheme water supply network phase A	50 000
9	Paralimni :Refugee self housing house to house scheme water supply phase D	2 000
10	Sotira :Water supply of village division of plots	9 500
11	Phrenaros :Refugee self housing house to house scheme water supply Phase E	2 500
12	Phrenaros :Extension of part of the village water supply network to the main road Phrenaros-Dherynia	6 500
13	Phrenaros :Refugee self housing house to house scheme water supply phase E	2 500

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost
STOCK FARMING AREAS WATER SUPPLY		
<u>Larnaca District</u>		
1	Ormidhia :Water supply for the village stock farming area	14 500
2	Tersephanou :Water supply for the village stock farming area	7 500
3	Oroklini :Water supply for the village stock farming area	3 500
ANTI FLOOD WORKS		
<u>Larnaca District</u>		
1	Aradhippou :Modification scheme or improvement of the river bed of Aradhippou river	24 000
VARIOUS MINOR SCHEMES		
<u>Larnaca District</u>		
1	Anaphotia :Pumping scheme of the borehole 121/86 for the live stock and irrigation purposes	3 100
2	Aradhippou :Relocation of a pipeline of the village water supply	3 600
3	Vavatsinia :Relocation of part of the conveyance pipeline of the spring of the village water supply	450
4	Kiti :Relocation of a pipeline of the village water supply network	1 380
5	Livadhia :Repair of the village water supply storage tank	1 700
6	Maroni :Relocation of part of the conveyance water supply pipeline	1 800
7	Melini :Water supply of the village cemetery ...	420
8	Layia :Relocation of part of the village water supply network	150
9	Xylonhagou :Relocation of a pipeline of the village water supply network	1 080

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost
VARIOUS MINOR SCHEMES (cont.)		
10	Odhou :Repair of the water tank of the irrigation division Odhou A	700
	Odhou :Relocation of a pipeline of the irrigation division Odhou A	250
11	Ormidhia :Relocation of part of the village water supply network of Vattena refugee self housing	2 500

IRRIGATION WORKS

Larnaca District

1	Psematismenos :Improvement of the borehole 72/76 for Dhrakondies irrigation division ..	47 000
2	Psematismenos :Supplementary water supply from borehole 45/61 for Dhrakondies irrigation division	1 500

SEWAGE SCHEMES

Larnaca District

1	Tersephanou :Sewage scheme for refugee self housing of the village	100 000
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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 advise and assistance to several Gov-

- ernment, 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 District Engineer in the Water Board Meetings as a representative of the Director. Through its membership of Water Boards the District 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).
- 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 advise 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 participates in the meetings of the Committees of the Water Commissioners of Vasilikos-Pendaskinos Government Projects and Lefkara Dam. Also it has undertaken a survey in cooperation with the District Agricultural Department, of 17 Irrigation Divisions falling within the above Projects, to find out the water rights of each Division.

MAJOR PROJECTS IMPLEMENTATION

General

Although in principle the activities of the District Office cover mainly the branches of Water Resources, and Hydrology, Investigations and Design, Construction and Operation and Maintenance, it was however this year required to extend its activities by undertaking to carry out some detailed surveys and investigations, the results of which were used for the implementation of the Major Projects of the Southern Conveyor-Kokkinochoria Irrigations and Vasilikos-Pendaskinos.

SOUTHERN CONVEYOR PROJECT - KOKKINOKHORIA IRRIGATION

Hydrological Investigations

During the year the following works were carried out for the Southern Conveyor :

- The groundwater level of 95 wells/boreholes was taken in South-Eastern Mesaoria and another 46 in the area of Kiti. In addition

the water levels were measured by 4 automatic recorders situated at Kiti, Xylophagou, Liopetri and Phrenaros and were visited once a month.

- A list of the wells/boreholes which were included in the area of Akhna Dam was prepared for the District Office of Land and Surveys in order to be used for compulsory Land Acquisition.
- For the establishment of a Well Inventory 4 members of the staff were assigned in coordination with 3 other members of the Hydrological Section from the Headquarters, in a 3 month Hydrological Survey, which covered all the villages of Kokkinochoria Area. More than 8000 boreholes were surveyed.

Land Consolidation

The District 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.

Redesign of Kokkinochoria Distribution System for Irrigation

The Larnaca District Office of the Water Development Department together with the Famagusta Agricultural Office worked on the establishment of an Irrigation Model for the Irrigation Block No. I covering an Area of 355 hectares.

For the establishment of this Irrigation Model the following data was collected, worked out and used :

- Area of the Irrigation Block, present situation and road network
- Soil Characteristics
- Quantity and quality of underground water
- Land Use
- Sources of Irrigation
- Total demand of water for present cultivations
- Land ownership data and size of agricultural lots.
- Proposed irrigation system from Southern Conveyor Project
- Percentage of employment of land owners in Agriculture.

Based on the findings of this Irrigation Model a detailed survey was undertaken for the redesign of the 23 Irrigation Blocks, covering approximately a total area of 10 000 hectares of land.

A team of 10 Technicians (6 from the District Office of the Water Development Department and 4 from the Famagusta Agricultural Office) was set up, with the main task to collect and prepare data of Irrigation Blocks necessary for the finalisation of the redesign process of the 23 Irrigation Blocks of Kokkinochoria Area.

The following data was collected :

- Land ownership Data :This contains the ownership in the Irrigation Block by name. In total 6 500 owners with 5 500 plots of land were investigated and registered. This information was taken from the official records of the District Office of Land and Surveys Department.

ment and was verified by site visits.

- Land ownership by irrigation hydrant outlet :The survey covered 1500 owners who will get water from 340 hydrant outlets.
- Joint Land Ownership Data :This covers 500 plots owned jointly by 1250 persons.
- Undeclarable Land :115 plots of land have been found and registered. These plots belong either to persons who are missing due to the Turkish invasion or to refugee persons who have not yet applied to the Department of Lands and Surveys for registration.

All the above information was transferred on maps to a scale of 1:5000 which later were used for the preparation of the layout and design of the distribution systems of the irrigation blocks.

Special Investigations and reports on Communal Claims

Within the frame of Kokkinochoria Irrigation Project, special investigations were carried out and reports were prepared and sent to the Director for the following cases :

Claims for additional land to be irrigated

The investigations for revision and expansion of irrigation blocks for additional land to be irrigated covered the following communities:

- Akhna :A total area of 328 hectares
- Avgorou :A total area of 260 hectares
- Dherynia (Strovilia) :A total area of 52 hectares of permanent plantations (citrus)
- Phrenaros-Akheritou (Vrysoulles) :A total area of 194 hectares of which 115 hectares are permanent plantations (citrus).
- Paralimni (Protaras) :A total area of 300 hectares of which 180 hectares are covered by the Protaras Tourist Area and were excluded from irrigation.

Subtraction of Land from Irrigation Areas

Some areas of land falling within the irrigation areas were also covered by other Governmental Water Projects such as village water supply areas and tourist areas therefore they were excluded from irrigation.

The investigations carried out and the reports prepared covered the following communities :

- Liopetri :Water Supply Area 89 hectares
- Phrenaros :Water Supply Area 71 hectares
- Ormidhia :Water Supply Area 57 hectares

- Sotera :Tourist Area 97 hectares
- Paralimni :Protaras Tourist Area 180 hectares

VASILIKOS PENDASKINOS PROJECT

During the year the District 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.

Concerning the Communal Claims for inclusion/irrigation areas not covered by Vasilikos-Pendaskinos Project the District Office carried out detail surveys and investigations followed by reports which covered the following Communities :

- Ayios Theodoros;Irrigation Division Pendaskinos No.1 54 hectares
- Maroni:(i) Irrigation Division Vasiliko 40 hectares
(ii) Irrigation Division Asvesto 155 hectares
- Khirokitia;Irrigation Division Potamos 154 hectares
- Kalavastos;Irrigation Division Kalavastos No.1 31 hectares

Within the framework of the Water Commissioner for water rights the District Office of the Water Development Department Larnaca/Famagusta in coordination with the District Agricultural Office and the District Administration Office, carried out surveys and investigations for the following 18 Irrigation Divisions.

Vasilikos River

Irrigation Division Kalavastos No.1
Irrigation Division Kalavastos No.2
Irrigation Division Syrmata-Kopetra
Irrigation Division Tokhni-Zyyi
Irrigation Division Mari

Community

Kalavastos
Kalavastos
Kalavastos
Tokhni
Mari

Maroni River

Irrigation Division Anefantis-Milianos
Irrigation Division Potamos
Irrigation Division Drakonties
Irrigation Division Ratsou
Irrigation Association Kannouva
Irrigation Division Laki-Xalona
Irrigation Division Asvesto
Irrigation Division Safto-Lourka
Irrigation Division Vasiliko

Community

Khirokitia
Khirokitia
Psematismenos
Psematismenos
Psematismenos
Maroni
Maroni
Maroni
Maroni

Pendaskinos River

Irrigation Division Pendaskinos No.1
Irrigation Division Pendaskinos No.2
Irrigation Division Pittinew
Irrigation Division Skarinou

Community

Ayios Theodoros
Ayios Theodoros
Ayios Theodoros
Skarinou.

CONSTRUCTION

Village Water Supplies

Ser. No.	Village	Scheme	Est. Cost	Remarks
1	Paralimni	Protaras tourist area WS Phase B	70 000	Commenced in 1984 Work in progress
2	Paralimni-Ay.Napa	Supplementary WS from F/sta pipeline to Phrenaros pumping station Scheme A	68 000	Commenced in 1985 Completed in 1986
3	Paralimni-Ay.Napa	Supplementary WS from F/sta pipeline to Phrenaros pumping station Scheme B	372 000	Commenced in 1985 Work in progress
4	Ormidhia-Xylophagou	Connection of F/sta pipeline Phase A	85 000	Commenced in 1985 Completed in 1986
5	Ormidhia-Xylophagou	Connection to F/sta pipeline Phase B	130 000	Commenced in 1985 Completed in 1986
6	Kiti	Construction of a new water tank	14 000	Commenced in 1985 Completed in 1986
7	Khirokitia	New Distribution System	40 000	Commenced in 1985 Completed in 1986
8	Pervolia	Construction of a new water tank	14 500	Commenced in 1985 Completed in 1986
9	Layia	Replacement of a pipe line on Khirokitia-Layia-Ora road	150	Completed
10	Mari-Zyvi Governors Beach	New conveyor pipeline from Khirokitia Treatment Plant	240 000	Completed

Village Water Supplies (cont.)

Ser. No.	Village	Scheme	Est. Cost	Remarks
11	Ormidhia	Improvement of WS	10 500	Completed
12	Avgorou	Replacement of a pipeline	4 000	Completed
13	Ay. Napa	Relocation of a pipeline from Ayia Napa to Cape Greco road	1 800	Completed
14	Vavatsinia	Relocation of a pipeline	337	Completed
15	Kalochorio	New distribution system	28 000	Completed
16	Kornos	New distribution system to Government plots phase B	3 000	Completed
17	Xylophagou	New distribution system to Government plots Phase B	8 500	Completed
18	Kellia	WS to T/C plots	1 000	Completed
19	Kiti	New conveyor pipeline	14 000	Completed
20	Pervolia	New distribution system Phase B	18 000	Completed
21	Ay. Theodoros	New conveyor pipeline	7 000	Completed
22	Sotira	Repair of the metal tower tank	1 000	Completed
23	Skarj nou	New pipeline from the village to Ay. Loucas Monastery	1 800	Completed
24	Kophinou	WS to Nicosia-Limassol-Larnaca slaughter house	56 400	Work in Progress
25	Ayia Napa	New distribution system to Ayia Mavri area	10 000	Work in Progress

Village Water Supplies (cont.)

Ser. No.	Village	Scheme	Est. Cost	Remarks
26	Ormidhia	Replacement of the pipeline at Vattena antiflood works	2 500	Work in Progress
27	Voroklini	New Distribution system	34 000	Work in Progress
28	Avgorou	New distribution system Phase A	45 000	Work in Progress
29	Dherinia	New distribution system Phase A	45 000	Work in Progress
<u>Self Housing Projects</u>				
1	Akhna Forest Phase A+B+C	House to House Scheme	90 000	Work in Progress Commenced in 1982
2	Akhna Forest Phase B	House to House Scheme	32 000	Work in Progress Commenced in 1982
3	Vryouilles Phase E	House to House Scheme	4 000	Completed
4	Dekelia Phase C	House to House Scheme	2 600	Completed
5	Xylophagou Phase F	House to House Scheme connected to Xylophagou distribution system	500	Completed
6	Anglisidhes A	Sewage Scheme	31 000	Completed
7	Akhna Forest Phase C	House to house Scheme	5 800	Completed
8	Akhna Forest Phase D	House to House Scheme	2 100	Completed
9	Pervolia Phase D	House to House Scheme Connected to Pervolia Distr. system	2 200	Completed

Self Housing Projects (cont.)

Ser. No.	Village	Scheme	Est. Cost	Remarks
10	Akhna Forest	Water supply to plots for work shops	6 200	Completed
11	Tersephanou A+B+C	Sewage Scheme	100 000	Work in Progress
<u>Irrigation Systems</u>				
1	Odhon	Irrigation division No.2 New Spring	2 500	Completed
2	Aradhippou	Rizoelia Antiflood works	56 000	Completed
3	Kiti	Relocation of a channel	750	Completed
4	Maroni	Maroni river flow gauging station	3 200	Completed
5	Melini	New Irrigation Scheme from B/H No. 36/83	33 000	Work in Progress
6	Tekke	Repair and cleaning of T/C well	1 000	Completed
7	Khrokitia	Repair of the conveyor pipeline from the weir to Khrokitia pond	2 700	Completed
8	Anaphotia	New Irrigation system from B/H 121/86	3 100	Completed
<u>Live Stock Areas Water Supply</u>				
1	Tersephanou-Dhromolaxia	New distribution system and connection to F/sta pipeline	7 500	Completed

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 four main sections as follows:

- Water Resources
- Investigation and Design
- Construction
- Operation and Maintenance

The Regional Office is manned by 49 staff as follows:

- 1 Executive Engineer II
- 2 Senior Technicians
- 11 Technicians I
- 1 Chief Foreman
- 2 Assist. Chief Foremen
- 10 Technicians II
- 1 Accounting Officer
- 2 Clerk II
- 15 Foremen

For the execution of the construction works about 282 skilled and unskilled workers were engaged.

WATER RESOURCES

Hydrological measurements were carried out in the prescribed areas which are under the Special Measures of 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 Menagri gauging station 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 69) and at the same time 7 water samples were taken for suspended sediment analysis. Another 14 water samples were taken, for ionic analysis.

Springs and Streams

The discharge of 39 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 482 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-Evdhimeu, Pisseuri-Evdhimeu, Parekklisha and the rest of Limassol District.

Special Measures Law - Akrotiri Pisseuri 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-Asematos 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	13.2
Domestic	3.6
Industrial	0.7
Total	17.5
Water supplied from Dams	1.1
Total supplied for irrigation from the aquifer and from the Dams	14.3

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 5.2 M.C.M. was released for recharge, in the aquifer, from Yermasoyia Dam. Also a quantity of 0.30 M.C.M. was pumped and released into the aquifer from Episkopi B/Hs (Kouris Delta)

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 577 cases were investigated and permits were finally granted by the D.O. for 496 of them.

Limassol Water Supply

Water supply to Limassol, for domestic purpose from the springs and boreholes is gauged monthly. A total quantity of 8.92 MCM. was supplied, 1.23 MCM from springs and 7.69 MCM from boreholes.

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. 35.8 mm on 25.12.1986) water evaporation (Max. 10.2 mm on 27.6.86) temperature (Max. 39.0 °C on 18.7.1986), wind velocity and sun reflection, at Yermasoyia Dam.

Records were also kept for rainfall (Max. 31.0 mm on 5.9.1986) and water evaporation (Max. 10.2 mm on 26.6.86), at Polemidhia Dam.

Quarry and Gravel Pits Permits

12 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 1984 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 29 cases were examined, studied and the relevant designs were prepared for the total cost of £849,045 as follows.

TABLE XII - 1

IRRIGATION SCHEMES PREPARED IN 1986

Ser. No.	Village & Description	Est. cost £
1	Agriehia. Rehabilitation of "Reuseu" Irrigation Division	9 000
2	Pelendria - Trimiklini. Relocation of pipelines on the new road	4 000
3	Meniatis. Rehabilitation of "Meniatis" Irrigation Division	40 000
4	Potamitissa. Rehabilitation of "Pane Potamos" Irrigation Division	3 500
5	Akrounda. Rehabilitation of Akrounda Irrigation Division	43 500
6	Prodromos. Utilization of B/H 158/84 for "Hartji-Fractis" Irrigation Division	25 100
7	Kaminaria. Utilization of B/H 117/78 for "Ayios Vasilios" Irrigation Division (new scheme).	50 000
8	Episkopi. Extension of the distribution system of Episkopi Irrigation Division to plot 63/2 Sh/Pl.58/4	1 020

9	Yermasoyia - Polemidhia. Extension of Yermasoyia Polemidhia distribution system to plot 279/1 Sh/Pl. 58/8	1 920
10	Ayios Ioannis (Agros). Rehabilitation of "Makheras" Irrigation Division	31 600
11	Lania. Lania - Dhoros irrigation project	325 000
12	Trakhoni Extension. Re-evaluation of Trakhoni Extension "Phase C"	10 000
13	Monagri. Rehabilitation of "Sykalithkia" Irrigation Association	21 000
14	Sylikou. Rehabilitation of "Lavrania" Irrigation Division	8 700
15	Trakhoni Extension. New re-evaluation of Trakhoni Extension "Phase C"	
	1st cost	4 908
	2nd cost	19 364
16	Ayios Yeoryios (Silikou). Rehabilitation of "Kato Livadhia - Mousa - Tseuriches" Irrigation Division	1 550
17	Ayios Yeoryios (Silikou). Rehabilitation of "Kato Pygadhia" Irrigation Division	1 950
18	Saittas - Perapedhi - Platres. Relocation of pipelines on the new road	11 500
19	Perapedhi - Kilani - Vouni. Relocation of pipelines on the new road.	2 650
20	Palodhia - Yerasa - Zoopiya. Relocation of pipelines on the new road	82 000
21	Kaminaria. Re-evaluation of "Ayios Vasilios" Irrigation Division Scheme	63 300
22	Kato Platres. Utilization of B/H 81/81 for "Kato Platres" Irrigation Division	
	1st cost	35 200
	2nd cost	18 800
23	Asgata. Relocation of pipelines on the new road Moni - Monagroulli - Asgata	3 950
24	Trakhoni Extension. New re-evaluation of Trakhoni Extension "Phase C"	
	1st cost	20 500
	2nd cost	6 145
25-29	Five cases in five villages of total cost	2 888
	Total	<u>£849 045</u>

In addition to the above 61 cases (applications) were examined and the relevant technical advice was given to the people concerned.

Domestic Water Supply

For the development of water supply systems of Limassol District, 76 cases were examined, studied and the relevant designs were prepared for the total cost of £748,912 as follows:

TABLE XII - 2

DOMESTIC WATER SUPPLY SCHEMES PREPARED IN 1986

Ser. No.	Village & Description	Est. cost £
1	Amathus. Estimate for installation the pipeline of Phace B' of Amathus project	138 500
2	Kato & Pano Polemidhia. Improvement of water supply scheme	32 300
3	Souni-Zanaja. Supplementary supply from "Kamaroudhi" "Koustoupanou" and "Kanneri" springs	143 500
4	Amathus. Utilization of B/H Hydrological No. 1099 for Amathus project	29 100
5	Armenokhori. Refugee self-housing scheme phace B'	11 500
6	Yermaseyia. Protection works for Yermasoyia borehols	2 600
7	Saittas - Perapedhi. Relocation of pipelines on the new road	2 360
8	K. Polemidhia. Re-evaluation of the land division (File No. D.676/82)	2 760
9	Trakheni - Asomatos. Estimate for a stand by pump for the B/H 97/70	9 500
10	Episkopi. Extension of the distribution system	5 280
11	Kyperounda. Extension of the distribution system to Kyperounda Hespital	13 560
12	Akapnou. Installation of water metres for the distribution system	1 740
13	Palodhia. Re-evaluation of the land division (File No. D.123/83)	4 900
14	Limnatis. Water supply for the land division (File No. D.866/70)	1 300
15	Pano Platres - Phini. Estimate to protect a private spring on the new road	2 280
16	K. Polemidhia. Water supply of plots 14/95, 14/96, Sh/Pl. 54/41	3 560
17	K. Polemidhia. Water supply for land division (File No. D.525/79)	2 400
18	Amathus. Water supply of plot 27/1, Sh/Pl. 54/47	1 650
19	Yermasoyia. Water supply for land division (File No. D.166/79)	1 960
20	Ypsonas. Re-evaluation of the land division (File No. D.934/72)	3 900
21	Amathus. Water supply of plot 165/2/1, Sh/Pl. 54/45	4 000
22	Amathus. Water supply of plot 45 Sh/Pl. 54/45	3 400
23	Kelossi. Re-evaluation of the land division (File No. D.382/82)	1 400

24	Yermasoyia. Water supply for land division (File No. D.338/82)	3 000
25	Yerasa. Utilization of B/H 106/82 for supplementary supply of Yerasa village	22 700
26	Amathus. Water supply of plot 527 Sh/Pl. 54/44 & 52	6 240
27	Pano Polemidhia. Refugee self-housing scheme (plot 66, Sh/Pl. 53/48)	5 400
28	Pano Polemidhia. Substitution of pipelines in the old village	3 500
29	Episkopi. Refugee self-housing scheme (phase Z')	2 060
30	Pano Platres. Water supply of plot 722 Sh/Pl. 47/11 B1W	5 040
31	Moniatis. Water supply of land division (File No. D.330/79)	1 200
32	Amathus. Water supply of plot 266 Sh/Pl. 54/48	27 960
33	Paramali. Water supply of live stoke area	9 800
34	Louvaras. Water supply of Government land division	6 900
35	Louvaras. Water supply scheme from B/H 32/77 of "Vournes" Irrigation Division	5 500
36	Louvaras. Water supply scheme from the storage tank of 16/81 B/H of "Vournes" Irrigation Division	
	1st solution	1 910
	2nd solution	3 440
37	Ayios Konstantinos. Water supply scheme from B/H 123/76 of "Ayios Konstantines" Irrigation Division	2 500
38	Moniatis. Water supply of land division (File No. D.330/79)	2 400
39	Amathus. Water supply of "RITA COURT"	1 800
40	Yermasoyia. Water supply of land division (File No. D.743/85)	2 350
41	Kolossi. Water supply of land division (File No. D.463/82)	9 960
42	Kolossi. Refugee Self-housing scheme (pluce F) . .	42 000
43	Kolossi. Water supply of plot 116/2 Sh/pl. 58/6. .	1 600
44	Pano & Kato Polemidhia. Water supply of land divisions (File Nos D.1188/69, D.960/73, D.961/73)	15 700
45	Pissouri. Extension of the distribution system	4 380
46	Amathus. Water supply of land divisions (File Nos B.559/77, B.727/85, B.158/79, B.470/85, B.109/79) .	42 000
47	Yermasoyia. Water supply of plot 203/2 Sh/Pl. 54/52	1 880
48	Ayios Athanasios. Re-evaluation of land division (File No. 67/74)	3 240
49	Ayios Yeoryios (Alamanou). Relocation of pipelines to Ayios Yeoryios (Alamanou) Monastery	2 800
50	Mouttayiaka. Refugee self-housing scheme (Phase Z')	6 500
51	Kato Platres. Utilization of B/H 81/81 for supplementary supply of Kato Platres village . . .	44 400

52	Ypsonas. Re-evaluation of land division (File No. D.406/83)	7 260
53	Trimiklini. Relocation of pipelines from plot 556, Sh/Pl. 47/29	1 392
54	Pano Polemidhia. Refugee self-housing scheme (Phase Z')	2 270
55	Ayios Konstantinos. Relocation of pipelines of the distribution system	6 400
56	Prodromos. Utilization of B/H 158/84 for supplementary supply of Prodromos village	9 700
57- 76	Twenty cases in twenty villages of total cost . . .	10 280
		<u>£748 912</u>

In addition to the above 111 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. The total cost of construction works in 1986 was £1 849 673.

Materials and Machinery

By the end of the year 1986 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	-	4 309 20
Tiper lorries	W/hours	4 806	16 822 00
Buses	W/days	605	8 355 00
Electrowelding machines	W/hours	2 770.5	3 189 00
Caterpillars	W/hours	84	1 126 80
Caterpillars	agreed	-	840 00
Cutting machines	W/hours	2 245	-
Bulldozer	W/days	72	1 870 00
Land rovers	W/days	4 060	40 439 20
Diggers	W/hours	22 211.5	80 836 19
Compressors	W/hours	1 106	1 679 94
Concrete mixers	W/days	691	2 122 50
Braker	agreed	-	250 00

TABLE XII - 3 MACHINERY USED BY LIMASSOL REGIONAL OFFICE (Cont.)

Machinery Employed	Unit	Quantity	Value £
Braker	W/hours	451	2 986 40
Hydraulic Excavator . . .	W/hours	1 286	10 301 34
Hydraulic Excavator . .	agreed	-	63 549 05
Motor Roller	W/hours	1 510	5 581 00
Grader	W/hours	344	2 782 96
Mobile Concrete Mixer .	W/days	88	1 970 00
Drilling Machine	agreed	-	396 00
Vibrator	W/days	10	100 00
Total			<u>249 506 58</u>

TABLE XII - 4

MATERIALS USED BY LIMASSOL REGIONAL OFFICE

Materials used	Unit	Quantity	Value £
Galvanized steel pipes	m	31 432	87 520 07
Steel pipes (coated or uncoated)	m	3 633	31 096 69
Ductile iron pipes . .	m	14 327	337 638 37
Asbestos cement pressure			
Pipes - class 15 . . .	m	27 262.50	144 716 97
Pipes - class 20 . . .	m	24 753.50	148 517 53
Pipes - class 25 . . .	m	3 560	24 034 34
Pipes - class 30 . . .	m	120	488 40
P.V.C. and polythene pipes	m	63 082	25 356 72
Cement	tones	583.80	16 556 57
Sand	m ³	360.71	1 091 01
Fine and coarse sand . .	m ³	1 141.49	4 682 70
Gravels for Construction			
of field roads	m ³	31 096.74	17 469 71
Aggregates	m ³	1 589.19	5 444 24
Mild steel	tones	55.98	9 266 37
Sand for pipe bedding	m ³	25 668.63	32 654 16
Ready mixed concrete .	m ³	321.09	6 583 00
Fittings	No.	35 318	142 658 20
Sluice valves	No.	3 475	37 748 95
Water meters	No.	442	9 191 99
Shingle	m ³	83.86	405 77
Total			<u>1 083 121 76</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

For repairing and maintenance of water meters and valves and general maintenance and painting of metal structures, etc. a sum of £22 624 was spent on Yermasoyia-Polemidhia Dams and Distribution network. The amount of £23 107 was spent for the operation and maintenance of the pumping units in Kouris Delta Emergency 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 Officer. For supervision, repairs and maintenance of water meters and valves and general maintenance and painting of metal structures etc. Expenditure : £4 136.

Village water supply schemes

For repairs and maintenance of several water supply systems the sum of £5,986 was spent.

MEETINGS

During the year under review the Regional Engineer attended several meetings as the representative of the Director of the Department.

XIII PAPHOS REGIONAL OFFICE

by
A. Lambrou
Executive Engineer I
Regional Engineer

General

In 1986 the staff of the Regional Office was composed of the following:

1	Executive Engineer I	
10	Technicians	I
11	Technicians	II
1	Chief Foreman	
1	Ass. Chief Foreman	
4	Foremen Monthly	
5	Foremen Weekly	
1	Officer Clerk	
7	Clerical and accounting staff	
1	Telephone Operator	
1	Messenger	

WATER RESOURCES

Surface Hydrology

During the year 10 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 382 current meter measurements were taken during the year for calibration purposes. Also samples for suspended load and boron analysis were taken regularly.

Springs

During the year 30 springs were under observation and a number of 624 spring discharges were gauged, 25 by current meter and 599 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 rain gauge recorders were in operation during the year, under weekly and monthly visits for observation.

Ground Water Hydrology

Ground water conditions in South Western Paphos were observed with the help of 128 wells/boreholes.

The distance from established bench marks on top of every observation well/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 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 146 wells/BHs during the year for special studies.

During the year a total number of 2019 measurements were taken from wells/BHs under observation as follows:
1770 water levels from S.W. Paphos Hydrological Area
249 water levels from Polis Project Area.

Analysis

A total number of 741 samples for analysis were taken from wells/boreholes, springs and streams, 54 of which were submitted to the Government analyst for Boron and Ionic analysis, 24 to the Departmental laboratory for suspended sediment, 219 to Khirokitia analyst for Nitrates & Ionic and 444 for Chloride content.

Questioning

The annual questioning was carried out in south western Paphos Hydrological Area and in Dhiarizos - Xeros - Ezousa riverbeds, on 3604 owners of wells during summer for determining the ground water extracted, area irrigated and kind of crops planted.

Well sinking permits

A total number of 232 applications for sinking and covering permits for wells/boreholes were examined and submitted to the District Office 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
65	85	35	14	21	12

Encroachments in rivers and streams

Twenty seven cases for land encroachments in rivers and streams were examined and the Director of Land and Surveys Department was advised accordingly.

Quarry and gravel pit permits

Twenty five 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 river beds.

Plotting

During 1986, 11 wells/boreholes were plotted on LRO plans at Kouklia and into the riverbed of Xeros special measure law area covering a total area of 10 sq.km.

Pumping Tests

During the year 13 pumping tests, 12 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 District Office for 1986 included 26 Water Supply and Irrigation Schemes of a total cost of £444,063.00. Also another £212,631.00 was spent for several other works, mainly coming from Public Works Department and the District Officer Paphos. A table for all construction works, is given under chapter VII CONSTRUCTION DIVISION.

INVESTIGATION AND DESIGN

The planning and design of irrigation scheme were in progress during 1986 and a total number of 4 new and old projects were prepared. The schemes were submitted to the Director for approval and submission to the interdepartmental Committee for evaluation. The table below shows separately the extend of land and the cost of each Irrigation Scheme.

TABLE XIII - 1
IRRIGATION SCHEMES PREPARED IN 1986.

Ser. No.	Village and Description	Est. cost £
1.	Fasoulla "Kalamos" Irrigation (new plan) irrigated 850 donums (B/H 166/83 and 236/62)	114 250.00
2.	Yiolou (B/H 111/81) irrigation (new plan) irrigated 250 donums	94 000.00
3.	Improvements to Mamonia Irrigation division (B/H 4/63)	5 660.00
4.	Lasa (Irrigation Scheme "Romanos") new plan with pipelines	4 000.00
	Total	<u>£217 910.00</u>

TABLE XIII - 2
DOMESTIC WATER SUPPLY SCHEMES PREPARED IN 1986

Ser. No.	Village and Description	Est. Cost £
1.	Pano Yialia W. Supply (house to house)	40 570.00
2.	"Appides" Scheme replacement of pipelines to Phyti and Panayia
3.	Kissonerga Water Supply of National Guard	1 840.00
	Total	<u>42 410.00</u>

Also 95 applications were investigated by this section during the year.

OPERATION AND MAINTENANCE

During 1986 the Paphos District Office dealt with the operation and maintenance of the several water works in Paphos i.e. Paphos Dams, Khrysokhou valley irrigation scheme and the Various Government Water Supply Scheme.

Regarding the Government Water Supply Schemes a detail report covering both the expenditure and the revenue generated has been submitted to the Director.

Also 283 applications regarding E.A.C and CYTA way leaves were examined during 1986.