



WATER DEVELOPMENT
DEPARTMENT
1047 NICOSIA



REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE , RURAL
DEVELOPMENT AND ENVIRONMENT

REUSE OF TREATED EFFLUENT IN CYPRUS

LIMASSOL 11-5-2016

NICOS NEOCLEOUS
ACTING CHIEF WATER OFFICER

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- **THE WATER SHORTAGE PROBLEM IN CYPRUS**
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- **QUALITY CHARACTERISTICS AND CONTROL OF
THE TREATED EFFLUENT**

The water shortage problem in Cyprus

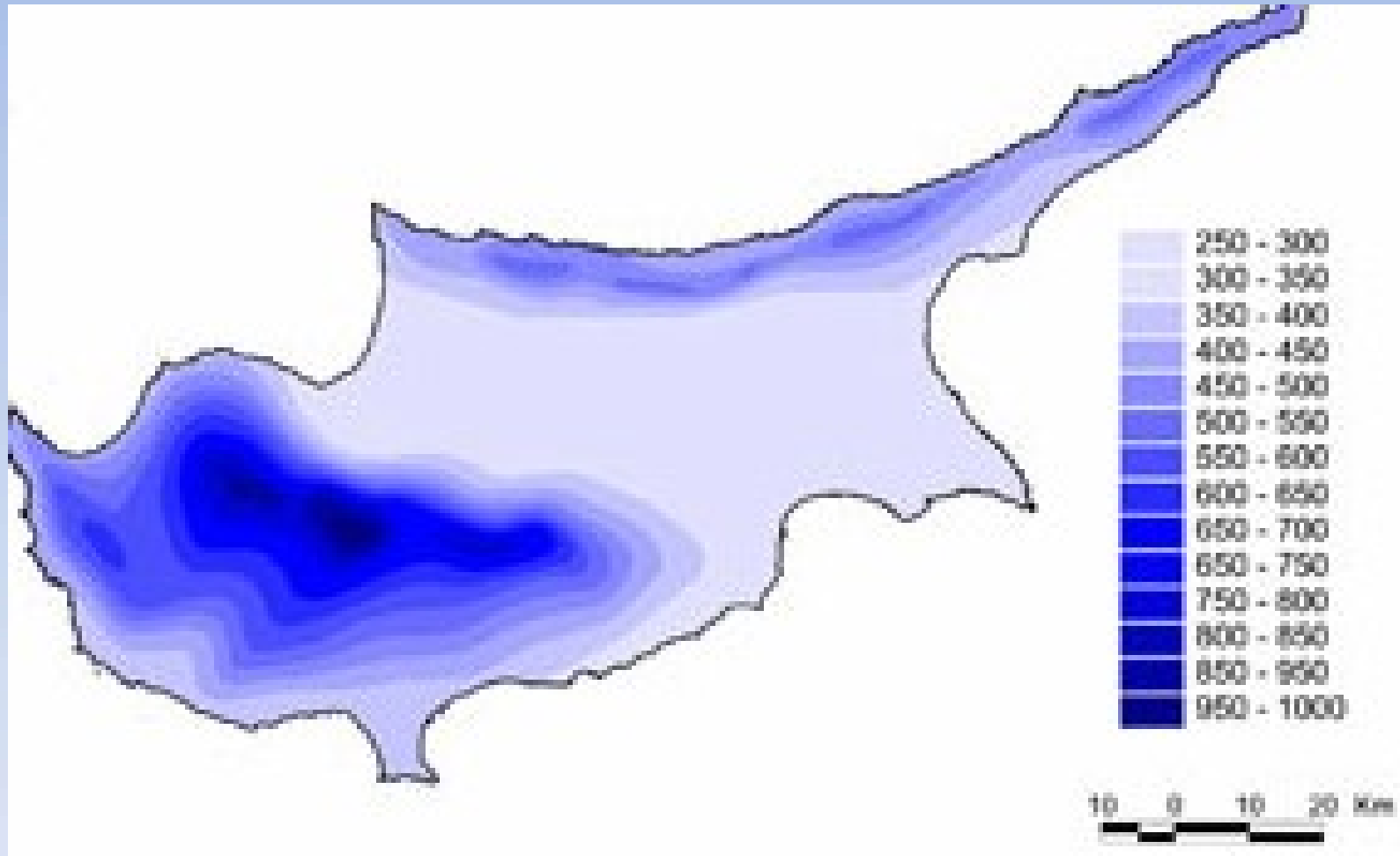
- The increasing water demand for both irrigation and human consumption, during the past century, has led to the development of large infrastructure projects such as dams, water treatment plants, large conveyors and reservoirs, to store, process and transfer water throughout the island.
- Some of the infrastructure projects are:
 - The construction of over 100 dams with total storage capacity of 332 million cubic meters of water
 - The implementation of several regional major schemes
 - The construction of water treatment plants

- *Despite the development of the conventional surface and underground water sources, Cyprus continued to face an acute water shortage problem.*

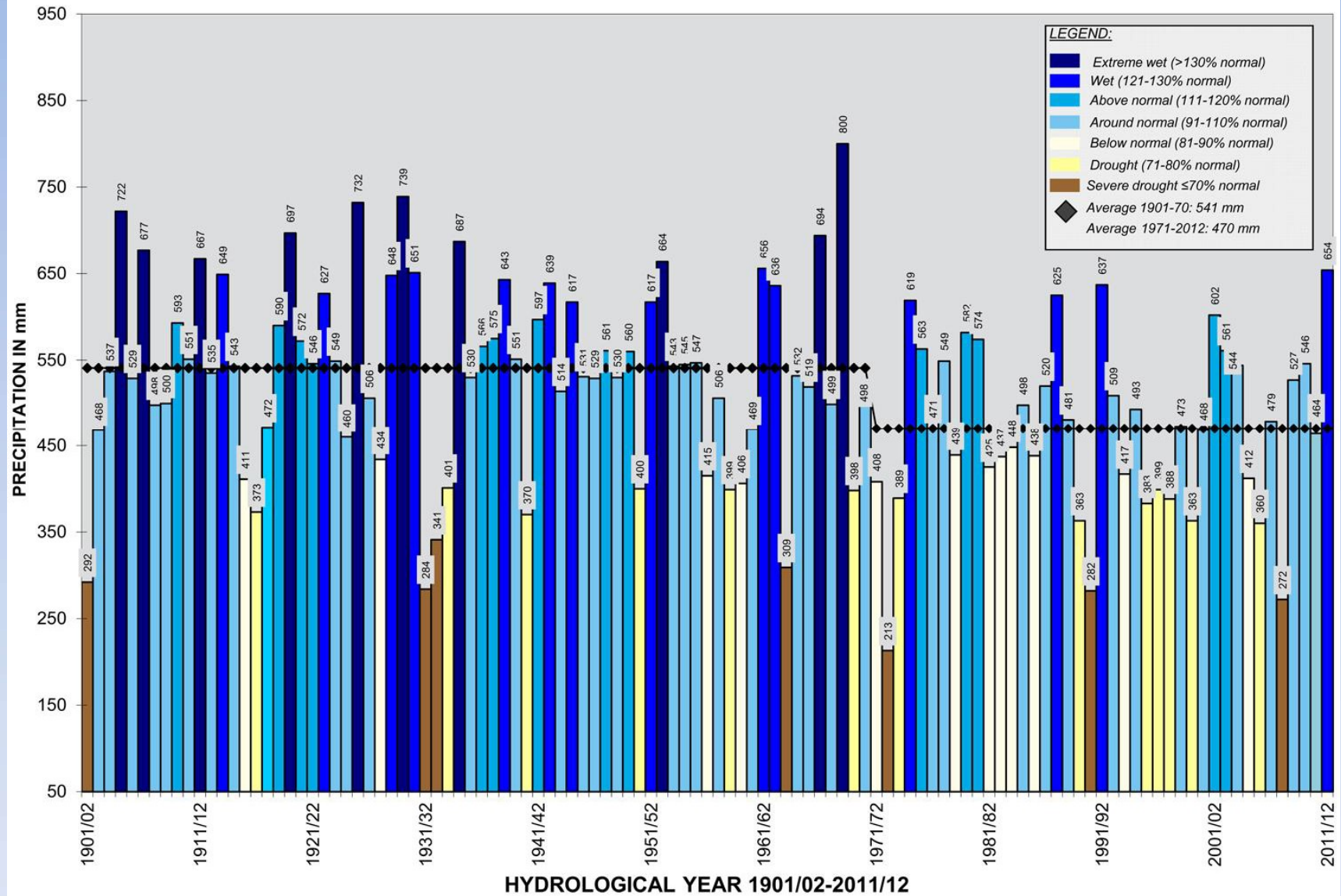
- Therefore, in order to eliminate the dependency of the domestic water supply on annual rainfall, the Government decided:

- To proceed with the construction of sea water desalination plants.
- To replace fresh water used in agriculture by treated effluent.

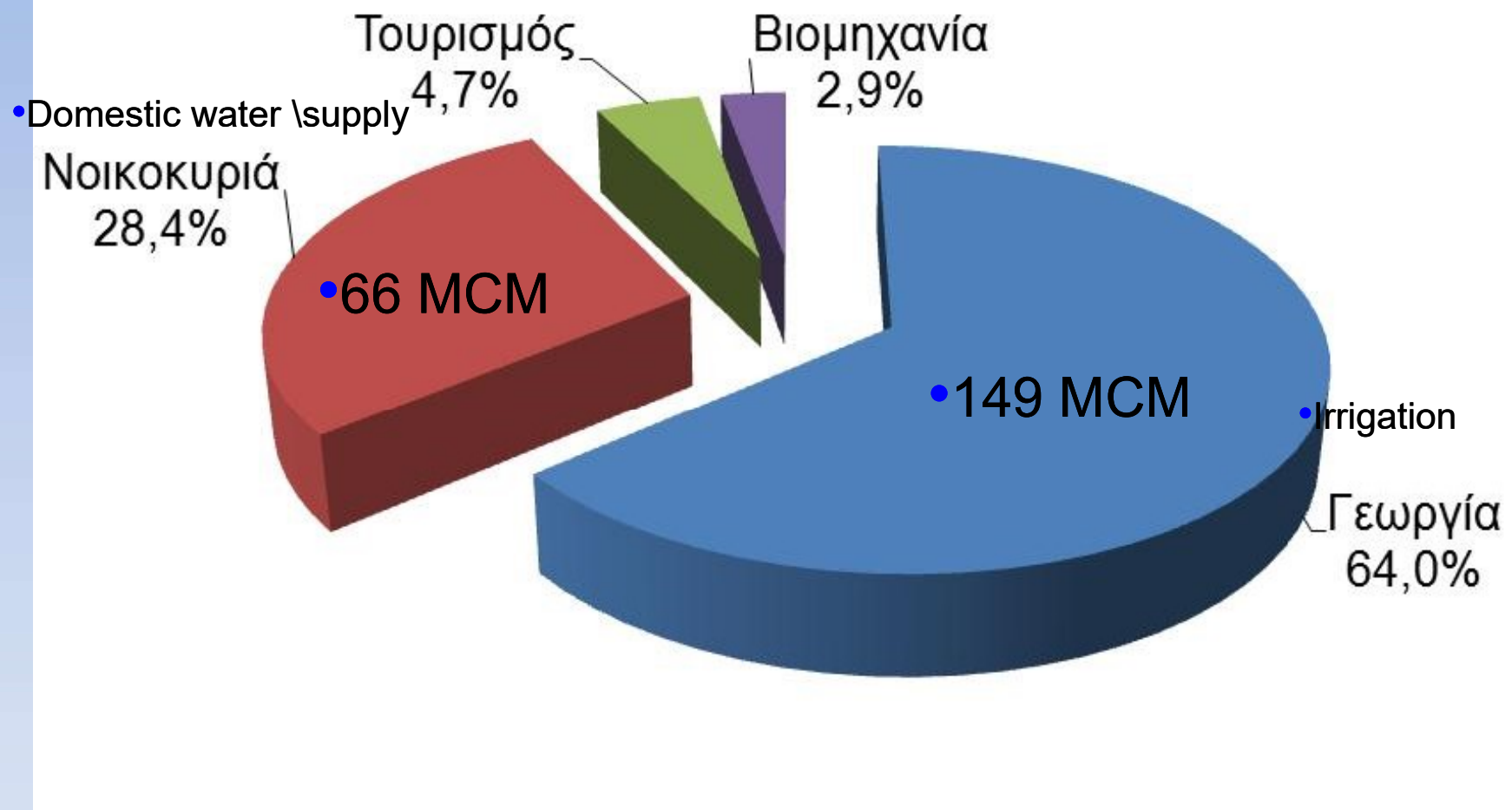
Annual Average Rainfall (mm)



CYPRUS ANNUAL PRECIPITATION (AREA UNDER GOVERNMENT CONTROL)



•Tourism •11 MCM •Industry •7 MCM



•Yearly Consumption: 233 MCM

DAMS OF CYPRUS





•KOURIS DAM



•ASPROKREMMOS DAM

DESALINATION PLANTS

- LARNACA DESALINATION PLANT: 60.000 CM/DAY
 - DEKELIA DESALINATION PLANT: 60.000 MCM/DAY
 - VASILIKOS DESALINATION PLANT: 60.000 CM/DAY
 - LIMASSOL DESALINATION PLANT: 40.000 CM/DAY
-
- TOTAL CAPACITY: 220 CM/DAY=ABOUT **80 MCM/YEAR**

RO 1ST STAGE MEMBRANE TRAINS



Integrated Water Management Law N. 79(I) / 2010

Based on the Integrated Water Management Law, Water Development Department (WDD) among all the other responsibilities, is responsible for :

- The establishment of wastewater treatment systems**
- The establishment of Storm water drainage systems**
- The management and reuse of treated effluent**

Wastewater Treatment Plants

Existing MAIN Urban Wastewater Treatment Plants

Plant	Owner of the Plant	Capacity (m ³ /day)
Anthoupolis	Nicosia Sewerage Board	13.000
Vathia Gonia	Nicosia Sewerage Board	22.000
Vathia Gonia	Water Development Department	2.100
Mia Milia	UNDP	30.000
Limassol (Moni)	Sewerage Board of Limassol Amathus	40.000
Larnaca	Sewerage Board of Larnaca	18.000
Paphos (Achelia)	Sewerage Board of Paphos	19.500
Paralimni –Ayia Napa	Sewerage Board of Paralimni- Ayia Napa	21.000

• **TOTAL CAPACITY 165.600 CM/DAY**

CURRENT SITUATION OF THE CYPRUS NATIONAL IMPLEMENTATION PROGRAMME (NIP-2008) OF THE URBAN WASTEWATER TREATMENT DIRECTIVE 91/271/EEC



Legend

- Urban Agglomerations
- Rural Agglomerations without collection network.
- Rural Agglomerations with collection network in operation.
- Rural Agglomerations with collection network under construction.
- Urban Waste Water Treatment Plant (UWWTP) in operation.
- UWWTP in operation and in parallel under expansion.
- UWWTP planned for construction.
- 1 agglomeration : 1 UWWTP
- n agglomerations : 1 UWWTP
- 1 agglomeration : n UWWTPs

Date: June 2010

Prepared and printed by the Water Development Department.
Dwg. Ref. : NIP-2008

SUPPLY OF TREATED EFFLUENT

The policy of the Government is that the treated effluent produced by the Urban Sewerage Boards will be handled and disposed by the Government.

The cost for the construction and the operation and maintenance of the tertiary treatment plant is undertaken by the Government.

The Water Development Department is the Department of the Government responsible for the supply of treated effluent.

REUSE OF TREATED EFFLUENT

IN CYPRUS THE TREATED EFFLUENT FROM THE URBAN WASTEWATER TREATMENT PLANTS IS USED:

- **FOR IRRIGATION**

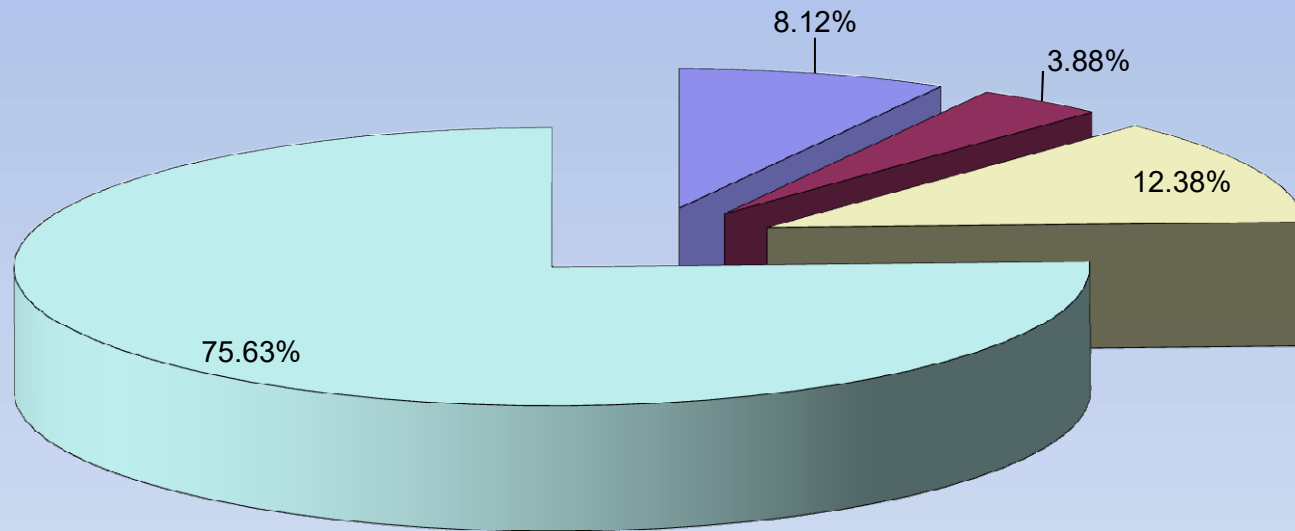
THE IRRIGATION IS DONE UNDER THE CODE OF CORRECT AGRICULTURAL PRACTICE.

- **FOR THE RECHARGED OF AQUIFERS**

(LIMASSOL & PAPHOS WASTEWATER TREATMENT PLANT)

NOTE: DURING SOME WINTER MONTHS IN LARNACA AND LIMASSOL SOME QUANTITIES ARE DISCHARGED INTO THE SEA THIS IS A TEMPORARY SOLUTION WHICH WILL STOP AFTER THE IMPLEMENTATION OF THE REUSE PROJECTS

PERCENTAGES OF TREATED EFFLUENT DISPOSED



- PERCENTAGE OF TREATED EFFLUENT DISCHARGED TO THE SEA
- PERCENTAGE OF TREATED EFFLUENT DISCHARGED TO POLEMIDIA DAM
- PERCENTAGE OF TREATED EFFLUENT USED FOR AQUIFER RESCHARGE
- PERCENTAGE OF TREATED EFFLUENT USED FOR IRRIGATION PURPOSES

FUTURE QUANTITIES OF TREATED EFFLUENT

		2025
MUNICIPAL WASTEWATER TREATMENT PLANTS		69,000,000
WASTEWATER TREATMENT PLANTS FOR RURAL COMMUNITIES		16,000,000
TOTAL QUANTITIES		85,000,000

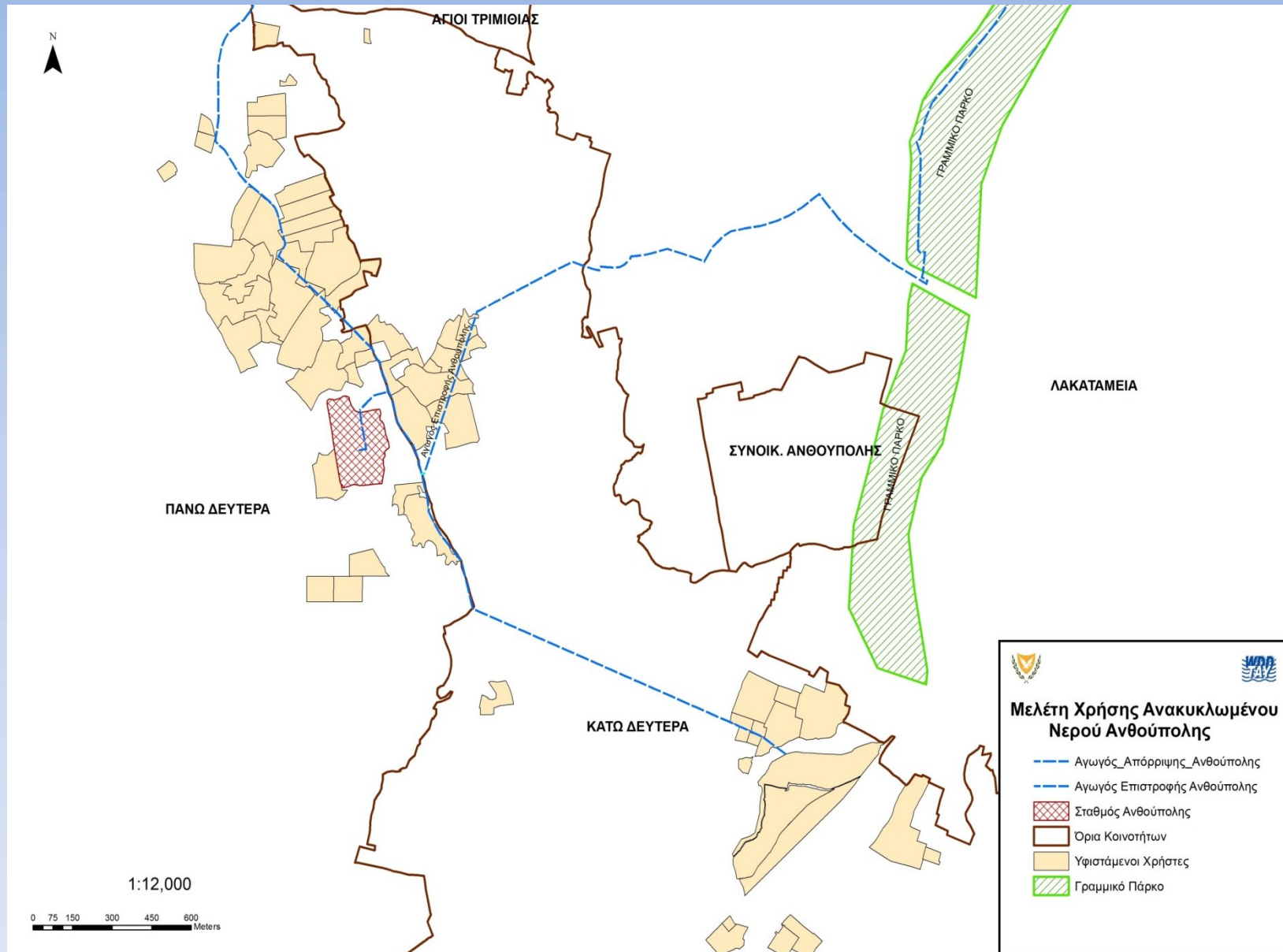
**7. SELLING RATES OF TREATED EFFLUENT
FROM TERTIARY TREATMENT PLANTS**

The rate of the treated effluent from the wastewater treatment plants has been set by a ministerial decree as per the following table. These rates are charged by the government

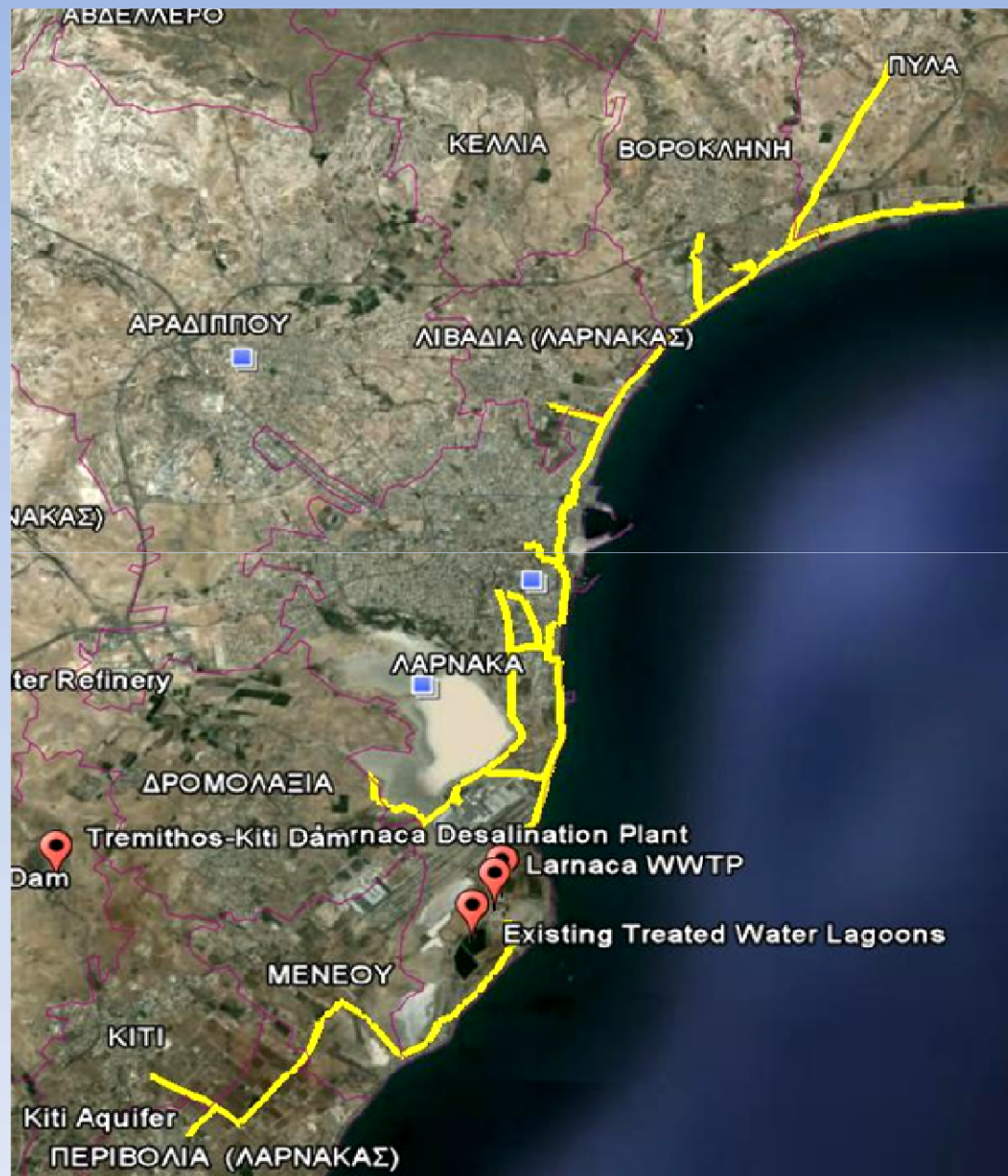
A/A	USE	Water Selling Rate	
		Existing Rate of Tertiary Treated Effluent	<i>Existing Selling Rate of Fresh not filtered water from governmental water works</i>
		EURO Cent/ m3	<i>EURO Cent/ m3</i>
1	a) For Irrigation divisions for agricultural production	5	15
	b) For Persons for agricultural production	7	17
2	For sports	15	34
3	For irrigation of hotels green areas and gardens	15	34
4	For irrigation of Golf Courses	21	34
5	For pumping from an underground aquifer recharged by treated effluent	8	
6	For over consumption for items 1 to 5	increase by 50%	56

TREATED EFFLUENT IRRIGATION SCHEMES

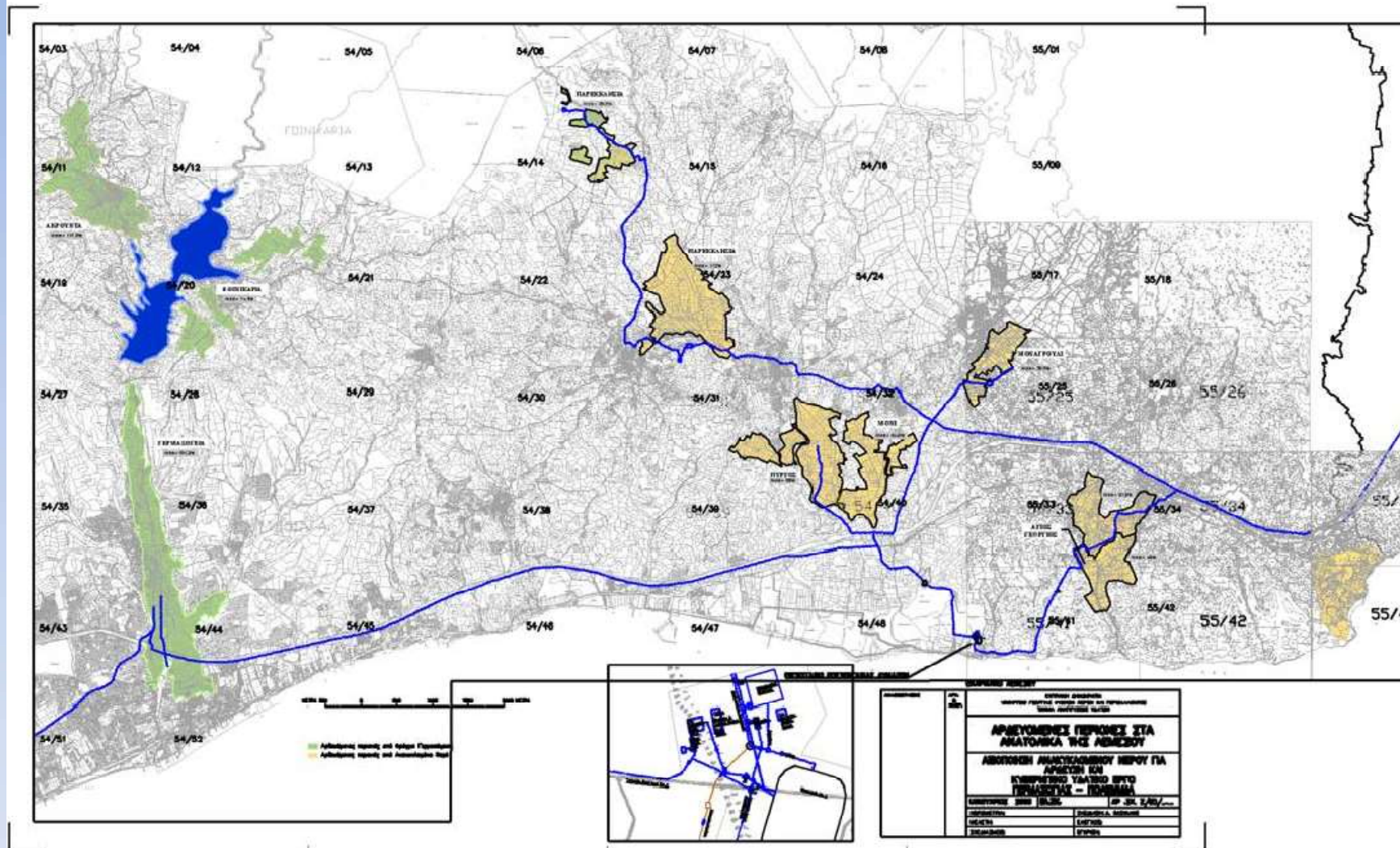
• IRRIGATION NETWORK FOR ANTHOUPOLIS WWTP



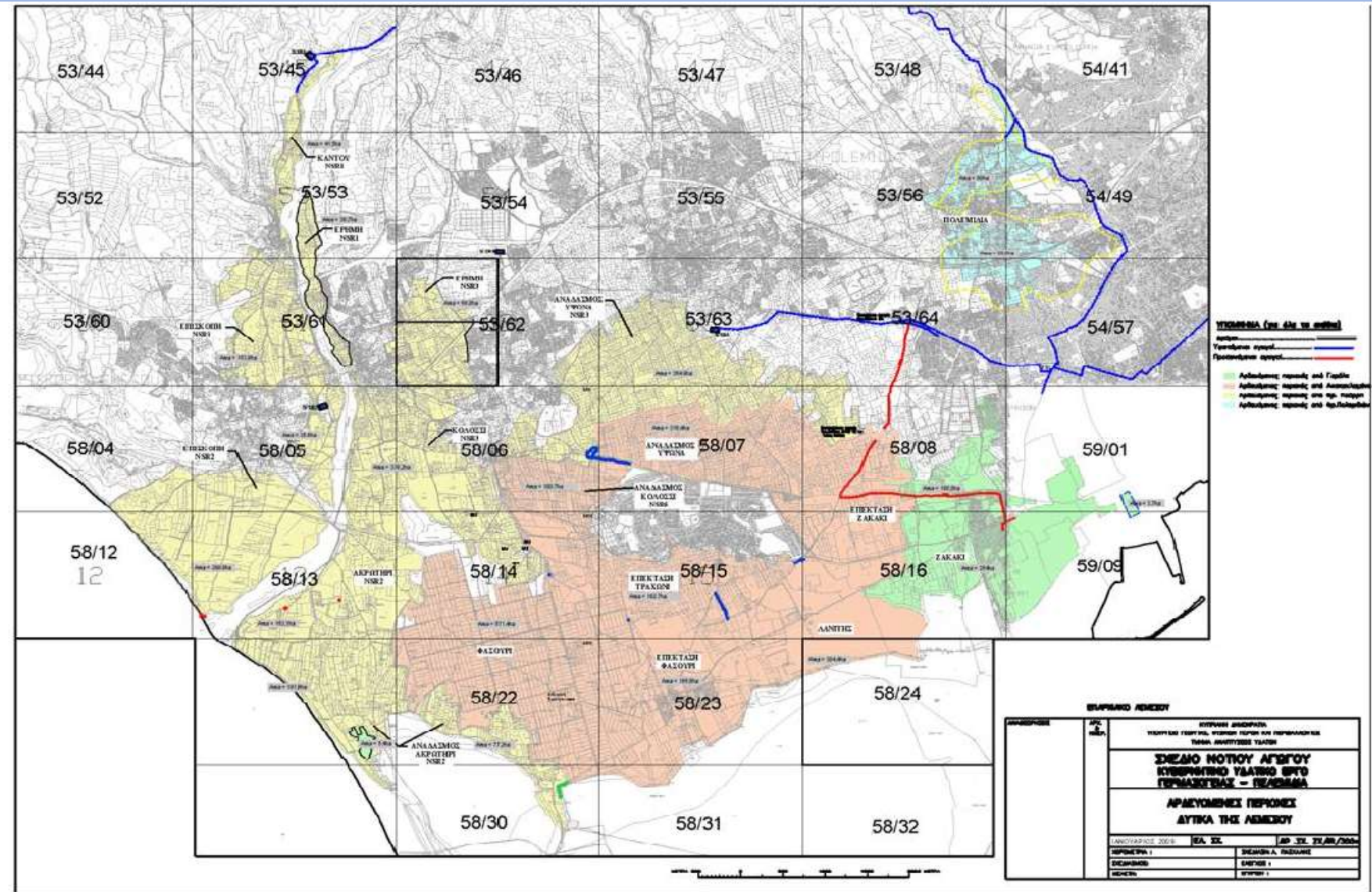
- **LARNACA AREA TREATED EFFLUENT IRRIGATION SCHEME**



LIMASSOL AREA TREATED EFFLUENT IRRIGATION SCHEME



LIMASSOL AREA TREATED EFFLUENT IRRIGATION SCHEME

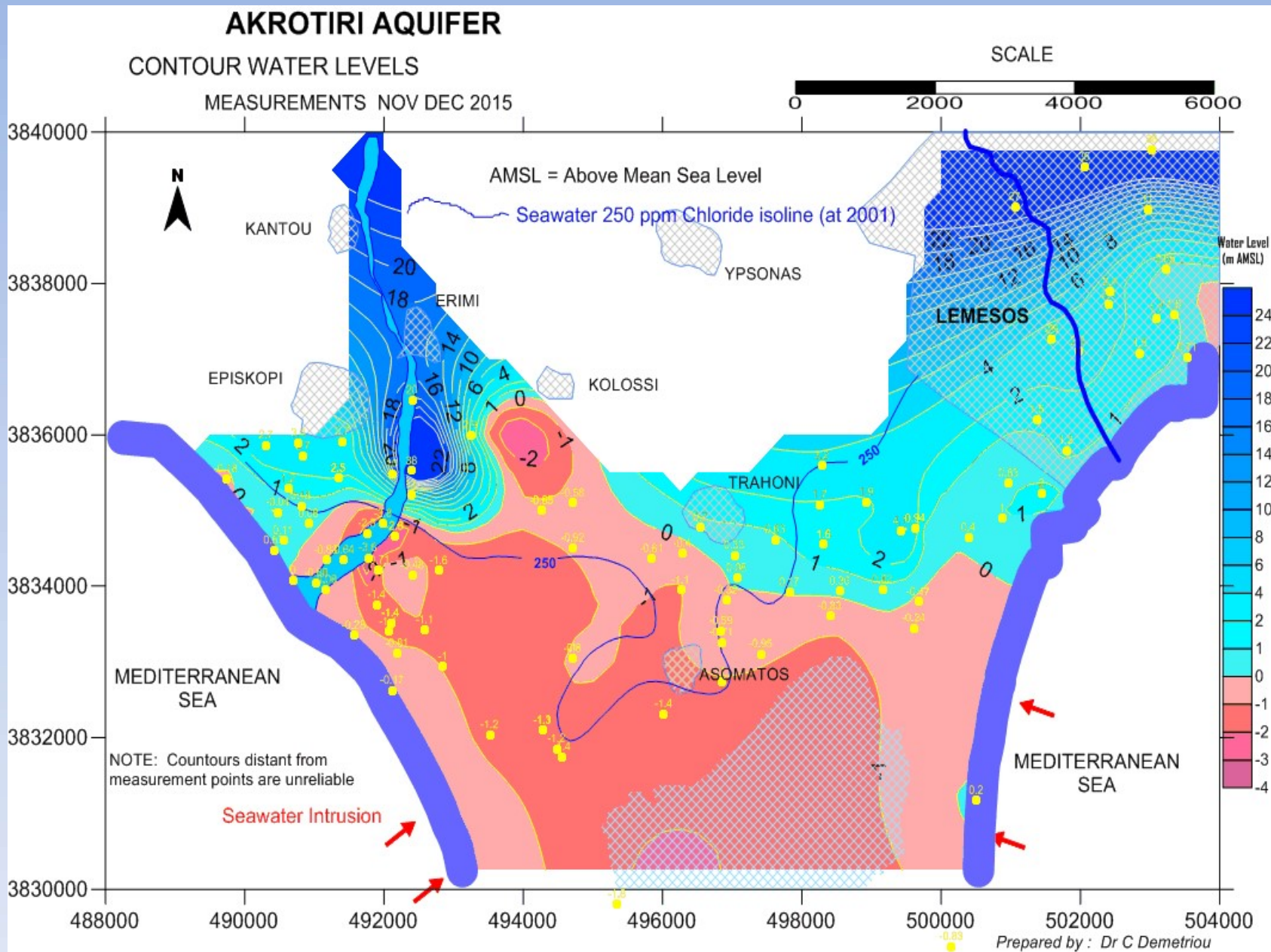


AQUIFER RESCHARGE

AKROTIRI AREA

THE TREATED EFFLUENT IS USED FOR THE RECHARGE OF AKROTIRI AQUIFER MAINLY IN WINTER WHEN THERE IS SURPLUS OF WATER.

RECHARGING THE AKROTIRI AQUIFER WITH RECYCLED WATER

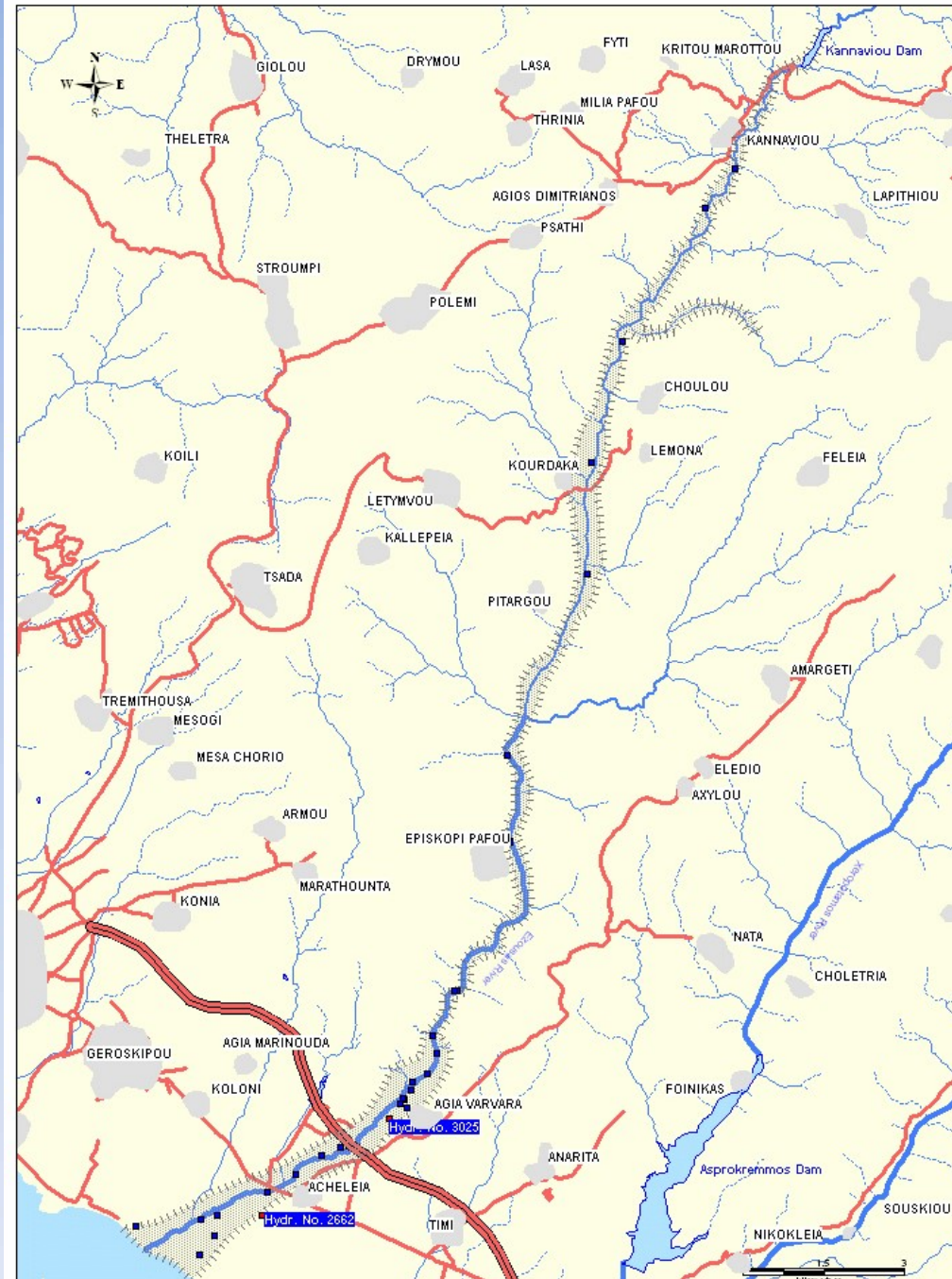


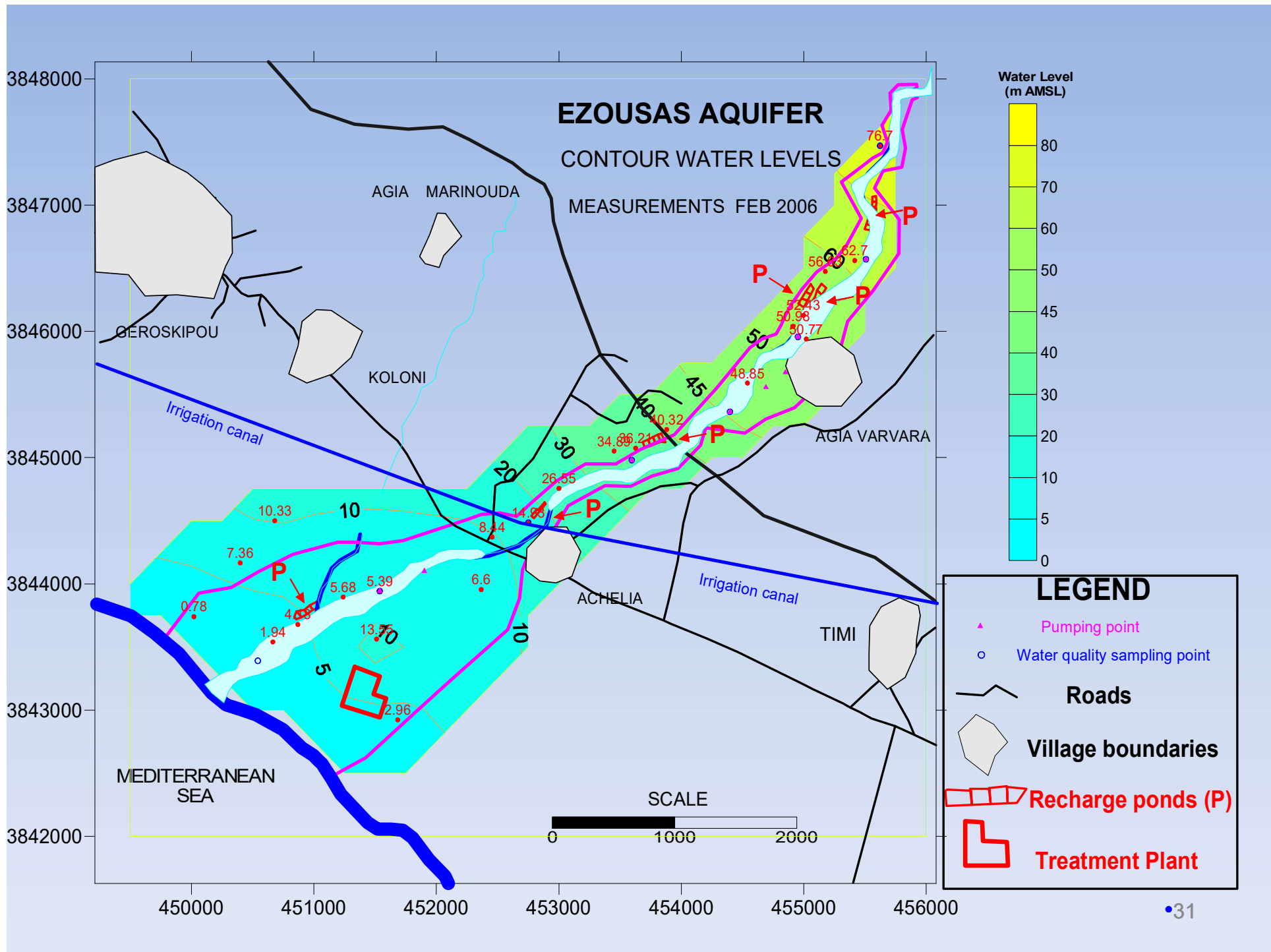


AQUIFER RESCHARGE

PAPHOS AREA

IN THIS AREA ALL THE QUAANTITY OF THE TREATED EFFLUENT IS USED FOR THE RECHARGE OF EZOUSA AQUIFER.





DISCHARGE PERMITS:

QUALITY CHARACTERISTICS AND CONTROL OF THE TREATED EFFLUENT

According to the Laws of the Water Pollution Control of 2002 -2007,for the municipal wastewater treatment plants the Minister Of Agriculture is issuing a Wastewater Discharge Permit to the following competent authorities:

- Sewerage Boards
- Water Development Department

In the Discharge Permit the following are defined:

- quality characteristics
- number and the type of analysis
- disposal of the treated effluent

ΚΥΠΡΙΑΚΗ



ΔΗΜΟΚΡΑΤΙΑ

ΥΠΟΥΡΓΕΙΟ ΓΕΩΡΓΙΑΣ, ΦΥΣΙΚΩΝ ΠΟΡΩΝ ΚΑΙ ΠΕΡΙΒΑΛΛΟΝΤΟΣ

Οι περί Ελέγχου της Ρύπανσης των Νερών Νόμοι του 2002 μέχρι 2007
(Αρ. 106(I)/2002, Αρ. 160(I)/2005, Αρ. 76(I)/2006, Αρ. 22(I)/2007)

ΑΔΕΙΑ ΑΠΟΡΡΙΨΗΣ ΑΠΟΒΛΗΤΩΝ

ΑΡΙΘΜΟΣ: 55 / 2008

Σύμφωνα με τους περί Ελέγχου της Ρύπανσης των Νερών Νόμους του 2002 μέχρι 2007 (Άρθρο 11, Ν.106(I)/2002) παραχωρώ Άδεια Απόρριψης Αποβλήτων στο **Τμήμα Αναπτύξεως Υδάτων για τη Διάθεση των Επεξεργασμένων Λυμάτων από τον Σταθμό Επεξεργασίας Λυμάτων του Συμβουλίου Αποχετεύσεων Λάρνακας**. Οι Όροι της Άδειας Απόρριψης (Γενικοί και Ειδικοί) επισυνάπτονται στο Παράρτημα.


Μιχάλης Πολυνείκης Χαραλαμπίδης
Υπουργός Γεωργίας, Φυσικών Πόρων και Περιβάλλοντος

7 Μαρτίου, 2008

Το παρόν έγγραφο της Άδειας θα πρέπει να τοποθετείται σε περίοπτη θέση εντός των υποστατικών του φορέα εκμετάλλευσης της διεργασίας.

Πίνακας 1 – Ποιοτικά χαρακτηριστικά των επεξεργασμένων λυμάτων και συχνότητα ελέγχου στην έξοδο της τριτοβάθμιας επεξεργασίας

α/α	Χαρακτηριστικά	Ανώτατα Όρια	Συχνότητα ελέγχου
1	Βιοχημικά Απαιτούμενο Οξυγόνο (BOD ₅) ¹ :	10 mg/l	4 φορές το χρόνο
2	Χημικά Απαιτούμενο Οξυγόνο (COD):	70 mg/l	4 φορές το χρόνο
3	Αιωρούμενα Στερεά (SS):	10 mg/l	4 φορές το χρόνο
4	Ηλεκτρική Αγωγιμότητα:	2200 μS/cm	4 φορές το χρόνο
5	Ολικό Άζωτο (TN):	15 mg/l	4 φορές το χρόνο
6	Ολικός Φωσφόρος (TP):	10 mg/l	4 φορές το χρόνο
7	Χλωριούχα (Cl):	300 mg/l	4 φορές το χρόνο
8	Λίπη και Έλαια:	5 mg/l	4 φορές το χρόνο
9	Ψευδάργυρος (Zn):	0,1mg/l	2 φορές το χρόνο
10	Χαλκός (Cu):	0,1 mg/l	2 φορές το χρόνο
11	Μόλυβδος (Pb):	0,15 mg/l	2 φορές το χρόνο
12	Κάδμιο (Cd):	0,01 mg/l	2 φορές το χρόνο
13	Υδράργυρος (Hg):	0,005 mg/l	2 φορές το χρόνο
14	Χρώμιο (Cr):	0,1 mg/l	2 φορές το χρόνο
15	Νικέλιο (Ni):	0,2 mg/l	2 φορές το χρόνο
16	Βόριο (B):	1 mg/l	2 φορές το χρόνο
17	Εντερικά Κολοβακτηρίδια :	50 E. Coli ανά 100ml	4 φορές το χρόνο
18	Λυγιά Εντερικών Παρασίτων :	Τίποτε	Κάθε 3 μήνες
19	Υπολειμματικό Χλώριο :	1 mg/l	4 φορές το χρόνο
20	pH :	6,5 – 8,5	4 φορές το χρόνο

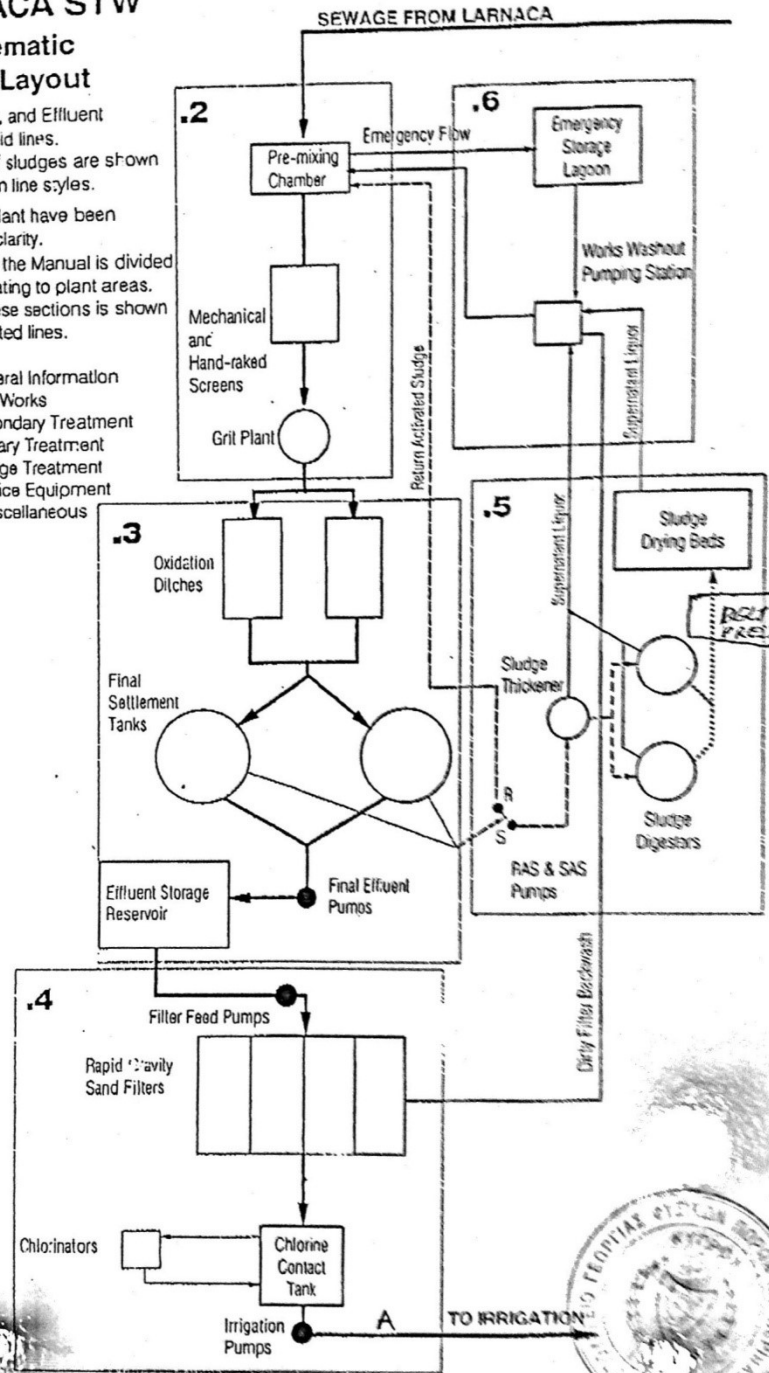
LARNACA STW

Schematic Plant Layout

Sewage, Liquors, and Effluent are shown by solid lines.
 Different types of sludges are shown by various broken line styles.

Minor items of plant have been omitted to help clarity.
 Each Chapter of the Manual is divided into sections relating to plant areas.
 The extent of these sections is shown by the chain-dotted lines.

- .1 General Information
- .2 Inlet Works
- .3 Secondary Treatment
- .4 Tertiary Treatment
- .5 Sludge Treatment
- .6 Service Equipment & Miscellaneous



QUALITY SPECIFICATIONS OF THE TREATED EFFLUENT FROM MUNICIPAL WASTEWATER TREATMENT PLANTS

	SPECIES ALLOWED TO BE IRRIGATED	BOD₅ mg/l	SUSPENDED SOLIDS mg/l	E. COLI /100ml	INTESTINAL WORMS***
1	All CROPS AND GREEN AREAS WITH NOT RESTRICTED USE (A)	10*	10*	5*	NIL
2	COOKED VEGETABLES (B)	10*	10*	50*	NIL
		15**	15**	100**	
3	PRODUCTS FOR HUMAN EATING, GREEN AREAS WITH RESTRICTED USE BY THE PUBLIC	20*	30*	200*	NIL
		30**	45**	1000**	
4	FODDER CROPS	20*	30*	1000*	NIL
		30**	45**	5000**	
5	INDUSTRIAL PLANTS	50*	--	3000*	--
		70**		10000**	

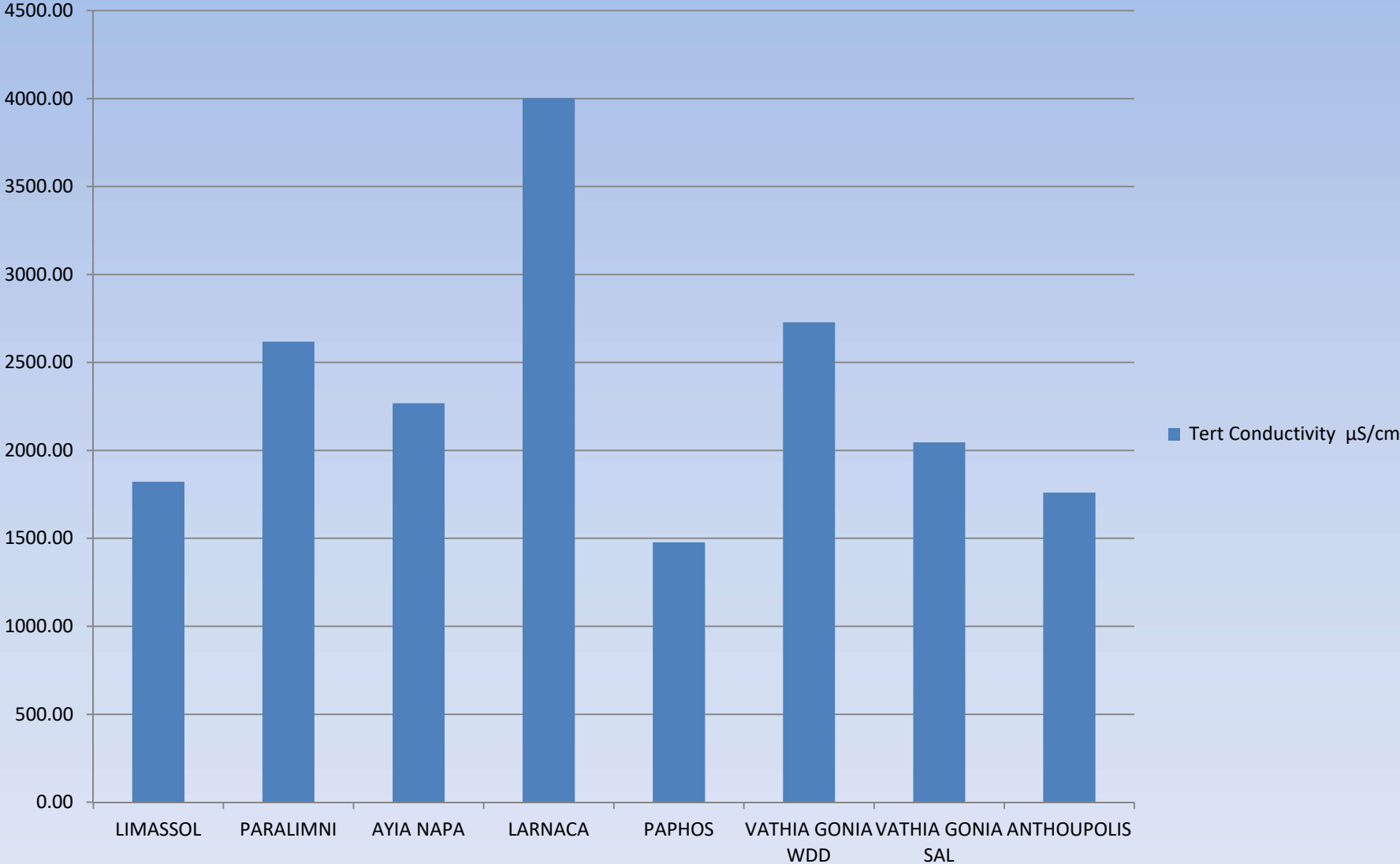
* **80% OF THE SAMPLES, 24 SAMPLES / YEAR**

** **MAXIMUM ACCEPTABLE VALUE**

*** **SAMPLING FREQUENCY ONCE A YEAR / SUM**

(a) VEGETABLES WITH LEAVES, BULBS AND CONDYLES EATEN
(b) POTATOES, BEETROOTS

2010 Treated Effluent Conductivity



METHODS OF DISINFECTION OF URBAN WASTEWATER TREATMENT PLANTS

TYPE OF DISINFECTION		
NAME OF WWTP	TYPE	METHOD
LIMASSOL	CHLORINATION	ONSITE CHLORINE GENERATION AND SODIUM HYPOCHLORITE
PARALIMNI	CHLORINATION	ONSITE CHLORINE GENERATION AND SODIUM HYPOCHLORITE
AYIA NAPA	CHLORINATION	ONSITE CHLORINE GENERATION AND SODIUM HYPOCHLORITE
LARNACA	CHLORINATION	ONSITE CHLORINE GENERATION AND SODIUM HYPOCHLORITE
PAPHOS	CHLORINATION	ONSITE CHLORINE GENERATION AND SODIUM HYPOCHLORITE
VATHIA GONIA (WDD)	CHLORINATION	ONSITE CHLORINE GENERATION AND SODIUM HYPOCHLORITE
VATHIA GONIA (SBN)	UV DISINFECTION	-
ANTHOUPOLIS	UV DISINFECTION	-

DATA FOR SOIL IRRIGATED WITH TREATED EFFLUENT

LIMASSOL AREA.

Sampling Date:	08-09-10
Control Parameters	
Plot No:	39, LAYOUT.: 54/40 W1
Exchangeable cations (mg/kg)	2015.5
Total Salinity (mg/kg)	970.2

ANTHOUPOLIS AREA.

Sampling Date:	07-09-10
Control Parameters	
Plot No.	384
Exchangeable cations (mg/kg)	239.10
Total Salinity (mg/kg)	826.20

GENERAL COMMENTS FOR THE REUSE OF TREATED EFFLUENT

- The treated effluent is another constant source of water.
- The Government's policy is to introduce the treated effluent in the Cyprus Water Balance.
- The Quality is under control and remains constant.
- The treated effluent is suitable for the majority of the crops.
- The farmers use less quantities of fertilisers because the treated effluent contains already nutrients such as Phosphorous and Nitrogen
- Almost all the Wastewater Treatment Plants in Cyprus are equipped with Tertiary Treatment , consisting of Sand Filtration and Chlorination in order to achieve higher quality characteristics and use the treated effluent in the Agriculture safely.



● **LIMASSOL (MONI) WWTP**



ANTHOUPOLIS WASTEWATER TREATMENT PLANT -SBN



LARNACA WASTEWATER TREATMENT PLANT-SBL

ΤΜΗΜΑ ΑΝΑΠΤΥΞΕΩΣ ΥΔΑΤΩΝ

ΥΠΟΥΡΓΕΙΟ ΓΕΩΡΓΙΑΣ, ΦΥΣΙΚΩΝ ΠΟΡΩΝ ΚΑΙ ΠΕΡΙΒΑΛΛΟΝΤΟΣ





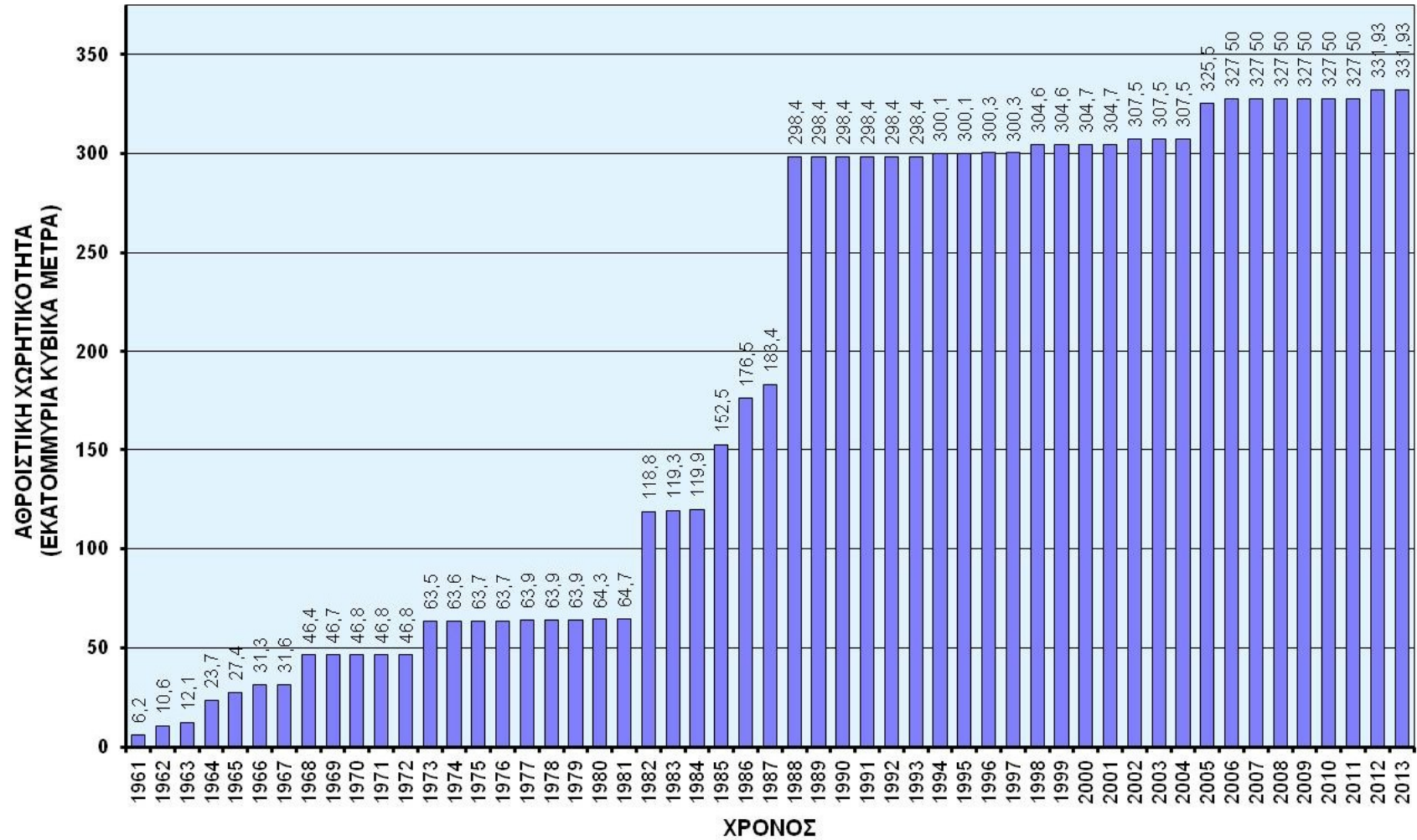
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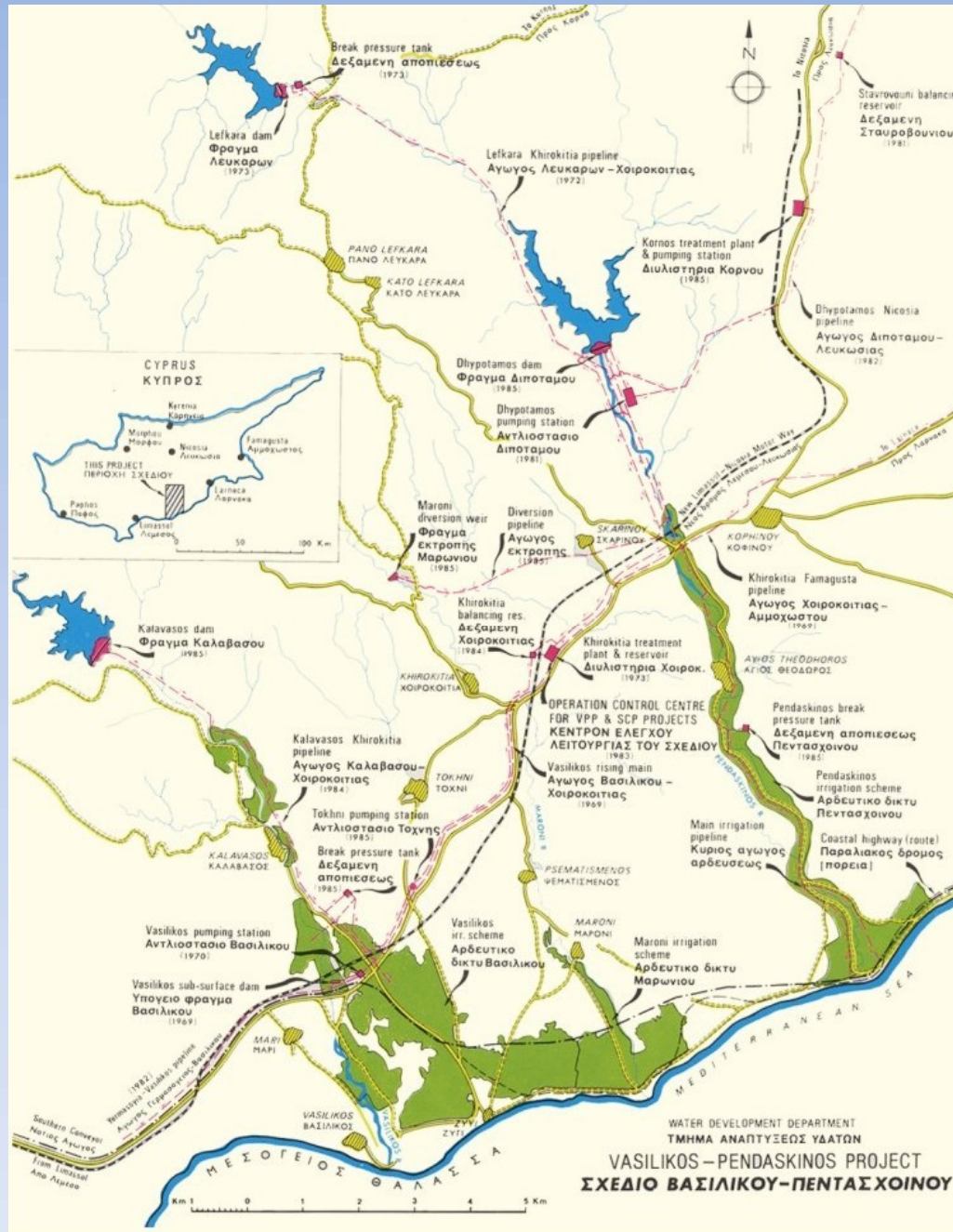
THANK YOU

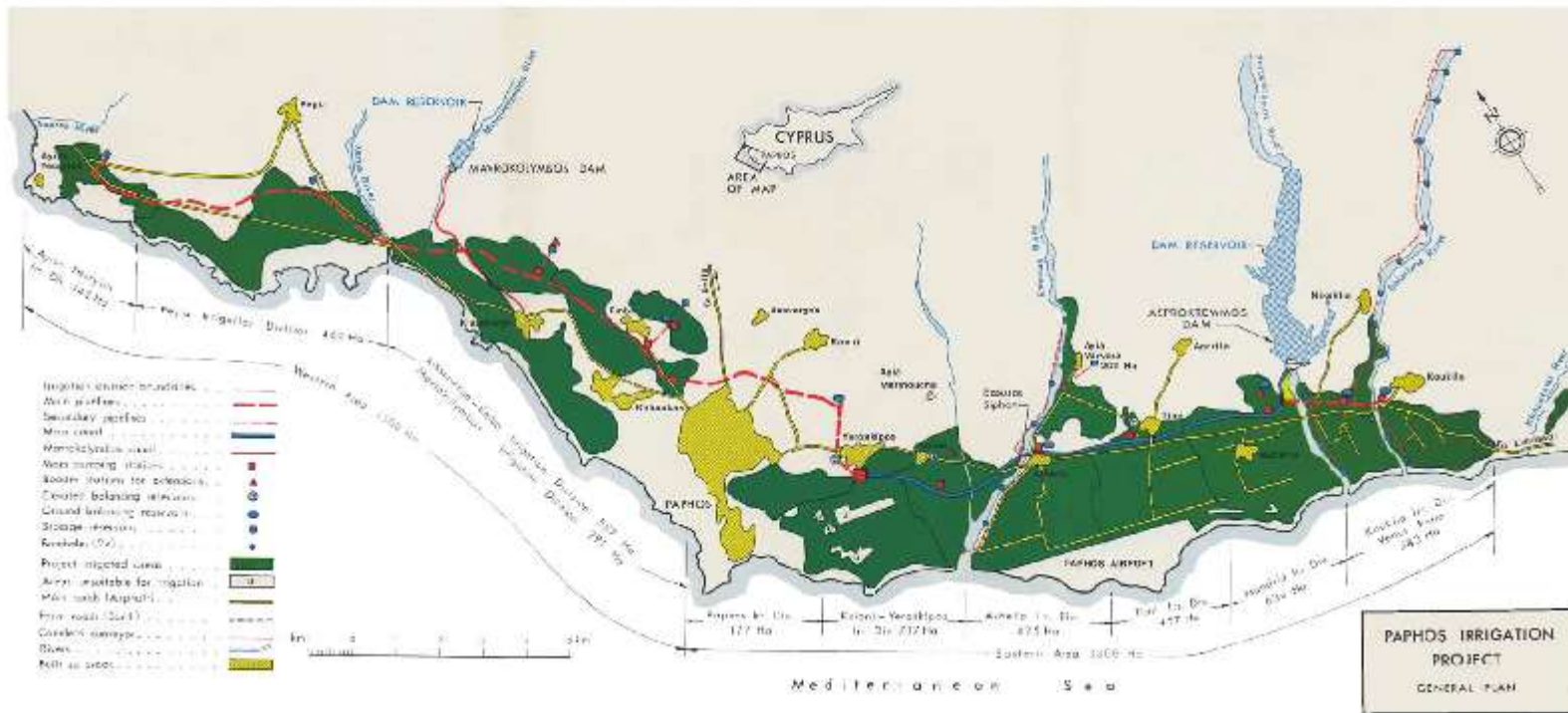
ΚΑΤΑΣΚΕΥΗ ΦΡΑΓΜΑΤΩΝ 1961-2013



SOUTHERN CONVEYOR PROJECT









ΠΡΩΤΟ ΣΧΕΔΙΟΜΕ ΠΛΑΝΟ
ΑΡΔΕΥΤΙΚΟ ΣΧΕΔΙΟ ΧΡΥΣΟΧΟΥΣ
 ΤΕΛΙΚΗ ΔΙΑΤΑΧΗ



● **LARNACA WASTEWATER TREATMENT PLANT-SBL**