Water monitoring in former mining areas

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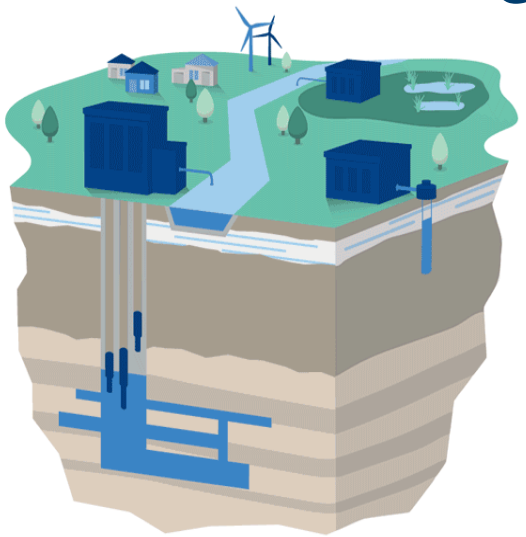
Mine water rebound monitoring

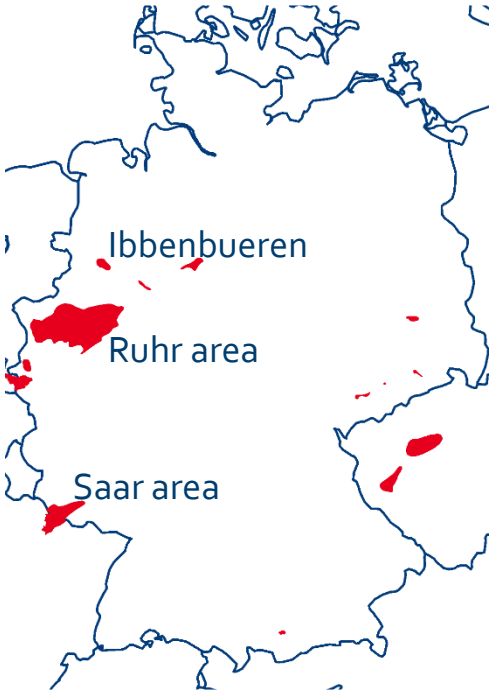
Mine water in the post-mining era

What are the so-called "perpetual tasks"?

all technical tasks following the cessation of coal mining extraction in the coal mining areas – sometimes over an indefinite period of time.

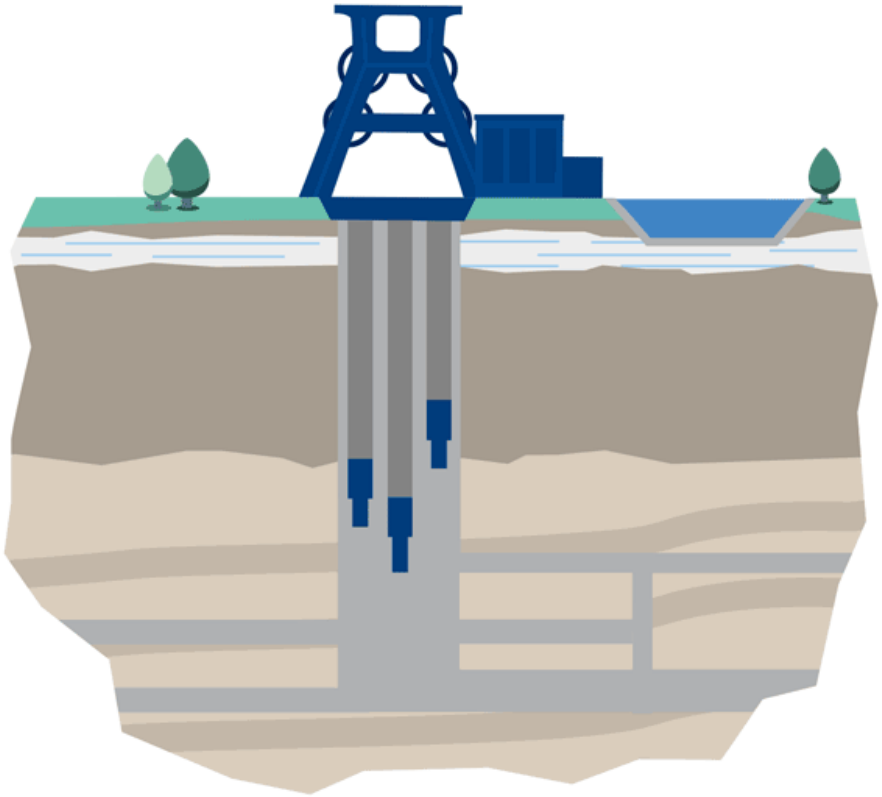
- **Mine water management**
- **Pumping of the surface water**
- **Ground water monitoring**





Mine water rebound monitoring

Mine water rebound process



Following the cessation of underground coal mining, it is not necessary any more to keep the underground mining operations and shafts dry.

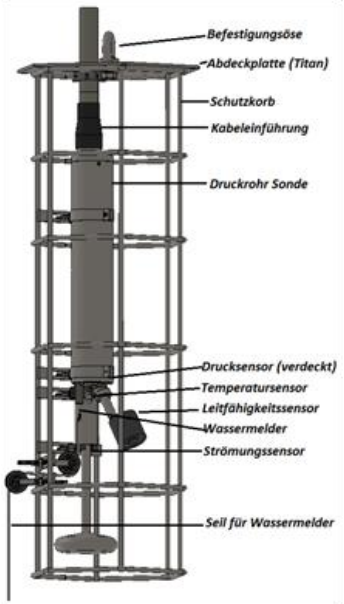
Therefore, the water is allowed to rise in a controlled manner => mine water rebound. This takes places quite slowly via natural inflows such as groundwater and seepage.

! In order to prevent mine water from interacting with groundwater levels in overlying strata it is necessary to pump it to a certain level!

Monitoring of the mine water rebound process required

Mine water rebound monitoring

Underground mine water monitoring system



Underground mine water monitoring system

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- Temperature:
  - Range: 10°c bis 60°C
  - Resolution: 0,01°c
  - Precision: +/-0,05°C
- Water pressure:
  - Range: up to 100 bar
  - Resolution: 0,003 bar
  - Precision: +/-0,15 bar
- Electrical conductivity:
  - Range: 0 till 200 mS/cm
  - Resolution: 0,004 mS/cm
  - Precision: +/-0,1 mS/cm
- Current: [Velocity and direction]
  - Range: +/- 3m/s
  - Resolution: 0,002m/s
  - Precision: +/-0,03 m/s

Deployment in pumping stations at the Ruhr (mines Auguste Victoria, Zollverein, Prosper Haniel, Heinrich) at the Saar (mines Reden and Duhamel) and in Ibbenbueren mine

Pumping of the surface water

Mine water in the post-mining era

Why do we also have to pump water streams located on the surface?

- Centuries of intensive mining activities have led to subsidence causing the formation of large cones – **called polders**.
- In areas like these, some of the water streams can no longer flow freely. The deeper-lying areas therefore have to be continuously drained **to prevent the accumulation of water in the surrounding rivers and lakes and overflooding residential settlements.**

Pumping of the surface water

Polder management

- **186 pumping stations** at the rivers Emscher and Lippe
- **~850 Mio. m³** water out of the polder areas at Emscher, Lippe and Rhine

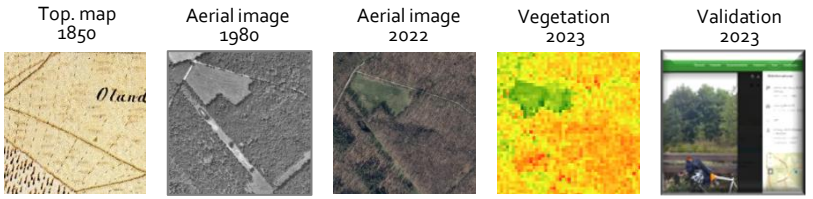
Pumping of the surface water

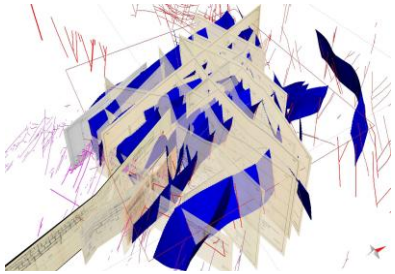
Polder monitoring

- **Integration of Geodata (deposit, mining history overlying strata geology, faults) and overburden with multispectral remote sensing**
- **Spatial-temporal and multispectral analyses to identify environmental changes**

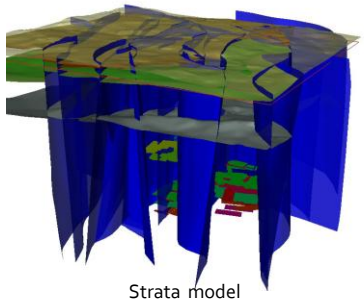
⇒ **Development of a new remote „water index" for post-mining regions**

⇒ **Monitoring of performance of rehabilitation measures**





Evaluation of mine maps



Strata model

Pawlik et al. 2023

Thank you

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