



The area-oriented groundwater management in Stuttgart

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STUTTGART





Area-oriented groundwater management in Stuttgart

Contents

1. Project area Stuttgart-Feuerbach
2. Objectives
3. Strategy
4. Results of investigation
5. Remediation planning
6. Conclusions



Stuttgart Feuerbach example – framework conditions

City district Stuttgart-Feuerbach:

- Area 11,56 km²
- Inhabitants 27.000
- Employees 32.000
- 150 years of industrial tradition: chemistry, metall processing and automotive suppliers

And as one result:
contamination of soil and
groundwater – mainly VOC



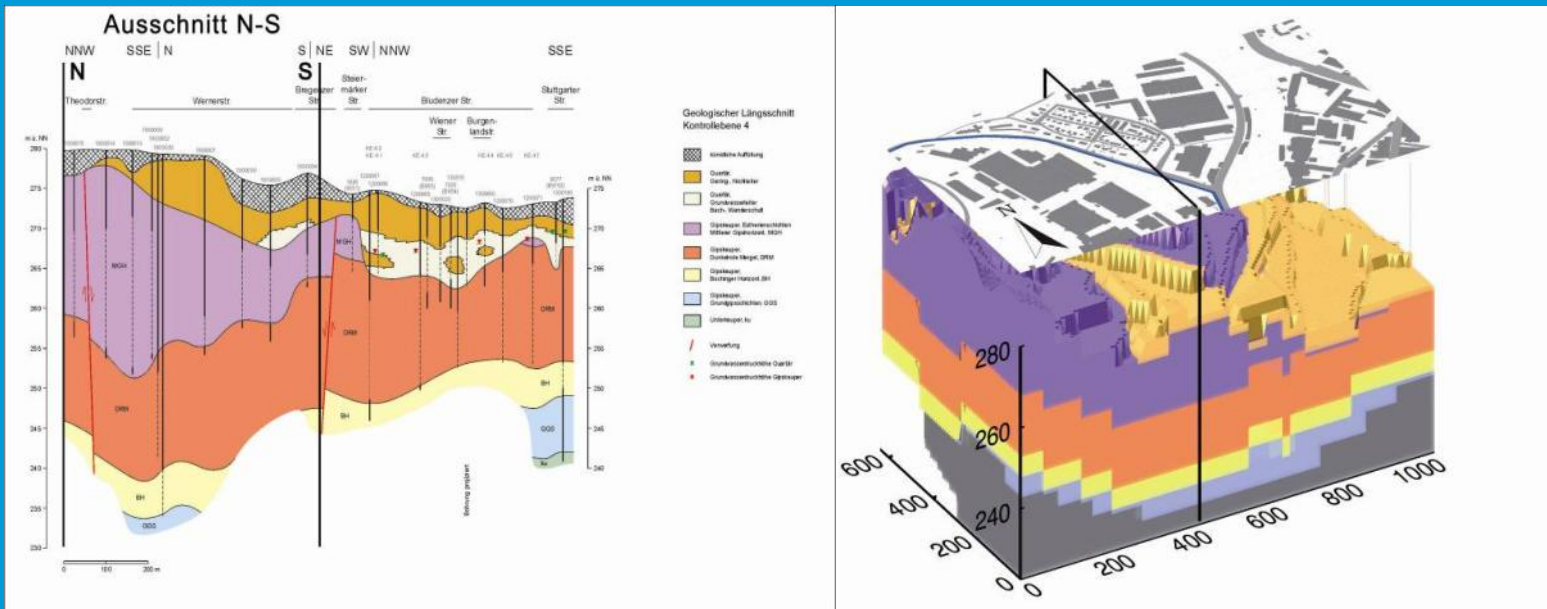
Suspicious Sites in Feuerbach



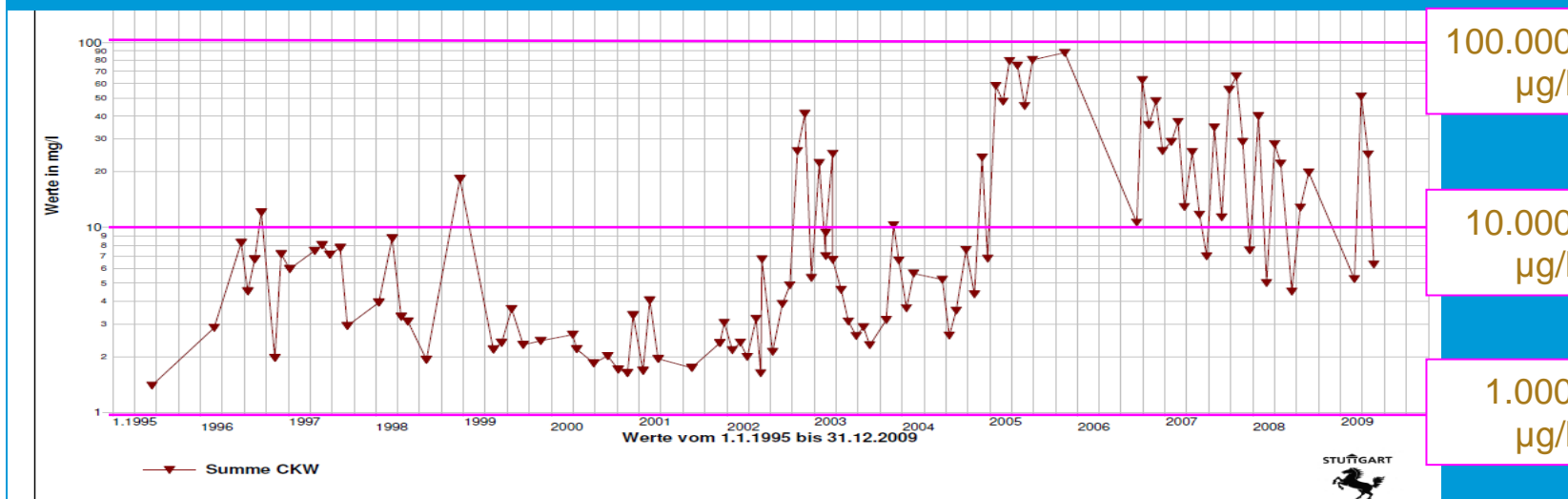
Project area Stuttgart-Feuerbach:

- Area: 530 ha
- 204 sites potentially contaminated with chlorinated solvents

- 5 aquifers
- Variable groundwater supply and flow direction
- Changing groundwater use over time



- 387 existing ground-water monitoring wells
- Investigation and remediation activities in 71 wells starting 1984
- Long term remediation (pump & treat) – trends?
→ **new perspective required!**



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- Description and **understanding** of the system (sources, pathways and receptors)
- Identification of **degradation** processes of contaminants
- Identification of **unknown sources**
- Identification of **key sources** of CHC-contamination (driving forces)
- Development of a **remediation concept**
- Developement of a **monitoring concept**

A large, light blue downward-pointing arrow with a blue outline, spanning the right side of the slide.

from investigation to remediation

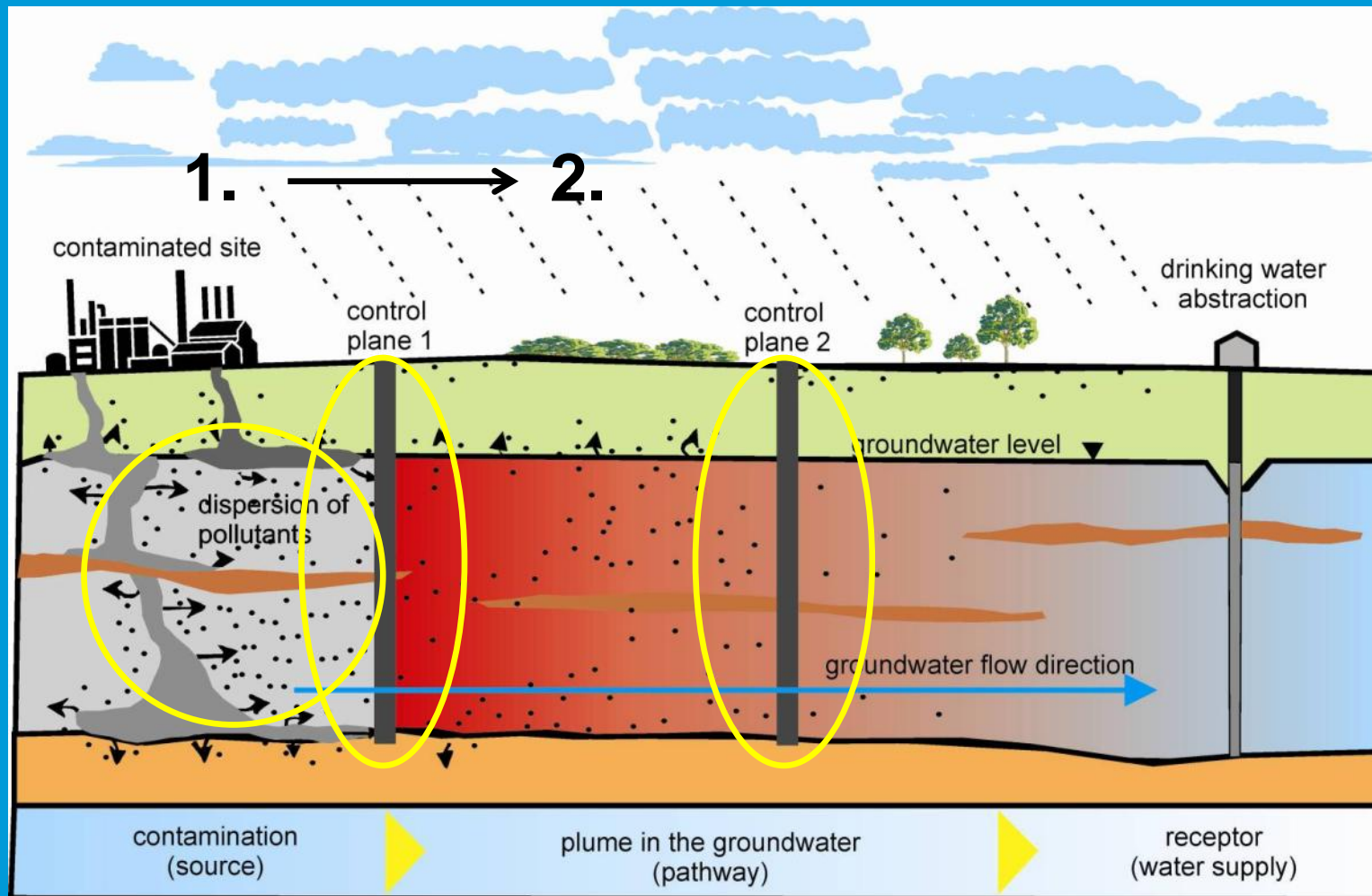


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Sites, Sources and Plumes I

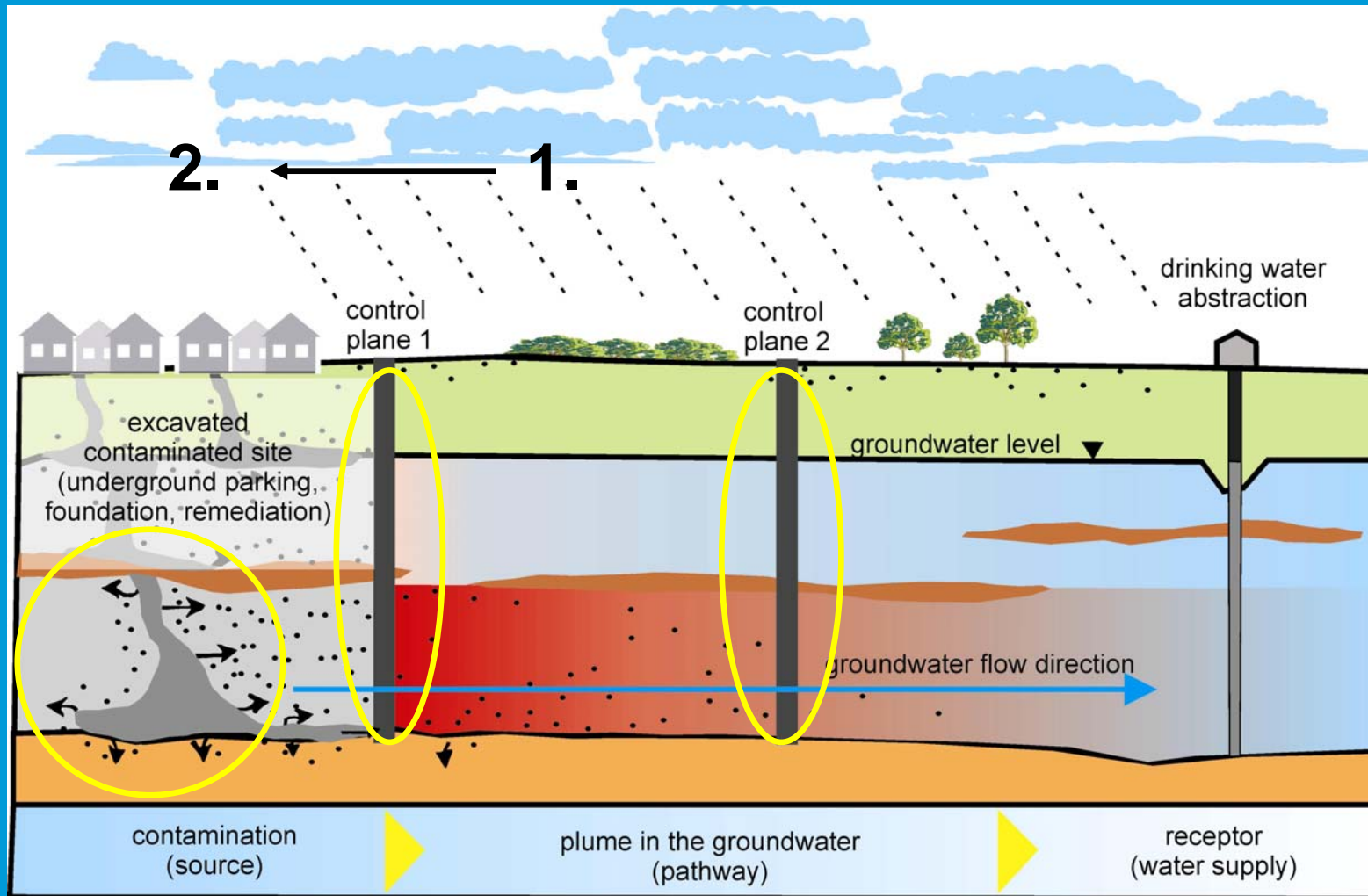




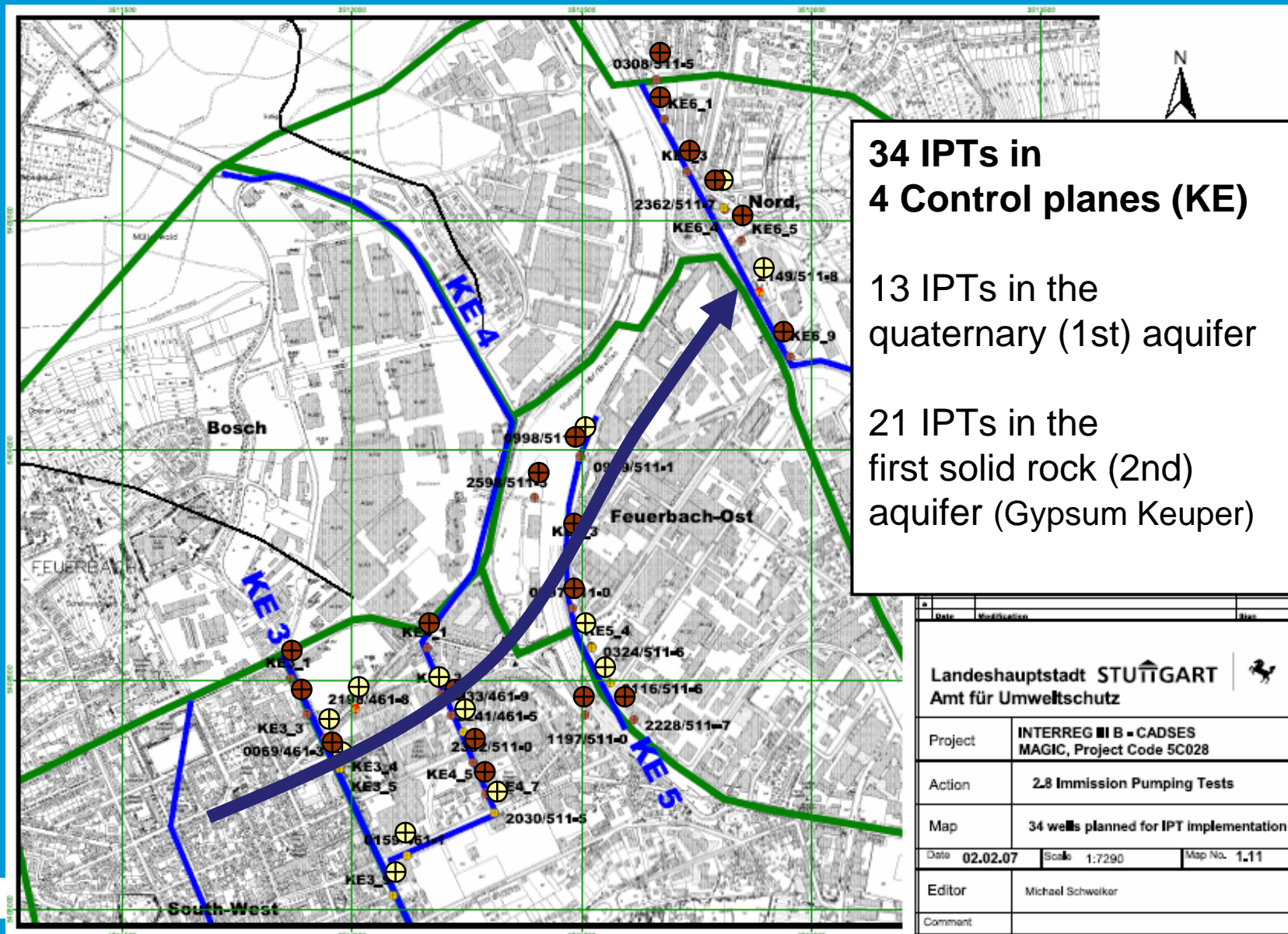
Change in land use (but industry is still there)



Sites, Sources and Plumes II



Integral Pumping Tests



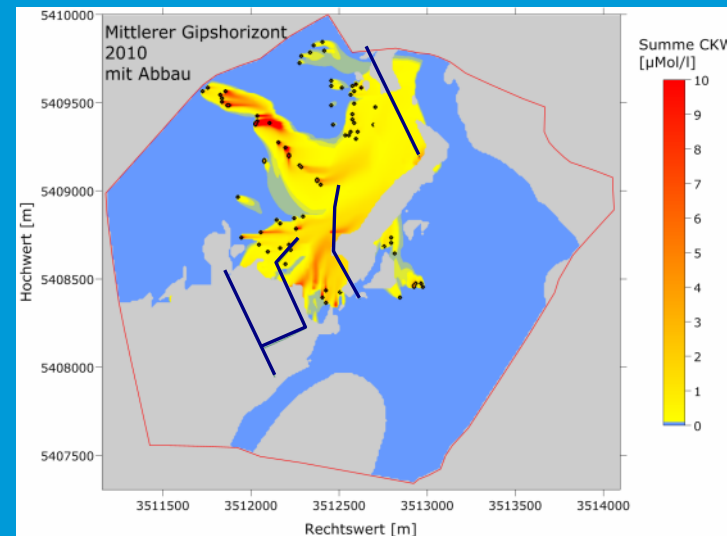
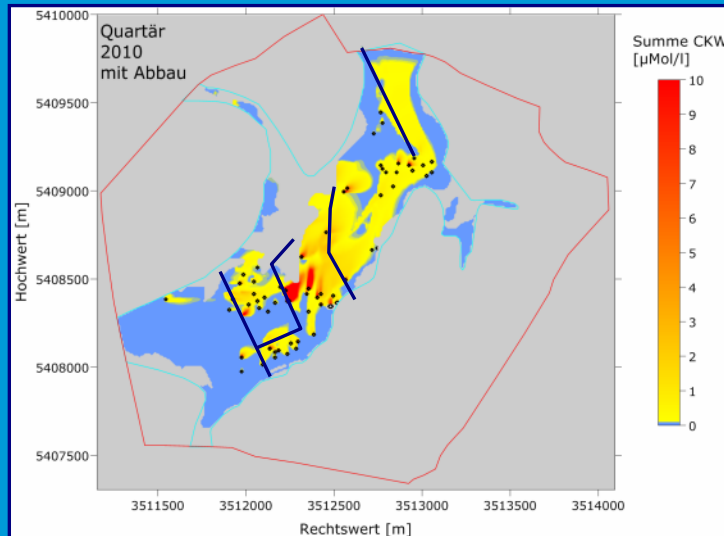


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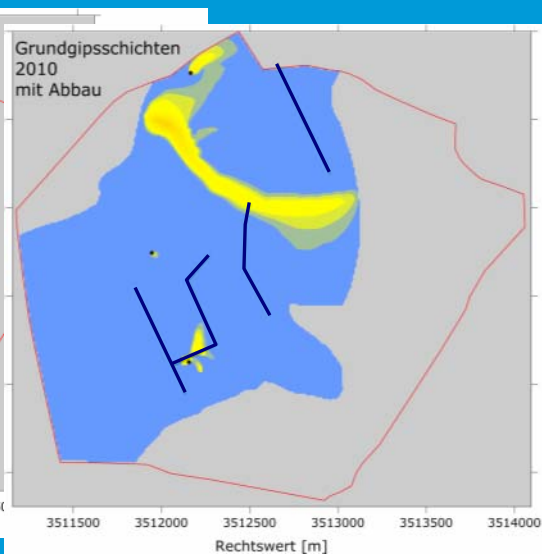
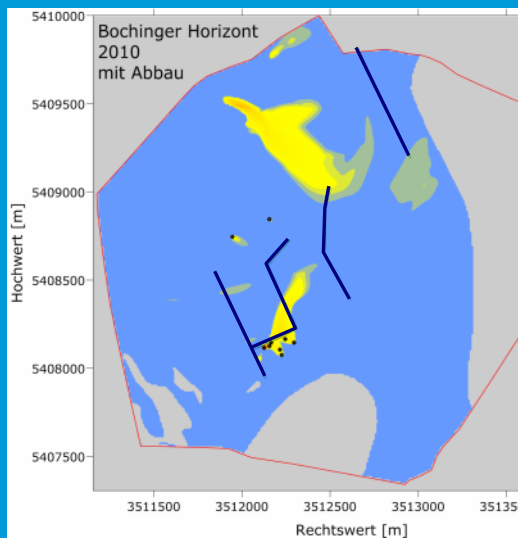
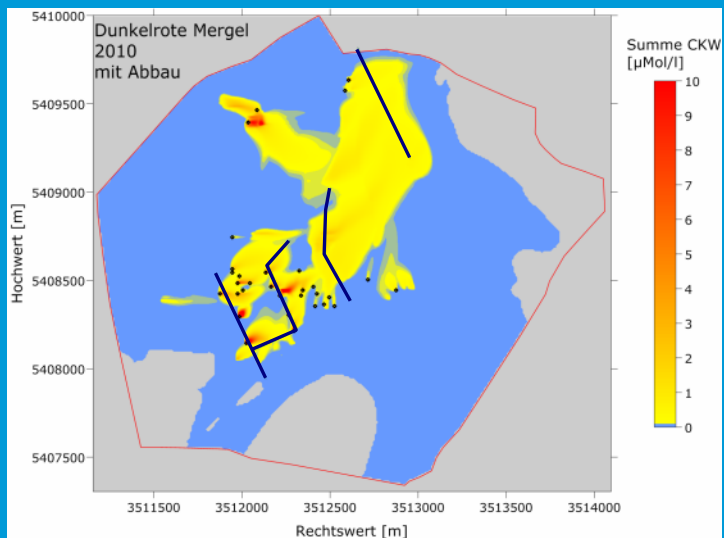
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Spatial overview on 5 aquifers

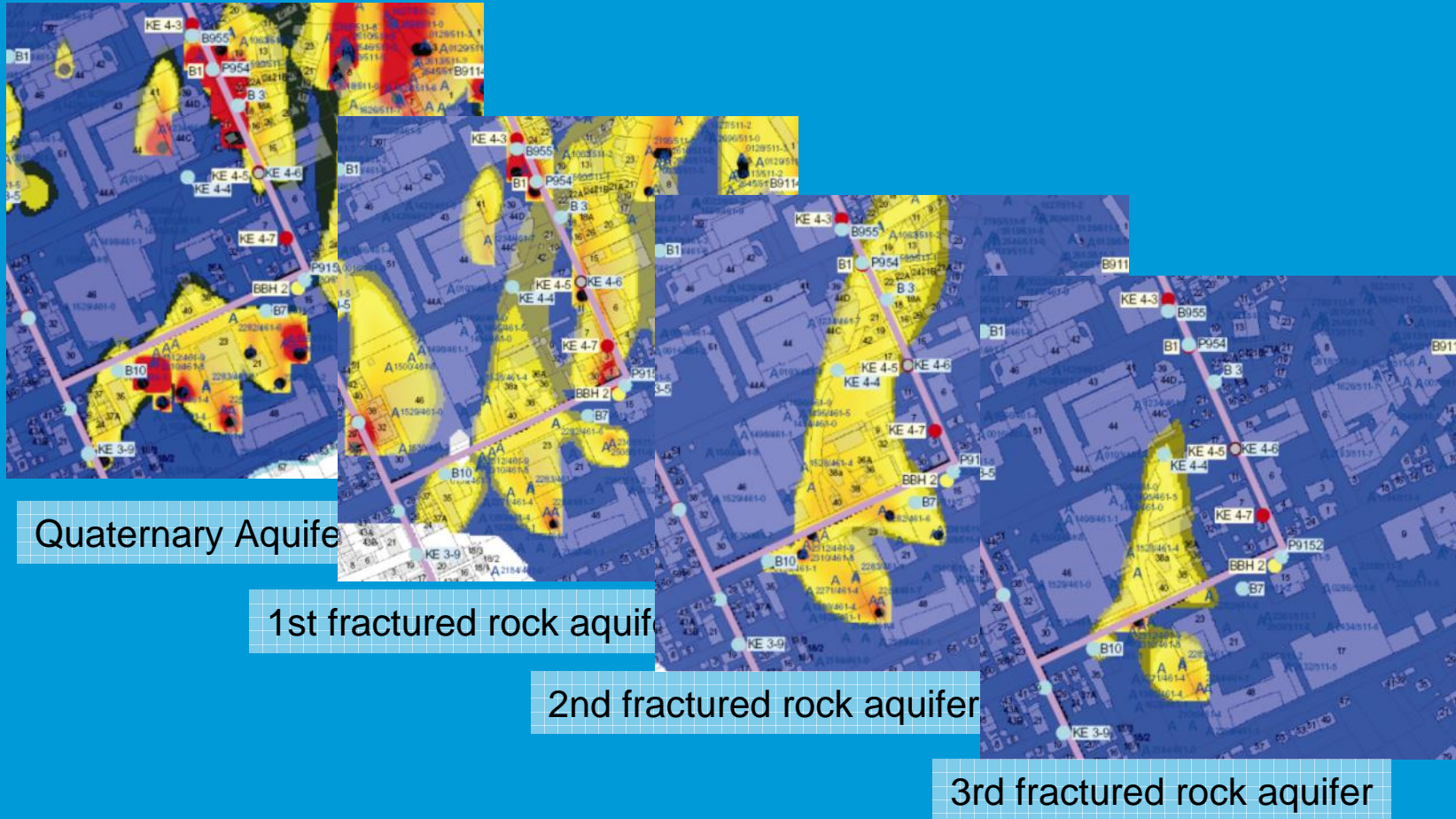


**CHC-
concentration**
yellow:
10-200 µg/l,
orange: 200 -
2.000 µg/l,
red > 2.000
µg/l





Plumes migrating horizontally and vertically between different aquifers



Quaternary Aquifer

1st fractured rock aquifer

2nd fractured rock aquifer

3rd fractured rock aquifer

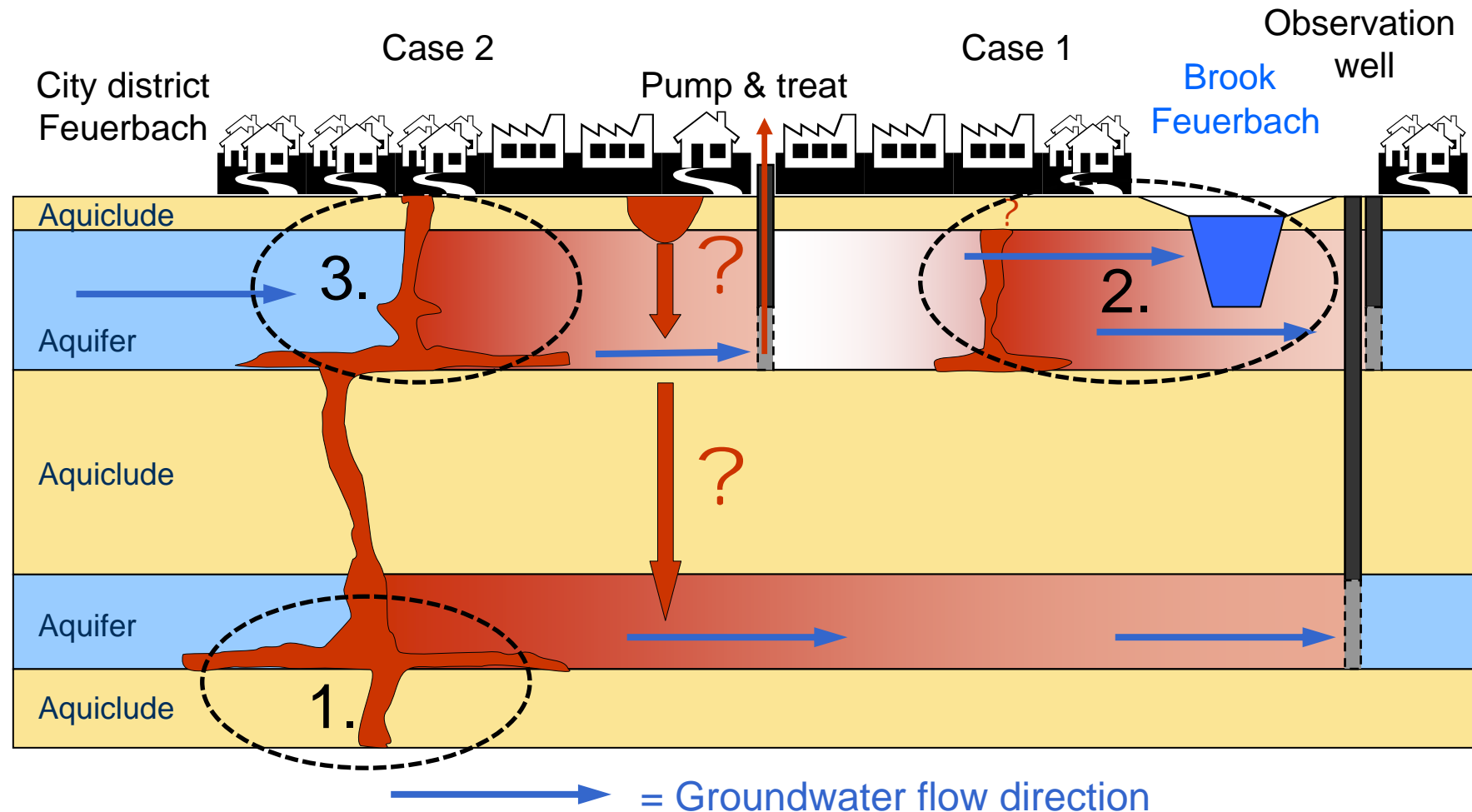


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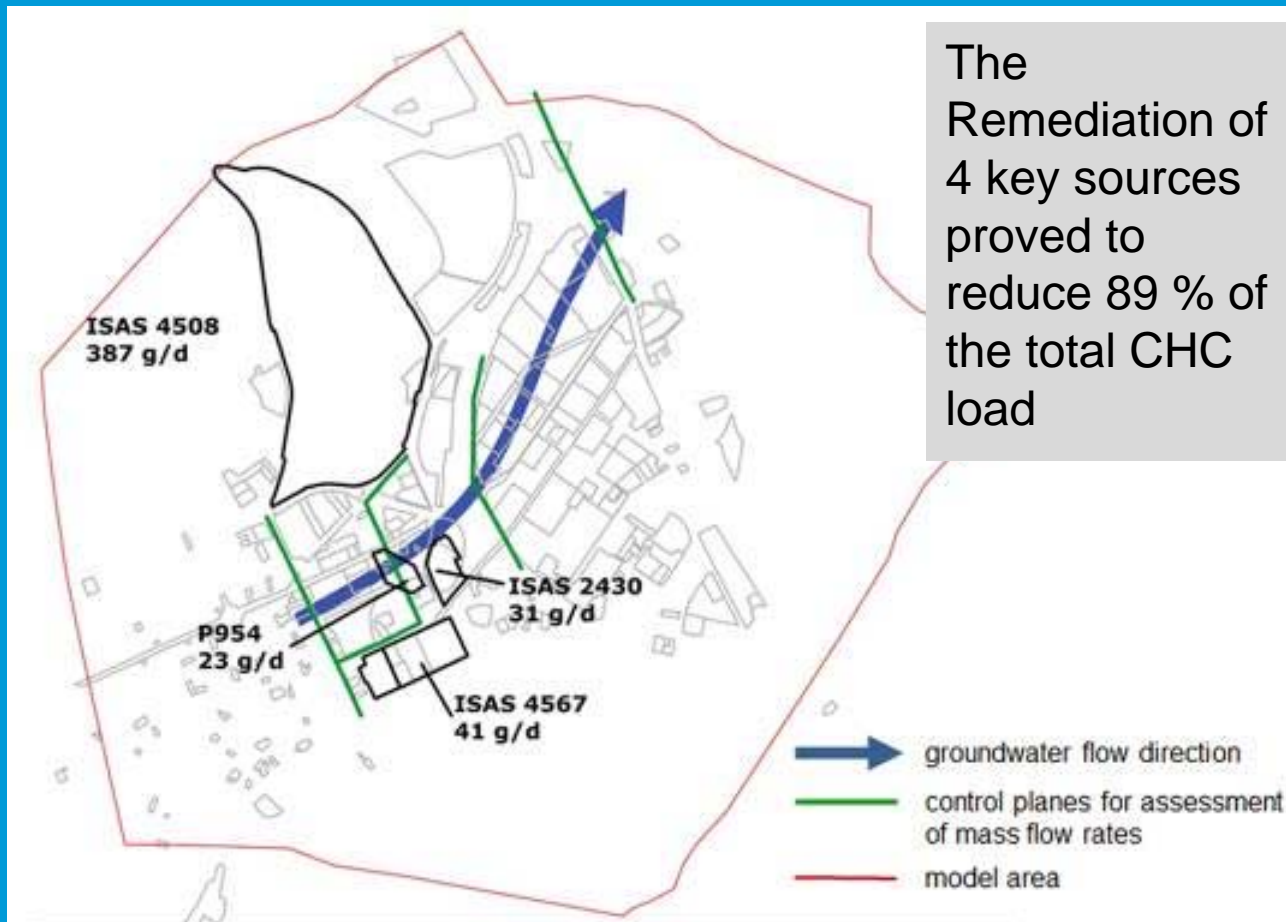
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Risk management – key targets for groundwater protection



1. *Priority:* Prevention of contaminant input and transport in **deeper aquifers**
2. *Priority:* Prevention of contaminant transfer into the **Brook Feuerbach**
3. *Priority:* **Limitation of the contaminant release** to the Quaternary aquifer

4 Key sources





Groundwater Management Plan for Feuerbach

Calculated effect of single main source remediation
[g/d = grams PER-equivalent per day]

	All 193 sources in Feuerbach	Four main key sources				Reduction by complete remediation or degradation of 4 key sources	
		Case 1 ISAS 4508	Case 2 P954	Case 3 ISAS 4567	ISAS 2430		
	g/d	g/d	g/d	g/d	g/d	g/d	% of all sources
Sink rate deep aquifers	36	1	10	18	2	31	86
Input of the Feuerbach Brook	168	129	2	6	9	146	87
Degradation	336	257	11	17	20	305	91
Total release	7540	387	23	41	31	482	89



Outlook: Action plan for Feuerbach

- Basic understanding of the CHC system in Feuerbach available
- Implementation of remediation measures in the key sources of CHC contamination (e.g. in-situ thermal remediation)
- Monitoring of the groundwater quality (after the identification of representative wells)
- Evaluation of the trends (positive trends expected according to EU GW directive)



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Key success factors

- Identifying and involving actors: identify all parties concerned (actors) identifying their interests and goals
- Building a business case – Interreg Projects Magic and FOKS
- Managing Knowledge & Technical innovations
- Making use of a longer Timeframe

Area-oriented groundwater management

- leads to an **understanding** of the system, (sources, pathways and receptors) → modelling helps
 - possibility to **detect** secondary and unknown sources
 - knowledge about source-plume constellation allows better risk assessment and **priorisation**
 - identify and remediate the **key sources** → be efficient
- Area-oriented groundwater management is „the“ method in industrialized areas**

Thank you for your attention!



Further information can be founds in the report „Area oriented investigation approach for groundwater management.