



Vesi

Groundwater management and protection in Estonia

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Ministry of the Environment

Water Department

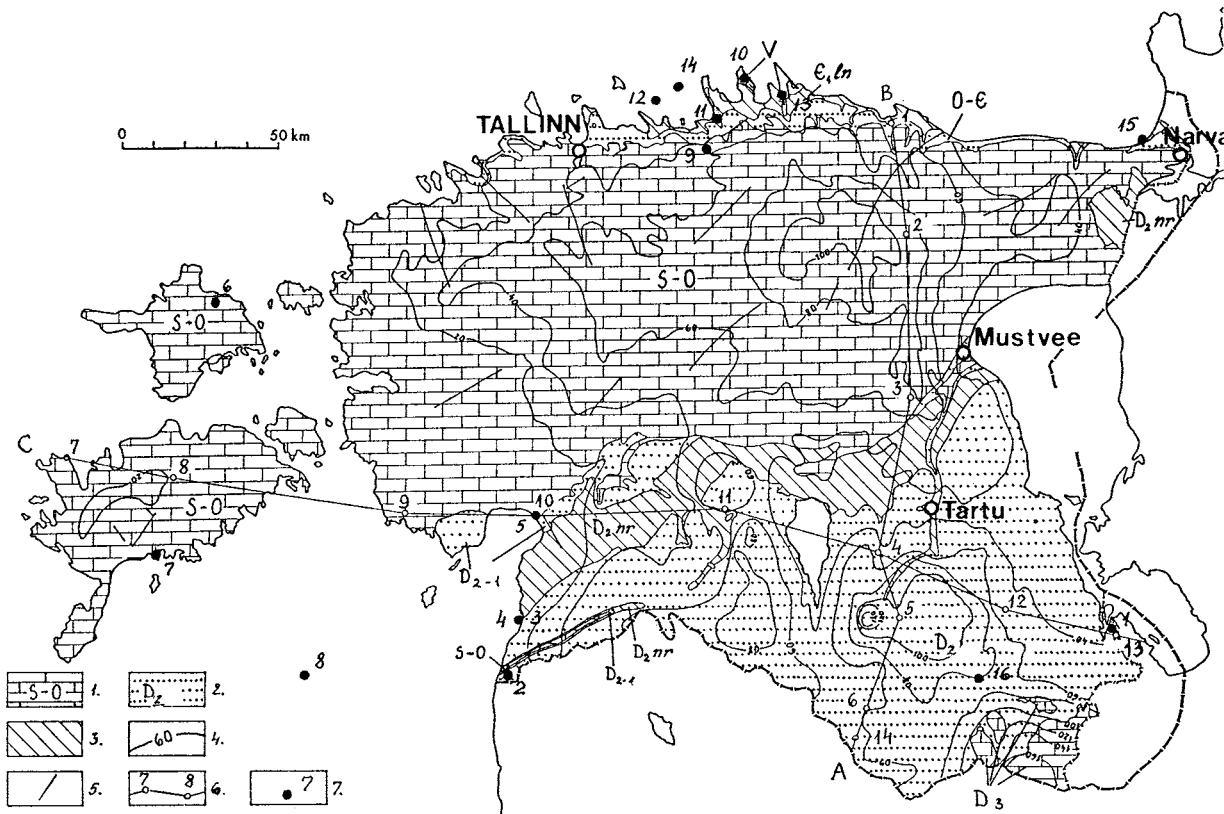
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Basic facts on Estonian groundwater:

- Total amount 2000 km³
- 5 main aquifers:
 - ✓ Devonian (Southern Estonia)
 - ✓ Silur-Ordovician and Ordovician (central part)
 - ✓ Ordovician-Cambrian, Cambrian-Vendian (Northern Estonia)
- Fed on precipitation by 70 mm (3.2 km³) annually
- Available resource 1.5 million m³ per day

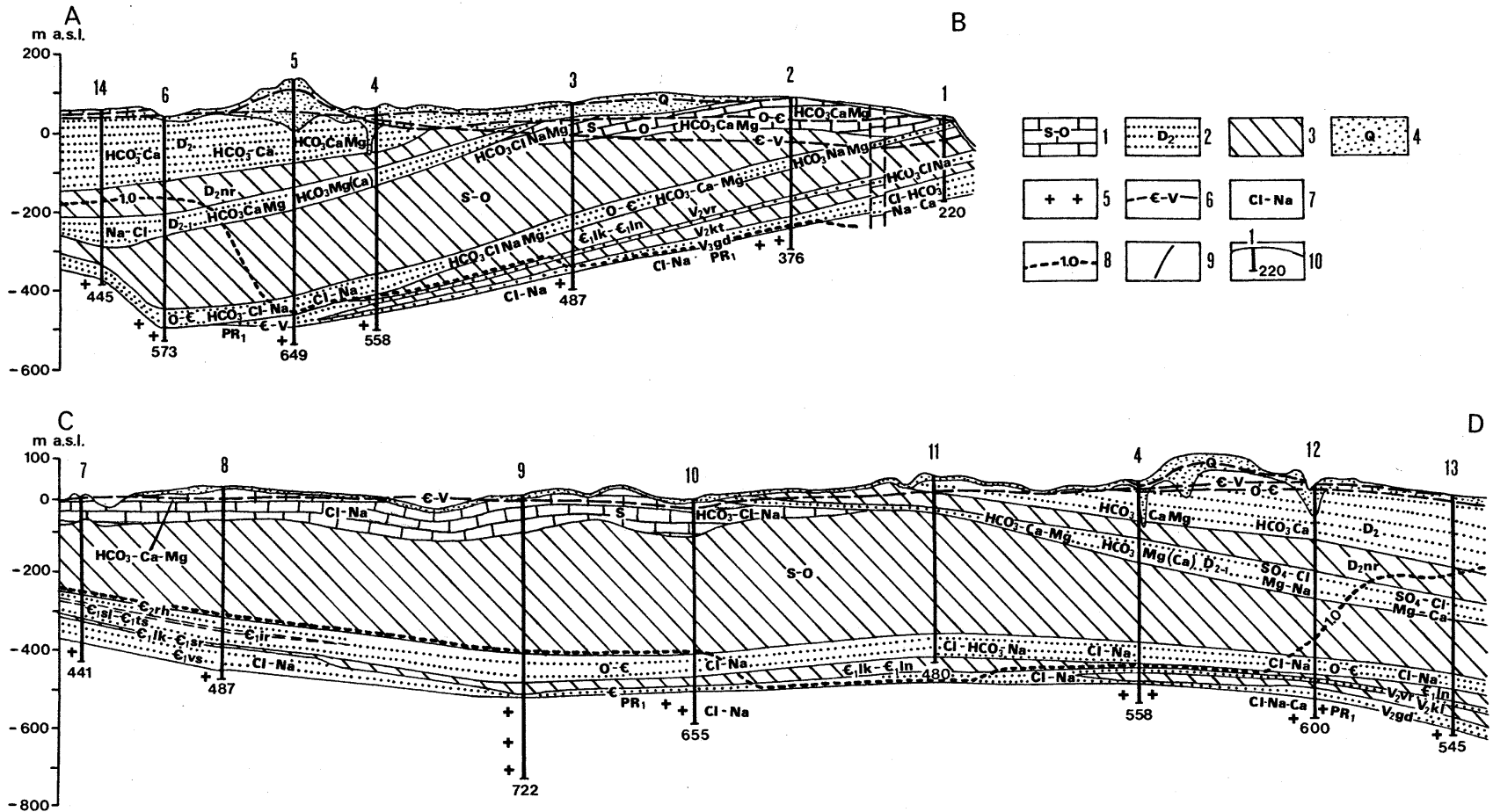


Hydrogeological sketch-map of Estonian aquifers and aquitard



1 – carbonaceous water-bearing rocks; 2- terrigenous water-bearing rocks; 3 – sporadically water-bearing and impermeable rocks; 4 – groundwater table, potentiometric surface (asl, m); 5 – tectonic fault; 6 – cross-section; 7 – mineral water resources.

Hydrogeological cross-sections of Estonian bedrock



1 – carbonaceous water-bearing rocks; 2- terrigenous water-bearing rocks; 3 – sporadically water-bearing and impermeable rocks; 4 – Quaternary sediments; 5 – crystalline basement; 6 – groundwater table and potentiometric surface; 7 – hydrochemical type of water; 8 – limit of fresh groundwater; 9 – tectonical fault; 10 – boreholes (depth, m shown below).

Groundwater use:

- Drinking water for 65% of the population
- Total abstraction 254 million m³ (in 2000):
 - ✓ Domestic + Industrial use: 56 million m³
 - ✓ Minings: 198 million m³
 - ✓ Mineral water: 0.008 million m³

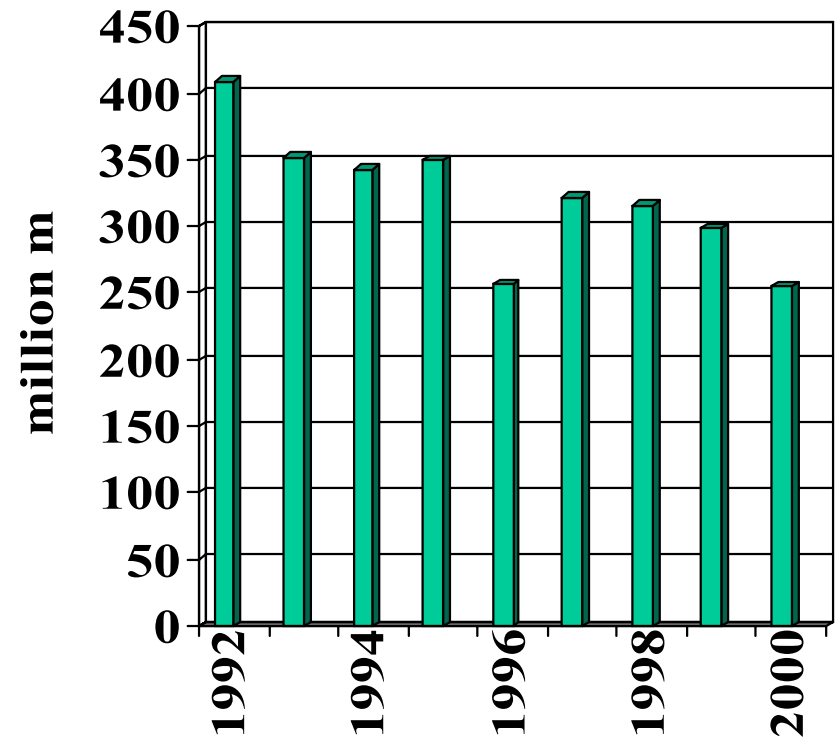


Groundwater abstraction...

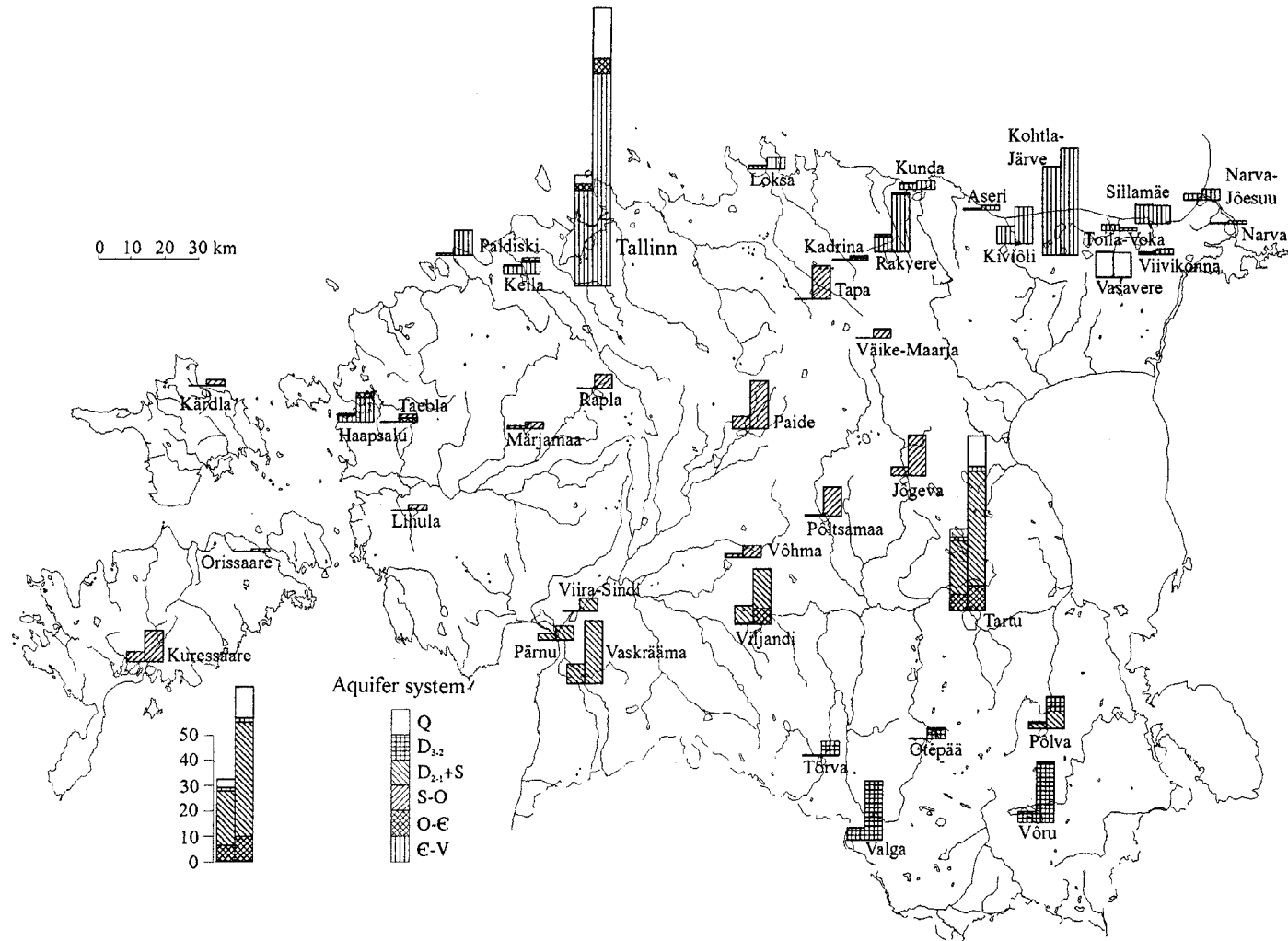
...formed 17% from total water abstraction in Estonia in 2000

...from minings formed 77% of groundwater abstraction in 2000

...has decreased 37% during 1992-2000



Groundwater abstraction and resource



Groundwater safe yield on right column, actual pumping rate on left (thousands m³/d)

Water Management

- Groundwater is a state property.
- Water abstraction costs depend on aquifer:

	EEK/m ³	DEM/m ³
Quaternary	0.3	0.037
Devonian, Silurian, Ordovician-Cambrian	0.4	0.05
Cambrian-Vendian	0.45	0.056
High-quality groundwater for technological purposes	0.8	0.1
Dewatering of minings	0.05	0.006

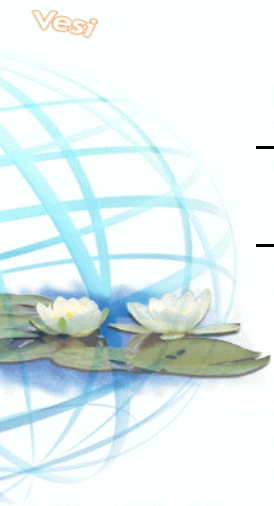
Water permit

- Water abstraction is managed through permitting system \Rightarrow water permits.
- Water permit needed:
 - ✓ groundwater abstraction $>5 \text{ m}^3$ a day
 - ✓ surface water abstraction $>30 \text{ m}^3$ a day
 - ✓ abstraction of mineral water
 - ✓ wastewater discharges
 - ✓ recharging or diverting of groundwater, lowering of groundwater level
 - ✓ water use alters the physical or chemical properties of the water



Water permit (2)

- Issued by County Environmental Departments (CED, regional level of MoE)
- For water abstraction $>500 \text{ m}^3$ a day:
 - hydrogeological studies must be carried out,
 - Groundwater Commission determines the groundwater resource,
 - Minister of Environment approves the resource,
 - Data into state Groundwater Catastre



Groundwater protection

- Sanitary protection zones for wells:
 - ✓ 50 m radius if abstraction $>10 \text{ m}^3/\text{d}$
 - ✓ 200 m radius if abstraction $>500 \text{ m}^3/\text{d}$
- Sanitary zone not needed if abstraction is $<10 \text{ m}^3/\text{d}$ for a single property
- Minister of Environment may reduce the sanitary zones:
 - ✓ Up to 10 m if abstraction is $<10 \text{ m}^3/\text{d}$ for public water supply,
 - ✓ Up to 30 m if aquifer is well protected.



Vulnerable zones in Estonia

(according to 91/676/EEC)



Restrictions in the vulnerable zone

- Fertilisers use: $<170 \text{ kg N / ha / year}$
Mineral fertilisers: $<120 \text{ kg N / ha / y}$,
 $<80 \text{ kg N / ha / y}$ on unprotected areas
- 50 m protection zone around karst and springs (forbidden activities: fertilisers use, pesticides use, keeping manure in stacks)
- From arable land 50% form “green fields”
- Manure storages if >5 au cattle

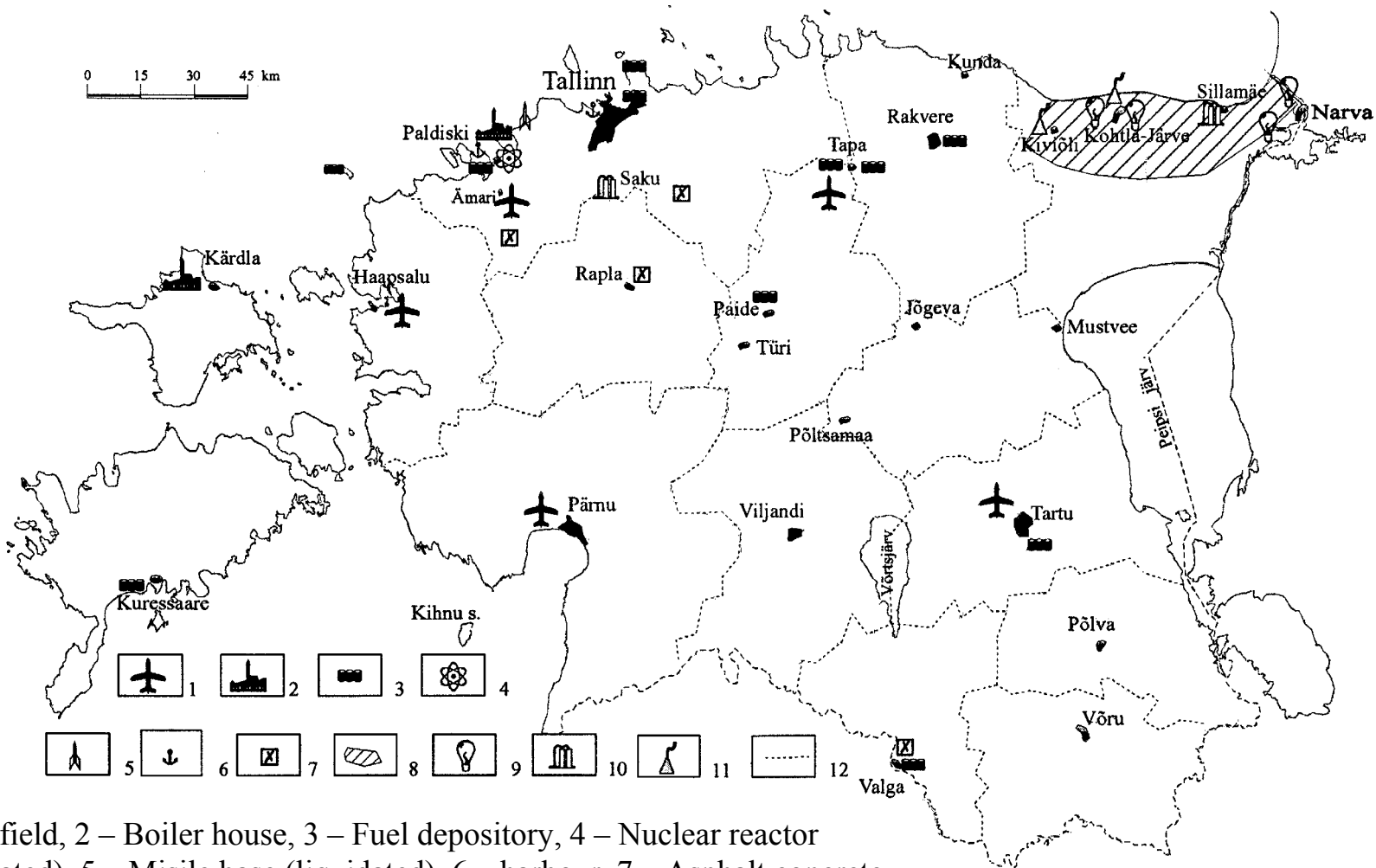


Threats to groundwater

- Past pollution, especially from military sites:
 - ✓ Inventory made for 212 sites,
 - ✓ Clean-up works on 22 sites
- Pollution from industrial activities
- Pollution from landfills
- Old oil, pesticides, fertilizers storages



Significant point pollution sources



1 - Airfield, 2 – Boiler house, 3 – Fuel depository, 4 – Nuclear reactor (liquidated), 5 – Misile base (liquidated), 6 – harbour, 7 – Asphalt concrete works, 8 – Industrial region, 9 – Power station, 10 – Radioactive waste depository, 11 – Oil-shale enterprise, 12 – County border.

Groundwater as drinking water source

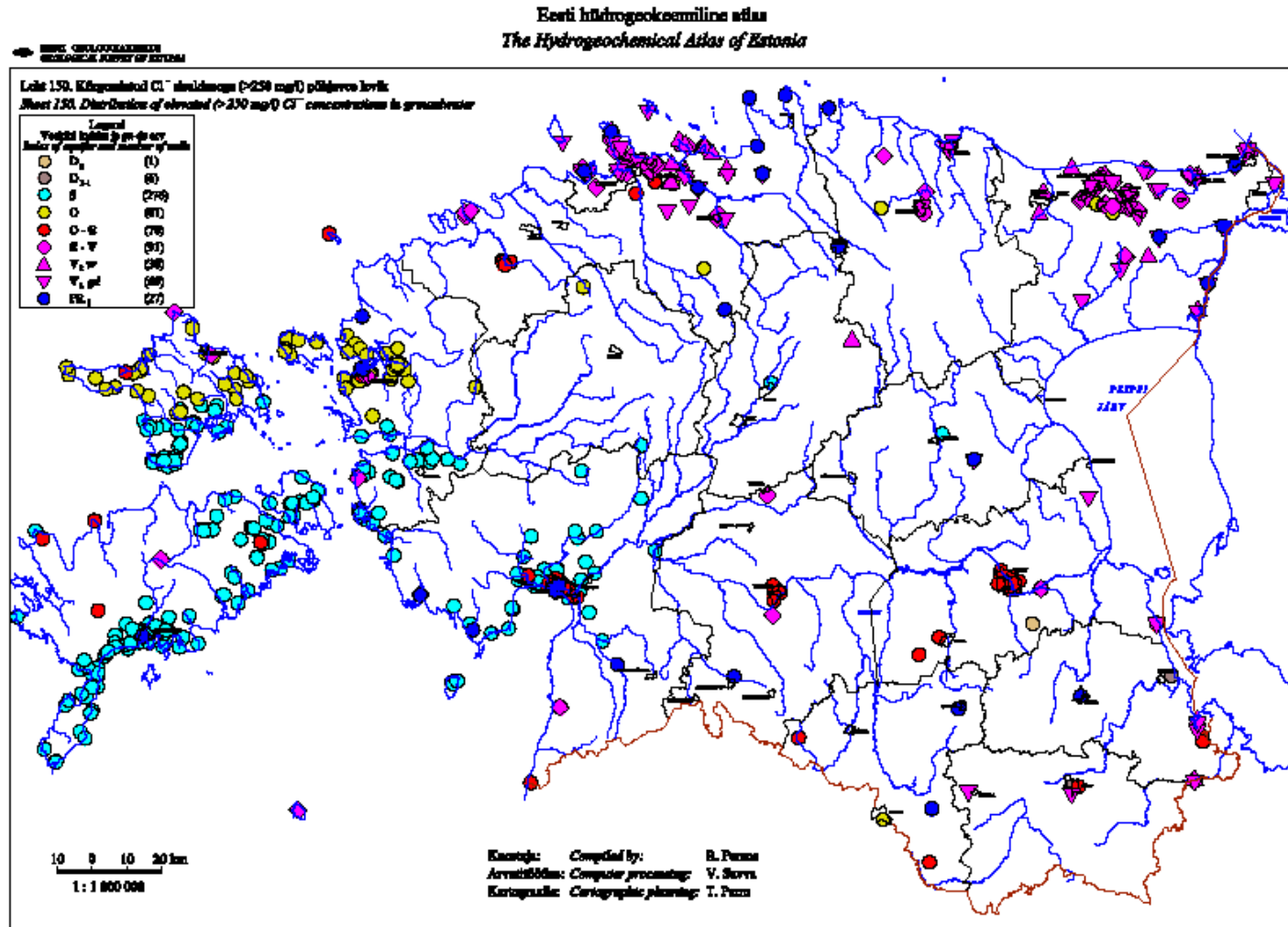
- 23 drinking water treatment facilities:
Aeration & Filtration

Ministry of Social Affairs:

- ✓ Health protection programs
- ✓ Drinking water quality control
- ✓ Quality requirements for drinking water source
- ✓ Permitting of drinking water supply if water quality is not in accordance with drinking water standard, but it does not pose a threat to human health.



Cl concentration >250 mg/l in Estonian groundwater



SO₄ concentration >250 mg/l in Estonian groundwater

Eesti hidrogeokeemiline atlas
The Hydrogeochemical Atlas of Estonia

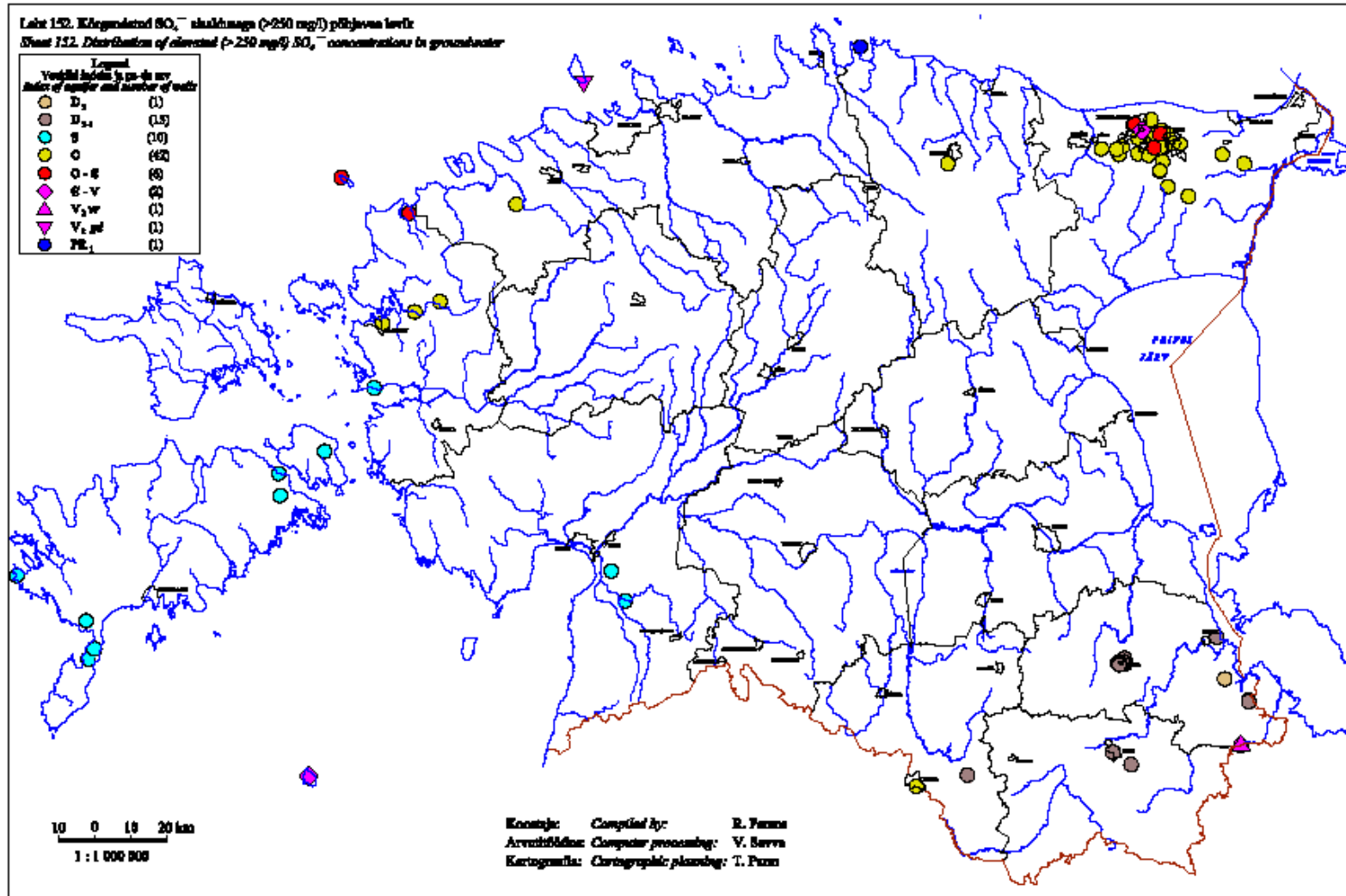
RIISI GEOLOOGIAMINISTRIKUM
 GEOLOGICAL SURVEY OF ESTONIA

Liik 152. Kõrgendatud SO₄⁻ sisaldus (>250 mg/l) põhjavesi
 Sheet 152. Distribution of elevated (>250 mg/l) SO₄⁻ concentrations in groundwater

Legend

Yeastid tähistab ka-ko arv
 Index of quality and number of wells

	D ₁	(1)
	D ₂₊₃	(15)
	S	(10)
	O	(62)
	O-S	(8)
	E-V	(2)
	V ₂ W	(3)
	V ₂ W	(3)
	PE ₁	(3)



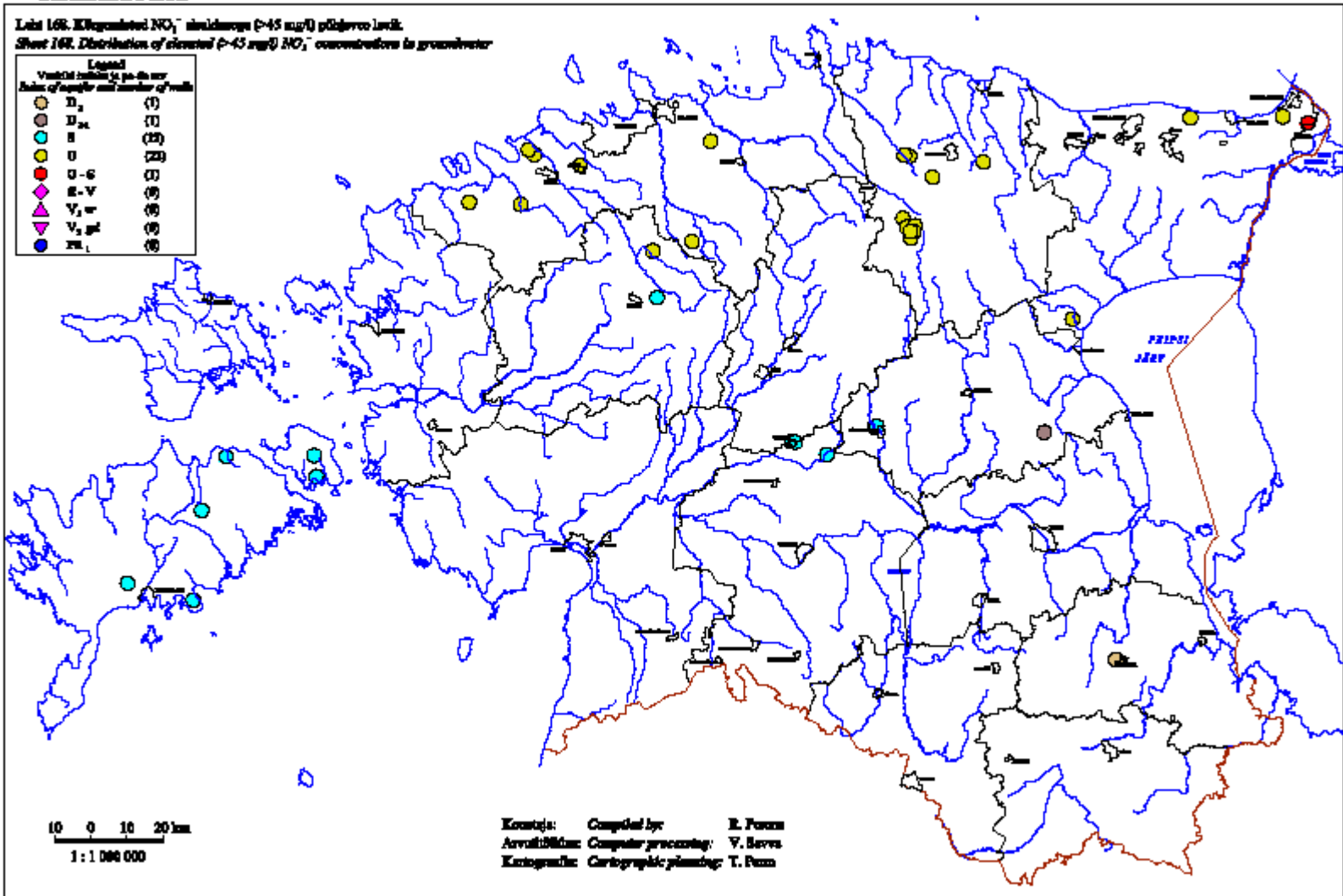
NO₃ concentration >45 mg/l in Estonian groundwater

Eesti hidrogeokeemiline atlas The Hydrogeochemical Atlas of Estonia

RIIKLIK GEOLOOGILINE
GEOLOOGILINE KESKUS

Leht 168. Kõrgendatud NO₃⁻ sisaldus (>45 mg/l) põhjavesi loodis.
Sheet 168. Distribution of elevated (>45 mg/l) NO₃⁻ concentrations in groundwater.

Legend	
Vastikud loodis ja nende arv	
Basins of aquifer and number of wells	
○	D ₂ (1)
○	D _{2a} (1)
○	II (13)
○	U (13)
○	U-6 (1)
◇	U-V (1)
▽	V ₁ gr (1)
▽	V ₂ gr (1)
○	XI ₁ (1)



Fe concentration >0.2 mg/l in Estonian groundwater

