Ecotoxicological assessment of groundwater samples from the Hessian Ried

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Background & Sampling Campaign

- the gwTriade Project aims to combine chemical, ecotoxicological, and groundwater fauna assessment
- \rightarrow This forms the basis for comprehensive groundwater (GW) monitoring, identifying indicator substances, and a well-founded risk assessment.
- Water samples were collected from a monitoring station of the WaRM project at the Landgraben river investigated.
- The Hessian Ried is a key region for the drinking water supply of the metropolitan Frankfurt region.

- GW samples were collected from two multilevel wells (MW) downstream of a wastewater treatment plant (WWTP).
- Samples were taken at depths of 1.5 m and 3.5 m in MW1, and at 1.6 m and 4.6 m in MW2.
- Extracts of the samples were prepared using solid phase extraction (SPE).
- \rightarrow samples were analysed for dioxin-like activity (µEROD), estrogenic (ER), anti-estrogenic (anti-ER), mutagenicity in the AMES test, and genotoxicity in the umu-test.
- \rightarrow Results are expressed as Bioanalytical equivalents (BEQs).

	U2OS <mark>Cytotox</mark> IC10 [REF]		BEQ [pg	Anti-ER CALUX: BEQ [pg TAM/L]	Anti-AR CALUX: BEQ [µg FLU/L]	H4IIE <u>Cytotox</u> IC20 [REF]	BEQ [pg	AMES-Test umu-Test
Pumpenblank		17,6						
Landgraben		62,2			10,1	37,0	47,1	
MW_1A		21,9			7,0			
MW_1C		93,7			21,2	39,8	29,0	
MW_3A		20,0			5,5		14,7	
MW_3C		344			9,8		64,7	
							F	
	no effect	medium	neffect	strong effect				







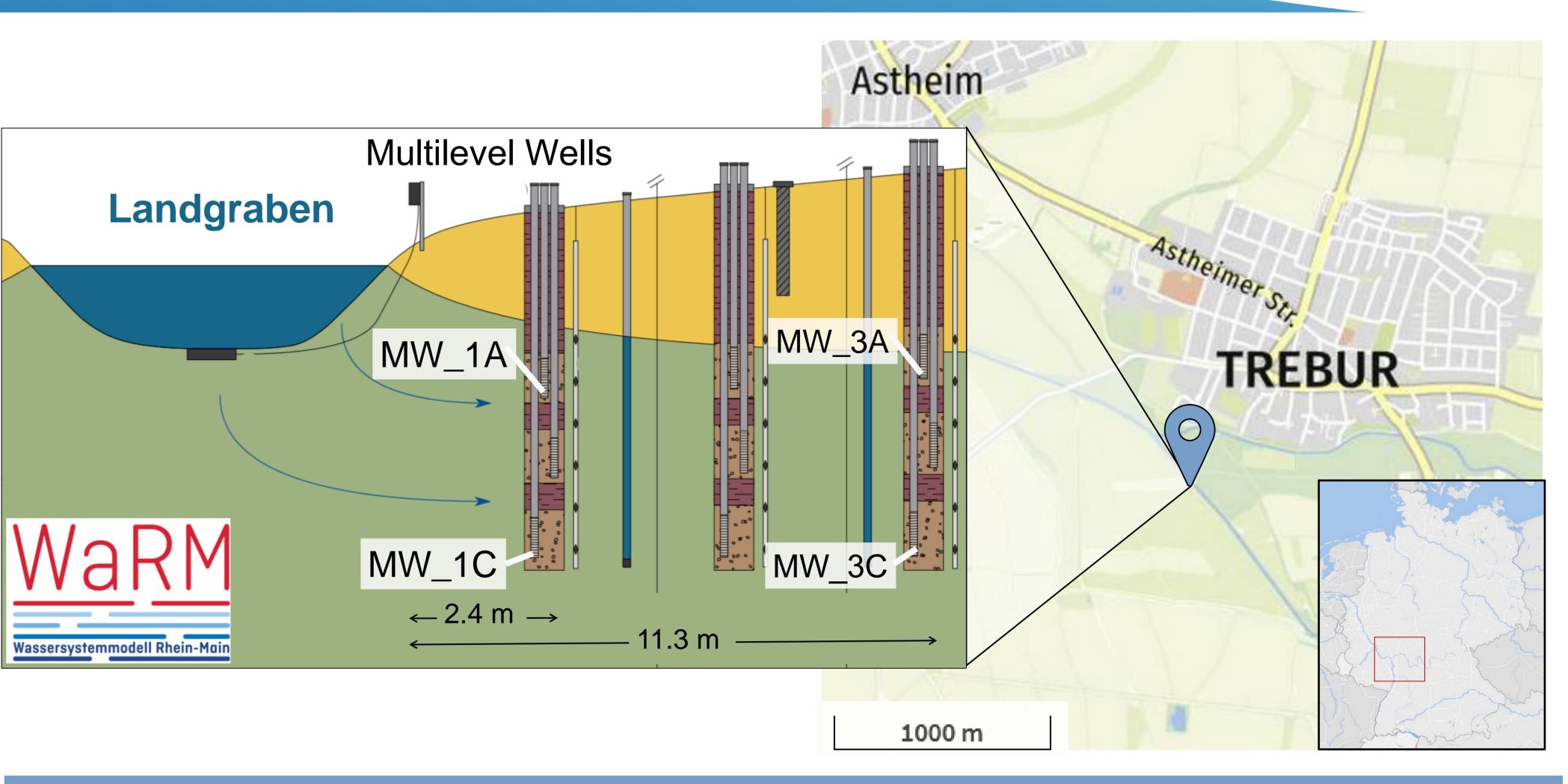


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downstream of a wastewater treatment plant (WWTP), where surface-groundwater interactions are

Methods

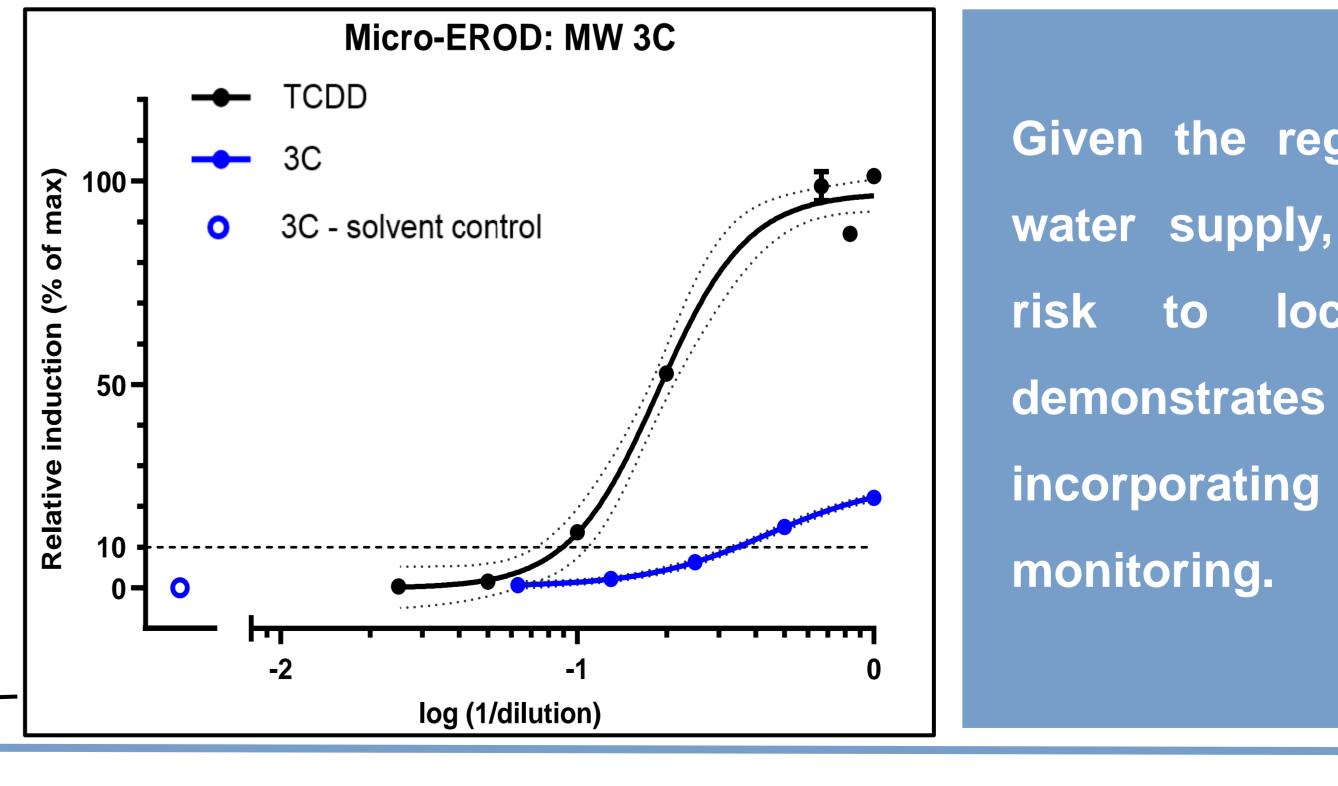
androgenic (AR), and anti-androgenic (anti-AR) activity (Ant-AR) in the CALUX® assay, for



Results & Discussion

All samples showed strong anti-androgenic effects, and both the Landgraben and the well samples 1C and 3C showed high estrogenic and dioxin-like activity, exceeding effect-based trigger values (EBT) for drinking water (Been et al. 2021). The estrogenic and dioxin-like activity for sample 3C also exceeded EBT for surface water (Escher et al. 2018).

The observed effect patterns provide evidence of the infiltration of WWTP-impacted river water. Strong effects in samples from greater depths suggesting no attenuation during sediment filtration.







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Given the region's key role in drinking water supply, this indicates a potential local GW resources and the importance Of incorporating effect-based tools into GW

