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Innovation Demonstration for a Competitive and Innovative European Water Reuse Sector: DEMOWARE (FP7 61940)

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Head of Water Technologies

EIP Water
Boosting opportunities – Innovating water

Common Implementation Strategy for the WFD

Roadmap for a resource efficiency Europe

Water Reuse

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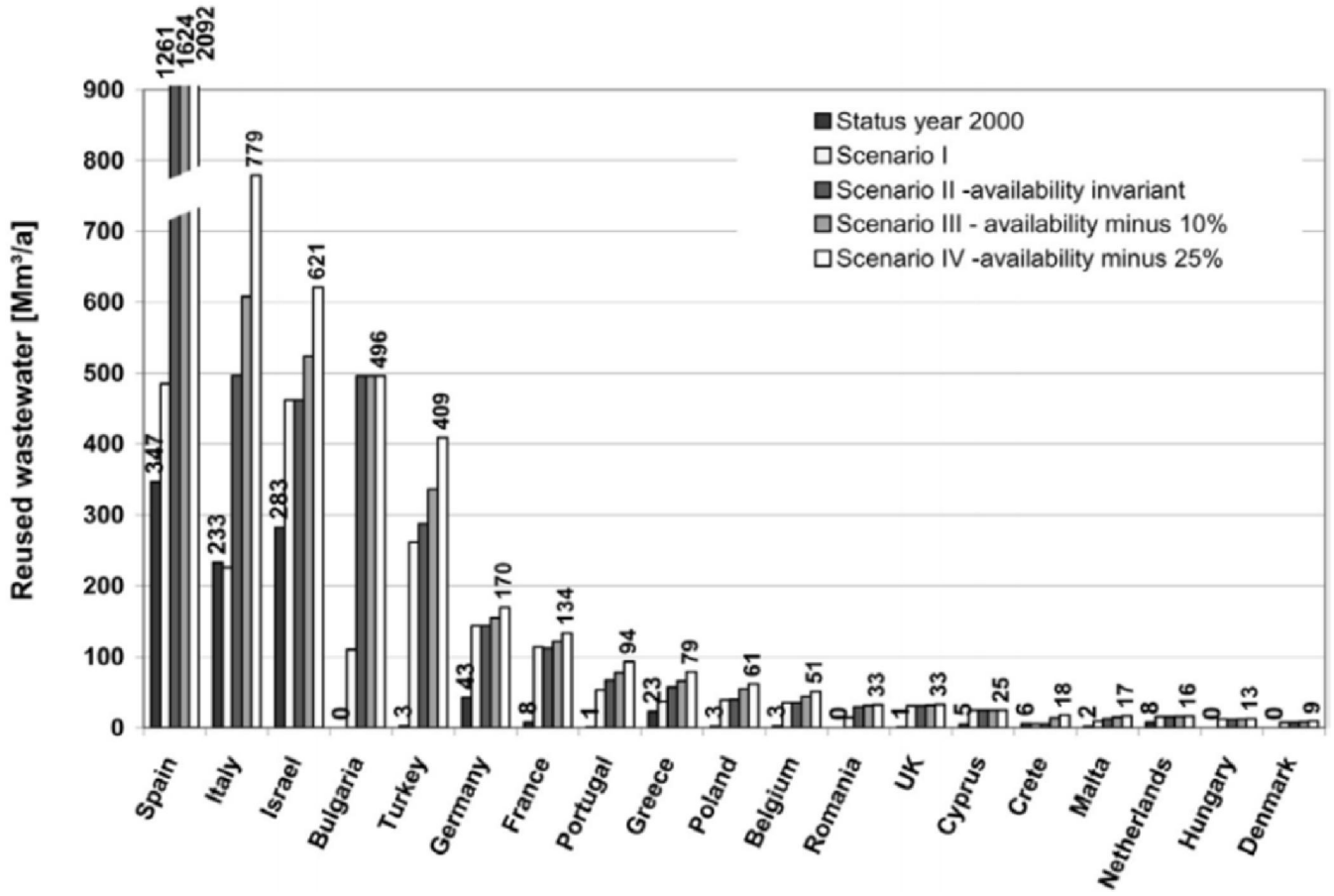
There is an overly proportionate increase in wastewater reuse potential with declining water availability in most European countries. An average water availability curtailment of 25% on a country level can already result in tremendous wastewater reuse potential increase.

Hochstrat et al. (2006) Assessing the European wastewater reclamation and reuse potential — a scenario analysis. Desalination 188, vol. 1-6, 2006.



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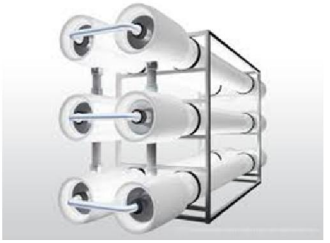
Barriers



- Inconsistent and unreliable methods for identification and optimization of appropriate wastewater treatment technologies

- Difficulty in specifying and selecting effective whole system monitoring techniques and technologies.

- Significant challenges in reliably assessing the environmental and public health risk / benefit of water reuse

- Poorly developed business models for water reuse schemes and markets for recycled water.

- Low levels of public and government enthusiasm for water reuse.

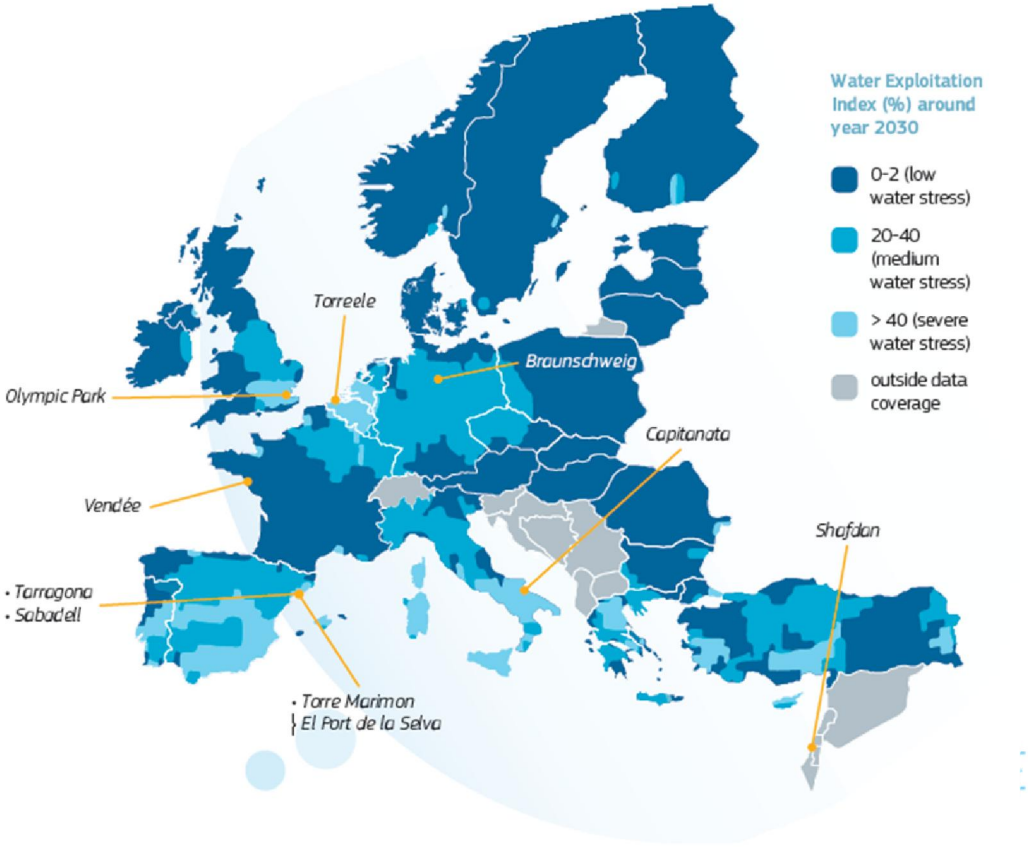
- Lack of a unifying identity and professional image for the European water reuse sector.

WATEREUSE

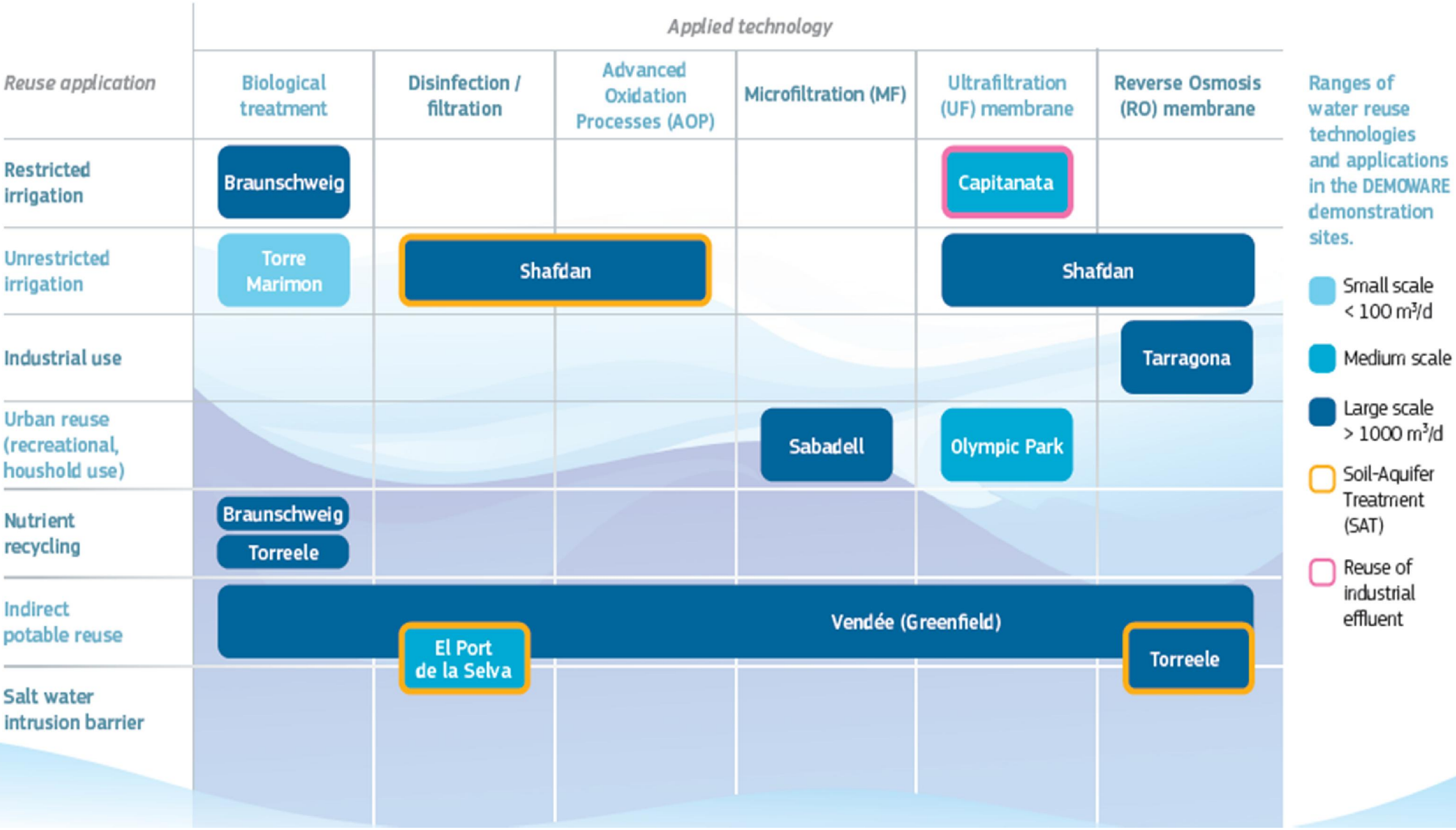
Project Data

Partners: 27
Demo-sites: 10
Budget: 10.504.470 €
Requested UE contribution: 5.999.566 €
Duration: 3 years

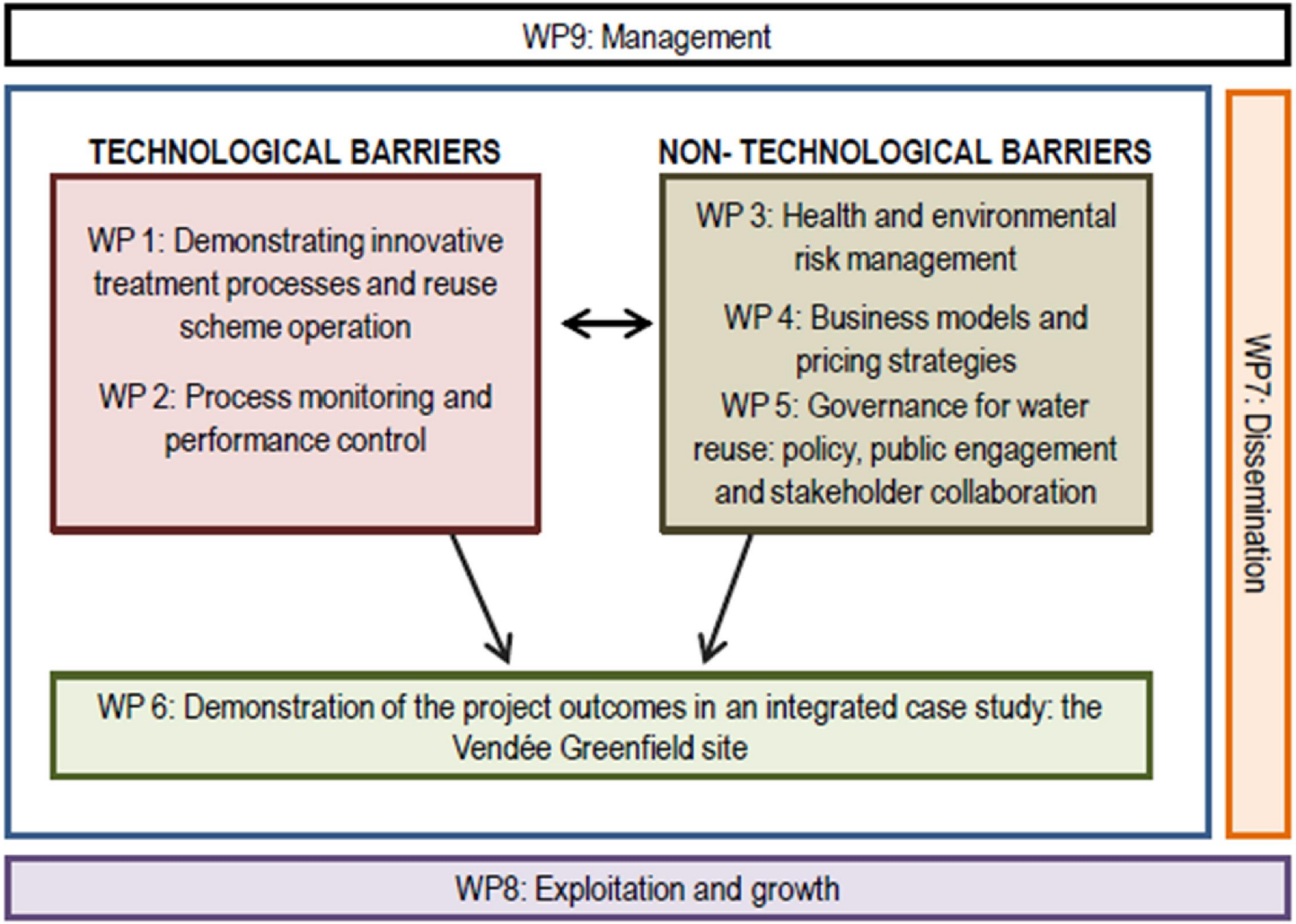
Work Packages: 9
Person-months: 961.8
Deliverables: 42
Milestones: 28
External Stakeholders: 12



Sites and Technologies



Project Structure



Site 5: Tarragona – Catalonia, Spain

IND

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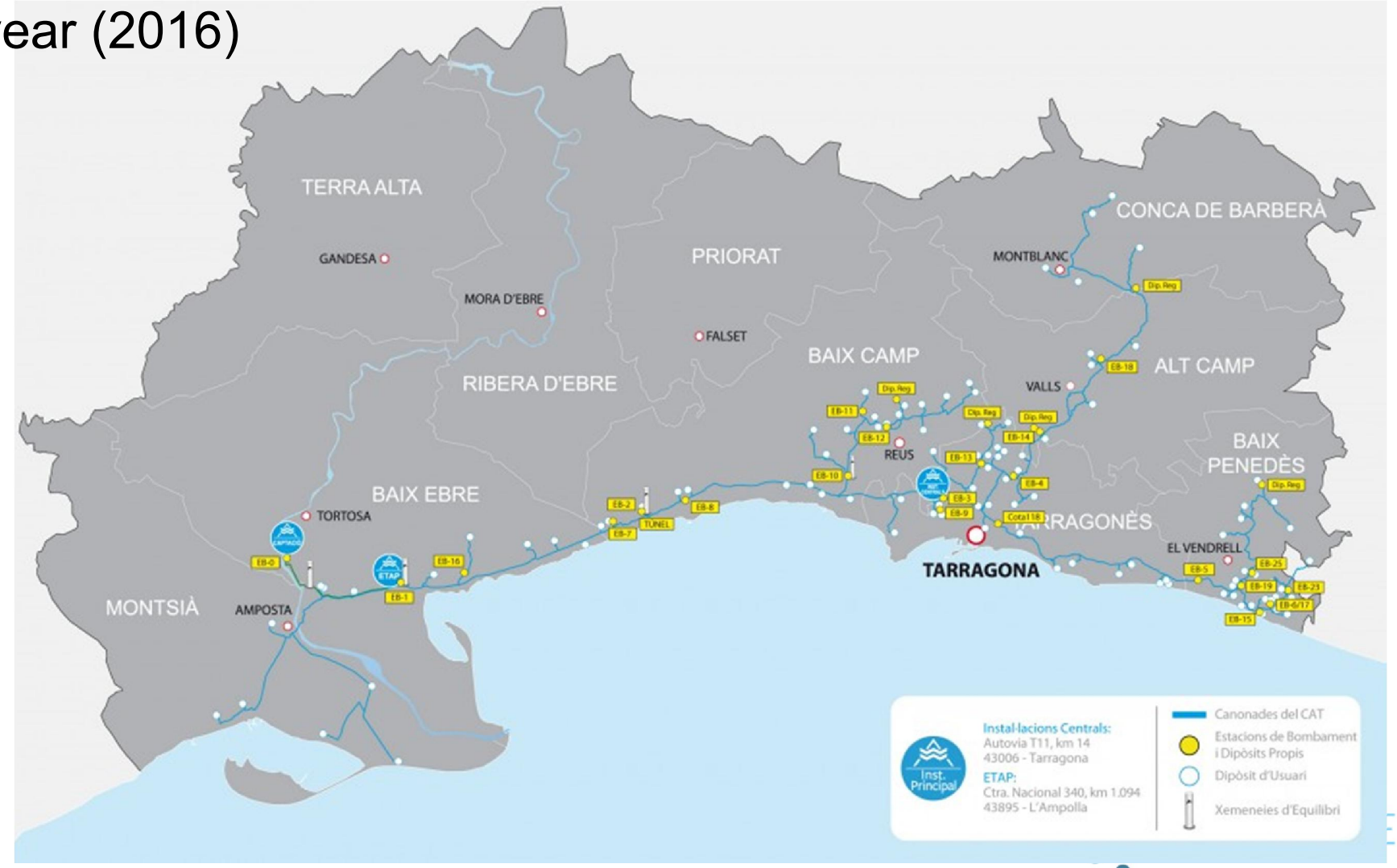
71 hm3/year (2016)



Source: Consorci Aigües de Tarragona

Site 5: Tarragona – Catalonia, Spain

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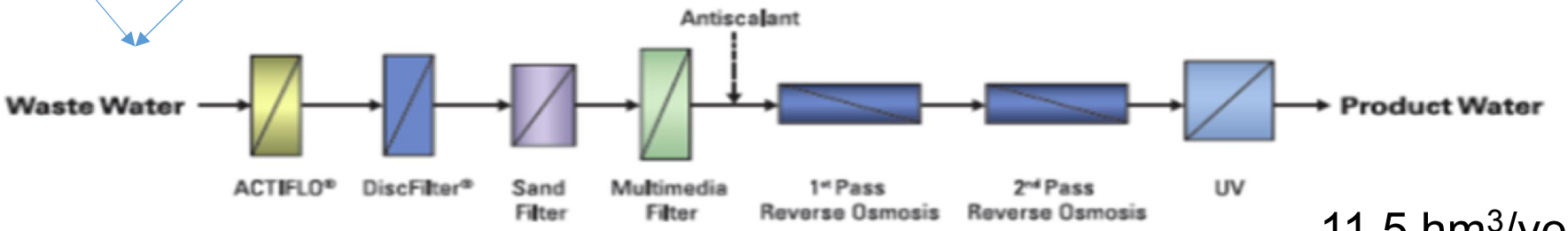
WWTP Vilaseca WWTP Tarragona



11,5 hm^3/year

Agència Catalana de l'Aigua

VEOLIA

27,7 hm^3/year Industrial water

50 anys aitasa aguas industriales de tarragona s.a.

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Site 5: Tarragona – Catalonia, Spain

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Cracker and Octene plant

- Ethylene,
- Propylene
- C4 Fraction for octene production

350 to 500 m3/hr freshwater
25.000 m3/hr cooling circuit

Challenges: Corrosion and biofouling

Compound	Ebro	RO Permeate	Ebro x 4	Permeate x 7
Conductivity	950 µS/cm	19 µS/cm	3800 µS/cm	135 µS/cm
Cl	260 mg/L	2.94 mg/L	1040 mg/L	21 mg/L
$CaCO_3$	95 mg/L	< 0.1 mg/L	380 mg/L	< 1.0 mg/L
SO_4	160 mg/L	0.0167 mg/L	640 mg/L	0.07 mg/L
NH_3	0.1 mg/L	< 0.8 mg/L	0.4 mg/L	< 5.0 mg/L
PO_4	0.1 mg/L	< 0.002 mg/L	0.4 mg/L	< 0.02 mg/L
TOC	1.2 mg/L	< 0.3 mg/L	4.8 mg/L	< 2.0 mg/L

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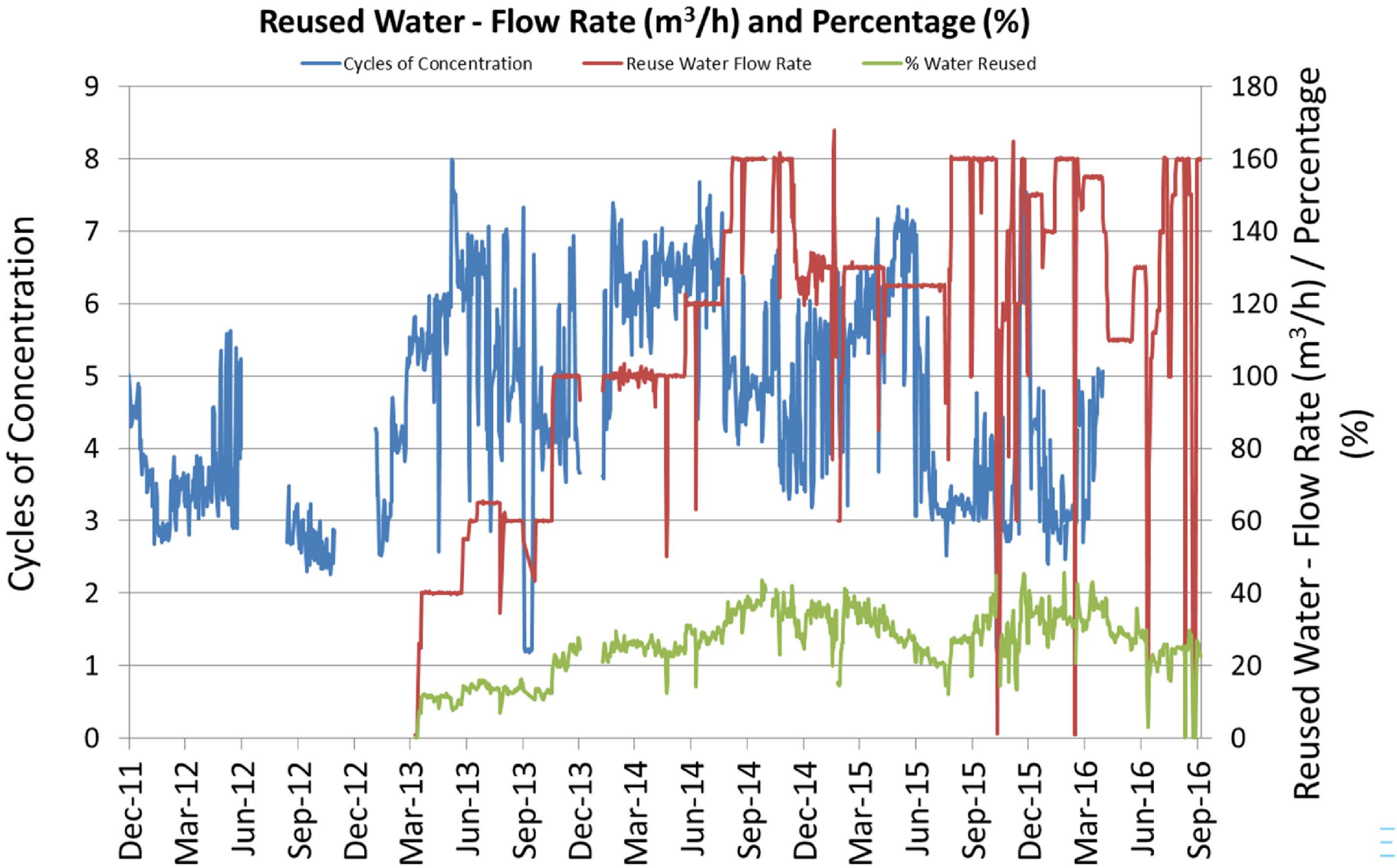

Site 5: Tarragona – Catalonia, Spain

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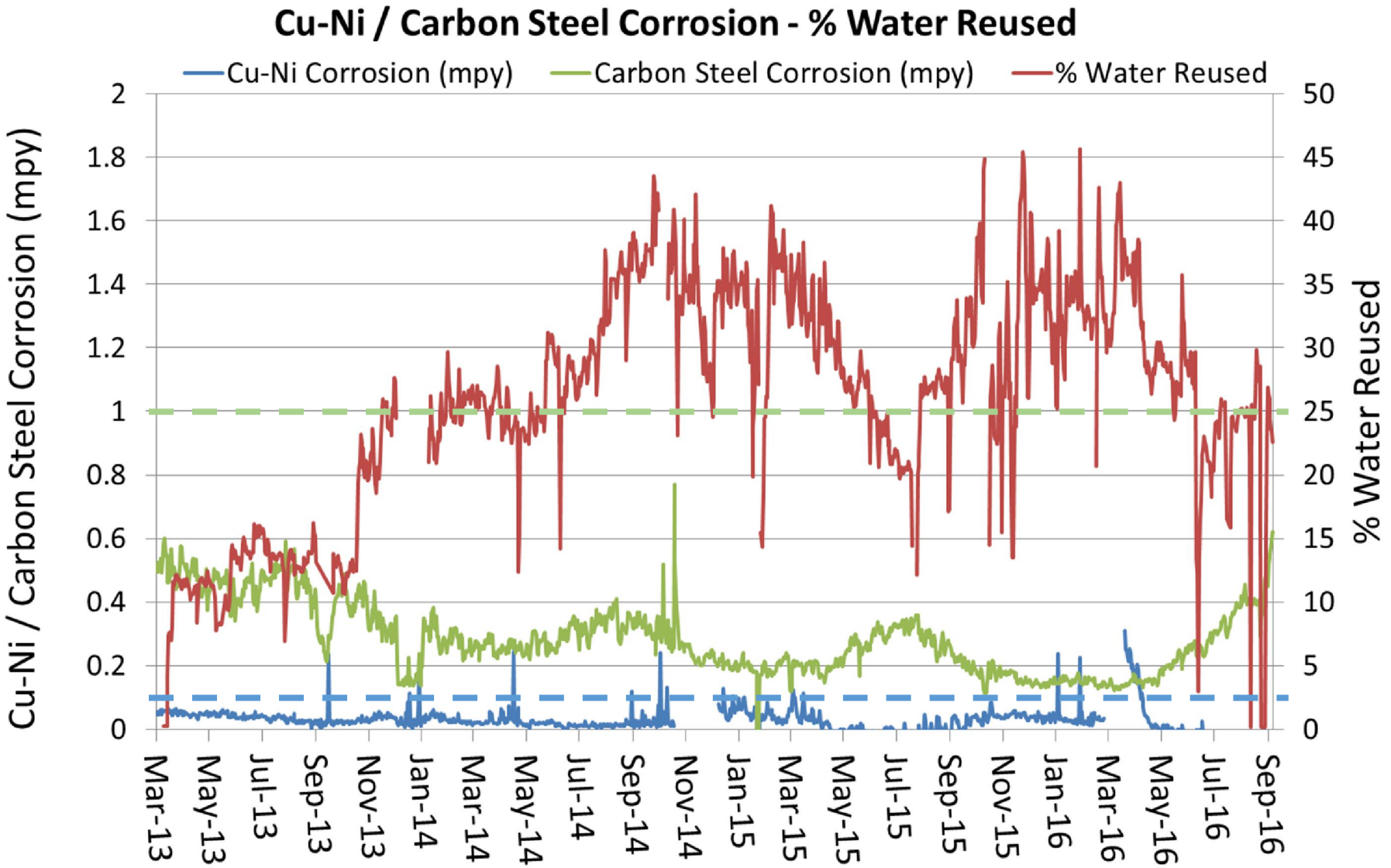

Site 5: Tarragona – Catalonia, Spain

IND

Up to 160m3/h (40%) of freshwater is reclaimed
110.5 m3/h (22%) in total water savings
> 200 m3/h of freshwater from Ebro saved
76 m3/h in blowdown and so sewage reduction
1,4% savings in water costs (120,000 €/year)

Next steps:

Use of reclaimed water in Dow South (Derviatives)
Up to 90% reclaimed water in both sites

Prizes:

- WRAP (Waste Reduction Always Pays) – Dow Chemical Company (Internal). June 2015
- Environmental Project of the Year - Environmental Leader (USA). June 2016
- ICheM 2016 (Finalist). November 2016
- Certificate of merit for industry technology and innovation. IDA conference. September 2016
- #2025 Sustainability Award - Dow Chemical Company (Internal).November 2016

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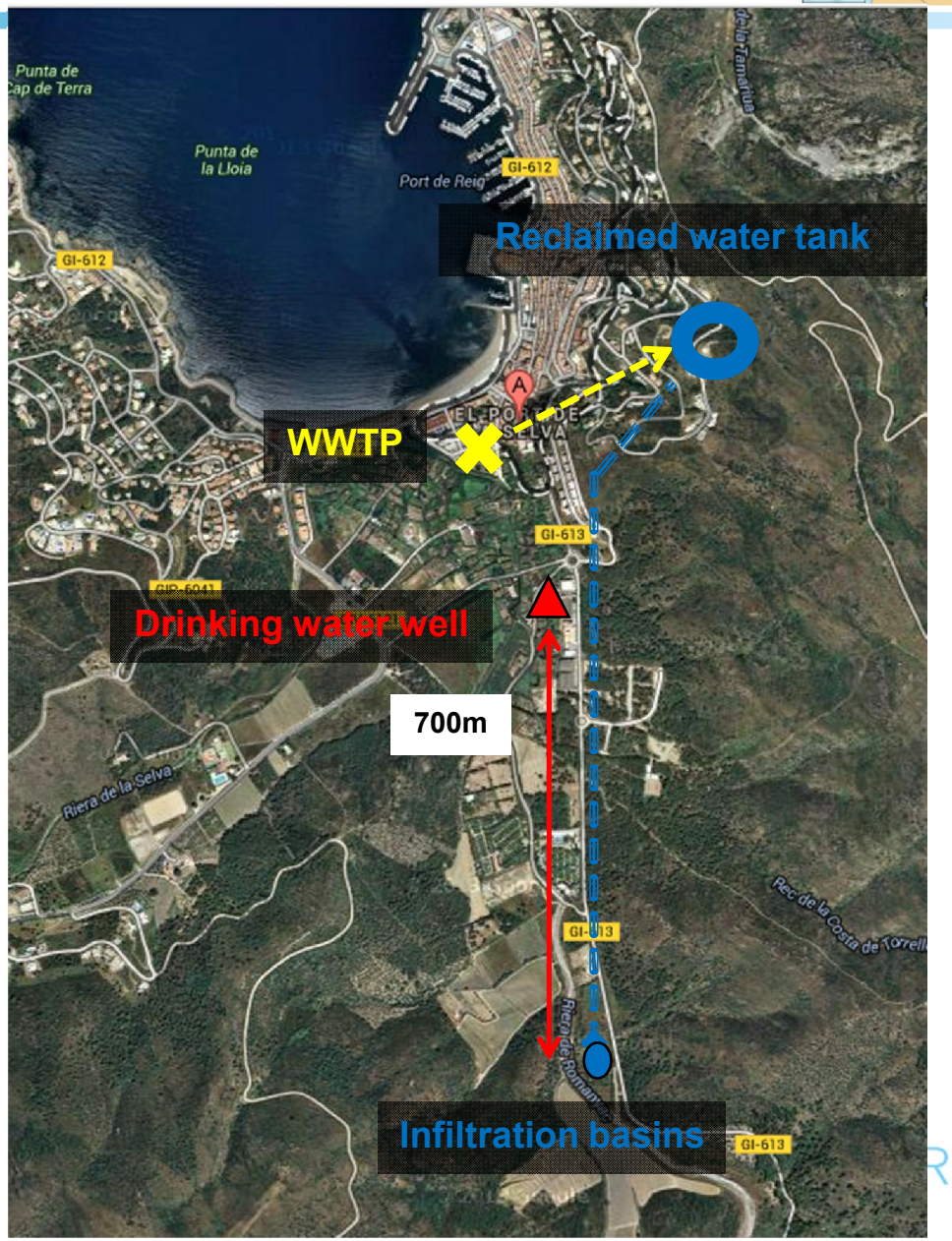
Site 9: El Port de la Selva - Spain

IPR



Water reuse:

- Public Irrigation
- Private Irrigation
- IPR

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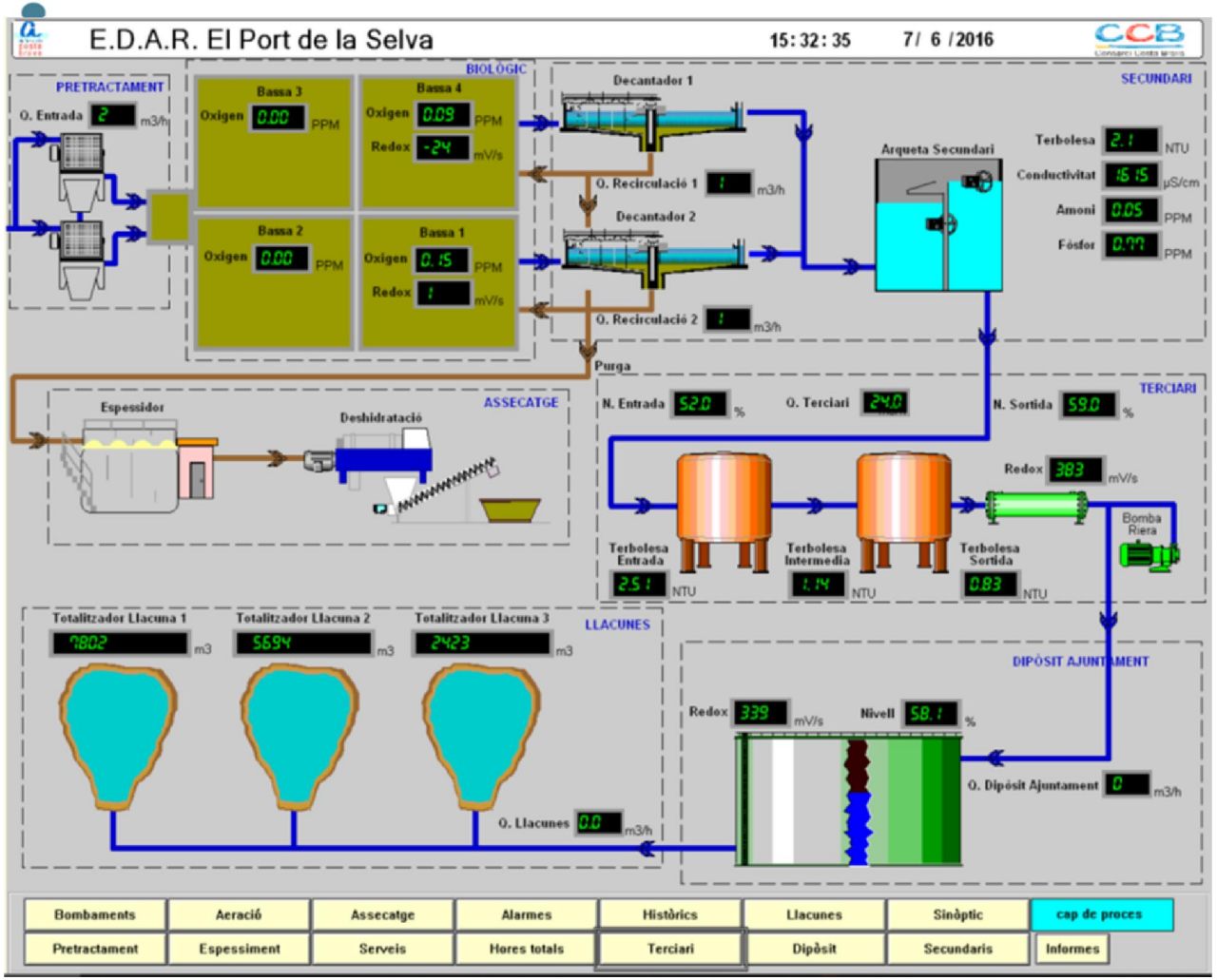
IPR



- Activated Sludge
- Multimedia filtration
- GAC
- UV
- (Chlorination)
- Soil-aquífer treatment (infiltration basins)

VEOLIA

CCB Consorci Costa Brava

AMPHOS 21

KOMPETENZZENTRUM WasserBerlin

Urban Secondary Effluent → Multimedia Filtration → GAC → UV → SAT → Indirect potable reuse

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IPR

Parameter	Associated concerns	Target	Measures taken/ planned
TSS (/ turbidity)	SAT clogging, oxygen depletion	as low as possible	Install frequency converters for improved filtration (+ additional benefits from precipitation)
E. coli	hygienic water quality	< 1,000/100mL	Improve filtration & UV disinfection schemes
Ammonium	microorganism growth, oxygen depletion	< 1 mg/L	Increase aeration
Total nitrogen	microorganism growth, oxygen depletion	< 10 mg/L	Improve control, increase WWTP retention time
Total phosphorous	microorganism growth	< 2 mg/L	Improve control, install precipitation
Conductivity (salinity)	salt concentration	< 1,500 µS/cm	Install online conductivity probe & provide system shut down in case of exceedance
Halogenated organics	Toxicity of disinfection by-products	as low as possible	Switch off chlorination during infiltration periods
Organic micro-pollutants	(Potential) toxicity	as low as possible	Install adsorption stage (granular activated carbon)

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Site 9: El Port de la Selva - Spain

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- 200 m^3/day
- 439 m^2
- > 1 m/d
- 1 m depth (50 cm sand layer)

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Water Quality

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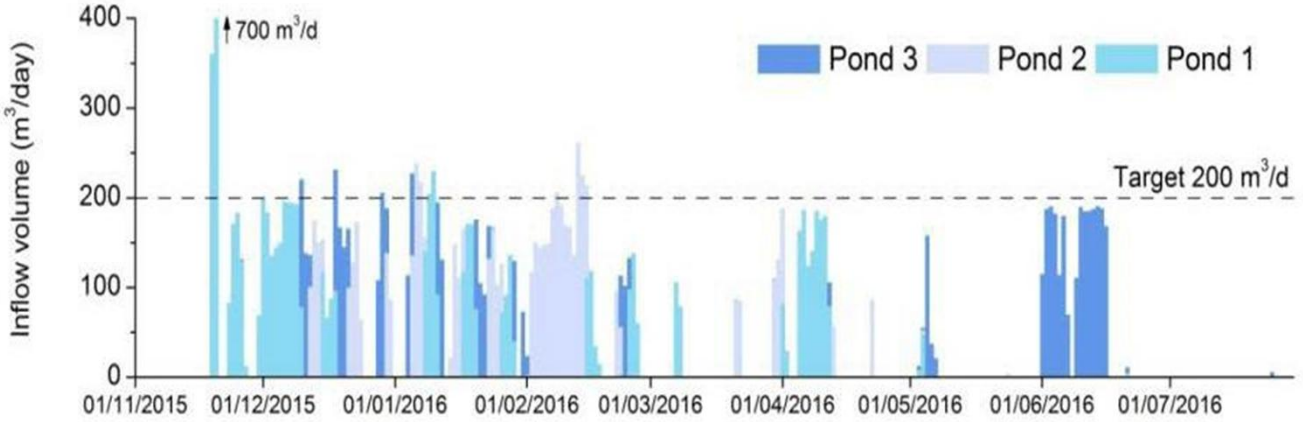

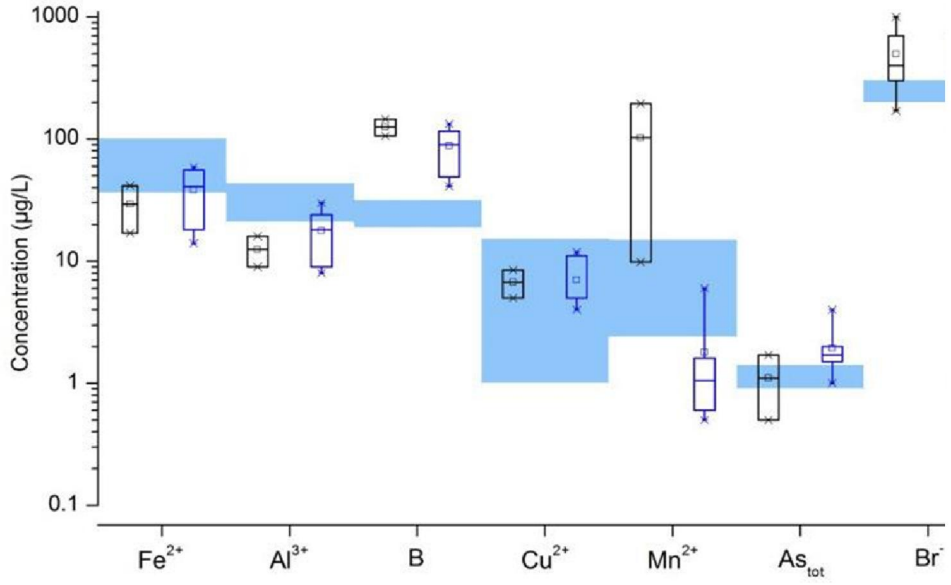

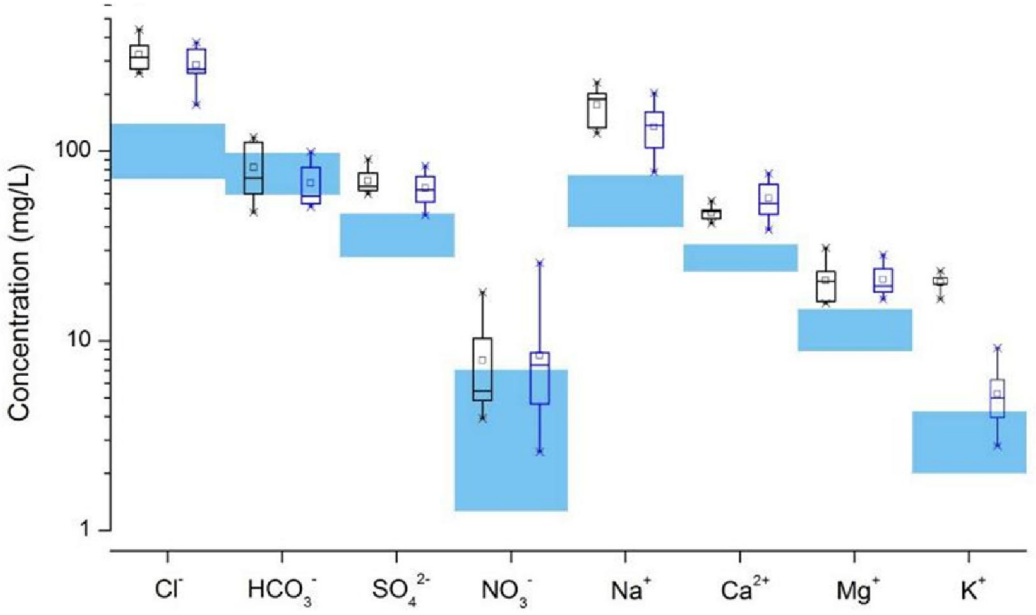

Microbiological Quality

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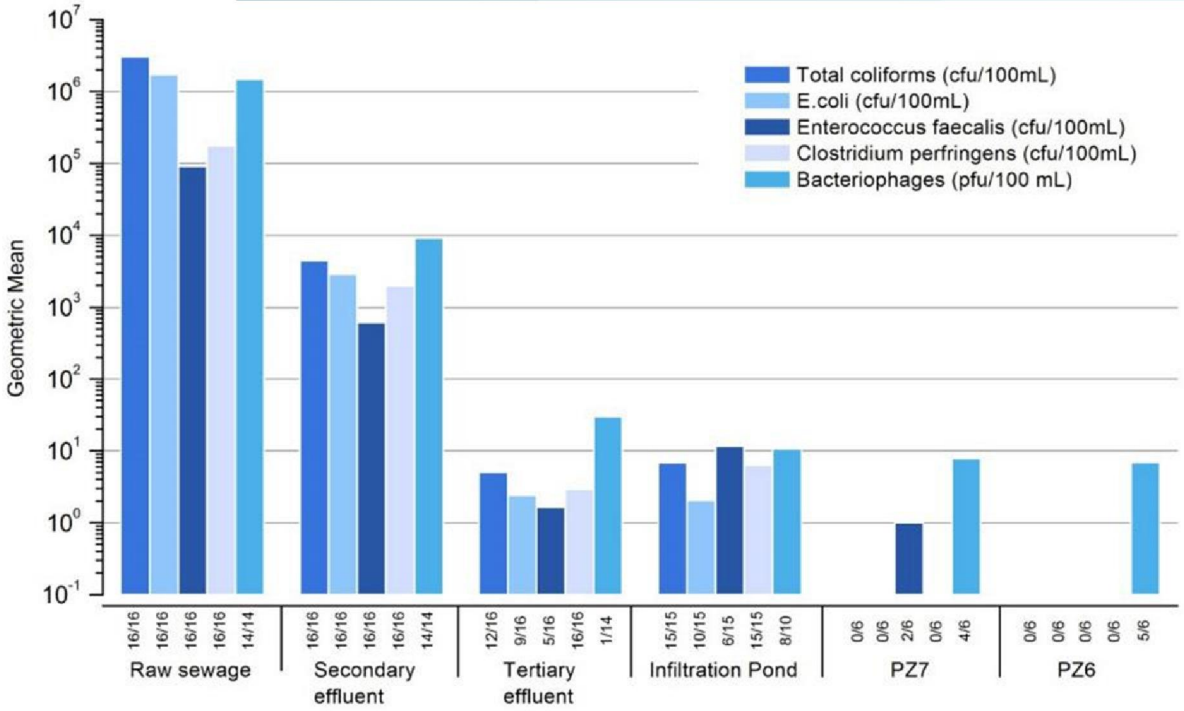
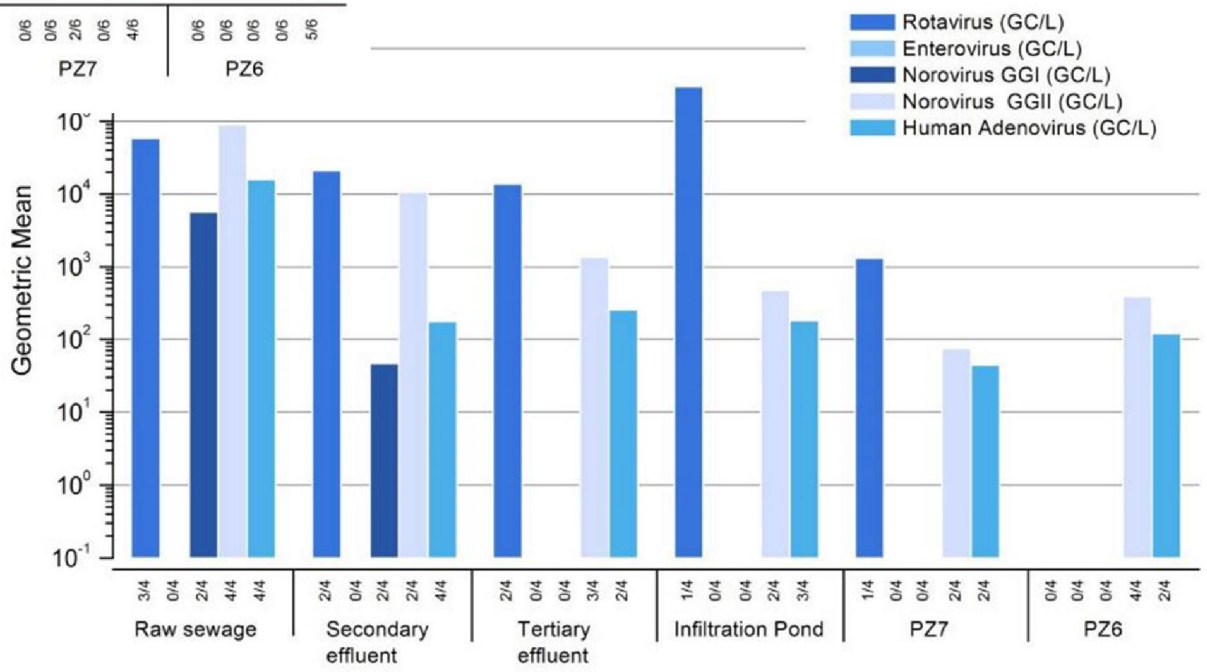


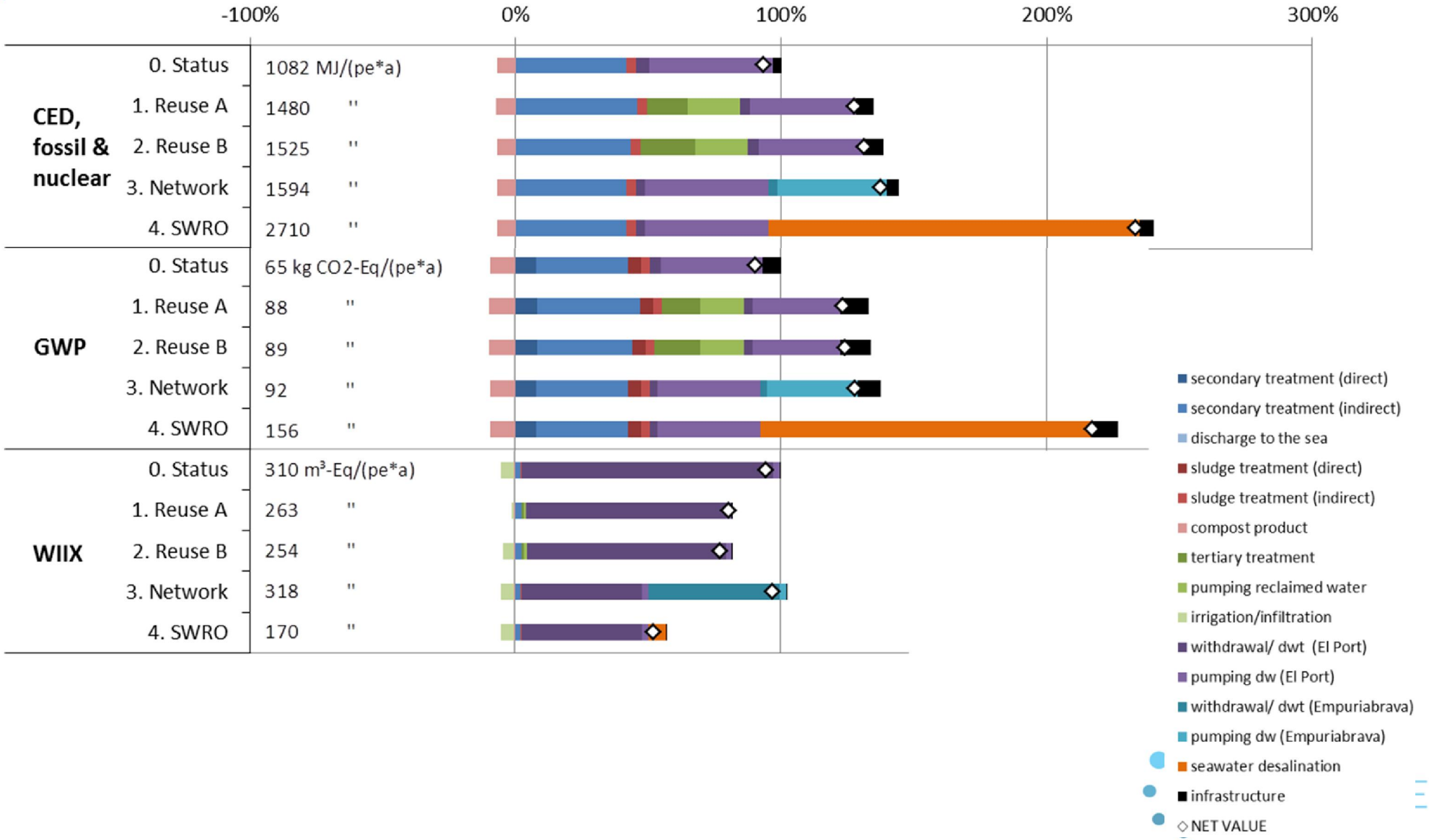


Analysis: PCRq

Infection capacity?

Life Cycle Assessment

IPR



Site 5: Tarragona – Catalonia, Spain

IPR

Up to 14% of reclaimed water
320 < t < 680 days travel time
High Certainty to achieve WHO 1 uDALY/person/year in all scenarios

Next steps:
Further studies required for trace organic contaminants
Optimization of GAC performance

Main conclusions:
In general indirect potable reuse via MAR is possible:

- If aquifer is suitable
- If distance between MAR site and abstraction is high enough
- If travel time is > 300 d (if no full disinfection e.g. via ultrafiltration membrane)
- If pre-treatment is suitable to meet the Spanish regulation on water reuse + agreed target for micro pollutant removal
- If citizens accept the solution

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www.demoware.eu

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