

Groundwater associated aquatic ecosystem (GAAE) identification goals, methodology and results in Estonia

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WaterAct

Joint actions for more efficient management
of common groundwater resources



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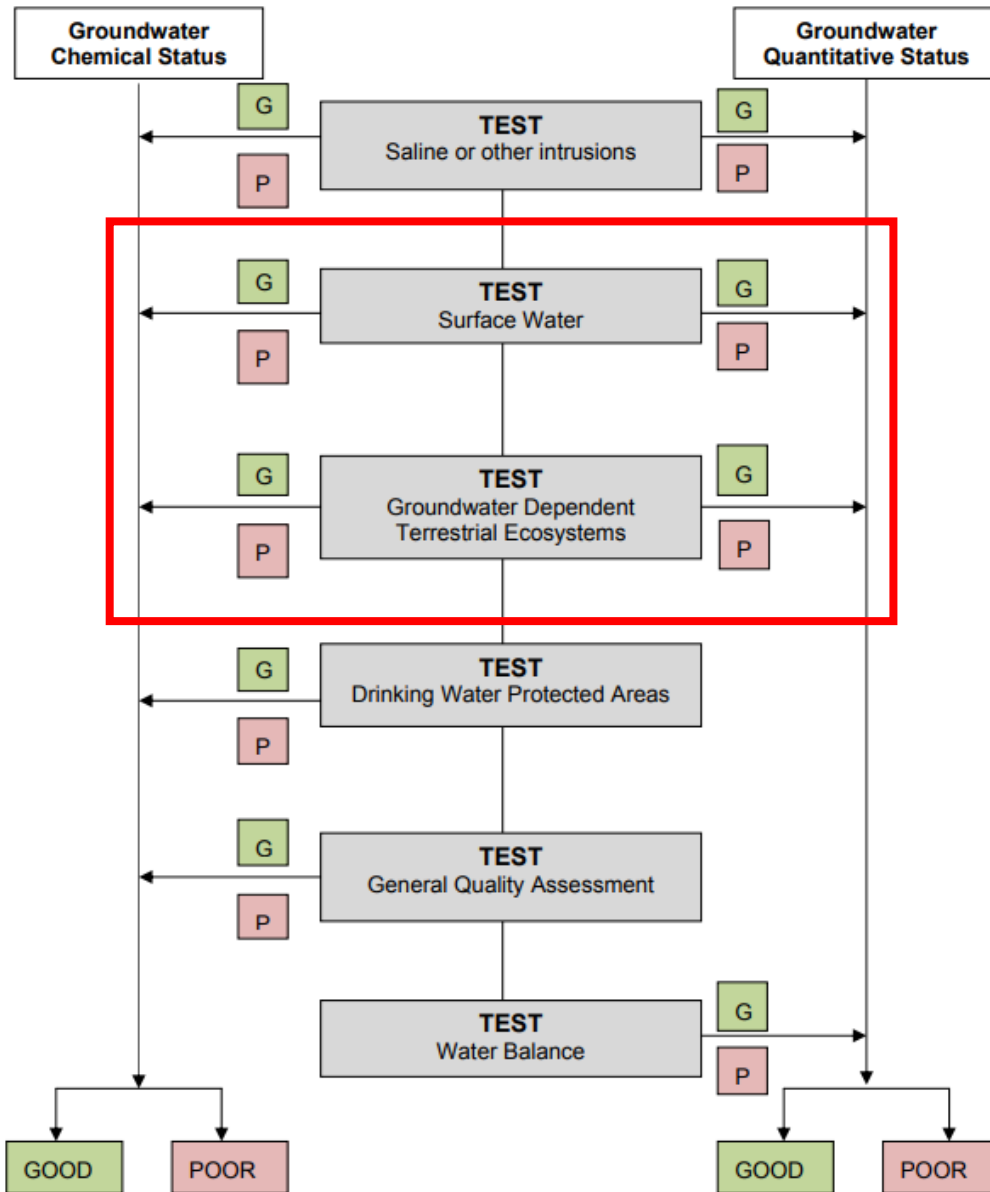


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GDEs in the Water Framework Directive (2000/60/EC)

- Member States should aim to achieve the objective of **at least good water status** [...]. Where good water status already exists, it should be maintained.
- Definition of good quantitative status for groundwater:
 - The level of groundwater is not subject to anthropogenic alterations such as would result in: – failure to achieve the environmental objectives specified under Article 4 for **associated surface waters**; – any significant diminution in the status of such waters; – any significant damage to **terrestrial ecosystems** which **depend directly on the groundwater body** [...].
- Definition of good groundwater chemical status for groundwater:
 - The chemical composition of the groundwater body is such that the concentrations of pollutants: [...] – are not such as would result in failure to achieve the environmental objectives specified under Article 4 for **associated surface waters** nor any significant diminution of the ecological or chemical quality of such bodies nor in any significant damage to **terrestrial ecosystems** which **depend directly on the groundwater body**.

Groundwater body (GWB) status assessment



Groundwater dependent ecosystem (GDE):

- Groundwater dependent terrestrial ecosystem (GDTE)
- Groundwater associated aquatic ecosystem (GAAE)

GDE identification and assessment in Estonia

- A project ordered by the Ministry of Environment and conducted in 2014 and 2015 by the Institute of Ecology at Tallinn University.
- To determine ecosystems depending on groundwater bodies and to develop methods to assess whether the groundwater bodies have a negative effect on the GDEs.
- Based on existing databases and previous studies, no new data was collected.
- Then there were 39 GWBs, including 13 Q only GWBs.
- Since 2019 there are 32 GWBs in Estonia and just 4 of them are Q only.
- Altogether 197 significant groundwater associated permanent lakes, 26 karst lakes, 114 flowing water bodies and 70 terrestrial ecosystems (mires) were identified.

Identification of significant GAAEs (permanent and karst lakes) I

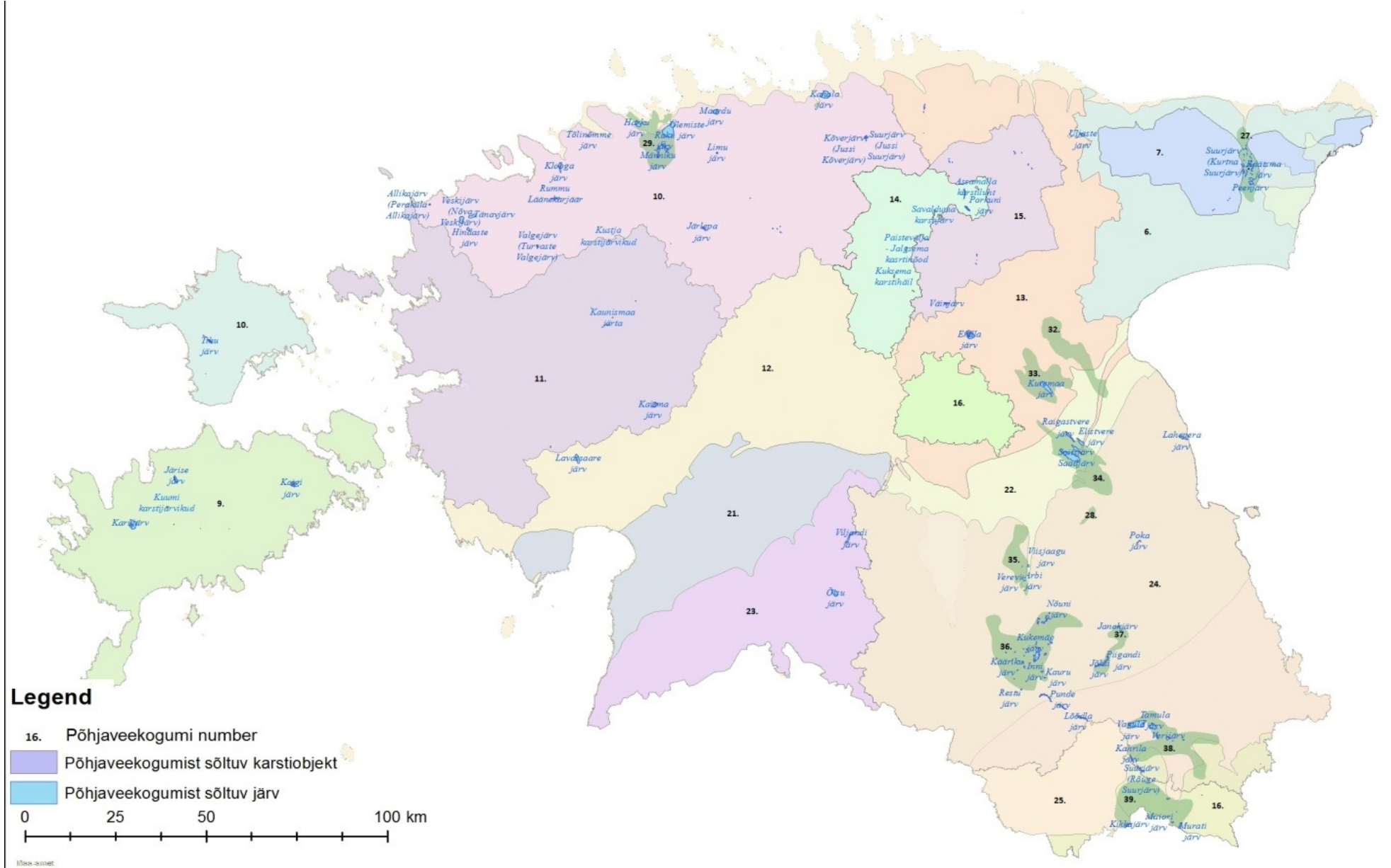
- Lakes where groundwater is the dominant source of water.
- Basically all lakes are groundwater dependent, besides bog and coastal lakes and lakes with considerable surface water throughflow. The main question was how to distinguish between significant and nonsignificant lakes.
- Three groups of lakes were considered as significant:
 - Lakes in the Book of Primeval Nature – compiled in the 1980s and 1990s. According to its statute, only lakes connected to groundwater are included in it. Therefore all these lakes were considered to be significant GAAEs. Associating them with the correct GWB was occasionally problematic (whether Q or S, O, D).
 - Water bodies – Denominated as significant through the Water Framework Directive. Several lakes overlapped with the ones in the Book of Primeval Nature. For the others, the potential dependence on bedrock GWBs was estimated based on expert decision according to the water level depth of the GWBs around the lakes. Lakes with dark and soft water and coastal lakes were automatically considered not dependent.

Identification of significant GAAEs (permanent and karst lakes) II

- Lakes listed as habitats according to the Habitats Directive – only those were evaluated that were located on Quaternary GWBs or form protected lake districts. All habitat-lakes on Q GWBs were considered dependent on the Q GWB, except habitat type 3160 – *Natural dystrophic lakes and ponds*. In case of protected lake districts not on Q GWBs, the potential dependence on bedrock GWBs was evaluated according to GWB water level depth.
- 197 significant groundwater dependent permanent lakes and 26 karst lakes were identified.



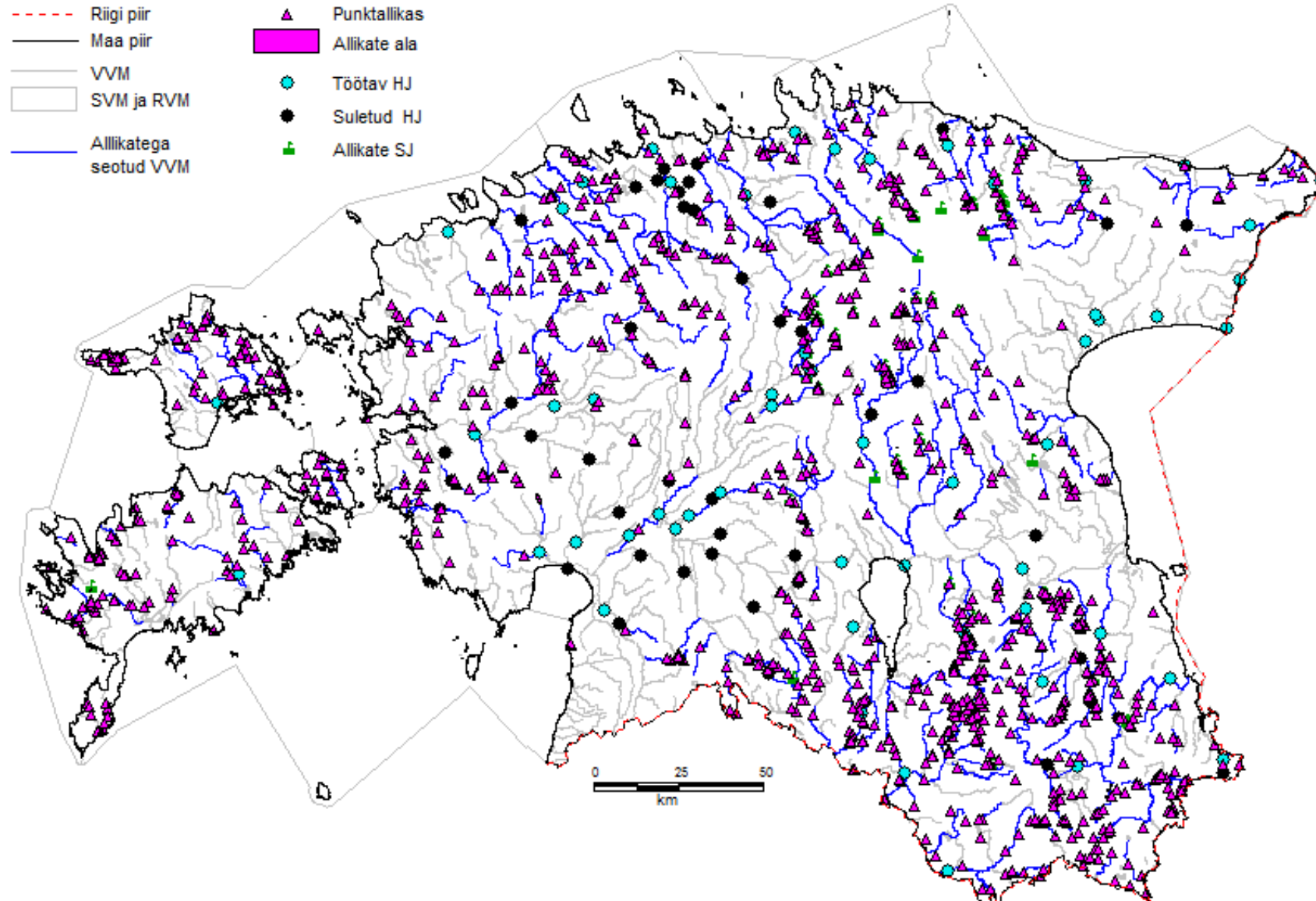
Significant GWB associated lakes in Estonia



Identification of significant GAAEs (flowing water bodies) III

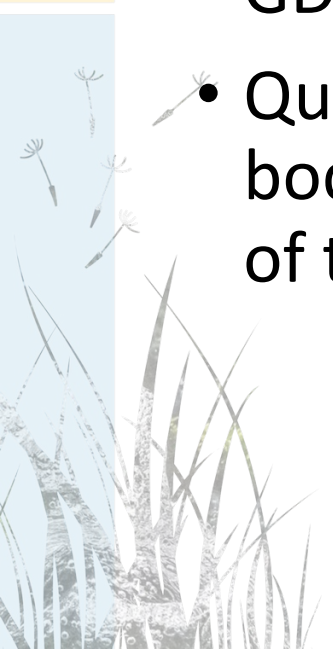
- Flowing water bodies according to the Water Framework directive were taken as the initial list to choose from.
- Only flowing water bodies with clear water (with exceptions).
- There is information on the share of groundwater in annual discharge at selected locations for the largest rivers in Estonia, but the data is more than 50 years old. Therefore that could not be taken as the criteria for the selection.
- Dependence on groundwater was assumed if there were springs present in a 1 km radius of the water bodies. Some water bodies were excluded afterwards, where, according to expert opinion, the groundwater contribution from the spring(s) was clearly insignificant.
- The resultant water bodies were associated with the topmost GWB beneath the water body.
- 114 significant flowing water bodies dependent on GWBs were identified.
- According to EC Technical report no.9 (2015), critical dependence on groundwater means that groundwater should be the dominant source of water (>50%). Therefore the Estonian list may be overestimated.

Significant GWB dependent flowing water bodies in Estonia



Effect of groundwater bodies on GAAEs

- Groundwater body can have a negative quantitative and/or qualitative effect on the GAAE.
- Quantitative effect – human influence has caused too low groundwater level that does not provide enough water to sustain the GDAE in its natural state.
- Qualitative effect – human influence has affected the groundwater body in a way that its chemical composition causes the deterioration of the ecological or chemical status of the GAAE.



• Thank you for the attention!



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