

Achieving low(er) P-discharge levels

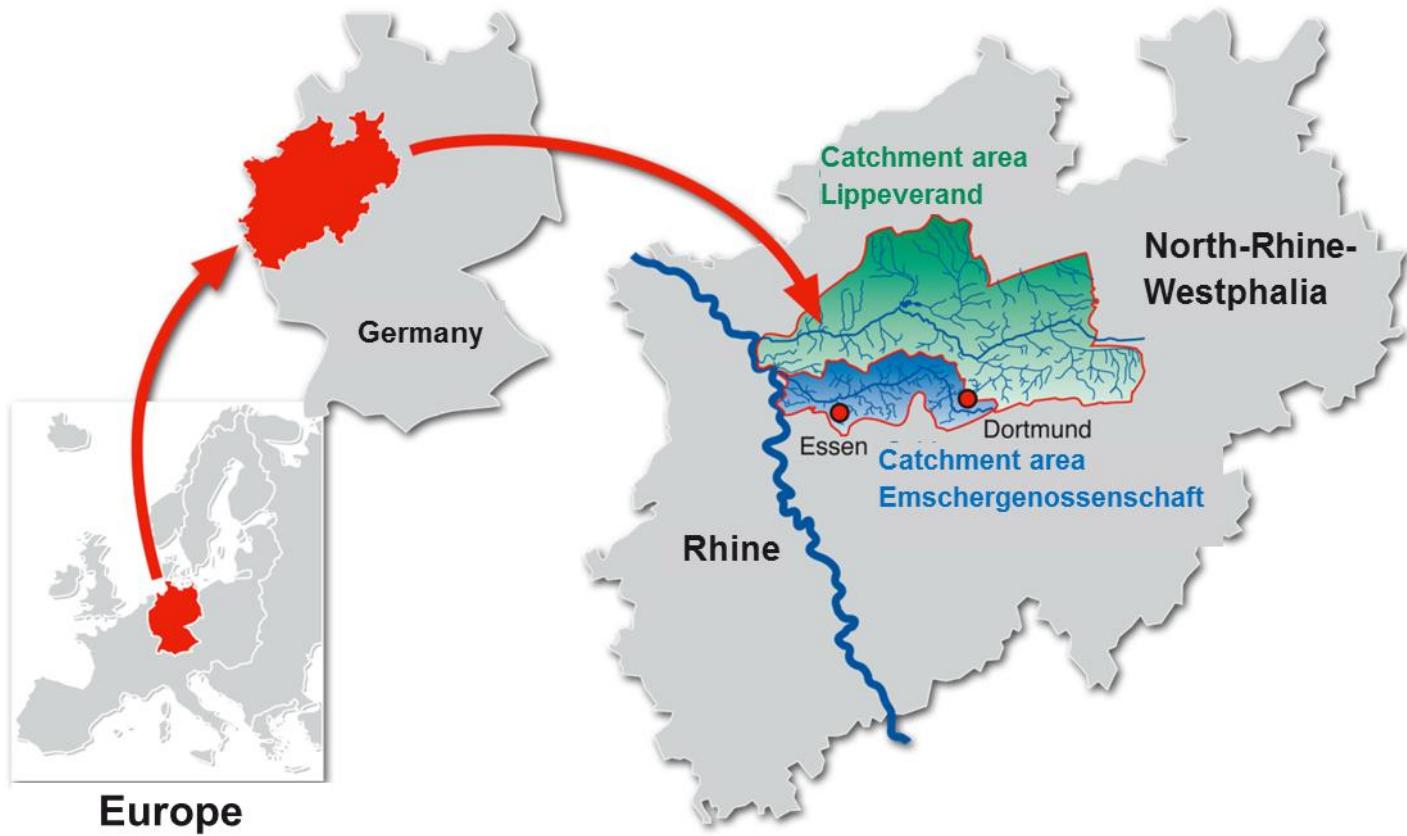
Current situation and activities of EGLV



Daniel Klein, EGLV; 09.10.2019, ESPP / Liège

EMSCHERGENOSSENSCHAFT / LIPPEVERBAND

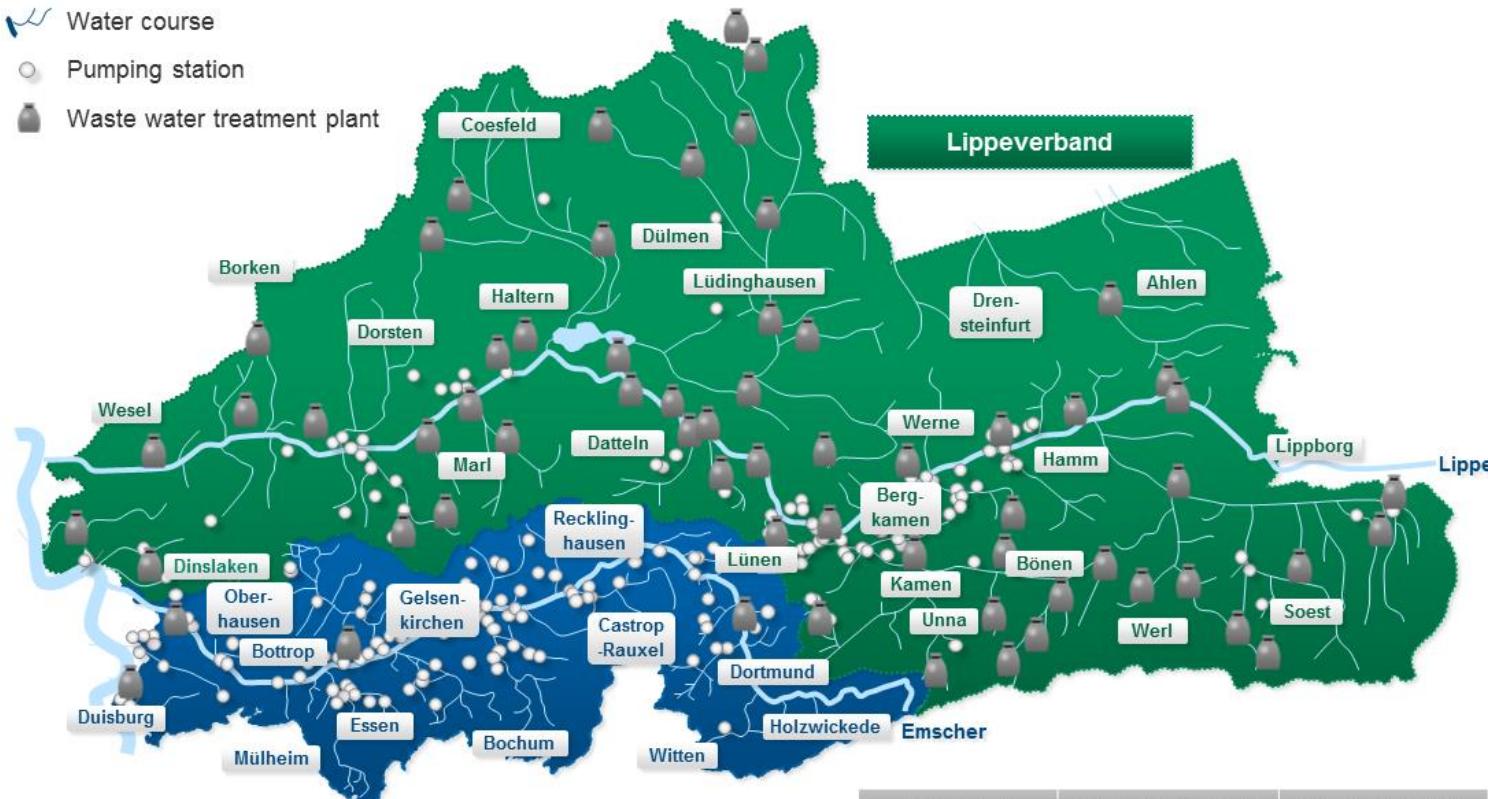
EMSCHER LIPPE
GENOSSENSCHAFT EGLV.de VERBAND



CATCHMENT AREAS OF EGLV

EMSCHER LIPPE
GENOSSENSCHAFT EGLV.de VERBAND

- Water course
- Pumping station
- Waste water treatment plant



Emschergenossenschaft

	Area (km ²)	Inhabitants (Mill.)	Inhabitants/ km ²
Lipperverband	3,280	1.4	427
Emschergenossenschaft	865	2.4	2,775

DISCHARGE LIMITS IN GERMANY

Minimum requirements / monitoring values

(According to
waste water
ordinance
(AbwV) 1997)

> 10.000 P.E, size
class 4

> 100.000 P.E, size
class 5

Proben nach Größenklassen der Abwasserbehandlungsanlagen ⁷	CSB mg/l	BSB ₅ mg/l	NH ₄ -N mg/l	N _{ges} mg/l	total P mg/L
	(qualified random sample or 2h-composite sample)				
Größeklasse 1 kleiner als 60 kg/d BSB ₅ (roh)	150	40	-	-	-
Größeklasse 2 60 bis 300 kg/d BSB ₅ (roh)	110	25	-	-	-
Größeklasse 3 größer als 300 bis 600 kg/d BSB ₅ (roh)	90	20	10	-	-
Größeklasse 4 größer als 600 bis 6.000 kg/d BSB ₅ (roh)	90	20	10	18	2
Größeklasse 5 größer als 6.000 kg/d BSB ₅ (roh)	75	15	10	18	1

AbwV 1997

DISCHARGE LIMITS IN GERMANY

Examples of additional / higher requirements

Size of the wwtp (P.E.)	Anforderungswert C _P in mg/l ⁵⁾		
	AbwV	State Baden-Württemberg	Lake Constance
< 600	–	–	–
600 – 999	–	1,5 mg/l ^{2),4)}	–
1.000 – 2.999	–	1,5 mg/l ²⁾	1,0 mg/l
3.000 – 9.999	–	1,0 mg/l ²⁾	1,0 mg/l
10.000 – 29.999	2,0 mg/l ^{1),3)}	1,0 mg/l ²⁾	1,0 mg/l ⁴⁾
30.000 – 39.999	2,0 mg/l ^{1),3)}	1,0 mg/l ²⁾ /0,3 mg/l ⁴⁾	(1,0 mg/l)
40.000 – 100.000	2,0 mg/l ^{1),3)}	1,0 mg/l ²⁾ /0,3 mg/l ⁴⁾	0,3 mg/l
> 100.000	1,0 mg/l ^{1),2),3)}	0,3 mg/l ⁴⁾	0,3 mg/l

Maier 2007; in TMLNU 2009

- Higher / stricter requirements can also be “declared” by the wwtp operator (in agreement with the relevant authorities)

SITUATION AT EGLV

Actual P-effluent concentrations

- Wwtp **over > 100.000 P.E. (size class 5)** usually have total P-effluent-concentrations in the range of 0.4 to 0.7 mg/L
- With regard to the waste water ordinance, the monitoring values (1 mg/L) are held
- Wwtp **over > 10.000 P.E. (size class 4)** have total P-effluent-concentrations in the range of approx. 0.5 to 1.5 mg/L
- With regard to the waste water ordinance, the monitoring values (2 mg/L) are held as well (therefore, in some cases, the value is declared to 1 mg/L)
- All wwtp of EGLV use “standard” technology, usually chemical precipitation (in combination with (enhanced) bio-P)

EU WATER FRAMEWORK DIRECTIVE (WFD)

Target values of total P in rivers

- Target mean annual values of total P in different types of rivers to be classified as “good” (or “very good”...) with regard to chemical conditions

“very good
(high)”

“good”

“moderate”

Quality classification for total phosphorus in mg/l, comparison value: Annual average

Surface water type	I	I-II	II	II-III	III	III-IV	IV
1.1, 1.2, 2.2, 3.2, 4, 5, 9, 9.1, 9.1K, 9.2, 10, 14, 15, 15g, 16, 17, 20, 23	≤ 0.05	≤ 0.075	≤ 0.1	≤ 0.2	≤ 0.4	≤ 0.8	> 0.8
12, 19	≤ 0.05	≤ 0.1	≤ 0.15	≤ 0.3	≤ 0.6	≤ 1.2	> 1.2
22.1, 22.2, 22.3	≤ 0.1	≤ 0.2	≤ 0.3	≤ 0.6	≤ 1.2	≤ 2.4	> 2.4
T1, T2	≤ 0.03	≤ 0.0375	≤ 0.045	≤ 0.09	≤ 0.18	≤ 0.36	> 0.36
Lake type 12 *	-	-	≤ 0.1	≤ 0.2	≤ 0.4	≤ 0.8	> 0.8

Orientation value / goal

UBA 2017

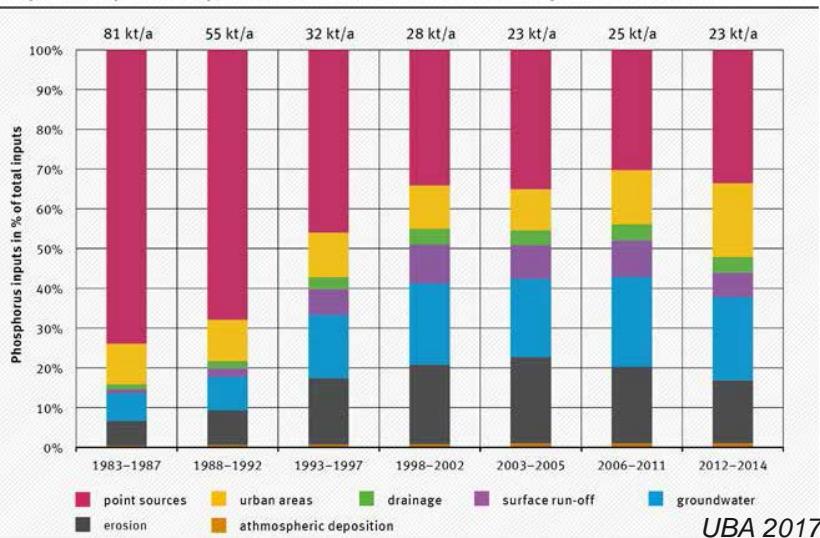
CURRENT DEVELOPMENTS

Effluent concentrations in view of WFD

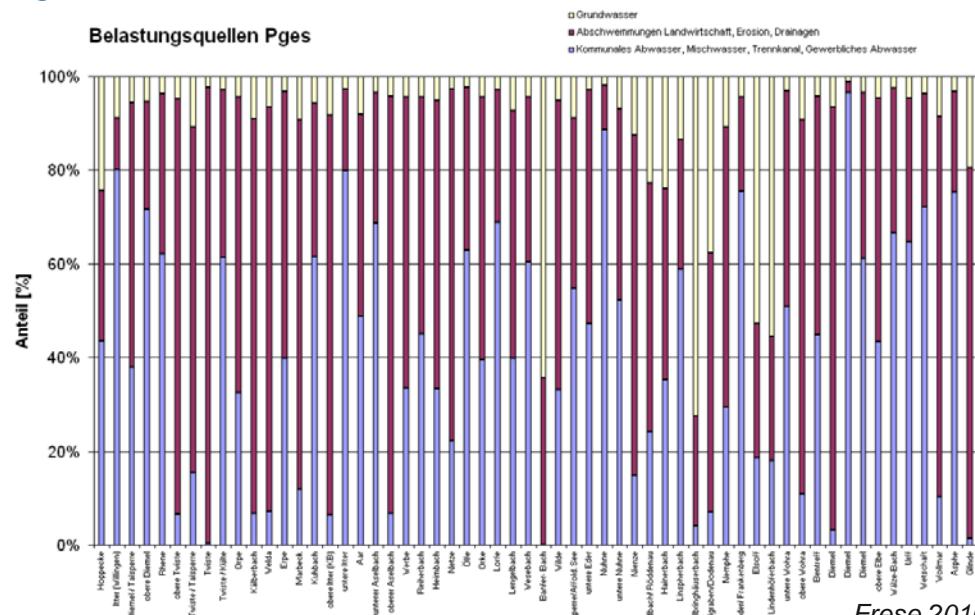
- Usually, total P in rivers is higher than the target values of the WFD
 - Reducing the P-inputs from wwtp effluents (point source of P) is one strategy to reduce total P in rivers

Figure 18

Phosphorus inputs from point and diffuse sources into Germany's surface waters



Source: German Environment Agency (MoER), as at: August 2011



Frese (2010): Reduzierung von Phosphoreinträgen in oberirdische Gewässer nach der Europäischen Wasserrahmenrichtlinie- WRRL, Presentation 17.03.2010, LK Waldeck-Frankenberg

CURRENT DEVELOPMENTS

Effluent concentrations in view of WFD

- Discharge limits (example: state of Hesse):
 - Size classes 5 and 4+: total P monitoring value 0.4 mg/L ; 0.2 mg /L monthly mean (“plant performance”)
 - Size class 4: 0.7 mg/L and 0.5 mg/l, respectively (+ requirements for PO₄-P)
 - Size classes 2 and 3: 2.0 mg/L and 1.0 mg/L, respectively
- North-Rhine-Westphalia:
 - No general discharge limits
- EGLV:
 - Plant-specific mean values (\neq monitoring values) under discussion with authorities (range: 0.2 to 0.5 mg/L)

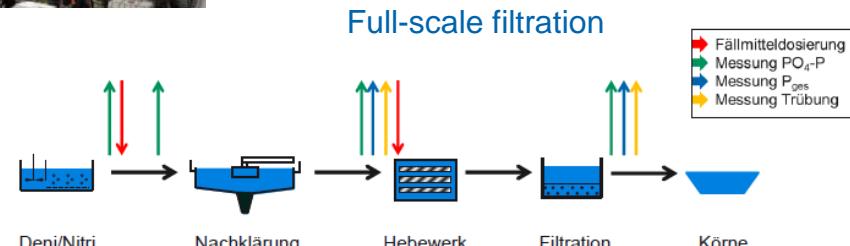
- ***Simultaneous precipitation***: mean values of approx. 0.5 to 0.7 mg/L possible → not sufficient
 - To safely achieve concentrations \leq 0.5 mg/L, wwtp have to be upgraded
 - ***Flocculation and filtration*** (achievable mean values 0.2 – 0.3 mg/L total P), depending on type of filtration / sieving
 - ***Membrane filtration*** (achievable mean values \sim 0.1 mg/L total P)
- !** Actually achievable concentrations depend on specific ww properties and wwtp operation
- !** Choice of technologies also depends on type of limit value (e.g. monitoring values vs. mean values / performance values)

- Commitment with authorities to upgrade various wwtp with filtration steps
 - Examples: Large wwtp of EG (Bottrop, Do-Deusen)
- Own research at pilot plant site and full-scale studies at own plants

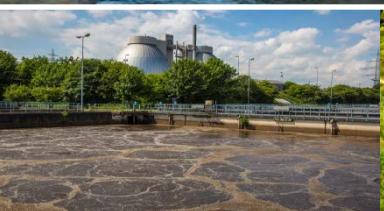
Cloth filter



Sand filter



Thank you for your attention!



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