MINISTRY OF AGRICULTURE
OF THE CZECH REPUBLIC

Ministry of the Environment
of the Czech Republic

REPORT ON WATER MANAGEMENT IN THE CZECH REPUBLIC IN 2021

Report on Water Management in the Czech Republic in 2021

Ministry of Agriculture of the Czech Republic
Ministry of the Environment of the Czech Republic

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Dear readers,

You are holding the 26th edition of the water management yearbook traditionally known as the Blue Report. This year's edition presents water management in 2021, a comparison with previous years and is expanded to include a chapter on "Implementation of the programmes of measures adopted by river basin plans in 2015", which is submitted to the Government every third year, as required by the Water Act. It contains information on the status of surface water and groundwater, water management in the river basin districts and the implementation of the programmes of measures.

The first yearbook was published in 1997 in cooperation between the Ministry of Agriculture and the Ministry of the Environment. Its aim was, and still is, to inform readers about the state of water management and related facts in the year under review, to compare it with previous years, to present trends and changes achieved. Water management is very important, affecting all areas of our lives and related to a number of industries. Therefore, in this Yearbook you will find information on hydrology, water quality and pollution, water management, on activities of watercourse administrators, water supply and sewerage, water funding, related legislation, planning and strategies, as well as international relations in this field and research and development.

This Blue Report informs you about the situation in 2021. You will find that 2021 was the second coldest year in the past 10 years in terms of average temperature, with the average annual air temperature (8.0°C) being 0.3°C below the 1991–2020 average. In terms of discharge, 2021 was a relatively average year, in most of the river basins monitored. In terms of runoff, 2021 was highly variable, both in the main river basins and especially during the year. In terms of precipitation, 2021 was an average year in the Czech Republic, with mean annual precipitation of 683 mm representing 100% of the 1991–2020 average.

River Boards and Forests of the Czech Republic, state enterprises, administer major and minor watercourses and are under the jurisdiction of the Ministry of Agriculture. Last year, they spent more than CZK 4 billion on watercourse management from their own and other sources. You can also read in this yearbook about their management and other activities, including a comparison of data from previous years.

Water consumption invoiced to households increased by 2.1 litres per person per day to 93.2 litres per person per day in 2021. The average price excluding VAT for water and sewerage was CZK 43.80 and CZK 38.50 per cubic meter, respectively. The water supply network was extended by 1,093 km to 80,197 km and the sewerage network by 874 km to 50,554 km. The number of wastewater treatment plants increased by 66 in 2021 to a total of 2,861. Further interesting information can be found in the chapter on water supply and sewerage.

The Ministry of Agriculture spent a total of CZK 4.6 billion on water management in 2021. Financial support for water management includes selected national and supranational subsidy programmes. Projects concerning water supply and sewerage, flood protection, small watercourses and small water reservoirs, drought prevention and land improvement were supported. A number of research projects are also underway in the water sector, to which the Ministry of Agriculture has contributed CZK 89.3 million to them.

I am convinced that this Blue Report enriches your knowledge of water management and you will get a better understanding of the topic. I hope that it will subsequently stimulate your interest in water, as it is a very important and irreplaceable resource necessary for life and for the existence of our planet and it is essential that we take care of it.

Zdeněk Nekula
Minister of Agriculture

Dear readers,

You are now holding in your hands a publication entitled "Report on the State of Water Management in the Czech Republic in 2021", briefly referred to as the "Blue Report". This report provides a comprehensive overview of the state of water protection and water management in our country in 2021.

I am very pleased it is me who presents this report to you. It has been my lifelong professional endeavour to care about clean water and water protection. I am very conscious of its importance and strategic significance. Water is the foundation of our present and future and water resources have always been life-giving. The availability and quality of water determines how nature and, consequently, we humans will thrive in a given area. Protecting water resources and assigning water protection the highest priority, including enshrining it in the constitution is my aim and my task.

2021 was an average year in terms of temperature and precipitation in the Czech Republic. Compared to previous years, it was not exceptional in terms of hydrological drought or floods. However, let me point out that this is not the norm. The issue of drought and water scarcity has plagued us for many years and the situation is unlikely to change in the near future. Besides mitigation, we must cope with climate change via adaptation. And we cannot take adaptation measures without striving for water conservation.

In 2021, the Ministry of the Environment provided financial support for water management under European and national subsidy programmes. The total financial support amounted to CZK 7.33 billion.

At the same time, preparations for the new Operational Programme Environment 2021–2027, which will bring considerable funds to the field of water protection, continued in 2021. Projects that will be supported are, in particular, those aimed at improving the condition of surface waters and groundwaters, improving the quality and supply of drinking water, supporting preventive measures against floods and droughts, use and management of rainwater and grey water, creation of pools and small water reservoirs, implementation of green roofs, as well as promotion of sustainable use of agricultural land.

I am convinced that this report will not only provide you with useful information on the state of water management in the Czech Republic, but will also make you realise that water protection helps us use this valuable resource for our daily needs in a high-quality. Allow me to thank all those who are actively involved in water protection, even if only by using water wisely in their daily lives.

Anna Hubáčková
Minister for the Environment

Caught the Sun, the March 2021, The Znojmo Dam (author: Grund Petr)

1. HYDROLOGICAL BALANCE

1.1 Temperature and precipitation

The year 2021 can be assessed as normal in terms of temperature in the Czech Republic, the mean annual air temperature (8.0°C) was 0.3°C lower than the 1991–2020 average. It was the second coldest year in the past 10 years in terms of mean annual air temperature. Only 2013 was colder, with a mean annual temperature of 7.9°C. The previous three years were warmer by more than 1.0°C with mean annual temperatures of 9.1°C (2020), 9.5°C (2019) and 9.6°C (2018).

Most months of 2021 were rated as average compared to the 1991–2020 average. However, the spring months of April and May were very cold and were rated as strongly below average in terms of temperature, with mean monthly air temperature deviations from normal of -3.1°C and -2.5°C, respectively. This was followed by strongly above average June (deviation of +2.3°C). August was relatively cool and can be assessed as below average (deviation of -1.9°C). September, on the other hand, was above average (deviation +1.2°C).

The Freezing Sun, The January 2021, The Oleskovice Dam (author: Grund Petr)

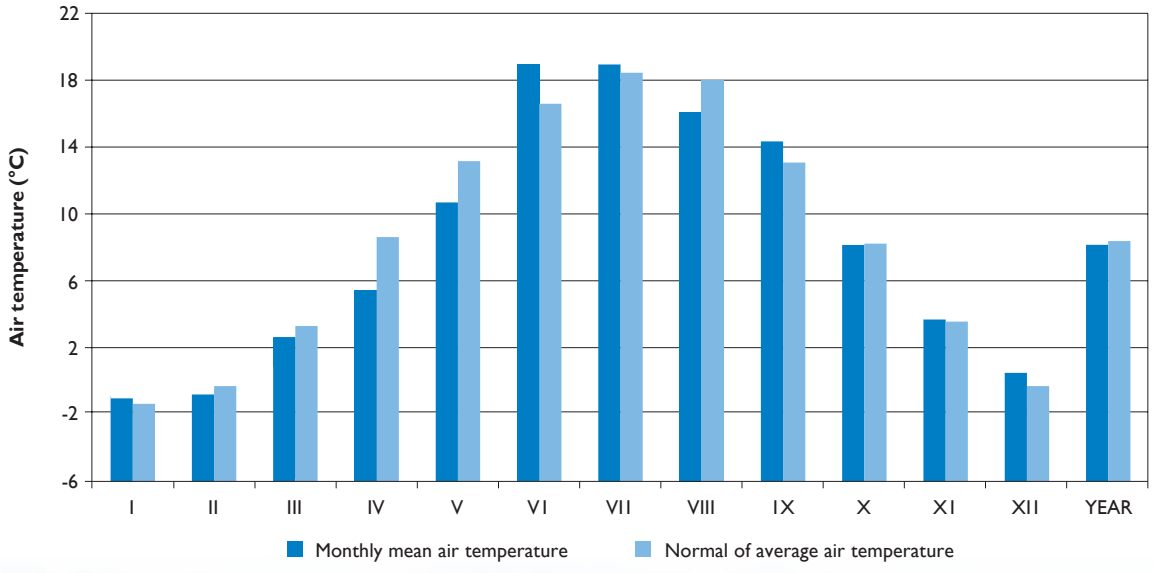
Interval limits for assessing normality (or abnormality) are defined for each month separately, which means the limits may vary for different months. The table below shows what the intervals mean and how they are defined. Abnormality of a phenomenon is generally defined by quantile values Q_p, for which the following is true: $P(X \leq Q_p) = p$ (i.e. the probability that a phenomenon reaches the quantile value of Q_p or lower equals to p). Temperature and precipitation are assessed in accordance with the classification in Table 1.1.1.

Table 1.1.1
Interval limits for assessing normality (abnormality)

Degree	Interval limits by quantiles	Exceedance probability (climate hedge in %)
Extremely below average	$< Q_{0,02}$	>98
Strongly below average	$<Q_{0,02}, Q_{0,10})$	(90, 98>
Below average	$<Q_{0,10}, Q_{0,25})$	(75, 90>
Average	$<Q_{0,25}, Q_{0,75}>$	<25, 75>
Above average	$(Q_{0,75}, Q_{0,90}>$	<10, 25)
Strongly above average	$(Q_{0,90}, Q_{0,98}>$	<2, 10)
Extremely above average	$> Q_{0,98}$	< 2

Source: CHMI

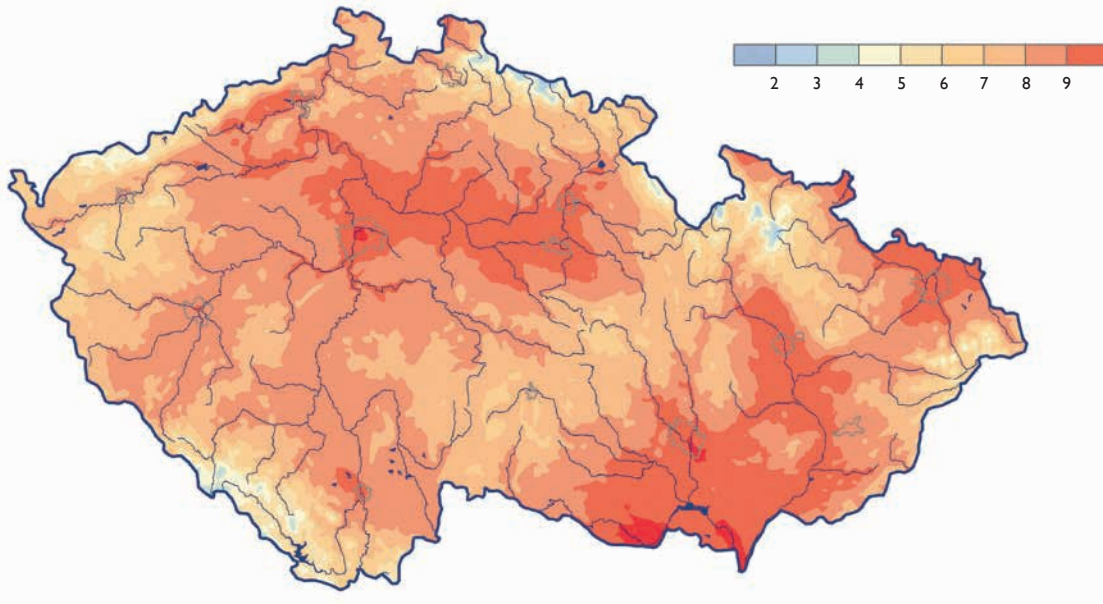
Graf 1.1.1
Average monthly air temperatures in the Czech Republic in 2021 compared to the 1991–2020 average



Source: CHMI

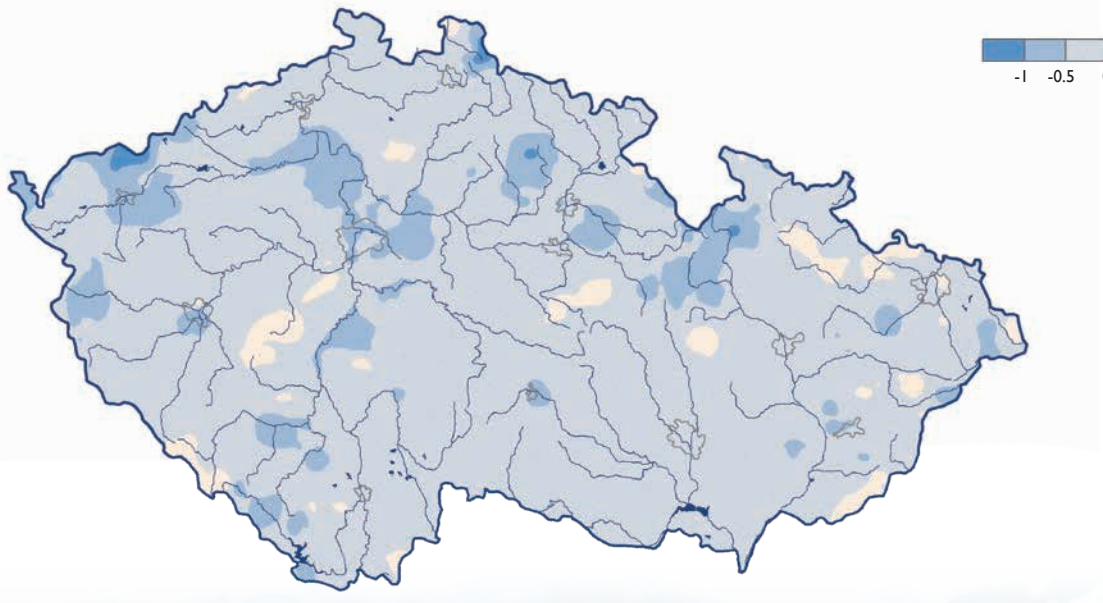
Winter 2020/2021 as a whole was standard in the Czech Republic in terms of temperatures. The mean air temperature in the winter season (-0.1°C) was 0.6°C above the average. December 2020 was warm, with a deviation of the average monthly air temperature from normal of +2.1°C. January and February 2021 were normal, with a deviation of the average temperature of +0.3°C and -0.4°C, respectively. On 15 February, the Kořenov/Jizerka station recorded the lowest air temperature (-29.2°C) in the winter. However, stations outside the standard network of the Czech Hydrometeorological Institute (hereinafter referred to as ‚CHMI') in so-called frost basins in the Šumava, Iron and Jizera Mountains, recorded daily minima even below -30°C on 14 and 15 February, with the lowest temperature on 14 February at the Jelení/U mostu station (-32.7°C). The spring was very cold, with the average air temperature in the Czech Republic (6.2°C) being 2.1°C below the 1991–2020 average. Temperature-standard March (average temperature deviation from normal of -0.6°C) was followed by very cold April (deviation of -3.1°C) and May (deviation of -2.5°C). The spring marked as the 6th/7th coldest since 1961. On 31 March, the first summer day (a day when the air temperature peaks over 25°C) was recorded in the Czech Republic at the Prague/Karlov (25.1°C), Neumětely (25.1°C) and Dobřichovice (25.0°C) stations. The hottest days of spring were on 10 and 11 May, when the first tropical days (a day with a maximum air temperature exceeding 30°C) of 2021 were recorded in the Czech Republic at several stations. The summer as a whole was normal in terms of temperature, the average temperature of the summer months in the Czech Republic was 17.9°C (deviation from normal of +0.3°C). June was above average in the Czech Republic (average temperature deviation from the average of +2.3°C), July was normal

Figure 1.1.1
Average air temperature in 2021



Source: CHMI

Figure 1.1.2
Deviation of the mean air temperature in 2021 from the 1991–2020 average



Source: CHMI

(deviation of +0.5°C) and August was below normal (deviation of -1.9°C). The warmest day was 19 June, when 30°C or more was recorded at 190 stations in the CHMI network. Several of them even recorded daily maximum air temperatures exceeding 35°C, namely Bolevec/Pilsen (35.7°C), Mikulka/Pilsen (35.3°C), Tuhaň in the Mělník District (35.1°C). The highest temperature in 2021 was recorded on 8 July at the Strážnice station (36.5°C). The autumn as a whole was also normal with the average temperature in the Czech Republic of 8.6°C being 0.4°C above the average. After an above average September (average temperature deviation from average of +1.2°C), October and November were average (deviation from the average of -0.2°C and +0.1°C). December was average in the Czech Republic, with the average monthly temperature (0.4°C) 0.8°C above the average.

Precipitation in 2021 was average in the Czech Republic, the mean annual precipitation of 683 mm corresponds with 100% of the 1991–2020 average.

The months of May and August were above-average, when 141% and 136% of the precipitation average fell in the Czech Republic. The autumn months of September and October were strongly below average, with monthly precipitation totals of 38% and 39% of the average. The remaining months of 2021 were normal in terms of precipitation. However, March was close to a subnormal month, with 61% of the average. On the other hand, January was close to an above-normal month, with 125% of the average.

The average precipitation in Bohemia in 2021 was 694 mm (102% of the long-term average), whereas in Moravia and Silesia it was 661 mm (96% of the average). In western and central Bohemia, annual rainfall was mostly slightly above normal. The highest precipitation compared to normal fell in the Prague and Central Bohemia Regions (108% of the average), the Pilsen and Karlovy Vary Regions (106% of normal). The lowest precipitation compared to normal was recorded in the east of the country in the Olomouc (93% of normal), Zlín (91% of the average), Moravia-Silesia (95% of the average) and Hradec Králové (94% of the average) Regions.

In January, an average of 55 mm of precipitation fell in the Czech Republic, which is 125% of the average. Precipitation occurred quite often in the form of snow, even at lower altitudes. At the end of the month, 50 cm of snow or more was measured at about 20 stations at higher altitudes. In February, the mean monthly precipitation in the Czech Republic (38 mm) was 103% of the long-term average. Precipitation was spatially unevenly distributed. In Prague and the Central Bohemia and Ústí nad Labem Regions, more than 130% of the normal precipitation fell, while in the Liberec, South Bohemia and Zlín Regions it was less than 90% of the average.

In the spring months of March and April, the average precipitation in the Czech Republic was below-average, but the two months were still rated as normal in terms of precipitation. The average monthly rainfall in the Czech Republic was 28 mm (61% of the average) in March and 32 mm (82% of the average) in April. May, on the other hand, was rich in precipitation, with an average of 99 mm (141% of the average) and was rated as above-average. In March and April, snowfall still occurred in the Czech Republic, mainly during the cold episodes in the second decade of March and the first half of April. In May, several days with relatively high precipitation totals were recorded. On 1, 12 and 13 May, precipitation was recorded almost throughout the whole territory of the Czech Republic, with daily totals exceeding 10 mm at more than half of the stations in the CHMI network and daily totals exceeding 50 mm at several stations.

In all the summer months the average precipitation in the Czech Republic was higher than normal. The months of June (88 mm, 107% of the average) and July (107 mm, 120% of the average) were normal, while August with an average of 106 mm (136% of the average) was above normal. In June and July, the spatial distribution of rainfall was uneven. While in Bohemia monthly rainfall totals were high above normal, in Moravia and Silesia (especially in the Olomouc, Zlín and Moravia-Silesia Regions) they were below normal. In June, precipitation occurred mainly in the last decade of the month and was often associated with storm activity. On 21, 23, 24 and 29 June, precipitation was recorded throughout the Czech Republic, with daily totals exceeding 10 mm at more than half of the stations in the CHMI network and daily totals exceeding 50 mm at several stations. On 8 and 17 July, more than 20 stations in the CHMI network recorded daily totals higher than 50 mm. In August, precipitation totals were significantly higher than the average in all regions. The highest precipitation in August compared to the average fell in the Zlín Region (217% of the average) and the Moravia–Silesia Region (201% of normal). Heavy precipitation occurred in a large part of our territory mainly in the first and last decade of the month. Daily rainfall totals exceeding 100 mm were recorded on 23 August at the Luční bouda station (112.5 mm) and on 31 August at several stations in the Frýdek–Místek and Vsetín Districts, with highest values recorded at the Lysá Hora station (128.2 mm).

The autumn months of September (23 mm, 38% of the average) and October (19 mm, 39% of the average) were strongly below-average in the Czech Republic, while November (46 mm, 102% of the average) was normal. Thus, on average, only 88 mm (57% of normal) of precipitation fell in the Czech Republic during the whole autumn, making it the second driest autumn in the Czech Republic since 1961. In September and October, monthly precipitation totals were significantly below normal throughout the Czech Republic. In November, the highest precipitation compared to the average occurred in the South Moravia (122% of the average) and Olomouc (113% of the average) regions, while the lowest precipitation was recorded in the Pardubice and Hradec Králové Regions (80% and 85% of the average). The first significant snow episode, when new snow fell at most of the Czech Republic, occurred from 26 to 30 November. On 26 November, snow fell also at lower altitudes, particularly in Moravia and Silesia and in the Vysočina Region with more than 10 cm measured at many stations.

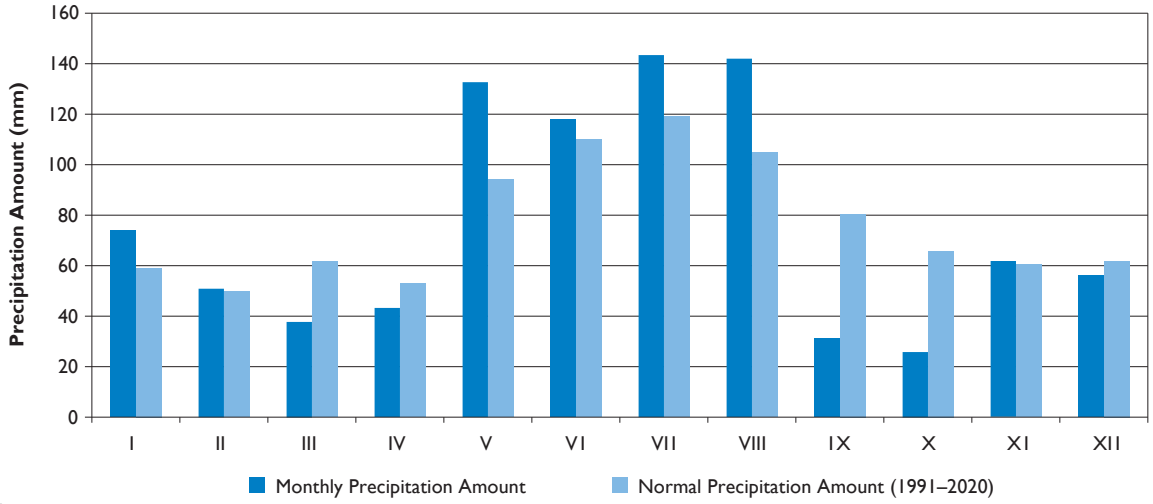
December was normal in the Czech Republic, the average precipitation in the Czech Republic (42 mm) was 91% of the average. The most precipitation compared to the average fell in the South Moravia Region (121% of the average) and the least in the Hradec Králové, Karlovy Vary and Ústí nad Labem Regions (less than 80% of the average). Precipitation occurred during the month in the form of rain and snow. On 9 December, new snow was recorded almost all over the Czech Republic, with 10 cm or more of new snow falling at more than 150 stations in the CHMI network.

Table 1.1.2
Renewable water resources in 2015–2021

Item	Annual values (millions of m³)						
	2015	2016	2017	2018	2019	2020	2021
Precipitation	41,957	50,240	53,868	41,170	50,004	60,411	53,674
Evapotranspiration	32,165	40,223	43,424	33,305	40,369	47,477	41,719
Annual inflow to the Czech Republic from neighbouring countries	398	402	339	320	405	840	785
Annual runoff from the territory of the Czech Republic	10,190	10,419	10,783	8,185	10,040	13,774	14,035
Surface water sources [1)]	3,591	4,421	4,258	3,355	3,732	5,000	5,692
Usable groundwater sources	939	925	911	765	789	978	1,213

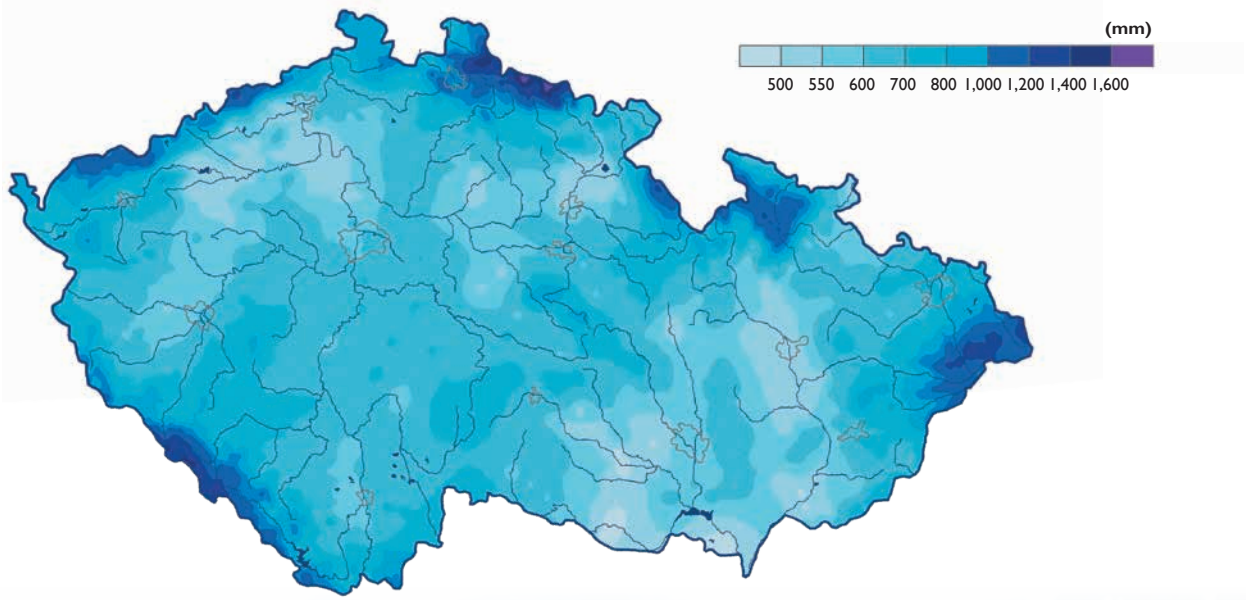
Source: CHMI
Note: [1)] Determined as the flow rate in the main river basins with 95% confidence.

Graph 1.1.2
Average monthly precipitation in the Czech Republic in 2021 compared to the 1991–2020 average



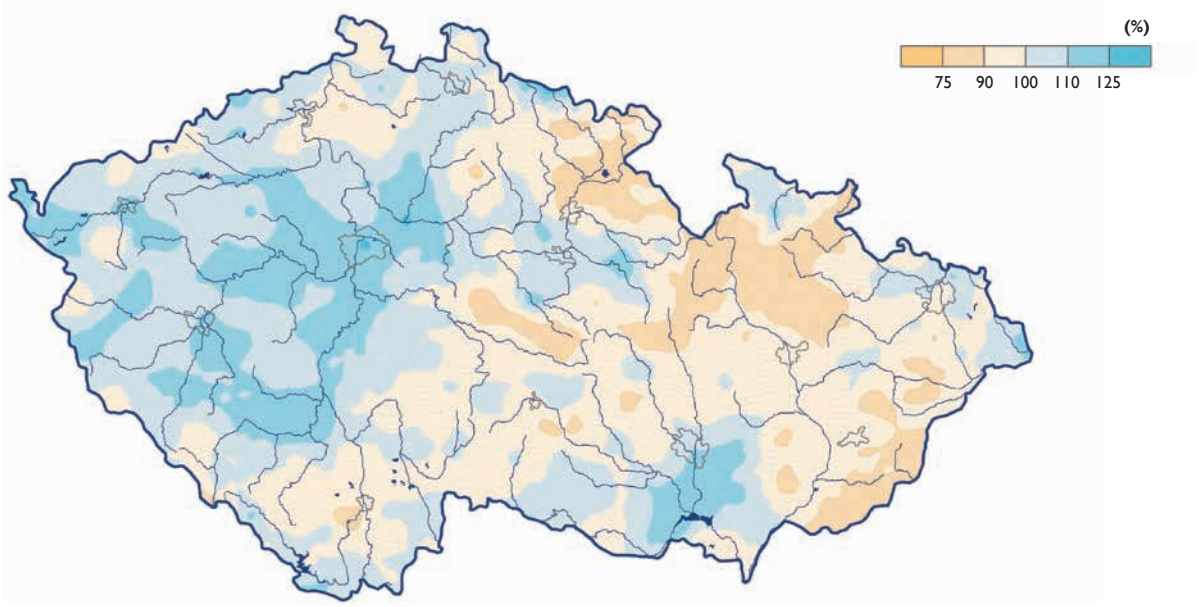
Source: CHMI

Figure 1.1.3
Total precipitation in 2021



Source: CHMI

Figure 1.1.4
Total precipitation in 2021 as a percentage of the 1991–2020 average



Source: CHMI

1.2 Runoff

Discharge was generally relatively average in most of the monitored river basins in 2021. In terms of runoff, 2021 is considered a very variable year, both from the perspective of the main river basins and, in particular, with respect to the values measured throughout the year.

The first two months of the year were above average in terms of runoff in the all the main river basins, with the exception of the Vltava and Elbe River Basins in January, with flow rates mostly around 1.5-multiple of the long-term averages for the two months. In contrast, March and April, with the exception of the Olše River Basin in April, were below average in terms of runoff. In May, runoff in the main river basins was above-average (120–190%) due to a flood episode. The following months had mostly below-average runoff, interrupted by flood episodes. The highest values of average monthly runoff in the main river basins were recorded in February in the Dyje River Basin and in the Vltava River Basin in July. The lowest average monthly runoff in July was in the Olše and Oder River Basins.

In terms of the number of operational hydrologic profiles for which a hydrologic drought condition (i.e., a flow rate that is achieved or exceeded on average for 355 days per year in a given profile) was indicated in 2021, the end of October / beginning of November was assessed as the hydrologically driest period. The highest number of profiles (23% of all reporting profiles) indicating hydrological drought was recorded on 31 October, with most profiles below the Q_{355d} hydrological drought level being in the Morava and Dyje River Basins (51%). Compared to 2020, the number of profiles indicating hydrological drought was significantly lower throughout 2021, with the exception of October and November.

In 2021, with the exception of March, October and November, every month had a runoff event reaching one of the flood activity degrees (hereinafter referred to as ‹FAD›). Significant runoff events in terms of the size of peak flows were in May, June and July, and in terms of the size of affected areas, particularly in July and May. In addition to a flood episode in May, runoff situations exceeding FAD III occurred in the months of June, July and August. The highest peak flows in terms of recurrence interval were reached on 14 July on the Brzina at the Hrachov profile and on the Svitávka in Zákupy on 18 July (both with a recurrence interval of 20 years).

The winter months (January, February) were very different in terms of runoff. While January was rather below average, slightly above average values prevailed in February. Watercourse levels fluctuated with occasional transient rises, caused mainly by snow melting and rainfall.

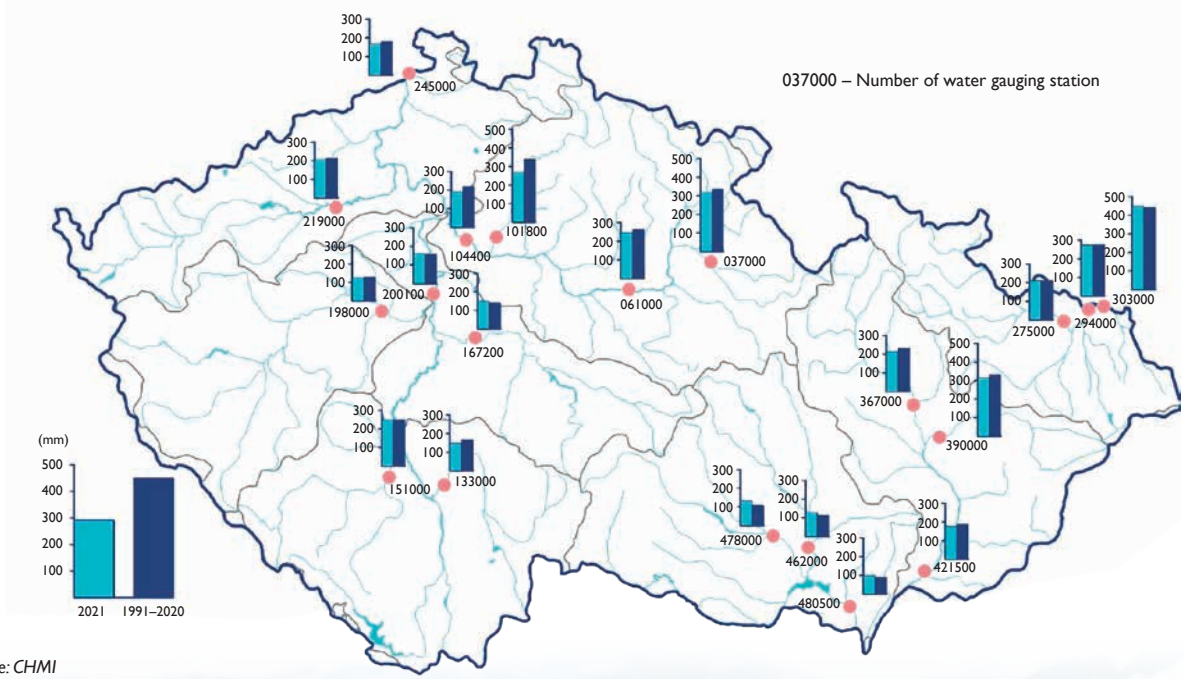
In terms of runoff, January was mostly average to below-average in the Elbe and Vltava River Basins and slightly above-average in the Moravian basins. Average monthly flow rates of most of the monitored watercourses were mainly 30–95% of Q_l, in the Morava, Dyje and Oder River Basins even up to 180% of Q_l. The levels of the monitored watercourses were almost constant or slightly fluctuating during most of the month. Until the beginning of the third decade of January, watercourse levels were mainly between $Q_{270–60d}$ in the Vltava and Elbe River Basins and $Q_{180–30d}$ in the Morava and Oder basins. At the beginning of the third decade there was a general increase in levels due to snow melting and rainfall. On the Bystřička, Vsetínská Bečva and Tichá Orlice Rivers, FAD I was reached on 23–24 January (at $Q_{<2}$). Increased flow rates remained on smaller watercourses due to snow melting and precipitation until the end of January, when FAD I was exceeded on 30–31 January on the left-hand tributaries of the Middle Elbe, in the Sázava River Basin, in the Berounka River Basin, on the tributaries of the Middle Vltava and in the Upper Morava and Dyje River Basins (all at $Q_{<2}$). At the end of the month, watercourse levels were mostly at $Q_{180–30d}$. February was rather above-average in terms of runoff in the whole of

the Czech Republic, with flow rates mostly at 1–2.5-multiples of Q_{II}. Watercourse levels in early February were mostly between Q_{90-60d}. As a result of thunderstorms and heavy rainfall, rapid rises in water levels occurred in the first decade of February not only at lower and middle altitudes, but even in mountainous areas. During this period, average weekly flow rates were usually 1.5–3-multiples of Q_{II}, and at some places in the Ohře River Basin even fivefold of Q_{I}. On 3–6 February, FAD I was exceeded in a number of profiles in almost all Czech river basins, but also in the Upper and Middle Morava and Dyje River Basins. The level of FAD II was reached on the Otava, Teplá, Ohře, Černovický Stream, Střela, Moravská Sázava, Moravská Dyje, Morava, Tichá Orlice and on 9 February also in the Veľká Stanovnice. Maximum water levels reached Q_2, in the Teplá River Basin even up to Q_5. At the end of the first decade of February the flow rates decreased slightly due to gradual cooling and cessation of precipitation. As a result of very heavy frosts, the surfaces, especially of smaller watercourses in the Czech Republic, gradually froze. Thus, in mid-February, approximately 35% of all monitored stations were affected by ice phenomena. The influence persisted into the beginning of the third decade, but due to further warming, ice phenomena on watercourses were almost non-existent by the end of the month. At the end of February, the average weekly flow rates increased again slightly due to melting and reached up to 3 times of Q_{II}, especially in the river basins in Moravia. This also corresponded to watercourse levels of $Q_{120-30d}$.

The spring months (March, April, and May) were generally between slightly below-average and average in terms of runoff. After a below-average runoff month in March, discharge values increased slightly in the second half of April due to precipitation and snow melting in mountainous areas. May was an above-average month in terms of runoff in all the main river basins of the Czech Republic. This was due to precipitations, which occurred with varying intensity throughout the month in the whole of the country.

March was below-average in terms of runoff throughout the country. With respect to the long-term March average, mean monthly flow rates were mostly in the range of 35–90% Q_{III} in all basins. At the beginning of the month, values were highest and reached 50–100% of Q_{II}I, later decreasing to 35–70% of Q_{III}. The lowest flow rates, with monthly averages around 25% Q_{III}, were most common in the Morava River Basin. Levels of most watercourses were stable or declined during the month. Slight fluctuations occurred repeatedly on watercourses draining mountainous areas due to snowmelt and occasional rainfall, but without reaching FAD. The water levels of the monitored watercourses in the Czech Republic ranged mainly from $Q_{180-60d}$, with slightly higher water levels in Moravia. Lower water levels (Q_{300d}) were sporadically reached by some watercourses in mountainous areas. A similar situation continued in April, which was also below-average in terms of runoff in all the main river basins except the Olše, where it was slightly above-average. The average monthly flows of most of the monitored watercourses ranged from 35–95% of Q_{IV}, while in the river basins of the Bečva, Olše and the Moravian part of the Oder River it was 110–200% of Q_{IV}. Until the end of the second decade of April, the average discharge decreased slightly, later, due to precipitation and snow melting from the mountain ridges, they increased, especially in the Oder and the Bečva River Basins, where they reached 2–3-multiple of Q_{IV} at the end of April. The levels of most watercourses were mostly stable or slightly declining. Slight fluctuations occurred repeatedly on watercourses draining mountainous areas due to snowmelt and occasional rainfall, with the Oder and Bečva River Basins in particular showing an increase at the turn of the second and third decade. The levels of the Ropinka and Bystřička Streams peaked on 20–22 April reaching FAD I with water levels near $Q_{<2}$. Overall, the water levels were mainly in the range of $Q_{240-60d}$, higher discharge was generally in watercourses in Moravia and Silesia and some watercourses draining mountains. May was above-average in terms of runoff compared to previous spring months. Mountain watercourses still had inflows of water from melting snow in the

Figure 1.2.1
Annual runoff compared to the 1991–2020 long-term average



Source: CHMI

first decade of the month. The average monthly discharge of most of the monitored watercourses were in the range of 90–200% of Q_V, in the Oder, Sázava and Berounka River Basins even up to 300% of Q_V. Watercourse levels fluctuated during the month depending on precipitation, FADs were reached on a number of profiles. Abundant precipitation occurred at the beginning of the month throughout the Czech Republic. In combination with snowmelt at higher altitudes, most of the watercourse levels in the Czech Republic rose on 1–2 May. The most significant rises were in the Berounka and Lower Vltava Basins, where FAD I was exceeded on the Červený Stream and the Botič (at Q_2), as well as in watercourses draining frontier mountain areas in North Bohemia. The Horní Úpa, Upper and Middle Jizera, Smědá, Řasnice, Ploučnice and Stěnava (all at $Q_{<2}$) rose to FAD I. Further significant rises occurred after heavy and sometimes persistent rainfall on 11–15 May. The level of FAD III was exceeded on 14 May by the Úslava at the Prádlo profile (at $Q_{<2}$). In the Vltava River Basin, FAD II was exceeded on the Úslava, Klabava, Berounka, Červený Stream, Smutná, Botič and Kocába. At a number of profiles in the Lužnice, Blanice, Sázava, Berounka, Lower Vltava and Oder River Basins, FAD I was exceeded, mostly at $Q_{<2}$. More abundant and sustained precipitation leading to FAD exceedance occurred on 16–18 May in the east of the country. In the Oder River Basin, levels rose to FAD I (mostly at $Q_{<2}$) on the Stružka, Opava, Olše and Ropičanka Rivers. The level of FAD I was also reached in the Bečva, Dřevnice and Olšava River Basins. FAD II was exceeded on the Velká Stanovnice ($Q_{<2}$). Since this flood episode, watercourse levels slowly decreased or remained stable. The water levels of the monitored watercourses were mostly in the range of $Q_{210–60d}$, increasing to $Q_{120–30d}$ in the second and third decade.

Runoff conditions in the summer months (June, July and August) were quite different from the previous period. The beginning of the summer was accompanied by mostly stable conditions. From the third decade of June, in particular in July, until the end of August, heavy rainfall, often accompanied by storms, led to repeated runoff situations with frequent exceedances of higher FADs.

June was a below-average to average month in terms of runoff for most of the time. Average monthly flows were mostly in the range of 50–110% of Q_{VI}. Watercourse levels were steady or slightly fluctuating until the beginning of the third decade of June. Strong storms with heavy rainfall occurred on 21–23 June, resulting to an increase in smaller watercourse levels up to FAD levels. On 21 June, FAD I was exceeded on the Lučina, Litava and Trkmanka (all up to $Q_{<2}$). On 22 and 23 June the level of FAD II was exceeded on the Křemelná River at $Q_{<2}$ and FAD I was reached on the Otava, Botič, Bystřička, Haná and Želetavka (all at $Q_{<2}$). The most significant rise reaching FAD III was recorded on the night of 24 June after a very strong storm at Volyňka in Sudslavice (at Q_{10}) and Botič in Prague–Nusle (approx. Q_{10}). On the same day, FAD II was also reached on the Otava (at $Q_{<2}$), Volyňka, Kocába (at Q_2), Rokytka (up to Q_{10}), Botič and Jevišovka (at $Q_{<2}$). Levels rose again on 24–26 June on the Stonávka (Q_2), Haná, Lomnice (both $Q_{<2}$) and FAD II was exceeded again on the Kocába (Q_2). In addition, FAD I was frequently exceeded on watercourses in the Upper Vltava, Lomnice, Berounka, Olše, Haná and Litava River Basins. On the Červený Stream and the Lučina, the levels peaked above FAD I at Q_5. Other strong storms came at the end of the month. In several other profiles in the Berounka and Botič River Basins, FAD I was exceeded (below $Q_{<2}$). Water levels in June corresponded to $Q_{240–120d}$, and increased to $Q_{270–30}$d in the last decade of the month. Lower water levels occurred in the Ploučnice River Basin, and also on tributaries of the middle Elbe, Oder and Dyje. July runoff was above-average in the Czech basins, but below-average in Moravia. At the beginning of the month, average discharge was mostly in the range of 40–200% of Q_{VII}. The levels of most watercourses in the Czech Republic were mostly stable at the beginning of the month, either decreasing or fluctuating due to previous rainfall. At the beginning of the month, the flood episode from the end of June reverberated, when FAD I was exceeded on the Lusatian Neisse ($Q_{<2}$) and on the Holoubkovský Stream ($Q_{<2}$) on 1 July. More significant rises in water levels occurred after heavy rainfall on 8–9 July. FAD III was exceeded on the Novohradka at the Luže profile (Q_{10}) and on the Úslava in Koterov (Q_2). FAD II levels were also reached in 8–12 July on the Tichá Orlice ($Q_{<2}$), Loučná, Novohradka, Doubrava (at Q2), Milevský Stream, Úslava ($Q_{<2}$), Klabava (Q2), Berounka ($Q_{<2}$), Botič (Q_5) and Jevíčka (Q_2). At a number of profiles on the tributaries of the Middle Elbe and Berounka, on the Smutná and Upper Sázava, Třebůvka and Svratka, FAD I was exceeded (at $Q_{<2}$ to Q_2). Precipitation was also significantly above-average in 12–17 July, when on the night of 14–15 July FAD III was recorded on the Lusatian Neisse in Proseč nad Nisou (Q_5), on the Úslava in Prádlo ($Q_{<2}$) and on the Brzina at the Hrachov profile (Q_{20}). Furthermore, FAD II on the Milevský Stream, on the Botič and on the Lusatian Neisse was exceeded (all at Q_2). At a number of profiles on tributaries of the Middle Elbe, on the Úslava, Střela, Botič, Rokytka and Lusatian Neisse River Basins, FAD I was exceeded (at $Q_{<2}$ to Q_2). On 18 July, FAD III was exceeded by the Smědá in Višňová ($Q_{<2}$), the Otava in Rejštejn and Sušice (Q_2), the Úslava in Koterov (Q_2), the Svitávka in Zákupy (Q_{20}) and the Bělá in Mikulovice and Jeseník (at Q_5). In the basins of the Lusatian Neisse, Horní Úpa and Upper Jizera, Otava, Upper Vltava, Skalice, Berounka, tributaries of the Lower Vltava and Lower Elbe and in the Upper Morava River Basin, FAD I and II was frequently exceeded, with peak flows ranging typically from $Q_{<2}$ to Q_2, with only the Skalice in Zadní Poříčí reaching Q_5. The last large July highs after significant rainfall gradually affected the south and east of Bohemia and Moravia in 25–27 July. The Želivka River in Čakovice (Q_2) and Želiv ($Q_{<2}$) rose to FAD II on 27 July, while some other watercourses in the region reached FAD I (all up to $Q_{<2}$). The water levels of the monitored watercourses in the Czech Republic were relatively highest during the first half of the month, when they were mostly in the range of $Q_{270–30d.}$ Then they gradually decreased and reached $Q_{330–30d}$ at the end of July. The highest flows ($Q_{60–30d}$) occurred most frequently in south-west and central Bohemia in the Berounka and Vltava River Basins and partly in the Bohemian-Moravian Highlands and in central and southern Moravia. Watercourses with lower discharge were generally those in the north-east part of the Czech Republic, with the lowest water levels at the hydrological drought level (Q_{355d}) occurring mainly in the Oder, Upper Morava, Bečva and Lower Elbe River Basins. In terms of runoff, August was mostly an average to slightly above-average month with flows in the wide range of 70–155% Q_{VIII}. Flows of the monitored watercourses were mostly between $Q_{270–60d.}$ Higher flow rates (Q_{30}d) occurred locally in the Berounka, Bečva and Middle Morava River Basins and in the Oder Basin. The flows draining the Beskid Mountains in particular rose as a result of heavy rainfall. On 5 August, FAD III (Q_5) was briefly exceeded on the Stružka in Rychvald. On the Stonávka River, FAD II was exceeded

The Chomutovka River (source: Ohře River Board, s.e.)

and on smaller watercourses in the Oder Basin FAD I was sporadically reached. During August, watercourse levels fluctuated slightly with a predominantly decreasing tendency. Further significant rises occurred, occasionally even above FAD I and even FAD II on 24 August after heavy rainfall in the Upper Elbe and Upper Jizera River Basins. The Elbe reached FAD II in Špindlerův Mlýn and at the Labská profile ($Q_{<2}$). At the very end of the month, prolonged heavy rainfall occurred in the northern, north-eastern and eastern border mountains, which caused watercourse level rises in late August and early September. On the Smědá at the Višňová profile, FAD III was briefly exceeded on 31 August ($Q_{<2}$). The Upper Elbe and Úpa Rivers in the Krkonoše Mountains, as well as the Rožnovská Bečva, Čeladenka and Olše Rivers (mostly at Q_2) rose to FAD II between 31 August and 1 September. In a number of profiles in the Bečva and Olše River Basins, FAD I was reached.

The autumn months (September, October and November) were generally below average in terms of runoff. In early September, the runoff situation from August reverberated. Thereafter, watercourse levels were mostly on a decline or stable, with only occasional slight fluctuations.

September was below average from the perspective of runoff in most of the main river basins, only in the Oder Basin slightly above-average. The average monthly discharge was mostly between 45–120% of Q_{IX}, initially 60–220% of Q_{IX}. This corresponded to watercourse levels in the range of $Q_{270–60d}$. In early September, most watercourse levels were on the rise following the situation in late August and early September. After this rainfall-runoff event, slightly decreasing trends or persistent levels prevailed on most watercourses. In the following weeks, flows were mostly between 35–100% of Q_{IX}. Water levels gradually decreased to $Q_{355–180d}$. October was also rather below average from a runoff perspective. Only the flows in the Elbe and Vltava River Basins were average, mostly between 25–105% of Q_X. The very low flows were particularly evident in the Bečva Basin (15–30% Q_X). Watercourse levels were mostly stable or slightly fluctuated in the first two decades of October. Slight rises without reaching a FAD were recorded after rainfall on the night of 5/6 October in the Horní Úpa, Upper Elbe, Bystřice and Upper Jizera River Basins. In the third decade, flows were mostly stagnant or declined. Levels of the monitored watercourses were mostly in the range of $Q_{355–180d}$. November was also below-average in terms of runoff. Average monthly flows of the monitored watercourses were mostly in the range of 20–90% of Q_{XI}. In the Elbe and Vltava River Basins, the flows were higher (most often 30–150% of Q_{XI}) and decreased significantly during the month due to manipulations at the Vrané Reservoir. Levels of other watercourses were balanced, with only a slight rise in the Oder and Morava Basins at the end of the month after heavier rainfall. Watercourses flow rates were mainly in the range of $Q_{330–180d}$.

The end of the year continued the trend of mostly below-average values. Slight fluctuations in levels were recorded only in the second half of December and more pronounced at the very end of the year. December was a below-average month in terms of runoff. Average monthly discharge of the monitored watercourses was typically in the range of 40–85% of Q_{XII} and watercourse levels mostly in the range of $Q_{300–180d}$. During the first half of December, levels remained mostly stable. Due to very low temperatures, a significant number of stations, especially on smaller and mountain watercourses, were affected by ice formation. In the second half of the month, water flows fluctuated throughout the area due to significant warming, rainfall and snowmelt from mountain and foothill areas. The most pronounced rises were recorded on 31 December in the Upper Jizera Basin, where FAD I was reached at the Jablonec nad Jizerou profile. Significant rises up to FAD I also occurred on the watercourses draining the Beskid Mountains. At the very end of the year, flows increased to an average of 60–200% of Q_{XII}, in the northern border mountains the flows of the drained watercourses reached 3–7-multiples of Q_{XII}. During this period, ice no longer occurred on watercourses due to warming.

Table 1.2.1
Runoff in 2021 as percentage of long-term average monthly runoff in 1991–2020

River	Profile	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
		(%)												
Orlice	Týniště nad Orlicí	84	155	77	66	139	98	181	107	81	58	40	68	95
Elbe	Přelouč	79	154	76	63	154	91	152	96	83	64	56	63	93
Jizera	Tuřice-Předměřice	52	107	56	53	138	72	118	105	86	72	73	80	79
Elbe	Kostelec nad Labem	67	145	70	58	145	78	148	97	80	67	60	63	88
Lužnice	Bechyně	67	214	62	39	164	59	124	97	98	75	65	61	90
Otava	Písek	63	155	62	54	146	125	235	116	87	68	65	65	100
Sázava	Nespeky	83	239	70	55	219	75	181	78	60	69	57	68	106
Berounka	Beroun	50	155	57	47	220	94	356	119	71	55	53	52	98
Vltava	Praha-Chuchle	62	191	68	43	170	84	232	100	83	114	80	62	102
Ohře	Louny	37	137	76	79	130	127	272	133	106	82	65	76	96
Elbe	Hřensko	59	157	71	55	151	84	195	103	84	88	71	65	94
Opava	Děhylov	146	160	93	81	198	71	42	85	93	71	56	61	101
Oder	Bohumín	159	164	80	104	178	62	35	126	109	47	42	66	99
Olše	Věřňovice	122	130	69	125	185	68	28	152	164	48	44	82	102
Morava	Olomouc-Nové Sady	154	170	82	63	131	79	76	88	62	51	46	50	92
Bečva	Dluhonice	163	164	66	96	153	71	34	140	107	25	34	72	95
Morava	Strážnice	170	174	80	72	130	70	53	109	71	37	42	64	94
Svratka	Židlochovice	162	223	86	72	121	104	116	155	96	95	66	92	114
Jihlava	Ivančice	165	318	90	55	175	104	121	114	101	139	53	66	125
Dyje	Ladná	152	273	86	57	136	87	112	128	86	95	66	75	113

Source: CHMI

Note: % of average 30 | 40 | 50 | 60 | 80 | 100 | 120 | 150 | 200 | 300

1.3 Groundwater regime

The level of groundwaters with shallow circulation and spring yields were generally average in 2021 (Figures 1.3.1 and 1.3.2). A new reference period of 1991–2020 was used for the 2021 assessment. As the new reference period includes the drought period lasting from 2015 through the first half of 2020, the overall condition looks slightly better in some areas and months than it would have been if the original 1981–2010 reference period were used. Watercourse levels and spring yields reached strongly above-average annual maxima in February. By April, watercourse levels and yields declined to normal and slightly below-average, respectively. In May, both the levels and yields improved to strongly and slightly above-average, respectively. The level and yield deteriorated, although slowly, until the end of the year, reaching a generally average annual lows in November.

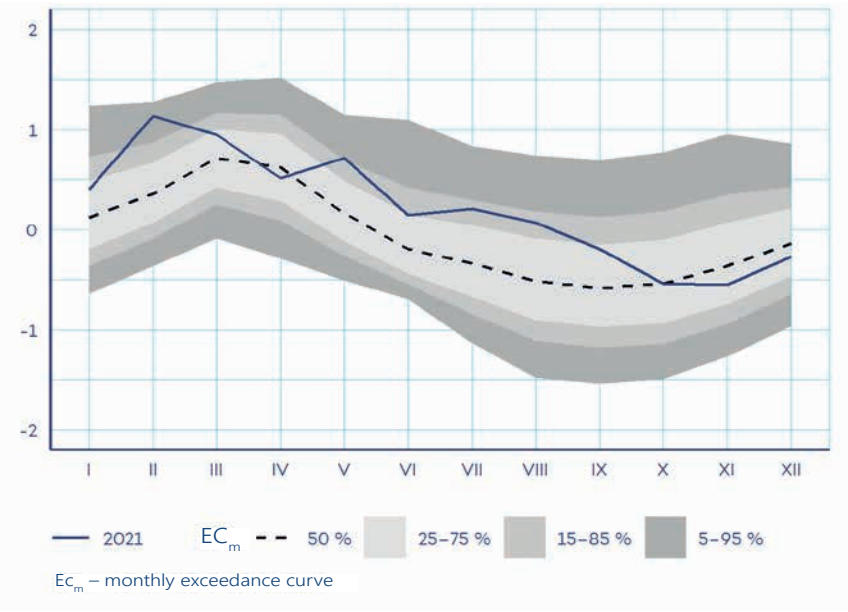
However, the situation was regionally different during the year. While in the west and north-west of the Czech Republic the drought persisted in January (the Ohře, Lower Elbe and other tributaries of the Elbe and Berounka River Basins) in Moravia the level and yield were above normal. A significant improvement in western Bohemia occurred in July, when the level in the Berounka Basin was extremely above-normal and spring yield was strongly above-average. In the last quarter, regional differences in levels evened out and average levels prevailed throughout the country, while yields remained strongly or extremely below-average in north-west Bohemia (the Ohře, Lower Elbe and other tributaries of the Elbe), with the exception of an average level in July.

In deep aquifers in parts of Bohemia, drought from previous years continued in a lesser extent, while in eastern Bohemia and Moravia the improvement in water levels from the end of the previous year continued (Figure 1.3.3). The level of some parts of the hydrogeological group regions (HGRs) in Bohemia was strongly or extremely below-average throughout the year. The most drought-affected area was the North Bohemian Cretaceous (the area between the Jizera River and the Lower Elbe River), where extremely below-average levels persisted almost throughout the year. In the first half of the year, on the other hand, moderately to extremely above-normal water levels persisted in parts of the East Bohemian Cretaceous, the East Bohemian Permo-carboniferous and the Moravian Tertiary. At the end of the summer, the level of the deep aquifers here also dropped to a mostly normal level, which lasted until the end of the year. In a part of the North Bohemian Cretaceous Cenomanian, which has a strongly perennial regime, the level was strongly above-average all year round.

Shallow aquifers

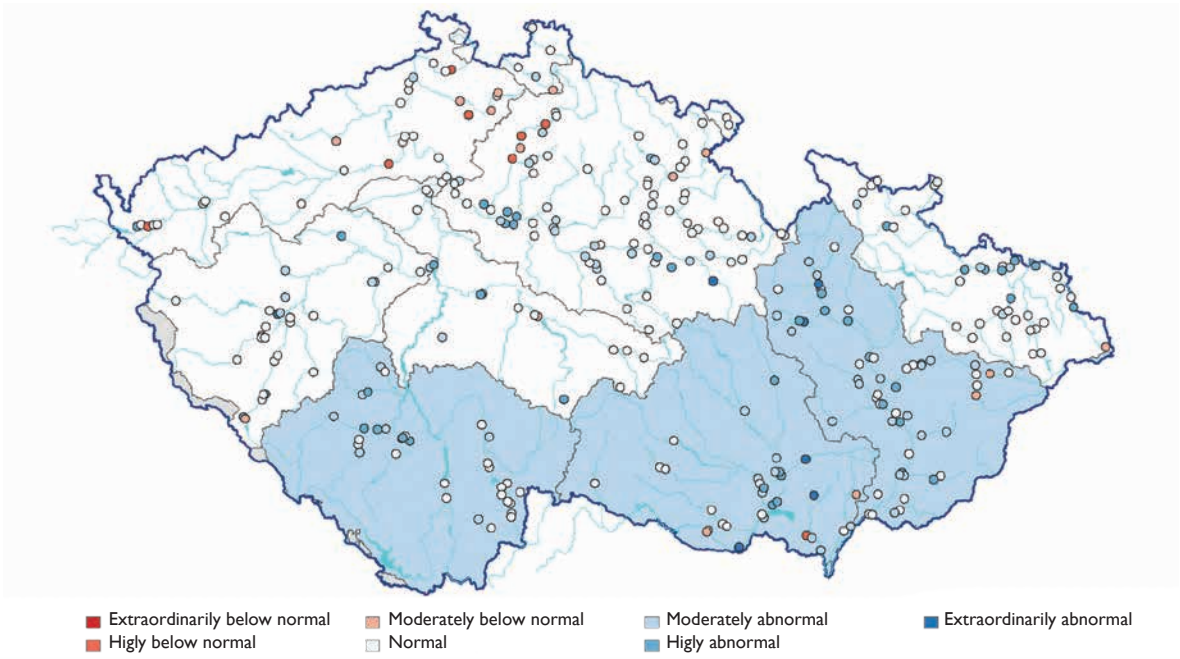
The beginning of 2021 was generally normal, but the situation was regionally very different, while in the west, namely in basins of the Ohře, Lower Elbe and other tributaries of the Elbe, the levels were extremely below-average (96% of EC_m) in most of the rest of Bohemia, with the exception of the slightly subnormal level in the Berounka Basin (78% of EC_m), the situation was normal. In Moravia, on the other hand, the levels were moderately to extremely above-average (Morava and Váh tributaries - 2% of EC_m). In February, levels rose to an overall strongly above-average annual maximum (7% of EC_m) throughout the country, as shown in Figure 1.3.1, and was even extremely above-average in Moravia. The maximum occurred in mid-February (week 6), when the level was strongly or extremely above-average in 50% of the shallow aquifers throughout the Czech Republic. This was followed by a significant decline to an overall average level by April (59% of

Graph 1.3.1
Average standardised levels of groundwaters in shallow aquifers in the monitoring network of the Czech Republic in 2021 compared to the 1991–2020 long-term average



Source: CHMI
Note: The graph also shows quantiles of monthly exceedance probability curves (EC_m)
The vertical axis shows the standard deviation.

Figure 1.3.1
Groundwater levels in shallow aquifers in 2021, compared to the 1991–2020 period



Source: CHMI

EC_m). In most of the area, the level was normal in April, but in the west in the Ohře, Lower Elbe and other tributaries of the Elbe Basin the levels deteriorated to strongly below-average (88% of EC_m) and in the Berounka Basin to slightly below-average (81% of EC_m). In May, there was an improvement to an overall strongly above-average level (14% of EC_m).

In June, the level dropped again to overall normal across the territory (26% of EC_m). In July, the level improved to slightly above normal (18% of EC_m), mainly due to the rise in Bohemia. The most significant improvement occurred in the Berounka Basin, where the condition was extremely above normal (3% of EC_m) and 70% of the boreholes reached strong or extremely above normal levels. On the other hand, throughout Moravia the level was mostly stagnant and normal in July. While in Bohemia the level declined in August, most significantly in the west, where in the Ohře, Lower Elbe and other tributaries of the Elbe basin the level dropped from strongly above normal (12% of EC_m) to normal (30% of EC_m), in Moravia the level rose slightly.

From September to November, water levels declined in most of the Czech Republic until they reached overall normal annual lows in November (63% of EC_m). In the last quarter, regional differences in levels evened out and normal conditions prevailed throughout the country, and December was also generally average (61% of EC_m), see Table 1.3.1.

Table 1.3.1
Probability of exceeding average groundwater levels in 2021 in % of EC_m in river basins (monthly exceedance curve for 1991–2020)

River Basin	Water level with respect to EC_m in %											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Upper and Middle Elbe	48	16	38	61	15	26	13	23	33	46	60	68
Upper Vltava	55	9	41	73	23	27	11	15	21	41	52	56
Berounka	78	26	58	81	16	20	3	10	21	42	42	47
Lower Vltava	54	14	45	68	15	25	10	17	31	42	56	63
Ohře and Lower Elbe	96	43	75	88	54	62	12	30	46	76	73	77
Upper Oder	16	5	24	31	8	32	53	29	20	50	79	54
Lusatian Neisse	77	31	60	69	4	36	21	44	48	74	77	82
Morava	2	1	10	32	16	22	31	22	33	49	65	55
Dyje	8	4	16	42	24	24	29	17	21	31	41	31
Czech Republic	**30**	**7**	**29**	**59**	**14**	**25**	**18**	**19**	**27**	**50**	**63**	**61**

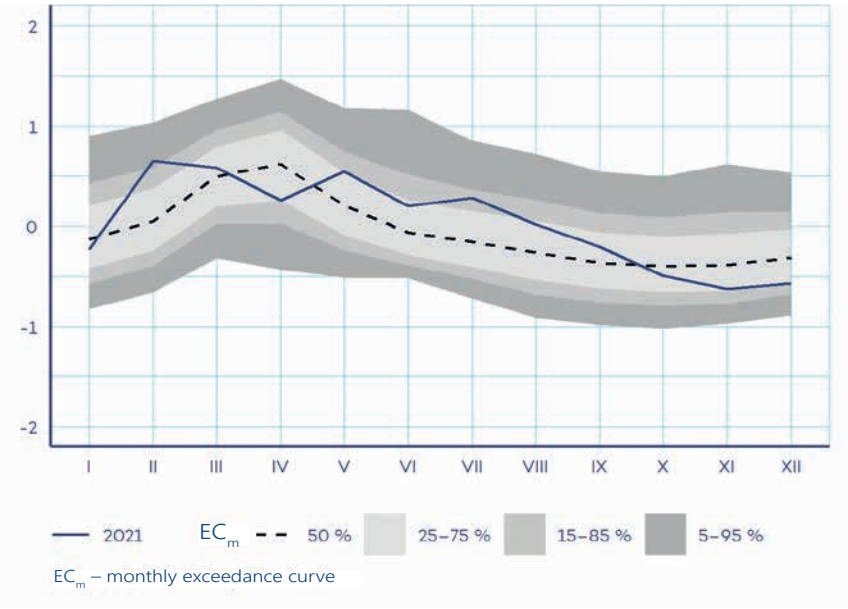
Source: CHMI
Note: The red colour scale corresponds to categories slightly (75–85%), strongly (85–95%) and extremely (95–100%) below-average levels. Blue colours indicate slightly (15–25%), strongly (5–15%) and extremely (0–5%) above-average yield.

The Bedřichov Dam (source: Labe River Board, s.e.)

Springs

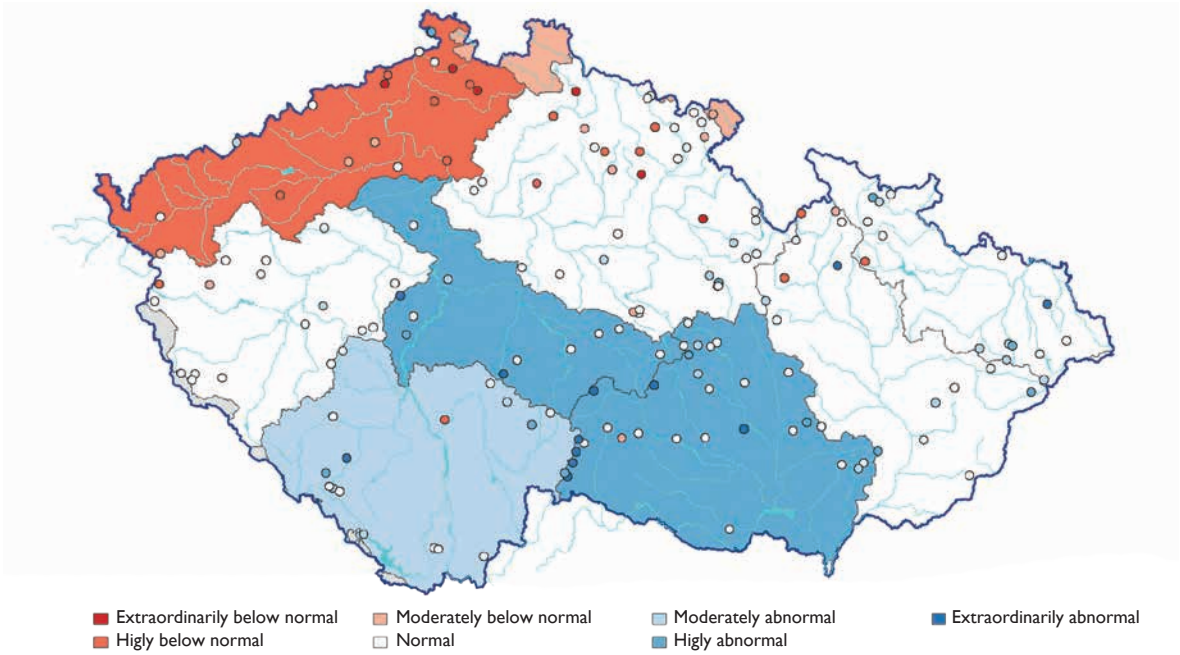
In January 2021, the spring yield in the Czech Republic was generally normal (59% EC_m), but as in the case of shallow aquifers, the situation varied significantly regionally. While in the Berounka and Ohře River Basins, the Lower Elbe and other Elbe tributaries, the yield was extremely below-average (96% and 100% of EC_m, respectively), in most of the rest of the Czech Republic the situation was normal, while in Moravia the spring yield was strongly or extremely above-average (Morava and Váh tributaries – 5% of EC_m) – see Table 1.3.2. In February, the overall yield increased to an annual strongly above-average maximum (13% of EC_m), see Graph 1.3.2. The largest increases occurred in the Lower Vltava (3% of EC_m) and Berounka (48% EC_m) Basins, where yields increased significantly compared to the previous month for 73% and 70% of the springs, respectively. This was followed by a significant decrease by April to an overall slightly below-average yield (75% of EC_m). In May, the

Graph 1.3.2
Average standardized spring yield in the monitoring network of the Czech Republic in 2021 compared to the 1991–2020 long-term average



Source: CHMI
Note: Quantiles of monthly exceedance curves are also given (EC_m).
The vertical axis represents the standard deviation.

Figure 1.3.2
Spring yield in 2021, compared to the 1991–2020 period



Source: CHMI

yield increased in the whole of the Czech Republic, most notably in the Lower Vltava Basin (2% of EC_m), where it was extremely above-average, while in the basins of the Ohře, Lower Elbe and other Elbe tributaries the yield remained strongly below-average despite the increase (92% of EC_m).

After a slight decrease in June, there was a significant increase in July across the whole country, especially in western Bohemia, in the Ohře and Lower Elbe River Basins and other Elbe tributaries, where there was an increase from extremely below-average (96% of EC_m) to normal (69% of EC_m) and in the Berounka River Basin from slightly above-average (25% of EC_m) to strongly above-average (8% of EC_m). By contrast, the yields in the most of Moravia were mostly stagnant and average in July, with the exception of strongly above-average yield in the Dyje Basin (11% of EC_m). From August to November, yields in the Czech Republic generally decreased slightly until they reached the normal annual minimum (74% of EC_m). In the last quarter, normal yields prevailed in most of the territory, but in the basins of the Ohře, Lower Elbe and other Elbe tributaries, as in most of the year, yields were strongly or extremely subnormal. In December, despite a slight increase in yield, the overall situation deteriorated to slightly below-average (77% of EC_m), as shown in Table 1.3.2.

Table 1.3.2
Probability of exceedance of spring yield in 2021 in river basins in % of EC_m (monthly exceedance curve for the 1991–2020 period)

River Basin	Water yield values in % of EC_m											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Upper and Middle Elbe	73	40	60	81	55	48	33	42	51	60	73	84
Upper Vltava	64	6	31	76	20	22	7	20	21	37	70	55
Berounka	96	48	84	90	50	25	8	19	36	54	63	74
Lower Vltava	64	3	24	64	2	12	4	13	21	29	36	41
Ohře and Lower Elbe	100	96	93	95	92	96	69	86	89	97	98	93
Upper Oder	10	6	16	22	9	33	70	53	17	53	77	78
Lusatian Neisse	89	77	83	92	86	71	52	46	36	50	60	72
Morava	5	2	16	51	20	38	43	43	47	62	72	82
Dyje	10	1	7	50	16	12	11	11	19	31	41	44
Czech Republic	**59**	**13**	**42**	**75**	**25**	**29**	**19**	**28**	**36**	**59**	**74**	**77**

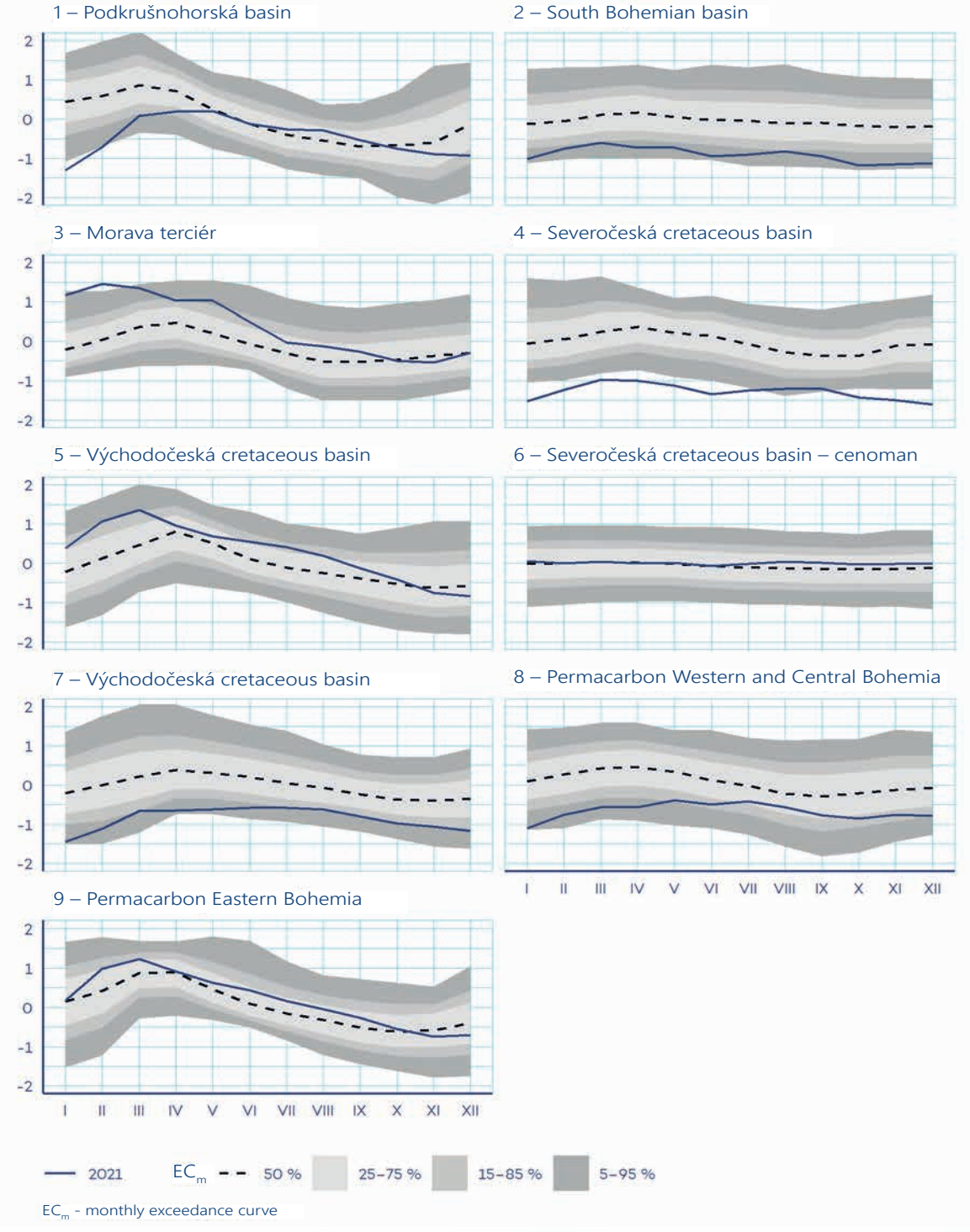
Source: CHMI
Note: The red colour scale corresponds to the classification of moderate (75–85%), severe (85–95%) and extreme (95–100%) subnormal yield. Blue indicates moderate (15–25%), severe (5–15%) and extremely (0–5%) above normal yields.

The Nechranice Dam (source: Ohře River Board, s.e.)

Deep aquifers

Levels of deep aquifers in some sections of the HGR were strongly or extremely below-average throughout the entire year. The most drought-affected area was the North Bohemian Cretaceous (HGR group 4, Figure 1.3.3), where extremely below-average levels persisted for almost the entire year (Graph 1.3.3). In parts of the Central and Western Bohemia Permo-carboniferous (8B) and South Bohemian basins (2A, 2D), a strongly or extremely below-average values persisted throughout the year. In the first quarter, the condition of a part of the basins in the zone below the Krušné Mountains (1A) was strongly or extremely below-average, while the level was normal for the rest of the year. The East Bohemian Cretaceous Cenomanian (7A) was also mostly strongly below-average throughout the year. Conversely, in parts of the East Bohemian Chalk (5A) and the East Bohemian Permo-carboniferous (9B), the level was slightly or strongly above-average until August, after

Graph 1.3.3
Average standardised deep aquifer levels in the monitoring network in groups of hydrogeological regions in 2021 compared to the 1991–2020 long-term average



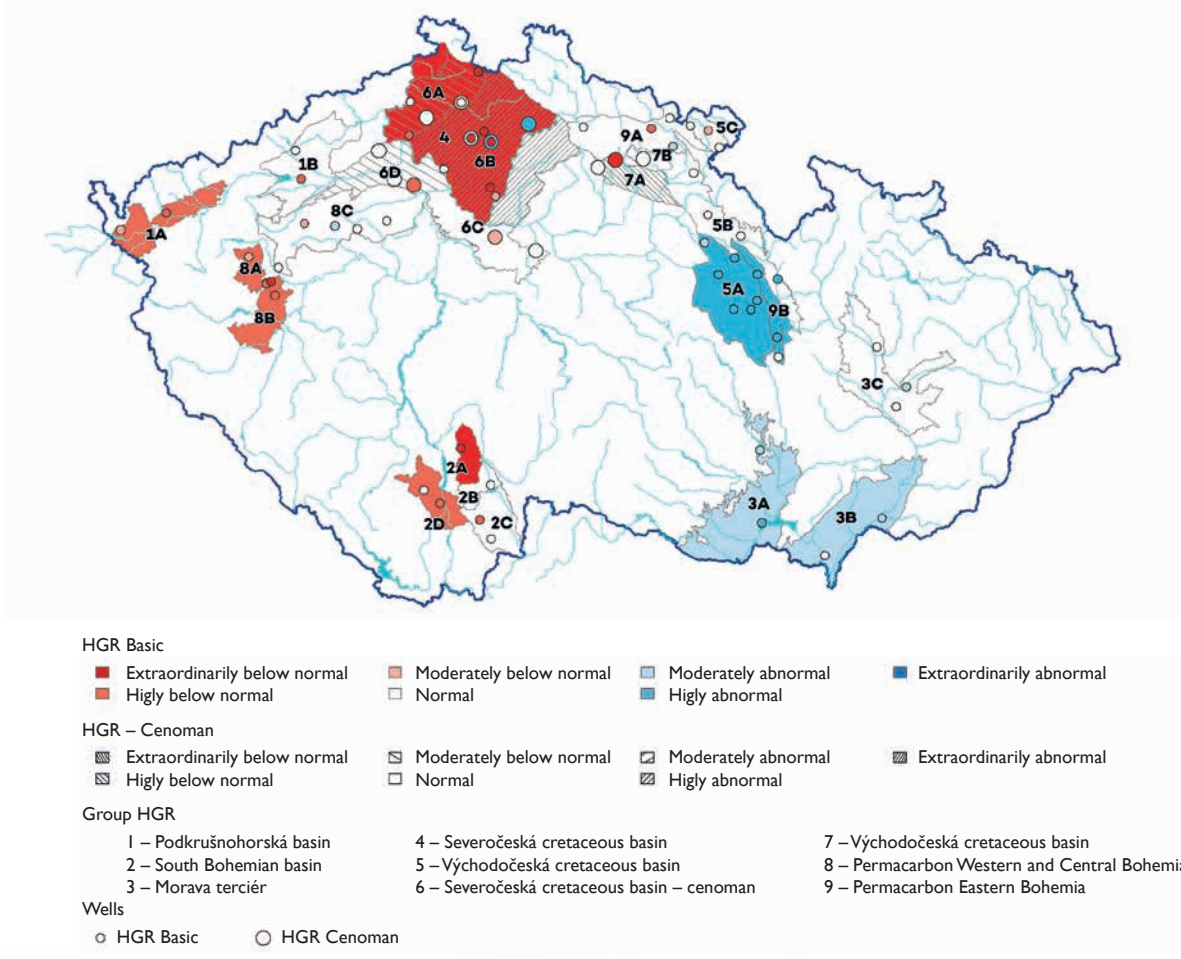
Source: CHMI

which it rapidly declined to a mostly normal state lasting until the end of the year. Levels in the Moravian Tertiary (3A, 3B, 3C) were also moderately to extremely above-average in the first quarter, but declined rapidly during the spring and were mostly average for the remainder of the year. Levels were mostly average throughout the year in parts of the Central and Western Bohemian Permo-carboniferous (8C), basins in the zone below the Krušné Mountains (1B), East Bohemian Cretaceous (5B, 5C) and East Bohemian Permo-carboniferous (9A). In part of the North Bohemian Cretaceous Cenomanian (6B), which has a distinctly perennial regime, levels were strongly above-average throughout the year. In the other parts of the North Bohemian Cretaceous Cenomanian (6A, 6C, 6D) the water level was normal or slightly below-average throughout the year.

Considering the usual annual water level regime, the condition of deep aquifers was worst in January, when 39% of them were severely or extremely below-average, 25% were within the normal range, and 20% of the aquifers were severely or extremely above-average. The best condition of the deep aquifers was in August, when 16% of them were severely or extremely below-average, 45% of them were within normal limits and 15% of them were severely or extremely above-average. Compared to the previous year, levels of 36% of the aquifers rose (some of them significantly), while only levels of 3% of the aquifers decreased (some of them significantly).

The Svitava Stream (source: Ohře River Board, s.e.)

Figure 1.3.3
Groundwater levels in deep aquifers in 2021, compared to the 1991–2020 period



Source: CHMI

Vladimir Wrangel (source: www.shutterstock.com)

2. HYDROLOGICAL EXTREMES

2.1 Flood situations

In terms of flood situations, the most abundant period in 2021 was from May to early September, when flood activity degrees were frequently exceeded on different watercourses due to repeated rain and storms with showers or torrential rainfall. River levels also rose during the winter period, with several flood situations occurring as a result of snowmelt and precipitation in January, February and December. The first half of the spring and all of the autumn months of 2021, with the exception of early September, were calm from a flood perspective, with no runoff events exceeding any of the flood degrees.

In the winter period of 2021 (January–April and November–December), the first significant rises in watercourse levels reaching FAD were recorded in the third decade of January. In response to warming, precipitation and subsequent snowmelt, the levels of most watercourses in the Czech Republic rose. On 23 January, the level of the Bystřička River at the Bystřička above the reservoir profile ($Q_{<2}$) and the Vsetínská Bečva River in Velké Karlovice ($Q_{<2}$) rose above the level of FAD I. On 24 January, the level of the Tichá Orlice River in Čermná nad Orlicí ($Q_{<2}$) rose. Increased flows on smaller watercourses remained until the end of January, due to snowmelt and precipitation, when the level of the Bystřička River was higher than on 30 and 31 January. FAD I was exceeded on the left-side tributaries of the Middle Elbe (the Novohradka, Doubrava), on the Skalice in Varvažov, in the Sázava Basin (the Šlapanka), in the Berounka Basin (the Holoubkovský Stream, Klabava, Berounka in Zbečno), on the Botič in Jesenice–Kocanda, in the Upper Morava (the Jevíčka) and Dyje Basins (the Želetavka, Svratka, Dyje in Podhradí), all at $Q_{<2}$.

Increased flows due to melting snow and rainfall continued on watercourses in the first week of February. Snow cover melted not only in low and medium altitudes but also in mountain areas. Watercourse levels rose in most of the river basins, especially in Bohemia. In Moravia, the levels rose in the Dyje and Upper and Middle Morava Basins. The level of the Otava River in Rejštejn ($Q_{<2}$) peaked above FAD II on 3 February. FAD II was exceeded on 4 February of the Černovický Stream in Tučapy in the Lužnice River Basin, the Střela in Plasy ($Q_{<2}$), the Teplá at the profiles of Teplička and Březová HS (at Q_5), the Ohře at the profile of Skalka HS ($Q_{<2}$), the Moravská Sázava in Lupěné ($Q_{<2}$) and the Moravská Dyje in Janov ($Q_{<2}$). One day later, on 5 February, FAD II was exceeded by the Tichá Orlice in Čermná nad Orlicí ($Q_{<2}$) and on the Morava in Moravičany ($Q_{<2}$). At a number of other profiles, FAD I was exceeded in 3–7 February, with water levels mostly at $Q_{<2}$, with only the Divoká Orlice in Orlické Záhoří, the Hamerský Stream in Planá and in Oldřiš and the Třebůvka in Mezihoří reaching two-year highs. In the second week of February, the levels of most watercourses were on the decline due to cooling and cessation of precipitation, only FAD II being exceeded on the Velká Stanovnice at the Karolinka below the reservoir profile due to an increased outflow from the reservoir.

From the second decade of February, snow in the Czech Republic melted without reaching a FAD until the beginning of the third decade of April. The combination of rainfall and snowmelt, especially in the Beskids, led to the greatest rises in water levels in the Oder and Bečva Basins. On 20–22 April, FAD I was reached on the Ropičanka River at the Řeka profile and on the Bystřička River at the Bystřička profile above the reservoir, the levels peaked at $Q_{<2}$.

Figure 2.1.1
Highest flood activity levels reached in winter in 2021

Source: CHMI

The Janov (source: Ohře River Board, s.e.)

The following winter season of 2021/22 brought rises in water levels sporadically even above FAD levels until the end of 2021. The combination of significant warming, rainfall and snowmelt from mountain and foothill areas resulted in rising watercourse levels throughout the country. The most significant rises were recorded in the Upper Jizera Basin, where FAD II was exceeded on the Jizera River in Jablonec nad Jizerou and FAD I in Železný Brod and on the Mumlava River at the Janov–Harrachov profile (all at $Q_{<2}$) on 31 December. The levels of the watercourses draining the Beskid Mountains, namely the Vsetínská Bečva in Velké Karlovice ($Q_{<2}$) and the Velká Stanovnice in Karolinka below the reservoir ($Q_{<2}$), also rose above FAD I on rare occasions, but the outflow was affected by manipulation at the reservoir.

The summer season of 2021 (May–October) was very rich in flood episodes until September. On 1 and 2 May, it rained intensively throughout the country, in the Šumava, Bohemian Forest, Berounka and Middle Elbe Basins, the maximum rainfall was 25–40 mm/24 hours. The watercourses in the Berounka Basin, the tributaries of the Vltava in the capital city of Prague and the watercourses draining the border mountain areas in north Bohemia, with snow reserves at the highest altitudes, reacted most strongly to rising levels. On 2 May, the Úpa in Horní Staré Město ($Q_{<2}$), the Jizera in Jablonec nad Jizerou and in Železný Brod, the Smědá in Višňová, the Řasnice in Frýdlant, the Ploučnice in Stráž pod Ralskem and the Stěnava in Meziměstí (all at $Q_{<2}$) exceeded FAD I. In the Vltava River Basin, FAD I was exceeded on the Červený Stream at the Hořovice profile (Q_2) and on the Botič in Jesenice–Kocanda (at $Q_{<2}$) as a result of heavy rainfall.

FADs were reached again after very abundant precipitations (permanent in Bohemia, whereas rather convective in Moravia and Silesia) in 11–15 May. On 13 May, after heavy storms with heavy rainfall, FAD III was exceeded on the Hvozdnice in Jakartovice in the Opava Basin lasting 6 hours and the level of the Hvozdnice peaked at Q_{100}. At some other profiles in the Oder Basin, FAD I was exceeded due to storms, mostly at $Q_{<2}$. The Černá Opava in Mnichov peaked at Q_2. FAD III was also exceeded on 14 May for 8 hours after sustained rainfall by the Úslava at the Prádlo profile, which peaked at $Q_{<2}$. In the Vltava River Basin, FAD II was exceeded at several profiles in the Berounka River Basin (the Úslava, Klabava, Berounka in Zbečno, Červený Stream), on the Smutná, on the Kocába, in the Sázava River Basin (the Blanice and Chotýšanka) and on the Botič. On the Kocába in Štěchovice and on the Úslava in Koterov two-year highs were reached, levels of other watercourses peaked at $Q_{<2}$. At numerous other profiles on the Lužnice, Sázava, Berounka and Lower Vltava Basins, FAD I was exceeded. Also, watercourse levels in the Elbe Basin exceeded FAD I (the Upper Elbe, Metuje, Loučná, Doubrava, Lower Elbe in Děčín), mostly at $Q_{<2}$. The Loučná in Litomyšl peaked at Q_2.

Significant rainfall leading to FAD exceedances also occurred in May in the east of the country on 16 and 17 May. In the Oder River Basin, on 17 and 18 May, watercourse levels exceeded FAD I (most frequently at $Q_{<2}$) on the Stružka in Rychvald, the Opava in Děhylov, the Olše in Český Těšín and Dětmarovice and the Ropičanka in the River profile. FAD I was also reached in the Bečva, Dřevnice and Olšava River Basins. On the Velká Stanovnice in the Karolinka below reservoir profile, FAD II was exceeded ($Q_{<2}$).

Heavy thunderstorms with intense rainfall of around 50 mm/24 hours occurred almost every day in the third decade of June, most significantly from 21 to 25 June and then at the end of the month. Some areas of the Czech Republic were also repeatedly affected by storm activity, which was reflected by repeated sharp rises to FAD levels. The southern half of the country was particularly affected. On 21 June, FAD I was reached on the Lučina, Litava and Trkmanka (all up to $Q_{<2}$). Between 22 and 23 June, FAD II was exceeded on the Křemelná in Stodůlky at $Q_{<2}$ and FAD I was exceeded on the Otava, Botič,

Bystřička, Haná and Želetávka (all at $Q_{<2}$). The most significant rise above FAD III was recorded on the night of 24 June after a very strong storm on the Volyňka in Sudslavice, when the level peaked at Q_{10}, and on the Botič in Prague–Nusle (Q_5). On the same night (24 June), after storms, FAD II was also exceeded on the Otava in Sušice and Rejštejn (at $Q_{<2}$), the Volyňka in Němětice (Q_2), the Kocába in Štěchovice (Q_2), the Rokytka in Prague–Vysočany (Q_5), the Botič in Jesenice–Kocanda ($Q_{<2}$) and the Jevišovka at the Jevišovice HS profile ($Q_{<2}$). FAD I was reached on the Loučná, Vydra (Q_2), Křemelná, Teplá Vltava (Q_2), Litávka (Q_2) and Jevišovka. The levels rose again from 24 to 26 June and FAD II was exceeded on the Stonávka in Hradiště (Q_2), Haná in Vyškov ($Q_{<2}$), Lomnice in Dolní Ostrovec ($Q_{<2}$) and again on the Kocába in Štěchovice (Q_2). In addition, FAD I was exceeded numerous times on watercourses in the Upper Vltava, Lomnice, Berounka, Olše, Haná and Litava River Basins. On the Červený Stream in Hořovice and on the Lučina in Horní Domaslavice, the levels peaked above FAD I at Q_5. Other strong storms occurred at the end of the month. The Klabava in Nová Huť rose to FAD II on 29 June and the Úslava in Prádlo on 30 June (both at $Q_{<2}$). FAD I was exceeded at several other profiles in the Berounka and Botič River Basins (all below $Q_{<2}$).

Sharp rises in levels caused by strong storms or a combination of storms and sustained rainfall continued in July. At the beginning of the month, a flood episode from the end of June reverberated, when FAD I was exceeded on the Lusatian Neisse in Liberec ($Q_{<2}$) on 1 July and on the Holoubkovský Stream at the Rokycany–Dvořákova profile. More pronounced rises in watercourse levels exceeding higher FADs occurred in July at the turn of the first and second decade, when on 8 and 9 July an average of 20 to 50 mm fell in a wide belt from south-west Bohemia to north-west Moravia, with peaks of over 60 mm. Thunderstorms occurred locally on other days as well. Exceedance of FAD III occurred on 9 July on the Novohradka at the Luže profile (at Q_{10}, lasting 6 hours) and on the Úslava in Koterov (Q_2, lasting 13 hours). Exceeding FAD II and peaking from 8 to 12 July were the levels of the Tichá Orlice in Čermná nad Orlicí ($Q_{<2}$), Loučná in Dašice (Q_2), Novohradka in Úhřetice (Q_2), Doubrava in Pařížov (Q_2), Milevský Stream in Milevsko ($Q_{<2}$), Úslava in Prádlo ($Q_{<2}$), Klabava in Hrádek (Q_2) and Nová Huť ($Q_{<2}$), Berounka in Zbečno ($Q_{<2}$), Botič in Nusle (Q_5) and Jevíčka in Chornice (Q_2). At a number of profiles on the tributaries of the Middle Elbe and Berounka, on the Smutná and Upper Sázava, and on the Třebůvka and Svratka, FAD I was exceeded with values of $Q_{<2}$ to Q_2.

The period from 12 to 17 July was also significantly above-average in terms of precipitation, when heavy storms, sometimes combined with rain, brought rainfalls almost every day ranging from 30 to 60 mm. On 17 July, totals in northern Bohemia and also in the Jeseníky Mountains reached highest values of 100 mm/24 hours, it also rained heavily in the Šumava. On the night of 14–15 July, FAD III was exceeded on the Lusatian Neisse in Proseč nad Nisou (at Q_5), on the Úslava in Prádlo ($Q_{<2}$) and on the Brzina at the Hrachov profile, where extreme danger was even briefly reached at Q_{20}, the watercourse level rose due to accumulation of floating material. Furthermore, FAD II was reached on the Milevský Stream in Milevsko, on the Botič in Jesenice–Kocanda and Průhonice and on the Lusatian Neisse in Liberec (all at Q_2). At a number of profiles on tributaries of the Middle Elbe (the Loučná, Doubrava, Cidlina, Bystřice), on the Úslava, Střela, Botič, Rokytka and Lusatian Neisse Basins, FAD I was exceeded in 14–16 July (at $Q_{<2}$ to Q_2).

Still that we are tied, The October 2021, The Křetínka Dam (author: Fafílková Eliška)

The Kadaň (source: Ohře River Basin, s.e.)

Watercourse levels rose again on 17 July and on the night of 18 July due to very strong storms and previous heavy saturation of the ground. The most affected river basins were the Upper Otava, the Berounka, Smědá, Lusatian Neisse, but also some watercourses in Prague and in the Central Bohemian Region (the Botič, Skalice, Litavka). FAD on the Smědá in Višňová ($Q_{<2}$), on the Otava in Rejštejn (Q_2) and in Sušice (Q_2), on the Úslava in Koterov (Q_2), on the Svitávka in Zákupy (Q_{20}) and on the Bělá in Mikulovice and Jeseník (at Q_5). At many profiles in the Lusatian Neisse, Horní Úpa and Upper Jizera, in the Otava, Upper Vltava, Skalice, Berounka, Lower Vltava and Lower Elbe tributaries and in the Upper Morava Basin, the FAD I and II were exceeded, with peak flows mostly ranging from $Q_{<2}$ to Q_2, with only 5-year flow rate highs reached on the Skalice in Zadní Poříčí.

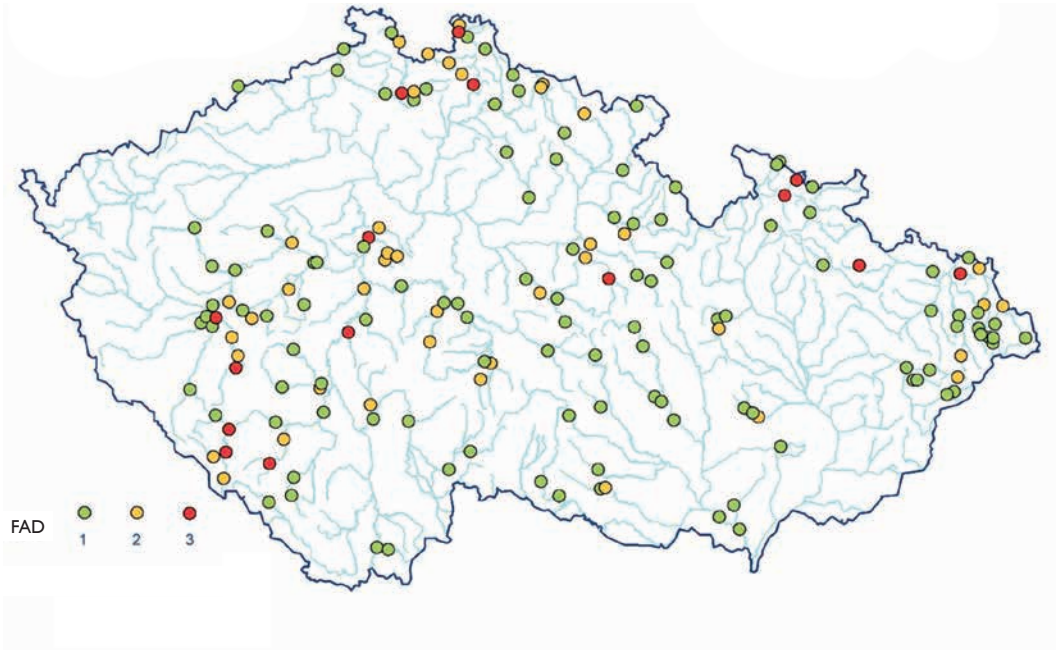
The last large July rises in watercourse levels occurred after significant rainfall, which gradually affected mainly the south and east of Bohemia and Moravia from 25 to 27 July. FAD II was exceeded on the Želivka River in Čakovice (Q_2) and Želiv ($Q_{<2}$) on 27 July. In the period from 26 to 29 July, FAD I was exceeded on the Blanice, on the Želivka in Poříčí, on the Loučka/Bobrůvka and on the Svratka, all at $Q_{<2}$).

Due to continued rainfall and storms, some watercourses were on the rise at the very beginning of August. The Ropičanka, Jihlava and Rakovnický Stream (all at $Q_{<2}$) were above FAD I. In Rakovník, however, water levels were affected by construction works concerning the watercourse bed. Furthermore, mainly the watercourses draining the Beskid Mountains were rising and 40–70 mm of rain fell in 24 hours from 5 to 6 August on the windward side of the Moravian–Silesian Beskid Mountains. Levels of the affected watercourses in the region rose rapidly to FAD levels. On 5 August, FAD III was briefly exceeded at Q_5 on the Stružka River in Rychvald. FAD II was exceeded on the Stonávka in Hradiště. FAD at Q_2 and FAD I was further exceeded on the Lučina (Q_2), Olešná, Ropičanka and Bystřička (at $Q_{<2}$). Further heavy precipitation resulted from storms on 7 and 8 August tin the northern part of the Czech section of the Oder River Basin. In Liberec, the level of the Lusatian Neisse rose above the level of FAD I at $Q_{<2}$.

Other significant rises, occasionally exceeding FAD I and even FAD II, occurred on 24 August after sustained and intense rainfall (up to 112 mm/24 hours) in the Upper Elbe and Upper Jizera Basins. The Elbe exceeded FAD II in Špindlerův Mlýn (at $Q_{<2}$) and at the Labská profile (at Q_2). The Úpa exceeded FAD I at the Horní Staré Město profile ($Q_{<2}$) and briefly also the Mumlava at the Janov–Harrachov profile ($Q_{<2}$).

The last flood episode in the summer of 2021 occurred in late August and early September. It was caused by persistent rain on 31 August and 1 September, which was particularly heavy in the northern and north-eastern frontier mountains (the Jizera Mountains, Krkonoše, Jeseníky and Beskids). Heavily saturated mountain catchments combined with significant rainfall led to rapid rises in watercourse levels, at some profiles even above FAD levels. On the Smědá River at the Višňová profile, FAD III was briefly exceeded on 31 August at $Q_{<2}$. In the Krkonoše Mountains, the Upper Elbe at the profiles of Špindlerův Mlýn and Labská (at $Q_{<2}$) and the Úpa in Horní Staré Město (Q_2) rose to FAD II. The Rožnovská Bečva at the Horní Bečva profile and the Čeladenka in Čeladná and the Olše in Český Těšín and Dětmarovice (all at Q_2) also exceeded FAD II on 1 September. FAD I was reached at a number of other profiles in the Jizera, Smědá, Ostravice, Olše, Oder and Bečva Basins.

Figure 2.1.2
Highest flood activity degrees reached in summer 2021



Source: CHMI

2.2 Remedying flood damage

The Ministry of Agriculture administered two programmes aimed at flood damage repair. Program 129 320 "Support for Remedying Flood Damage to the Infrastructure of Water Supply and Sewerage Systems II", and Program 129 370 "Remedying Flood Damage to State-owned Water Management Assets III".

Programme 129 320 is ready to respond quickly to consequences of damage or even destruction of water and sewerage infrastructure as a result of a natural event. In 2021, no support was provided for remedying flood damage to water supply and sewerage infrastructure. Program 129 370 was initiated in 2021 to remedy flood damage to watercourse systems, including associated facilities, waterworks, and state-owned riparian vegetation damaged by extreme stresses during flood events and implementation of purposeful stabilization structures and modifications to structures to ensure continued functionality of watercourse channels and associated facilities at failure points.

In 2021, the Ministry of the Environment conducted the final evaluation of the 115 270 "MoE Remedying Damage Caused by Natural Disasters" program.

The Ministry of the Environment issued the final evaluation of the project: Dolní Věstonice, rehabilitation of slopes necessary for opening of the road III/42117, which was part of the subprogramme 115 273 "Remedying Damage Caused by Natural Disasters in 2014". The sub-programme was created in response to the 2014 landslides in the South Moravia Region. Based on the completion of all actions and sub-programmes, the MoE prepared a final evaluation of the entire programme 115 270 "MoE Remedying Damage Caused by Natural Disasters" at the end of 2021.

More detailed information, including financial allocation, is provided in Chapter 9 Financial support for water management.

2.3 Drought situation

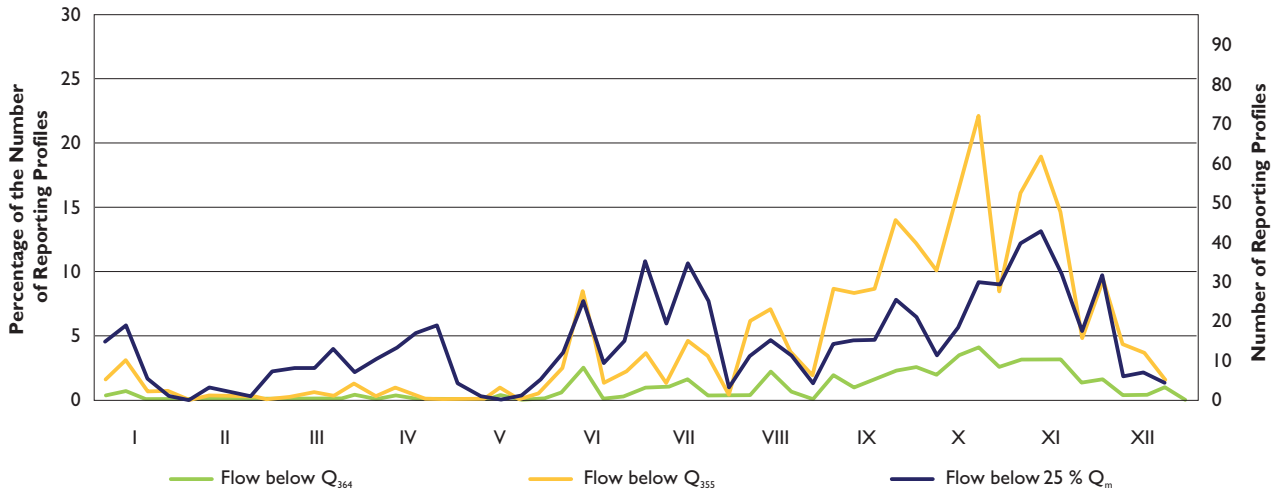
The occurrence of drought in surface waters is assessed according to the following characteristics: the number of profiles with discharge below 25% of the monthly average (<25% Q_m) and the number of profiles with discharge below Q_{355d} (i.e., discharge that was been reached or exceeded at a given profile 355 days per year on average and the failure to reach such discharge is indicative of hydrological drought) or Q_{364d} (a flow that has been reached or exceeded at a given profile throughout the entire year).

Compared to previous years, 2021 was not an exceptional year in terms of hydrological drought. While there were several months during the year when monthly flow values often remained below-average, compared to previous years, exceedances of the 50% Q_m threshold was rather rare. In April, the flows in the Vltava, Elbe and Dyje Basins were just below this limit, while in July and November it was the case of the flows in the Oder and Morava Basins. The percentage of profiles with water levels at the hydrological drought limit was also very low. From the beginning of the year until May, they were almost inexistent, but their number increased slightly in the summer months, and the maximum values were reached in October and November (Figure 2.3.1).

The first five months of 2021 continued the trend from the end of the previous year. Profiles indicating hydrological drought (Q_{355d} and Q_{364d}) were almost inexistent and the share of profiles with flows below 25% of Q_m was mostly below 5%. The latter threshold was exceeded only exceptionally in the first decade of January and at the end of April.

Profiles with discharge below Q_{355d} increased during the summer months, with the highest number, almost 9%, recorded in the second decade of June. In the Lower Elbe and Ohře Basins, almost a fifth of the profiles were below Q_{364d}.

Figure 2.3.1
Changes in mean discharge at monitored profiles in the Czech Republic in 2021



Source: CHMI

This was followed by a period when the proportion of profiles with discharge below Q_{355d} was mostly below 5%, only increasing to 7% in the second decade of August. Again, most of these were in the Lower Elbe and Ohře Basins (almost 17% of the profiles, with 8% below Q_{364d}). The proportion of profiles with flows below 25% of Q_m fluctuated mostly between 3% and 8% in the summer months, but exceeded 11% in July. The proportion of such low discharge was particularly high in the Oder Basin (whereas almost two thirds of the profiles had flows below 25% Q_m in the first decade of July).

In the autumn period, the proportion of profiles with flows below the hydrological drought level (Q_{355d}) was mostly between 10% and 20%, with 1% to 4% of profiles below Q_{364d}. In September, most profiles with flows below Q_{355d} were in the Morava Basin (about one third at the end of the month). In the context of the whole year, the highest proportion of profiles with indicated hydrological drought Q_{355d} in the last week of October was 23%, with 4% below $Q_{364d.}$ The highest number was in the Morava (51%, with 14% below Q_{364d}) and Oder (43%, with 5% below Q_{364d}) River Basins. In the other river basins, the proportion of profiles with flows below Q_{355d} was approximately between 10% and 20% at the end of October. Also, a relatively large number of profiles with flows below Q_{355d} were indicated in November, again with the highest number in the second decade in the Morava (39%, with 6% below Q_{364d}) and Oder (32%, with 5% below Q_{364d}) River Basins. The proportion of profiles with flows below a quarter of the monthly average remained at 13% during that period, which was a maximum in the context of the whole year. Such low discharge was recorded most frequently in the Morava (33% of profiles) and Oder (25% of profiles) River Basins.

In early December, the share of profiles with flow rates below the hydrological drought of Q_{355d} level was around 10%, as was the share of profiles with flow rates below a quarter of the monthly average. However, the share decreased in the second decade and by the end of the month, due to melting and heavy rainfall, even in the highest mountain areas, there was hardly any discharge below the hydrological drought level of Q_{355d}, or below 25% of Q_m on the monitored watercourses.

The Dry Retention Tank when capturing torrential rainfall, Mysločovice (source: State Land Office)

2.4 Interdepartmental commission WATER-DROUGHTO

Due to the Covid-19 pandemic, no meeting of the Interdepartmental WATER-DROUGHT Commission was held in 2021. The relevant ministries monitored the status of implementation of the individual measures under their responsibility. With respect to the scope of responsibility for 26 measures out of the total 42 included in the Concept, a traditional "position report" was prepared by the Ministry of Agriculture. The Position Report for 2021 was approved by the Management Meeting of the Ministry of Agriculture and will be used to compile the final information for the members of the Government on the implementation of the Concept under Government Resolution No. 528/2017. Regular annual assessment was also carried out by the Ministry of Industry and Trade and the Ministry of Regional Development. The Ministry of the Environment focused on preparing a summary report for the entire period of implementation of the Concept in 2022.

The evaluation of the financial support provided by the Ministry of Agriculture in 2021 shows that the annual volume of funds paid amounted to CZK 13.9 billion, which practically reaches the average level of support in the past 3 years, which amounted to CZK 14.2 billion. Disbursement for rehabilitation and construction of ponds and small water reservoirs (for municipalities) has been particularly successful, with 2,138 projects implemented since 2016 with support of CZK 7.4 billion. For development of water and sewerage infrastructure, CZK 1.6 billion was provided for implementation of 188 projects. Significant was the implementation of land development plans, which include plans for common facilities in which enhancement of water in the landscape as well as reduction of the rate of surface runoff is achieved. In 2021, the support amounted to CZK 3.4 billion.

In accordance with the Concept of Protection Against Drought Impacts in the Czech Republic, the Ministry of Industry and Trade, in cooperation with the Ministry of the Environment and the Technology Agency of the Czech Republic, has prepared the Methodology for the Evaluation of Water Use of Industrial Enterprises (the Water Audit), which will be followed by support programmes for implementation of measures aimed at optimising and reducing water consumption in enterprises, announced under the National Recovery Plan and the Operational Programme Technology and Applications for Competitiveness.

The total allocated funds under the subsidy programmes of the Ministry of Industry and Trade adjusted also for the purposes of limiting the consequences of drought and water shortage in 2021 amounted to CZK 22.6 billion for implementation of the EXPANZE - NRB programme (loans and guarantees) and for programmes (Expansion, Real Estate, Innovation Vouchers) from the Operational Programme Enterprise and Innovation for Competitiveness 2014–2020 (OP EIC 2014–2020). Measures supported by the Ministry of Industry and Trade are also included in the new programme period, the upcoming Operational Programme Technologies and Applications for Competitiveness 2021–2027 (OP TAC 2021–2027).

The Ministry of Regional Development continued the implementation of the national programme Support for municipal spatial planning activities. Landscape studies supported by the Integrated Regional Operational Programme (IROP) were also carried out and 48 landscape studies were completed in 2021 under the specific objective of IROP 2014–2020.

More information on the drought, the WATER-DROUGHT Commission and the Concept of Protection Against Consequences of Drought in the Czech Republic can be found on the website www.suchovkrajine.cz.

Anti-flood measures in the village of Fryčovice in the district Frýdek-Místek (source: Forest of the Czech Republik, s.e.)

josefkubes (source: www.shutterstock.com)

3. QUALITY OF SURFACE WATERS AND GROUNDWATERS

3.1 Surface water quality

Current surface water quality under CSN 75 7221 compared to the 1991–1992 biennium

The map of surface water quality on selected watercourses in the Czech Republic was first prepared for the 1991–1992 biennium under CSN 75 7221 Water Quality – Classification of Surface Water Quality. From this biennium onwards, the same maps have been produced annually so that they can always be compared with the current water quality status. With regard to the extent of the indicators monitored in the 1990s, only a basic classification could be used for this comparison. As of 1 December 2017, an amendment to CSN 75 7221 standard Water Quality – Classification of Surface Water Quality entered into force, having replaced the previous standard (CSN 75 7221 Water Quality – Classification of Surface Water Quality), which had been in force for the previous 19 years.

The subject of the amendment was to take into consideration the requirements concerning the current situation in surface water protection, both in terms of pollution indicators as well as the degree of acceptable pollution. The monitored indicators and limit values of the quality classes were reviewed. As a result, a new map of the quality of surface waters was produced for the 1991–1992 biennium (Figure 3.1.1) in accordance with the amended CSN 75 7221 for the sake of objective comparison.

The indicators used to assess the quality of surface waters were COD_{Cr}, BOD_5, $N\text{-}NH_4$, $N\text{-}NO_3$ and P_{total}. Figure 3.1.2 shows that water quality has improved over the past 25 years, but there are still watercourse sections with surface water quality classified in Class V. Most watercourses fall into Class III – polluted water. The number of watercourse sections in Classes I and II keeps growing annually.

For the preparation of the abovementioned map of water quality in the watercourses of the Czech Republic for the period 2020–2021, the resulting assessment from selected profiles of the water quality monitoring network in watercourses provided by the Czech Hydrological Monitoring Institute (from primary data sent by the individual River Boards, s.e.) was used. The classification of the monitored profiles in terms of contamination according to the amended CSN 75 7221 is as follows:

Class I unpolluted water – surface water status that was not significantly affected by human activity, with water quality indicators do not exceed values corresponding to the common natural background of the respective watercourse,

The Seč Dam (source: Elbe River Board, s.e.)

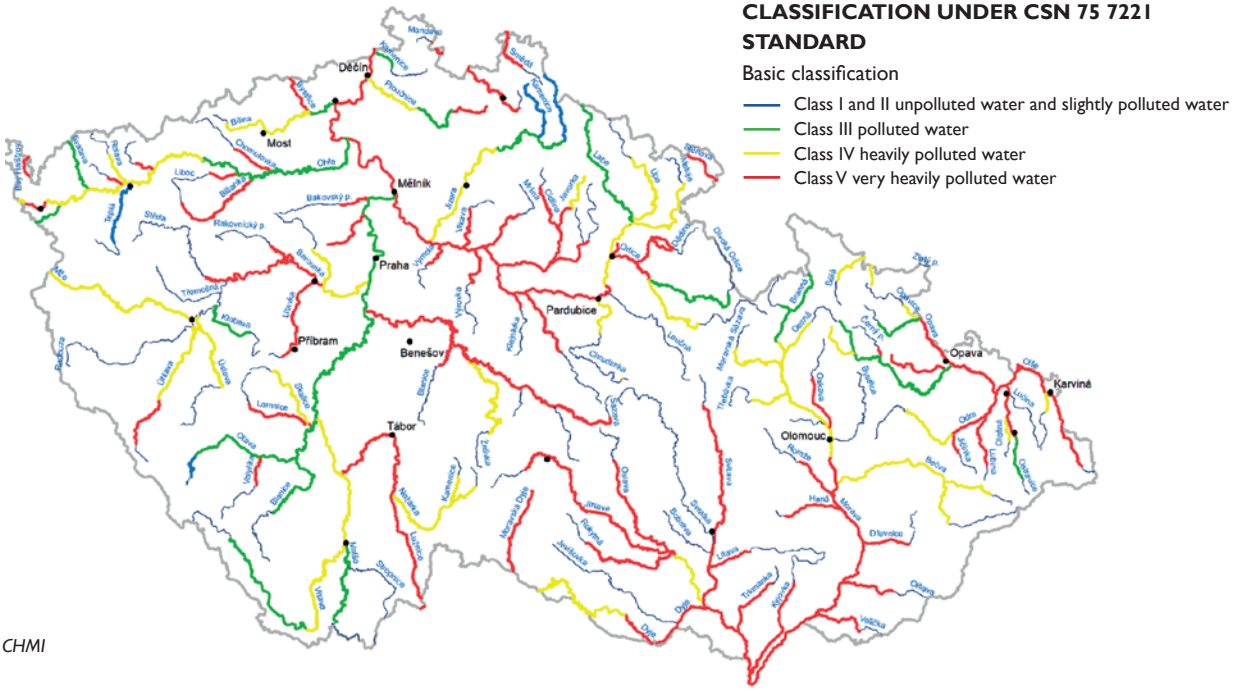
Class II slightly polluted water – surface water status that was affected by human activity to an extent that water quality indicators attain values allowing for the existence of a rich, balanced and sustainable ecosystem,

Class III polluted water – surface water status that was affected by human activity to an extent that water quality indicators attain values that may not be conducive to conditions allowing for the existence of a rich, balanced and sustainable ecosystem,

Class IV heavily polluted water – surface water status that was affected by human activity to an extent that water quality indicators attain values that are conductive to conditions allowing for the existence of only an unbalanced ecosystem,

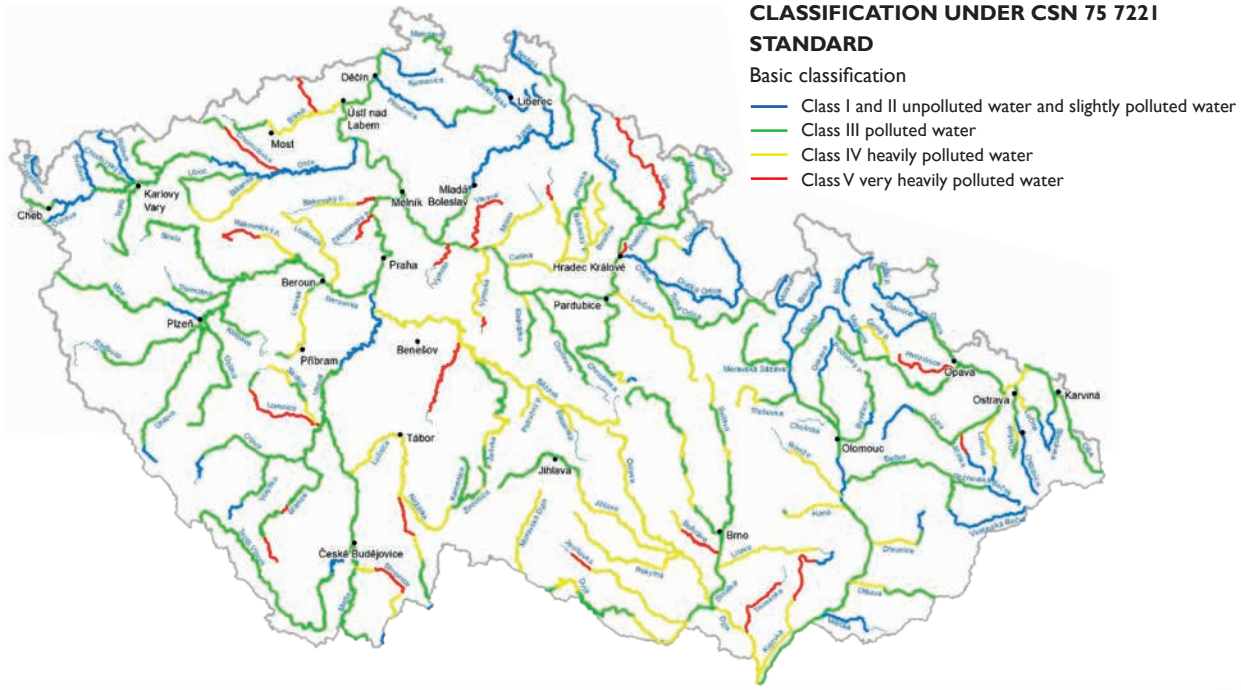
Class V very heavily polluted water – surface water status that was affected by human activity to an extent that water quality indicators attain values that are conductive to conditions allowing for the existence of only a heavily unbalanced ecosystem.

Figure 3.1.1
Quality of surface waters in the Czech Republic in 1991–1992



Source: CHMI

Figure 3.1.2
Quality of surface waters in the Czech Republic in 2020–2021



Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by the Czech National Water Management Institute and the CHMI

Radioactivity

In surface waters, radiological indicators are monitored on a long-term basis at selected profiles of the monitoring network. These profiles are situated at locations of nuclear facilities and in watercourse stretches affected by the discharge of mine waters and by seepage from refuse dumps at locations where uranium ores were formerly mined or treated.

In surface water of the Vltava River (significant watercourse) at the Vltava/Solenice profile (river km 144) downstream the Temelín Nuclear Power Station wastewater outfall, the annual mean volume activity of tritium in 2021 was 14.9 Bq/l with highest values of 23.5 Bq/l, the annual mean value at the Vltava/Štěchovice profile (river km 82.7) was 13.4 Bq/l with highest values of 17.7 Bq/l, at the Vltava/Prague–Podolí profile (river km 56.2) it was 9.3 Bq/l, with peak value of 13.2 Bq/l and before the outfall to the Elbe River at the Vltava/Zelčín profile (river km 4.5) the annual mean value was 8.3 Bq/l with peak value of 12.4 Bq/l. The values comply with acceptable pollution in surface waters under the environmental quality standard (hereinafter the ‚EQS') as per Government Decree No. 401/2015 Coll., on indicators and values of permissible surface water and wastewater pollution, details of the permit to discharge wastewater into surface water and sewage systems, and sensitive areas, as amended. The total alpha and beta volume activity was also detected in values that completely comply with the acceptable pollution values. No other activation and fission by-products from operation of nuclear power plants were detected. Low-volume activities of Strontium-90 and Cesium-137 were detected: such activities correspond to residual contamination after atmospheric nuclear weapon tests and the Chernobyl nuclear reactor explosion in the last century.

In the vicinity of the uranium ore deposits in Příbram, in surface waters of the Kocába Stream in the profiles Višňová (line km 38.5) and Štěchovice (line km 0.7) and in the Drásovský Stream in the profile Drásov (line km 0.2), elevated values of radiological indicators are repeatedly detected every year. In all three monitored profiles, the water quality falls under Class V – very heavily polluted water (as per CSN 75 7221). The acceptable pollution values as per Government Decree 401/2015 Coll. are exceeded in the indicators "total alpha volume activity" at all the three monitored profiles and "total beta volume activity" is exceeded at the Kocába Višňová profile.

The mean volume activity of tritium below the Dukovany Nuclear Power Station in 2020–2021 at the Jihlava/Mohelno profile was 120.4 Bq/l and at the Jihlava/Ivančice profile below 54.7 Bq/l. The concentrations of tritium comply with values of acceptable pollution in surface waters expressed by annual average or maximum values as per Government Decree No. 401/2015 Coll. Total volume activity beta was also detected in concentrations that comply completely with values of acceptable pollution. Under assessment per CSN 75 7221, the characteristic values of tritium were classified in Class III at both profiles. The values of total beta volume after correction to 40K and total beta volume activity ranked the Jihlava at the Mohelno profile as well as the Ivančice profile in Class II of water quality. When compared with the previous two years, we observe a decline in the mean values.

From the perspective of the annual mean total alpha volume activity and total beta volume activity, EQS values defined by Government Decree No. 401/2015 Coll., were not exceeded at the Stráž pod Ralskem deposit, but compared to previous years there was an increase in the annual mean radioactivity in the A-VCA indicator at the monitored profile. The maximum permissible pollution level according to the abovementioned regulation was exceeded by 0.1 Bq/l in 2021, which was reflected in reclassification to a higher class as per to CSN 75 7221, i.e. Class IV. The monitored parameters at the Ploučnice–Česká Lípa profile were classified in Class I to IV as per CSN 75 7221.

Water quality in water supply and other reservoirs

The water quality in vast majority of reservoirs (except for ponds) is relatively stable, though with considerable year-on-year variability, which depends not only on hydrological conditions of a given year but also on the situation in individual reservoirs.

The year 2021 was about average in terms of the reservoirs in the Vltava River Basin, for the second year in a row. Most of the reservoirs reached their standard volume (Švihov, Klíčava), which is a favourable situation for water quality. Highest precipitation fell in the summer months. This meant a high supply of nutrients (especially phosphorus compounds) during the growing season and a potential boost to the development of summer phytoplankton species, especially cyanobacteria. In elongated channel-like reservoirs (Hracholusky, Orlík, Slapy), the greatest eutrophication tended to occur in the middle and lower parts of the longitudinal profile, and the situation at the dam did not usually deviate from the normally observed levels. At the same time, as summer flow rates increased, the input of humic substances increased and, as a result, deterioration of raw water quality was detected in some reservoirs (the Lučina, Římov, Karhov). Increased flow rates meant an improvement in the oxygen regime near the bottom and resulted also in improved conditions in the watercourses below reservoir dams. In general, water quality is still threatened or affected by eutrophication (i.e. too intense growth of algae and especially cyanobacteria) caused by excessive input of phosphorus compounds from the catchment area, especially from point sources of pollution. In some sub-basins, e.g. the Orlík Reservoir or the Hracholusky Reservoir, the influence of highly eutrophic ponds is also present. Speaking of threats and impacts on water quality from pesticides, the situation in the Švihov Reservoir remains permanently unfavourable. There is also an ongoing burden of pesticide decomposition products. The inflow of erosion material from agricultural areas also has a persistent influence. This phenomenon is not linked to eutrophication, but to sedimentation of the upper parts of the reservoirs. In dry years, reservoirs are more vulnerable to eutrophication processes. In order to maintain at least the current water quality in the future, it is therefore essential to reduce systematically inflow of phosphorus compounds into the water environment. Water treatability is regularly impaired by eutrophication in the Lučina, Žlutice, and to a lesser extent in the Římov and Karhov Reservoirs. The Švihov Reservoir is significantly threatened, however, constant improvement is expected after reconstruction of the Pelhřimov WWTP that collects even much higher share of wastewaters from rainfall/runoff episodes. At other water reservoirs such as Orlík, Lipno, Hracholusky and České Údolí, eutrophication deteriorates their usability for bathing/recreation. Basic studies

Sampler installation, Hořepník (source: Vltava River Board, s.e.)

have been prepared for the Orlík and Hracholusky Reservoirs, including a proposal for measures aimed at improving their condition. For the České Údolí Reservoir, there is a feasibility study for allocation of a part of the reservoir with better water quality for recreational purposes. Particular attention should be paid to the Lipno Reservoir, especially in view of the new plans to build more recreational areas, whose wastewaters will be discharged directly into the reservoir, which, moreover, will be inadequately treated, as the current legislation does not allow to deal with cases in such exposed locations. The Lipno Reservoir is very vulnerable to eutrophication due to its morphology, recurring cyanobacterial blooms and its chemistry (virtual absence of nitrate ions). All the aforementioned aspects enhance recycling of phosphorus in the aquatic ecosystem, where cyanobacterial water blooms then grow intensively. The Lipno Reservoir is a textbook example where excessive pursuit of commercial recreational use threatens the recreational use itself, as the attractiveness of the location fades. In order to reduce eutrophication in the reservoirs, it is necessary to reduce the volume of phosphorus compounds in the water by approximately 50%. These are the conclusions of the studies assessing the situation of the Hracholusky and Orlík Reservoirs, but the same applies to other water supply reservoirs (Švihov, Žlutice, Římov). In order to achieve such an objective, it is necessary to reduce continuous phosphorus emissions from point sources of pollution with the aim of achieving concentrations below 0.5 mg/l of total phosphorus in treated wastewater, to minimise the impact of diluted wastewater from the unified sewerage system and to limit phosphorus outflow from ponds both during the year and at the time of fish harvesting, including phosphorus bound to resuspended sediments. There are 12 separate water bodies (ponds) administered by the Vltava River Board. The situation concerning ponds has long been a neglected issue, even though they are very important links in the hydrographic network, transforming material flows in river basins. Climate change, as observed in the Vltava River Basin, brings along changes in the behaviour of ponds. Ponds currently tend to retain less phosphorus, which means an increased eutrophication risk also for reservoirs further down the catchment area. Therefore, increased attention needs to be paid to pond management.

At the beginning of spring, water reservoirs administered by the Elbe River Board, were sufficiently filled in accordance with the valid manipulation set of rules, with the exception of the Vrchlice Water Reservoir. In the growing season, water inflows to the reservoirs in the Iron Mountains were slightly above-average until November 2021, inflows to other reservoirs were above-average. In terms of temperatures, 2021 was another slightly above-average year, even though the temperature indicators used were significantly lower when compared with the previous years. The long-term trend of increasing water temperature and related fact that the season with elevated temperatures is becoming longer and longer has impact on evaporation from the water level and chemistry in reservoirs. Consequences of eutrophication were intensely evident at the Křižanovice, Vrchlice and Hamry Water Reservoirs. The quality of raw water at the Hamry Reservoir was improved again by biomanipulation through influencing the composition of fish species. Repeated distinct oxygen stratification linked with development of elevated manganese concentrations in deeper oxygen-free layers of the reservoir was detected at the Vrchlice HS. Also in 2021, problems with primary production were noticed (maximum values of chlorophyl of 73 µg/l in May in the inflow section). Regular inspections of microscopic screening in situ in front of the hydraulic structure dam were conducted with the view of sample-taking from wastewater treatment plants in optimal time horizons. Monitoring the movement of xenobiotics (especially pesticides) in the tributaries as well as in the reservoir itself was intense throughout the year. The data obtained shall become important evidence for farming in the area above the water abstraction point. The water quality at the Josefův Důl and

Souš Water Structures was very good in 2021. Concentrations of chlorophyll were below 10 µg/l. From water supply perspective, these two hydraulic structures are almost problem-free sources of raw water. At the Labská Water Reservoir the water quality fluctuated. Transparency dropped from 430 cm in April to 100 cm in August. Additionally, primary production developed heavily in the summer. Water quality in this water reservoir keeps gradually deteriorating. The Seč Reservoir suffered from negative impact of eutrophication throughout the entire growing season. Under monitoring of surface waters intended for bathing conducted by hygienic service authorities in 2021, it was detected in August that water in this water reservoir had deteriorated. Monitoring of water quality intended for bathing was conducted at four other reservoirs in the Elbe River Basin in 2021, not only by the Elber River Board, but also by hygienic authorities. Water suitable for bathing throughout the season was at the Pastviny Reservoir in the Pardubice Region, at the Rozkoš in the Hradec Králové Region and at the Harcov and Mšeno Reservoirs in the Liberec Region. The City of Jablonec nad Nisou installed two sonar devices at the Mšeno Reservoir with the aim of eliminating cyanobacteria development. The townhall of Jablonec nad Nisou initiated and coordinated with the reservoir administration installation of floating vegetation islands in the central part of the reservoir: once fully employed, the islands could reduce the eutrophication risk in the bathing reservoir. Water quality development at this type of reservoirs was similar to previous years. Water at the Bedřichov Reservoir was traditionally of good quality. Water at the Fojtka Water Reservoir was of deteriorated quality (transparency less than 200 cm for the most of the growing season). The worst water quality was in the Pařížov Reservoir (transparency well below 100 cm from June to August and chlorophyll-a concentrations exceeding 200 µg/l in September) and the Les Království reservoir (transparency well below 100 cm from June to August and chlorophyll-a concentrations exceeding 150 µg/l).

Water reservoirs in the Ohře River Basin are located mainly in the upper parts of the watercourses in the Krušné Mountains. Due to the lower population density, there is a lower anthropogenic influence on water quality, especially the input of pollution (nutrients) from municipal wastewater is limited. Pollution of the tributaries of the reservoirs is specified by the natural conditions in their catchment areas, e.g. by the presence of peat bogs. For the indicators TOC, COD_{Cr}, humic substances, iron and manganese, the limits set in Government Decree No. 401/2015 Coll. and the limits for the treatability of raw water to drinking water of category A3 according to Decree No. 428/2001 Coll., as amended, are regularly exceeded. In 2021, the water quality was similar to that in 2020, when, due to the improved hydrological situation, there was no concentration of pollution and, except the Stanovice Reservoir, there was also a decrease in microbiological indicators of pollution in the reservoirs. Due to increased turbidity from bottom sediments linked with an increase in iron and manganese values in the Jirkov Reservoir, the reservoir was de-mudded in September 2021 and the values of these indicators subsequently decreased. The largest reservoirs in the Ohře River Basin not utilised by water supply systems are the Skalka, Jesenice and Nechranice Reservoirs in the Ohře river basin and Mácha Lake and Stráž pod Ralskem in the Ploučnice River Basin. Despite being burdened by phosphorus, pesticides, halogens and other substances (municipal and agricultural pollution), water quality in the reservoirs was generally good in 2021. In July 2021, the water in the Skalka Reservoir was declared unsuitable for bathing by the Regional Hygienic Station due to occurrence of cyanobacteria and water bloom. In addition, fish caught in the Skalka Reservoir have long been banned for consumption due to high mercury concentrations. The situation with reservoirs that were created by flooding after brown coal surface mining is quite specific. Such reservoirs have no natural inflow or outflow. Their management (especially concerning fish management) is strictly regulated and their water quality is thus very high. They exhibit indicators of natural pollution. Medard Lake contains manganese and iron, Barbora Lake contains phosphorus and arsenic, while halogens are literally omnipresent in Milada Lake.

The summer of 2021 was cold and wet in the Morava River Basin, whereas the autumn months were very dry, when some watercourses dried up unprecedently. However, the hydrometeorological situation for phytoplankton development in reservoirs intended for water supply systems and recreational reservoirs was similar to 2020. Among the worst, i.e. hypertrophic, reservoirs in 2021 were the Mostiště and Fryšták (intended for water supply systems), and from the recreational reservoirs the Jevišovice, Výrovice, the Middle and Lower Nové Mlýny, Moravská Třebová, Podhradský Pond and the Farářka profile near the reservoir Vranov. The Plumlov Reservoir shifted strongly towards significant hypertrophy. The Znojmo and Luhačovice Reservoirs were strongly eutrophic, almost on the border of hypertrophy, while the Bystřička Reservoir moved towards strong eutrophication in July. Most of the dams were again eutrophic such as Brno, Vír, Hubenov, Letovice, Boskovice, Horní Bečva, the Nové Mlýny Upper Reservoir, the Bidelec Pond, Opatovice (deteriorated situation), Nová Říše and Ludkovice (where the situation improved slightly). Reservoirs considered mesotrophic in 2021 were Slušovice, Landštejn, Vranov – dam and Bojkovice, while Boskovice, Koryčany and even Horní Bečva shifted nearer to mesotrophication from weaker eutrophication. The Karolinka Reservoir was oligotrophic in 2021, same as in previous years. The Plumlov Reservoir in particular, as well as Mostiště, Fryšták, Moravská Třebová and the Nové Mlýny Lower Reservoir, experienced a strong deterioration. Milder deterioration could be observed at Opatovice and Nová Říše. The situation improved significantly in the Luhačovice and Horní Bečva Reservoirs, less significantly in Vír, Boskovice, Slušovice, Ludkovice, Koryčany, Jevišovice, Výrovice and the Nové Mlýny Middle Reservoir. The remaining reservoirs corresponded with their intensity of phytoplankton development approximately to 2020. The largest development of cyanobacteria and water blooms occurred in the Mostiště, Plumlov, Podhradský Pond and the Nové Mlýny Lower Reservoir. Overall, the situation in 2021 in terms of phytoplankton development was similar to the previous year.

In the Šance Reservoir (with water intended for public supply systems) managed by the Oder River Board, the quality of raw water in 2021 was good and stable throughout the entire growing season. The water met the limits of category A1 as per Annex 13 to Decree No 428/2001 Coll. in most of the monitored parameters. The situation was quite the opposite with the Kružberk and Morávka Reservoirs (both with water intended for public supply systems): despite the positive development in the first half of the year, water quality deteriorated in the second half of the growing season in both of the reservoirs. The deterioration was caused by excessive occurrence of cyanobacteria in the water column, which

culminated in the formation of water bloom at the end of the growing season. Speaking of reservoirs not intended for water supply systems, water quality deteriorated only in the Těrlicko Reservoir in 2021, which was, however, not due to abundance of cyanobacteria, but because of the risk of cercariae occurrence. In other reservoirs (not intended for water supply systems) under the management of the Oder River Board, water quality was ranked in the first or second class as per the KHS methodology, meaning as water suitable for bathing or as water suitable for bathing with deteriorated sensory properties.

Quality of water used for bathing in the 2021 bathing season

In the 2021 bathing season, public health authorities monitored a total of 292 bathing sites, of which 170 were operated outdoor bathing sites and 122 bathing locations, and banned bathing at 9 locations. In the year under review, 27 biotopes were already in operation in the Czech Republic.

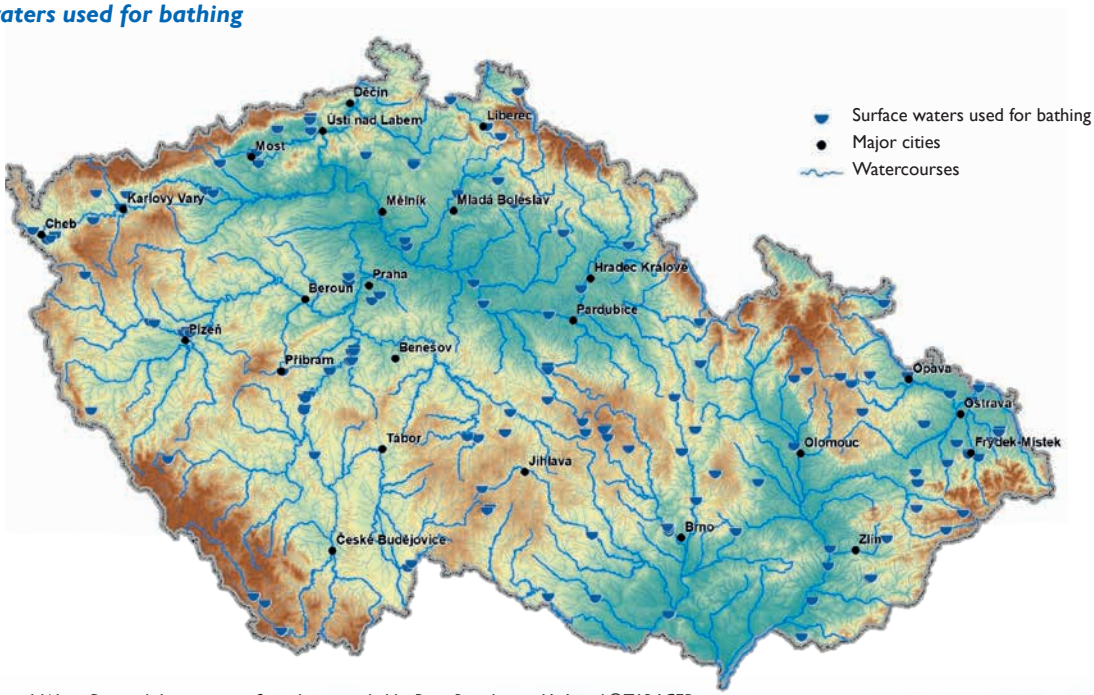
During the 2021 recreational season a large part of bathing sites encountered problems particularly with excessive growth of phytoplankton – cyanobacteria, which was the main reason for issuing a ban on bathing. Cyanobacteria occur due to surface water pollution mainly due to the phosphorus content which – under increased temperature and duration of sunshine – contributes to their excessive development. There are a number of methods that can prevent development of cyanobacteria. At present, various algicides are used more and more often to kill cyanobacteria as part of preventive water treatments; whereas in the case of cyanobacterial proliferation, substances that act as coagulants are used. Elimination of the developed cyanobacterial bloom is very expensive and it does not have a long-term effect. The priority should be to restrict nutrient (especially phosphorus) dotation in surface waters, which can only be ensured by thorough completion of the third level of wastewater purification in all current wastewater treatment plants and by building new wastewater treatment plants in all cities and municipalities that do not treat wastewaters at the moment.

Act No. 258/2000 Coll., on the protection of public health and on amendments to certain related acts, as amended, regulates the rights and obligations of natural and legal persons, which must be met in the field of protection and promotion of public health; it further establishes a system of public health protection bodies, their scope of activity and authority. One of the spheres that is protected by the Act, is outdoor bathing, operation of outdoor bathing pools, artificial bathing pools, swimming pools and saunas. Decree No. 238/2011 Coll., on defining hygienic requirements for swimming pools, saunas and hygienic limits for sand in sandpits in outdoor playgrounds, regulates the equipment of outdoor bathing sites and the requirements for the sample-taking and frequency of inspections as well as bathing water quality requirements.

Before the beginning of each summer recreational season the Ministry of Health (hereinafter referred to as the ‚MoH') proposes annually a list of locations where water quality shall be monitored with respect to bathing. The proposal of the list is published before the beginning of the bathing season on the website of all regional hygienic stations and of the MoH; anyone may submit observations: once the observations are considered, the list is adjusted.

Public health protection bodies took 1012 control samples and conducted laboratory tests, whereas operators took 898 samples. On the basis of the laboratory tests, public health protection bodies issued bans on bathing at 9 locations in the 2021 recreational season in the Czech Republic. Water quality that was assessed as unsuitable for bathing was detected at 30 locations, meaning that a total of 39 locations were considered unsuitable for bathing, which accounts for 13.3% of all bathing facilities monitored. Also in the 2021 recreational

Figure 3.1.3
Surface waters used for bathing



Source: T. G. Masaryk Water Research Institute, p.r.i. from data provided by River Boards, s.e., MoA and ©ZABAGED

season, many bathing sites faced problems primarily with excessive phytoplankton growth, i.e. cyanobacteria, which was the main reason why bans on bathing were issued. Another problem factor that some regions faced was the occurrence of cercarial dermatitis (swimmer's itch). Cercarial dermatitis is an allergic immune reaction to parasites that demonstrates in humans with formation of stains, blisters and skin reddening. It is accompanied with intense itching.

The number of bathing facilities and water bodies intended for bathing monitored by regional hygienic stations did not change much in comparison with previous years. More and more bathing sites with a system of natural water purification (so-called biotopes) are built and open to public. Water quality at such locations is typically very good throughout the entire recreational season. According to information from the CHMI, summer 2021 was average in terms of temperature and rather above-average in terms of precipitation.

Quality of suspended matters and sediments

Suspended matters and sediments are an important abiotic component of the aquatic ecosystem. They preferentially bind a number of chemical pollutants that are not detectable in water samples. Their analyses provide information on the presence of chemical substances in the water environment and they contribute to overall assessment of surface waters in watercourses in the Czech Republic. Directive 2000/60/EC of the European Parliament and of the Council (Water Framework Directive), Directive 2008/105/EC of the European Parliament and of the Council and Directive 2013/39/EU of the European Parliament and of the Council for solid matrices require monitoring of their long-term trends for a set of 20 selected priority hazardous substances. The volumes of these substances in sediments shall not increase in order to achieve good chemical status.

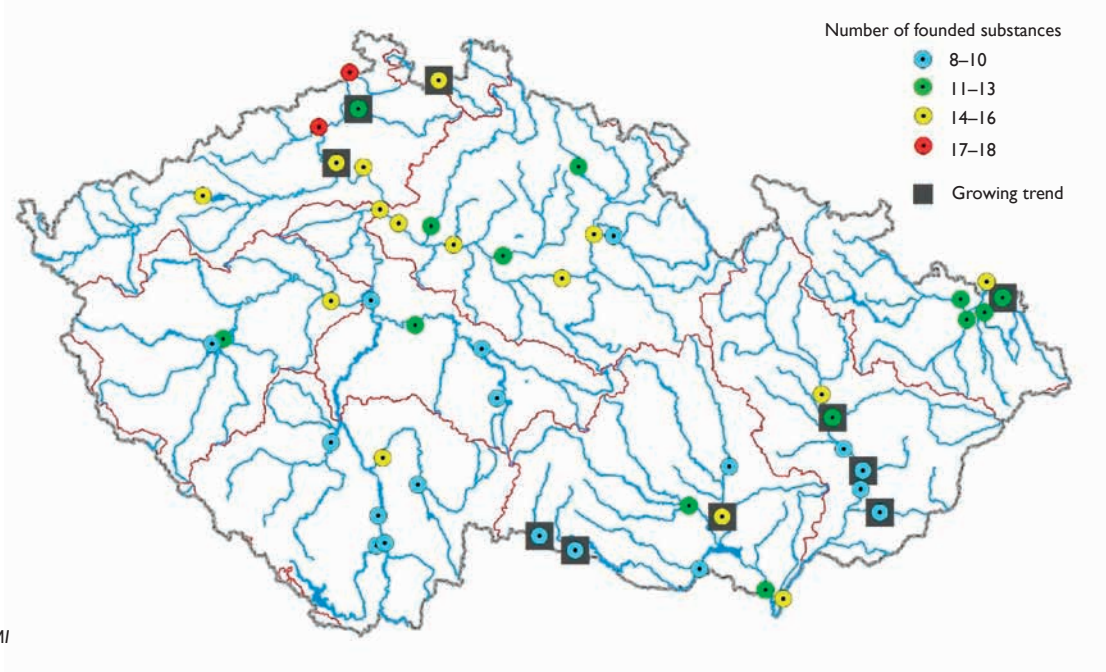
In 2021, 48 profiles were monitored for contents of heavy metals, metalloids and specific organic substances with the emphasis on priority substances in the sphere of water policy, totalling 130 chemical substances, of which 25 are listed as priority substances. The monitoring results were assessed in accordance with Government Decree No. 401/2015 Coll. on the basis of an analysis of long-term trends in concentrations of selected priority substances that may cumulate in sediments and suspended matters. The degree of contamination was assessed using foreign quality limits (sediment quality indices by the International Commission for the Protection of the Elbe River, hereinafter also referred to as the ‚ICPER').

The most significant contamination in terms of the number of priority substances detected was found, same as in the past, on the Bílina in Ústí nad Labem and on the Lower Elbe below Děčín, where specific pollution from old burdens (hexachlorobenzene, hexachlorobutadiene) is repeatedly measured together with contamination by other organic substances and metals (e.g. tributyltin, C10-13 chloralkanes, perfluorinated substances, hexabromocyclododecane, polybrominated diphenyl ethers, mercury). Higher numbers of priority substances are also found in watercourse sections downstream from large urban and industrial agglomerations (the Lusatian Neisse downstream from the Liberec–Jablonec agglomeration, the Berounka downstream from Pilsen, the Middle Elbe, the Oder in Bohumín, the Svratka downstream from Brno, the Lower Morava in Lanžhot). An overview of the number of priority substances found in measurable values in sediments and suspended matters is shown in Figure 3.1.4. Out of 25 priority substances monitored, substances from the group of polyaromatic hydrocarbons (PAH) and phthalates (DEHP) were measured nation-wide and in highest concentrations. Concentrations of polyaromatic hydrocarbons fluctuate in year-on-year comparisons, but in many profiles, particularly in the river sub-basin of the Upper Oder, in the Ostrava–Karviná agglomeration, in the Dyje and Morava River Basins they constantly reach high values exceeding quality limits in the following indicators: anthracene, fluoranthene and sum of 5 PAHs (i.e. a sum of benzo(a)pyrene with carcinogenic effects, benzo(b)fluoranthene, benzo(g,h,i) perylene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene. Concentrations of DEHP, a substance used as a softener in plastics does not exceed quality limits in any of the places. Other priority organic substances such as hexachlorobenzene, hexachlorobutadiene, tributyltin, chloroalkanes C10-13, PFOS, hexabromocyclododecane, PFOS were found in concentrations orders of magnitude lower. Their highest concentrations are found in sediments and suspended matters on the Elbe River downstream from Děčín, on the Bílina River in Ústí nad Labem (see Figure 3.1.1) and also in sedimentable suspended matters on the Lusatian Neisse in Hrádek nad Nisou. The highest total annual concentrations of priority organic substances were evaluated in sedimentable suspended matters on the Lusatian Neisse in Hrádek nad Nisou (DEHP averaging 5,000 µg/kg, C10-13 chloralkanes averaging 760 µg/kg) and in sediments on the Ploučnice River in Březiny with the highest detected concentrations of PAHs (anthracene, benzo(a)pyrene up to 2,500 µg/kg). Dioxins, furans and dioxin-effect PCBs were detected in different volume at all sites monitored. The highest total concentrations of their toxic equivalents (4–10 ng/TEQ/kg) were assessed on the Berounka River downstream from Pilsen, on the Middle Elbe in Valy, in Lysá nad Labem and on the Olše in Věřňovice. Other potentially hazardous substances were again measured, e.g. high levels of organochlorine pesticides of the DDT group in sedimentable suspended matters on the Bílina River in Ústí nad Labem (sum of DDT and its metabolite DDD up to 687 µg/kg) and on the Elbe River downstream from Děčín (357 µg/kg). Their concentrations there exceed the upper threshold of the ICPER sediment quality index for the Elbe River Basin by up to 100 times. Of the pesticides currently used, whose application is regulated, the pesticide glyphosate (up to 600 µg/kg) was detected in most of the suspended matters and in more than 50% of the sediment samples, its metabolite AMPA (up to 3,220 µg/kg), with the highest concentrations on the Middle Elbe in Lysá nad Labem, on the Oder in Bohumín and on the Lusatian Neisse in Hrádek nad Nisou was find in all the samples taken. Higher concentrations of other potentially hazardous substances (bisphenol A, triclosan, methyl triclosan, galaxolide, tonalide) were also measured in sediments and suspended matters in watercourses with lower discharge in sections downstream from urban agglomerations such as the Lusatian Neisse in Hrádek nad Nisou and the Svratka in Židlochovice downstream from Brno due to wastewater discharges.

A statistically significant increase in concentrations of any of the priority substances was assessed by analysing long-term trends

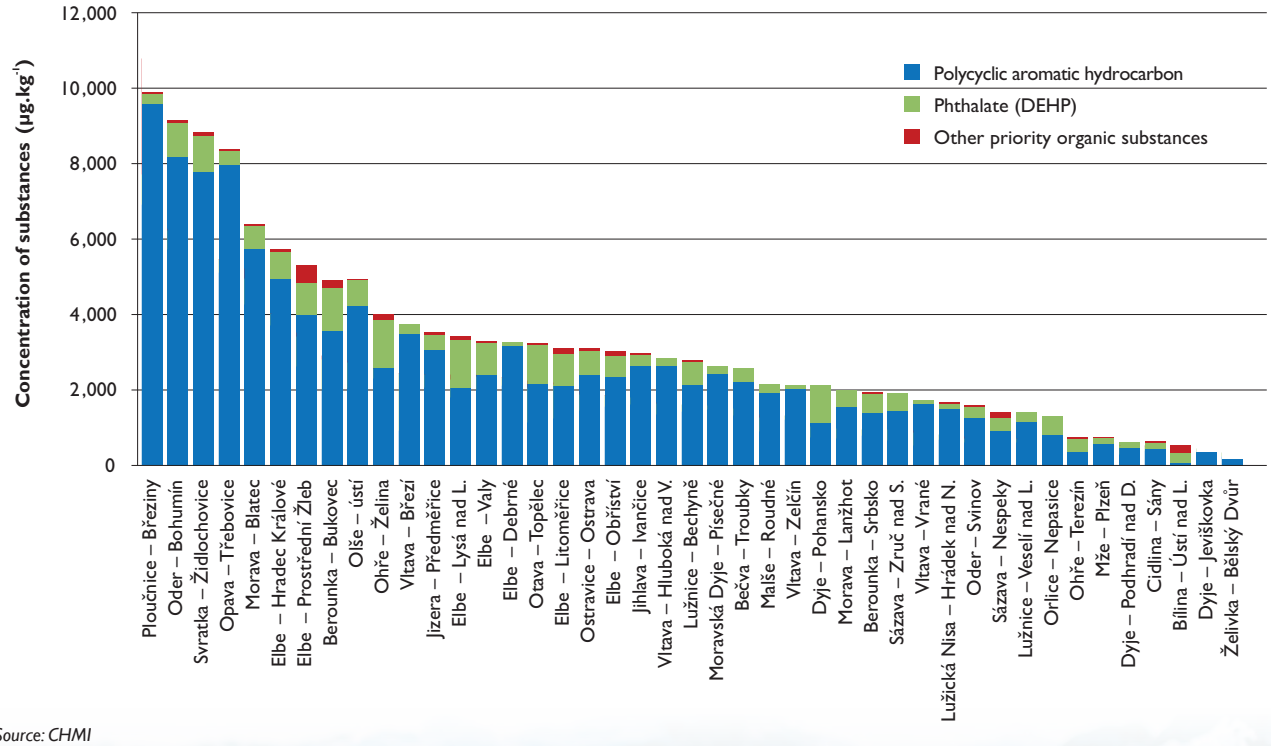
in sediments from 2000–2021 and in sedimentable suspended matters from 2013–2021 (see Graph 3.1.4). An increasing trend was confirmed in sediments at 7 sites: cadmium (the Dyje – Podhradí nad Dyjí), lead (the Olše – Věřňovice), mercury (the Moravská Dyje – Písečné), anthracene (the Ploučnice – Březiny, the Olšava – Havřice, the Lusatian Neisse – Hrádek nad Nisou and the Dřevnice – Otrokovice) and sum 5 PAHs (Dřevnice – Otrokovice). In sedimentable suspended matters, a significantly increasing trend was observed for cadmium (Lusatian Neisse – Hrádek nad Nisou, Ohře – Terezín, Svratka – Židlochovice) and C10-13 chloralkanes (Lusatian Neisse – Hrádek nad Nisou and Bečva – Troubky). In order to assess the development of pollution, it is necessary to consider the results of the trend analysis in the context of the pollution degree, i.e. by comparison with the quality limits, which are currently missing in the Czech legislation.

Figure 3.1.4
Number of profiles with findings of priority substances and detected growth trend in 2021



Source: CHMI

Graph 3.1.1
Total concentrations of priority organic pollutants in sediments in 2021



Source: CHMI

Raw water quality

Raw water quality in 2021 was assessed using data from 3,064 points of raw water abstraction (of which 139 surface water abstraction points and 2,925 groundwater abstraction points. Raw water treatability was assessed and classified in 4 categories of treatability as per Decree No. 428/2001, as amended, Coll.

In total, more than 72% of abstraction points had quality corresponding with A2 or better quality in 2021, surface sources of raw water are usually of worse quality than groundwater sources, hence the higher share of surface water abstraction points with worse treatability categories (only approximately 38% of surface abstraction points had A2 or better raw water quality). When comparing the quality of raw water by regions, it can be observed that the highest raw water quality in 2021 was in raw water sources in the Ústí Region and worst in the Zlín Region.

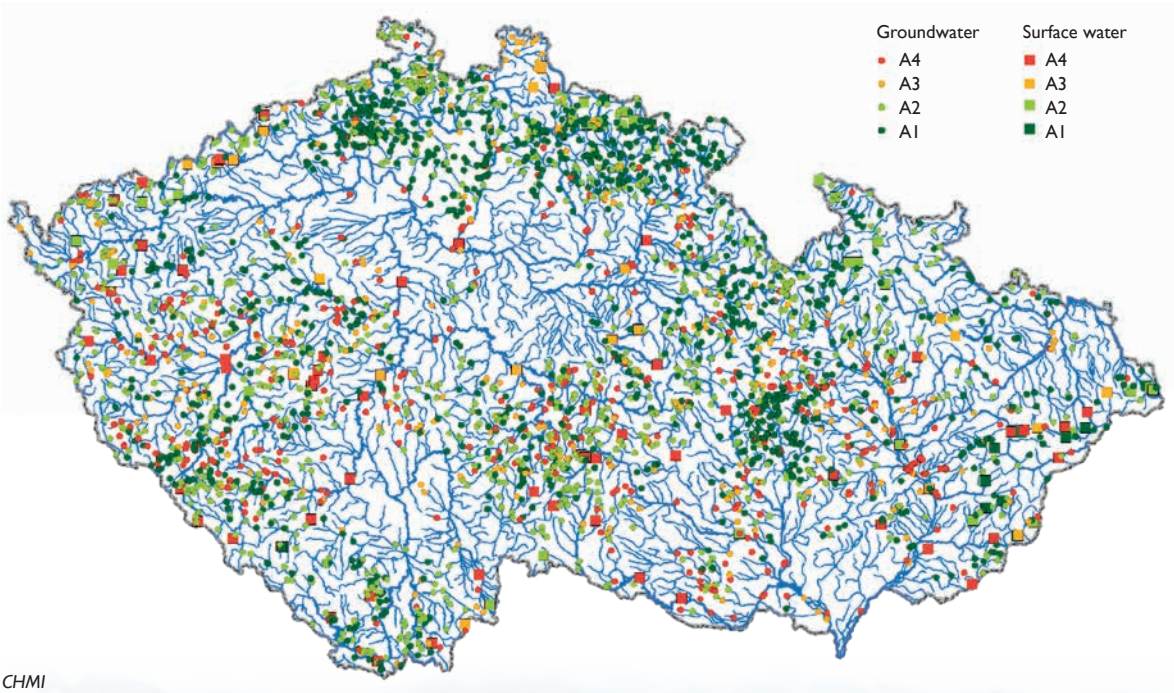
The most problematic for the quality of raw surface water are microbiological indicators, total organic carbon, adsorbable organically bound halogens (AOX), COD-Mn, metals such as

Table 3.1.1
Categories of raw water treatability and relevant types of treatments

Category	Type of treatment
A1	Raw water adjustment, possibly with added disinfection for removing compounds and elements that may affect its further use, aimed particularly at decreasing aggressiveness against the water supply system materials including household installations (chemical and mechanical de-acidification) together with elimination of smell and gas compounds by aerification. Simple filtration for removal of dissolvable matters and increasing quality.
A2	Raw water requires simpler treatment, e.g. coagulation filtration, single-degree de-ironing, demanganization or infiltration, slow biological filtration, treatment in rock environment together with final disinfection. Water stabilization is suitable for enhancing water quality.
A3	Raw water treatment requires two- or multi-degree treatment through clearing, oxidation, de-ironing and demanganization with final disinfection or a combination of such processes. Other suitable methods include, e.g., use of ozone, active charcoal, auxiliary flocculants, flotation. More expensive methods (e.g. sorption to special materials, ion exchange, membrane processes) are only used exceptionally.
A4	Water of this quality can exceptionally be supplied as drinkable water upon receiving exception by the relevant regional office. In order to become drinkable, such water needs to be treated through technologically demanding processes consisting in a combination of water treatments defined for the A3 category, while it is necessary to ensure stable quality of the water produced. Nevertheless, the preferred solution in such cases is the elimination of pollution causes or finding a new water resource.

Source: CHMI

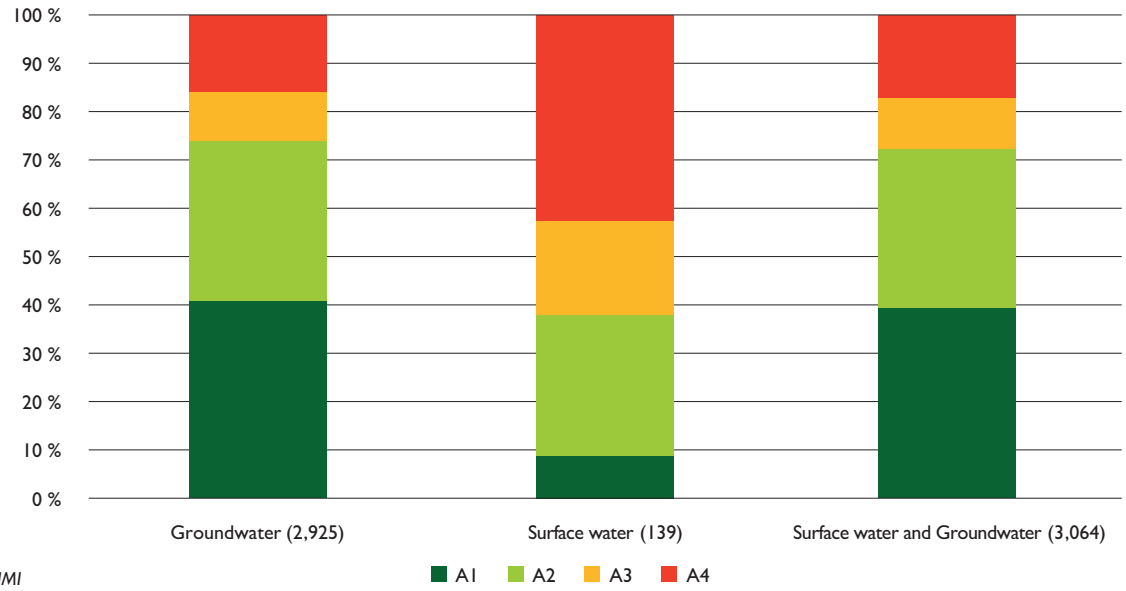
Figure 3.1.5
Raw water treatability categories at abstraction points in 2021



Source: CHMI

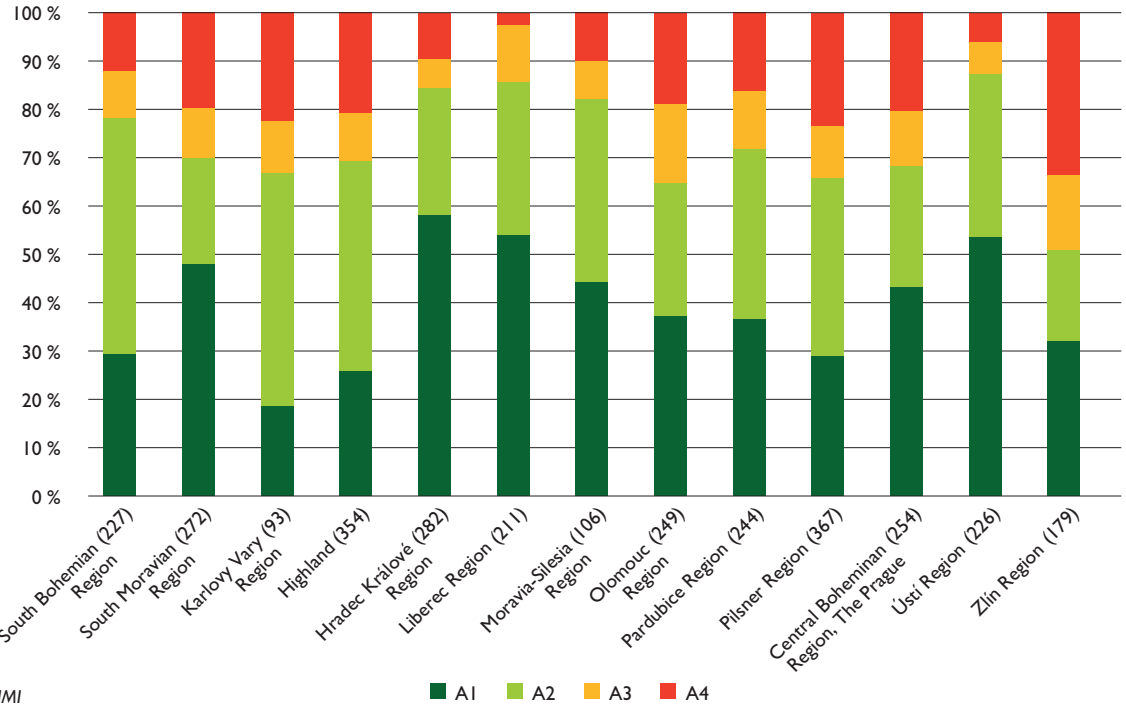
iron and manganese, humic substances, pesticides such as metazachlor ESA and metazachlor OA (metabolites of the metazachlor herbicide used for treating oilseed rape), metolachlor ESA (metabolite of the herbicide metolachlor used for treating maize), AMPA (metabolite of the total glyphosate herbicide). In the case of groundwaters, these are adsorbed organically bound halogens (AOX), metals such as iron and manganese, pesticides such as chloridazon desphenyl (metabolite of the chloridazon herbicide used for treating beetroot), alachlor ESA (metabolite of the now banned alachlor herbicide used for treating oilseed rape), metazachlor ESA (metabolite of the metazachlor herbicide used for treating oilseed rape) and metolachlor ESA (metabolite of metolachlor herbicide used for treating maize). Nitrate was only of concern for 5.6% of the sources using groundwater in 2021.

Graph 3.1.2
Categories of water treatability for types of raw water sources



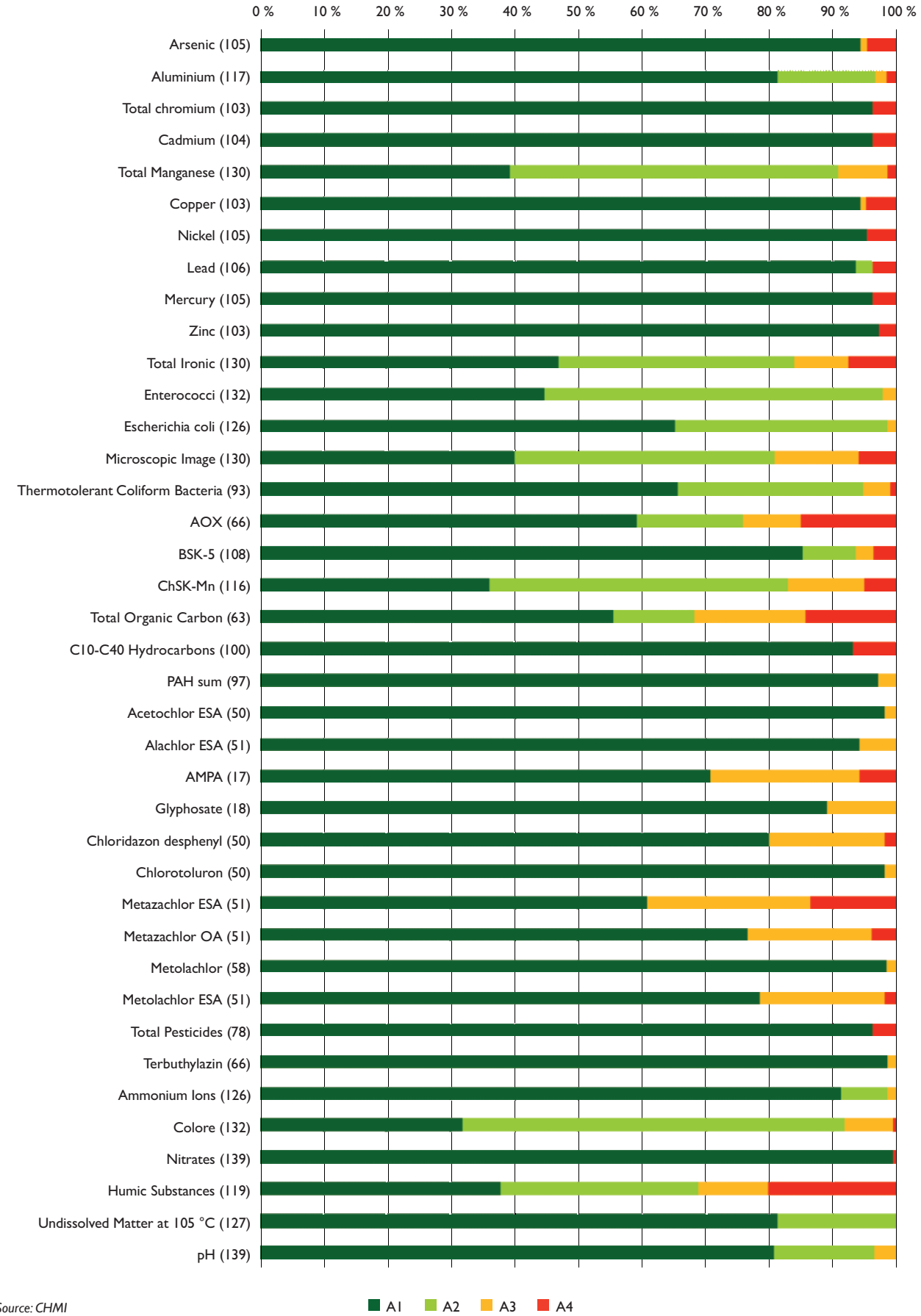
Source: CHMI
Note: The number of abstraction points is given in brackets. Data per year 2021.

Graph 3.1.3
Categories of water treatability by regions



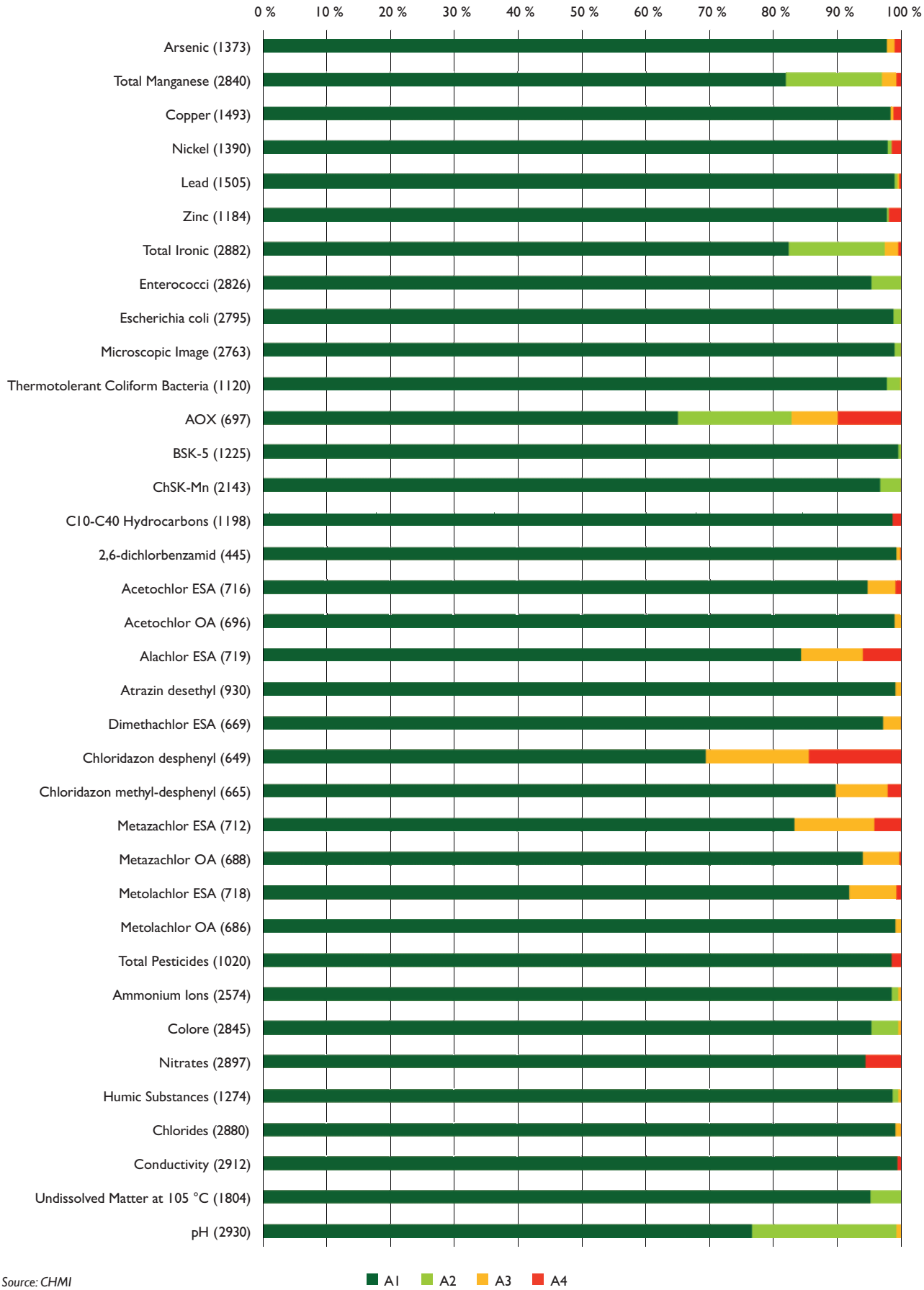
Source: CHMI
Note: The number of abstraction points is given in brackets. Data per year 2021.

Graph 3.1.4
Categories of surface water treatability for indicators most affecting surface water quality



Source: CHMI
Note: The number of abstraction points is given in brackets.
Data per year 2021.

Graph 3.1.5
Categories of groundwater treatability for indicators most affecting groundwater quality



Source: CHMI
Note: The number of abstraction points is given in brackets.
Data per year 2021.

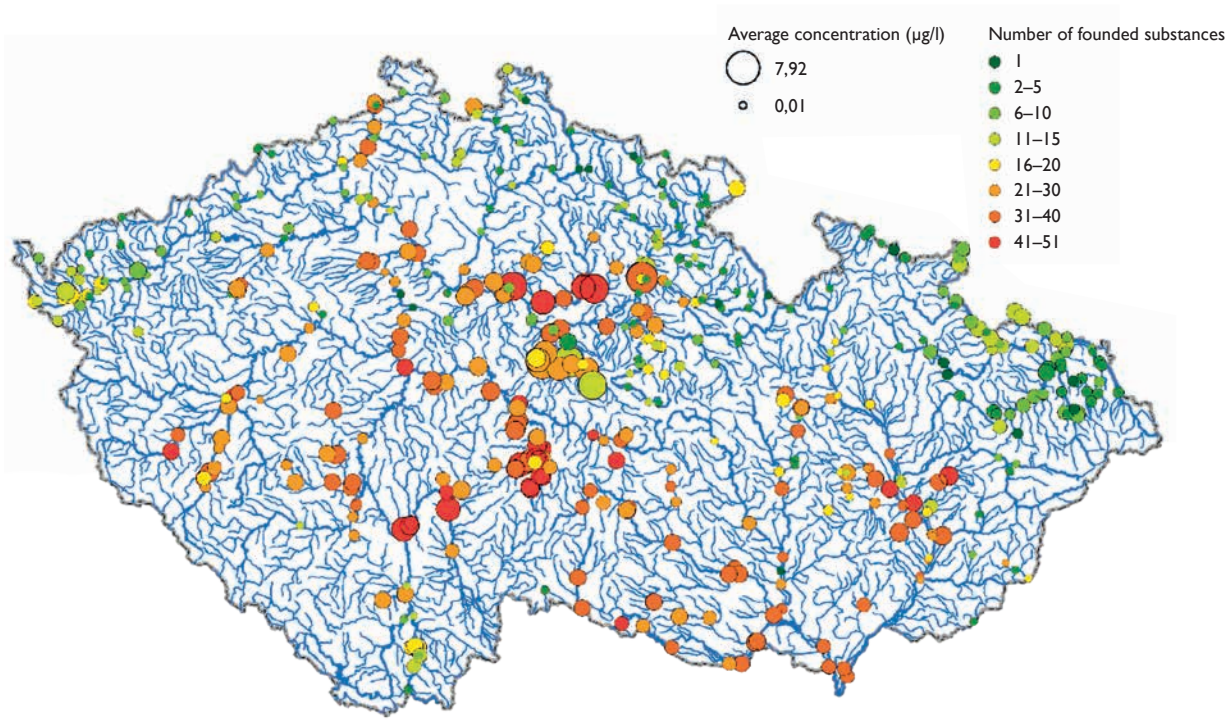
Microcontaminants in surface water

Microcontaminants in surface water have long been present in the whole of the Czech Republic. They include, in particular, residues of pesticides (mostly from agriculture), pharmaceuticals, roentgendiagnostic substances, anti-corrosives and other specific substances linked with wastewater discharge. Occurrence of the two most significant groups of such substances, i.e. pesticides and pharmaceuticals in surface waters in 2021 was assessed.

Pesticides

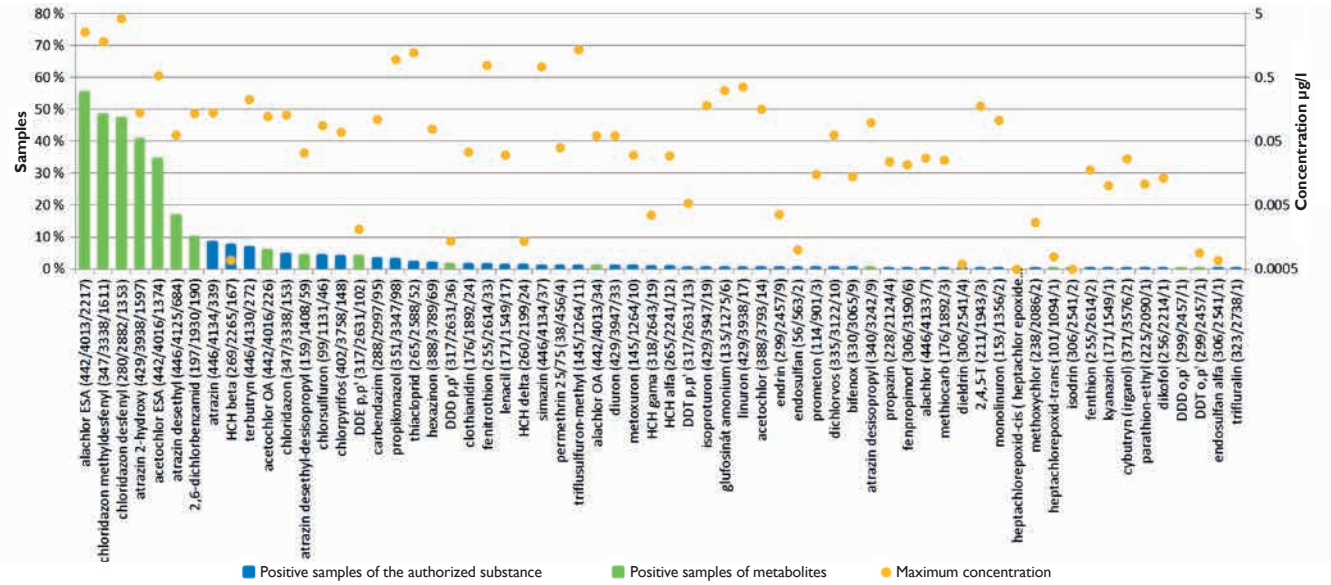
Water management laboratories of river Boards, s.e., monitor closely pesticide substances and their metabolites that get to surface waters particularly from agricultural activity. In 2021, results from 509 profiles (a total of 4,732 samples) for 262 analytes were processed. Pesticides were found at 473 profiles (92.9% of the monitored profiles), in 4,072 samples (i.e. in 86% of the samples). In 2021, a total of 149 pesticides and their metabolites were found in surface waters, out of which 46 substances were found in more than 5% of the samples. The results correspond with monitoring of the substances by individual River Boards, s.e. Where a wider spectrum of substances is monitored, pesticides are found more often. Similar to 2020, the most frequently found substances were herbicide metabolites used for treating oilseed rape, including at present allowed substances (metazachlor, pethoxamide, dimethachlor) as well as banned ones (alachlor, acetochlor), maize (allowed: metolachlor, terbuthylazine, pethoxamide and banned: atrazine, acetochlor), beetroot (chloridazon, banned as of 2021), and glyphosate (total herbicide) and its metabolite AMPA. The most frequently detected fungicide was an allowed substance tebuconazole. Most substances were found at the following profiles: Ústrašice – Maršovský Stream (tributary of Lužnice) and Krasíkovice – Želivka (51 substances), Skašice – Moštěnka, Dolní Věžnice – Šlapanka (tributary of Sázava), Rosín – Bílinský Stream (tributary of Lužnice) and Vlásenický Dvůr – Cerekvický Stream (tributary of Želivka) (49 substances), Luková – Cidlina and Sány – Cidlina (48 substances), Zruč nad Sázavou – Sázava, Polkovice – Valová, Poříčí – Želivka, Brtná – Trnava and Miletín – Želivka (47 substances), Samšín – Kejtovský Stream (tributary of Trnava) (46 substances), Nymburk – Mrlina, Doubravka – Úslava, Pelhřimov under – Bělá, Senožaty – Martinický Stream (tributary of Želivka) and Staňkov – Zubřina (tributary of Radbuza) (45 substances), Chlístov – Sázava and Kosičky – Bystřice (44 substances). Highest total concentrations of pesticides were detected at the following profiles: Čáslav – Hlubocký Stream (maximum 13.22 µg/l, average 7.92 µg/l), Hradec Králové – Piletický Stream (maximum 22.78 µg/l, average 7.48 µg/l), Bykáň – Opatovický Stream (maximum 13.46 µg/l, average 6.06 µg/l), Kosičky – Bystřice (maximum 13.5 µg/l, average 5.54 µg/l), Nymburk – Mrlina (maximum 14 µg/l, average 5.3 µg/l), Vrchlice HS – Švadlenka tributary (maximum 8.75 µg/l, average 4,95 µg/l), Zehuby – Ostašovka (maximum 7.66 µg/l, average 4.9 µg/l), Červená Řečice under – Trnava (maximum 7.76 µg/l, average 4.97 µg/l), Cidlina – Sány (maximum 11.57 µg/l, average 4.89 µg/l), Rosín – Bílinský Stream (tributary of Lužnice) (maximum 12,99 µg/l, average 4,77 µg/l), Vlásenický Dvůr – Cerekvický Stream (tributary of Želivka) (maximum 19.63 µg/l, average 3.82 µg/l) and Hořepník – Bořetický Stream (tributary of Trnava) (maximum 18.67 µg/l, average 4.68 µg/l).

Figure 3.1.6
Pesticides in the Czech Republic by number and concentration in 2021



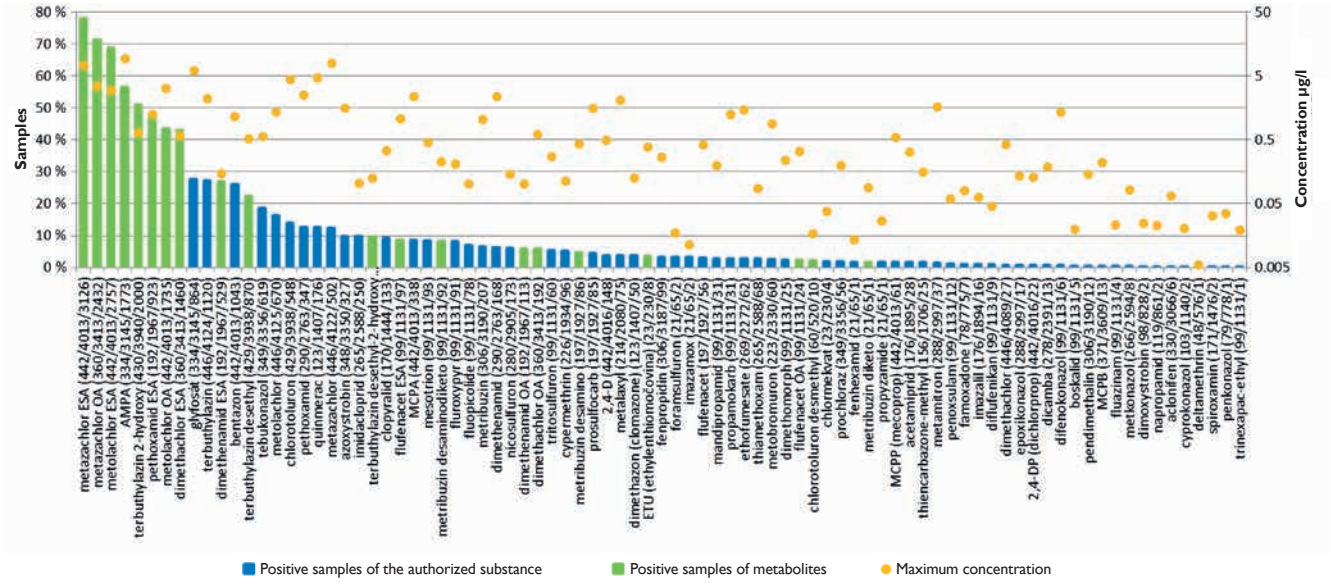
Source: CHMI

Graph 3.1.6
Frequency of occurrence of banned pesticides and their highest concentrations in surface waters in the Czech Republic in 2021



Source: CHMI
Note: Parentheses for each substance indicate the number of profiles / number of samples / number of positive samples

Graph 3.1.7
Frequency of occurrence of permitted pesticides and their maximum concentrations in surface waters in the Czech Republic in 2021



Source: CHMI
Note: Parentheses for each substance indicate the number of profiles / number of samples / number of positive samples

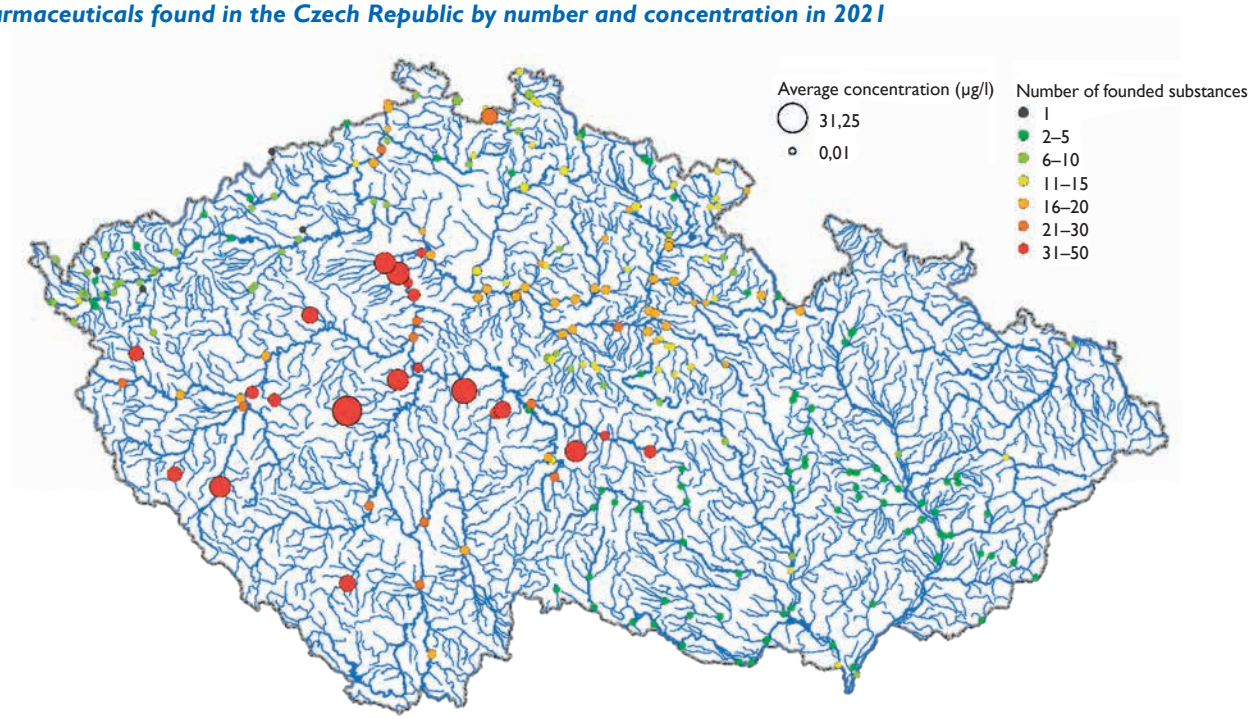
The Hubenov Dam (author: Procházková Lenka)

Pharmaceuticals

Considerable amounts of pharmaceuticals and their metabolites get to surface waters from municipal sources, results from 298 profiles (totalling to 2,746 samples) were processed for 79 analytes in 2021, the results partly reflect how monitoring of these substances is set by individual River Boards. Where a wider range of substances are monitored, pharmaceuticals are found more frequently. Similar to 2010, the occurrence of pharmaceuticals was most prominent in smaller watercourses that drain large urban areas. Pharmaceuticals were found at 295 profiles (98.9% of the profiles monitored) in a total of 2,463 samples (89.7% of samples). The most frequently found substances were telmisartan (antihypertensive), oxypurinol (gout drug), metformin (diabetes drug), tramadol (analgesic), ibuprofen and its 2-hydroxy and carboxy metabolites (analgesic, antipyretic, antiphlogistic), iomeprol (contrast agent), diclofenac (antirheumatic, analgetic), valsartan (antihypertensive), gabapentin (antiepileptic, analgesic), carbamazepine (antiepileptic), hydrochlorothiazide (diuretic), paracetamol (analgesic, antipyretic), metoprolol (antihypertensive), venlafaxine (antidepressant), irbesartan (antihypertensive), furosemide (diuretic) and the antibiotics clarithromycin and sulfamethoxazole. Most drugs were found at the profiles of Benešov – Benešovský Stream (50 substances), Trhové Dušníky – Příbramský Stream (47 substances), Humpolec – Pstružný Stream (46 substances), Kralupy nad Vltavou – Zákolanský Stream, Klatovy under – Drnový Stream and Běleč – Živný Stream (45 substances), Dolní Chlum – Rakovnický Stream and Senešnice – Novoveský Stream (43 substances), Rokycany – Klabava and Dolní Kramolín – Kosový Stream (39 substances), Pavlovice – Pavlovický Stream (38 substances), Plzeň – Bukovec (37 substances), Velvary – Červený Stream, Vlašim – Blanice, Radonice – Zubřina and Roztoky – Únětický Stream (36 substances), Pikovice – Sázava and Bavoryně – Červený Stream (35 substances). 91 µg/l), Klatovy – Drnový Stream (maximum 28.87 µg/l, average 13.59 µg/l), Humpolec pod – Pstružný Stream (maximum 31.62 µg/l, average 12.97 µg/l), Velvary – Červený Stream (maximum 26.71 µg/l, average 12.69 µg/l), Senešnice – Novoveský Stream (maximum 24.5 µg/l, average 10.73 µg/l), Běleč – Živný Stream (maximum 17.33 µg/l, average 9,5 µg/l), Hrádek nad Nisou – Lusatian Neisse (maximum 17.8 µg/l, average 8.45 µg/l) and Dolní Chlum – Rakovnický Stream (maximum 18.05 µg/l, average 7.83 µg/l).

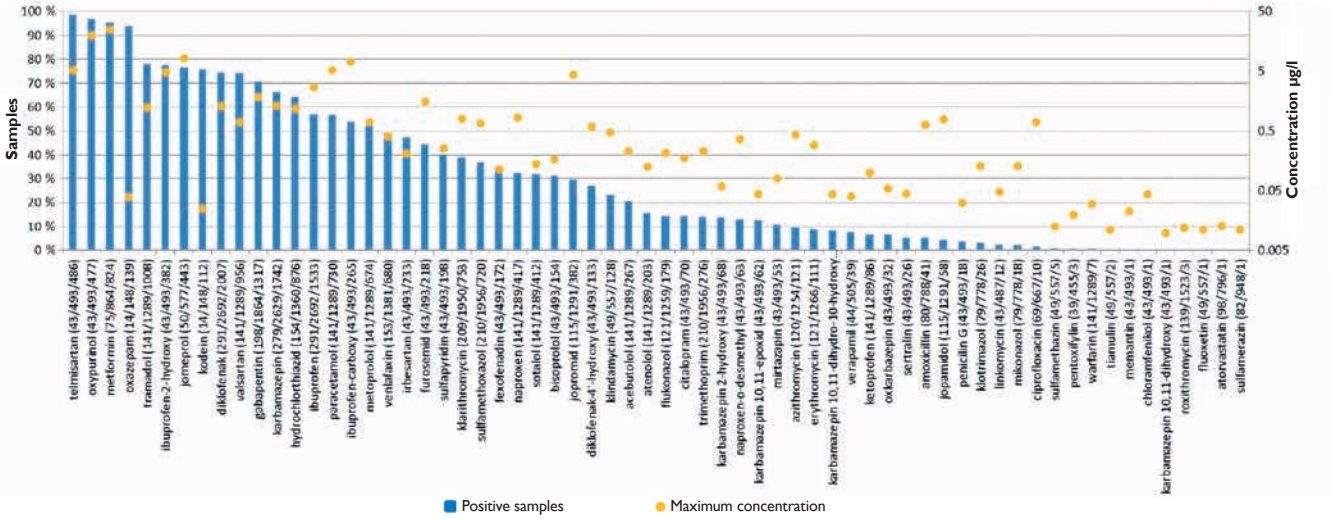
The Hubenov Dam, the full status (author: Kučerová Jana)

Figure 3.1.7
Pharmaceuticals found in the Czech Republic by number and concentration in 2021

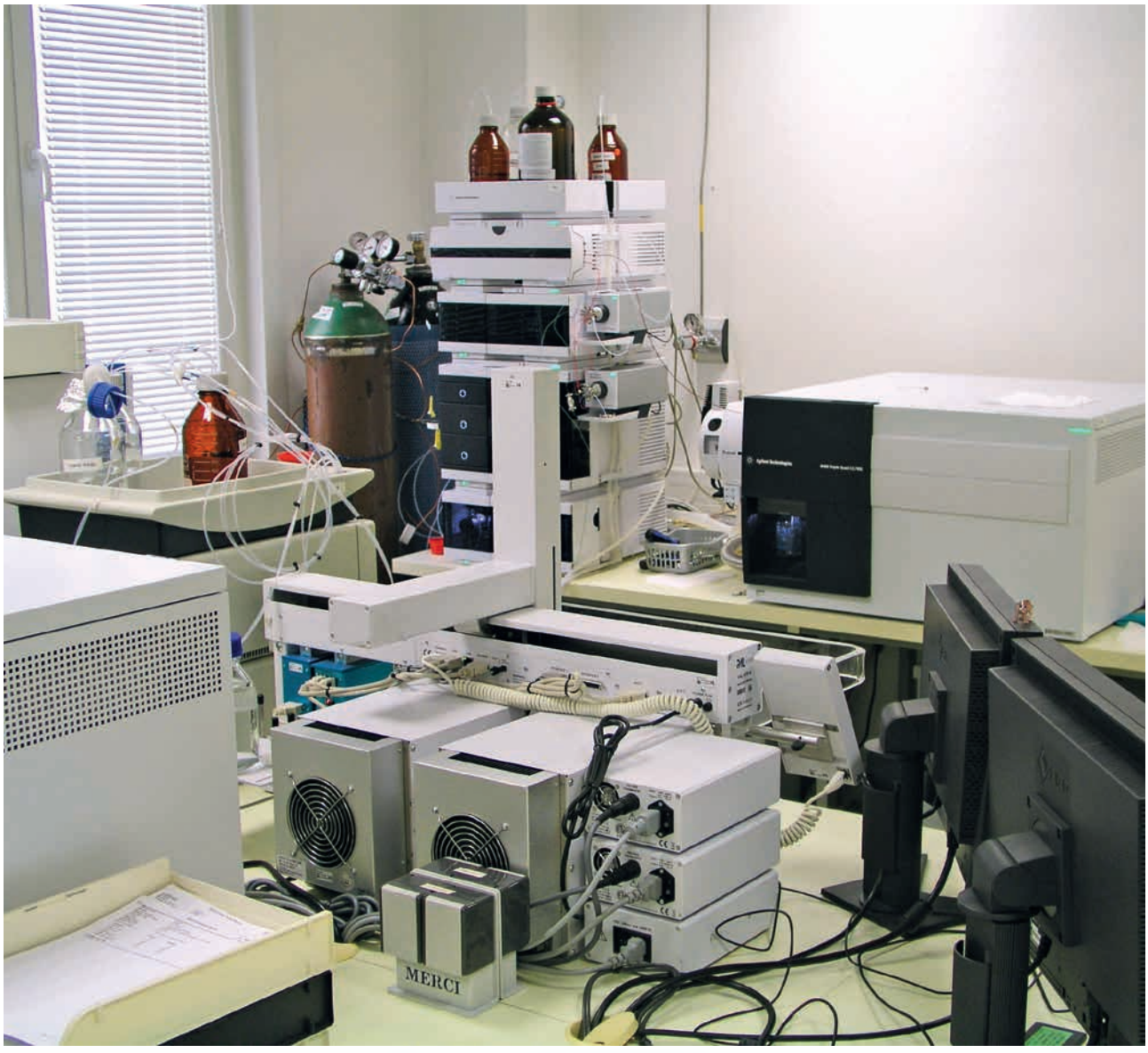


Source: CHMI
Note: The results of the monitoring are affected by the fact that each River Board, s.e., monitors a different range of pharmaceuticals and a differing number of profiles.

Graph 3.1.8
Monitoring of effective substances in pharmaceuticals in the Czech Republic in 2021



Source: CHMI
Note: Figures in brackets indicate the number of profiles / number of samples / number of positive samples.



The laboratory for the determination of pesticides and drugs (source: Vltava River Board, s.e.)

Accumulation biomonitoring of surface waters

The programme of bio-accumulation monitoring allows to comprehensively determine the status of the sites in question and it significantly contributes to an increase in knowledge of the state of contamination by biota. Monitoring uses not only fish and fry, but also other suitable matrices accumulating poisonous pollutants in connection with the manner of feeding and type of habitat.

In 2021, aquatic organism contamination by dangerous substances was monitored at 27 river profiles of significant Czech and Moravian rivers covered by surface water situational monitoring. The programme monitors occurrence of substances whose content in water samples is usually below detection limits and which cumulate well in water organisms. Monitoring concerned fish (*Squalius cephalus*), fish fry, benthic organisms (in most cases larvae of *Hydropsyche sp.*), leech (*Erpobdella sp.*), crustacean (*Gammarus sp.*).

The indicators selected for the monitoring assessment were those for which environmental quality standards (EQS) are set in Government Decree 401/2015 Coll. and also substances that occur in higher concentrations. They are polychlorinated biphenyls (sum of congeners PCB-28,PCB-52, PCB–101, PCB-118,PCB-138,PCB-153,PCB-180), DDT as a representative of chlorinated pesticides (DDT and its metabolites, with the dominant metabolite DDE), polybrominated diphenyl ethers (sum of PBDE congeners 28, 47, 99, 100, 153, 154), bis(2-ethylhexyl)phthalate (DEHP), perfluorooctane sulfonate (PFOS), of the polyaromatic hydrocarbons (PAHs) fluoranthene and benzo(a)pyrene. Among metals, mercury (Hg) was assessed, see Graph 3.1.9. All values stated are in wet weight.

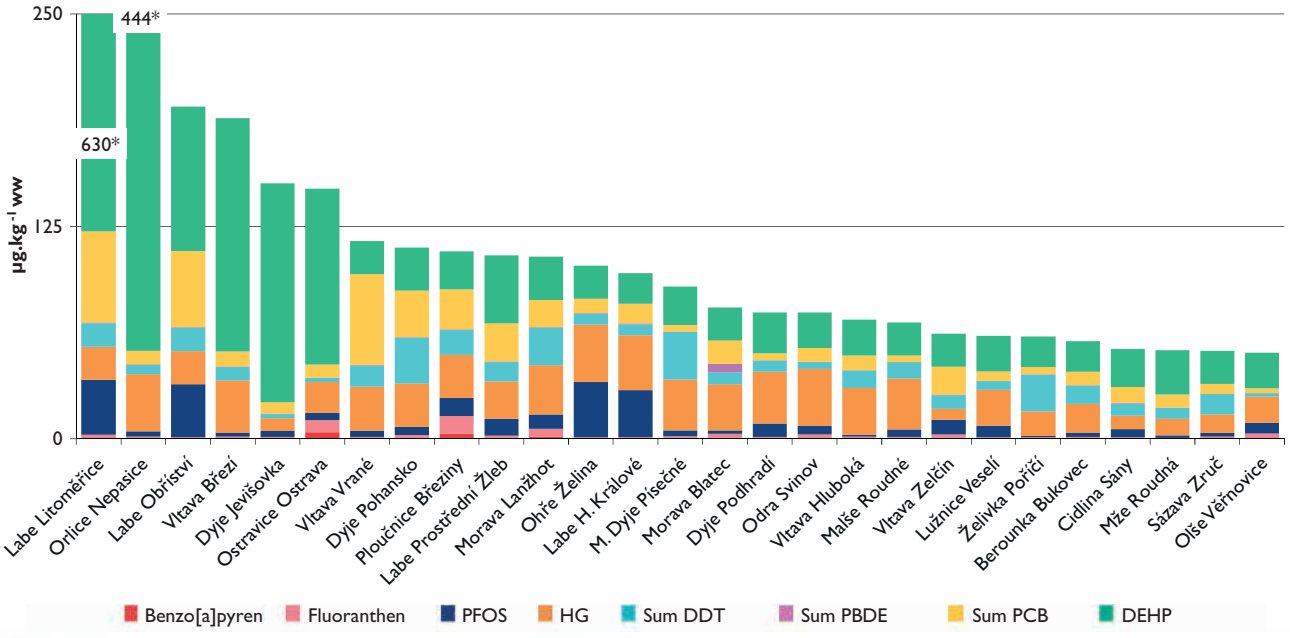
The highest total concentration of organic matter was found at the Elbe–Litoměřice profile (with highest DEHP concentrations) and at the Orlice–Nepasice profile also with high DEHP values.

The Kamenička stream in autumn (source: Ohře River Basin, s.e.)

No EQS was established for the two parameters. As regards polyaromatic hydrocarbons, an EQS was established for fluoranthene (30 µg/kg) and for benzo(a)pyrene (5 µg/kg), the values were not exceeded in either case in the fry matrix. For benthic organisms, the EQS was exceeded in 35% of the cases for benzo(a)pyrene and in 31% for fluoranthene. PAHs are not monitored in fish. For the perfluorooctane sulfonate (PFOS) the EQS (9.1 µg/kg) was exceeded in 22% in the fry matrix at the profiles monitored, in benthic organisms the environmental quality standard was not exceeded at any profile and in the fish matrix it was exceeded at only two profiles monitored. The mercury concentration in the fry matrix exceeded the EQS (20 µg/kg) in 59%, in benthos in 15% and in the fish the value of 20 µg/kg was exceeded at all profiles monitored. The values of the sum of PBDE congeners, similar to previous years, exceeded the EQS (0.0085 µg/kg) at all profiles, even by several orders of magnitude.

Monitoring aquatic organisms provides important information that cannot be obtained by analysing water samples. Results from several matrices then confirm complex pollution of the aquatic ecosystem. This information is used to assess water bodies and to decide on measures to improve the situation of water bodies.

Graph 3.1.9
Findings of hazardous organic substances in fish fry in 2021



Source: CHMI

3.2 Groundwater quality

A total of 707 sites were monitored in the national groundwater quality monitoring network in 2021. They comprised 202 springs, 224 shallow aquifers and 278 deep aquifers. A total of 322 quality indicators were analysed. Indicators from four major groups (basic indicators, metals, polar pesticides and pharmaceuticals) were monitored at most of the sites twice a year. Other groups of indicators were analysed at a selected lower number of locations, where a higher number of samples was taken, part of extended situational monitoring conducted in autumn 2021. The number of groundwater bodies exceeding limit values of monitored substances was slightly lower in comparison with previous years with a decreasing trend that started in 2019.

Monitoring of springs documents natural drainage of groundwaters, in particularly from the basement and local drainage of chalk structures. Shallow aquifers are concentrated mostly in the alluviums of the Elbe, Orlice, Jizera, Ohře, Dyje, Morava, Bečva, Oder and Opava Rivers – these groundwaters are harm-prone due to their higher hydraulic conductivity and thus with fast progress of pollution. Deep aquifers are concentrated particularly in the areas of the Bohemian Cretaceous Basin, České Budějovice Basin and Třeboň Basin and they monitor quality of groundwaters with deep water circulation.

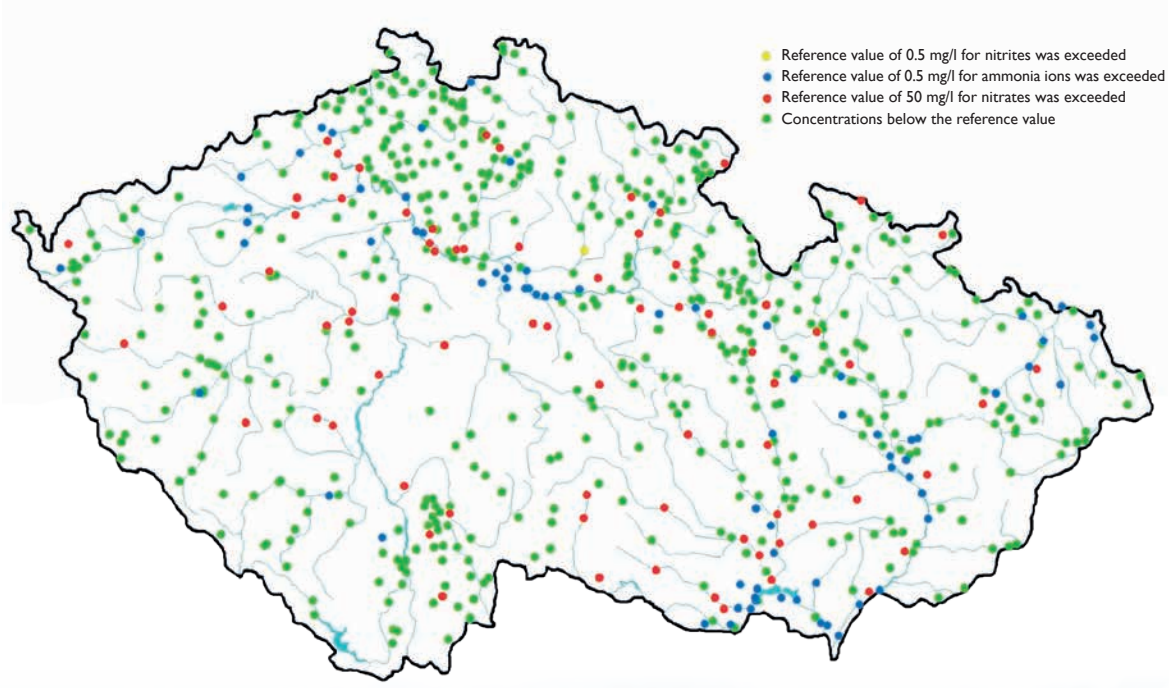
The results concerning groundwater quality in 2021 were assessed by comparing values of groundwater quality indicators with limit values for groundwater in accordance with Decree No. 5/2011 Coll., on delineation of hydrogeological regions and groundwater bodies, the method of assessing groundwater situation and requirements for programmes of ensuring and assessing groundwater situation and in accordance with Regulation of the European Parliament and of the Council 2006/118/EC – Annex I. An output of the assessment is also a map for indicators from two groups of pollutants monitored in groundwaters, namely nitrogenous substances and pesticides. The assessment included pollutants that exceeded the aforementioned criteria in groundwaters at least at two monitoring sites in 2021. The frequency of some herbicide occurrence (e.g. glyphosate and AMPA) may be affected by the fact that the scope of monitoring is limited to selected sites.

Table 3.2.1
Number of sites exceeding limits for groundwater in at least one indicator in 2021, comparison with 2020 and 2019

Sites	No. of sites	No. of sites exceeding limits for groundwater	% of sites exceeding limits for groundwater		
			2021	2020	2019
Shallow aquifers	227	218	96.0	95.5	96.0
Deep aquifers and springs	480	361	75.2	76.2	78.4
All sites	**707**	**579**	**81.9**	**82.4**	**84.1**

Source: CHMI

Figure 3.2.1
Concentrations of nitrogenous substances in groundwater in 2021, exceeding limits set by Decree No. 5/2011 Coll.



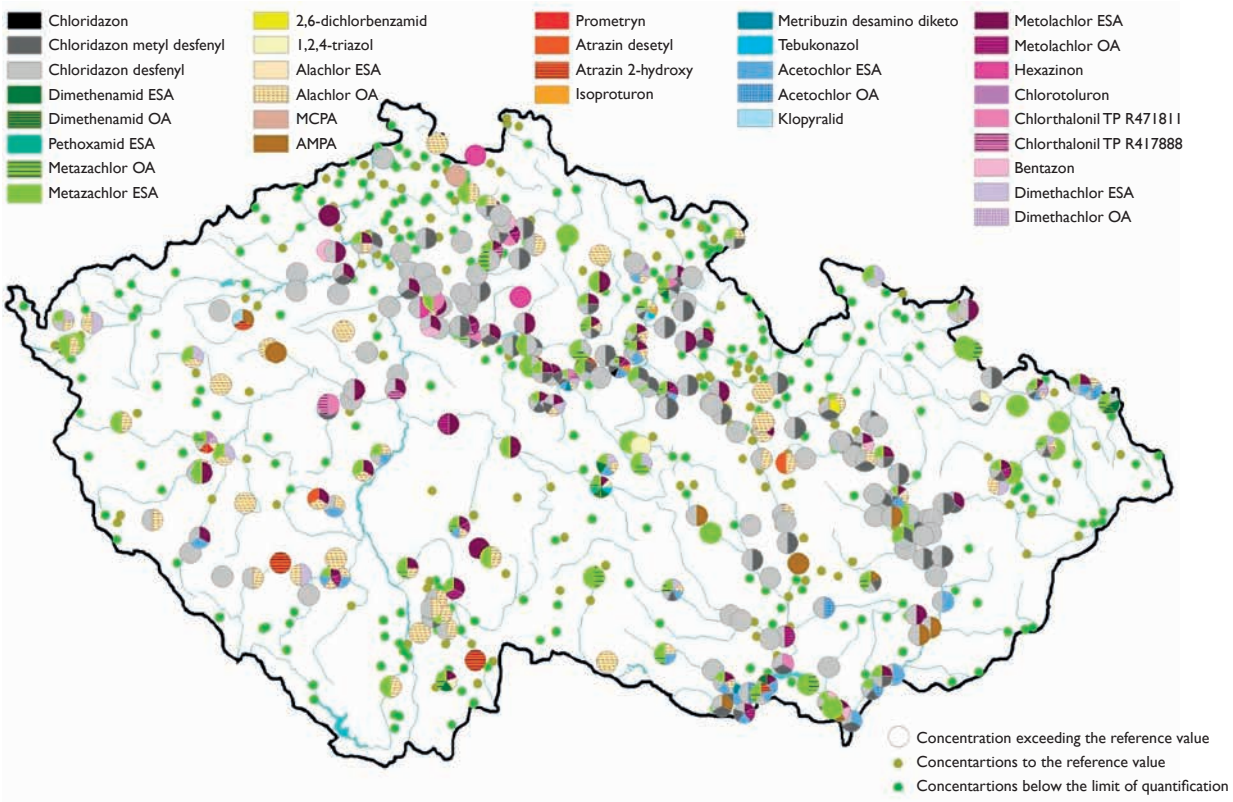
Source: CHMI

The most significant indicators of groundwater pollution compared to the limit values are pesticides (metabolites of herbicides used mainly for treating crops such as oilseed rape, maize and beetroot), inorganic substances (nitrates, ammonia ions and phosphates), determination of organic substances in aggregate (CODMn and dissolved organic carbon), metals (barium, manganese, arsenic and cobalt), volatile organic compounds (toluene and 1,2-cis-dichloroethylene) and PAHs (phenanthrene and chrysene).

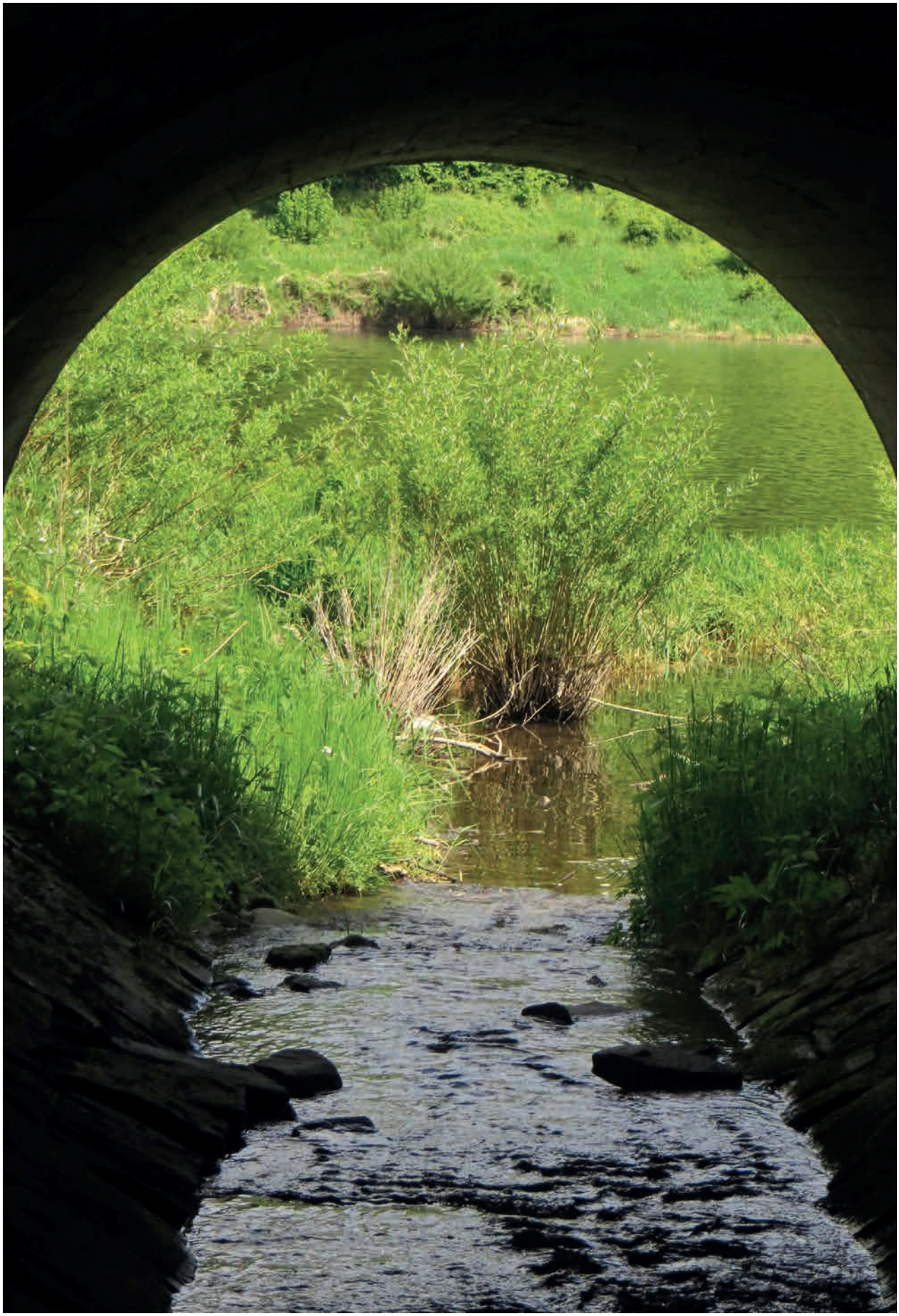
The results of groundwater quality assessment in 2021, with respect to the most frequently occurring monitored substances of each group, are a confirmation of results from the past years. The percentage of exceeding limits for given substances is affected by the extent of groundwater quality monitoring, but such influence on the assessment was eliminated in 2021 by the fact that both basic types of monitoring were carried out, i.e. broader situational monitoring in autumn and operational monitoring in spring, which for the groups of indicators with scarcer abundance is carried out only at sites where values above the detection limit were recorded in previous years. Groundwater quality in springs and deep aquifers with respect to foreign substances was only slightly better in 2021 when compared to the previous three years. However, the assessment of the contamination degree of the most vulnerable waters in shallow aquifers, which are most affected by anthropogenic activities, confirms that the situation remained unimproved even in 2021.

The Rozkoš Dam (source: Elbe River Basin, s.e.)

Figure 3.2.2
Concentrations of pesticides in groundwaters (substances exceeding limit values at two and more sites) in 2021



Source: CHMI
Note: Exceeded limit values under Decree No. 5/2011 Coll. as amended by Regulation of the European Parliament and of the Council 2006/118/EC



The water tunnel, the June 2021, The Karasínský Stream (author: Lošťáková Zuzana)

4. WATER USE

The monitoring of data on groundwater and surface water abstractions and on discharged waters is governed by Decree No. 431/2001 Coll., on the content of water balance, the method of its compilation and on data for the water balance. In 2021, we saw a year-on-year decrease in the amount of surface water and groundwater abstraction, while the volume of groundwater abstraction and discharged waters increased.

Pursuant to Section 10 of Decree No. 431/2001 Coll. on the content of water balance, the method of its compilation and the data for water balance (hereinafter also referred to as ‚Decree 431/2001 Coll.'), the scope of reported data changed after 2001 – water abstractions, waste water and mine water discharges exceeding 6,000 m³ per year or 500 m³ per month are registered. The source documents for ascertaining the data are the reports submitted to the Czech Statistical Office (hereinafter also referred to as the ‚CSO') by the respective river basin administrators before 31 March of the following year. The data for 2021 were classified based on the CZ-NACE according to Eurostat. The comparison of data for 2020 and 2021 was based primarily on final official data of the Czech Statistical Office (www.czso.cz). Table 4.1 shows detailed information about classification of surface water and groundwater abstractions, wastewater and mine water discharge in surface waters under the CZ-NACE. The classification also applies to Tables 4.1.1, 4.2.1 and 4.3.1 below.

Table 4.1
Classification of users in groups under the CZ-NACE classification

Public water supply networks	CZ-NACE 36
Public sewerage systems (excl. transfers)	CZ-NACE 37
Agriculture (incl. irrigation), forestry and fishing	CZ-NACE 01 – 03
Energy sector (electricity and heat generation and distribution)	CZ-NACE 35
Industry (incl. extraction of mineral resources – excl. energy sector)	CZ-NACE 05 – 33
Other (incl. construction industry)	CZ-NACE 38 – 96
Total (excl. fishponds and transfers)	CZ-NACE 01 – 96

Source: CSO

4.1 Surface water abstractionsd

From the longer-term perspective, the annual volume of surface water abstracted has decreased every year since 2016. In 2021, the total volume of surface water abstracted dropped year-on-year from 1,011.1 million m³ ton another all-time low of 986.8 million m³.

Water supply for public use and energy sector saw a decline in abstractions to their historical lows compared to 2020.

Miletínská (author: Hubalová Petra)

Abstractions for public water supply decreased by 1.9%, abstractions for energy sector with 439.5 million m³ (down by 5.4%) – the decrease is mainly due to a reduction in consumption because of switching to circulating cooling at the Mělník – Horní Počaply and Opatovice power plants (by a total of 34.7 million m³), agriculture dropped by 11.1%. The industry abstracted 207.6% million m³ (increased by 4.5%), while the category other abstractions including construction increased by 2.4%.

The registered surface water abstractions in 2021 decreased in the Elbe River Basin (by 4.4%), in the Ohře River Basin (by 4.7%), and in the Morava River Basin (by 3.8%). There was an increase in the Oder River Basin (by 3%) and in the Vltava River Basin (by 0.5%).

Exploitation of water sources dropped significantly at all levels after 1990 when valuation of water management services was rectified and the structure of industrial and agricultural production changed. This trend can be seen in Graph 4.1.1. Surface water abstractions for public water supply networks dropped from 744,9 million m³ in 1990 to 306.3 million m³ in 2021, which means in 2021 was consumed only 41.1% of the abstraction in 1990. Abstractions in agriculture decreased from 97.2 million m³ in 1990 to 21.3 million m³ in 2021, i.e. only 21.3% of the abstraction in 1990. The most significant drop was in industry from 830.1 million m³ in 1990 to 207.6 million m³, i.e. only 25% of the abstraction in 1990. In comparison with 1990, abstractions fell also in the energy sector: from 1,060.9 million m³ in 1990 to all-time low of 439.5 million m³, i.e. 41.4%.

Nevertheless, the abovementioned facts do not imply lower anthropogenic influence of water sources. For instance, so-called "irreversible consumption" (difference between abstracted and discharged volumes caused by evaporation in cooling towers of thermal and nuclear plants) in the energy sector grew (with respect to increasing production of electricity in the Czech Republic).

Annual assessment of the impact on water sources is conducted as part of water balance compiled under Decree No. 431/2001 Coll., whose principle is overall assessment of requirements for maintaining the minimum balance flow rate with flow rates at monitoring profiles that include all activities linked with water management.

From the longer-term perspective, there has been a significant drop in the volume of surface water abstracted since 1990, which is due to economic and environmental factors,

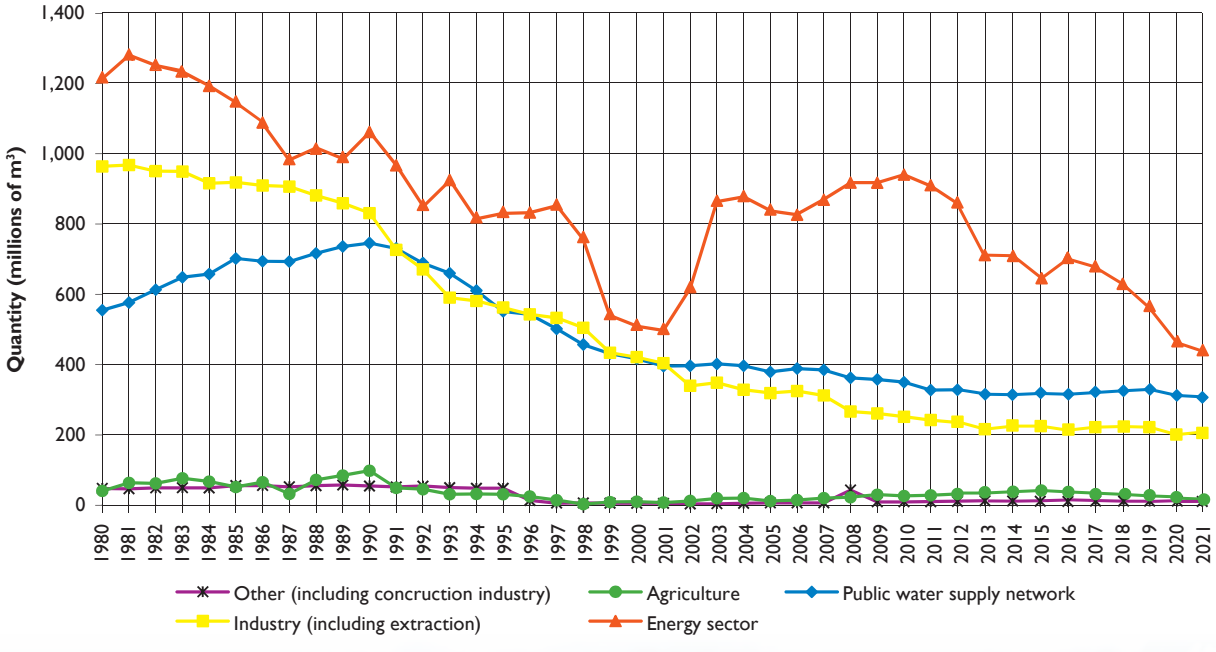
The Divoká Orlice Stream under the Earth Gate (source: Elbe River Board, s.e.)

Table 4.1.1
Surface water abstractions by customers over 6,000 m³/year or 500 m³/month in millions of m³ in 2021

River Board, s.e.	Public water supply networks		Agriculture incl. irrigation		Energy sector		Industry incl. extraction		Others incl. construction and public sewerage systems		Total	
	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number
Elbe	35.4	24	6.8	60	237.6	11	85.9	61	2.2	83	**367.9**	**239**
Vltava	136.0	37	1.5	19	51.2	12	29.1	52	8.0	73	**225.8**	**193**
Ohře	40.7	20	1.5	32	30.7	9	33.1	44	0.6	26	**106.6**	**131**
Oder	60.0	24	0.0	0	7.3	15	48.6	31	0.5	29	**116.4**	**99**
Morava	34.2	37	11.0	38	112.7	9	10.9	52	1.3	61	**170.1**	**197**
Total	**306.3**	**142**	**20.8**	**149**	**439.5**	**56**	**207.6**	**240**	**12.6**	**272**	**986.8**	**859**

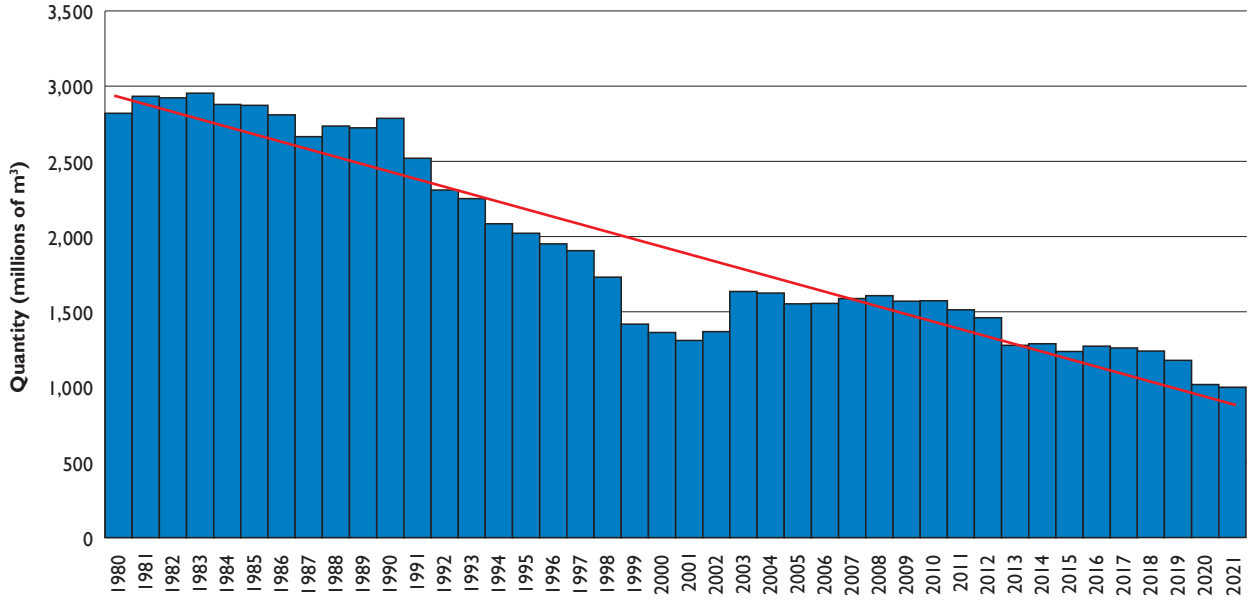
Source: River Boards, s.e.

Graph 4.1.1
Surface water abstractions in the Czech Republic by industries 1980–2021



Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by River Boards, s.e.

Graph 4.1.2
Surface water abstractions in the Czech Republic 1980–2021



Source: MoA using data provided by the T. G. Masaryk Water Research Institute, p.r.i., and River Boards, s.e.

modernisation of production which has lower water demand, and cutting losses in the water distribution network. 2021 was significantly affected by the Covid-19 pandemic, when public life was restricted. These restrictions impacted all spheres of the national economy in the Czech Republic.

In the long term, we can see a clear decline in surface water abstractions after 1990. The significant decline is mainly due to economic and environmental factors, modernisation of production, which reduces water demand, and a reduction in network losses. The last five years have also seen the impact of drought and the resulting availability of surface water resources. Surface water abstractions continued to decline in 2021.

Table 4.1.2 shows reported surface water abstractions for technical snowmaking where more than 6 000 m³/year or 500 m³/month (in thousands of m³) were abstracted, broken down for each of the River Board, s.e.

Table 4.1.2
Surface water abstractions by clients over 6,000 m³/year or 500 m³/month for snowmaking in 2021

River Board, s.e.	Snowmaking *)	
	Volume in thousands of m³	Number
Elbe	1,915.07	65
Vltava	433.01	13
Ohře	405.15	11
Oder	345.29	14
Morava	1,021.73	39
Total	**4,120.2**	**142**

Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by River Boards, s.e.
*Note: *) Ascertained using internal code VHB "260410 – snowmaking of technical snow" used by the River Boards, s.e., or by the name of the abstraction.*

The Křímov Dam (source: Ohře River Board, s.e.)

4.2 Groundwater abstractions

Groundwater abstractions increased to 362.1 million m³ in 2021. Groundwater abstractions in 2020 were 354.9 million m³.

Volumes of groundwater abstracted increased in 2021 in the following categories: industry by 7.3%, energy sector by 36.8% (which only accounts for 0.7 million m³ in total), agriculture by 3.9%, and abstractions for public water supply by 1.3%. Abstractions in the category other abstractions including construction were down 1.9% compared to 2020.

The highest share of total groundwater abstractions was in the Morava River Basin (34.1%), the lowest in the Oder River Basin (5.2%).

From the perspective of the volumes of groundwater abstractions, an increase was recorded in the territories administered by the Vltava River Board by 5.3%, the Morava River Board by 4.2% and the Ohře River Board by 1.5%. The other River Boards recorded a decrease in abstractions compared to the previous year - the Elbe River Basin by 1.3% and the Oder River Basin by 1%.

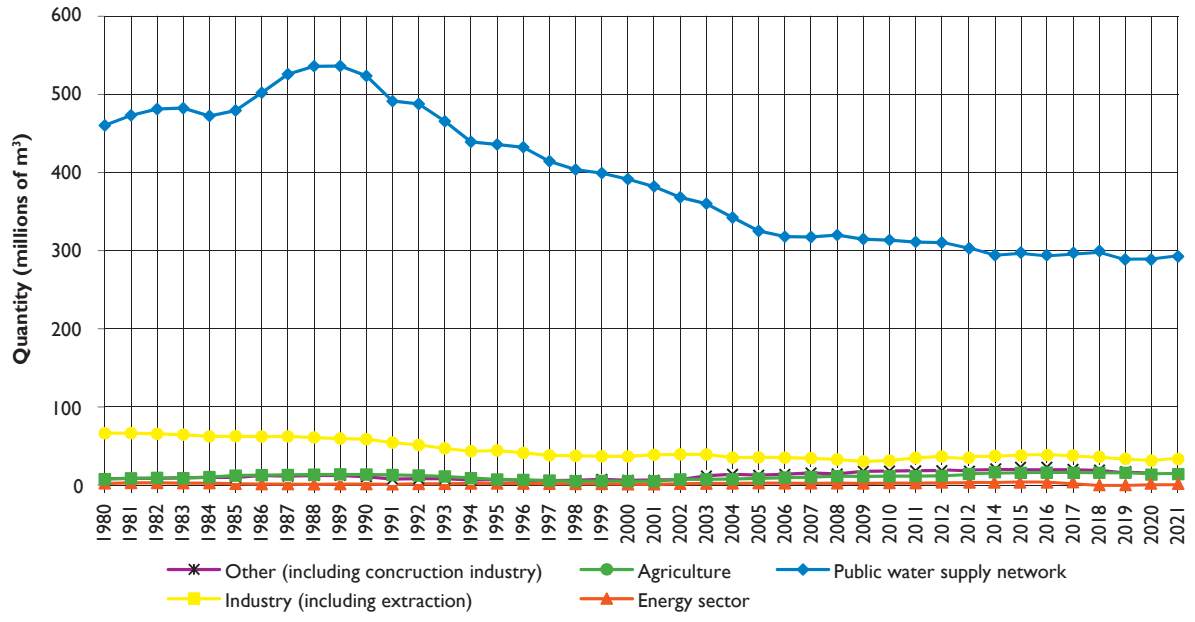
Comparison of the data from the long-term perspective shows that the highest volumes of groundwater were abstracted in 1988 and 1989. Since 1989, groundwater abstractions in the Czech Republic have been decreasing. Since 2006 a stagnation in volumes abstracted can be observed. In 2021, the amount abstracted is approximately the same as in 2016 (362.8 million m³).

Table 4.2.1
Groundwater abstractions (in millions of m³) by clients exceeding 6,000 m³/year or 500 m³/month in 2021

River Board, s.e.	Public water supply networks		Agriculture incl. irrigation		Energy sector		Industry incl. extraction		Others incl. construction industry and sewerage systems		Total	
	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number
Elbe	91.8	694	3.2	223	0.6	9	7.7	129	2.3	88	**105.6**	**1,143**
Vltava	33.4	581	5.8	367	1.0	12	10.0	112	9.2	459	**59.4**	**1,531**
Ohře	43.1	307	0.7	29	0.9	5	8.8	113	1.4	30	**54.9**	**484**
Oder	17.0	150	0.5	26	0.0	0	1.1	28	0.3	20	**18.9**	**224**
Morava	107.4	690	5.9	346	0.1	7	7.7	157	2.2	93	**123.3**	**1,293**
Total	**292.7**	**2,422**	**16.1**	**991**	**2.6**	**33**	**35.3**	**539**	**15.4**	**690**	**362.1**	**4,675**

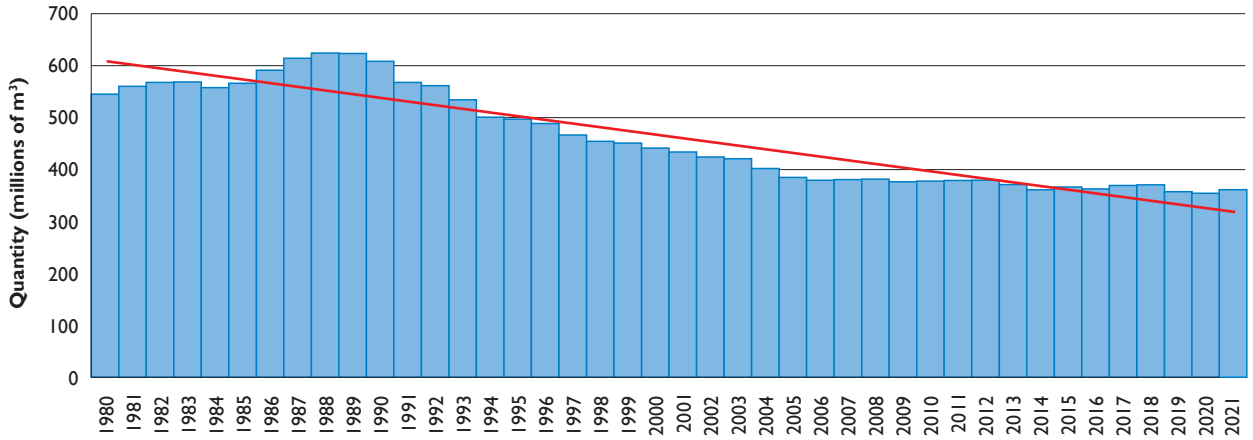
Source: River Boards, s.e.

Graph 4.2.1
Groundwater abstractions in the Czech Republic by industries 1980–2021



Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by River Boards, s.e.

Graph 4.2.2
Groundwater abstractions in the Czech Republic 1980–2021



Source: MoA using data provided by T. G. Masaryk Water Research Institute and River Boards, s.e.

Table 4.2.2 shows reported groundwater abstractions for technical snowmaking exceeding 6,000 m³/year or 500 m³/month in thousands of m³ in the Elbe, Vltava and Morava River Boards, s.e.

Table 4.2.2
Groundwater abstractions by clients exceeding 6,000 m³/year or 500 m³/month for snowmaking in 2021

River Boards, s.e.	Snowmaking *)	
	Volume in thousands of m³	Number
Elbe	12.0	1
Vltava	2.6	1
Morava	1.7	1
Total	**16.3**	**3**

Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by the River Boards, s.e.
*Note: *) Ascertained using internal code VHB "260410 – snowmaking of technical snow" used by the River Boards, or by the name of the abstraction.*

The Homolák Quarry (author: Hubalová Petra)

4.3 Wastewater discharges

In 2021, 1,512 million m³ of wastewaters and mine waters were discharged into watercourses, which means a year-on-year increase by 0.6%.

As in previous years, the total volume did not include water discharged from fishpond systems as the case was in the previous years (for the sake of uniformity of the data from individual River Boards, s.e.).

Only the energy category saw a decrease in discharges in 2021 (by 7.5%). Increases in wastewater discharges compared to 2020 were in the following categories: agriculture (by 10.5%), others including construction (by 9.3%), industry (by 7.9%) and public sewerage (by 1.6%).

In terms of the amount of wastewater discharged compared to 2020, there was an increase in the territorial jurisdiction of the Ohře River Basin (by 10.6%) and the Vltava River Basin (by 5.3%). The other sub-basins in their territorial jurisdiction recorded a decrease in discharges compared to the previous year – the Oder River Basin (by 4.2%), the Morava River Basin (by 3.2%) and the Elbe River Basin (by 1.5%).

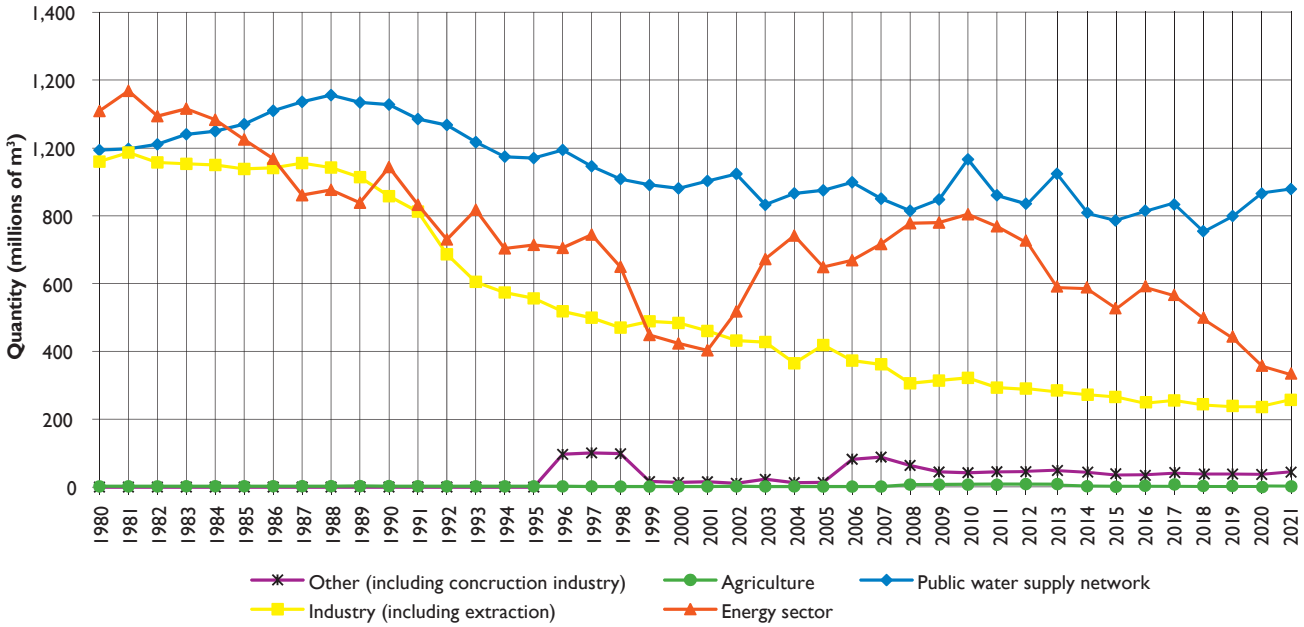
Seen from the long-term perspective, discharge of wastewaters and mine waters shows a slight decrease in the volume of discharged waters. This is due particularly to the system of discharge reporting with prevalence of discharges free of charge in the past when water was discharged directly into surface waters, not through a WWTP and volumes of discharged water was typically estimated on the basis of the invoiced water consumption. By extending sewerage systems, building new WWTPs with exact measuring of discharged wastewaters and by adopting the new Water Act in 2001, reports on discharged waters became more accurate. The last three years have been rather stable, with no significant fluctuations.

Table 4.3.1
Discharges of wastewaters and mine waters to surface waters (in millions of m³) for sources exceeding 6 000 m³/year or 500 m³/month in 2021

River Board. s.e.	Public sewerage		Agriculture incl. irrigation		Energy		Industry incl. mining		Others incl. construction and public water supply		Total	
	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number	Volume	Number
Elbe	187.6	771	0.0	2	213.0	21	78.9	157	2.4	59	**481.9**	**1,010**
Vltava	282.8	793	0.8	6	17.6	22	33.8	142	32.0	747	**367.0**	**1,710**
Ohře	81.0	288	1.0	3	13.4	22	74.5	143	1.2	25	**171.1**	**481**
Oder	103.5	324	0.0	2	8.4	15	50.4	80	4.3	59	**166.6**	**480**
Morava	224.6	1,194	0.3	6	78.4	15	18.6	137	3.5	100	**325.4**	**1,452**
Total	**879.5**	**3,370**	**2.1**	**19**	**330.8**	**95**	**256.2**	**659**	**43.4**	**990**	**1,512.0**	**5,133**

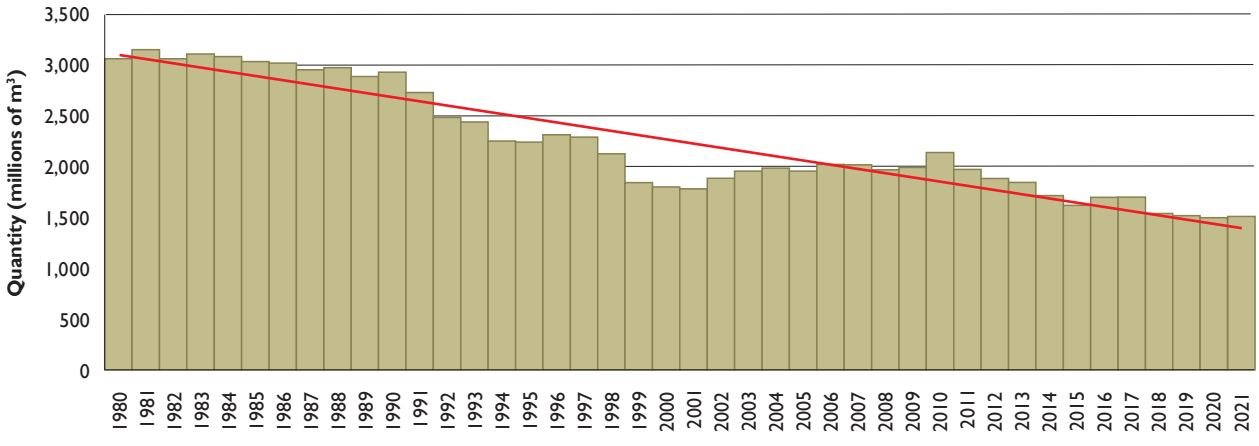
Source: River Boards, s.e.

Graph 4.3.1
Discharges of wastewaters in the Czech Republic 1980–2021



Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by River Boards, s.e.

Graph 4.3.2
Discharge of wastewaters in the Czech Republic 1980–2021



Source: MoA using data provided by T. G. Masaryk Water Research Institute, p.r.i., and River Boards, s.e.

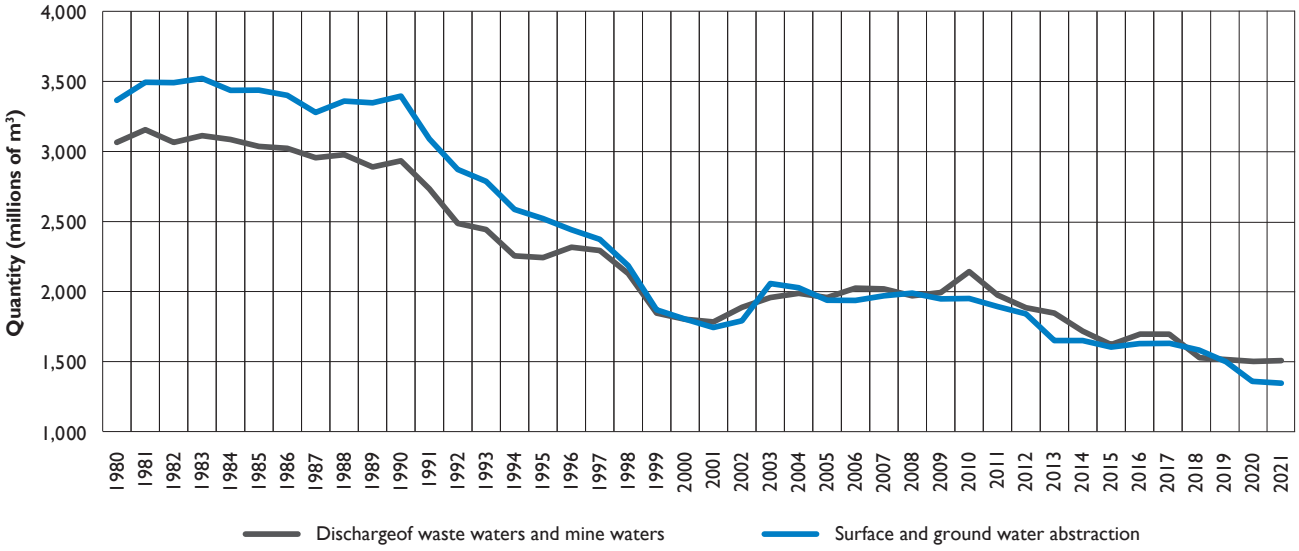
4.4 Overall comparison of water management

In 1980–2021, there was a very significant decrease in water abstractions and discharges after 1990, whereas after 2001 there was a slight growth for some time. However, after 2010 we saw another decrease in the volume of abstractions and discharges. The volumes of surface waters abstracted and discharged in 2021 reached all-time lowest values, as the case was in 2020. Groundwater abstractions increased from 354.9 million m³ in 2020 to 362.1 million m³ in 2021. Discharges in 2021 were about 10 million m³ higher than in 2020. Discharges were again slightly higher than abstractions.

The difference between the abstracted and discharged volumes before 1995 can be attributed to the different method of reporting discharges, higher leakages from water supply systems and non-uniformity of sewerage networks in many smaller towns (agglomerations with more than 2,000 equivalent inhabitants were only equipped with sewerage systems after the Czech Republic joined the EU in 2004).

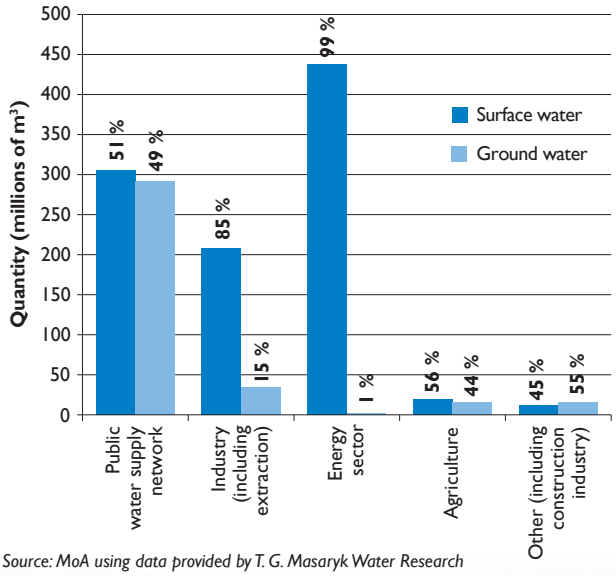
In dry years, the values of abstracted and discharged volumes of water are similar, while in more abundant years we notice higher volumes of discharged water than water abstracted which is linked with streaming a part of rainwaters into the sewerage system beyond the measured consumption in the water supply system.

Graph 4.4.1
Water abstractions and discharges in the Czech Republic 1980–2021



Source: MoA using data provided by T. G. Masaryk Water Research Institute, p.r.i., and River Boards, s.e.

Graph 4.4.2
Comparison of surface and groundwater abstractions by industry in 2021



Source: MoA using data provided by T. G. Masaryk Water Research Institute, p.r.i., and River Boards, s.e.

With respect to the fact that 2021 was average in terms of precipitation, the volume of water discharged again exceeds water abstractions. A total of 1.51 billion m³ of waters were discharged, whereas, the volume of surface water abstractions amounted to 1.35 billion m³.

When comparing surface and groundwater abstractions by industries, we can conclude that abstractions for water supply are almost identical, whereas majority of other industries uses mainly surface water. However, the exception is "other industries, including construction", where groundwater use has long been predominant.

In 2021, public water supply systems abstracted (as the case was in previous years) more water from surface sources. The water used by the energy sector is almost 100% surface water, which is also the case in other industries. Agriculture covers its needs with almost two thirds of surface water. The only industry – others incl. construction – abstracts larger volumes of groundwater than surface water. This is probably given also by the price of groundwater that is significantly lower than the price of surface water.

santima.studio (source: www.shutterstock.com)

5. SOURCES OF POLLUTION

5.1 Point sources of pollution

Surface water quality is affected primarily by point sources of pollution (cities and municipalities, industrial plants and farms with intensive agricultural animal production). The degree of water protection against pollution is most often assessed based on the development of the produced and discharged pollution.

The term "produced pollution" refers to the volume of pollution contained in produced (untreated) wastewaters. In line with EU requirements, the Czech Republic pays increased attention to data collection and analysis of the situation concerning pollution. In particular, data are collected from a larger number of reporting entities under so-called water balance in line with requirements of Decree No. 431/2001 Coll.

The produced pollution improved in 2021 in comparison with the previous year in three indicators: BOD_5 (biochemical oxygen demand) by 0.7%, COD_{Cr} (chemical oxygen demand) by 1.6% and NM (non-dissolved matters dried at 105°C) by 0.7%. The volume of DIS (dissolved inorganic salts) increased by 4.5%, N_{inorg} (inorganic oxygen) by 3.8% and P_{total} (total phosphorus) by 0.7%.

The pollution discharged, i.e. pollution contained in wastewaters discharged to surface waters, in two of six monitored indicators: NM (by 2%) and BOD_5 (by 1%). Discharged pollution increased in all other indicators: N_{inorg} (by 5.4%), DIS (by 3.6%), COD_{Cr} (by 0.5%) and P_{total} (by 0.3%). The development of discharged and invoiced pollution for each indicator since 1990 is illustrated in Table 5.1.1.

Between 1990 and 2021 there was a drop in the amount of discharged pollution as shown by the following indicators: BOD_5 by 96.6%, COD_{Cr} by 90.8% and NM by 95.2%. At the same time, there was a decrease in the volume of COD dangerous and extraordinarily harmful substances. There was also a significant drop in macronutrients (nitrogen, phosphorus) that was due to the introduction of biological removal of nitrogen and biological or chemical removal of phosphorus in wastewater treatment technologies applied in new and intensified WWTPs.

End of Work, the October 2021, the Vír Dam (author: Kopřivová Zuzana)

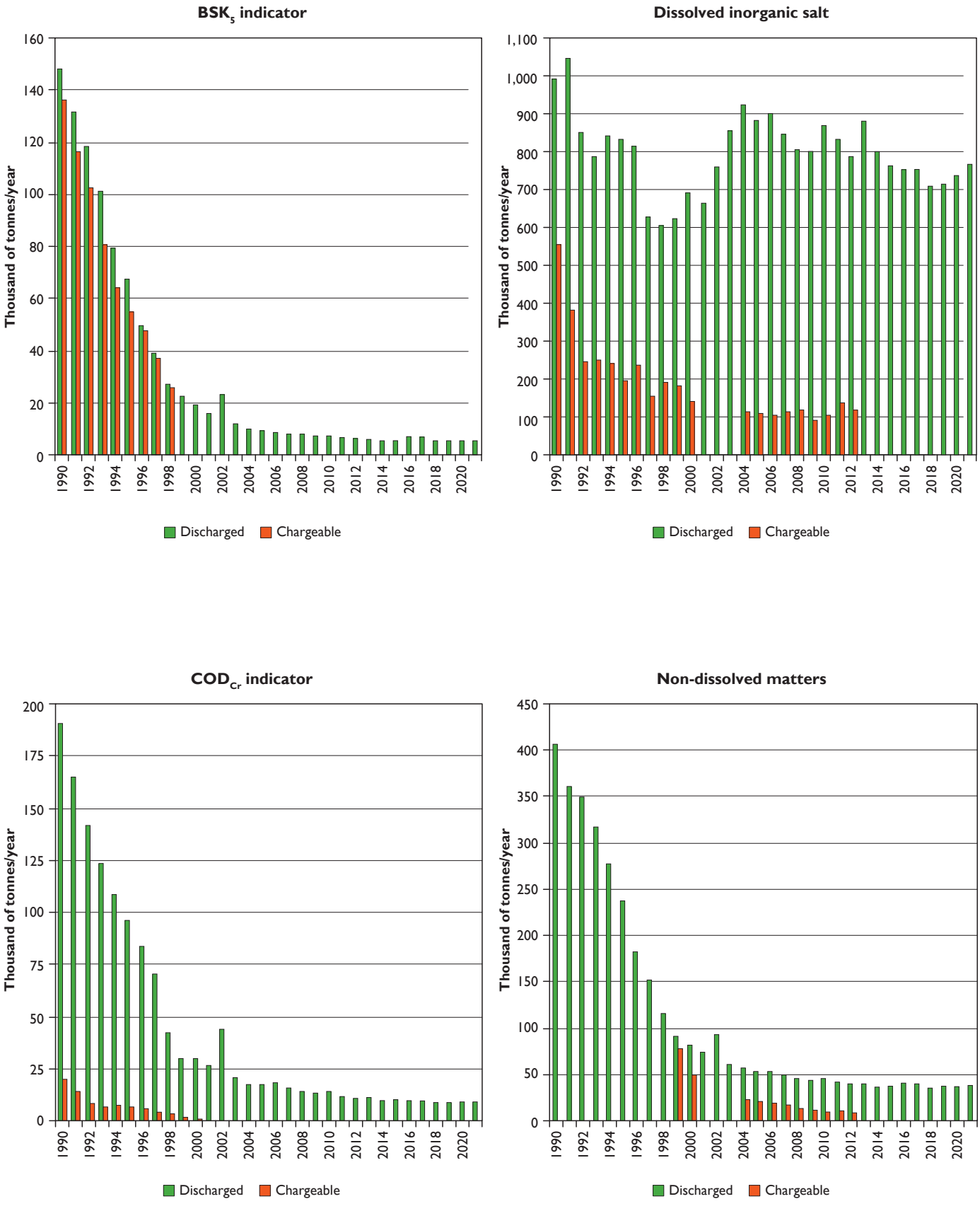
Table 5.1.1 shows that monitored DIS values of discharged pollution under the territorial scope of the Vltava River Board and the Oder River Board, state enterprises, are higher than produced pollution. The deviation in the resulting value of discharged pollution may be due to doses of salt used when reducing phosphorous chemically or when adding defoaming salts. Furthermore, indicators in the inflow and outflow to/from WWTPs are not monitored with the same frequency and/or not in the same type of sample, or the data about produced pollution might not be complete.

Table 5.1.1
Produced and discharged pollution in 2021

River Boards, s.e.	Produced pollution in tonnes/year						Discharged pollution in tonnes/year					
	BOD_5	COD	NM	DIS	N_{inorg}	P_{total}	BOD_5	COD	NM	DIS	N_{inorg}	P_{total}
Elbe *)	53,688	131,608	53,329	200,908	7,972	1,234	1,327	10,915	2,639	195,779	2,220	224
Vltava	85,982	203,350	90,552	107,434	9,033	2,312	1,390	9,786	2,291	111,598	2,318	258
Ohře *)	20,480	41,697	19,674	97,113	2,560	836	419	3,168	1,150	95,285	1,422	279
Oder *)	31,517	63,964	25,975	175,697	3,637	606	644	5,566	1,594	192,452	1,178	131
Morava *)	68,605	174,164	88,053	148,802	8,176	1,866	1,256	7,903	1,701	142,922	2,330	221

Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by the CSO and River Boards, s.e.
*Note: *) Some values in produced pollution were calculated using the volume of discharged pollution due to some notifiers' failure to report produced pollution.*

Graph 5.1.1
Discharged and invoiced pollution in 1990–2021



Source: T. G. Masaryk Water Research Institute, p.r.i., using data provided by the CSO and River Boards, s.e.

Cooling water pumping station for the Dukovany Nuclear Power Plant, July 2021, The Mohelno Dam (author: Pavlíková Eliška)

5.2 Area sources of pollution

Surface water and groundwater quality is also significantly affected by area sources of pollution – such as pollution from farming, from atmospheric deposition and from erosive runoff of the landscape. While pollution from point sources keeps decreasing, the contribution of area pollution is on the rise. Surface water and groundwater quality is most significantly affected by nitrates, pesticides and acidification and also by phosphorous, though not so much.

The most important measures aimed at decreasing area pollution of water from agricultural sources are Government Decree No. 262/2012 Coll., on the Designation of Vulnerable Areas and the Action Programme, as amended. This legal regulation reviews so-called vulnerable areas and initiates an action programme.

Direct funding and some subsidies from the Rural Development Programme (hereinafter referred to as the ‚RDP') and support intended for restructuring and transformation of vineyards under the joint organization of the wine market is conditioned by maintaining soil in "Good Agricultural and Environmental Condition" (hereinafter referred to as the ‚GAEC') and adhering to "Compulsory Requirements for Farming" (hereinafter referred to as the ‚CRF') in the sphere of Environment, Climate Change and Good Agricultural and Environmental Condition of Soil, Public Health, Health of Animals and Plants and Good Life Conditions for Animals.

In case a support applicant fails to meet with the requirements at any time of the calendar year in which they file the application for payment, the subsidy may be decreased or refused.

Conditions related to water pollution are CRF 1 – and GAEC 1 standards – unfertilized belts alongside watercourses, protection distances for application of plant protection preparations with the aim of protecting aquatic organisms and GAEC 3 – handling with harmful substances.

Agricultural land erosion and hydroamelioration aspects

The Czech Republic, like other countries, is increasingly exposed to hydrological extremes, which is due to climate change. It can be expected that regions affected by such extremes will expand significantly in the future. One of the key factors that can mitigate the impact of the climate change is suitable farming on agricultural land. In 2021, monitoring of water erosion recorded damage to 24% of water bodies.

The occurrence of water erosion in the Czech Republic is significantly affected by many factors, particularly by the fact that the blocks of soils are the largest in the EU soil plots, the lack of organic matter in the soil, very low share of landscape elements with soil protective (anti-erosion) function and inconvenient relation of farming subjects to the farmland. Water erosion results in soil loss and loss of topsoil and siltation of watercourse and reservoir beds. During prolonged periods of drought, sediments in watercourses may be subject to accelerated mineralization and once the water levels increase, water quality is deteriorated. This means that water erosion deteriorates water quality, contributes to eutrophication and complicates the use of water. Together with some extensive single-functional drainage systems, water erosion decreases water retention and accumulation in the land.

The reduction of erosion is addressed in the framework of cross-compliance by the GAEC 5 standard, aimed at protecting soil and is supported by setting specific conditions for cultivation of crops with low or medium erosion protection functions and setting the obligation to use soil conservation technologies when growing such crops on erosion-prone soil.

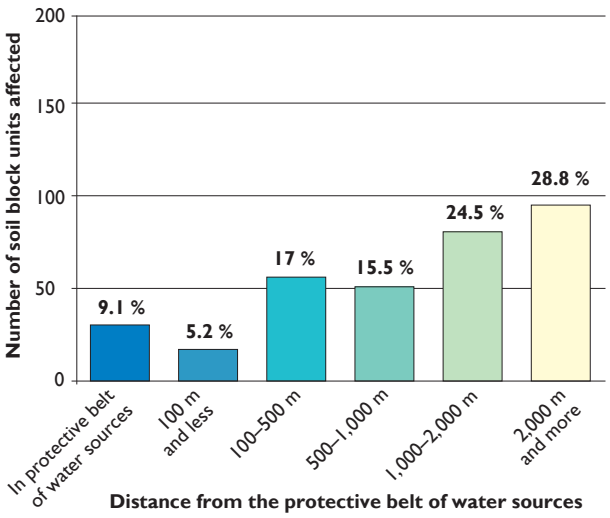
Since 2012, Research Institute for Soil and Water Conservation, p.r.i. (hereinafter also referred to as the ‚Research Institute for Soil and Water Conservation') has been monitoring farmland erosion (https://me.vumop.cz) with the aim of gathering relevant background materials about the extent of farmland erosion, causes of erosion, ascertaining whether the current policies in the field of fighting erosion are correctly aimed and about effectiveness (or ineffectiveness) of some anti erosion measures.

In 2021, Decree No. 240/2021 Coll., on the protection of agricultural land against erosion, came into force, which is directly linked to the system. As a result, it will be possible to assess the impact of this legislation on water pollution in the coming years.

For the monitored events from 2021, damage to water bodies was recorded in 24% of the cases, bringing the share of damage caused by erosion events close to the long-term average. The positive decrease that occurred in 2020 can be considered exceptional and no shift has occurred in water protection from the perspective of erosion. The monitoring identified especially visible damage – sediments. Runoff of erosion sediments carries other substances (pesticides, fertilizers, nutrients, etc.) that can reach water sources through the hydrographic network, which implies that the negative impact of erosion events on water source quality has several levels.

As Graph 5.2.1 shows, over 31% of affected soil blocks were within 500 m from water source protection zones and 9.1% of the blocks were inside the zones in 2021. It means that there was a decrease in the threat to the protection zones. This long-term assessment has displays for the second year in a row a slight decrease in single-digit percentage.

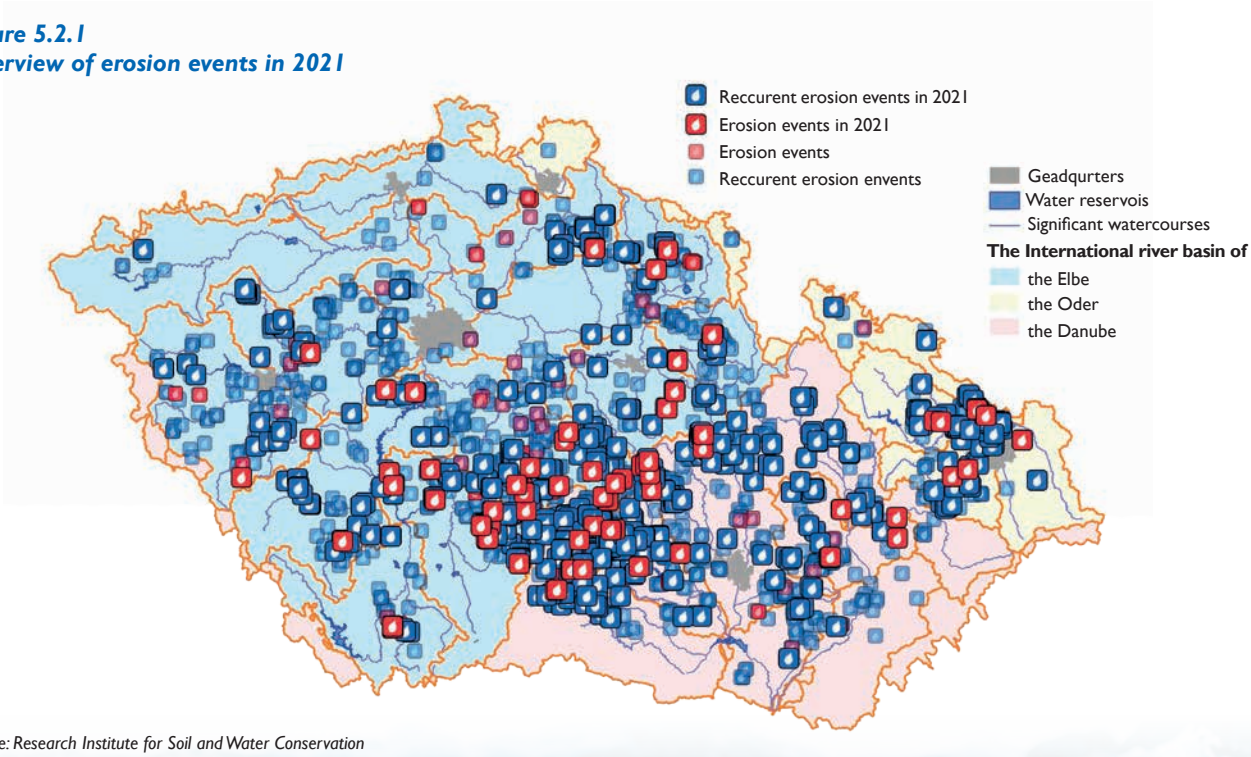
Graph 5.2.1
Recorded erosion events by distance from the water resource protection zone in 2021



Source: Research Institute for Soil and Water Conservation
Note: Number of soil block units affected = number of soil block units where erosion was detected.

Due to runoff of erosion sediments (according to the analyses, about 1.4 million m³ of sediments from the agricultural land fund gets to watercourses) and intake of other substances (pesticides, nutrients) that get to water sources through the hydrographic network and drainage systems affects adversely the water source quality. Major part of erosion events has negative impact on the water source quality: the amount of $N\text{-}NO_3$ offtake from arable drained land in the long-term average is approximately 30 $kg/ha^{-1}/year^{1}$.

Figure 5.2.1
Overview of erosion events in 2021



Source: Research Institute for Soil and Water Conservation

In order to mitigate impacts and effects of hydrological extremes in the landscape, it is necessary to adapt farming methods and use of agricultural landscape. Tools such as those published at https://geoportal.vumop.cz can be used to design such measures. Adaptations of drainage structures in terms of drainage runoff control or a range of other measures on agricultural drainage structures (drainage water transfers, water logging, artificial wetlands or biofilters) have considerable potential, which, in addition to the effect of slowing down water runoff from the landscape, also have an impact on water quality. By regulating drainage runoff, it is possible to raise the shallow water level by 20–70 cm, delay the peak drainage flow by 50–90% and reduce the total drainage runoff by 25–45%. What works in terms of improving the quality of water offtake are mechanisms used in drainage structures by increasing nutrient use by crops, reducing offtake (and thus nutrient offtake) and enhancing self-cleaning processes in the soil (e.g. denitrification in a water-saturated, anaerobic environment). On average, reductions of nitrogen and phosphorus offtake in drainage water have been documented to be 20–50% and 30–50% respectively, while maintaining or slightly increasing crop yields. Research Institute for Soil and Water Conservation, p.r.i. carries out several research projects in this field, processes contracts and studies and provides consultancy and services, however, it does not carry out an area-based, systematic survey of the extent and condition of drainage structures.

5.3 Accidental pollution

Surface water and groundwater quality is also affected by adverse impacts of accidental pollution. In 2021, the Czech Environmental Inspection registered a total of 167 accidental releases of harmful substances into surface waters and two accidental releases into groundwaters. The CEI imposed 372 fines totalling 16.6 million CZK in the sphere of water management.

According to the Water Act, the Czech Environmental Inspectorate (hereinafter referred to as ‚CEI') has maintained a central register of accidents since 2002. In 2021, 297 accidents were recorded in this register which fulfilled the definition of an accident under Section 40 of the Water Act. During 2021, additional accidents were reported to the CEI, which were not included in the central register of accidents, because of their insignificant scale, having no impact on water quality.

The most frequent accidents are still those caused by traffic. In 2021, 87 such accidents were registered, which accounts for 29% of the total number of recorded accidents. Fish mortality was an accompanying phenomenon in 30 cases, representing 10% of the total. Groundwater pollution occurred in only two cases. The origin of the accident was known in 162 cases.

Out of the 297 cases recorded, the most numerous group of pollutants was oil – 155 recorded cases, which is 52.2%, followed by other substances – 13.5% and chemicals (excluding heavy metals) – 9.1%. The nature of the pollutants was not detected in 28 accidents (9.4%).

In terms of the breakdown according to the groups of accident originators (CZ-NACE), the most frequent accidents were in section H – transportation and storage (17.8%), followed by accidents in section C – manufacturing industry (7.1%) and then accidents in section A – agriculture, forestry and fishing. The industry of accident originators could not be classified in 54.6% of cases.

In 2021, the CEI imposed 372 penalties for breaching legal regulations in water management, of which 330 penalties became fully effective in 2021. The total amount of fines resulting from decisions that became effective in 2021, regardless of the date of the decision, including decisions of appeal bodies, amounted to CZK 16.6 million.

The Finklův Pond (source: Ohře River Board, s.e.)

The Gloriuos Day, the July 2021, The Dyje Stream - unmodified, Poddyjí National Park (author: Grund Petr)

6. WATERCOURSE MANAGEMENT

6.1 Professional management of watercourses

The inland position of the Czech Republic at the heart of Central Europe predetermines its relation to the European river network. The basic hydrographic system is constituted by more than 100,000 km of watercourses with both natural and regulated watercourse beds. Watercourses in the Czech Republic are divided according to the Water Act into two categories: significant watercourses and minor watercourses. Professional management of watercourses is carried out in accordance with the provisions of Section 47 of the Water Act.

Important watercourse administrators under the MoA are River Boards, state enterprises, namely: Elbe River Boards, s.e., Morava River Boards, s.e., Oder River Boards, s.e., Vltava River Boards, s.e., and Forests of the Czech Republic, s.e. These administrators administer almost 94.5% of total watercourse length in the Czech Republic. The remaining 4.5% of watercourse lengths are administered by other administrators (the Ministry of Defence, national park administrators, municipalities, other natural persons and legal entities).

Table 6.1.1
Professional management of watercourses

Category	Administrator	Length of watercourses (km)	
		2020	2021
Significant watercourses	Elbe River Board	3,589	3,640
	Vltava River Board	5,539	5,540
	Ohře River Board	2,377	2,377
	Oder River Board	1,111	1,111
	Morava River Board	3,762	3,762
	River Boards in total	**16,378**	**16,430**
Minor watercourses	Forests of the Czech Republic	38,439	38,442
	River Boards, s.e., in total	38,897	38,858
	Other administrators [1)]	5,227	5,411
	Total	**82,563**	**82,711**
Watercourses in total		**99,108**	**98,941**

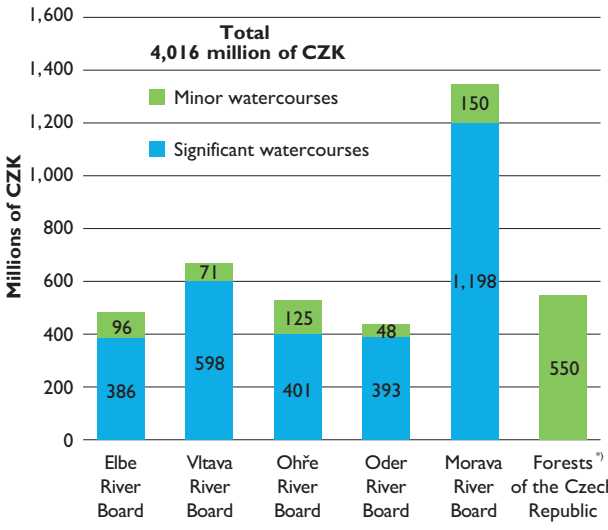
Source: MoA
Note: Digital lengths of watercourses from the Central Register of Watercourses are presented.
[1)] Including National Park Administrations, the Ministry of Defence (authorities of military districts), municipalities and other natural and legal persons.

All significant watercourses are listed in Annex No. 1 to Decree No. 178/2012 Coll. that defines a list of significant watercourses and methods for conducting activities linked with watercourse administration. It is an overview of 819 watercourses including their identifiers (watercourse ID); the overview also includes small watercourses that are so-called "border" watercourses. Significant watercourses with total length of 16,430 km are administered by the respective River Boards, s.e., under the provision of Section 4 of Act No. 305/2000 Coll., on River Basins. The backbone watercourses are the Elbe River (370 km), the Vltava River (431 km) and the Ohře River (254 km) in Bohemia, the Morava River (269 km) and the Dyje River (194 km) in the south of Moravia and the Oder River (135 km) and the Opava River (131 km) in the north of Moravia and Silesia.

All the other watercourses are classified as minor watercourses pursuant to Section 43 of the Water Act; they are administered based on the respective appointment by the MoA (provision of Section 48(2) of the Water Act). If no administration of a minor watercourse is appointed, such a watercourse is administered in accordance with the provision of Section 48(4) of the Water Act, by the administrator of the recipient into which such a watercourse flows. It is administered by such an authority until watercourse administrator is appointed in accordance with Section 48(4) of the Water Act. Minor watercourses may be administered by municipalities through which minor watercourses flow, natural persons or legal entities or organizational body that either use such a minor watercourse or is related to their activity. The template and content of an application to appoint the administrator of a minor watercourse is specified in detail in the abovementioned Decree No. 178/2012 Coll. According to the Central Register of Watercourses (hereinafter referred to as the ‚CRW'), the total length of minor watercourses is 82,711 km. The process of reassessment, refining and reclassification of the mapping of the designated minor watercourses continues to be underway.

Public administration bodies and the general public can find detailed information on the administration of watercourse in a CRW online application which is available at the website of the MoA (www.eagri.cz) and on the Water Management Information Portal (www.voda.gov.cz).

Graph 6.1.1
Funds spent on watercourse management in 2021



Source: MoA
*Note: *) The item includes funds for the management of watercourses and reservoirs.*

Watercourse administrators under the jurisdiction of the Ministry of Agriculture expended on significant and minor watercourse administration funds totalling to CZK 4,016 million, i.e. almost 27% more than in the previous year.

The acquisition value of tangible fixed assets related to watercourses increased by CZK 0.75 billion to almost CZK 56 billion in 2021 compared to the previous year.

The year-on-year growth is mainly caused by an increase in the tangible fixed assets generated by the renewal and planned development of entrusted property in the form of routine investment construction and by inclusions of assets taken over and completed hydraulic structures. Even in 2021, none of the watercourse administrators completed, approved or took over a hydraulic structure that would significantly influence the indicators expressing the acquisition value of the tangible fixed assets.

The Through the Lužnice Valley (author: Hubalová Peta)

Table 6.1.2
Acquisition value of tangible fixed assets related to watercourses

Watercourse administrator	2020	2021
	in billions of CZK	
Elbe River Board	10.79	10.86
Vltava River Board	11.78	11.82
Ohře River Board	10.58	10.65
Oder River Board	6.43	6.43
Morava River Board	8.93	9.00
River Boards in total	**48.51**	**48.76**
Forests of the Czech Republic	6.40	6.90
Total	**54.91**	**55.66**

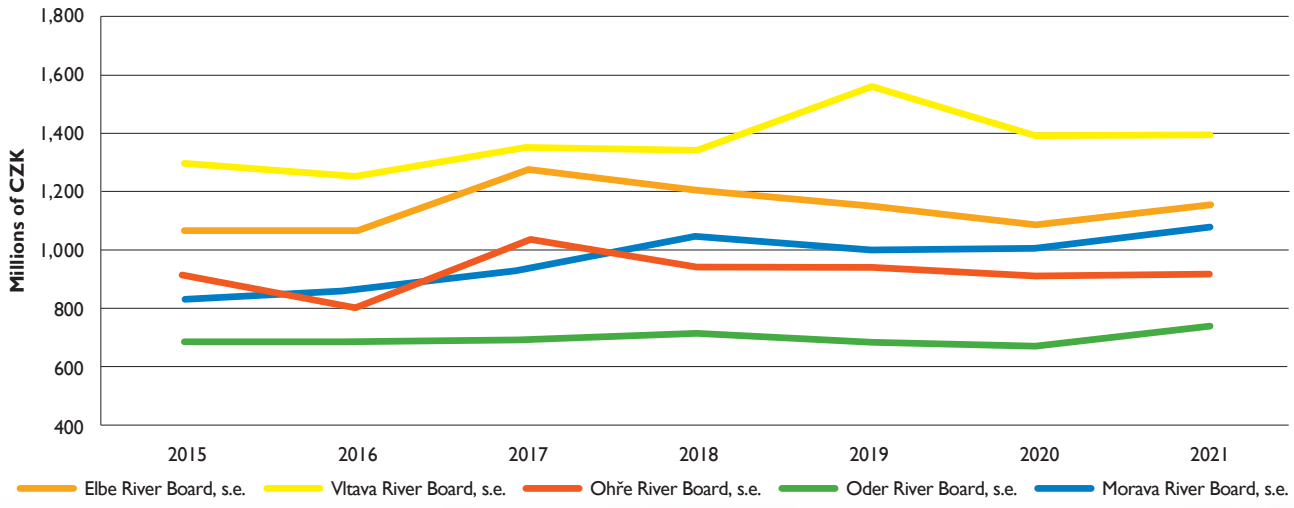
Source: MoA

6.2 River Boards, state enterprises

Total revenues generated by River Boards, state enterprises, amounted in 2021 to CZK 5,282.21 million, which means a year-on-year increase of more than CZK 210 million, i.e. by 4.2%. The biggest increase was in revenue from surface water abstractions, while revenue from electric power generation decreased.

The year-on-year growth in revenues of River Boards, s.e., was given by an increase in payments for surface water abstractions (up by CZK 193 million, i.e. by 5.4%). A big drop was in revenues from electric power generation (down by CZK 62 million, i.e. by almost 9%).

Graph 6.2.1
Revenues of River Boards, s.e. in 2015–2021



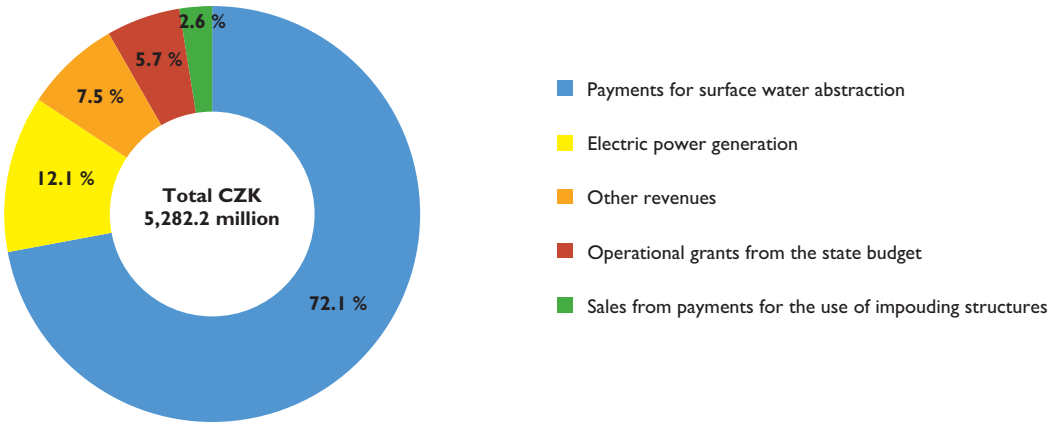
Source: MoA

Table 6.2.1
Structure of revenues of River Boards, s.e. in 2021

Indicator	River Boards, s.e.					Total
	Elbe	Vltava	Ohře	Oder	Morava	
	in thousands of CZK					
Payments for surface water abstractions	976,064	872,061	582,366	617,420	759,360	**3,807,271**
Electric power generation	50,914	265,903	220,523*)	77,183	26,748	**641,271**
Revenue from the use of weirs	6,898	120,358	2,613	0	4,956	**134,825**
Other revenues	70,926	112,483	89,726	40,101	84,013	**397,249**
Special-purpose non-investment grants[1)]	49,970	26,608	23,060	3,003	198,984	**301,625**
River Boards in total	**1,154,772**	**1,397,413**	**918,288**	**737,707**	**1,074,061**	**5,282,241**

Source: River Boards, s.e.
*Note: *) The item includes revenue from photovoltaic power plants.*
[1)] Includes all special-purpose non-investment grants for minor watercourses, grants from the STIF and other non-investment grants.

Graph 6.2.2
Structure of revenues of River Boards, s.e. in 2021



Source: MoA

Total costs of River Boards increased year-on-year by 5.4% to CZK 5,208 million in 2021. The greatest increase was in repairs and personal costs, by contrast, other costs dropped significantly.

Costs increased significantly in only two items: repairs (by CZK 184.3 million, i.e. by 19%) and personnel costs (by CZK 89 million, i.e. by 4%). Costs for material also increased (by almost CZK 20 million, i.e. by 13%). As compared with the previous year, other costs (down by almost CZK 21 million, i.e. by 15%), depreciation and service costs decreased.

The financial results reached by all River Boards, state enterprises, were in black figures with a total profit of almost CZK 75 million in 2021, which means a year-on-year drop by almost 40%, i.e. by CZK 58.3 million. The drop in 2021 was partly due to the pandemic situation, as the case was in many other industries.

Only two River Boards, s.e. grew in 2021: the Elbe River Board (year-on-year increase of approximately CZK 1 million, i.e. by 11% and, and the Oder River Board (profit increased by almost CZK 2 million, i.e. by 16%. All other River Boards, s.e. saw a decrease in their profits, the highest decrease of more than 67% was reported by the Vltava River Board, the profit of the Morava River Board decreased by 53% and of the Ohře River Board by 28%.

The Gradient on the River Mohelnice (source: Oder River Board, s.e.)

Table 6.2.2
Costs of River Boards, s.e. in 2020 and 2021

Type of costs	Year	River Board, s.e.					Total
		Elbe	Vltava	Ohře	Oder	Morava	
		in millions of CZK					
Write-offs	2020	196.2	345.7	183.8	149.0	167.4	**1,042.0**
	2021	190.9	340.0	181.4	147.9	168.6	**1,028.7**
Repairs	2020	148.9	263.9	166.9	105.1	283.7	**968.5**
	2021	196.9	271.4	202.1	143.5	338.9	**1,152.7**
Material	2020	33.1	25.2	16.9	30.6	42.1	**147.8**
	2021	35.9	33.0	19.8	33.3	45.3	**167.4**
Energy and fuels	2020	33.9	33.4	21.8	4.9	15.8	**109.8**
	2021	36.4	36.1	24.2	6.2	16.5	**119.4**
Personnel costs	2020	580.7	527.7	421.3	296.5	447.1	**2,273.4**
	2021	602.9	550.0	446.9	306.8	455.5	**2,362.0**
Services	2020	59.3	73.5	53.2	30.3	37.7	**254.0**
	2021	68.9	81.3	47.0	27.5	29.2	**253.9**
Financial costs	2020	0.4	0.4	0.1	0.2	1.1	**2.1**
	2021	0.4	1.1	0.2	0.2	0.9	**2.8**
Other costs	2020	27.6	48.5	19.3	42.5	3.4	**141.2**
	2021	11.8	60.1	-21.5 *)	55.2	15.1	**120.7**
Total costs	**2020**	**1,080.1**	**1,318.2**	**883.4**	**659.1**	**998.3**	**4,939.1**
	2021	**1,144.2**	**1,373.0**	**900.0**	**720.5**	**1,070.0**	**5,207.7**

Source: River Boards, s.e.
*Note: *) The negative value is due to the drawdown of the accounting provision for repairs of assets.*

Table 6.2.3
Economic results of River Boards, s.e. (profit, loss) in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	in thousands of CZK						
Elbe	16,471	22,026	60,276	22,880	15,631	9,534	10,563
Vltava	16,038	13,711	73,880	49,221	67,123	74,489	24,379
Ohře	20,300	27,422	169,652	73,346	41,380	25,387	18,262
Oder	12,495	20,845	22,291	53,053	9,503	14,826	17,224
Morava	18,830	112,916	11,721	17,875	12,300	8,619	4,098
Total	**84,134**	**196,920**	**337,820**	**216,375**	**145,937**	**132,855**	**74,526**

Source: River Boards, s.e.

Table 6.2.4
Distribution of profits of River Boards, s.e. in 2021

River Board, s.e.	Profit	Distribution of profit or coverage of loss					
		Reserve Fund	Social Welfare Fund	Social Fund	Remuneration Fund	Own capital	Unreimbursed loss from previous years
	in thousands of CZK						
Elbe	**10,563**	0	9,738	15	810	0	0
Vltava	**24,379**	0	15,000	0	9,379	0	0
Ohře	**18,262**	0	14,448	0	0	3,814	0
Oder	**17,224**	0	8,534	190	8,500	0	0
Morava	**4,098**	0	4,098	0	0	0	0

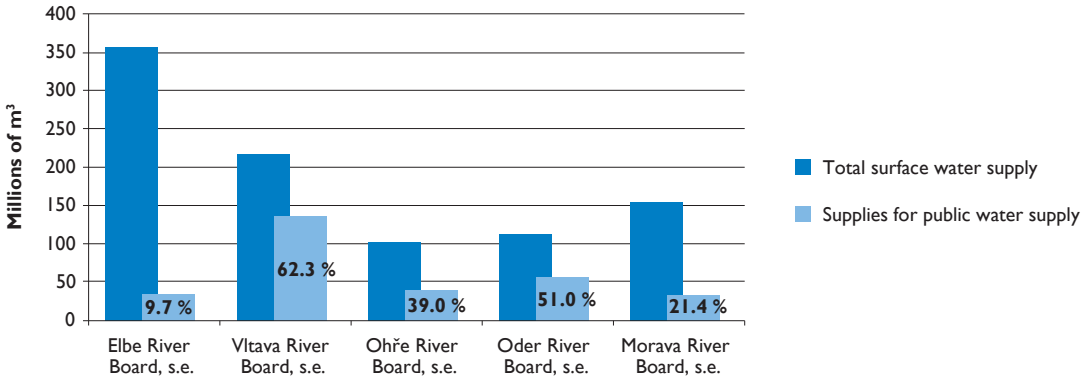
Source: River Boards, s.e.

Table 6.2.5
Surface water supplies invoiced under the territorial jurisdiction of River Boards, s.e. in 2015–2021

River Board, s.e.		2015	2016	2017	2018	2019	2020	2021
		in thousands of m³						
Elbe	a)	547,658	614,377	583,838	526,598	460,970	372,872	357,935
	b)	37,271	37,707	38,873	39,017	38,861	35,806	34,705
Vltava	a)	213,944	204,885	219,138	224,819	224,871	216,160	217,840
	b)	134,544	134,333	139,485	142,813	140,292	135,106	135,765
Ohře	a)	120,352	119,384	122,837	124,054	122,628	109,849	103,809
	b)	40,777	40,305	40,953	40,919	42,243	42,955	40,504
Oder	a)	136,832	127,995	124,144	125,379	115,696	108,655	112,874
	b)	65,045	62,306	60,592	60,901	60,204	57,150	57,529
Morava	a)	160,288	151,857	156,666	168,582	176,873	162,369	155,580
	b)	32,975	32,816	35,763	37,715	39,478	37,144	33,321
River Boards in total	**a)**	**1,179,074**	**1,218,498**	**1,206,623**	**1,169,432**	**1,101,038**	**969,905**	**948,038**
	b)	**310,612**	**307,467**	**315,666**	**321,365**	**321,078**	**308,161**	**301,824**

Source: River Boards, s.e.
Note: a) invoiced in total,
b) of which for water supply for public use.

Graph 6.2.3
Water supplies invoiced in the territorial jurisdiction of River Boards, s.e., by purpose in 2021



Source: River Boards, s.e.

The Soběnice (source: Ohře River Basin, s.e.)

The average price for other surface water abstractions per m³ in 2021 was CZK 5.50, up 7.8% on the previous year. It is a cost-based regulated price, which can only include justified costs, reasonable profit and tax according to the relevant tax regulations.

In addition to flow-through cooling and other abstractions, abstraction levels and prices of surface water intended for charged agricultural irrigation and flooding of artificial depressions in the landscape have been monitored since 2003. Charged water for agricultural irrigation was abstracted in 2021 in areas administered only the s.e. Vltava River Board, Elbe River Board and Ohře River Board. These abstractions amounted to a total of 133 thousand m³, which means a year-on-year decrease by 33%. Surface water abstractions intended for flooding artificial depressions in the landscape were not recorded by any River Board, s.e., in 2021.

Table 6.2.6
Price of surface water abstractions for flow-through cooling in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	CZK/m³						
Elbe	0.70	0.72	0.74	0.77	0.79	0.82	0.96
Vltava	1.25	1.27	1.32	1.32	1.34	1.37	1.41
Morava	1.19	1.21	1.22	1.23	1.25	1.28	1.38

Source: River Boards, s.e.
Note: The unit price per m³ does not include value added tax.

Table 6.2.7
Price of other surface water abstractions in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	CZK/m³						
Elbe	4.39	4.49	4.58	4.72	4.82	4.99	5.38
Vltava	3.62	3.69	3.84	3.84	3.90	3.98	4.10
Ohře	4.51	4.69	4.92	4.97	5.07	5.17	5.61
Oder	4.21	4.33	4.46	4.62	4.78	4.97	5.47
Morava	6.52	6.65	6.68	6.69	6.79	6.93	6.99
Average price of state-owned enterprises Basin *)	**4.34**	**4.64**	**4.77**	**4.88**	**4.97**	**5.10**	**5.50**

Source: River Boards, s.e.
Note: The unit price per m³ does not include value added tax.
*) *Calculated using weighted average.*

Confluence of the Elbe and the Cidlina (source: Elbe River Board, s.e.)

In the current approach, the current prices reflect the costs of the River Boards linked with administering the watercourses and river basins, not the value of surface water. The current prices are subject to regulation pursuant to Act No. 526/1990 Coll., on prices, and the rules stipulated by the decisions of the Ministry of Finance on price regulation, i.e. by the relevant notifications issuing the list of goods with regulated prices published in the Price Bulletin.

Revenues from surface water abstractions are the most significant source of income of the River Boards, s.e. In 2021, they increased by 5.3% compared to 2020, i.e. by CZK 192 million. The total amount of the revenues was CZK 3,807 million.

Table 6.2.8
Payments for surface water abstractions in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	in millions of CZK						
Elbe	860	996	1,001	1,027	993	882	976
Vltava	759	745	832	852	861	838	872
Ohře	543	560	604	617	622	568	582
Oder	576	554	554	579	553	540	617
Morava	637	672	715	804	827	786	759
River Boards in total	**3,375**	**3,527**	**3,706**	**3,879**	**3,856**	**3,614**	**3,807**

Source: River Boards, s.e.

The second most important source of revenues of the River Boards, s.e. is electric power generation, accounting for more than 12% of the total income. The number of small hydropower plants in operation is unchanged from the previous year, with a total of 104. The total revenues in this item decreased by more than 8.5% compared to the previous year and amounted to almost CZK 640 million.

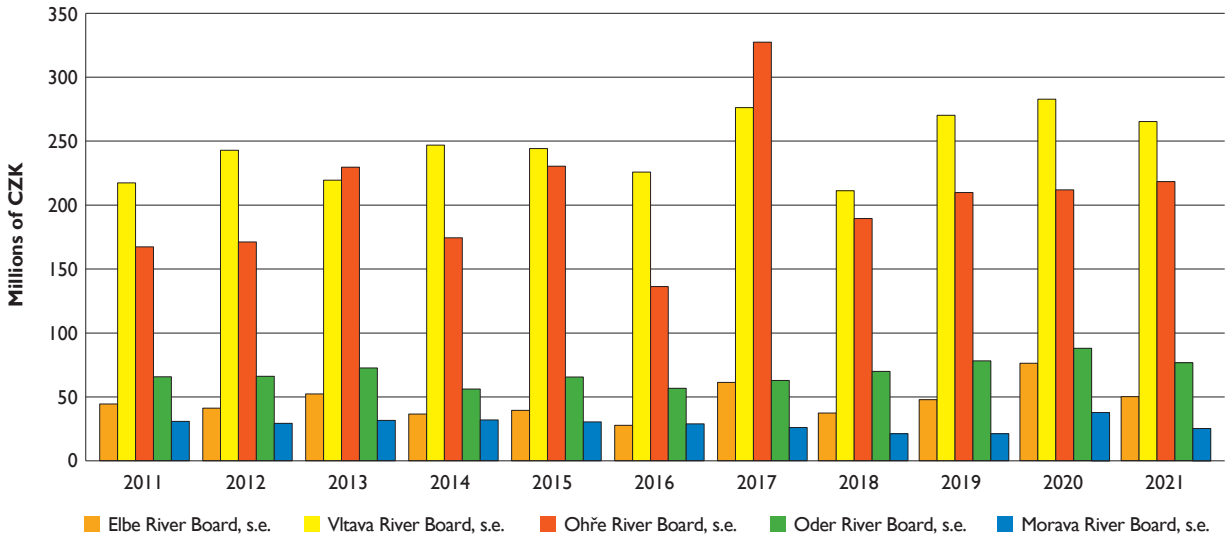
The highest revenues from power generation are repeatedly reported by the Vltava and Ohře river basins. Details of the own hydropower plants in the individual basin districts are given in Table 6.2.9 and Graph 6.2.4.

Table 6.2.9
Small hydropower plants owned by River Boards, s.e. in 2015–2021

River Board, s.e.	Indicator	2015	2016	2017	2018	2019	2020	2021
Elbe	Number of small hydropower plants	20	20	20	20	20	20	20
	Installed capacity in kW	6,438	6,795	6,819	6,819	6,989	7,001	7,001
	Electric power generation in MWh	15,880	12,288	22,440	13,835	16,327	24,796	23,343
	Sales in thousands of CZK	39,390	27,754	61,268	38,012	48,758	76,808	50,914
Vltava	Number of small hydropower plants	19	19	19	20	20	21	21
	Installed capacity in kW	22,016	22,128	22,128	22,328	22,328	21,950	21,950
	Electric power generation in MWh	88,474	99,497	77,475	77,922	91,123	91,693	102,569
	Sales in thousands of CZK	244,146	225,704	276,114	211,048	271,244	283,769	265,892
Ohře	Number of small hydropower plants	21	21	22	22	22	22	22
	Installed capacity in kW	16,966	16,966	17,091	17,091	17,091	17,091	17,091
	Electric power generation in MWh	84,954	84,910	84,244	72,908	76,484	67,024	92,537
	Sales in thousands of CZK	230,236	136,223	327,221	189,511	211,005	212,222	218,543
Oder	Number of small hydropower plants	16	23	23	26	25	26	26
	Installed capacity in kW	5,809	6,236	6,236	6,352	6,262	6,524	6,524
	Electric power generation in MWh	24,535	21,569	23,181	25,073	27,612	29,943	26,673
	Sales in thousands of CZK	65,509	56,669	62,942	69,487	79,630	89,112	77,183
Morava	Number of small hydropower plants	15	15	15	15	15	15	15
	Installed capacity in kW	3,497	3,497	3,497	3,497	3,551	3,635	3,588
	Electric power generation in MWh	11,535	11,008	9,609	8,239	7,566	14,614	15,576
	Sales in thousands of CZK	30432	28,812	26,039	22,279	22,215	38,744	26,748
Total	**Number of small hydropower plants**	**91**	**98**	**99**	**103**	**102**	**104**	**104**
	Installed capacity in kW	**54,726**	**55,622**	**55,771**	**56,087**	**56,221**	**56,201**	**56,154**
	Electric power generation in MWh	**225,378**	**229,272**	**216,949**	**197,977**	**219,112**	**228,070**	**260,698**
	Sales in thousands of CZK	**609,713**	**475,162**	**753,455**	**530,337**	**632,852**	**700,655**	**639,280**

Pramen: S. p. Povodí

Graph 6.2.4
Development of revenues of small hydropower plants owned by River Boards, s.e. in 2011–2021



Source: River Boards, s.e.

The Kadaň (source: Ohře River Board, s.e.)

I look good, the March 2021, The Nové Mlýny Dam

Other revenues of the River Boards, s.e., grew in 2021 year-on-year by more than CZK 31 million, totalling to more than CZK 397 million.

Other revenues is a sum of less significant items such as lease of land, non-residential premises and water areas and other business activities. The most significant items are revenue from the performance of machinery and road haulage, performance of laboratories and for designing and engineering work. Other revenues are often significantly affected by a number of unplanned items such as insurance payments, increased interest rates received and also the number of transfers of certain specified sales from previous periods but were only effectuated in the monitored year. As such unplanned items cannot be always anticipated, they may show considerable year-on-year fluctuations.

Table 6.2.10
Other revenues of River Boards, s.e. in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	in thousands of CZK						
Elbe	86,346	73,388	149,163*)	91,122	86,446	69,515	70,926
Vltava	93,132	71,409	78,738	120,231	108,072	96,952	112,483
Ohře	79,965	75,702	85,264	108,496	96,623	111,563	89,726
Oder	43,221	41,191	49,013	61,595	45,375	34,989	40,101
Morava	57,799	56,462	48,295	130,084	61,124	52,585	84,013
Total	**360,463**	**318,152**	**410,473**	**511,528**	**397,640**	**365,604**	**397,249**

Source: River Boards, s.e.
*Note: *) The item includes the recognition of proceeds from the sale of a security of Oberbank AG in the amount of CZK 50 million.*

In order to ensure crucial activities of the River Boards, various special-purpose non-investment and investment subsidies are used every year. The total amount of subsidies provided in 2021 increased by almost 26% compared to the previous year to a total of CZK 2.3 billion.

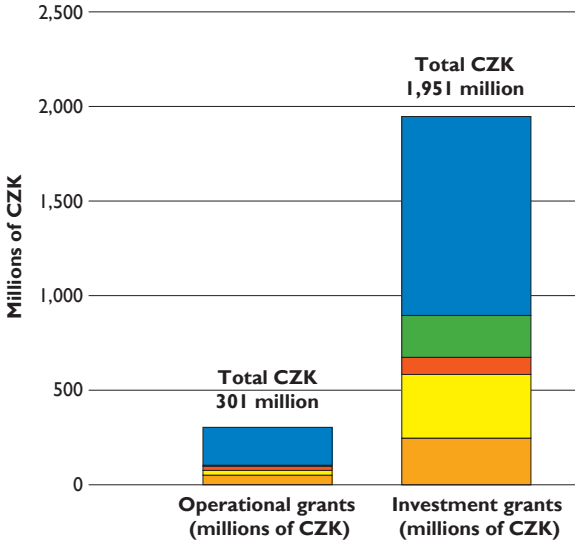
State subsidies are necessary for systematic activities allowing for implementation of state priorities such as flood control measures, delineation of flood zones, preparation of conceptual studies, remedying consequences of floods etc. In 2021, investment subsidies grew year-on-year by 29% (i.e. an increase of CZK 434 million), special-purpose non-investment subsidies grew by 13% (i.e. by CZK 34 million).

Grants were allocated for programmes focusing both on prevention and remedying of flood damage from previous years. The grants were provided from the budge of the MoA, the Operational Programme Environment (hereinafter referred to as the ‚OPE'), the EU Solidarity Fund (hereinafter referred to as the ‚SF'), European Regional Development Fund (hereinafter referred to as the ‚ERDF'), flood control measures were also co-funded by some regional offices and municipalities.

Investments by River Boards, s.e. recorded a 13% increase in 2021. Almost CZK 3 billion was spent on their implementation, with 65% from other sources and 35% from own sources.

The Construction on the Chomutovka Stream (source: Ohře River Board, s.e.)

Graph 6.2.5
Grants used by River Boards, s.e. in 2021



	Operational grants (millions of CZK)	Investment grants (millions of CZK)
Morava River Board, s.e.	198,984	1,054,355
Oder River Board, s.e.	3,003	226,242
Ohře River Board, s.e.	23,060	84,678
Vltava River Board, s.e.	25,840	339,381
Elbe River Board, s.e.	49,970	246,059

Source: MoA, River Boards, s.e.

The increase in the total investment sum of River Boards, s.e. compared to 2020 represents an increase of 356 million CZK. Other sources covering investment construction amounted to CZK 1.9 billion, of which 97.5% were financial sources from the state budget and 2.5% from other sources. Other sources included funds from the OPE, regions, cities and gratuitous transfers. Own sources intended for investments amounted to more than CZK 1.0 billion.

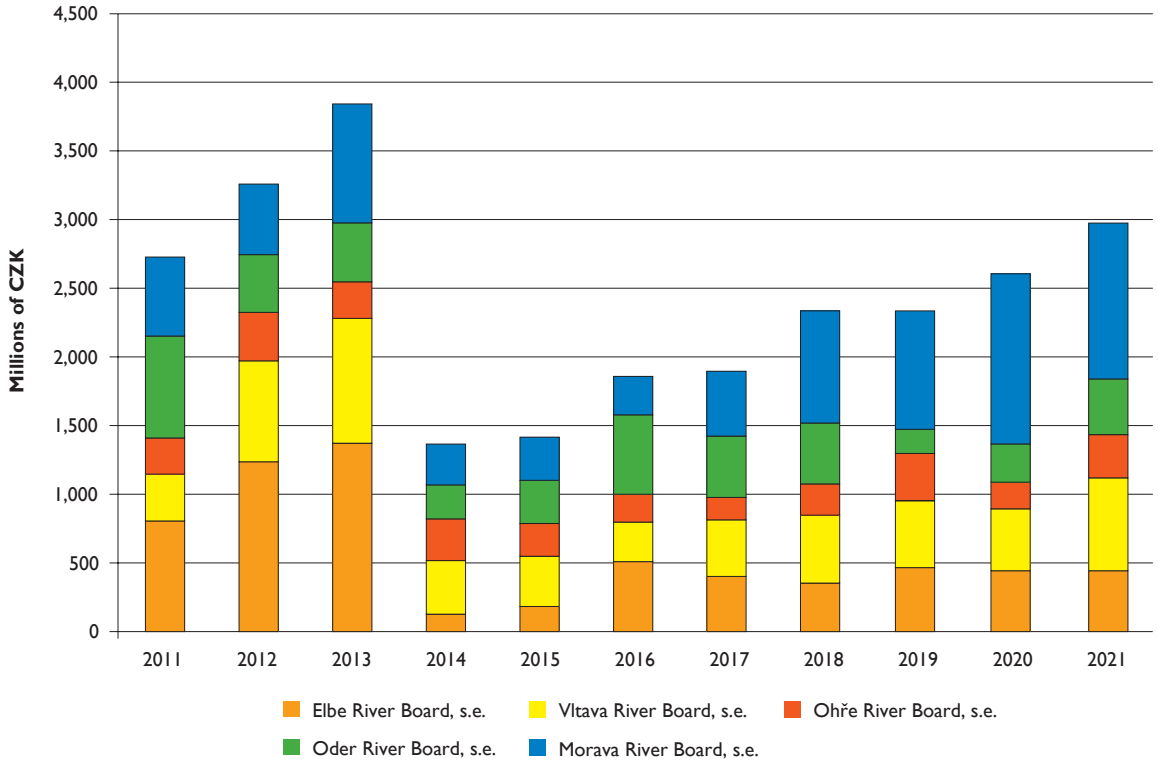
The largest increase in investments was reported by the Vltava River Board (48%, an increase of CZK 218 million). Compared to 2020, the Ohře River Board (71%, an increase of CZK 135 million) and the Oder River Board (45%, an increase of CZK 128 million) recorded a significant increase in investments. The Morava River Board recorded a decrease in investments (down almost 10%, i.e. by CZK 124 million).

Table 6.2.11
Investments of River Boards, s.e. in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	in millions of CZK						
Elbe	189.9	514.6	401.2	360.0	461.6	447.9	448.1
Vltava	361.5	286	410.9	493.0	495.3	452.8	670.4
Ohře	242.5	210.7	161.6	221.2	346.1	188.8	323.4
Oder	313.7	568.2	453.4	445.5	176.2	284.2	411.7
Morava	314.45	283.66	468	823.7	851.7	1,243.0	1,118.8
Total	**1,422.05**	**1,863.16**	**1,895.1**	**2,343.4**	**2,330.9**	**2,616.7**	**2,972.6**

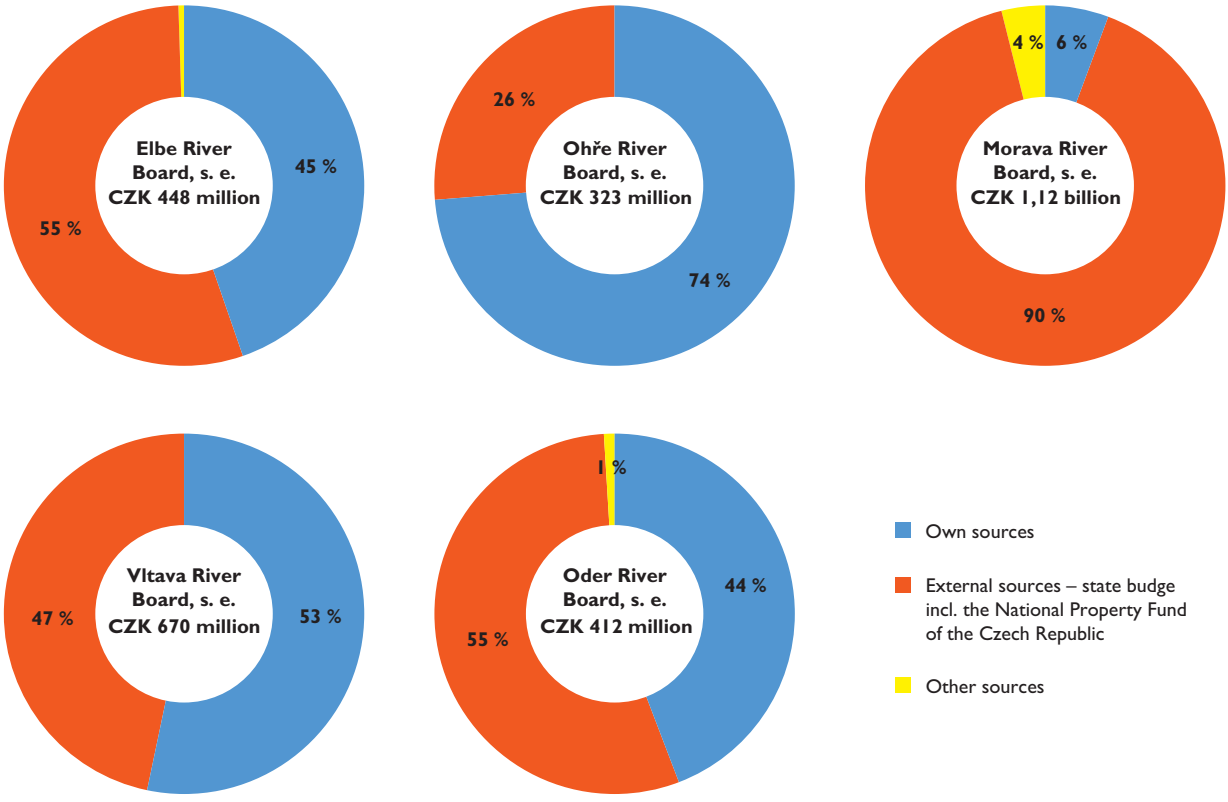
Source: River Boards, s.e.

Graph 6.2.6
Development of investment construction of River Boards, s.e. in 2011–2021



Source: MoA, River Boards, s.e.

Graph 6.2.7
Structure of the use investment funds by sources in River Boards, s.e. in 2021



Source: MoA, River Boards, s.e.

Compared to the previous year, the number of employees was reduced by 19 in 2021, with a total of 3,527 employees working for the River Boards, s.e.

Table 6.2.12
Number of employees of River Boards, s.e. in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
Elbe	919	904	894	884	878	874	865
Vltava	852	855	861	867	873	865	863
Ohře	619	614	605	617	614	611	611
Oder	462	465	463	464	458	452	446
Morava	713	737	742	739	746	744	742
Total	**3,564**	**3,575**	**3,565**	**3,571**	**3,569**	**3,546**	**3,527**

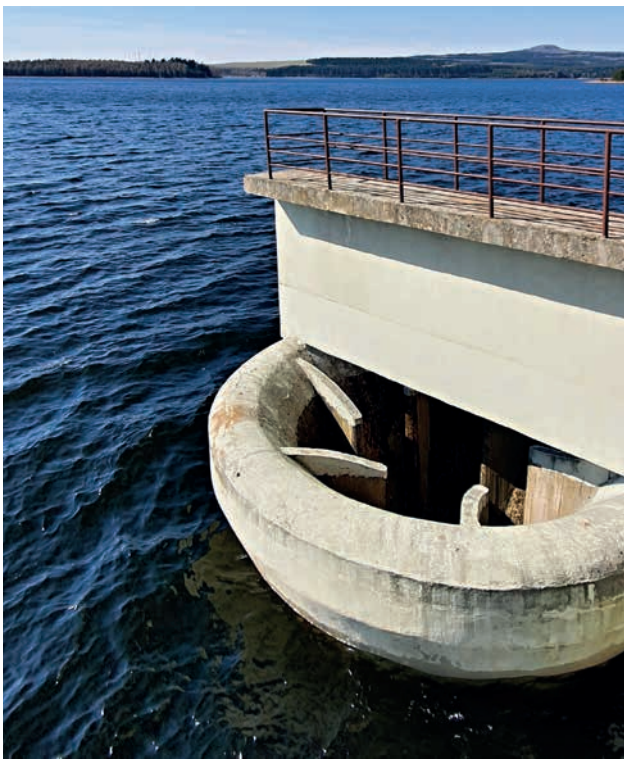
Source: River Boards, s.e.
Note: Average headcount, rounded to whole numbers.

In 2021, the average monthly salary in River Boards, s.e. increased by 3.6% and the average wage was CZK 39,460.

The year-on-year increase in the average monthly salary in River Boards, s.e. was CZK 1,357, while in the Vltava and Oder River Boards it increased by almost CZK 2,000. less in other River Boards. The average salary in the Ohře River Board has long been the highest, while it is the lowest in the Morava River Board.

Activity of the River Boards, s.e., is regularly checked by relevant inspection bodies. In 2021, due to the pandemic situation and related measures, 62 audits were carried out, almost the same number as last year.

The other inspection bodies include those that carried out one inspection in 2021: the Supreme Audit Office, the Energy Regulatory Office, the Ministry of the Environment, the Institute for Forest Management, the Central Inspection and Examination Office for Agriculture, the Office for the Protection of Competition, the General Health Insurance Institution, the Ministry of Transport and the Tax Office each carried out one audit. None of the audits found serious deficiencies. Minor deficiencies identified were corrected during the regular monitoring visit.



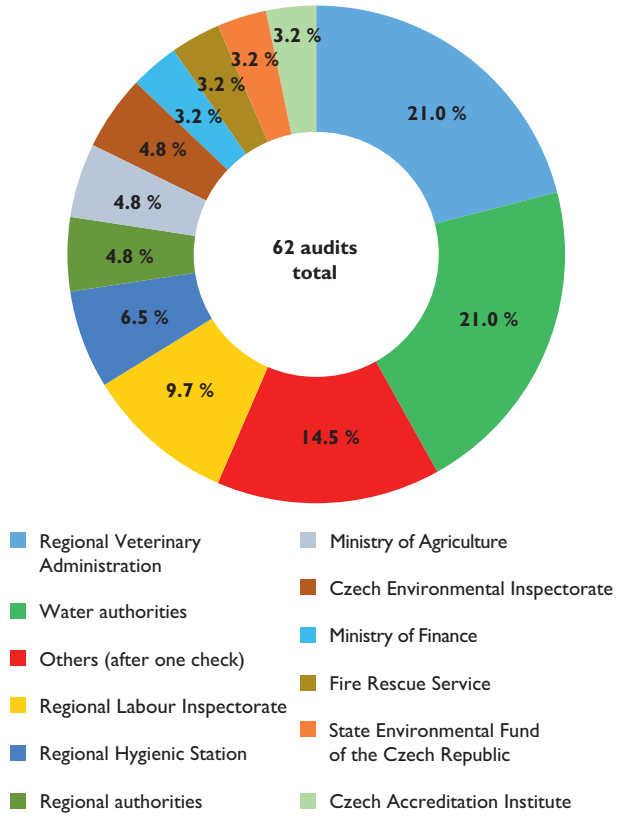
The Přísečnice Dam, Spillway (source: Ohře River Basin, s.e.)

Table 6.2.13
Average salaries in individual River Boards, s.e. in 2015–2021

River Board, s.e.	2015	2016	2017	2018	2019	2020	2021
	CZK/month						
Elbe	31,596	32,538	33,653	35,050	37,472	39,074	40,686
Vltava	30,398	31,087	31,550	32,740	35,017	37,131	39,044
Ohře	33,242	33,505	34,541	37,079	38,365	39,683	40,490
Oder	31,133	31,787	32,629	34,409	36,695	38,232	40,040
Morava	27,167	28,392	29,782	32,464	34,981	36,674	37,320
Average monthly salary in River Boards *)	**30,650**	**31,497**	**32,357**	**34,221**	**36,383**	**38,094**	**39,460**

Source: River Boards, s.e.
*Note: *) Calculated using weighted average.*

Graph 6.2.8
Inspection bodies carrying out inspections in River Boards, s.e. in 2021



Source: River Boards, s.e.

The Orlík Dam, Boat Lift (author: Hubalová Petra)

6.3 Forests of the Czech Republic, s.e.

Forests of the Czech Republic, s.e., administers specified minor watercourses and torrents as one of the non-production forest functions. In 2021, Forests of the Czech Republic administered more than 38.4 thousand km of watercourses and 1,005 small water reservoirs.

Watercourse management carried out by Forests of the Czech Republic, s.e. includes management of assets relating to watercourses, with acquisition value of CZK 6.9 billion (especially watercourse regulation, torrent and ravine damming, flood control measures and water reservoirs). Watercourse management was performed by seven watercourse organisational units - regional directorates.

In 2021, the activities performed by Forests of the Czech Republic in the field of water management focused in particular on the following:

- implementation of both capital investment projects and non-investment projects aimed at flood control measures, river channel stabilization and erosion control measures,
- construction, restoration and repairs of water reservoirs, pools and wetland with the aim of decelerating surface runoff and retention of water in the landscape and preparation of other projects aimed at mitigating negative impacts of drought and lack of water in the Czech Republic,
- carrying out repairs and maintenance of property,
- other activities aimed at riparian stand management, revitalization of watercourses which were improperly adjusted in the past, non-production forest functions, support for endangered species, elimination of non-indigenous invasive plant species, etc.,
- administering the Central Register of Watercourses and Water Reservoirs and inventory of assets.

Watercourse management, preparation and implementation of measures (repairs, rehabilitation and new investments) were mainly financed from the organization's own resources and from grants and subsidies. As regards subsidies, the funds were aimed at support for measures carried out in the public interest pursuant to Section 35 of Act No. 289/1995 Coll. on forests and on amendments to certain Acts (Forest Act), financed by the European Recovery and Resilience Facility under the National Recovery Plan, and funding from the state budget allocated for programmes of the Ministry of Agriculture pursuant to Section 102 of the Water Act, namely "Support for Prevention Against Floods" and "Support for Measures at Minor Watercourses and Minor Water Reservoirs" and from the EU Funds (the "Operational Programme Environment" and the "Rural Development Programme"). Activities linked with watercourse management are of a non-commercial nature and they generate virtually no profit with respect to the funds expended.

In connection with the management of watercourses and water reservoirs, Forests of the Czech Republic, s.e., disbursed in 2021 a total of CZK 550.0 million, including expenditures of capital investment nature amounting to CZK 240.1 million; the amount includes investments in construction as well as in purchase of land necessary for ensuring care of watercourses. Its own sources used for these investments amounted to CZK 65.5 million. In total CZK 309.9 million, of which CZK 271.0 million of own sources, was used to perform management of defined minor watercourses and repairs and maintenance of the relevant fixed assets. A total of CZK 35.7 million, of which CZK 16.9 million of own sources, was expended on remedying flood damage. The funds expended include all costs relating to watercourse and water reservoir management. The funding structure is shown in Table 6.3.1.

The revenues from surface water abstractions intended for covering the costs of watercourse management 2021 amounted to CZK 18 million. The development of revenues from surface water abstractions and unit prices is shown in Table 6.3.2.

Graphs 6.3.1 and 6.3.2 show total investment costs of water management and funds spent on repairs and maintenance of water management assets of the Forests of the Czech Republic over a longer period of time.

Table 6.3.1
Forests of the Czech Republic, s.e. – Funding structure – water management in 2021 (total costs)

Projects	Total	Own sources	Total subsidies	Of which flood damage	
				Subsidies	Own sources
	in millions of CZK				
Investments	240.1	65.5	174.6	18.8	5.8
Non-investment	309.9	271.0	38.9	0.0	11.1
Total	**550.0**	**336.5**	**213.5**	**18.8**	**16.9**

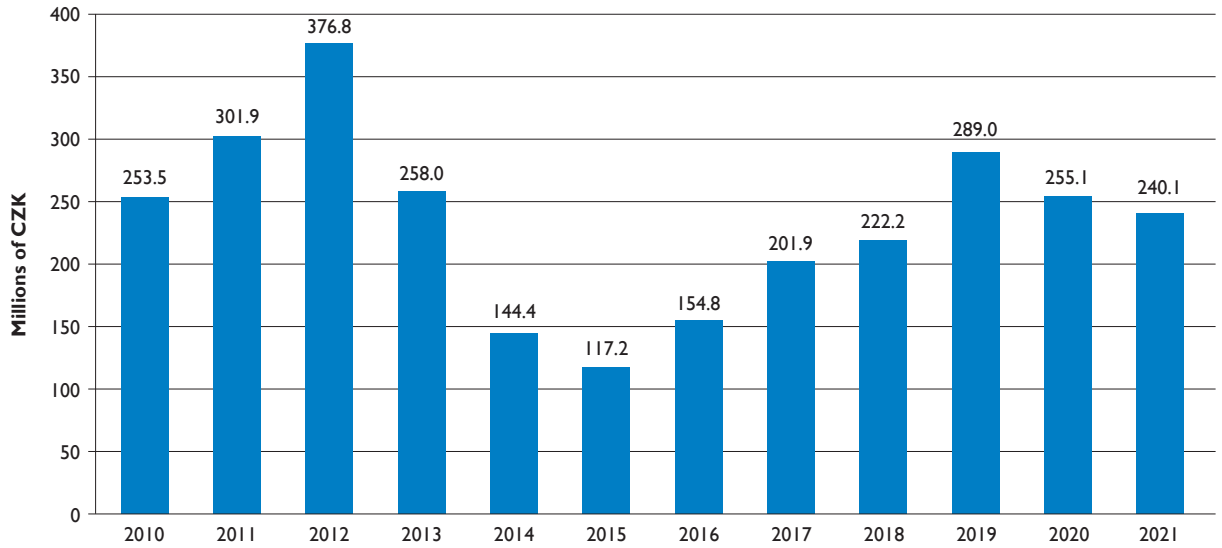
Source: Forests of the Czech Republic

Table 6.3.2
Forests of the Czech Republic, s.e. – Revenues from surface water in 2011–2021

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	in thousands of CZK										
Revenue	12,969	13,679	12,211	11,544	10,682	13,192	15,106	15,481	15,610	14,946	18,035
Price per m³ *)	1.9	1.96	2.00	2.05	2.06	2.26	2.52	2.65	3.06	3.47	4.00

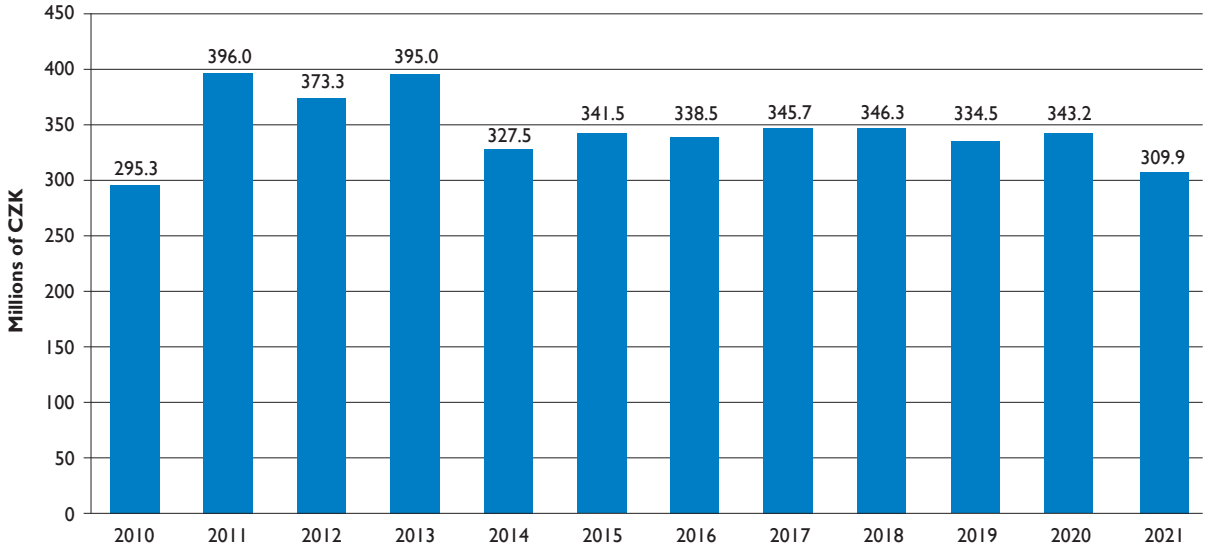
Source: Forests of the Czech Republic
*Note: *) The unit price per m³ does not include value added tax and is quoted in CZK.*

Graph 6.3.1
Forests of the Czech Republic, s.e. – Investments in 2010–2021 – water management



Source: Forests of the Czech Republic

Graph 6.3.2
Forests of the Czech Republic, s. e. – Expenses in 2010–2021 – repair and maintenance of watercourses and reservoirs (total costs)



Source: Forests of the Czech Republic

In 2021, major flood events were occurred in the summer months (June, July and August). Due to intense precipitations, local flood damage occurred in northern Moravia (Jeseník District and Šumperk District) and in northern and eastern Bohemia (Děčín District and Česká Lípa District). In particular, fortification of watercourse beds was damaged and they were blocked by sediments. Most of the damages were solved by immediate implementation of safety works amounting to over CZK 8 million.

In the context of ongoing climate change, the "Returning Water to the Forest" programme continued to contribute to water retention in the landscape. The programme aims to implement measures to mitigate the negative effects of drought and water scarcity. This includes measures aimed at slowing down surface water runoff (revitalisation of forestry drainage and watercourses), creating and restoring water features in the landscape, such as pools, wetlands and small water reservoirs. In total, 70 constructions and 110 minor measures in the landscape were completed in 2021, 40 constructions were initiated and the preparation of other constructions is ongoing.

Major measures implemented within the competence of individual Regional Directorates

In North Moravia, flood control measures were completed in the municipality of Fryčovice, Frýdek-Místek district, and construction of flood control measures was started in the municipality of Nové Sedlice in the Opava District and in the municipality of Třemešná in the Bruntál District. Completed projects include reconstruction of beds of watercourses flowing through the municipalities of Hošťálkovy and Krásné Loučky near Krnov and in Zlaté Hory in the Jeseník District. Two small water reservoirs were restored near the municipality of Černá Voda in the Jeseník District and above the municipality of Krásná near Frýdek–Místek. A new water reservoir was built above the municipality of Loštice.

In South Moravia, the "LP Lažánky project" in the municipality of Milonice was completed in order to stabilise the watercourse with transverse objects and to create a retention area. A water reservoir in the municipality of Niva in the Prostějov District was restored with the main purpose of ensuring safe transfer of increased/flood flows. The reconstruction and revitalisation of the watercourse in the municipality of Radějov allowed for water to flow in the floodplain and promoted the biodiversity of the area.

In Vysočina, a longitudinal channel in the municipality of Hrutov in the Jihlava District was reconstructed as part of the care of existing water management assets. Increasing capacity of the Rožínka riverbed in the urban area of the Rožná municipality in the Žďár District was completed. The Skřivánek retention reservoir in the Jihlava District was completely rebuilt. Another 3 historical flow-through reservoirs in the Dačice and Žďár Districts were completely reconstructed and sediments were completely removed with the aim of increasing the retention capacity of the reservoirs.

In South Bohemia, the second stage of the revitalisation of the Borkovice Marshes in the Tábor District was completed. With the aim of restoring the natural hydrological regime of the inadequately drained area of industrially mined peatland, works continued in Hrdlořezy in the Nové Hrady District. As part of an action aimed at preserving cultural and natural heritage, restoration of the historic canal on the Schwarzenberg and Otovský Streams was completed. The channel of the Musík watercourse in the municipality of Chlum near Sedlčany was stabilised and flood protection increased by increasing the capacity of the channel.

In West Bohemia, a sedimentation dam was built in the Kozojedy u Kralovic municipality in order to limit the volume of transported sediments. On land near the municipality of Třemešná in the Tachov District, a piped watercourse and its water meadow were revitalised. Reconstruction of a small

Revitalization of Borkovické blat in Táborsko – II. stage (source: Forest of the Czech Republic, s.e.)

water reservoir and de-mudding of an inundation area was carried out on the Umířovský Stream in the Pilsen Region.

In North Bohemia, the Vlčí Reservoir near the town of Šluknov and the dam of the Vojenská Reservoir were reconstructed. In the municipality of Pustověty, maintenance of a stone dam was carried out on the Čepinský stream. Repairs of transverse structures and longitudinal fortifications was also carried out in the bed of the Zvonící Stream in the Chomutov District. The reconstruction of water reservoirs south-west of the municipality of Svatá in the Beroun District will enhance flood protection.

In East Bohemia, damming of the torrents in the Východní Stream catchment area was completed in order to prevent transport of a significant volume of sediments into the lower part of the watercourse flowing through the urban part of the town of Hostinné. Reconstruction of two water reservoirs, including de-mudding of one of them, was carried out near the municipality of Nový Ples in the Hradec Králové Region. In addition, the Kanice Reservoir near Nový Bydžov was restored. In the municipality of Bartošovice v Orlických horách, a right-side tributary of the Bartošovický Stream was revitalised. The fortification of the Drahtinka Stream was reconstructed in the town of Hlinsko.

6.4 Land consolidation and structures used for amelioration

Land consolidation

Long-term water retention in the landscape and erosion protection, i.e. the construction of ponds, small water reservoirs, wetlands and elements ensuring anti-erosion protection, continued to be the main priorities of land consolidation in 2021. By 31 December 2021, water management measures, part of land consolidation improvements implemented since 1991, were built on an area of more than 736 ha and anti-erosion control measures on an area of approximately 859 ha. In 2021, water management measures worth almost CZK 319 million were implemented as part of land consolidation and anti-erosion measures worth more than CZK 78 million.

Transport and green infrastructure were developed, i.e. measures ensuring access to plots and environmental measures. Such measures (referred to as "joint structures") are typically designed as polyfunctional: unpaved roads have draining and retaining ditches, newly designed plots of land are divided by balks, swales and anti-erosion dikes complemented with planting of shrubs and trees, green vegetation is also planted around water reservoirs under construction and alongside paths/roads. In addition to the transport and environmental function, such measures serve the purpose of soil protection and improve water management in the landscape. A total of CZK 2,630 million was expended on joint structures in 2021.

In order to allow for building such measures in the landscape, it is first necessary to have suitable plots. The most effective instrument for new arrangement of plots in the landscape is land consolidation that rearranges ownership of land and creates conditions so that land owners can manage them rationally. At the same time, land consolidation provides conditions for improving the environment, protection and reclamation of land resources, forest and water management, particularly in reducing adverse effects of floods and drought and addressing runoff conditions and improving the ecological stability of the landscape.

The authority competent for conducting land consolidation under No. 139/2002 Coll., on land consolidation and land offices, and amending Act No. 229/1991 Coll.,

regulating the ownership of land and other agricultural property, as amended, and by implementing Decree No. 13/2014 Coll., on the procedure for implementation of land consolidations and requirements for land adjustment proposals, is the State Land Office (hereinafter referred to as the ‚SLO').

Land consolidation is carried out either as comprehensive or simple consolidation. Currently, simple and comprehensive land consolidation has been completed for almost 38.4% of

total agricultural land resources, while land consolidation is underway in 12.5% of agricultural land. Over CZK 378 million was spent on designing land consolidation including non-investment activities in 2021.

One of the main outputs of comprehensive land consolidation, in addition to the new digital cadastral map, is a plan of the aforementioned joint structures that is closely linked to municipality master plans. It is subject to approval by municipal councils and the ownership of lands designated for placement of joint structures is typically transferred to the given municipality.

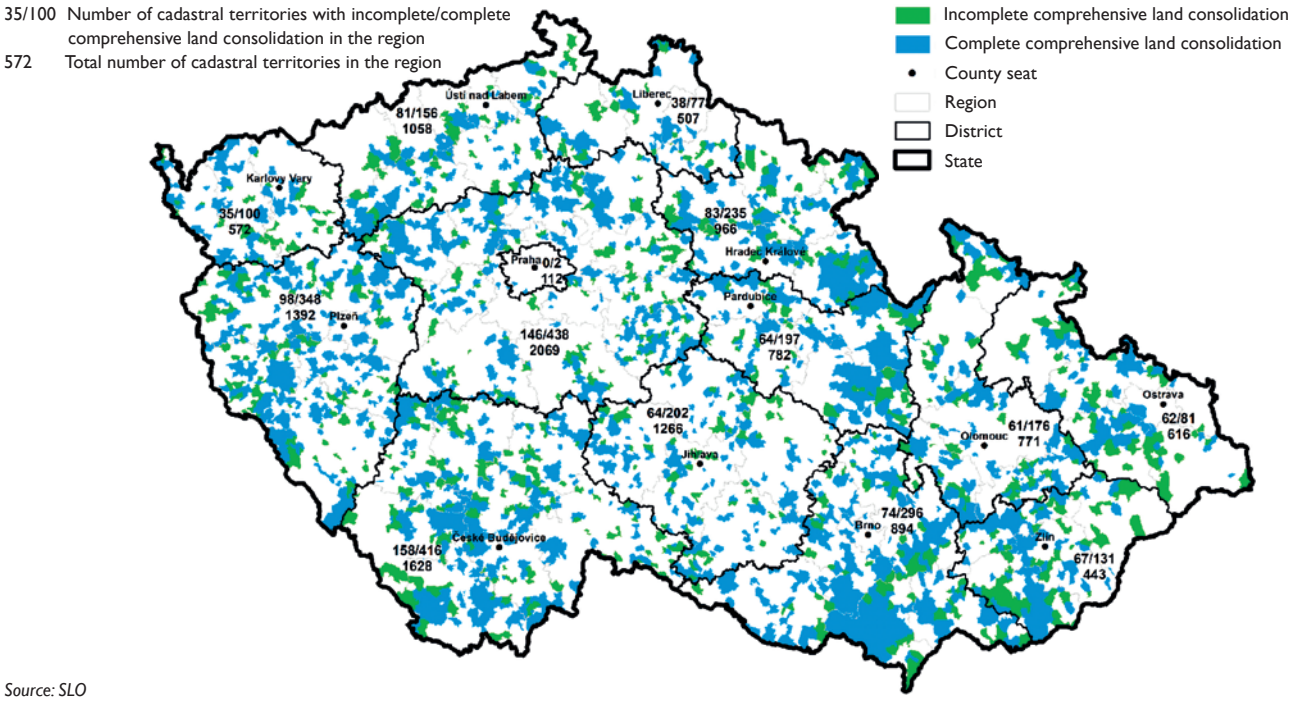
Thanks to land consolidation and clearly defined ownership, the SLO may subsequently implement proposed measures. The SLO ensures proposals of land consolidation and implementation of joint structures through funds from the General Treasures Management, SLO budget, relevant EU funds (RDP, OPE) and the National Restoration Plan since 2021 and others (Road and Motorway Directorate, budgets of municipalities and towns, private entities). For the next programme period, disbursement of funds for land consolidation under the Common Agricultural Policy Strategic Plan for 2023–2027 is set to give priority to projects helping to

Table 6.4.1
State Land Office – Use of funds for land consolidation in 2021

Non-investment activities		Implementation						Total non-investment activities and implementation
Total	of which land consolidation proposals	Total	of which					
			roads	anti-erosion measures	water management measures	environmental measures	Other *)	
in thousands of CZK								
377,852	313,198	2,630,134	2,107,111	78,318	318,904	69,870	55,931	3,007,986

Source: SLO
*Note: *) Operational and technical activities.*

Figure 6.4.1
Overview of comprehensive land consolidation measures by regions on 31 December 2021



Source: SLO

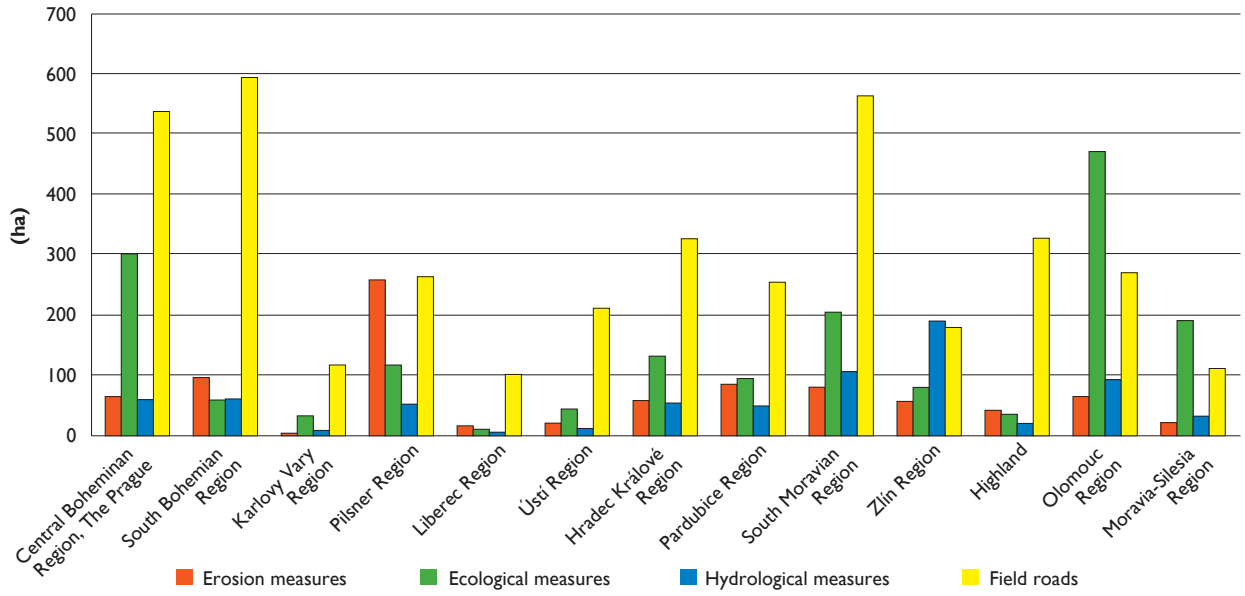
Table 6.4.2
State Land Office – Total implemented joint measures – on 31/12 2021

Measure	Anti-erosion measures	Environmental measures	Water management measures	Roads
	ha			km
Total	858.81	1,766.71	736.62	3,845.90

Source: SLO

Construction of anti-erosion and flood protection measures in the cadastral area Hruška (source: State Land Office)

Graph 6.4.1
Implemented joint measures in land consolidation by region on 31 December 2021



Source: SLO

reduce the negative impact of climate change. Grant support for land consolidation projects from the National Recovery Plan is provided under activity/investment 2.6.4. Implementation of land consolidation with a positive effect on erosion prevention and precipitation retention.

Structures used for amelioration

In 2021, the State Land Office expended CZK 47.5 million from the MoA state budget section on management, maintenance and operation of amelioration structures of state-owned land and the authority to carry out the management. Maintenance and repair costs reached a total of CZK 16.5 million, costs for ensuring the operation and repair of pumping stations (drainage and irrigation) including consumption of electric power were CZK 31 million.

The SLO is authorized to administer structures used for amelioration of land and related hydraulic structures pursuant to Section 56 (6) of the Water Act, as amended, and Section 4 (2) of Act No. 503/2012 Coll., on State Land Office and on the amendment to some relevant acts, as amended. The SLO thus ensures management, maintenance, repairs and operation of major drainage facilities, major irrigation facilities and erosion control measures. On 31 December 2021, the total acquisition

Water biocentre with littoral zone in cadastral area Sendražice u Smiřice (source: State Land Office)

value of the property administered by the SLO amounted to CZK 2,576 billion, consisting of 18,954 items of tangible fixed assets, of which 8,923.100 km of channels (5,162.354 km of open channels and 3,760.746 of piped channels), 21 water reservoirs and 129 pumping stations.

Agendas linked to administration of structures used for land amelioration are ensured by the Department of Water Management Structures of the State Land Office. In addition to the routine operation, activities of the employees of the Department focused on modernization of the current irrigation systems and building new ones. Modernization of irrigation systems administered by the State Land Office is funded through MoA programme 129 310 "Support for Competitiveness of Agri-food Complex – Irrigate – Stage II" and sub-programme 129 313 "Support for Optimization of Irrigation Networks Administered by the State Land Office" from which funds totalling to CZK 4.4 million were used for 2 projects in 2021.

In 2021, the SLO carried out an analysis of the linear structures of the main drainage facilities and identified structures suitable for revitalisation and water retention in the landscape. The proposed measures will be implemented through the land adjustment institute. The first measures are being prepared at the Český Krumlov and Znojmo branches. The SLO thus starts to fulfil tasks arising from the Plan of Measures for Drought Management through Land Improvement and Adaptation of Water Amelioration with the view of completion in 2030.

In 2021, the SLO implemented over-the-limit public contracts for operation of 5 irrigation systems under its management. The implementation of these contracts will ensure operation of the irrigation systems under its management for 4 years. At the same time, the Water Structures Department also prepared essential documentation for introduction of a dynamic purchasing system for procurement of maintenance jobs (services) at the amelioration structures entrusted to it. The contracts are to be implemented in this regime from 2022 onwards.

6.5 Waterways

Pursuant to Act No. 114/1995 Coll., on Inland Navigation, as amended, the management of the development and modernization of waterways of importance to shipping is in the competence of the Ministry of Transport. This activity concerns, in particular, the management of the development of the Elbe-Vltava waterway, which is the most important waterway system in the Czech Republic and is the only navigable connection between the Czech Republic and the West European waterway network.

Under the "European Agreement on Main Inland Waterways of International Importance" the E 20 main European waterway on the Elbe and its branch E 20-06 on the Vltava River, is a waterway of international importance. As defined in Regulation No. 1315/2013 the European Parliament and of the Council of 11 December 2013 on the main trends of the European Union for the development of trans-European transport network, the entire Elbe waterway from the state border between the Czech Republic and Germany to Pardubice and the Vltava waterway from Mělník to Třebenice is included in the TEN-T network. In Annex 1, Part 1 of this Regulation, this waterway is included in the "Eastern and East Mediterranean" corridor and into predetermined projects "Hamburg – Dresden – Prague – Pardubice" – "work on improved navigability and modernization".

From this perspective, it is a project of highest importance. The necessity to increase parameters is also documented by the Corridor Study of December 2014 prepared for the European Commission and by the work schedule of the European coordinator for this corridor which identifies as critical for the Elbe and the Vltava Waterways the fact that their parameters fail to meet the requirements for Class IV of waterways.

From the Ústí nad Labem – Střekov HS to Přelouč in the Elbe River and to Třebenice on the Vltava River, navigability is ensured by a system of hydraulic structures constituting a fully

Kostelec lock on the Elbe waterway (source: Elbe River Board, s. e.)

functioning transport system, independent of external natural conditions. However, navigation traffic in the regulated stretch from Střekov down the stream to the Czech Republic/ Germany state border depends on water levels of the current flow rates and on the overall water situation in the entire Elbe and Vltava River Basins. In order to ensure trouble-free navigation on the Elbe–Vltava Waterway, it is essential to improve the navigation conditions in the 40 km long stretch between Ústí nad Labem and the state border.

The strategic material of the Ministry of Transport entitled "Water Transport Concept for 2016–2023" has been under discussion for a long time.

Operation and maintenance of waterways including operation of lock chambers is ensured by the Vltava, Elbe and Morava River Boards, s.e. For more detailed information including funding see Chapter 9.1 herein.

Nymburk lock on the Elbe waterway (source: Elbe River Board, s.e.)

The Wastewater Treatment Plant, Týn nad Vltavou (author: Hubalová Petra)

7. PUBLIC WATER SUPPLY AND SEWERAGE

7.1 Drinking water supply

In 2021, 10.076 million inhabitants in the Czech Republic were supplied from water supply systems, i.e. 96.0% of the total population.

A total of 579.1 million m³ of drinking water was produced in all water supply systems. 478.7 million m³ of drinking water was supplied (invoiced) for payment, of which 342.6 million m³ of drinking water was supplied to households. Drinking water losses amounted to 86.5 million m³, i.e. 14.9% of the water intended for implementation.

The data provided by the CSO was based on a sample of 1,629 respondents, i.e. 314 professional water supply and sewerage operators and a selected sample of 1,315 municipalities that operate their own water management infrastructure. The published outputs for the regions and the Czech Republic are the result of a mathematical calculation.

You won't see it underwater, the January 2021, The Svratka stream, The Brno Dam (author: Husák Vladimír)

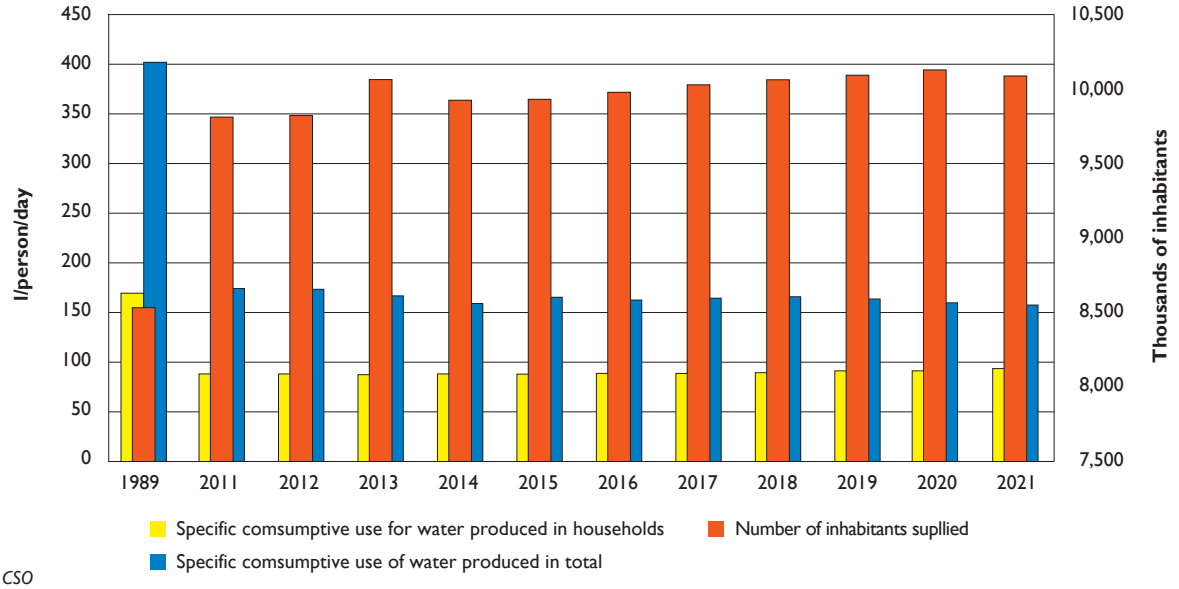
The specific quantity of total water invoiced is the proportion of total water invoiced (to households, industry and other customers) per supplied inhabitant per day, and represents how many litres of total water consumption (invoiced water) consumes a supplied inhabitant. In 2021, the specific amount of water invoiced in total increased by 1.0 l/person/day to 130.2 l/person/day and water invoiced to households also increased by 2.1 l/person/day to 93.2 l/person/day.

Table 7.1.1
Water supply from water supply systems in 1989 and 2016–2021

Indicator	Unit of measurement	1989	2016	2017	2018	2019	2020	2021
Inhabitants (mean)	thousands of inhabitants	10,362	10,565	10,584	10,626	10,669	10,700	10,501
Inhabitants actually supplied with water from water supply systems	thousands of inhabitants	8,537.0	9,972.5	10,027.4	10,064.1	10,090.1	10,126.3	10,075.9
	%	82.4	94.4	94.7	94.7	94.6	94.6	96.0
Water produced by water supply systems	million m³/year	1,251.0	593.3	603.8	609.7	602.4	589.4	579.1
	% as at 1989	100.0	47.4	48.3	48.7	48.2	47.2	46.4
Water invoiced in total	million m³/year	929.4	478.9	482.0	490.4	492.6	479.0	478.7
	% as at 1989	100.0	51.5	51.9	52.8	53.0	51.5	51.5
Specific consumptive use of water produced	l/person/day	401.0	162.5	164.9	165.9	163.5	159.5	157.5
	% as at 1989	100.0	40.5	41.1	41.4	40.8	39.8	39.3
Specific quantity of water invoiced in total	l/person/day	298.0	131.2	131.7	133.5	133.8	129.2	130.2
	% as at 1989	100.0	44.0	44.2	44.7	44.9	43.4	43.7
Specific quantity of water invoiced to household	l/person/day	171.0	88.3	88.7	89.2	90.6	91.1	93.2
	% as at 1989	100.0	51.6	51.8	52.2	52.3	52.6	54.5
Water losses per 1 km of water mains	l/km day	16,842.0*)	3,167.9	3,409.4	3,303.5	2,993.5	3042.3	2955.1
Water losses per 1 inhabitant supplied	l/person/day	90.0*)	24.7	26.7	25.8	23.4	23.8	23.5

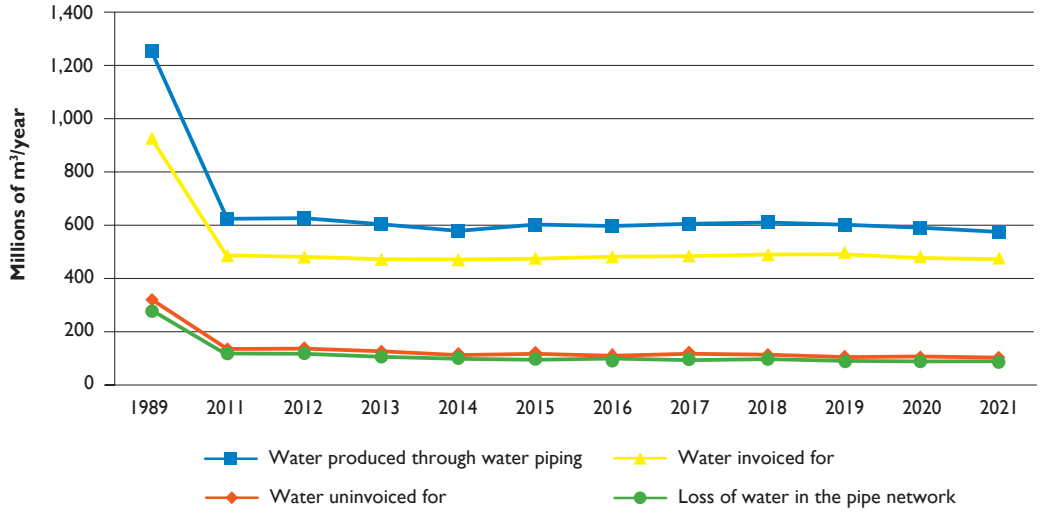
Source: SLO
*Note: *) Data for the water supply systems of the main operators.*

Graph 7.1.1
Development of the number of inhabitants supplied, specific needs for water produced and specific amount of water invoiced to households in 1989 and 2011–2021



Source: CSO

Graph 7.1.2
Development in the quantity of water produced in water supply systems and water invoiced in total in 1989 and 2011–2021



Source: CSO

Karlovy Vary (author: Hubalová Petra)

The highest share of the population supplied with drinking water from water supply systems in 2021 was in the Karlovy Vary Region (100%), in the Capital City of Prague (100%) and in the Moravia–Silesia and Ústí nad Labem Regions (99.9%), while the lowest share of inhabitants supplied with drinking water was in the Central Bohemian Region (88.4%) and the Pilsen Region (88.7%).

In 2021, the length of water supply network was extended by 1,093 km and reached the total length of 80,197 km. Due to the year-on-year decline in the population of the Czech Republic (by almost 200,000), the number of inhabitants supplied also decreased by 50,400, so the length of water supply network per one inhabitant supplied is 7.96 m.

The number of water supply connections increased by 34,516 to 2,241,324. The number of water meters installed increased by 36,363 to a total of 2,243,616. There are almost five inhabitants per water connection. The figures reflect consequences of relatively massive construction of family houses.

Table 7.1.2
Population supplied, production and supply of water from waterworks in 2021

Region	Population		Water from water supply system	Water invoiced	
	supplied with water from water supply system	share of population supplied with water		Total	of which for households
	(number)	(%)	(thousands of m³)		
City of Prague	1,267,173	100.0	90,021	75,445	55,484
Central Bohemia	1,220,081	88.4	66,347	55,600	40,387
South Bohemia	577,817	90.8	32,213	26,437	17,473
Pilsen	511,980	88.7	30,178	24,853	16,526
Karlovy Vary	283,677	100.0	16,422	13,174	9,435
Ústí nad Labem	798,457	99.9	48,464	36,776	27,678
Liberec	412,747	94.4	24,992	18,649	13,875
Hradec Králové	526,346	97.0	30,048	23,455	16,284
Pardubice	504,816	98.2	27,099	22,370	15,079
Vysočina	485,776	96.4	25,223	21,793	15,299
South Moravia	1,152,123	97.4	62,759	55,235	39,602
Olomouc	596,464	95.6	31,390	26,021	18,578
Zlín	559,438	97.6	28,448	23,220	16,518
Moravia–Silesia	1,179,000	99.9	65,502	55,719	40,388
Czech Republic	**10,075,895**	**96.0**	**579,106**	**478,747**	**342,606**

Source: CSO

7.2 Discharge and treatment of municipal wastewaters

In 2021, 9.174 million inhabitants of the Czech Republic lived in houses connected to the sewerage system, which is 87.4% of the total population. A total of 451.8 million m³ of wastewater was discharged into the sewerage systems (excluding rainwater invoiced). Out of this quantity, 97.5% of wastewaters (excluding rainwater) were treated, which amounts to 440.7 million m³.

The number of inhabitants connected to the sewerage system decreased by 36,061 year-on-year. The volume of wastewater discharged into the sewerage system excluding rainwater increased by 1.3 million m³ year-on-year. The quantity of treated water (including rainwater) increased by 14.6 million m³ year-on-year.

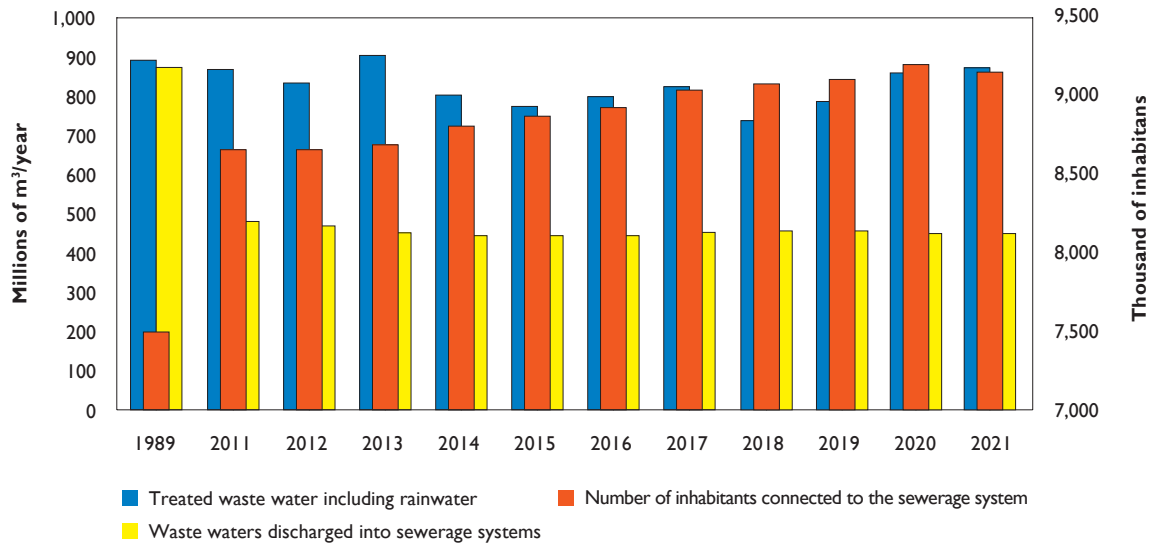
The highest share of inhabitants connected to the sewerage system in 2021 was in the Karlovy Vary Region (100.0%) and the Capital City of Prague (100.0%), the lowest share was in the Liberec Region (74.3%) and the Pardubice Region (76.6%)..

Table 7.2.1
Discharge and treatment of wastewaters from sewers in 1989 and 2016–2021

Indicator	Unit of measurement	1989	2016	2017	2018	2019	2020	2021
Inhabitants (mean)	thousands of inhabitants.	10,364	10,565	10,584	10,626	10,669	10,700	10,501
Residents in houses connected to sewerage systems	thousands of inhabitants.	7,501	8,944	9,052	9,090	9,120	9,211	9,174
	%	72.4	84.7	85.5	85.5	85.5	86.1	87.4
Total wastewaters discharged to sewerage systems (excluding rainwater invoiced)	millions of m³	877.8	446.9	453.3	457.3	461.1	450.5	451.8
	% as at 1989	100.0	50.9	51.6	52.1	52.5	51.3	51.5
Treated wastewaters including rainwater [1)]	millions of m³	897.4	803.4	826.2	743.6	792.6	863.0	877.6
Total treated wastewaters excluding rainwater	millions of m³	627.6	434.9	442.2	446.3	450.3	439.3	440.7
	% as at 1989	100.0	69.3	70.5	71.1	71.7	69.9	70.2
Percentage of treated wastewaters excluding rainwater [2)]	%	71.5	97.3	97.5	97.6	97.7	97.5	97.5

Source: CSO
Note: [1)] In 1989, the figures relate to sewerage systems run by the main operators.
[2)] This percentage relates to of waters discharged to sewerage systems (excluding rainwater invoiced).

Graph 7.2.1
Development in the number of inhabitants living in houses connected to the sewerage system and the quantity of discharged and treated wastewaters in 1989 and 2011–2021



Source: CSO

Table 7.2.2
Number of inhabitants living in houses connected to the sewerage system and the quantity of discharged and treated wastewater in each region in 2021

Region	Inhabitants living permanently in buildings connected to the sewerage system		Water discharged to sewerage systems (excluding rainfall invoiced)	Treated wastewaters (excluding rainwater)	
	Total	Share of total population	Total	Total	Share
	(number)	(%)	(thousands of m³)	(thousands of m³)	(%)
City of Prague	1,267,173	100.0	75,210	75,210	100.0
Central Bohemia	1,061,448	76.9	52,571	52,423	99.7
South Bohemia	549,909	86.4	27,542	26,542	96.4
Pilsen	510,495	88.4	26,496	25,394	95.8
Karlovy Vary	283,677	100.0	12,107	12,100	99.9
Ústí	709,443	88.7	31,261	30,316	97.0
Liberec	324,899	74.3	14,546	14,144	97.2
Hradec Králové	435,859	80.3	21,176	20,572	97.1
Pardubice	393,427	76.6	18,424	18,149	98.5
Vysočina	442,342	87.8	18,592	17,113	92.0
South Moravia	1,098,014	92.9	52,891	52,332	98.9
Olomouc	538,115	86.3	27,602	27,161	98.4
Zlín	557,878	97.4	26,795	24,935	93.1
Moravia–Silesia	1,001,777	84.9	46,612	44,328	95.1
Czech Republic	**9,174,456**	**87.4**	**451,825**	**440,719**	**97.5**

Source: CSO

The length of the sewerage network was extended by 874 km to reach 50,554 km in 2021. According to the CSO, the total number of WWTPs increased by 66 compared to the previous year to a total of 2,861 WWTPs in the Czech Republic.

The Hamry Dam (source: Elbe River Board, s.e.)

7.3 Development of water and sewerage prices

In 2021, according to a survey by the Czech Statistical Office, the average price of water excluding VAT was 43.80 CZK/m³ and the average price for sewerage was 38.50 CZK/m³.

Before the amendment to Act No. 76/2006 Coll. came into force in 2006, information about the average price of water and sewerage charges was defined on the basis of data that selected water supply and sewerage system operators sent upon request to the MoA. The amendment now requires owners (or operators authorized by owners) to send to the MoA annually by 30 April of the following calendar year detailed information about comparing all items in price calculation in accordance with price regulation for water and sewerage charges and actual numbers from the previous year pursuant to the provision of Section 36(5) of Act No. 274/2001 Coll., on Water supply and sewerage systems for public use and on amendments to certain related acts (act on water supply and sewerage systems), as amended (hereinafter referred to as the ‚WSS Act'). The MoA receives information about the prices including VAT through inquiry, while mean values are obtained through weighted average. With respect to the deadline for filing the comparisons it was impossible to include and assess the data in this publication. For this reason, we only present data ascertained by an inquiry of the CSO such as share in revenue from customers and the volume of drinkable water supplied and wastewaters discharged (including rainwater invoiced). The overall data obtained by the CSO concerning the Czech Republic are not a weighted average and they thus cannot be compared with data from MoA materials.

Based on a survey carried out by the CSO, the highest average price (49.9 CZK/m³) of water charge was in the Capital City of Prague, exceeding the nationwide average by 13.9%. The highest average price of sewerage charge was in the Liberec Region (44.4 CZK/m³), exceeding the national average by 20.5%. By contrast, the lowest average price of water charge (37.1 CZK/m³) was in the Olomouc Region. The lowest average price of sewerage charge (31.3 CZK/m³) was in the Vysočina Region.

Table 7.3.1
Strike prices of water and sewerage charges in 2020 and 2021

Indicator	Measurement unit	2020	2021	Index 2021/2020
Water rates in total	millions of CZK	19,850	20,988	1.06
Water invoiced in total	millions of m³/year	479.0	478.7	1.00
Average price of water rate	CZK/m³ excl. VAT	41.4	43.80	1.06
Sewerage rates in total	millions of CZK	19,023	20,225	1.06
Wastewaters discharged to sewerage systems *)	millions of m³/year	521.5	524.8	1.01
Average price of sewerage rate	CZK/m³ excl. VAT	36.5	38.5	1.05

Source: CSO
*Note: *) Since 2013, including rainwater invoiced.*

Table 7.3.2
Water consumption, average prices without VAT for water and sewerage in 2021

Region	Specific quantity of water invoiced in total	Specific quantity of water invoiced to households	Average price of water rate	Average price of sewerage rate
	(l/person/day)		(CZK/m³ excl.VAT)	
City of Prague	163.1	120.0	49,9	42,4
Central Bohemia	124.9	90.7	47,1	38,5
South Bohemia	125.4	82.8	40,5	32,2
Pilsen	133.0	88.4	46,1	33,2
Karlovy Vary	127.2	91.1	43,6	39,1
Ústí	126.2	95.0	48,8	45,5
Liberec	123.8	92.1	48,1	46,4
Hradec Králové	122.1	84.8	39,0	38,4
Pardubice	121.4	81.8	39,4	40,0
Vysočina	122.9	86.3	41,8	31,3
South Moravia	131.3	94.2	41,6	39,6
Olomouc	119.5	85.3	37,1	37,4
Zlín	113.7	80.9	40,1	34,9
Moravia–Silesia	129.5	93.9	39,9	36,3
Czech Republic	**130.2**	**93.2**	**43,8**	**38,5**

Source: CSO

7.4 Regulation of water supply and sewerage systems

In 2021, a total of 13 audits of owners and operators of water supply and sewerage systems for public use were carried out.

Audits of the MoA, carried out by the Office of the Chief Regulator and Supreme Supervision of the Water Supply and Sewerage Sector, focused in 2021 on checking of the fulfilment of obligations of owners and operators of water supply and sewerage systems (hereinafter also referred to as ‚W&S') arising from the WSS Act, as well as from Decree No. 428/2001 Coll. water supply act. Despite unfavourable pandemic conditions, 13 audits were conducted. In the period when it was impossible to conduct audits due to the aforementioned, the MoA carried on with other activities aimed at improving the situation in the W&S sector and focused on identifying owners of W&S for public use who do not maintain property and operational records of water supply and sewerage systems, do not submit selected data from such records to locally competent water authorities and do not send to the Ministry of Agriculture comparisons of all items in calculation of the price of water and sewerage rates and the achieved reality, and who can therefore reasonably be expected to fail to comply with other obligations under the WSS Act.

Inspections focused primarily on water system infrastructure owners´ and operators´ performance of basic duties. In case of finding any shortcomings, the MoA required remedial actions. The most serious and repeated shortcomings include, e.g., partial or complete absence or incorrect preparation of renovation funding plan, absence of calculation of water supply and sewerage rates and incompliance with rules for calculation defined by Decree No. 428/2001 Coll., absence of comparison or non-compliance with rules defined by Decree No. 428/2001 Coll. for its preparation, customer agreements non-compliant with legal requirements, non-compliance with ‚VÚME' (Selected data from Public Water Supply and Sewerage Systems Assets Registry) and ‚VÚPE' (Selected data from Public Water Supply and Sewerage Systems Operational Registry) with issued permits for operating their W&S, incorrectly defined volumes of drinkable water supplied or wastewater discharged for invoicing water supply and sewerage rates to consumers, absence of agreements between owners of related water supply and sewerage systems, etc.

Table 7.4.1
Number of audits of owners and operators of water supply and sewerage systems in 2021

Entities inspected	Number of audits
Supply and sewerage system owners	3
– of which cities and municipalities	3
Water supply and sewerage system owners that are also operators	10
– of which cities and municipalities in the mode of independent operation	8
Total checks carried out	**13**

Source: MoA (Report on the performance of audits of owners and operators of water supply and sewerage systems for public use in the Czech Republic in 2021)

The MoA finds significant differences between the audited entities. It is continuously confirmed that some municipalities who are owners of water supply and sewerage systems, underestimate the issue that is quite complex and regardless of whether they lease the infrastructure or operate it on their own behalf and under their own responsibility. In some cases, this is reflected, e.g., their prices for water and sewerage in relation to the issue plans for funding W&S renovation. Typically, small and medium-sized municipalities tend to prefer a price for water and sewerage charges that is significantly lower than the total costs expended on the operation and renovation of the W&S, which often leads to incomplete or distorted values in the price calculation and/or comparisons. In addition, the MoA found that these entities (as operators of water supply or sewerage systems) did not receive services from a professional representative and in some cases such experts were not even in a contractual relationship with the municipality. The institute of a professional representative is intended to safeguard that W&S is operated in accordance with the applicable legislation as well as the technical and operational requirements of the infrastructure in question. It has been repeatedly observed that some professional representatives perform their function rather formally, either because of low financial remuneration or because of their reduced availability in certain regions. The MoA also provides audited entities with methodological assistance in the framework of the audit, if they are interested. On the basis of the aforementioned experience, the MoA gathers and assesses background materials aimed at refining the legislation in force.

In 2021, a targeted campaign continued to identify possible owners of water supply systems or sewerage systems for public use who, in breach with Section 5(1) to (3) of the WSS Act, have not kept long-term property and operational records of water supply systems and sewerage systems and do not send selected data from the records to the locally competent water authority, and where it can therefore be reasonably assumed that they are in breach of other obligations under the WSS Act. Of the municipalities identified in 2020, the MoA approached 216 entities, which represent approximately 117,000 potential customers. These municipalities were sent an invitation to send their observations and submit relevant documents. Ownership of the public W&S for public use was documented for a total of 104 of them (i.e. 48% of the municipalities contacted). The MoA invited these owners to remedy the situation and to fulfil all their obligations under the WSS Act At the same time, the MoA informed those owners whose observations indicated that they were not aware of the aforementioned obligations, nor of the other obligations imposed on W&S owners and operators under the WSS Act. A total of 81 of the municipalities (i.e. 38%) provided evidence that the municipality is the owner of a water supply or sewerage system, but that these assets do not fulfil the conditions of water supply or sewerage systems for public use according to Section 1(3) and (5) of the WSS Act and are therefore not subject to the obligations under the WSS Act. A further 29 of the municipalities (i.e. 13%) provided evidence that W&S construction on their territory has not yet been completed. In cooperation with the local water authorities, two of the municipalities surveyed are still carrying out a inventory checking procedure in order to determine the nature of their sewerage system.

The Slezská Harta Dam - collection tower (source: Oder River Board, s. e.)

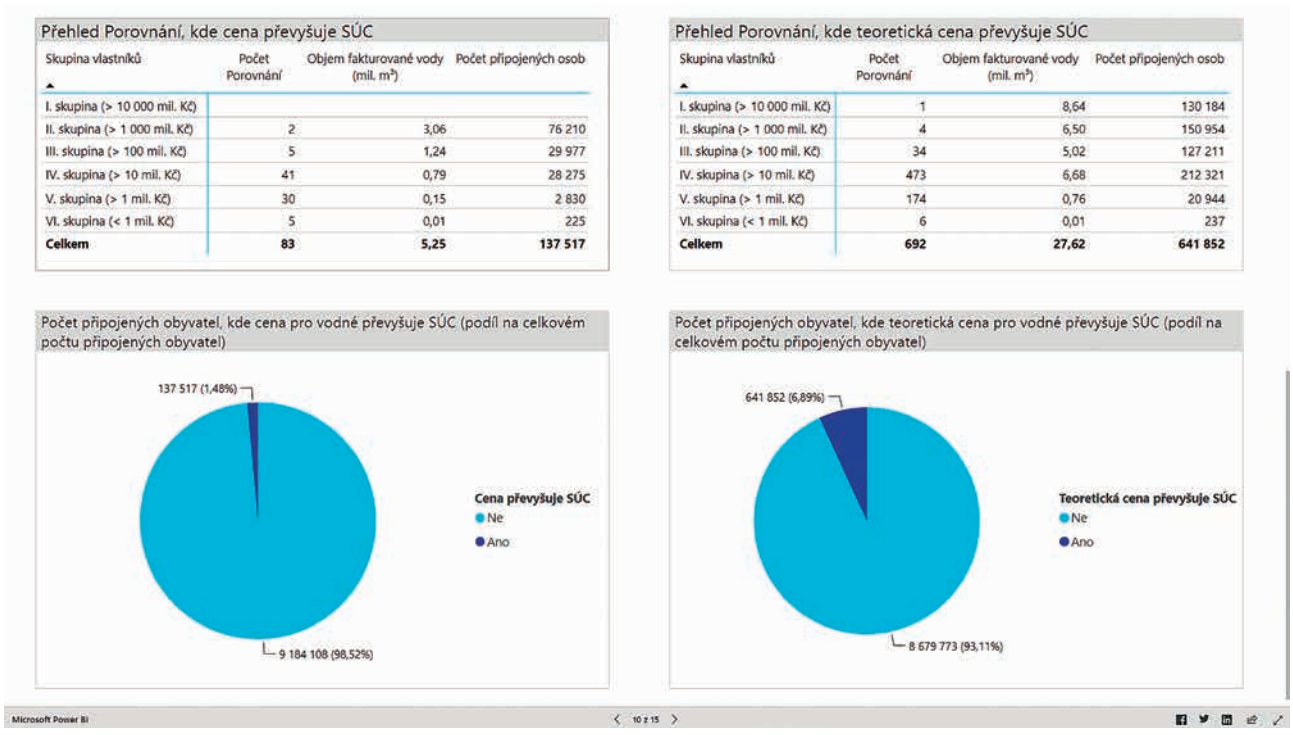
In addition to the audits, the Office of the Chief Regulator and Supreme Supervisor of the W&S was long engaged in analytical activities aimed at providing relevant information on the situation in the sector necessary for designing and adopting adequate regulatory measures. Since 2016, two separate projects Benchmarking of Owners and Benchmarking of Operators have been running at the MoA at regular annual intervals.

In 2020, the projects managed to incorporate data representing a 99% market share for drinking water and a 97% market share for wastewater. The results of both projects are summarised in the Benchmarking Report 2020 (the "Report"). The Report and results from both projects will be published on the MoA website in the Water – Water supply and sewerage systems – W&S Benchmarking section. At the beginning of 2022, an upgraded web presentation of data from the W&S sector was published on the MoA website under Water – Water and sewerage – W&S Data Web Presentation. This user-friendly presentation conveys detailed information derived from analysed reports including benchmarking findings (see Graph 7.4.1).

The Benchmarking of Owners project places great emphasis on monitoring fulfilment of the objective, which is to achieve the highest possible degree of self-funding of water infrastructure. From this point of view, the lack of generation of funds for renewal of water infrastructure assets from water and sewerage charges appears to be the most significant problem. From 2016 to 2020, according to the methodology in force, a theoretical deficit in the creation of funds for the renovation of W&S infrastructure assets was calculated at a total of CZK 7.95 billion, see Table 7.4.2 below. The Ministry of Agriculture does not have sufficient information on the

The Well, Educational Trail K. J.Erbena (author: Hubalová Petra)

Graph 7.4.1
Excerpt from the output of the W&S data website presentation



Přehled Porovnání, kde cena převyšuje SÚC

Skupina vlastníků	Počet Porovnání	Objem fakturované vody (mil. m³)	Počet připojených osob
I. skupina (> 10 000 mil. Kč)			
II. skupina (> 1 000 mil. Kč)	2	3,06	76 210
III. skupina (> 100 mil. Kč)	5	1,24	29 977
IV. skupina (> 10 mil. Kč)	41	0,79	28 275
V. skupina (> 1 mil. Kč)	30	0,15	2 830
VI. skupina (< 1 mil. Kč)	5	0,01	225
Celkem	**83**	**5,25**	**137 517**

Přehled Porovnání, kde teoretická cena převyšuje SÚC

Skupina vlastníků	Počet Porovnání	Objem fakturované vody (mil. m³)	Počet připojených osob
I. skupina (> 10 000 mil. Kč)	1	8,64	130 184
II. skupina (> 1 000 mil. Kč)	4	6,50	150 954
III. skupina (> 100 mil. Kč)	34	5,02	127 211
IV. skupina (> 10 mil. Kč)	473	6,68	212 321
V. skupina (> 1 mil. Kč)	174	0,76	20 944
VI. skupina (< 1 mil. Kč)	6	0,01	237
Celkem	**692**	**27,62**	**641 852**

Source: MoA – website presentation of W&S data

Table 7.4.2
Missing funds for restoration in 2016–2020

Missing funds for restoration	2016	2017	2018	2019	2020	Total
	millions of CZK/year					
Drinking water	456.46	460.21	532.36	507.84	817.07	2,773.94
Wastewaters	758.85	808.21	1,045.56	1,033.58	1,534.21	5,180.41
Total per year	1,215.31	1,268,42	1,577,92	1,541.42	2,351.28	7,954.35
Total	**15,908.7**					

Source: MoA

extent to which the deficit is compensated by subsidies from public or private sources. In 2020, the deficit in renovation funds was also affected by the update of the Ministry of Agriculture's methodological instruction No. 14000/2020-15132-1, which increased the price indicators for calculating the reproduction cost of assets. This has resulted in an increase in the deficit in renovation costs, but it provides more realistic information than in previous years.

The subject of the analyses of the Benchmarking of Operators project is the quality of services provided, pricing and environmental impacts. The focus is mainly on the quality of drinking water supplied, monitoring of drinking water losses, and the development of the share of non-compliant samples of drinking water and wastewater.

The analysis of the balance data on drinking water losses sent for 2020 related to comparisons confirmed positive impacts of the survey, which was conducted on entities reporting zero or, by contrast, high drinking water losses in 2019. There was a more than 50% drop in the number of comparisons analysed that reported zero drinking water losses in the related VÚPE Registry. The quality of the drinking water supplied showed a consistently high level in the years observed.

The most significant obstacle to remedying the deficiencies identified in both benchmarking projects seems to be the existence of a large number of owners and operators. The high degree of atomisation of the W&S sector is reflected in all related processes and in the provision of services to the public. Most of the shortcomings identified in both benchmarking projects were found in the comparison with invoiced water volumes of less than 0.4 million m³, especially for municipal operators. The shortcomings are mainly insufficient generation of funds for renewal, unsystematic care of water infrastructure assets, lower professional level of operation and failure to fully ensure the obligations arising from the WSS Act and its implementing Decree No. 428/2001 Coll.

More detailed information on the activities of the MoA in the field of water supply and sewerage regulation is available on the MoA website in the section dedicated to W&S.

The Vltava stream, the Port of Prague Smíchov – demolition of the ice mainland (source: Vltava River Board, s.e.)

Nadya Yf (source: www.shutterstock.com)

8. FISHERIES AND FISHPOND MANAGEMENT

At present, there are approximately 24 thousand fishponds and water reservoirs with total surface area of approximately 52 thousand ha in the Czech Republic. 21 tonnes of marketable fish were caught in the Czech Republic in 2021.

Fisheries in the Czech Republic is divided in fish farming and recreation fishing, both regulated by Act No. 99/2004 Coll., on fish farming, performance of fishing right, fishing inspection, protection of marine fishing resources and on amendments to some acts (the Fisheries Act), and its implementing Decree No. 197/2004 Coll. Fish farming for production is a traditional part of agricultural production.

Fish is farmed at more than 41 hectares of fishponds and water reservoirs in the Czech Republic with more than 180 significant fish producers (i.e. companies producing more than 5 tonnes of fish per year) and several hundreds of minor breeders. Big producers of fish and waterfowl, fish processors, fish research and education institutes and fish associations are associated under the Czech Fish Farmers Association of the Czech Republic seated in České Budějovice.

There are more than 2,000 official fishery districts in the Czech Republic with total area of approximately 42,000 hectares and around 350,000 recreation fishermen registered. Fishery districts are classified as either extra-trout-fishing waters or trout-fishing waters. The greatest users of fishery districts in the Czech Republic are the Czech Fishing Union, interest association, and Moravian Fishing Union, interest association. Recreation fishermen catch every year in fishery districts around 3–4 thousand tonnes of fish, the most caught fish is common carp.

Czech fishery has been facing many negative factors on a long-term basis. One of the main problems that interferes with production and recreation fishing is an increased pressure from fish-eating predators such as heron, otter and cormorant. Damage caused by such predators is hundreds of millions CZK every year. Fishery is also affected by the ongoing climate change which manifests in fish production as well as in fish population in fishing districts. Another adverse factor that complicates fish production is restriction of farming with respect to requirements concerning nature preservation and it desirable to find a compromise between interests of nature preservation and fish production.

The total fish production in 2021 included 19.7 thousand tonnes of fish from fishponds, 1.2 thousand tonnes from special facilities (mainly from flow systems with salmonoid fish and from recirculatory aquacultural systems) and 23 tonnes from dams.

Swamps after fishing off, January 2021, The Svratka Stream, The Brno Dam (author: Husák Vladimír)

Table 8.1.1
Market production of farmed fish in the Czech Republic in 2013–2021

Type	2013	2014	2015	2016	2017	2018	2019	2020	2021
	tonnes								
Carp	16,809	17,833	17,860	18,354	18,460	18,430	17,945	17,370	17,616
Total	**19,358**	**20,135**	**20,200**	**20,952**	**21,685**	**21,751**	**20,986**	**20,401**	**20,991**

Source: MoA and Czech Fish Farmers Association

In 2021, 7,622 tonnes of live fish were supplied to the Czech market, which means a year-on-year decrease by 5 tonnes. Export of live fish was 9,716 tonnes, which means an increase by 484 tonnes. 2.4 thousand tonnes of fish were processed in live weight, which accounts for 11.4% of the total of fish caught.

The species composition of marketable fish is relatively stable and has not changed significantly, compared to the previous years. Of the total volume of harvested fish, carp accounted for 83.9%, salmonids 5.1%, herbivorous fish 5.2%, tench 0.7% and predatory fish accounted for 1.4% of the total harvested quantity.

The domestic market continued to prefer supplies in the form of live fish, which in the past three years accounted for 36–40% of the production obtained by fish farming. Exports of live fish corresponded during the three previous years with 45–49% of the total catch and displayed stable interest in fish produced mainly by member organizations of the professional association. Fish processing plants processed into products 11% of the freshwater marketable fish produced.

The consumption of freshwater fish produced by fish farming in 2021 reached the value of 0.9 kg/person/year. To calculate the total consumption of freshwater fish per capita in 2021, population number of 10,516,707 as of 31 December 2021 was considered.

Under the surface, June 2021, The Jevišovka Stream, Božice (author: Grund Petr)

The Mlýnský Reservoir (source: Ohře River Board, s.e.)

Table 8.1.2
Use of marketable fish produced by farming in the Czech Republic in 2013–2021

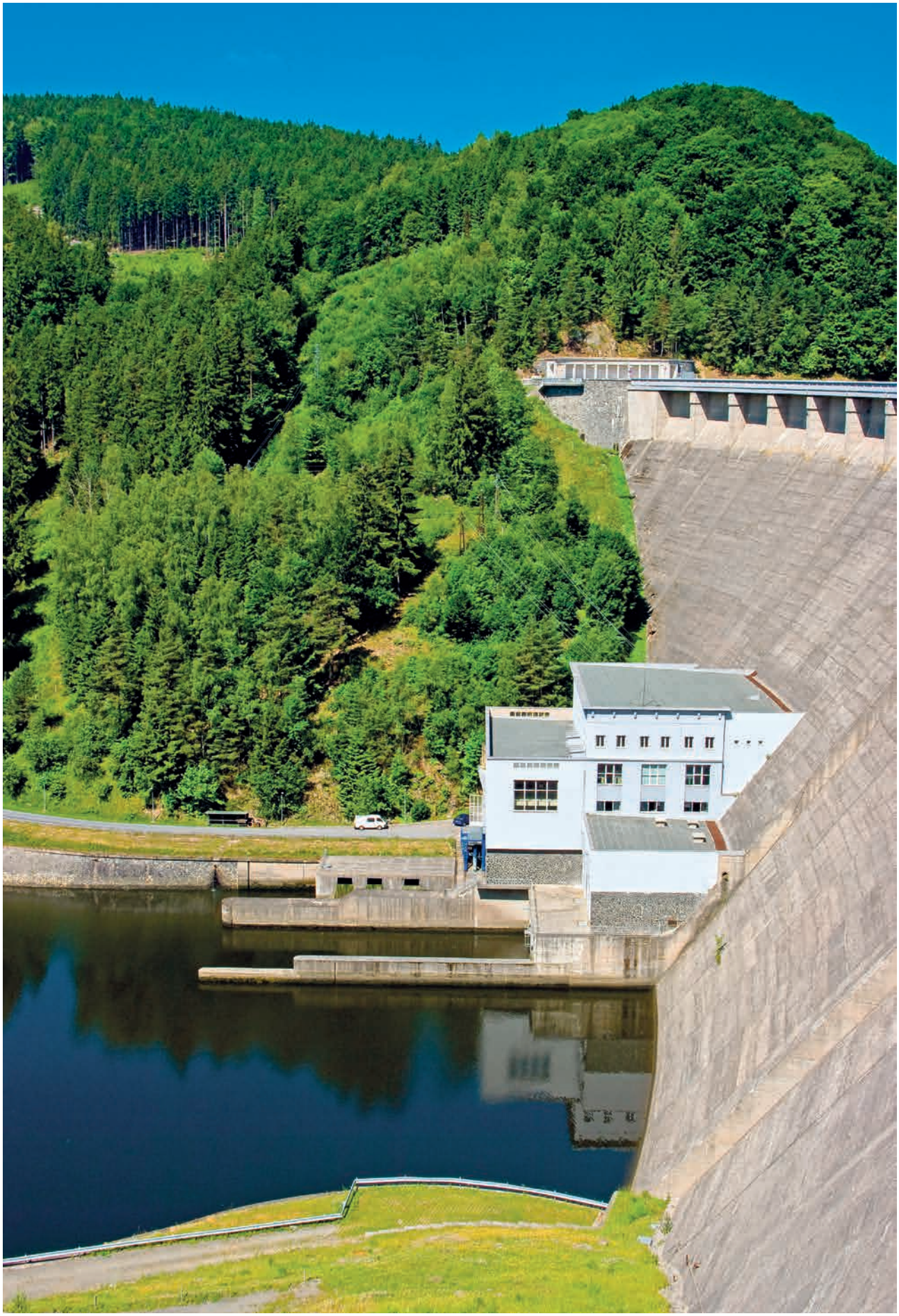
Year	Total production	of which *)		
		sale of live fish in the Czech market	processed fish (live weight)	export of live fish
	tis. tun			
2013	19.4	9.0	2.4	8.4
2014	20.1	8.5	2.1	8.4
2015	20.2	9.2	1.9	9.9
2016	21.0	8.3	2.5	11.0
2017	21.7	8.2	2.4	11.1
2018	21.8	8.4	2.2	10.3
2019	21.0	8.5	2.4	10.3
2020	20.4	7.6	2.4	9.2
2021	21.0	7.6	2.4	9.7

Source: MoA and Czech Fish Farmers Association
*Note: *) Includes beginning and end of year stocks, losses and imports of live freshwater fish.*

Table 8.1.3
Fish consumption in the Czech Republic 2013–2021

Species	2013	2014	2015	2016	2017	2018	2019	2020	2021
	kg/person/year								
Total fish	**5.3**	**5.4**	**5.5**	**5.1**	**5.4**	**5.6**	**6.0**	**5.7**	*)
of which freshwater fish produced and caught in the Czech Republic	1.4	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.2

Source: CSO and Czech Fish Farmers Association
*Note: *) Data for 2021 not available.*



Zbynek1 (source: www.shutterstock.com)

9. FINANCIAL SUPPORT FOR WATER MANAGEMENT

9.1 Financial support from national and transnational grant programmes

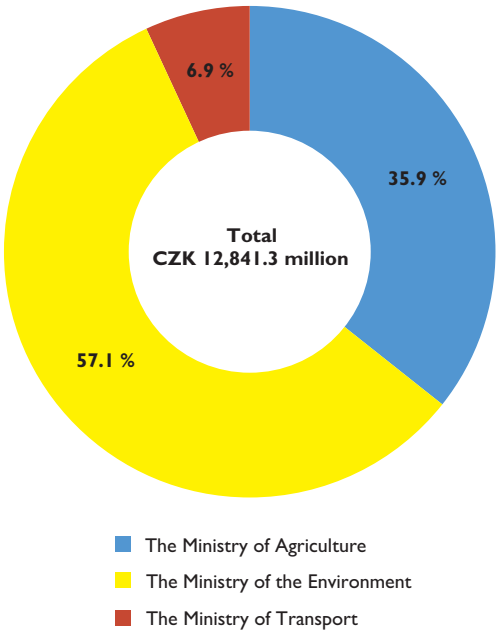
Financial support for water management includes selected national and transnational grant programmes linked with water management. In 2021, this support was CZK 12,841.3 million with the Ministry of Agriculture contributing to the sum with 36% (subsidies amounting to CZK 4,615.8 million), the Ministry of the Environment with 57% (i.e. CZK 7,334.9 million) and the Ministry of Transport with 7% (CZK 890.6 million).

Table 9.1.1
Crucial state financial support in water management in 2021

Resort	Total funds spent in millions of CZK
Ministry of Agriculture	4,615.8
Ministry of the Environment	7,334.9
Ministry of Transport	890.6
Total	**12,841.3**

Source: MoA using data of the Ministry of the Environment and the Ministry of Transport

Graph 9.1.1
Financial support for water management by ministries in 2021



Source: MoA using data of MoE and the Ministry of Transport

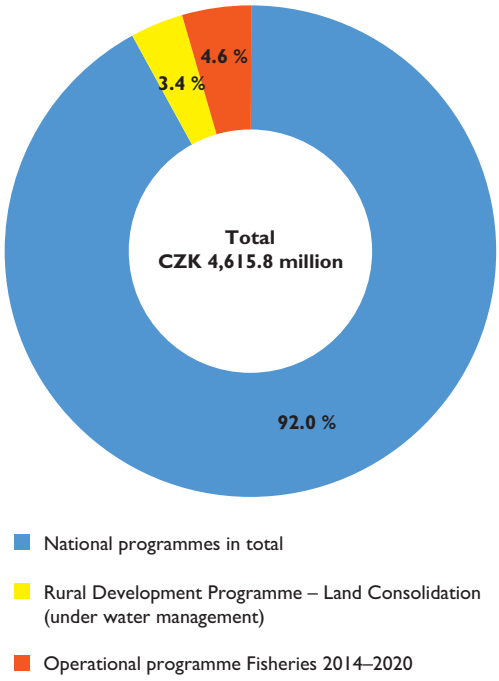
The Hranice Weir, progress of construction, June 2021 (source: Morava River Board, s.e.)

9.1.1 Financial support provided by the Ministry of Agriculture

In 2021, the Ministry of Agriculture administered 17 grant programmes focused on water management, of which 15 were national and two were funded from national or supranational sources. In total, funds totalling CZK 4,616 million were allocated.

Increasing the capacity of the Rožínka stream in the urban area of the village of Rožná in Žďársko (source: Forest of the Czech Republic, s.e.)

Graph 9.1.1.1
Use of funds under the Ministry of Agriculture in 2021



Source: MoA using data of MoE and the Ministry of Transport

Table 9.1.1.1
Funds provided for water management by the Ministry of Agriculture in 2021

Programme ID No.	Programme name	Programme expenditures in millions of CZK
129 300	Support for Construction and Technical Improvement of Water Supply and Sewerage System Infrastructure II	1,531.10
129 400	Support for Measures Aimed at Mitigating Negative Impacts of Drought and Lack of Water	333.10
129 410	Support for Construction and Technical Improvement of Water Supply and Sewerage System Infrastructure III	27.40
129 420	Support for Purchase and Integration of Water Supply and Sewerage Infrastructure	2.50
	Subsidy of part of interests on commercial loans under the 229 310 and 129 180 programmes	0.70
129 260	Support for Flood Prevention III	132.15
129 360	Support for Flood Prevention IV	850.08
129 280	Support for Water Retention in the Landscape – Ponds and Reservoirs	211.72
129 290	Support for Measures at Minor Watercourses and Small Water Reservoirs	55.19
129 310	Support for Competitiveness of Agriculture and Food Processing – Irrigations – Stage II	106.35
129 370	Remediation of Flood Damage to State Water Management Assets III	61.24
129 390	Support for Measures at Minor Watercourses and Small Water Reservoirs – Stage II	577.38
Skalička HS	Purchase of Land for Construction of the Skalička HS	39.60
129 330	Vlachovice – Settling rights to immovable property affected by the planned construction of a hydraulic structure	200.00
129 340	Settling rights to immovable property affected by the planned implementation of comprehensive drought measures in the Rakovník District	94.53
17	Support for Non-productive Functions of Fishing Grounds	22.99
National programmes in total		4,246,03
	Rural Development Programme – Land Consolidation (water management)	159.00
	Operational Programme Fisheries 2014–2020	210.77
Total		**4,615.80**

Source: MoA

Ensuring quality of surface water sources

As part of reducing the impacts of primary agricultural production in the protection zone of the Švihov Water Reservoir on the Želivka River a sum of CZK 50.3 million was paid in 2021.

The subsidy was intended to mitigate erosion and restricting application of plant protection agents on agricultural land and in protection zones of the Švihov Water Reservoir, where intense farming results in an increased occurrence of pesticides and their metabolites in the Švihov Water Reservoir. The extension of this measure to the protection zones of the water reservoirs of Římov, Vrchlice and Opatovice is currently in the notification process.

Water supply and sewerage systems

In 2021, investors received support in the form of subsidies and "subsidised loans". Under the programme 129 300 "Support for Construction and Technical Improvement of Water Supply and Sewerage System Infrastructure II" and the new programme 129 410 "Support for Construction and Technical Improvement of Water Supply and Sewerage System Infrastructure III" of the Ministry of Agriculture, support was provided to 173 projects in the total amount of approx. CZK 1,558 million.

129 300 programme is approved for 2017–2022, and its follow-up programme 129 410 for 2021–2025. Both programmes are aimed at implementing measures to comply with European Union directives in the field of water supply and sewerage and at the development of the water supply and sewerage sector.

In 2021, a total of 62 projects were supported by the state budget in the form of subsidies totalling approximately CZK 423 million under sub-programmes 129 302 and 129 412 (measures focused on water supply systems) and a total of 111 projects under sub-programmes 129 303 and 129 413 (measures focusing on sewerage systems) amounted to CZK 1,135 million. Under sub-programme 129 304 (measures aimed at addressing the impact of the planned expansion of the Polish brown coal mine of Turów on the Czech Republic), the state budget supported one project in 2021 with a total amount of approx. CZK 0.7 million.

"Subsidised loans" were provided for projects under 129 180 and 229 310 programmes that were terminated. The loans were provided in the form of payments against parts of interests on commercial loans in 102 projects from 2008–2013 that were demanding in terms of investments with loan agreements totalling approximately CZK 1,578 million and had a maximum maturity of 10 years. In 2021, a part of the interest on the remaining 29 outstanding loans was paid in the total amount of approx. CZK 0.7 million. These are non-investment funds, kept outside programme funding.

Table 9.1.1.2
State budget funds provided under programmes 129 300, 129 400, 129 410 and 129 420 of the Ministry of Agriculture including subsidies for part of the interests on commercial loans in 2021

Form of support	Water supply systems and water treatment plants	Sewerage systems and wastewater treatment plants	Renovation of water supply systems and sewerage systems after floods	Total
	in millions of CZK			
Subsidies for development and renovation of the water supply infrastructure	756.279	1,135.288	0	1,891.567
Subsidies for purchase and consolidation of the W&S infrastructure	2.487	0	0	2.487
Subsidies for part of the interest on commercial loans	0.063	0.619	0	0.682
Total subsidies	**758.829**	**1,135.907**	**0**	**1,894.736**
Repayable financial assistance	0	0	0	0
Total	**758,829**	**1,135,907**	**0**	**1,894,736**

Source: MoA

Table 9.1.1.3
Development of state support for the construction of water supply systems, water treatment plants, sewage systems and wastewater treatment plants under the Ministry of Agriculture in 2017–2021

Financial source	2017	2018	2019	2020	2021
	in millions of CZK				
Repayable financial support	0	0	0	0	0
State budget subsidies	1,683	597	974	1,087	1,895
Support from state budget	**1,683**	**597**	**974**	**1,087**	**1,895**
Subsidised loan (EIB and CEB)	0	0	0	0	0
Total support	**1,683**	**597**	**974**	**1,087**	**1,895**

Source: MoA

The implementation of two other subsidy programmes 129 400 "Support for Measures Aimed at Mitigating Negative Impacts of Drought and Lack of Water" and 129 420 "Support for Purchase and Unification of the W&S Infrastructure", which are approved to last until the end of 2025, continued. In 129 420 programme, one project was supported with CZK 2.5 million.

Programme 129 400 "Support for Measures Aimed at Mitigating Negative Impacts of Drought and Lack of Water" was extended in 2021 by a new sub-programme 129 403. Programme 129 420 "Support for Purchase and Integration of Water Supply and Sewerage Infrastructure" was approved at the end of 2020 with an allocation of CZK 300 million. The aim is to achieve consolidation of assets and transfer of ownership rights under the management of the cities and municipalities of the Czech Republic.

No funds were expended from Chapter 397 of the State Financial Assets Operations for the abovementioned programs.

Flood control

In 2021, programme 129 260 "Support for Flood Prevention III" continued to be implemented. The programme is a follow-up to the previous stage, while its emphasis is on the implementation of measures with retentive effects. In 2021, only one project was funded from the state budget under this programme with funds amounting to CZK 132.2 million.

The programme is divided in four sub-programmes focused on support for preparatory design works for significant constructions, support for flood measures with retention and support for flood measures along watercourses.

Sub-programmes 129 262 "Support for Design documentation for Zoning Proceedings" and 129 263 "Support for Design Documentation for Construction Proceedings" are aimed at support for design documentations for significant constructions of flood measures that shall subsequently be implemented under further sub-programmes and for project preparation of projects prepared on the basis of Government Resolution of 29 February 2016 No. 171 on initiating preparations of water reservoir constructions in regions affected by drought and jeopardized by water insufficiency.

Sub-programme 129 264 "Support for Flood Prevention with Retention" is aimed at constructing new retention areas, adjustments at existing water reservoirs with retention effect in order to increase protection against floods, measures against flood spilling and support for water retention in dry reservoirs in minor watercourses.

Sub-programme 129 265 "Support for Flood Measures Along Watercourses" is primarily aimed at construction of protective dykes and stabilization and increasing capacity of watercourse beds (especially in built-up areas).

Table 9.1.1.4
Use of funds for major projects under programme 129 260 of the Ministry of Agriculture in 2021

Watercourse administrator	Project	Implementation date	Total cost	Subsidies in 2021
			in millions of CZK	
Morava River Board	Morava, Olomouc – increasing the channel capacity, stage II	11/2017 – 09/2022	735.563	132.145

Source: MoA

Table 9.1.1.5
Use of funds from the state budget by watercourse administrators under programme 129 260 of the Ministry of Agriculture in 2021

Owners and administrators	Investments	Non-investment
	in millions of CZK	
Elbe River Board	0	0
Vltava River Board	0	0
Ohře River Board	0	0
Oder River Board	0	0
Morava River Board	132.145	0
Forests of the Czech Republic	0	0
Municipalities	0	0
Total	**132.145**	**0**

Source: MoA

Same as in previous year, programme 129 260 is implemented by watercourse administrators (i.e. River Boards, s.e., and Forests of the Czech Republic and minor watercourse administrators appointed by the MoA pursuant to Section 48(2) of the Water Act. Municipalities participate actively in the programme as applicants for subsidies for construction of local measures aimed at reducing flood risk of torrential rain and in minor watercourses.

The programme allowed municipalities and associations of municipalities, towns and regions to participate in the procedure of designing flood measures through the institute of so-called "proposer"; measures designed by proposers are subsequently implemented by watercourse administrators.

In 2021, the Ministry of Agriculture initiated funding projects under 129 360 programme "Support for Remedying Flood Damage IV". The programme is a follow-up to previous stages and it emphasises implementation of measures with retention effects. Immediate implementation of significant projects

Table 9.1.1.6
Use of funds for selected major projects under 129 360 programme of the Ministry of Agriculture in 2021

Watercourse administrator	Project	Implementation date	Total cost	Subsidies in 2021
			in millions of CZK	
Ohře River basin	Nechranice HS	05/21–12/24	121.650	6.000
Vltava River Basin	Hněvkovice HS – flood protection of the HS	03/20–12/22	268.490	110.00
Elbe River Basin	Třebovka, Třebovice – Č. Třebová, modification – construction	01/19–06/23	461.708	132.69
Oder River Basin	02.106 Measures in the section downstream from Krnov, protection of the left bank area – Poland, Measures in upper Opava	03/20–04/22	115.753	65.999
Morava River basin	Bečva River, Hranice – capacitating of the weir	05/18–06/23	212.281	94.206
Forests of the Czech Republic	Markovický Stream	03/21–12/22	11.797	8.607

Source: MoA

after the launching of the programme was possible thanks to previously processed design preparation conducted during Stage III. 29 projects totalling to CZK 850.1 million were funded in 2021.

The programme is divided in four sub-programmes focused on preparation of design works for significant constructions, support for flood measures with retention, support for flood measures along watercourses and also on preparation and implementation of selected construction related to the construction of the Nové Heřminovy Water Structure.

Sub-programme 129 363 "Support for Design Documentation" is aimed at support for design documentations for significant constructions of flood measures that shall subsequently be implemented under further sub-programmes and for pre-project preparation of projects prepared on the basis of Government Resolution No. 243 of 18 April 2018 No. 243 on preparations of water reservoir constructions in regions affected by drought as an effective measure of reducing water insufficiency and proposal of their funding and funding of other significant hydraulic structures.

Table 9.1.1.7
Use of state budget funds by individual watercourse administrators under programme 129 360 the Ministry of Agriculture in 2021

Owners and administrators	Investments	Non-investment
	in millions of CZK	
Elbe River Board	184.872	0
Vltava River Board	132.922	0
Ohře River Board	6.000	0
Oder River Board	201.756	0
Morava River Board	277.073	3.000
Forests of the Czech Republic	34.480	2.783
Municipalities	7.197	0
Total	**844.3**	**5.783**

Source: MoA

Sub-programme 129 364 "Support for Flood Prevention with Retention" is aimed at constructing new retention areas, adjustments at existing water reservoirs with retention effect in order to increase protection against floods, measures against flood spilling and building and renovating polders including other related measures.

Sub-programme 129 365 "Support for Flood Measures Along Watercourses" is primarily aimed at construction of protective dykes and stabilization and increasing capacity of watercourse beds (especially in built-up areas).

In 2019, the programme was extended by new sub-programme 129 366 "Support for Preparation and Implementation of Investments and Constructions Resulting from the Construction of the Nové Heřminovy Water Structures" aimed at adjusting the location for the intended construction of a new hydraulic structure through conducting preparatory works and technical measures. The programme is performance of Government Resolution No. 386 of 3 June 2020 No. 386 concerning the Report on the state of preparation and implementation of measures aimed at reducing flood risks at the Upper Opava River including a proposal of funding the preparation and implementation of investment and constructions resulting from the "Measures at the Upper Opava" intent.

As in previous years, programme 129 360 is implemented by watercourse administrators (i.e. River Boards, s.e., and Forests of the Czech Republic and minor watercourse administrators appointed by the MoA pursuant to Section 48(2) of the Water Act. Municipalities participate actively in the programme as applicants for subsidies for construction of local measures aimed at reducing flood risk of torrential rain and in minor watercourses.

This programme also allows municipalities and associations of municipalities, towns and regions to participate in the procedure of designing flood measures through the institute of so-called "proposer"; measures designed by proposers are subsequently implemented by watercourse administrators.

Remedying flood damage

In 2021, the Ministry of Agriculture launched programme 129 370, "Remedying Flood Damage to State-owned Water Management Assets III." A total of 14 projects were supported with a total amount of more than CZK 61 million.

Program 129 370 provides for remedying flood damage to watercourse channels including constructions, hydraulic structures and riparian vegetation owned by the state, damaged by extreme stresses during floods and the implementation of purposeful stabilization structures and modifications to structures, ensuring continued functionality of watercourse channels and related structures and facilities where failures occur. The implementation of the programme is approved for the period 1 March 2021 – 31 December 2026.

The Lobkovice Lock (author: Hubalová Petra)

Table 9.1.1.8
Use of state budget funds and number of projects funded under programme 129 370 in 2021

Owners and administrators	Use of funds			Number of funded projects
	Investments	Non-investment	Total	
	in millions of CZK			
Forests of the Czech Republic	0	0	**0**	0
Morava River Basin	6.499	54.739	**61.238**	14
Total 129 370	**6.499**	**54.739**	**61.238**	**14**

Source: MoA

The objective of sub-programme 129 372 "Remedying of the 2020 floods consequences" is to remedy flood damage to watercourses, including related structures, hydraulic structures and riparian vegetation owned by the state, damaged by extreme stresses during the 2020 floods and to carry out purposeful stabilisation structures and modifications to structures ensuring continued functionality of watercourse channels and related structures and facilities where failures occur. The implementation of this sub-programme is approved for the period from 1 March 2021 to 31 December 2023 for two applicants – the Morava River Board and the Forests of the Czech Republic.

Minor watercourses and small water reservoirs

In 2021, the Ministry of Agriculture continued its programme 129 290 "Support for Measures on Minor Watercourses and Small Water Reservoirs", specifically its sub-programme 129 293. A total of 40 projects were supported with founds amounting to more than CZK 55 million. Under sub-programme 129 292, no support was allocated.

Sub-programme 129 293 "Support for Measures at Fishponds and Small Water Reservoirs Owned by Municipalities" is intended for municipalities and associations of municipalities. Under this sub-programme, funds amounting to CZK 55.194 million were allocated to for 40 projects in 2021.

In 2021, programme 129 390 "Support for Measures on Minor Watercourses and Small Water Reservoirs – Stage II" was continued and divided into two sub-programmes: 129 392 and 129 393. A total of 389 projects were supported with a total amount of CZK 577.4 million.

Table 9.1.1.9
Use of state budget funds and number of projects funded under programme 129 290 of the Ministry of Agriculture in 2021

Owners and administrators	Use of funds			Number of funded projects
	Investment	Non-investment	Total	
	in millions of CZK			
Total 129 292	**0**	**0**	**0**	**0**
Total 129 293 – Municipalities	**46.492**	**8.702**	**55.194**	**40**
Total 129 290	**46.492**	**8.702**	**55.194**	**40**

Source: MoA

Sub-programme 129 392 "Support for Measures on Minor Watercourses, Fishponds and Small Water Reservoirs – Stage II" is intended for River Boards, s.e. and Forests of the Czech Republic. In 2021, it provided financial support to 106 projects with a total amount of CZK 248.5 million.

Sub-programme 129 393 "Support for Measures at Fishponds and Small Water Reservoirs Owned by Municipalities – Stage II" is intended for municipalities and associations of municipalities. Under this sub-programme, financial support was allocated to 283 projects in the amount of CZK 328.8 million in 2021.

Table 9.1.1.10
Use of state budget funds and number of projects funded under programme 129 390 of the Ministry of Agriculture in 2021

Owners and administrators	Use of funds			Number of funded projects
	Investments	Non-investment	Total	
	in millions of CZK			
Ohře River Basin	14.633	21.052	**35.685**	5
Forests of the Czech Republic	56.571	18.598	**75.169**	60
Morava River Basin	32.984	42.400	**75.384**	22
Vltava River Basin	1.666	3.035	**4.701**	8
Oder River basin	12.315	3.003	**15.318**	2
Elbe River Basin	12.999	29.266	**42.265**	9
Total 129 392	**131.168**	**117.354**	**248.522**	**106**
Total 129 393 – Municipalities	**287.400**	**41.456**	**328.856**	**283**
Total 129 390	**418.568**	**158.810**	**577.378**	**389**

Source: MoA

Wheel, mill wheel (author: Hubalová Petra)

Water in the landscape

In 2021, the Ministry of Agriculture continued to administer programme 129 280 "Support for Water Retention in the Landscape – Fishponds and Water Reservoirs" funded between 2016 and 2021. The funds expended in 2021 supported 27 projects totalling to CZK 211.72 million.

Programme 129 280 is divided in three sub-programmes: sub-programme 129 282 "Support for Construction, Rehabilitation, renovation and De-mudding of Fishponds and Water Reservoirs", sub-programme 129 283 "Remedying of Emergency Situations at Fishponds and Water Reservoirs" and Sub-programme 129 284 "Remedying of Flood Damage at Fishponds and Water reservoirs".

Table 9.1.1.11
Use of state budget funds under programme 129 280 in 2021

Sub-programme	Number of projects	Funds
		in millions of CZK
129 282	26	203.82
129 283	1	7.90
129 284	0	0
Total	**27**	**211.72**

Source: MoA

Table 9.1.1.12
Use of state budget funds for selected projects under programme 129 280 in 2021

Applicant	Project	Implementation date	Total cost	Funds in 2021
			in millions of CZK	
Vladimír Pospíchal	New construction of the Dolní Fedrpyš Pond	07/21–12/21	15.095	12.076
Rybniční hospodářství, s.r.o.	De-mudding and reconstruction of the dam and of the Skříň Pond	10/21–12/22	45.598	20.000
Rybářství Litomyšl s.r.o.	Reconstruction of the Pařez Pond	07/20–12/21	6.135	4.908

Source: MoA

In 2021, funds under sub-programme 129 282 supported 26 projects with a total amount of CZK 203.82 million; one project was supported under sub-programme 129 283 with CZK 7.9 million.

In 2021, the Ministry of Agriculture continued the programme 129 310 "Support for the competitiveness of the agri-food complex – irrigation – Stage II". Under the 129 310 programme, financial support was provided for 76 projects in the amount of CZK 106.35 million.

The objective of programme 129 310 is to decrease the need for water and irrigation, energy demandingness of irrigation and use of positive environmental and extra-economic effects of irrigations as a measure of adopting to the climate change and thus increasing competitiveness of agricultural entities and stabilization of farming production. Programme 129 310 is divided in two sub-programmes: sub-programme 129 312 "Support for Renewal and Construction of Irrigation Detail and Optimization of Irrigation Systems – Stage II" is intended as a support for restoration and building irrigation detail and support for restoration, building and optimization of irrigation networks. Sub-programme 129 313 "Support for Optimization of Irrigation Networks Administered by the State Land Office" is aimed at the support for restoration, building and optimization of irrigation networks.

Table 9.1.1.13
Use of state budget funds under programme 129 310 of the Ministry of Agriculture in 2021

Sub-programme	Number of funded projects	Financial support
		in millions of CZK
129 312	74	101,95
129 313	2	4,40
Total	**76**	**106,35**

Pramen: MZe

The Jordan Waterfall (author: Hubalová Petra)

Table 9.1.1.14
Use of state budget funds under programme 129 310 of the Ministry of Agriculture in 2021

Applicant	Project	Implementation date	Total cost	Subsidies in 2021
			in millions of CZK	
ZD Dřísy a.s.	Purchase of irrigation equipment	04/21–04/22	7.586	5.520
Hop Institute s.r.o.	Purchase of irrigation pivots	10/20–07/21	5.066	2.533
Vlastimil Kozel	Extension of irrigation technology Vrbice	10/20–06/21	1.230	1.107

Source: MoA

Preparation of hydraulic structure construction

In 20201 the Ministry of Agriculture administered three dotation programmes focused on purchase of real estate affected by preparation for construction of significant hydraulic structures. The following hydraulic structures are concerned: Skalička, Vlachovice and all-embracing measure aimed at drought in the Rakovník District (water reservoirs of Kryry, Senomaty, Šenov and water feeders).

Under the 129 330 programme «Vlachovice – Settling Rights to Immovable Property Affected by the Planned Construction of a Water Structure", funds totalling to CZK 200 million were used in 2021.

The aim of the programme is to implement the task arising from Government Resolution No. 257 of 15 April 2019, which approved the Principles for Settling rights to immovable property affected by the planned construction of the Vlachovice HS. The main purpose of the programme is to settle the property rights of all owners affected by the future construction of the Vlachovice HS in accordance with the approved incentive compensations by 2023. The programme includes one sub-programme 129 332 „Vlachovice – Settling Rights to Immovable Property Affected by the Planned Construction of the Vlachovice Water Structure", through which the actual property rights will be settled. The beneficiary of the subsidy is the Morava River Board.

The Vlachovice Water Structure is to be the key resource of drinking water for the Zlín District and will be able to supply water to the adjacent parts of the South Moravian and Olomouc Regions through joint water supply systems. It is one of the most important measures aimed at mitigating effects of the climate change in the Czech Republic.

Under programme 129 340 "Settling Rights to Immovable Property Affected by the Planned Comprehensive Drought Solution in Rakovník", funds amounting to CZK 94.53 million were used in 2021.

Government Resolution No. 971 of 5 October 2020 approved the Principles for the settlement of rights to immovable property affected by the planned implementation of the complex drought in Rakovník - Stage I and approved funding totalling to CZK 485 million in 2020–2025. In the first stage, immovable property affected by the implementation of the Kryry, Senomaty and Šanov hydraulic structures is settled. Programme 129 340 is divided into two sub-programmes, namely sub-programme 129 342 "Kryry HS – Settling rights to immovable property affected by the planned implementation of the hydraulic structures", where the Ohře River Board is the beneficiary of the subsidy, and sub-programme 129 343 "Senomaty and Šanov – Settling rights to immovable property affected by the planned implementation of water supply structures", where the Vltava River Board is the beneficiary of the subsidy.

The Kryry Water Structure is a crucial element in the planned system of measures aimed at addressing drought in the Rakovník District. Together with the small water reservoirs of Senomaty and Šanov in the Rakovnický Stream Basin and its feeders, it is an effective solution to enhancing water resources and mitigating water deficit in the area.

Within the framework of the Principles for the settlement of rights to immovable property affected by the planned construction of the Skalička Hydraulic Structure», funds in the amount of CZK 39.6 million were disbursed in 2021.

The Bečva River Basin is one of the most exposed areas in the Czech Republic in terms of flood risks, which is why the Principles for the settlement of rights to immovable property affected by the planned construction of the Skalička HS were approved in 2017 on the basis of Government Decree No. 274 of 10 April 2017.

Preparation and construction of flood protection in the Bečva River Basin is divided into two stages. The total amount of funds intended for the purchase of immovable property affected by the construction of the Skalička HS is CZK 1.24 billion. So far, property worth CZK 690 million has been bought in Stage I, the recipient of the subsidy is the Morava River Board. The Skalička HS will be built in Stage II. Land purchases for the Skalička HS will be completed in 2023. With respect to the climate change and the need to ensure sufficient water resources, different versions of the hydraulic structure technical design are being assessed so that the hydraulic structure addresses both hydrological extremes, i.e. floods and drought.

Fisheries

In 2021, the subsidy program 17 "Support for Non-productive Functions of Fisheries" was split into 17.A "Support for Non-productive Functions of Fisheries" and 17.B "Support for Fish Community Recovery After a Water Clarity Incident". In 2021, funds totalling CZK 22.99 million were allocated.: under programme 17.A, 50 applications were funded for a total of CZK 22.24 million and one application for CZK 0.75 million was funded under Programme 17.B.

In order to promote extra-production functions of fishing districts, the Ministry of Agriculture established, pursuant to provisions of Sections 1, 2 and 2(d) of Act No. 252/1997, on Agriculture, as amended, national grant programme DT17 "Support for Extra-production Functions of Fisheries" in 2015.

Table 9.1.1.15
Use of state budget funds under subsidy programme 17 "Support for Non-productive Functions of Fisheries" of the Ministry of Agriculture in 2021

Program	Number of applications received	Number of funded projects	Financial support in millions of CZK
17.A	50	50	22.24
17.B	1	1	0.75
Total	**51**	**51**	**22.99**

Source: MoA

The 17.A grant programme was established with the view of promoting the biodiversity of fish stocks in surface waters intended for users of fishing grounds. The subsidy rate is per hectare of fishing grounds. Funds may only be used for costs covering the introduction of those fish species that have been introduced in accordance with the established stocking levels. The 17.B grant programme was established with the view of restoring fish populations in surface waters after a water clarity incident that resulted in minimal survival of the fish community for users of fishing grounds. The subsidy rate is per hectare of fishing ground. The funds may be used only for the costs covering restocking of those fish species which have been bred in accordance with the established stocking levels.

Operational Programme Fisheries 2014–2020

In 2021, the Ministry of Agriculture paid subsidies to 207 projects from the Operational Programme Fisheries 2014–2020 in a total amount of almost CZK 211 million.

The Operational Programme Fisheries 2014–2020 is a programme through which fishermen can use funds from the European Marine and Fishing Fund under Priority Axis 2 – Support for knowledge-based environmentally sustainable, innovative and competitive aquaculture, support for new breeders and introduction of European eel (Anguilla anguilla) in selected fishing districts in the Elbe and Oder River Basins. Under EU Priority Axis 3 – Support for common fishing policy promotes data gathering and monitoring of fishing and aquaculture products. Under EU Priority Axis 5 – Support for new introductions to the market and processing, the grant concerns promotion and investment in fish processing.

Rural Development Programme

The Rural Development Programme of the Czech Republic for 2014–2020 is based on the Joint Strategic Plan, Partnership Agreement and other strategic documents and it was designed in accordance with Regulation of the European Parliament and of the Council No. 1305/2013. Water management is partially concerned by this programme by its Land consolidation. In 2021, funds amounting to almost CZK 159 million were expended under Operation 4.3.1 Land consolidation.

Grants from RDP are co-funded from the European Agricultural Fund for Rural Development (hereinafter referred to as the ‚EAFRD') and from the state budget. RDP 2014–2020 funding is prefunded from the state budget, meaning all payments to recipients are first covered from national funds.

The RDP 2014–2022 supports Land consolidation with a single grant recipient defined: the SLO through its branches of regional land offices. The programme is a follow-up to previous RDP 2007–2013. 100% of eligible costs are funded. Funds from the EAFRD cover 49.5% of public costs, funds from the state budged of the Czech Republic cover 50.5% of public costs. EUR 130 million (approximately CZK 3.4 billion), was allocated for 2014–2022, continuous reception of applications started on 22 February 2016.

In the programming period 2014–2022, a total of 346 applications for subsidies in the amount of CZK 3.5 billion were registered under Operation 4.3.1 Land Consolidation by 31 December 2021, while 334 applications in the amount of CZK 3.3 billion were approved and 329 projects worth CZK 3.3 billion were actually reimbursed.

Table 9.1.1.16
Operational Programme Fisheries 2014–2020 – Use of funds in 2021

EU priority	Measure number	Project	Number of projects	Funds reimbursed in millions of CZK
2 – Support for knowledge-based, environmentally sustainable, innovative, competitive and resource-efficient aquaculture	2.1	Innovation	7	8,86
	2.2	Productive investments in aquaculture	127	87,49
	2.3	Support for new farmers	1	0,10
	2.4	Recirculation equipment and flow systems with additional purification	2	7,33
	2.5.	Aquaculture providing environmental services	4	3,53
	2.6	Increasing competitiveness of aquaculture enterprises	28	46,28
Total EU Priority 2			**169**	**153,59**
3 – Support for implementation of common fishing policy	3.1	Data collection	2	6,16
	3.2	Product traceability	5	0,32
Total EU Priority 3			**7**	**6,48**
5 – Support for introduction to the market and processing	5.1	Production plans	-	-
	5.2	Marketing of products	8	7,12
	5.3	Investment in product processing	14	31,87
Total EU Priority 5			**22**	**38,99**
		Technical assistance	9	11.71
Total			**207**	**210.77**

Source: MoA

Table 9.1.1.17
Use of funds under Operation 4.3.1 Land Consolidation in 2021

Operation 4.3.1 Land consolidation	Unit	Intent a) Land survey work	Intent b) Implementing plans for joint structures	Total	Of which allocated to water management
No. of projects registered	pcs	0	0	**0**	**0**
Amount for projects registered	in millions of CZK	-	-	**-**	**-**
No. of approved projects	pcs	0	2	**2**	**2**
Amount for projects approved	in millions of CZK	-	43.6	**43.6**	**43.6**
Funded projects	pcs	0	31	**31**	**14**
Funded	in millions of CZK	-	379	**379**	**159**

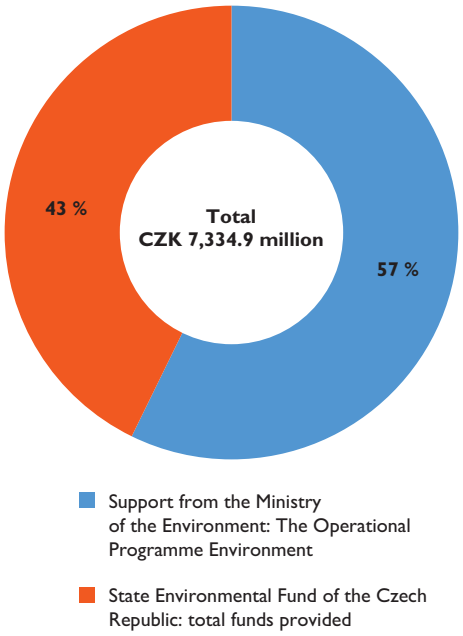
Source: MoA

9.1.2 Financial support provided by the Ministry of the Environment

In 2021, the Ministry of the Environment provided financial support under transnational and national grants. Financial support from the state budget amounted to CZK 4,209.5 million. Financial support from the State Environmental Fund of the Czech Republic amounted to CZK 3,125.4 million. Thus, the total funds provided under the Ministry of the Environment for water management amounted to CZK 7,334.9 million.

The Old Pond, the construction (source: Ohře River Board, s.e.)

Graph 9.1.2.1
Funds provided for water management by the Ministry of the Environment in 2021



Source: MoE, SEF

Table 9.1.2.1
Funds provided for water management by the Ministry of the Environment in 2021

Programme name	Programme expenditures in millions of CZK
Operational Programme Environment 2014–2020	4,209.5
Ministry of the Environment – total	**4,209.5**
National Programme Environment	**2,814.6**
Call No. 2/2016 PU/Call No. 1/2019 PU according to Directive No. 8/2017 of the Ministry of the Environment – loans from the State Environmental Fund	309.1
Norwegian funds	1.7
State Environmental Fund of the Czech Republic – total support provided	**3,125.4**
Total funds provided by the Ministry of the Environment	**7,334.9**

Source: MoE, SEF

The Kubov Weir, the Opava Stream (source: Oder River Board, s.e.)

Operational Programme Environment 2014–2020

The Ministry of the Environment provides financial support under programmes co-funded from the European Union grants through the Operational Programme Environment. In 2021, funds from the Cohesion Fund and European Regional Development Fund were provided for priority axes 1 and 4 for water management and for care and protection of nature and landscape, totalling to CZK 4,209.5 million.

The programme document for OPE 2014–2020 was approved by the European Commission on 30 April 2015. The funds started to be used in December 2015. The OPE 2014–2020 is a follow-up to the OPE 2007–2013. In comparison with the previous programme, there is a decrease in the number of activities supported by so-called priority axes. In 2014–2020, support from the programme may be received in one of the following priority axes:

- Improving water quality and decreasing the risk of floods,
- Improving air quality in urban areas,
- Waste and material flows, ecological burden and risks,
- Protection and care of the nature and landscape,
- Energy savings.

Under Priority Axis 1 – improving water quality and reducing flood risk – 106 projects have been approved for funding in 2021 with a total EU contribution of EUR 466.0 million. 137 projects have been issued with a total EU contribution of CZK 554.5 million. CZK. In 2021, Cohesion Fund funds were drawn down in the total amount of CZK 2,797.7 million.

Under Priority Axis 4 – Protection and care of the nature and landscape (specific objective 4.3 – To strengthen natural landscape functions and 4.4 – To improve quality of the environment in residential areas) including measures against drought, 119 projects were approved for funding with contribution from the EU of CZK 275.8 million and legal act confirming future provision of CZK 282.4 million was issued for 124 projects in 2021. Funds used from the ERDF amounted to CZK 1,411.9 million in 2021.

In 2021, applications for grants from the Operational Programme "Environment 2014–2020" for water management and protection and care of landscape were received under three calls (of which one under specific objectives 1.1 to 1.4 and two calls under specific objectives 4.3 and 4.4). A total of seven calls were opened in 2021.

Table 9.1.2.2
Projects approved for funding from the Operational Programme Environment 2014–2020 in water management in 2021

Priority axis	Area of support	Number of	Total cost	Total eligible expenditure	European Union contribution
			in millions of CZK		
1	1.3	68	602.57	415.16	343,02
	1.4	38	175.06	173.92	123,01
Priority Axis 1 Total		**243**	**106**	**777.63**	**589.08**
4	4.3	9	77.42	77.38	75,18
	4.4	110	364.54	296.69	200,63
Priority Axis 4 Total		**119**	**441.96**	**374.06**	**275.81**
Total		**225**	**1,219.59**	**963.15**	**741.84**

Source: Monitoring System of European Structural and Investment Funds for 2014–2020
Note: Project approved for funding is a project approved by the Selection Committee of the Managing Body of the Operational Programme Environment.

Table 9.1.2.3
Projects with legal act on granting support from the Operational Programme Environment 2014–2020 in water management in 2021

Priority axis	Area of support	Number of	Total cost	Total eligible expenditure	European Union contribution
			in millions of CZK		
1	1.1	2	72.21	59.65	38.03
	1.3	91	736.68	533.16	445.27
	1.4	44	97.50	94.75	71.17
Priority Axis 1 Total		**137**	**906.39**	**687.57**	**554.47**
4	4.3	12	86.63	85.57	82.97
	4.4	112	365.48	293.31	199.38
Priority Axis 4 Total		**124**	**452.11**	**378.88**	**282.35**
Total		**261**	**1,358.49**	**1,066.44**	**836.82**

Source: Monitoring System of European Structural and Investment Funds for 2014–2020
Note: Project with an issued permit is a project with a Project registration and Decision on Grant Provision.

Table 9.1.2.4
Drawdown of funds under the Operational Programme Environment 2014–2020 in 2021

Area of support	European Union contribution in millions of CZK
1.1 – Reducing the amount of pollution discharged to surface and groundwater from municipal sources and the input of pollutants to surface and groundwater	1,629.96
1.2 – Ensuring the supply of drinking water of adequate quality and quantity	653.03
1.3 – Ensuring flood protection in the inner city	243.17
1.4 – Supporting preventive flood control measures	271.53
Priority Axis 1 Total	**2,797.69**
4.3 – Strengthening the natural functions of the landscape	1,290.09
4.4 – Improving the quality of the environment in settlements	121.76
Priority axis 4 total (4.3, 4.4)	**1,411.85**
Total	**4,209.54**

Source: Monitoring System of European Structural and Investment Funds for 2014–2020

Table 9.1.2.5
Calls for the Operational Programme Environment 2014–2020 in the field of water management in 2021

Call number	Number and name of the specific objective	Allocation of European Union funds in millions of CZK	Start of receipt of applications	End of receipt of applications
52	1.3 Ensuring flood protection of urban areas	1 000	03/02 2020	01/03 2021
88	1.3 Ensuring flood protection of urban areas	56	15/10 2020	01/03 2021
115	1.4 Promoting flood prevention measures	50	15/10 2020	01/03 2021
127	1.1 Reducing the amount of pollution discharged into surface and ground water from municipal sources and the input of pollutants into surface and groundwater	39	01/09 2020	25/02 2021
128	4.3 Strengthening natural landscape functions	40	16/08 2021	03/01 2022
119	4.4 Improving quality of the environment in residential areas	60	16/08 2021	03/01 2022
140	1.3 Ensuring flood protection of urban areas	500	25/10 2021	31/01 2022

Source: Monitoring System of European Structural and Investment Funds for 2014–2020

State Environmental Fund of the Czech Republic

The State Environmental Fund (SEF) of the Czech Republic established by Act No. 388/1991 Coll., is a specifically oriented institution which is an important financial resource for support for implementation of measures aimed at protecting and improving the status of the environment in its respective compartments. On 31 December 2020, the revenue part of its budget amounted to CZK 10.56 billion.

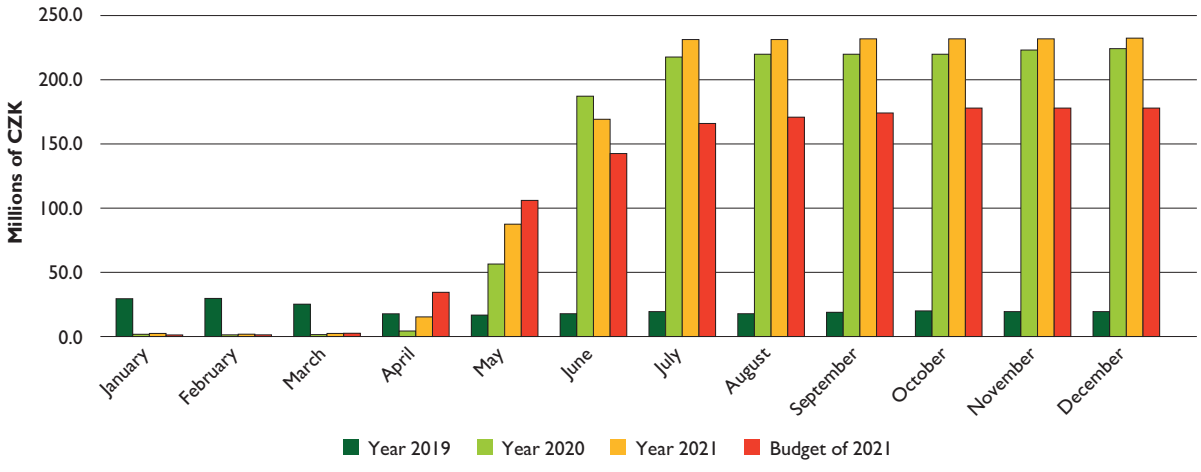
The revenues of the State Environmental Fund of the Czech Republic ("SEF") included collected charges for environmental pollution of CZK 1,679.3 million. Revenues from fines and financial penalties amounted to CZK 41.7 million. In the sphere of water protection, it is a charge for wastewater discharges into surface waters and a charge for abstracted groundwater as shown in Table 9.1.2.6.

Table 9.1.2.6
State Environmental Fund – Structure of the revenue part of the budget (water only) – 2021

Item (water protection)	Budget for 2021	Revenue as of 31/12 2021	Payments	Difference
	in millions of CZK		%	in millions of CZK
Wastewater	180.0	235.5	130.8	55.5
Groundwater	320.0	353.6	110.5	33.6

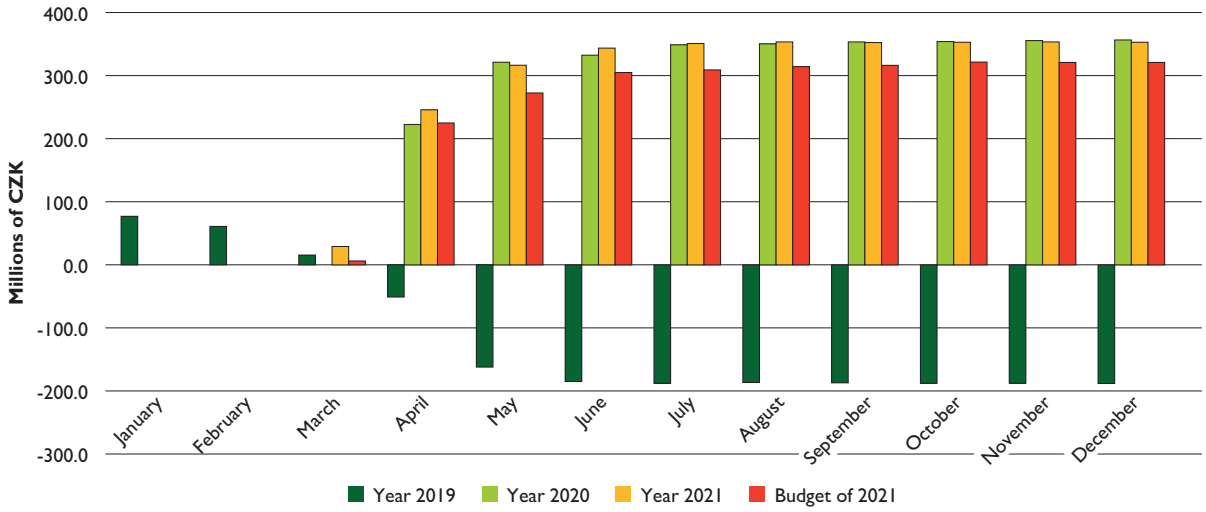
Source: SEF

Graph 9.1.2.2
State Environmental Fund – Development of revenues from charges for wastewater in 2019–2021



Source: SEF

Graph 9.1.2.3
State Environmental Fund – Development of revenues from charges for groundwater in 2019–2021

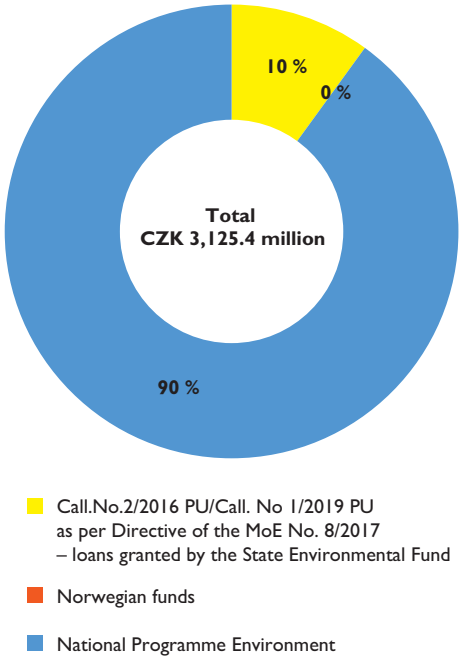


Source: SEF

National programmes administered by the State Environmental Fund of the Czech Republic

Since its inception, the State Environmental Fund of the Czech Republic has provided funding from national sources to support a wide range of environmental measures in the Czech Republic. The funds were offered under so-called national programmes. Their focus was based on the priorities of the current State Environmental Policy and the Strategy of the State Environmental Fund of the Czech Republic; after the availability of European funds in 2004, they acquired a complementary function to the EU subsidies. In 2015, the national programmes were replaced by the National Programme Environment. In 2021, the State Environmental Fund of the Czech Republic administered four programmes under which approximately CZK 3,125.4 million were paid out.

Graph 9.1.2.4
State Environmental Fund of the Czech Republic – administered national programmes (water management) – use of funds in 2021



Source: SEF

National Programme Environment

The National Programme Environment supports projects aimed at protecting and improving the environment in the Czech Republic using national funds. It is intended particularly for towns and smaller municipalities. It uses funds of the State Environmental Fund obtained from environmental feels and it complements other grants, particularly OPE and the New Green Savings programme.

The State Environmental Fund administered under this programme 22 applications and one application outside the programme in 2021 – for details see Table 9.1.2.7. 3,879 applications totalling to CZK 2,815 million were paid under the calls.

Fish crossing, the Smědá Stream in Frýdlant (source: Elbe River Board, s.e.)

Table 9.1.2.7
Calls administered under the National Programme Environment in 2021

Call number	Call title	Applications received		Applications approved		Applications funded	
		number	Subsidies in millions of CZK	number	Subsidies in millions of CZK	number	Subsidies in millions of CZK
out of call	Turów (Czech Geological Service)	1	29.9	1	29.9	1	18.2
8/2016	Research, intensification and construction of drinkable water resources	0	0.0	0	0.0	13	13.3
10/2016	Green vegetation for towns and municipalities	0	0.0	0	0.0	15	0.6
11/2016	Domestic wastewater treatment plants	0	0.0	0	0.0	1	5.0
6/2017	Rainwater	0	0.0	4	0.2	5	0.2
12/2017	Rainwater II	2,206	90.4	2,390	92.4	2,586	99.6
15/2017 – selection of applications	Support for municipalities in national parks – application selection	0	0.0	0	0.0	1	0.2
17/2017	Domestic wastewater treatment plants	0	0.0	0	0.0	15	48.0
18/2017	Green vegetation for towns and municipalities	0	0.0	0	0.0	26	3.3
20/2017	Liquidation of unnecessary drills	0	0.0	0	0.0	3	3.0
2/2018	Drinkable water resources	125	217.9	305	539.0	172	179.8
3/2018 – selection of applications	Eco-innovation – application selection	0	0.0	0	0.0	1	14.5
8/2018	WWTPs and sewerage systems	0	0.0	0	0.0	34	330.4
4/2019	Water supply and sewerage systems	0	0.0	1	46.2	185	1 739.3
9/2019	Tree planting	695	138.2	610	105.9	613	105.3
12/2019	Domestic wastewater treatment plants	22	147.9	26	161.1	0	0.0
3/2020	Project preparation – water management projects	106	129.5	124	151.2	187	231.9
6/2020	Project preparation – drought and floods	22	23.3	22	23.3	21	22.2
3/2021	Plans for drought	13	7.7	0	0.0	0	0.0
4/2021	Tree planting – individual projects	340	74.8	112	24.3	0	0.0
6/2021 – selection of applications	Support for municipalities in national parks – selection of applications	2	3.5	0	0.0	0	0.0
7/2021	Domestic wastewater treatment plants	9	53.9	0	0.0	0	0.0
9/2021	Drinking water sources	1	1.7	0	0.0	0	0.0
Total		**3,542**	**918.6**	**3,595**	**1,173.5**	**3,879**	**2 814.6**

Source: SEF

Call No. 2/2016 PU as per Directive No. 8/2017 of the Ministry of the Environment - loans from the State Environmental Fund

The call was made in 2016 with the objective of enhancing own sources expended on implementing projects supported under OPE 2014–2020, Priority Axis I, specific objectives 1.1 and 1.2 with the intent of improving quality of drinking water for the population. Applications were received from 17 October 2016 until 31 December 2018 or until all funds were allocated. The funds allocated amounted to CZK 690 million. In 2021, CZK 309.1 million was paid. Call No. 1/2019 PU was made in 2019 with total allocation of funds amounting to CZK 500 million in Priority Axis I with applications received from 2 January 2020.

Table 9.1.2.8
Overview of terminated Call No. 2/2016 PU and Call No. 1/2019 PU for loans for implementors of water management projects under the Operational Programme Environment on 31 December 2021

Call	Maturity in years	Allocation	Applications submitted	Applications administered	Applications with issued Decision of the Minister	Contracts concluded with receivers	Paid to recipients
		in millions of CZK					
2/2016	max. 10	690	728.1	0	0	674.4	658.6
1/2019	max. 10	500	342.5	0	0	334.9	280.9

Source: SEF

Norwegian funds – the Programme Environment, Ecosystems and Climate Change

The programme is funded from the Norwegian Financial Mechanism for 2014–2021, the State Environmental Fund co-funds the programme with 15%. The programme is focused on improving the state of ecosystems, decreasing air and water pollution including monitoring and on adoption and mitigation measures linked with the climate change.

In the field of waters, the programme focuses on enhancing substance monitoring in accordance with the Water Framework Directive (list of priority substances and list of monitored substances – "watchlist") and on implementing projects aimed at reducing pharmaceutical pollution in surface waters.

In 2021, two calls focused on pilot and demonstration projects aimed at both reducing the content of pharmaceuticals and hormones (including their metabolites) in wastewater (the "Trondheim" call) and pilot projects aimed at implementing real (in situ) measures to improve ecosystems and protect biodiversity (the "Rago" call), with a total allocation of CZK 243.9 million. The selection of projects is planned to be finalised in the first quarter of 2022.

The remaining four calls of the programme (including the call supporting measures to provide appropriate infrastructure and analytical methods for identification of pollutants in water) will be launched in the first half of 2022.

9.1.3 Financial support of the Ministry of Transport

In 2021, the State Fund for Transport Infrastructure spent a total of CZK 697 million on development, modernisation and maintenance of waterways of transport importance through the Waterways Directorate of the Czech Republic, of which, investment expenditures amounting to approx. CZK 697 million and non-investment expenditure of approx. CZK 663 million. Financial participation in the entire amount of CZK 13.7 million was allocated to the RIS COMEX project under the programme Connecting Europe Facility.

State Fund for Transport Infrastructure

The Ministry of Transport provides financial support through the State Fund for Transport Infrastructure (hereinafter referred to as ‚SFTI') which was established with Act No. 104/2000 Coll., on the State Transport Infrastructure Fund of 4 April 2000 with effect as of 1 July 2000. The purpose of the fund in water management is to fund construction, modernization, repairs and maintenance of significant national waterways.

Waterways Directorate of the Czech Republic

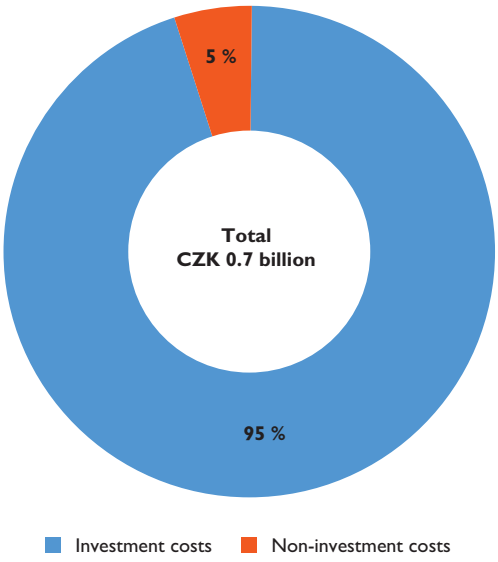
The Waterways Directorate is an investor organisation of the Ministry of Transport. It was established by the Ministry of Transport and Communications of the Czech Republic on 1 April 1998 as an organisational unit of the state whose main activity is to ensure the development of the waterway infrastructure of the Czech Republic from the State Fund for Transport Infrastructure.

In 2021, funds from the STIF and Connecting Europe Facility programme were primarily allocated to a set of investment projects aimed at general increase of the parameters of the Vltava Waterway between Mělník, i.e. the ongoing implementation of the project "Underpass Clearance Increase in the Vltava Waterway" in the amount of CZK 370 million and "Increasing Draught on the Vltava Waterway" amounting to approx. CZK 74.685 million and the completed project "Adjustment of the head of the Hořín Lock" amounting to approx. CZK 47.280 million. In September 2021, these projects capped the overall increase of underpass heights on the Vraňany – Hořín Navigation Channel to 7.0 m. inter alia, by means of 4 unique lifting bridges with remote control. Furthermore, investment projects aimed at development of recreational navigation "Passenger water transport mooring on the Lower Elbe" were successfully implemented in the amount of approx. CZK 15.346 million. The "Recreational Port of Kolín" in the amount of approx. CZK 5.987 million and, in particular, modernisation and extension of the "Recreational Port Veselí nad Moravou" on the Bata Canal was completed in the amount of approx. CZK 35.306 million. The item Investment projects with budget costs below CZK 30 million used funds amounting to approx. CZK 47.487 million for minor projects in 2021. From the point of view of safety of waterway use, opening of two new stable fuel filling stations for vessels, including comprehensive wastewater collection, in the ports of Veselí nad Moravou and Hluboká nad Vltavou was significant. These are the first secure refuelling stations on the Bata Canal and on the Vltava River in the South Bohemia Region.

Significant funds amounting approx. to CZK 43.489 million were also spent on intensive preparation of other investment projects aimed at general development of the entire network of transport-significant waterways. The main obstacle to the ongoing preparation of investment projects was the unresolved

issue of the use of lands by River Boards, s.e. needed for construction, while in the case of the Děčín Weir it is necessary that the SEA assessment of the Water Transport Concept is first completed. Additionally, as part of other investment project preparation, the EIA assessment of the Recreational Port Slovácko, the Recreational Port Hodonín and the Kostelec nad Labem Wharf was completed, and the merged permit for the Modernization of the OLD Ústí nad Labem – Vaňov mooring was obtained and project documentation for other waterway infrastructure development projects was prepared. The RIS COMEX project, a joint project of 13 European countries for implementation of harmonised corridor-based River Information Services, continued with intensive implementation of national services connected to the central EuRIS COMEX system and the new ERI CEERIS portal. The whole solution will be fully operational in June 2022.

Graph 9.1.3.1
Waterways Directorate – Use of funds in 2021



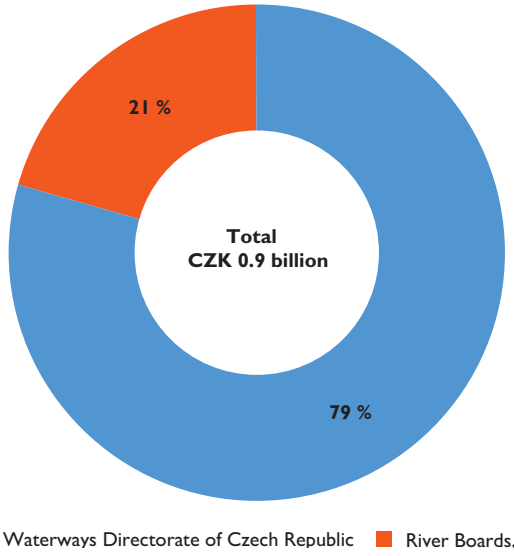
Source: Ministry of Transport

Blatenský příkop, oprava opevnění (autor: Hubalová Petra)

In 2021, River Boards, s.e., expended on operation and maintenance of waterways funds amounting to CZK 239 million, of which more than CZK 59 million was from their own sources and almost CZK 180 million from grants. The grants were allocated from the State Transport Infrastructure Fund.

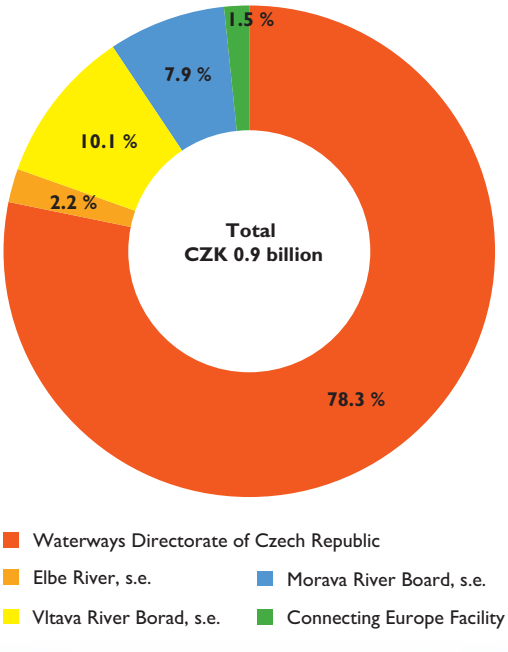
The Vltava, Elbe and Morava River Boards, s.e., used funds for renovation, operation and maintenance of waterways under their authority. They used funds from the STIF in a total amount of CZK 179.9 million, of which non-investment funds amounted to CZK 112.2 million and special-purpose investment funds to CZK 67.7 million.

Graph 9.1.3.2
Use of funds from the State Transport Infrastructure Fund in 2021



Source: MoA using data provided by the Ministry of Transport and River Boards, s.e.

Graph 9.1.3.3
Funds spent on transport-significant waterways through the Ministry of Transport in 2021



Source: MoA using data of River Boards, s.e. and the Ministry of Transport

Table 9.1.3.1
Waterways – selected projects of the State Enterprise Basin Management in 2021

River Board, s.e.	Name of event	Total cost in millions of CZK	Source of funding
Elbe	Kostomlátky HS, repair of the lock bed	10.4	STIF
	Klavary HS, corrosion protection of lock chamber gates	3.5	STIF
	Lysá n. L. HS, corrosion protection of lock chamber gates	3.2	STIF
Vltava	Štvanice HS – repair of the lower gate of small lock chamber	11.2	STIF
	Kořensko HS – ensuring navigation depths below the HS	64.6	STIF
	Protective stand Miřejovice	23.4	STIF
Morava	Bat'a Canal, Vnorovy – Veselí n. Mor, km 14,895 - 17,825, corridor fortification	16.1	STIF
	Modernisation of the navigation locks of the Bat'a Canal	24.9	STIF
	Service berths for service vessels – Sudoměřice, Strážnice, Spytihněv	9.7	STIF

Source: River Boards, s.e.

Table 9.1.3.2
Funds resources expended by River Boards, s.e. on repair, maintenance, building, reconstruction and modernisation of waterways under their management in 2021

River Boards, s.e.	Own resources	Special-purpose non-investment grants *)	Investment grants *)	Total subsidies	Total own resources and subsidies
	thousands of CZK				
Elbe	5,615	19,173	800	**19,973**	**25,588**
Vltava	49,232	22,484	67,481	**89,965**	**139,197**
Morava	4,317	25,993	43,962	**69,955**	**74,272**
Total	**59,164**	**67,650**	**112,243**	**179,893**	**239,057**

Source: River Boards, s.e.
*Note: *) Grant provider – STIF.*

The Hranice Weir after completion, January 2022 (source: Morava River Board, s.e.)

9.2 Financial support from international cooperation

Projects focused on the area of water management in 2014–2020

The programme period 2007–2013 ended and is successfully followed by new programme period for 2014–2020. It consists of the following nine independent programmes:

Cross-border cooperation
- Interreg IVC Czech Republic – Poland
- Interreg IVC Slovak Republic – Czech Republic
- Interreg IVC Austria – Czech Republic
- Programme of transboundary cooperation Czech Republic – Free State of Bavaria (under the Objective of European Territorial Cooperation 2014–2020)
- Programme of cooperation Free State of Saxony – Czech Republic 2014–2020

National and inter-regional cooperation
- Interreg CENTRAL EUROPE
- DANUBE
- Interreg EUROPE
- URBACT III

Under these nine programmes, projects that contribute to improving the environment (natural and technological risks including the climate change and influence on water management, etc.) were submitted, approved and subsequently funded. 2020 was a year of full implementation of all the projects, while still several new projects focusing on the abovementioned issues were approved.

- **Programme of transboundary cooperation Czech Republic – Free State of Bavaria (under the Objective of European Territorial Cooperation 2014–2020)**

1. *Joint research of natural substances from blue algae as a mode of cross-border scientific partnership / Gemeinsame Erforschung von Naturstoffen aus Blaualgen als Entwicklungsmodell der grenzüberschreitenden wissenschaftlichen Partnerschaft*

No. of partner(s) on the Czech side: 1
Partner's budget:
- Institute of Microbiology of the CAS, p.r.i.: EUR 897,107.40

The objective of the project is interconnecting two significant workplaces and innovations from the given region, i.e. the ALGATECH Centre of the Institute of Microbiology of the CAS in Třeboň and Wissenschaftszentrum Straubing in Bavaria. The project is focused on joint research of cyanobacteria seen as a source of precious substances (high value products) while using other parts of the biomass grown. The Czech party shall bring in the joint project know-how in the sphere of mass cultivation of suitable organisms, methods of increasing production and methods of extraction of precious substances, whereas the Bavarian part endows the project with their experience of substance testing, technologies linked with further processing and testing the application potential. The target groups are research institutions of the partners, researchers and students.

2. *Silva Gabreta Monitoring – Implementation of cross-border monitoring of biodiversity and water regime, Silva Gabreta Monitoring – Realisierung eines grenzübergreifenden Monitorings von Biodiversität und Wasserhaushalt*

No. of partner(s) on the Czech side: 3
Partner's budget:
- Šumava National Park Administration: EUR 513,674.10
- Czech University of Life Sciences in Prague: 79,215.00
- Masaryk University: EUR 53,955,00

The objective of the project is to create functional infrastructure for a cross-border monitoring network and conduct, for the first time in history, monitoring of forest, moor and water biodiversity in both national parks using standardized modern methods. Additionally, the project will allow for sharing and assessing data from a joint biodiversity databank. The results will become an important basis for further steps aimed at building closer relations in conservational management in the shared area of Czech–Bavarian Šumava. Cross-border application of standard methodical processes will allow for compiling a unified dataset that will be a valuable basis for improving conservationist and scientific collaboration between the two neighbouring national parks.

3. *Measures on the Kössein and Röslau Rivers aimed at mitigating the problem with mercury at the Skalka Water Reservoir, project No. 214*

No. of partner(s) on the Czech side: 1
Partner's budget:
- Ohře River Board, s.e.: EUR 37,725.29

Water, sediments and fish in the Kössein, Röslau and Ohře Rivers are contaminated with mercury of anthropogenic origin. Sediments contained with mercury are deposited in the Skalka Water Reservoir. It has not been conclusively ascertained to what degree such sediments have on food chain in the water reservoir and on human use of the reservoir. Outcomes of an inquiry aimed at answering such questions will be risk analysis that will be conducted by the Czech partner. The risk analysis will serve the Bavarian partner as a background material for discussing remedial measures and will allow for defining priority of selected measures. Under the project, the Bavarian partner shall examine all possible measures in a feasibility study. The measures shall be assessed in terms of their efficiency, sustainability, costs and feasibility (with respect to technical and legal aspects including compliance with the Water Framework Directive). In case of long-term measures consisting in reinforcing long riverbank belts and bedrock and measures in valley meadows we can expect restrictions as some of the sites are considered European Significant Locations (EVL – Natura 2000). That is the reason why four or five measures shall be first implemented during common watercourse maintenance, while it will be tested in close cooperation with nature conservation authorities whether such measures can be considered environment-friendly.

4. Green infrastructure measures from multi-purpose use of waste sludge (green IKK) through cross-border interregional cooperation, project No. 70

Partners on the Czech side: 2
Partners' budget:
– CHEVAK Cheb a. s.: EUR 47,584
– Forestry and Game Management Research Institute, p.r.i. – EUR 124,854.50

The objective is to establish cross-border cooperation in the sphere of substance and energy use of municipal waste sediments (multi-purpose use). New processes and measures of green infrastructure shall be initiated in management of landscape care, in particular through nutrient reclamation and use of phosphorus. Furthermore, the project shall contribute to decreasing costs linked with disposal of waste sediments and thus minimize the burden to local economies by lowering sewerage charges.

5. Water – Wasser 2020, project No. 287

Partner on the Czech side: 1
Partner's budget:
– Zelený poklad ("Green Treasure") Foundation: EUR 125,409.40

The aim is to positively motivate the target group to change the situation concerning issues linked with inefficient rainwater management. At the same time, it is necessary to develop and put into operation as soon as possible strategies of groundwater protection as it is jeopardized by the climate change (extreme droughts with severe impacts on humans, environment and nature). The projects are aimed at contributing to positive motivation and promote education of teachers, municipality representatives, public administration and municipality employees to tackle the impeding threat of water scarcity.

6. Granite and Water, project No. 307

Partners on the Czech side: 2
Partners' budget:
– The town of Planá: EUR 6,974.33
– Sokolov Museum, c.o. of the Karlovy Vary Region: EUR 91,949.27

Project description: The project creates sustainable transboundary value by preserving, making accessible, enhancing and connecting several of the most valuable geological and mountain-historical monuments of the Czech–Bavarian borderland. Sustainability of the monuments is ensured on two levels through awareness-raising and research activities leading to information preservation and raising awareness of the value of geological monuments and through promotion of environment-friendly tourism. The monuments in question are located on the granite bedrock of the Moldanubik, which runs from Bohemia to Bavaria, and they represent different aspects of how the granite bedrock visibly influences life and economy in the area: Flossenbürg (granite mining / building material), the Jeroným Mine (granite, ore resource / establishment of mining settlements) and Planá (granite and groundwaters). The sites form an imaginary diagonal through the transboundary geopark area and thus connect the hitherto unappreciated peripheral areas of the geopark. The project will preserve both tangible industrial and cultural heritage and intangible heritage through studies of stonework and mines with the view of water extraction.

– Interreg V-A Austria – Czech Republic

1. Project No. ATCZ7 – Dyje 2020

Partners on the Czech side: 2
Partners' budget:
– Morava River Board, s.e.: EUR 646,791.04
– T. G. Masaryk Water Research Institute, p.r.i.: EUR 218,890.11

Project completed by 31 December 2021.
The main objective of the project was to create a scientific, methodological and personnel basis for coordinated development of the region and achieving the desired quality of environment and ecosystem services in the borderland region. Ten cross-border vehicles aimed at harmonizing monitoring and assessment of watercourse situation, support for fish population development and improvement of watercourse morphology were established.

2. Project No. ATCZ28 – SEDECO

Partners on the Czech side: 2
Partners' budget:
– Brno University of Technology: EUR 267,577.45
– Morava River Board, s.e.: EUR 388,303.63

Project in progress.
The objective of the project is to ensure better ecosystem services, biodiversity and reduce the impact of floods and droughts, mainly through construction and design of targeted effective green infrastructure measures such as meander restoration, bank restoration using deadwood construction and creation of islands in reservoirs. A new hydraulic laboratory and research centre, together with measurements and modelling, will form the basis for optimal green infrastructure designs. The aim is to improve knowledge of the Dyje River system, including sustainable reservoir management strategy in terms of siltation, which will help minimise flood and drought risks. Another objective of the project is to improve the morphodynamics of the stream meanders in the transboundary area and the protection of the natural and restored banks of the Dyje River.

3. Project No. ATCZ163 – Schwarzenberg Navigational Canal / Bavarian Water Meadow

Partners on the Czech side: 3
Partners' budget:
– Military forests and assets of the Czech Republic, s.e.: EUR 1,732,613.92
– Forests of the Czech Republic: EUR 728,566.87
– Šumava National Park Administration – strategic partner

Project in progress.
The main outputs of the project include the enhancement of a part of the Schwarzenberg Navigation Canal, a cultural monument of international importance, and the improvement of its accessibility to the public. In addition, it is about the accessibility and appreciation of the Bavarian Peatland in the form of a nature trail with barrier-free access to bring the peatland's habitat and

the need for environmental protection closer to visitors. In addition, hydrological restoration of the peatland is necessary.

4. Project No. ATCZ167 – Hydrothermal potential of the area

Partners on the Czech side: 2
Partner's budget:
– Masaryk University: 672,182.70 EUR
– Ministry of the Environment – strategic partner

Project completed by 31 December 2021.
The project dealt with the origin, capacity and possible use of transboundary thermal waters in the Laa – Pasohlávky region. The aim of the project was to describe the occurrence of thermal waters in a comprehensive geoscientific model and to assess their possible potential use together with conflicts in use. On the basis of the best possible understanding of the occurrence of thermal waters in the region, strategies and concrete measures or tools for future joint management of these resources should be developed in cooperation with decision-makers and regional stakeholders. This includes harmonisation of administrative procedures, proposals for establishment of a common legal framework and institutional mechanisms

5. Project No. ATCZ86 – Innovative technologies for monitoring of water and microbiological parameters in the aquatic ecosystem

Partners on the Czech side: 2
Partner's budget:
– Brno University of Technology: EUR 227,293.32
– Regional Hygienic Station of the South Moravia Region in Brno – strategic partner

Project in progress.
The aim of the project is protection and improvement of the aquatic ecosystem by measures aimed at monitoring technical and microbiological parameters of water and improve water quality. To this end, necessary competencies and a basis for innovation will be created in the region. The innovative step consists in a more comprehensive use of real-time sensors for monitoring physical, chemical and microbiological parameters for water quality assessment.

6. Project No. ATCZ236 – Impacts of the climate change on the Dyje River Basin

Partners on the Czech side: 4
Partner's budget:
– Czech Hydrometeorological Institute: EUR 33,365.48
– Institute of Global Change Research of the CAS, p.r.i.: EUR 44,943.75
– T. G. Masaryk Water Research Institute, p.r.i.: EUR 43,616.05
– Morava River Board, s.e.: EUR 26,359.24

Project in progress.
The aim of the project is to examine impacts of climate change on the water balance in the Dyje River Basin until 2050 in order to develop a proposal for a mutually coordinated "emergency" management regulations based on the findings. In this respect, it is necessary to estimate the water balance and compare it with expected water demand in future. Based on the results, the project will develop dry season management measures in mutual agreement between the two parties.

7. Project No. ATCZ266 – Dyje, equilibrium dynamics of runoff conditions

New project.
Partner on the Czech side: 1
Budget of the partner Morava River Board, s.e.: EUR 563 720,00

The aim of the project is to investigate the dynamics of flood waves on the Dyje River, both in terms of the timeline of flood waves coming from the Czech upper part of the basin and their other natural characteristics under the conditions of regulated hydraulic structures, and subsequently to develop proposals for optimization. In the border section of the Dyje, erosion and siltation in the riverbank belt will be assessed in

The Blatno construction (source: Ohře River Board, s.e.)

detail. Further comprehensive engineering measures are to be implemented in the border section of the Dyje. As a continuation of the activities of the Dyje 2020 project, connection of other branches is envisaged. This will improve water retention in the area, connection of the river with the surrounding area and quality of the habitats.

– Cross-border Cooperation Programme Czech Republic - Free State of Saxony (Objective ECA 2014–2020)

1. Project No. 100266035 – Vita-Min

Partner on the Czech side: 1
Partner's budget:
– Ústí nad Labem Region: EUR 493,241.40

The main objective of the project is to improve water quality and the condition of groundwater and surface water bodies in the Czech-Saxon border region. To this end, measures are to be implemented in the field of monitoring and reduction of pollutants and remediation of water bodies and soils.

2. Project No. 100272124 – Flood protection measures in the Vilémovský Stream Basin – Sebnitz – feasibility study

Partner on the Czech side: 1
Partner's budget:
– Ohře River Board, s.e.: EUR 124,196.90

The aim of the project is to improve the flood protection in the Vilémovský Stream catchment area near the town of Sebnitz. In the event of a flood, inhabitants and material values will be better protected. Specifically, measures will be analysed and proposed which, with regard to nature conservation and cost-effectiveness, will protect the town of Sebnitz and other areas around the stream in the event of floods.

3. Project No. 100320948 – TraboRiMa – Cross-border integrated management of the Mandau River

Partners on the Czech side: 2
Partners' budget:
– T. G. Masaryk Water Research Institute, p.r.i.: EUR 545,380.64
– Czech Technical University: EUR 174,906.00

The aim of the project is to design a sophisticated management system for the Mandau River, a border watercourse, and its tributaries with a view of improving and creating new ecological habitats together with sustainable flood risk management. The "TraboRiMa" project focuses on systemic implementation of the Water Framework Directive and the Floods Directive (2007/60/EC) in the Mandau River Basin and its tributaries.

– Interreg V-A Programme Czech Republic – Poland

1. EN.11.2.45/0.0/0.0/15_003/0000266 – AQUA MINERALIS GLACENSIS

Partners on the Czech side: 2
Partner's budget:
– City of Náchod: EUR 622,917.00 from ERDF
– City of Hronov: EUR 534,803.97 from the ERDF

The main objective of the project is to create a Czech-Polish spa circuit trail using the potential of unique mineral waters. The project addresses harnessing the potential of mineral waters through renovation of parks and relevant buildings in order to attract tourists and consequently boost economic growth and employment growth in the Kłodzko District that has the highest occurrence of mineral and curative springs

2. CZ.11.4.120/0.0/0.0/17_028/0001633 – SUWAT: Transboundary cooperation in monitoring of chemical and radiation contamination of surface waters by mine waters

Project partner: 1
Budget of the partner:
– Technical University of Ostrava: EUR 137,109.42 EUR from ERDF

Aim: The project proposal is based on the synergistic potential of an existing and proven inter-institutional cooperation between Technical University of Ostrava and GIG Katowice. In the framework of the project, this cooperation will be further intensified by jointly addressing a new and topical issue such as possible contamination of surface waters by highly saline and otherwise contaminated mine waters. The joint research will be carried out in locations burdened by intensive mining activities in the border regions.

– Interreg V-A Programme Slovakia – Czech Republic

1. D168 - Živé břehy "Live Riverbanks" – joint protection of river ecosystems

Project partner: 1
Partner's budget:
– Krok Kyjov, i.o.: EUR 211,034.41

The project focuses on monitoring, research, protection and practical management of target animal species fixed to riverbanks and shores and to pollard willows. It concerns, in particular, the following protected species: sand martin, common kingfisher, common merganser and hermit beetle. These species are so-called "umbrella species", meaning their protection ensures protection of varied communities of other endangered species. The main objectives of the project lie primarily in detailed and profound understanding of the mentioned species and their biotopes. Appropriate biotope management will improve conditions for such species. The project strives for raising awareness of such species and their biotopes on the part of general public.

2. S251 - Fighting together water erosion and wetland drying

Project partner: 1
Partner's budget:
– Czech Union for Nature Conservation, Valašské Meziříčí unit: EUR 160,519.88

The project focuses on measures aimed at wetland protection by building an international expert team and on practical measures taken at dozens of locations in the Czech and Slovak Republic. Such measures are aimed at monitoring of the erosion process and compiling a joint plan of measures at the support and protection of wetlands.

– Interreg EUROPE programme

1. Water Technology Innovation Roadmaps (PGI05062 - iWATERMAP)

Partner on the Czech side: 1
Budget of the partner CREA Hydro&Energy, i.o.: EUR 122,650.00

The project is focused on support for innovative policies in water management sectors and thus contribute to an increase in the critical number of innovative ecosystems in partner regions. The general objective of the project is to improve innovative policies with the view of boosting critical mass development of innovative ecosystems in the field of water technologies.

2. Water reuse policies advancement for resource efficient European regions (PGI05592 - AQUARES)

Partner on the Czech side: 1
Budget of the partner Regional Development Agency of the Pardubice Region: EUR 143 860,00

Water reuse is a key way to promote resource efficiency in Europe's scarce areas, as well as to take advantage of opportunities in the expanding water market, thereby easing pressure on Europe's wetlands and coastal areas. The Strategic Implementation Plan of the European Innovation Partnership on Water was launched to promote water efficiency in Europe, where water scarcity affects 11% of the population. In this context, AQUARES will support the identification of viable strategies for harnessing water reuse, addressing inefficient water use and more.

– Interreg DANUBE programme

1. Reducing the flood risk through floodplain restoration along the Danube River and tributaries (DTP2-003-2.1Danube Floodplain)

Partner on the Czech side: 1
Partner's budget:
– Morava River Board, s.e.: EUR 151,407.50

The main output of the project will be improvement and sustainability of supranational flood risk management in the Danube River Basin. The project will enhance a harmonized approach to the protection and restoration of riparian meadows, consensus of local stakeholders in the question of priority measures and broader public support for integrating flood management with protection and restoration of flood areas.

2. Drought Risk in the Danube Region (DTP1-182-2.4 DriDanube);

Partner on the Czech side: 1
Partner's budget:
– Global Change Research Institute of the CAS, p.r.i.: EUR 179 000.00

The main objective of the project is to increase capacity of the Danube Region and to address drought-related risks. The objective has been identified as a response to issues related to shortcomings in both the drought monitoring process and in the drought management systems. Water scarcity and drought often affected the Danube Region and have a major impact on the economy and people's well-being. Despite the damage in recent decades, drought is still not considered a high priority issue.

– Interreg CENTRAL EUROPE programme

1. Integrated Approach to Management of Groundwater quality in functional urban Areas (Amiiga - CE32)

Partners on the Czech side: 2
Partner's budget:
– City of Nový Bydžov: EUR 159,681.50
– Technical University of Liberec: EUR 235,219.60

The project addresses especially groundwater contamination from brownfields, an issue that states of Central Europe have in common. AMIIGA provides a well-balanced combination of technical, research, management and expert know-how that is shared and transferred in order to approach the issue of groundwater contamination in an all-embracing manner.

2. Integrated Heavy Rain Risk Management (Rainman - CE968)

Partners on the Czech side: 2
Partner's budget:
– T. G. Masaryk Water Research Institute: EUR 201,170.00
– South Bohemia Region: EUR 72,380.99

The main objective of the project is to improve integrated management capacities of public authorities with the aim of mitigating risks of heavy rains, implementation of warning infrastructure in the affected regions. Partners from six countries develop, in a joint effort, methods focused on actual situation and new tools of reducing casualties and damage caused by heavy/torrential rain.

3. Increased renewable energy and energy efficiency by integrating, combining and empowering urban wastewater and organic waste management systems (CE946 - REEF 2W)

Partners on the Czech side: 2
Partners' budget:
– University of Chemistry and Technology: EUR 172,533.25
– VEOLIA: EUR 207,634.25

The main purpose of the project is to increase energy efficiency and production of renewable energy in public infrastructures.

4. Enhancing environmental management capacities for sustainable use of the natural heritage of Central European SPA towns and regions as the driver for local and regional development (CE1308 HealingPlaces)

Partner on the Czech side: 1
Partner's budget:
– Mendel University in Brno: EUR 22,948.38

The project focuses on sustainable development of spa while protecting unique groundwater resources that form its core. The objective will be achieved by increasing knowledge and

raising awareness of the impact that various factors have on groundwater reservoirs and by building multi-level and multi-territorial models for management of valuable natural spa resources. The decisive element of the project will be development of a joint, innovative online tool for assessing threats and pressures on mineral and hot water reservoirs. HealingPlaces will design, test and implement innovative solutions for sustainable management with mineral water in spas via various participatory models.

5. Board for Detection and Assessment of Pharmaceutical Drug Residues in Drinking Water – Capacity Building for Water Management in CE (CE1412 boDEREC-CE)

Partner on the Czech side: I
Partner's budget:
– Czech University of Life Sciences Prague: EUR 33,290.24

Recent research has shown that the aquatic environment from which we produce drinking water in Europe contains anthropogenic substances that were unknown just a few years ago. The boDEREC-CE project defines an innovative approach by implementing pilot sites in Central European countries for monitoring emerging contaminants, mainly pharmaceuticals and personal care products. Thus, boDEREC-CE focuses not only on studying the behaviour of pharmaceutical and personal care products, but special attention is paid to assessment of mitigation effectiveness of this specific type of contamination by different types of technological treatments of drinking water: the main output are innovative decisions based on a model that can be used as an early warning tool with respect to future legal limits. This tool will be tested in waterworks under different conditions. Furthermore, activities will be launched to inform the public about measures to reduce the use and waste of pharmaceutical and personal care products.

6. JoinT Efforts to increase water management Adaptation to climate CHanges in central EuRope (CE1670 - TEACHER-CE)

Partner on the Czech side: I
Partner's budget:
– Czech University of Agriculture in Prague: EUR 56,000.00

TEACHER-CE integrates and harmonises the results of previously funded projects recognising their links to climate change adaptation and risk prevention. The main territorial challenge to be addressed is the development of effective climate change adaptation and water risk prevention processes in Central Europe, where effects can be clearly observed and could have a strong impact at territorial level in the years to come. The main objective is to develop an integrated set of tools aimed at water resource management, including climate change adaptation, flood/heavy rain/drought risk prevention, small-scale water retention measures and water resource protection through sustainable land management, based on integration of tools from selected projects: RAINMAN, FRAMWAT, PROLINE-CE, SUSTREE, LUMAT (all chemicals and products); H2020 FAiRWAY; LifeLocalAdapt; DRIDANUBE and DAREFFORT (DTP), C3SDisaster sectoral information system for risk reduction and C3S soil erosion demo case. The project focuses on providing project outputs/tools at the municipality/regional level; the TEACHER-CE project will build on integrated water management tools, including climate change adaptation and risk prevention from previously funded projects. Experience gained at the local level under TEACHER-CE will be used to maximize the utilization of the toolbox for effective and robust climate change adaptation in sectoral plans. The TEACHER-CE innovation is a guided and documented process of integrating outputs and numerous tools of previously funded projects from different grant programmes in a single toolbox with testing and validation in nine pilot projects in eight countries.

Reconstruction of the crown, The Pastviny Dam (source: Labe River Board, s.e.)

View Through the Pines, May 2021, The Vranov nad Dyjí Dam (author: Grund Petr)

10. LEGISLATIVE MEASURES

10.1 Water Act and implementing regulations

In 2021, the Water Act was amended by three indirect amendments. Act No. 284/2021 Coll., amending certain acts in connection with the adoption of the Building Act, effective as of 1 July 2023, had a major impact on the form of the Water Act. The other two amendments were of a smaller scale. In addition, there were four amendments to the implementing legislation for the Water Act.

Act No. 284/2021 Coll., amending certain acts in connection with the adoption of the Building Act

The main purpose of the amendment is to integrate selected competences of water administration authorities into a building authority. As a result, building authorities are newly included in the system of water authorities.

The basic competence of building authorities under the Water Act is issuing permits for hydraulic structures and competences in matters related to hydraulic structures. These include in particular technical and safety supervision, establishing of protection zones of a hydraulic structure, supervision of hydraulic structures, and permitting removal of a hydraulic structure. In the application procedure for an intention to build, the building authority will also assess whether the conditions for issuing a permit pursuant to Section 17 or a binding opinion of the water authority have been met; these will no longer be issued separately for construction projects.

Building notification (Sections 15a to 15c) is deleted from the Water Act, as this procedure is completely abolished in the new Building Act; hydraulic structures that needed were subject to notification procedure will now be subject to traditional permit procedure.

Permitting of water management remains the responsibility of the existing water authorities.

Act No. 364/2021 Coll., amending certain acts in connection with the implementation of European Union regulations in the field of invasive non-native species

This indirect amendment to the Water Act deleted the word "non-native" from the provisions of Sections 35, 116 and 125a for fish and other aquatic animals in connection with the implementation of Regulation (EU) No. 1143/2014 of the European Parliament and of the Council on the prevention and control of the introduction or planting and spread of invasive non-native species and Council Regulation (EC) No. 708/2007 on the use of alien and locally absent species in aquaculture through effective regulation of invasive non-native species as well as non-native species, especially alien and locally absent species in aquaculture.

Act No. 261/2021 Coll., amending certain acts in connection with further digitization of procedures of public authorities

The indirect amendment deleted paragraph 3 from the provision of Section 104 of the Water Act and the following paragraphs 4 to 8, which regulate the provision of information by the Ministry of the Interior with the Police of the Czech Republic to state administration authorities for the purpose of exercising competence in the field of water management. Such data meant reference data from the basic population register, data from the agenda information system for population registration and data from the agenda information system for foreigners.

Government Decree No. 445/2021 Coll., amending Government Decree No. 401/2015 Coll., on indicators and values of permissible pollution of surface waters and wastewaters, the requirements for permits for discharge of wastewaters into surface waters and sewerages and on sensitive areas

The amendment to the Government Regulation responded to the European Commission's criticisms raised in the EU Pilot procedure concerning the implementation of Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) in the Czech legislation. In particular, the European Commission criticised the Czech Republic for insufficient transposition of Section 46(4) of the Directive, which concerns discharge of wastewaters from waste gas treatment plants during incineration and co-incineration of waste, and Article 68 of the Directive concerning production of titanium dioxide.

The amendment to the Government Decree also corrected inaccuracies and legislative and technical errors contained in the annexes to the Government Decree, in particular: incorrect definition of the environmental quality standard for two indicators in Annex 3, Table 1b, where incorrect values of the NEC-NPK for polyaromatic hydrocarbons were given.

Decree No. 44/2021 Coll., amending Decree No. 49/2011 Coll., on the definition of surface water bodies

The main purpose of the amendment was to incorporate in legislation the list of surface water bodies, including artificial and heavily influenced surface water bodies, which now forms Annex 2 of the Decree. The list includes the name of the body, its unique identification code, its classification (river, lake) and the designation of its hydromorphological character (natural, heavily influenced, artificial). In addition, the definition of a lake for the purposes of this Decree has been extended in Section 2(c) and the way in which surface water bodies are defined has been amended in Section 3(1).

Decree No. 86/2021 Coll., amending Decree No. 471/2001 Coll., on technical and safety supervision of hydraulic structures, as amended by Decree No. 255/2010 Coll.

The main purpose of the amendment was to introduce the changes brought to water law by the amendment to the Water Act (Parliamentary Document No. 556). This amendment to the Water Act clarified the procedures for

carrying out technical safety supervision and keeping records of technical safety supervision of Category I to III hydraulic structures. The Decree now provides for the keeping of records of technical safety supervision for Category IV hydraulic structures.

Decree No. 87/2021 Coll., amending Decree No. 252/2013 Coll., on the extent of data in the records of the status of surface waters and groundwaters and on the method of processing, storing and transmitting the data to public administration information systems

The main purpose of the amendment was to introduce the changes brought to water law by the amendment to the Water Act (Parliamentary Document No 556), where it was defined that the survey and assessment of the status of surface waters and groundwaters includes, in particular, the establishment, maintenance and updating of records of watercourses and other surface water or groundwater lines that are not watercourses and the objects on them, hydrological basins of watercourses, hydrogeological districts and water reservoirs.

10.2 The Water Supply and Sewerage Act

Act No. 274/2001 Coll., on water supply and sewerage for public use and on amendments to certain related acts (the Act on Water Supply and Sewerage), did not undergo any direct amendment in 2021. The Act on Water Supply and Sewerage was indirectly amended by Act No. 284/2021 Coll. amending certain acts in connection with the adoption of the Building Act. The amendment to the Act will bring about changes related to the integration of decision-making competences in construction matters in the new building authorities, which will take over some of the competences of the water and sewerage authorities. Therefore, the public administration in the field of water supply and sewerage under this Act should be newly performed by the building authorities as of 1 July 2023, which are also authorised to carry out inspections and impose administrative penalties in cases where they are competent to decide on the matter.

Act No. 544/2020 Coll., which came into force on 1 February 2021, extended the possibility for a water supply operator to interrupt or restrict the supply of drinking water from a public water supply without prior notice if, in a state of water scarcity, its water management is regulated, restricted or prohibited by the drought commission. Now the drought commission, like the water authority, may temporarily restrict the use of potable water from the public water supply. In such a case, the customer is required to allow the water supplier access to the water meter. Furthermore, penalties have been laid down for breaches of the new obligations.

Decree No. 428/2001 Coll., which implements the Water Supply and Sewerage Act, was amended in 2021 in connection with a direct amendment to Decree No. 244/2021 Coll. This decree, effective from 1 July 2021, responds to the possibility of exemption from the fee for discharge of wastewaters into surface waters under the Water Act and sets out technical conditions for the construction and operation of relief chambers. With effect from 1 July 2021, the existing long-term rainfall average used to calculate the amount of rainwater discharged to the public sewerage system was also extended.

In 2021, the Public Water Supply and Sewerage Act Interpretation Committee updated the existing Interpretation No. 58 and approved new Interpretation No. 83 that specifies what can be considered a relief chamber.

10.3 Audits of state administration in the field of water management

The Ministry of Agriculture and the Ministry of the Environment are entrusted with the exercise of supreme state supervision by Act No. 2/1969 Coll., on the establishment of ministries and other bodies of central government of the Czech Republic, as amended, through the provisions of Section 111 of Act No. 254/2001 Coll., on waters and on amendments to certain acts (Water Act), as amended.

Audits of regional authorities are conducted in accordance with Government Resolution No. 689 of 11 September 2013 on Planning, Assessment and Coordination of Audits of the Exercise of Delegated and Independent Competence of Territorial Self-Government Units by Central Administrative Authorities, Regional Authorities, the Prague City Hall and the Municipalities of Territorial Statutory Cities. The Ministry of the Interior of the Czech Republic prepared a three-year audit plan for regions and the Capital City of Prague for 2020–2022. The number of audits conducted in 2021 was significantly reduced compared to the plan due to the pandemic situation and related government measures.

Ministry of Agriculture

Auditing of the execution of delegated powers in water management is carried out within the organizational structure of the Ministry of Agriculture by the Department for State Administration in Water

The Terezín Weir (source: Ohře River Board, s.e.)

Management and for River Basin Administration as the central water authority. In 2021, the MoA conducted only six audits (due to epidemiological constraints), all at regional water authorities. Due to the restrictions in force at that time, no inspections were carried out at water authorities of municipalities with extended powers in 2021.

Audits carried out by the Ministry of Agriculture focus primarily on implementation of the Water Act in cases in which the powers of central water authority are exercised by the Ministry of Agriculture, and regulations issued pursuant to this Act; the Public Water Supply and Sewerage Act, as amended, and regulations issued pursuant to this Act; Act No. 106/1999 Coll. on Free Access to Information, as amended, Act No. 500/2004 Coll., Code of the Administrative Procedure, as amended; and Act No. 183/2006 Coll., on Land-Use Planning and Building Code (the Building Act), as amended, and its implementing legal regulations. Audits at regional offices focus on adherence to the provisions of Section 67(1)(a,b,c and e) of Act No. 129/2000 Coll., on Regions (Establishment of Regions), as amended; and at regional offices with extended powers on adherence to the provisions of Section 61 of Act No. 128/2000 Coll., on Municipalities (Establishment of Municipalities), as amended.

Beyond the abovementioned scope, audits also focused on the way how water authorities operate, involving their personnel, material and organizational background, especially in terms of qualification and experience of their staff.

Randomly chosen files were examined during each audit. The MoA makes a report of each inspection, including description of any irregularities found. Based on audits carried out it can be concluded that the exercise of the delegated powers of regional authorities in the field of water management is consistently on a high level. Another positive aspect are the continuing efforts of regional water authorities to provide detailed methodological guidance for offices within their competence. None of the entities audited were required to adopt remedial actions, the shortcomings identified were mainly of formal nature and did not result in invalidity of the decisions vetted.

The Ministry of Agriculture uses findings from audits at water authorities as feedback that not only helps deepen mutual communication at all levels of administrative hierarchy, but it is very useful for the Ministry of Agriculture to become acquainted with the regional and local water management issues. Audit findings are subsequently applied in the methodological guidance for water authorities. Findings concerning the application of regulations within the competence of the Ministry of Agriculture together with water management issues are annually presented at a work meeting of the MoA Water Management Department with water authorities. In 2021, the meeting was held in Tábor on 25–27 October 2021. Representatives of the MoA also present their findings from inspections in the framework of meetings of regional authorities with their subordinate water authorities.

Ministry of the Environment

Supervision of the execution of the delegated powers in water management sector is annually carried out, as part of supreme water management supervision, by the Ministry of the Environment as the central water authority through the Departments for Execution of State Administration (DESA). Supervision activities at the Czech Environmental Inspectorate and municipalities with extended powers (water authorities) were prepared in accordance with the 2021 plan of supervisory activities of the Ministry of the Environment, DESA-IX. In 2021, nine inspections were carried out at regional authorities and three at water authorities, while no inspections were carried out at the CEI.

Supervision activity is an essential element of verifying the level of state administration execution, its purpose is to supervise how lower administration authorities (regional authorities, water authorities and the CEI) carry out state administration in the entrusted sphere of water management, how they implement provisions of the Water Act and regulations issued under it. In particular, supervision focuses on correct application of legal regulations, relevant statutory provisions and compliance with Act No. 500/2004 Coll., the Administrative Procedure Code, as amended. Audits also focus on the way how performance of water authorities is ensured, officials' qualification and experience, work organisation and equipment of organisational units.

The purpose of supreme state supervision consists primarily in eliminating irregularities of a systemic nature. In individual cases, wrong decisions may be rectified by means of an extraordinary remedy (review of the decision in a review procedure, reopening of the proceedings).

Audits at water authorities constitutes a minor part of the supervision activities performed by the MoE. More frequent and extensive with their scope are inspections at regional authorities and other entities.

The number of audits of the exercise of delegated powers at water authorities in municipalities with extended powers was affected by the ongoing measures linked with the Covid-19 pandemic and only 3 of the planned 7 audits were carried out. No deficiencies requiring imposition of corrective measures were found, only minor administrative shortcomings and partial errors in terms of exceeding the deadlines for issuing decisions or in justification of amounts of a fine, which lacked assessment of the nature and seriousness of a given offence, but which did not concern the validity nor legality of the administrative acts issued and were discussed with the officials in the course of the actual exercise of the supreme water authority's supervision as part of methodological assistance.

Based on the conclusions of the audits carried out within the scope of supreme water management supervision, it can be concluded that the exercise of delegated powers in the field of water protection performed by water authorities audited in 2021 is at a very good level, the decisions issued contain the particulars required by the Code of the Administrative Procedure and references to the relevant provisions of the Water Act. The methodologies and guidelines of the MoE are respected in the proceedings and decision-making.

After the Summer Storm, July 2021, the Unimproved Dyje, Podhradí nad Dyjí (author: Grund Petr)

11. PRIORITY TASKS, PROGRAMMES AND KEY DOCUMENTS IN WATER MANAGEMENT

11.1 Water planning

In 2021, preparation of the third phase of water planning for the period until 2027, consisting in review and update of existing river basin management plans, was completed. In the second implementation phase of the Floods Directive, commenting processes on plans for flood risk management were carried out. At the same time, measures from the currently valid river basin management plans and flood risk management plans were implemented.

As part of the preparation of the third stage in water planning, the general public and water users had the opportunity to submit by 18 May their written observations concerning the national river basin plan drafts (Elbe, Oder, Danube) together with the plan drafts for respective sub-basins (Upper and Middle Elbe; Upper Vltava; Berounka; Lower Vltava; Ohře, Lower Elbe and other tributaries of the Elbe; Upper Oder; Lusatian Neisse and other tributaries of the Oder; Morava and tributaries of the Váh; Dyje; other tributaries of the Danube). The settlement of the observations submitted and the manner in which they were taken into account (incoroporated) was published in the form of a report on the website of the Ministry of Agriculture.

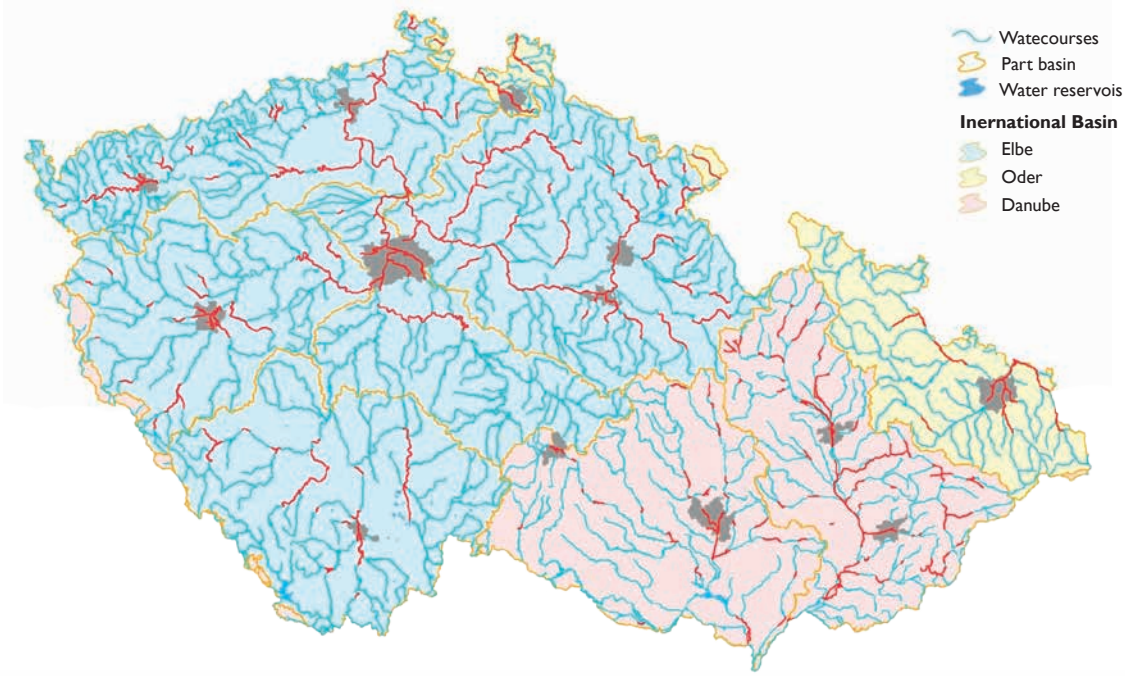
The river basin management plans for the third stage of water planning propose a total of 3,692 measures, of which 2,469 are included in the programmes of measures and 960 in the stack of ‚other measures', while 263 measures were expected to be implemented by the end of 2021 (this group of measures is included in the river basin plans so that their effect can be taken into account when estimating the status of water bodies in 2021). The estimated financial resources for the measures under the programmes of measures are to amount to a total of CZK 68.1 billion by 2027, of which national funding of CZK 52.3 billion and financial support from EU funds of CZK 15.8 billion is expected.

The measures included in the river basin management plans have been proposed on the basis of an assessment of the status of water bodies and they represent substantive needs so that their good status or potential is achieved. Most of the measures aim at preventing and controlling pollution from point sources (e.g. construction or reconstruction of sewerages and wastewater treatment plants), reducing the adverse effects of drought and ensuring adequate hydromorphological conditions of water bodies with a view of achieving good ecological status and good ecological potential (e.g. revitalisation and passage of watercourses).

The national river basin plans were submitted to the Government for approval in December 2021. Due to a change of Government, the national river basin plans could not be approved in 2021 and were placed on the Government agenda the following year.

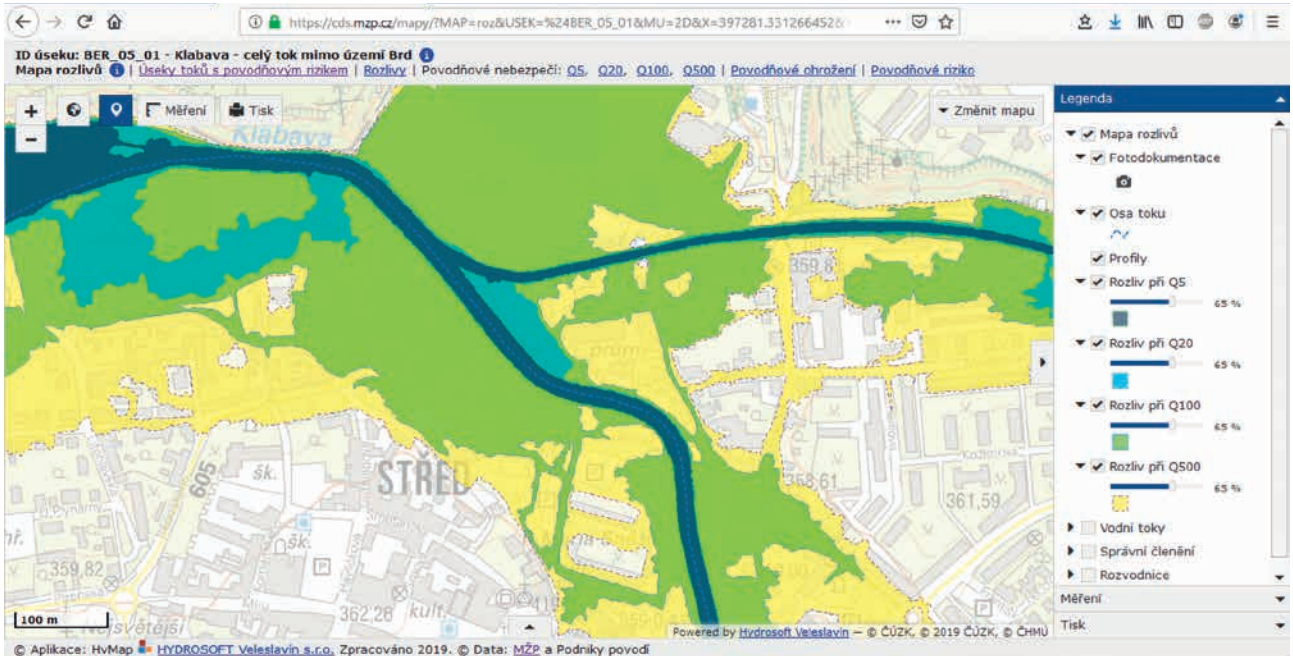
Current and general information on the water planning process, including materials and minutes from the Water Planning Commission meetings, is available to the public on the MoE website with links to the websites of the MoE and individual river basin administrators.

Figure 11.1.1
Defining areas with significant flood risk for the 2nd planning cycle under the Floods Directive



Source: T. G. Masaryk Water Research Institute, p.r.i.

Figure 11.1.2
View of the flood risk map on the map portal



Source: MoE

In accordance with the Water Act, the flood risk management plans were made available for written observations to water users and the general public for a period of six months until 18 June 2021. In accordance with Section 19(4) of Decree No. 24/2011 Coll., on river basin management plans and flood risk management plans, as amended, the settlement of observations was published on the official boards of the MoA and the MoE from 17 August 2021. According to the Administrative Procedure Code, a draft of measures of general nature concerning publication of the management plans was published for observations that could be submitted by 18 June 2021.

In September 2021, the flood risk management plans were finalised based on the observations from the aforementioned processes, followed by an internal comment procedure terminated on 7 October 2021 and an interdepartmental comment procedure terminated on 22 November 2021. By the end of 2021, the flood risk management plans were submitted to the Government for approval.

For the purposes of implementing the Floods Directive, the Flood Information System (www.povis.cz) is used as a communication platform, where information on the process of preparing flood risk management plans is published.

11.2 Water supply and sewerage development plans

The Water Supply and Sewerage Development Plan in the Czech Republic, prepared pursuant to Section 29(1)(b) of Act No. 274/2001 Coll., on water supply and sewerage systems for public use and on amendments to certain related acts, as amended, is placed on the website of the Ministry of Agriculture.

Water supply and sewerage development plans in the Czech Republic (WSSDP, RWSSDP) including their updates represent a medium-term continuously updated concept of the water supply and sewerage sector.

The Regional Water Supply and Sewerage Development Plans in the Czech Republic (hereinafter referred to as the ‚RWSSDP') are the basis for the use of European Community funds and national financial resources for the construction and renewal of water supply and sewerage infrastructure. Therefore, the obligations of each applicant for the provision and use of state financial support include documenting the compliance of the technical and economic solution submitted with the valid WSSDP.

The Water Supply and Sewerage Development Plan in the Czech Republic (hereinafter referred to as the ‚WSSDP') is based on a synthesis of information from the RWSSDPs prepared, discussed and approved by the regional councils, including their updates. It follows up other strategic documents and departmental policy documents and also respects the requirements arising from the relevant European Community regulations. The WSSDP includes statements of the MoA issued to each of the updates of the WSSDP.

In its general part, the WSSDP defines the main principles of government policy for ensuring long-term public interest in the field of water supply and sewerage in the Czech Republic, i.e. sustainable use of water resources and water management while adhering to requirements for water management service (drinkable water supply, sewerage and cleaning of waste waters).

Pursuant to Section 29(1()c) of the aforementioned Act, the Ministry of Agriculture continued to issue statements on the approved and effective RWSSDP in the Czech Republic concerning the proposed updates of the technical solutions

for drinking water supply and waste water sewerage and treatment.

In 2021, 306 statements were issued. In total, for the period from 2006 to 2021, 8,537 statements of the MoA were issued, which accounts for approximately 49.73% of the17,166 municipalities and local districts of the Czech Republic addressed in the WSSDP and RWSSDP.

In 2021, the WSSDP and RWSSDP continued to be updated, with main focus on drought and drafting proposals of specific measures implemented in the existing water management systems (namely reviews of the current capacities, design of new or extension of existing facilities, interconnecting existing and/or new facilities, proposal of drinkable water optimization during drought), including costs calculation linked with such measures.

Such updates of the WSSDP were implemented in accordance with Government Resolution No. 620 of 29 July 2015 as performance of C3 task "Review of the functionality of interconnection and ensuring new possible interconnections of water supply systems during drought". The SEA process was completed in 2021.

The WSSDP in the Czech Republic are used by the MoA, MoE, regions (regional authorities), municipalities with extended powers (water authorities), municipalities, owners and operators of water supply and sewerage systems and the professional and general public.

11.3 Programmes and measures aimed at reducing surface water pollution

Construction projects for water quality protection completed in 2021

Among the most significant projects concerning sources of pollution with more than 2,000 equivalent population were 6 new municipal wastewater treatment plants and one new industrial wastewater treatment plant completed in 2021, while other wastewater treatment plants were reconstructed and/or expanded.

Table 11.3.1
New and renovated wastewater treatment plants with capacity over 2,000 equivalent population in 2021

State	Wastewater treatment plants	Location	Capacity	Nitrification	Denitrification	Chemical phosphorus removal
			number of PE	YES/NO	YES/NO	YES/NO
New	Industrial	Park Prague North D8-2 MAKRO Kozomín	2,579	YES	YES	YES
	Municipal	Darkovice*)	2,000	YES	YES	NO
		Lysice*)	2,500	YES	YES	YES
		Píšť*)	2,600	YES	YES	YES
		Staříč	2,500	YES	YES	YES
		Velká Polom*)	3,200	YES	YES	YES
		Veřovice*)	2,100	YES	YES	YES
Reconstructed/expanded	Industrial	Deza, a.s. Valašské Meziříčí	12,887	YES	YES	YES
		Měšťanský pivovar in Polička, a.s. (local brewery)	7,667	YES	YES	YES
	Municipal	Belkovice – Lašťany*)	2,600	YES	YES	YES
		Hodonice*)	5,000	YES	YES	YES
		Kamenice*)	7,500	YES	YES	YES
		Klecany	5,000	YES	YES	YES
		Líbeznice	4,000	YES	YES	YES
		Mirovice	2,520	YES	YES	YES
		Rájec – Jestřebí*)	4,300	YES	YES	YES
		Svatobořice – Mistřín	8,311	YES	YES	YES
		Újezd (Olomouc District)*)	2,000	YES	YES	YES
		Vrané nad Vltavou*)	5,360	YES	YES	YES
		Vysoký Újezd Kozolupy	2,300	YES	YES	YES

Source: SEF, River Boards, s.e.
*Note: *) WWTPs with support from the SEF*

Action Programme under Directive of the Council 91/676/EEC (Nitrates Directive)

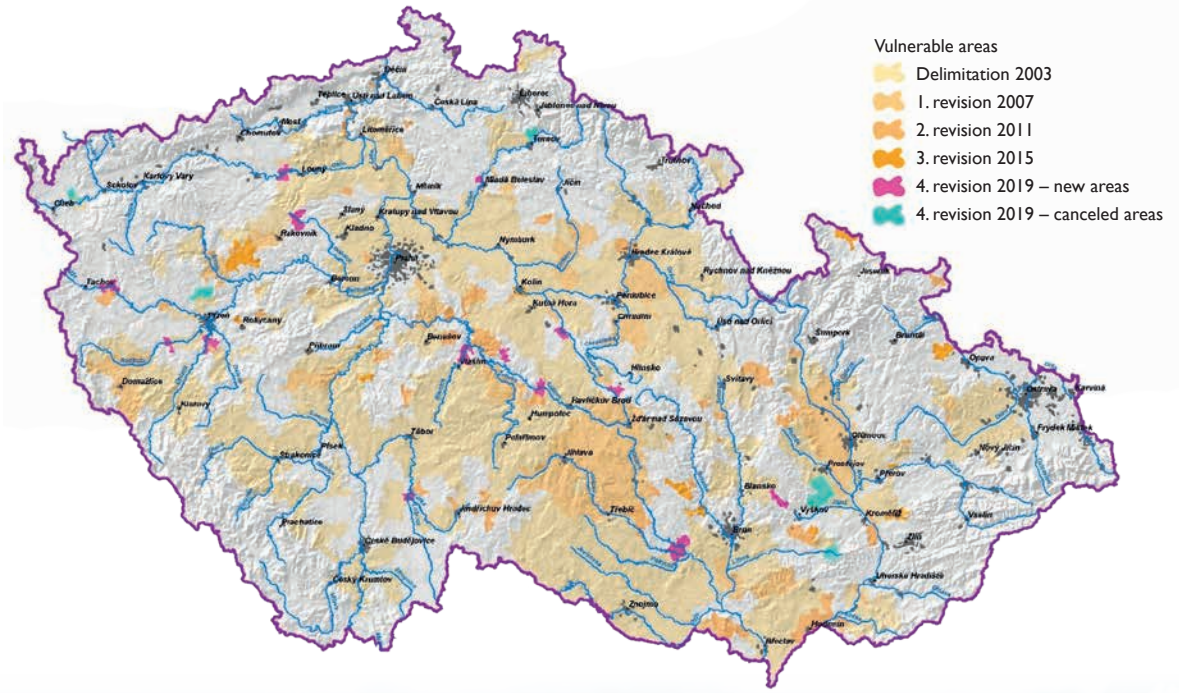
In 1991, Council Directive 91/676/EEC on the protection of waters against pollution caused by nitrates from agricultural sources – the Nitrates Directive – was adopted. In the Czech Republic, this directive is transposed in the act on fertilizers, the Water Act and Government Decree No. 262/2012 Coll., on defining vulnerable areas and the action programme. Vulnerable areas are locations where contamination of underground waters and surface waters with nitrates exceeded or could exceed the defined threshold of nitrate concentration of 50 mg/l. As required by the Nitrates Directive, vulnerable areas were identified in 2003 and are reviewed once in 4 years since. The latest, i.e. fourth, revision of the designation of vulnerable areas was carried out by the T. G. Masaryk Water Research Institute in 2019 and was announced by Government Decree No. 277/2020 Coll., with effect as of 1 July 2020. Vulnerable areas containing nitrate-polluted waters cover 1.8 million hectares, i.e. more than half of the agricultural land used in the Czech Republic.

As of 1 July 2020, new conditions of the 5th Action Programme of the Nitrates Directive, set for the period 2020–2024, apply. In the case of defining vulnerable areas, the amendments are based on water monitoring and the Action Programme, research results, climate change and hands-on observations. The Action Programme is updated every four years and represents mandatory management practices in designated vulnerable areas aimed at reducing risk of nitrogen leaching to surface waters and groundwaters and is the most effective system of measures for implementing the Nitrates Directive. The rules of the 5th Action Programme are laid down in the amendment to Government Decree No. 262/2012 Coll., on the designation of vulnerable areas and the Action Programme.

The Spring Jordan Reservoir (author: Hubalová Petra)

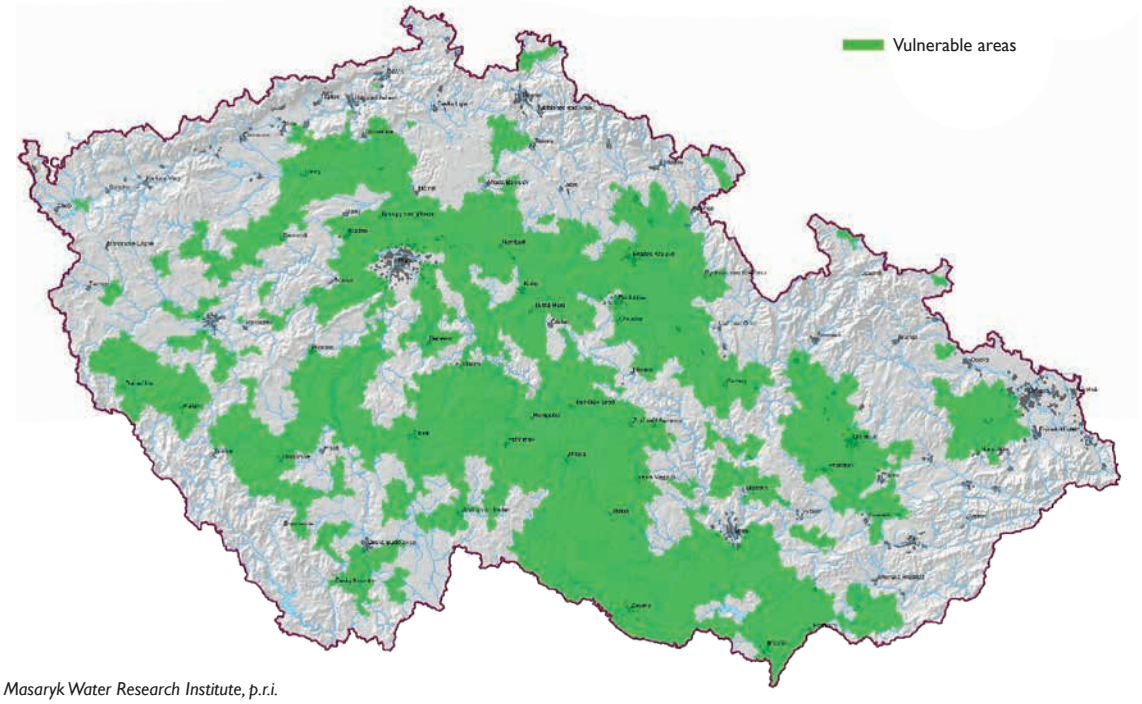
The main measures of the Action Programme include a period with a ban on fertilizing, fertilization limits according to crop yield levels, crop rotation – restriction of maize cultivation in 3rd application zone, storage of fertilizers, nitrogen balance farming on slopes and in the vicinity of surface water bodies. The measures included in the Action Programme have to guarantee that no entity using organic and/or organic-mineral fertilizers for farming in vulnerable areas exceeds the limit of 170 kg of nitrogen per hectare per year.

Figure 11.3.1
Map of vulnerable areas in 2019



Source: T. G. Masaryk Water Research Institute, p.r.i.

Figure 11.3.2
Map of vulnerable areas as per Government Decree No. 262/2012 Coll., on defining vulnerable areas and the action programme – Amendment No. 277/2020 Coll.



Source: T. G. Masaryk Water Research Institute, p.r.i.

11.4 Reporting activities of the Czech Republic to the European Union

Reporting under Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 on the management of bathing water quality and repealing Directive 76/160/EEC.

In terms of European legislation, the issue of bathing waters is governed by Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC.

Every year, before the bathing season, a list is compiled pursuant to Section 6g(1)(a) of Act No. 258/2000 Coll., as amended by Act No. 151/2011 Coll. The list is drawn up by the MoA in cooperation with the MoE and the MoA. In the Czech Republic, waters used for bathing in the open air are divided into natural bathing sites operated on surface waters used for bathing (i.e. surface waters where the operator offers bathing services) and surface waters where a large number of people can be expected to bathe and for which a permanent bathing ban or a permanent warning against bathing has not been issued by the competent public health authority (i.e. other surface waters for bathing). Prior to the beginning of the 2021 bathing season, a list of waters designated as bathing waters for the 2021 recreational season was submitted to the EC.

The Ministry of the Environment, in cooperation with the MoE, submitted to the EC a report on the results of the monitoring and assessment of the quality of the surface waters listed for the 2021 bathing season, which was prepared in accordance with the requirements of Directive 2006/7/EC. Bathing waters were classified as unsatisfactory, acceptable, good or excellent on the basis of their quality. The assessment was made on the basis of a set of quality data compiled for the 2021 bathing season and the four preceding bathing seasons. The reports from each European country are published annually on the EC portal http://ec.europa.eu/environment/water/water-bathing/index_en.html once the results have been compiled.

The most frequent water quality problems in the Czech Republic are related to the mass development of cyanobacteria, which led to the announcement of a bathing ban at 7 locations in the 2021 bathing season, and at one location due to massive fish mortality. Out of a total of 155 reported bathing waters, one site was classified as non-compliant according to the requirements of Directive 2006/7/EC (Staňkovský Pond).

Drainage ditch with retarding elements and accompanying greenery in the cadastral area Třanovice (source: State Land Office)

The Work of the Sun's Rays on the Surface, Velička – Tasov (author: Dostálová Martina)

12. INTERNATIONAL RELATIONS

International cooperation of the Czech Republic in water protection is based on the principles of the «UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes», to which the Czech Republic is a party.

Within the framework of international cooperation in water protection, the so-called Joint Technical Commission between the then Czechoslovak Republic and the Republic of Austria was established as early as 1928 to deal with the technical and economic modifications of the border sections of the Danube, Dyje and Morava Rivers, as well as the in the Malše and Lužnice River Basins. Currently, the Czech Republic is a contracting partner to nine international treaties in the field of water protection.

12.1 Cooperation within the UNECE

UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes is intended to strengthen national measures for the protection and ecologically sound management of transboundary surface waters and groundwaters. The Convention invites the contractual parties to prevention, monitoring and reduction of the transboundary influence and to using waters in a sustainable manner.

The basic principle is bilateral cooperation of neighbouring states in the field of water management, based on concluded international agreements, treaties and conventions. Emphasis is laid on mutual exchange of information, joint research and development (for example, through bilateral and multilateral projects, international commissions, etc.), improving warning and alarm systems, as well as access to information by the public.

The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes

This document entered into force on 6 October 1996. The Czech Republic has been a party to the Convention since 10 September 2000. Representatives of the Czech Republic participate in activities relating to the fields of integrated management of water resources and aquatic ecosystems, protection of waters against accidental pollution from industrial sources, support for international cooperation on transboundary watercourses and in commissions for international river basins. Cooperation under the Convention also focuses on the relation between water quality and human health. The supreme body of the Convention is the Meeting of the Parties, held once every three years. The Ninth Meeting of the Parties was held in Geneva from 29 September to 1 October 2021. This meeting approved an ambitious programme for the next triennium. Furthermore, the results of the second reporting on indicator 6.5.2 of the Sustainable Development Goals were presented, in which the Czech Republic was ranked in the top group of countries. A growing number of states outside the UNECE express interest in membership in the Convention.

Protocol on water and health

This document was produced in collaboration with the World Health Organization (WHO) and addresses the link between water and human health. The Protocol entered into force in

The Horka Reservoir (source: Ohře River Board, s.e.)

2005, but the Czech Republic has been a party to the Protocol since 2001 and the national targets of the Czech Republic are updated within the framework of the Protocol. The Czech Ministry of Health is the administrator of the Protocol. The Council for Health and Environment entrusted a permanent working team consisting of representatives of the MoH, MoE, MoA and the State Institute of Health with drafting national objectives and supervision of their implementation. The next meeting was scheduled for 2022.

More information about the Convention and the Protocol can be found at www.unece.org/env/water.

12.2 International cooperation of the Czech Republic in the Elbe, Danube and Oder River Basins

Modern principles of water protection, based on the hydrological basins of large transboundary rivers, started to be applied in the Czech Republic in 1990 through launching cooperation in protection of the Elbe River in accordance with the Agreement on the International Commission for the Protection of the Elbe River. At that time, also the Agreement on the International Commission for the Protection of the Oder River against Pollution started to be prepared, later followed by preparation of the Convention on Cooperation for Protection and Sustainable Use of the Danube River.

International cooperation in protection of the main river basins in the Czech Republic is conducted through international commissions for protection of the Elbe, Danube and Oder Rivers and focuses primarily on the following:

- reducing the pollution load in the Elbe, Danube and Oder River,
- striving to achieve an ecosystem that is as close as possible to natural condition with a healthy diversity of species,
- allowing the use of water, especially the provision of drinking water from bank infiltration and the agricultural use of water and sediments,
- reducing pollution in the North Sea from the Elbe River Basin, in the Black Sea from the Danube River Basin and in the Baltic Sea from the Oder River Basin,
- flood control,
- coordinated implementation of the Water Framework Directive of the European Parliament and of the Council, establishing a framework for Community action in the field of water policy in integrated river basins.

Agreement on the International Commission for the Protection of the Elbe River

On 8 October 1990, the Agreement on the International Commission for the Protection of the Elbe River (hereinafter referred to as the ‚ICER') was signed in Magdeburg. The Agreement entered into force on 14 September 1992 and the Commission acquired legal subjectivity by the Protocol to the Agreement of 9 December 1991, which entered into force on 13 August 1993. The ICPER is the most important body of Czech–German cooperation in the field of water protection in the international Elbe River Basin.

The 34th meeting of the ICPER in October 2021 was held as an online meeting due to the Covid-19 pandemic. The discussed issues were, in particular, the status of work and the deadline for the completion of the draft update of the International Elbe River Basin District Plan (Part A) for 2022–2027 and the deadline for the approval of the assessment of public observations on the draft update of the International Elbe River Basin District Plan. The draft update of the International Plan for Flood Risk Management in the Elbe River Basin District was discussed and a deadline was set for its submission for approval in a written procedure. The ICPER approved the text of the report "Hydrological assessment of drought in the Elbe River Basin in 2018" and its publication. The workshop on the implementation of the "ICPER Concept for Sediment Management" and the International Elbe Forum held in April 2021 were evaluated.

Furthermore, the ICPER requested transboundary water commissions to agree on the designation of surface water bodies as transboundary for the purpose of electronic reporting of the national Elbe River Basin Plans to the WISE system in 2022.

The ICPER contributes significantly to the organisation of the Magdeburg Workshop on Water Protection, which is held every two years, alternately in the Czech Republic and Germany. In October 2021, the 19th edition was held on the topic "Water Revitalization and Water Regime in the Elbe River Basin", due to the Covid-19 pandemic as a video-conference.

Detailed information on the activities of the ICPER can be found at: www.ikse-mkol.org.

Convention on Cooperation for the Protection and Sustainable Use of the Danube River

The Convention was established with the view of a coordinated approach to watercourse protection in the Danube River Basin. It was signed on 29 June 1994 and entered into force on 22 October 1998. The Czech Republic joined the Convention on 10 March 1995. The sustainable and fair use of waters from the Danube River Basin is ensured by the International Commission for the Protection of the Danube River (ICPDR), consisting of 15 contractual parties.

Two meetings were held in 2020 at the level of the heads of delegation of the parties. The 18th ICPDR meeting of the steering group was held in June and the 23rd ICPDR plenary meeting was held in December. The most important topic discussed at the meetings were the preparation of river basin management plans for the third planning period and flood risk management plans for the second planning period, which were published for public observations in 2021. In 2020, data collection for these plans was updated and finalized. The meetings discussed, among other things, current issues concerning the EU Strategy for the Danube Region (EUSDR) in close cooperation with the EUSDR national coordinators. Main work on the final summary

report of the Danube JDS4 survey was completed, the report was published at www.danubesurvey.org in 2021; it contains information about the survey as such, chemical analyses, microplastics present in waters and about environmental DNA testing. In addition, a summary report on wastewater treatment plants was finalised, the report was part of a monitoring campaign under the SOLUTIONS project. More details about the SOLUTIONS project can be found at www.solutions-project.eu.

Detailed information on the activities of the ICPDR can be found at: www.icpdr.org.

Agreement on the International Commission for the Protection of the Oder River against Pollution

The International Commission for the Protection of the Oder River against Pollution (ICPORaP) was established by the international Agreement on the International Commission for the Protection of the Oder River against Pollution, which was concluded by the Government of the Czech Republic, the Government of the Republic of Poland, the Government of the Federal Republic of Germany and the European Community on 11 April 1996. The Agreement entered into force after ratification on 26 April 1999.

The activity of the International Commission for the Protection of the Oder River against Pollution is focused especially on international coordination of meeting the requirements of the Water Framework Directive, flood protection and prevention of water pollution. The work of the Commission is carried out in working groups focused mainly on flood protection, accidental pollution, legal issues, monitoring and data management.

In December 2021, the 24th Plenary Meeting of the ICPORaP was held in Wroclaw. Due to the Covid-19 pandemic, the meeting was held in a combined format. At the meeting it was agreed that the update of the International Oder River Basin District Flood Risk Management Plan and the second update of the International Oder River Basin District Plan would be published on the ICPORaP website together with a table containing responses to the public observations submitted within public consultation by 22 March 2022 at the latest. The Plenary Meeting also discussed the document Strategy for Reduction of Nutrients in the Waters of the International Oder River Basin District. The adoption of this strategy was planned for mid–2022. Subsequently, information was received that work on the update of the Strategy for the Implementation of Common Objectives for Major Water Management Issues will start in the first half of 2022. This strategy will be supplemented with a chapter on the newly identified significant water management issue of supra-regional importance, which is the negative environmental impacts resulting from the operation of active and former lignite mines. An ad-hoc sub-working group on ‚Mining' will be established to address this trans-regional problem.

Detailed information on the activities of the ICPORaP can be found at: http://mkoo.pl/index.php?lang=CZ.

The Land Gate (author: Hubalová Petra)

12.3 International cooperation of the Czech Republic on transboundary waters

The total length of the state border of the Czech Republic with neighbouring states is 2,290 km, of which approximately a third is known as the "wet borderline", which means that approximately 740 km of the state border are constituted by watercourses and water surfaces. Under international cooperation on transboundary waters, the Czech Republic has international agreements with all neighbouring countries and it implements them through relevant commissions for transboundary waters.

Transboundary waters are watercourses and water bodies that are crossed by the state border as well as watercourses which criss-cross the state border and surface waters and groundwaters where the measures implemented on the territory of one party would substantially affect water management conditions on the territory of the other party. In order to avoid potential disputes with neighbouring states, the Czech Republic entered into international agreements with all neighbouring countries.

Through the relevant commissions for transboundary waters, the following issues are addressed at the level of bilateral cooperation: regulation and maintenance of transboundary watercourses including construction and operation of structures on these watercourses, water supply and amelioration of border areas, protection of transboundary waters from pollution (including monitoring, joint measuring of the quality of transboundary waters, exchange of data and organization of warning and alert service in case of emergency), hydrology and flood forecasting (including monitoring, joint measurements, exchange of data and organization of warning and alert service in case of emergency), water management procedures regarding transboundary waters, protection of aquatic and littoral biotopes, the course of the state borders on transboundary watercourses, etc.

The results of the meetings of the commissions are always included in the Protocols, which are presented to involved ministries to issue a statement and they are subsequently approved by the Minister of the Environment.

Agreement between the Czech Republic and the Federal Republic of Germany on Cooperation on Transboundary Waters in the Field of Water Management

The Agreement was signed on 12 December 1995 and entered into force on 25 October 1997. The fulfilment of the Agreement takes places through the Czech–German Commission for Transboundary Waters. With regard to the territorial division of the Federal Republic of Germany, the cooperation is conducted through the Standing Committee Bavaria and the Standing Committee Saxony under the umbrella of the Commission.

In 2021, the 23rd meeting of the Bavaria Standing Committee was held in August, the 23rd meeting of the Saxony Standing

The Revitalization of the Trkmanka Stream, Velké Pavlovice (source: Morava River Board, s.e.)

Committee was held in September and the 24th meeting of the Commission in October. In the framework of these meetings and the meetings of the working groups of the Standing Committees, the issue of elevated mercury concentrations in stream loads and sediments in the Röslau River (transboundary watercourse), which are subsequently deposited in the Skalka Reservoir, was intensively discussed. The issue is addressed by the joint cross-border project "Measures on the Kössein and Röslau Rivers aimed at mitigating the problem with mercury in the Skalka Reservoir" under the "Programme of transboundary cooperation Czech Republic – Free State of Bavaria 2014–2020 ECA Objective", which was extended until the end of 2021. As a result of the negotiations, the "Feasibility Study", which is the Bavarian part of the project, was modified according to the requirements of the Czech party and the project partners agreed to plan and implement effective hard construction measures on three sections of this border watercourse. The Bavarian party promised at the Commission meeting that the implementation of the pilot measures would start in October 2021.

Other topics discussed included specific intents at transboundary waters concerning adjustments and repairs, wastewater discharges, surface water and groundwater abstractions, small water power plants, etc. Further joint transboundary projects aimed at improving the quality and quantity of surface waters, protection of the pearl mussel and thick shelled river mussel in transboundary watercourses and their river basins and implementation of the Water Framework Directive in transboundary waters were also discussed. Both parties exchanged information concerning implementation of the Floods Directive at national levels.

In the framework of the implementation of the Framework Directive on transboundary waters, it was noted that a harmonised assessment of the status of a total of nine Czech–Saxon and Czech–Bavarian shared transboundary surface water bodies had been prepared. The Commission noted that the ICPER had requested it at its 34th meeting in October 2021 to agree on the designation of surface water bodies as transboundary in the electronic reporting of the national Elbe River Basin Plans to the WISE system in 2022 and mandated the Standing Committees to address this matter.

Agreement between the Czechoslovak Socialist Republic and the Republic of Austria on Regulation of Water Management Issues on Transboundary Waters

The Agreement was signed on 7 December 1967 and entered into force on 18 March 1970. The subject of the agreement is performed through the Czech–Austrian Commission for Transboundary Waters that addresses current issues in transboundary waters of the two countries.

In 2021, due to the Covid-19 pandemic, only the 29th session of the Commission was held in early November. Online remote meetings of Sub-Commission II were held in March and of Sub-Commission I in May. There was no regular meeting of the Government agents to inform each other on current issues and progress in the field of water management. During the meetings, the usual issues related to maintenance of transboundary watercourses and monitoring of their quality were discussed. One of the main topics was again the issue of the impact of the Austrian chemical plant in Pernhofen on the Dyje River and the prolonged drought affecting the conditions in the Vranov Reservoir. A draft update of the Directive on the warning service on the Czech–Austrian transboundary waters was also discussed and subsequently approved by the Commission.

Agreement between the Government of the Czech Republic and the Government of the Slovak Republic on Cooperation on Transboundary Waters

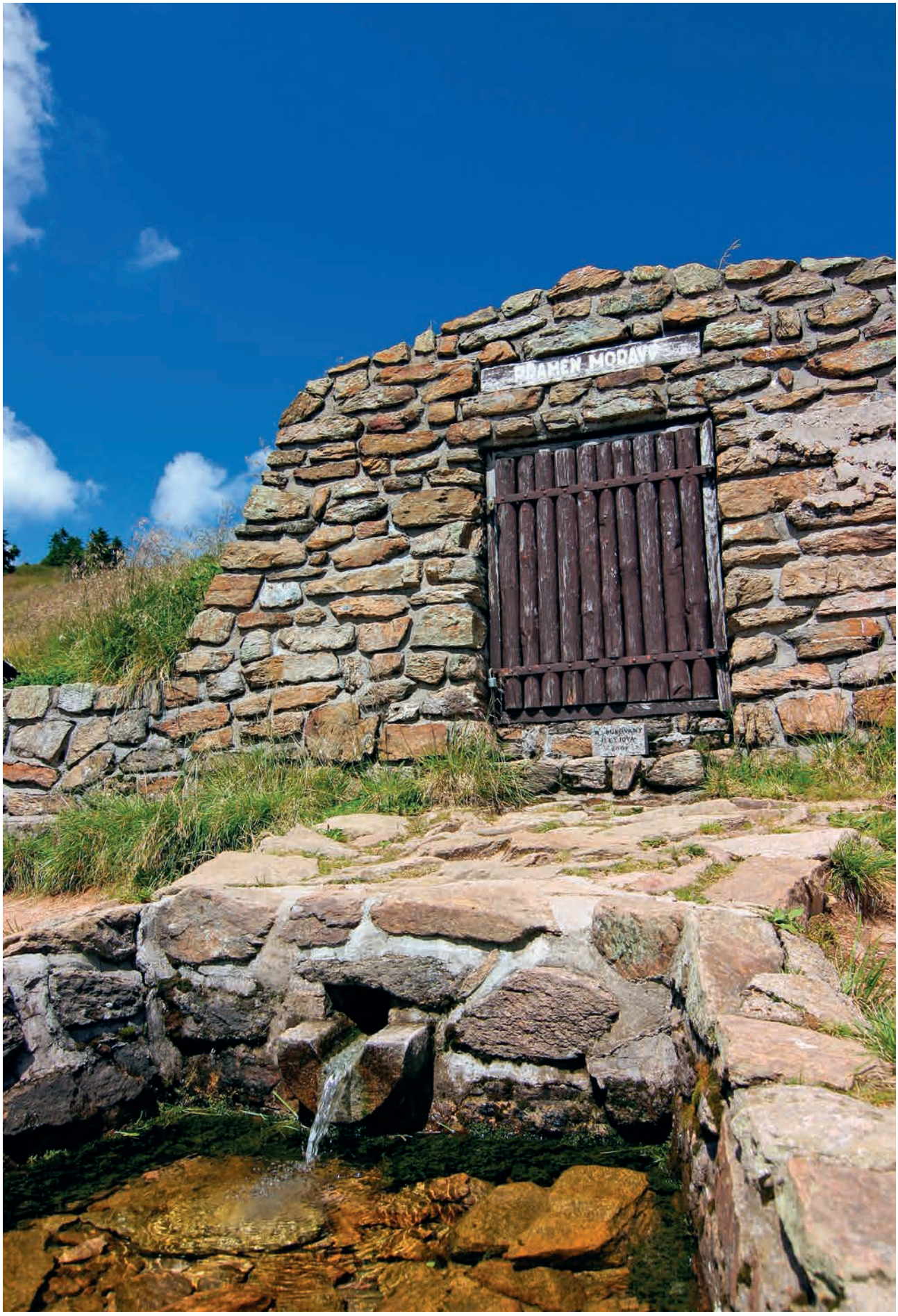
The Agreement was signed and entered into force on 16 December 1999. It is fulfilled through the Czech-Slovak Commission for transboundary waters. The Commission is divided in four work groups addressing technical aspects, hydrology, water protection and the Water Framework Directive.

In 2021, because of the Covid-19 pandemic, the 21st meeting of the Commission was held online. During this meeting, the maintenance of border watercourses, navigation issues and joint cross-border projects on the Bat'a Canal were discussed. At the same time, the meeting exchanged information on the Czech–Slovak monitoring of border watercourses and its assessment for 2020 and on groundwater monitoring facilities in near-border and cross-border areas. The implementation of the Floods Directive at the national levels and the current legislation in the field of water management that had come into force since the previous Commission meeting were also discussed. Concerning the implementation of the Water Framework Directive, it was noted that an assessment of the status of the Czech–Slovak shared border surface water bodies had been prepared. The Commission noted that it had been asked by the ICPER at its meeting in October 2021 to agree on the designation of surface water bodies as transboundary. The Commission will continue to pursue this matter.

Agreement between the Government of the Czech Republic and the Government of the Republic of Poland on Cooperation in Water Management on Transboundary Waters

The Agreement was signed on 20 April 2015 and entered into force on 5 October 2015. The Agreement is implemented through the Czech–Polish Commission for Transboundary Waters. Within the framework of the Czech–Polish Commission, five standing working groups were established, focusing on investment plans, hydrology, hydrogeology, flood protection, regulation of watercourses, the protection of waters against pollution and the Water Framework Directive.

In 2021, due to the COVID-19 pandemic, the Commission did not hold a regular meeting. Information was exchanged remotely by electronic means at the level of heads of the Commission working groups. The exchanged information concerned results of cooperation in the field of water management planning on transboundary waters, collaboration in the field of hydrology, hydrogeology and flood protection and collaboration in the field of transboundary watercourse management and amelioration of border areas. Also, information on implementation of the Water Framework Directive to transboundary waters and of the Floods Directive at national levels was also discussed.

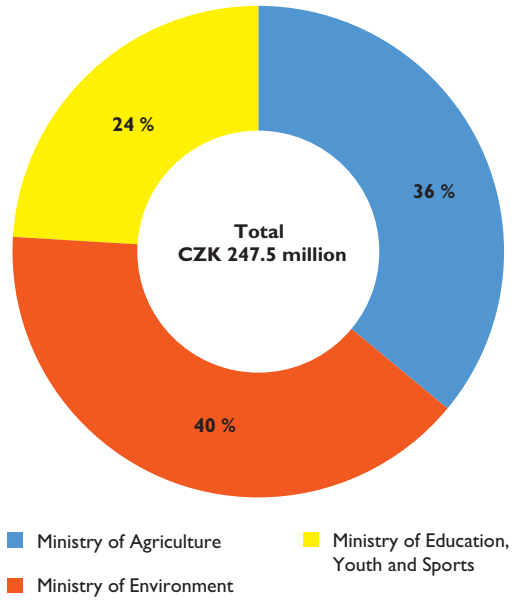


Jaroslav Machacek (source: www.shutterstock.com)

13. WATER RESEARCH AND DEVELOPMENT

A number of research projects are being carried out. This chapter is intended to present briefly research and development in the field of waters within the scope of the Ministry of Agriculture, the Ministry of the Environment and the Ministry of Education, Youth and Sports that fund the central bodies either directly, in the form of institutional support or through Technology Agency of the Czech Republic. Publicly accessible data on R&D projects and granted institutional support for long-term conceptual development are available on the website of the Information System of Research, Experimental Development and Innovations at www.rvvi.cz (Central Register of R&D projects, Central Register of Activities). The information on the results obtained from research activities is available on the same website in the Information Register of R&D results. In 2021, funding totalling more than CZK 247.5 million was provided for research and development in water management. The total amount of funding for research and development in water management is estimated at CZK 250 million. The Ministry of Agriculture contributed to funding with 36% (CZK 89 million), the Ministry of the Environment with 40% (CZK 99 million) and the Ministry of Education, Youth and Sports with 24% (CZK 59 million).

Graph 13.1
Funds provided for water research and development in water management in 2021



Source: MoA using data provided by the MoE and Ministry of Education, Youth and Sports

13.1 Research and development within the scope of the Ministry of Agriculture

In 2021, the Ministry of Agriculture provided special-purpose and institutional funding aimed at implementing research and development projects and long-term conceptual development of research organizations in the field of water management in the amount exceeding CZK 89 million.

In 2021, a total of CZK 76,347 thousand was spent on support of research and development projects. CZK. The R&D projects are mainly focused on soil and water conservation in sustainable development of the agricultural sector, creation, revitalisation and protection of cultural landscape, forests and water bodies and rationalisation of water management, including addressing the impacts of the climate change. An overview of current R&D projects shown in Table 13.1.

Water research and development projects carried out in 2021 were the result of public tenders held under the departmental research programme entitled "Applied Research Programme of the Ministry of Agriculture for the period of 2017–2025, EARTH" (hereinafter referred to as the ‚EARTH').

Specific objectives of the EARTH programme are defined by three key areas and nine research directions. The key area Sustainable Management with Natural Resources continues to be fulfilled, among others, by the research direction "Water". The aim of this research direction is to achieve a good ecological and chemical status of surface waters and a good chemical and quantitative status of groundwaters, to increase retention and accumulation of surface waters and groundwaters, to reduce pollution risk and to protect water resources against pollution from point and non-point sources, to reduce contamination by micropollutants (pesticides, pharmaceuticals and others including their metabolites), to apply new technologies in the field of water treatment and to recycle water in circulation. In addition, the Water research direction is focused on optimising water management with the view of eliminating manifestations of hydrological extremes and to design a system of adaptation measures to mitigate them.

Within the framework of long-term development concepts of research organisations, some research organisations addressed also the issue of water management. These are mainly the Research Institute for Soil and Water Conservation and to a lesser extent the Crop Research Institute, p.r.i., the Forestry and Game Management Research Institute, p.r.i., and the Research Institute of Agricultural Engineering, p.r.i. Institutions carrying out research in this sphere ware supported with a total amount of CZK 13 million in 2021.

Within the framework of long-term development concepts of research organisations, some research organisations have also addressed the issue of water management. These are mainly Research Institute for Soil and Water Conservation, p.r.i. and, to a lesser extent, the Research Institute of Plant Production, p.r.i., the Research Institute of Forestry and Hunting, p.r.i., or the Research Institute of Agricultural Technology, p.r.i. For this research area, institutional support of approximately CZK 13 million was provided to research organisations in 2021.

Publicly accessible data on R&D projects and on institutional support provided for long-term conceptual development are available on the website of the Research, Development and Innovation Information System https://www.isvavai.cz/ (CEC – Central Evidence of Projects, CEA – Central Evidence of Activities). Data on the results generated by research activities are also available in the Register of Information on Results.

Table 13.1.1
Research and development projects in the field of water management financed by the Ministry of Agriculture in 2021

Project no.	Project name	From–To	Coordinator	Funds (in thousands of CZK)
QK1710379	Safe use of mud from WWTPs on farmland using torrefaction technology	01/02 2017 31/12 2021	Czech University of Life Sciences Prague	1,771
QK1810010	SMARTFIELD – Automatic system for collection and processing of temperature and humidity parameters of the microclimate and soil for conditions of precise agriculture in the Czech Republic on the principle of the Internet of Things (IoT)	01/01 2018 31/12 2022	Crop Research Institute, p.r.i.	3,673
QK1810186	Improving soil structure stability and increasing infiltration via agrotechnological procedures	01/01 2018 31/12 2022	Crop Research Institute, p.r.i.	3,238
QK1810415	Influence of wood plant composition and forest cover structure on the microclimate and hydrological situation in the landscape	01/01 2018 31/12 2022	Forestry and Game Management Research Institute, p.r.i.	3,503
QK1810463	Development of a new form of probiotic superabsorbent bedding with subsequent use for rainwater retention in soil	01/01 2018 31/12 2021	Veterinary Research Institute, p.r.i.	2,293
QK1910029	Previous saturation and design rainfall intensity as factors of runoff response in small river basins	01/01 2020 31/12 2022	Czech Technical University in Prague	3,516
QK1910086	Decreasing the burden by areal sources of agricultural pollution in surface waters when applying regulation of drainage outfall at current agriculture drainage structures	01/01 2020 31/12 2023	Research Institute f or Soil and Water Conservation, p.r.i.	3,442
QK1910165	Modern methods in irrigation regime of fruit trees in conditions of water deficit	01/01 2020 31/12 2023	Research and Breeding Institute of Pomology Holovousy s.r.o.	3,779
QK1910282	Options of mitigating impacts of extreme rainfall-runoff phenomena in small river basins with respect to requirements for sustainable agricultural farming and fish production	01/01 2020 31/12 2023	Masaryk University	4,235
QK1910299	Sustainable management of natural resources with emphasis on non-productive and productive soil capacity	01/01 2020 31/12 2023	Czech University of Life Sciences Prague	3,292
QK1910334	Innovation of environment-friendly system of maize growing using undersow crops for limiting soil degradation and improving water management in conditions of changing climate	01/01 2020 31/12 2023	Mendel University in Brno	4,345
QK1910382	Innovation in technologies of growing root crop and vegetables for more efficient use rainwater and irrigation, better stability and quality of the production	01/01 2020 31/12 2023	Crop Research Institute, p.r.i.	3,665
QK1920011	Methodology of quantifying predatory fish species in water reservoirs for optimizing aquatic ecosystem management	01/01 2020 31/12 2021	Biology Centre of the CAS,p.r.i.	3,217
QK1920214	Innovation in the system of potato growing in water resource protection zones with limited input of pesticides and fertilizers resulting in water pollution and maintaining potato farmers' competitiveness	01/01 2020 31/12 2021	Potato Research Institute Havlíčkův Brod, s.r.o.	4,651

Project no.	Project name	From–To	Coordinator	Funds (in thousands of CZK)
QK21010189	Implementation of ecosystem services with focus on water balance in viticulture practice	01/01 2021 31/12 2025	Research Institute of Plant Production, p.r.i.	3,399
QK21010247	Optimisation of management on unbalanced land by using effective mapping of soil conditions and taking into account changes in moisture conditions in order to stabilise yield levels	01/01 2021 31/12 2024	Research Institute for Soil and Water Conservation	2,875
QK21010300	Optimization of treatment technology of sludge from municipal wastewater treatment plants with regard to its chemical and microbial composition and water retention capacity with the aim of its safe use on agricultural and forest land	01/01 2021 31/12 2024	Technical University of Ostrava	3,283
QK21010310	Evaluation of the possibility of using planned linear structures to implement water transfers between basins and between water supply systems	01/01 2021 31/12 2024	Research Institute for Soil and Water Conservation	2,828
QK21010328	Potential for the development of small water bodies in the landscape as adaptation measures to eliminate hydrometeorological extremes	01/01 2021 31/12 2024	Brno University of Technology	3,017
QK21010341	Optimisation of a set of measures for agricultural catchment areas in the framework of the land improvement process	01/01 2021 31/12 2025	Research Institute for Soil and Water Conservation	3,097
QK21020022	Comprehensive assessment of the application of treated sewage sludge in agriculture with respect to micropollutants	01/01 2021 31/12 2023	Czech University of Life Sciences Prague	4,031
QK21020080	Fate of selected micropollutants present in treated water and sewage sludge in soil	01/01 2021 31/12 2023	Czech University of Life Sciences Prague	3,997
QK21020386	Categorization and optimization of management of reclamation districts for increasing the retention function of forests	01/01 2021 31/12 2023	Research Institute of Forestry and Hunting, p.r.i.	1,200
Total				**76,347**

Source: MoA

13.2 Research and development within the competence of the Ministry of the Environment

In 2021, the Ministry of the Environment provided institutional support in the total amount of CZK 98.9 million to its two research organisations in the field of water: to the T. G. Masaryk Water Research Institute, p.r.i., in the amount of CZK 78.4 million and to the Czech Hydrometeorological Institute in the amount of CZK 20.6 million.

In addition to institutional support, the Ministry of the Environment has administered since 2019 a research programme called "Environment for Life". The programme focuses on support for applied research, experimental development and innovations in the environment. The provider and implementor of the programme is the Technology Agency of the Czech Republic. The duration of the programme with total allocation of CZK 4.46 billion is 7 years, i.e. until 2026. Half of the total funds is intended for research related to climate change.

The programme is divided into three sub-programmes:
- Support for projects in public interest (hereinafter referred to as the ‚SP1')
- New procedures, environmental technologies, eco-innovation
- Long-term research

Fifth call for tenders was launched, with applications accepted until 30 June 2021. A total sum of CZK 202,000 was allocated to SP1, which aims to simplify and streamline public administration and improve environmental management and regulation. The number of priority research topics was reduced to 32 from the original 41 for the fifth call for tenders. A total of 183 project proposals were submitted to the call for tenders and 28 project proposals were supported, the success rate was 15.3%. The supported projects in the field of water management are listed in Table 13.2.1.

In the field of research, the MoE also uses the "Public Procurement Programme in Applied Research and Innovation for the Needs of State Administration BETA2 (2017–2024)". Table 13.2.2 shows an overview of currently running research projects commissioned on the basis of the needs of the MoE.

Table 13.2.1
Research and development projects in water management supported by the Ministry of the Environment in 2021 under the fifth call for tenders of the Environment for Life Programme

Project No.	Project name	Main implementor	Funds (in thousands of CZK)
SS05010180	Update of the concept of permissible soil loss from agriculture land	Research Institute for Soil and Water Conservation, p.r.i.	8,336
SS05010225	Effective control of design of stormwater management systems in urbanized areas	Czech Technical University in Prague	2,168
SS05010009	Development of effective tools for monitoring and assessing the ecological status and ecosystem services of ponds and for improving communication with stakeholders	Botanical Institute of the CAS, p.r.i.	7,980
SS05010134	Importance and protection of floodplains as an environment for eco-stabilising functions of the landscape	Institute of Global Change Research, CAS, p.r.i.	7,411
SS05010124	Assessment of the impact of land cover changes on local hydrology and climate in the Krkonoše National Park using remote sensing and hydrological modelling	Charles University	9,297
SS05010157	Analysis of the spatiotemporal dynamics of snow cover for the prediction and prevention of hydrological extremes and sizing of adaptation measures in land management	Mendel University in Brno	7,999
SS05010210	Tools for risk assessment of parts of a river basin associated with water abstraction points for human consumption	T. G. Masaryk Water Research Institute, p.r.i.	5,914
SS05010090	Water in the landscape of Bohemian Switzerland	Jan Evangelista Purkyně University in Ústí nad Labem	6,811
SS05010135	Development of methodology for monitoring and evaluation of hydromorphological characteristics of watercourses	Institute of Global Change Research, CAS, p.r.i..	9,532
Total			**65,448**

Source: Technology Agency of the Czech Republic

Table 13.2.2
Research and development projects in the field of water management funded by the Technology Agency of the Czech Republic (BETA2) for the Ministry of the Environment in 2021

Project No.	Project name	From–To	Main implementor	Funds (in thousands of CZK)
TITSMZP809	The influence of small reservoirs on groundwater levels and the overall hydrological balance, with emphasis on dry periods	01/05 2019 – 31/12 2021	Czech Technical University in Prague	9,731
TITSMZP720	Potential use of dry reservoirs in landscape water management	01/06 2019 – 31/12 2021	T. G. Masaryk Water Research Institute, p.r.i.	4,898
TITSMZP707	Impact of technical snowmaking on biological components of the natural environment in the Krkonoše National Park and its protection zone	01/05 2018 – 31/12 2021	Masaryk University in Brno	10,492
TITSMZP703	Watercourse drying and biodiversity of flowing waters: the influence of natural conditions and anthropogenic interventions	01/06 2018 – 30/11 2021	Masaryk University in Brno	9,999
TITSMZP945	Analysis of changes in the water regime of land and watercourses in the Krkonoše National Park caused by the road network	09/12 2021 – 301/05 2024	T. G. Masaryk Water Research Institute, p.r.i.	3,149
Total				**38,269**

Source: Technology Agency of the Czech Republic

13.3 Research and development within the competence of the Ministry of Education, Youth and Sports

The Ministry of Education, Youth and Sports supports research and development in areas related to water management through the Joint Programming Initiative «Water for a Changing World» and the large research infrastructure projects CzeCOS and CENAKVA and related international cooperation projects of the Czech Republic in research and development. In 2021, funds amounting to CZK 59.3 million were provided.

Water JPI

Joint Programming (JP) is a voluntary partnership of EU Member States and Associated Countries to define and carry out joint strategic research and development in areas of "Grand Societal Challenges". Individual countries are involved in Joint Programming Initiatives (JPIs). The Water JPI addresses research in the field of water and hydrological sciences and is guided by the Water JPI Vision 2030 strategy. The Czech Republic has been participating in the Water JPI activities as a full member since November 2018 and is represented at the Board meetings through the Ministry of Education, Youth and Sports (MoEYS). In May 2021, the cooperation agreement between the JPI Secretariat and the MoEYS was renewed, creating an obligation for the MoEYS to pay the membership fee, while confirming the continued participation of the Czech Republic in the JPI. Last year, Tunisia, as an associate country, and Slovenia, as an observer, joined the initiative with a view to future participation as full members. At the end of 2021, the Water JPI included 20 full members, 5 associate countries and 3 observer countries. In November 2021, the third Water JPI conference was held to address the threat of impending water challenges caused by climate change, industrialization and lack of protection of water resources. Successful processes were presented that applied research to practice.

CzeCOS Large Research Infrastructure

CzeCOS is a distributed research infrastructure focused on research on global atmospheric change and changes in the most important ecosystems of Central Europe, such as forests, agro-ecosystems, grasslands, pastures or wetlands. The infrastructure was upgraded in 2021, among other things in terms of hydrological research (installation of a new sampler for chemical composition and rainfall in the GEOMON project – small forest catchments, new lysimeters for soil water sampling at the Slavkovský les critical zone observatory). In 2021, a total of 110 user publications and 70 CzeCOS development publications were published.

Large research infrastructure CENAKVA – South Bohemian Research Centre for Aquaculture and Biodiversity of Hydrocenoses

The main scientific objective of the CENAKVA Research Centre is to fully understand the ongoing processes in freshwater ecosystems and their societal relevance in terms of biodiversity conservation, protection of the aquatic environment and protection of water resources for human life and activities. In 2021, CENAKVA was used to carry out a total of 50 research projects, a 16% increase compared to 2020. A total of 73 user publications and 9 publications aimed at developing this large research infrastructure were published.

Czech participation in European research infrastructures

The Czech Republic, through the Ministry of Education and Science and the large research infrastructures CzeCOS and CENAKVA, participates in two consortia of European research infrastructures - ICOS ERIC and AnaEE ERIC, and as a proposed founding member state is also involved in the preparation of consortia to manage the European research infrastructures ACTRIS, DANUBIUS-RI and eLTER-RI.

Table 13.3.1
Research and development projects in the field of water management funded by the Ministry of Education, Youth and Sports in 2021

Project No. / designation	Acronym	Solver, name	Funds (in thousands of CZK)
	Water n	Water Challenges for a changing world Joint Programming Initiative on Water Challenges for a Changing World	385
LM2018099	PRICING	South Bohemian Research Centre for Aquaculture and Biodiversity of Hydrocenoses – large research infrastructure CENAKVA.	16,920
LM2018123	CzeCOS	The CzeCOS large research infrastructure for the implementation of complex international interdisciplinary research on global change and its impacts on ecosystems.	41,995
Total			**59,300**

Source: Ministry of Education, Youth and Sports

Colorshadow (source: www.shutterstock.com)

14. IMPLEMENTATION OF THE PROGRAMMES OF MEASURES ADOPTED BY RIVER BASIN MANAGEMENT PLANS IN 2015

Every three years, the Ministry of Agriculture, in cooperation with the Ministry of the Environment and regional authorities, submits to the Government a summary report on the implementation of the programmes of measures and on the status of surface waters and groundwaters and water management in river sub-basins under the provisions of Section 26(7) of the Water Act under this Chapter. The summary of the programmes of measures is a selection of measures which constitute the most cost-effective combination of measures aimed at achieving the framework objectives under Section 23 of the Water Act. Monitoring and assessment of the effectiveness of the measures is a source of important information needed to link successive planning periods.

14.1 Description of adopted river basin management plans

The Water Framework Directive (2000/60/EU) introduced new targets for the protection and restoration of aquatic ecosystems in the EU in 2000 to serve as a basis for long-term and sustainable water use. The requirements of the Water Framework Directive were incorporated into the Water Act and river basin management plans and the corresponding programmes of measures proposed therein for each river sub-basin were established as the main instrument for implementing the Directive.

As part of the water planning process, the following documents were produced and subsequently approved for the second planning period for 2015–2021:

- **The National River Basin Plans** (hereinafter referred to as ‚NRBPs'), namely the Elbe NRBP, the Oder NRBP and the Danube NRBP, which represent a long-term concept and strategy for the protection and use of water. They integrate the aims and objectives of the departmental policies of the central water authorities with shared competences in accordance with the provisions of Section 108 of the Water Act. The NRBPs were approved by Government Resolution No. 1083 on 21 December 2015.

- **The River Sub-Basin Plans** (hereinafter referred to as ‚RSBPs'), namely the Upper and Middle Elbe RSBP, the Upper Vltava RSBP, the Berounka RSBP, the Lower Vltava RSBP, the Ohře RSBP, the Lower Elbe and other tributaries of the Elbe RSBP, the Morava RSBP and tributaries of the Váh, the Dyje RSBP, other tributaries of the Danube RSBP, the Upper Oder RSBP, the Lusatian Neisse and other tributaries of the Oder RSBP, are conceptual documents summarising information on the current status of water bodies in the sub-basins and set specific objectives aimed at achieving and maintaining their good status, preventing deterioration of the aquatic environment, promoting sustainable water use, reducing the impacts of extreme flow conditions (floods and droughts) and proposing measures to ensure the objectives by 2021. The RSBPs were approved by the respective regional councils by 30 June 2016.

- **The international river basin districts plans**, namely the Elbe International River Basin District Plan, the Oder International River Basin District Plan and the Danube International River Basin District Plan, were prepared in accordance with Article 13.2 of the Water Framework Directive, under which the Member States sharing the relevant international river basin districts ensured preparation of one international river basin district plan. The Czech Republic has actively participated in the preparation of the respective river basin management plans through its representatives and experts in the working groups of international commissions (ICPER, ICPORaP and ICPDR). The international river basin management plans were updated as of 22 December 2015.

The approved river basin management plans and information on the process of preparation of the plans are published on the websites of the Ministry of Agriculture (www.eagri.cz) and the Ministry of the Environment (www.mzp.cz).

The river basin management plans set out all the measures that should be implemented in the respective river basins in order to achieve good status for all water bodies in terms of the objectives of good ecological status/potential and chemical status of surface waters and good quantitative and chemical status of groundwaters. The summary of the programmes of measures includes the core measures, divided into groups: mandatory core measures (required for implementation of EU legislation), other core measures and complementary and additional measures. The measures aimed at achieving the objectives are activities that include investment projects of a construction nature, monitoring and organisational measures at local or regional level, but also necessary legislative changes at national level.

The measures in the NRBP and the RSBP group can be generally divided into three groups and can be characterised by their scope:

- **Measure A** is a proposal for a specific action to reduce or eliminate a significant effect. In river basin management plans, these are typically measures concerning sewerage networks and wastewater treatment plants, revitalisation of watercourses, removal of transverse barriers and remediation of old environmental burdens. Such measures are carried out by municipalities, towns, regions, river basin administrators, watercourse administrators, the Nature Conservation Agency of the Czech Republic and other entities. The effect of these measures is usually local, concerns a given water body, or the effect of the measures is shown further downstream.

- **Measure B** proposes a general course of action to reduce or eliminate a certain effect, whose impact has been identified via an exceeded condition assessment indicator, but the specific cause of such an impact is unknown. As the impact on a water body is known (e.g. exceedance of the P_{total} limit causing eutrophication of the aquatic environment), a general management approach can be proposed, but as the cause/source of the impact is unknown, the scope of the measure should focus on the entire water body. Operational or exploratory monitoring can be used to identify the source of the impact, or a tracer study can be carried out.

- **Measure C** is a measure of nation-wide scope. Such measures include in particular changes in legislation, creation of strategic documents, databases, etc. They highlight gaps in legislation and strategic actions of the state that cannot be addressed by Measures A or B. They are carried out by central water authorities, in particular the Ministry of Agriculture and the Ministry of the Environment. If implemented, they can be attributed with a significant national effect.

Tady naše práce začíná, 11–2021, Kubelín Soběšice-Mokrá Hora (autor: Nejezchleb Martin)

14.2 Status of measure implementation

The data on the status of implementation of the measures have been assessed. Besides the status of implementation of the measures, the aspects taken into account were: the measure type, inclusion in programmes of measures and focus on anthropogenic impacts and water bodies where the measures are implemented.

The main reasons for non-implementation of the measures proposed in the second planning period are property law issues, financial and economic reasons, technical infeasibility, or the reason for implementation ceased to exist. A significant part of the measures that were not implemented in the originally expected timeframe were reviewed, adjusted to current needs and incorporated with significant parameter adjustments in the river basin management plans for the third planning period until 2027.

In total, data were collected for 2,222 Measures A and B and for 63 sub-measures specified in 11 sheets for Measures C. Data on the status of implementation of each measure, actual costs (for the period 2018–2021), water bodies where the measures are implemented, impacts that they are intended to mitigate and quality components and substances expected to be improved or reduced by the measures were assessed.

14.2.1 Implementation of the measures adopted in the national river basin management plans

The Elbe, Oder and Danube NRBPs were approved by Government Resolution No. 1083 of 21 December 2015. On 12 January 2016, the MoE subsequently issued Chapters IV.1, IV.2, IV.3, IV.4, IV.5 and V of the National River Basin Plans in accordance with the provisions of Section 25(4) of the Water Act by means of measures of a general nature, which came into force on 28 January 2016.

A total of 11 complementary Measures C (comprising 63 sub-measures), listed below, have been adopted within the NRBPs. These measures, which have a nation-wide reach, respond to a generally understood problem which, by its nature, cannot be addressed by a specific physical measure. They are mostly administrative or conceptual in nature. Measures that are implemented on an ongoing basis are registered as completed.

Table 14.2.1
Status of implementation of all proposed measures in the river basin plans (sheets for Measures A, B, C) as of 31 December 2021

Letter of precautions	In the programme of measures	Status of measure implementation			
		Completed	Ongoing	not started	Cancelled
A	Yes	227	355	174	81
A	No	236	389	274	132
B	Yes	4	188	6	7
B	No	2	129	1	17
C	Yes	28	20	15	1
Total		**497**	**1 081**	**470**	**238**

Source: MoA, MoE, River Boards, s.e.

Table 14.2.2
Status of implementation of proposed measures in the national river basin management plans (Measures C) as of 31 December 2021

Name of the measure	Status of implementation of sub-measures			
	Completed	Ongoing	Not launched	Cancelled
Pond management	0	1	1	0
Protected areas (areas designated for the protection of habitats or species and wetlands)	1	1	0	0
Restoration of natural watercourse channels	1	2	0	0
Limiting the negative effects of pesticides on surface waters and groundwaters	2	1	4	0
Reducing pollution in atmospheric deposition	1	1	0	0
Reducing pollution from agriculture and protecting the aquatic environment	8	1	2	1
Determination of natural groundwater resources for groundwater bodies	1	2	6	0
Strategies for gradual reducing or complete elimination of hazardous substance intake into surface waters	1	3	0	0
Drought and shortage of water resources	8	6	1	0
Areas reserved for abstraction for human consumption	3	0	0	0
Improving passability of the river network	2	2	1	0
Total	**28**	**20**	**15**	**1**

Source: MoA, MoE, River Boards, s.e.

The Křímov Dam (source: Ohře River Board, s.e.)

Selected interesting data for 2021

- Basic hydrological network – 98,941 km of watercourses
- Funds expended on watercourse management (River Boards, s.e., Forests of the Czech Republic, s.e.): CZK 4,016.1 million
- River Boards, s.e.:
  - revenues: CZK 5,282.2 million (up by 10.7%)
  - costs: CZK 5,207.7 million (up by 5.1%)
  - investment: CZK 2,977.4 million (up by 13%) – of which CZK 1,044.4 million from own sources (35%)
  - grants: CZK 2,251.6 million
  - number of small water power plants: 104
- Average price for 1 m³ of surface water – CZK 5.5 (year-on-year increase by 7.8%)
- Land consolidation: CZK 2,630.1 million, of which CZK 319.2 million for water management measures and CZK 78.3 million for anti-erosion measures
- Water and sewerage systems:
  - Population supplied with drinkable water: 10.08 million (96%), population connected to the sewerage system: 9.17 million (87.4%)
  - Water consumption (invoiced to households): 93.2 l/person/day (year-on-year increase by 2.1 l/person/day)
  - Total length of the water supply system: 80,197 km (extended by 1,093 km, compared to 2020)
  - Total length of the sewerage system: 50,554 km (extended by 874 km, compared to 2020)
  - Number of wastewater treatment plants: 2,861 (down by 66, compared to 2020)
  - Water rate: average price: CZK 43.80 per m³
  - Sewerage charge: average price: CZK 38.50 per m³
- State financial support in water management: CZK 12,841.3 million (year-on-year increase by 9.7%)
  - Programmes of the Ministry of Agriculture: CZK 4,615.8 million
    - 16 national programmes (CZK 4,246.0 million) + 2 international programmes (CZK 369.8 million)
  - Programmes of the Ministry of the Environment: CZK 7,334.9 million:
    - Operational Programme "Environment 2014–2020" (water management): CZK 4,209.5 million, 3 national programmes: CZK 3,125.4 million
  - Support from the Ministry of Transport: CZK 890.6 million:
    - State Transport Infrastructure Fund (CZK 876.9 million), Connecting Europe Facility (CZK 13.7 million)
- Research and development in water management: CZK 247.5 billion
  - MoA CZK 89.3 million
  - MoE CZK 98.9 million
  - Ministry of Education, Youth and Sports CZK 59.3 million

Acronyms

BOD_5	biochemical five-day oxygen demand
CAS	Czech Academy of Sciences
CEF	Connecting Europe Facility
CEI	Czech Environmental Inspection
CHMI	Czech Hydrometeorological Institute
COD	chemical oxygen demand
CRF	Compulsory Requirements for Farming
CRW	Central Register of Watercourses
CSO	Czech Statistical Office
CZ-NACE	Classification of economic activities according to the CSO (in accordance with Eurostat standard)
CSN	Czech State Standard
DDT	Dichlorodiphenyltrichloroethane
DEHP	di(2-ethylhexyl)phthalate
DESA	Departments for Execution of State Administration
DIS	dissolved inorganic salts
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EIA	Environmental Impact Assessment
EUSDR	Action Plan of the EU Macro-regional Strategy for the Danube Region
EQS	Environmental Quality Standard
ERDF	European Regional Development Fund
EU	European Union
FAD	flood activity degree
GAEC	Good Agricultural and Environmental Condition
HGR	hydrogeological region
HS	hydraulic structure
ICPDR	International Commission for the Protection of the Danube River
ICPER	International Commission for the Protection of the Elbe River
ICPORaP	International Commission for the Protection of the Oder River against Pollution
i.o.	interest organization
EC_m	monthly exceedance curve
MoA	Ministry of Agriculture
MoE	Ministry of the Environment
MoH	Ministry of Health
N_{inorg}	inorganic nitrogen
NM	non-dissolved matters
NRBP	National River Basin Plans
OPE	Operational Programme Environment
PAH	polyaromatic hydrocarbons
PBDE	polybrominated diphenyl ethers
PCB	polychlorinated biphenyls
p.r.i.	public research institution
P_{total}	total phosphorus
Q_m	average monthly flow rate
$Q_{355}d$	flow that was reached or exceeded on average 355 days per year in a given profile and whose exceedance is indicative of hydrological drought
Q_{364d}	flow that has been reached or exceeded in the profile throughout the year
RDP	Rural Development Programme
RSBP	River Sub-Basin Plans
RWSSDP	Regional Water Supply and Sewerage Development Plans
s.e.	state enterprise
s.r.o.	limited company established under Czech law
SEA	Strategic environmental assessment
SEF	State Environmental Fund of the Czech Republic
SF	Solidarity Fund
SLO	State Land Office
SPI	Support for projects in public interest
STIF	State Transport Infrastructure Fund
TOC	total organic carbon
UNECE	United Nations Economic Commission for Europe
VAT	value added tax
VÚME	Selected data from Public Water Supply and Sewerage Systems Assets Registry
VÚPE	Selected data from Public Water Supply and Sewerage Systems Operational Registry
W&S	Water and sewerage
WSS Act	Act No. 274/2001 Coll., on water supply and sewerage for public use and on amendments to certain related acts, as amended
WSSDP	Water Supply and Sewerage Development Plans
WWTP	wastewater treatment

Important contacts in water management

Ministry of Agriculture
Těšnov 65/17, Prague 1, 110 00, www.eagri.cz
Ministry of the Environment
Vršovická 1442/65, Prague 10, 100 10, www.mzp.cz
Elbe River Basin, state enterprise
Víta Nejedlého 951/8, Hradec Králové, 500 03, www.pla.cz
Vltava River Basin, state enterprise
Holečkova 3178/8, Prague 5, 150 00, www.pvl.cz
Ohře River Basin, state enterprise
Bezručova 4219, Chomutov, 430 03, www.poh.cz
Oder River Basin, state enterprise
Varenská 3101/49, Ostrava, Moravská Ostrava, 701 26, www.pod.cz
Morava River Basin, s. p.
Dřevařská 932/11, Brno, 602 00, www.pmo.cz
Forests of the Czech Republic, s.e.
Přemyslova 1106/19, Hradec Králové, 500 08, www.lesycr.cz
Czech Hydrometeorological Institute
Na Šabatce 2050/17, Prague 412 - Komořany, 143 06, www.chmi.cz
T. G. Masaryk Water Research Institute, p.r.i.
Podbabská 2582/30, Prague 6, 160 00, www.vuv.cz
State Land Office
Husinecká 1024/11a, Prague 3 - Žižkov, 130 00, www.spucr.cz
Research Institute of Melioration and Soil Conservation, p.r.i.
Žabovřeská 250, Prague 5 - Zbraslav, 156 27, www.vumop.cz

The Orlík Dam (author: Hubalová Petra)

The Obříství Lock on the Elbe Waterway (source: Elbe River Board, s.e.)

Notes

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As of 31 December 2021

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Ministry of the Environment of the Czech Republic

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