VLAAMSE MILIEUMAATSCHAPPIJ

‘Source files’ – joint approach on identifying source related risks

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VLAAMSE MILIEUMAATSCHAPPIJ

Part 1
Water use and water availability in Flanders

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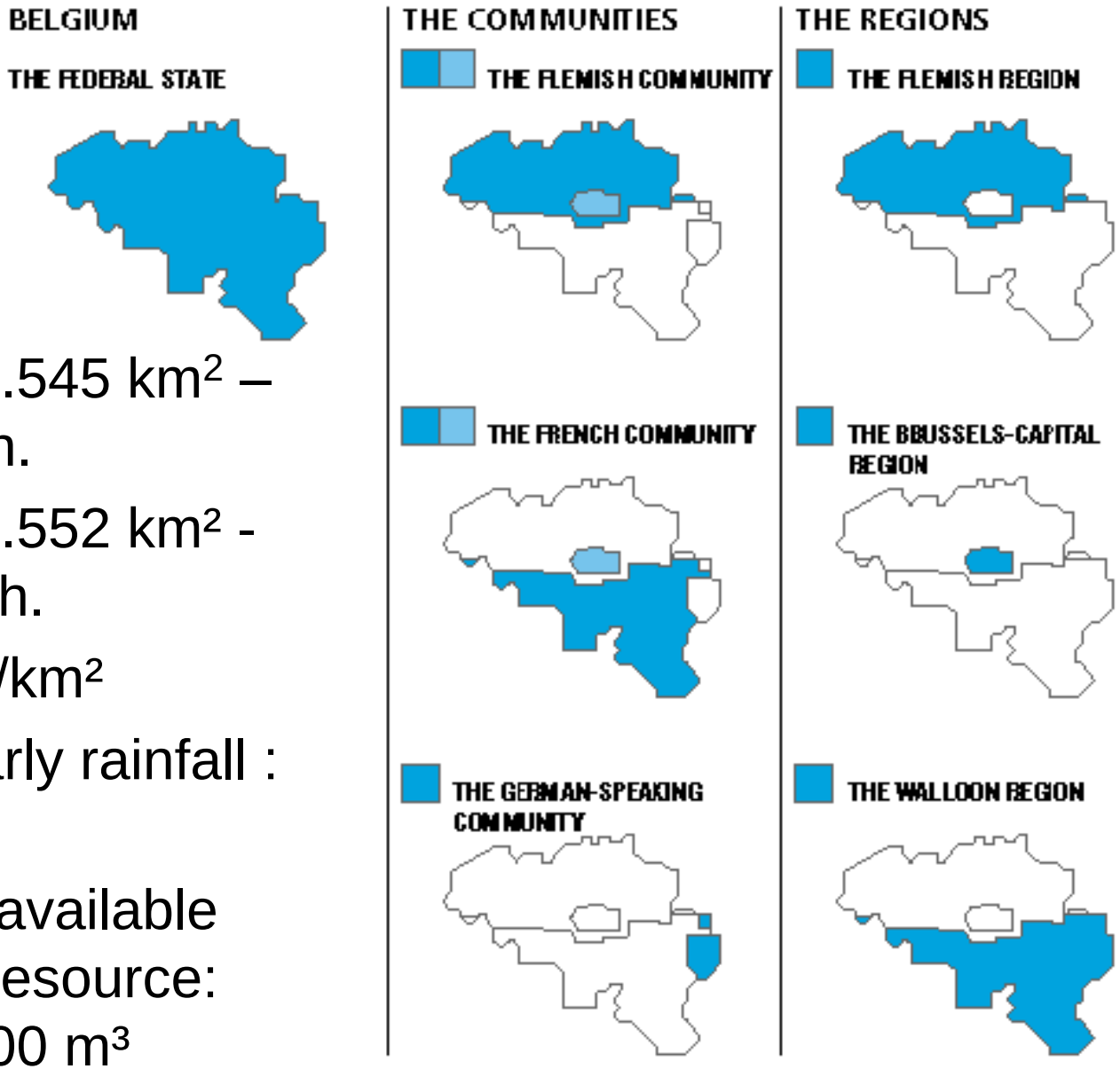
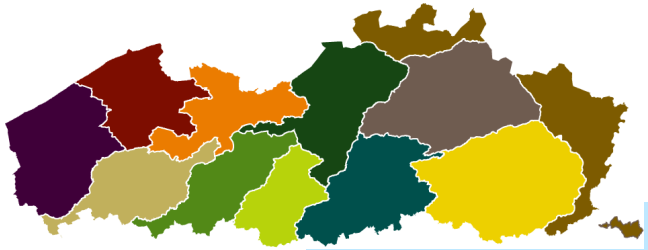
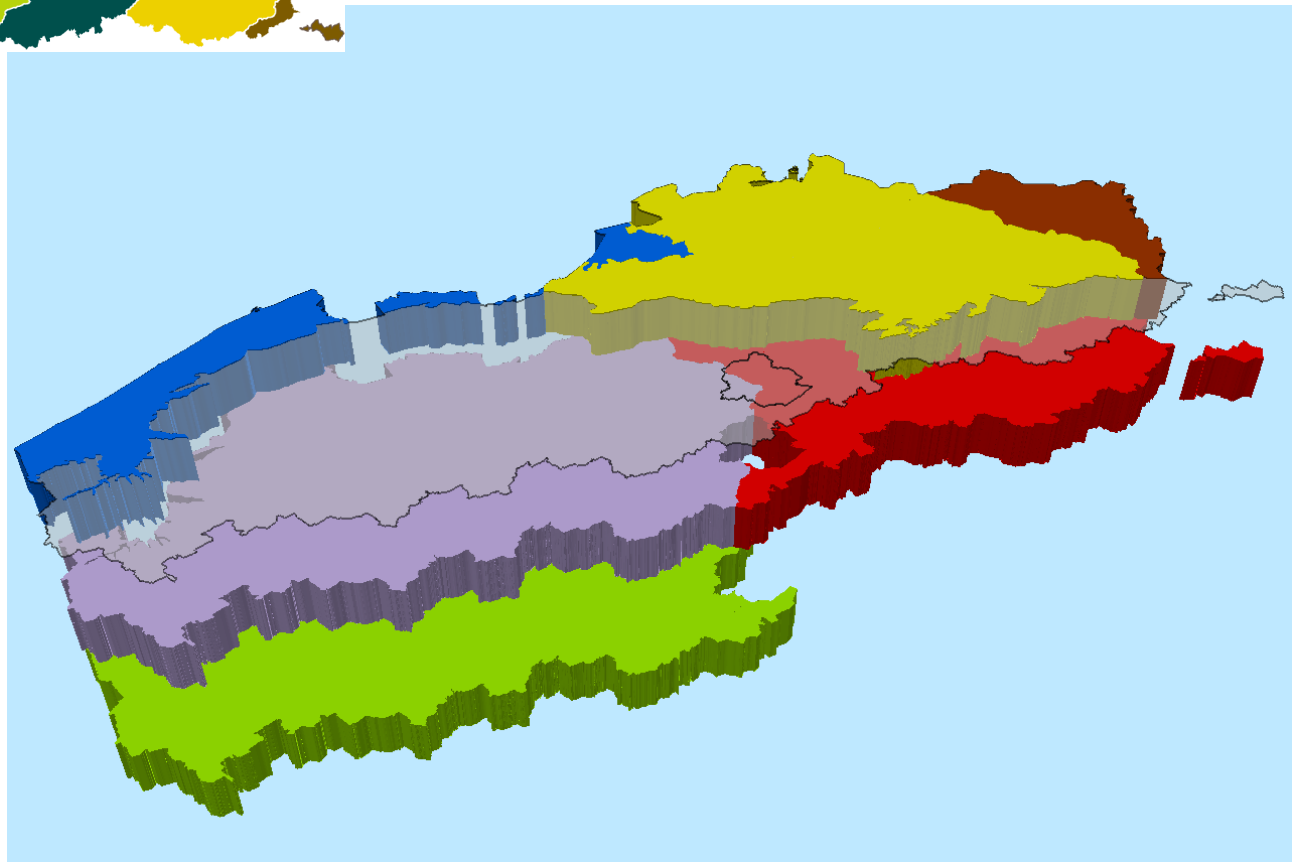


- Belgium: 32.545 km² – 11 million inh.
- Flanders: 13.552 km² - 6.078.000 inh.
  - 452,4 inh/km²
- Average yearly rainfall : 800 mm
- Total yearly available fresh water resource: 8.000.000.000 m³



6 Groundwater systems



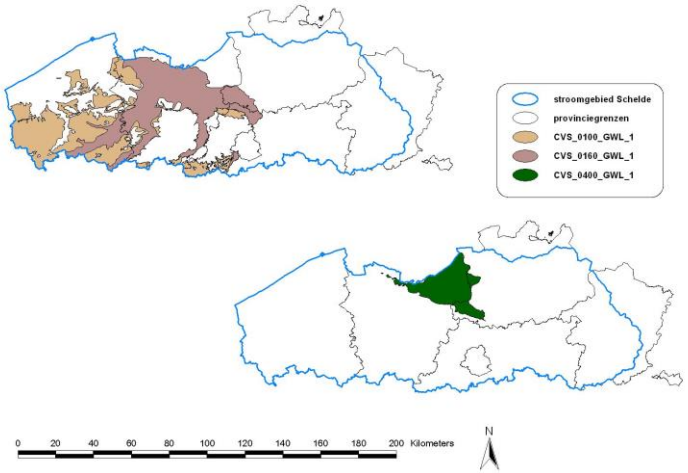
West

- **Kust- en poldersystem**
- **Centraal Vlaams System**
- **Sokkelsystem**

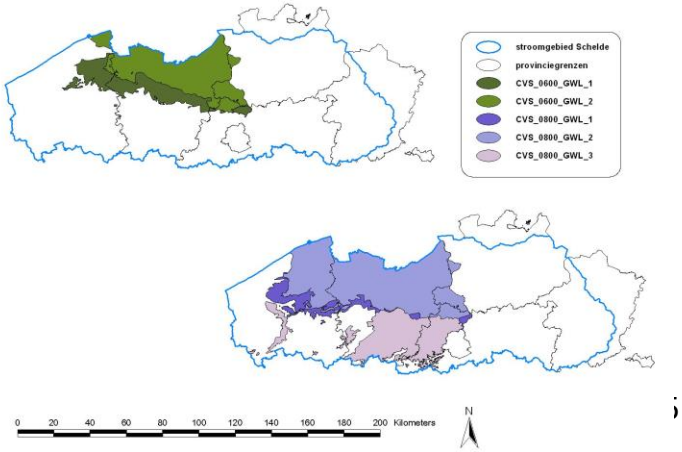
East

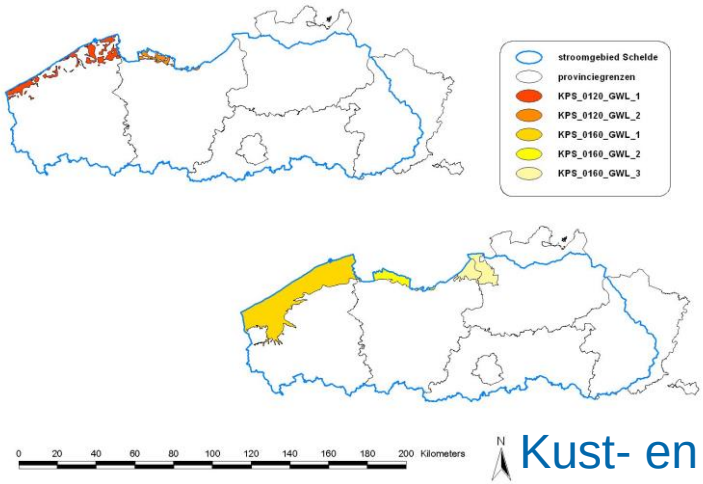
- **Maassystem**
- **Centraal Kempisch System**
- **Brulandkrijtsysteem**

42 Groundwater bodies

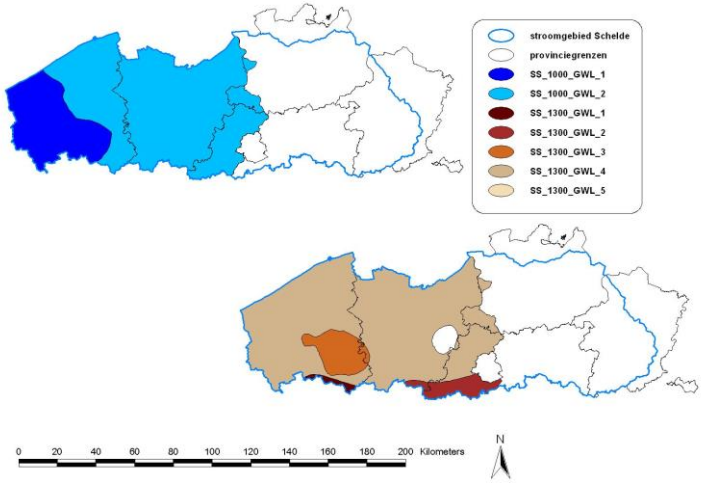


Centraal Vlaams Systeem



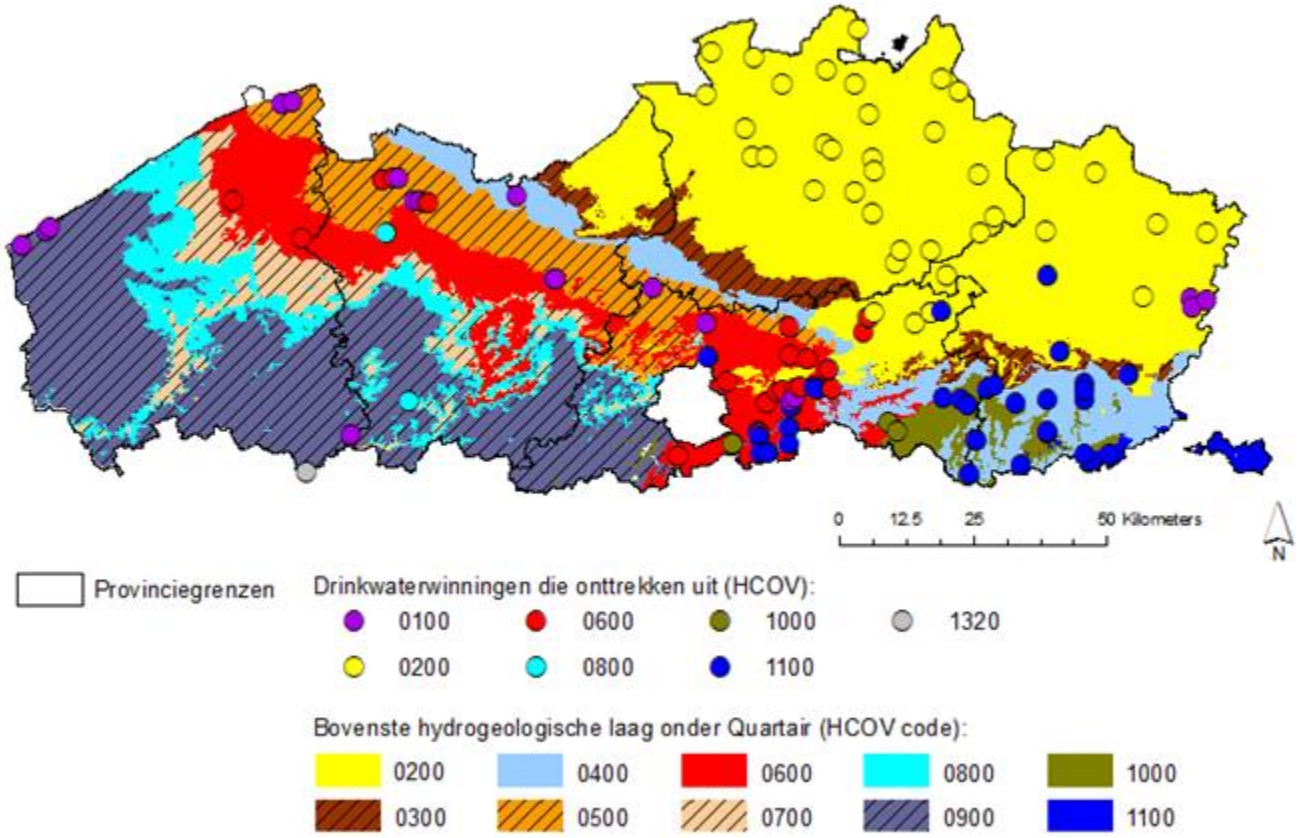


Kust- en Poldersysteem
Sokkelsysteem



Demand for Groundwater?

- Groundwater permits: 302 million m³/year for drinking water production



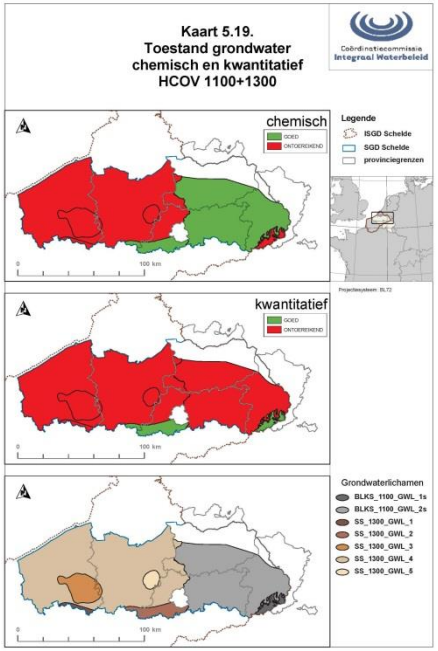
Demand for Groundwater?

- 22.825 groundwater permits in DOV
  - In 2008: 2400 advices for GW permits
  - In 2010: 3200 advices for GW permits
- Permits for 147,8 million m³ (excl. drinking water) a.o.
  - Industry: 71 million m³
  - Agriculture: 60,2 million m³

Environmental Quantity Standards

- 1° Changes in the groundwater system may not have significant negative effects on the actual or intended nature types in groundwater dependent terrestrial ecosystems, especially in protected areas and wetlands.
- 2° Captations may not cause salt water intrusion.
- 3° Confined aquifers must keep their conditions so that no oxidation can take place.
- 4° No regional lowering of groundwater levels (depression cones) that induce quality changes.
- 5° No continuous lowering of groundwater levels occur (taking into account climatological variations)
- 6° Baseflow remains sufficient for preservation of water courses
- 7° A lowering of the baseflow does not lead to the non compliance of the environmental quality standards for the recipient surface water

Groundwater bodies: status



- **42 groundwater bodies**

- 14 in poor quantitative status
- 31 in poor qualitative status
- 6 in good status overall

Policy

- First message: Use as little (ground)water as possible
- Re-use of water
- Search for sustainable alternatives
  - Surface water
  - Rain water
  - Process water
  - Phreatic groundwater
  - Drinking water

Instruments

- Permit system
- Metering obligatory
- Pricing policy including groundwater taxes
- Restoration programmes for groundwater bodies in bad status
- Enforcement policy
- Control of drilling companies

VLAAMSE MILIEUMAATSCHAPPIJ

Part 2
Protecting our drinking water resources

Background


VOGEL IN WATERTOREN: WATER B[illegible]NA 6.000 GEZINNEN ONDRINKBAAR

Grote ellende door banale duif

BIERBEEK/OUD-HEVERLEE/BOUTERSEM

Het leidingwater in alle deelgemeenten van Bierbeek (maar niet in Korbeek-Lo), Haasrode, Blanden (Oud-Heverlee) en van Neerveip (Boutersem), is tot nader order ondrinkbaar verklaard door de Vlaamse Watermaatschappij. Oorzaak van het verontreinigde water is een duif die vermoedelijk tijdens een recent onweer in de watertoren van Bierbeek is gesukkeld. Hierdoor zitten

- In Flanders in 2010-2011:
  some accidental pollutions
- Policy initiatives:
  - filling in the “operational service goals”
    - Water safety planning
    - Shared responsability, but drinking water companies responsable for “hazard identification – risk assesment – risk reduction”

Background

- concept ‘ <u>Water Safety Planning</u>’
  - Concept World Health Organisation (WHO)
  - Supported by the sector IWA – Bonn charter
  - Supported by EC

“risk-based management”

as answer to an increased pressure on water resources and complexicity of the process

Starting points

- Source files as support for (water) management

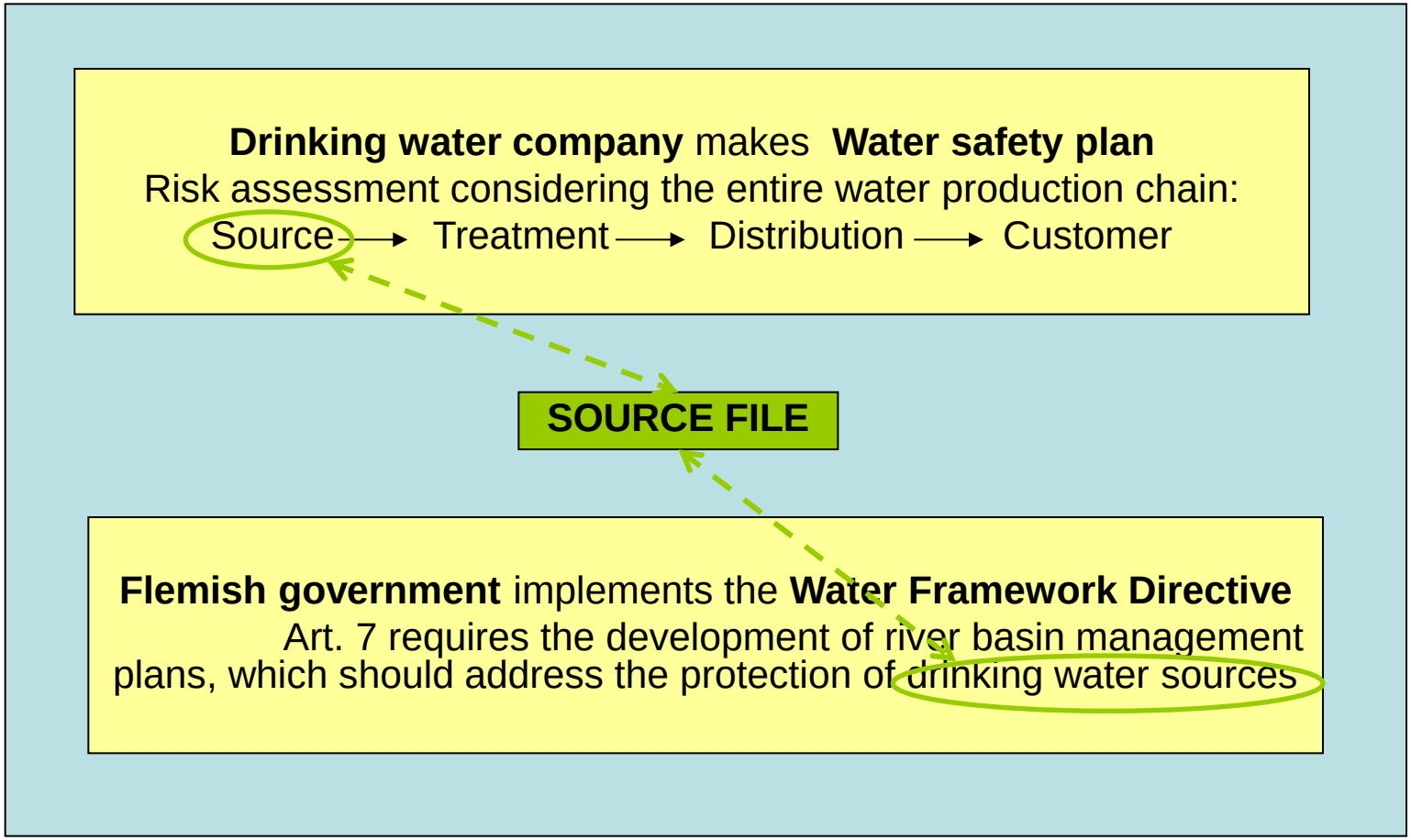
- Set up
  - Fase 1: Common knowledge of important factors influencing the quality water resources

  - Fase 2: development of vision on protection of water resources (specifically in relation to drinking water production)

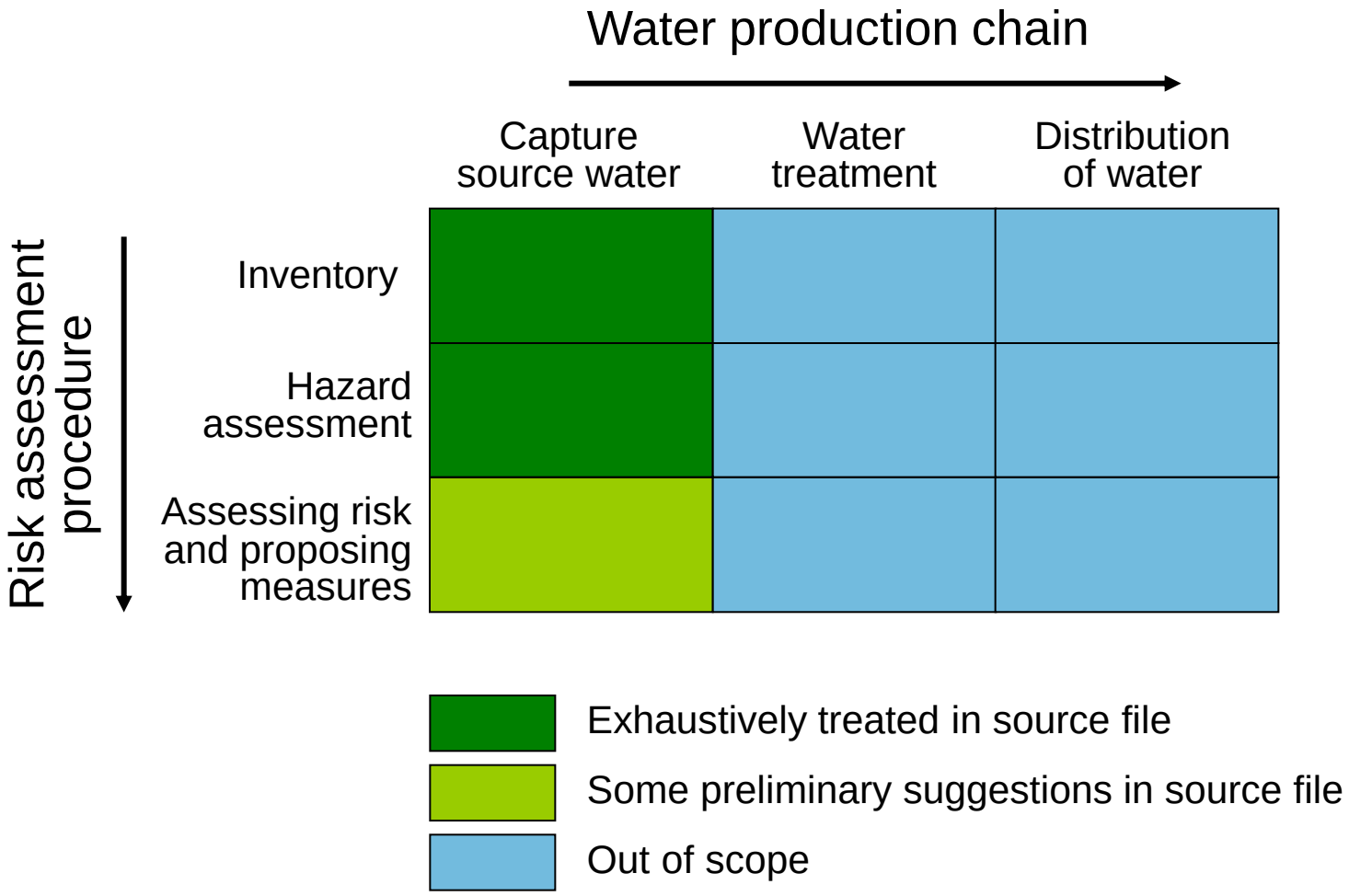
Starting points

- Source file is only first step:
  - Characterisation of water resource and risks
  - Development cfr. specific actions in RBMP
- From information to agreements to possible actions and measures
- Cooperation and communication between partners
- Source file is a dynamic tool

Source file: In between water safety plans and WFD



Scope of source file compared to WSP

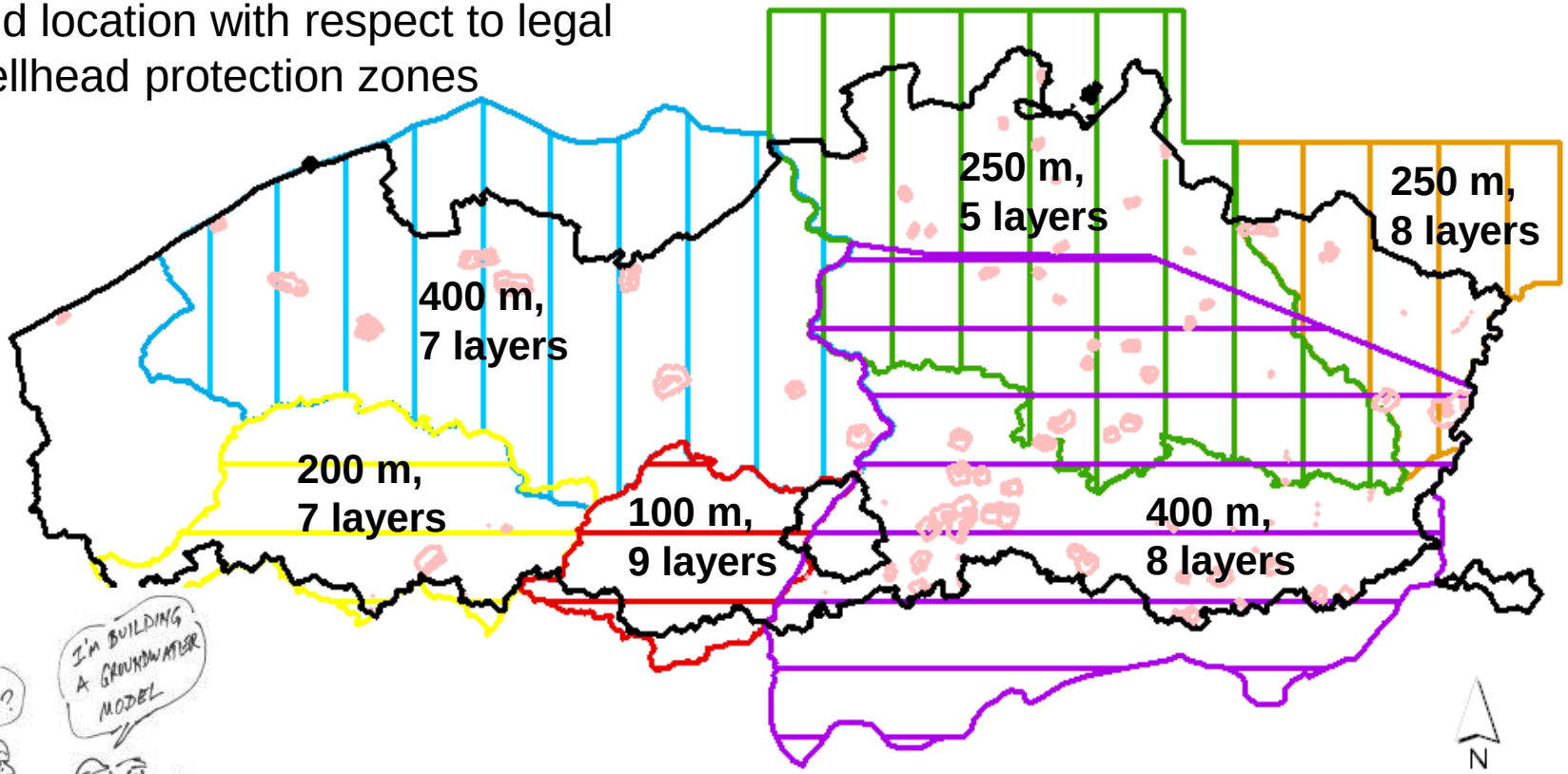


Role of Flemish Environmental Agency

- Supervisor drinking water distribution
  - Public services
  - Quality
  - Cfr. Drinking water directive
- Water resource management
  - Surface water (unnavigable water courses)
  - Groundwater Cfr. Water Framework Directive, Groundwater directive, Nitrates Directive,…
- …

Available regional groundwater models

Areas covered by regional models, indicating the resolution and location with respect to legal wellhead protection zones



Monitoring network of VMM

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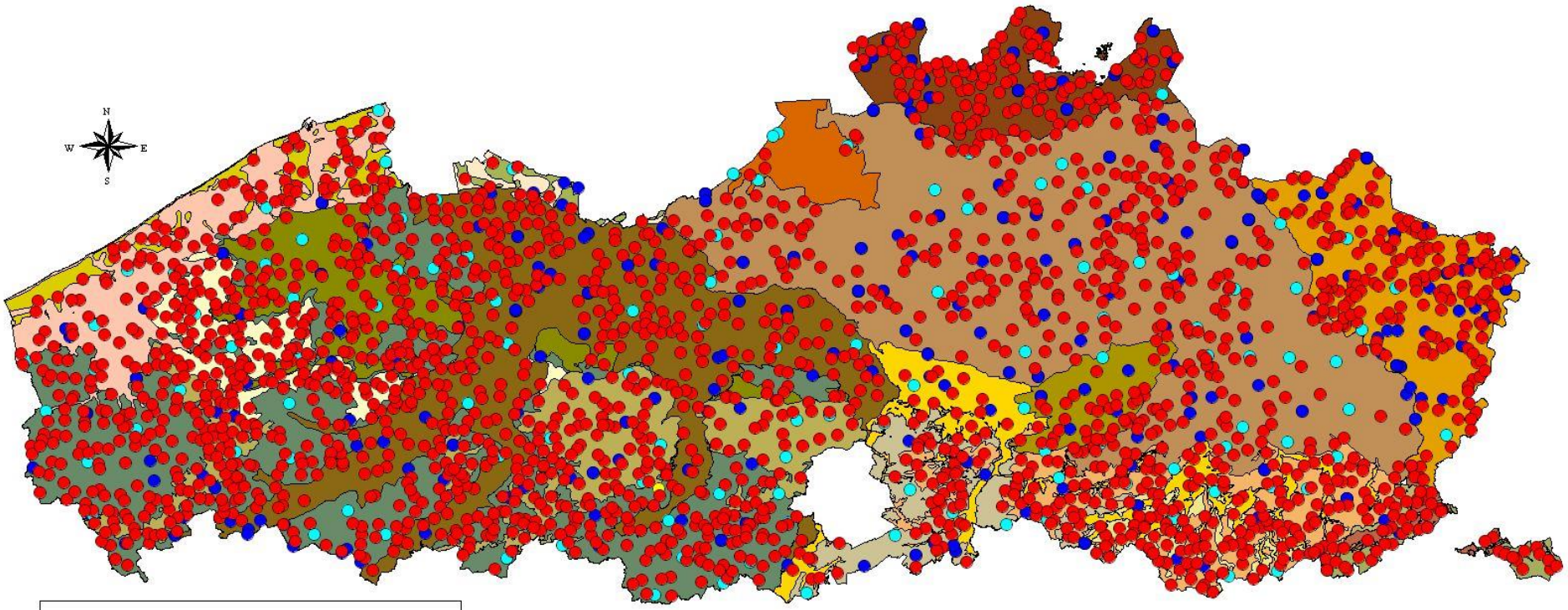
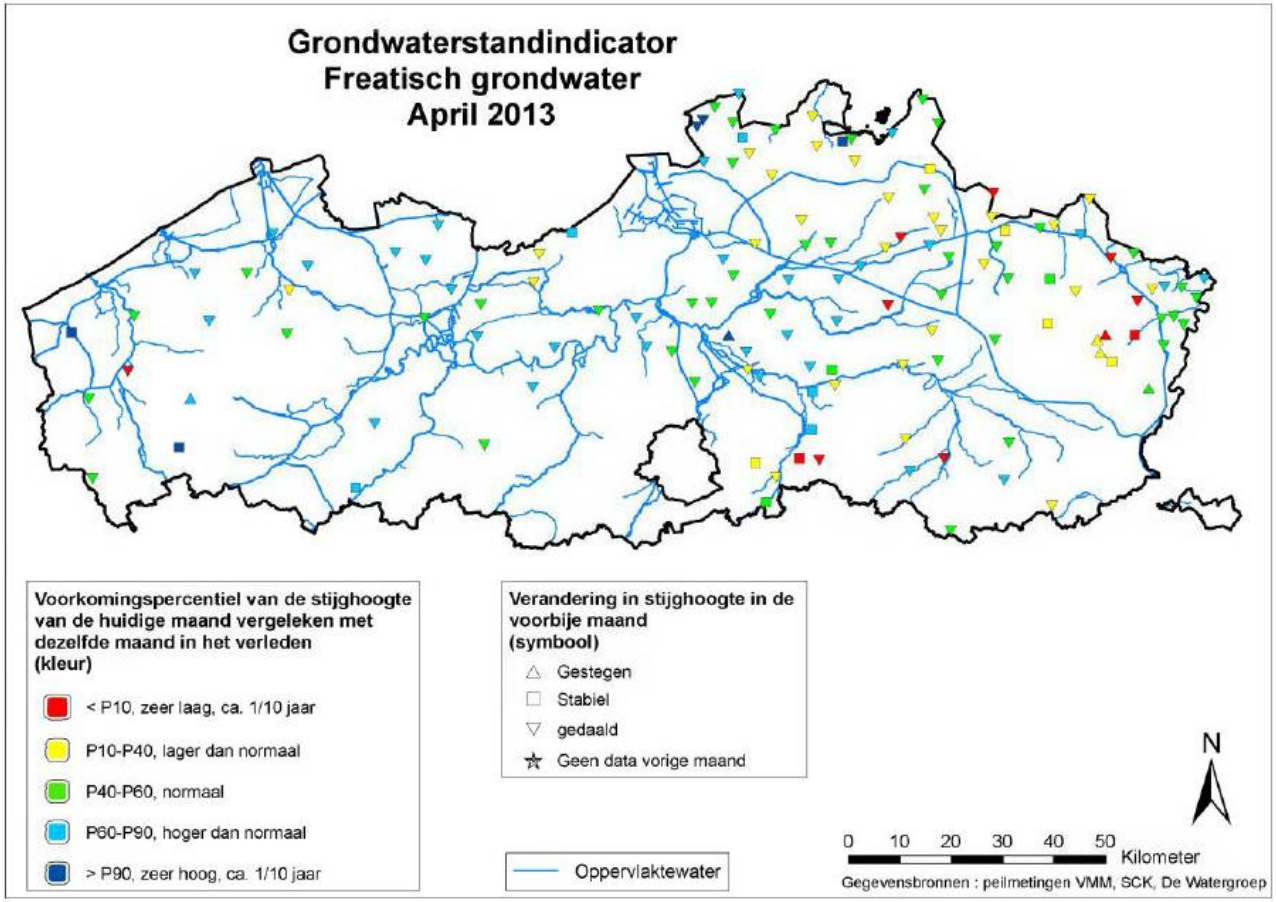
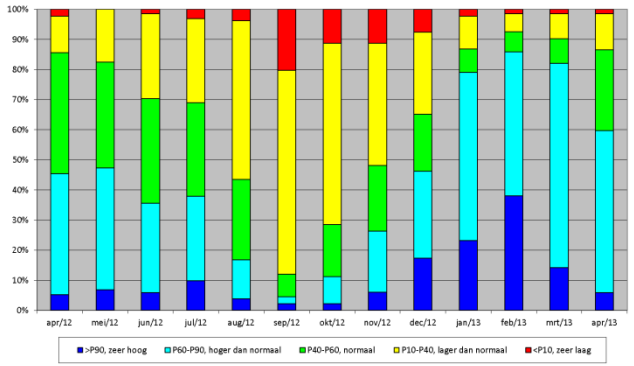
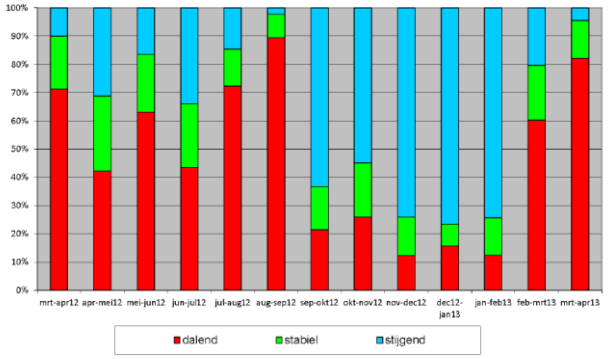


Phreatic network: 2107 locations (5200 filters)
Nature network: 80 locations
Primary network : 436 locations(860 filters)

Groundwater level indicator





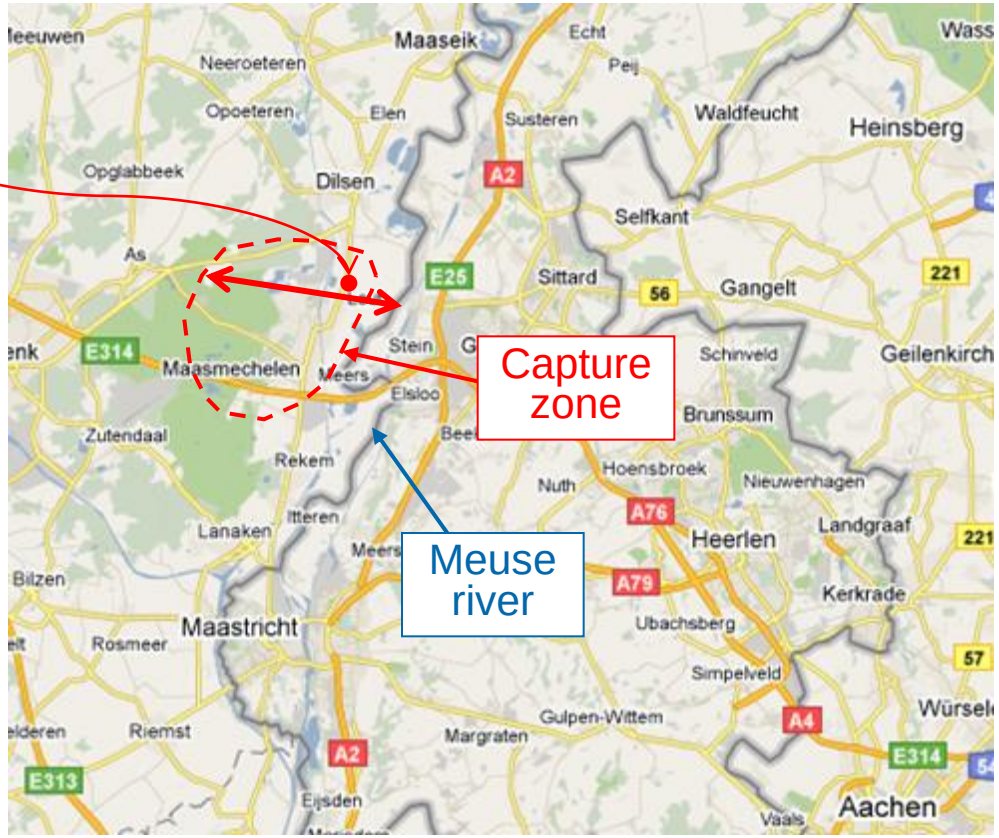


Partners in crime

- VMM (Flemish Environmental Agency)
  - Responsible as “member state” for implementing WFD
  - Management of water resources
  - Policy (need for uniformity, …)
  - Information and knowledge
- Drinking Water companies
  - Operational responsability “water chain”
  - Information and knowledge
- Other actors, mainly administrations for knowledge transfer on specific matters (e.g. land use,…)

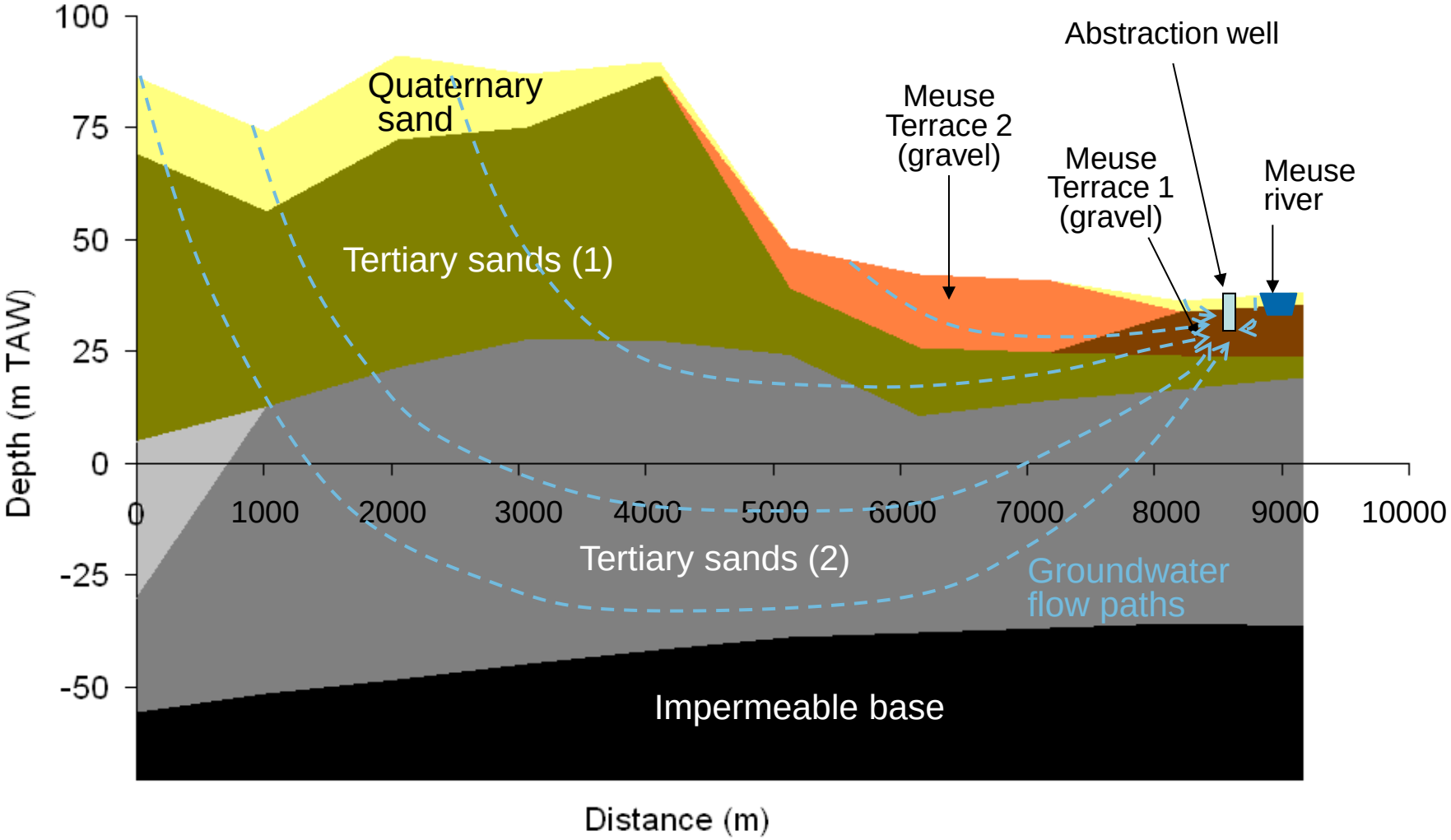
Case: phreatic groundwater abstraction in the Meuse valley

Location of well site

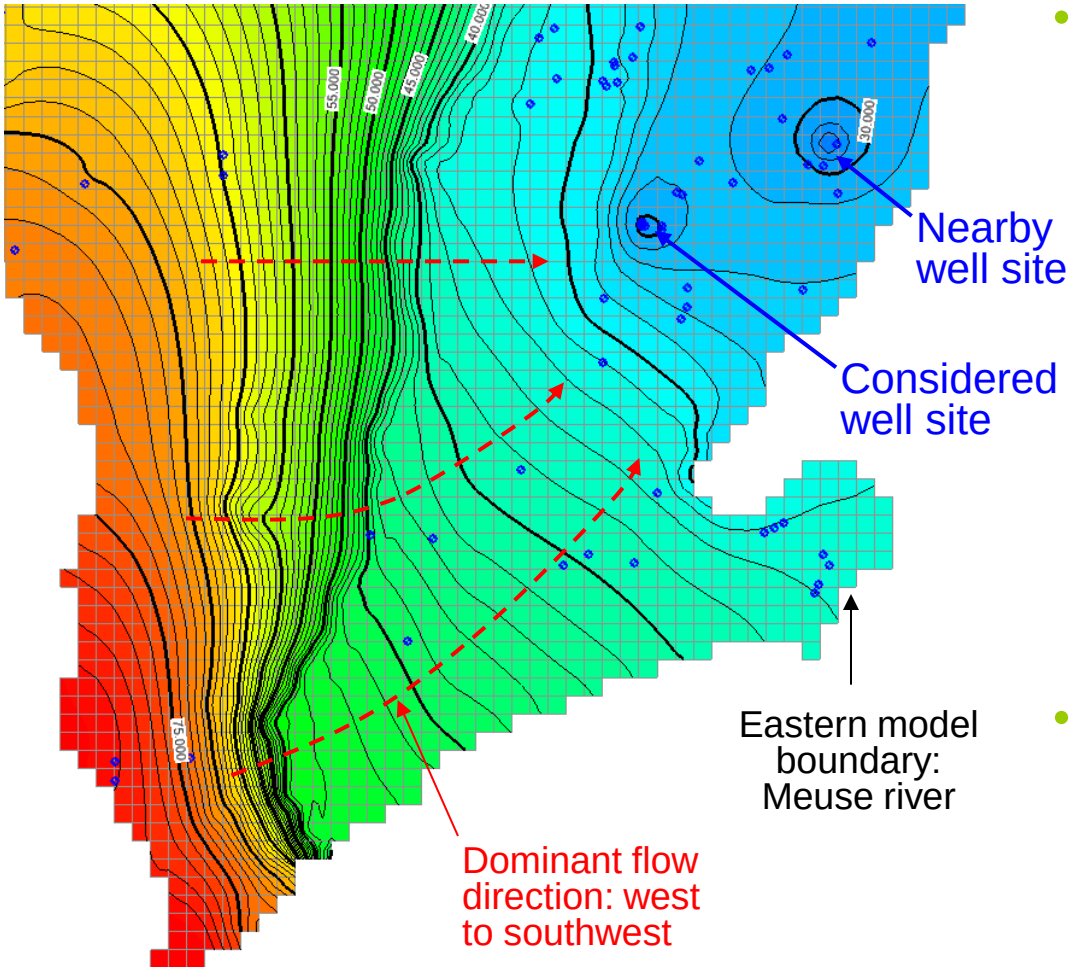


- ‘Eisden’ well site
- Phreatic well
- Upto 14.6 million m³/yr
- Mine subsidence area
- In alluvial plain of the Meuse river
- Very vulnerable

Hydrogeological system

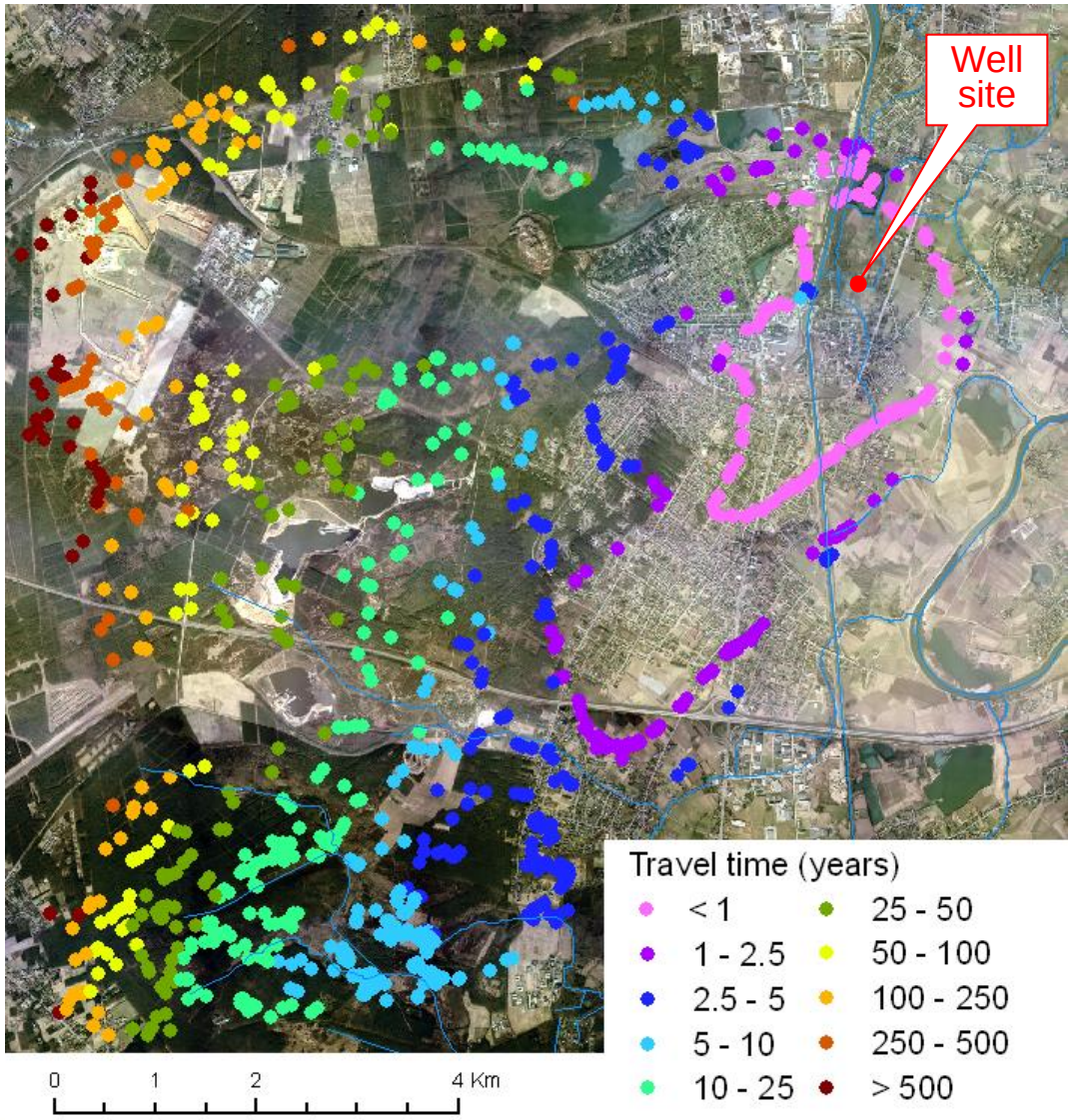


Modelling the phreatic groundwater system



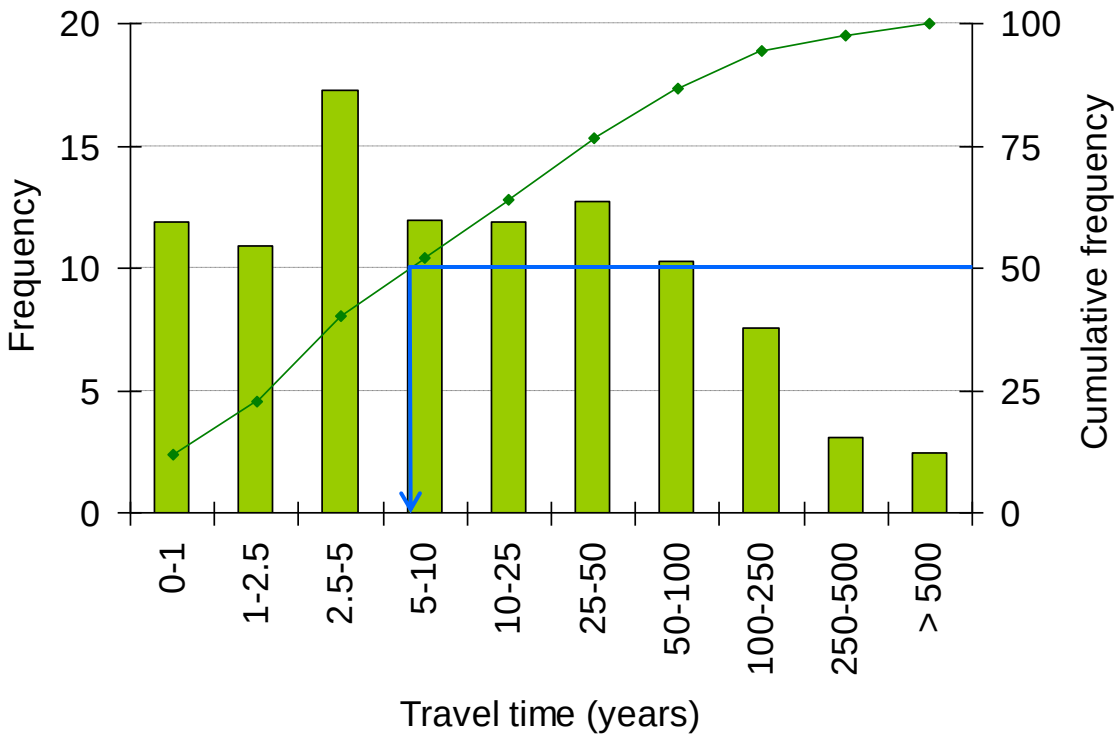
- Regional groundwater model for the Meuse system is available:
  - Resolution: 250 m (grey grid)
  - Groundwater withdrawals with permitted abstraction rates (blue dots)
  - Steady-state or ‘equilibrium’ model
- Model is used to calculate flowpaths and delineate the capture zone

Delineating the capture zone



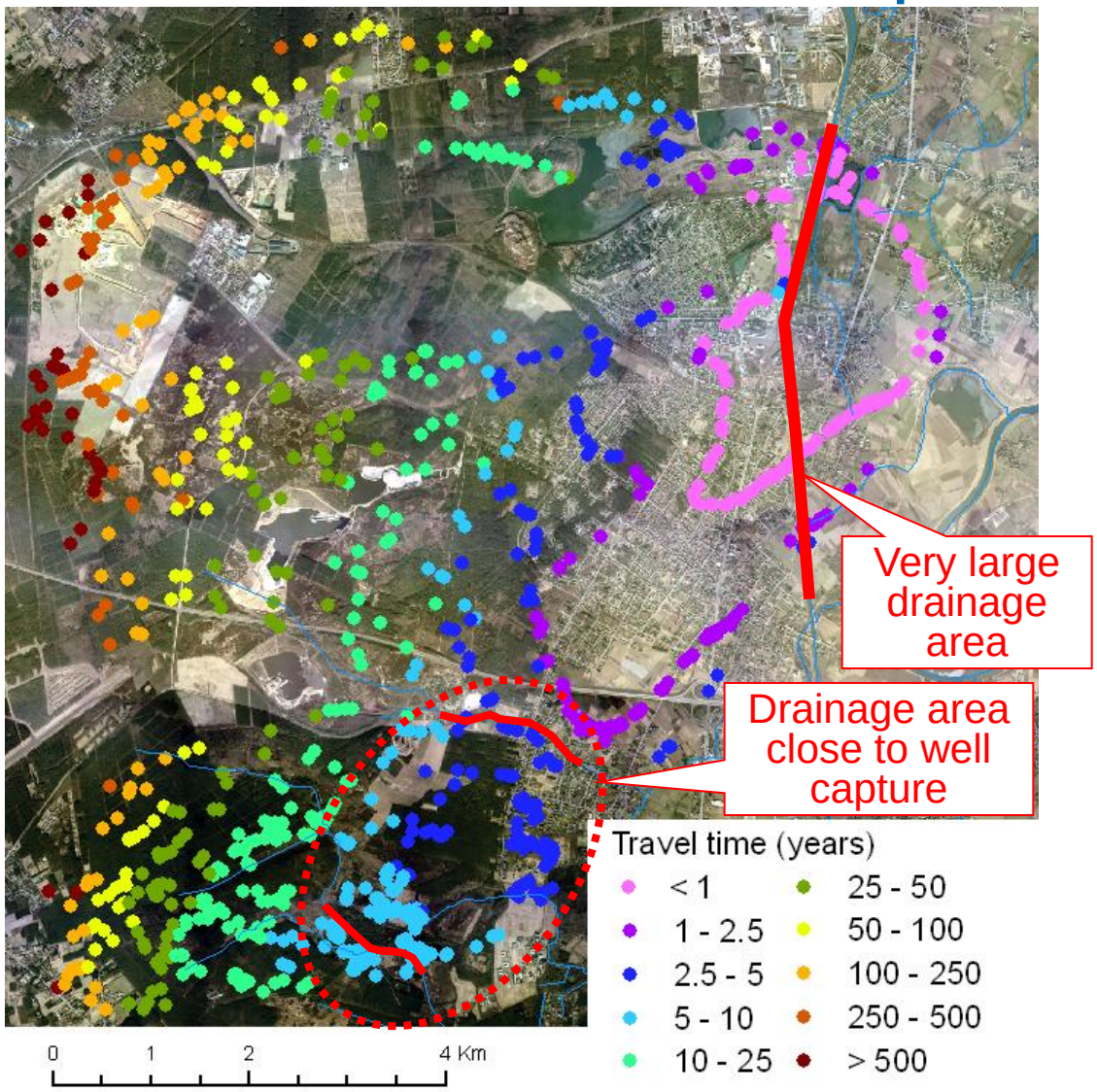
- Track the flow path of some virtual water particles in backward direction, from the well to the location where rainwater has infiltrated
- Doing so, we can obtain:
  - Capture zone
  - Travel time distribution

Travel time distribution



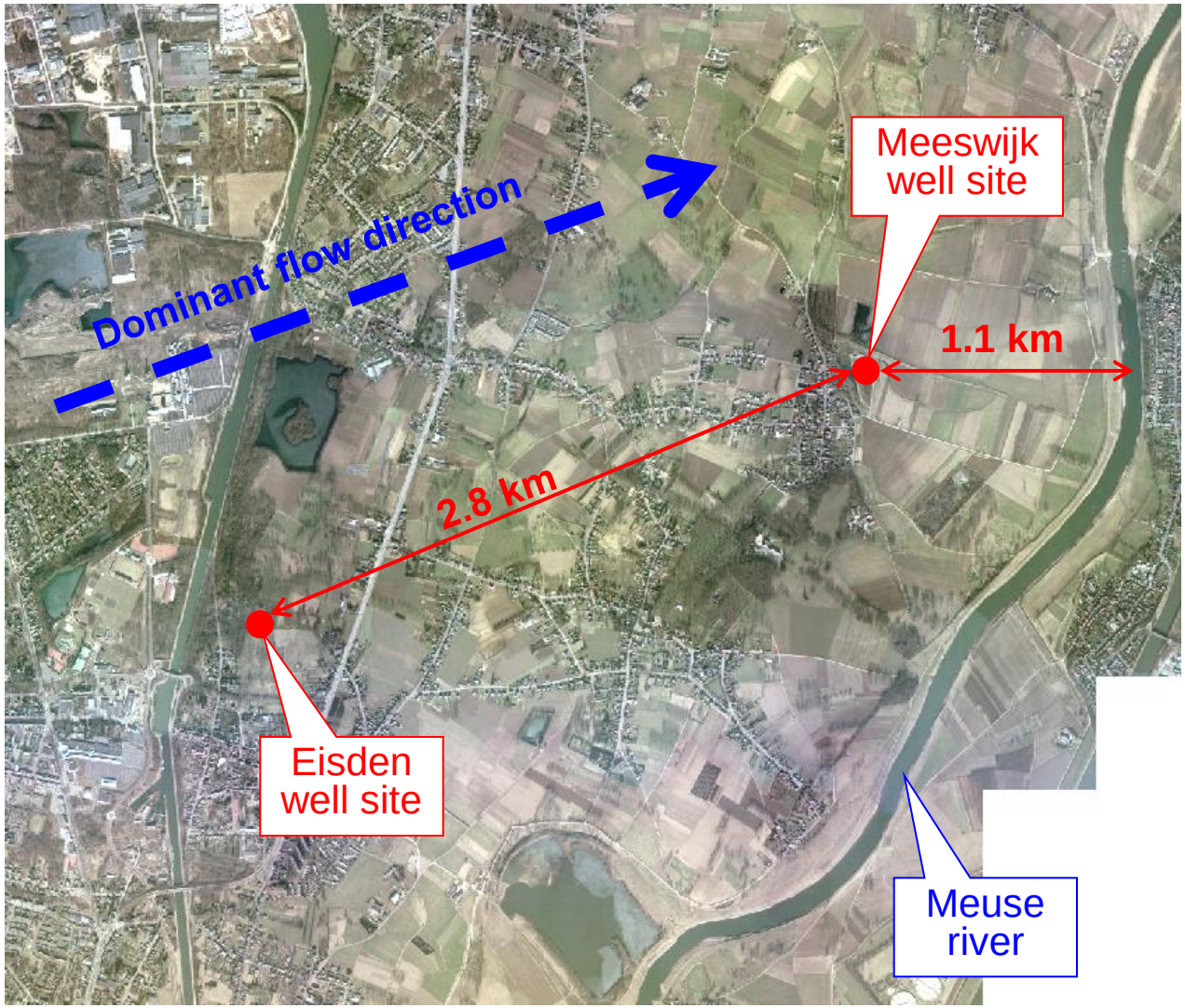
- Half of the water is less than 10 years old. This water infiltrated in the river valley, which is heavily urbanised.
- The remainder infiltrated on the plateau, in forests and nature reserves. It takes decades to centuries before this water reaches the well site.

Impact of infiltrating rivers on capture zones



- Infiltrating rivers: Polluted river water might reach the well site. This pollution might be caused by activities outside the capture zone.
- How to delineate the focus area:
  - include drainage area of river
  - include upwards part of the river until the next monitoring site

Impact of a second well site on the capture zone

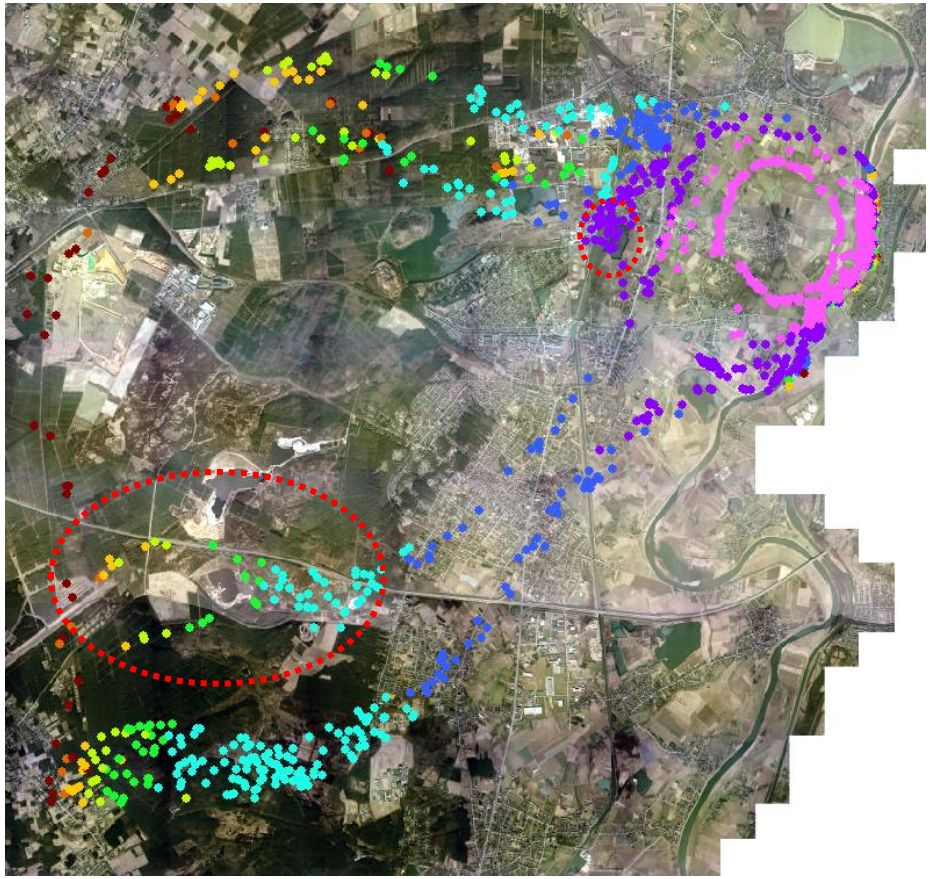


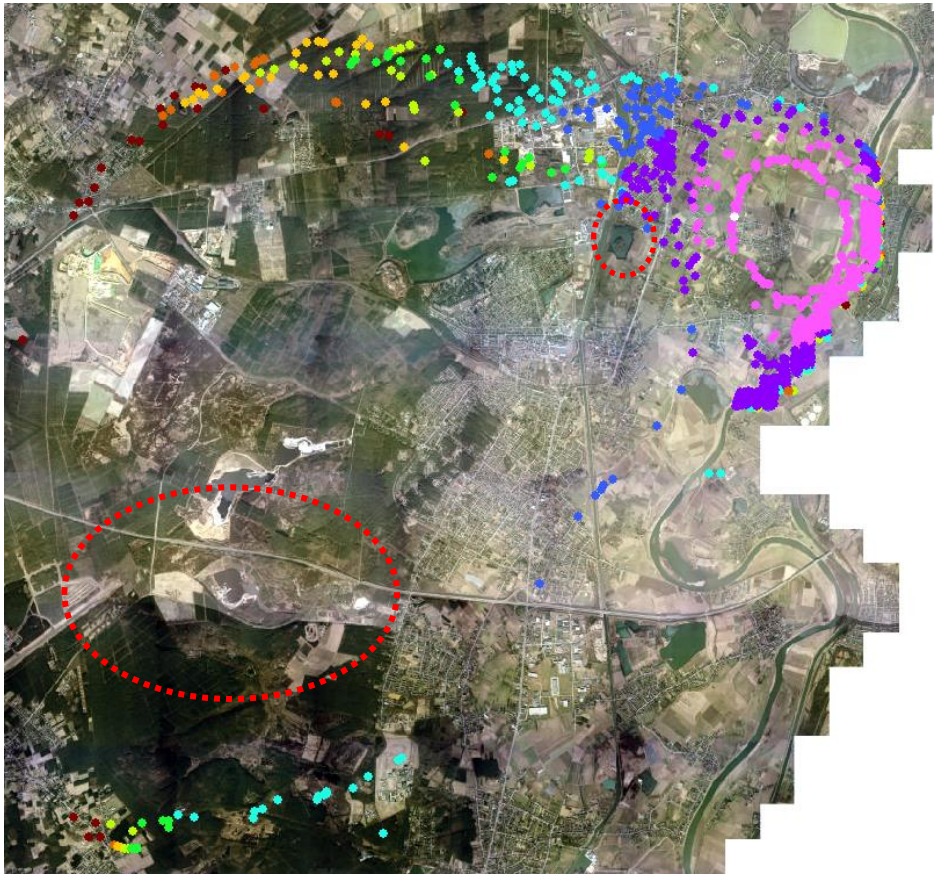
- What happens if a second well site is located in the capture zone?
- Consider the capture of the well site of ‘Meeswijk’, that given the dominant flow direction, will interfere with the Eisden well site

Impact of a second well site on the capture zone

EISDEN WELL SITE INACTIVE

EISDEN WELL SITE ACTIVE

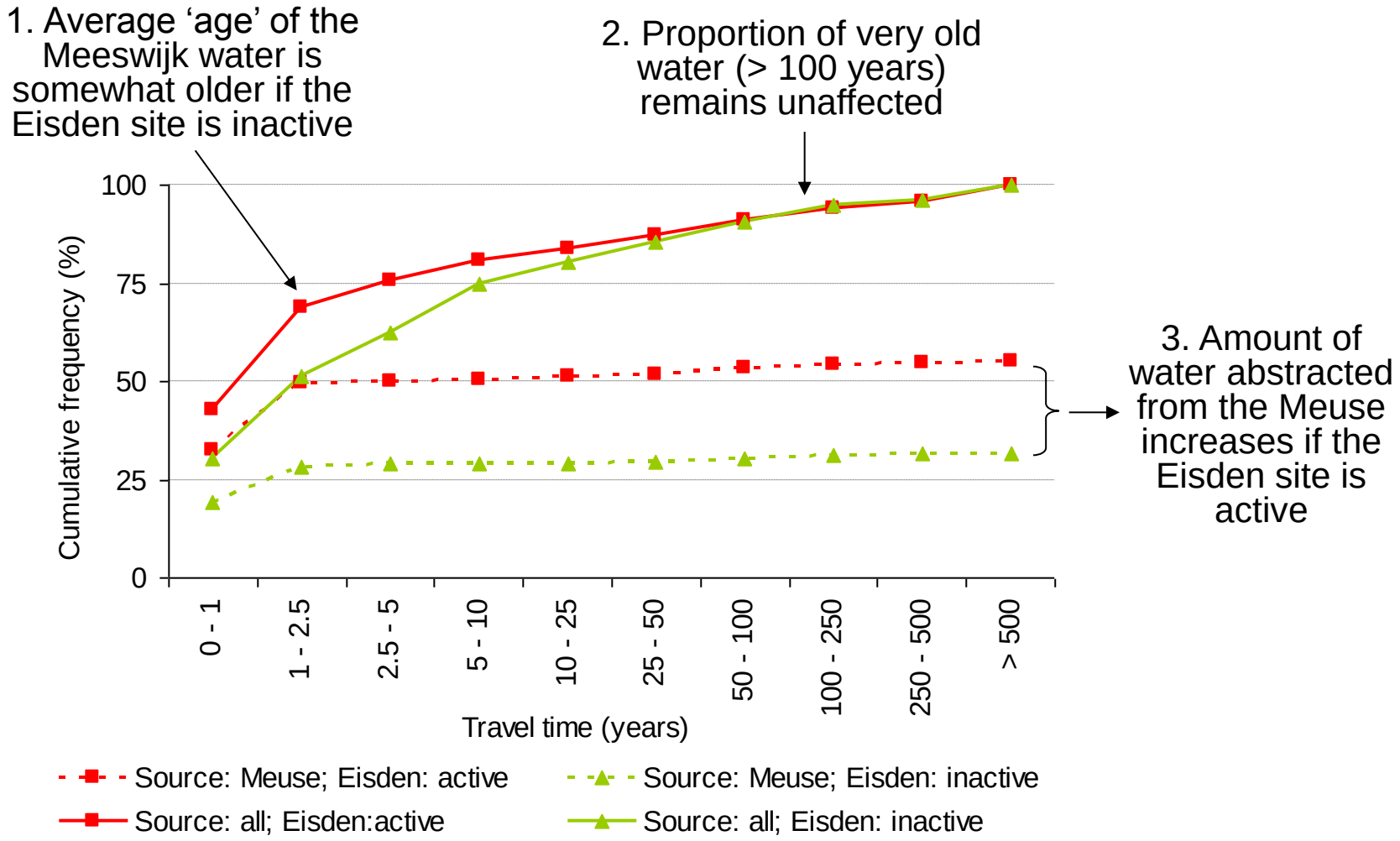




Travel time (years)

< 1	2.5 - 5	10 - 25	50 - 100	250 - 500
1 - 2.5	5 - 10	25 - 50	100 - 250	> 500

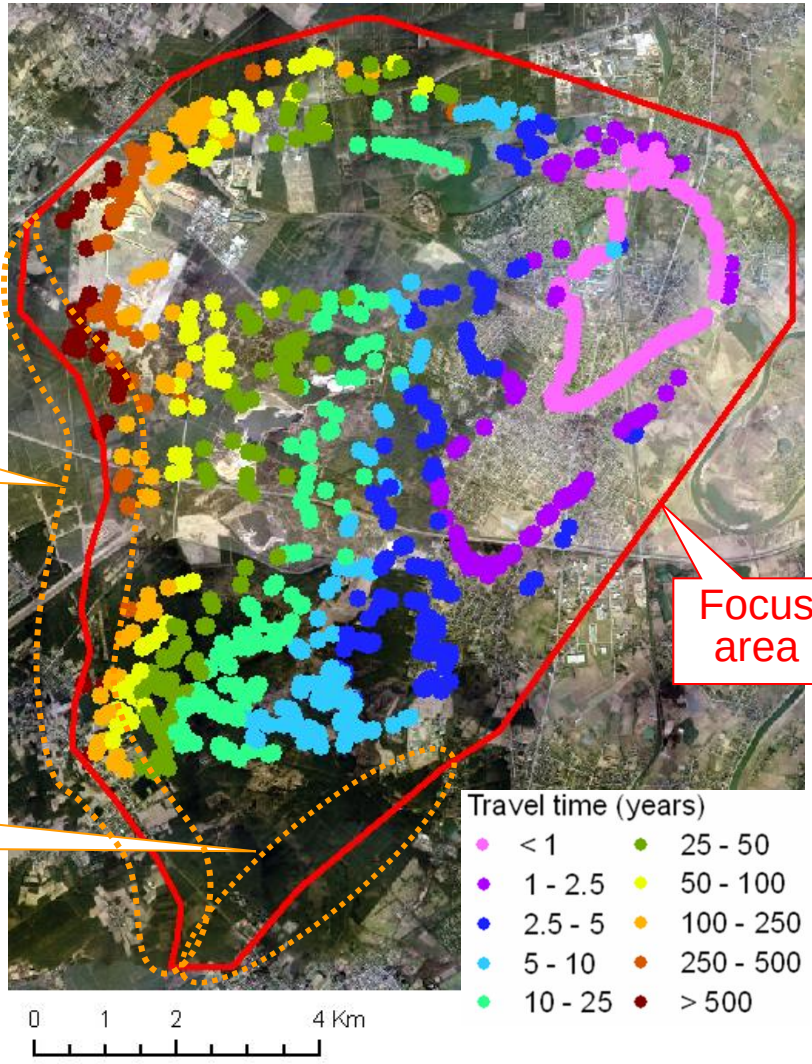
Impact of a second well site on the travel time distribution



From capture zone to focus area

- Boundaries of capture zones are fuzzy because of
  - Interaction with infiltrating and draining rivers
  - Interaction with other well sites
  - Capture zones vary in time, depending on climate (groundwater recharge)
  - Uncertainties related to groundwater modelling and the tracking algorithm for reconstructing flowpaths
- Delineate the focus area, in which all human activities will be inventoried, as a regular polygon circumscribing the capture zones under different scenarios, respecting physical boundaries (e.g., water divide)

Focus area for the Eisden well site

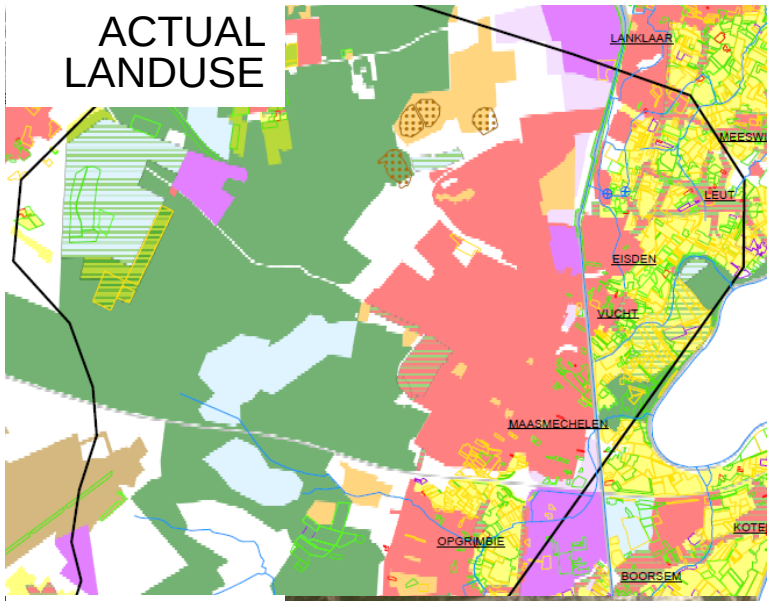


- Regular polygon with a buffer zone of several 100 m up to 1 km around the capture zone
- Physical boundaries:
  - South: outcrop of impermeable base
  - West: water divide of the Meuse basin

  → the focus area will always be part of only 1 (WFD) groundwater body, and will only occupy a part of this body

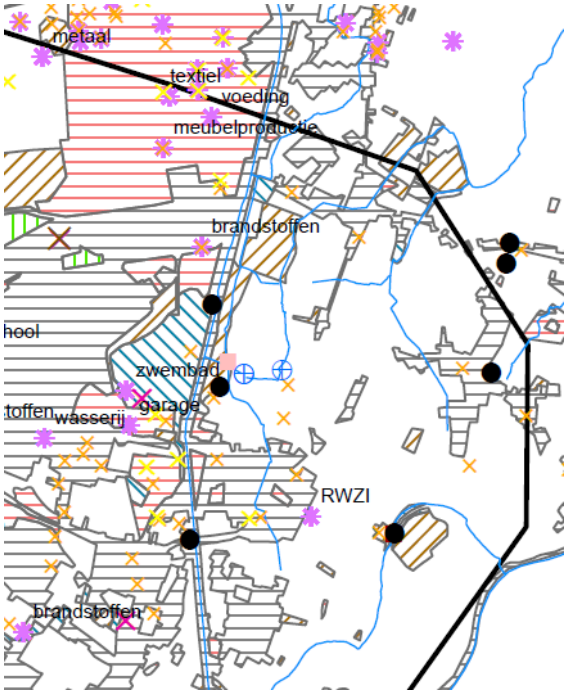
Contents of source files

ACTUAL LANDUSE

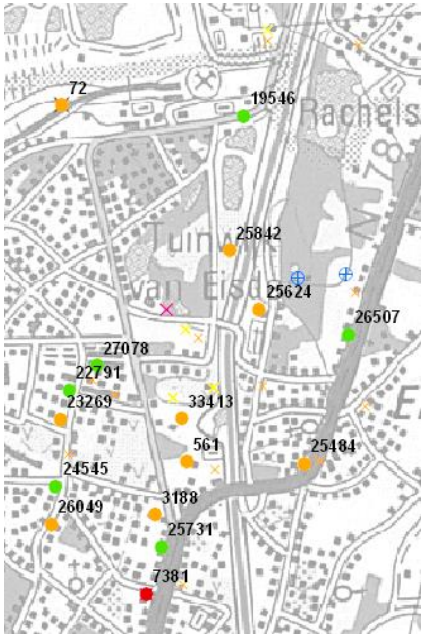


FUTURE LAND USE

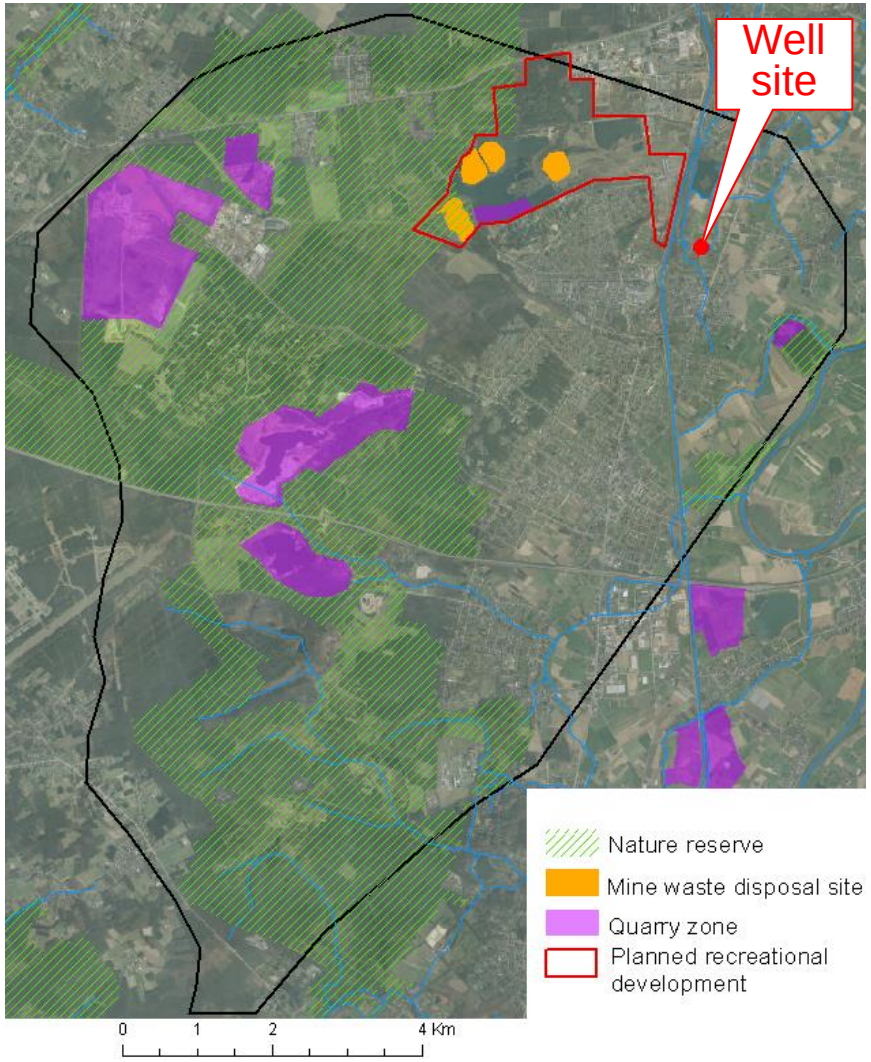
PERMITS, DISCHARGES, …,



SOIL POLLUTIOIN

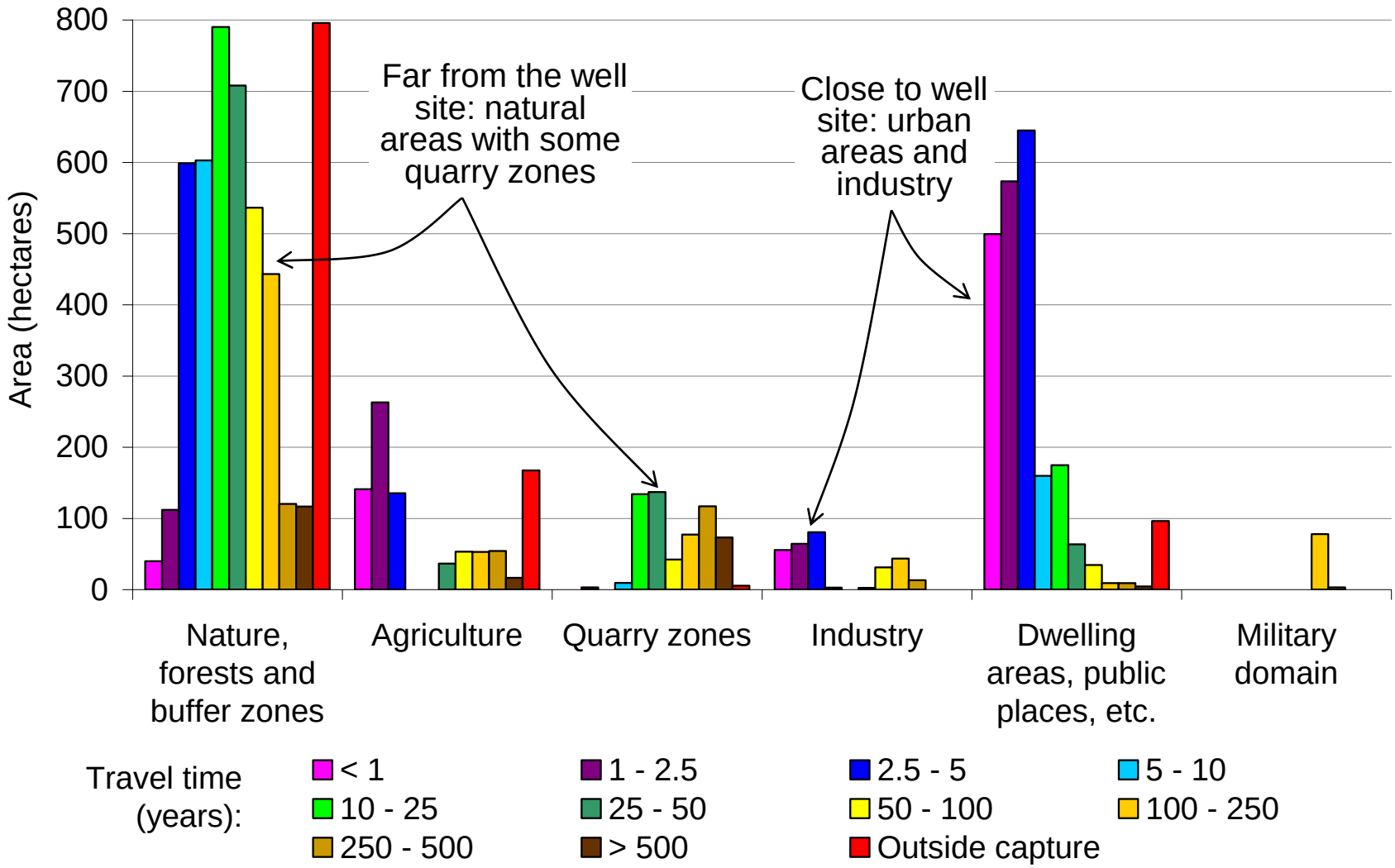


Future land use

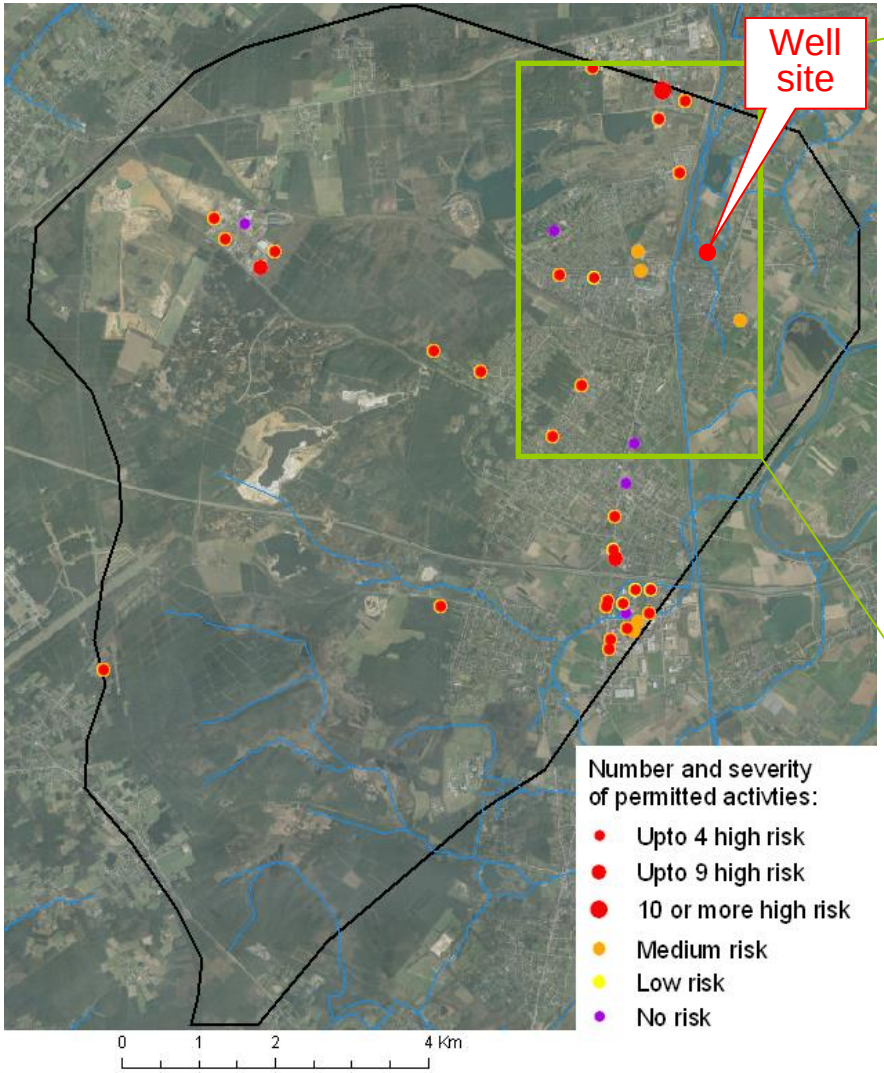


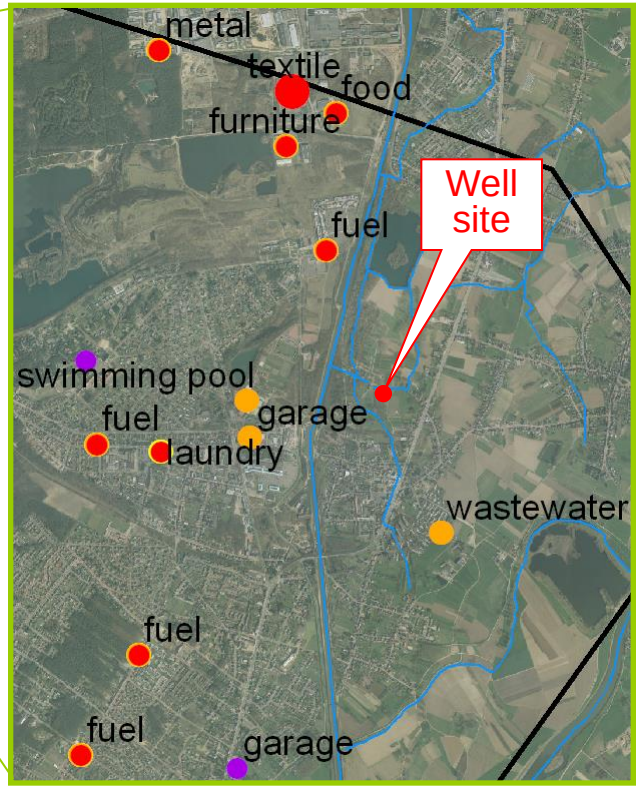
- Inventory of ongoing urban and rural planning processes
  - Some might have positive effects e.g. assuring protection of the nature reserve in the west of the focus area
  - Some might have negative effects e.g. development of recreation (golf) on a former mining site

Land use in the focus area



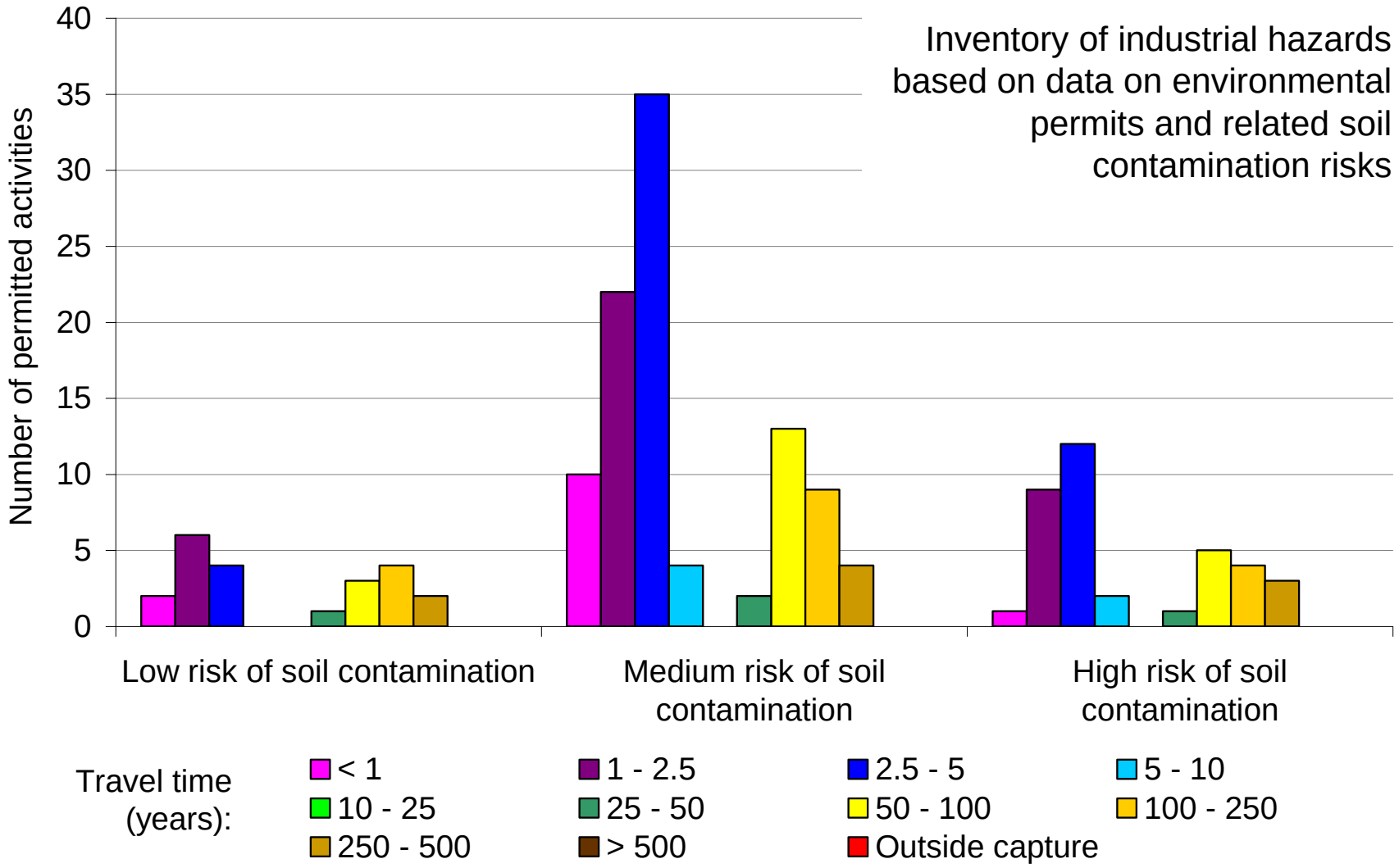
Industrial activities and hazards



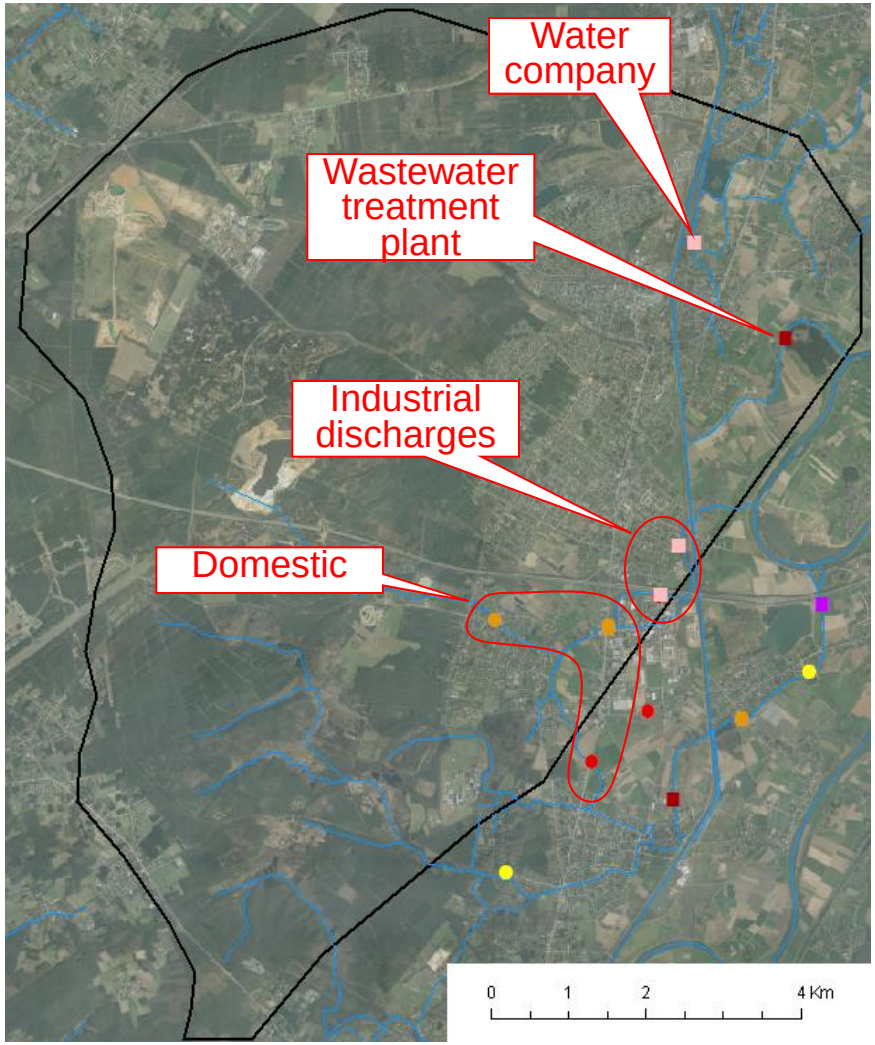


For every single site, the type of industrial activity is known and a list of permitted activities is available

Industrial activities and hazards

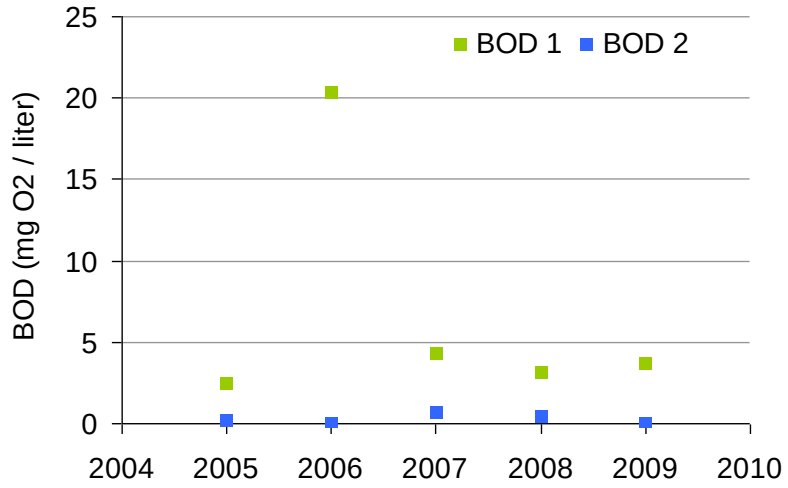


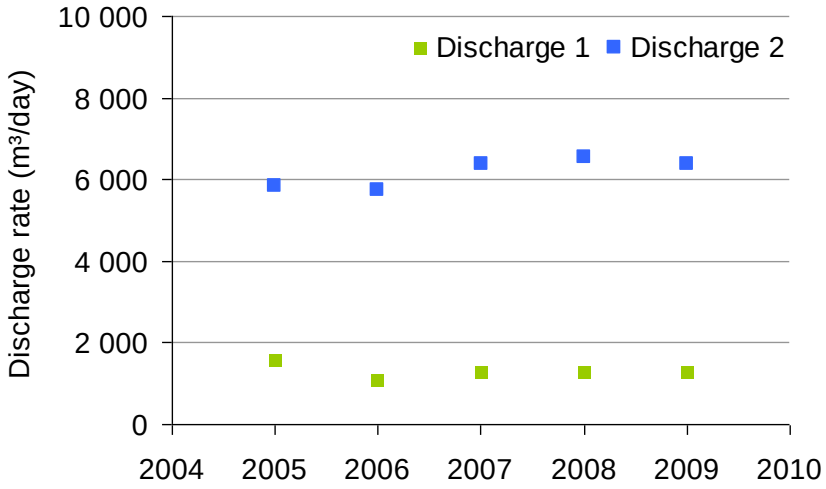
Wastewater discharges



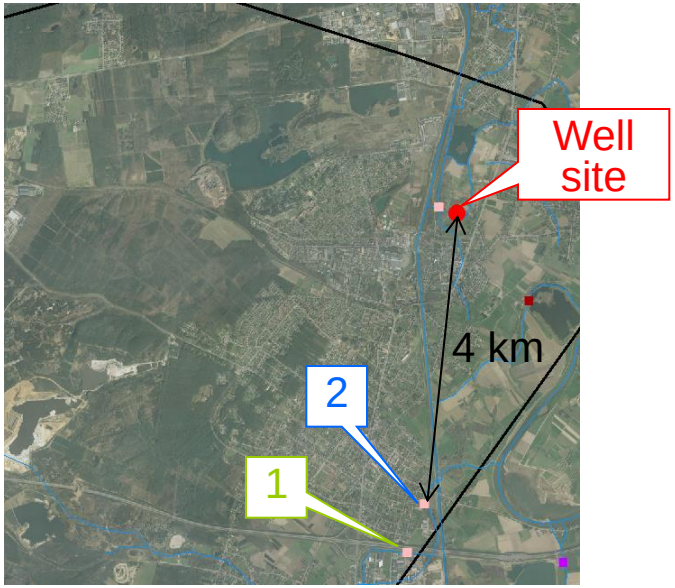
- Discharges in infiltrating rivers might affect the well site
- Some discharges are (or will be) unproblematic:
  - Discharge of wastewater treatment plant will be relocated to Meuse
  - 2 out of 3 domestic discharges will be remediated
  - Remaining problems:
    - 1 domestic discharge
    - 2 industrial discharges?

Industrial discharges





- Water quality monitoring of wastewater discharges suggests that overall, these discharges will have no significant impact on the well site

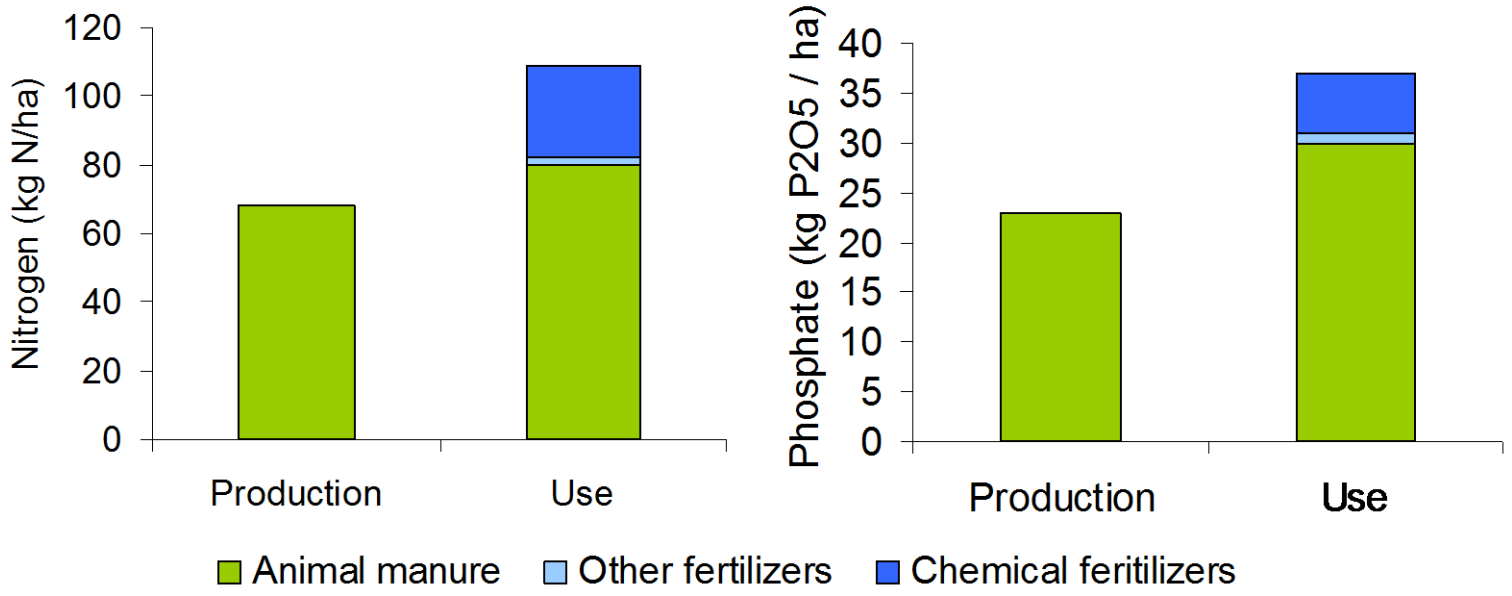


Diffuse pollution - pesticides

- Inventory of pesticides used by agriculture:
  - Hard to get location-specific data
  - Estimated in a general way from crop type
- Inventory of pesticide use on public terrains:
  - Taken from existing inventory of pesticides used by local authorities (municipalities), considering the following questions:
    - How is the pesticide applied? Mainly herbicides that are applied on the soil are problematic
    - What are the active substances and metabolites?
    - Does the list of used products vary from year to year?

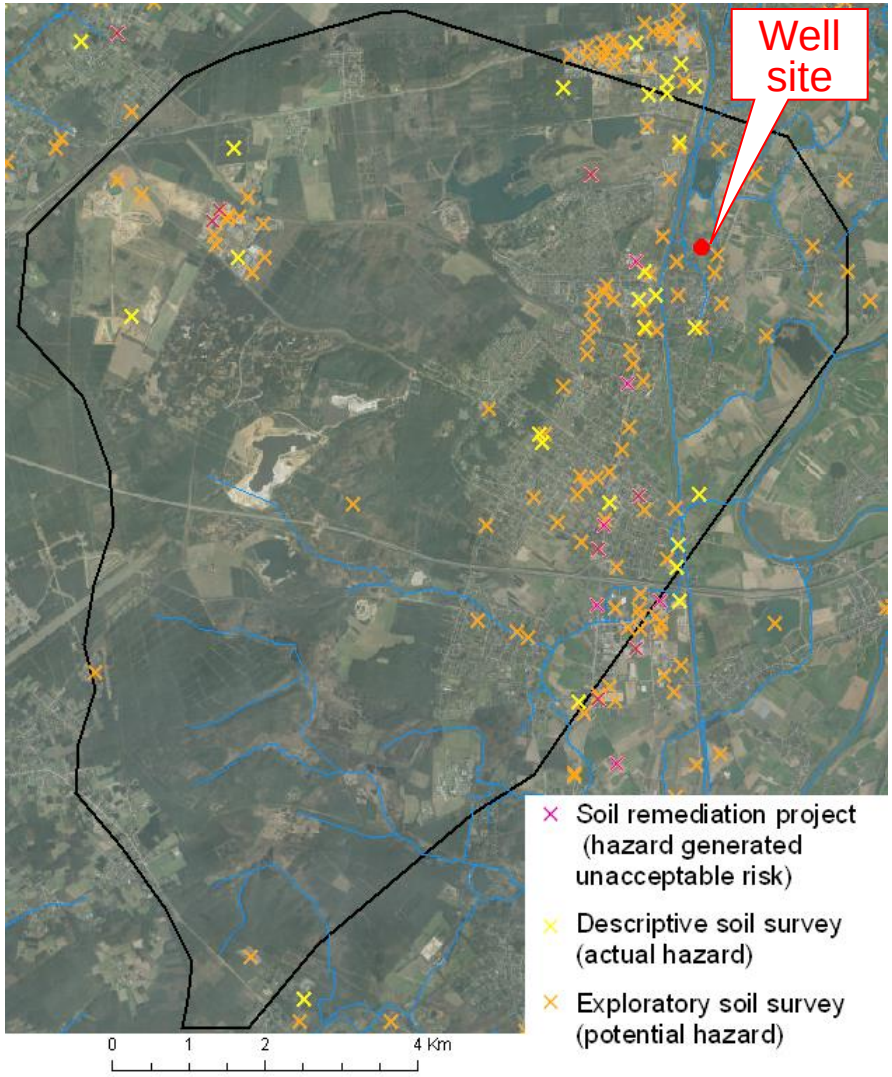
→ Derive a list of hazardous active substances and metabolites and compare with current monitoring campaigns

Diffuse pollution – manure application



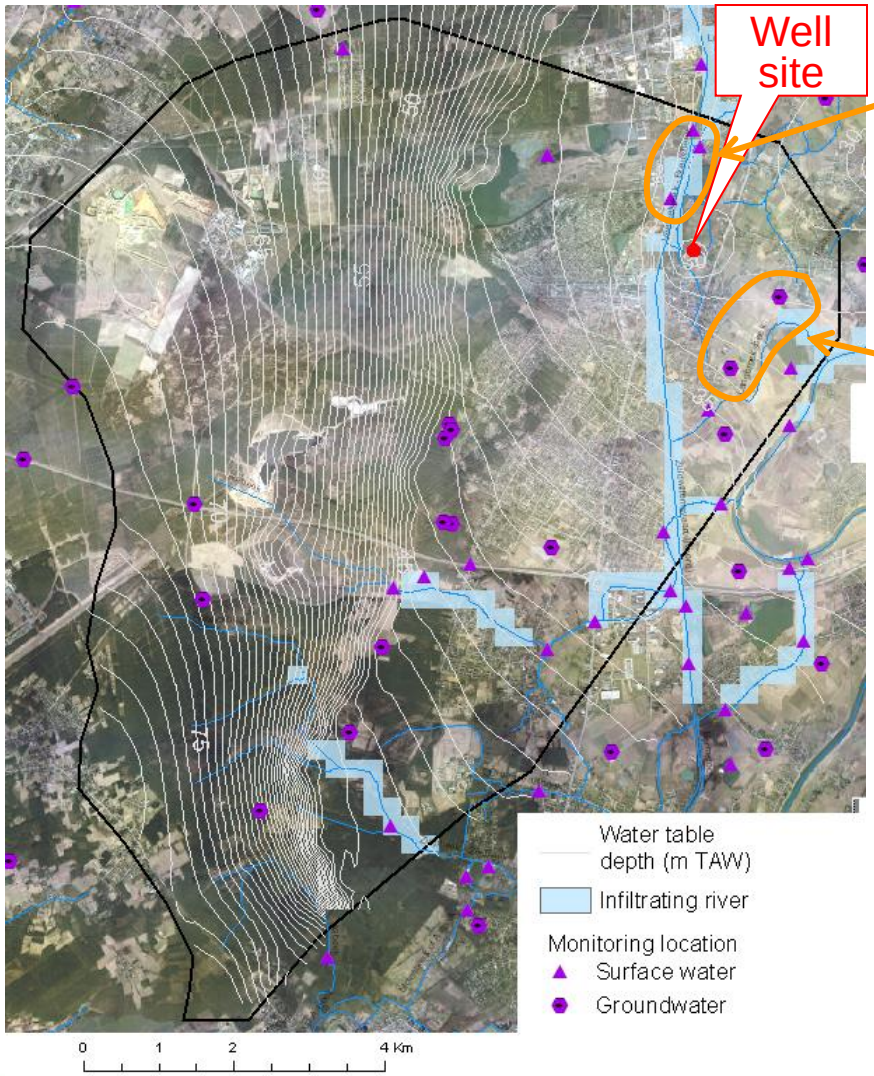
- Available data: average N and P production/use per hectare in a given municipality
- In the focus area of the Eisden well site:
  - Animal manure production is smaller than manure application
  - Average rates of manure application are acceptable

(Historical) soil pollution



- Soil pollution inventory from the public waste agency (OVAM)
  - Exploratory and descriptive soil surveys
  - Soil remediation projects
- Historical soil pollution at the former mining site (sulfur)
- Small-scale contamination problems with mineral oil and heavy metals, mainly in the river valley

Water quality monitoring



Surface water monitoring on infiltrating rivers close to the well site, that are no longer operational

→ re-activate the monitoring

Groundwater monitoring revealed the presence of BAM, which could not be explained by the inventories activities

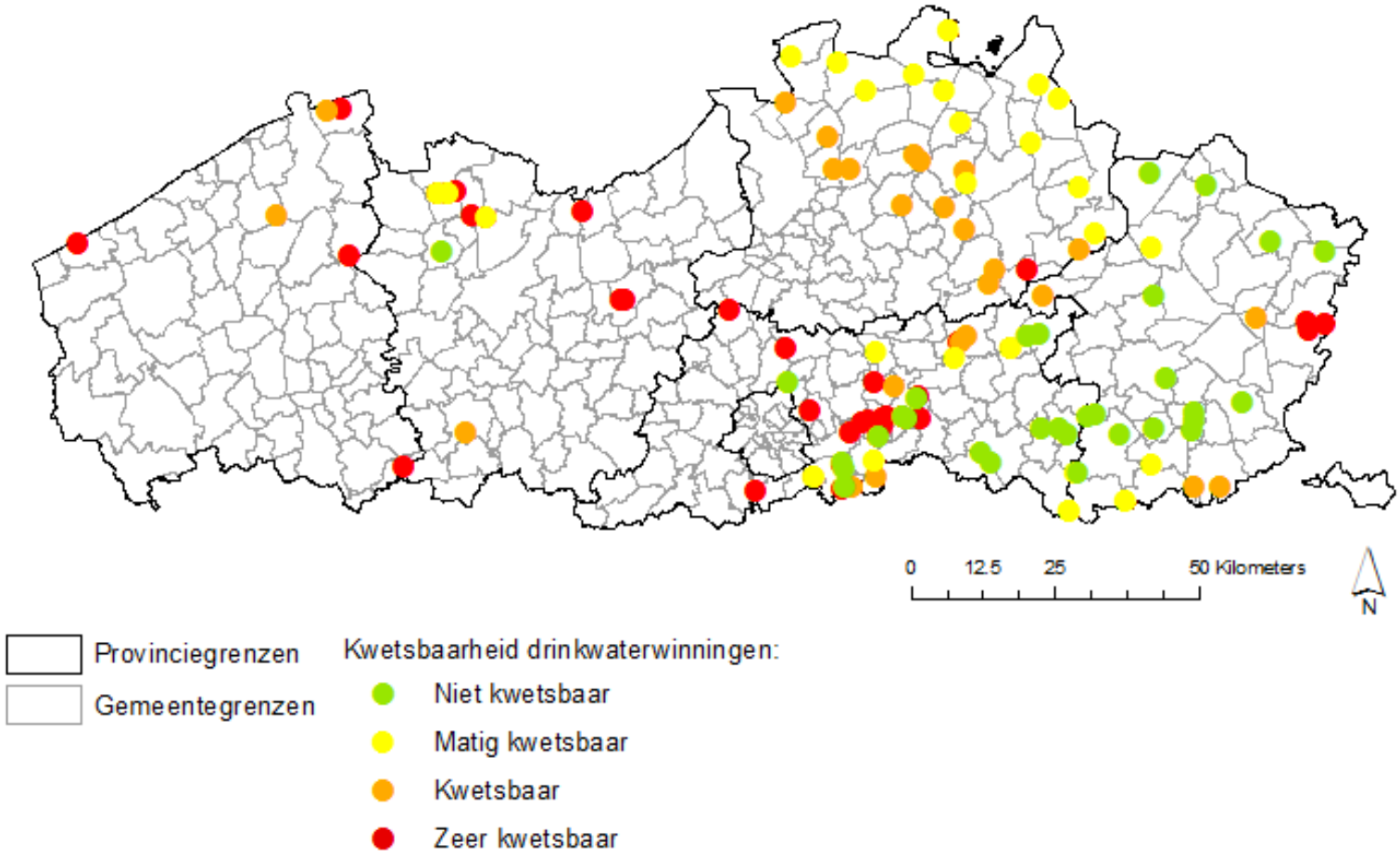
→ reconsider the inventory

Why should we compile source files?

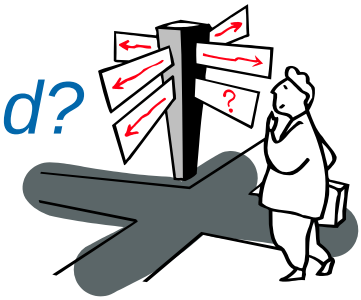
- Source-related risks are one of the issues that should be dealt with in Water Safety Plans (WSP)
- To assess source-related risks, we need to know:
  - Where is the water coming from (capture zone)?
  - What is happening in this capture zone?
    - Hydrological and hydrogeological processes
    - Human activities:
      - Past: e.g., historical soil contamination
      - Present: agriculture, industry, waste disposal, dwelling areas, …
      - Future: urban and rural planning

→ The source file should provide all necessary info for the **source-related issues of the WSP**

Potential vulnerability of groundwater captations for drinking water production



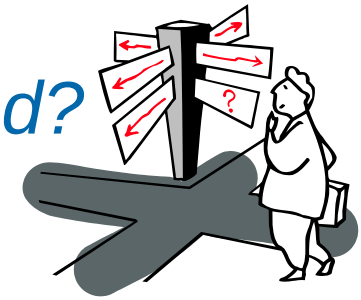
How do we need to proceed?



- consensus with drinking water companies on prioritisation (vulnerability)
  - 36 very vulnerable captations
  - 28 vulnerable
  - All of them priority?

- consensus on focus areas
- Need for clustering ?

How do we need to proceed?



RBMP

Monitoring
Groundwater
Surface water
Waste water

Protection of water resources

…

Policy:
Agriculture and industry
Spatial planning
Pesticides
Wastewater treatment
…

Permits:
Groundwater captations
Waste water discharges
Buildings and activities

Conclusion

- Source files aim to provide all source-related information necessary for WSPs, but
  - Uncertainty on capture zones makes it difficult to delineate the focus area
    → go for a ‘worst case’ scenario, including all areas that might contribute plus a buffer zone
  - Data on some issues remain rather vague or incomplete, e.g. pesticide use
    → use monitoring data to detect gaps in the inventory
  - Cooperation between administration and drinking water companies
  - Source file is only first step!!


ALONE WE CAN DO SO LITTLE
TOGETHER WE CAN DO SO MUCH
-helen keller