Interreg Baltic Sea Region

Co-funded by the European Union

SUSTAINABLE WATERS WaterMan

Overview of the pilot status

Recycling treated wastewater for commercial use

KWB – Berlin Centre of Competence for Water gGmbh

30 April 2025


Source: Berliner Wasserbetriebe

WaterMan – Feasibility Study Berlin:

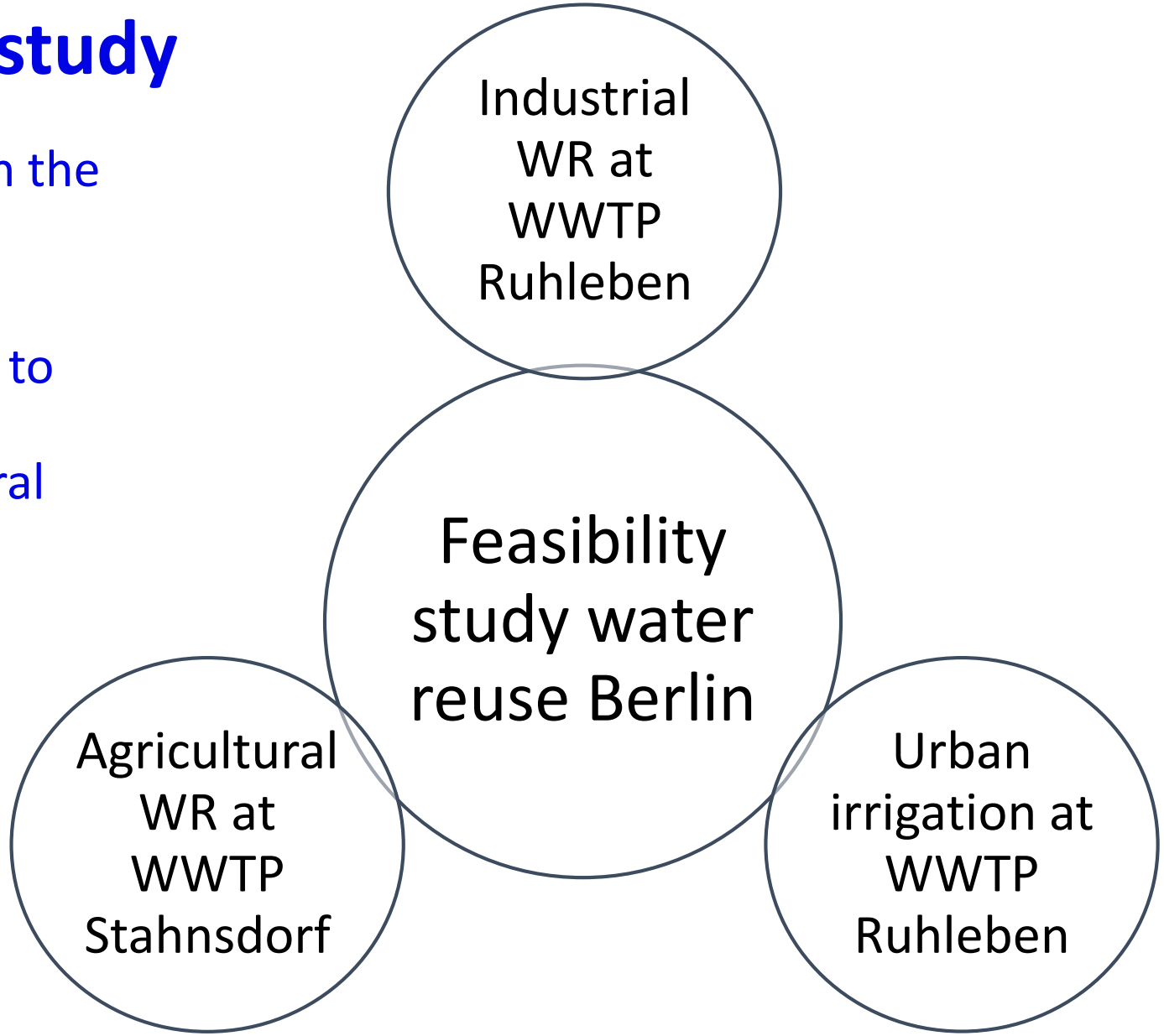
Potential of Water Reuse in Berlin – Latvia 2025

Elisa Rose, Pia Schumann

Scope of feasibility study

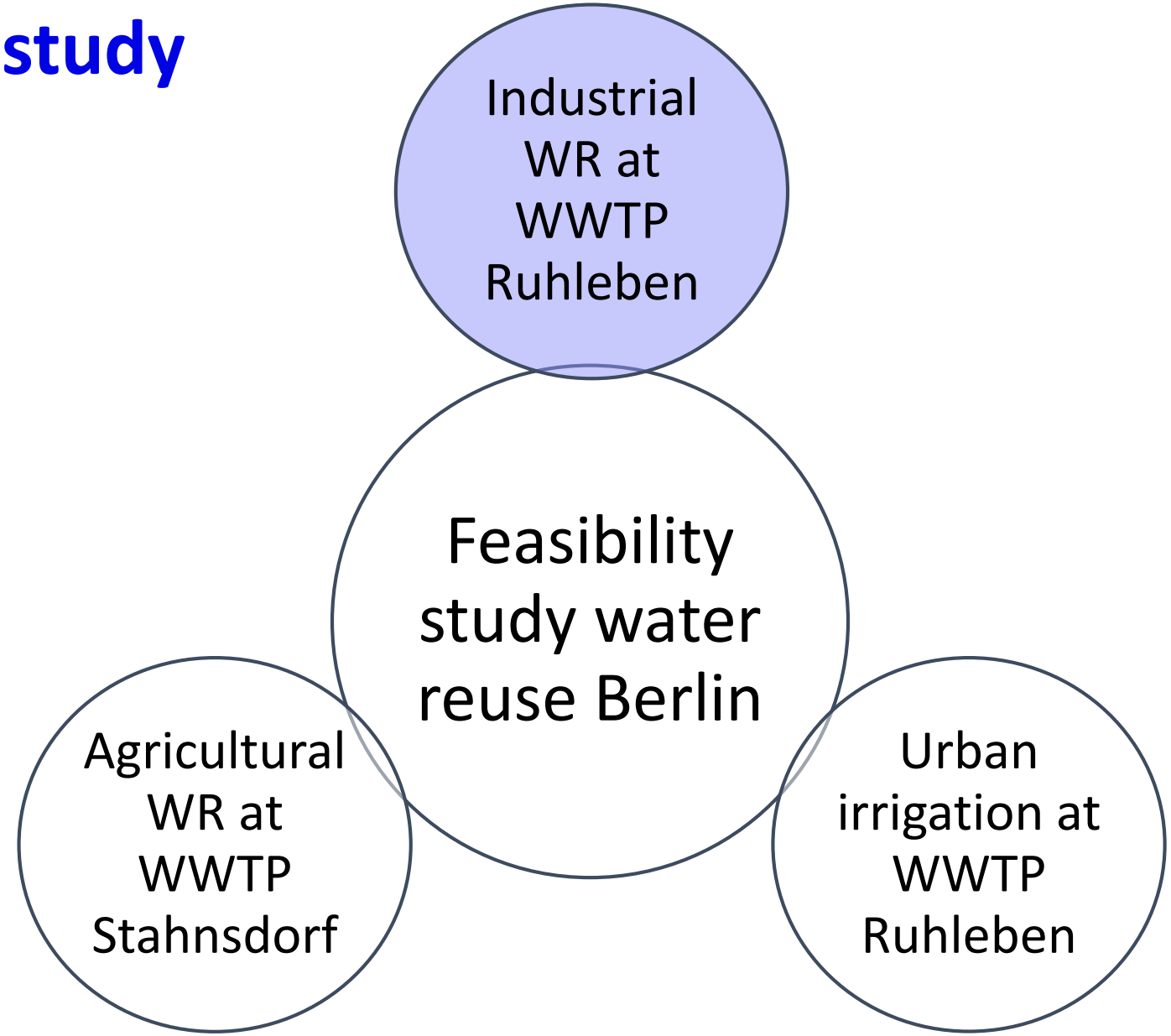
More and more water stress in the Metropolitan region Berlin Brandenburg

→Expansion of the scope due to stakeholder interest of urban irrigation in Berlin & agricultural irrigation around the WWTP Stahnsdorf



WR: Water reuse
WWTP: wastewater treatment plant

Scope of feasibility study



Feasibility Study Berlin – Local Background

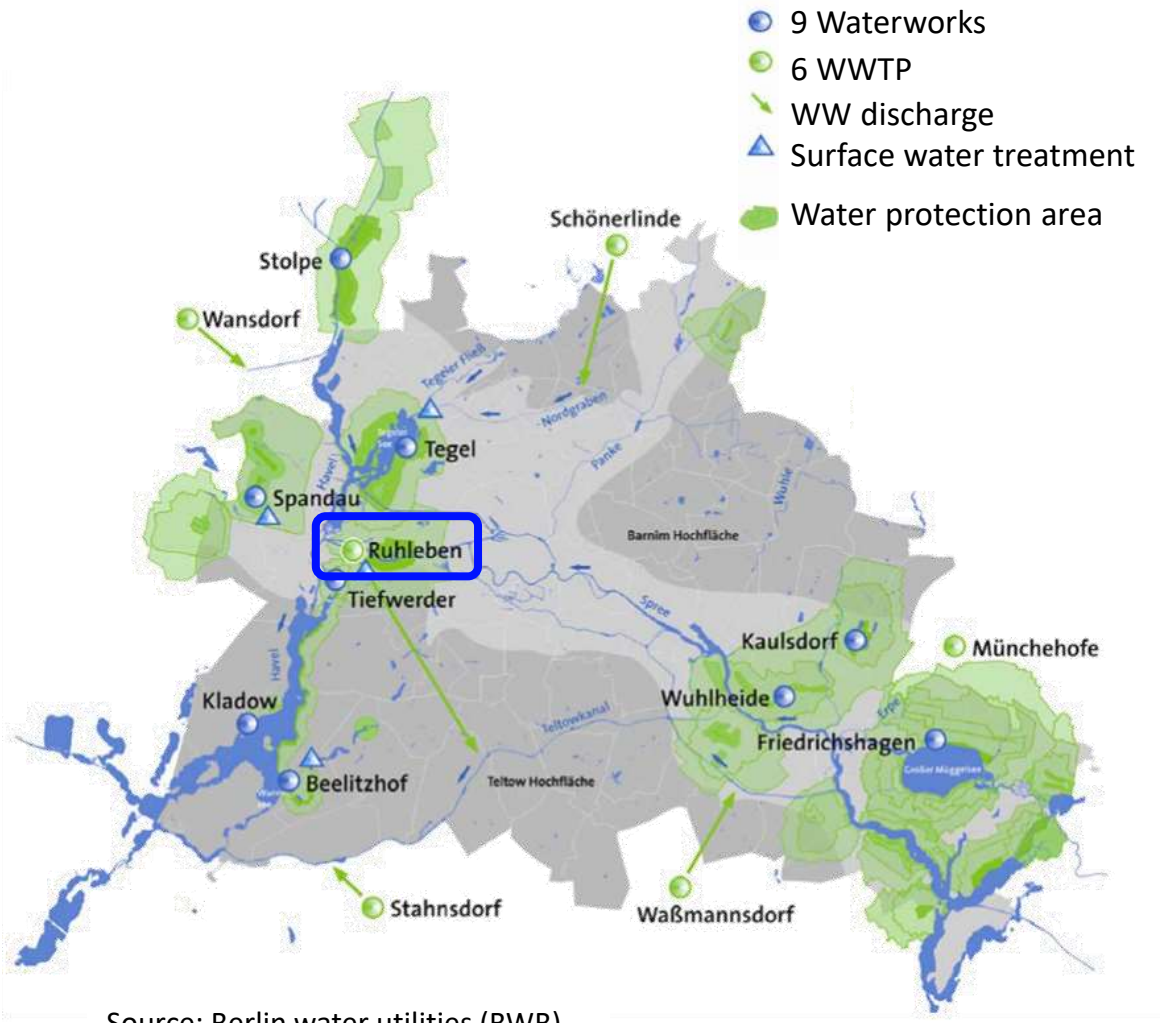
Context

- large urban WWTP near industrial zone
- Winter period: treated WW discharge in Spree river
- Summer period: treated WW discharge into Teltowkanal (16 km distance)

Aim

- Assess fit-for-purpose water treatment & water reuse potential
- Industrial & commercial use: e.g. power plant, car wash

Wastewater treatment plant Ruhleben



Source: Berlin water utilities (BWB)

WWTP Berlin-Ruhleben

Capacity: 1.6 mio population equivalents

Source: Berlin water utilities (BWB)

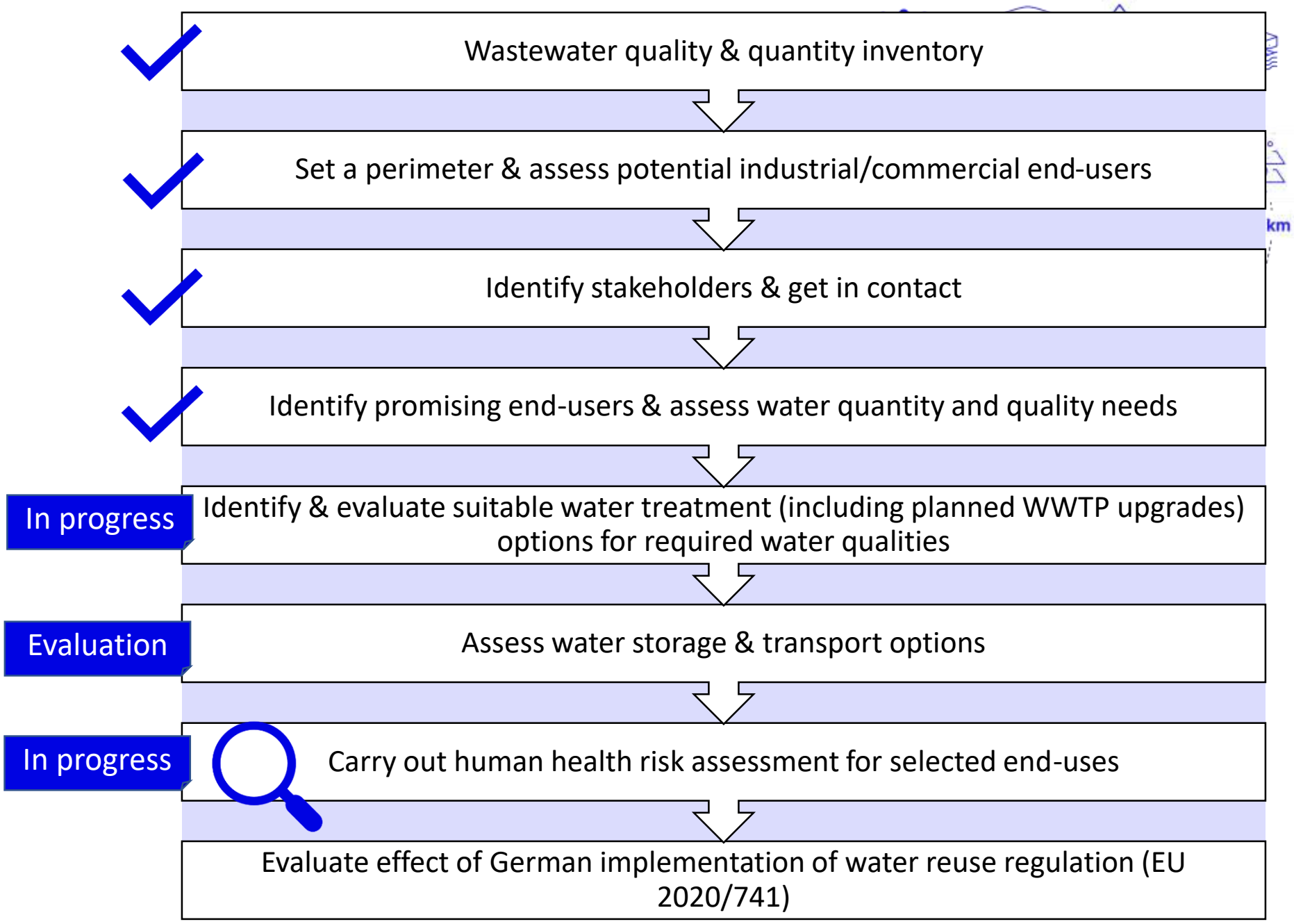
Existing wastewater treatment:

1. Primary/mechanical:
   - 6 automatically cleared screens & grit chambers
   - 16 primary sedimentation tanks
2. Secondary/biological:
   - 16 activated sludge tanks for the reduction of phosphorus (Bio-P), nitrogen (denitrification & nitrification) & organic substances
   - 54 secondary clarifier
3. Advanced: UV disinfection of partial secondary effluent flow

Planned extensions:

- Coagulation filtration for nutrient removal + full-stream UV disinfection (until 2027)
- Advanced treatment for micropollutant removal (e.g. activated carbon, ozonation)

Approach


Wastewater quality & quantity inventory
Set a perimeter & assess potential industrial/commercial end-users
Identify stakeholders & get in contact
Identify promising end-users & assess water quantity and quality needs
In progress
Identify & evaluate suitable water treatment (including planned WWTP upgrades) options for required water qualities
Evaluation
Assess water storage & transport options
In progress
Carry out human health risk assessment for selected end-uses
Evaluate effect of German implementation of water reuse regulation (EU 2020/741)

Microbiology in municipal wastewater

Indicator organisms indicating faecal pollution

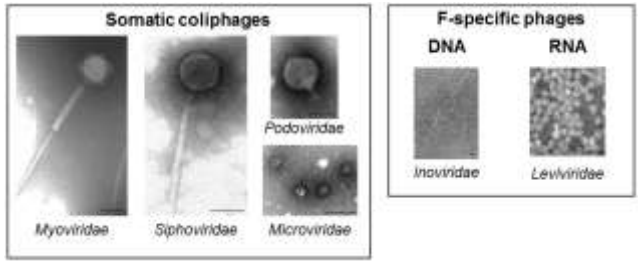
Escherichia Coli

Source: Rocky Mountain Laboratories

Intestinal enterococci

Source:https://commons.wikimedia.org/w/index.php?curid=1669200

Coliphages



Source:https://www.mdpi.com/2073-4441/8/5/199

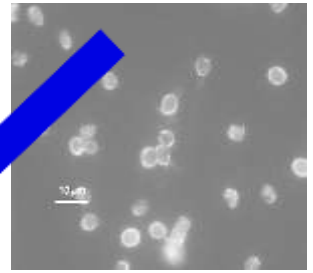
Clostridium perfringens

Source:https://de.wikipedia.org/wiki/Clostridium_perfringens#/media/Datei:Clostridium_perfringens.jpg

Real pathogens causing illness (e.g. gastroenteritis)

Parasites

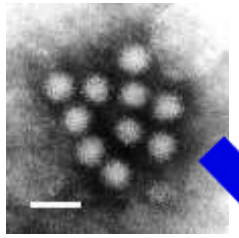
Giardia intestinalis



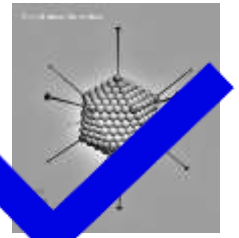
Cryptosporidium parvum

Source: Cryptosporidium parvum – Wikipedia
Giardia duodenalis - Wikipedia

Viruses



Norovirus

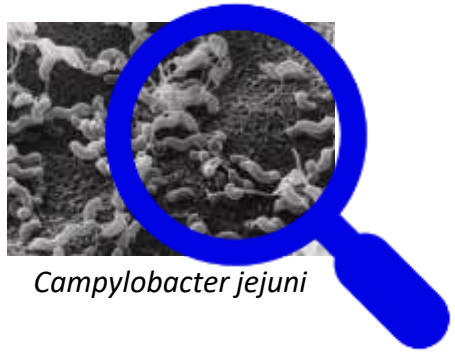


Adenovirus

Rotavirus

Von Gleiberg - Eigenes Werk, CC BY-SA 2.0 de, https://commons.wikimedia.org/w/index.php?curid=11869453

Bacteria



Campylobacter jejuni

Source: Campylobacter Jejuni Bacteria by Science Photo Library

Monitoring at WWTP Ruhleben

- What:
  - Montoring of *Campylobacter jejuni* in Ruhleben WWTP influent (and effluent)
- When:
  - Started in March 2025
  - Covering maximum period of time possible – planned until autumn 2025
- Why:
  - To close knowledge gap and produce a representative data set for WWTP effluents in Berlin
  - To complement QMRA data set
  - Conduct a QMRA on the basis of real data (instead of literature data that are available e.g. in the QMRA tool)

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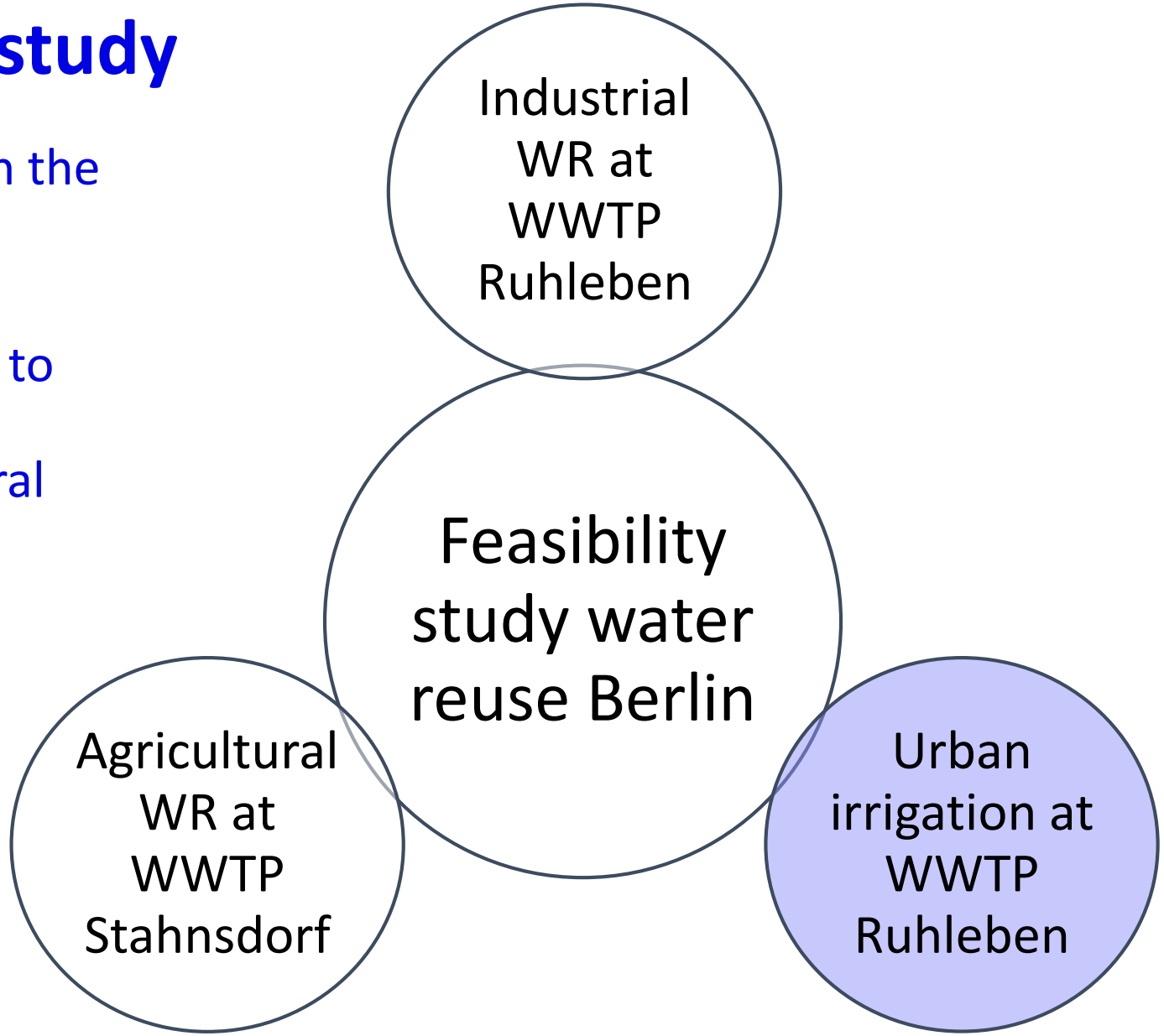
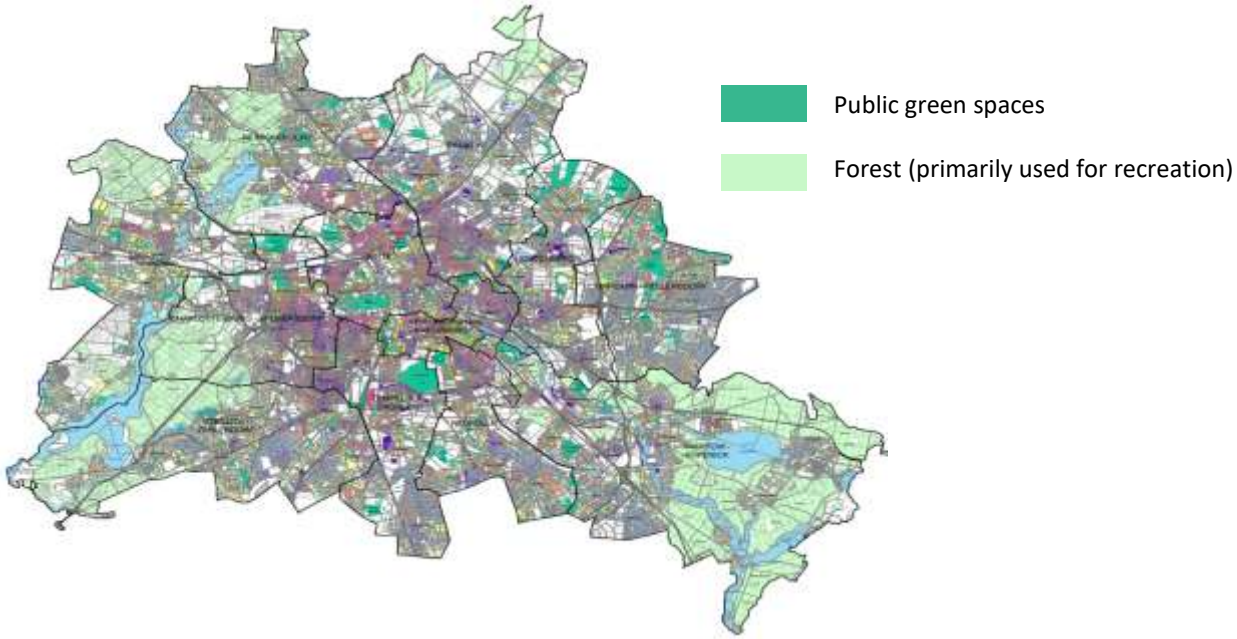
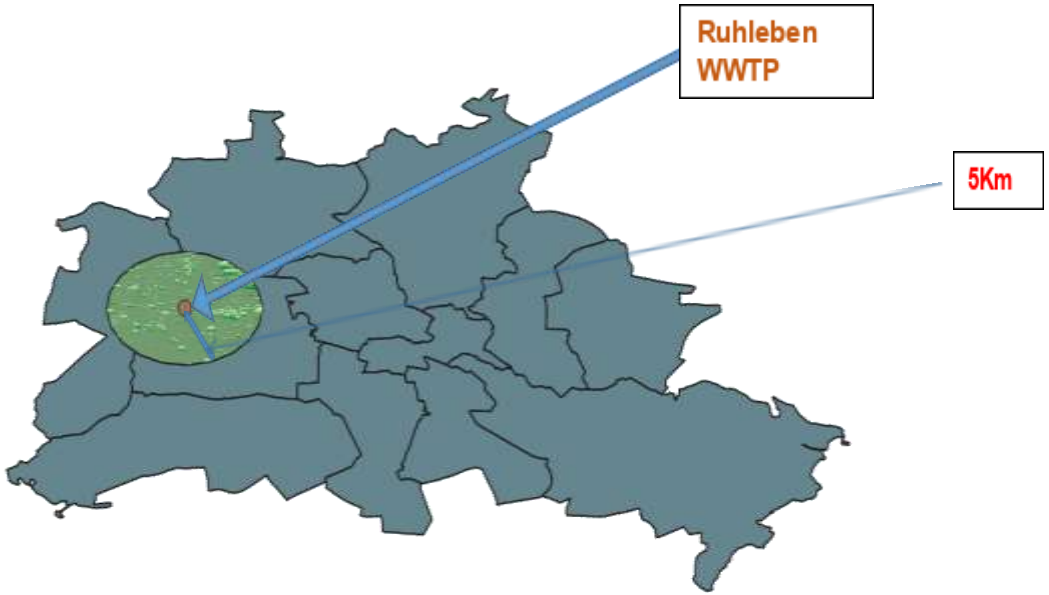


Assessment of urban irrigation potential

1. Identification of green urban spaces within a 5 km radius around the WWTP Ruhleben

- Green spaces were identified using the Environmental Atlas Berlin
- The total area of green space coverage were estimated to be ca. 8.6 km²



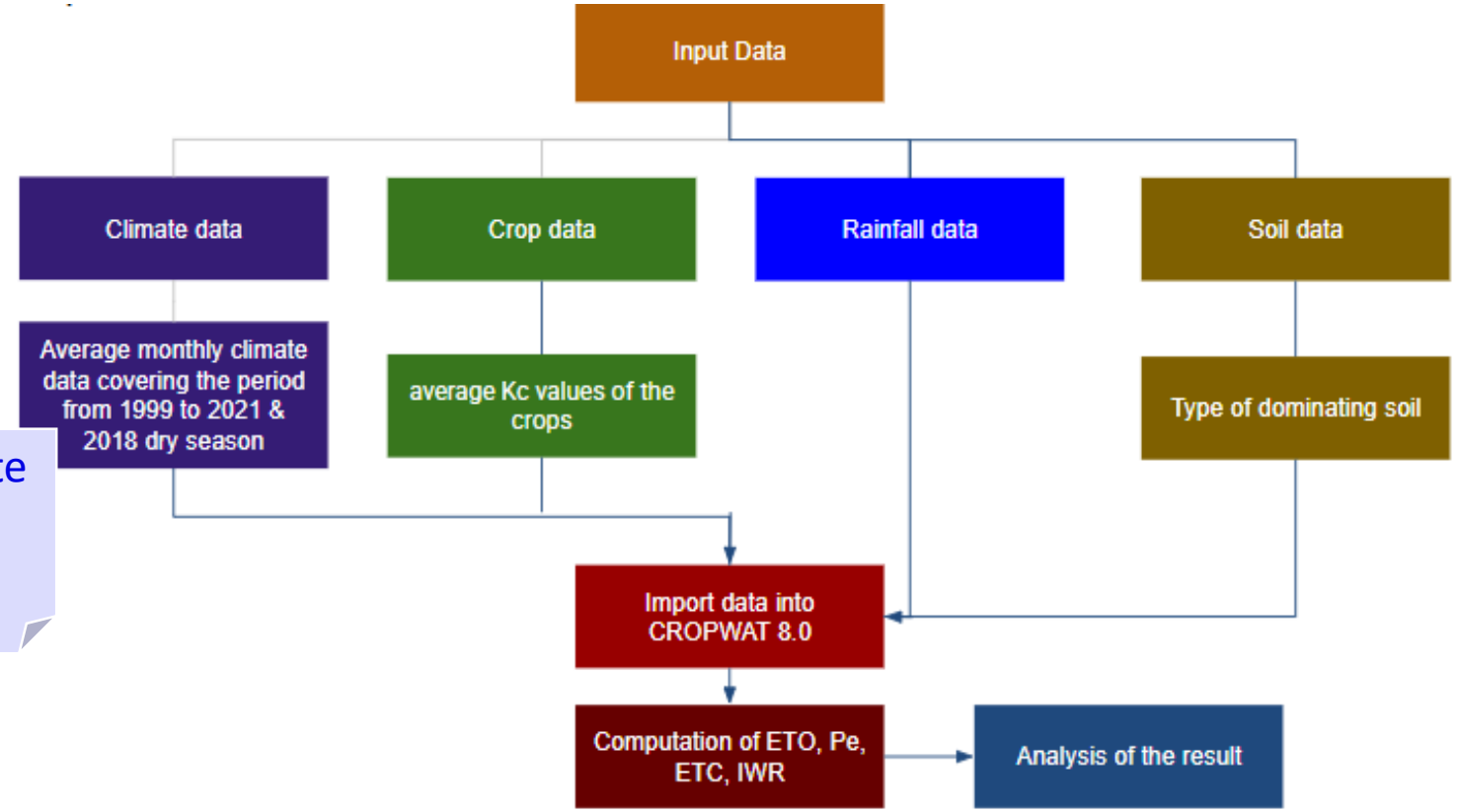


Sources: https://fbinter.stadt-berlin.de/fb/index.jsp?loginkey=showMap&mapId=ek06_05gruenversorg2020@esenstadt&Szenario=fb_en.

Assessment of urban irrigation potential

CROPWAT is a decision support tool developed by the Land and Water Development Division of FAO.

1. Identification of green urban spaces
2. Assessment of irrigation demand using CROPWAT 8.0[1]



2 different climate baselines were considered

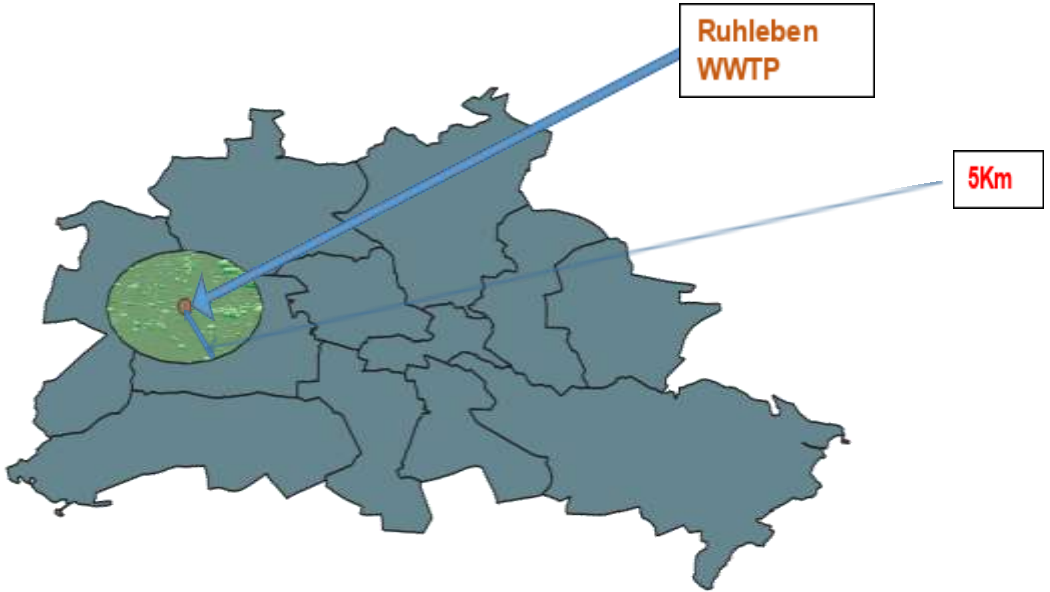
[1]https://www.fao.org/land-water/databases-and-software/cropwat/en/

Assessment of urban irrigation potential

1. Identification of green urban spaces
2. Assessment of irrigation demand using CROPWAT 8.0[1]

Total Green Space Area	8.6 km²
Total Irrigation Demand (2018)	200,400 m³
Total Irrigation Demand (20-year average)	59,800 m³
Categories of Green Spaces	Allotments, Parks, Cemeteries, Grass, Scrub, Meadow

More than 3 times higher irrigation demand in dry year of 2018 compared to 20 year average



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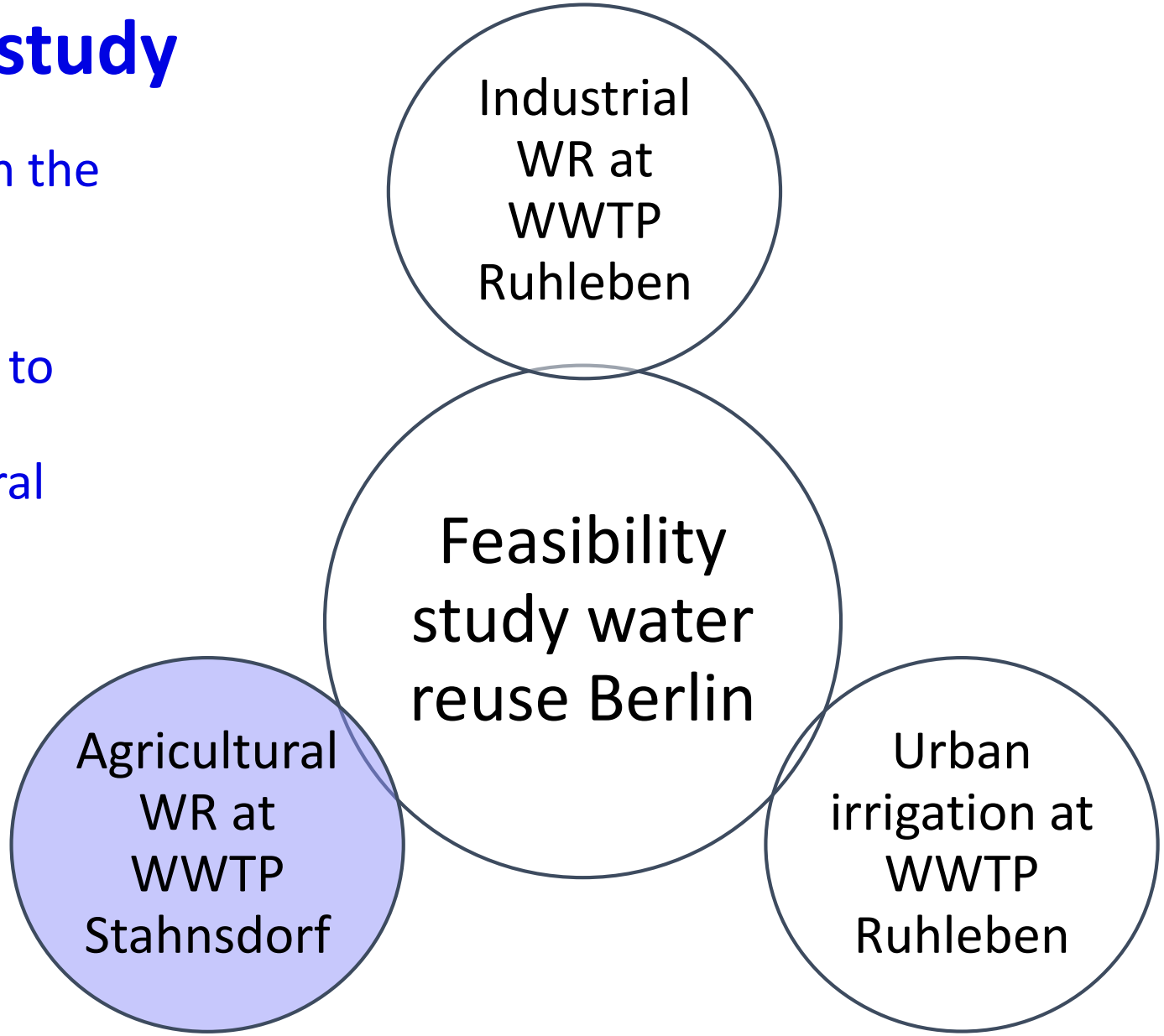
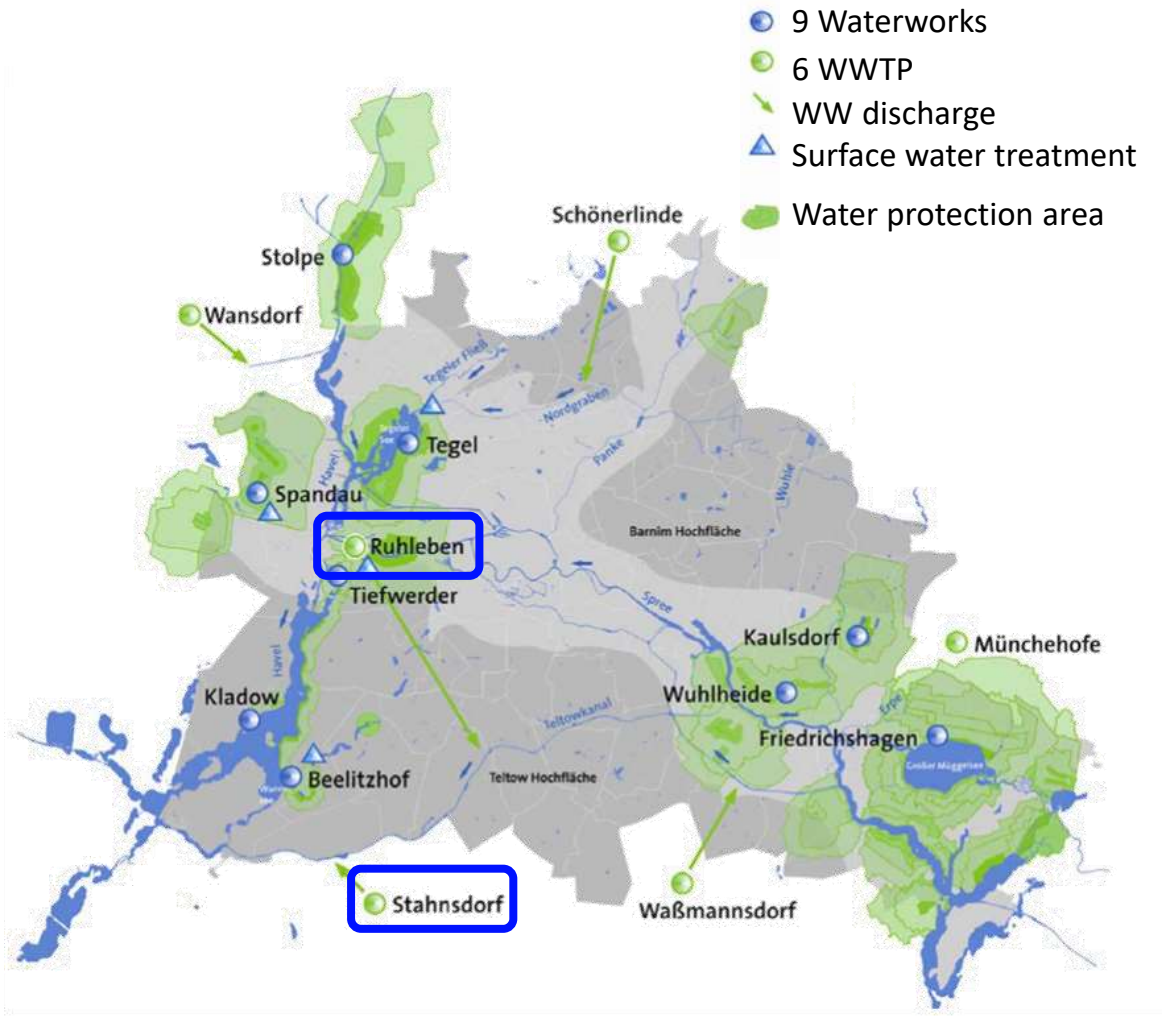


Reuse of municipal wastewater for agricultural irrigation – case study at the WWTP Stahnsdorf

Source: Berlin water utilities (BWB)

Wwtp Stahnsdorf

- Aim to assess the potential of reuse of municipal wastewater at WWTP Stahnsdorf
  - Focus on agricultural reuse
  - Urban irrigation may be included as well
- Close cooperation with Berlin water utility (BWB)
- Boundary conditions:
  - New wwtp will replace old wwtp by 2037
  - Assessment shall include current wwtp and wwtp of the future
  - Capacity current WWTP 410,000 p.e./50,000 m³/a
  - Capacity future WWTP 900,000 p.e./100,000 m³/a

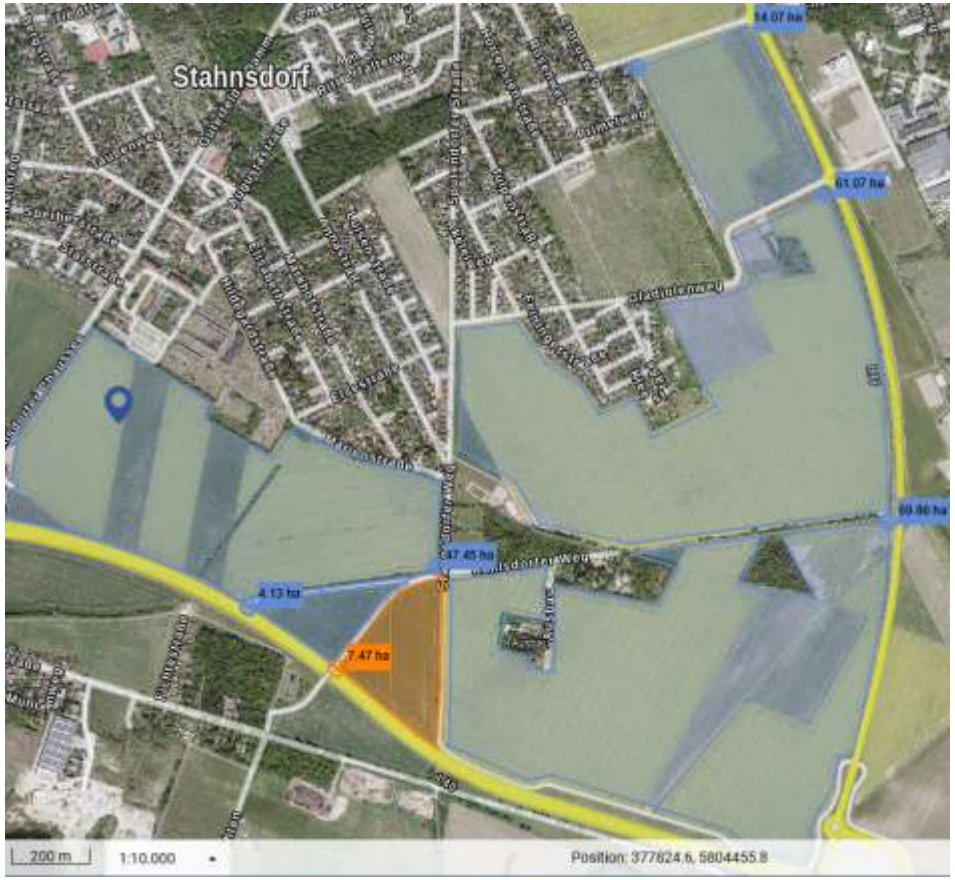


Source: Berlin water utilities (BWB)

Assessment of irrigation demand

Requirements for irrigation systems:

- Min area traveling gun irrigation system 25 ha / radius of 300 m
- Min area linear irrigation system 20 ha, square area



Possible organization of irrigation systems:

- Area covered by linear irrigation system: approx. 80 ha
- Remaining area to be irrigated by traveling gun irrigation system: approx. 130 ha

Source: Google amended by KWB

Assessment of irrigation demand & treatment capacity need

Input

- precipitation
- Pot. evapotranspiration
- spec. evapotranspiration
- spec. root depth
- plant-available water capacity

modell

Output

- spec. Additional water demand
- amount per irrigation cycle
- Number of irrigation cycles p.a.
- Water demand per year
- **Capacity of the treatment system**

	Winter crop
Surface area (ha)	**209**
Amount per irrigation cycle (mm)	**21**
Number of irrigation cycles per year (n)	**11**
Water demand per irrigation cycle (m^3)	**43,827**
Additional water demand per year (mm/a)	**193**
Water demand per year (m^3/a)	**482,100**

Common irrigation practice:
7 days, 20 hours

	Scenario 1	**Scenario 2**	**Scenario 3**
Irrigation cycle (d)	7	5	2
Daily operation time (h)	20	20	20
Water demand (m^3/h)	**391**	**548**	**1.370**

Treatment options
Aim: Class B 2020/741

Upgrade of existing wwtp plant

Minimum requirements

Filtration[1] → UV disinfection

Including organic micropollutant removal

Filtration[1] → Granular activated carbon filtration → UV disinfection

From 2037

Partial treatment of new wwtp effluent

Ozonation → Biological activated carbon filtration → UV disinfection (high dose)

[1]Filtration options
- Micro sieve, cloth filter, cartridge filter
- Fixed-bed filter (DynaSand, DynaCarb)
- Ultrafiltration

Stakeholder analysis for Stahnsdorf

Identification of all relevant actors incl. responsibilities (WR 2020/741)

1. **Operators of the Treatment Facility & Municipal Wastewater Treatment Plant (public/private):**
   - BWB – Stahnsdorf Wastewater Treatment Plant
   - Water and Wastewater Association (WAZV) "Der Teltow“
   - Mittemärkische Wasser- und Abwasser GmbH (Service provider for WAZV "Der Teltow")
2. **Operators of Facilities for the Storage and Distribution of Treated Water (if applicable):**
   - See references (1) or (3).
3. **Operators Responsible for Irrigation** (Farmers/Agricultural Associations/Irrigation Associations):
   - e.g., Agro Saarmund GmbH
4. **Relevant Authorities (excluding the primary responsible authority):**

- Water, Health & Environmental Authorities:
  - Upper Water Authority – State Office for the Environment (LfU) Brandenburg
  - Health Department – Potsdam-Mittelmark District
- Lower Nature Conservation Authority
- Lower Soil Protection Authority
- State Office for Rural Development, Agriculture, and Land Reorganization (Plant Protection)

5. **Other Stakeholders:**

- Entities responsible for parts of the water and wastewater system or located within the affected area.
  - E.g. users of surfaces close to farm land to be irrigated

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Interreg Baltic Sea Region

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SUSTAINABLE WATERS
WaterMan

Access the „BSR Water Recycling Toolbox" here.
https://www.eurobalt.org/waterrecyclingtoolbox/

The „BSR Water Recycling Toolbox" was elaborated as part of the project "WaterMan - Promoting water reuse in the Baltic Sea Region through capacity building at local level", The project is co-financed by the European Union (European Regional Development Fund) and implemented within the Interreg Baltic Sea Region Programme. More information:

eurobalt.org/WaterRecyclingToolbox
interreg-baltic.eu/project/waterman

WaterMan promotes a region-specific approach to water recycling, which intends to use the alternation of too much and too little water that has become typical in the Baltic Sea Region to make the local water supply more resilient, and supports municipalities & water companies in adapting their strategies.