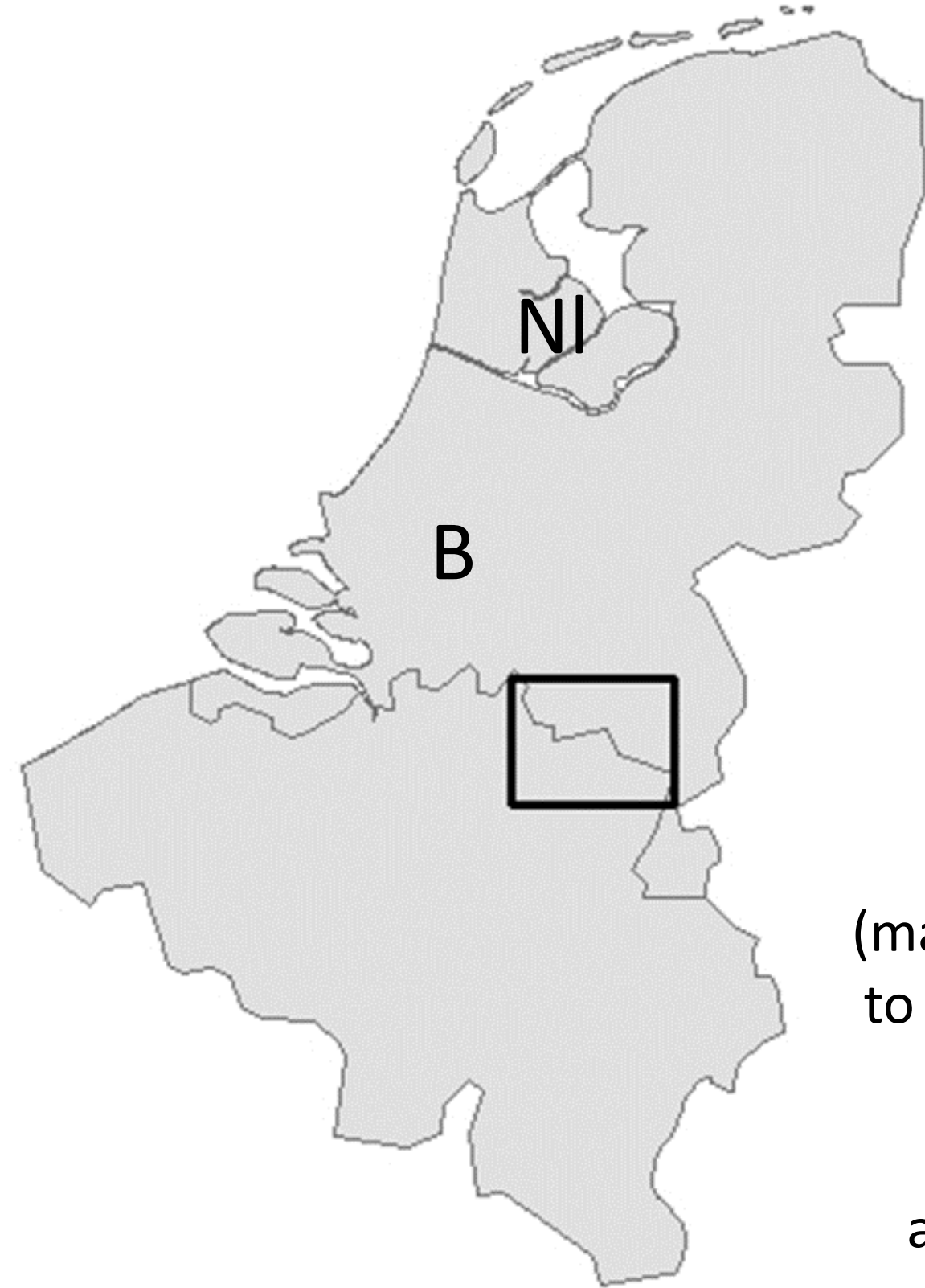


CHARATERIZATION OF THE IMPACT OF HEAVY METAL POLLUTION ON SURFACE WATER BODIES AS RESULT OF THE REGIONAL DIFFUSE SOIL AND GROUNDWATER POLLUTION IN THE CAMPINE AREA (NE BELGIUM)

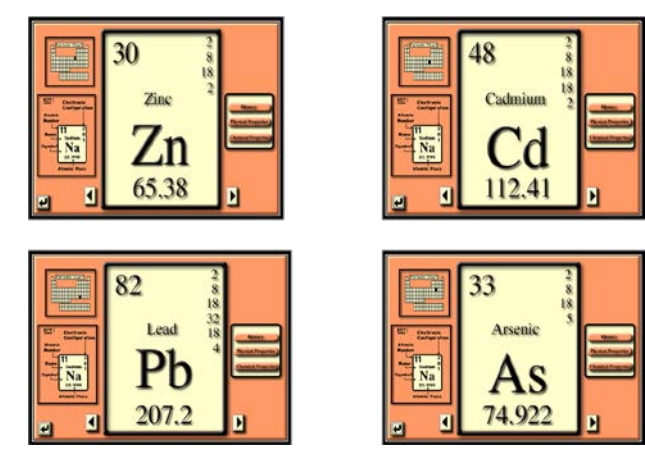
J. Bronders^(1,5), I. Van Keer⁽¹⁾, J. Vos⁽¹⁾, N. Desmet⁽¹⁾, I. Joris⁽¹⁾, J. Patyn⁽¹⁾, D. Paulus⁽²⁾, T. Lieben⁽³⁾, P. De Clercq⁽³⁾, A. Van Autenboer⁽⁴⁾

(1) VITO Belgium; (2) Tauw Belgium; (3) OVAM Belgium; (4) SWECO Belgium
(5) contact: jan.bronders@vito.be

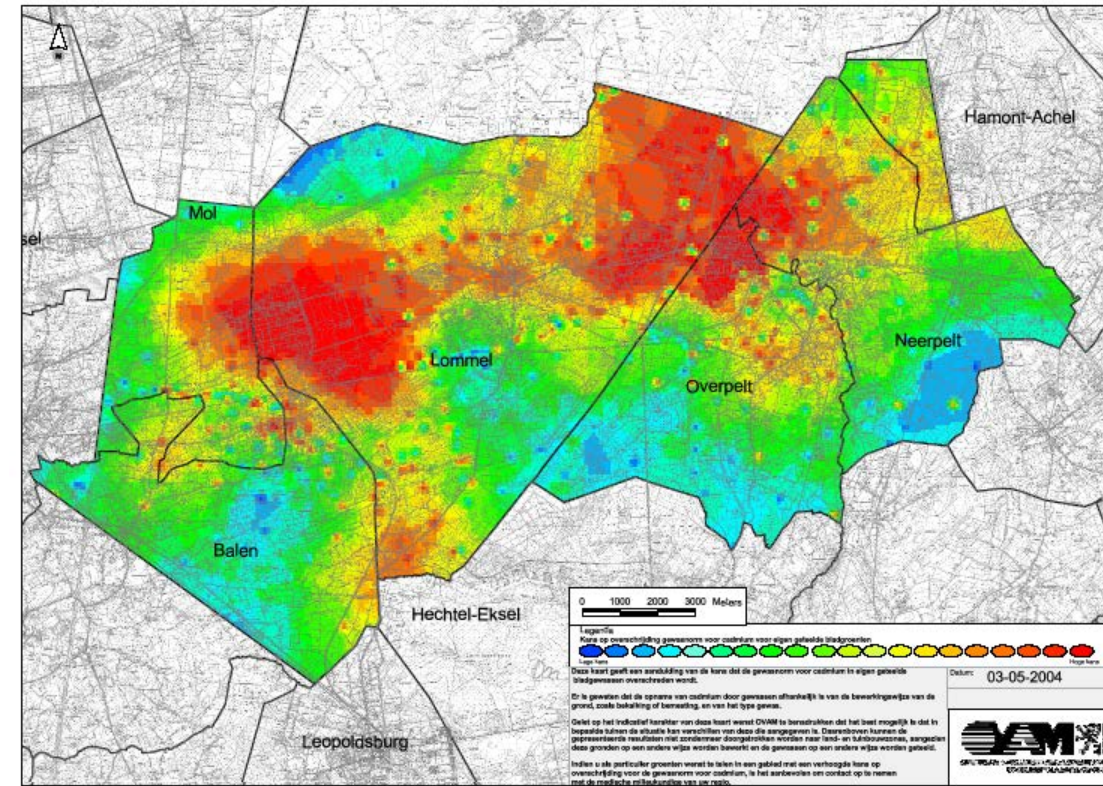
THE PROBLEM



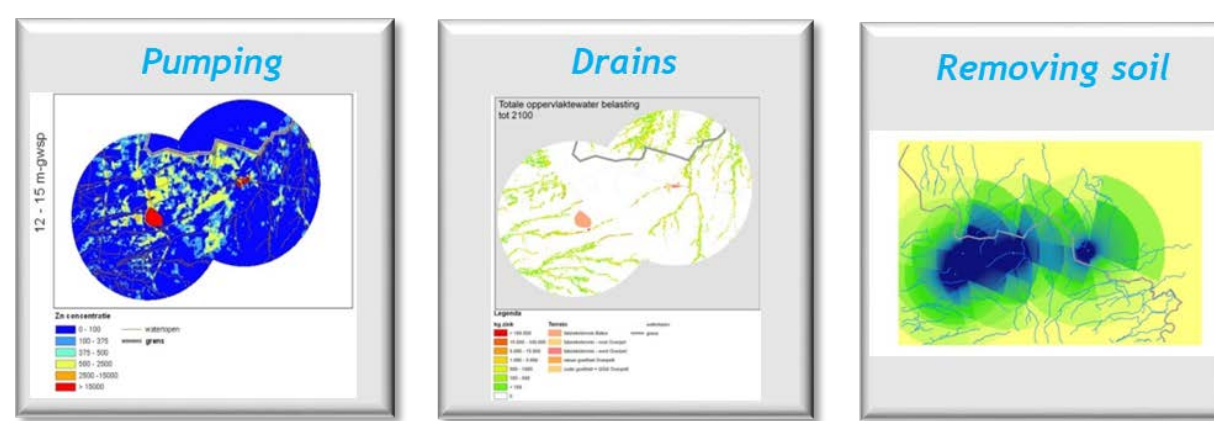
The soil and water system is polluted with heavy metals (mainly zinc and cadmium) due to the former activities of non-ferro industry. The polluted area covers an area in the order of 700 km².



Deposition



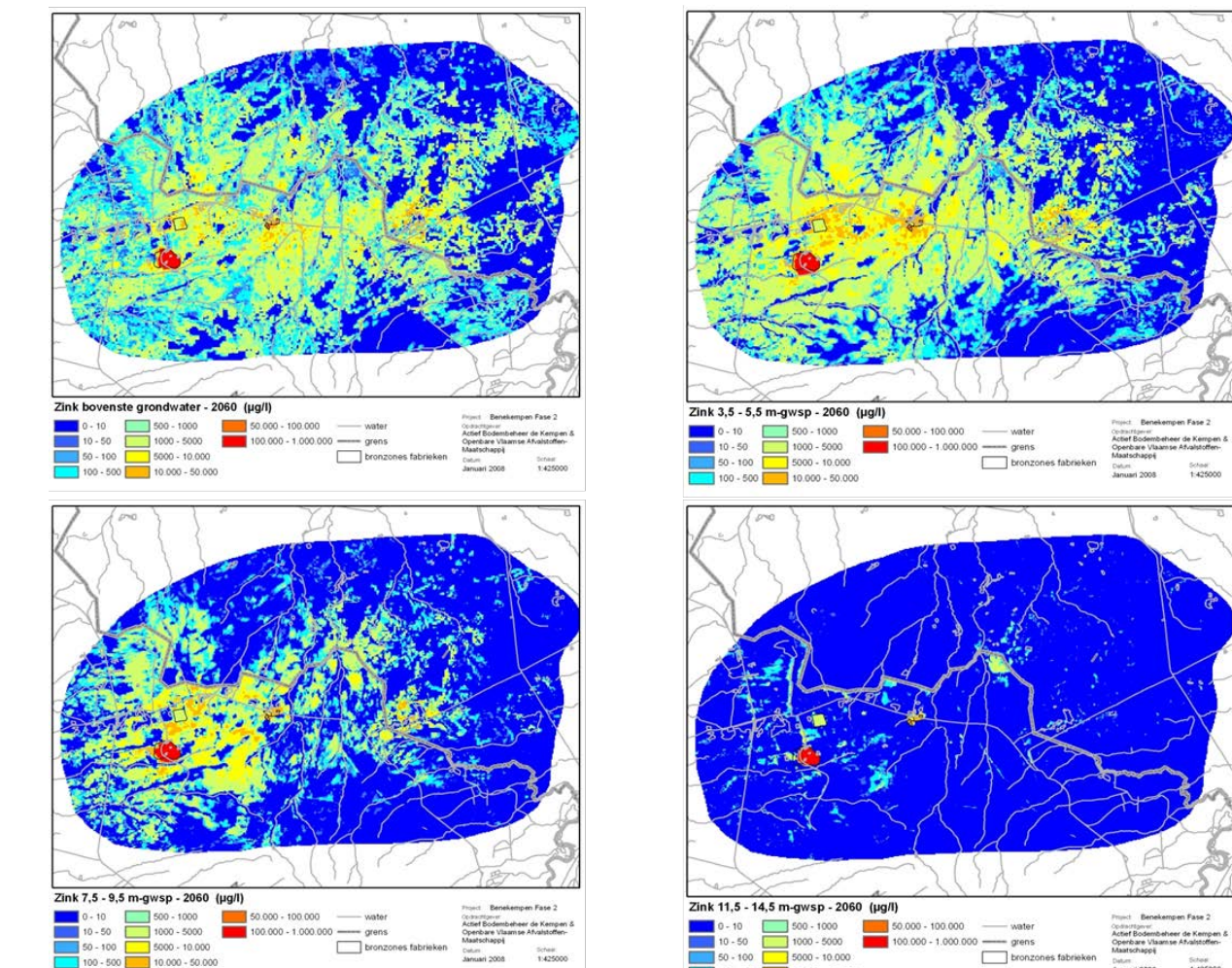
Evaluation of (groundwater) remedial actions



INVESTIGATIONS / STUDY / REMEDIATION 1995 - 2019

Average regional groundwater concentrations are between 500 – 3000 µg/l for Zn and up to 20 µg/l for Cd. Also surface water is affected, depending on the location, concentrations in the order of 3 µg/l for Cd and 300 µg/l for Zn are present. The values are for above the reference values.

Groundwater modelling + scenario's



DECISION APPROVED BY THE AUTHORITY

Taking into account the Flemish legislative framework on soil/groundwater pollution, certain feasible measures were identified, in agreement with the stakeholders

Remedial actions at the non-ferro industrial sites

Inventory of non-ferro waste under roads

Removal of non-ferro waste at :
• Schools
• Nature reserves
• Private gardens

Water bodies:
• Surface water: Focus on selected rivers
• Scheppelijke Nete
• Eindergatloop
• Groundwater: Monitoring (network)
• Status of groundwater bodies

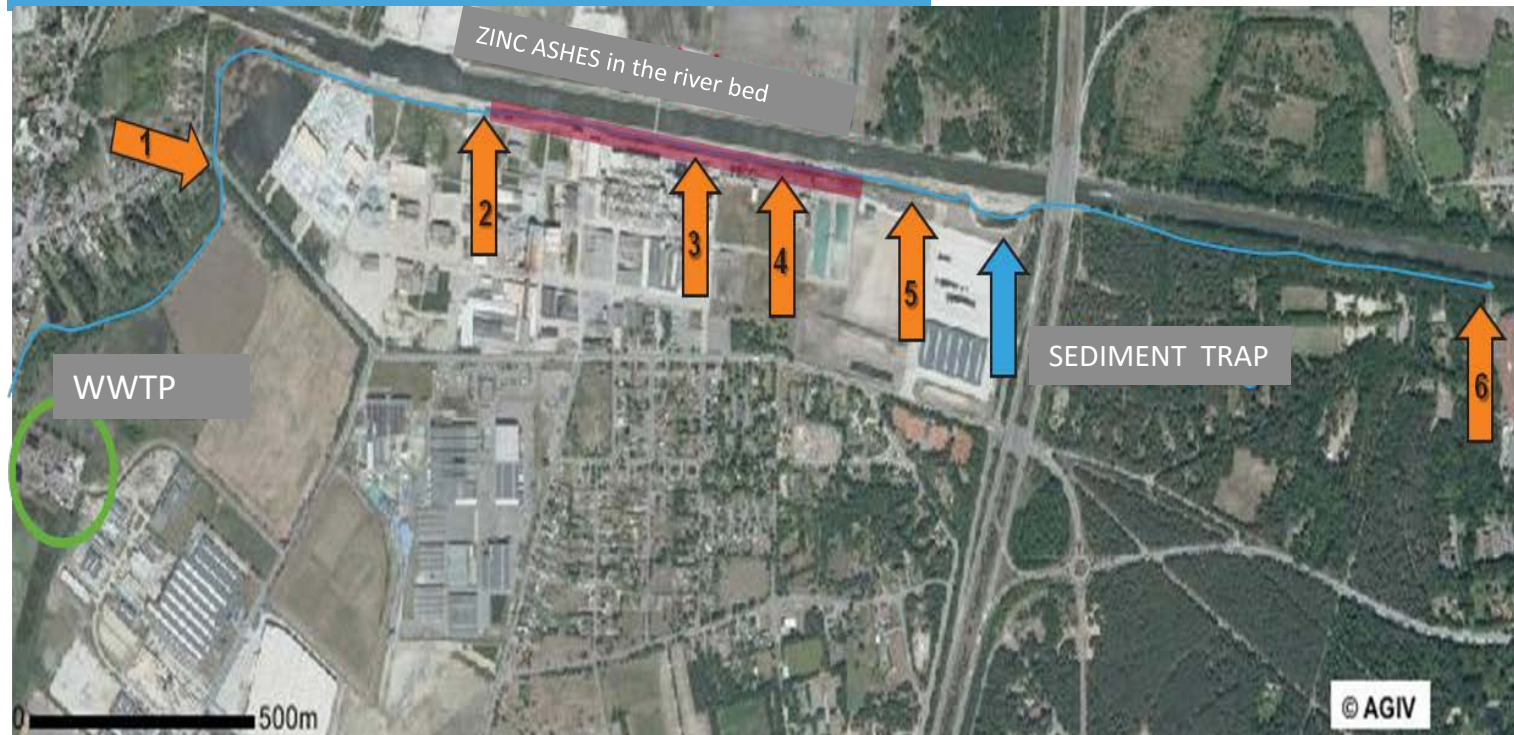
Specific problem for this river:

- Status surface water body: Not good (mainly for Cd and Zn)
- Major contribution of Cd & Zn pollution located in the downstream part of the Eindergatloop
- 50-70 % of the pollution present in receiving down- stream river, Dommel, originates from the Eindergatloop
- Major input of pollutants to the river via groundwater

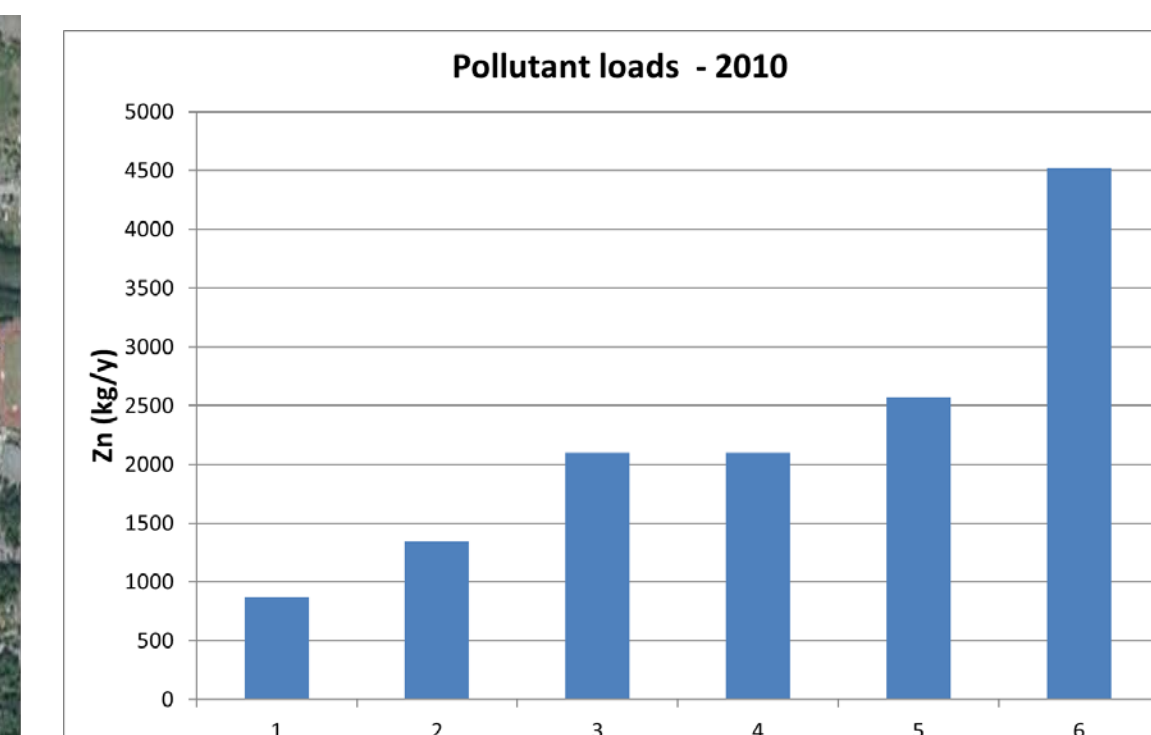
RIVER EINDERGATLOOP: LOCATION AND PROBLEM



RIVER EINDERGATLOOP: STUDY OF THE PROBLEM



Surface water characterization: quality / quantity

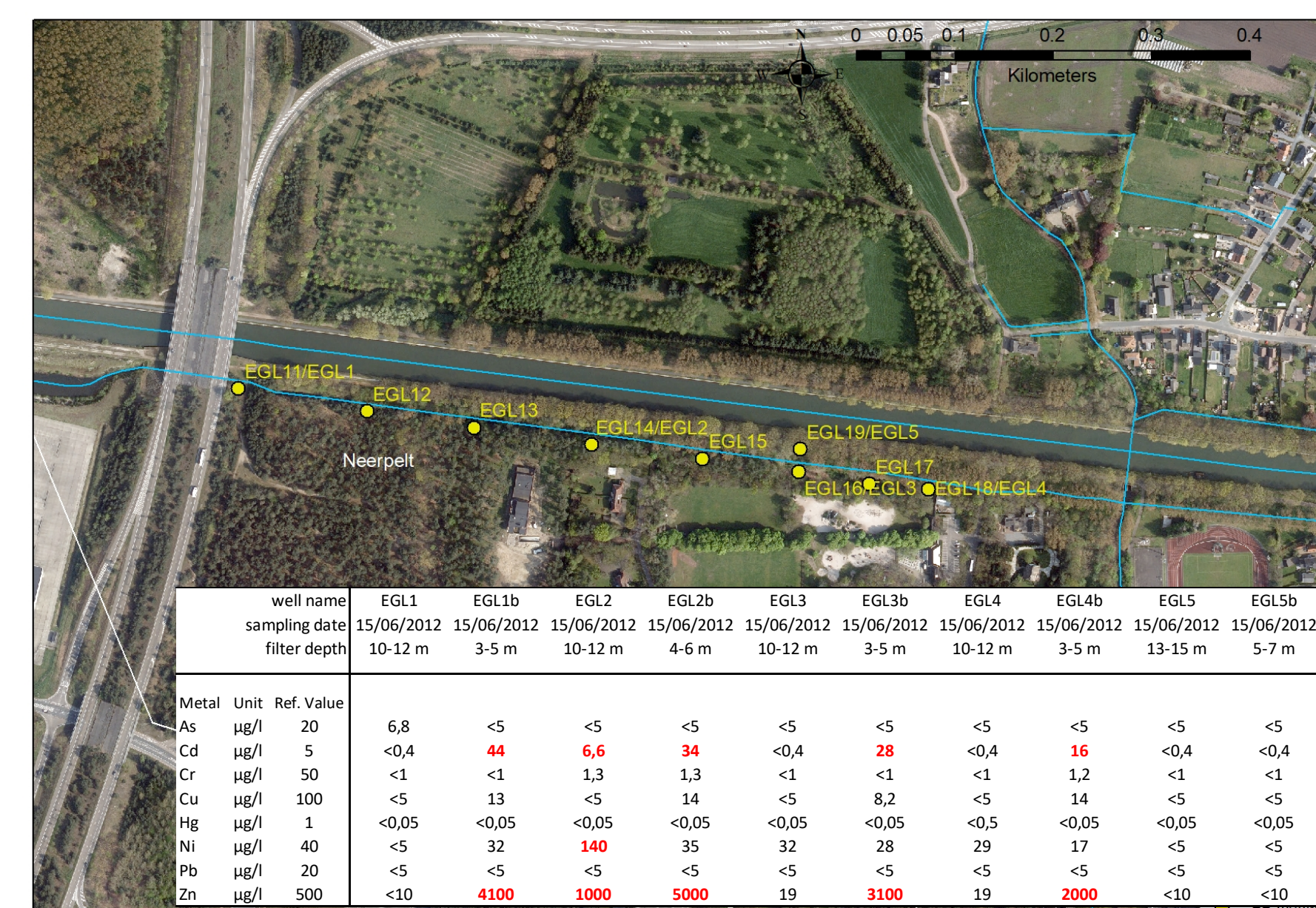


Groundwater water characterization: quality / quantity

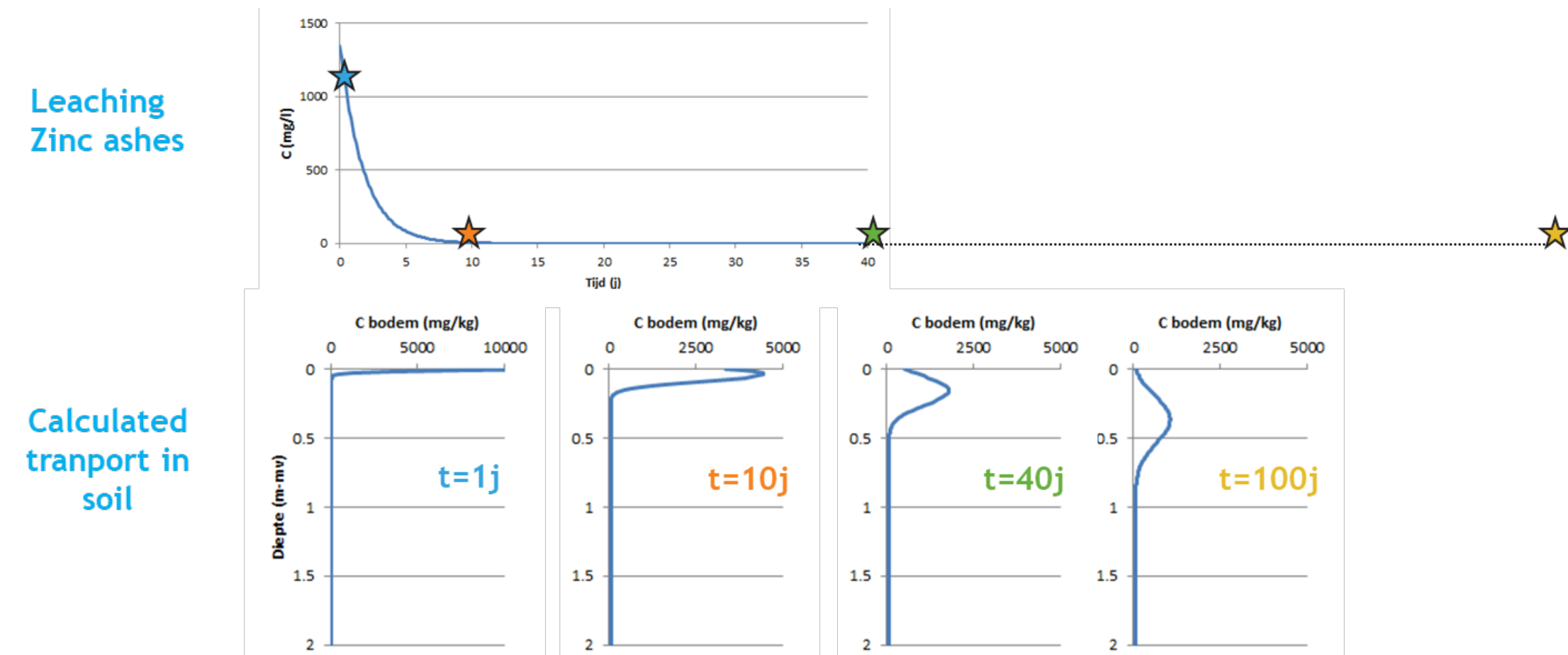
Source identification: pollutant load of the river

	(1) River Eindergatloop	(2) River Dommel upstreams	(3) River Dommel downstreams	(1) / (3)
	Discharge (m3/s)			Discharge ratio
yearly mean	0,3	0,95	1,25	0,24
	Pollutant load (kg/j)			Load ratio
Cd (dissolved)	25,1	6,4	34,8	0,72
Zn (dissolved)	2528	2866	5041	0,50

Source identification: groundwater quality



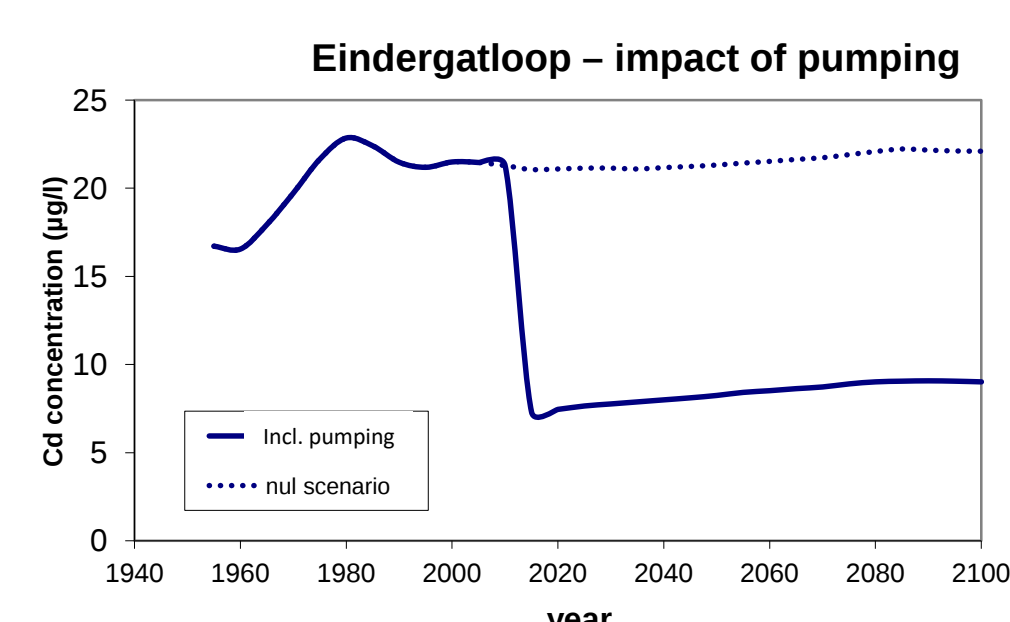
Source identification: Zinc ash leaching



Relatively fast leaching to the bottom, then slow transport

Selection of actions considered for the up stream part of the river

River banks containing Zinc ashes, causing surface water pollution through erosion



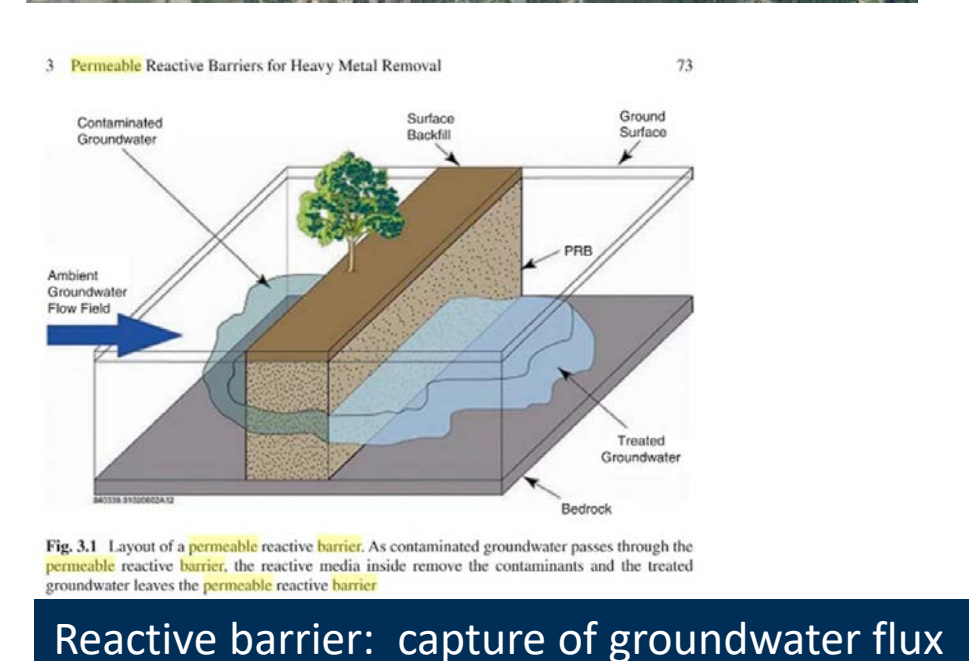
SURFACE WATER EINDERGATLOOP: REMEDIATION - ACTUAL



Covered river bank: after removal of 40 cm of ashes, a geotextile and gabion cages prevent contamination of the surface water

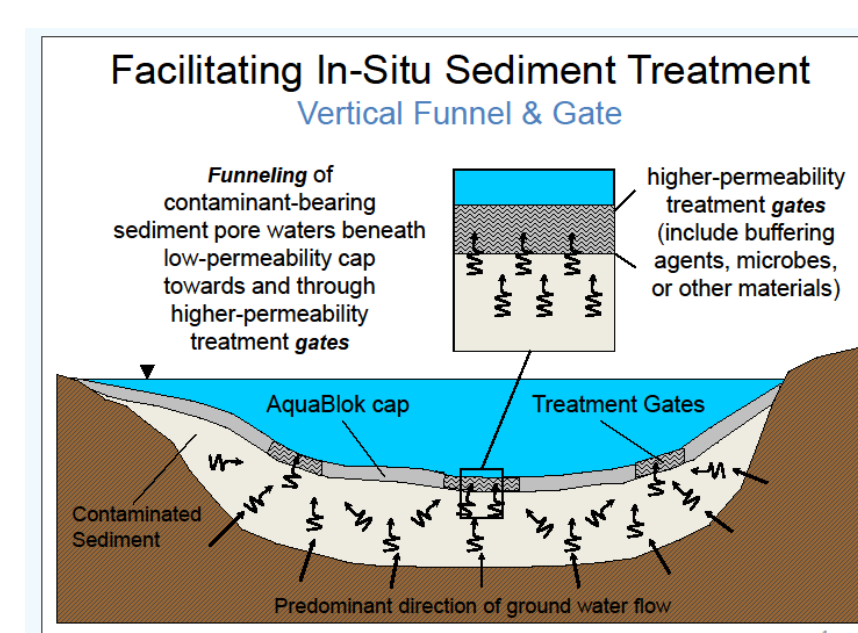
Groundwater abstraction near the present non-ferro industry: 87 wells with a total flow rate of 160 to 170 m³ / h
Reduces the groundwater flow towards the River Eindergatloop

Selection of actions considered for the downstream part of the river



Reactive barrier: capture of groundwater flux

SURFACE WATER EINDERGATLOOP: REMEDIATION – TO BE EVALUATED



River bed infiltration: Capture of infiltrating groundwater



Passive treatment of surface water using absorbentia