



Application of the Water Footprinting Concept for Sustainable Water Management

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Project Advisory Committee

- Steve Whipp, United Utilities
- Helen Gavin, Atkins
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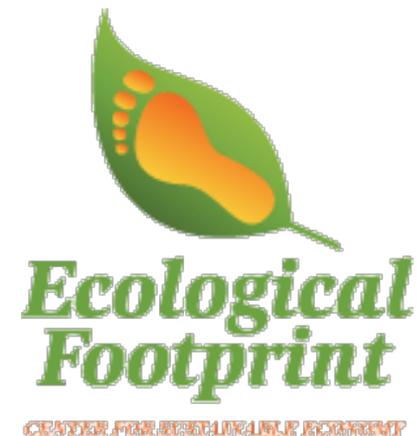
Agenda

- Water Footprint Concept
- Project Background
- Methodology
- Description of Pilot Area
- Preliminary Results
- Summary

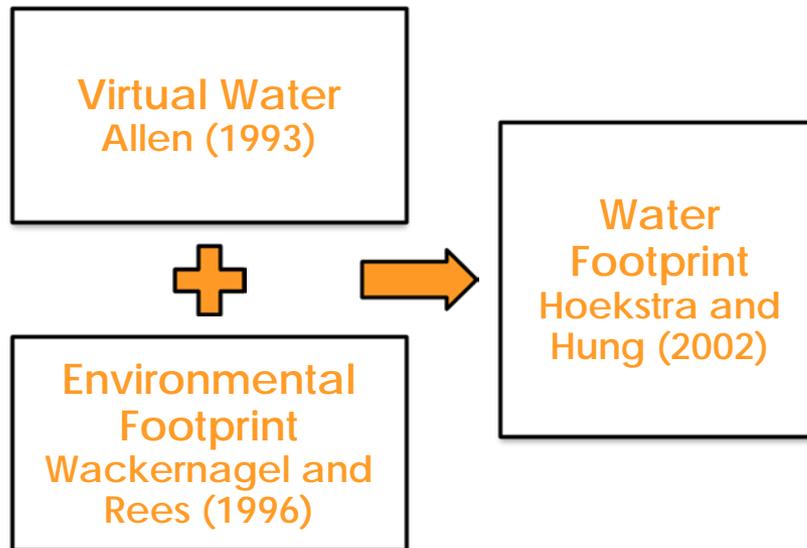
What is a “Footprint”?

- The impact of an activity (e.g. production or consumption) over its life cycle on a receptor (e.g. the environment)

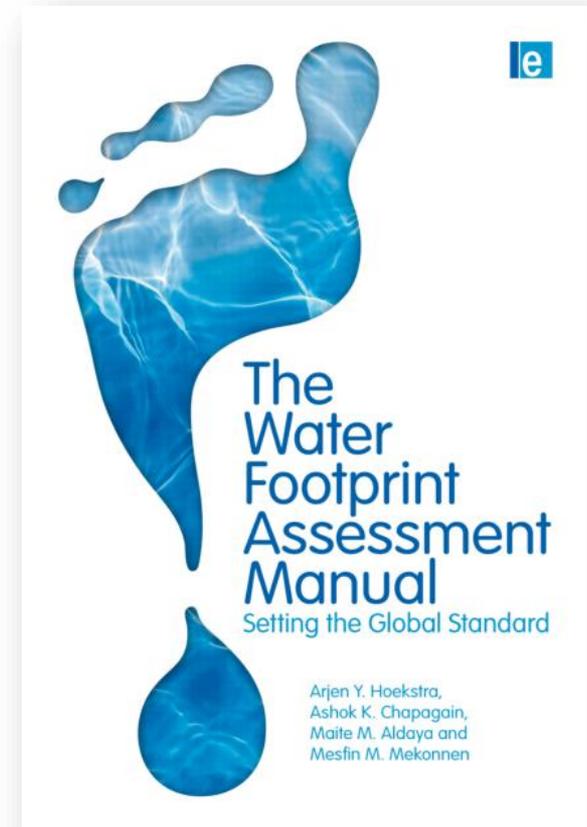
*“ A carbon footprint is an **estimate of the climate change impact of activity** – such as making a product, living a lifestyle or running a company.”*



Origin of Water Footprint

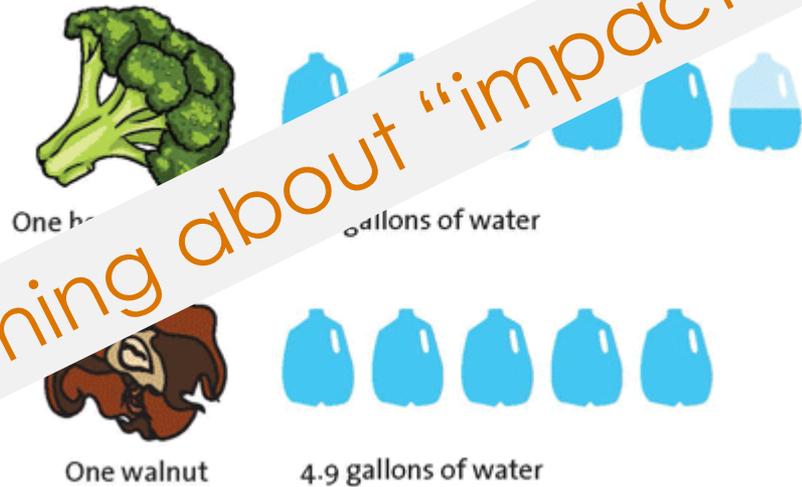


- ... the amount of **fresh water utilized** in the production or supply of the goods and services used by a particular person or group



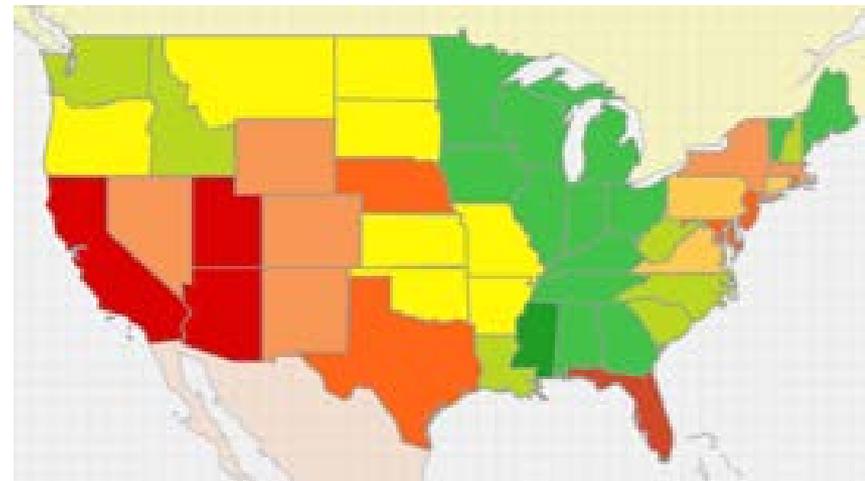
Why Impact Assessment?

Amount of water required to grow one piece of walnut is about 19L



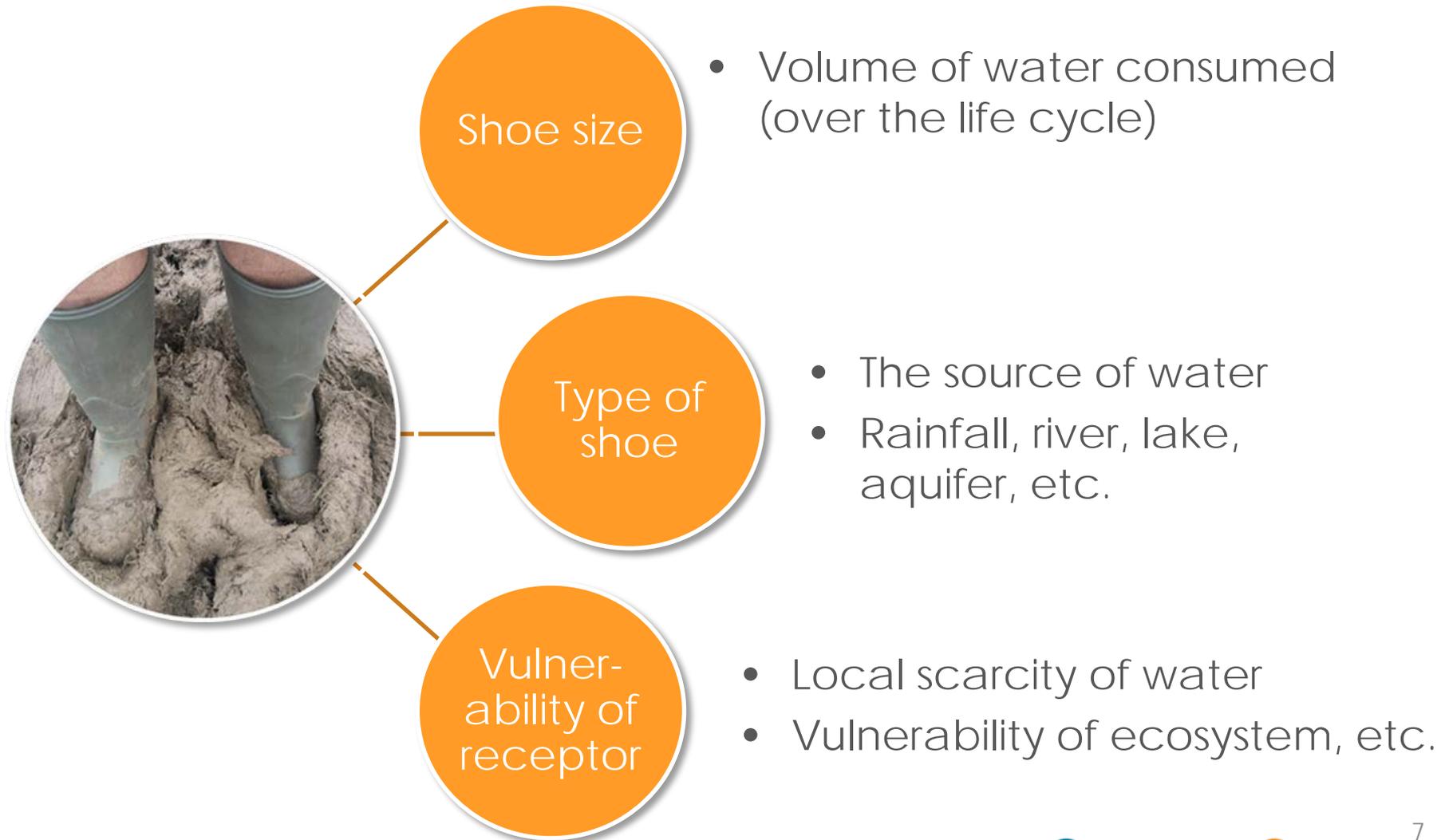
Why should a water utility pay attention?

- How much water is required to supply 1L of water to my customer?
- What is the impact of supplying 1L water on the water environment?

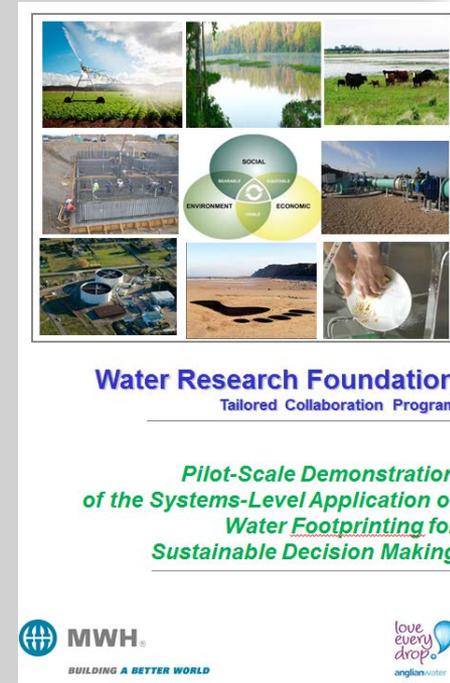
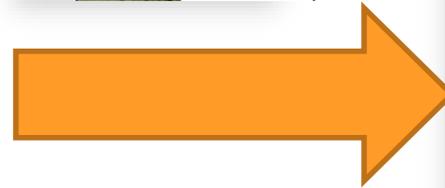
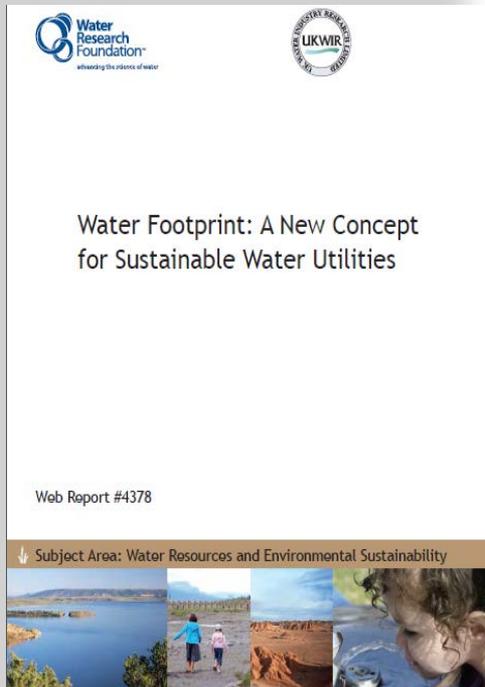


Water scarcity profile

The Components of a Water Footprint



Research Questions



2012-2014

Is there any application of the concept for sustainable decision making?

(benchmarking, optioneering, water resources planning, communication)

2015 to Present

Can we demonstrate the applicability of the ISO framework for water utilities?

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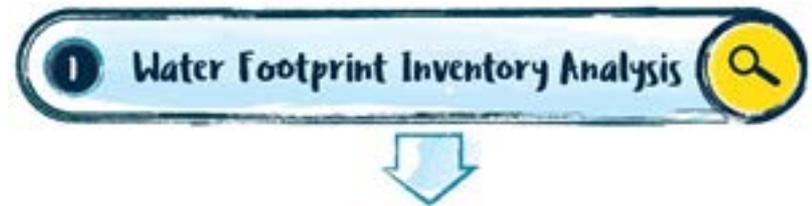
What is the ISO 14046?

- Life cycle assessment approach (e.g., abstraction, treatment, distribution, wastewater treatment, water reuse)
- The water footprint is the potential environmental impacts(of an activity) related to water



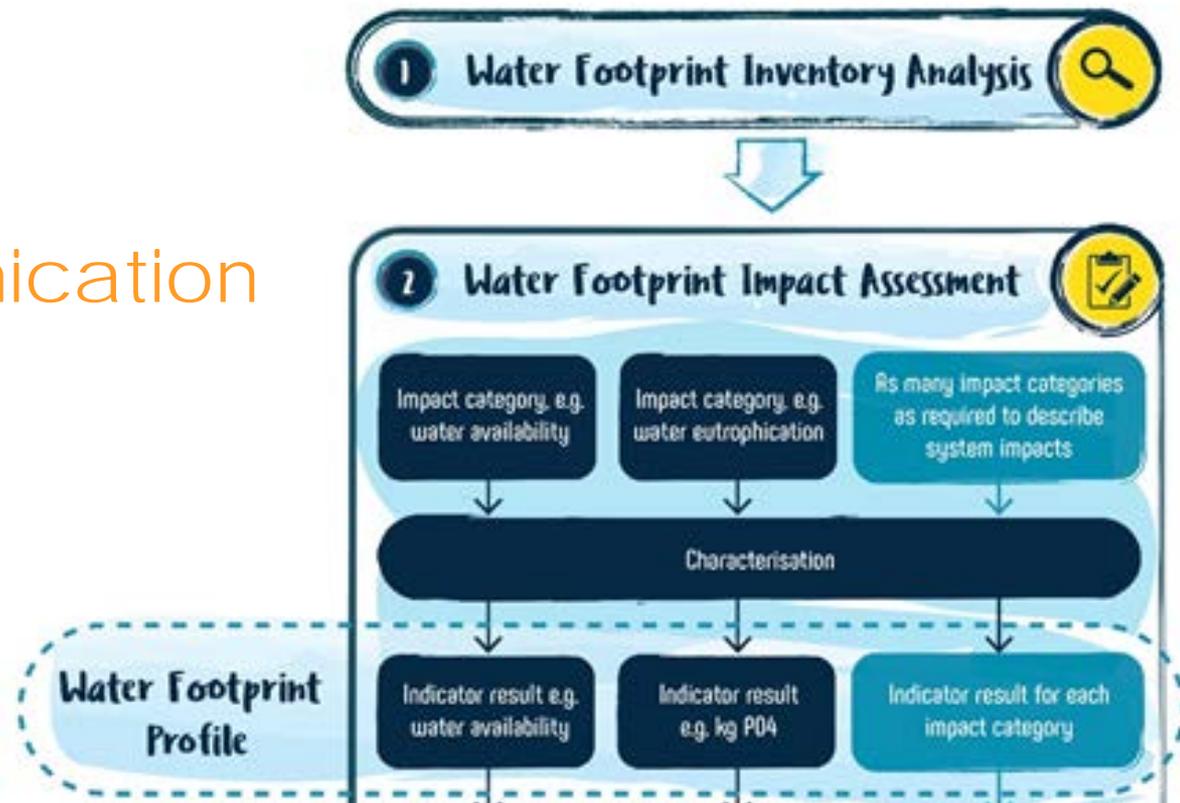
Water Footprint Inventory Analysis

- Quantities of water withdrawn and discharged
- Resource types of water used
- Water quality parameters and/or characteristics
- Geographical location of water withdrawal and/or discharge



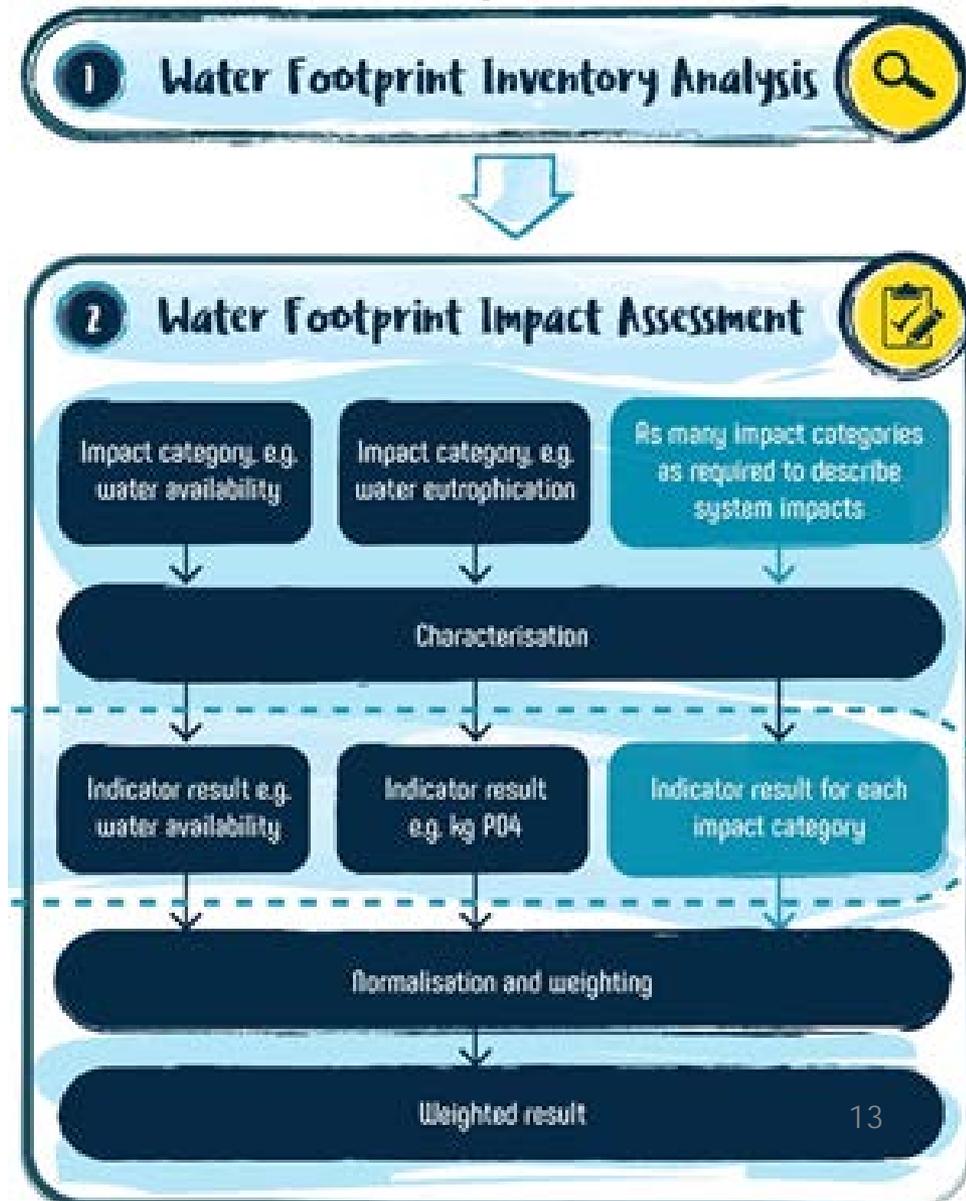
Water Footprint Profile Assessment

- Water **scarcity** footprint
- Water **eutrophication** footprint



Comprehensive Water Footprint

- The components of the water footprint profile can be normalized, weighted and summed to determine a Water Footprint



Water Footprint of an Activity in term of m^3H_2O eq

Positive or negative value (applies to water abstraction or return)

Water body characterization factor

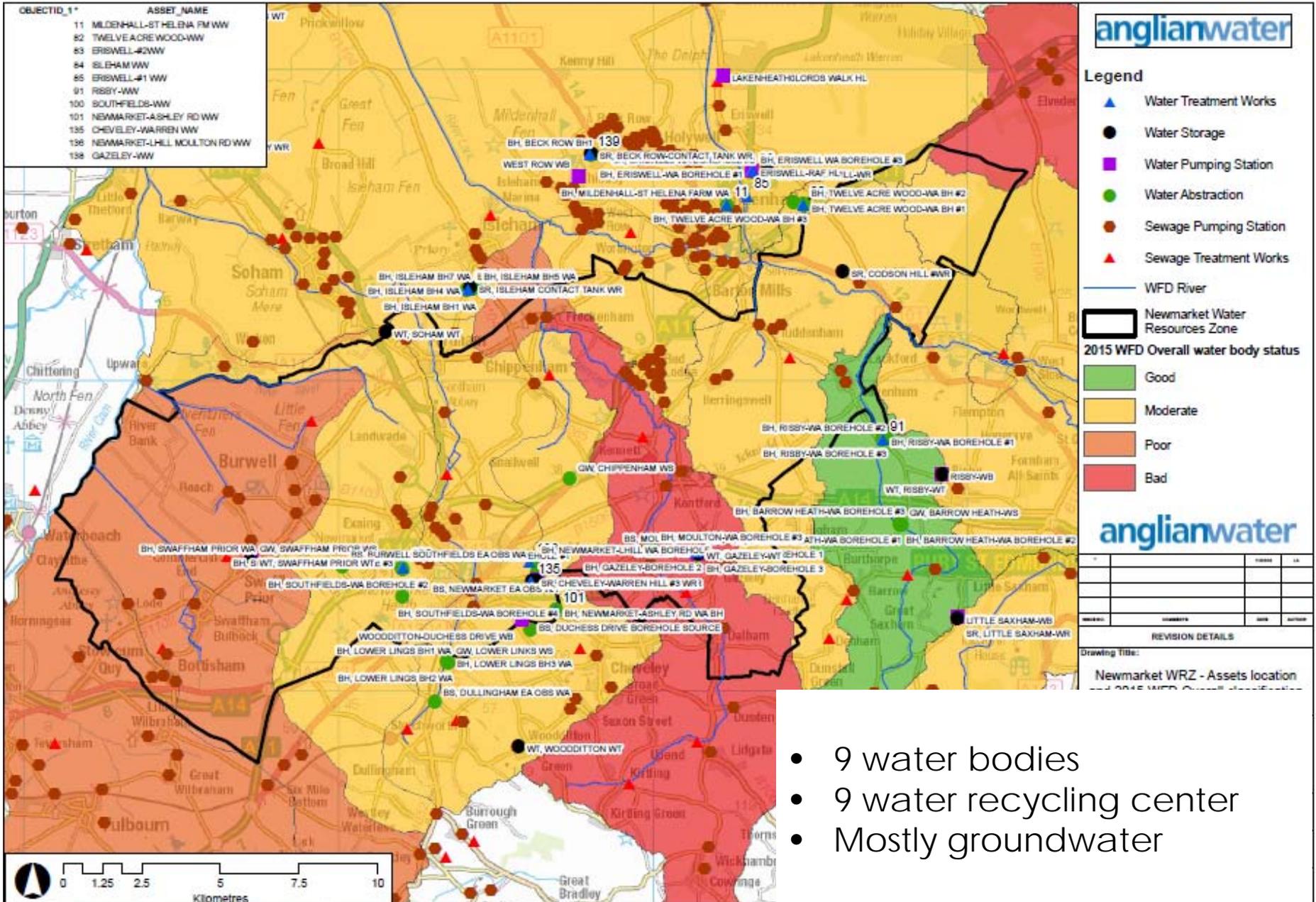
Impact category	Unit	Inventory Value	Impact /unit	Overall impact	Weight	Normalised impact ($m^3 H_2O$ eq)
Water availability	$m^3 H_2O$	Q	a	a.Q	1	a.Q
Eutrophication	kg PO_4	M	b	b.M	p	p.b.M

Positive value (applies to discharge only)

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Pilot Area (10.7 ML/day, 2.6 MGD)

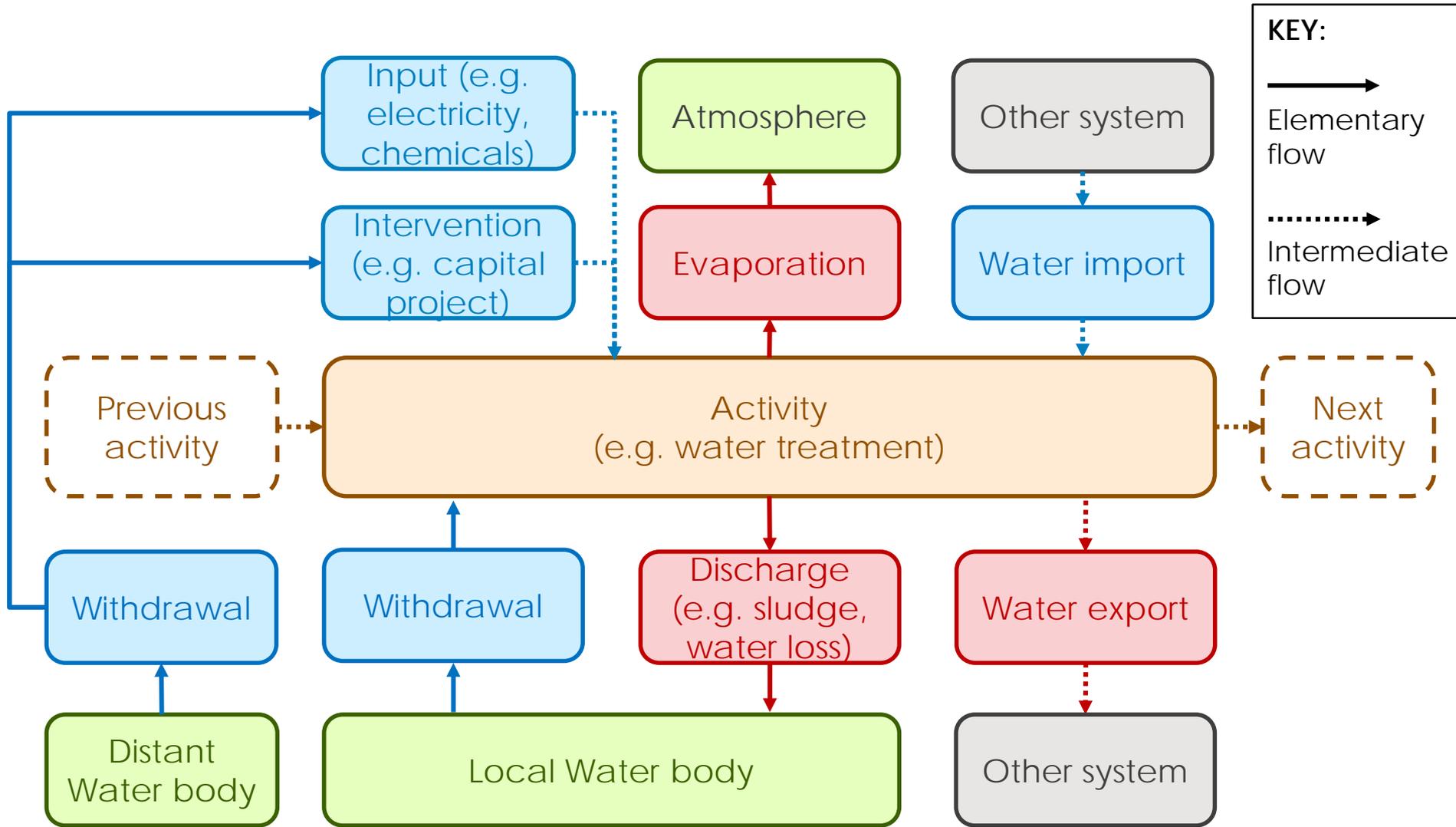


- 9 water bodies
- 9 water recycling center
- Mostly groundwater

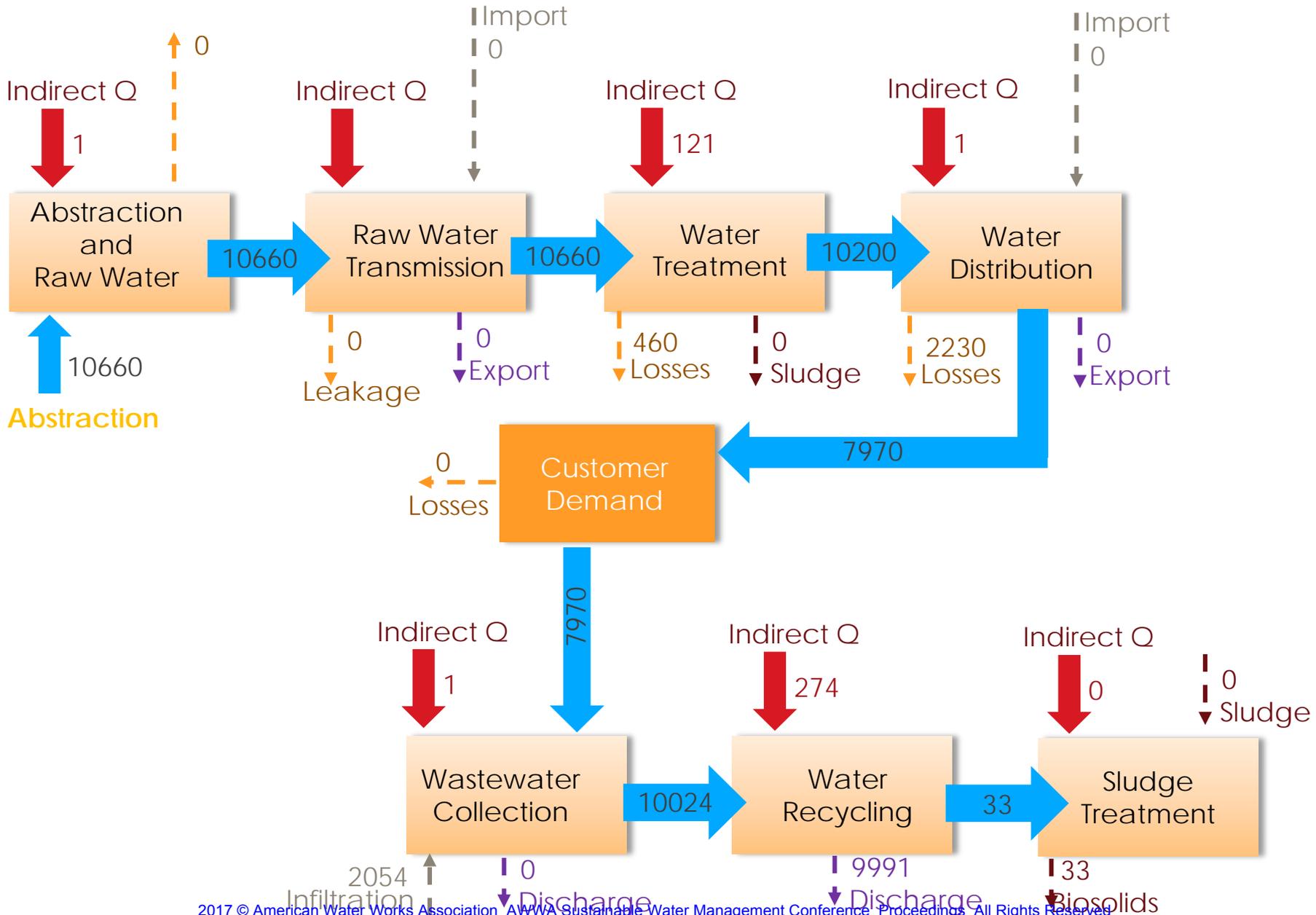
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Water Flows for Each Activity



Direct and Indirect Water Consumption (m³/day)

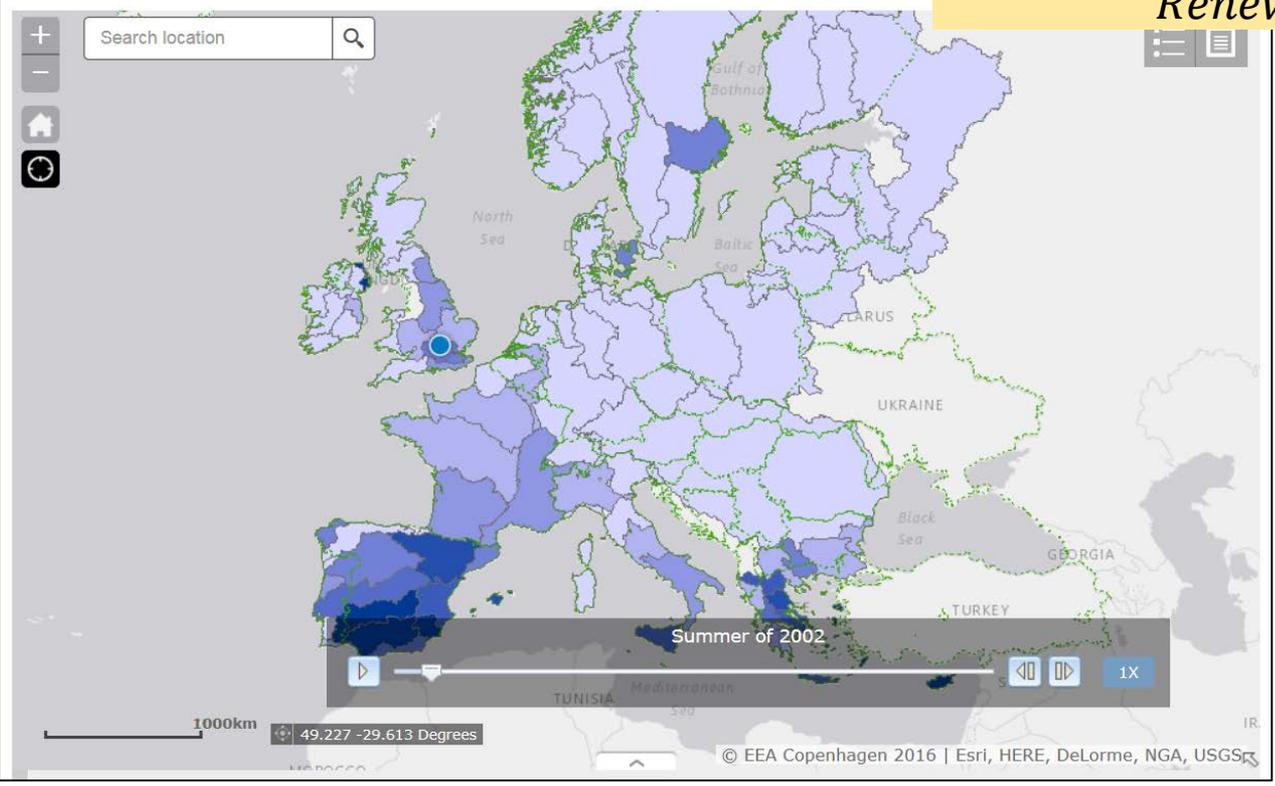


Characterization Factors: Water Availability

$$WEI += \frac{\text{Abstractions} - \text{Returns}}{\text{Renewable Water Resources}}$$

Is the abstraction rate of water sustainable?

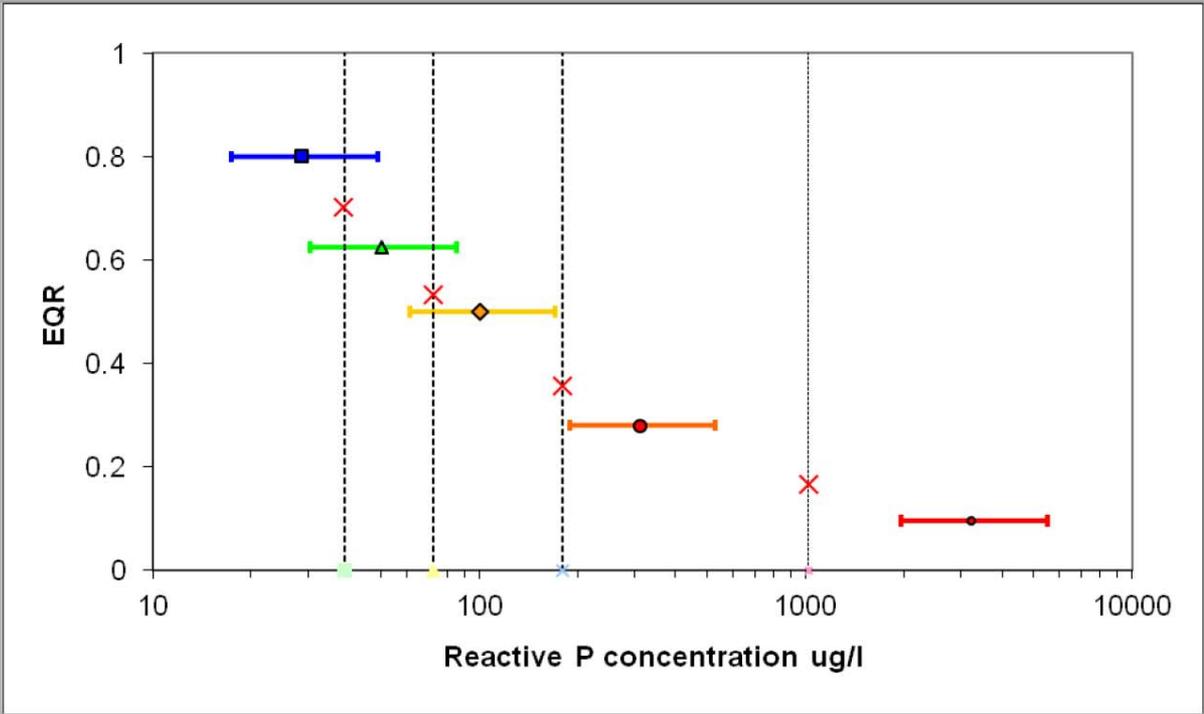
Fig. 1: Water exploitation index for river basin districts



Available at granularity of local water bodies and is already in use

Characterization Factors: Water Quality

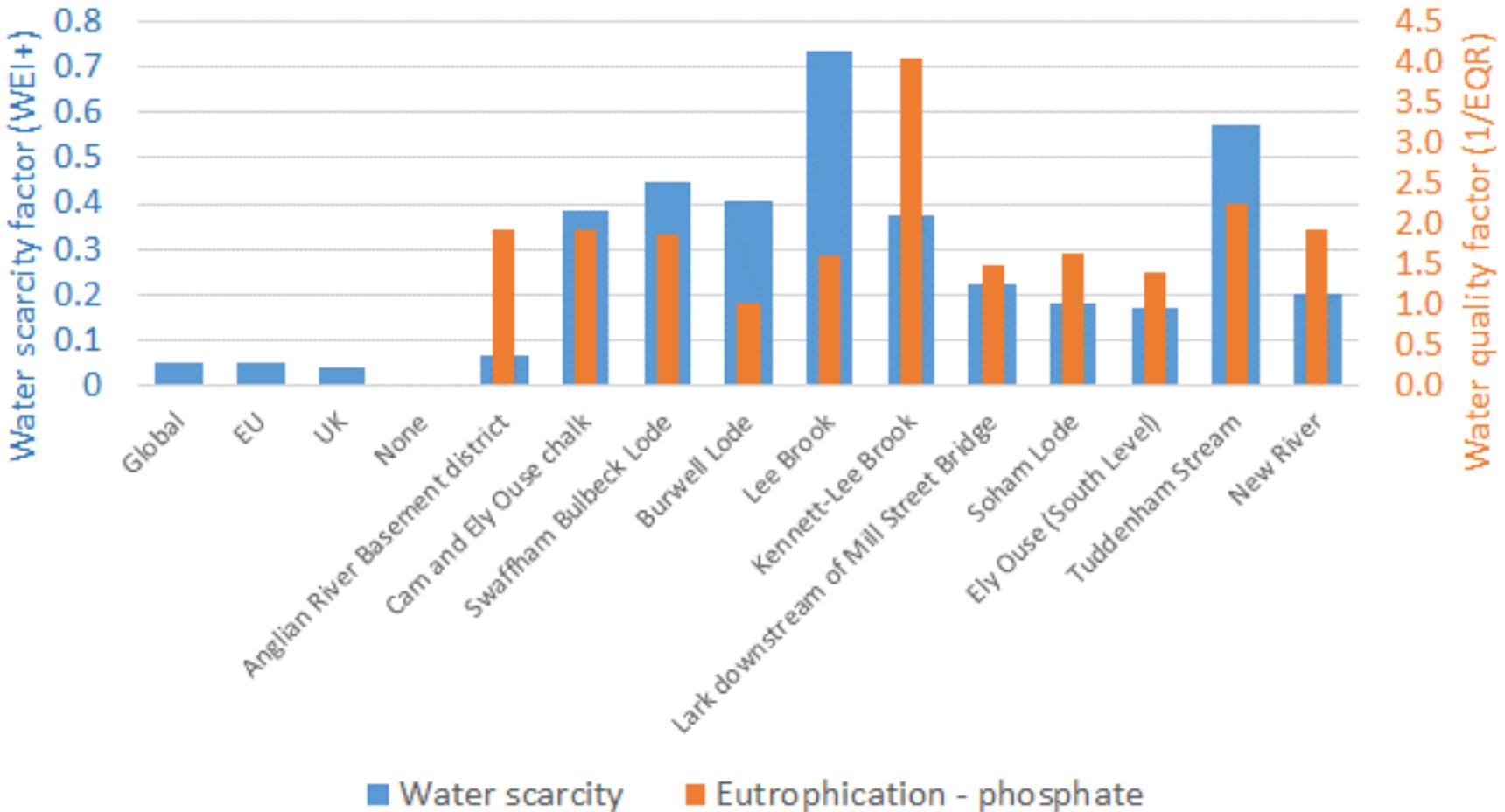
EQR: Ecological Quality Ratio



- The “EQR” values on the y-axis represent the **degree of disturbance** of the biology compared with near undisturbed conditions
- Available at granularity of local water bodies and is already in use

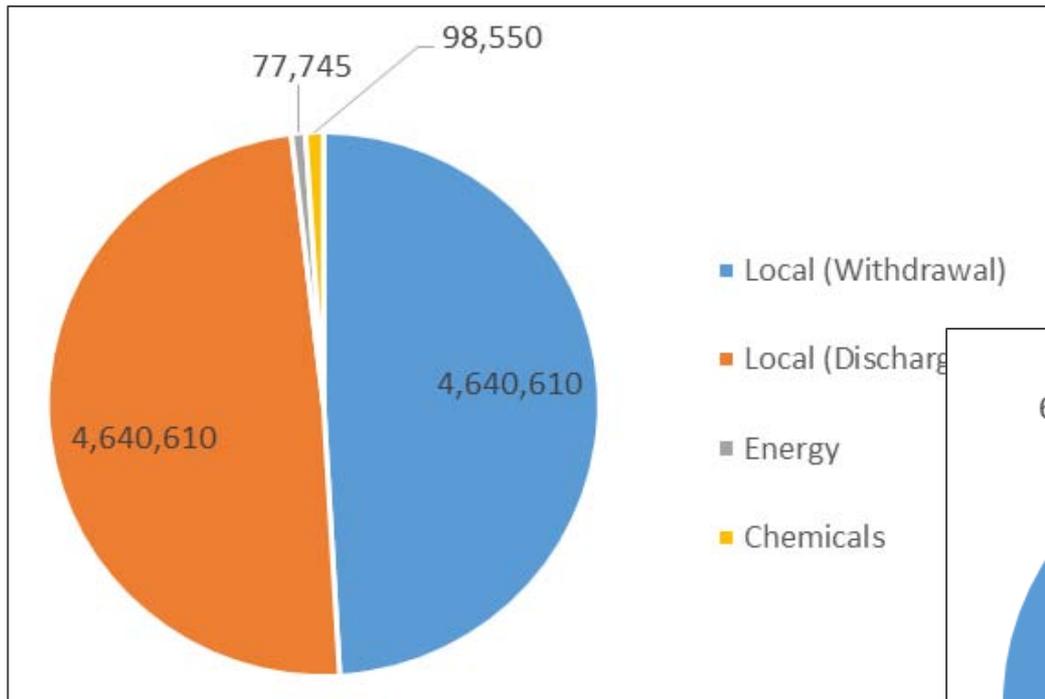
Characterization Factors for Water Bodies

Water Bodies Characterization Factors for Water Scarcity and Phosphate

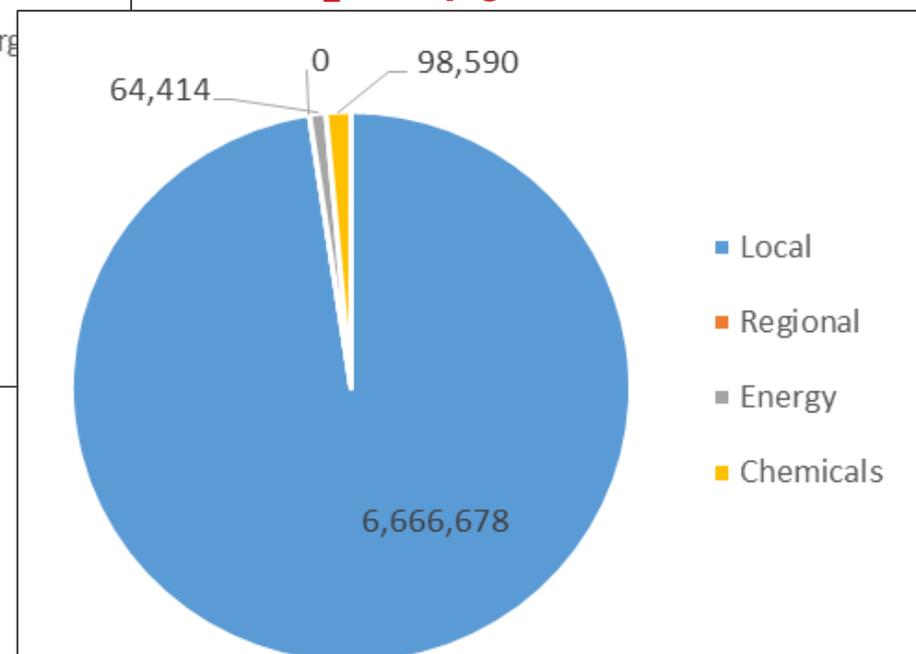


Preliminary Data Analysis Results: Newmarket for Baseline Year (2014/15)

Water Consumption (m³ H₂O/year)

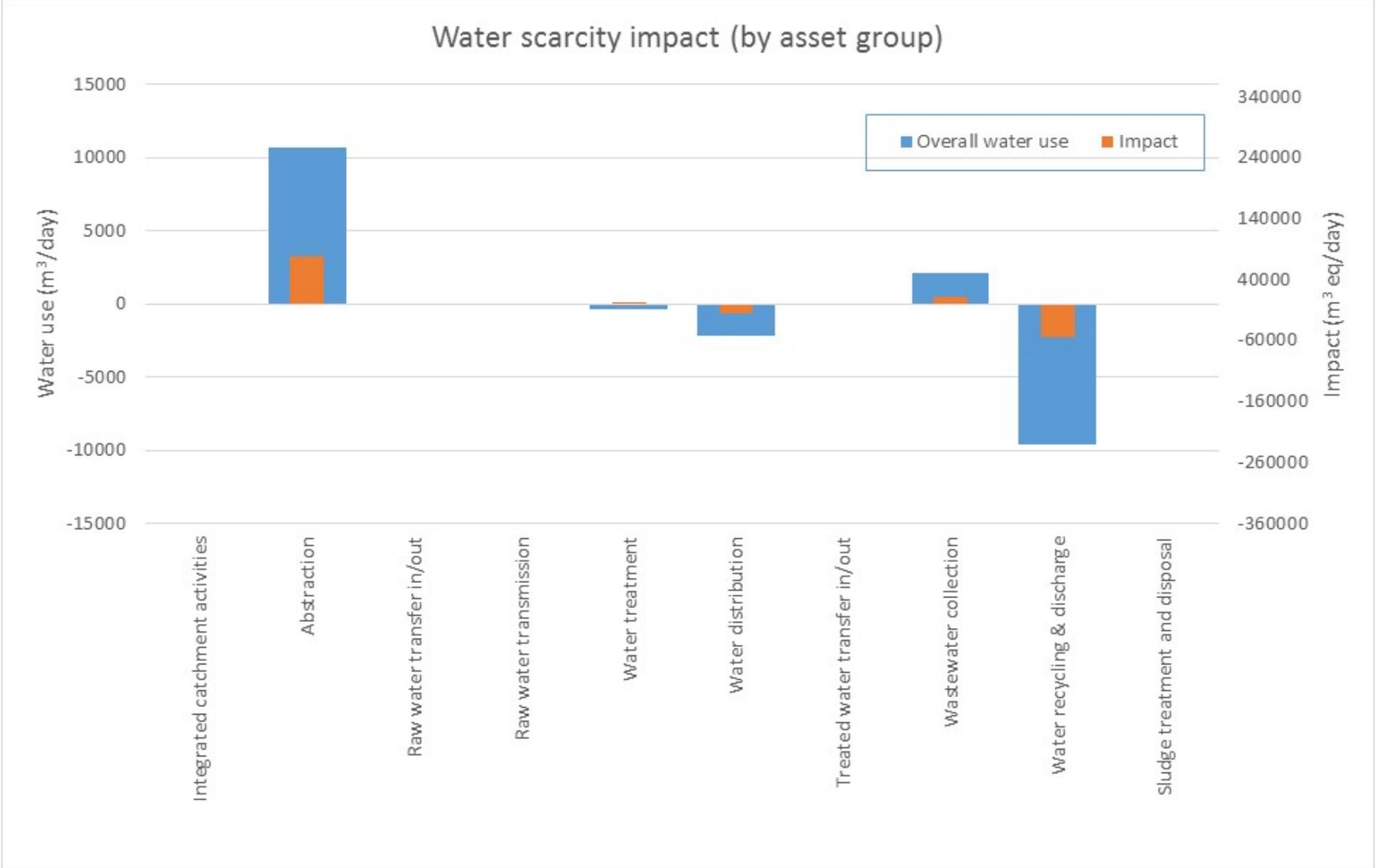


Water Scarcity Footprint (m³ H₂Oeq/year)

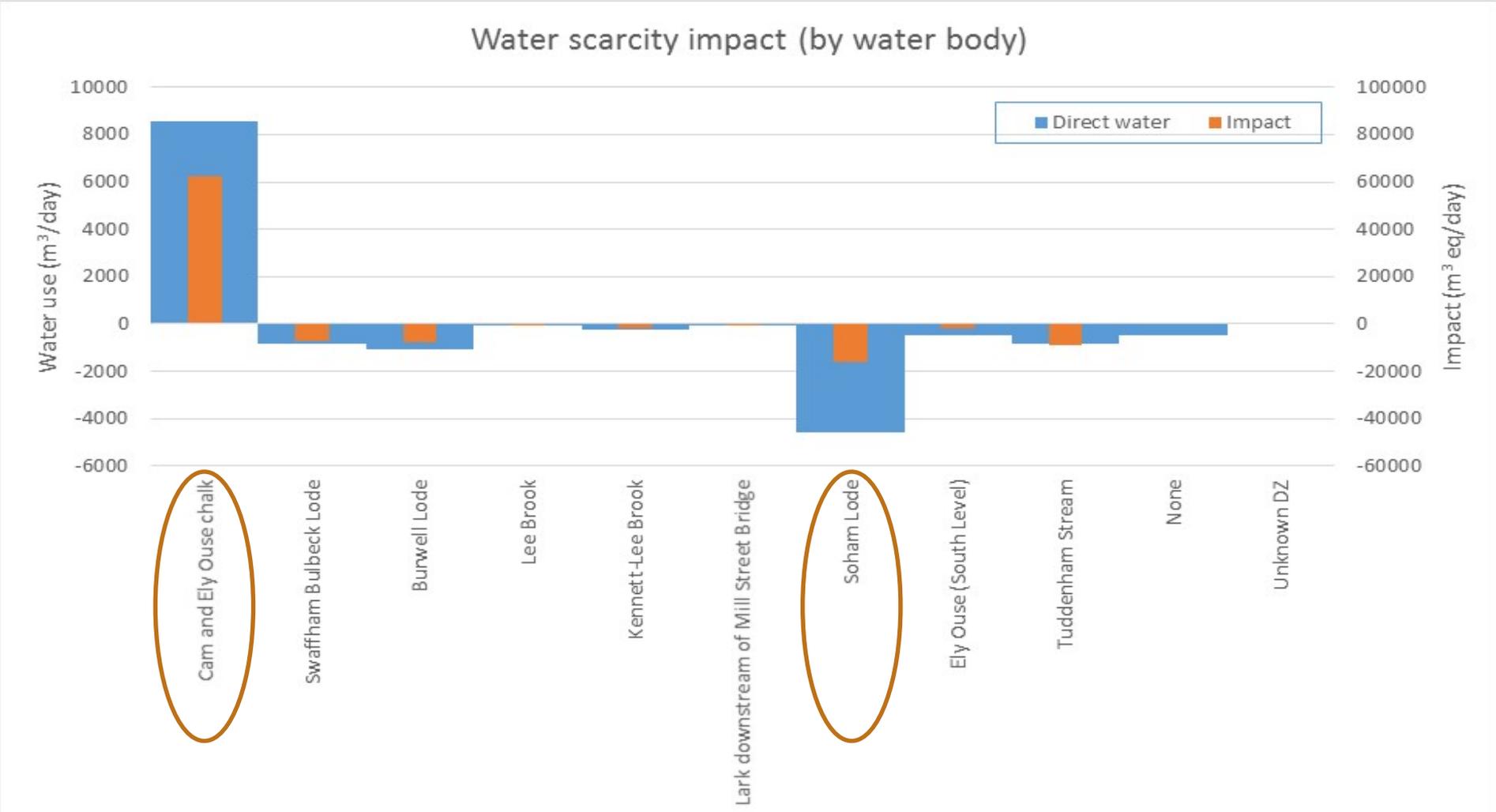


Preliminary Data Analysis by Activity

Water Scarcity Impact (by Asset Group)



Preliminary Data Analysis Results: Water Body



Preliminary Data Analysis Results: Water Quality Impact by Water Body

Phosphate Eutrophication Impact (by Water Body)

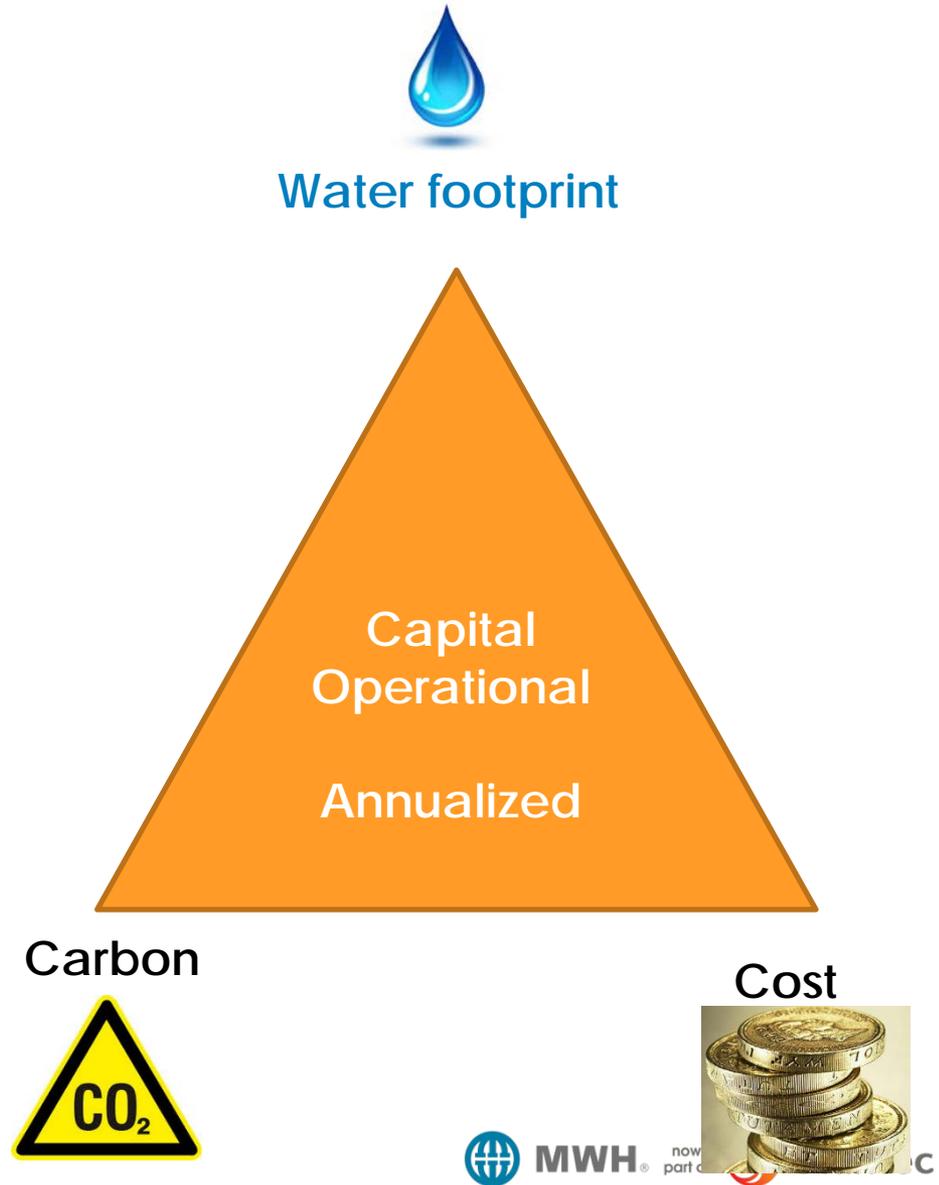


Summary

- Water footprint assessment is a **data intensive complex process**, but can be done using the ISO-14046 Standard method
- Water Footprint assessment may generate a number of **potential values** of water utilities for sustainable decision making and support the “one water” concept
- **Discussion with** the regulatory/environmental agencies is critical regarding the selection and evaluation of characterization factors
- Communications of **water footprint numbers** (e.g., absolute number, change in WF) should be tailored for the targeted stakeholders

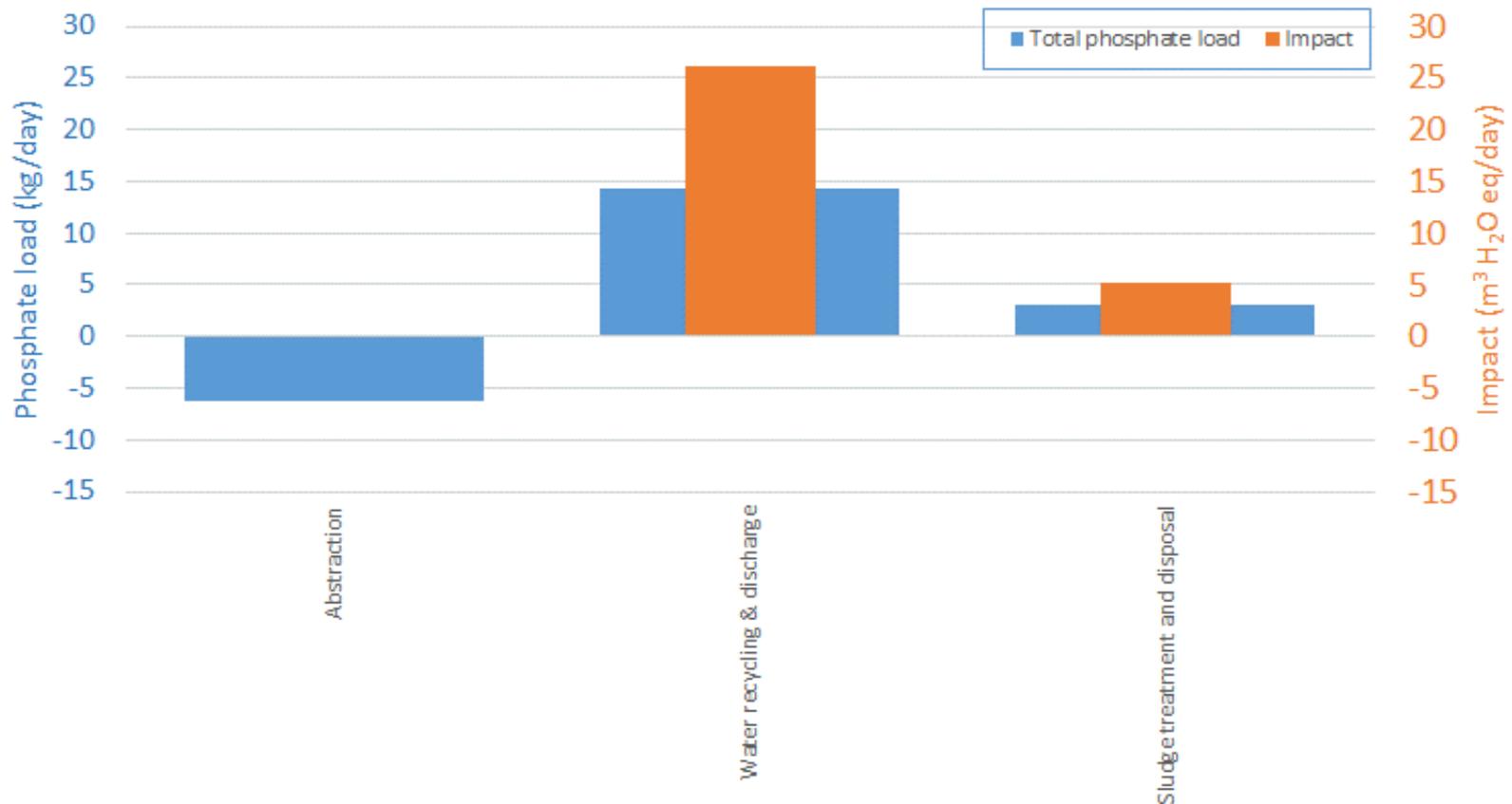
Current Activities

- Perform **Scenario analysis** (leakage reduction, local vs. import water supply, desalination vs water reuse)
- Assessment of **trade-offs** between cost, carbon footprint and water footprint of capital improvement projects
- Development of a water footprint **assessment tool**



Preliminary Data Analysis Results: Water Quality Impact

Phosphate Eutrophication Impact (by Asset Group)



Example of data-related challenges

Weighting of different impact categories

Water scarcity: *“extent to which demand for water compares to the replenishment of water in an area”*

Water quality degradation *“negative change in water quality”*

Water Impact	Weighting Factor	
	Source 1	Source 2
Water scarcity	1.7	1
Water quality degradation (N)	53	1.3
Water quality degradation (P)	53	1.27

Source 1: ISO 14064 Technical Guidance (Draft) Table 30 Example O Non-comprehensive weighted water footprint of municipal water management.

Source 2: Hauschild et al (2013) Life-cycle and freshwater withdrawal impact assessment of water supply technologies *Water Research* 2013.02.005

Only reason for weighting and aggregating to a total water footprint is for public communication

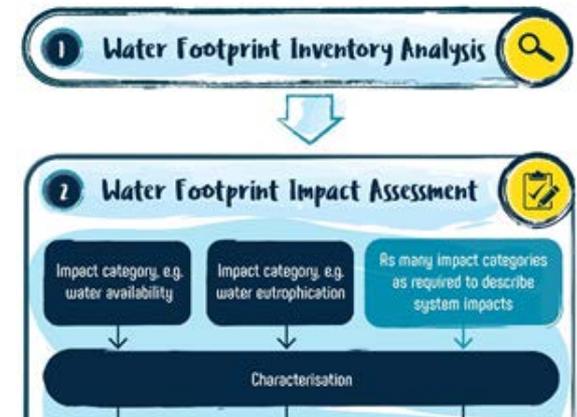
Water Footprint Impact Assessment

- Identify impact categories

- Water scarcity
- Water eutrophication

- Characterization

- What is the potential contribution of 1 m³ of water withdrawal on water scarcity?
- What is the potential contribution of 1 kg of phosphate discharged on water eutrophication?



THANK YOU!

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