



Groundwater modelling

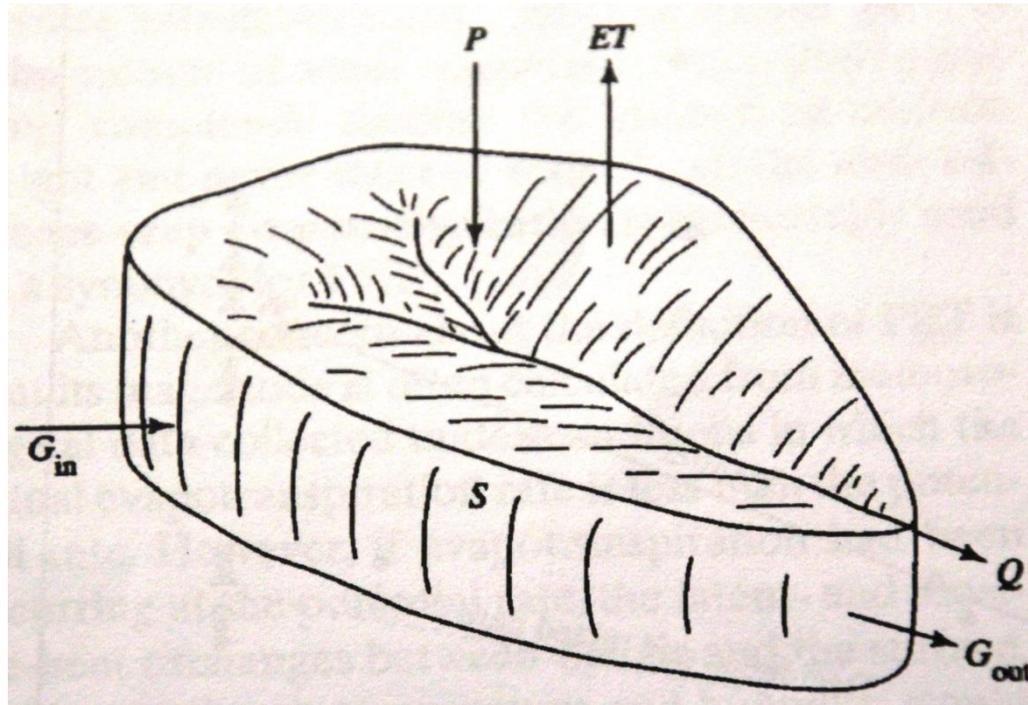
Samrit Luoma, Kimmo Hentinen and Antti Pasanen

Seminar on management of water balance in mining areas, 28.8.2015, SYKE

- Groundwater plays an essential role in the hydrological cycle and be critical for maintaining wetlands and river flows. It also provides the base-flow to surface water systems
- Mining activities have impacts on the water system in some certain levels
- Therefore, in each mine site, it is important to understand groundwater flow system and its characteristics, the interactions of groundwater and surface water and also the water balance of the watershed area



- Water management and water balance in mine sites is very important for mine sites.
- Water management in dry areas has to be done in a way that there is enough water for mining operations but on the other hand in wet conditions water management has to take care that contaminated waters are controlled.
- Water balance models provide information about the volumes and if possible about the quality of the water to guide water management.



- At a watershed:

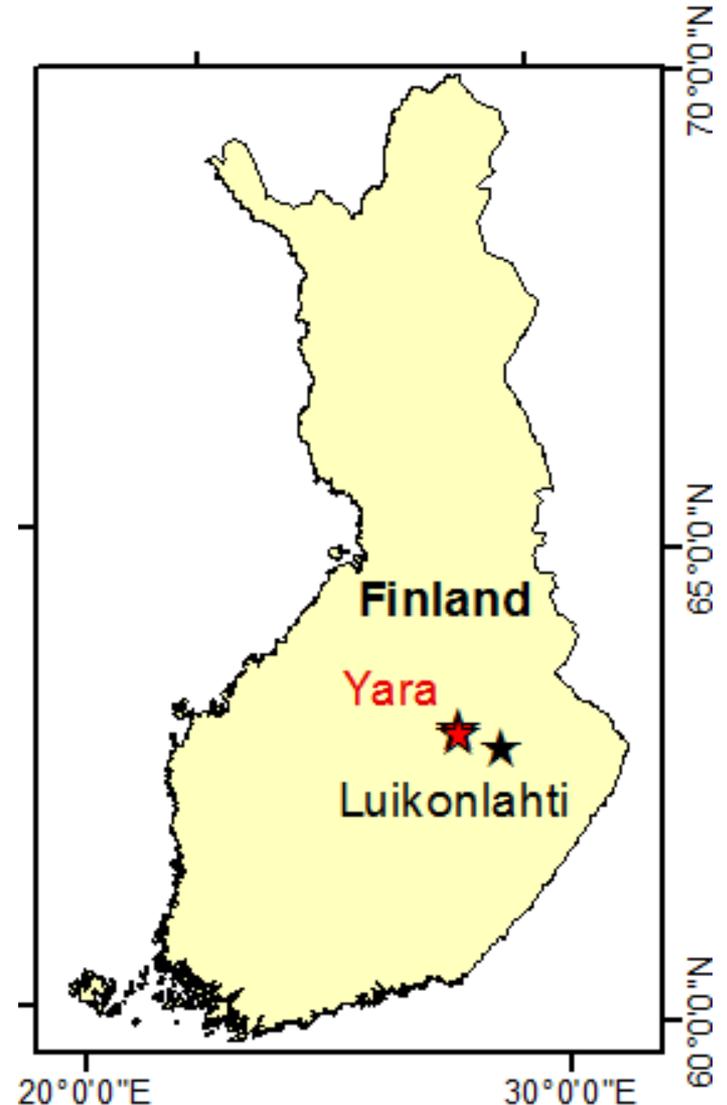
$$P + G_{in} - (Q + ET + G_{out}) = \Delta S$$

- WaterSmart Project – GTK's main task is in WP2: Data collection, monitoring and groundwater modelling in two study areas:

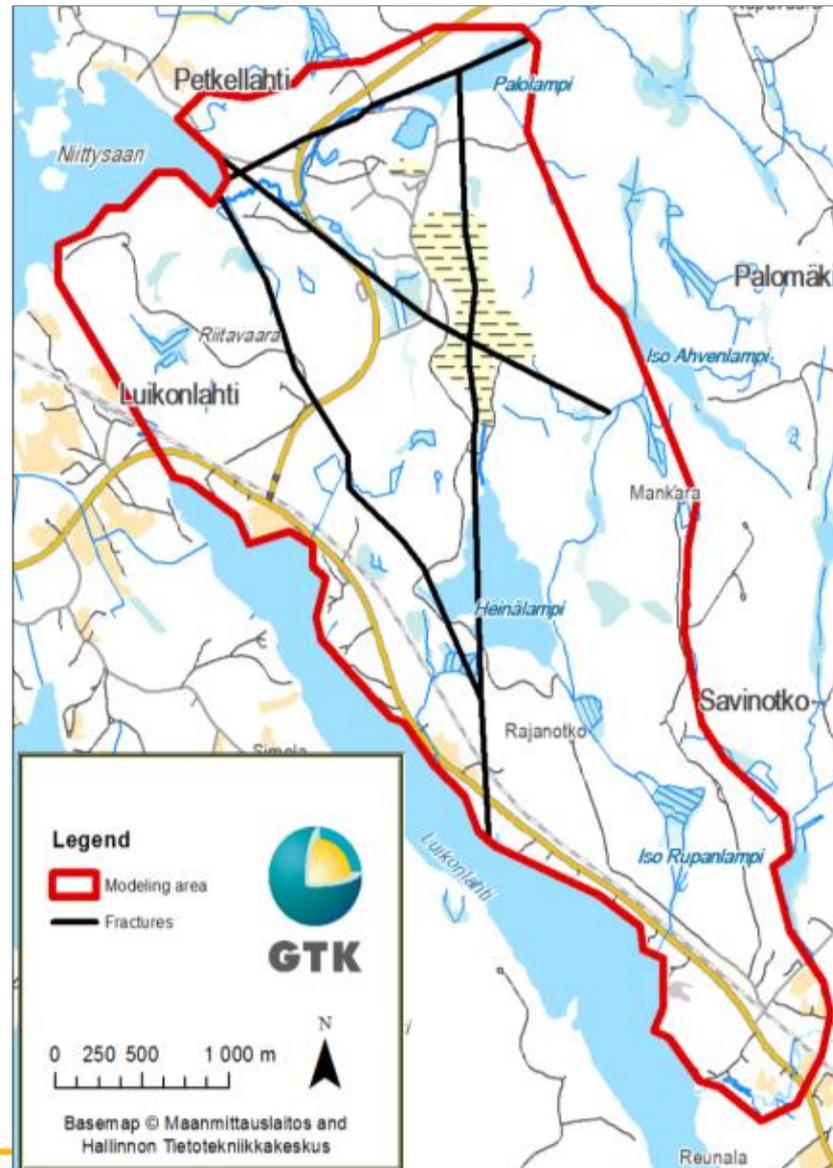
- Yara Suomi Oy – Siilinjärvi Mine



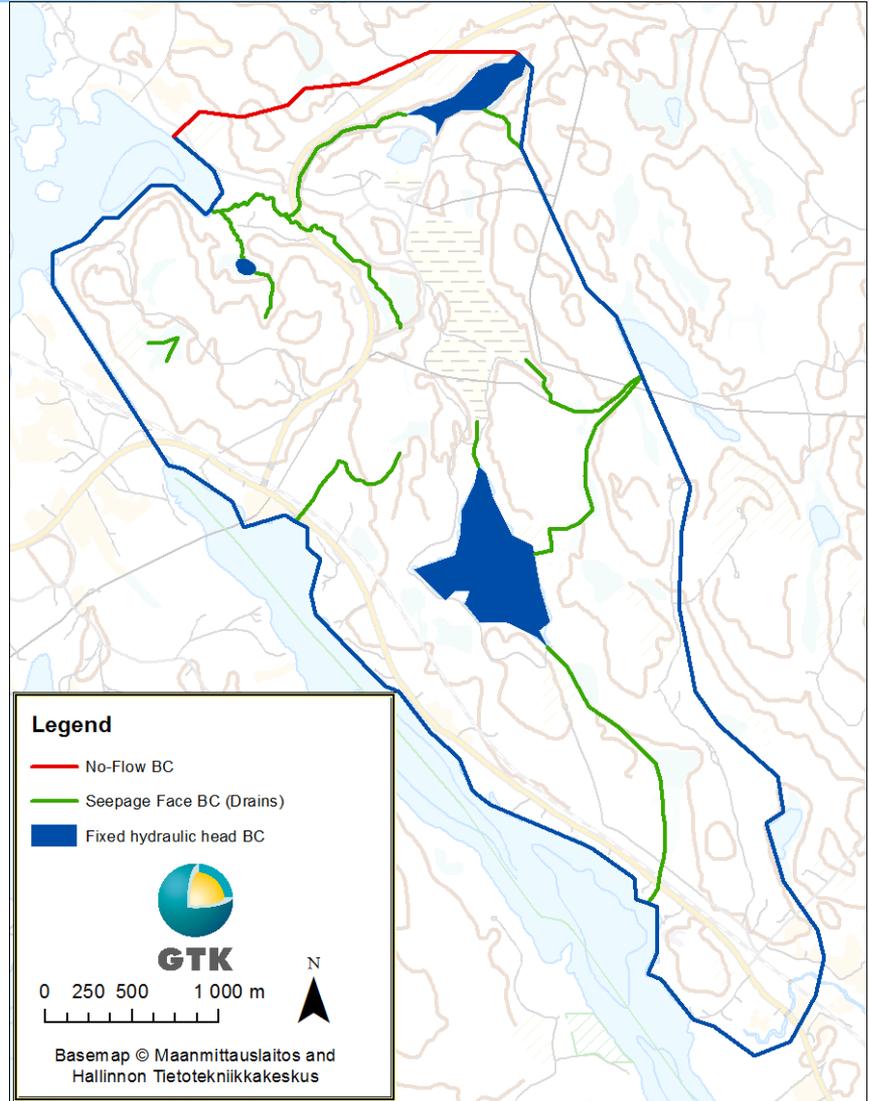
- Altona Mining Oy - Luikonlahti Site

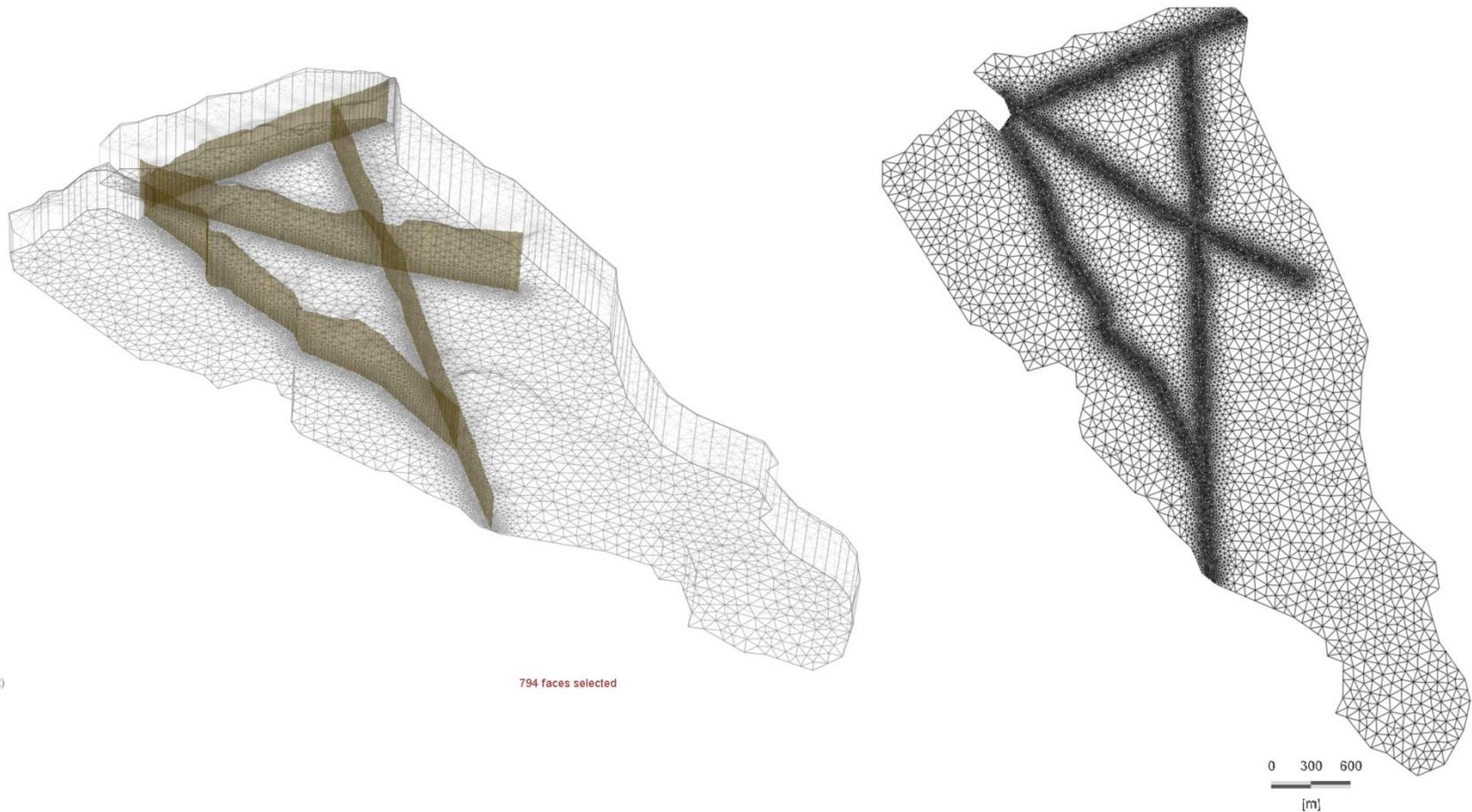


- FEFLOW steady-state groundwater flow model
 - 2 layers model of soil, bedrock and fault zones
 - Coupling with surface water model WSFS implemented with FEFLOW interface



- Boundary condition of groundwater modelling:
 - Fixed hydraulic head
 - Seepage face
 - No flow boundary





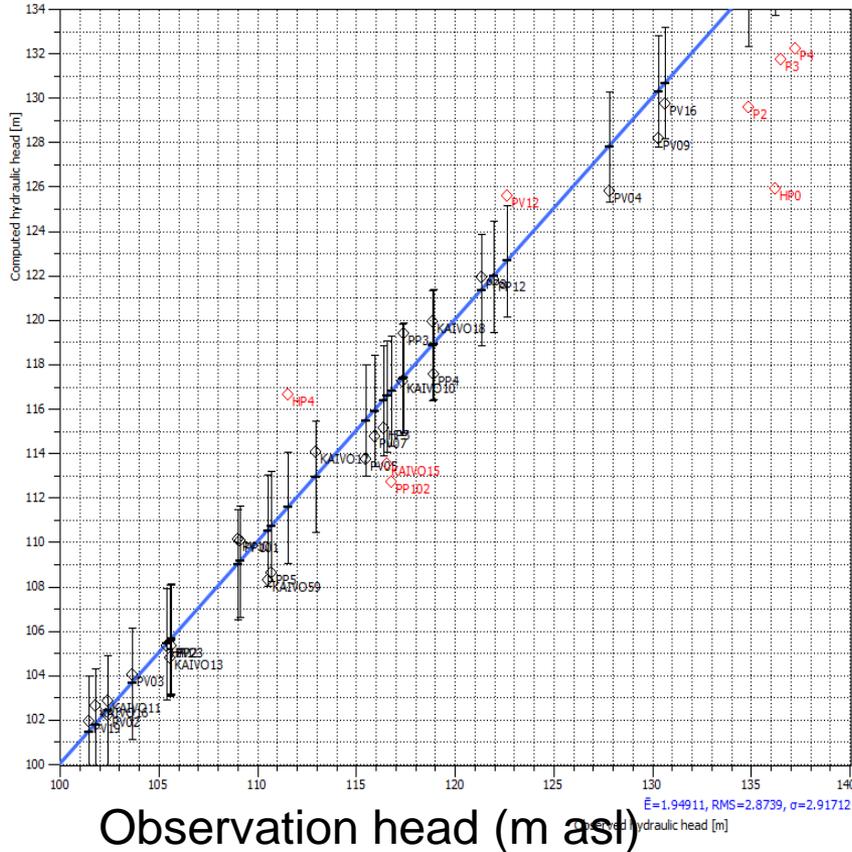
Finite element mesh for the Luikonlahti mine site.
Local refinement around fractures.



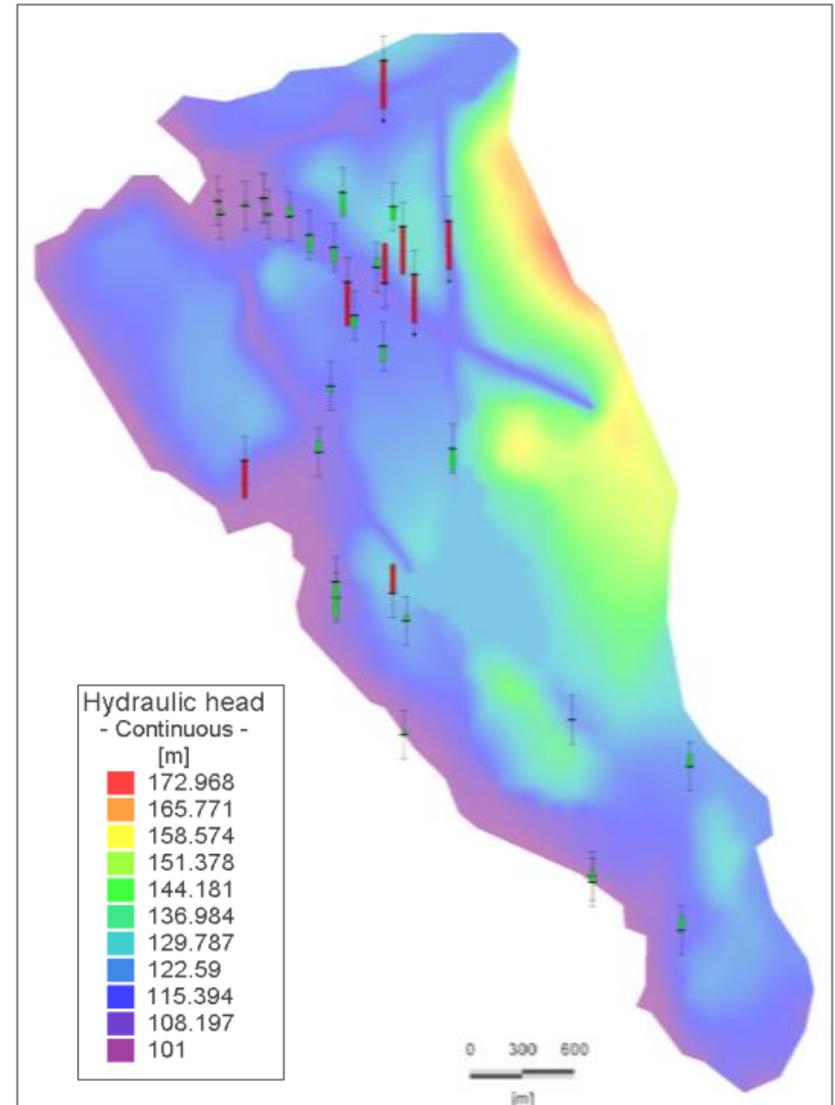
Simulated hydraulic head distribution in Luikonlahti

Tekes

Computed head (m asl)

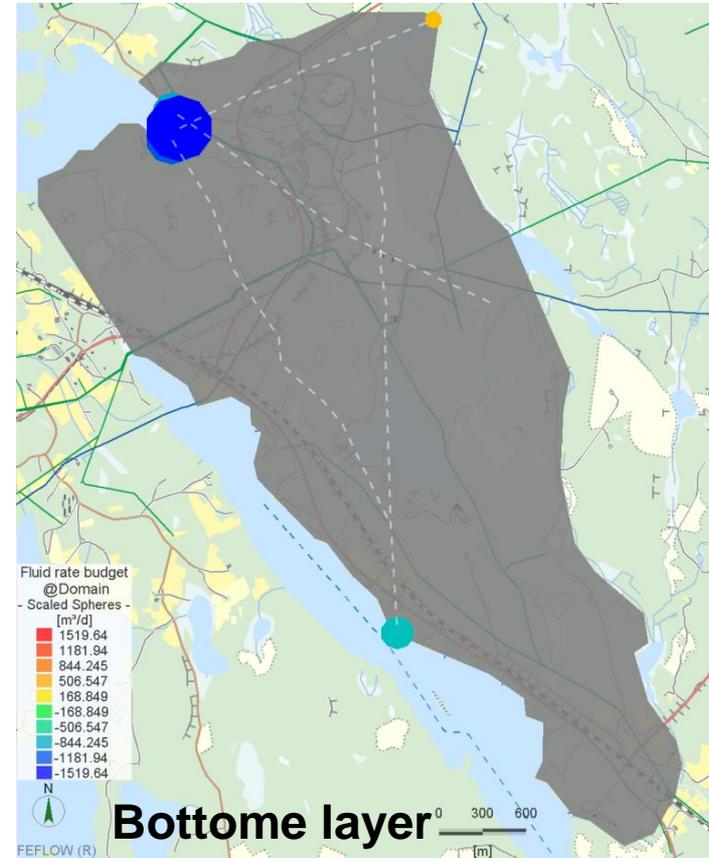
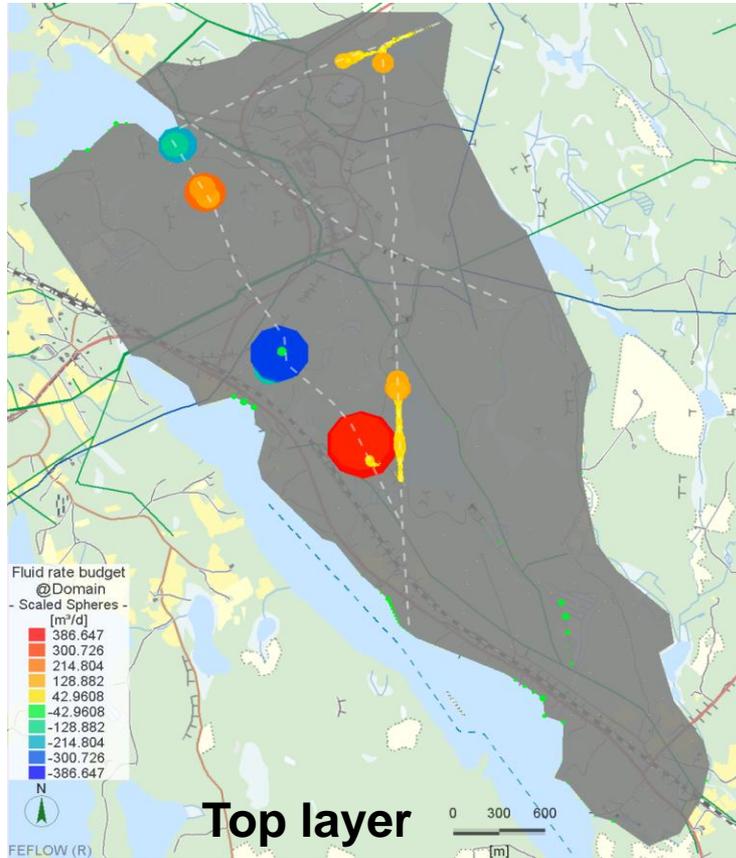


Correlation of simulated and observed hydraulic head values. ± 2.5 m confidence interval, red points outside the confidence interval.



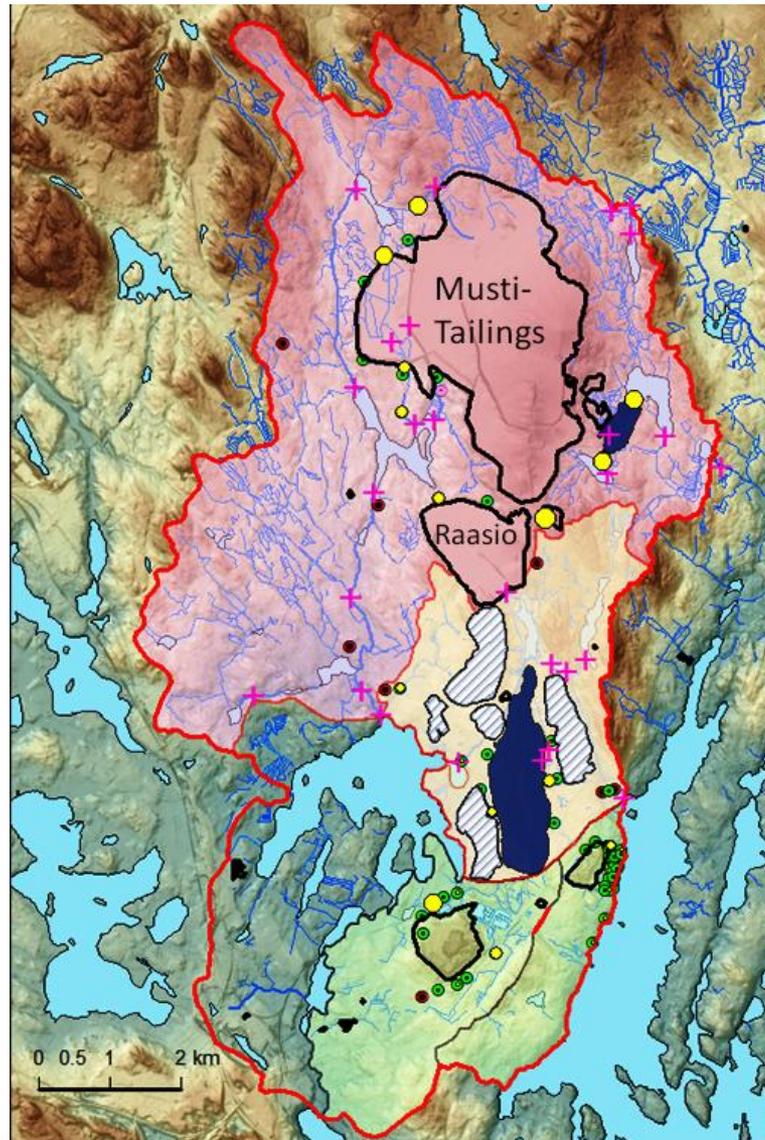


Flow rates in & out of the Luikonlahti model Tekes

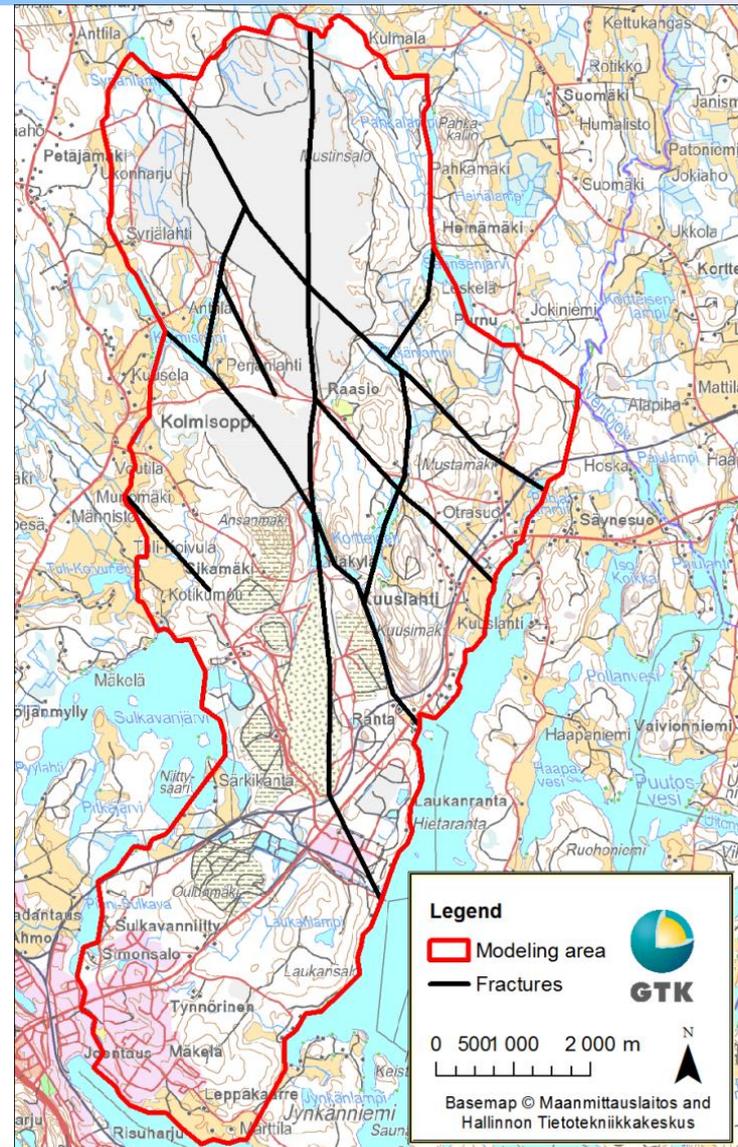




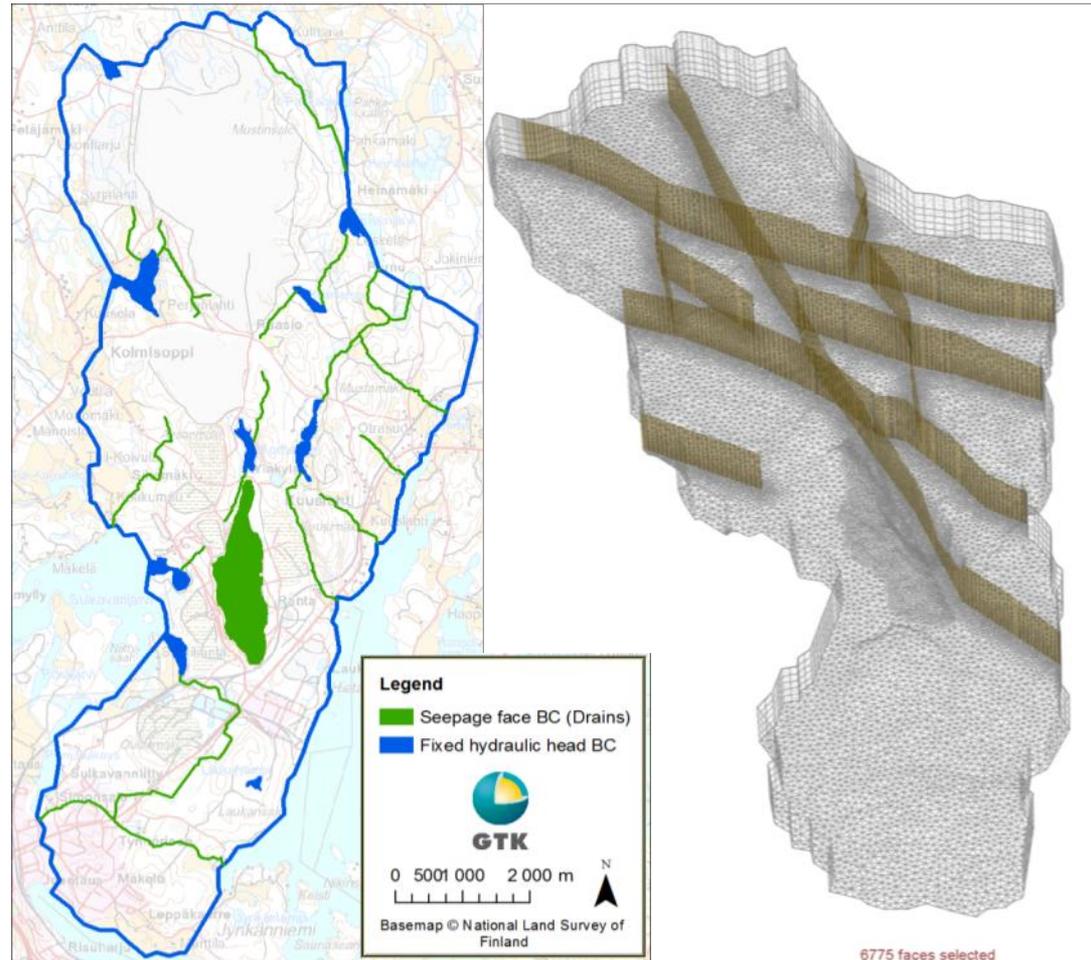
Watershed areas in Yara- Siilinjärvi mine site Tekes

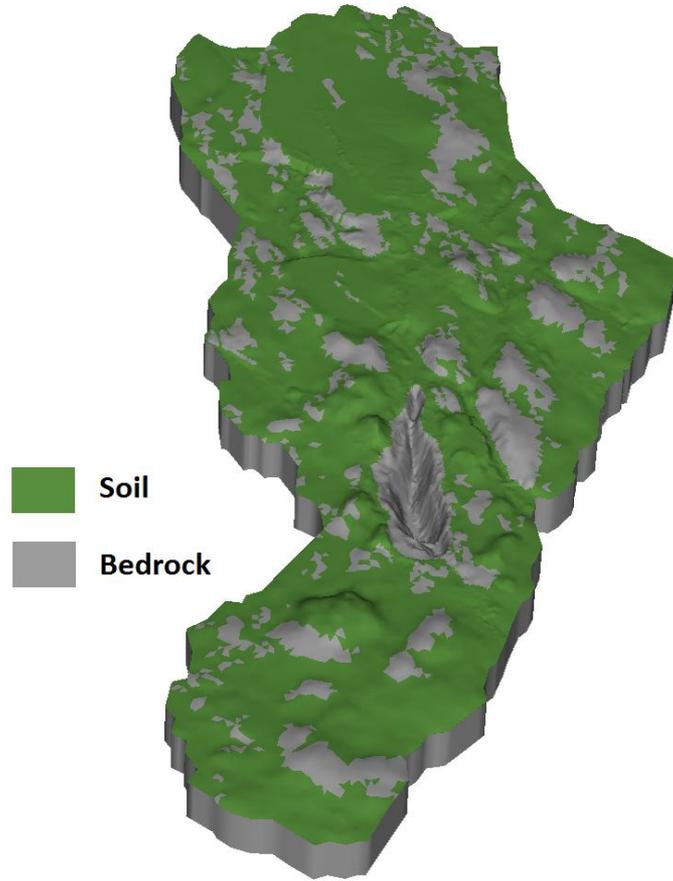


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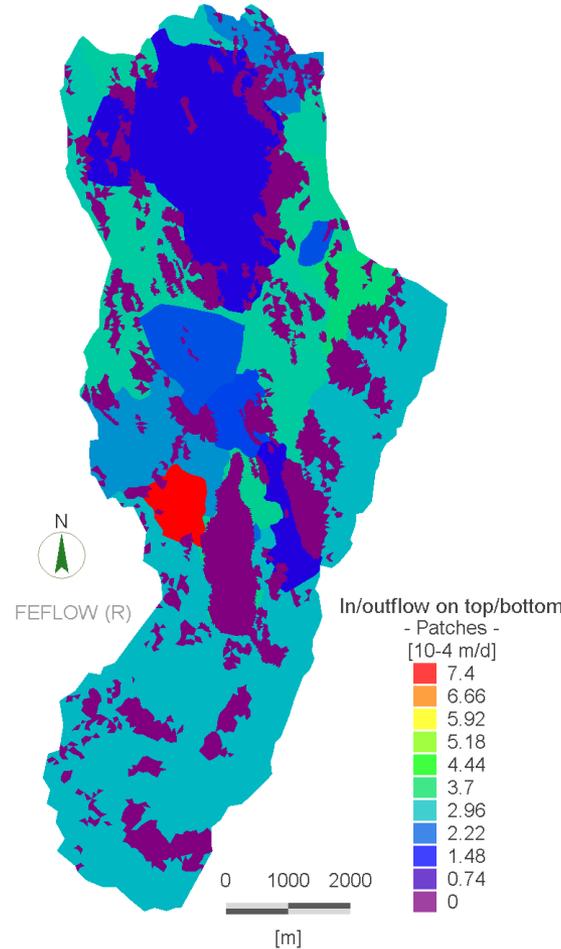


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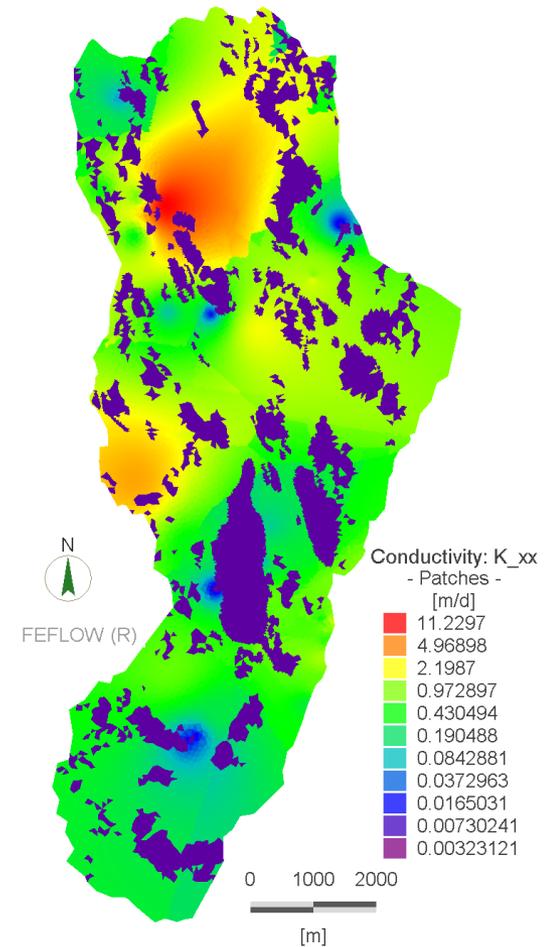




GW Recharge

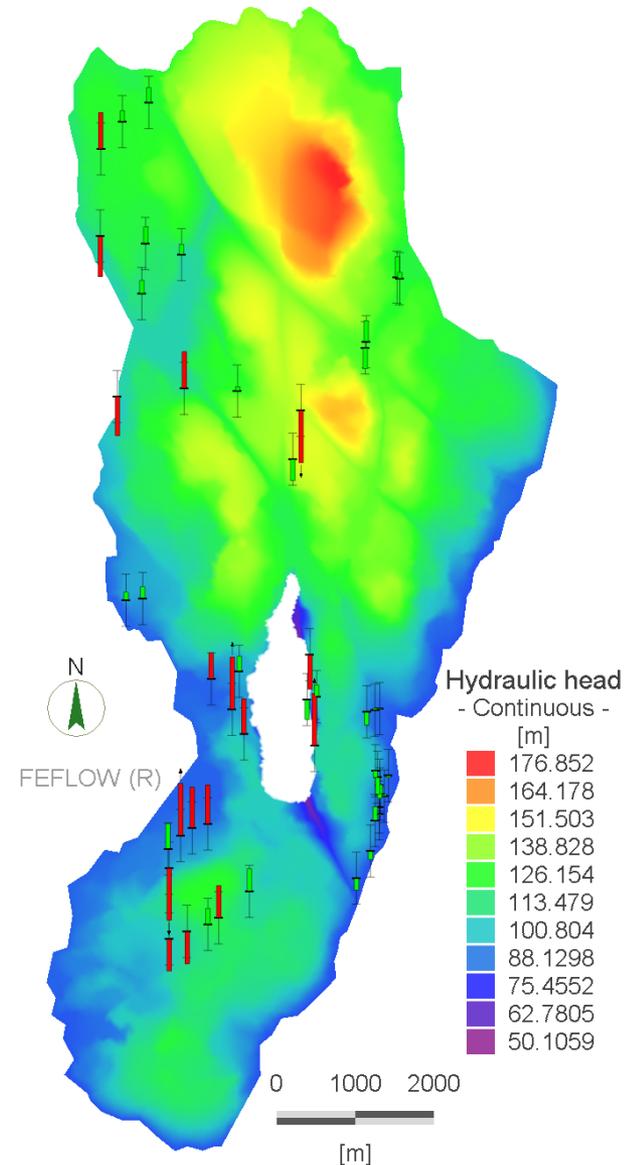
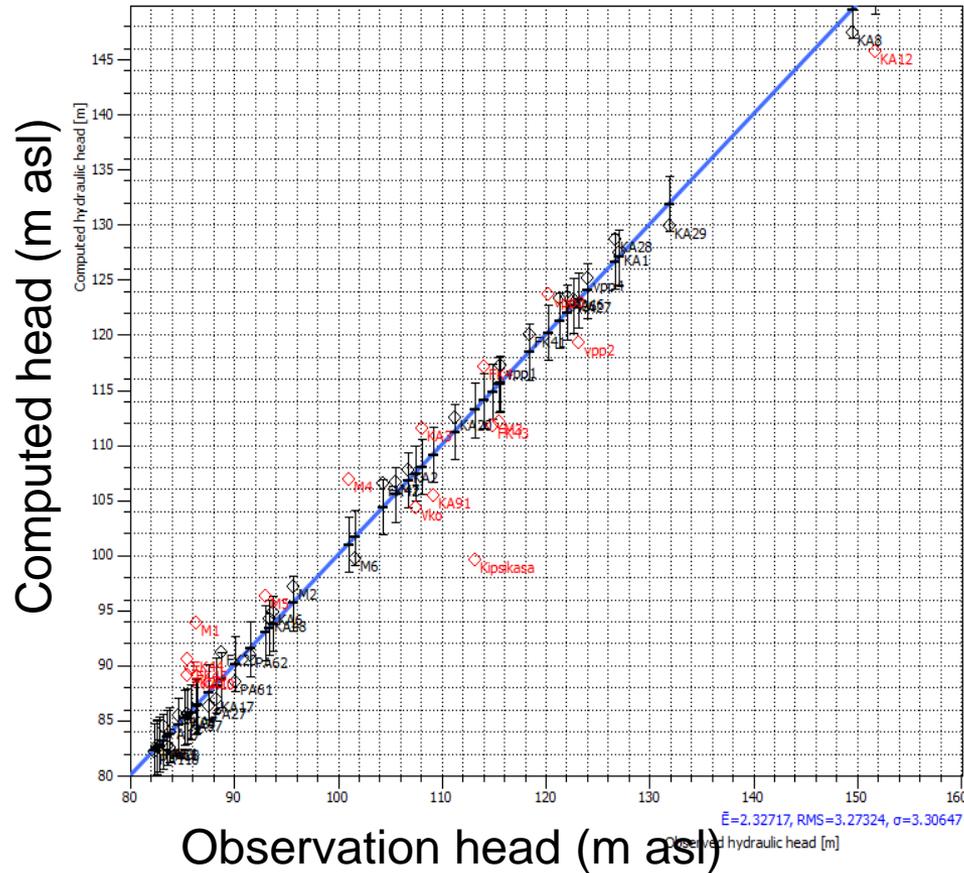


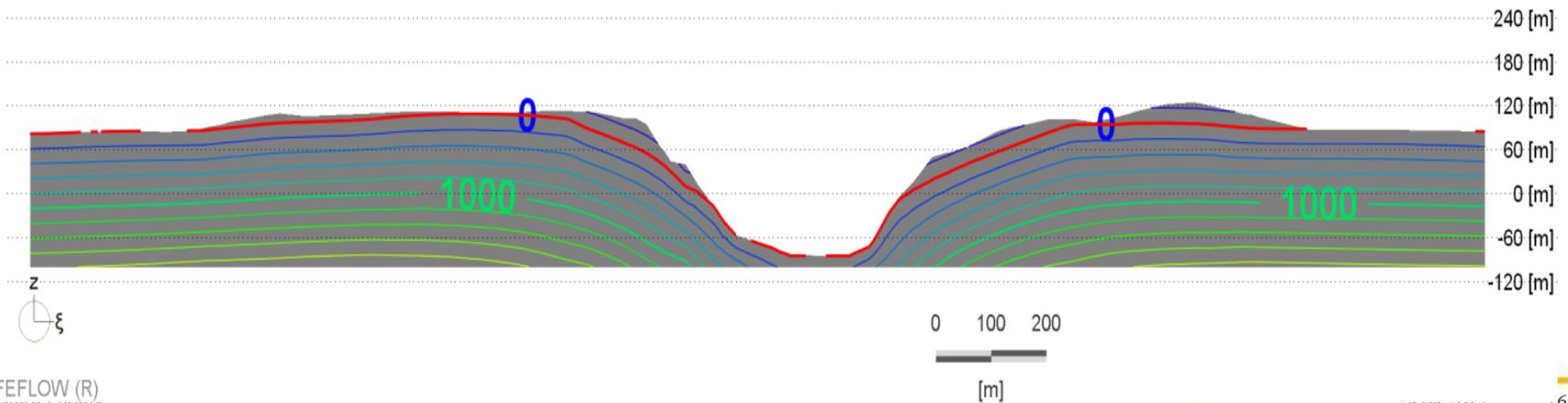
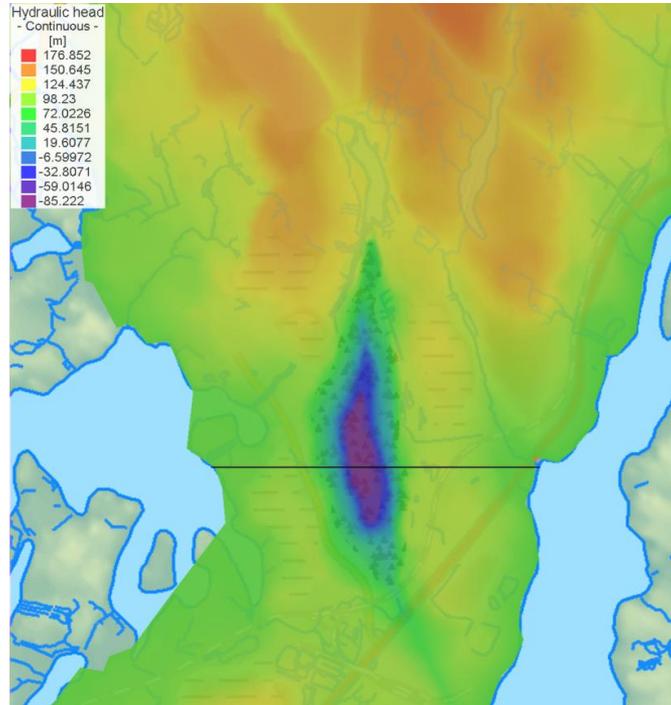
K- value





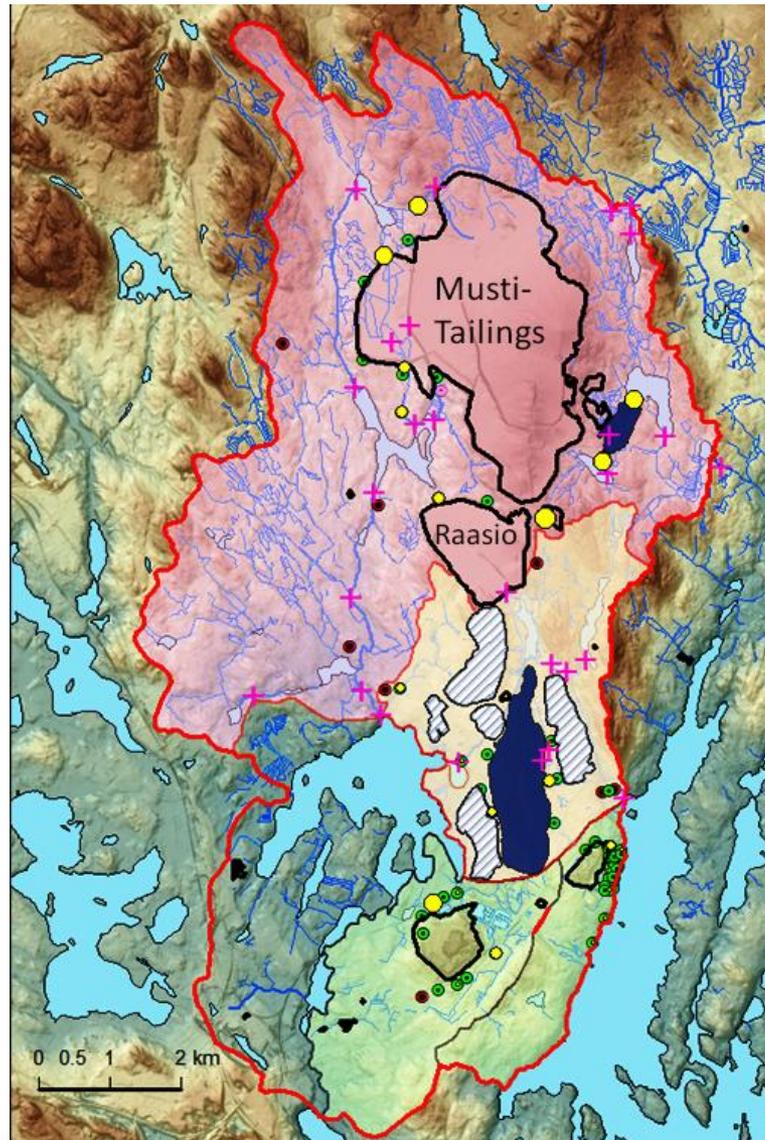
Simulated hydraulic head distribution in Yara Tekes







Watershed areas in Yara- Siilinjärvi mine site Tekes





Thank you!

Tekes

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