FRAME

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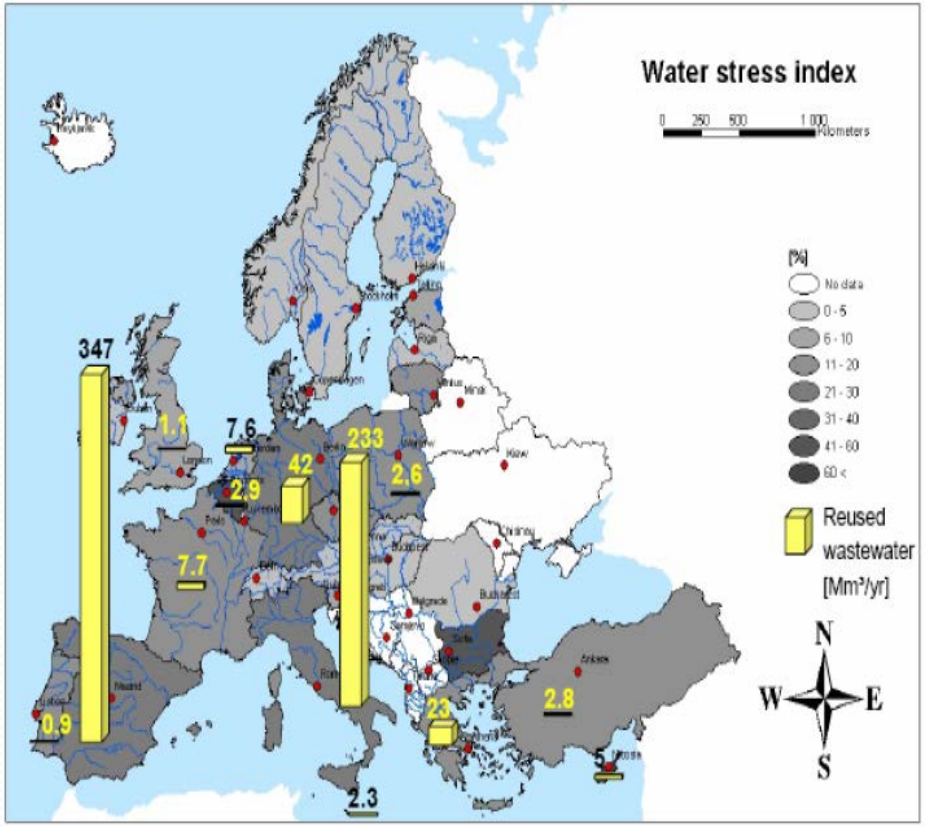
Water JPI
Pilot Call Kick-off meeting
11th of March 2015, Brussels

Water Reuse: EU activities

EC activities on water reuse could be accessed at
http://ec.europa.eu/environment/water/blueprint/follow_up_en.htm

Reuse of reclaimed water (2006)



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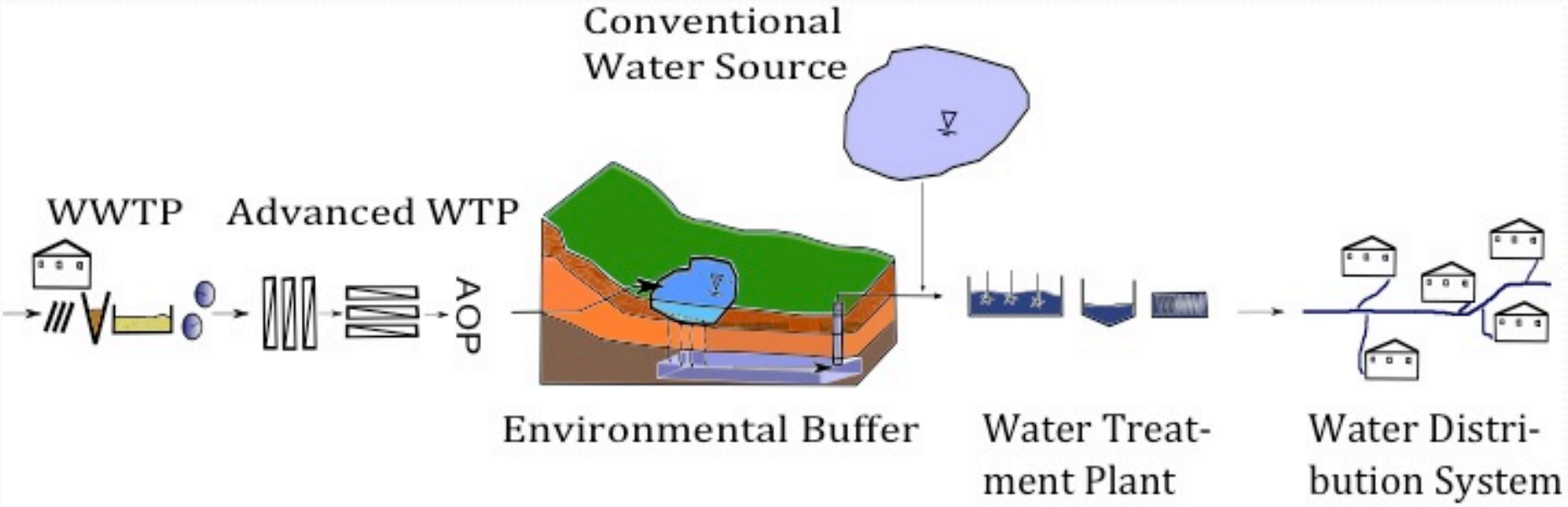
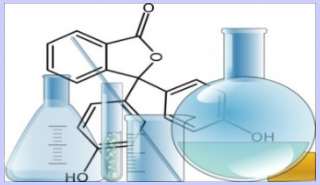
Indirect Potable Reuse (INPR)



Drewes and Horstmeyer (2015). Recent Developments in Potable Water Reuse. The Handbook of Environmental Chemistry. Emerging Challenges in Wastewater Reuse: Contaminants, Treatment, Effects. Springer.

Overal objectives of FRAME

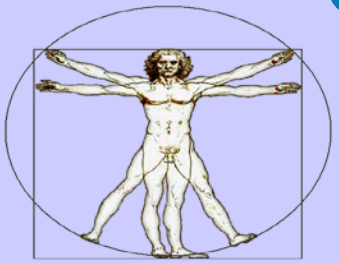
Development of an evaluation scheme for INPR to provide national & EU authorities with a reliable decision support tool for future implementations



analytical & modelling approaches

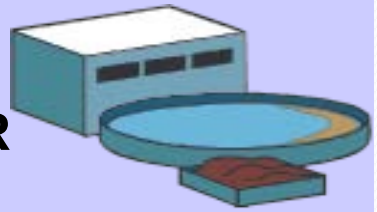
ecotoxicology

Detecting and mimimizing adverse human and environmental health effects

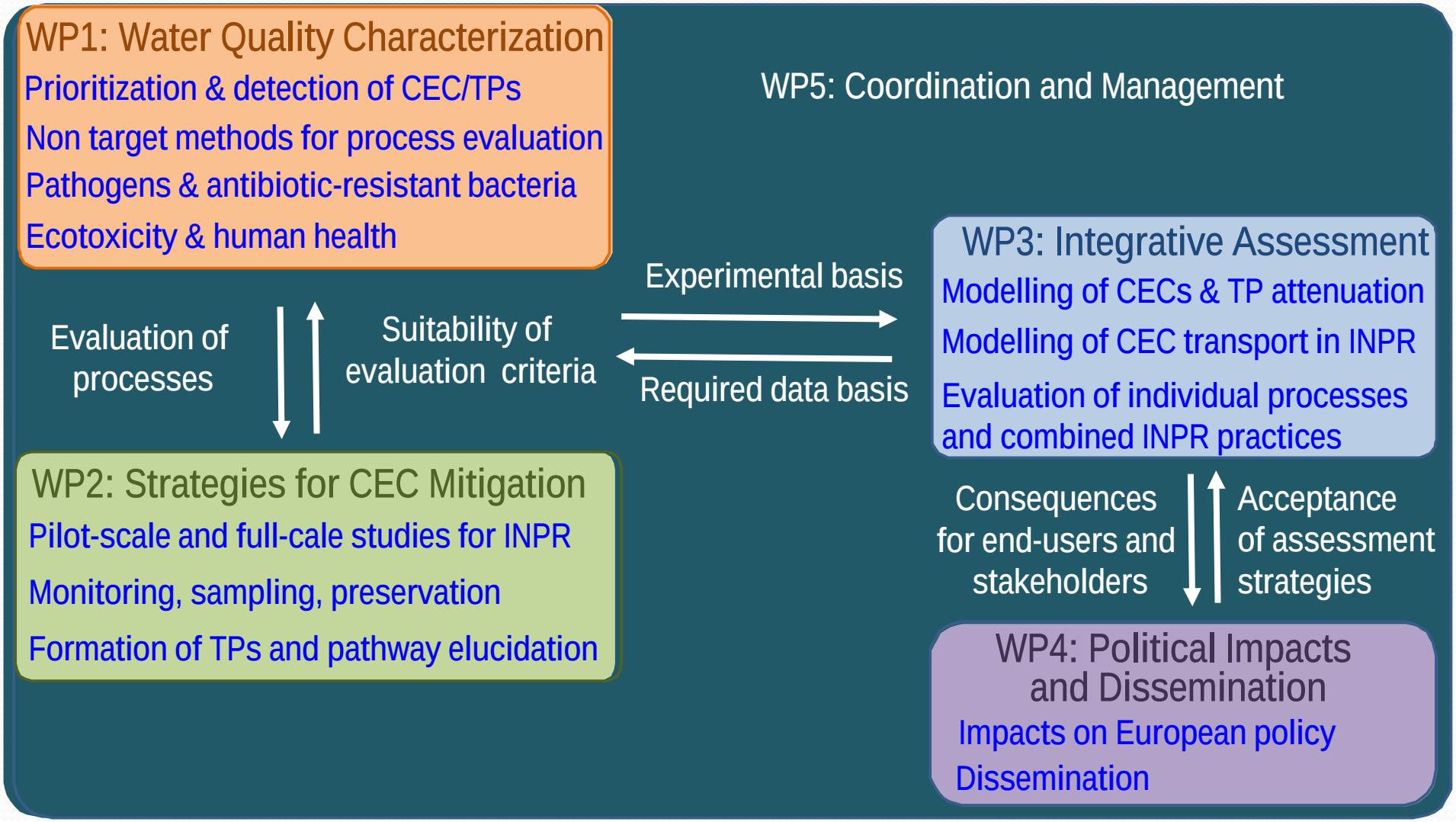


human toxicology

treatment processes for INPR

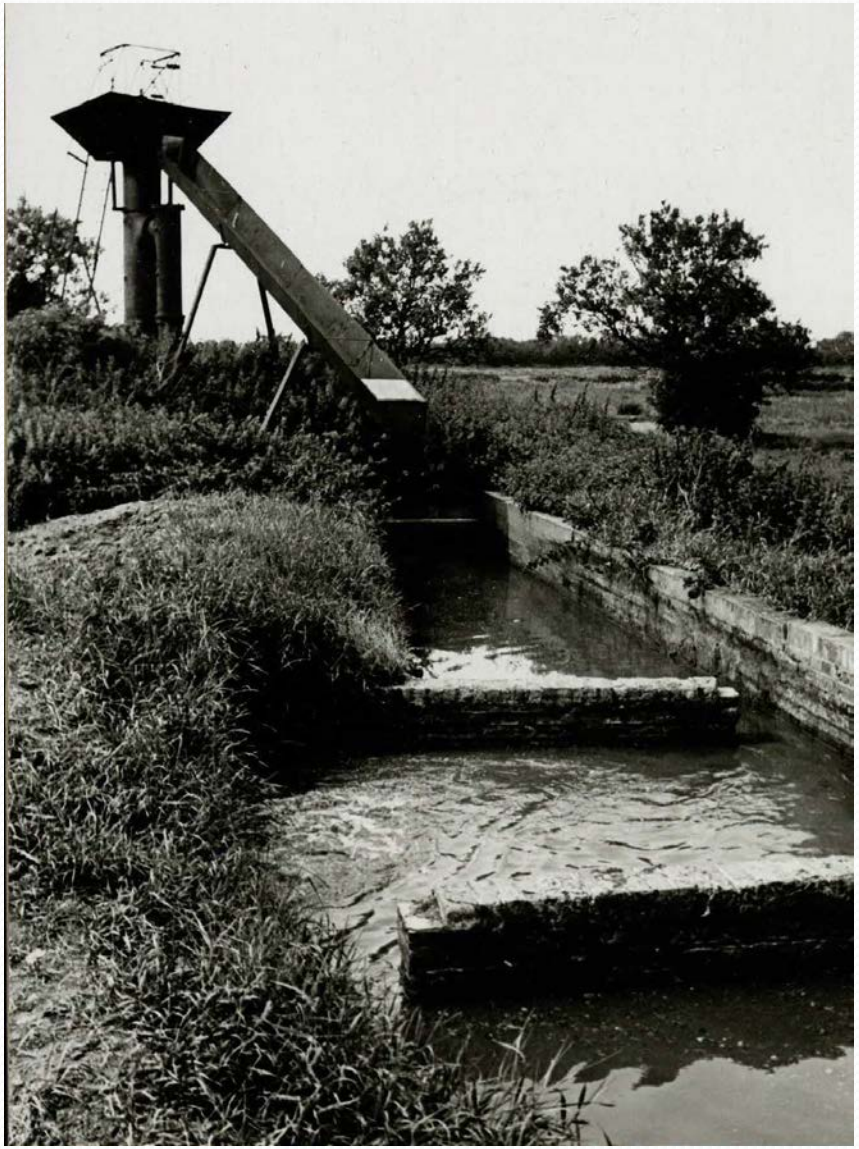


FRAME is structured in five WPs

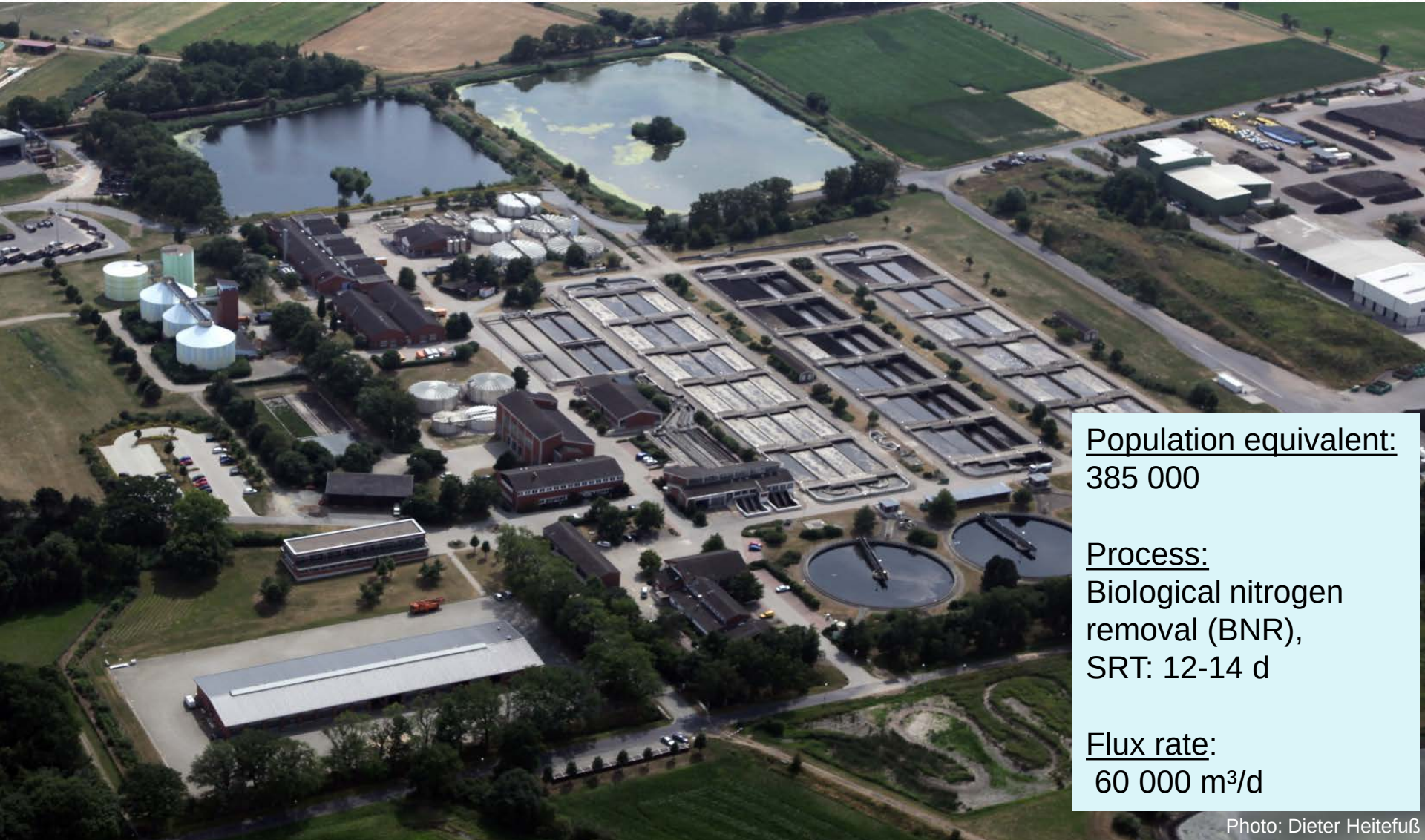


1900: Infiltration fields in Braunschweig

1900: Infiltration fields Braunschweig



2014: Wastewater treatment in Braunschweig



Population equivalent:
385 000

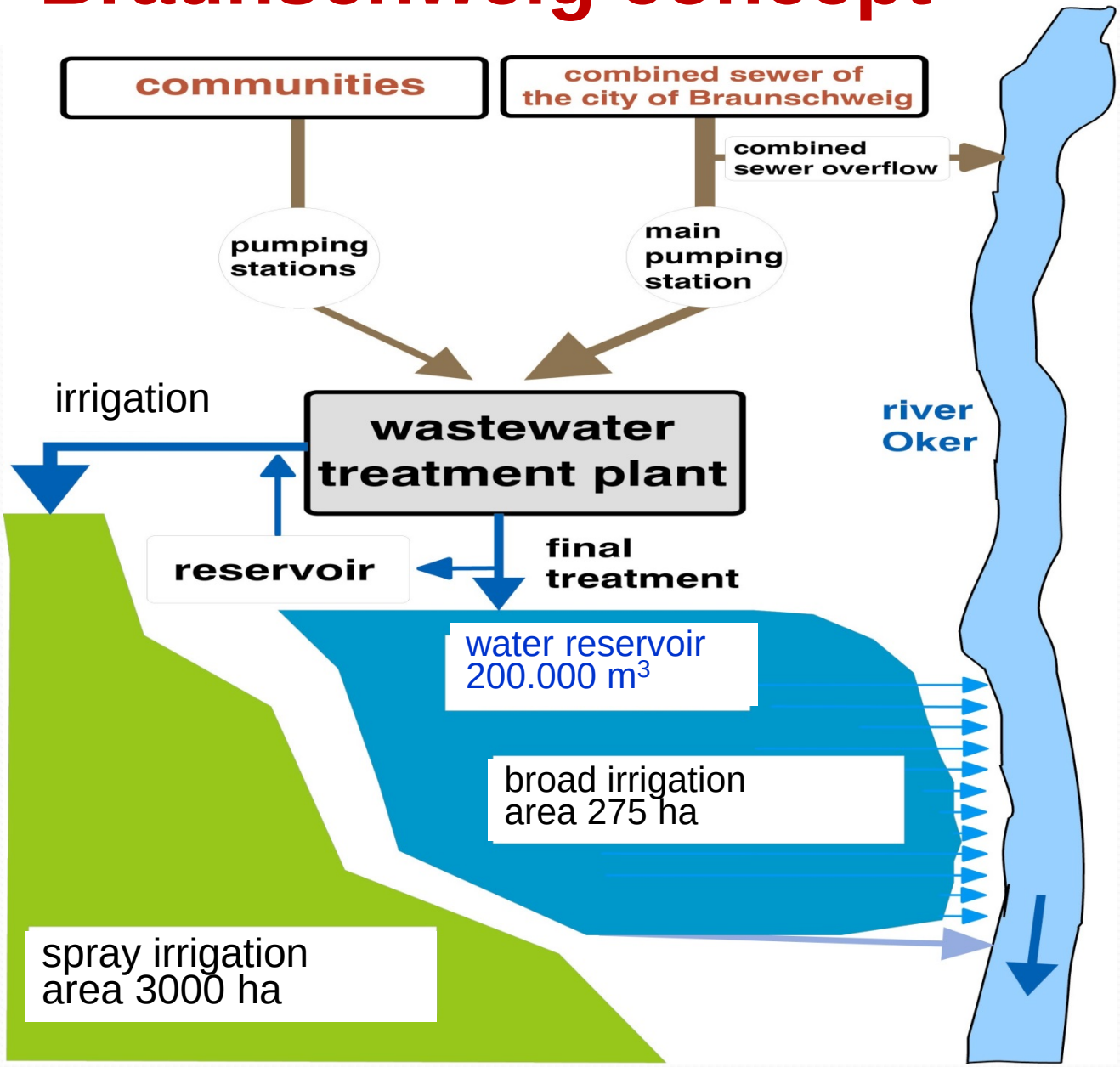
Process:
Biological nitrogen removal (BNR),
SRT: 12-14 d

Flux rate:
60 000 m³/d

Photo: Dieter Heitefuß

2014: Reservoirs in Braunschweig

Braunschweig concept



Water reuse in Llançà and Tossa de Mar

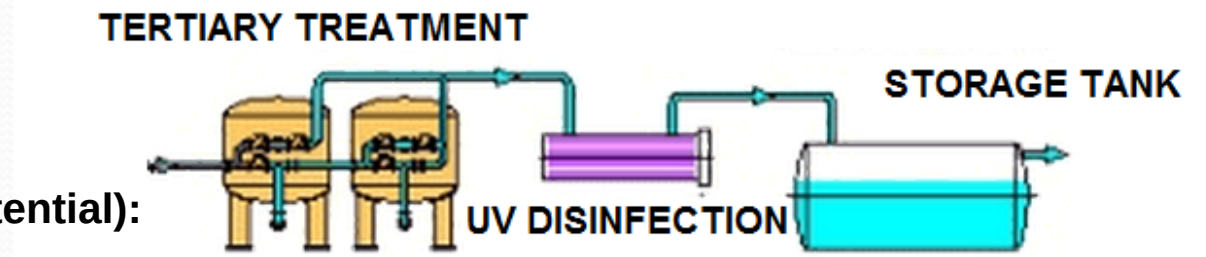
LLANCÀ Capacity: 25 m^3/h

Present reclaimed water uses:

Groundwater replenishment
to mitigate seawater intrusion.

Future reclaimed water uses (potential):

- Aquifer recharge upstream



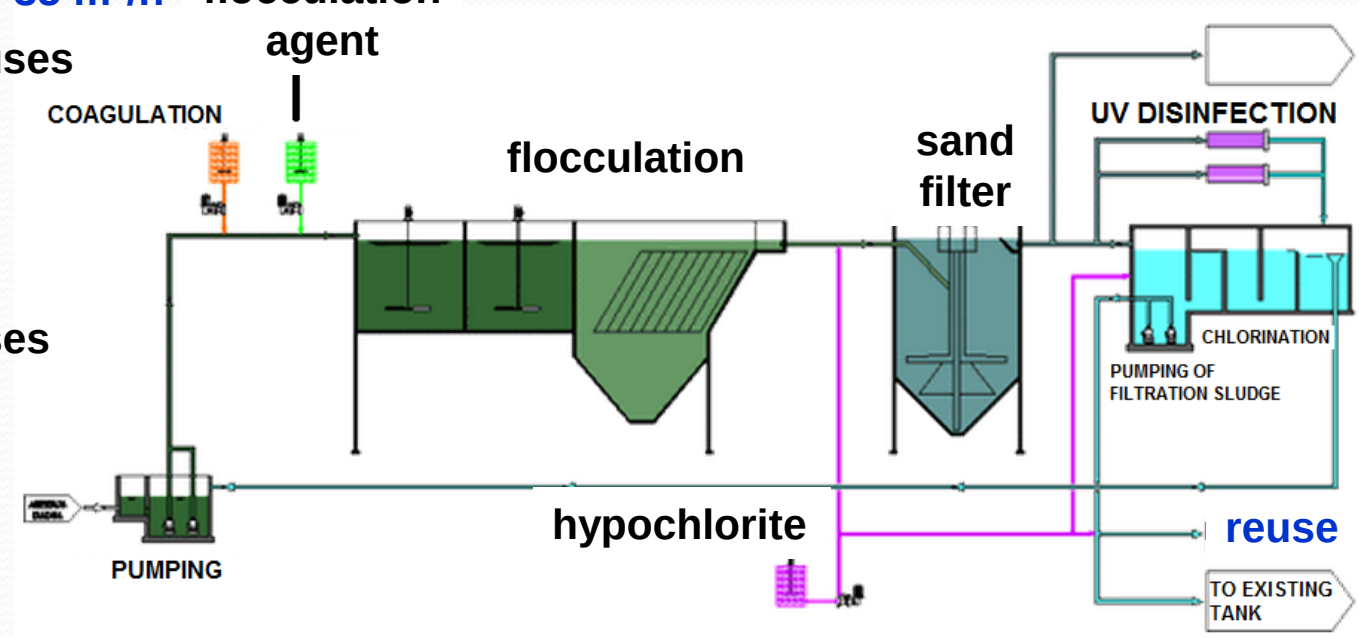
TOSSA DE MAR Capacity: 35 m^3/h

Present reclaimed water uses

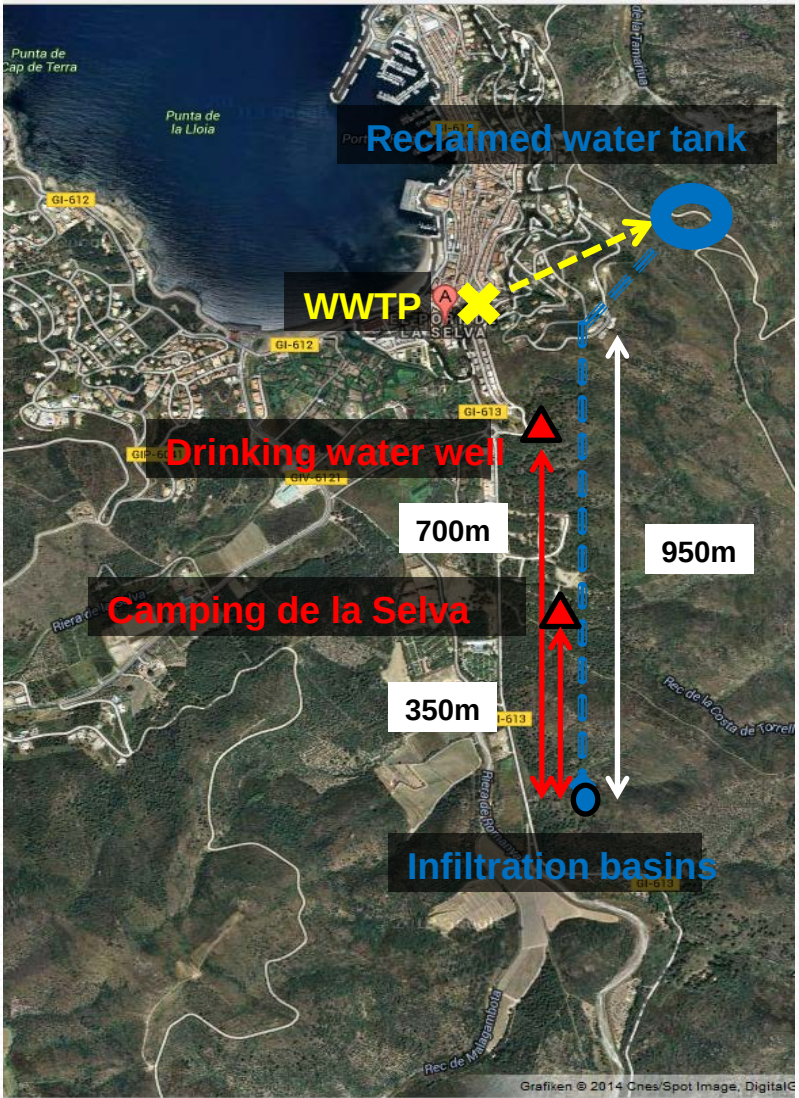
Urban landscape irrigation
non-potable urban uses
(street cleaning etc.)
streamflow augmentation

Future reclaimed water uses

irrigation of prívate gardens
indoor non-potable uses,
toilet flushing in public
buildings, hotels etc.)



Groundwater recharge and streamflow augmentation, Port de la Selva - DEMOWARE



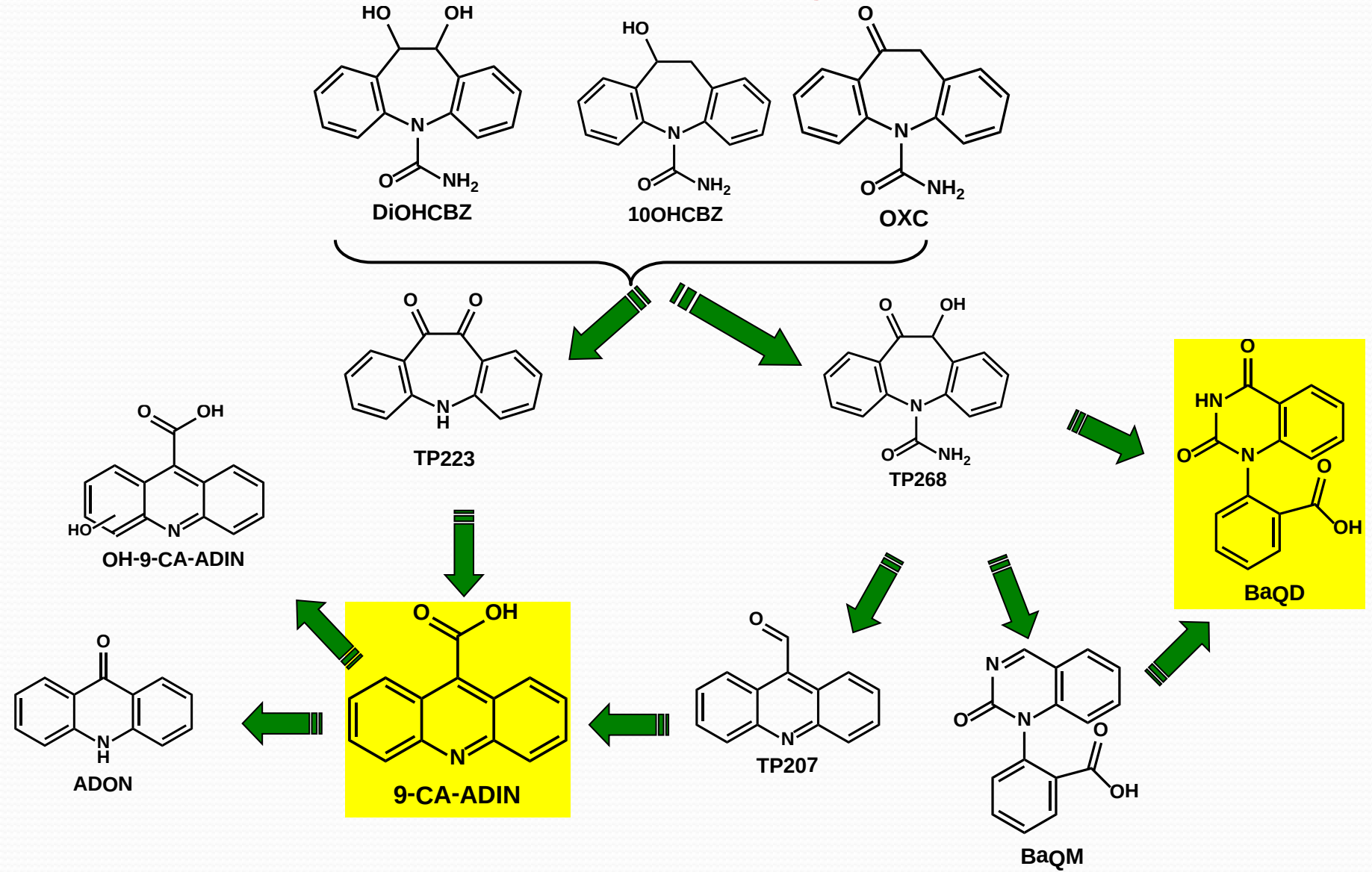
Component	System in El port de la Selva
Capture zone	WWTP El Port de la Selva
Pre-treatment	secondary treatment + coagulation filtration + UV-disinfection + Chlorination
Recharge	infiltration via constructed basins or riverbed
Subsurface storage	unconfined aquifer
Recovery	extraction from aquifer via 2 wells
Post treatment	chlorination
End use	drinking water supply

Source: Ulf Miehe, DEMOWARE project

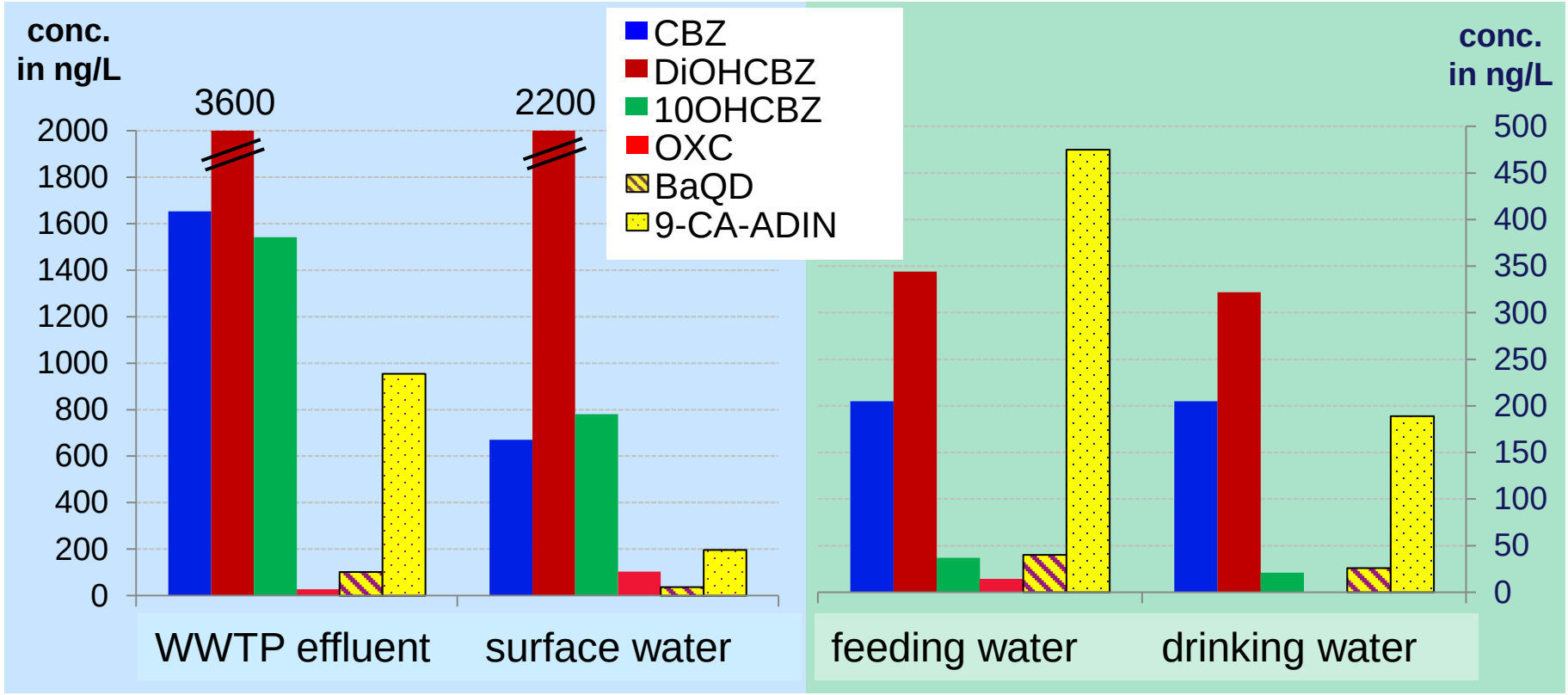
Evaluation criteria of FRAME for INPR (WP1)

- **Prioritizing representative chemicals of emerging concern (CECs) and their transformation products (TPs) as suitable indicators for assessing INPR**
- **Developing sensitive analytical multi-methods for CECs and their TPs**
- **Developing non-target methods for process evaluation**
- **Designing methodologies to assess inactivation or elimination of**
  - Fecal indicator bacteria (E. coli, enterococci)
  - Waterborne pathogens (P. aeruginosa, C. perfringens)
  - Antibiotic-resistant bacteria / genes
- **Assessing short- and long-term adverse impacts on ecology/human health (including viruses)**

Transformation pathway of Carbamazepine metabolites in aerobic biological active systems



Occurrence of Carbamazepine (CBZ), its human metabolites and TPs in wastewater, surface water and drinking water



Source: Kaiser et al., ES&T, **2014,** *48* (17), 10208-10216.

Modelling approach of FRAME (WP3)

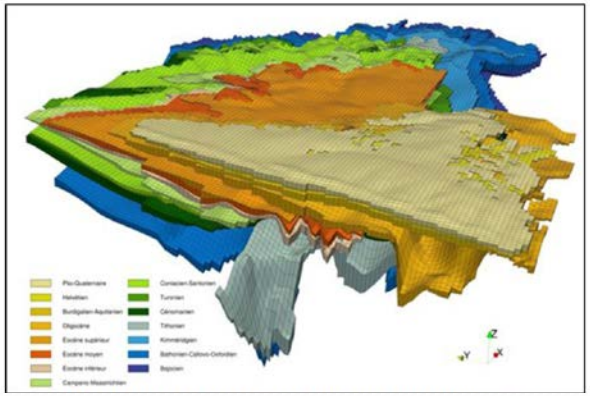
Combined treatment process models coupled with hydrodynamic models: MARTHE

- Establishment of conceptual site-specific model for one field scale study (unsaturated flow conditions; groundwater/river exchange…)
- Determination of appropriate level of resolution to properly describe contaminant attenuation at the system scale for INPR strategies

Modelling TOOLS

M A R T H E

MODELLING **A**QUIFERS WITH **R**ECTANGULAR CELLS, **T**RANSPORT AND **H**YDRODYNAMICS



Source: concept of BRGM

Political impacts and dissemination of FRAME (WP4)

a) **Transfer of knowledge to the stakeholders** to improve current technologies and approaches;

b) Disseminate the results of the project to the relevant **CIS WFD groups** (WGs measures, groundwater, chemicals).

c) Create a sustainable knowledge exchange network in the **scientific community**

Source: concept of IRSA, ISS

FRAME Handbook for Stakeholders

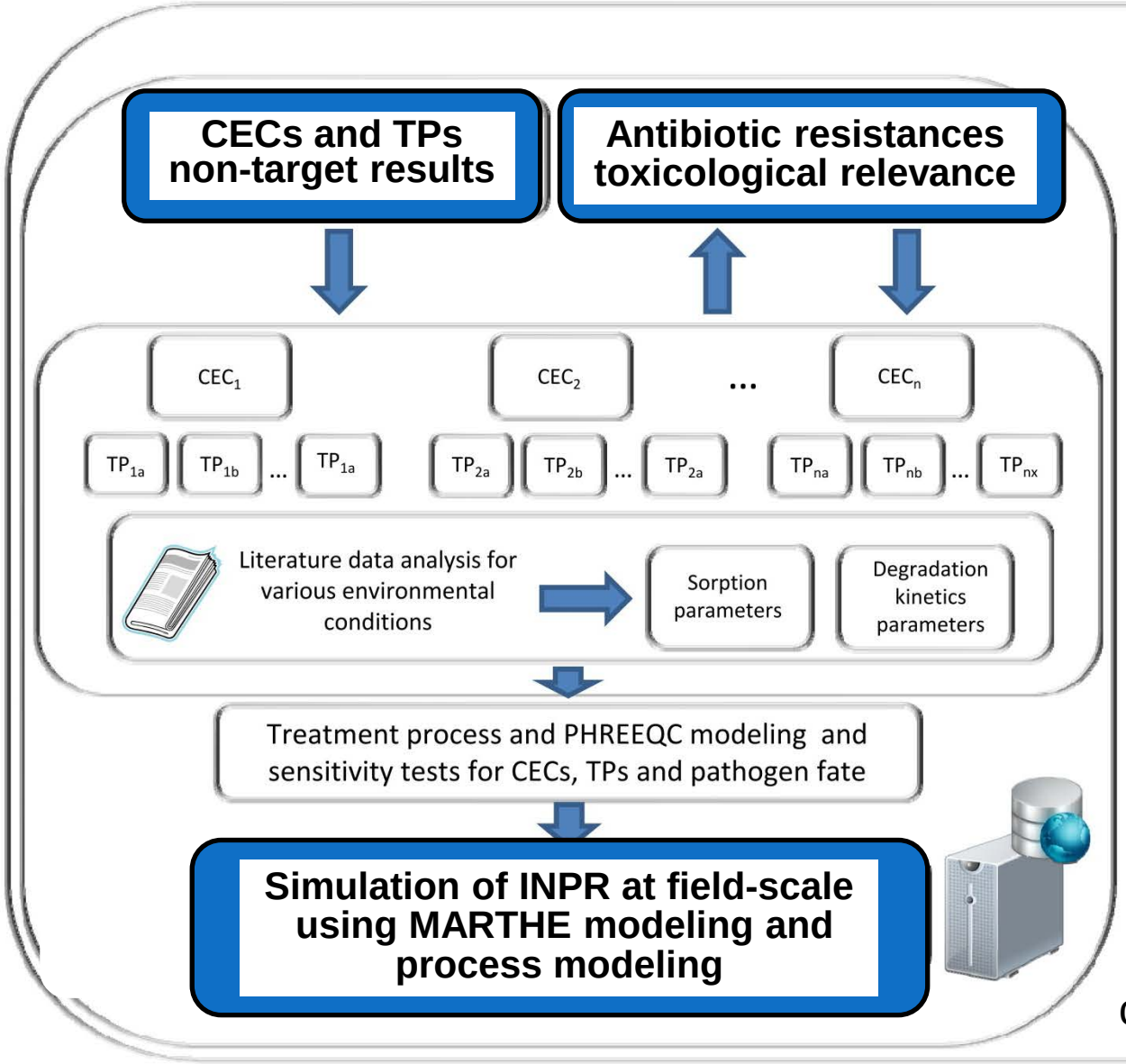
- All information relevant for dissemination will be collected in a final **FRAME Handbook for Stakeholders** that will be offered to **basin authorities, the EU and Member States.**

- The **Handbook** will provide a practical guide to implement FRAME concepts regarding the evaluation of impacts by INPR into **national and European regulations such as WFD**.

Handbook's aims and content

- Describing the **Decision Support Framework** regarding INPR**,** including a **water information systems**
- Applying and reviewing the **INPR evaluation criteria** at the experimental sites selected within FRAME
- Evaluating the **requirements** of the developed INPR evaluation criteria to be implemented in the countries involved in FRAME.

Decision support framework (DSF)



Outcome

Removal of CECs, TPs, pathogens, antibiotic resistances, toxicological effects during individual INPR processes/sites

Source:
concept of Geo hyd

Partner Mobility Concept (PMC)

BfG => TUM: perform experiments at pilot-scale to elucidate the fate of CECs.

BfG => NIVA: determine the toxicological relevance of CECs and TPs.

TUM => BfG: identify and quantify CECs and TPs

TUM => BRGM: model CEC removal during soil passage

NIVA => BfG: elucidate CECs transformation pathway and TPs

IRSA => BfG: elucidate chemical structures of ozonation products

BRGM => TUM: link different models to predict CEC fate and CEC transport

ISS => TUM: review of INPR practices occurring worldwide

Partner Mobility Concept (PMC)

stay in weeks	Host							
	BfG	TUM	NIVA	IRSA	BRGM	Geo-Hyd	ISS	
BFG	X	3	3	3				
TUM	4	X			1			
NIVA	2	2	X					
IRSA	2	2		X				
BRGM		3			X			
Geo-Hyde						X		
ISS		1	1				X	

Acknowledgement for the financial support
BMBF, ONEMA, RCN, MIUR

Thank you for your attention

Infiltration fields Braunschweig - Grey goose