



B-WaterSmart: desafios e soluções mais inteligentes

Maria João Rosa, Rita Ribeiro, Helena Alegre (LNEC – *LL mentor*)

Pedro Teixeira, Fátima Neo (CML – *LL owner*)

O Caminho da Inovação – 7.^a Edição

FÁBRICA DA ÁGUA DE ALCÂNTARA
10 de outubro de 2023

b-watersmart.eu

B-WaterSmart

**B-WaterSmart accelerates the transformation to water-smart economies and societies
in coastal Europe and beyond**

OUR APPROACH

OUR SOLUTIONS

<https://b-watersmart.eu/>

17,3 M€ de orçamento (EC → 15 M€)

4 anos de duração (Setembro 2020 a Agosto 2024)

36 parceiros

Coordenação



“Societies are water-smart when they generate societal well-being via sustainable management of water resources.

In water-smart societies, well-informed citizens and actors across sectors engage in continuous co-learning and innovation to develop an efficient, effective, equitable and safe circular use of water and the related resources.

This is achieved by adopting a long-term perspective to ensure water for all relevant uses, to safeguard ecosystems and their services to society, to boost value creation around water, while anticipating change towards resilient infrastructure.”

Objetivos estratégicos

A.
Assegurar
água para
todos

B.
Salvaguardar
ecossistemas
e serviços

C.
Impulsionar
criação de valor
em torno da
água


D.
Promover a
mudança
adaptativa

E.
Envolver
cidadãos e
atores de todos
os sectores

#34 Quadro de Avaliação B-WaterSmart

Quadro de avaliação de inteligência na gestão da água, considerando: eficiência técnica, sustentabilidade (económica, ambiental e social) e risco associado a diferentes escalas (local, urbana, regional ou nacional) para...

1. Ajudar os profissionais a avaliar os ganhos no processo de realização dos objetivos estratégicos a longo prazo de uma forma não prescritiva, transparente, coerente, credível, baseada nas partes interessadas e fácil de utilizar
2. Ajudar os responsáveis políticos e decisores a ultrapassar as barreiras existentes e a implementar as suas agendas estratégicas para a gestão inteligente da água, apoiando as prioridades de desenvolvimento sustentável
3. Permitir benchmarking, através de um conjunto de métricas para comparação, no tempo e com outras organizações



Final version of the water-smartness assessment framework

Deliverable 6.3

Deliverable author(s)

Catarina Silva, Maria Adriana Cardoso, Maria João Rosa, Helena Alegre (LNEC), Rita Ugarelli, Camillo Bosco, Gema Raspati, Kamal Azrague, Stian Bruaset, Sigrid Damman (SINTEF), Stef Koop, Stefania Munaretto (KWR), Marcella Melo Silva da Conceição, Carla Gomes (ICS), Laura Flores Rosell (CET), Alexandra Schmuck, Clemens Strehl (IWW), Prasanna Mohan Doss (NTNU).

STRATEGIC OBJECTIVE →	ASSESSMENT CRITERIA →	NUMBER OF METRICS (V2)
A. Ensuring water for all relevant uses	A.1 Safe and secure fit-for-purpose water provision A.2 Accessibility and equity (for any user) A.3 Financial viability	12
B. Safeguarding ecosystems and their services to society	B.1 Safeguarded water ecosystems B.2 Enhanced ecosystem services to society B.3 Resource efficiency	12
C. Boosting value creation around water	C.1 Circular policy making C.2 Circular economy growth C.3 Resource recovery and use	13
D. Promoting adaptive change towards resilient infrastructure	D.1 Enabling planning to promote adaptive change towards circularity and resilience D.2 Implementing adaptive change towards resilient infrastructure D.3 Effectiveness of the adaptive change towards resilient infrastructure (Diagnosis)	11
E. Engaging citizens and actors across sectors in continuous co-learning and innovation	E.1 Awareness and knowledge E.2 Multi-sector network potential E.3 Stakeholder engagement processes	12

6 Laboratórios Vivos

3 **idades** e
3 **regiões**
costeiras
na Europa



Metodologia

coprodução

& abordagem sistémica

integrada

+ **tecnologias**

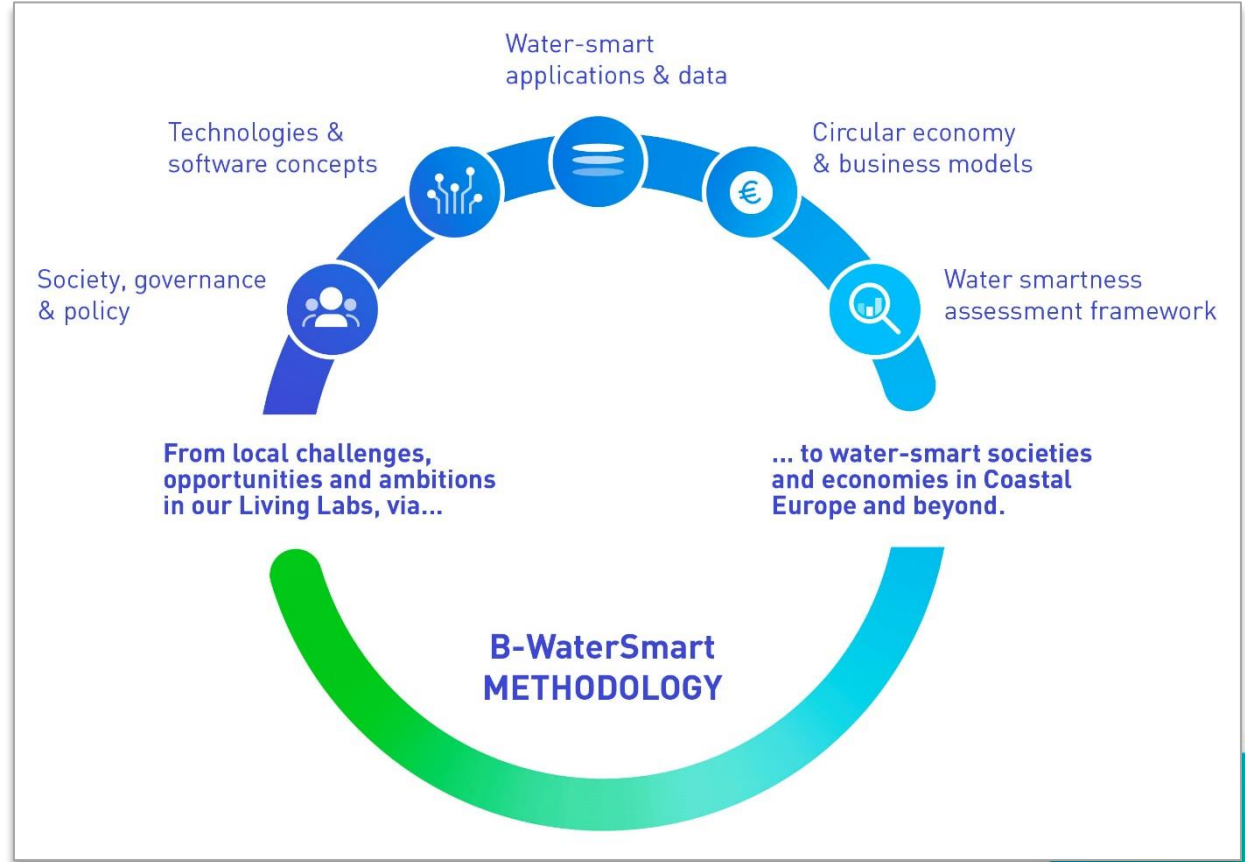
+ **aplicações digitais**

+ **cadeias de valor de economia circular**

+ **aspectos sociais**

+ **governança**

+ **políticas**



... para acelerar a transformação numa sociedade e economia **Water-Smart**



Laboratório Vivo de Lisboa



b-watersmart.eu

Motivação | desafios

Resiliência climática



Temperatura

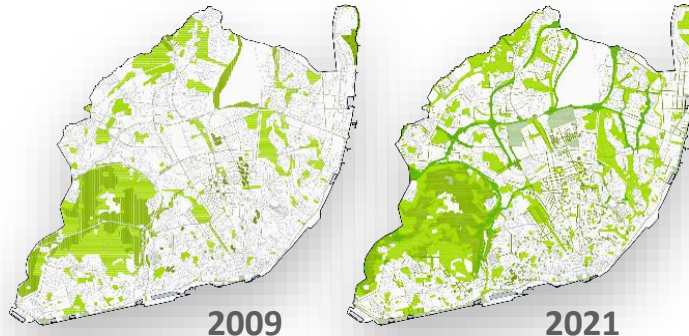


Precipitação



Eventos extremos

Aumento da área verde, qualidade de vida

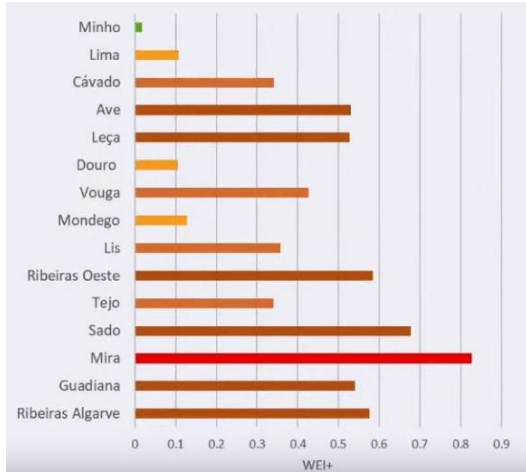


Crescimento da população e economia



Motivação | desafios

Escassez de água



WEI+ inferior a 10% - Sem Escassez
WEI+ entre 10% a 20% - Escassez Baixa
WEI+ entre 20% a 30% - Escassez Moderada
WEI+ entre 30% a 50% - Escassez Elevada
WEI+ entre 50% a 70% - Escassez Severa
WEI+ superior 70% - Escassez Extrema

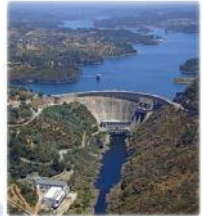
Fonte: Rodrigo Oliveira, IST, 7/12/ 2021, <https://youtu.be/Hx2xq4w2pJ8>, 3:16:37)



Origens distantes



Fonte: EPAL



Laboratório Vivo de Lisboa

b-watersmart.eu



CML – “Dono” dos desafios a responder no âmbito do LV, Agenda estratégica, plano estratégico

LNEC – coordenação do trabalho de cocriação/demonstração de inovação sistémica

AdTA – produção de ApR (entidade gestora)

Baseform – desenvolvimento de soluções/*software*

Adene – certificação *climate readiness* (fração, edifício e bairro)

LEN – desenvolvimento do Observatório do Ciclo Urbano da Água de Lisboa

ICS-UL – coordenação do trabalho relacionado com aspetos sociais e de governança

Laboratório Vivo de Lisboa ... em números

7

parceiros

1

Ferramenta
tecnológica

1

Comunidade
de Prática
(CoP)

41

Pessoas
R&D&I

6

Ferramentas
informáticas

1

Agenda
estratégica

20

pilotos

1

Aliança de
Inovação (InAll)
com 6 Lab Vivos

1

Plano
estratégico

1

Quadro de Avaliação
da inteligência no
uso da água

LV Lisboa | comunidade de prática (CoP)



- **3 reuniões plenárias** (2022-2023)
- **2 ‘focus groups’ temáticos** (2023)
- Mais duas reuniões previstas até o final do projeto
- **Grupos de trabalho temáticos** (entre outros):
 - reutilização para usos não potáveis
 - informação e comunicação
 - monitorização
- **Moderador** da CoP: ICS-Ulisboa
- **Participantes:** co-criadores, followers/replicadores, da Área Metropolitana de Lisboa, parceiros do projeto

@B_WaterSmart no X/Twitter

Website: <https://b-watersmart.eu/>

LV Lisboa | ações



1. Melhorar a gestão da oferta e da procura de água e a pegada hídrica, energética e de fósforo da cidade, aumentando também as zonas verdes

2. Promover a utilização segura de origens alternativas (e.g., água para reutilização)



3. Promover edificação eficiente do ponto de vista hídrico e energético e preparada para as alterações climáticas



A.
Assegurar
água para
todos

B.
Salvaguardar
ecossistemas
e serviços

C.
Impulsionar
criação de valor
em torno da
água

D.
Promover a
mudança
adaptativa

E.
Envolver
cidadãos e
atores de todos
os sectores

Objetivos estratégicos



Laboratório
Vivo de Lisboa



Impactos esperados



EI 1 Diminuição do
uso de água doce

EI 2 Melhoria eficiência
no uso da água

EI 3+4 Reutilização
da água

EI 5 Redução da energia
relacionada com o uso da água

EI 7 Recuperação
de nutrientes

Agenda estratégica do LL e Plano estratégico do ML

Objetivos estratégicos

- A. Assegurar água para todos
- B. Salvar e proteger ecossistemas e serviços
- C. Impulsionar criação de valor em torno da água
- D. Promover a mudança adaptativa
- E. Envolver cidadãos e atores de todos os sectores

Agenda estratégica
(ancorada na CoP)



Impactos esperados

EI 1 Diminuição do uso de água doce

EI 2 Melhoria eficiência no uso da água

EI 3+4 Reutilização da água

EI 5 Redução da energia relacionada com o uso da água

EI 7 Recuperação de nutrientes

Plano estratégico (InAll (innovation alliance) + BWS Assessment Framework)

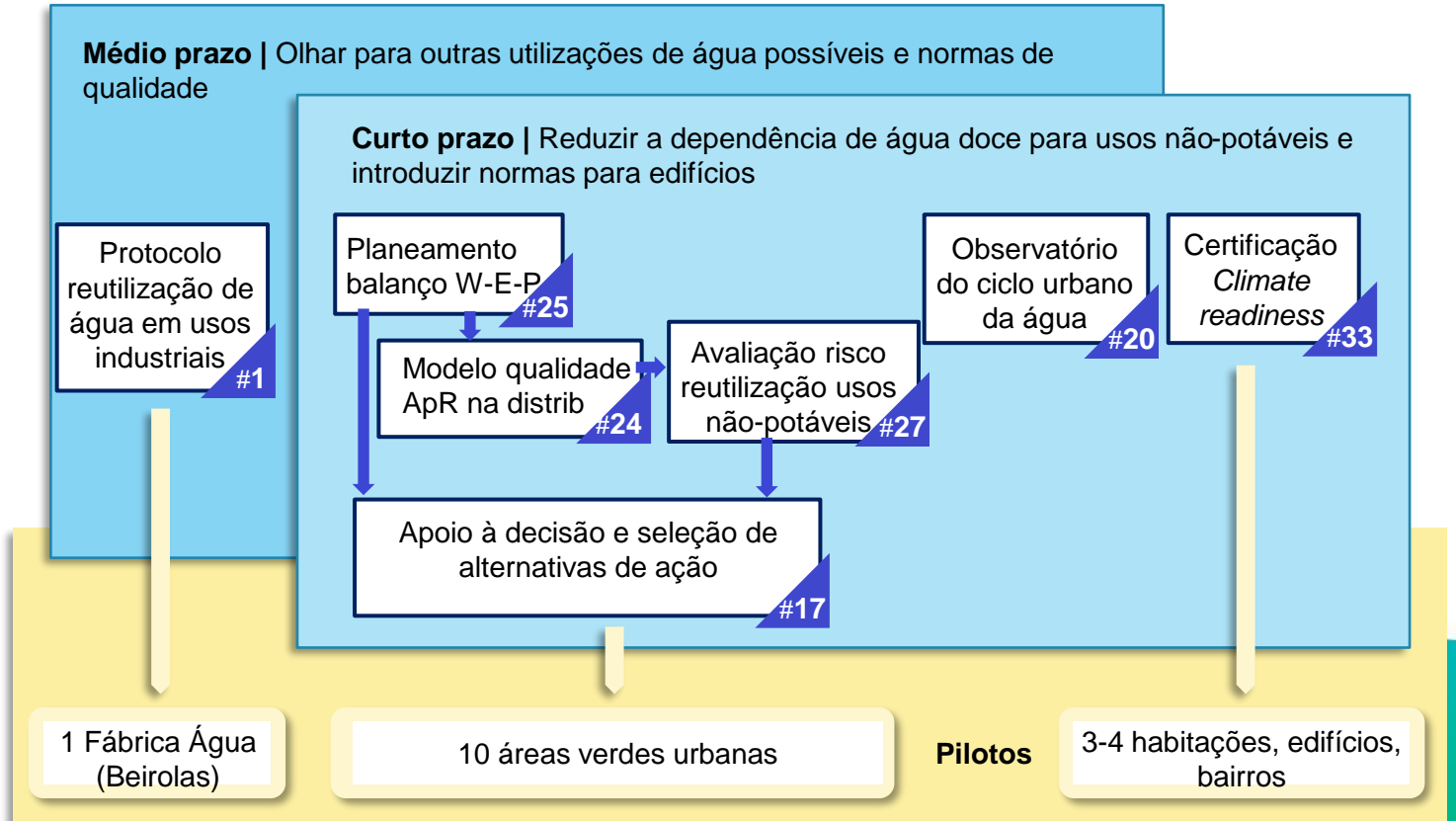


Objective	Measure	Target	Actual	Score
Water smartness	A.1.1.1.1.1	100%	100%	5
	A.1.1.1.1.2	100%	100%	5
	A.1.1.1.1.3	100%	100%	5
	A.1.1.1.1.4	100%	100%	5

Table 13 - Strategic indicators framework

Objective	Measure	Target	Actual	Score
Water smartness	A.1.1.1.1.1	100%	100%	5
	A.1.1.1.1.2	100%	100%	5
	A.1.1.1.1.3	100%	100%	5
	A.1.1.1.1.4	100%	100%	5

LV Lisboa | soluções



LV Lisboa | soluções



Lisbon LL #1 Water reclamation protocol for potable water reuse in beverage industry

D. Figueiredo, R. Viegas, S. Chantus, E. Mesquita, M. Campinho, Carla Costa, R. Loureiro, M.J. Rosa

ADTA - Agência de Águas de Lisboa
 I-UEG - Instituto de Urbanismo e Geografia - Universidade Nova de Lisboa

Objectives

- To define an evaluation protocol for water reuse in the beverage industry in Lisbon (Portugal) (2019)
- Compare the implementation of the Water Cycle (WC) model against the current situation
- For projects and studies on recycling water for industrial and domestic consumption
- Define a regulatory model for water reuse in the WC model

Expected Social, Environmental & Economic Impacts

- Reduce the water consumption in the beverage industry, contributing to the reduction of water costs and the impact on the environment
- Reduce the water consumption in the beverage industry, contributing to the reduction of water costs and the impact on the environment
- Reduce the water consumption in the beverage industry, contributing to the reduction of water costs and the impact on the environment

Pilot at AdTA's Beirolos WRRF

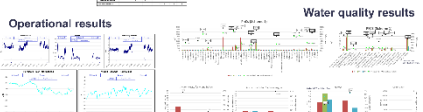


Figure 1: Water consumption in Lisbon



Lisbon LL #20 solution to facilitate access to urban water cycle data at city level and single user level

Rui Mendes, Rui Dires, Eduardo Silva

General description

The Lisbon Water Cycle Observatory is a data observatory platform to monitor and optimize performance, allowing urban practitioners to make better decisions. Following the motto "to know is to manage" the Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Top-down approach tool

This tool provides a top-down approach to the water cycle, allowing urban practitioners to monitor and optimize performance. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Bottom-up approach tool

This tool provides a bottom-up approach to the water cycle, allowing urban practitioners to monitor and optimize performance. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Water efficiency indicators



Figure 2: Water consumption in Lisbon

Figure 3: Water consumption by user level



Lisbon LL #33 solution to promote climate adaptation in buildings

P. Cardoso, S. Ramêdes, M. Simões, P. Dias, F. Newton, J. Fernandes

Concept

The Climate Ready Calculator (CRC) is a tool to assess the climate adaptation potential of buildings. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Methodology

The methodology involves the use of the Climate Ready Calculator (CRC) to assess the climate adaptation potential of buildings. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Benefits

The benefits of the CRC include the ability to assess the climate adaptation potential of buildings. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Water efficiency indicators



Figure 4: Climate Ready Calculator (CRC) interface

Figure 5: Climate Ready Calculator (CRC) interface



Lisbon LL #17, 24, 25 & 27 tools to increase the use of fit-for-purpose water in urban non-potable uses

R. Ribeiro, R.M. Viegas, D. Vilhinho, D. Andrade, S.T. Coelho, P. Teixeira, M.J. Rosa

Water Smart Allocation

The Water Smart Allocation tool is designed to optimize water allocation in urban non-potable uses. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Tool #25 Water-Energy-Phosphorus balance planning

Tool #25 is a tool for water-energy-phosphorus balance planning. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Tool #24 Reclaimed water quality model in the distribution network

Tool #24 is a model for reclaimed water quality in the distribution network. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Tool #27 Risk assessment for urban water reuse

Tool #27 is a risk assessment tool for urban water reuse. It allows the visualization of the water cycle in the city. The Observatory stores, organizes and disseminates information on the water cycle in the city. The Observatory enables the visualization of the water cycle in the city.

Figure 6: Water Smart Allocation tool interface

Figure 7: Water Smart Allocation tool interface



Lisbon LL # 1 Water reclamation protocol for potable water reuse in beverage industry

D. Figueiredo¹, R. Viegas², S. Charrua^{1,2}, E. Mesquita², M. Campinas², Carla Costa³, R. Lourinho¹, M.J. Rosa²

¹ AdTA — Águas do Tejo Atlântico

² LNEC—National Laboratory for Civil Engineering ³ Moinhos Água e Ambiente



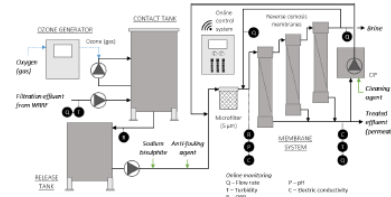
Objectives

- To deliver and showcase a protocol for safe water reuse in artisanal craft beer production → Direct Potable Reuse (DPR)
- Compare different pretreatments of Reverse Osmosis (RO) towards operational performance and water quality
 - for pathogens and chemicals, including conventional and emerging contaminants
 - advanced analytical monitoring - new Directive EU 2020/2184 on drinking water + pharmaceutical compounds + PFAS + coliphages

Expected Social, Environmental & Economic impacts

- Presenting to society artisanal beer produced with reclaimed water contributes to the public awareness on water scarcity and the public engagement and acceptance on water reuse
- Introducing a rainwater-independent water source contributes to increase the industry resilience to climate change
- RO desalted and dechlorinated water is advantageous for beverage industry, e.g. beer and soft-drinks' production

Pilot @ AdTA's Beirolas WRRF



- Design conditions**
- 3 stage RO (2:1:1) with concentrate recirculation
 - 2 membranes per pressure vessel
 - Hydranautics CPAS-LD-4040 membranes
 - Total membranes (8) area 60 m²
 - Water recovery 70%
 - Feed flowrate: 1.8 m³/h; Permeate flowrate: 0.55 m³/h
 - Ozone dosing 0-5 mg/L (0.1 m³/h, 90 g/m³)



Expresso50

Publicado

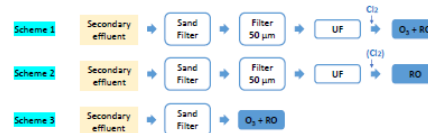
A água tratada de esgoto poderá ser servida à mesa no futuro



Desenvolvimento de moinhos de Água de esgoto para consumo industrial na Fabrika de Água de Beirolas. ESTOR, as Águas do Tejo Atlântico, 2017

Nalguns locais do mundo já o é, como em Singapura. Em Portugal ainda se está na fase de investigação e de projetos piloto a pensar em alternativas para enfrentar um futuro onde a escassez de água se vai acentuar

Research Plan



Monitoring

Operational control



Operational Control	Regular analytical monitoring		Extended Analytical Monitoring	
	Frequency	Method	Frequency	Method
Conductivity	Continuous	Standard	Continuous	Standard
Turbidity	Continuous	Standard	Continuous	Standard
ORP	Continuous	Standard	Continuous	Standard

Analytical control

LV Lisboa | soluções

Instrumento de visualização de dados para monitorizar e comunicar o desempenho, apoiar o planeamento e a tomada de decisão, seguindo o lema “**conhecer para reduzir**”.

Observatório do Ciclo Urbano da Água de Lisboa:

- **Abordagem top-down:** informação clara e acessível, dados anuais de água e águas residuais
- **Abordagem bottom-up:** permite a análise dos dados de consumo de água de instalações



Lisbon LL #20 solution to facilitate access to urban water cycle data at city level and single user level

Rui Mendes¹, Rui Dinis¹, Eduardo Silva¹

General description

The Lisbon Urban Water Cycle Observatory is a data visualization instrument to monitor and communicate performance, support urban planning and decision making. Following the motto “to know so to reduce”, the Observatory covers water and wastewater dimensions, as well also other environmental dimensions of the city.

This Observatory includes two complementary tools:

- Top-down approach tool, with open data information of the water and wastewater city dimensions
- Bottom-up approach tool, for individual entities to integrate and analyse, via a set of analytics, the water consumption data of their facilities

Top-down approach tool

The top-down approach privileges the use of infographics with creative data to build awareness, engage and empower citizens.

It provides information on the city's water matrix, on an annual basis, regarding main water flows, consumption disaggregation by type of water source (potable and alternative water sources, including reclaimed water), by type of use and by type of user, per capita indicators, amount of treated wastewater and reclaimed water production.

This accessible, comprehensive, and clear data allows citizens and city stakeholders to be informed, to know their impact and feel motivated to participate and act towards increasing efficiency, assessing the impact of implemented policies, monitoring the benefits of behaviour changes and, consequently, continue the path towards the sustainable transition.

https://observatorios-lisboa.pt/en/info_agua.html
https://observatorios-lisboa.pt/en/info_aguasresiduais.html

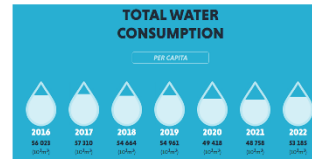


Figure 2. Water consumption of Lisbon



Figure 1. Lisbon Observatories platform

Bottom-up approach tool

It is a web application integrating water consumption of user's facilities, with several characteristics and also a set of data analytics to the data for a deeper understanding of use of water.

This tool has bottom-up approach, since it is aimed at single entities to monitoring and analyse their water consumption. It allows visualization of water consumption per facility and its evolution, aggregation in categories per type of use, water source, associated costs, performance indicators, identify water efficiency opportunities/ measures and monitor their impacts after implementation.

The tool also allows to perform individual analysis per facility, which can be more detailed depending on the frequency of available data per water meter, integrating monthly, daily or quarter-hour data. Users can generate automatic performance reports based on all the data analytics presented for each facility and also set up the analysis of customised alerts for specific consumption levels for each facility.

<https://privado.observatorios-lisboa.pt/dashboards/>

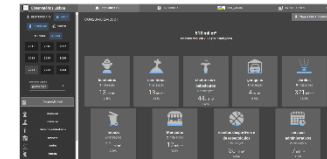


Figure 3. Water consumption per type of use



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017717. This publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.



LV Lisboa | soluções

O sistema de certificação "**Climate-Ready Certification**" (CRC) avalia num certificado três dimensões, fornecendo uma análise de desempenho transversal que permite considerar e adotar medidas de eficiência hídrica e de adaptação climática.

- **3 dimensões:** eficiência hídrica / nexus água-energia / adaptação climática
 - **3 escalas:** fração / edifício / quarteirão
 - **3 etapas:** projeto, construção, utilização
- Metodologia com 109 critérios de avaliação.

Lisbon LL #33 solution to promote climate adaptation in buildings

P. Cardoso¹, S. Remédios¹, M. Simões¹, P. Dias¹, F. Newton¹, J. Fernandes¹

¹ ADENE - Agência para a Energia

Concept

The Climate-Ready Certification (CRC) scheme assesses in one certificate three dimensions: water efficiency, water-energy nexus, and climate adaptation, providing a transversal performance analysis that allows for the consideration and adoption of water efficiency and climate adaptation measures.

It can be considered in the different stages of the building:

- Design phase;
- New construction;
- Operation.

It can be applied to residential, small service or commercial buildings, as well as to 'neighbourhoods', considering buildings and outdoor areas.

The classification identified in each CRC varies from F (less efficient) to A+ (most efficient). It encompasses one global classification and three sub-classifications related to each evaluated dimension.

CRC builds on and expands from the existing efficiency rating scheme, AQUA+0, developed by ADENE, which focuses on water efficiency and energy-related consumption, deepening the water-energy nexus analysis and adding climate adaptation evaluation criteria.

Methodology

The methodology has 109 evaluation criteria: 57 criteria distributed per five categories for assessing water efficiency, 33 criteria distributed per eight categories for the water-energy nexus, and 19 criteria distributed per three categories for the climate adaptation dimension.

Water efficiency categories:

Alternative water sources and water distribution; Outside uses; Fixtures; Devices (washing machines); and Domestic hot water system (DHW).

Water energy nexus categories:

Alternative water sources; Water distribution and building networks; Irrigation (soils, green roofs, green facades); Swimming pool; Fixtures; Devices (washing machines); Domestic hot water system (DHW); and Energy Monitoring and control.

Climate adaptation categories:

Local Policies and Strategy; Project Area; and Project Response.

The applicability of the criteria is adaptable to different scales of the project: household, building and neighborhood. However, some of the criteria are not applicable to the households and outdoor spaces analysis. The methodology has closed questions, that can be answered by a single option, multiple options or percentages.

So far, the methodology has been tested in the Lisbon area: one neighborhood, three buildings, four detached houses and thirteen households/dwellings in multi-family.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101017174. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.



Figure 1. The Climate Ready Certificate's first page template.

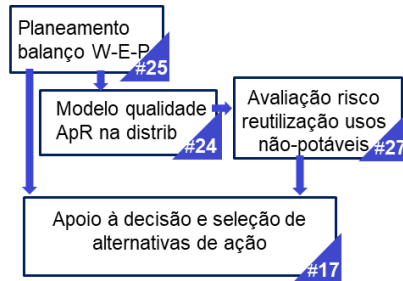
Benefits

Through CRC, the different stakeholders, from policymakers to urban planners, building developers and property owners, are aware of the building's performance, benefiting from a robust decision support tool in the different phases of the project.

In resume, CRC guides adopting improvement measures that leverage the development of water-resilient and climate-adapted buildings, contributing to the sustainable climate transition of cities.

LV Lisboa | soluções

Utilização integrada de soluções para apoio a instituições de gestão urbana e serviços de fornecimento de água das cidades na tomada de decisões inteligentes e resistentes às alterações climáticas no domínio da água, com vista a um **balanço eficiente entre água, energia e nutrientes** (fósforo), incluindo a **reutilização segura de água**.



Lisbon LL # 17, 24, 25 & 27 tools to increase the use of fit-for-purpose water in urban non-potable uses

R. Ribeiro¹, R.M. Viegas¹, D. Vitorino², D. Andrade², S.T. Coelho², P. Teixeira³, M.J. Rosa¹

¹ National Laboratory for Civil Engineering ² Baseform ³ Lisbon Municipality

WATER SMART ALLOCATION

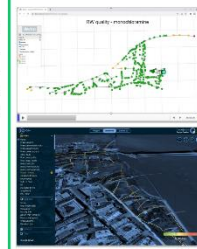
Tool #25 Water-Energy-Phosphorus balance planning

A user-friendly solution for **matchmaking water sources** (potential supplies) and **water demands**, enabling the design of supply chain solutions (the shorter and more circular the better) to a set of potential users of non-potable water, namely, reclaimed water and other water sources alternative to those currently in use. The supply/demand alternative combinations (matches) over a target period are assessed through a range of performance and cost metrics, for supporting strategic and tactical (aligned) planning (e.g., satisfied demand, reclaimed water used, carbon footprint of energy consumption, P-fertilizer production avoided, total cost).



Tool #24 Reclaimed water quality model in the distribution network

A complete hydraulic and water quality extended-period simulation model for pressure flow networks. By modelling the (bulk and wall) decay of the residual chlorine, the key barrier for water microbial stability, it aims primarily at mapping and quantifying risk in reclaimed water distribution networks. It is compatible with EPANET file formats.



Tools' integrated use for supporting urban management institutions and water utilities in making smart and climate-resilient water decisions for an efficient water-energy-nutrient balance in the city including safe water reuse

Tool #27 Risk assessment for urban water reuse

A user-friendly solution for carrying out **human health and environmental (groundwater and surface water) risk assessments**, requiring a basic knowledge of risk management and the legislation applicable to water reuse. The process for risk assessment is based on relevant ISO standards and EU Regulation. A methodology for building hazard exposure scenario developed from scratch.



Tool #17 Environment for decision support and selection of alternative courses of action

The supply/demand alternative combinations are assessed and prioritized through a subset of standardized, user-selected key metrics, extracted from those employed to qualify the initial selection in #25 and the risk in #24 and #27. To ensure the alignment of decisions for improving water supply/demand management with the Lisbon LL Strategy, the metrics correspond as much as possible to metrics integrated in the BWS Assessment Framework (Tool #34).

W
O
R
L
D
C
I
T
I
E
S
S
A
F
E
W
A
T
E
R

... in distribution systems

... at places of use

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101017717. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.



#25 Planeamento do balanço água-energia-fósforo



LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

baseform



Correspondência (**matchmaking**) entre diferentes origens de água (ApR, subterrânea, nascente e potável) e usos não-potáveis de água na cidade (e.g., rega de jardins).

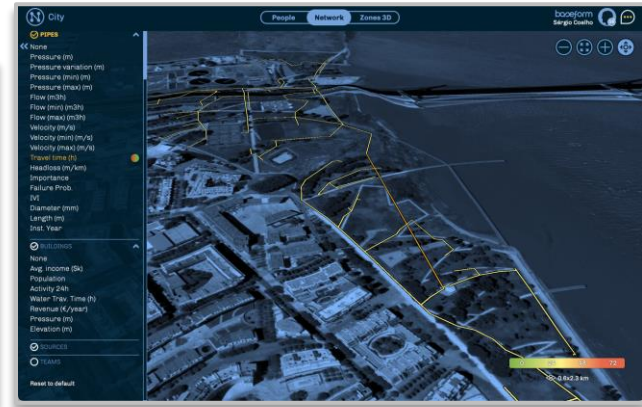
As alternativas oferta/procura são avaliadas através de métricas de desempenho e custo, para apoiar o planeamento estratégico e tático (e.g., satisfação da procura, ApR utilizada, pegada de carbono do consumo de energia, produção evitada de fertilizante (fósforo), custo total).

The screenshot displays the B-WaterSmart software interface, which is used for matchmaking analysis. It shows a central map of Lisbon with various water and energy sources and demands marked. The interface is divided into several panels:

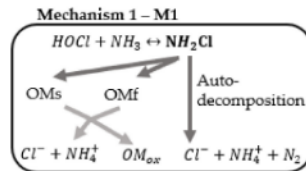
- Supply Panel:** Shows a list of water supplies, including 'RECLAIMED_WATER' (Class A RL119/2019) and 'PARK' (Parque Eduardo VII de Inglaterra).
- Demand Panel:** Shows a list of demands, including 'PARK' (Parque Eduardo VII de Inglaterra) and 'JARDIM' (Jardim Amália Rodrigues and Jardim da Amnistia Internacional).
- Matchmaking Analysis Panel:** Displays a table of 'MATCHMAKING ALTERNATIVES' with columns for 'Baseline', 'Investment cost', 'Monthly cost', 'Energy cost', 'Carbon footprint', and 'Phosphorus'. It lists various water uses and their associated costs and carbon footprints.
- Matchmaking Alternative - Circular economy Panel:** Shows a detailed view of a specific matchmaking alternative, including a 'DEMAND SATISFACTION' table and a list of 'INDICATORS' such as 'Satisfied demand (%)', 'Reclaimed water used (%)', 'Energy consumption (kWh/m³)', and 'Carbon footprint of energy consumption (kg CO2eq/m³)'. It also includes a 'VARIABLES' table with metrics like 'Water consumption (demand) (m³/month)' and 'Drinking water used (m³/month)'. The interface also features a 'SERIES: WATER' graph showing water consumption over time and a 'SERIES: PHOSPHORUS' graph showing phosphorus production over time.

#24 Modelo de qualidade da ApR na rede de distribuição

Modelo de simulação hidráulica e da qualidade da água em redes de distribuição de água em pressão (implementação em EPANET). Permite mapear e quantificar o risco para a saúde humana nas redes de distribuição de água para reutilização (residual de cloro = barreira chave para a estabilidade microbiana da água).



Modelo da qualidade da água / **decaimento de cloro** no seio da água e na parede das tubagens →



Article

Identification and Modelling of Chlorine Decay Mechanisms in Reclaimed Water Containing Ammonia

Joana Costa ^{1,2}, Elsa Mesquita ¹, Filipa Ferreira ², Maria João Rosa ¹ and Rui M. C. Viegas ^{1,*}

#27 Avaliação do risco na reutilização da água em usos não potáveis – risco para a saúde

Avaliação do risco para a saúde humana associado à reutilização de água em usos não potáveis na cidade, com base na **normalização internacional** (e.g., ISO 20426:2018) e no **regulamento europeu 741/2020** e em articulação com o **DL 119/2019**.

EXPOSURE SCENARIO	HAZARD	RISK EVALUATION	RISK EVALUATION
Scn1	Pathogenic bacteria - Legionella	MODERATE	LOW
Scn2	Pathogenic bacteria - Legionella	MODERATE	LOW
Scn3	Pathogenic bacteria - Legionella	LOW	LOW
Scn4	Pathogenic bacteria (indicator) - ...	MODERATE	LOW
Scn5	Pathogenic bacteria (indicator) - ...	LOW	LOW
Scn6	Pathogenic bacteria (indicator) - ...	LOW	LOW
Scn7	Pathogenic bacteria (indicator) - ...	MODERATE	LOW
Scn8	Pathogenic bacteria (indicator) - ...	MODERATE	LOW



Demand Risk Assessment - Parque Eduardo VII de Inglaterra

CREATE SCENARIO

1. RISK IDENTIFICATION

Hazards	Pathogenic bacteria: Legionella
Exposure routes	Inhalation
Exposure sites	Zone: Lawns
Population at risk	Users : Immature immune system
Activity	Using the green area
hazardous events	Manual watering without the use of PPE

Metodologia para a **construção de cenários de exposição** aos perigos desenvolvida de raiz.

#27 Avaliação do risco na reutilização da água em usos não potáveis – risco para as águas subterrâneas

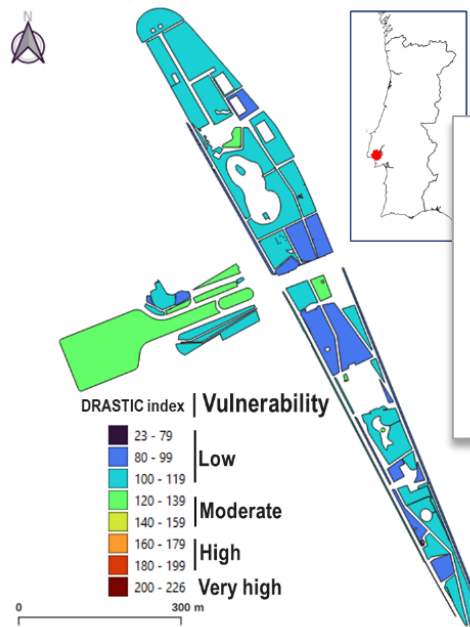
Campo Grande garden and Alameda da Universidade de Lisboa site

Risk matrix of contamination of groundwater using Reclaimed Water		Consequences (Aquifer vulnerability to contamination – DRASTIC index)			
		Low (<120)	Moderate (120-159)	High (160-199)	Very high (>199)
Likelihood of the exposure of the receptor to the risk source (harmful effect of the contaminant load)	Reclaimed Water: $\text{NH}_4^+ \leq 0.5 \text{ mg/L}$ and total N $\leq 10.9 \text{ mg/L}$	1	1	1	1
	Other cases	1	1	2	3

Risk of contamination

1 – low
2 – average
3 – high

LOW RISK OF GROUNDWATER CONTAMINATION USING RECLAIMED WATER



Low			Moderate		High		Very high
23 - 79	80 - 99	100 - 119	120 - 139	140 - 159	160 - 179	180 - 199	200 - 226
0	21%	56%	23%	0	0	0	0

13.º Seminário sobre Águas Subterrâneas
O papel das Águas subterrâneas na sustentabilidade das cidades do século XXI

28 e 29 de abril de 2022

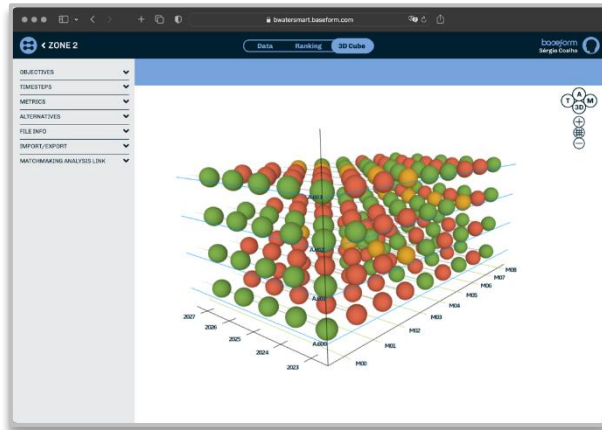
Universidade de Lisboa, Instituto Superior Técnico, Departamento de Engenharia Civil, Arquitectura e Desenhados (DECAD)

GROUNDWATER RISK OF CONTAMINATION USING RECLAIMED WATER (RW) IN THE IRRIGATION OF THE CAMPO GRANDE GARDEN AND ALAMEDA DA UNIVERSIDADE DE LISBOA, IN LISBON – A CONTRIBUTION OF THE B-WATERSMART PROJECT

Manuel M. OLIVEIRA¹, Teresa E. LEITÃO¹, Tiago N. MARTINS¹, Rita RIBEIRO¹, Maria João ROSA¹, Cláudia PINTO², Alexandra HENRIQUES²

1. Laboratório Nacional de Engenharia Civil, Av. do Brasil 101, 1700-066 Lisboa, moliveira@lnec.pt, tleitao@lnec.pt, tmartins@lnec.pt, rribeiro@lnec.pt, mjrosa@lnec.pt
2. Câmara Municipal de Lisboa, Campo Grande 25, 2.º E, 1749-099 Lisboa, claudia.pinto@cm-lisboa.pt, alexandra.henriques@cm-lisboa.pt

#17 Ambiente para apoio à decisão e seleção de alternativas de ação



Avaliação e priorização das combinações de alternativas de oferta/procura de água através de um subconjunto de métricas-chave padronizadas e selecionadas pelo utilizador, extraídas das utilizadas para qualificar a seleção inicial das alternativas na ferramenta #25 e o risco nas ferramentas #24 e #27.

Alinhamento das decisões de melhoria da gestão da oferta/procura de água **com a Estratégia de Lisboa** assegurada através de métricas que correspondem, tanto quanto possível, às métricas integradas no Quadro de Avaliação da BWS (Ferramenta #34).

CML Pedro Teixeira (*LL owner*), Fátima Neo, Catarina Freitas, Maria João Telhado, Pedro Oliveira, Rui Simão, José Canêdo, Marina Perdigão, Hélder Dias

LNEC Maria João Rosa (*LL mentor*), Rita Ribeiro, Rui Viegas, Margarida Campinas, Elsa Mesquita, Vítor Napier, Manuel Oliveira, Teresa Leitão, Tiago Martins, Catarina Silva, Helena Alegre, Maria Adriana Cardoso, Margarida Rebelo

AdTA David Figueiredo, Rita Lourinho

LEN Rui Mendes, Rui Dinis, Eduardo Silva

BASEFORM Sérgio Teixeira Coelho, Diogo Vitorino, Diogo Andrade

ADENE Pedro Cardoso, Joana Fernandes, Filipa Newton, Sílvia Remédios, Mariana Simões

ICS Luísa Schmidt, Carla Gomes, Marcella Melo

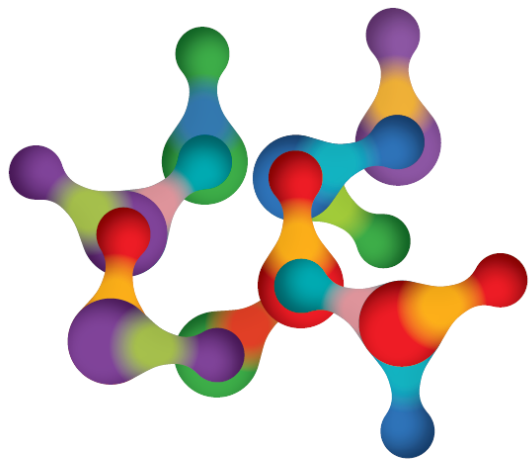


Lisbon Living Lab

EQUIPA



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869171. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.



LNEC LISBON CONFERENCE

Floods, water scarcity and extreme events 2023

LNEC Congress Centre | Lisbon | Portugal | 19-20 October

[Ineclisbonconference.lnec.pt](https://ineclisbonconference.lnec.pt)

Participação gratuita
Inscrição obrigatória

Participem!