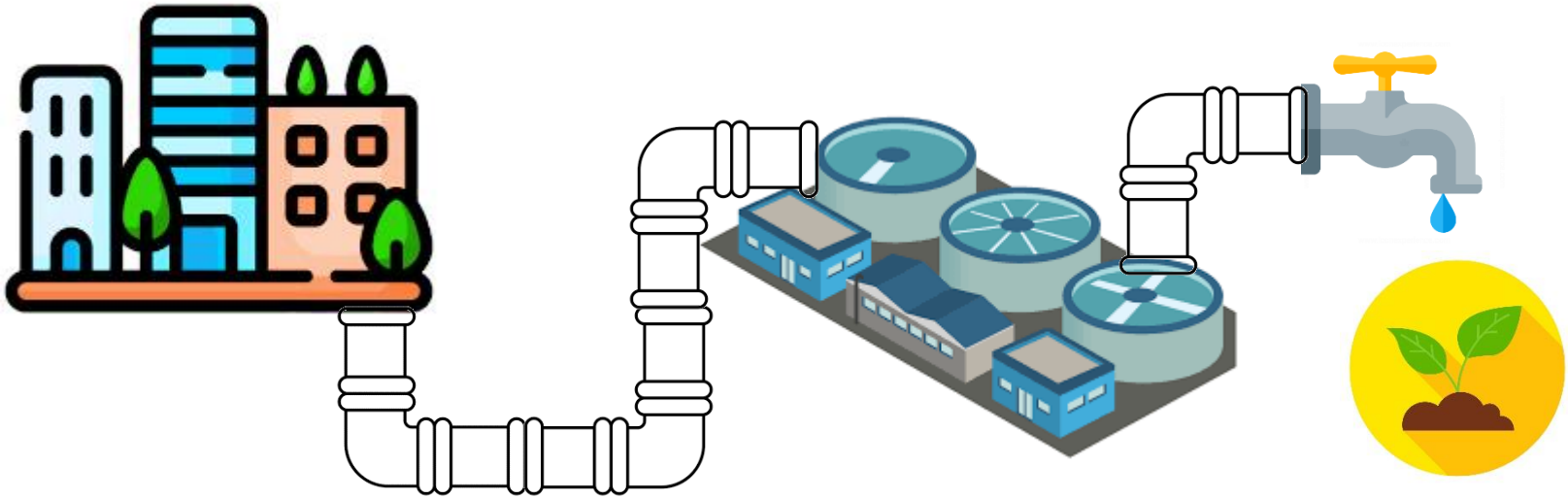

MEETING OF THE
WG WATER REUSE
7-8th November 2023
Madrid, Spain.
GOBIERNO DE ESPAÑA
VICEPRESIDENCIA TERCERA DEL GOBIERNO
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO
European Commission
UE23
PRESIDENCIA ESPAÑOLA
CONSEJO DE LA UNIÓN EUROPEA

Implementation of the Regulation (EU) 2020/741 on minimum requirements for water reuse in Cyprus



7th of November 2023
Meeting of the WG Water Reuse
Madrid, Spain

Angeliki Larcou-Yiannakou
Wastewater and Reuse Division, Coordinator
Water Development Department

Annual Water Balance in Cyprus

Year	Water demand (MCM)	Available quantity of water from conventional sources				Enrichment of the water balance from unconventional sources		Total available quantity of water (MCM) [from rainfall) + (from rainfall) + desalinized + recycled	Water balance (MCM) [= Available quantity of water- water demand]	Quantity of water given for drinking (MCM)
		Rainfall (mm)	Volume of rain (MCM)	Available quantity of water from rainfall (MCM) [Note: Around 90% of rainfall is lost due to evapotranspiration and around 0.02% from run off to the sea]	Water balance (MCM) [= available quantity of water from rainfall- Water Demand]	Quantity of desalinized water (MCM)	Quantity of recycled water (MCM)			
2010	257	429	2570	197	-60	53	12	262	5	82
2011	258	558	3348	265	7	49	14	328	70	81
2012	259	790	4737	404	145	18	17	438	179	80
2013	260	295	1770	117	-143	11	17	145	-115	78
2014	261	393	2358	173	-88	33	17	222	-39	80
2015	262	484	2904	228	-34	38	17	284	23	82
2016	263	430	2580	198	-65	69	19	285	22	90
2017	264	326	1956	136	-128	69	20	224	-40	94
2018	265	607	3642	300	35	70	21	391	126	95
2019	266	797	4782	405	139	55	24	484	218	94
2020	266	472	2832	221	-45	30	22	273	7	90
2021	266	454	2724	210	-56	49	22	281	15	97
2022	266	460	2760	214	-52	53	24	291	25	102

- **Frequent and long periods of drought**
- **Limited water resources**
- **Water Utilisation Index ~ 73%**
- **Drinking Water - Increasing demand (population, tourism, lifestyle) - Priority**
- **Farming sector - The biggest consumer of water - Deficit irrigation – cuts of up to 70% in dry periods**
- **Climate change is expected to worsen water availability**

Supplementation with alternative water sources is required:

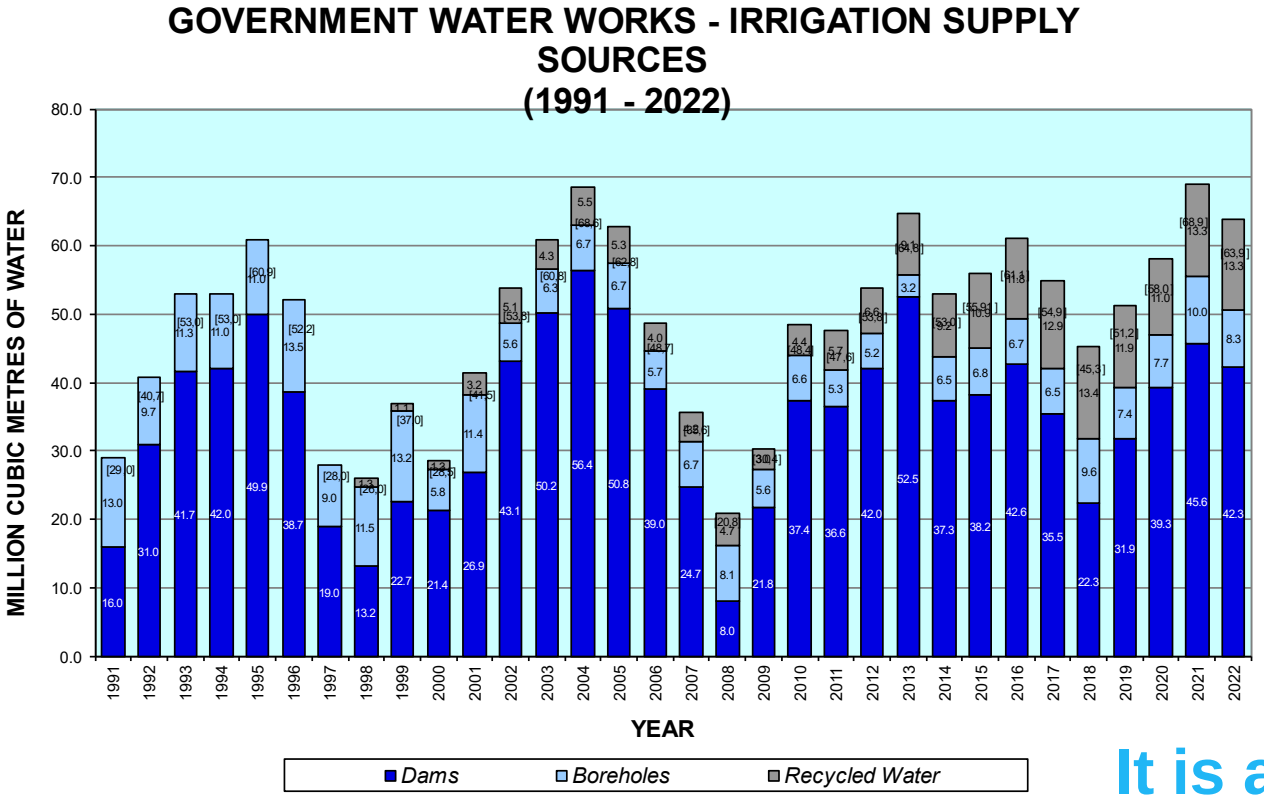
- **Desalination for drinking water supply**
- **Reclaimed water for irrigation and other possible uses (e.g., aquifer recharge)**

Reuse of treated effluent in Cyprus

In Cyprus, the treated effluent from the urban wastewater treatment plants is reused for the following purposes:

- Irrigation (direct or indirect)
- Recharge of the aquifers
- Dry bed of rivers for infiltration

Or discharge into the sea (due to seasonal demand of water for irrigation and limited storage capacity)



Treated wastewater is a growing resource in Cyprus

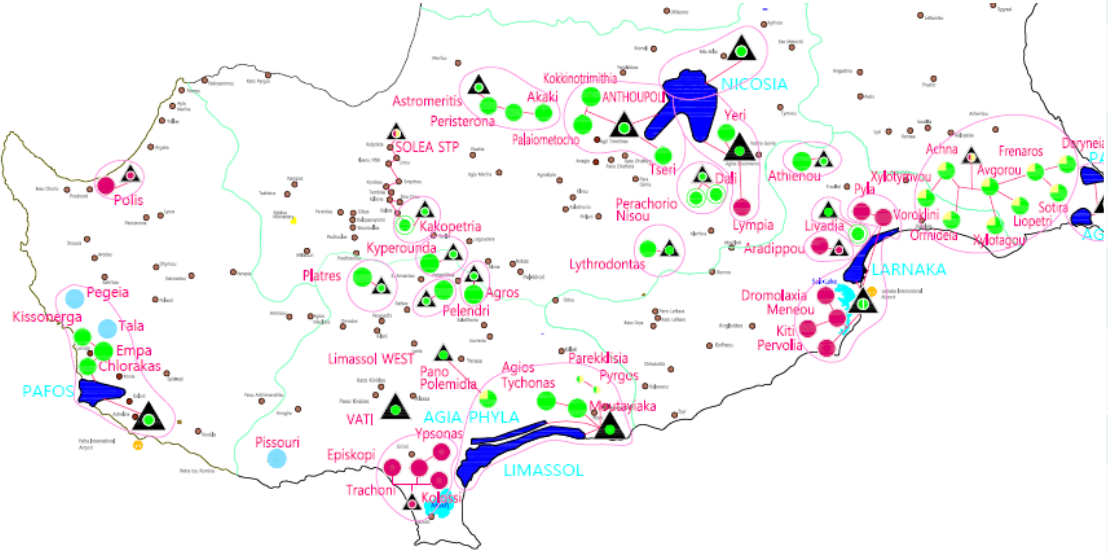
In 2022, 27 million cubic meters (MCM) of recycled water was produced (by 2026 will be 65 MCM).

- 42% direct irrigation
- 33% indirect irrigation (aquifer recharge or disposal to irrigation dams)
- 5% discharge to sea

It is a matter of survival !

Urban wastewater treatment plants

CURRENT SITUATION OF THE CYPRUS NATIONAL IMPLEMENTATION PROGRAMME OF THE URBAN WASTEWATER TREATMENT DIRECTIVE 91/271/EEC



Wastewater treatment plant	Capacity million m^3 / year	Production 2021 million m^3	Production 2022 million m^3
Anthoupoli	4.75	1.9	2.0
Vathia Gonia SBN	8.03	3.0	3.3
Vathia Gonia WDD	0.4	0.1	0.1
Larnaca	8.03	3.1	3.3
Limassol - Moni	14.6	9.9	9.8
Limassol - West	4.75	-	0.2
Pafos	7.11	4.3	5.4
Ayia Napa - Paralimni	7.67	2.8	3.1
TOTAL		25.1	27.2

Requirements of the Directive 91/271/ΕΟΚ: Secondary Treatment

Policy of Cyprus: Tertiary Treatment (meaning additional treatment processes which result in further purification than that obtained by applying primary and secondary treatment)

The cost for the construction, operation and maintenance of tertiary treatment plants carried out by the Urban Sewerage Boards is undertaken by the Government.

Reuse Perspective

The water is used in the wider area of UWTPs from which it is produced for:

- Irrigation of existing crops to replace fresh water
- Irrigation of green areas of municipalities/communities that contribute to the production of reclaimed water
- Irrigation of new crops with high efficiency, mainly livestock crops

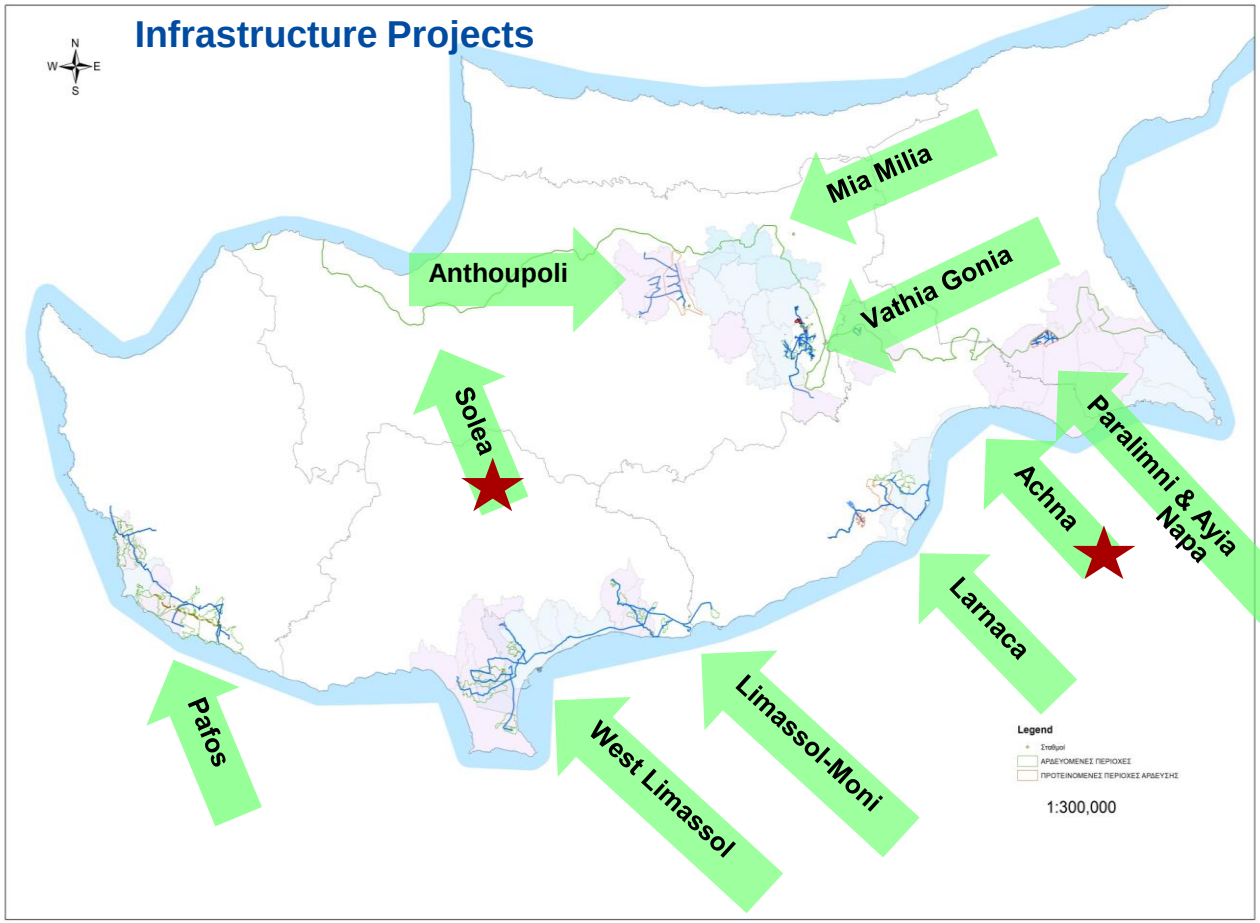
New Infrastructure Projects:

Sewerage System of the Solea Complex: construction of sewerage collection networks in seven communities of Solea, and of a wastewater treatment plant with a maximum capacity of 1287 m^3/d

Sewerage System of the Kokkinochoria Complex: construction of a wastewater treatment plant with a maximum capacity of 10644 m^3/d, which will be located in Achna

Co-funded by the Cohesion Fund of the European Union

European Union Cohesion Fund
Republic of Cyprus
Structural Funds of the European Union in Cyprus



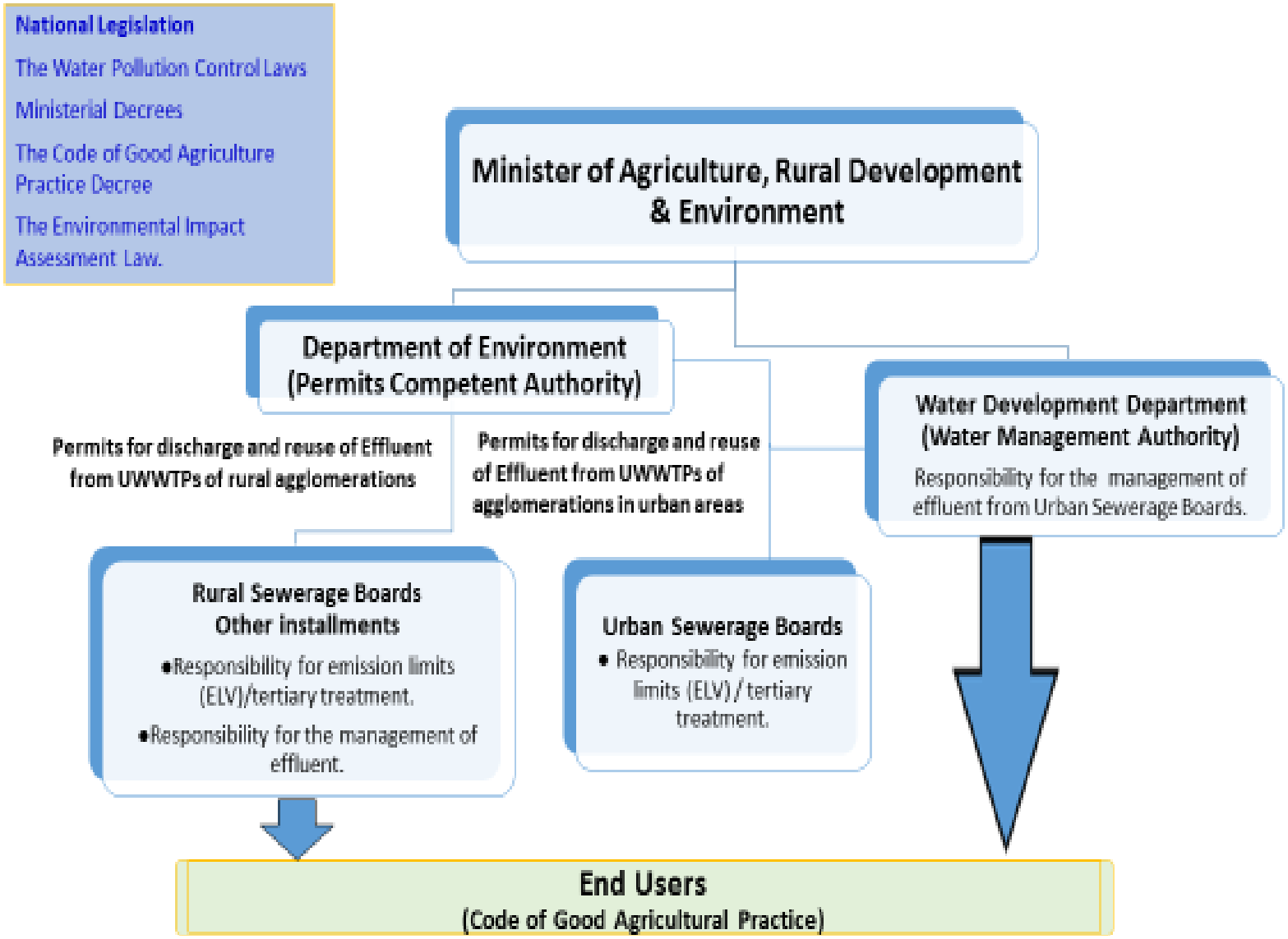
The added value for society and the environment outweigh the capital costs, are in line with EU regional policy objectives and contribute to the well-being of the wider region

Legislative Framework

Water reuse in Cyprus is regulated by:

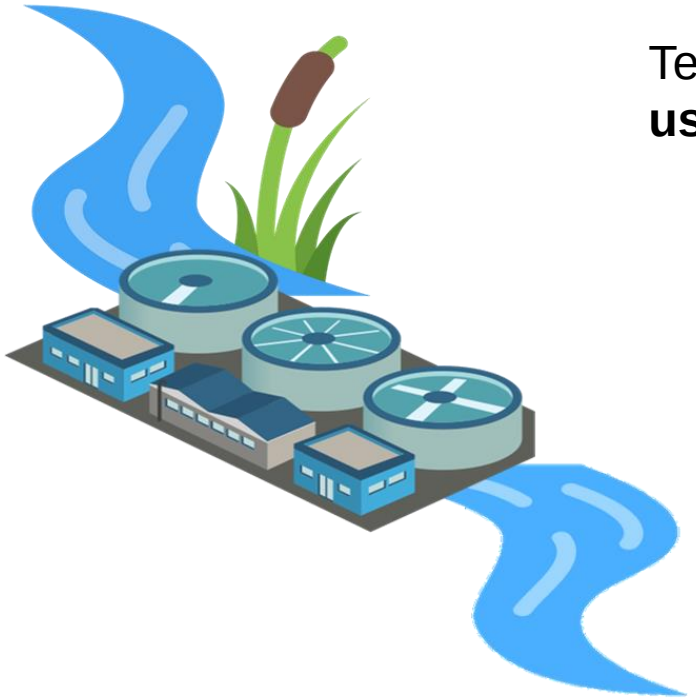
- **The Water Pollution Control Laws, 106(I)/2002 to 2013** **Will be revised**
- The Water Pollution Control (Discharge of Urban Wastewater) Regulations of 2003, No. 772/2003
- The Water Pollution Control (Sensitive Areas for Disposal of Urban Wastewater) Ministerial Decree of 2013, No. 280/2013
- **The Code of Good Agricultural Practice Decree, No. 283/2023** **Revised**
- The Ministerial Decree for small-scale wastewater treatment plants < 2000 p.e., No. 379/2015
- **Integrated Water Management Laws of 2010, 79(I)/2010** **Will be revised**
- The Environmental Impact Assessment Law for discharge to water bodies and for the management of the effluent for new UWWTPs, No. 127(I)/2018
- Regulation (EU) 2020/741 of the European Parliament and of the Council on minimum requirements for water reuse

Permitting and Management of Reclaimed Water



Water Reuse in Cyprus

In Cyprus, irrigation is done under the Code of Good Agricultural Practice



Tertiary treatment **mandatory, regardless of the use of the treated effluent:**

- Irrigation
- Recharge of aquifers
- Disposal to the sea

- **Eliminate the possibility of any health incident**
- **Reduce the risk of possible eutrophication** when discharging to the Eastern Mediterranean Sea, the most oligotrophic sea in the world
- **Reduce farmers skepticism and barriers to reusing**
- **Encourage public acceptance - enhance marketability of crops**

- If the land farm has access to a reclaimed water irrigation network, the end user (i.e., the farmer) applies to the Water Authority/ Reclamation facility operator for the supply of reclaimed water, stating the type of crop and the required water quantity.

- The Water Authority/ Reclamation facility operator approves the application and provides the end user with the necessary information regarding the crops allowed to be irrigated as well as the irrigation methods and techniques to be used.

In Cyprus, **the end users have small agricultural farms and 90% of them are smaller than 0.5 ha.**

Reclamation facility operator

A natural or legal person who operates or controls a reclamation plant.

Reclamation facility operators should:

- ensure that the outlet of the reclamation plant complies with the minimum requirements
- draft a Reclaimed Water Reuse Risk Management Plan.
- perform key risk management tasks, in cooperation at least with the reclaimed water distribution and the storage operator.

The Water Pollution Control Laws 106(I)/2002 to 2013

Revisions

Article 1

- Change on the title
- Addition of the Regulation (EU) 2020/741 to the purposes of changing the law

Article 2

- Replacement of the definition of the term 'body' by the term ‘Reclamation facility operator’

Article 9 - Addition of the following paragraph

- (2A) In the event that the application for granting or renewing the Discharge Permit concerns the production, supply and use of reclaimed water for agricultural irrigation from facilities that fall within the provisions of Regulation (EU) 2020/741, **this should be accompanied by a risk management plan for reuse of water in accordance with the provisions of article 5 of the Regulation on the minimum requirements for the reuse of water** in accordance with the provisions of regulation (EU) 2020/741 (article 6).

Article 29 - Replacement of the paragraph (4) with the following

- Any person who violates any provision of this law or of the Decrees and/or Regulations issued pursuant thereto for which no relevant penalty is provided as well as the provisions of EU Regulation (2020/741), is guilty of an offense and, in case of conviction, is subject to a fine not exceeding one hundred thousand euros (€100,000).

Integrated Water Management Laws of 2010 79(I)/2010

Revisions

Article 1

- Change on the title

Article 2

- Addition of the definition for the term EU Regulation 2020/741
- Replacement of the term 'recycled water', with the new term: *'recycled' or 'reclaimed water' means water that comes from a wastewater treatment plant and meets the requirements of Regulation (EU) 2020/741*
- **Replacement of the term 'recycled water' with the term 'reclaimed water' throughput the text**

Article 15

- Replacement of the word 'recycling' with the word 'reuse'

Article 36 - Addition of the following paragraphs

- (1) Water which is the product of a sewage treatment plant belonging to a Drainage Board may, by agreement with the relevant Drainage Board, be taken by the Director and disposed of as he decides, in accordance with the provisions of Regulation (EU) 2020/741.
- (2) The Director shall provide reclaimed water for use in parcels within the irrigation works managed by him, in terms and conditions relating to the obligations of the person using that water in accordance with Regulation (EU) 2020/741.
- New article addition 36A for Offences and Penalties.

Code of Good Agricultural Practice Decree No. 283/2023

Revisions

- The Code has become stricter than the previous one (263/2007) in relation to the use of reclaimed water and the use of sludge in agriculture

Article 37

- It is now stated that the minimum requirements of Regulation (EU) 2020/741 should be met in relation to water reuse
- In particular for the use of reclaimed water for the irrigation of the various crops, what is mentioned in relation to their irrigation is even stricter than Regulation (EU) 2020/741

Article 38

- In the event that it is not possible to pass the pipeline under the drinking water pipeline, then the reclaimed water pipeline should be placed with the pipe-in-pipe method at a distance of 10 meters on either side of the drinking water pipeline

Regulation (EU) 2020/741 on minimum requirements for water reuse

Cyprus: Tertiary Treatment, which consists of

Secondary treatment, filtration and disinfection

or

Membrane Bioreactor

⬇

Quality class of reclaimed water A

Table 1 – Classes of reclaimed water quality and permitted agricultural use and irrigation method

Minimum reclaimed water quality class	Crop category (*)	Irrigation method
A	All food crops consumed raw where the edible part is in direct contact with reclaimed water and root crops consumed raw	All irrigation methods
B	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops used to feed milk- or meat-producing animals	All irrigation methods
C	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops used to feed milk- or meat-producing animals	Drip irrigation (**) or other irrigation method that avoids direct contact with the edible part of the crop
D	Industrial, energy and seeded crops	All irrigation methods (***)

(*) If the same type of irrigated crop falls under multiple categories of Table 1, the requirements of the most stringent category shall apply.

(**) Drip irrigation (also called trickle irrigation) is a micro-irrigation system capable of delivering water drops or tiny streams to the plants and involves dripping water onto the soil or directly under its surface at very low rates (2–20 litres/hour) from a system of small-diameter plastic pipes fitted with outlets called emitters or drippers.

(***) In the case of irrigation methods which imitate rain, special attention should be paid to the protection of the health of workers or bystanders. For this purpose, appropriate preventive measures shall be applied.

Table 2 – Reclaimed water quality requirements for agricultural irrigation

Reclaimed water quality class	Indicative technology target	Quality requirements				
		E. coli (number/100 ml)	BOD_5 (mg/l)	TSS (mg/l)	Turbidity (NTU)	Other
A	Secondary treatment, filtration, and disinfection	≤ 10	≤ 10	≤ 10	≤ 5	*Legionella* spp.: < 1 000 cfu/l where there is a risk of aerosolisation Intestinal nematodes (helminth eggs): ≤ 1 egg/l for irrigation of pastures or forage
B	Secondary treatment, and disinfection	≤ 100	In accordance with Directive 91/271/EEC (Annex I, Table 1)	In accordance with Directive 91/271/EEC (Annex I, Table 1)	-	
C	Secondary treatment, and disinfection	≤ 1 000			-	
D	Secondary treatment, and disinfection	≤ 10 000			-	

Irrigation with treated effluent – Type of plants

LIMASSOL PLANT	**LARNACA PLANT**	**PARALIMNI – AYIA NAPA PLANT**	**VATHIA GONIA PLANT**
CITRUS FRUITS	COWGRASS	CITRUS FRUITS	COWGRASS
FODDER CROPS AND INDUSTRIAL PLANTS (COWGRASS AND CORN)	CORN	OLIVE TREES	CORN
VEGETABLES	LOLIUM AND SUTAX	POTATOES	BARLEY
PUBLIC GREEN AREAS	PUBLIC GREEN AREAS	PUBLIC GREEN AREAS	FODDER CROPS
	FOOTBALL FIELDS	FOOTBALL FIELDS	GRASS PRODUCTION

Code of Good Agricultural Practice
Regulation No. 283/2023)

Goal: proper use of reclaimed water in agriculture → protection of the public health and the environment

Restriction on the type of crops irrigated: **Irrigation of** all types of plants, seasonal and permanent **except of foliaceous vegetables, bulbs and condyles that are eaten raw**.

Type of plants: citrus fruits, fodder crops and industrial plants (cow grass and corn), olive trees, lolium and sutax, potatoes, **flowers (e.g., carnations)**, public green areas, football fields, grass production.

Safety precautions for the proper use of water

- The use is prohibited by unauthorized persons
- Marking pipes with red line
- Clear signaling to alert the public that the water is undrinkable
- Hydrants and distribution system should have protection and always be in good operational condition

Irrigation practices	Methods of irrigation	Recommendations
Irrigation for grass, green areas with limited use, and forage crops	• groundwater irrigation, • drippers, low-capacity sprinklers, • surface irrigation, • high-capacity sprinklers - 300 m buffer zone	▼ cultivated forage, irrigation stops at least one week before harvest ▼cultivated forage for grazing, dairy animals are not permitted.
Irrigation conditions for grass, green spaces with free use	• subsurface drip irrigation, • low angle Pop-up sprinklers (<15°) • irrigation during night • (no wind)	
Vineyard	• drip irrigation • micro sprinkler	• Where drops comes with contact with fruit, irrigation must stop two weeks before harvest • Collection of fruit from the ground should be avoided
Tree crops	• drip irrigation • Micro sprinkler	The collection of fruit from the ground is prohibited except in cases of nuts. Where irrigation drops comes in contact with fruit , irrigation must stop at least a week before harvest.
Vegetables that are cooked before consumption	• sub surface drip irrigation, sprinkler irrigation • drip irrigation	

Regulation (EU) 2020/741
on minimum requirements for water reuse

Minimum requirements for water quality and monitoring and provisions on risk management, for the safe use of reclaimed water

Guarantee that reclaimed water is safe for agricultural irrigation

Table 3 – Minimum frequencies for routine monitoring of reclaimed water for agricultural irrigation

	Minimum monitoring frequencies					
Reclaimed water quality class	*E. coli*	BOD_5	TSS	Turbidity	*Legionella* spp. (when applicable)	Intestinal nematodes (when applicable)
A	Once a week	Once a week	Once a week	Continuous	Twice a month	Twice a month or as determined by the reclamation facility operator according to the number of eggs in waste water entering the reclamation facility
B	Once a week	In accordance with Directive 91/271/EEC (Annex I, Section D)	In accordance with Directive 91/271/EEC (Annex I, Section D)	-		
C	Twice a month			-		
D	Twice a month			-		

Treatment requirements
UWWTPs in agglomerations of ≥ 2.000 p.e.

- Reclaimed water in Cyprus is used for the **irrigation of agricultural and livestock crops** as well as **green areas**, under strictly regulated conditions and following EU best practices.
- More stringent treatment requirements than the proposed ones are already applied.

Qualitative monitoring of the effluent of UWWTPs ≥ 2.000 p.e.:

Parameters	Limit
BOD_5	<10 mg/L
COD	<70 mg/L
Suspended solids	<10 mg/L
Total Nitrogen	<15 mg/L
Total Phosphorus	<10 mg/L
Conductivity	<2500 μS/cm
pH	6.5 - 8.5
Heavy metals	
Boron	
Chlorides	<300 mg/L
E. coli	<5 *E. coli* / 100 mL
Priority substances	
Pesticides	
Toxicity	

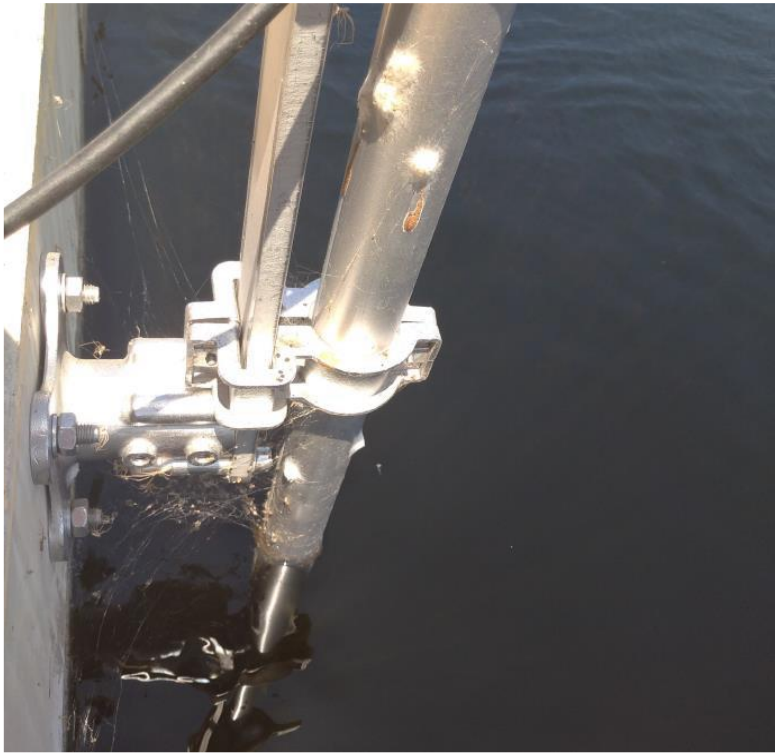
Further monitoring obligations are set in the permits when the tertiary effluent is **recharged in aquifers** or **discharged into surface waters (dam or sea)** taking into consideration the standards specified to:
- Groundwater Directive 2006/118/EC
- Directive 2008/105/EC,
regarding Environmental Quality Standards, respectively.

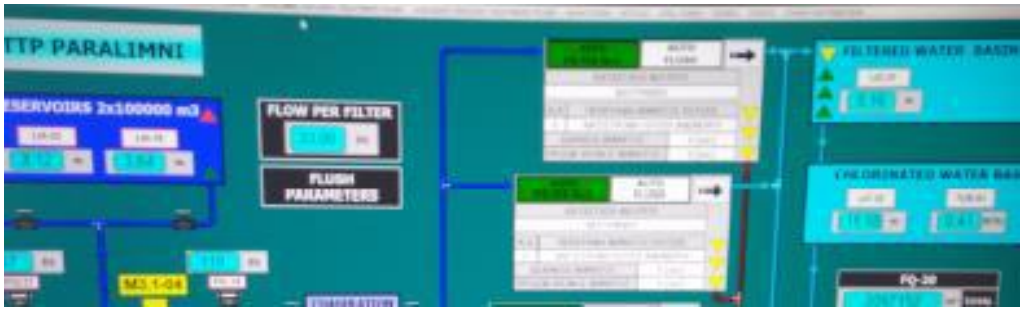
PARAMETERS	Limits (EU 2020/741)	Frequency of analysis NOW (WDD/DoE/Operators)	Frequency of analysis BEFORE
BOD_5	**10 mg/L**	**1/week**	**2/month**
Suspended Solids	**10 mg/L**	**1/week**	**2/month**
Conductivity	**2 500 μS/cm**	**1/month**	**2/month**
E. coli	**5 *E. coli* / 100 mL**	**1/week**	**2/month**
Turbidity	**< 5 NTU**	**continuous**	**-**
***Legionella* spp.**	**< 1 000 cfu/L**	**1/month**	**-**

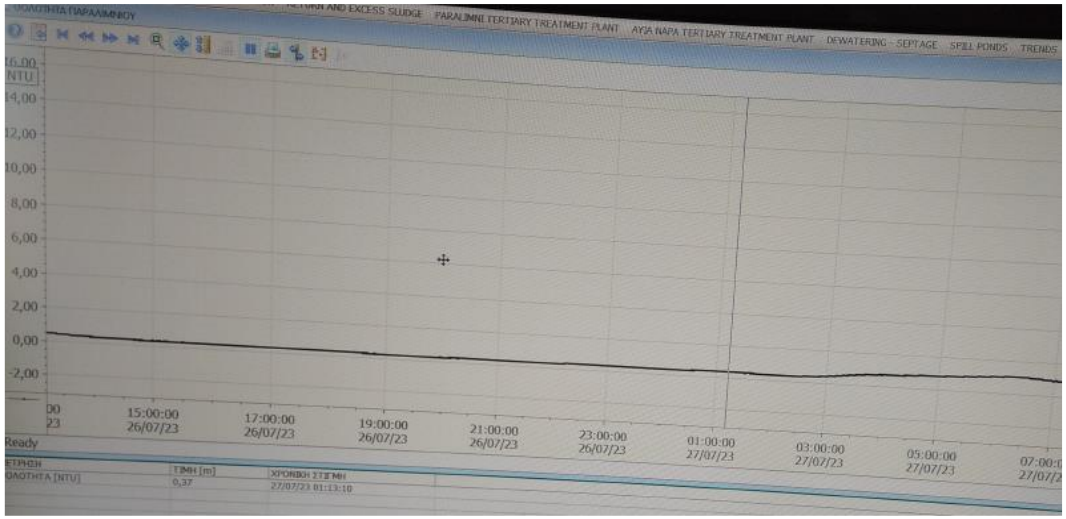
Additionally, discharges from UWWTPs to sensitive areas (water bodies which are eutrophic) **meet more stringent requirements related to TN and TP**.

limit values can be TN=10 mg/L and TP=1 mg/L

Installation of turbidity meters

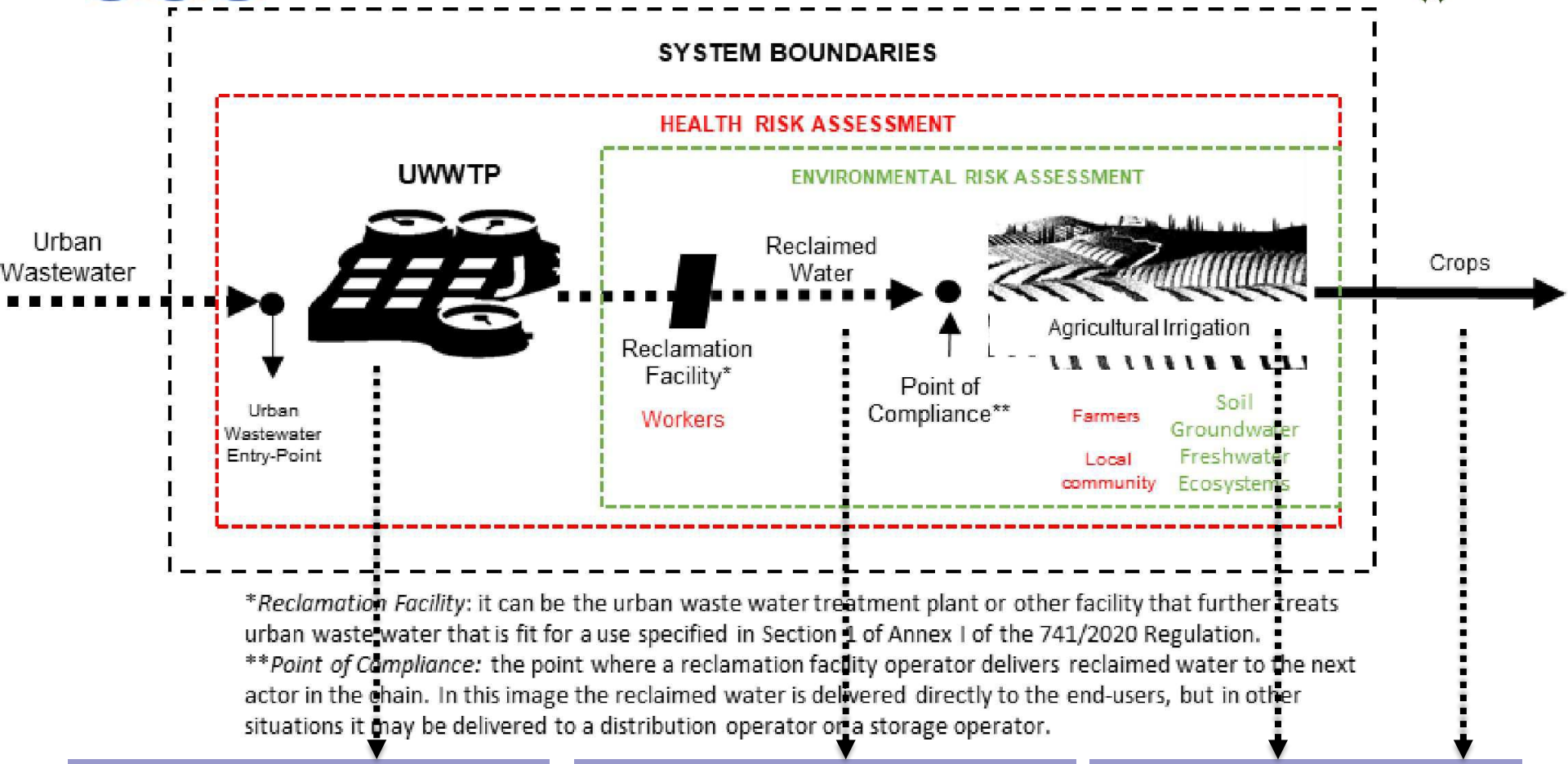






Continuous monitoring of turbidity at Paralimni UWWTP

Data collection



**Reclamation Facility*: it can be the urban waste water treatment plant or other facility that further treats urban waste water that is fit for a use specified in Section 1 of Annex I of the 741/2020 Regulation.
***Point of Compliance:* the point where a reclamation facility operator delivers reclaimed water to the next actor in the chain. In this image the reclaimed water is delivered directly to the end-users, but in other situations it may be delivered to a distribution operator or a storage operator.

UWWTPs Annual Reports Discharge Permits

Reclaimed water quality – Results of analyses 2017 - 2023

- Limassol - Moni
- Limassol - West
- Vathia Gonia SBN
- Vathia Gonia WDD
- Anthoupolis
- Pafos
- Ayia Napa/Paralimni
- Larnaca

Users of Reclaimed Water Registry

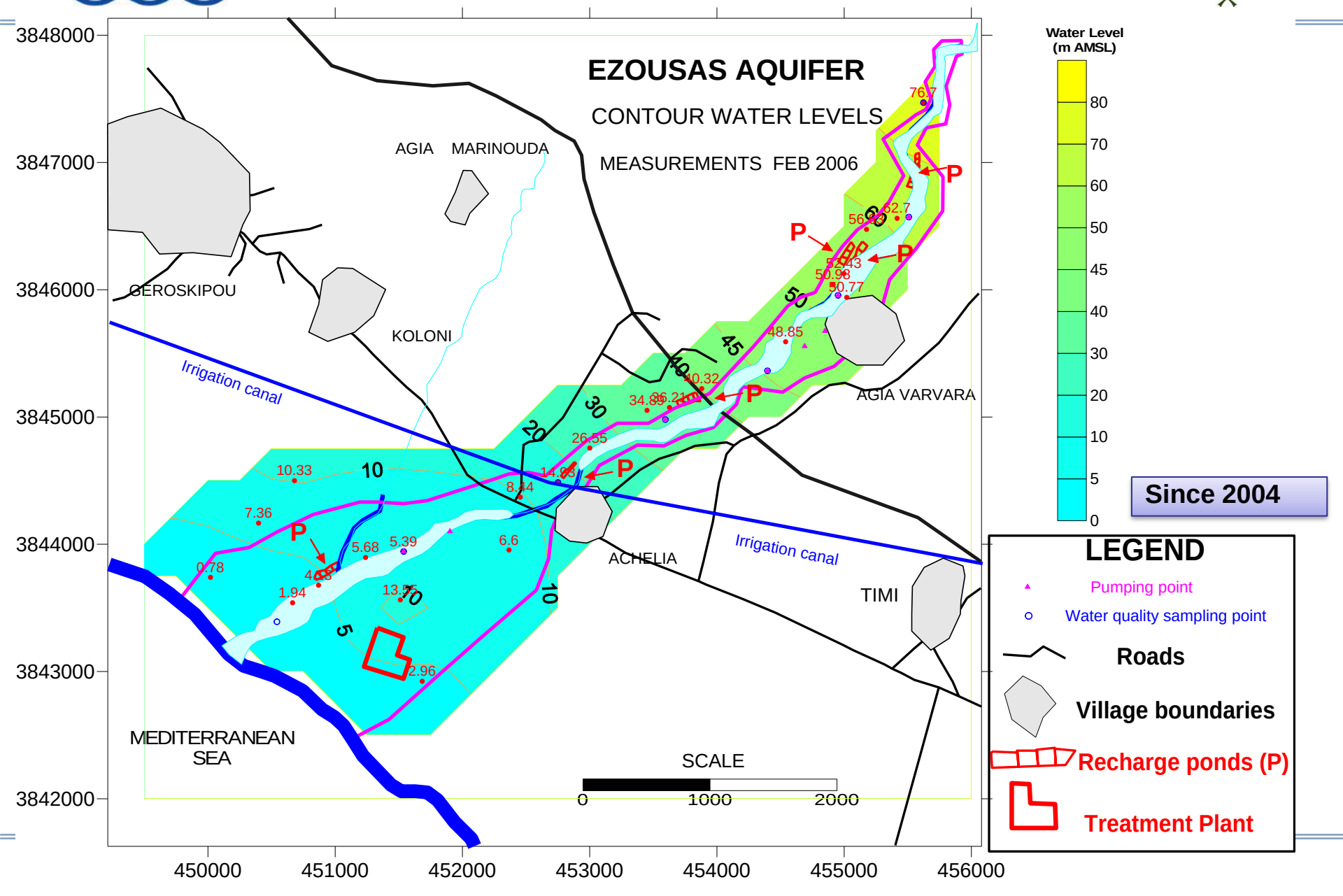
Selling rates of treated effluent

The rate of the treated effluent from the UWWTPs has been set by a ministerial Decree ΚΔΠ 48/2017 as per the following table

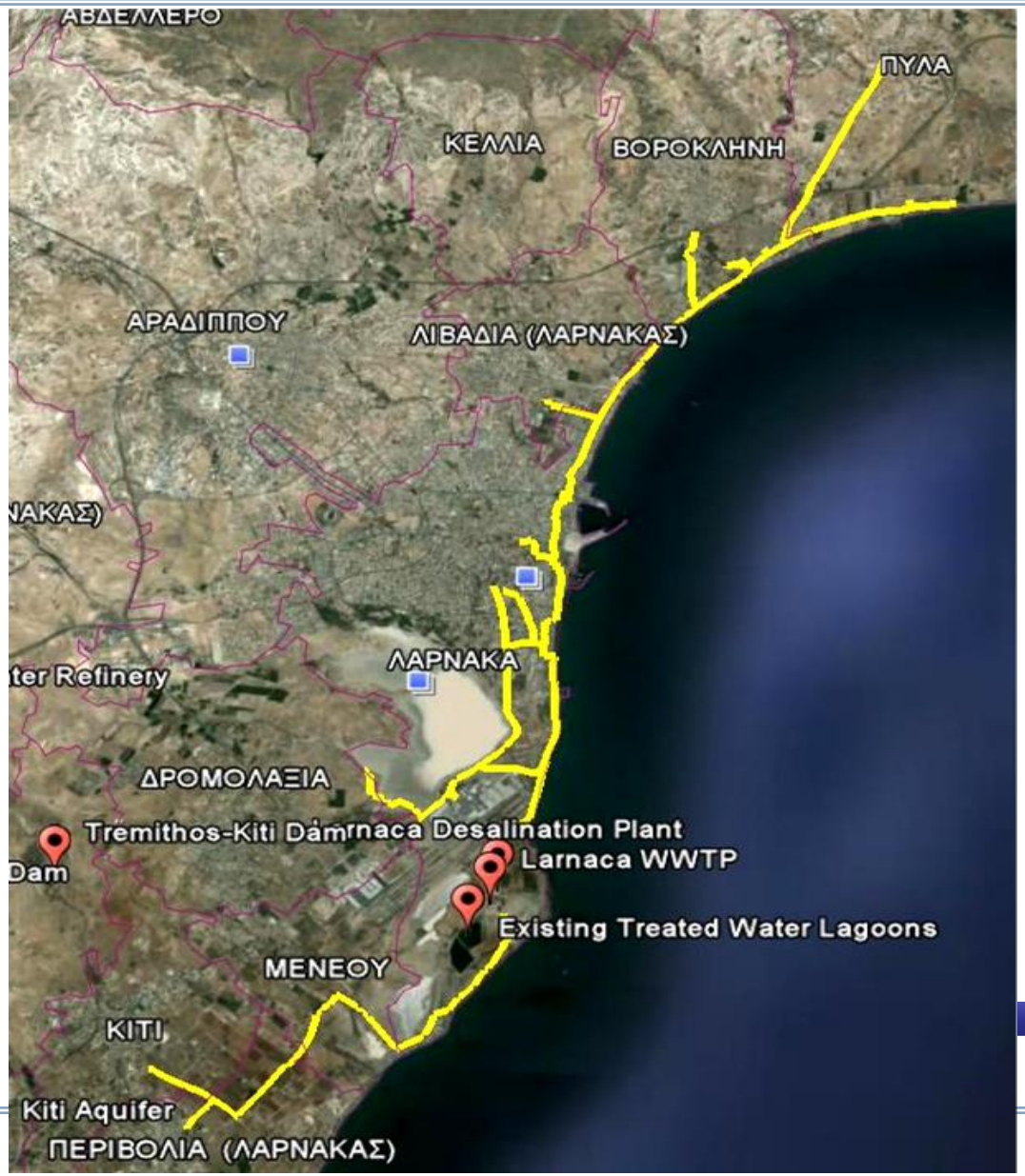
	Provision of reclaimed water from tertiary treatment units that fall under the jurisdiction of the state	Financial	Environment and resource	Total
		€ / m³		
1	Fixed annual fee	€ 2,40 / he		
2	For Persons for agricultural production	0,06	0,01	**0,07**
3	To irrigation water providers	0,01	0,01	**0,02**
4	Industrial use	0,15	0,02	**0,17**
5	Irrigation for other uses			
	a) turf of football pitches and sports fields and islands, parks and other green spaces falling under the jurisdiction of State / Local Authorities	0,10	0,02	**0,12**
6	b) turf of private football and sports fields and private green areas, hotel gardens and houses	0,15	0,02	**0,17**
	c) Golf courses irrigation	0,15	0,08	**0,23**
7	Overconsumption for all uses			Twice as normal

Suggested selling rate of fresh not filtered water from governmental water works: € 0,17

Aquifer Recharge - Pafos



Larnaca Reclaimed Water – Irrigation Network



Quality: Tertiary treated

→ ***Conductivity and chlorides are high*** (WDD monitoring program)

The plant should reduce conductivity

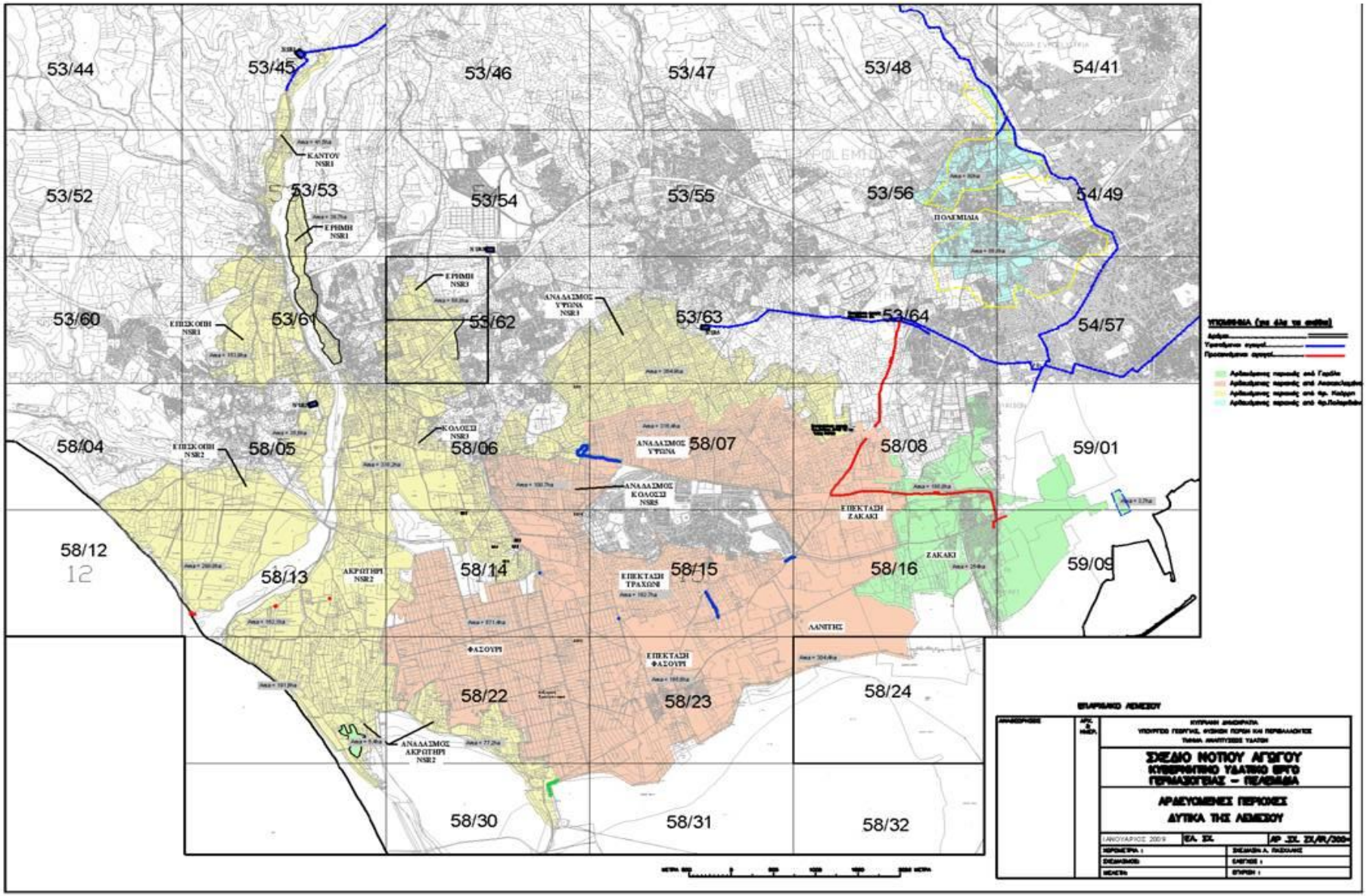
Average value of **Conductivity**: **3563 µS/cm** (limit: 2500 µS/cm)

Average value of **Chlorides**: **799 mg/L** (όριο: 300 mg/L)

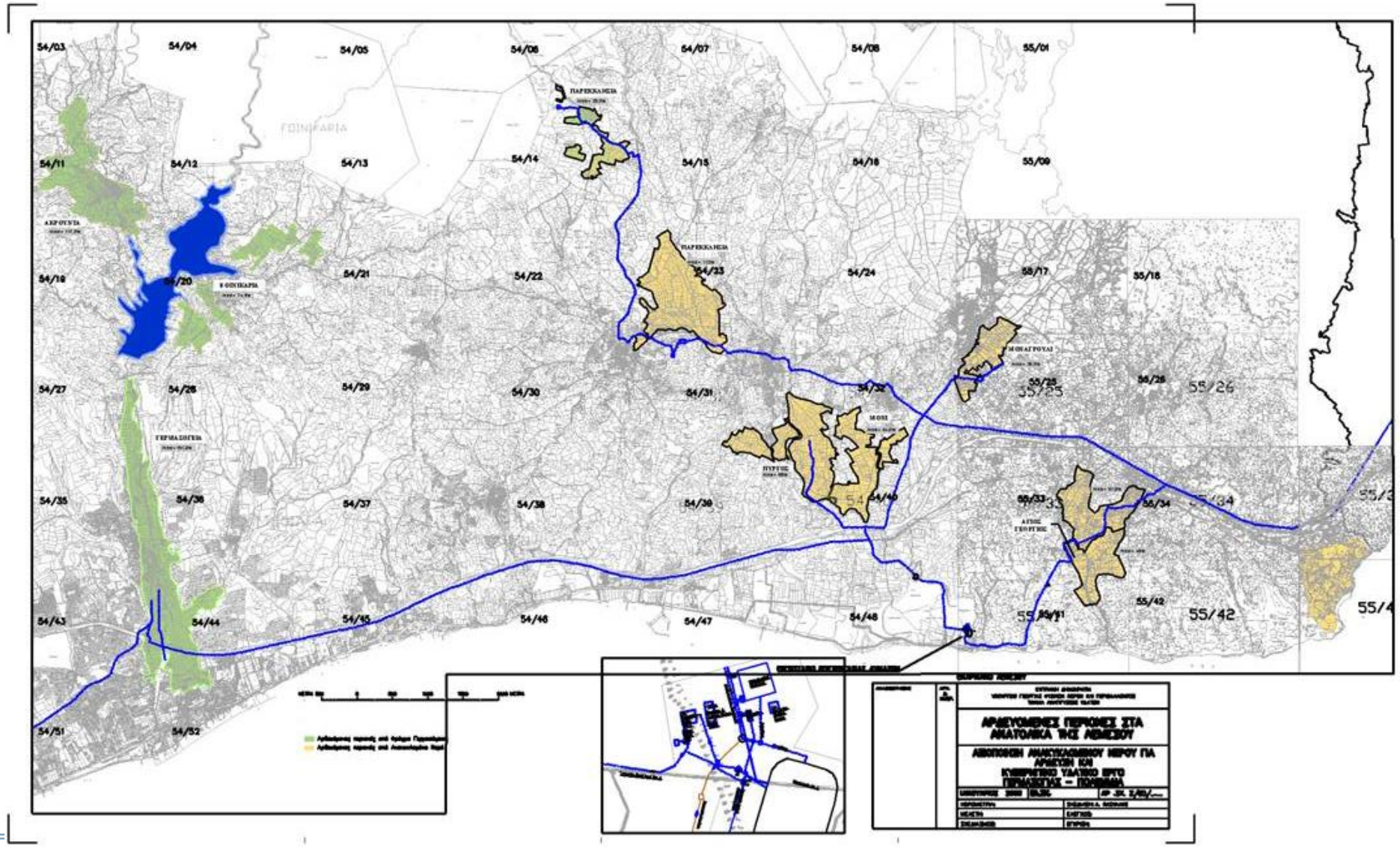
To solve the problem, a study was prepared in the past by TAU, for the installation of a desalination unit at the Larnaca station with the aim of reducing salinity and removing nitrogen and phosphorus

→ It was dropped due to the refusal of the communities of the surrounding area to dispose of the brine of the unit to the sea.

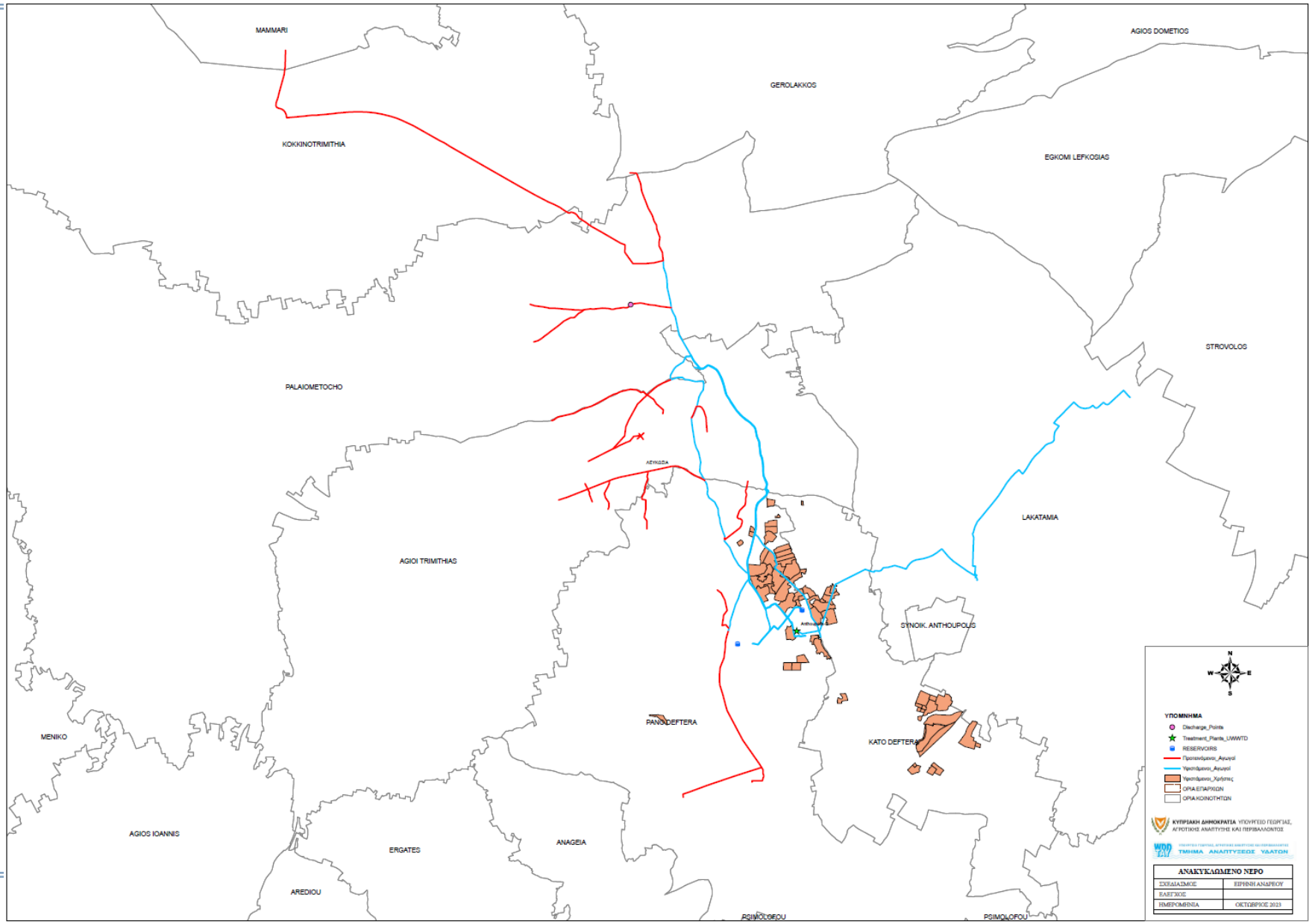
Limassol Reclaimed Water – Irrigation Network



Limassol Reclaimed Water – Irrigation Network



Anthoupolis Reclaimed Water – Irrigation Network



THANK YOU

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