Transboundary Aquifer Information Sheet

EU 108 – Ordovician-Cambrian Groundwater Body

**Geography**
- Total area TBA (km²): 81 000
- No. countries sharing: 2
- Countries sharing: Estonia, Russian Federation
- Population: 1 900 000
- Climate zone: Humid Continental
- Rainfall (mm/yr): 660

**Hydrogeology**
- Aquifer type: Multiple layers hydraulically connected
- Degree of confinement: Confined
- Main Lithology: Sedimentary rocks - sandstones

---

**Simplified cross-section: Ordovician Cambrian aquifer (in light blue)**

Map and cross-section are only provided for illustrative purposes. Dimensions are only approximate.
Transboundary Aquifer Information Sheet

EU 108 – Ordovician-Cambrian Groundwater Body

TWAP Groundwater Indicators from Global Inventory

<table>
<thead>
<tr>
<th></th>
<th>Recharge (mm/y) (1)</th>
<th>Renewable groundwater per capita (m³/y/capita)</th>
<th>Natural background groundwater quality (%) (2)</th>
<th>Human dependency on groundwater (%)</th>
<th>Groundwater depletion (mm/y) (3)</th>
<th>Groundwater pollution (%) (4)</th>
<th>Population density (Persons/km²)</th>
<th>Transboundary legal framework (Scores) (5)</th>
<th>Transboundary institutional framework (Scores) (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonia</td>
<td>1</td>
<td>20</td>
<td>100</td>
<td>A</td>
<td>31</td>
<td>50</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russian Federation</td>
<td>0</td>
<td>19</td>
<td></td>
<td>B</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBA Level</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Recharge: This is the long term average recharge (in m³/yr) divided by the surface area (m²) of the complete country segment of the aquifer (i.e. not only the recharge area).

(2) Natural background groundwater quality: Estimate of percentage of surface area of aquifer where the natural groundwater quality satisfies local drinking water standards.

(3) Groundwater pollution: A. No pollution has been identified; B. Some pollution has been identified; Positive number: Significant pollution has been identified (% of surface area of aquifer).

(4) Groundwater development stress: Annual groundwater abstraction divided by recharge.

(5) Legal framework: A. Agreement with full scope for TBA management signed by all parties; B. Agreement with limited scope for TBA management signed by all parties; C. Agreement under preparation or available as an unsigned draft; D. No agreement exists, nor under preparation; E. Legal Framework differs between Aquifer States (see data at National level).

(6) Institutional Framework: A. Dedicated transboundary institution fully operational; B. Dedicated transboundary institution in place, but not fully operational; C. National/Domestic institution fully operational; D. National/Domestic institution in place, but not fully operational; E. No institution exists for TBA management; F. Institutional Framework differs between Aquifer States (see data at National level).

X A value was provided in the questionnaire, but it was considered un-realistic and therefore removed from the table.

Key parameters table from Global Inventory

<table>
<thead>
<tr>
<th></th>
<th>Distance from ground surface to groundwater table (m)</th>
<th>Depth to top of aquifer formation (m)</th>
<th>Full vertical thickness of the aquifer system* (m)</th>
<th>Degree of confinement</th>
<th>Predominant aquifer lithology</th>
<th>Primary Porosity</th>
<th>Secondary Porosity</th>
<th>Transmissivity (m²/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonia</td>
<td>48</td>
<td>130</td>
<td>33</td>
<td>Whole aquifer confined</td>
<td>Sedimentary rocks - Sandstone</td>
<td>Low primary porosity intergranular porosity</td>
<td>No secondary porosity</td>
<td>35</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>28**</td>
<td>13**</td>
<td>130</td>
<td>Whole aquifer confined</td>
<td>Sedimentary rocks - Shale</td>
<td>High primary porosity fine/medium sedimentary deposits</td>
<td>Secondary porosity: Fractures</td>
<td></td>
</tr>
</tbody>
</table>

TBA Level

* Including aquitards/aquicludes

** These values would need revision, since a groundwater table lower than depth to top of the aquifer is un-realistic for a confined aquifer.

X A value was provided in the questionnaire, but it was considered un-realistic and therefore removed from the table.
Aquifer description

Aquifer geometry
This is a confined aquifer system constituted by multiple layers that are hydraulically connected. The average depth to the water table varies between 28m and 48m. The average depth to the top of the aquifer varies between 13m and 130m. The average thickness of the aquifer ranges between 30m and 130m in Estonia and Russia respectively.

Hydrogeological aspects
The aquifer is composed of sandstones, with inter-granular as well secondary porosity due to dissolution and fissured sandstone. The average transmissivity is 35m²/day within Estonia. The average amount of recharge, which is all due to natural recharge, within the Estonia portion (see Appendix) is 20 Mm³/annum.

Linkages with other water systems
Recharge is from the overlying aquifer through leakage, and discharge is produced to other connected aquifers. There is no interaction with surface waters. Groundwater flow direction is from Russia to SW Estonia.

Environmental aspects
Besides the presence of some natural salinity that has been reported by Russia, the natural water quality is generally suitable for human consumption. Some local pollution from metals, industrial waste disposal and fertilizers has been reported within the Russia side, but no groundwater pollution has been observed within Estonia. No shallow groundwater or groundwater dependent ecosystems have been recorded within the aquifer area.

Socio-economic aspects
The total amount of groundwater that was abstracted from the aquifer during 2010 was 96 Mm³, 90% of it in Russia. The type of use was only recorded for Estonia - water supply, industry and a minor consumption for agriculture. The total fresh water abstraction within the aquifer area has not been reported for either country.

Legal and Institutional aspects
A ratified agreement exists for Estonia-Russia TBA management, that was signed during 1995 and a new agreement is in preparation (Estonia). A dedicated Transboundary Institution exists on the Estonian side. Local management is under the National legislation and regulations.

Priority issues
The main pressure on the TBA is the groundwater abstraction taking place in both countries. The most important threat to the confined aquifer with limited recharge is declining piezometric levels as a result of aquifer exploitation.

Contributors to Global Inventory

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Country</th>
<th>E-mail</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucila Candela</td>
<td>Universidad Politècnica de Catalunya</td>
<td>Spain</td>
<td><a href="mailto:Lucila.Candela@upc.edu">Lucila.Candela@upc.edu</a></td>
<td>Regional coordinator</td>
</tr>
<tr>
<td>Rein Perens</td>
<td>Geological Survey of Estonia</td>
<td>Estonia</td>
<td><a href="mailto:perens@egk.ee">perens@egk.ee</a></td>
<td>Contributing national expert</td>
</tr>
<tr>
<td>Eda Andresmaa</td>
<td>Environmental Agency</td>
<td>Estonia</td>
<td><a href="mailto:eda.andresmaa@envir.ee">eda.andresmaa@envir.ee</a></td>
<td>Contributing national expert</td>
</tr>
<tr>
<td>Heddy Klasen</td>
<td>Ministry of the Environment</td>
<td>Estonia</td>
<td><a href="mailto:heddy.klasen@envir.ee">heddy.klasen@envir.ee</a></td>
<td>Lead National Expert</td>
</tr>
</tbody>
</table>
Transboundary Aquifer Information Sheet

EU 108 – Ordovician-Cambrian Groundwater Body

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
<th>Country</th>
<th>E-mail</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boris Korolev</td>
<td>Federal state unitary geological organization &quot;Hydrospecialgeology&quot;</td>
<td>Russia</td>
<td><a href="mailto:korolyev@mail.ru">korolyev@mail.ru</a></td>
<td>Contributing national expert</td>
</tr>
</tbody>
</table>

**Considerations and recommendations**

Most data in the tables and text above have been provided by national and regional experts (listed above) or have been derived from the global WaterGAP model. See colophon for more information, including references to data from other sources.

Both TBA countries provided information that allowed description of the system, but it was not enough to calculate the groundwater indicators for the transboundary system.

Data gaps and also differences between data from national experts (Global Inventory) and data derived from WaterGAP highlight the need for further research on transboundary aquifers.

**Appendix: EU 108**

Map showing Recharge zones within the Ordovician-Cambrian Groundwater Body
Transboundary Aquifer Information Sheet

EU 108 – Ordovician-Cambrian Groundwater Body

Colophon

This Transboundary Aquifers information sheet has been produced as part of the Groundwater Component of the GEF Transboundary Water Assessment Programme (GEF TWAP). GEF TWAP is the first truly global comparative assessment of transboundary groundwater, lakes, rivers, large marine ecosystems and the open ocean. More information on TWAP can be found on: www.geftwap.org. The Groundwater component of TWAP carried out a global comparison of 199 transboundary aquifers and the groundwater systems of 41 Small Island Developing States. The data used to compile this transboundary aquifer information sheet has been made available by national and regional experts from countries involved in the TWAP Groundwater project. For aquifers larger than 20 000 km2 and which are not overlapping, additional data are available from modelling done by the Goethe University Frankfurt (Germany) as part of TWAP Groundwater. All data were compiled by UNESCO-IHP and the International Groundwater Resources Assessment Centre (IGRAC – UNESCO Category II Institute). Values given in the fact-sheet represent an approximate guide only and should not replace data obtained from recent local assessments. The editors of this information sheet are not responsible for the quality of the data.

For more information on TWAP Groundwater and for more data, please have a look at the TWAP Groundwater Information Management System which is accessible via www.twap.isarm.org or www.un-igrac.org.

Request:
If you have additional data or information about this transboundary aquifer that can improve the quality of this information sheet and the underlying database, please contact us via email at info@un-igrac.org. If appropriate, the information will be uploaded to the database of transboundary aquifers and will also be used in new versions of this information sheet.

References:
- Climate: Climate indicates the major climate zone which occurs in the aquifer area. If more than 1 climate zone is present the zone with the largest surface area was selected. Source climate data: ArcGIS Online (2015), Simplified World Climate zones. Owner: Mapping Our World GIS Education. Original map: National Geographic World Atlas for Young Explorers (1998).
- All other data: TWAP Groundwater (2015).

Version: December 2015