

# Mapping and modelling of the transboundary thermal groundwater system – supra regional to local scale

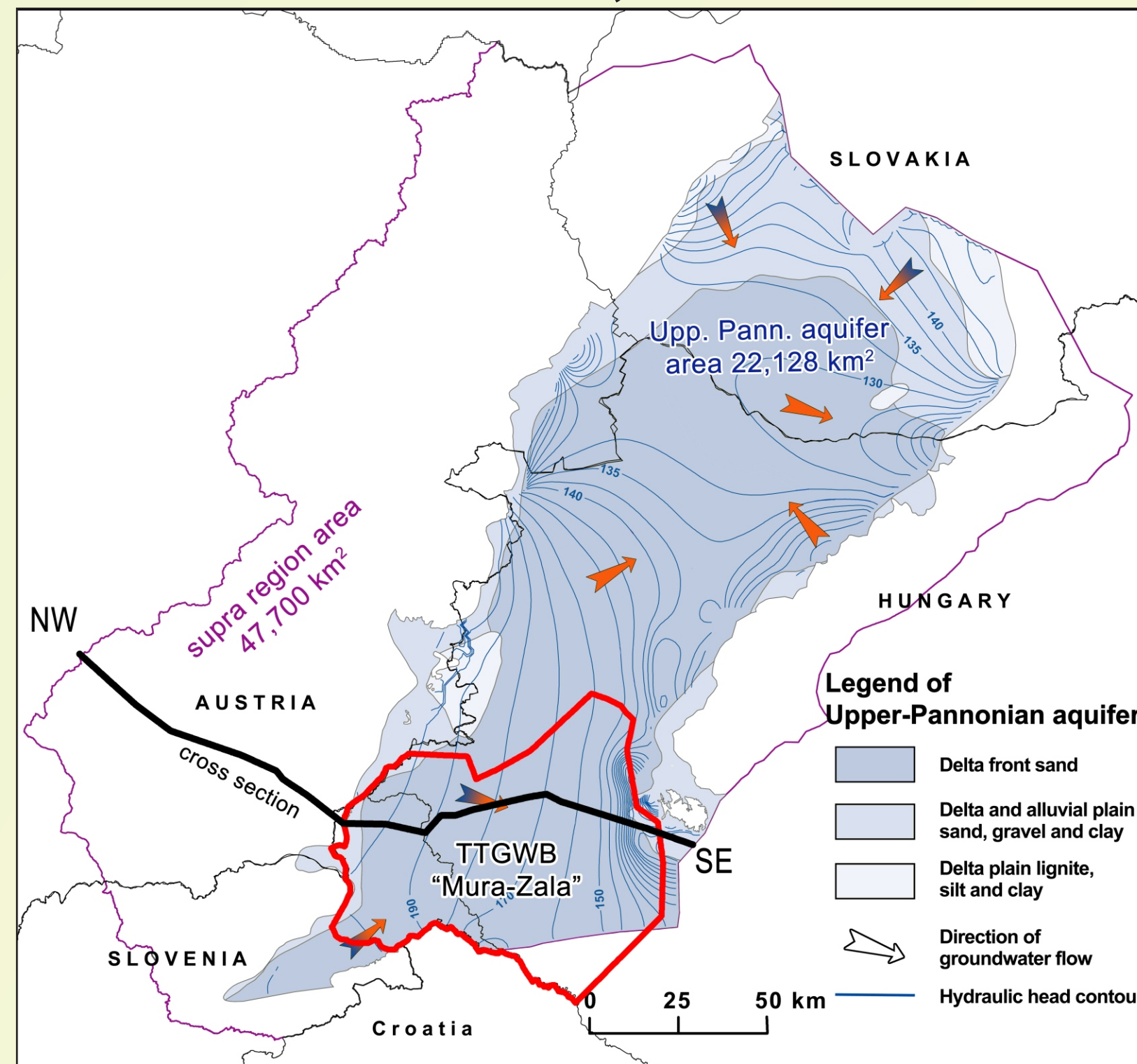
## A newly proposed transboundary thermal groundwater body „Mura – Zala” between Hungary and Slovenia

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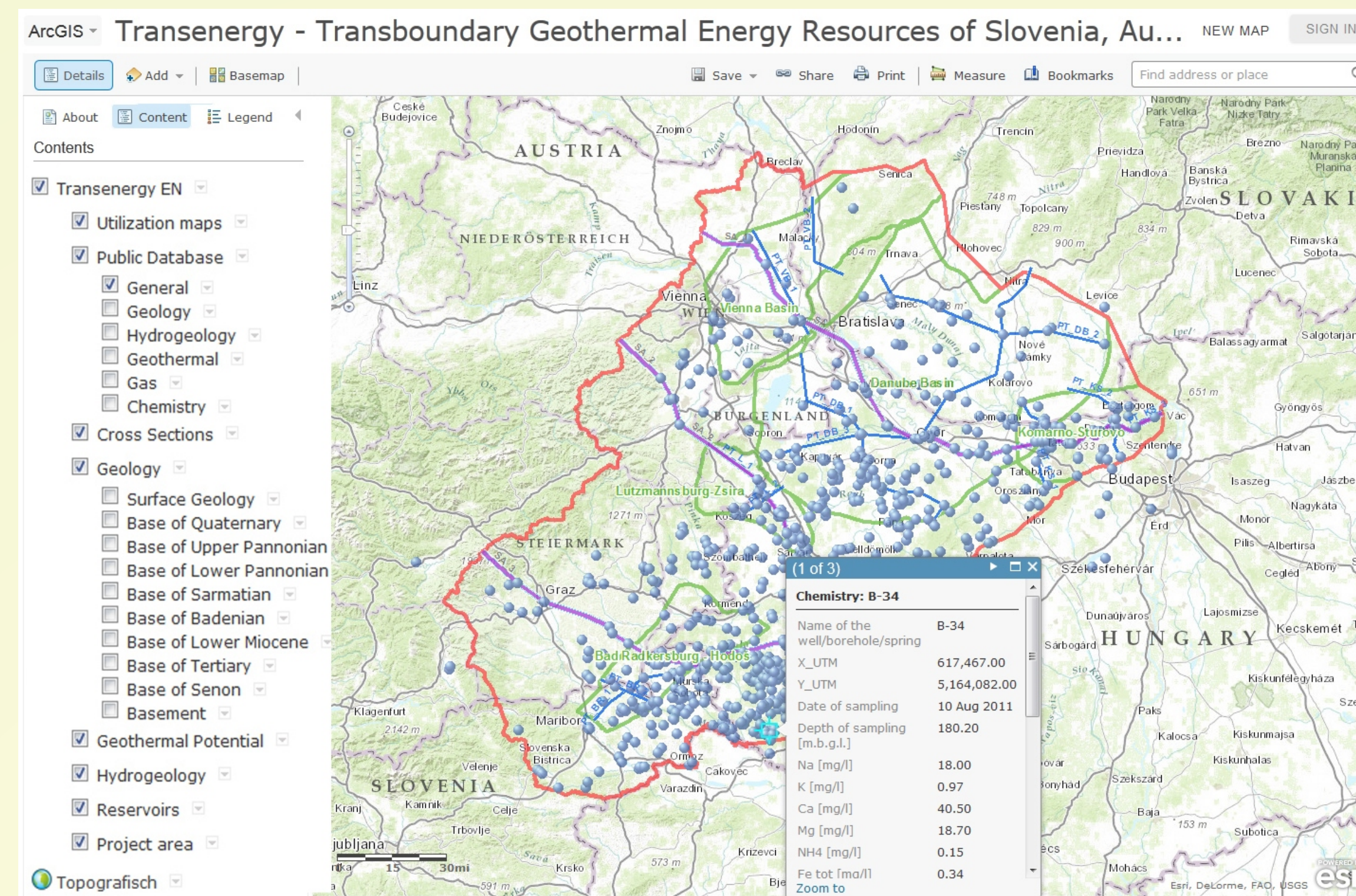
<http://transenergy-eu.geologie.ac.at>; <http://akvamarin.geo-zs.si/authorities/>; [http://akvamarin.geo-zs.si/t-jam\\_boreholes/](http://akvamarin.geo-zs.si/t-jam_boreholes/); <http://akvamarin.geo-zs.si/users>

### MAPPING AND MODELLING

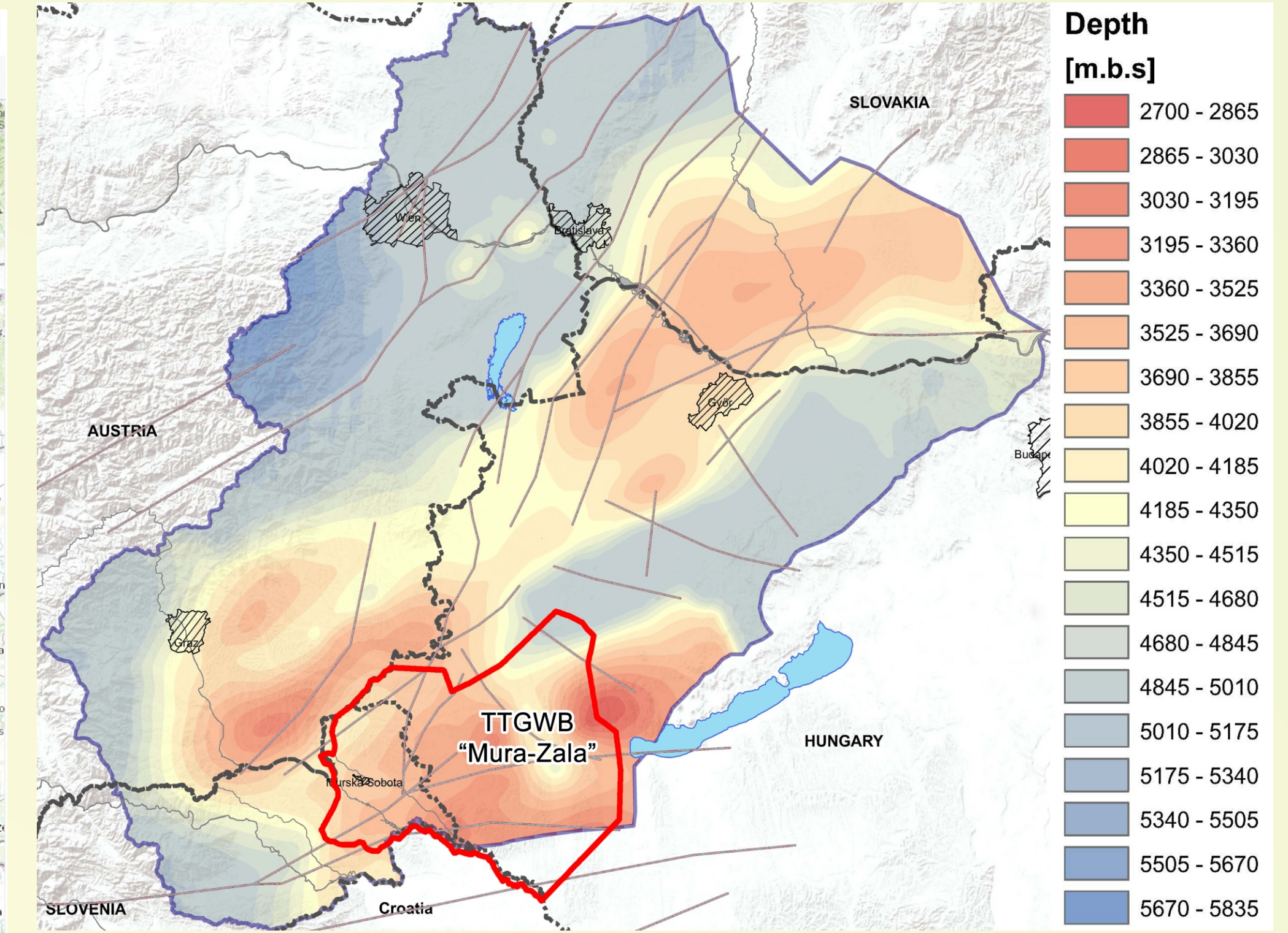
Supra-regional model 1 : 500 000 and local models 1 : 100 000, 1 : 200 000



Databases and viewer



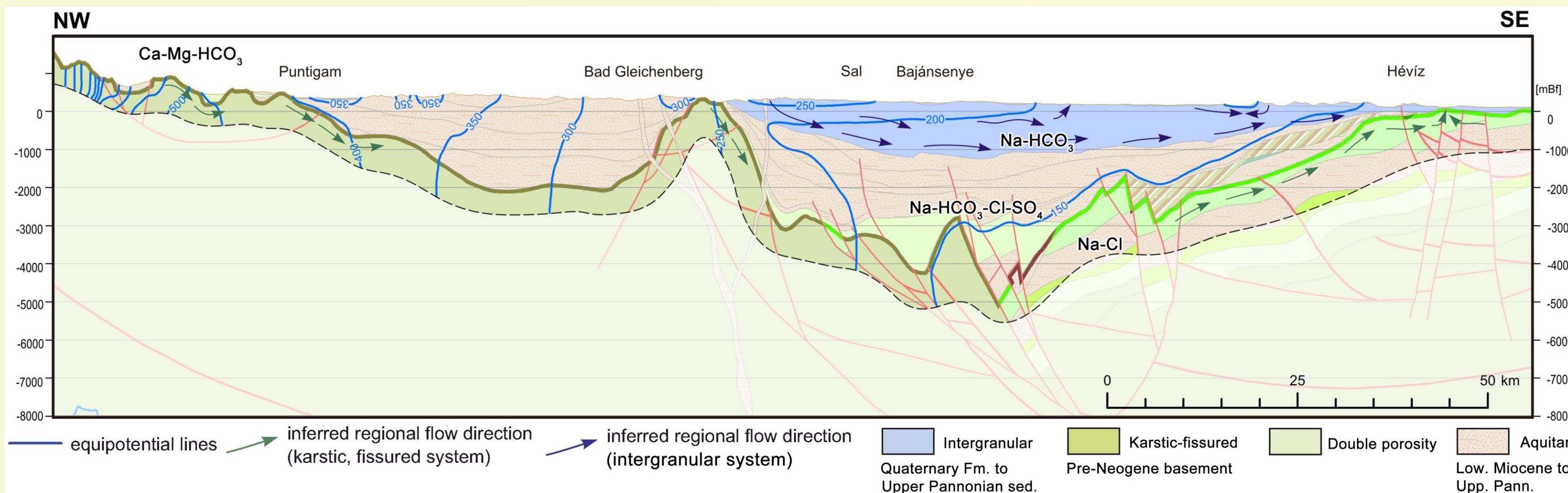
Geothermal model - Depth contour map of the 150 °C isotherm



Significant shallow depths (3,000 m) of the 150 °C isotherm are in the Mura-Zala and Styrian basins.

Calculated infiltration to thermal Upper Pannonic sandy aquifer: 1.02 mm/year in natural conditions.

Actual abstraction of thermal water: 0.49 mm/year (48%).



### INCENTIVES AND MEASURES

Transboundary thermal groundwater body (TTGWB) „Mura – Zala”

Energy policy 2009/28/EC - incentives  
 Objective:  
 - 3.7 times higher energy use (2008 – 2020).

Water policy 2000/60/EC – measures  
 Objective:  
 - long term positive water balance,  
 - unchanged groundwater flow direction,  
 - not affected neighbouring wells,  
 - not deteriorated conditions for exploitation in the future.

Special recommendations for transboundary management of „Mura-Zala“:

**Abstraction** - should not be increased more than 3.5 times.

**Water rights** - should be granted depending on the trend of water level, taking into account the critical level point and critical point of abstraction.

**Critical level point** - is recommended not to be more than 30 meters below the original level before any exploitation.

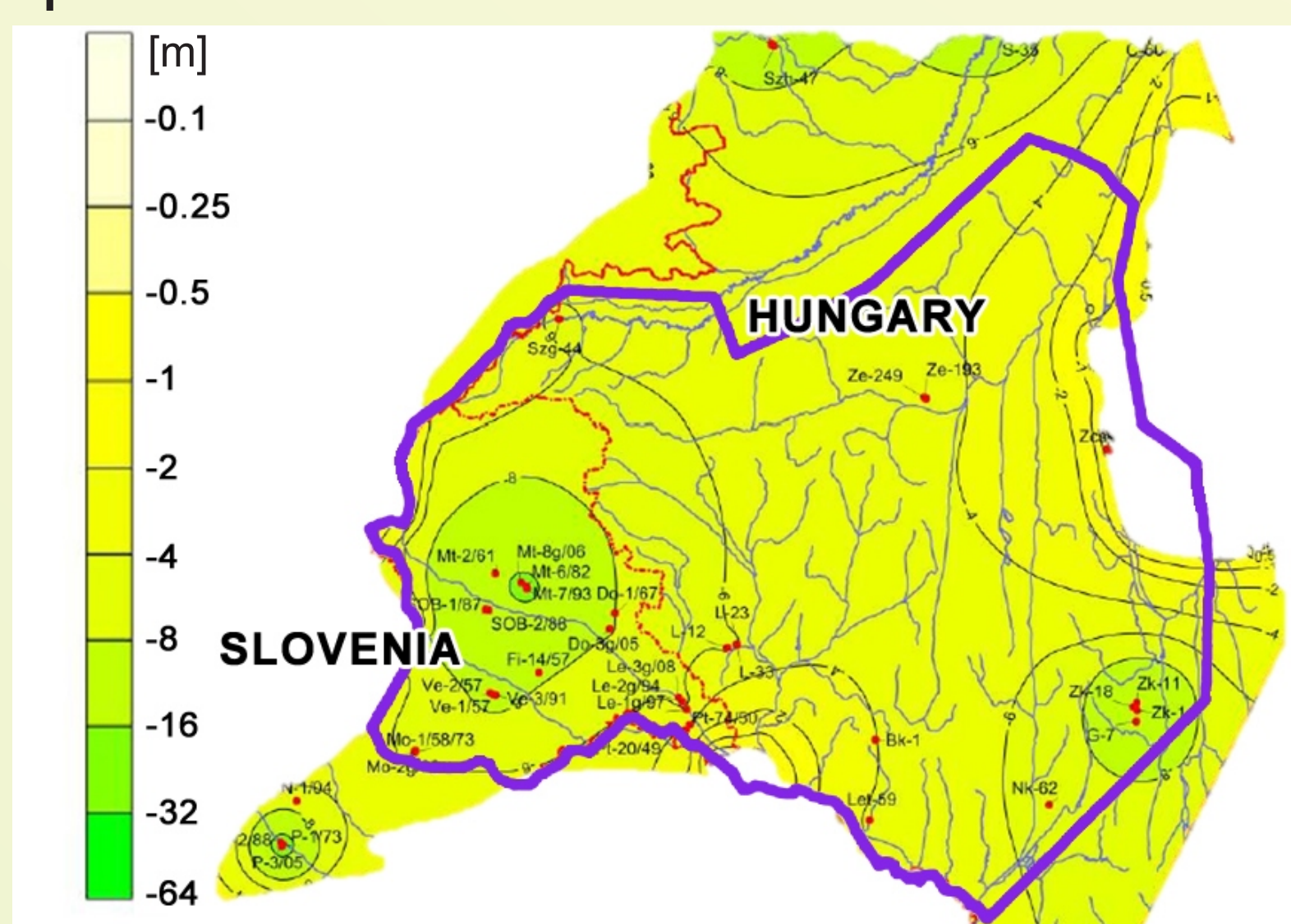
**Thermal water balance and critical level point** - have to be updated at least every 6 years, regarding the monitoring data.

**Thermal efficiency** - has to be increased from 30 % to 70 %.

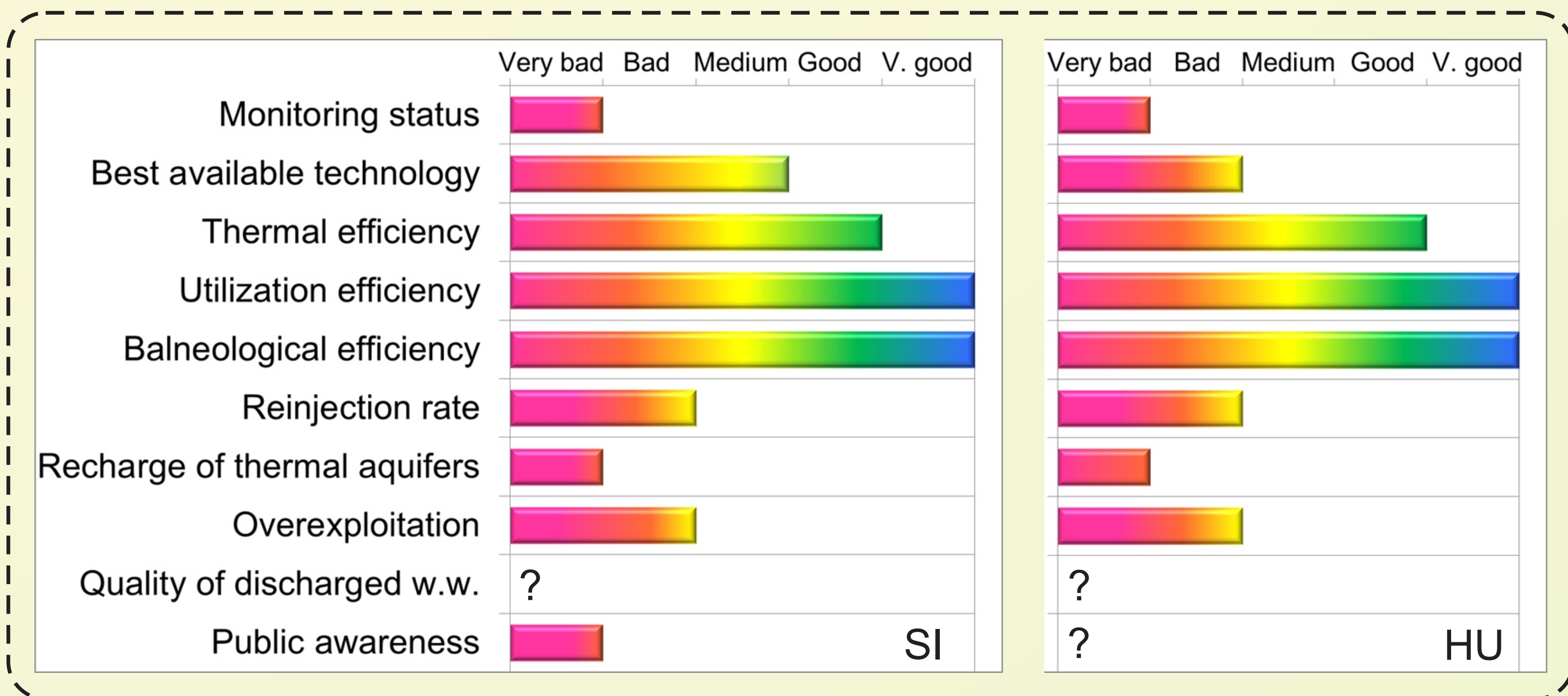
**Information has to be regularly exchanged** - of intended abstraction increment and intended drilling activities on the 20 km border area.

### SUSTAINABILITY OF MANAGEMENT

Maximum depression at the border line is 6-8 m, reflecting all the joint effects of the cold and thermal water production of both countries.



Benchmarking indicators



Three immediate priorities:

- yearly reports of monitoring results - submitted by user and approved by granting authority,
- definition of critical level points for abstraction wells - defined at least from other available data or locations,
- free accessible info to the public – above all: quality of discharged waste water and overexploitation indications.