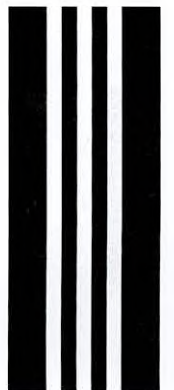


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Report '61?

REPUBLIC OF CYPRUS

Tendashynos
Tremithios
Ezwa

DEPARTMENT OF WATER DEVELOPMENT

ANNUAL REPORT FOR 1960

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CYPRUS
DEPARTMENT OF WATER DEVELOPMENT
ANNUAL REPORT FOR 1960

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Introduction:

This is the first annual report of the Water Development Department to be published after the establishment of the Cyprus Republic.

The engineering and geological side of all Government water development work has been in the hands of the Department of Water Development whose duties include the search for new sources, the conservation and development of supplies for irrigation, domestic and industrial use, and the problems connected with river training, flood protection and land drainage. The administration of Village Irrigation Divisions and Associations and domestic Water Commissions has been supervised by the District Officers. Disputes over water rights have been handled chiefly by the District Officer in consultation with the Law Officers and the Departments of Land Registration and Water Development. Soil Conservation and the agricultural problems involved in the economic use of water for irrigation are responsibilities of the Department of Agriculture.

Because of the mass resignation of the overseas officers all the senior posts in the Department have been left vacant for the whole of 1960. Owing to this great shortage of staff as well as the inadequacy of funds the activities of the Department were very adversely affected. As it will be seen from Appendix I the total expenditure incurred by the Department amounted to £605,613.

In the reports which follow an account is given by the Heads of Sections of the work done in 1960 by each of the major sections of the Department.

The title of the Head of the Department has in 1960 been changed from Director of Water Development to Chief Water Development Officer.

Y. HJI STAVRINOU
For Chief Water Development Officer.

APPENDIX I
TABLE SHOWING EXPENDITURE OF THE
DEPARTMENT OF WATER DEVELOPMENT IN 1960

| Ser. No. | | Government Funds | Contribution by Beneficiaries | Total |
|-------------|--|---------------------|-------------------------------------|---------|
| | | £ | £ | £ |
| 1 | Irrigation and Drainage | 85,036 | 9,683 | 94,719 |
| 2 | Village Water Supplies | 66,299 | 71,526 | 137,825 |
| 3 | Prospecting for Water | 6,521 | - | 6,521 |
| 4 | Drilling upon repayment | 42,316 | - | 42,316 |
| 5 | Greater Nicosia Water Supply Scheme | 14,476 | - | 14,476 |
| 6 | Morphou Bay Scheme | 146,055 | - | 146,055 |
| 7 | Town Water Supplies upon repayment | - | 29,226 | 29,226 |
| 8 | Hydrological Research | 6,059 | - | 6,059 |
| 9 | Miscellaneous Works for Govt. Authorities | 4,569 | - | 4,569 |
| 10 | Maintenance and running of Greater Nicosia Scheme | 30,613 | - | 30,613 |
| 11 | Departmental and Maintenance | 93,234 | - | 93,234 |
| | | 495,178 | 110,435 | 605,613 |

Included in the above statement are:-

| | | | | | |
|---|--|----|----|----|---------|
| 1 | Personal Emoluments | .. | .. | .. | 52,069 |
| 2 | Wages for labour | .. | .. | .. | 232,172 |
| 3 | Travelling | .. | .. | .. | 12,186 |
| 4 | Government Controlled Irrig. Works | .. | .. | .. | 1,726 |
| 5 | Pump testing wells and boreholes | .. | .. | .. | 840 |
| 6 | Value of Casing Pipes fixed in boreholes | .. | .. | .. | 9,082 |
| 7 | Total cost of drilling and cleaning boreholes excluding items 5 and 6 | .. | .. | .. | 48,217 |
| 8 | Maintenance of Govt. Water Supplies and purchase of water | .. | .. | .. | 6,563 |

APPENDIX 2

TABLE SHOWING PERSONNEL OF
WATER DEVELOPMENT DEPARTMENT IN 1960.

| | |
|--|-------|
| Geologist | 1 |
| Executive Engineers | 6 |
| Superintendent of Works | 1 |
| Senior Inspectors of Works | 4 |
| Inspectors of Works | 8 |
| Chief Foremen | 3 |
| Assistant Chief Foremen | 2 |
| Technical Assistants | 23 |
| Foremen | 73 |
| Clerical Assistants and Miscellaneous | 46 |
| | <hr/> |
| | 167 |
| | <hr/> |
| | ===== |

Vacant Posts in 1960.

| | |
|---|---|
| 1 | Chief Water Development Officer |
| 1 | Assistant Chief Water Development Officer |
| 1 | Engineer Hydrologist |
| 2 | Senior Water Engineers |
| 1 | Superintendent of Works |
| 3 | Inspectors of Works |
| 1 | Assistant Chief Foreman |
| 3 | Technical Assistants |
| 5 | Foremen |

TABLE SHOWING LABOURERS EMPLOYED
DURING 1960

| <u>Month</u> | |
|--------------|-------|
| January | 834 |
| February | 789 |
| March | 1,003 |
| April | 1,028 |
| May | 751 |
| June | 867 |
| July | 850 |
| August | 812 |
| September | 725 |
| October | 990 |
| November | 961 |
| December | 805 |

Average = 868

APPENDIX 3

IRRIGATION AND DRAINAGE WORKS AND
INVESTIGATIONS FOR MAJOR IRRIGATION PROJECTS

By C.A.C. KONTEATIS, B.Sc., (Eng.), A.M.I.C.E., A.M.I.W.E.
Executive Engineer Irrigation Works

Because of the transitional period (Independence was in August, 1960) and the slackness that resulted in Government functions, only a limited amount of money was allocated for the construction of irrigation works.

I. CONSTRUCTION OF IRRIGATION WORKS

It can be seen from appendices 4 and 5 that £90,686 was available for irrigation works out of which £57,328 were spent on the construction of the Lefka mass concrete dam which is not yet completed. The remaining money was spent on 31 very small irrigation schemes. The land benefited from these works is estimated to be 1,120 donums of perennial crops, 477 donums of spring crops and 483 donums of winter crops.

These figures do not include many private small irrigation works following the drilling of boreholes by Government or by private drillers. A great number of the boreholes specially in the Famagusta district were drilled without Government permission and a lot of uncontrolled pumping is going on.

The irrigation works carried out by Government for Irrigation Divisions or Irrigation Associations can be classified in one or more of the following groups:-

- (i) Impoundment of water in gravity mass concrete dams for the purpose of controlled perennial irrigation.
- (ii) Diversion of stream flow into channels or pipelines for the purpose of irrigation.
- (iii) Lining of channels and laying of pipelines for irrigation purposes.
- (iv) Construction of concrete or masonry storage reservoirs for irrigation.

*I must have
a look*
"
"

- (v) Excavation and building of springs and chain-of-wells for the purpose of increasing the yield of flow and of protecting the source.
- (vi) Pumping irrigation schemes.
- (vii) Antiflood works.
- (viii) Repair and improvement works on existing irrigation systems.

The total area of Cyprus is about 6,700,000 donums out of which 3,900,000 donums is arable i.e. 58%. Of this arable land about 3,200,000 is cultivated i.e. about 82% of the arable land. 600,000 donums of the cultivated land are irrigated i.e. 29% of the cultivated land. Of the irrigated land about 450,000 donums are irrigated in winter only, and 150,000 donums are irrigated in spring, summer or perennially. Well over half of the 600,000 donums of irrigated land has come under irrigation due to works carried out by the Water Development Department since its establishment in 1939.

The most important irrigation works under construction in 1960 were:-

- (i) The Lefka mass concrete gravity dam which is being built on the Marathassa river near M.P. 38 on the Lefka-Pedhoulas road. A total volume of about 15,000 cubic yards 1:2:4 concrete had been placed by the end of 1960 which represents about 75% of the total volume of concrete to be cast to complete the dam to a height of 85 feet above main river bed level, giving a storage capacity in the order of 100 million gallons of water. A lot of machinery was used for the construction of the dam such as draglines, vertical and inclined elevators for casting the concrete, traxcavators for excavations, bulldozers for levelling and scraping, brayloaders for transporting aggregate, mixers for mixing the concrete and air compressors for operating pneumatic tools such as vibrators for vibrating the concrete and drills for cutting hard rock. On the average about 60 labourers and artisans were working daily on this job and the expenditure reached £57,328 by the end of 1960.

450,000 M³

- (ii) At the Kouklia reservoir regulating iron screw gates were fixed on one of the upstream spillways north of Prastio-Gaidhouras road. These regulating gates will enable the diversion of the Pedhieos river floods into the Kouklia reservoir for storage and then for controlled irrigation of the lands of the villages downstream of the reservoir. Previously timber logs were used as gates but they were easily damaged and washed away and a lot of water was being wasted. In fact in the winter 1959-1960 three times huge quantities of water escaped through this spillway and was lost to the sea. The cost of the work including some minor repairs on the reservoir was £852.
- (iii) At the Ayios Lucas reservoir Famagusta, the embankment and spillway were raised by one foot and six inches. This enables the storing of 90 million gallons of water instead of 68 million gallons previously. The water in the reservoir is used for the recharge of the Famagusta sandstone aquifer through the Ayios Loucas - Paralimni infiltration gallery and through vertical recharge in the lake itself. As it is known the Famagusta aquifer is suffering from the depression of the water table below sea level which resulted to serious sea intrusion threatening the rich orange groves of the area. £1,214 were spent on this work.
- (iv) The lining of channels in concrete of the Polis Irrigation Association started in 1960. As a first stage £3,529 were spent on this work which irrigates an area of about 500 donums of winter crops, 255 donums of early summer crops and 255 donums of perennial crops. The lining of the channels was necessary because of the great losses of water in the earth channels which are several miles long. It is hoped that in 1964 another £13,900 will be spent to complete this work. The total length of channels to be lined are $3\frac{1}{2}$ miles.
- (v) At Pyrgos (Tylliria) £4,574 were spent on the extension of the piped distribution system from the Pyrgos dam constructed in 1959. This work was necessary for the efficient irrigation of the lands commanded by the dam.

- (vi) At Evretou - Simou - Philousa £4,126 were spent on the construction of two diversion weirs on the Stavros-tis-Psokas (Sarama) and the construction of 3,000 feet of R.C. channels for the irrigation of 40 donums of early summer crops and 40 donums of perennial crops.

II. INVESTIGATIONS FOR MAINTENANCE AND CONSTRUCTION PROJECTS.

Field surveys and Drawing works for the larger irrigations projects has continued throughout the year at a limited scale due to the paucity of staff. The schemes examined during 1960 are as follows:-

(i) Pendaskynos Catchment.

Investigations were carried out with a view of using the water of the Pendaskynos river for the irrigation of the villages in the catchment which are Lefkara, Skarinou and Ayios Theodoros. Six dam sites were surveyed along the river and three were chosen as enough for Lefkara and two for Ayios Theodoros and Skarinou. The lower dam will be an earth dam downstream of Ayios Theodoros which will allow any water to escape to the sea in years of exceptional rainfall. This dam will also help for the recharge of the coastal aquifer. The dams on this catchment will be constructed in stages whilst in the meantime the behaviour of the surface and underground resources will be kept under observation.

* Final proposals for this scheme will be submitted in 1961.

(ii) Tremithios Catchment.

Tremithios river is of about the same flow capacity as Pendaskynos river but the villages to be benefited by this river are many more. They include Lymbia, Psevdhas, Ayia Anna, Klavdhia, Kalokhorio, Tersephanou, Kiti and in addition the Larnaca domestic supply.

Six Dam sites have been investigated, 3 of them for concrete dams and four for earth dams. Four of them may be recommended when the investigations are completed. The one earth dam will serve for the recharge of the aquifer which supplies water to the Larnaca town as well as for the surface irrigation of downstream villages.

■ ■ ■

* in 1961.

(iii) Ezuza Catchment, is nearly twice as big in flow compared with Tremithios or Pendaskynos. Five damsites have been surveyed, 4 of them upstream of Kannaviou village and one downstream. The investigations are still going on and final proposals will be submitted in 1961.

* (iv) The proposed Geunyeli Earth Dam has been resurveyed with a view of a more economic design. The survey will be completed early in 1961.

(v) ³ An earth dam at Athalassa was surveyed on the Vathys river to impound 170 million gallons of water. This dam would cost £22,000 and would serve three purposes.

765 000 M

(1) The use of the surface of water for the irrigation of Athalassa, Eylenja and Kaimakli lands 1750 donums are estimated to be irrigated.

(2) To protect the Athalassa farm against floods. In 1960 the damages to the Athalassa farm from floods were £6,000.

(3) The recharge of the farm aquifer.

~~(vi)~~ An earth dam for Exometokhi on the Ayios Vassilios stream has been designed which would serve for the surface irrigation of Exometokhi and Epikho lands and for protection against the flooding of Exometokhi village. The dam is to impound 31 million gallons of water and is estimated to cost £10,400.

400 donums of land are estimated to be irrigated.

? ~~(vii)~~ An earth dam at Neokhorion (Kythrea) has been designed on the Neokhorio stream to impound 42 million gallons of water at an estimated cost of £10,800. 420 donums of lands belonging to Neokhorion village are to be commanded. A provision can be made for raising this dam if necessary to take the surplus of the Kythrea spring in winter.

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85
68
765

This cannot proceed before the Chief Officer Crops Research and Extension gives his views on whether there can be a surplus of water in winter.

- (viii) At Lefkoniko on the Yerokolymbos stream an Earth Dam was designed for Lefkoniko village which will impound 130 million gallons of water at an estimated cost of £15,000. About 1000 donums of land may be irrigated from this dam. *where* ?
- (ix) At Sotira village at the locality "Phonissa" an Earth Dam was designed to store 15 million gallons of water for the recharge of the Sotira aquifer. ?
- (x) Investigations on the extension of the recharge works at Famagusta have continued and final recommendations will be submitted in 1961. *
- (xi) Investigations for constructing a big Earth Dam on the Serrachis river at Morphou for surface irrigation and for the recharge of the area have started and recommendations will be submitted in 1961.

APPENDIX 4

IRRIGATION SCHEMES COMPLETED IN 1960

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off. | | | Remarks |
|----------|----------------------|--|--------|--|--------|-----------|-----------------------------|
| | | | | D o n u m s | | | |
| | | | | Winter | Spring | Perennial | |
| | <u>Nicosia Dist.</u> | | | | | | |
| 1 | Tseri ✓ | De-silting of tunnel | 676 | - | - | - | Improvement works |
| 2 | Kalokhorio ✓ | Raising the walls of the existing reinforced concrete channels | 569 | - | - | - | - do - |
| 3 | Milikouri ✓ | Construction of two storage tanks and laying of pipes | 529 | - | - | 6 | Improved and new irrigation |
| 4 | Palekythro ✓ | Repairs to the existing weir | 857 | - | - | - | Improvement works |
| 5 | Episkopio ✓ | Construction of a concrete groyne intake and lining of intake channels | 1,050 | - | - | - | - do - |
| 6 | Argates ✓ | Construction of a concrete groyne intake and lining of intake channel | 962 | - | - | - | - do - |
| 7 | Kato Zodhia ✓ | Construction of a concrete groyne intake | 652 | - | - | - | - do - |
| 8 | Limnitis ✓ | Construction of a pumphouse | 1,105 | - | - | - | - do - |
| | | Total for Nicosia | 5,400 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off. | | | Remarks |
|----------|--|--|-----------|--|--------|-----------|---------------------------|
| | | | | D o n u m s | | | |
| | | | | Winter | Spring | Perennial | |
| | | B/F | 5,400 | | | | |
| 1 | <u>Kyrenia Dist.</u> Kalogrea ✓ | Excavation and building of four springs and laying pipes | 420 | - | 9 | 4 | Improved & new Irrigation |
| | | Total for Kyrenia | 420 | | | | |
| 1 | <u>Larnaca Dist.</u> Melini ✓ | Construction of a storage tank, R.C.Channels and laying of pipes | 729 | | | | Improved & new Irrigation |
| | | Total for L'ca | 729 | | | | |
| 1 | <u>Famagusta Dist.</u> Ay. Loucas ✓ | Repairing of the embankment of the Ayios Loucas reservoir | 1,214 | | | | Improvement works |
| 2 | Kouklia ✓ | Installation of screw-gates and general repairs to the Kouklia reservoir | 852 | | | | Improvement works |
| | | Total for Famagusta | 2,066 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off. D o n u m s | | | Remarks |
|----------|-------------------|---|-----------|---|--------|-----------|-----------------------------|
| | | | | Winter | Spring | Perennial | |
| | Limassol Dist. | B/F | 2,066 | | | | |
| 1 | ✓ Ay. Therapon | Construction of R.C. channels and repair works | 1,505 | | | | Scheme continued from 1959 |
| 2 | ✓ Ay. Demetrios | Construction of aqueduct | 350 | | | | Improvement works |
| 3 | ✓ Limnatis | Desilting of tunnel | 268 | | | | - do - |
| 4 | ✓ Ayios, Yeorgios | Laying of pipes | 695 | - | 7 | 5 | Improved and new irrigation |
| 5 | ✓ Athrakos | (a) Repairs to the existing weir | | | | | |
| | | (b) Laying of pipes & construction of a storage tank. | | | | | |
| | | Total | 1,128 | | 70 | 10 | - do - |
| 6 | ✓ Tris Elies | Laying of an intake pipeline 6" ø | 167 | | | | Improvements works |
| 7 | ✓ Potamitissa | Repairs to the existing weir | 253 | | | | - do - |
| 8 | ✓ Dhymes | Construction of a storage tank and laying of pipes | 452 | | 8 | 8 | Improved and new irrigation |
| 9 | ✓ Paleomylos | Construction of R.C. channels, two small intake weirs, protective wall & irr. ports | 573 | | | 180 | - do - |
| | | Total for Limassol | 5,421 | | | | |

| Sr. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|---------|---------------------|--|-------------------------|--|--------|-----------|---|
| | | | | Winter | Spring | Perennial | |
| | <u>Paphos Dist.</u> | B/F. | 5,421 | | | | |
| 1 | Statos ✓ | Construction of a storage tank, tunnel and laying of pipes | 2,257 | | | | Improvement works |
| 2 | Dhrousha ✓ | Construction of channels laying of pipes and repair works | 168 | | 8 | 8 | Improvement and new irrigation |
| 3 | Inia ✓ | Construction of R.C. channels | 145 | | 20 | 22 | - do - |
| 4 | Prastio ✓ | Laying of pipes and repair works | 235 | | | | Improvement works |
| 5 | Polis ✓ | Construction of R.C. Channels | 3,529 | 500 | 255 | 225 | Improved and new irrigation Scheme incomplete |
| 6 | Ktima ✓ | Anti-flood works | 1,080 | | | | |
| | | Total for Paphos | <u>7,714</u> | | | | |
| | | Grand Total | <u>£21,750</u> ===== | | | | |

APPENDIX 5

IRRIGATION SCHEMES UNDER CONSTRUCTION AT THE END OF 1960 TO CONTINUE IN 1961

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off | | | Remarks |
|----------|--------------------------|---|---------|---|--------|-----------|---|
| | | | | D o n u m s | | | |
| | | | | Winter | Spring | Perennial | |
| | <u>Nicosia Dist.</u> | | | | | | |
| 1 | Lefka ④ | Construction of a mass concrete gravity overflow dam | 57,328 | - | - | 550 | Improved and new irrigation |
| 2 | Louroujina ✓ | Repairing and regrading of the existing chain-of wells construction of R.C. Channels, one pump and one stor.tank. | 1,588 | - | 20 | 10 | - do - |
| 3 | Pyrgos ✓ | Supplementary distribution pipes and ancillary works from the existing dam | 4,574 | - | - | - | Completion of Pyrgos impounding scheme. |
| | <u>Larnaca Dist.</u> | | | | | | |
| 4 | Kiti ✓ | Desilting and regrading of channels, construction of silt-trap and other improvement works | 1,320 | - | - | - | Improvement works |
| | <u>Paphos Dist.</u> | | | | | | |
| | Evretou-Simou-Philousa ✓ | Construction of a weir and laying of pipes | 4,126 | - | 40 | 60 | Improved and new irrigation |
| | | Total | 368,936 | | | | |

APPENDIX 6

IRRIGATION SCHEMES APPROVED BY THE GOVERNMENT FOR CONSTRUCTION IN 1961
 (Some of them may be rejected by the villages concerned)

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|-------------------------|--|---------------|--|--------|-----------|---------------------------------------|
| | | | | Winter | Spring | Perennial | |
| | <u>Nicosia Dist.</u> | | | | | | |
| 1 | Vroisha | Laying pipes with the necessary sluice valves and minor repairs to the existing storage tank | 350 | - | - | 8 | Improved and new irrigation. |
| 2 | Politiko | Regrading and lining of the existing chain of wells where necessary and lining of channels | 7,200 | 300 | 100 | - | - do - |
| 3 | Pera | Desilting, regrading and building of the existing cutting, regrading of the tunnel where necessary and lining of channels in reinforced concrete. | 5,880 | 600 | 120 | - | - do - |
| 4 | Ay. Ioannis (Maloundas) | Excavation of a new tunnel, lining of tunnel, desilting, regrading and bulding of cuttings, laying of precast cement pipes, lining of channels in reinforced concrete and other repair works | 12,000 | - | 400 | 100 | - do - |
| 5 | Platanistassa | Construction of R.C. Channels | 560 | - | 20 | 10 | - do - |
| 6 | Epikho | Construction of irrigation ports, diversion gates and deepening of channels | 1,200 | - | - | - | Improvement works |
| 7 | Limnitis | River training | 2,700 | - | - | - | Land reclamation and antiflood works. |
| 8 | Limnitis | Lining of channels in concrete | 4,000 | 250 | 50 | - | Improved and new irr. |
| | | | <u>33,890</u> | | | | |

- 15 -

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|-------------------------------------|---|---------|--|--------|-----------|-----------------------------|
| | | | | Winter | Spring | Perennial | |
| | <u>Nicosia Dist.</u> (continued) | B/F | 33,890 | | | | |
| 9 | Moutoullas | Lining of channels in reinforced concrete | 17,200 | - | - | 392 | Improved and new irrigation |
| 10 | Moutoullas | Improvement of springs for summer irrigation | 900 | - | - | 36 | - do - |
| 11 | Kambi-tou-Pharmaka | Construction of a storage tank and R.C. Channels | 530 | 20 | 19 | 2 | - do - |
| 12 | Kambi-tou-Pharmaka | Piping of the water from two springs to a new storage tank to be constructed. Laying of pipes | 550 | - | - | 10 | - do - |
| 13 | Kythrea & (Suburbs) | Supplementary lining of irrigation channels | 33,000 | - | - | 1000 | - do - |
| 14 | Geunyeli | Construction of flood detention dam for controlled irrig. in winter and spring | 17,000 | 700 | 300 | - | - do - |
| 15 | Syrianokhori | Lining of channels in concrete | 31,000 | - | 700 | 700 | - do - |
| 16 | Koutraphas | Construction of groyne intake and R.C. Channels | 3,000 | - | 160 | - | - do - |
| 17 | Kambos | Lining and improvement of existing channels | 24,000 | - | - | 230 | - do - |
| | | | 161,070 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|-------------------------------------|--|---------|--|--------|-----------|-----------------------------|
| | | | | Winter | Spring | Perennial | |
| | <u>Nicosia Dist.</u> (continued) | B/F | 151,070 | | | | |
| 18 | Oekos | Laying of pipes with the necessary sluice valves, construction of irrigation ports | 1,270 | - | 10 | 6 | Improved and new irrigation |
| 19 | Nikitari | Lining of channels in reinforced concrete, laying of pipes, construction of irrigation ports | 2,500 | 380 | 200 | - | - do - |
| 20 | Dhali | Cleaning of chain-of-wells and lining of 300 feet of tunnel where necessary | 1,600 | 1000 | - | 50 | - do - |
| 21 | Elea | Pumping scheme and laying of pipes | 7,500 | - | - | 220 | - do - |
| 22 | Masari | Pumping scheme and R.C. Channels with the necessary irrigation ports | 6,800 | 400 | - | 50 | - do - |
| 23 | Louroujina | Conveyor pipeline | 320 | - | 20 | 10 | - do - |
| 24 | Ay. Sezomenos and Potamia | Groyne intake and lining of channels in reinforced concrete | 1,100 | 1000 | - | - | - do - |
| 25 | Palekhorj | Lining of channels | 18,500 | 900 | 130 | - | - do - |
| 26 | Exo Metokhi and Epikho | Construction of flood detention dam for controlled irrigation and flood protection | 10,400 | 400 | - | - | - do - |
| | | | 211,060 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|-------------------------------------|---|---------------|--|--------|-----------|-----------------------------|
| | | | | Winter | Spring | Perennial | |
| | <u>Nicosia Dist.</u> (Continued) | B/F | 211,060 | | | | |
| 27 | Exometokhi | Improvement works on a weir | 300 | - | - | - | Improvement works |
| 28 | Tembria | Lining of channels | 750 | - | - | 20 | Improved and new irrigation |
| 29 | Morphou | Earth dam on the Scrakhis river to be used for surface irrigation and for the recharge of the Morphou aquifer | 50,000 | - | - | - | |
| 30 | Lefka | Construction of a mass concrete dam | 10,000 | - | - | - | Continuation of the work |
| | <u>F'gusta Dist.</u> | | | | | | |
| 1 | Ay. Andronikos | Pumping scheme and lining of channels in concrete | 3,200 | - | 50 | 80 | Improved and new irrigation |
| 2 | Lefkoniko | Construction of earth dam | 14,960 | 700 | 275 | - | - do - |
| 3 | Gaidhouras | General improvements on spate irrigation works | 3,800 | 1,500 | - | - | - do - |
| 4 | Vitsadha | Anti-soil erosion and irrigation weir | 3,500 | - | - | - | Anti-erosion scheme |
| 5 | Milea | Construction of irrigation ports | 1,000 | 100 | - | - | Improved and new irrigation |
| 6 | Lysi | Installation of a new pump, repairing of pumphouse | 700 | - | - | - | Improvement works |
| | | | <hr/> 289,270 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|--------------------------------|--|---------|--|--------|-----------|---|
| | | | | Winter | Spring | Perennial | |
| | Famagusta Dist. (Continued) | B/F | 289,270 | | | | |
| 7 | Famagusta-Dherinia | Extension of the existing recharge works include the construction of a conveyor canal to take the flow of the Phrenaros, Ayia Erini and Ayios Nicolaos catchments into a proposed dam at Ay. Nicolaos from where the water will go into the Ay. Lucas reservoir. The overflow will follow a canal into the Fresh Water Lake and thence into the Ay. Lucas reservoir. A weir at "Mutti-tis-Halis" will divert the overflow of the Yialias river into the Fresh Water Lake. An earth dam at Harangas is also to be constructed | 25,000 | - | - | - | Extension and improvements on the existing recharge works |
| | Larnaca Dist. | | | | | | |
| 8 | Ora | Construction of a storage tank and R.C. Channels | 2,000 | 80 | 15 | 7 | Improved and new irrigation |
| 9 | Tersephanou | Improvements on channels | 3,000 | 780 | - | - | - do - |
| 10 | Ay.Theodoros | Construction of a diversion weir and excavation of earth channels | 8,500 | 2,563 | - | - | - do - |
| 11 | Kalavastos | Repairs on existing channels and weir | 4,900 | - | - | - | Improvement works |
| | | | 332,670 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s. | | | Remarks |
|----------|-------------------------------------|--|----------------|---|--------|-----------|-----------------------------|
| | | | | Winter | Spring | Perennial | |
| | <u>Larnaca Dist.</u> (Continued) | B/F | 332,670 | | | | |
| 5 | Aplanda | Repairs to the existing storage tank | 150 | - | - | - | Improvement works |
| 6 | Odhou | Repairs of the cracks at several places on the existing channels. Lining of 640 feet of channels in reinforced concrete | 480 | - | - | - | - do - |
| | <u>Paphos Dist.</u> | | | | | | |
| 1 | Moladhia | Construction of new storage circular tank and laying of pipes with the necessary sluice valves | 1,050 | - | 4 | 7 | Improved and new irrigation |
| 2 | Ay. Isidhoros-Steni | Piped irrigation system | 450 | - | 20 | 10 | - do - |
| 3 | Archimandrita, Pano | Excavation and building of the spring (D.W.S. and Irrigation spring) and lining of channels in reinforced concrete | 250 | - | 10 | 6 | - do - |
| 4 | Lyso | Piped irrigation system from existing storage tank | 330 | - | 3 | 2 | - do - |
| 5 | Marathounda | Scheme A. Construction of a weir, storage tank and laying of pipes. Scheme B. Construction of a small weir and laying of pipes | 4,400 | 90 | - | 90 | - do - |
| | | | <u>339,780</u> | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off | | | Remarks | |
|----------|------------------------------------|--|----------------|---|--------|-----------|--|----|
| | | | | D o n u m s | | | | |
| | | | | Winter | Spring | Perennial | | |
| | <u>Paphos Dist.</u> (Continued) | B/F | 339,780 | | | | | |
| 6 | Philousa | Construction of a weir and laying of pipes with the necessary sluice valves | 1,050 | 20 | 10 | 15 | Improved and new irrigation | |
| 7 | Nata-Kholetria | Extension of the existing perforated concrete pipeline | 1,600 | - | - | 180 | - do - | |
| 8 | Istinjo | (a) Excavation and building of the spring (D.W.S. and irrigation spring) | 600 | - | - | - | - do - | 21 |
| | | (b) Excavation, building and covering of another spring building of shafts construction of R.C.Channels and laying of pipes with the necessary sluice valves | 1,400 | 20 | 8 | 8 | - do - | |
| 9 | Evretou | Stage II (completion). Construction and laying of 540 feet of concrete pipes 12" ϕ . Construction of a trough and settling tank. Laying of pipes with the necessary sluice valves | 8,900 | 32 | 57 | 66 | - do - | |
| 10 | Kritou-Terra | Drilling of a B.H. pumping installations | 3,000 | - | - | - | The land to be irrigated depends on the success of the proposed B.H. | |
| | | | <u>356,330</u> | | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|-----------------------------|---|---------|--|--------|-----------|---|
| | | | | Winter | Spring | Perennial | |
| | Paphos Dist. (Continued) | B/F | 356,330 | | | | |
| 11 | Pelathousa | Cleaning and repairing of the spring, troughs and storage tank and laying of pipes with the necessary sluice valves | 1,550 | - | 20 | 9 | Improved and new irrigation |
| 12 | Phinikas | Stage I. Laying of a perforated pipeline 12" ϕ in the gravels of the "Xeros" river | 3,700 | - | - | - | Land to be irrigated depends on the quantity of water to be found |
| 13 | Polis | Lining of channels in reinforced concrete | 13,900 | 500 | 255 | 225 | Improved and new irrigation (Completion of Scheme) |
| 14 | Ay. Nicolaos (Philousa) | Stage II. Construction of a storage tank and retaining wall. Lining of channels in R.C. | 1,680 | - | - | 26 | Improved and new irrig. |
| 15 | Saramas | Construction of a weir and laying of pipes | 3,200 | - | - | 50 | - do - |
| 16 | Kithasi | Drilling of a B.H. and pumping installations | 1,040 | - | - | - | The land to be irrigated depends on the quantity of water to be found |
| | | | 381,400 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|--|--|-----------|--|--------|-----------|---|
| | | | | Winter | Spring | Perennial | |
| | <u>Limassol Dist.</u> | B/F | 381,400 | | | | |
| 1 | Plataniskia | Construction of R.C. Channels, laying of pipes and repairs to the existing storage tank | 540 | - | 8 | 8 | Improved and new irrigation |
| 2 | Episkopi) Kandou (Erimi) Kolossi (Ypsonas) | Prospecting boreholes | 4,000 | - | - | - | Prospecting boreholes for irrigation purposes |
| 3 | Agros | Lining of channels in reinforced concrete | 450 | - | - | 20 | Improved and new irrigation |
| 4 | Ay. Pavlos | Construction of a small weir, intake channel, storage tank and laying of pipes | 1,140 | - | - | - | - do - |
| 5 | Agriidhia | Raising of the weir, construction of a storage tank and laying of pipes | 1,200 | - | 60 | 20 | - do - |
| 6 | Phini | Construction of a small weir, lining of channels in reinforced concrete, construction of a storage tank and irrigation ports | 2,400 | - | - | 30 | - do - |
| 7 | Phini | Construction of a small weir and pipeline | 280 | - | - | 10 | - do - |
| 8 | Evdhimou | (a) Improvements on existing winter irrigation system (b) Prospecting boreholes | 2,800 | - | - | - | Land to be irrigated depends on the quantity of water to be found |
| | | | 394,210 | | | | |

| No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|-----|--------------------------------------|--|-----------|--|--------|-----------|---|
| | | | | Winter | Spring | Perennial | |
| | <u>Limassol Dist.</u> (Continued) | B/F | 394,210 | | | | |
| 9 | Kandou | Pumping scheme and distribution system | 7,000 | - | - | - | Land to be irrigated depends on the quantity of water to be found |
| 10 | Trimiklini | Sluice gate and improvement works | 2,000 | - | - | - | Improvement works |
| 11 | Perapedhi | Sluice gate and improvement works | 1,200 | - | - | - | - do - |
| 12 | Athrakos | Lining of channels | 150 | - | - | 6 | Improved and new irrigation |
| 13 | Ay. Theodoros | Construction of a cut-off wall to prevent the leakage from the weir and construction of a protective wall to prevent any damage to the existing storage tank | 150 | - | - | - | Improvement works |
| 14 | Kapilio | Lining of channels | 3,000 | - | - | 70 | Improved and new irr. |
| 15 | Polemidhia | Improvement works of winter irr. scheme | 3,000 | - | - | 500 | - do - |
| 16 | Ay. Ioannis | Laying of pipes and construction of R.C. Channels | 780 | - | 50 | 50 | - do - |
| 17 | Ay. Ioannis-Kato Mylos | Lining of channels and general improvements to the existing irrigation system | 1,540 | - | - | 90 | - do - |
| | | | 413,030 | | | | |

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| P. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|--------|--------------------------------------|--|-----------|--|--------|-----------|-----------------------------|
| | | | | Winter | Spring | Perennial | |
| | <u>Limassol Dist.</u> (Continued) | B/F | 413,030 | | | | |
| 18 | Ay. Yeorghios | Laying of pipes from existing storage tank | 1,050 | - | 25 | 10 | Improved and new irrigation |
| 19 | Paleomylos | Construction of a small weir and pipeline | 450 | - | - | 10 | - do - |
| 20 | Kato Amiandos | Construction of a groyne intake and laying of pipes | 16,000 | - | - | 500 | - do - |
| 21 | Kalokhorio | Laying of pipes or lining of channels, minor repairs | 380 | - | - | - | Improvement works |
| 22 | Yermasoyia | Repairs on flood damaged works | 1,700 | - | - | - | - do - |
| 23 | Omodhos | Laying of pipes | 880 | - | - | 10 | Improved and new irrigation |
| | | | 433,490 | | | | |

| Ser. No. | Village | Nature of Work | Cost £ | Approx. extend of land under irrigation in a normal year of run-off D o n u m s | | | Remarks |
|----------|----------------------|---|-----------|--|--------|-----------|--|
| | | | | Winter | Spring | Perennial | |
| | <u>Kyrenia Dist.</u> | B/F | 433,490 | | | | |
| 1 | Lapithos | Excavation of spring | 1,125 | - | - | - | Improvements of chain-of wells |
| 2 | Kharcha | Excavation of cutting and laying of pipes | 353 | - | 10 | 7 | Improved and new irrigation |
| 3 | Bellapais | Lining of channels in reinforced concrete | 8,900 | - | - | 80 | Improved and new irrigation ("Kephalovry-sos" spring). |
| 4 | Kazaphani | Improvements in conveyor system, excavation of spring and laying of pipes | 590 | - | 5 | 5 | Improved and new Irrigation "Vasiliki" spring. |
| 5 | Karayvas | Lining of channels | 15,000 | - | - | 800 | Improved and new Irrigation |
| | | | 459,458 | | | | |

APPENDIX 7

TOWN WATER SUPPLIES

By H. S. Suphi, B.Sc. Executive Engineer.

NICOSIA AND SUBURBS

The Greater Nicosia Scheme was under the control of the Water Board of Nicosia and the water available from both Greater Nicosia and Nicosia Water Board sources was being evenly distributed in the two supply areas. Owing to low rainfall and the consequent general lowering of the underground water level the total quantity of water available from the sources was below the peak demand of the Town. To meet this demand and thus avoid restrictions in the supply emergency arrangements were made, at a cost of £10,000, to pump 1.00 million gallons of water per day from two boreholes owned by Government at Morphou through the 18" diameter steel pumping main of the Morphou Bay Scheme. The maximum consumption in Greater Nicosia Area was 1.10 million gallons per day. 4.5 miles of distribution mains were laid for the private developers and 515 house connections were made.

Work on the excavation of trenches and laying of 18" ϕ main pipeline of the Morphou Bay Scheme for a point at Kyra-Massari Road Junction to Engomi Reservoir and the whole distance of 24 miles was completed by early June.

The construction of the pumping station with adjoining buildings and reservoirs undertaken by the P.W.D. was practically completed. There now remains to carry out the installation by E.M.E. of the submersible pumps on the boreholes, the supply of electric current by E.A.C. and the installation of 3 No. centrifugal pumps in the pumping Station (on order with Messrs. Harland) which have not yet arrived. These outstanding items together with some work on the feeder line, such as connections with the submersible pumps, will mean the completion of Morphou Bay Scheme, Stage I, which started in August, 1959.

LIMASSOL

The gravity supply of the town fell to 0.4 m.g.d. in mid-summer and by bringing into commission the two successful boreholes on the Garillis River Area and acquisitioning that of Galatarictis, it was possible to avoid restrictions on the supply.

Of course, pumping from Chiflikoudhia chain-of-wells and from two private boreholes continued from May until late in December when the yield of the springs had gone up to 1.2 m.g.d.

During the year the distribution mains were extended by 8.2 miles (including 6.4 miles of pipes laid for private developers), 34 fire hydrants installed and 822 house-connections made. Similarly two pump-houses and 0.856 miles of steel pumping mains were laid.

A new scheme to supply Limassol with additional 2 m.g.d. from Yermasoyia area, is at present at the stage of planning, where four boreholes have already been drilled by Water Development Department. This Scheme provides for four pumphouses on the existing boreholes, pumping mains of 6" and 8" to a nearby collecting tank of 100,000 gallons capacity to be constructed at approximately 180 feet level. A pump-house attached to the aforesaid connecting tank with centrifugal pumps capable to deliver 2 m.g.d., through a steel pumping main of 12" ϕ and 3.5 miles in length to a new Reservoir of 0.8 m.g. capacity to be constructed beside the existing one on the Ayia Phyla Road.

FAMAGUSTA

As a result of illegal drilling of a number of boreholes in the Paralimni area the Panayia spring dried up completely and thus the Town was deprived from a supply of about 78,000 gallons of water per day. Action is being taken by Government to prevent further illegal drilling in the area and close down those already drilled as soon as possible.

Restrictions on the supply during summer were just avoided by working all pumps to full capacity and by using up to 6.5% saline water from the boreholes near the reception tank at Stavres. The maximum summer consumption of the Town was 1.20 million gallons per day.

LARNACA

Restrictions on the water supply were again necessary in summer so that the higher areas of the Town could draw water for some hours each day. To begin with the Town was divided into four areas and each area was supplied with water for six hours per day. Adjustments to the duration of supply were made as and when required to meet the increasing shortage of water.

In an effort to supplement the Town's water supply, two boreholes were sunk, the first in July and the second in August, about 3,600 feet upstream of Tremithios River from Bekir Pasha headwell. Emergency installations were made at a cost of \$4,300 to pump 290,000 gallons of water per day from the boreholes into the Bekir Pasha chain-of-wells for conveyance to Larnaca for distribution.

In summer the total supply was about 400,000 gallons per day which provided 20 gallons per capita for a population of 20,000.

7,000 feet of mains were laid for private developers and 344 house connections were made. 114 saccoraphia were replaced by water meters.

APPENDIX 8

VILLAGE DOMESTIC WATER SUPPLIES

By H.P. KARAKANNAS, M.I.P.H.E., M.R.S.H., SUPERINTENDENT OF
WORKS

The work of the Village Domestic Water Section is confined mostly to water supplies for villages and Rural Municipalities but it also includes the towns of Paphos and Kyrenia. Sources of water are examined, measured and where suitable developed. Supply and distribution pipelines are laid and storage tanks and public fountains constructed. A "fountain" is a combined public stand pipes, trough and soak-away pit. There is a growing demand for house connections and practically all villages where the supply is 20 gallons per day per capita the scheme is designed for a house-to-house supply and water is installed to all houses. The water is delivered to each consumer, usually through a Constant Head Regulator at the rate of 100 gallons per day.

The sources of village water supply may be springs, infiltration galleries, boreholes or wells. The use of boreholes and wells has been much favoured in places where there are no suitable springs for a gravity supply. The prevailing drought has affected all springs in the island, with the result that shallow springs decreased substantially and in some cases they dried up completely. In some cases springs or shallow wells dried up as a result of the lowering of the water table. During the summer and autumn, it was found necessary to supply water to 68 dry villages by tanker. A quantity of 4 gallons per capita was supplied, in order to meet the fundamental domestic requirements. In the case of pumped supplies turbine pumps are installed, which pump water onto ground level or elevated re-inforced concrete tanks, whose function is not only to provide adequate storage but at the same time to act as a reservoir from where a restricted and uniform quantity of water can be withdrawn.

During the year 28 village water supply works were completed and 64 miles of pipes were laid. Six of these schemes were new and the remainder were improvements or complete replacements to existing supplies that were formerly unsatisfactory or inadequate.

It is now estimated that of the total of 627 villages named in the census of 1946 the number with piped supplies is 530 or 84.53%. 229 (47.69%) may be considered satisfactory and 231 (36.84%) need fundamental repairs, replacements and supplementary supply. Because of rising standards and the prevailing drought water supplies that were formerly considered satisfactory are now inadequate and require improvements. The 97 villages without piped supplies are on the whole situated far from reliable sources, and the cost and difficulty of supplying them with piped supply will in most cases be greater than in past schemes.

In addition to the 28 schemes completed in 1960, a further 17 schemes were under construction but incomplete at the end of the year. Plans have been prepared for a further 142 and although some need modification in view of changing circumstances, most are ready for starting as soon as money becomes available.

The following table indicates the work done as village water supplies during the year under review:-

LENGTH OF PIPES LAID IN 1960
(Galvanised mild steel pipes)

| Size:- | $\frac{3}{4}$ " | 1" | 1 $\frac{1}{4}$ " | 1 $\frac{1}{2}$ " | 2" | 2 $\frac{1}{2}$ " | 3" | 4" | 6" | Total |
|---------|-----------------|-------|-------------------|-------------------|-------|-------------------|------|------|------|--------|
| Miles:- | 2.95 | 10.78 | 3.14 | 7.31 | 18.15 | 9.75 | 2.80 | 5.30 | 6.18 | 120.36 |

(Asbestos-cement pipes)

| Size:- | 3" | 4" | 6" | Total |
|---------|------|------|------|-------|
| Miles:- | 0.25 | 1.65 | 2.06 | 3.96 |

Elevated Tanks: 2. Ground Level Tanks: 25
Pump/houses 6 Fountains 141 Distribution Boxes 16.

The schemes completed may be classified as shown below:- "Village Standard" means that the distribution of the water is effected by street fountains only and not by house connection. The house-to-house distribution is very much favoured by the villages, and is now implemented practically in all villages where the supply is adequate.

| | | | | | | |
|-----|--|----|----|----|----|----|
| (a) | New schemes where previously there was no piped water to village standard and including home connection. | .. | .. | .. | .. | 6 |
| (b) | Improvements to village standard | .. | .. | .. | .. | 19 |
| (c) | Water supplies to Schools and Police Stations | .. | .. | .. | .. | 3 |

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Lists showing the village schemes completed, those in hand and schemes which have been prepared are given in Appendices 9, 10, 11, 12.

During the year, improvements were carried out on the Ktima water supply. Two new boreholes have been put to operation; and a 100,000 gallons circular reinforced concrete storage tank was constructed. Distribution mains were laid to supply water to newly built areas. This is part of the major scheme which is being designed and which will solve the water supply problem of this Town by pumping from either Ezuza or Xeros rivers.

A large village domestic supply waterwork executed during the year was the combined gravity scheme for Kalokhorio (Lefka), Ayios Nicolaos and Peristeronari. A steady continuous gravity of 24,000 gallons per day is conveyed to these three villages. Each village has been provided with adequate storage and distribution mains have been laid in all streets for a house-to-house service. The distribution system is a combination of street fountains and have connections.

Another large village domestic supply waterwork executed during the year is the gravity scheme for the dry Tylliria villages Ayios Ioannis(Selemani), Ammadhies and Limnitis. Work was still continuing at Limnitis at the end of the year. The source of supply is a steady spring in the Paphos Forest, and the water was conveyed through a composite pipeline 2½" and 2" ϕ 10 miles long. Storage tanks and street fountains have been provided at these villages.

The drilling of successful boreholes in the areas of Kokkini Trimithia and the Eastern Mesaoria have made it possible to prepare pumping schemes for the supply of domestic water to a number of dry villages. Regional schemes have been designed to supply domestic water by gravity from springs in the Troodos range to 17 villages in the Limassol District.

APPENDIX 9
NUMBER AND PERCENTAGE OF VILLAGE
WITH PIPED DOMESTIC SUPPLY
31st DECEMBER, 1960.

| District | Village with Piped water | | | Village with no piped water | | Total villages |
|------------|--------------------------|---------------------|-------|-----------------------------|-------|----------------|
| | Satisfactory | Needing Improvement | Total | No. | % | |
| | No. | No. | No. | | | |
| Nicosia | 85 | 59 | 144 | 32 | 18.18 | 176 |
| Larnaca | 25 | 25 | 50 | 9 | 15.25 | 59 |
| Limassol | 48 | 55 | 103 | 10 | 8.85 | 113 |
| Famagusta | 38 | 32 | 70 | 28 | 28.57 | 98 |
| Paphos | 87 | 36 | 123 | 11 | 8.21 | 134 |
| Kyrenia | 16 | 24 | 40 | 7 | 14.89 | 47 |
| Totals | 299 | 231 | 530 | 97 | 15.47 | 627 |
| Percentage | 47.69 | 36.84 | 84.53 | 15.47 | 15.47 | 100 |

Note: The above figures are the result of an up-to-date survey and they do not correspond with others given in the annual reports of former years. Some supplies that were previously satisfactory are now considered unsatisfactory, because with an expanded population and higher standards of living more water and more facilities are required. The prevailing drought for the last 4 consecutive years, has greatly affected all water sources.

APPENDIX 10
VILLAGE WATER SUPPLY SCHEMES COMPLETED
IN 1960.

| No. | Village | District | Nature of Work | Date of completion |
|-----|--------------------------|-----------|----------------|--------------------|
| 1 | Voroklini | Larnaca | ✓ | 21.2.60 |
| 2 | Kridhia | Famagusta | ✓ | 1.3.60 |
| 3 | Ay.Symeon | " | * | 15.3.60 |
| 4 | Anglisides | Larnaca | ✓ | 15.3.60 |
| 5 | Marathounda | Paphos | ✓ | 13.3.60 |
| 6 | Kithasi | " | ✓ | 5.5.60 |
| 7 | Kambos | Nicosia | ✓ | 14.5.60 |
| 8 | Psematismenos | Larnaca | ✓ | 3.6.60 |
| 9 | Odhou | " | ✓ | 4.6.60 |
| 10 | Tsadha | Paphos | ✓ | 25.6.60 |
| 11 | Lapithos | Kyrenia | ✓ | 25.6.60 |
| 12 | Gaidhouras | Famagusta | ✓ | 4.7.60 |
| 13 | Trakhoni | Limassol | * | 18.8.60 |
| 14 | Angolemi | Nicosia | ✓ | 21.8.60 |
| 15 | Pendakomo | Limassol | ✓ | 14.9.60 |
| 16 | Lagoudhera | Nicosia | ✓ | 17.9.60 |
| 17 | Ktima | Paphos | ✓ | 30.9.60 |
| 18 | Kalo Khorio (Lefka) | Nicosia | * | 30.9.60 |
| 19 | Ay.Nicolaos (Lefka) | " | * | " |
| 20 | Kondea-Sinda- Kouklia | Famagusta | ✓ | 22.10.60 |
| 21 | Kornos | Larnaca | ✓ | 25.10.60 |
| 22 | Pyrgos | Limassol | ✓ | 8.11.60 |
| 23 | Pyla | Larnaca | ✓ | 12.11.60 |
| 24 | Ammadhies | Nicosia | ✓ | 9.12.60 |
| 25 | Ay.Joannis (Selemani) | Nicosia | * | 9.12.60 |
| 26 | Mitsero | Nicosia | ✓ | 15.12.60 |
| 27 | Ay.Marinou- dha | Paphos | * | 31.12.60 |
| 28 | Panayia Pano | " | ✓ | 31.12.60 |

✓ Improvements to an existing supply

* New Schemes

✓ Water supply to school and Police Station.

APPENDIX 11
VILLAGE WATER SUPPLY SCHEMES
IN HAND AT THE END OF 1960

| Ser.No. | Village | District |
|---------|----------------------|-----------|
| 1 | Alithinou | Nicosia |
| 2 | Kalokhorio (Kapouti) | - do - |
| 3 | Limnitis | - do - |
| 4 | Palekhorio (Orinis) | - do - |
| 5 | Phterikoudhi | - do - |
| 6 | Mitsero | - do - |
| 7 | Dhiorios | Kyrenia |
| 8 | Myrtou | - do - |
| 9 | Karpasha | - do - |
| 10 | Kalavassos | Larnaca |
| 11 | Kellia | - do - |
| 12 | Melousha | - do - |
| 13 | Kalokhorio | - do - |
| 14 | Kornokipos | Famagusta |
| 15 | Emba | Paphos |
| 16 | Lemba | - do - |
| 17 | Stroumbi | - do - |

APPENDIX 12

VILLAGE WATER SUPPLY SCHEMES READY FOR CONSTRUCTION
AT THE END OF 1960 BUT NOT YET STARTED

| Ser. No. | Village | Ser. No. | Village |
|----------|-------------------|----------|------------------|
| | <u>Nicosia</u> | | |
| 1 | Anayia | 31 | Paleometokho |
| 2 | Angolemi | 32 | Peristeronari |
| 3 | Astromeritis | 33 | Petra |
| 4 | Ayia Varvara | 34 | Philia |
| 5 | Ayii Trimithias | 35 | Polystipos |
| 6 | Dhali | 36 | Sha |
| 7 | Epikho | 37 | Tsakistra |
| 8 | Exometokhi | 38 | Varisha |
| 9 | Galini | 39 | Voni |
| 10 | Bey Keuy | 40 | Xeri |
| 11 | Geunyeli | 41 | Xerovounos |
| 12 | Kalopanayiotis | 42 | Zodhia, Panc |
| 13 | Kambos | 43 | Zodhia, Kato |
| 14 | Kanli Keuy | 44 | Katydhata |
| 15 | Karavostasi | | <u>Kyrenia</u> |
| * 16 | Katokopia | 45 | Asomatos |
| 17 | Kokkini Trimithia | 46 | Ayios Amvrosios |
| 18 | Korakou | 47 | Ayios Yeorghios |
| 19 | Kannavia | 48 | Bellapais |
| 20 | Kythrea | 49 | Kalogrea |
| 21 | Loutros | 50 | Kharcha |
| 22 | Lythredonda | 51 | Kyrenia |
| 23 | Masari | 52 | Lapithos |
| 24 | Hyra | 53 | Photta |
| 25 | Morphou | 54 | Trapeza |
| 26 | Moutoullas | | <u>Famagusta</u> |
| 27 | Neokhorio | 55 | Akhna |
| 28 | Nikitas | 56 | Ayia Trias |
| 29 | Oekos | 57 | Ayios Elias |
| 30 | Palekythro | 58 | Ayios Iacovos |

| Ser. No. | Village | Ser. No. | Village |
|----------|-----------------|----------|------------------|
| 59 | Ayios Khariton | 88 | Ayios Pavlos |
| 60 | Engomi | 89 | Dhierona |
| 61 | Ephtakomi | 90 | Dhoros |
| 62 | Galatia | 91 | Dhymes |
| 63 | Liopetri | 92 | Kaminaria |
| 64 | Livadhi | 93 | Khandria |
| 65 | Lysi | 94 | Kouka |
| 66 | Makrasyka | 95 | Kouphi |
| 67 | Mandres | 96 | Lania |
| 68 | Monarga | 97 | Lemythou |
| 69 | Neta | 98 | Limnatis |
| 70 | Paralimni | 99 | Erimi |
| 71 | Styllos | 100 | Mandria |
| 72 | Yerani | 101 | Mesayitonia |
| | <u>Larnaca</u> | 102 | Monagri |
| 73 | Aradhippou | 103 | Moutayiaka |
| 74 | Delikipos | 104 | Omodhos |
| 75 | Kophinou | 105 | Pareklisia |
| 76 | Kornos | 106 | Pelendria |
| 77 | Lefkara, Pano | 107 | Plataniskia |
| 78 | Ormidhia | 108 | Pissouri |
| 79 | Pyrga | 109 | Platres, Pano |
| 80 | Tokhni | 110 | Platres, Kato |
| | <u>Limassol</u> | 111 | Polemidhia, Pano |
| 81 | Agridhia | 112 | Polemidhia, Kato |
| 82 | Alektora | 113 | Prodhromos |
| 83 | Amiandos, Kato | 114 | Sotira |
| 84 | Arsos | 115 | Tris Elies |
| 85 | Asgata | 116 | Vasa (Kilani) |
| 86 | Ayios Amvrosios | 117 | Ypsonas |
| 87 | Ayios Mamas | 118 | Silikou |
| | | 119 | Potamitissa |

| Ser. No. | Village |
|-------------|---------------------|
| | <u>Paphos</u> |
| 120 | Akourdalia |
| 121 | Akoursos |
| 122 | Anadhiou |
| 123 | Androlikou |
| 124 | Archimandrita, Pano |
| 125 | Armou |
| 126 | Ayia Marinoudha |
| 127 | Ayios Yeorghios |
| 128 | Khlorakas |
| 129 | Khrysokhou |
| 130 | Kissonerga |
| 131 | Letymbou |
| 132 | Mandria |
| 133 | Mesokhorio |
| 134 | Mesoyi |
| 135 | Nata |
| 136 | Phasli |
| 137 | Steni |
| 138 | Tala |
| 139 | Theletra |
| 140 | Vrecha |
| 141 | Yeroskipos |
| 142 | Yialia |

APPENDIX 13

DRILLING FOR WATER

By Y. Hji Stavrinou, B.Sc. (Lon.), A.R.C.S., F.G.S., P.A.I.W.E.,
Geologist.

During 1960 the department's drilling plant consisted of 14 rigs at the beginning of the year, and another was taken on loan from the army in mid. September. At the beginning of the year there were one Ruston-Bucyrus 60 R.L., eleven Ruston-Bucyrus 22-Ws, one Bucyrus type rig constructed by W.D.D. and two Edecos. Another Bucyrus 22-W on loan from the army was brought into use in September. All these rigs are of the percussion type but one 22-W is fitted with a rotary attachment enabling the rig to be used for either percussion or rotary (shot crown or tungstem-carbide crown) core drilling. The normal capacity range of the rigs is 8" to 10" diameter boreholes to depths of up to 500 feet but the 60 R.L. is a much heavier duty rig. Under normal conditions it can drill an 8" diameter borehole to a depth of over 1000 feet or, alternatively, can be used to drill 18" diameter holes to over 250 feet depth.

The department has also a number of transportable deep-well pumping units for long, continuous test-pumping of wells and boreholes. In addition to several old reciprocating pumping units, there are two diesel-driven turbine pumps of 5,000 and 15,000 gallons per hour capacity respectively, at 100 feet head and two 25 K.V.A. mobile diesel-electric generating sets which are used in conjunction with 7½" diameter electro-submersible pumps. With these units borehole test-pumpings may be carried out in the capacity head range of 18,000 gallons per hour from 100 feet to 8,000 gallons from 400 feet. In all 28 long test pumpings, from 48 hours to 268 hours continuous duration, were carried out, involving a total pumping time of 3,500 hours and a total volume of 37.5 million gallons of water. Experience has proved that such exhaustive test-pumpings are absolutely essential for proving the reliability of the aquifers.

The number of boreholes drilled during 1960 was 188 with an aggregate footage of 49,887 and an average depth of 265 feet. 180 boreholes with a total footage of 48,213 were drilled for water. The average drilling depth for water was 267 feet. The average time taken to complete a borehole including the time taken to lay casing and to carry out an

eight hour test-pumping of a successful borehole was 19.7 days. The average footage drilled per day was 13.4 feet. The total tested yield of boreholes sunk for water in 1960 was 33 768,000 gallons per day. In addition to new drillings 53 old boreholes were cleaned and renovated, involving 533 drilling days, equivalent to the average time taken to drill 27 new boreholes.. 121 boreholes were sunk for irrigation; of these 92 or 76.0% produced on test an aggregate of 26.72 million gallons per day a quantity which is considered sufficient to irrigate 13,500 donums in summer.

The number of successful irrigation boreholes drilled by Government since 1946 is now 1,266 with a tested output of 260.7 million gallons per day sufficient to irrigate 130,000 donums of summer crops.

The actual area now being irrigated as a result of these drillings is conservatively estimated to be of the order of 106 000 donums. The Census of 1946 estimated that at the time some 53,000 donums of land were being irrigated perennially by pumped water. By the end of 1960 as a result of Water Development Department drilling alone this has been increased by 200% to 159 ^{thousands} donums.

Apart from the necessity of meeting the continual heavy demand for new boreholes from the highly productive Western Mesaoria, drilling for water has been fairly evenly distributed throughout Cyprus in 1960. By districts, the borehole distribution was as follows:-

| | |
|-------------------|-----|
| Nicosia & Kyrenia | 104 |
| Femagusta | 11 |
| Larnaca | 8 |
| Limassol | 34 |
| Paphos | 23 |

Thirty five prospecting boreholes were sunk in 1960. Most of these were drilled for domestic water supply purposes. Although all the major underground sources of water must by now be known several prospecting boreholes have produced interesting discoveries of water. Once again the seismic survey of 1958 of the major river valleys of the island proved very useful and accurate in locating borehole sites.

Boreholes located on the results of this survey proved its accuracy to be upto 95%. Such drillings were put down in the Yermasoyia and Ezuza river valleys.

The most useful find, however, of the year were the two Government boreholes put down in the Tremithios river valley as emergency boreholes to augment Larnaca domestic water supply. The first borehole Map Ref. No. 37,250 E.20,250 was put on the bank of the present course of the above river with the object of testing the well-bedded Lapithos chalks which are exposed in this area. Water was struck in this borehole at 49 and 70-173 ft. This bore was test-pumped all through last summer for about 16 months and its yield was found to be very steady. The NaCl content of the borehole is rather on the high side 878 p.p.m., but it is probable that with prolonged pumping the salinity will be reduced. The second Larnaca borehole, Grid Reference N. 37,035 E. 20,010 was put opposite the first one at a distance of about 1050 feet and 3,300 feet away from the headwell of the Bekir Pasha chain-of-wells, the main source of Larnaca water supply. This second borehole was put down with the view of confirming the results shown by a seismic traverse of the 1958 survey. The low velocity obtained above the bedrock of this borehole site was proved to be caused by coarse alluvium the total thickness of which was 91 feet. This second borehole was also test-pumped for the whole of last summer and proved to be very free-yielding. It was pumped at the rate of 12,000 g.p.h. with a small draw down of about two feet.

The extensive hydro-geological and geophysical research programme of the areas of Ormidhia and Xylophagou mentioned in para 2 of p. 34 of the 1959 annual report has been extended to cover the whole of the Dhekelia Ayios Nicolaos and Akrotiri Episkopi Sovereign Base Areas.

This survey has been carried out by a private firm for the War Office Authorities and a detailed report on the groundwater resources of the areas inside and adjoining the two Sovereign Base Areas has been prepared. The main features of this report is the accurate determination by means of Geophysics (the electrical resistivity method was used) of the boundaries of the Akrotiri Phasouri Aquifer as well as the extent of the Phrenaros coral sandstone aquifer northwards into the Ayios Nicolaos area. The results of the Geophysical survey were confirmed by trial drilling. Porosity tests carried out by this Department on core samples taken from the

Xylophagou reef limestone proved the specific yield of this rock to be about 33%.

There were thirty six privately owned drilling rigs, licensed to drill for water, operating in Cyprus at the end of 1960 showing an increase in number of eleven rigs compared with 1959. Altogether they drilled 135 new boreholes all for water with an aggregate footage of 29,666. Unfortunately there were quite a number of illegal drillings of which no information is available. Of these legal boreholes 75.6% were successful and gave an estimated total output of 659,650 gallons per hour. Twenty five are locally made some of them quite well constructed, but they are of a rather light type generally only suitable for drilling in favourable rock conditions. There has been a tendency towards the use of imported drilling rigs by private contractors. In 1960 in addition to 25 locally made rigs there were seven Ruston-Bucyrus 22-W, one Ruston Bucyrus 60 R.L. and 3 swedish made rigs. As in previous years the majority of boreholes have been sunk in the Famagusta and Larnaca districts where drilling is comparatively easy and wells may be sunk without casing. There has however, been increased activity in the Nicosia district during 1960 where drilling rigs were operating near Nicosia and 3 in the vicinity of Morphou.

By law, private drilling contractors are obliged to give notice of drilling, to keep records of depth of boreholes and static water levels and to retain borehole samples for inspection by an officer of the Water Development Department. Test pumpings are not normally carried out but from information received it is possible to arrive at an approximate figure of the total water yield of these private drillings. As many of the boreholes were drilled in the bottom of existing wells the increase in yields is somewhat conjectural but it is conservatively estimated that the increase in perennial irrigation as a result of these drillings is of the order of 4,000 donums in 1960.

The average cost of departmental drillings in 1960 was £256 per borehole or £0.967 mils per foot of drilling. These costs are inclusive of the expenses of laying casing pipes and of an eight hour test-pumping of successful boreholes. They are exclusive of the purchase price of borehole casing pipes and the capital cost and installation charges of permanent pumping plant. They include the wages of the drilling crews, fitters and blacksmiths, and the cost of workshop maintenance, fuel and lubricating oils, bit sharpening and repairs and replacements of drilling tools and equipment. They do not include depreciation of drilling plant and the salaries and expenses of the supervisory staff.

No subsidized boreholes were drilled in 1960 for no funds were made available for subsidized drilling. 175 boreholes were drilled on a full repayment basis and 13 were drilled entirely from Government funds. Provision for an additional number of observation boreholes is absolutely essential but unfortunately no funds were made available in 1960.

APPENDIX 14

NUMBER AND FOOTAGE OF BOREHOLES
NUMBER OF BOREHOLES DRILLED
1953 - 1960

| Purpose | 1946-53 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 |
|-------------------------------------|---------|--------|--------|--------|--------|--------|--------|--------|
| For Private Individuals & Companies | 976 | 182 | 170 | 128 | 202 | 106 | 155 | 165 |
| For Government | 236 | 57 | 101 | 55 | 62 | 35 | 9 | 13 |
| For War Department and A.M. | 119 | 15 | 62 | 30 | 29 | 16 | 27 | 10 |
| Totals | 1,341 | 254 | 333 | 213 | 293 | 157 | 191 | 188 |
| Aggregate Footage Drilled | 22,966 | 49,159 | 58,437 | 42,681 | 51,420 | 32,842 | 48,250 | 49,887 |
| Average Depth | 189 | 194 | 175 | 200 | 175 | 209 | 253 | 265 |

Boreholes Drilled in 1960

| Purpose | No. | Existing well Footage | Footage Drilled | % age successful | Total Tested Yield G.P.D. |
|--------------------------|-----|-----------------------|-----------------|------------------|---------------------------|
| Irrigation | 121 | 5,181 | 33,403 | 76.0 | 26,716,800 |
| Domestic Water Supplies | 28 | 356 | 7,052 | 71.4 | 3,492,000 |
| Prospecting | 35 | - | 6,209 | 68.0 | 2,865,600 |
| Industrial | 6 | 100 | 1,549 | 83.3 | 693,600 |
| Total for Water | 190 | 5,637 | 48,213 | 74.4 | 33,768,000 |
| Technical and Geological | 8 | - | 1,674 | - | - |
| Total Drilled | 188 | 5,637 | 49,887 | - | - |

Old Boreholes Renovated 53.

APPENDIX 15
BOREHOLES DRILLED FOR WATER IN 1960
SUMMARY OF RESULTS

| District | Locality | No. of B.Hs. drilled | No. Successful | %age Successful | Total Tested Output G.P.D. | Average Yield per successful borehole G.P.D. |
|-----------|----------------------|-------------------------|-------------------|--------------------|-------------------------------|--|
| Nicosia | Western Mesaoria | 52 | 47 | 90.4 | 15,476,000 | 414,400 |
| | K. Trimithia-Meniko- | | | | | |
| | Ay. Trimithias | 14 | 12 | 85.7 | 1,444,800 | 120,400 |
| | Lakatamia-Episkopio | 10 | 9 | 90.0 | 2,167,200 | 240,800 |
| | Strovolos-Eylenja- | | | | | |
| | Geunyeli | 5 | - | - | - | - |
| | Angolemi-Galini | 9 | 6 | 66.6 | 880,800 | 146,800 |
| | Phileri | 1 | 1 | 100.0 | 144,000 | 144,000 |
| Kyrenia | Mitsero | 1 | 1 | 100.0 | 36,000 | 36,000 |
| | Yeri-Laxia-Potamia | 10 | 4 | 40.0 | 727,200 | 181,800 |
| | Lapithos-Larnaca tis | | | | | |
| | Lapithou | 2 | - | - | - | - |
| Larnaca | Alaminos-Dhromolaxia | 6 | 4 | 66.6 | 732,000 | 183,000 |
| | Troulli | 1 | - | - | - | - |
| | Kalavassos | 1 | 1 | 100.0 | 96,000 | 96,000 |
| Pamagusta | Kouklia-Kondea-Lysi | 4 | 4 | 100.0 | 717,600 | 179,400 |
| | Platani-Lefkoniko | 5 | - | - | - | - |
| | Ovgoros | 2 | 1 | 50.0 | 24,000 | 24,000 |

| District | Locality | No. of B.Hs. drilled | No. Successful | %age Successful | Total Tested Output G.P.D. | Average Yield per successful borehole G.P.D. |
|-------------|----------------------------|----------------------|----------------|-----------------|----------------------------|--|
| Paphos | Ktima-Kouklia | 11 | 9 | 81.8 | 825,600 | 91,700 |
| | Nata-Ay. Georghios-Mamonia | 6 | 5 | 83.3 | 1,084,800 | 216,900 |
| | Polemi | 4 | 3 | 75.0 | 676,800 | 225,600 |
| | Ay. Nicolaos | 1 | - | - | - | - |
| | Akourdalia | 1 | 1 | 100.0 | 108,000 | 108,000 |
| Limassol | Polemidhia-Limassol | | | | | |
| | Ay. Athanasios | 19 | 13 | 68.4 | 2,548,800 | 196,000 |
| | Moni | 1 | 1 | 100.0 | 156,000 | 156,000 |
| | Kandou-Cherkez Chiftlik | 7 | 7 | 100.0 | 1,653,600 | 236,200 |
| | Alektora | 3 | 1 | 33.3 | 48,000 | 48,000 |
| | Paramali-Symvoulos | 4 | 4 | 100.0 | 156,000 | 39,000 |
| T o t a l s | | 180 | 134 | 74.4 | 33,768,000 | 251,300 |

* A successful borehole is one that yields on test less than 1,000 gallons per hour of usable water.

APPENDIX 16

HYDROLOGICAL NOTES 1959-60

By Nicos Chr. Toufexis, Inspector of Works
(This report covers the period from 1st October
1959 to 30th September, 1960).

Meteorological.

The principal features of the rainfall during
the year were:-

- (a) The average rainfall over the whole island was 14.09 inches which is 71% of normal as compared with the average since 1908 which is 19.82 inches.
- (b) October and March were the only months of the year with above average rainfall. The precipitation in all other months was considerably below average.
- (c) Rainfall with exceptional high intensity occurred in Nicosia area on the 5th January, when 1.33 inches of rain fell in 15 minutes causing floods in the town and its suburbs.
- (d) Some snow fell at the high altitudes of the Troodos massif during the period December to March. The snow-cover persisted until April.
- (e) Temperatures tended to be below normal during the Autumn and above normal during winter, springs and Summer. The highest temperature measured at Nicosia was 108° F on the 15th August and the lowest 28° F on the 4th February.

Flood discharges.

The only serious floods reported in 1959-60 occurred early in winter and in spring when isolated heavy rains fell on the eastern slopes of the central massif. The highest flood flows were 16,000 cusecs in the Yialias river recorded near Kochatis on the 31st December, 1959, and 8,000 to 8,500 cusecs in the Tremithios river recorded at Ayia Anna on the 10th March, 1960. *when?*

The table below summarises some of the larger floods and gives an idea of the maximum rainfalls measured in the catchment on the day of the flood:-

| River | Place | Peak flow in cusecs m^3/s | Rainfall in inches | Place | Date |
|-------------------|--------------------------------|-----------------------------|--------------------|--------------------|----------|
| Pedhieos | Nicosia (Ex-Railway bridge) | 3,000 ⁴⁵ ✓ | 2.22 | Pano Dheftera | 31.12.59 |
| - do - | - do - | 1,800 ⁵¹ ✓ | 1.57 | Nicosia | 5.1.60 |
| - do - | - do - | 2,900 ⁴² ✓ | 2.15 | - do - | 10.3.60 |
| Yialias | Kochatis | 16,000 ⁴⁵⁵ ✓ | 1.50 | Mandra-tou-Kambiou | 31.12.59 |
| Ovgos | Morphou-Kyrenia Rd. bridge | 1,700 ⁴⁸ ✓ | 0.87 | Skyloura | 5.1.60 |
| Tremithios | Kiti | 4,300 ¹²⁰ ✓ | 2.45 | Kornos | 10.3.60 |
| - do - | Ayia Anna | 8000/8500 ²²⁵ ✓ | 2.45 | - do - | 10.3.60 |
| Kokkini-Trimithia | Kokkini-Trimithia | 1,100 ³¹ ✓ | 1.80 | Kokkini-Trimithia | 5.1.60 |
| Almiros | Geunyeli | 2,740 ⁷⁸ ✓ | 2.30 | Aghirda | 31.12.59 |
| - do - | - do - | 1,200 ³⁴ ✓ | 0.74 | - do - | 5.1.60 |
| - do - | - do - | 1,030 ²⁹ ✓ | 2.70 | - do - | 10.3.60 |
| Dhiarizos | Kouklia(P) | 1,800 ⁵¹ ✓ | 0.83 | Ay. Nicolaos (P) | 5.1.60 |
| Xeros (P) | Mandria(P) | 1,000 ²⁸ ✓ | 1.00 | Kelokedhara | 5.1.60 |

3. River Discharges:-

As a result of the generally low rainfall intensities experienced over the Island during 1959-60, the total discharges from most of the mountain rivers were below normal. The only gauging stations which recorded above normal total discharges are those on catchments of the Eastern End of Troodos range as well as those situated on the South of Kyrenia range.

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

| No. | Catchment | Location | Type of installation |
|-----|-----------------------|---------------------------|---|
| 1 | Pedhieos | Nicosia Ex-Railway Bridge | Depth recorder |
| 2 | Yialias | Near Kochati | Depth recorder on 60 feet measuring weir. |
| 3 | Ovgos | Morphou-Kyrenia Bridge | Depth recorder |
| 4 | Serakhis | Near Morphou | Depth recorder |
| 5 | Xeros N'sia) | Xeros Bridge | Depth recorder |
| 6 | Marathasa | Lefka-Skouriotissa Bridge | Depth recorder |
| 7 | Kharangas (Famagusta) | Near Kato Varosha | Depth recorder on 70 feet irrigation weir |
| 8 | Avgorou | Near Avgorou | Depth recorder on 40 feet measuring weir |
| 9 | Paralimni | Near Paralimni Lake | Depth recorder on 2 feet flume. |
| 10 | Pyrgos | Near Phileyia | Depth recorder on 30 feet measuring weir. |
| 11 | Limnitis | Near Limnitis Saw-mill | Depth recorder on 30 feet measuring weir |
| 12 | Ovgos | Near Syriankhori | Depth recorder on 6'7" measuring weir |
| 13A | Kouris | Limassol-Troodos Bridge | Depth recorder on 18 feet measuring weir |
| 13B | Kouris | Near Trimiklini Dam | Depth recorder on 1'6" flume |
| 14 | Peristerona | Near Panayia Bridge F.S. | Depth recorder on 25 feet measuring weir |
| 15 | Tremithios | Kiti | Depth recorder on 70 ft. irrigation weir |
| 16 | Yermasoyia | Nicosia-L'ssol Bridge | Depth recorder |
| 17 | Kouris | Near Kandou | Depth recorder on 300 feet irrigation weir. |
| 18 | Kolopannes | Near Kalopsidha | Depth recorder on 25 feet measuring weir. |

| No. | Catchment | Location | Type of installation |
|-----|-------------------|---------------------------------------|---|
| 19 | Akhna | Near Akhna Police Station | Depth recorder on 40 ft. measuring weir |
| 20 | Phrenaros | Near Asprovounitissa Church | Depth recorder on 40 feet measuring weir |
| 21 | Kokkini-Trimithia | Near Kokkini-Trimithia | Depth recorder on 40 feet measuring weir. |
| 22 | Liopetri | Near Liopetri | Depth recorder on 40 feet measuring weir |
| 23 | Akaki | Near Malounda | Depth recorder on 40 feet measuring weir |
| 24 | Skylloura | Near Ay. Vassilios | Depth recorder on 60 feet measuring weir |
| 25 | Ak-Sou | Near Petra-tou-Dhigheni | Depth recorder on 30 feet measuring weir |
| 26A | Almiros | Near Geunyoli | Depth recorder on 40 feet measuring weir |
| 26B | Almiros | Near 26A | Depth recorder on standing wave flume with 1 feet throat. |
| 27 | Khrysokhou | Near Skoulli | Depth recorder on 40 feet measuring weir |
| 28 | Evretou | Near Trimithousa-Evretou Rd. Junction | Depth recorder on 25 feet measuring weir. |
| 29 | Syrgates | Near Skarinou | Depth recorder |
| 30 | Dhiarizos | L'ssol-Paphos Bridge near Kouklia | Depth recorder |
| 31 | Xeros (P) | L'ssol-Paphos bridge near Mandria | Depth recorder |
| 32 | Alakati | Platimatis near Ay. Amvrosios (K'nia) | Depth recorder on 22 ft. measuring weir |
| 33 | Karyiotis | Near Pendayia | Depth recorder on 60 ft. measuring weir |
| 34 | Tremithios | Ayia Anna | Depth recorder on 40 ft. measuring weir |
| 35 | Elea | Morphou-Pendayia Bridge | Depth recorder |

Measured discharges 1959/60.

The discharges measured at the gauging stations of the previous paragraph are as follows:-

| Recorder No. | Catchment | Rainfall 10 ⁶ c.ft. | Run-off 10 ⁶ c.ft. | Maximum discharge in a day 10 ⁶ c.ft. | Maximum flow cusecs | Percentage Run off |
|--------------|----------------------------|-----------------------------------|----------------------------------|--|------------------------|-----------------------|
| 1 | Pedhicos | 1798 | 82.15 | 23.8 | 3000 | 4.6 |
| 2 | Yialias | 1112 | 134.44 | 53.0 | 16000 | 12.1 |
| 3 | Ovgos | 1734 | 27.67 | 25.3 | 1700 | 1.6 |
| 4 | Serakhis | 5534 | 95.1 | 12.0 | 200 | 1.7 |
| 5 | Xeros (N) | 1158 | - | - | - | - |
| 6 | Marathasa | 1121 | 47.04 | 4.1 | 85 ^{2.4} | 4.2 |
| 7 | Kharangas | 142 | 0.05 | 0.03 | 15 ^{0.4} | 0.04 |
| 8 | Avgorou | 247 | - | - | - | - |
| 9 | Paralimni Lake outfall | - | - | - | - | - |
| 10 | Pyrgos | 632 | 161.39 | 7.8 | 94 ^{2.7} | 25.5 |
| 11 | Limnitis | 1003 | 170.2 | 6.3 | 82 ^{2.3} | 17.0 |
| 12 | Ovgos Summer flow | - | 4.82 | 1.6 | 60 | - |
| 13 | Kouris (Trimiklini) | 1320 | 348.0 | 7.4 | 176 ^{5.0} | 26.4 |
| 14 | Peristerona | 1364 | 169.93 | 9.2 | 160 ^{4.5} | 12.4 |
| 15 | Tremithios (Kiti) | 1751 | 46.7 | 42.7 | 4300 | 2.7 |
| 16 | Yermasoyia | 2705 | 51.4 | 5.6 | 250 ⁷ | 1.9 |
| 17 | Kouris(Kandou) | 6265 | 381.8 | 26.3 | 880 ²⁵ | 6.1 |
| 18 | Kolopannes (Kalopsidha) | - | 1.9 | 0.08 | 1.4 | - |
| 19 | Akhna | 226 | - | - | - | - |
| 20 | Phrenaros | 74 | 1.4 | 0.8 | 212 ^{6.0} | 1.9 |
| 21 | Kokkini/Trimitikia | 236 | 6.17 | 6.0 | 1100 | 2.6 |
| 22 | Liopetri | 79 | 20.4 | 5.4 | 108 ^{3.0} | 25.8 |
| 23 | Akaki | 1381 | 131.40 | 5.9 | 123 ^{3.5} | 9.5 |
| 24 | Skylleoura | 532 | 5.95 | 3.9 | 550 ^{16.0} | 1.1 |
| 25 | Ak-Sou | 79 | 14.65 | 3.8 | 180 ^{5.0} | 18.5 |
| 26 | Almiros | 313 | 42.0 | 20.6 | 2740 | 13.4 |
| 27 | Skoulli | 1120 | 76.3 | 2.1 | 53 ^{1.5} | 6.8 |
| 28 | Evretou | 1934 | 134.89 | 19.7 | 413 ^{12.0} | 7.0 |
| 29 | Syrgates | 1858 | 23.7 | 3.2 | 380 ¹¹ | 1.3 |
| 30 | Dhiarizos | 5687 | 777.4 | 35.2 | 1800 | 13.7 |
| 31 | Xeros (P) | 4872 | 499.1 | 43.2 | 1000 | 10.2 |
| 32 | Alakati | 141 | 0.76 | 0.3 | 61 ^{1.7} | 0.5 |
| 33 | Karyotis <i>Pand</i> | 1598 | 2.24 | 0.5 | 62 ^{1.7} | 0.1 |
| 34 | Tremithios (Ay.Anna) | 1044 | 100.7 | 44.4 | 8000- 8500 | 9.6 |
| 35 | Elea | 1845 | - | - | - | - |

Spring Discharges.

During the hydrological year, 1629 spring discharges were measured, giving an average of 136 measurements each month. 100 springs are now measured regularly, 5 every fortnight, 31 at monthly intervals, 30 every three months, 18 every four months, 65 every six months and 1 every year.

The below normal overall rainfall for the fourth year in succession resulted in spring discharges being nearly everywhere very much below average and in certain parts the yields were the lowest ever measured.

Springs in the Kyrenia range area had their flow steadily declining throughout the year. The Kythrea Kephlovrysos yield was near to 2,200,000 gallons per day during the greater part of the year and by the end of September it dropped to 2,063,000 gallons per day. This is the lowest discharge recorded since systematic measurements were commenced in 1932. Similarly, the Lapithos Kephlovrysos discharged 542,000 gallons per day in the first three months of the year and then by steady and gradual decrease during the remaining months, it dropped to the minimum of 358,000 gallons per day.

The Karavas Kephlovrysos flowing at the low rate of 487,000 gallons per day during the entire twelve months has shown a remarkable freedom from fluctuations.

On the high altitude of the Troodos mountains the snow which fell during the wet months caused a deeper penetration of surface water into the substrata and the flow of some springs was back to normal in the summer of 1960 after the usually low discharges of the year before. Thus, the Troodos water supply springs were discharging 25,000 gallons per day in September, compared with 19,000 g.p.d. last year and the Kannoures spring also was yielding 18,000 gallons per day more than the 26,000 gallons per day minimum discharge recorded last year. On the lower altitudes, spring discharges were everywhere below average and some, in the Kouris valley, were the lowest on record. For example, the Mavrommata spring used for the Limassol water supply was only discharging 86,000 gallons per day at the end of September, the lowest rate of flow ever measured. On the south west end of the mountains the yield of the springs supplying Ktima were the lowest for several years.

In Pedhicos and Yialias valleys, the flow of the chain of wells followed the same behaviour which was observed in the springs of the lower altitude of the Kyrenia and Troodos mountains.

Ground Water used for Town Water Supplies

Details of the water extracted from underground reserves for the three largest towns of Cyprus are given below:-

| <u>Nicosia</u> | <u>Quantity</u> (<u>Million cub. feet</u>) | <u>Percentage</u> |
|------------------------------------|---|-------------------|
| Kokkini Trimithia & Makēdhonitissa | 102.9 | 64 |
| Upper Arab Ahmet | 7.2 | 5 |
| Laxia | 9.1 | 6 |
| Morphou | 13.0 | 8 |
| Dhali | 8.2 | 5 |
| Sykhari | 5.3 | 3 |
| Dhikomo | 4.3 | 3 |
| Prodhromos (Approx.) | 4.0 | 2 |
| Others (Approx.) | 7.0 | 4 |
| Total extraction during 1959-60 | 161.0 | 100 |

| <u>Fmagusta</u> | <u>Quantity</u> (<u>Million cub. feet</u>) | <u>Percentage</u> |
|---------------------------------|---|-------------------|
| Phrenaros West | 18.9 | 34 |
| Phrenaros North | 28.9 | 53 |
| Others | 6.9 | 13 |
| Total extraction during 1959/60 | 54.7 | 100 |

| <u>Limassol</u> | <u>Quantity</u> (<u>Million cub. feet</u>) | <u>Percentage</u> |
|---|---|-------------------|
| Kephalovrysos Kria Pighadhia & Mavrommata springs | 50.1 | 63 |
| Chiftlikoudhia chain-of-wells | 15.9 | 20 |
| Others | 13.7 | 17 |
| Total extraction during 1959/60 | 79.7 | 100 |

Ground-Water Levels.

The records of the monthly measurements of the underground water-levels taken during 1959-60 in the 57 observation boreholes, show that the water table of the aquifer in the Eastern and Western Mesaoria as well as of the Akrotiri Peninsula is steadily declining.

The greatest decline in the underground water levels has been observed in the Western Mesaoria at Morphou area, where the water table has almost reached the sea level. It is apparent that increased demands for pumped irrigation-water during the year caused this serious drop in the level which is viewed with considerable concern. Since 1955, when records commenced, the average water table, has been depressed by about 5.5' at the coastal area and by about 18.0' two miles inland.

In the Kokkini Trimithia area, which provided Nicosia with most of its domestic water requirements, the average fall of the water level in the observation boreholes was 2.7' during the year compared with 2.5' in 1958-59 and 2.1' in 1957-58.

In the Eastern Mesaoria at Phrenaros area from which water for the Famagusta domestic supply is obtained, there was an average decrease in water level of 3.2' compared with 3.0' last year. The average level in the observation boreholes is now about 50 feet above sea level.

The water-table levels in the Ormithia-Xylophagou coastal zone has been depressed to nearly sea level and there is no doubt that if pumping for irrigation at the present rate is permitted to continue it will have serious results. Similar conditions exist in the Akrotiri peninsula.

Appendix A gives the water levels recorded at all observation boreholes after drilling and during the years 1958-59 and 1959-60.

Recharge Activities.

The artificial re-charge of underground water reserves which are being depleted by over-pumping has become a recognised practice where surface strata are porous enough to absorb water in substantial quantities. During 1959-60 this form of activity has been in operation at Chiftlikoudhia in the low coastal area west of Limassol town.

Total recharge into
Aquifer

9.1 million cubic feet

Total pumped from
Aquifer

15.9 million cubic ft.

The salinity of the well-water which was 70 p.p.m. of NaCl at the end of recharge in May, had risen to 568 p.p.m. by the end of September, 1960.

No water was fed into the recharge scheme of Ayios Memnon area, Famagusta, either from Ayios Loucas or from Paralimni lakes because they were dry due to low rainfall.

Chemical Analyses.

During the year 1650 samples of water were sent to the Government Analyst. This number included 5 samples for full chemical analysis, 1051 samples for partial chemical analysis from domestic water sources and 594 samples for partial chemical analysis from springs, observation boreholes and irrigation boreholes.

Bacteriological Analyses.

During the year 744 samples of water taken mainly from town water supplies were analysed by the Government Pathologist.

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

| <u>Water Supply.</u> | <u>No. of samples.</u> | <u>No. of Unsatisfactory samples</u> |
|----------------------|------------------------|--------------------------------------|
| Nicosia | 484 | 55 |
| Famagusta | 120 | 11 |
| Limassol | 48 | 8 |
| Larnaca | 43 | 15 |
| Paphos | 49 | 22 |
| Totals | <u>744</u> | <u>111</u> |

Most of the unsatisfactory samples from the Nicosia supply were collected from the chain-of-wells and from Borehole P.102. Chlorinated samples at all reservoirs were satisfactory.

At Famagusta the unsatisfactory samples were usually from Borehole 19/52. Chlorinated samples at the Reservoir were satisfactory.

At Limassol, Larnaca and Paphos most of the unsatisfactory samples came from the Reservoir before chlorination. Chlorinated samples were all satisfactory.

Special Investigations.

A number of special hydrological investigations were conducted during the year of which the most important was at the Western Mesaoria, in the Morphou Bay and Kokkini Trimithia areas. A detailed study is in progress of the naturally stored groundwater in relation to rainfall and pumping in an area of 145 square miles. The preliminary results appear to indicate that there is an enormous excess of extraction over recharge. It is thus clear that unless the volume of pumping is reduced or alternatively, unless the excess of extraction can be supplied by artificial recharge, the result will be the failure of many wells and boreholes in the area.

Water Duty.

The records which are regularly kept on the actual quantity of water used in practice by ordinary irrigators in the Eastern and Western Mesaoria, show that most of them, especially in Morphou area, are over irrigating their crops. There is no doubt that if better methods and practices were used in the application of the irrigation water a smaller quantity would produce equal crops.

APPENDIX 17

WATER LEVEL IN CONTROL BOREHOLES

(Feet above sea level)

| Ser. No. | Place | Bore-hole No. and year | Maximum water level | | | Minimum water level | | |
|----------|-------------------|------------------------|---------------------|-------|-------|---------------------|-------|-------|
| | | | Year after drilling | 58-59 | 59-60 | Year after drilling | 58-59 | 59-60 |
| 1 | Kokkini Trimithia | 90/50 | 685.8 | 665.8 | 662.1 | 681.2 | 662.0 | 658.3 |
| 2 | Kokkini Trimithia | 160/50 | 682.7 | 667.0 | 663.4 | 679.8 | 663.3 | 657.9 |
| 3 | Kokkini Trimithia | 161/50 | 686.0 | 662.8 | 657.4 | 680.2 | 657.1 | 649.5 |
| 4 | Astromeritis | 91/50 | 370.4 | 356.6 | 350.6 | 365.1 | 337.8 | 337.0 |
| 5 | Morphou | 168/50 | 89.2 | 74.3 | 68.4 | 84.1 | 68.4 | 64.1 |
| 6 | Morphou | 92/50 | 83.7 | 62.8 | 49.6 | 69.9 | 37.2 | 36.5 |
| 7 | Prastio | 93/50 | 27.1 | 15.3 | 15.3 | 22.1 | 7.5 | 7.5 |
| 8 | Prastio | 11/57 | 25.0 | 15.8 | 10.7 | 14.0 | 6.8 | 3.1 |
| 9 | Ghaziveran | 94/50 | 18.5 | 10.8 | 8.2 | 16.2 | 8.2 | 5.5 |
| 10 | Pendayia | 95/50 | 10.6 | 7.5 | 7.5 | 8.0 | 5.1 | 5.1 |
| 11 | Syriano-khori | 150/54 | 9.7 | 7.5 | 5.9 | 8.4 | 4.4 | 4.7 |
| 12 | " | 151/54 | 9.3 | 6.9 | 5.3 | 8.1 | 4.3 | 4.4 |
| 13 | " | 152/54 | 7.2 | 4.6 | 2.7 | 5.2 | 2.5 | 1.1 |
| 14 | " | 153/54 | 4.3 | 2.4 | 1.7 | 3.4 | 1.5 | 0.5 |
| 15 | " | 1/55 | 23.1 | 12.9 | 8.7 | 17.7 | 6.2 | 0.2 |
| 16 | " | 23/55 | 20.9 | 11.3 | - | 17.4 | 9.6 | - |
| 17 | " | 201/56 | 17.2 | 12.0 | 7.8 | 12.2 | 6.0 | 0.3 |
| 18 | " | 209/56 | 16.1 | 12.0 | 7.7 | 11.4 | 5.2 | 0.1 |
| 19 | " | 195/57 | 6.0 | 5.7 | 4.6 | 4.2 | 3.2 | 0.7 |
| 20 | " | 209/57 | 3.4 | 2.3 | 1.9 | 2.3 | 1.5 | 1.0 |
| 21 | " | 212/57 | 3.7 | 2.7 | 2.2 | 2.9 | 1.9 | 0.9 |
| 22 | " | 248/57 | 9.6 | 6.9 | 4.1 | 5.4 | 3.8 | 1.3 |
| 23 | " | 253/57 | 9.5 | 7.5 | 4.6 | 5.8 | 4.3 | 1.7 |
| 24 | Xylophagou | 70/51 | 19.1 | 13.6 | 12.5 | 15.9 | 11.9 | 10.8 |
| 25 | " | 71/51 | 13.1 | 5.7 | 4.4 | 10.6 | 3.0 | 0.6 |
| 26 | " | 72/51 | 18.5 | 12.9 | 11.7 | 14.7 | 11.4 | 9.4 |
| 27 | " | 73/51 | 6.0 | 4.8 | 5.0 | 3.7 | 4.0 | 4.0 |

| Ser No. | Place | Bore-hole No. and Year | Maximum water level | | | Minimum water level | | |
|---------|-------------------------|------------------------|---------------------|-------|-------|---------------------|-------|-------|
| | | | Year after drilling | 58-59 | 59-60 | Year after drilling | 58-59 | 59-60 |
| 28 | Xylophagou | 74/51 | 6.9 | 5.5 | 4.9 | 4.5 | 4.5 | 3.2 |
| 29 | Ormidhia | 189/57 | -1.6 | 1.7 | -1.4 | -2.3 | 2.5 | -2.5 |
| 30 | " | 227/57 | 0.7 | 0.6 | 0.3 | 0.4 | 0.1 | -0.2 |
| 31 | " | 246/57 | -0.8 | 0.9 | -0.7 | -1.2 | 1.5 | -1.7 |
| 32 | Makrasyka | 48/54 | 117.0 | 106.3 | 99.1 | 110.7 | 94.4 | 89.9 |
| 33 | " | 49/54 | 120.1 | 112.4 | 110.2 | 117.4 | 109.9 | 106.4 |
| 34 | Kalopsidha | 54/54 | 68.5 | 59.5 | 53.3 | 60.3 | 51.2 | 43.1 |
| 35 | " | 55/54 | 73.9 | 67.7 | 64.3 | 72.4 | 64.2 | 60.3 |
| 36 | " | 56/54 | 75.3 | 70.1 | 67.7 | 74.4 | 67.5 | 64.1 |
| 37 | Pergamos | 86/51 | 256.6 | 243.9 | 242.2 | 254.7 | 240.4 | 237.2 |
| 38 | Phrenaros West | 51/51 | 87.0 | 68.2 | 65.4 | 86.6 | 65.2 | 62.3 |
| 39 | " | 52/51 | 85.8 | 67.2 | 62.7 | 85.4 | 62.6 | 59.5 |
| 40 | " | 53/51 | 85.2 | 70.1 | 67.6 | 84.9 | 67.2 | 50.7 |
| 41 | " | 67/53 | 81.1 | 69.7 | 67.8 | 80.4 | 67.5 | 64.1 |
| 42 | Phrenaros North | 108/52 | 72.2 | 54.9 | 51.6 | 71.3 | 51.3 | 47.4 |
| 43 | " | 109/52 | 70.6 | 54.7 | 51.4 | 67.0 | 51.3 | 47.3 |
| 44 | " | 110/52 | 70.2 | 55.0 | 51.9 | 66.6 | 51.7 | 48.0 |
| 45 | " | 76/56 | 58.1 | 52.9 | 50.4 | 55.8 | 50.3 | 46.4 |
| 46 | " | 77/56 | 64.1 | 61.4 | 61.1 | 62.6 | 60.6 | 59.4 |
| 47 | " | 78/56 | 65.6 | 60.5 | 58.6 | 66.1 | 58.5 | 55.8 |
| 48 | " | 79/56 | 72.8 | 69.5 | 68.3 | 70.8 | 68.0 | 64.4 |
| 49 | Ay.Nicolaos (Famagusta) | 89/56 | 29.4 | 28.0 | 27.5 | 28.5 | 26.6 | 26.3 |
| 50 | Ay.Memnon | 69/38 | -1.2 | 1.0 | -2.7 | -5.0 | 6.6 | -9.5 |
| 51 | " | 50/53 | 3.2 | 1.5 | 0.1 | 0.2 | 1.8 | -3.7 |
| 52 | Kolossi | 88/54 | 16.0 | 10.0 | 8.0 | 12.0 | 5.5 | 2.0 |
| 53 | Laxia | 208/55 | 672.2 | 660.4 | 654.8 | 666.3 | 653.1 | 650.6 |
| 54 | Ephtakomi | 163/55 | 496.4 | 475.8 | 464.5 | 490.2 | 465.0 | 462.6 |
| 55 | Khalassa | 23/58 | 547.6 | 547.6 | 547.3 | 544.2 | 544.2 | 543.7 |
| 56 | Ayios Andronikos | 249/55 | 391.3 | 391.3 | 390.6 | 390.6 | 390.6 | 389.1 |
| 57 | " | 322/55 | 386.2 | 386.2 | 386.3 | 385.7 | 385.7 | 384.7 |

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