



# Reclaimed Water at Madrid Region

The successful case of Canal de Isabel II

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Madrid, Spain

# Canal de Isabel II



**6,77** mill.  
inhabitants



**8.028** km<sup>2</sup>



**15.000** km  
sewer network



**156** WWTP

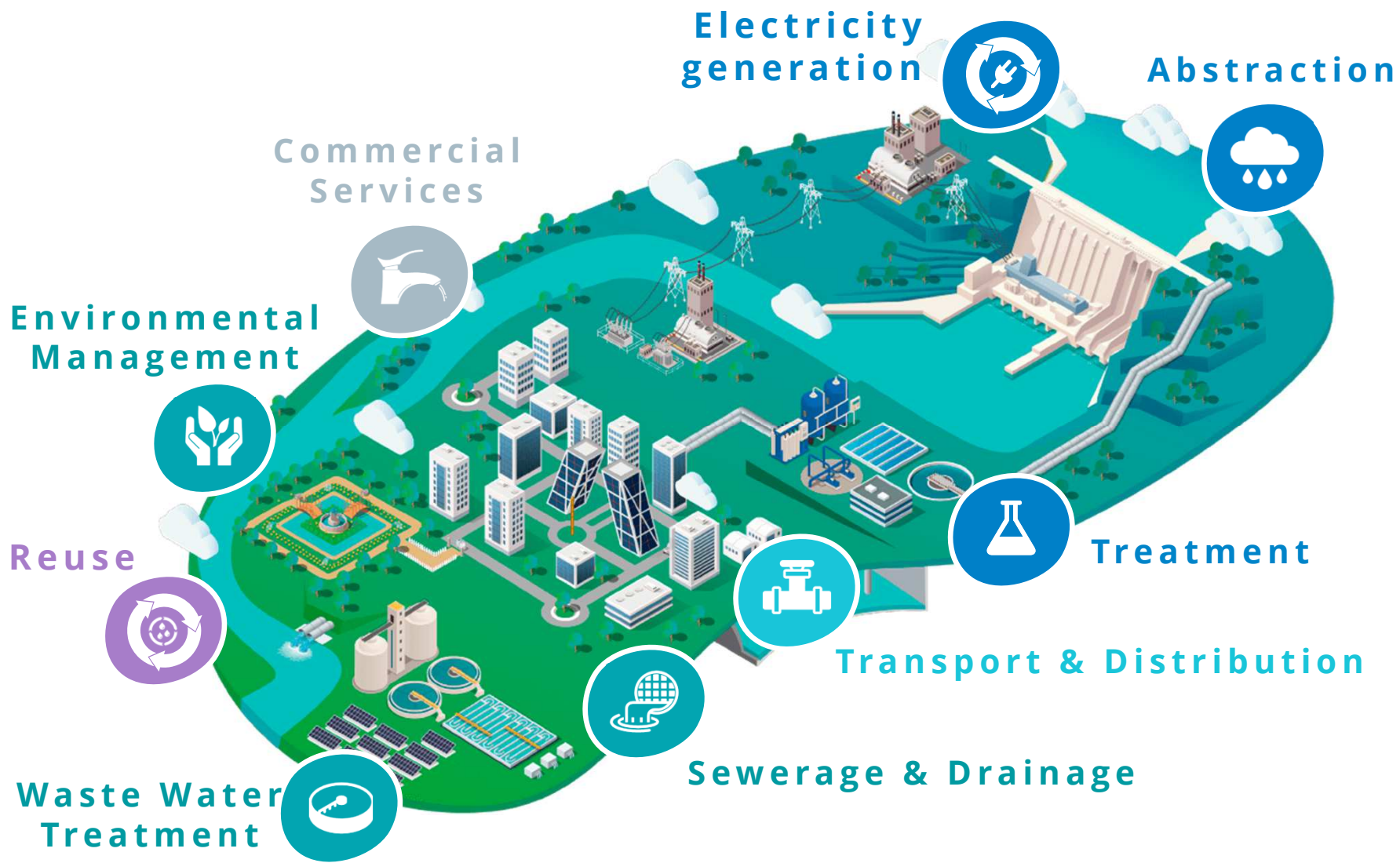


**13** dams



**14** DWTP





Digital Transformation



Drinking Water Quality



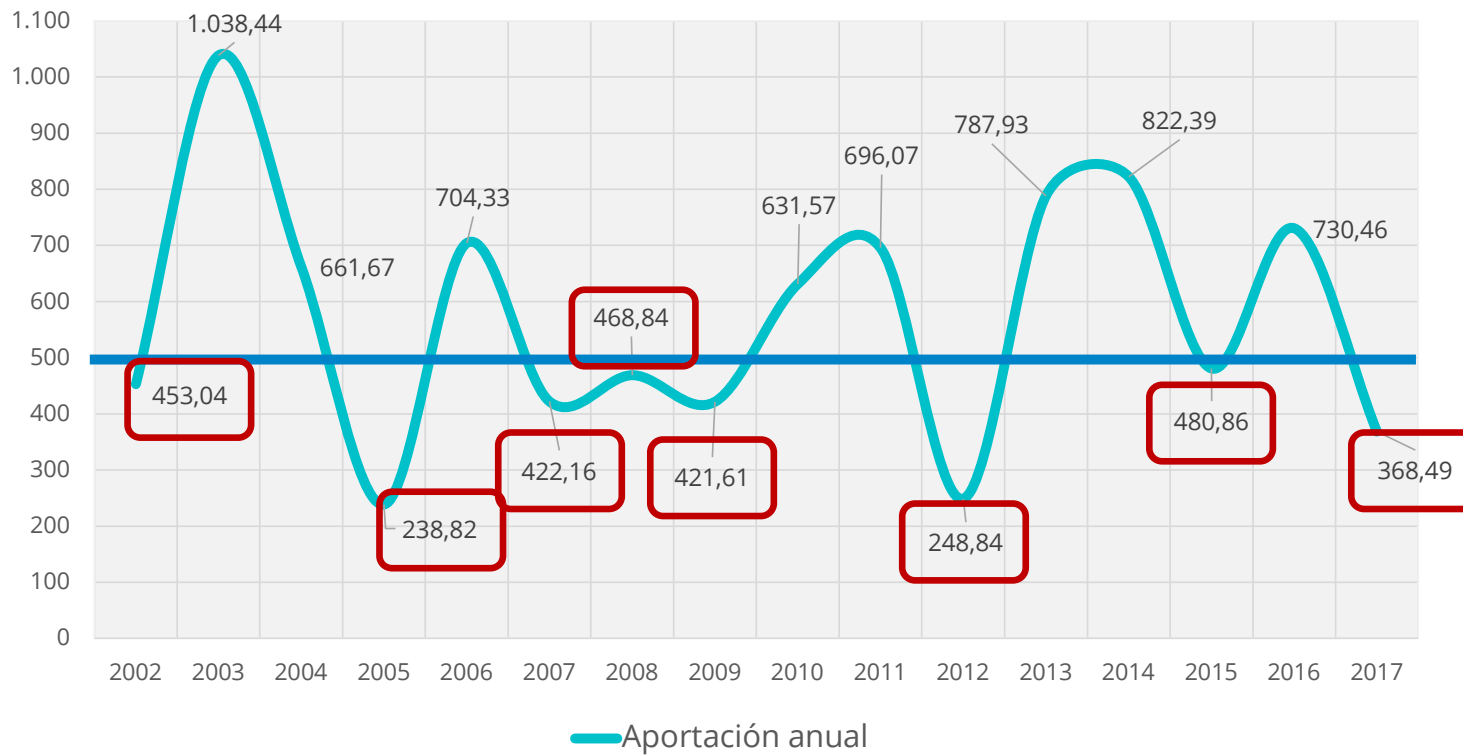
Contingency Management



Telecontrol & Communication

# THE CHALLENGE

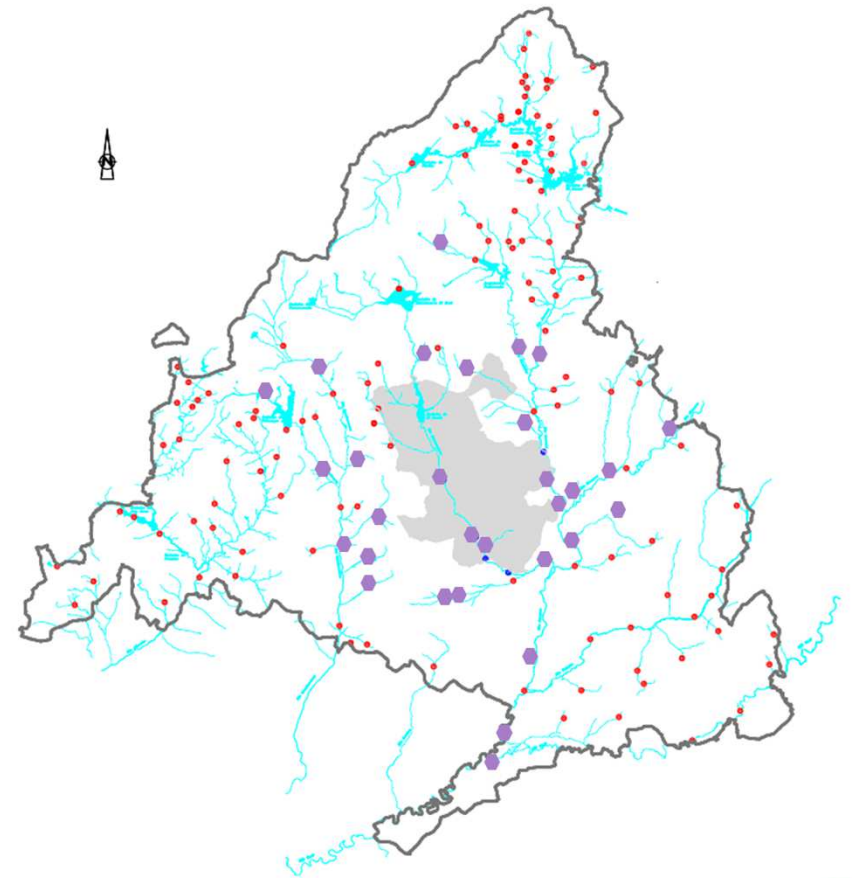
Natural contributions of rivers to Canal de Isabel II reservoirs, 2002-2017  
(annual hm<sup>3</sup>)



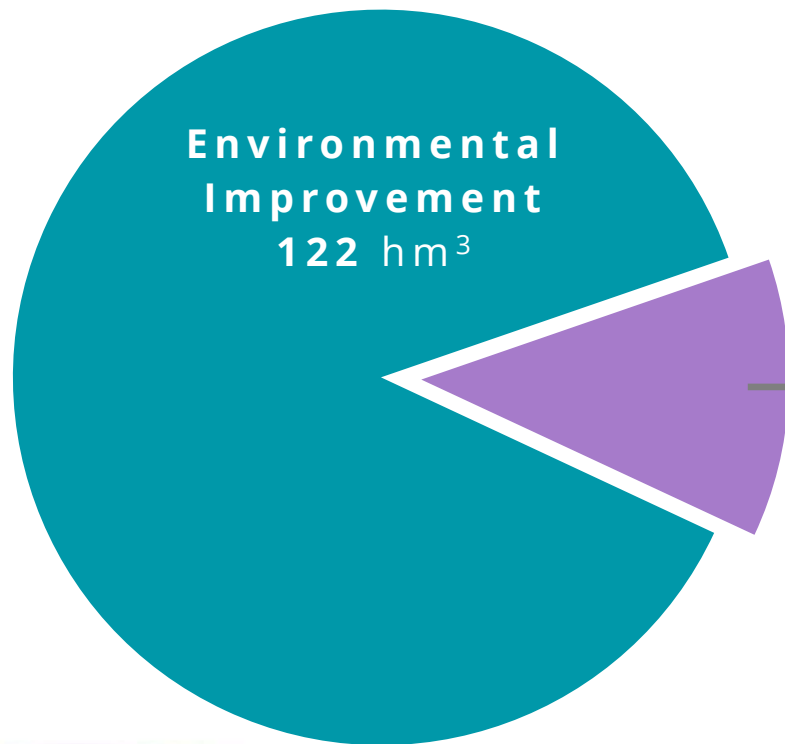
**50% of the years there has been water deficit**

# RECLAIMED WATER MAIN FIGURES

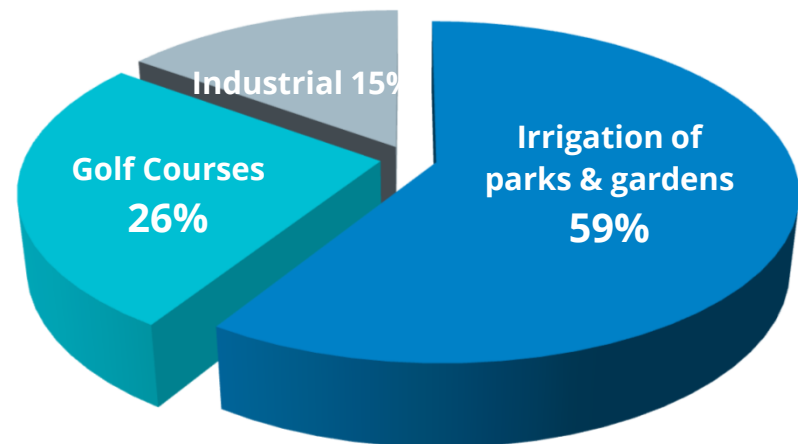
- ✓ 156 WWTP
- ✓ 33 Tertiary (4,1 m<sup>3</sup>/s)
- ✓ 705 km reclaimed water network
- ✓ 139 hm<sup>3</sup> produced in 2021



# RECLAIMED WATER USES



Reuse 17 hm³



# RECLAIMED WATER MAIN FIGURES

- ✓ 25 municipalities supplied
- ✓ 446 reuse contracts
- ✓ 416 parks
- ✓ 11 golf courses
- ✓ 3700 ha irrigated (urban)





# RECLAIMED WATER MAIN FIGURES

✓ First European reference for the  
manufacture of 100% recycled  
paper with 100% reclaimed water





# TECHNOLOGY

- ✓ Canal de Isabel II has practically all the technologies available on the market installed.
- ✓ Canal de Isabel II has the capacity to produce any quality of water demanded.



# OTHER BIG CHALLENGE

Networks in consolidated urban land



Interferences with pre-existing infrastructures.



Urban affections.





# Culebro Basin

A European reference  
in extension of the use  
of reclaimed water



- ✓ **7 municipalities** supplied.
- ✓ More than **900.000 inhabitants.**
- ✓ **45 mill. €** Investment.



# CULEBRO BASIN TRANSPORT NETWORK

- ✓ **700 l/s FRP pipe**  
(fiberglass reinforced polyester)  
(60.000 m<sup>3</sup>/day).
- ✓ **49 km** long
- ✓ **18,9 mill. €** investment





**Tertiary  
Treatment**

**Advanced  
Tertiary  
Treatment**

# CULEBRO BASIN INFRASTRUCTURES

MUNICIPALITIES			DEPOSITS			DISTRIBUTION NETWORK	INVESTMENT
Municipio	Irrigation area (ha)	Demand (m <sup>3</sup> /day)	Number	Capacity	Level	Long (m)	
Alcorcón	213	3.195	1	5.250	708	6.167	2,82 M€
Leganés	558	8.115	3	7.300	688	13.364	4,93 M€
Getafe	336	5.046	4	9.050	691	17.183	4,11 M€
Fuenlabrada	226	3.385	3	4.000	645	14.945	4,25 M€
Humanes	12	182	1	250	676	7.189	0,784 M€
Parla	215	3.224	1	4.000	670	4.278	1,85 M€
Pinto	37	6.115	3	3.100	603	21.808	5,22 M€
	<b>1.597</b>	<b>29.262</b>	<b>16</b>	<b>32.950</b>		<b>84.934</b>	<b>23,96 M€</b>
Transport Network	700 l/s FRP pipe (60.000 m <sup>3</sup> /day)					49.000 m	18,90 M€
Tertiary Treatment	Treatment: F-Q + sand filtration by gravity + disinfection (U.V + hypochlorite)						2,52 M€
	<b>1.597 ha</b>	<b>29.262 m<sup>3</sup>/day</b>	<b>16</b>	<b>32.950 m<sup>3</sup></b>		<b>133.934 m</b>	<b>45,38 M€</b>



# DEPLOYMENT: INFINITE INTERFERENCES



Roads  
(10)



Train (5)  
AVE



Pipes  
(517)



Water Basins  
(4 riverbed)



Gas  
(24)



Power lines  
(233)



Vegetation (5)



Subway

# ADVANTAGES OF CENTRALIZED PRODUCTION

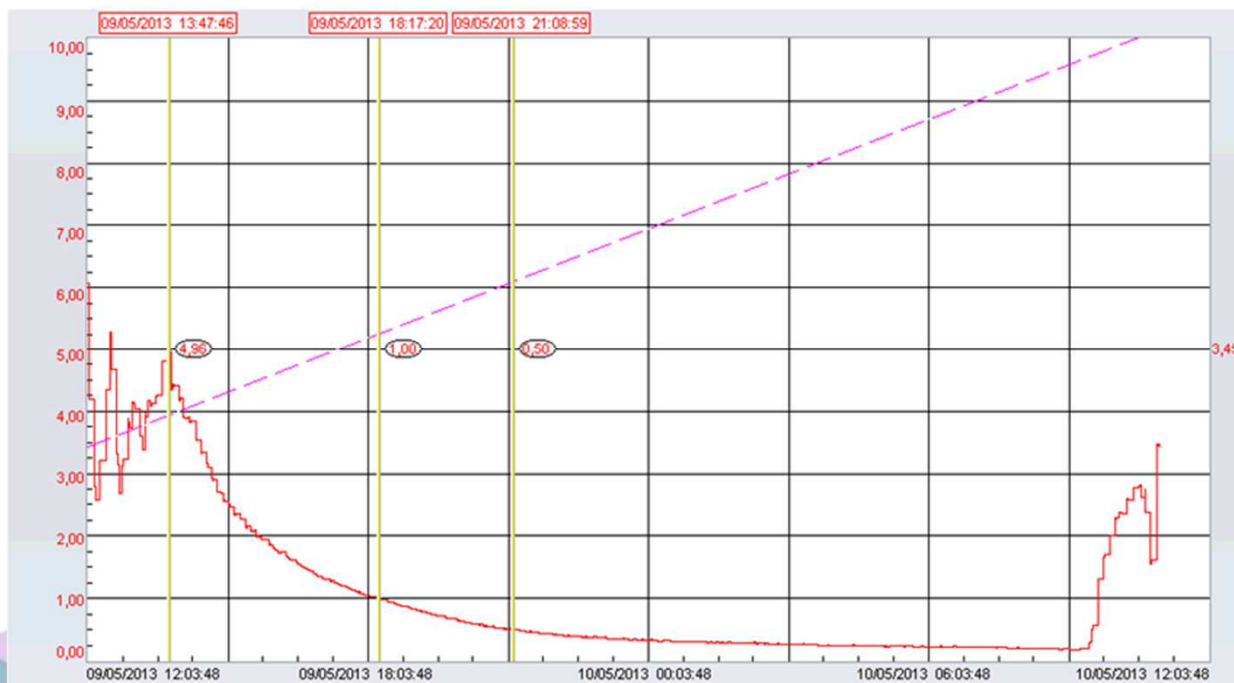
- ✓ Centralized quality control, which minimizes risks and strengthens the response to problems.
- ✓ Reduced retention times that increase the efficiency of disinfection.



Tertiary quality control panel (E.V.A.) in Culebro System  
Continuous measurement of total chlorine and turbidity

# ADVANTAGES OF CENTRALIZED PRODUCTION

## Chlorine evolution curve with retention time

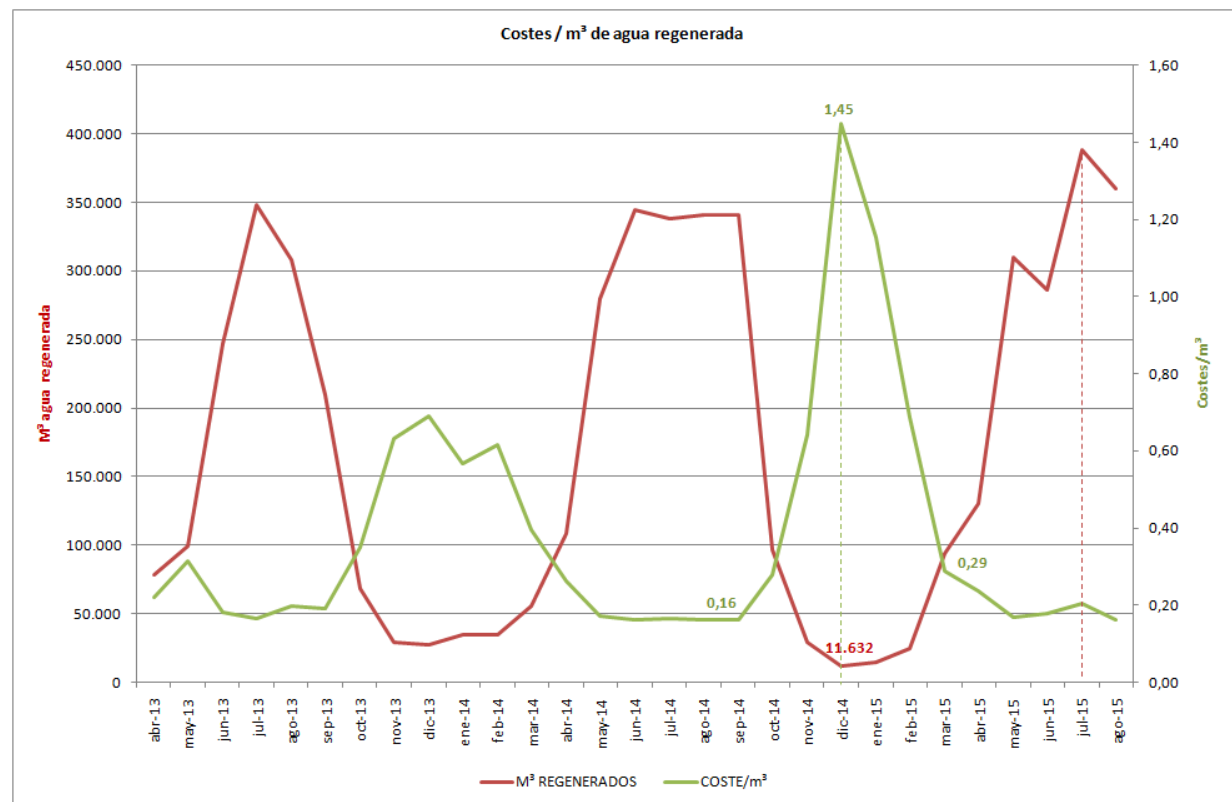


In 4 hours, it loses 80% of the total residual chlorine.

In 4 hours and a half it is reduced from 5 to 1, and in 7 hours and a half from 5 to 0.5

# ADVANTAGES OF CENTRALIZED PRODUCTION

- ✓ Very relevant economies of scale with production savings of more than 30%.



# ADVANTAGES OF CENTRALIZED PRODUCTION

For an annual production of 5.4 hm<sup>3</sup>, equivalent to producing 30,000 m<sup>3</sup>/day for 180 days, the production costs by tertiary size are:

	€/m <sup>3</sup> Operation Cost	
	With pump	Without pump
<i>Tertiary Treatment</i>		
$Q = 166 \text{ m}^3/\text{h}$	0,115 €/m <sup>3</sup>	0,065 €/m <sup>3</sup>
$Q = 1.250 \text{ m}^3/\text{h}$	0,075 €/m <sup>3</sup>	0,0331 €/m <sup>3</sup>

	With pump	Without pump
<i>7 tertiary of 166 m<sup>3</sup>/h cost</i>	621.000 €	351.000 €
<i>Centralized Tertiary of 1.250 m<sup>3</sup>/h cost</i>	405.000 €	178.524 €

**Saving > 35%**

# PROMOTION OF THE USE OF RECLAIMED WATER THROUGH THE TARIFF POLICY

**DATOS DEL SUMINISTRO**

N.º Contrato: 0    N.º Factura: 27673    Lugar y fecha de emisión: Madrid, 16 de mayo de 2018

Dirección del suministro:

**TRES CANTOS**

Uso: Otros Usos  
 N.º Contador:  
 Tipo suministro: Acometida ú

**2,1646 €/m<sup>3</sup>**

**LECTURAS Y CONSUMO**

Periodo		Lectura		Consumo	
Fecha lectura anterior	Fecha lectura actual	Anterior	Actual	Modo de cálculo	m <sup>3</sup>
01-06-2018	31-07-2018				120.000

**FACTURA**

Concepto	Importe (sin I.V.A.)
ADUCCIÓN	200.696,68
DISTRIBUCIÓN	60.102,40
Base sometida al tipo del 10% de I.V.A.:	260.799,08
Importe I.V.A.:	26.079,91
<b>Total factura (I.V.A incluido):</b>	<b>286.878,99 €</b>
Importe total a pagar	0,00 €
Importe de la factura percibido por:	
Canal de Isabel II, S.A.	

**DATOS DEL SUMINISTRO**

N.º Contrato: 254563867    N.º Factura: 27678    Lugar y fecha de emisión: Madrid, 16 de mayo de 2018

Dirección del suministro:  
 AV PERALES S/N  
 CAJA MAGICA 2  
 TRES CANTOS

Titular del contrato: MADRID DESTINO CULTURA TURISMO Y NEGOCIO SA

MADRID DESTINO CULTURA TURISMO Y NEGOCIO SA  
 CIF: A84073105

Uso: Otros Usos  
 N.º Contador: 3F500008 Diám  
 Volumen diario contratado VD  
 Coeficiente Inversión Regener  
 Coeficiente Inversión Transpor  
 Agrupación: 8888887  
 Tipo suministro: Acometida ú

**0,4153 €/m<sup>3</sup>**

**LECTURAS Y CONSUMO**

Periodo		Lectura		Consumo	
Fecha lectura anterior	Fecha lectura actual	Anterior	Actual	Modo de cálculo	
01-06-2018	31-07-2018	69.917			

Fecha de la próxima lectura: 2 de julio de 2018

Su consumo medio mensual ha sido de 40.000m<sup>3</sup>.  
 El importe diario medio de su factura, durante el último periodo, ha sido de 0,00 euros.

**FACTURA**

Concepto	Importe (sin I.V.A.)
REGENERACIÓN AGUA REUTILIZABLE	40.419,35
TRANSPORTE AGUA REUTILIZABLE	10.464,03
Base sometida al tipo del 10% de I.V.A.:	50.883,37
Importe I.V.A.:	5.088,34
<b>Total factura (I.V.A incluido):</b>	<b>55.971,71 €</b>
Importe de la factura percibido por:	
Canal de Isabel II, S.A.	50.883,37 €

**80% savings**






# Conclusions


Culebro Basin, a successful case thanks to the CENTRALIZED production:

- i. **Centralized quality control**  
minimizes risks and strengthens the response to potential problems
  
- ii. **Very relevant economies of scale**  
increasing efficiency with savings in production of more than 30%.





*You cannot wait for water emergencies to provide solutions.  
Reclaimed water requires long-term planning.  
More if it is urban use*



16102/50087 01:52 ISO/DIS 16422 -CANAL DE ISABEL II- -AGUA REGENERADA NO POTABLE-

iMuchas gracias!

