

## REVIEW OF GROUNDWATER RESOURCES

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### **Abstract**

*Assessment of groundwater resources was an integral part of the regional hydrogeological survey of Czechoslovakia and later the Czech Republic performed in the period 1966–1990. Meanwhile, methods of investigation and conditions of groundwater recharge have changed. Therefore, the former values of groundwater resources are now older than 20–30 years and their actual relevance is very problematic. The Czech Geological Survey has proposed the project called Review of Groundwater Resources, which reflected a rated review of the former results and should comply with the requirements of the water balance according the Czech Water Act and characterization of quantitative status of the groundwater bodies according the European Water Framework Directive. This project includes 56 hydrogeological zones which should be newly reviewed.*

The groundwater flow (baseflow) presents a part of the total surface water discharge ranging between 15 to 50 percent of it, and therefore it is an important part of the environment as well as conditions for the public water supply and for ecosystems depending on groundwater. Besides, the estimation of groundwater resources is necessary to comply with the legislative requirements. First, the Czech Water Act No. 254/2001 established in Art. 22 the National Water Balance. The balance should be performed annually with groundwater resources being an integral part of it. Second, the Water Framework Directive 2000/60/EC has introduced the 6-year period for the water-policy planning which requires periodical revisions of the quantitative status of the groundwater bodies.

The systematic assessment of groundwater resources originated from results of the nationwide regional hydrogeological survey performed during the period 1966–1990. The investigation covered the prevailing part of the important hydrogeological structures, namely the Bohemian Cretaceous Basin (Herčík et al. 2003) and the Neogene basins in southern Bohemia. The presumed survey of the Quaternary fluvial deposits could not be realized. An overview of the completed tasks has been presented by Kadlecová et al. (2009).

Evaluations of groundwater resources were an integral part of the survey tasks defined by the instructions of the special governmental committee (Commission for Classification of the Mineral Resources – KKZ). The evaluations were due to be approved by this Committee which verified and ratified the final value. Up to this date, 86 of the records of the Committee are still valid. The regional survey in the territory of the former Czechoslovakia and later the Czech Republic was organized on the basis of hydrogeological zoning. The first version has been constructed

in combination with the hydrogeological map at a scale 1 : 500 000 in 1965, later reviewed according with results of the regional survey at a more detailed scale 1 : 200 000 in 1973 and 1986. The present version of 2005 of hydrogeological zoning used the GIS technology depicting 3 layers of zones at the scale 1 : 50 000, and is now available either on CD (Olmer et al. 2006) or at web sites <heis.vuv.cz> <voda.gov.cz>. The hydrogeological zones reflect both the geological genetic characteristics and the area of groundwater flow, and are described in the interconnected tables (fig. 1).

The regional hydrogeological survey was performed during a period of 25 years. Meanwhile, techniques of investigation and methods of groundwater evaluation and balances have been developed. Furthermore, conditions of groundwater recharge and both long-time and seasonal flow regime have been affected due to abstractions and climate changes. These facts led to several efforts to prove the actual relevance and/or validity of the former results and to continue and fulfill the original goals. A real step presented the study by Kadlecová et al. (2010) which prepared proposals for a new phase of a general review of groundwater resources, reflecting the governmental resolution (since 2007) and using the chance to gain a support of funding by The Operational Programme Environment.

The preparatory study was based on a specific analysis (Herrmann 2008) rating the former results and actual needs as well, taking into account:

- availability, level and relevance of the groundwater resources values being introduced in the water balance presented by the Czech Hydrometeorological Institute (CHMI),
- groundwater abstractions over 1 mill. m<sup>3</sup> per year,
- poor or failing quantitative status of the groundwater body,

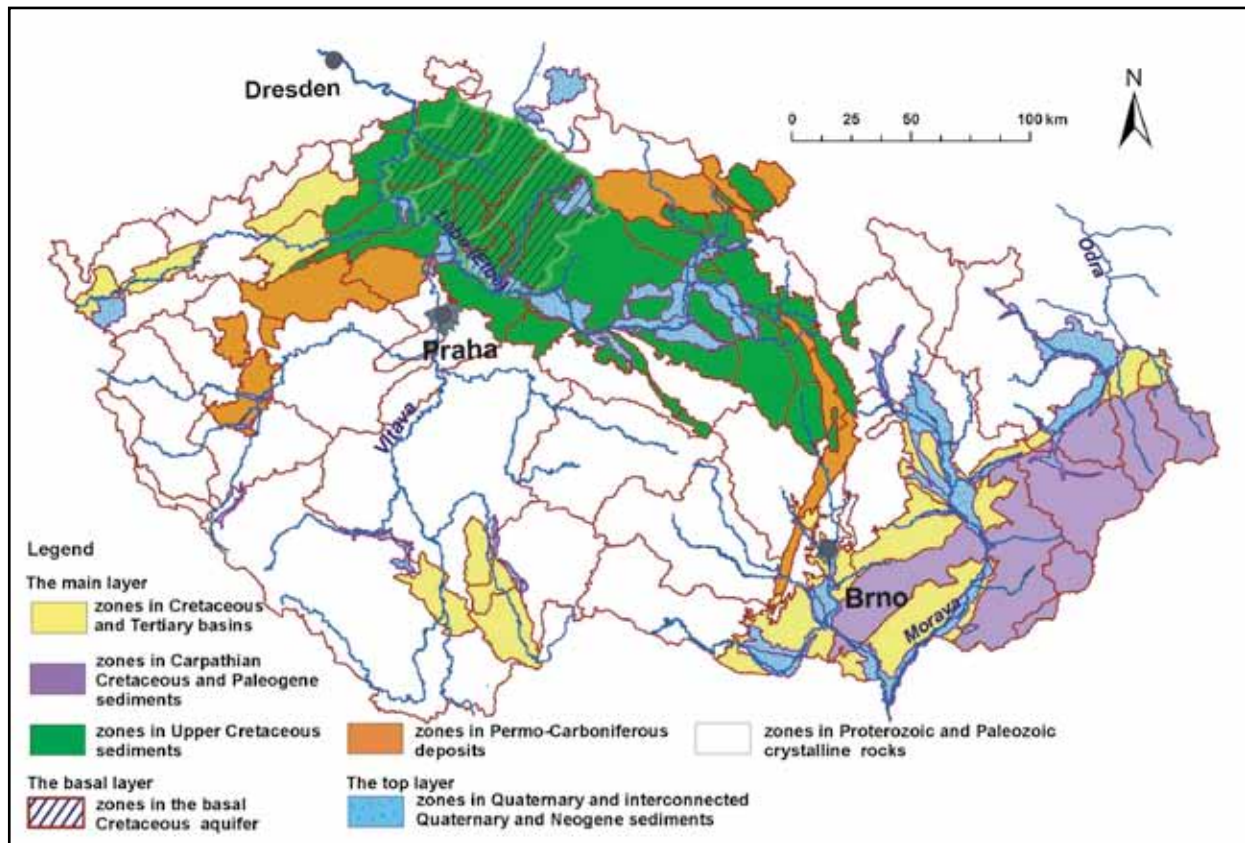


Fig. 1: Hydrogeological zones of the Czech Republic.

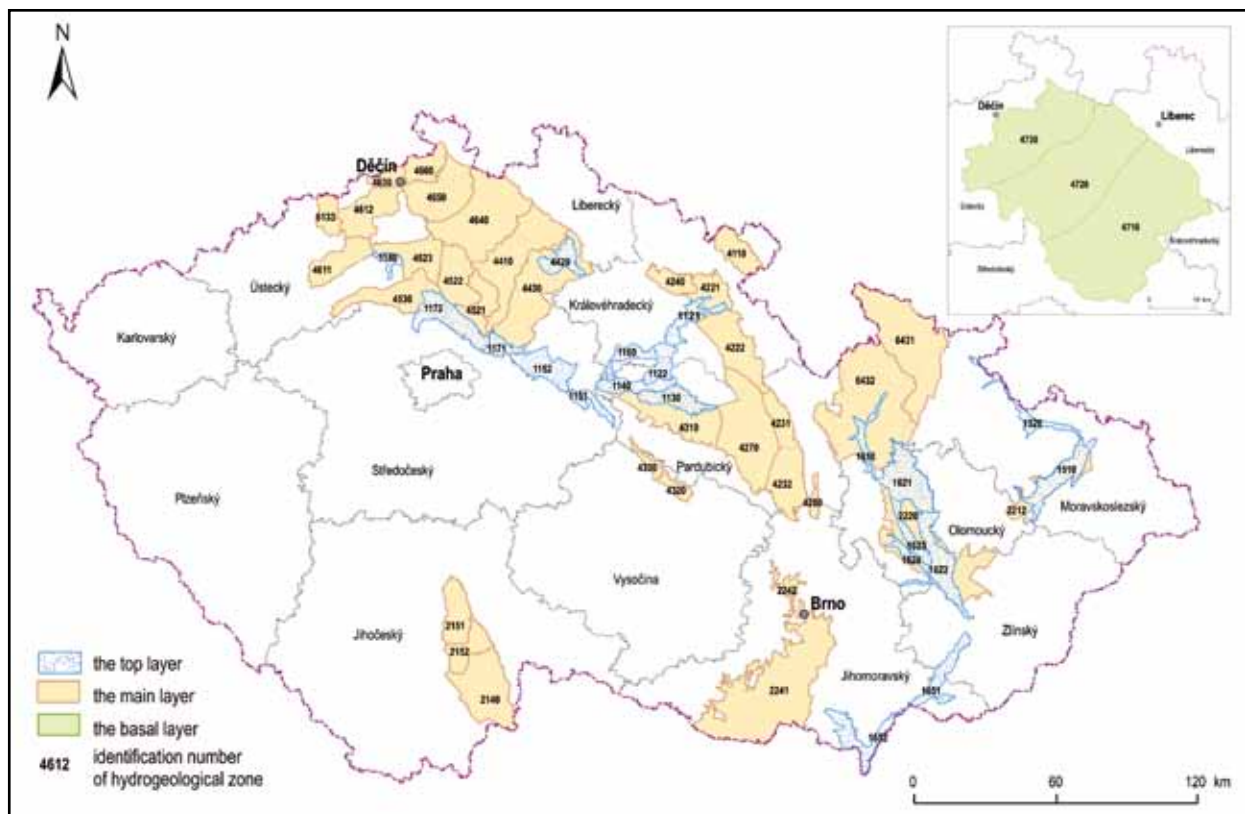


Fig. 2: Hydrogeological zones proposed for the review.

ID HGR	název hydrogeologického rajonu (HGR)	the name of the hydrogeological region	area km <sup>2</sup>
1121	Kvartér Labe po Hradec Králové	Quaternary of the Labe River downstream to Hradec Králové	146.1
1122	Kvartér Labe po Pardubice	Quaternary of the Labe River downstream to Pardubice	127.8
1130	Kvartér Loučná a Chrudimky	Quaternary of the Loučná and Chrudimka Rivers	181.9
1140	Kvartér Labe po Týnec	Quaternary of the Labe River downstream to Týnec	146.9
1151	Kvartér Labe po Kolín	Quaternary of the Labe River downstream to Kolín	88.1
1152	Kvartér Labe po Nymburk	Quaternary of the Labe River downstream to Nymburk	238.6
1160	Kvartér Urbanické brány	Quaternary of the Urbanice Gate	105.1
1171	Kvartér Labe po Jizeru	Quaternary of the Labe River downstream to the Jizera River	88.7
1172	Kvartér Labe po Vltavu	Quaternary of the Labe River downstream to the Vltava River	293.8
1180	Kvartér Labe po Lovosice	Quaternary of the Labe River downstream to Lovosice	57.8
1510	Kvartér Odry	Quaternary of the Odra River	262.9
1520	Kvartér Opavy	Quaternary of the Opava River	124.7
1610	Kvartér Horní Moravy	Quaternary of the upper Morava River	92.2
1621	Pliopleistocén Hornomoravského úvalu – severní část	Plio-Pleistocene of the Upper Moravian Graben – northern part	356.8
1622	Pliopleistocén Hornomoravského úvalu – jižní část	Plio-Pleistocene of the Upper Moravian Graben – southern part	289.1
1623	Pliopleistocén Blaty	Plio-Pleistocene of the Blata River	99.7
1624	Kvartér Valové, Romže a Hané	Quaternary of the Valová, Romže and Haná Streams	84.2
1651	Kvartér Dolnomoravského úvalu	Quaternary of the Lower Moravian Graben	168.2
1652	Kvartér soutokové oblasti Moravy a Dyje	Quaternary of the Morava and Dyje Rivers confluence area	216.8
2140	Třeboňská pánev – jižní část	Třeboň Basin – southern part	551.1
2151	Třeboňská pánev – severní část	Třeboň Basin – northern part	260
2152	Třeboňská pánev – střední část	Třeboň Basin – middle part	202.2
2212	Oderská brána	Odra Gate	307.2
2220	Hornomoravský úval	Upper Moravian Graben	257.2
2241	Dyjsko-svratecký úval	Dyje-Svratka Graben	1 460.8
2242	Kuřimská kotlina	Kuřim Basin	80.1
4232	Ústecká synklinála v povodí Svitavy	Ústí n. Orl. Syncline in the Svitava River catchment	358
4240	Královédvorská synklinála	Dvůr Králové Syncline	145.3
4270	Vysokomýtská synklinála	Vysoké Mýto Syncline	799.9
4280	Velkoopatovická křída	Cretaceous of the Velké Opatovice area	49.6
4310	Chrudimská křída	Cretaceous of the Chrudim area	595.8
4320	Dlouhá mez – jižní část	Dlouhá mez – southern part	65.7
4330	Dlouhá mez – severní část	Dlouhá mez – northern part	60.3
4530	Roudnická křída	Cretaceous of the Roudnice area	405.8
4611	Křída Dolního Labe po Děčín – levý břeh, jižní část	Cretaceous of the lower Labe River downstream to Děčín, left-bank – southern part	280.1
4612	Křída Dolního Labe po Děčín – levý břeh, severní část	Cretaceous of the lower Labe River downstream to Děčín, left-bank – northern part	331.8
4630	Děčínský Sněžník	Děčínský Sněžník	97.7
4640	Křída Horní Ploučnice	Cretaceous of the upper Ploučnice River	833
4650	Křída Dolní Ploučnice a Horní Kamenice	Cretaceous of the lower Ploučnice and upper Kamenice Rivers	481.4
4660	Křída Dolní Kamenice a Křinice	Cretaceous of the lower Kamenice River and the Křinice Stream	180.3
4720	Bazální křídový kolektor od Hamru po Labe	Cretaceous basal aquifer between Hamr and the Labe River valley	1 339.7
4730	Bazální křídový kolektor v benešovské synklinále	Cretaceous basal aquifer of the Benešov Syncline	948.9
4521	Křída Košáteckého potoka	Cretaceous of the Košátecký Stream	337.6
4522	Křída Liběchovky a Pšovky	Cretaceous of the Liběchovka and Pšovka Streams	335.2
4523	Křída Obrtky a Úštěckého potoka	Cretaceous of the Obrtka and Úštěcký potok Streams	309
4110	Polická pánev	Police Basin	214
4221	Podorlická křída v povodí Úpy a Metuje	Cretaceous of the Orlické hory (Mts.) piedmont in the catchments of the Úpa and Metuje Rivers	252.5
4222	Podorlická křída v povodí Orlice	Cretaceous of the Orlické hory (Mts.) piedmont in the Orlice River catchment	434.5
4231	Ústecká synklinála v povodí Orlice	Ústí n. Orl. Syncline in the Orlice River catchment	176.3
4410	Jizerská křída pravobřežní	Cretaceous of the Jizera River, right-bank part	685
4420	Jizerský coniak	Coniacian of the Jizera River	152.2
4430	Jizerská křída levobřežní	Cretaceous of the Jizera River, left-bank part	899.5
4710	Bazální křídový kolektor na Jizeře	Cretaceous basal aquifer in the Jizera River catchment	1 881.8
6133	Teplický ryolit	Rhyolite of the Teplice Spa area	134.4
6431	Krystalinikum severní části Východních Sudet	Crystalline of the northern part of the Eastern Sudeten	922.9
6432	Krystalinikum jižní části Východních Sudet	Crystalline of the southern part of the Eastern Sudeten	1 422.8

Tab. 1: Hydrogeological zones proposed for the review.

- importance of the groundwater unit resulting from the River basin management plans,
- other water management problems.

All of the 152 hydrogeological zones of the Czech Republic were investigated after the mentioned points and ordered according to urgency and necessity of a new review.

A new digital hydrogeological map of the Czech Republic is performed in the frame of the VaV Project (No. SP/2e1/07) representing a base in the project: Review of the Groundwater Resources.

The Czech Geological Survey has presented the project "Review of the Groundwater Resources" (Ident. No. 1559996). Expenses of investigating all of the rated zones was shared after a unified method (Kadlecová et al. 2010). The selection has been made in accordance with the results of the above mentioned preparatory study and rating analysis and with the expected limit of the funding, i. e. 25 000 EURO. The final term for this task is given by 2015. The proposal of the actual phase of the review respected both the results of rating and the financial limit, and thus the list of the selected hydrogeological zones has been closed by the number 56 (fig. 2, tab. 1).

The goals of the proposal of reviewing the hydrogeological and water management conditions have been described as „Activities“, which at the same time are defining the partial items for the selection procedures:

1. inventory, selection and analysis of archive records, delimitation of aquifers,
2. values of resources implemented in the quantitative status of groundwater bodies,
3. actualization of archive records by remote sensing, geophysical and field investigation,
4. testing of aquifers by hydrogeological boreholes,
5. hydrogeological conceptual modeling,
6. hydrological modeling,
7. hydraulic modeling,
8. quantitative status of groundwater bodies, hydrochemical modeling,
9. protection of groundwater and on water depending ecosystems,
10. summary,
11. publicity, web.

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